The Nautical Almanac 1981

TheNauticalAlmanac.com

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Explanation of The Nautical Almanac *Daily Pages*

1	Date and Time based on GMT/UT
2	**Mer. pass**- meridian passage of Aries at the Prime Meridian- Greenwich- 0°. Time figure is GMT/UT.
3	Planet or Moon GHA **v** value and planet or Moon declination **d** value. **v**- "The change in hour angle arising from v of the body at the time of the sight observation is accounted for with the *v correction*." *Source- Bowditch 2017, Chapter 19- Sight Reduction p. 313.* The planet's **v** is positive unless preceeded by a minus sign which is sometimes the case with Venus. The sign of the Moon's **v** is positive. **d**- "The change in declination of the body at the time of the sight observation is accounted for with the *d correction*." *Source- Bowditch 2017, Chapter 19- Sight Reduction p. 313.* The sign of the Moon or planet's **d** correction is determined by the declination trend- positive if successive declination values increase and negative if they decrease. Corrections for both **v** and **d** are found in the Increments and Corrections pages of The Nautical Almanac. To find the correction for either **v** or **d** enter the Increments and Corrections pages for the minutes in time of the observation and find the value in the **v and d corr.** columns Find the **v**, or **d**, value in the left side of one of the three columns. To the right of that value is the **v**, or **d**, correction. Be sure to add or subtract the values depending upon the *sign* of the value as mentioned above.
	Example for v & d correction- June 10, 2020 GMT- 21:19:10 Body- Moon
	GHA= 247° 20.4′ ***v =*** 12.1′ GHA increment 4° 34.4′ ***v-*** correction for 12.1′ + 0° 03.9′ GHA= 251° 58.7′ Dec= S 17° 43.8′ **d**= 8.9′ **d-** correction for 8.9′ – 0° 02.9′ dec= S 17° 40.9′ *declination trend is decreasing so the sign of d correction is negative*
4	**m**- is the *magnitude* or brightness of the planet. A bright planet will have a *minus* sign beside the figure. A fainter planet will have no sign beside its magnitude figure.
5	**Stars**- **SHA**, *Sidereal Hour Angle*, and **Declination**. 59 stars are listed. Typically, only 57 stars are used for navigational purposes in both Northern and Southern Hemispheres. Here you'll also find Polaris and Scheat. In the Northern Hemisphere Polaris is often used for determination of latitude.
6	**Mer. pass**- planet meridian passage time at the Prime Meridian- Greenwich- 0°. Time figure is GMT/UT.
7	**SHA**- planet SHA. Planet SHA is calculated by subtracting Aries GHA from planet GHA. If planet GHA figure is less than Aries GHA, add 360° to planet GHA and then subtract Aries GHA.
8	**Horizontal parallax**- for Venus and Mars. Horizontal parallax is the angle subtended by half the Earth's diameter as viewed from the planet in minutes of arc.
9	**SD**- Semi-diameter of the Sun in minutes of arc. One half of the angular width of the Sun as observed on earth.

10	**d**- the daily average change, per hour, in the Sun's declination in minutes of arc.
11	**SD**- Semi-diameter of the Moon in minutes of arc. Semi-diameter is one half of the angular width of the Moon, as observed on earth.
12	**HP**- the angle between two lines, one from the center of the Moon to the center of the Earth, the other from the center of the Moon to the edge of the Earth. This angle is about 56', but it changes slightly from day to day as the distance to the Moon changes along its elliptical path around the Earth. *Source- starpath.com*
13	**Sun- Eqn. of Time**- Basically the Equation of Time (EoT) is the difference between clock time and time seen on a sundial. This is comparing "clock time", as a mechanical measurement of time, and the sundial being time determined by the position of the Sun at any given moment. The figures listed are for 00^h and 12^h. Using the EoT you can get fairly accurate determination of when Meridian Passage (Local Apparent Noon) occurs at your position. Unshaded EoT values are subtracted from 12:00 to get Meridian Passage. Shaded EoT values are added to 12:00 to get Meridian Passage. An Equation of Time chart (as a curve) is provided in each almanac on TheNauticalAlmanac.com **Example**- Meridian Passage on May 30, 2020 equals 12:00 – EoT of 2 minutes 21 seconds MP= 11:57:39 *Local Apparent Noon* **Example**- Meridian Passage on August 25, 2020 equals 12:00 + EoT of 1 minute 59 seconds MP= 12:01:59 *Local Apparent Noon*
14	**Sun- Mer. Pass** just to the right of the **Eqn. of Time** is the approximate GMT/UT when the Sun crosses The Prime Meridian (at Greenwich) for that specific date.
15	**Moon- Mer. Pass**- is the approximate GMT/UT when the Moon crosses The Prime Meridian (at Greenwich) or the 180° line of longitude. **Upper** means the GMT/UT when the Moon crosses The Prime Meridian (Greenwich). **Lower** means the GMT/UT when the Moon crosses the 180° line of longitude.
16	**Moon- Age**- this is the number of days past a new Moon. Typically, there are 29 days in a lunar month. Moon- %- the amount of the Moon's illumination. 100% would be a full moon. 49% would be about ½ of the Moon is illuminated. A 3 day range percentage is provided but only one graphic for the phase.
17* see notes at bottom	**(morning) Twilight- Naut.**- the approximate GMT/UT when morning Nautical Twilight begins. Nautical twilight is the time when the center of the sun is 12° below the horizon and the horizon is visible enough to be used for marine sextant observations. First locate your approximate Latitude in the **Lat**. column and then follow across horizontally to the right to find the time.
17* see notes at bottom	**(morning) Twilight- Civil-** the approximate GMT/UT of morning civil twilight starts when the geometric center of the sun is 6° below the horizon. First locate your approximate Latitude in the **Lat**. column and then follow across horizontally to the right to find the time.
17* *see* notes *at bottom*	**Sunrise**- the approximate GMT/UT when the Sun is 0° 50' (semi-diameter plus refraction) below the horizon. First locate your approximate Latitude in the Lat. column and then follow across horizontally to the right to find the time.

17* see notes at bottom	**Sunset**- the approximate GMT/UT when the Sun is 0° 50' (semi-diameter plus refraction) below the horizon. First locate your approximate Latitude in the Lat. column and then follow across horizontally to the right to find the time.
17* see notes at bottom	**(evening) Twilight- Civil-** the approximate GMT/UT of evening civil twilight that ends when the geometric center of the sun is 6° below the horizon. First locate your approximate Latitude in the **Lat**. column and then follow across horizontally to the right to find the time.
17* see notes at bottom	**(evening) Twilight- Naut.**- the approximate GMT/UT of when evening Nautical Twilight ends. Nautical twilight is the time when the center of the sun is 12° below the horizon and the horizon is no longer visible enough to be used for sextant observations. First locate your approximate Latitude in the Lat. column and then follow across horizontally to the right to find the time.
18* see notes at bottom	**Moonrise**- the approximate GMT/UT when the Moon is about 0° 05' to 0° 10' below the horizon. First locate your approximate Latitude in the Lat. column and then follow across horizontally to the right to find the time under the specific day.
18* see notes at bottom	**Moonset**- the approximate GMT/UT when the Moon is about 0° 05' to 0° 10' below the horizon. First locate your approximate Latitude in the Lat. column and then follow across horizontally to the right to find the time under the specific day.

* Note-

▭ means the Sun or Moon remains continuously above the horizon on that day.

–:– can also mean twilight lasts all night

▬ means the Sun or Moon remains continuously below the horizon on that day.

–:– means Moon does not rise or set on that day but may have risen or set the previous day or following day.

* **Note**- Time of Sunrise, Sunset, Moonrise, Moonset and twilight is based on GMT/UT of the event at 0° (Greenwich) and can be condsidered as approximate LMT (Local Mean Time) with a tolerance of +/- 30 minutes depending on where you are within a time zone.

January 01, 02 ,03 (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	100°32.5	181°58.1	S23°38.5	318°04.0	N18°45.1	131°37.2	S13°36.5	275°29.9	N00°18.5
1	115°35.0	196°57.1	38.4	333°06.8	45.4	146°39.2	36.4	290°32.3	18.5
2	130°37.4	211°56.1	38.3	348°09.6	45.6	161°41.2	36.2	305°34.7	18.5
3	145°39.9	226°55.1	·· 38.2	3°12.4	·· 45.8	176°43.2	·· 36.0	320°37.1	·· 18.5
4	160°42.4	241°54.2	38.1	18°15.2	46.0	191°45.1	35.8	335°39.5	18.5
5	175°44.8	256°53.2	38.0	33°18.1	46.2	206°47.1	35.7	350°41.9	18.5
6	190°47.3	271°52.2	S23°37.9	48°20.9	N18°46.5	221°49.1	S13°35.5	5°44.3	N00°18.5
7	205°49.8	286°51.3	37.8	63°23.7	46.7	236°51.1	35.3	20°46.7	18.5
8	220°52.2	301°50.3	37.7	78°26.5	46.9	251°53.0	35.1	35°49.2	18.5
9	235°54.7	316°49.3	·· 37.6	93°29.4	·· 47.1	266°55.0	·· 35.0	50°51.6	·· 18.4
10	250°57.2	331°48.4	37.5	108°32.2	47.3	281°57.0	34.8	65°54.0	18.4
11	265°59.6	346°47.4	37.4	123°35.0	47.6	296°59.0	34.6	80°56.4	18.4
12	281°02.1	1°46.4	S23°37.3	138°37.9	N18°47.8	312°00.9	S13°34.4	95°58.8	N00°18.4
13	296°04.5	16°45.5	37.2	153°40.7	48.0	327°02.9	34.3	111°01.2	18.4
14	311°07.0	31°44.5	37.1	168°43.5	48.2	342°04.9	34.1	126°03.6	18.4
15	326°09.5	46°43.5	·· 37.0	183°46.4	·· 48.5	357°06.8	·· 33.9	141°06.0	·· 18.4
16	341°11.9	61°42.6	36.9	198°49.2	48.7	12°08.8	33.7	156°08.4	18.4
17	356°14.4	76°41.6	36.8	213°52.0	48.9	27°10.8	33.6	171°10.8	18.4
18	11°16.9	91°40.6	S23°36.7	228°54.9	N18°49.1	42°12.8	S13°33.4	186°13.2	N00°18.3
19	26°19.3	106°39.6	36.5	243°57.7	49.4	57°14.7	33.2	201°15.7	18.3
20	41°21.8	121°38.7	36.4	259°00.6	49.6	72°16.7	33.0	216°18.1	18.3
21	56°24.3	136°37.7	·· 36.3	274°03.4	·· 49.8	87°18.7	·· 32.9	231°20.5	·· 18.3
22	71°26.7	151°36.7	36.2	289°06.3	50.0	102°20.7	32.7	246°22.9	18.3
23	86°29.2	166°35.8	36.1	304°09.1	50.3	117°22.6	32.5	261°25.3	18.3
Mer.pass.:17:14		v-1.0 d0.1 m-3.8		v2.8 d0.2 m-0.7		v2.0 d0.2 m-2.0		v2.4 d-0.0 m0.9	

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	101°31.7	181°34.8	S23°36.0	319°12.0	N18°50.5	132°24.6	S13°32.3	276°27.7	N00°18.3
1	116°34.1	196°33.8	35.8	334°14.8	50.7	147°26.6	32.2	291°30.1	18.3
2	131°36.6	211°32.9	35.7	349°17.7	51.0	162°28.6	32.0	306°32.5	18.3
3	146°39.0	226°31.9	·· 35.6	4°20.5	·· 51.2	177°30.5	·· 31.8	321°34.9	·· 18.3
4	161°41.5	241°30.9	35.5	19°23.4	51.4	192°32.5	31.6	336°37.3	18.2
5	176°44.0	256°30.0	35.3	34°26.2	51.6	207°34.5	31.5	351°39.8	18.2
6	191°46.4	271°29.0	S23°35.2	49°29.1	N18°51.9	222°36.4	S13°31.3	6°42.2	N00°18.2
7	206°48.9	286°28.0	35.1	64°31.9	52.1	237°38.4	31.1	21°44.6	18.2
8	221°51.4	301°27.1	34.9	79°34.8	52.3	252°40.4	30.9	36°47.0	18.2
9	236°53.8	316°26.1	·· 34.8	94°37.7	·· 52.6	267°42.4	·· 30.8	51°49.4	·· 18.2
10	251°56.3	331°25.1	34.7	109°40.5	52.8	282°44.3	30.6	66°51.8	18.2
11	266°58.8	346°24.2	34.5	124°43.4	53.0	297°46.3	30.4	81°54.2	18.2
12	282°01.2	1°23.2	S23°34.4	139°46.3	N18°53.3	312°48.3	S13°30.2	96°56.6	N00°18.2
13	297°03.7	16°22.2	34.3	154°49.1	53.5	327°50.2	30.1	111°59.1	18.2
14	312°06.1	31°21.3	34.1	169°52.0	53.7	342°52.2	29.9	127°01.5	18.2
15	327°08.6	46°20.3	·· 34.0	184°54.9	·· 54.0	357°54.2	·· 29.7	142°03.9	·· 18.1
16	342°11.1	61°19.3	33.8	199°57.7	54.2	12°56.2	29.5	157°06.3	18.1
17	357°13.5	76°18.4	33.7	215°00.6	54.4	27°58.1	29.3	172°08.7	18.1
18	12°16.0	91°17.4	S23°33.6	230°03.5	N18°54.7	43°00.1	S13°29.2	187°11.1	N00°18.1
19	27°18.5	106°16.5	33.4	245°06.4	54.9	58°02.1	29.0	202°13.5	18.1
20	42°20.9	121°15.5	33.3	260°09.3	55.1	73°04.0	28.8	217°16.0	18.1
21	57°23.4	136°14.5	·· 33.1	275°12.1	·· 55.4	88°06.0	·· 28.6	232°18.4	·· 18.1
22	72°25.9	151°13.6	33.0	290°15.0	55.6	103°08.0	28.5	247°20.8	18.1
23	87°28.3	166°12.6	32.8	305°17.9	55.9	118°09.9	28.3	262°23.2	18.1
Mer.pass.:17:11		v-1.0 d0.1 m-3.8		v2.9 d0.2 m-0.8		v2.0 d0.2 m-1.9		v2.4 d-0.0 m0.9	

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	102°30.8	181°11.6	S23°32.7	320°20.8	N18°56.1	133°11.9	S13°28.1	277°25.6	N00°18.1
1	117°33.3	196°10.7	32.5	335°23.7	56.3	148°13.9	27.9	292°28.0	18.1
2	132°35.7	211°09.7	32.4	350°26.6	56.6	163°15.9	27.8	307°30.4	18.1
3	147°38.2	226°08.7	·· 32.2	5°29.4	·· 56.8	178°17.8	·· 27.6	322°32.9	·· 18.0
4	162°40.6	241°07.8	32.0	20°32.3	57.0	193°19.8	27.4	337°35.3	18.0
5	177°43.1	256°06.8	31.9	35°35.2	57.3	208°21.8	27.2	352°37.7	18.0
6	192°45.6	271°05.8	S23°31.7	50°38.1	N18°57.5	223°23.7	S13°27.0	7°40.1	N00°18.0
7	207°48.0	286°04.9	31.6	65°41.0	57.8	238°25.7	26.9	22°42.5	18.0
8	222°50.5	301°03.9	31.4	80°43.9	58.0	253°27.7	26.7	37°44.9	18.0
9	237°53.0	316°03.0	·· 31.2	95°46.8	·· 58.2	268°29.6	·· 26.5	52°47.4	·· 18.0
10	252°55.4	331°02.0	31.1	110°49.7	58.5	283°31.6	26.3	67°49.8	18.0
11	267°57.9	346°01.0	30.9	125°52.6	58.7	298°33.6	26.2	82°52.2	18.0
12	283°00.4	1°00.1	S23°30.7	140°55.5	N18°59.0	313°35.5	S13°26.0	97°54.6	N00°18.0
13	298°02.8	15°59.1	30.6	155°58.4	59.2	328°37.5	25.8	112°57.0	18.0
14	313°05.3	30°58.1	30.4	171°01.3	59.5	343°39.5	25.6	127°59.4	18.0
15	328°07.8	45°57.2	·· 30.2	186°04.2	·· 59.7	358°41.4	·· 25.4	143°01.9	·· 18.0
16	343°10.2	60°56.2	30.1	201°07.1	18°59.9	13°43.4	25.3	158°04.3	17.9
17	358°12.7	75°55.3	29.9	216°10.0	19°00.2	28°45.4	25.1	173°06.7	17.9
18	13°15.1	90°54.3	S23°29.7	231°13.0	N19°00.4	43°47.3	S13°24.9	188°09.1	N00°17.9
19	28°17.6	105°53.3	29.5	246°15.9	00.7	58°49.3	24.7	203°11.5	17.9
20	43°20.1	120°52.4	29.4	261°18.8	00.9	73°51.3	24.6	218°13.9	17.9
21	58°22.5	135°51.4	·· 29.2	276°21.7	·· 01.2	88°53.3	·· 24.4	233°16.4	·· 17.9
22	73°25.0	150°50.4	29.0	291°24.6	01.4	103°55.2	24.2	248°18.8	17.9
23	88°27.5	165°49.5	28.8	306°27.5	01.7	118°57.2	24.0	263°21.2	17.9
Mer.pass.:17:07		v-1.0 d0.2 m-3.8		v2.9 d0.2 m-0.8		v2.0 d0.2 m-1.9		v2.4 d-0.0 m0.9	

Stars	SHA	Dec
Alpheratz	357°46.2	29°09.0
Ankaa	353°18.1	-42°15.2
Schedar	349°43.6	56°35.9
Diphda	348°58.3	-17°55.9
Achernar	335°28.3	-57°11.3
Hamal	328°03.5	23°30.8
Polaris	318°47.1	89°18.8
Akamar	315°19.9	-40°16.0
Menkar	314°17.5	4°07.8
Mirfak	308°43.7	49°54.0
Aldebaran	290°52.0	16°31.9
Rigel	281°14.1	-8°11.4
Capella	280°37.8	46°00.6
Bellatrix	278°34.4	6°21.5
Elnath	278°15.5	28°37.0
Alnilam	275°48.6	-1°11.7
Betelgeuse	271°03.7	7°24.5
Canopus	263°56.7	-52°42.1
Sirius	258°35.5	-16°43.6
Adara	255°14.1	-28°59.2
Procyon	245°01.9	5°12.0
Pollux	243°30.3	28°00.0
Avior	234°18.6	-59°32.4
Suhail	222°54.0	-43°28.3
Miaplacidus	221°39.7	-69°45.4
Alphard	217°58.3	-8°42.2
Regulus	207°45.9	11°54.9
Dubhe	193°54.2	61°41.4
Denebola	182°36.0	14°30.8
Gienah	175°54.9	-17°35.9
Acrux	173°12.3	-63°09.1
Gacrux	172°03.9	-57°10.0
Alioth	166°22.8	55°53.9
Spica	158°34.0	-11°12.9
Alcaid	153°00.9	49°15.4
Hadar	148°51.9	-60°25.1
Menkent	148°10.8	-36°25.1
Arcturus	145°58.0	19°07.9
Rigil Kent.	139°55.6	-60°52.4
Zubenelg.	137°08.4	-16°05.0
Kochab	137°20.2	74°06.5
Alphecca	126°13.4	26°40.7
Antares	112°29.7	-26°27.2
Atria	107°34.4	-69°02.6
Sabik	102°15.8	-15°44.3
Shaula	96°25.8	-37°06.6
Rasalhague	96°09.1	12°33.1
Eltanin	90°47.8	51°29.2
Kaus Aust.	83°47.5	-34°22.8
Vega	80°41.1	38°47.5
Nunki	76°01.8	-26°17.1
Altair	62°11.1	8°53.7
Peacock	53°23.6	-56°42.2
Deneb	49°33.7	45°19.1
Enif	33°49.9	9°55.4
Alnair	27°47.1	-46°54.8
Fomalhaut	15°26.9	-29°34.2
Scheat	13°56.1	28°08.4
Markab	13°41.0	15°15.7

Jan 01 Fri	SHA	Mer.pass
Venus	81°25.5	11:53
Mars	217°31.4	02:47
Jupiter	31°04.7	15:12
Saturn	174°57.4	05:37

Jan 02 Sat	SHA	Mer.pass
Venus	80°03.2	11:54
Mars	217°40.3	02:43
Jupiter	30°53.0	15:08
Saturn	174°56.1	05:33

Jan 03 Sun	SHA	Mer.pass
Venus	78°40.8	11:56
Mars	217°50.0	02:38
Jupiter	30°41.1	15:05
Saturn	174°54.8	05:29

Horizontal parallax	
Venus:	0.1
Mars:	0.2

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file date- June 16 2020

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2020 January 01 to Jan. 03

h	Sun		Moon				
Wed	GHA	Dec	GHA	v	Dec	d	HP
0	179° 13.7	S23° 03.5	110° 56.9	15.3′	S09° 58.5	10.7′	54.3′
1	194° 13.4	03.3	125° 31.3	15.4′	09° 47.8	10.7′	54.3′
2	209° 13.1	03.1	140° 05.7	15.4′	09° 37.1	10.7′	54.3′
3	224° 12.8	·· 03.0	154° 40.1	15.5′	09° 26.3	10.8′	54.3′
4	239° 12.5	02.8	169° 14.6	15.5′	09° 15.5	10.8′	54.3′
5	254° 12.2	02.6	183° 49.1	15.5′	09° 04.7	10.8′	54.2′
6	269° 11.9	S23° 02.4	198° 23.6	15.6′	S08° 53.8	10.9′	54.2′
7	284° 11.6	02.2	212° 58.2	15.6′	08° 42.9	10.9′	54.2′
8	299° 11.3	02.0	227° 32.8	15.6′	08° 32.0	10.9′	54.2′
9	314° 11.0	·· 01.8	242° 07.5	15.7′	08° 21.0	11.0′	54.2′
10	329° 10.7	01.6	256° 42.2	15.7′	08° 10.0	11.0′	54.2′
11	344° 10.4	01.4	271° 16.9	15.7′	07° 59.0	11.0′	54.2′
12	359° 10.1	S23° 01.2	285° 51.7	15.8′	S07° 48.0	11.1′	54.2′
13	14° 09.8	01.0	300° 26.4	15.8′	07° 36.9	11.1′	54.2′
14	29° 09.5	00.8	315° 01.2	15.8′	07° 25.8	11.1′	54.2′
15	44° 09.2	·· 00.6	329° 36.1	15.9′	07° 14.7	11.1′	54.2′
16	59° 08.9	00.4	344° 10.9	15.9′	07° 03.5	11.2′	54.2′
17	74° 08.6	00.2	358° 45.8	15.9′	06° 52.3	11.2′	54.2′
18	89° 08.3	S23° 00.0	13° 20.7	15.9′	S06° 41.1	11.2′	54.2′
19	104° 08.0	22° 59.7	27° 55.7	16.0′	06° 29.9	11.2′	54.2′
20	119° 07.7	59.5	42° 30.7	16.0′	06° 18.7	11.3′	54.2′
21	134° 07.5	·· 59.3	57° 05.6	16.0′	06° 07.4	11.3′	54.2′
22	149° 07.2	59.1	71° 40.6	16.0′	05° 56.1	11.3′	54.2′
23	164° 06.9	58.9	86° 15.7	16.0′	05° 44.8	11.3′	54.2′
	SD.=16.3	d=0.2	S.D.=14.8				

Thu	GHA	Dec	GHA	v	Dec	d	HP
0	179° 06.6	S22° 58.7	100° 50.7	16.1′	S05° 33.4	11.3′	54.2′
1	194° 06.3	58.5	115° 25.8	16.1′	05° 22.1	11.4′	54.2′
2	209° 06.0	58.3	130° 00.9	16.1′	05° 10.7	11.4′	54.2′
3	224° 05.7	·· 58.1	144° 36.0	16.1′	04° 59.3	11.4′	54.2′
4	239° 05.4	57.9	159° 11.1	16.1′	04° 47.9	11.4′	54.2′
5	254° 05.1	57.6	173° 46.3	16.1′	04° 36.5	11.4′	54.2′
6	269° 04.8	S22° 57.4	188° 21.4	16.2′	S04° 25.0	11.5′	54.2′
7	284° 04.5	57.2	202° 56.6	16.2′	04° 13.5	11.5′	54.2′
8	299° 04.2	57.0	217° 31.7	16.2′	04° 02.1	11.5′	54.2′
9	314° 03.9	·· 56.8	232° 06.9	16.2′	03° 50.6	11.5′	54.2′
10	329° 03.6	56.6	246° 42.1	16.2′	03° 39.0	11.5′	54.2′
11	344° 03.3	56.3	261° 17.3	16.2′	03° 27.5	11.5′	54.2′
12	359° 03.0	S22° 56.1	275° 52.6	16.2′	S03° 16.0	11.5′	54.2′
13	14° 02.8	55.9	290° 27.8	16.2′	03° 04.4	11.6′	54.2′
14	29° 02.5	55.7	305° 03.0	16.2′	02° 52.8	11.6′	54.2′
15	44° 02.2	·· 55.5	319° 38.3	16.2′	02° 41.3	11.6′	54.2′
16	59° 01.9	55.2	334° 13.5	16.2′	02° 29.7	11.6′	54.2′
17	74° 01.6	55.0	348° 48.8	16.3′	02° 18.1	11.6′	54.2′
18	89° 01.3	S22° 54.8	3° 24.0	16.3′	S02° 06.5	11.6′	54.2′
19	104° 01.0	54.6	17° 59.3	16.3′	01° 54.8	11.6′	54.2′
20	119° 00.7	54.3	32° 34.5	16.3′	01° 43.2	11.6′	54.2′
21	134° 00.4	·· 54.1	47° 09.8	16.3′	01° 31.6	11.6′	54.2′
22	149° 00.1	53.9	61° 45.0	16.3′	01° 19.9	11.7′	54.2′
23	163° 59.8	53.7	76° 20.3	16.3′	01° 08.2	11.7′	54.3′
	SD.=16.3	d=0.2	S.D.=14.8				

Fri	GHA	Dec	GHA	v	Dec	d	HP
0	178° 59.5	S22° 53.4	90° 55.5	16.2′	S00° 56.6	11.7′	54.3′
1	193° 59.3	53.2	105° 30.8	16.2′	00° 44.9	11.7′	54.3′
2	208° 59.0	53.0	120° 06.0	16.2′	00° 33.2	11.7′	54.3′
3	223° 58.7	·· 52.7	134° 41.3	16.2′	00° 21.5	11.7′	54.3′
4	238° 58.4	52.5	149° 16.5	16.2′	S00° 09.9	11.7′	54.3′
5	253° 58.1	52.3	163° 51.7	16.2′	N00° 01.8	11.7′	54.3′
6	268° 57.8	S22° 52.0	178° 26.9	16.2′	N00° 13.5	11.7′	54.3′
7	283° 57.5	51.8	193° 02.1	16.2′	00° 25.2	11.7′	54.3′
8	298° 57.2	51.6	207° 37.3	16.2′	00° 36.9	11.7′	54.3′
9	313° 56.9	·· 51.3	222° 12.5	16.2′	00° 48.6	11.7′	54.3′
10	328° 56.6	51.1	236° 47.7	16.2′	01° 00.3	11.7′	54.3′
11	343° 56.4	50.8	251° 22.8	16.1′	01° 12.0	11.7′	54.4′
12	358° 56.1	S22° 50.6	265° 58.0	16.1′	N01° 23.7	11.7′	54.4′
13	13° 55.8	50.4	280° 33.1	16.1′	01° 35.4	11.7′	54.4′
14	28° 55.5	50.1	295° 08.2	16.1′	01° 47.1	11.7′	54.4′
15	43° 55.2	·· 49.9	309° 43.3	16.1′	01° 58.8	11.7′	54.4′
16	58° 54.9	49.6	324° 18.4	16.1′	02° 10.5	11.7′	54.4′
17	73° 54.6	49.4	338° 53.4	16.0′	02° 22.2	11.7′	54.4′
18	88° 54.3	S22° 49.2	353° 28.4	16.0′	N02° 33.9	11.7′	54.4′
19	103° 54.0	48.9	8° 03.5	16.0′	02° 45.6	11.7′	54.4′
20	118° 53.8	48.7	22° 38.4	16.0′	02° 57.3	11.7′	54.5′
21	133° 53.5	·· 48.4	37° 13.4	16.0′	03° 09.0	11.7′	54.5′
22	148° 53.2	48.2	51° 48.4	15.9′	03° 20.6	11.7′	54.5′
23	163° 52.9	47.9	66° 23.3	15.9′	03° 32.3	11.7′	54.5′
	SD.=16.3	d=0.2	S.D.=14.8				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	08:23	10:41	▬	▬	13:27	15:45
N 70°	08:05	09:49	▬	▬	14:19	16:03
68°	07:50	09:16	▬	▬	14:52	16:18
66°	07:37	08:53	10:27	13:41	15:15	16:31
64°	07:26	08:34	09:49	14:19	15:34	16:41
62°	07:17	08:18	09:23	14:45	15:49	16:51
60°	07:09	08:05	09:02	15:06	16:02	16:59
N 58°	07:02	07:54	08:45	15:23	16:14	17:06
56°	06:56	07:44	08:31	15:37	16:24	17:12
54°	06:50	07:35	08:19	15:49	16:32	17:18
52°	06:44	07:28	08:08	16:00	16:40	17:24
50°	06:39	07:20	07:58	16:09	16:47	17:29
45°	06:28	07:05	07:38	16:29	17:03	17:40
N 40°	06:18	06:52	07:22	16:46	17:16	17:50
35°	06:08	06:40	07:08	17:00	17:28	17:59
30°	06:00	06:30	06:56	17:12	17:38	18:08
20°	05:44	06:11	06:35	17:32	17:56	18:24
N 10°	05:28	05:54	06:17	17:50	18:13	18:40
0°	05:11	05:38	06:00	18:08	18:30	18:56
S 10°	04:53	05:20	05:43	18:25	18:48	19:15
20°	04:31	05:00	05:24	18:43	19:08	19:37
30°	04:02	04:35	05:03	19:05	19:32	20:05
35°	03:44	04:20	04:50	19:17	19:47	20:23
40°	03:21	04:03	04:35	19:32	20:05	20:46
45°	02:52	03:41	04:18	19:50	20:27	21:15
S 50°	02:08	03:12	03:56	20:11	20:55	21:59
52°	01:42	02:57	03:45	20:22	21:10	22:24
54°	01:02	02:40	03:33	20:34	21:27	23:03
56°	▭	02:19	03:20	20:47	21:48	▭
58°	▭	01:51	03:03	21:04	22:15	▭
S 60°	▭	01:08	02:44	21:23	22:58	▭

18

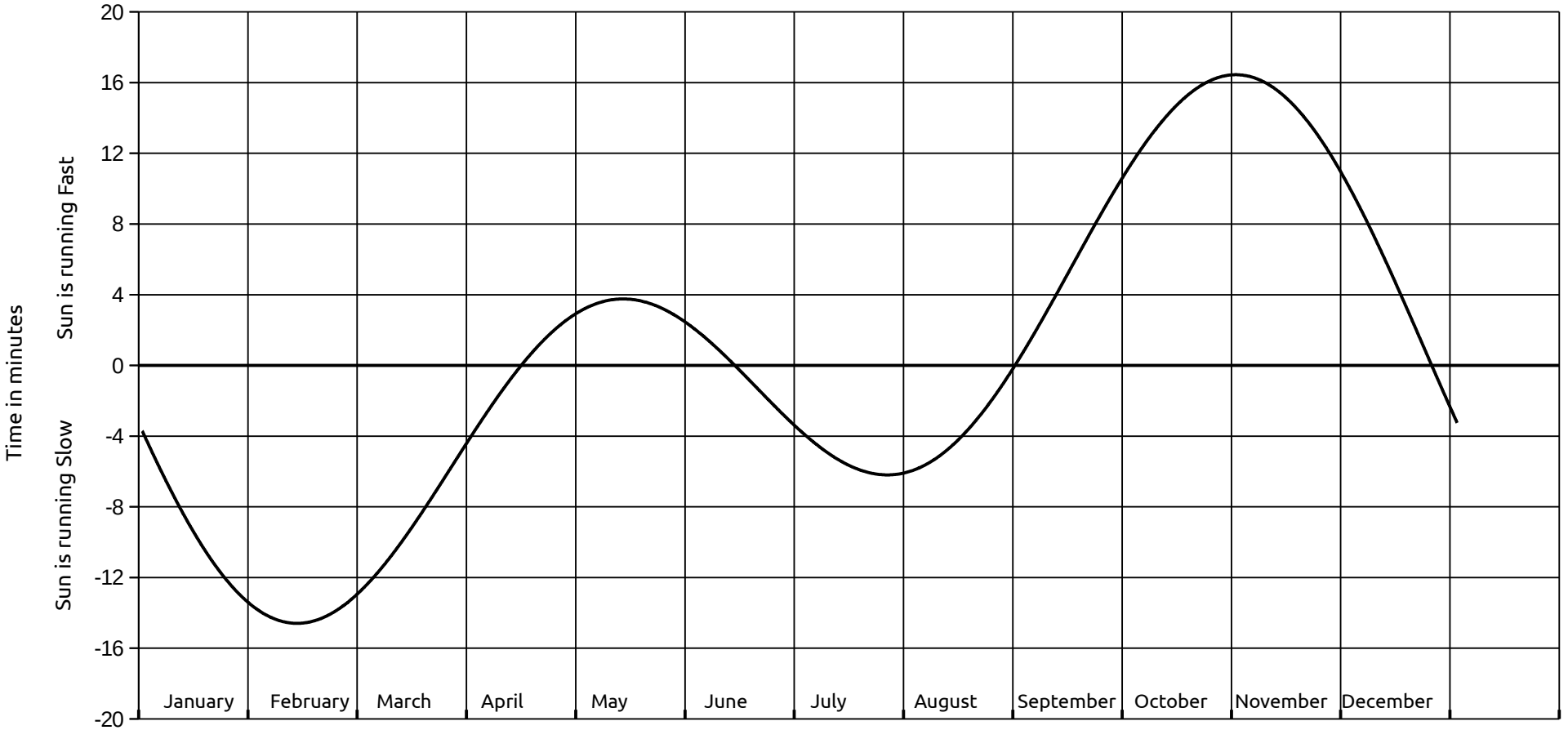
Lat.	Moonrise Wed	Moonrise Thu	Moonrise Fri	Moonset Wed	Moonset Thu	Moonset Fri
N 72°	12:37	12:18	12:00	21:58	23:43	–:–
N 70°	12:26	12:13	12:02	22:06	23:44	–:–
68°	12:17	12:10	12:03	22:14	23:45	–:–
66°	12:09	12:07	12:04	22:20	23:46	–:–
64°	12:02	12:04	12:05	22:25	23:47	–:–
62°	11:57	12:02	12:06	22:29	23:48	–:–
60°	11:52	12:00	12:07	22:33	23:49	–:–
N 58°	11:48	11:58	12:08	22:36	23:49	–:–
56°	11:44	11:56	12:08	22:39	23:50	–:–
54°	11:40	11:55	12:09	22:42	23:50	–:–
52°	11:37	11:54	12:10	22:44	23:51	–:–
50°	11:34	11:52	12:10	22:46	23:51	–:–
45°	11:28	11:50	12:11	22:51	23:52	–:–
N 40°	11:23	11:48	12:12	22:55	23:52	–:–
35°	11:18	11:46	12:13	22:58	23:53	–:–
30°	11:14	11:44	12:14	23:01	23:54	–:–
20°	11:07	11:41	12:15	23:06	23:54	–:–
N 10°	11:01	11:39	12:16	23:11	23:55	–:–
0°	10:55	11:36	12:17	23:15	23:56	–:–
S 10°	10:49	11:34	12:18	23:19	23:57	–:–
20°	10:43	11:31	12:19	23:24	23:57	–:–
30°	10:36	11:28	12:20	23:29	23:58	–:–
35°	10:32	11:26	12:21	23:31	23:59	–:–
40°	10:27	11:25	12:22	23:35	23:59	–:–
45°	10:21	11:22	12:23	23:38	–:–	00:00
S 50°	10:15	11:20	12:24	23:43	–:–	00:00
52°	10:12	11:18	12:25	23:45	–:–	00:01
54°	10:08	11:17	12:25	23:47	–:–	00:01
56°	10:05	11:15	12:26	23:49	–:–	00:01
58°	10:01	11:14	12:27	23:52	–:–	00:02
S 60°	09:56	11:12	12:28	23:55	–:–	00:02

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Age 6-8 34-53%
01	03:05	03:20	12:03	17:05	04:44	
02	03:34	03:48	12:04	17:46	05:26	
03	04:02	04:16	12:04	18:27	06:06	

9 10 3 11 3 12 13 14 15 16

file date- June 16 2020

Equation of Time
for the Sun



Equation_of_Time_Curve.odt

Celestial Navigation

useful Formulas

About Calculators

The Casio *fx-300ES Plus* is an inexpensive calculator at about 11 USD. It features *natural input* so you enter a formula just as it would be written on paper. Entering degrees, minutes and seconds is very simple. The Casio *fx-300ES Plus* has 9 memory locations and you can review many of the previous entries you make using a special key on the calculator.

Determine Hc using a calculator

The formula

Hc = asin[sin(**Declination**)*sin(**Latitude**) + cos(**Latitude**)*cos(**Declination**)*cos(**LHA**)]

As it would be entered into the Casio calculator Note- Sin^{-1} is the arc-sin key

Sin^{-1}(Sin(**Ap Latitude**) x Sin(**Declination**) + Cos(**Ap Latitude)** x Cos(**Declination**) x Cos(**LHA**)

Declination is the declination of the Celestial body you're observing. When the heavenly body's declination is *Contrary name* to your Ap Latitude enter a negative sign before it.

Latitude "The AP latitude is chosen to be the nearest whole degree in latitude to the DR latitude." *from Bowditch 2019 Vol. 1 Chapter 19 section 1902 p. 310* Consider this to be where you are, think you are or where you would like to determine Hc for. Typically, you'll be using an *Assumed position Latitude* or *Ap Latitude* as it's called. *See Bowditch 2019 Vol. 1 Chapter 19 section 1902 p. 310*

About LHA determination

Assumed Position longitude (***a* λ**) "The AP longitude is that nearest the DR longitude resulting in a whole degree of LHA for the observed body." *From Bowditch 2019 Vol. 1 Chapter 19 section 1902 p. 310*

In Western Longitudes *see Bowditch 2019 Vol. 1 Chapter 19 section 1905 p. 313*

LHA is the Local Hour Angle derived by subtracting your Assumed Longitude (***a* λ**) whole degree value from the whole degree ***GHA*** (Greenwich Hour Angle) value. If GHA is less than the ***a* λ** than the add 360° to it then subtract the ***a* λ.** *Ignore the arc minutes* of GHA and ***a* λ.**

Example when GHA is less than ***a* λ** **GHA**= 43° 25.2' ***a* λ**= W 55° 15.1'

360° + 43° = 403° Then....403° – 55° = 348° (LHA)

In Eastern Longitudes *see Bowditch 2019 Vol. 1 Chapter 19 section 1905 p. 313*

LHA**, in **Eastern Longitudes, is determined by adding the entire GHA figure (degrees and minutes) to the whole degree figure of the Assumed longitude (***a* λ**) *plus* the amount of arc minutes required to get to the next degree of the GHA. If the resulting LHA figure is greater than 360° then subtract 360° from the figure to obtain the LHA.

Example- **GHA**= 58° 01.2' ***a* λ**= E 9° 10.1' (ignore the 10.1')

Step 1- *get GHA degree difference;* 59° - 58° 01.2' = 0° 58.8'

Step 2- add *a* λ degrees to *difference* found in step 1; 9° + 0°58.8' = 9° 58.8' *a* λ

Step 3- *get LHA;* 58° 01.2 + 9° 58.8' = 68° (LHA)

Why would you want to determine Hc using a calculator?

It's faster than looking up in Pub. No. 249 and Pub. No. 229, highly accurate and you don't need a lot of printed out pages of Latitudes from Pub. No. 249 and Pub. No. 229. Pub. No. 249 Vol. 2 & 3 don't cover any declination greater than 29 degrees so you'd have to use Pub. No. 229 which is extremely large.

Celestial Navigation

Determine Z

Z = acos[(sin(**Declination**) – sin(**Ap Latitude)** x sin(**Hc**)) ÷ (cos(**Ap Latitude**) x cos(**Hc**))]

As it would be entered into the Casio calculator... Note- Cos^{-1} is the arc-cosine key

Cos^{-1}((Sin(**Declination**) – Sin(**AP Latitude**) x Sin(**Hc**)) ÷ (Cos(**AP Latitude**) x Cos(**Hc**)

If the heavenly body's declination is *Contrary name* to the Ap Latitude enter a negative sign before it.

To obtain Zn see the rules below for Northern and Southern latitudes.

Determine Z independent of Hc

$$Z = \tan^{-1}\left(\frac{\sin \mathrm{LHA}}{(\cos \mathrm{L} \tan \mathrm{d}) - (\sin \mathrm{L} \cos \mathrm{LHA})}\right)$$

"L" is latitude and "*d"* is declination. When the heavenly body's declination is *Contrary name* to your Ap Latitude enter a negative sign before it.

As it would be entered into the Casio calculator... Note- $\tan^{-1}$ is the arc-tangent key

Z = $\tan^{-1}$ ((sin (**LHA**) ÷ (cos(**AP latitude**) x tan(**declination**) – (sin(**AP latitude**) x cos(**LHA**))

The sign convention used in the calculation of this azimuth formula is as follows:
from *Bowditch Chapter 22 CALCULATIONS AND CONVERSIONS, page 331*

1) If latitude and declination are of contrary name, declination is treated as a negative quantity;
2) If the local hour angle is greater than 180°, it is treated as a negative quantity. If the azimuth angle as calculated is negative, add 180° to obtain the desired value.

To obtain Zn apply the following rules

In Northern Latitudes	**In Southern Latitudes**
LHA greater than 180°....Zn=Z	LHA greater than 180°....Zn= 180° – Z
LHA less than 180°.....Zn=360° – Z	LHA less than 180°.....Zn= 180° + Z

Determine Refraction 0.96 ÷ Tan of (Ha)
Gives good results down to about 8° from the horizon but not less.

Refraction (good overall formula from 90° to below 8° from the horizon)

$$R_0 = \cot\left(H_a + \frac{7.31}{H_a + 4.4}\right)$$

As it would be entered into the Casio calculator...

1 ÷ Tan((Ha + (7.31 ÷ (Ha + 4.4))

Both refraction formulas use the standard pressure and temperature of;

1010 mb 10° C
29.83 in 53° F

Determine Dip using feet 0.97 x (Square Root of *He* (Height of Eye) in feet)

Determine Dip using meters 1.76 x (Square Root of *He* (Height of eye) in meters)

Rules to Calculate Latitude using the Sun- *Noon-Sight*

1- Latitude and declination *Same name* but latitude is greater than declination:

Latitude= (90° – Ho) + declination

2- Latitude and declination *Same name* but declination greater than latitude:

Latitude= Declination – (90° – Ho)

3- Latitude and declination *Contrary name*:

Latitude= (90° – Ho) – Declination

To get AP longitude (needed for plotting the LOP)

In Western longitudes

Combine the DR Longitude figure with only the minutes (of arc) of the total GHA figure. The Ap λ figure will be used when plotting the LOP on the UPS.

In Eastern longitudes

In Eastern longitudes the Ap λ is determined as follows;

DR longitude + (0°60' *minus* GHA minutes of arc)

Example- E 075° + (0°60' – 0° 02')= 75° 58' Ap longitude

fair winds...clear skies and following seas
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Formula Sheet added to NA.odt

Useful Information

Time Signals- by telephone

WWV 303-499-7111 **WWVH** 808-335-4363

CHU **English:** 613-745-1576 (CHU provides only Eastern time announcements)
French: 613-745-9426

Time signals- by Radio

WWV (Fort Collins, Colorado)	2.5, 5, 10, 15, 20 MHz (male voice)
WWVH (Kauai, Hawaii)	2.5, 5, 10, 15 MHz (female voice)
CHU (Ottawa, Canada)	3330, 7850, and 14,670 kHz (USB)

Bowditch *2017- The American Practical Navigator*

https://TheNauticalAlmanac.com/2017_Bowditch-_American_Practical_Navigator.html

Organized in a convenient and useful manner. Download the Chapters, Parts or Tables you want or the entire work.

The Terrestrial Almanac Annual calendar and day planner for the entire year.

https://TheNauticalAlmanac.com/TerrestrialAlmanac.html

Pub. No. 249 Download individual Latitudes or Volumes

https://TheNauticalAlmanac.com/Pub. No. 249.html

Pub. No. 229 Download individual Volumes covering a range of Latitudes

https://TheNauticalAlmanac.com/Pub. No. 229.html

Sight Reduction Forms & Methods

https://www.TheNauticalAlmanac.com/Methods.html

January 01, 02, 03 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	100°33.5	204°26.5	S21°57.7	157°14.8	S21°04.5	271°18.5	S02°33.9	270°54.1	S01°36.0
1	115°35.9	219°25.6	58.1	172°15.2	04.1	286°20.8	34.0	285°56.4	36.1
2	130°38.4	234°24.8	58.5	187°15.7	03.6	301°23.1	34.1	300°58.8	36.1
3	145°40.8	249°23.9	·· 58.9	202°16.1	·· 03.2	316°25.4	·· 34.1	316°01.2	·· 36.1
4	160°43.3	264°23.0	59.3	217°16.5	02.8	331°27.7	34.2	331°03.6	36.1
5	175°45.8	279°22.1	21°59.7	232°16.9	02.3	346°30.0	34.2	346°06.0	36.1
6	190°48.2	294°21.2	S22°00.1	247°17.3	S21°01.9	1°32.3	S02°34.3	1°08.4	S01°36.2
7	205°50.7	309°20.4	00.5	262°17.7	01.5	16°34.6	34.4	16°10.8	36.2
8	220°53.2	324°19.5	00.8	277°18.1	01.0	31°36.9	34.4	31°13.2	36.2
9	235°55.6	339°18.6	·· 01.2	292°18.6	·· 00.6	46°39.2	·· 34.5	46°15.5	·· 36.2
10	250°58.1	354°17.7	01.6	307°19.0	21°00.2	61°41.4	34.5	61°17.9	36.2
11	266°00.6	9°16.8	02.0	322°19.4	20°59.7	76°43.7	34.6	76°20.3	36.3
12	281°03.0	24°16.0	S22°02.4	337°19.8	S20°59.3	91°46.0	S02°34.7	91°22.7	S01°36.3
13	296°05.5	39°15.1	02.8	352°20.2	58.9	106°48.3	34.7	106°25.1	36.3
14	311°08.0	54°14.2	03.2	7°20.6	58.4	121°50.6	34.8	121°27.5	36.3
15	326°10.4	69°13.3	·· 03.6	22°21.1	·· 58.0	136°52.9	·· 34.8	136°29.9	·· 36.3
16	341°12.9	84°12.4	03.9	37°21.5	57.6	151°55.2	34.9	151°32.3	36.3
17	356°15.3	99°11.5	04.3	52°21.9	57.1	166°57.5	35.0	166°34.7	36.4
18	11°17.8	114°10.7	S22°04.7	67°22.3	S20°56.7	181°59.8	S02°35.0	181°37.0	S01°36.4
19	26°20.3	129°09.8	05.1	82°22.7	56.3	197°02.1	35.1	196°39.4	36.4
20	41°22.7	144°08.9	05.5	97°23.1	55.8	212°04.4	35.1	211°41.8	36.4
21	56°25.2	159°08.0	·· 05.8	112°23.6	·· 55.4	227°06.7	·· 35.2	226°44.2	·· 36.4
22	71°27.7	174°07.1	06.2	127°24.0	54.9	242°09.0	35.3	241°46.6	36.5
23	86°30.1	189°06.2	06.6	142°24.4	54.5	257°11.3	35.3	256°49.0	36.5
Mer.pass. 17:15		ν -0.9′	d 0.4′	m -3.95	ν 0.4′	d 0.4′	m 1.20	ν 2.3′	d 0.1′ m -2.02	ν 2.4′	d 0.0′ m 0.83

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	101°32.6	204°05.3	S22°07.0	157°24.8	S20°54.1	272°13.6	S02°35.4	271°51.4	S01°36.5
1	116°35.1	219°04.5	07.3	172°25.2	53.6	287°15.9	35.4	286°53.8	36.5
2	131°37.5	234°03.6	07.7	187°25.6	53.2	302°18.2	35.5	301°56.2	36.5
3	146°40.0	249°02.7	·· 08.1	202°26.1	·· 52.7	317°20.5	·· 35.6	316°58.6	·· 36.6
4	161°42.4	264°01.8	08.4	217°26.5	52.3	332°22.8	35.6	332°01.0	36.6
5	176°44.9	279°00.9	08.8	232°26.9	51.9	347°25.1	35.7	347°03.3	36.6
6	191°47.4	294°00.0	S22°09.2	247°27.3	S20°51.4	2°27.4	S02°35.7	2°05.7	S01°36.6
7	206°49.8	308°59.1	09.5	262°27.7	51.0	17°29.7	35.8	17°08.1	36.6
8	221°52.3	323°58.2	09.9	277°28.1	50.5	32°32.0	35.8	32°10.5	36.6
9	236°54.8	338°57.4	·· 10.3	292°28.6	·· 50.1	47°34.3	·· 35.9	47°12.9	·· 36.7
10	251°57.2	353°56.5	10.6	307°29.0	49.6	62°36.6	36.0	62°15.3	36.7
11	266°59.7	8°55.6	11.0	322°29.4	49.2	77°38.9	36.0	77°17.7	36.7
12	282°02.2	23°54.7	S22°11.3	337°29.8	S20°48.8	92°41.2	S02°36.1	92°20.1	S01°36.7
13	297°04.6	38°53.8	11.7	352°30.2	48.3	107°43.5	36.1	107°22.5	36.7
14	312°07.1	53°52.9	12.0	7°30.7	47.9	122°45.8	36.2	122°24.9	36.8
15	327°09.6	68°52.0	·· 12.4	22°31.1	·· 47.4	137°48.1	·· 36.2	137°27.3	·· 36.8
16	342°12.0	83°51.1	12.8	37°31.5	47.0	152°50.4	36.3	152°29.7	36.8
17	357°14.5	98°50.2	13.1	52°31.9	46.5	167°52.7	36.4	167°32.1	36.8
18	12°16.9	113°49.3	S22°13.5	67°32.3	S20°46.1	182°55.0	S02°36.4	182°34.4	S01°36.8
19	27°19.4	128°48.4	13.8	82°32.8	45.6	197°57.3	36.5	197°36.8	36.8
20	42°21.9	143°47.6	14.2	97°33.2	45.2	212°59.6	36.5	212°39.2	36.9
21	57°24.3	158°46.7	·· 14.5	112°33.6	·· 44.7	228°01.9	·· 36.6	227°41.6	·· 36.9
22	72°26.8	173°45.8	14.9	127°34.0	44.3	243°04.2	36.6	242°44.0	36.9
23	87°29.3	188°44.9	15.2	142°34.4	43.9	258°06.6	36.7	257°46.4	36.9
Mer.pass. 17:11		ν -0.9′	d 0.4′	m -3.95	ν 0.4′	d 0.4′	m 1.20	ν 2.3′	d 0.1′ m -2.03	ν 2.4′	d 0.0′ m 0.83

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	102°31.7	203°44.0	S22°15.6	157°34.9	S20°43.4	273°08.9	S02°36.8	272°48.8	S01°36.9
1	117°34.2	218°43.1	15.9	172°35.3	43.0	288°11.2	36.8	287°51.2	36.9
2	132°36.7	233°42.2	16.2	187°35.7	42.5	303°13.5	36.9	302°53.6	37.0
3	147°39.1	248°41.3	·· 16.6	202°36.1	·· 42.1	318°15.8	·· 36.9	317°56.0	·· 37.0
4	162°41.6	263°40.4	16.9	217°36.5	41.6	333°18.1	37.0	332°58.4	37.0
5	177°44.1	278°39.5	17.3	232°37.0	41.2	348°20.4	37.0	348°00.8	37.0
6	192°46.5	293°38.6	S22°17.6	247°37.4	S20°40.7	3°22.7	S02°37.1	3°03.2	S01°37.0
7	207°49.0	308°37.7	17.9	262°37.8	40.3	18°25.0	37.1	18°05.6	37.0
8	222°51.4	323°36.8	18.3	277°38.2	39.8	33°27.3	37.2	33°08.0	37.1
9	237°53.9	338°35.9	·· 18.6	292°38.7	·· 39.3	48°29.6	·· 37.3	48°10.4	·· 37.1
10	252°56.4	353°35.0	18.9	307°39.1	38.9	63°31.9	37.3	63°12.8	37.1
11	267°58.8	8°34.1	19.3	322°39.5	38.4	78°34.2	37.4	78°15.2	37.1
12	283°01.3	23°33.2	S22°19.6	337°39.9	S20°38.0	93°36.5	S02°37.4	93°17.6	S01°37.1
13	298°03.8	38°32.3	19.9	352°40.3	37.5	108°38.9	37.5	108°20.0	37.1
14	313°06.2	53°31.4	20.3	7°40.8	37.1	123°41.2	37.5	123°22.4	37.1
15	328°08.7	68°30.5	·· 20.6	22°41.2	·· 36.6	138°43.5	·· 37.6	138°24.8	·· 37.2
16	343°11.2	83°29.6	20.9	37°41.6	36.2	153°45.8	37.6	153°27.1	37.2
17	358°13.6	98°28.7	21.3	52°42.0	35.7	168°48.1	37.7	168°29.5	37.2
18	13°16.1	113°27.8	S22°21.6	67°42.5	S20°35.3	183°50.4	S02°37.7	183°31.9	S01°37.2
19	28°18.6	128°26.9	21.9	82°42.9	34.8	198°52.7	37.8	198°34.3	37.2
20	43°21.0	143°26.0	22.2	97°43.3	34.3	213°55.0	37.8	213°36.7	37.2
21	58°23.5	158°25.1	·· 22.5	112°43.7	·· 33.9	228°57.3	·· 37.9	228°39.1	·· 37.3
22	73°25.9	173°24.2	22.9	127°44.2	33.4	243°59.6	38.0	243°41.5	37.3
23	88°28.4	188°23.3	23.2	142°44.6	33.0	259°02.0	38.0	258°43.9	37.3
Mer.pass. 17:07		ν -0.9′	d 0.3′	m -3.94	ν 0.4′	d 0.4′	m 1.20	ν 2.3′	d 0.1′ m -2.03	ν 2.4′	d 0.0′ m 0.82

Stars

	SHA	Dec
Alpheratz	358°09.1	28°59.2
Ankaa	353°40.1	-42°24.9
Schedar	350°08.7	56°26.2
Diphda	349°20.7	-18°05.7
Achernar	335°45.0	-57°20.4
Hamal	328°28.5	23°22.4
Polaris	326°37.4	89°10.9
Acamar	315°36.8	-40°23.2
Menkar	314°40.7	4°00.8
Mirfak	309°15.4	49°47.7
Aldebaran	291°17.5	16°28.2
Rigel	281°35.5	-8°13.5
Capella	281°10.5	45°58.8
Bellatrix	278°58.2	6°19.9
Elnath	278°43.5	28°35.5
Alnilam	276°11.1	-1°12.9
Betelgeuse	271°27.7	7°24.1
Canopus	264°06.6	-52°41.2
Sirius	258°55.1	-16°41.5
Adhara	255°31.6	-28°56.8
Procyon	245°25.2	5°16.4
Pollux	243°57.6	28°04.3
Avior	234°27.5	-59°26.8
Suhail	223°10.2	-43°21.2
Miaplacidus	221°44.1	-69°38.2
Alphard	218°20.1	-8°34.5
Regulus	208°09.6	12°03.6
Dubhe	194°21.6	61°51.0
Denebola	182°58.8	14°40.7
Gienah	176°17.7	-17°26.0
Acrux	173°37.0	-62°59.2
Gacrux	172°28.4	-57°00.0
Alioth	166°42.4	56°03.6
Spica	158°57.4	-11°03.6
Alkaid	153°18.5	49°24.3
Hadar	149°23.3	-60°16.5
Menkent	148°36.9	-36°16.3
Arcturus	146°18.4	19°16.9
Rigil Kent.	140°25.8	-60°44.9
Kochab	137°19.7	74°13.8
Zuben'ubi	137°33.0	-15°57.6
Alphecca	126°32.2	26°46.7
Antares	112°56.9	-26°23.3
Atria	108°21.5	-68°59.4
Sabik	102°41.2	-15°42.0
Shaula	96°55.9	-37°05.3
Rasalhague	96°29.7	12°34.4
Eltanin	90°58.2	51°29.5
Kaus Aust.	84°17.0	-34°23.6
Vega	80°56.1	38°46.0
Nunki	76°29.3	-26°19.2
Altair	62°32.7	8°49.1
Peacock	53°58.7	-56°47.9
Deneb	49°48.7	45°12.9
Enif	34°11.6	9°47.3
Al Na'ir	28°15.0	-47°03.4
Fomalhaut	15°51.4	-29°43.6
Scheat	14°17.5	27°58.8
Markab	14°03.1	15°06.2

Jan 01 Thu	SHA	Mer.pass
Venus	103°53.1	10:23
Mars	56°41.4	13:31
Jupiter	170°45.1	05:54
Saturn	170°20.6	05:55

Jan 02 Fri	SHA	Mer.pass
Venus	102°32.8	10:24
Mars	55°52.2	13:30
Jupiter	170°41.0	05:50
Saturn	170°18.8	05:52

Jan 03 Sat	SHA	Mer.pass
Venus	101°12.2	10:26
Mars	55°03.1	13:29
Jupiter	170°37.1	05:47
Saturn	170°17.1	05:48

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h

Thu	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	179°09.0	S23°01.5	241°12.2	14.8′	S09°54.2	9.1′	54.2′
1	194°08.7	01.3	255°46.0	14.7′	10°03.3	9.0′	54.2′
2	209°08.4	01.1	270°19.7	14.7′	10°12.3	9.0′	54.2′
3	224°08.1	·· 00.9	284°53.4	14.7′	10°21.3	9.0′	54.2′
4	239°07.8	00.7	299°27.1	14.6′	10°30.3	8.9′	54.2′
5	254°07.5	00.5	314°00.7	14.6′	10°39.2	8.9′	54.2′
6	269°07.2	S23°00.3	328°34.3	14.5′	S10°48.1	8.9′	54.2′
7	284°06.9	23°00.1	343°07.8	14.5′	10°57.0	8.8′	54.3′
8	299°06.6	22°59.9	357°41.3	14.5′	11°05.8	8.8′	54.3′
9	314°06.3	·· 59.7	12°14.8	14.4′	11°14.6	8.7′	54.3′
10	329°06.0	59.5	26°48.2	14.4′	11°23.3	8.7′	54.3′
11	344°05.7	59.3	41°21.5	14.3′	11°32.0	8.6′	54.3′
12	359°05.5	S22°59.1	55°54.9	14.3′	S11°40.6	8.6′	54.3′
13	14°05.2	58.8	70°28.2	14.2′	11°49.2	8.6′	54.3′
14	29°04.9	58.6	85°01.4	14.2′	11°57.8	8.5′	54.3′
15	44°04.6	·· 58.4	99°34.6	14.2′	12°06.3	8.4′	54.3′
16	59°04.3	58.2	114°07.8	14.1′	12°14.7	8.4′	54.3′
17	74°04.0	58.0	128°40.9	14.1′	12°23.1	8.4′	54.4′
18	89°03.7	S22°57.8	143°13.9	14.0′	S12°31.5	8.3′	54.4′
19	104°03.4	57.6	157°47.0	14.0′	12°39.8	8.3′	54.4′
20	119°03.1	57.4	172°19.9	13.9′	12°48.1	8.2′	54.4′
21	134°02.8	·· 57.1	186°52.8	13.9′	12°56.3	8.2′	54.4′
22	149°02.5	56.9	201°25.7	13.8′	13°04.5	8.1′	54.4′
23	164°02.2	56.7	215°58.5	13.8′	13°12.6	8.0′	54.4′
	SD = 16.3′	d = 0.2′	SD = 14.8′				

Fri	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	179°01.9	S22°56.5	230°31.3	13.7′	S13°20.6	8.0′	54.4′
1	194°01.6	56.3	245°04.0	13.7′	13°28.6	8.0′	54.5′
2	209°01.3	56.0	259°36.7	13.6′	13°36.6	7.9′	54.5′
3	224°01.0	·· 55.8	274°09.3	13.6′	13°44.5	7.8′	54.5′
4	239°00.8	55.6	288°41.9	13.5′	13°52.3	7.8′	54.5′
5	254°00.5	55.4	303°14.4	13.5′	14°00.1	7.7′	54.5′
6	269°00.2	S22°55.1	317°46.9	13.4′	S14°07.8	7.7′	54.5′
7	283°59.9	54.9	332°19.3	13.4′	14°15.5	7.6′	54.5′
8	298°59.6	54.7	346°51.7	13.3′	14°23.1	7.6′	54.6′
9	313°59.3	·· 54.5	1°24.0	13.3′	14°30.7	7.5′	54.6′
10	328°59.0	54.2	15°56.3	13.2′	14°38.2	7.4′	54.6′
11	343°58.7	54.0	30°28.5	13.2′	14°45.6	7.4′	54.6′
12	358°58.4	S22°53.8	45°00.6	13.1′	S14°53.0	7.3′	54.6′
13	13°58.1	53.6	59°32.7	13.0′	15°00.3	7.2′	54.6′
14	28°57.8	53.3	74°04.7	13.0′	15°07.5	7.2′	54.6′
15	43°57.5	·· 53.1	88°36.7	12.9′	15°14.7	7.2′	54.7′
16	58°57.3	52.9	103°08.7	12.9′	15°21.9	7.0′	54.7′
17	73°57.0	52.6	117°40.5	12.8′	15°28.9	7.0′	54.7′
18	88°56.7	S22°52.4	132°12.4	12.8′	S15°35.9	6.9′	54.7′
19	103°56.4	52.2	146°44.1	12.7′	15°42.8	6.9′	54.7′
20	118°56.1	51.9	161°15.8	12.7′	15°49.7	6.8′	54.7′
21	133°55.8	·· 51.7	175°47.5	12.6′	15°56.5	6.7′	54.8′
22	148°55.5	51.5	190°19.1	12.5′	16°03.2	6.7′	54.8′
23	163°55.2	51.2	204°50.6	12.5′	16°09.9	6.6′	54.8′
	SD = 16.3′	d = 0.2′	SD = 14.8′				

Sat	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	178°54.9	S22°51.0	219°22.1	12.4′	S16°16.5	6.5′	54.8′
1	193°54.6	50.7	233°53.5	12.4′	16°23.0	6.4′	54.8′
2	208°54.3	50.5	248°24.9	12.3′	16°29.4	6.4′	54.8′
3	223°54.1	·· 50.3	262°56.2	12.3′	16°35.8	6.3′	54.9′
4	238°53.8	50.0	277°27.5	12.2′	16°42.1	6.3′	54.9′
5	253°53.5	49.8	291°58.7	12.1′	16°48.4	6.1′	54.9′
6	268°53.2	S22°49.5	306°29.8	12.1′	S16°54.5	6.1′	54.9′
7	283°52.9	49.3	321°00.9	12.0′	17°00.6	6.0′	54.9′
8	298°52.6	49.0	335°31.9	12.0′	17°06.6	5.9′	55.0′
9	313°52.3	·· 48.8	350°02.9	11.9′	17°12.5	5.9′	55.0′
10	328°52.0	48.6	4°33.8	11.8′	17°18.4	5.8′	55.0′
11	343°51.8	48.3	19°04.6	11.8′	17°24.2	5.7′	55.0′
12	358°51.5	S22°48.1	33°35.4	11.7′	S17°29.9	5.6′	55.0′
13	13°51.2	47.8	48°06.1	11.7′	17°35.5	5.5′	55.1′
14	28°50.9	47.6	62°36.8	11.6′	17°41.0	5.5′	55.1′
15	43°50.6	·· 47.3	77°07.4	11.6′	17°46.5	5.3′	55.1′
16	58°50.3	47.1	91°38.0	11.5′	17°51.8	5.3′	55.1′
17	73°50.0	46.8	106°08.5	11.4′	17°57.1	5.3′	55.1′
18	88°49.7	S22°46.6	120°38.9	11.4′	S18°02.4	5.1′	55.1′
19	103°49.5	46.3	135°09.3	11.3′	18°07.5	5.0′	55.2′
20	118°49.2	46.1	149°39.6	11.3′	18°12.5	5.0′	55.2′
21	133°48.9	·· 45.8	164°09.9	11.2′	18°17.5	4.9′	55.2′
22	148°48.6	45.5	178°40.1	11.2′	18°22.4	4.7′	55.2′
23	163°48.3	45.3	193°10.3	11.1′	18°27.1	4.7′	55.3′
	SD = 16.3′	d = 0.2′	SD = 14.9′				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	08:23	10:40	▬	▬	13:29	15:46
N 70°	08:04	09:48	▬	▬	14:20	16:04
68°	07:49	09:16	▬	▬	14:53	16:19
66°	07:37	08:52	10:26	13:42	15:16	16:32
64°	07:26	08:34	09:49	14:20	15:35	16:42
62°	07:17	08:18	09:22	14:46	15:50	16:51
60°	07:09	08:05	09:02	15:07	16:03	16:59
N 58°	07:02	07:54	08:45	15:23	16:14	17:06
56°	06:56	07:44	08:31	15:37	16:24	17:13
54°	06:50	07:36	08:19	15:50	16:33	17:19
52°	06:44	07:28	08:08	16:00	16:41	17:24
50°	06:39	07:20	07:59	16:10	16:48	17:29
45°	06:28	07:05	07:38	16:30	17:04	17:41
N 40°	06:18	06:52	07:22	16:46	17:17	17:51
35°	06:09	06:40	07:08	17:00	17:28	18:00
30°	06:00	06:30	06:56	17:12	17:38	18:08
20°	05:44	06:12	06:36	17:33	17:57	18:24
N 10°	05:28	05:55	06:17	17:51	18:14	18:40
0°	05:12	05:38	06:00	18:08	18:30	18:56
S 10°	04:53	05:20	05:43	18:25	18:48	19:15
20°	04:31	05:00	05:25	18:43	19:08	19:37
30°	04:03	04:36	05:03	19:05	19:32	20:05
35°	03:44	04:21	04:50	19:18	19:47	20:23
40°	03:22	04:03	04:36	19:32	20:05	20:46
45°	02:52	03:41	04:18	19:50	20:27	21:15
S 50°	02:09	03:12	03:56	20:11	20:55	21:59
52°	01:43	02:58	03:46	20:22	21:10	22:24
54°	01:03	02:41	03:34	20:34	21:27	23:03
56°	////	02:19	03:20	20:47	21:48	////
58°	////	01:52	03:04	21:03	22:15	////
S 60°	////	01:09	02:45	21:23	22:57	////

Lat.	Moonrise Thu	Moonrise Fri	Moonrise Sat	Moonset Thu	Moonset Fri	Moonset Sat
N 72°	04:24	06:15	08:31	11:37	11:19	10:41
N 70°	04:06	05:44	07:29	11:57	11:51	11:43
68°	03:52	05:22	06:54	12:12	12:14	12:19
66°	03:41	05:05	06:29	12:25	12:32	12:44
64°	03:31	04:51	06:10	12:35	12:47	13:04
62°	03:23	04:39	05:54	12:44	13:00	13:20
60°	03:16	04:29	05:41	12:52	13:10	13:34
N 58°	03:10	04:20	05:30	12:59	13:20	13:46
56°	03:04	04:12	05:20	13:05	13:28	13:56
54°	02:59	04:06	05:12	13:11	13:35	14:05
52°	02:55	04:00	05:04	13:16	13:42	14:13
50°	02:51	03:54	04:57	13:20	13:48	14:20
45°	02:42	03:42	04:42	13:30	14:00	14:35
N 40°	02:35	03:32	04:30	13:38	14:11	14:48
35°	02:29	03:24	04:20	13:45	14:20	14:59
30°	02:24	03:17	04:11	13:51	14:28	15:09
20°	02:15	03:04	03:56	14:02	14:42	15:25
N 10°	02:07	02:53	03:42	14:11	14:54	15:39
0°	01:59	02:43	03:30	14:20	15:05	15:53
S 10°	01:52	02:33	03:17	14:29	15:17	16:06
20°	01:44	02:22	03:04	14:38	15:29	16:21
30°	01:35	02:10	02:49	14:49	15:43	16:37
35°	01:30	02:03	02:40	14:56	15:51	16:47
40°	01:24	01:55	02:30	15:03	16:00	16:58
45°	01:17	01:46	02:18	15:11	16:11	17:11
S 50°	01:09	01:35	02:04	15:21	16:24	17:27
52°	01:05	01:29	01:58	15:26	16:30	17:34
54°	01:01	01:24	01:51	15:31	16:37	17:42
56°	00:57	01:17	01:43	15:37	16:45	17:52
58°	00:52	01:10	01:34	15:43	16:53	18:02
S 60°	00:46	01:02	01:23	15:51	17:03	18:14

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 25-27 25-11%
01	03:24	03:38	12:04	08:10	20:32	
02	03:52	04:06	12:04	08:54	21:17	
03	04:20	04:34	12:05	09:41	22:06	

January 04, 05, 06 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	103°30.9	203°22.4	S22°23.5	157°45.0	S20°32.5	274°04.3	S02°38.1	273°46.3	S01°37.3
1	118°33.3	218°21.5	23.8	172°45.4	32.1	289°06.6	38.1	288°48.7	37.3
2	133°35.8	233°20.6	24.1	187°45.9	31.6	304°08.9	38.2	303°51.1	37.3
3	148°38.3	248°19.7	·· 24.4	202°46.3	·· 31.1	319°11.2	·· 38.2	318°53.5	·· 37.3
4	163°40.7	263°18.8	24.8	217°46.7	30.7	334°13.5	38.3	333°55.9	37.4
5	178°43.2	278°17.9	25.1	232°47.1	30.2	349°15.8	38.3	348°58.3	37.4
6	193°45.7	293°17.0	S22°25.4	247°47.6	S20°29.8	4°18.2	S02°38.4	4°00.7	S01°37.4
7	208°48.1	308°16.1	25.7	262°48.0	29.3	19°20.5	38.4	19°03.1	37.4
8	223°50.6	323°15.2	26.0	277°48.4	28.8	34°22.8	38.5	34°05.5	37.4
9	238°53.0	338°14.3	·· 26.3	292°48.8	·· 28.4	49°25.1	·· 38.5	49°07.9	·· 37.4
10	253°55.5	353°13.4	26.6	307°49.3	27.9	64°27.4	38.6	64°10.3	37.4
11	268°58.0	8°12.5	26.9	322°49.7	27.4	79°29.7	38.6	79°12.7	37.5
12	284°00.4	23°11.6	S22°27.2	337°50.1	S20°27.0	94°32.0	S02°38.7	94°15.1	S01°37.5
13	299°02.9	38°10.7	27.5	352°50.5	26.5	109°34.4	38.7	109°17.5	37.5
14	314°05.4	53°09.8	27.8	7°51.0	26.1	124°36.7	38.8	124°19.9	37.5
15	329°07.8	68°08.9	·· 28.1	22°51.4	·· 25.6	139°39.0	·· 38.8	139°22.3	·· 37.5
16	344°10.3	83°08.0	28.4	37°51.8	25.1	154°41.3	38.9	154°24.7	37.5
17	359°12.8	98°07.1	28.7	52°52.2	24.7	169°43.6	38.9	169°27.1	37.5
18	14°15.2	113°06.2	S22°29.0	67°52.7	S20°24.2	184°45.9	S02°39.0	184°29.5	S01°37.6
19	29°17.7	128°05.3	29.3	82°53.1	23.7	199°48.3	39.0	199°31.9	37.6
20	44°20.2	143°04.4	29.6	97°53.5	23.3	214°50.6	39.1	214°34.3	37.6
21	59°22.6	158°03.5	·· 29.9	112°54.0	·· 22.8	229°52.9	·· 39.1	229°36.7	·· 37.6
22	74°25.1	173°02.6	30.2	127°54.4	22.3	244°55.2	39.2	244°39.1	37.6
23	89°27.5	188°01.7	30.5	142°54.8	21.9	259°57.5	39.2	259°41.5	37.6
Mer.pass. 17:03		ν -0.9′	d 0.3′	m -3.94	ν 0.4′	d 0.5′	m 1.20	ν 2.3′	d 0.1′ m -2.04	ν 2.4′	d 0.0′ m 0.82

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	104°30.0	203°00.7	S22°30.8	157°55.2	S20°21.4	274°59.8	S02°39.3	274°44.0	S01°37.6
1	119°32.5	217°59.8	31.1	172°55.7	20.9	290°02.2	39.3	289°46.4	37.7
2	134°34.9	232°58.9	31.4	187°56.1	20.5	305°04.5	39.4	304°48.8	37.7
3	149°37.4	247°58.0	·· 31.6	202°56.5	·· 20.0	320°06.8	·· 39.4	319°51.2	·· 37.7
4	164°39.9	262°57.1	31.9	217°57.0	19.5	335°09.1	39.5	334°53.6	37.7
5	179°42.3	277°56.2	32.2	232°57.4	19.1	350°11.4	39.5	349°56.0	37.7
6	194°44.8	292°55.3	S22°32.5	247°57.8	S20°18.6	5°13.8	S02°39.6	4°58.4	S01°37.7
7	209°47.3	307°54.4	32.8	262°58.2	18.1	20°16.1	39.6	20°00.8	37.7
8	224°49.7	322°53.5	33.1	277°58.7	17.6	35°18.4	39.7	35°03.2	37.7
9	239°52.2	337°52.6	·· 33.3	292°59.1	·· 17.2	50°20.7	·· 39.7	50°05.6	·· 37.8
10	254°54.7	352°51.7	33.6	307°59.5	16.7	65°23.1	39.8	65°08.0	37.8
11	269°57.1	7°50.7	33.9	323°00.0	16.2	80°25.4	39.8	80°10.4	37.8
12	284°59.6	22°49.8	S22°34.2	338°00.4	S20°15.8	95°27.7	S02°39.9	95°12.8	S01°37.8
13	300°02.0	37°48.9	34.4	353°00.8	15.3	110°30.0	39.9	110°15.2	37.8
14	315°04.5	52°48.0	34.7	8°01.3	14.8	125°32.3	40.0	125°17.6	37.8
15	330°07.0	67°47.1	·· 35.0	23°01.7	·· 14.3	140°34.7	·· 40.0	140°20.0	·· 37.8
16	345°09.4	82°46.2	35.3	38°02.1	13.9	155°37.0	40.1	155°22.4	37.8
17	0°11.9	97°45.3	35.5	53°02.5	13.4	170°39.3	40.1	170°24.8	37.9
18	15°14.4	112°44.4	S22°35.8	68°03.0	S20°12.9	185°41.6	S02°40.2	185°27.2	S01°37.9
19	30°16.8	127°43.5	36.1	83°03.4	12.4	200°44.0	40.2	200°29.6	37.9
20	45°19.3	142°42.5	36.3	98°03.8	12.0	215°46.3	40.3	215°32.0	37.9
21	60°21.8	157°41.6	·· 36.6	113°04.3	·· 11.5	230°48.6	·· 40.3	230°34.4	·· 37.9
22	75°24.2	172°40.7	36.9	128°04.7	11.0	245°50.9	40.4	245°36.9	37.9
23	90°26.7	187°39.8	37.1	143°05.1	10.5	260°53.3	40.4	260°39.3	37.9
Mer.pass. 16:59		ν -0.9′	d 0.3′	m -3.94	ν 0.4′	d 0.5′	m 1.19	ν 2.3′	d 0.0′ m -2.05	ν 2.4′	d 0.0′ m 0.81

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	105°29.2	202°38.9	S22°37.4	158°05.6	S20°10.1	275°55.6	S02°40.5	275°41.7	S01°37.9
1	120°31.6	217°38.0	37.6	173°06.0	09.6	290°57.9	40.5	290°44.1	38.0
2	135°34.1	232°37.1	37.9	188°06.4	09.1	306°00.2	40.6	305°46.5	38.0
3	150°36.5	247°36.2	·· 38.2	203°06.9	·· 08.6	321°02.6	·· 40.6	320°48.9	·· 38.0
4	165°39.0	262°35.2	38.4	218°07.3	08.1	336°04.9	40.6	335°51.3	38.0
5	180°41.5	277°34.3	38.7	233°07.7	07.7	351°07.2	40.7	350°53.7	38.0
6	195°43.9	292°33.4	S22°38.9	248°08.2	S20°07.2	6°09.5	S02°40.7	5°56.1	S01°38.0
7	210°46.4	307°32.5	39.2	263°08.6	06.7	21°11.9	40.8	20°58.5	38.0
8	225°48.9	322°31.6	39.4	278°09.0	06.2	36°14.2	40.8	36°00.9	38.0
9	240°51.3	337°30.7	·· 39.7	293°09.5	·· 05.7	51°16.5	·· 40.9	51°03.3	·· 38.0
10	255°53.8	352°29.8	39.9	308°09.9	05.3	66°18.9	40.9	66°05.7	38.1
11	270°56.3	7°28.8	40.2	323°10.3	04.8	81°21.2	41.0	81°08.2	38.1
12	285°58.7	22°27.9	S22°40.4	338°10.8	S20°04.3	96°23.5	S02°41.0	96°10.6	S01°38.1
13	301°01.2	37°27.0	40.7	353°11.2	03.8	111°25.8	41.1	111°13.0	38.1
14	316°03.7	52°26.1	40.9	8°11.6	03.3	126°28.2	41.1	126°15.4	38.1
15	331°06.1	67°25.2	·· 41.2	23°12.1	·· 02.8	141°30.5	·· 41.2	141°17.8	·· 38.1
16	346°08.6	82°24.3	41.4	38°12.5	02.4	156°32.8	41.2	156°20.2	38.1
17	1°11.0	97°23.3	41.6	53°12.9	01.9	171°35.2	41.2	171°22.6	38.1
18	16°13.5	112°22.4	S22°41.9	68°13.4	S20°01.4	186°37.5	S02°41.3	186°25.0	S01°38.1
19	31°16.0	127°21.5	42.1	83°13.8	00.9	201°39.8	41.3	201°27.4	38.1
20	46°18.4	142°20.6	42.4	98°14.2	20°00.4	216°42.2	41.4	216°29.8	38.2
21	61°20.9	157°19.7	·· 42.6	113°14.7	19°59.9	231°44.5	·· 41.4	231°32.3	·· 38.2
22	76°23.4	172°18.8	42.8	128°15.1	59.5	246°46.8	41.5	246°34.7	38.2
23	91°25.8	187°17.8	43.1	143°15.5	59.0	261°49.2	41.5	261°37.1	38.2
Mer.pass. 16:55		ν -0.9′	d 0.3′	m -3.94	ν 0.4′	d 0.5′	m 1.19	ν 2.3′	d 0.0′ m -2.05	ν 2.4′	d 0.0′ m 0.81

Stars

	SHA	**Dec**
Alpheratz	358°09.2	28°59.2
Ankaa	353°40.1	-42°24.9
Schedar	350°08.8	56°26.2
Diphda	349°20.7	-18°05.7
Achernar	335°45.0	-57°20.4
Hamal	328°28.5	23°22.4
Polaris	326°38.3	89°10.9
Acamar	315°36.9	-40°23.2
Menkar	314°40.7	4°00.8
Mirfak	309°15.5	49°47.7
Aldebaran	291°17.5	16°28.2
Rigel	281°35.5	-8°13.5
Capella	281°10.5	45°58.8
Bellatrix	278°58.2	6°19.9
Elnath	278°43.5	28°35.5
Alnilam	276°11.1	-1°12.9
Betelgeuse	271°27.7	7°24.1
Canopus	264°06.6	-52°41.3
Sirius	258°55.1	-16°41.5
Adhara	255°31.5	-28°56.8
Procyon	245°25.2	5°16.4
Pollux	243°57.5	28°04.3
Avior	234°27.5	-59°26.8
Suhail	223°10.2	-43°21.2
Miaplacidus	221°44.1	-69°38.2
Alphard	218°20.1	-8°34.6
Regulus	208°09.6	12°03.6
Dubhe	194°21.6	61°51.0
Denebola	182°58.7	14°40.7
Gienah	176°17.7	-17°26.0
Acrux	173°36.9	-62°59.3
Gacrux	172°28.4	-57°00.1
Alioth	166°42.4	56°03.6
Spica	158°57.4	-11°03.6
Alkaid	153°18.5	49°24.3
Hadar	149°23.2	-60°16.5
Menkent	148°36.9	-36°16.3
Arcturus	146°18.4	19°16.8
Rigil Kent.	140°25.8	-60°44.9
Kochab	137°19.7	74°13.8
Zuben'ubi	137°33.0	-15°57.6
Alphecca	126°32.2	26°46.7
Antares	112°56.9	-26°23.3
Atria	108°21.5	-68°59.4
Sabik	102°41.2	-15°42.0
Shaula	96°55.9	-37°05.3
Rasalhague	96°29.7	12°34.4
Eltanin	90°58.2	51°29.5
Kaus Aust.	84°17.0	-34°23.6
Vega	80°56.1	38°46.0
Nunki	76°29.3	-26°19.2
Altair	62°32.7	8°49.1
Peacock	53°58.7	-56°47.9
Deneb	49°48.7	45°12.8
Enif	34°11.6	9°47.2
Al Na'ir	28°15.0	-47°03.4
Fomalhaut	15°51.4	-29°43.6
Scheat	14°17.5	27°58.8
Markab	14°03.1	15°06.2

Jan 04 Sun	**SHA**	**Mer.pass**
Venus	99°51.6	10:27
Mars	54°14.1	13:29
Jupiter	170°33.4	05:43
Saturn	170°15.5	05:44

Jan 05 Mon	**SHA**	**Mer.pass**
Venus	98°30.7	10:29
Mars	53°25.2	13:28
Jupiter	170°29.8	05:39
Saturn	170°13.9	05:40

Jan 06 Tue	**SHA**	**Mer.pass**
Venus	97°09.7	10:30
Mars	52°36.4	13:27
Jupiter	170°26.4	05:35
Saturn	170°12.5	05:36

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = -0.2034 sec ΔT = TT-UT1 = +51.3874 sec

1981 January 04 to Jan. 06 UT

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Sun	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	178°48.0	S22°45.0	207°40.4	11.0′	S18°31.8	4.6′	55.3′
1	193°47.7	44.8	222°10.4	11.0′	18°36.4	4.6′	55.3′
2	208°47.5	44.5	236°40.4	10.9′	18°41.0	4.4′	55.3′
3	223°47.2	·· 44.3	251°10.3	10.9′	18°45.4	4.3′	55.3′
4	238°46.9	44.0	265°40.2	10.8′	18°49.7	4.3′	55.4′
5	253°46.6	43.7	280°10.0	10.8′	18°54.0	4.2′	55.4′
6	268°46.3	S22°43.5	294°39.8	10.7′	S18°58.2	4.0′	55.4′
7	283°46.0	43.2	309°09.5	10.7′	19°02.2	4.0′	55.4′
8	298°45.7	42.9	323°39.2	10.6′	19°06.2	3.9′	55.4′
9	313°45.5	·· 42.7	338°08.8	10.6′	19°10.1	3.8′	55.5′
10	328°45.2	42.4	352°38.3	10.5′	19°13.9	3.7′	55.5′
11	343°44.9	42.1	7°07.8	10.4′	19°17.6	3.6′	55.5′
12	358°44.6	S22°41.9	21°37.3	10.4′	S19°21.2	3.5′	55.5′
13	13°44.3	41.6	36°06.7	10.3′	19°24.7	3.4′	55.6′
14	28°44.0	41.3	50°36.0	10.3′	19°28.1	3.3′	55.6′
15	43°43.8	·· 41.1	65°05.3	10.2′	19°31.4	3.2′	55.6′
16	58°43.5	40.8	79°34.5	10.2′	19°34.6	3.1′	55.6′
17	73°43.2	40.5	94°03.7	10.1′	19°37.7	3.0′	55.6′
18	88°42.9	S22°40.3	108°32.9	10.1′	S19°40.7	2.9′	55.7′
19	103°42.6	40.0	123°02.0	10.0′	19°43.6	2.8′	55.7′
20	118°42.3	39.7	137°31.0	10.0′	19°46.4	2.8′	55.7′
21	133°42.1	·· 39.4	152°00.0	9.9′	19°49.2	2.6′	55.7′
22	148°41.8	39.2	166°28.9	9.9′	19°51.8	2.5′	55.8′
23	163°41.5	38.9	180°57.8	9.9′	19°54.3	2.4′	55.8′
	SD = 16.3′	d = 0.3′		SD = 15.1′			

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	178°41.2	S22°38.6	195°26.7	9.8′	S19°56.7	2.3′	55.8′
1	193°40.9	38.3	209°55.5	9.8′	19°59.0	2.2′	55.8′
2	208°40.6	38.1	224°24.3	9.7′	20°01.2	2.1′	55.8′
3	223°40.4	·· 37.8	238°53.0	9.7′	20°03.3	2.0′	55.9′
4	238°40.1	37.5	253°21.7	9.6′	20°05.3	1.8′	55.9′
5	253°39.8	37.2	267°50.3	9.6′	20°07.1	1.8′	55.9′
6	268°39.5	S22°37.0	282°18.9	9.5′	S20°08.9	1.7′	55.9′
7	283°39.2	36.7	296°47.4	9.5′	20°10.6	1.6′	56.0′
8	298°39.0	36.4	311°15.9	9.5′	20°12.2	1.4′	56.0′
9	313°38.7	·· 36.1	325°44.4	9.4′	20°13.6	1.4′	56.0′
10	328°38.4	35.8	340°12.8	9.4′	20°15.0	1.2′	56.0′
11	343°38.1	35.5	354°41.2	9.3′	20°16.2	1.1′	56.1′
12	358°37.8	S22°35.3	9°09.6	9.3′	S20°17.3	1.1′	56.1′
13	13°37.6	35.0	23°37.9	9.3′	20°18.4	0.9′	56.1′
14	28°37.3	34.7	38°06.1	9.2′	20°19.3	0.8′	56.1′
15	43°37.0	·· 34.4	52°34.4	9.2′	20°20.1	0.7′	56.1′
16	58°36.7	34.1	67°02.6	9.2′	20°20.8	0.5′	56.2′
17	73°36.5	33.8	81°30.8	9.1′	20°21.3	0.5′	56.2′
18	88°36.2	S22°33.5	95°58.9	9.1′	S20°21.8	0.4′	56.2′
19	103°35.9	33.2	110°27.0	9.1′	20°22.2	0.2′	56.2′
20	118°35.6	32.9	124°55.1	9.0′	20°22.4	0.2′	56.3′
21	133°35.3	·· 32.6	139°23.1	9.0′	20°22.6	0.0′	56.3′
22	148°35.1	32.4	153°51.1	9.0′	20°22.6	0.1′	56.3′
23	163°34.8	32.1	168°19.1	9.0′	20°22.5	0.2′	56.3′
	SD = 16.3′	d = 0.3′		SD = 15.2′			

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	178°34.5	S22°31.8	182°47.1	8.9′	S20°22.3	0.3′	56.4′
1	193°34.2	31.5	197°15.0	8.9′	20°22.0	0.4′	56.4′
2	208°34.0	31.2	211°42.9	8.9′	20°21.6	0.6′	56.4′
3	223°33.7	·· 30.9	226°10.8	8.9′	20°21.0	0.6′	56.4′
4	238°33.4	30.6	240°38.7	8.8′	20°20.4	0.8′	56.4′
5	253°33.1	30.3	255°06.5	8.8′	20°19.6	0.9′	56.5′
6	268°32.9	S22°30.0	269°34.3	8.8′	S20°18.7	1.0′	56.5′
7	283°32.6	29.7	284°02.1	8.8′	20°17.7	1.1′	56.5′
8	298°32.3	29.4	298°29.9	8.8′	20°16.6	1.2′	56.5′
9	313°32.0	·· 29.1	312°57.6	8.7′	20°15.4	1.4′	56.6′
10	328°31.7	28.8	327°25.4	8.7′	20°14.0	1.4′	56.6′
11	343°31.5	28.5	341°53.1	8.7′	20°12.6	1.6′	56.6′
12	358°31.2	S22°28.2	356°20.8	8.7′	S20°11.0	1.7′	56.6′
13	13°30.9	27.9	10°48.5	8.7′	20°09.3	1.8′	56.7′
14	28°30.7	27.6	25°16.1	8.7′	20°07.5	1.9′	56.7′
15	43°30.4	·· 27.3	39°43.8	8.6′	20°05.6	2.0′	56.7′
16	58°30.1	27.0	54°11.4	8.6′	20°03.6	2.2′	56.7′
17	73°29.8	26.6	68°39.0	8.6′	20°01.4	2.2′	56.7′
18	88°29.6	S22°26.3	83°06.7	8.6′	S19°59.2	2.4′	56.8′
19	103°29.3	26.0	97°34.3	8.6′	19°56.8	2.5′	56.8′
20	118°29.0	25.7	112°01.9	8.6′	19°54.3	2.6′	56.8′
21	133°28.7	·· 25.4	126°29.5	8.6′	19°51.7	2.7′	56.8′
22	148°28.5	25.1	140°57.0	8.6′	19°49.0	2.9′	56.9′
23	163°28.2	24.8	155°24.6	8.6′	19°46.1	2.9′	56.9′
	SD = 16.3′	d = 0.3′		SD = 15.4′			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	08:20	10:30	▬	▬	13:41	15:52
N 70°	08:02	09:43	▬	▬	14:29	16:10
68°	07:47	09:12	11:30	12:42	14:59	16:24
66°	07:35	08:50	10:20	13:51	15:22	16:36
64°	07:25	08:32	09:45	14:27	15:40	16:46
62°	07:16	08:17	09:20	14:52	15:55	16:55
60°	07:08	08:04	09:00	15:11	16:07	17:03
N 58°	07:01	07:53	08:44	15:28	16:18	17:10
56°	06:55	07:43	08:30	15:41	16:28	17:16
54°	06:49	07:35	08:18	15:53	16:36	17:22
52°	06:44	07:27	08:07	16:04	16:44	17:27
50°	06:39	07:20	07:58	16:13	16:51	17:32
45°	06:28	07:05	07:38	16:33	17:06	17:43
N 40°	06:18	06:52	07:22	16:49	17:19	17:53
35°	06:09	06:41	07:09	17:02	17:30	18:02
30°	06:01	06:31	06:57	17:14	17:41	18:10
20°	05:45	06:13	06:36	17:35	17:59	18:26
N 10°	05:30	05:56	06:19	17:52	18:15	18:41
0°	05:13	05:39	06:02	18:09	18:32	18:58
S 10°	04:55	05:22	05:45	18:26	18:49	19:16
20°	04:33	05:02	05:27	18:44	19:09	19:38
30°	04:05	04:38	05:05	19:05	19:33	20:06
35°	03:47	04:23	04:53	19:18	19:47	20:23
40°	03:25	04:06	04:38	19:32	20:05	20:45
45°	02:56	03:44	04:21	19:49	20:26	21:14
S 50°	02:14	03:16	04:00	20:11	20:54	21:56
52°	01:49	03:02	03:49	20:21	21:08	22:21
54°	01:13	02:45	03:38	20:33	21:25	22:56
56°	////	02:25	03:24	20:46	21:45	////
58°	////	01:58	03:09	21:01	22:11	////
S 60°	////	01:19	02:50	21:20	22:49	////

Lat.	Moonrise Sun	Moonrise Mon	Moonrise Tue	Moonset Sun	Moonset Mon	Moonset Tue
N 72°	▬	▬	▬	▬	▬	▬
N 70°	09:25	▬	▬	11:30	▬	▬
68°	08:25	09:45	10:38	12:30	12:57	13:55
66°	07:51	09:03	09:56	13:05	13:40	14:37
64°	07:26	08:34	09:27	13:30	14:09	15:05
62°	07:07	08:12	09:06	13:49	14:31	15:27
60°	06:51	07:54	08:48	14:06	14:48	15:44
N 58°	06:37	07:40	08:33	14:19	15:03	15:59
56°	06:26	07:27	08:21	14:31	15:16	16:12
54°	06:16	07:16	08:10	14:41	15:27	16:22
52°	06:07	07:06	08:00	14:51	15:37	16:32
50°	05:59	06:57	07:51	14:59	15:46	16:41
45°	05:42	06:39	07:33	15:16	16:04	16:59
N 40°	05:28	06:24	07:17	15:31	16:19	17:14
35°	05:16	06:11	07:05	15:43	16:32	17:27
30°	05:06	06:00	06:54	15:54	16:43	17:38
20°	04:48	05:41	06:34	16:12	17:02	17:56
N 10°	04:33	05:25	06:18	16:28	17:19	18:13
0°	04:18	05:09	06:02	16:43	17:35	18:28
S 10°	04:04	04:54	05:47	16:58	17:50	18:43
20°	03:49	04:38	05:30	17:14	18:07	18:59
30°	03:32	04:19	05:11	17:32	18:26	19:18
35°	03:21	04:08	05:00	17:43	18:37	19:29
40°	03:10	03:56	04:47	17:55	18:50	19:41
45°	02:56	03:41	04:32	18:09	19:05	19:56
S 50°	02:40	03:23	04:14	18:27	19:23	20:14
52°	02:32	03:14	04:05	18:35	19:32	20:22
54°	02:24	03:05	03:56	18:45	19:42	20:31
56°	02:14	02:54	03:45	18:55	19:53	20:42
58°	02:03	02:42	03:32	19:07	20:05	20:54
S 60°	01:51	02:28	03:17	19:21	20:20	21:08

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 28-0 6-0%
04	04:48	05:02	12:05	10:30	22:56	
05	05:15	05:29	12:05	11:22	23:48	
06	05:42	05:55	12:06	12:15	–:–	

January 07, 08, 09 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	106°28.3	202°16.9	S22°43.3	158°16.0	S19°58.5	276°51.5	S02°41.6	276°39.5	S01°38.2
1	121°30.8	217°16.0	43.5	173°16.4	58.0	291°53.8	41.6	291°41.9	38.2
2	136°33.2	232°15.1	43.8	188°16.9	57.5	306°56.1	41.6	306°44.3	38.2
3	151°35.7	247°14.2	·· 44.0	203°17.3	·· 57.0	321°58.5	·· 41.7	321°46.7	·· 38.2
4	166°38.1	262°13.2	44.2	218°17.7	56.5	337°00.8	41.7	336°49.1	38.2
5	181°40.6	277°12.3	44.4	233°18.2	56.0	352°03.1	41.8	351°51.5	38.2
6	196°43.1	292°11.4	S22°44.7	248°18.6	S19°55.6	7°05.5	S02°41.8	6°54.0	S01°38.3
7	211°45.5	307°10.5	44.9	263°19.0	55.1	22°07.8	41.9	21°56.4	38.3
8	226°48.0	322°09.6	45.1	278°19.5	54.6	37°10.2	41.9	36°58.8	38.3
9	241°50.5	337°08.7	·· 45.3	293°19.9	·· 54.1	52°12.5	·· 41.9	52°01.2	·· 38.3
10	256°52.9	352°07.7	45.6	308°20.4	53.6	67°14.8	42.0	67°03.6	38.3
11	271°55.4	7°06.8	45.8	323°20.8	53.1	82°17.2	42.0	82°06.0	38.3
12	286°57.9	22°05.9	S22°46.0	338°21.2	S19°52.6	97°19.5	S02°42.1	97°08.4	S01°38.3
13	302°00.3	37°05.0	46.2	353°21.7	52.1	112°21.8	42.1	112°10.8	38.3
14	317°02.8	52°04.0	46.4	8°22.1	51.6	127°24.2	42.2	127°13.3	38.3
15	332°05.3	67°03.1	·· 46.7	23°22.5	·· 51.1	142°26.5	·· 42.2	142°15.7	·· 38.3
16	347°07.7	82°02.2	46.9	38°23.0	50.6	157°28.8	42.2	157°18.1	38.3
17	2°10.2	97°01.3	47.1	53°23.4	50.2	172°31.2	42.3	172°20.5	38.3
18	17°12.6	112°00.4	S22°47.3	68°23.9	S19°49.7	187°33.5	S02°42.3	187°22.9	S01°38.4
19	32°15.1	126°59.4	47.5	83°24.3	49.2	202°35.9	42.4	202°25.3	38.4
20	47°17.6	141°58.5	47.7	98°24.7	48.7	217°38.2	42.4	217°27.7	38.4
21	62°20.0	156°57.6	·· 47.9	113°25.2	·· 48.2	232°40.5	·· 42.5	232°30.2	·· 38.4
22	77°22.5	171°56.7	48.1	128°25.6	47.7	247°42.9	42.5	247°32.6	38.4
23	92°25.0	186°55.8	48.3	143°26.1	47.2	262°45.2	42.5	262°35.0	38.4
Mer.pass. 16:51		ν -0.9′	d 0.2′	m -3.94	ν 0.4′	d 0.5′	m 1.19	ν 2.3′	d 0.0′ m -2.06	ν 2.4′	d 0.0′ m 0.80

Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	107°27.4	201°54.8	S22°48.5	158°26.5	S19°46.7	277°47.5	S02°42.6	277°37.4	S01°38.4
1	122°29.9	216°53.9	48.7	173°26.9	46.2	292°49.9	42.6	292°39.8	38.4
2	137°32.4	231°53.0	48.9	188°27.4	45.7	307°52.2	42.7	307°42.2	38.4
3	152°34.8	246°52.1	·· 49.1	203°27.8	·· 45.2	322°54.6	·· 42.7	322°44.6	·· 38.4
4	167°37.3	261°51.1	49.3	218°28.3	44.7	337°56.9	42.7	337°47.1	38.4
5	182°39.8	276°50.2	49.5	233°28.7	44.2	352°59.2	42.8	352°49.5	38.4
6	197°42.2	291°49.3	S22°49.7	248°29.1	S19°43.7	8°01.6	S02°42.8	7°51.9	S01°38.5
7	212°44.7	306°48.4	49.9	263°29.6	43.2	23°03.9	42.9	22°54.3	38.5
8	227°47.1	321°47.4	50.1	278°30.0	42.7	38°06.3	42.9	37°56.7	38.5
9	242°49.6	336°46.5	·· 50.3	293°30.5	·· 42.2	53°08.6	·· 42.9	52°59.1	·· 38.5
10	257°52.1	351°45.6	50.5	308°30.9	41.7	68°11.0	43.0	68°01.6	38.5
11	272°54.5	6°44.7	50.7	323°31.4	41.2	83°13.3	43.0	83°04.0	38.5
12	287°57.0	21°43.7	S22°50.9	338°31.8	S19°40.7	98°15.6	S02°43.1	98°06.4	S01°38.5
13	302°59.5	36°42.8	51.1	353°32.2	40.2	113°18.0	43.1	113°08.8	38.5
14	318°01.9	51°41.9	51.3	8°32.7	39.7	128°20.3	43.1	128°11.2	38.5
15	333°04.4	66°41.0	·· 51.5	23°33.1	·· 39.2	143°22.7	·· 43.2	143°13.6	·· 38.5
16	348°06.9	81°40.0	51.6	38°33.6	38.7	158°25.0	43.2	158°16.1	38.5
17	3°09.3	96°39.1	51.8	53°34.0	38.2	173°27.4	43.3	173°18.5	38.5
18	18°11.8	111°38.2	S22°52.0	68°34.5	S19°37.7	188°29.7	S02°43.3	188°20.9	S01°38.5
19	33°14.3	126°37.3	52.2	83°34.9	37.2	203°32.0	43.3	203°23.3	38.5
20	48°16.7	141°36.3	52.4	98°35.3	36.7	218°34.4	43.4	218°25.7	38.5
21	63°19.2	156°35.4	·· 52.6	113°35.8	·· 36.2	233°36.7	·· 43.4	233°28.2	·· 38.6
22	78°21.6	171°34.5	52.7	128°36.2	35.7	248°39.1	43.4	248°30.6	38.6
23	93°24.1	186°33.6	52.9	143°36.7	35.2	263°41.4	43.5	263°33.0	38.6
Mer.pass. 16:47		ν -0.9′	d 0.2′	m -3.94	ν 0.4′	d 0.5′	m 1.19	ν 2.3′	d 0.0′ m -2.07	ν 2.4′	d 0.0′ m 0.80

Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	108°26.6	201°32.6	S22°53.1	158°37.1	S19°34.7	278°43.8	S02°43.5	278°35.4	S01°38.6
1	123°29.0	216°31.7	53.3	173°37.6	34.2	293°46.1	43.6	293°37.8	38.6
2	138°31.5	231°30.8	53.4	188°38.0	33.7	308°48.5	43.6	308°40.2	38.6
3	153°34.0	246°29.8	·· 53.6	203°38.4	·· 33.2	323°50.8	·· 43.6	323°42.7	·· 38.6
4	168°36.4	261°28.9	53.8	218°38.9	32.7	338°53.2	43.7	338°45.1	38.6
5	183°38.9	276°28.0	53.9	233°39.3	32.2	353°55.5	43.7	353°47.5	38.6
6	198°41.4	291°27.1	S22°54.1	248°39.8	S19°31.6	8°57.9	S02°43.8	8°49.9	S01°38.6
7	213°43.8	306°26.1	54.3	263°40.2	31.1	24°00.2	43.8	23°52.3	38.6
8	228°46.3	321°25.2	54.5	278°40.7	30.6	39°02.6	43.8	38°54.8	38.6
9	243°48.8	336°24.3	·· 54.6	293°41.1	·· 30.1	54°04.9	·· 43.9	53°57.2	·· 38.6
10	258°51.2	351°23.4	54.8	308°41.6	29.6	69°07.3	43.9	68°59.6	38.6
11	273°53.7	6°22.4	54.9	323°42.0	29.1	84°09.6	43.9	84°02.0	38.6
12	288°56.1	21°21.5	S22°55.1	338°42.5	S19°28.6	99°12.0	S02°44.0	99°04.5	S01°38.6
13	303°58.6	36°20.6	55.3	353°42.9	28.1	114°14.3	44.0	114°06.9	38.6
14	319°01.1	51°19.6	55.4	8°43.4	27.6	129°16.7	44.0	129°09.3	38.7
15	334°03.5	66°18.7	·· 55.6	23°43.8	·· 27.1	144°19.0	·· 44.1	144°11.7	·· 38.7
16	349°06.0	81°17.8	55.7	38°44.2	26.6	159°21.4	44.1	159°14.1	38.7
17	4°08.5	96°16.8	55.9	53°44.7	26.1	174°23.7	44.2	174°16.6	38.7
18	19°10.9	111°15.9	S22°56.0	68°45.1	S19°25.5	189°26.1	S02°44.2	189°19.0	S01°38.7
19	34°13.4	126°15.0	56.2	83°45.6	25.0	204°28.4	44.2	204°21.4	38.7
20	49°15.9	141°14.1	56.3	98°46.0	24.5	219°30.8	44.3	219°23.8	38.7
21	64°18.3	156°13.1	·· 56.5	113°46.5	·· 24.0	234°33.1	·· 44.3	234°26.3	·· 38.7
22	79°20.8	171°12.2	56.6	128°46.9	23.5	249°35.5	44.3	249°28.7	38.7
23	94°23.2	186°11.3	56.8	143°47.4	23.0	264°37.8	44.4	264°31.1	38.7
Mer.pass. 16:43		ν -0.9′	d 0.2′	m -3.94	ν 0.4′	d 0.5′	m 1.19	ν 2.3′	d 0.0′ m -2.07	ν 2.4′	d 0.0′ m 0.80

Stars

	SHA	**Dec**
Alpheratz	358°09.2	28°59.2
Ankaa	353°40.1	-42°24.9
Schedar	350°08.8	56°26.2
Diphda	349°20.7	-18°05.7
Achernar	335°45.1	-57°20.4
Hamal	328°28.6	23°22.4
Polaris	326°39.3	89°10.9
Acamar	315°36.9	-40°23.2
Menkar	314°40.7	4°00.8
Mirfak	309°15.5	49°47.7
Aldebaran	291°17.5	16°28.2
Rigel	281°35.5	-8°13.5
Capella	281°10.5	45°58.8
Bellatrix	278°58.2	6°19.9
Elnath	278°43.5	28°35.5
Alnilam	276°11.1	-1°12.9
Betelgeuse	271°27.7	7°24.1
Canopus	264°06.6	-52°41.3
Sirius	258°55.1	-16°41.5
Adhara	255°31.5	-28°56.9
Procyon	245°25.2	5°16.4
Pollux	243°57.5	28°04.3
Avior	234°27.4	-59°26.9
Suhail	223°10.2	-43°21.3
Miaplacidus	221°44.0	-69°38.2
Alphard	218°20.1	-8°34.6
Regulus	208°09.5	12°03.6
Dubhe	194°21.5	61°51.0
Denebola	182°58.7	14°40.6
Gienah	176°17.6	-17°26.0
Acrux	173°36.9	-62°59.3
Gacrux	172°28.4	-57°00.1
Alioth	166°42.3	56°03.6
Spica	158°57.3	-11°03.6
Alkaid	153°18.4	49°24.3
Hadar	149°23.2	-60°16.5
Menkent	148°36.8	-36°16.3
Arcturus	146°18.4	19°16.8
Rigil Kent.	140°25.7	-60°44.9
Kochab	137°19.6	74°13.8
Zuben'ubi	137°32.9	-15°57.6
Alphecca	126°32.2	26°46.7
Antares	112°56.9	-26°23.3
Atria	108°21.4	-68°59.4
Sabik	102°41.2	-15°42.0
Shaula	96°55.8	-37°05.3
Rasalhague	96°29.7	12°34.4
Eltanin	90°58.1	51°29.4
Kaus Aust.	84°17.0	-34°23.6
Vega	80°56.1	38°46.0
Nunki	76°29.3	-26°19.2
Altair	62°32.6	8°49.1
Peacock	53°58.7	-56°47.9
Deneb	49°48.7	45°12.8
Enif	34°11.6	9°47.2
Al Na'ir	28°15.0	-47°03.4
Fomalhaut	15°51.4	-29°43.6
Scheat	14°17.5	27°58.8
Markab	14°03.1	15°06.2

Jan 07 Wed	**SHA**	**Mer.pass**
Venus	95°48.6	10:32
Mars	51°47.7	13:27
Jupiter	170°23.2	05:32
Saturn	170°11.2	05:32

Jan 08 Thu	**SHA**	**Mer.pass**
Venus	94°27.4	10:33
Mars	50°59.1	13:26
Jupiter	170°20.1	05:28
Saturn	170°10.0	05:29

Jan 09 Fri	**SHA**	**Mer.pass**
Venus	93°06.1	10:34
Mars	50°10.5	13:25
Jupiter	170°17.2	05:24
Saturn	170°08.8	05:25

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h — Sun — Moon

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	178°27.9	S22°24.5	169°52.2	8.6′	S19°43.2	3.1′	56.9′
1	193°27.6	24.2	184°19.8	8.6′	19°40.1	3.2′	56.9′
2	208°27.4	23.8	198°47.3	8.6′	19°36.9	3.3′	56.9′
3	223°27.1	·· 23.5	213°14.9	8.6′	19°33.6	3.4′	57.0′
4	238°26.8	23.2	227°42.4	8.6′	19°30.2	3.5′	57.0′
5	253°26.6	22.9	242°10.0	8.6′	19°26.7	3.6′	57.0′
6	268°26.3	S22°22.6	256°37.5	8.6′	S19°23.1	3.8′	57.0′
7	283°26.0	22.3	271°05.1	8.6′	19°19.3	3.8′	57.1′
8	298°25.8	21.9	285°32.7	8.6′	19°15.5	4.0′	57.1′
9	313°25.5	·· 21.6	300°00.2	8.6′	19°11.5	4.1′	57.1′
10	328°25.2	21.3	314°27.8	8.6′	19°07.4	4.2′	57.1′
11	343°24.9	21.0	328°55.4	8.6′	19°03.2	4.3′	57.1′
12	358°24.7	S22°20.7	343°22.9	8.6′	S18°58.9	4.4′	57.2′
13	13°24.4	20.3	357°50.5	8.6′	18°54.5	4.6′	57.2′
14	28°24.1	20.0	12°18.1	8.6′	18°49.9	4.6′	57.2′
15	43°23.9	·· 19.7	26°45.7	8.6′	18°45.3	4.8′	57.2′
16	58°23.6	19.4	41°13.3	8.6′	18°40.5	4.9′	57.2′
17	73°23.3	19.0	55°40.9	8.6′	18°35.6	4.9′	57.3′
18	88°23.1	S22°18.7	70°08.5	8.6′	S18°30.7	5.1′	57.3′
19	103°22.8	18.4	84°36.2	8.6′	18°25.6	5.2′	57.3′
20	118°22.5	18.1	99°03.8	8.7′	18°20.4	5.3′	57.3′
21	133°22.3	·· 17.7	113°31.5	8.7′	18°15.1	5.4′	57.3′
22	148°22.0	17.4	127°59.1	8.7′	18°09.7	5.6′	57.4′
23	163°21.7	17.1	142°26.8	8.7′	18°04.1	5.6′	57.4′
	SD = 16.3′	d = 0.3′		SD = 15.5′			

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	178°21.5	S22°16.7	156°54.5	8.7′	S17°58.5	5.7′	57.4′
1	193°21.2	16.4	171°22.2	8.7′	17°52.8	5.9′	57.4′
2	208°20.9	16.1	185°49.9	8.7′	17°46.9	5.9′	57.4′
3	223°20.7	·· 15.7	200°17.7	8.8′	17°41.0	6.1′	57.5′
4	238°20.4	15.4	214°45.4	8.8′	17°34.9	6.1′	57.5′
5	253°20.1	15.1	229°13.2	8.8′	17°28.8	6.3′	57.5′
6	268°19.9	S22°14.7	243°41.0	8.8′	S17°22.5	6.3′	57.5′
7	283°19.6	14.4	258°08.8	8.8′	17°16.2	6.5′	57.5′
8	298°19.3	14.1	272°36.7	8.8′	17°09.7	6.6′	57.6′
9	313°19.1	·· 13.7	287°04.5	8.9′	17°03.1	6.6′	57.6′
10	328°18.8	13.4	301°32.4	8.9′	16°56.5	6.8′	57.6′
11	343°18.5	13.0	316°00.3	8.9′	16°49.7	6.9′	57.6′
12	358°18.3	S22°12.7	330°28.2	8.9′	S16°42.8	7.0′	57.6′
13	13°18.0	12.4	344°56.1	9.0′	16°35.8	7.0′	57.7′
14	28°17.7	12.0	359°24.0	9.0′	16°28.8	7.2′	57.7′
15	43°17.5	·· 11.7	13°52.0	9.0′	16°21.6	7.3′	57.7′
16	58°17.2	11.3	28°20.0	9.0′	16°14.3	7.3′	57.7′
17	73°16.9	11.0	42°48.0	9.0′	16°07.0	7.5′	57.7′
18	88°16.7	S22°10.6	57°16.1	9.1′	S15°59.5	7.5′	57.8′
19	103°16.4	10.3	71°44.1	9.1′	15°52.0	7.7′	57.8′
20	118°16.2	09.9	86°12.2	9.1′	15°44.3	7.7′	57.8′
21	133°15.9	·· 09.6	100°40.3	9.1′	15°36.6	7.9′	57.8′
22	148°15.6	09.3	115°08.5	9.2′	15°28.7	7.9′	57.8′
23	163°15.4	08.9	129°36.6	9.2′	15°20.8	8.0′	57.8′
	SD = 16.3′	d = 0.3′		SD = 15.7′			

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	178°15.1	S22°08.6	144°04.8	9.2′	S15°12.8	8.1′	57.9′
1	193°14.9	08.2	158°33.0	9.2′	15°04.7	8.2′	57.9′
2	208°14.6	07.9	173°01.3	9.3′	14°56.5	8.3′	57.9′
3	223°14.3	·· 07.5	187°29.5	9.3′	14°48.2	8.4′	57.9′
4	238°14.1	07.1	201°57.8	9.3′	14°39.8	8.4′	57.9′
5	253°13.8	06.8	216°26.2	9.3′	14°31.4	8.6′	58.0′
6	268°13.6	S22°06.4	230°54.5	9.4′	S14°22.8	8.6′	58.0′
7	283°13.3	06.1	245°22.9	9.4′	14°14.2	8.8′	58.0′
8	298°13.0	05.7	259°51.3	9.4′	14°05.4	8.8′	58.0′
9	313°12.8	·· 05.4	274°19.7	9.4′	13°56.6	8.8′	58.0′
10	328°12.5	05.0	288°48.1	9.5′	13°47.8	9.0′	58.0′
11	343°12.3	04.7	303°16.6	9.5′	13°38.8	9.1′	58.1′
12	358°12.0	S22°04.3	317°45.1	9.5′	S13°29.7	9.1′	58.1′
13	13°11.7	03.9	332°13.6	9.6′	13°20.6	9.2′	58.1′
14	28°11.5	03.6	346°42.2	9.6′	13°11.4	9.3′	58.1′
15	43°11.2	·· 03.2	1°10.8	9.6′	13°02.1	9.4′	58.1′
16	58°11.0	02.9	15°39.4	9.6′	12°52.7	9.4′	58.1′
17	73°10.7	02.5	30°08.0	9.7′	12°43.3	9.5′	58.1′
18	88°10.5	S22°02.1	44°36.7	9.7′	S12°33.8	9.6′	58.2′
19	103°10.2	01.8	59°05.3	9.7′	12°24.2	9.7′	58.2′
20	118°09.9	01.4	73°34.1	9.7′	12°14.5	9.7′	58.2′
21	133°09.7	·· 01.0	88°02.8	9.8′	12°04.8	9.8′	58.2′
22	148°09.4	00.7	102°31.6	9.8′	11°55.0	9.9′	58.2′
23	163°09.2	00.3	117°00.3	9.8′	11°45.1	10.0′	58.2′
	SD = 16.3′	d = 0.4′		SD = 15.8′			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	08:15	10:19	▬	▬	13:55	15:59
N 70°	07:58	09:36	▬	▬	14:38	16:16
68°	07:44	09:08	11:10	13:04	15:06	16:30
66°	07:33	08:46	10:13	14:01	15:28	16:41
64°	07:23	08:29	09:40	14:34	15:45	16:51
62°	07:14	08:14	09:16	14:58	16:00	17:00
60°	07:07	08:02	08:57	15:17	16:12	17:07
N 58°	07:00	07:51	08:41	15:33	16:23	17:14
56°	06:54	07:42	08:28	15:46	16:32	17:20
54°	06:48	07:34	08:16	15:58	16:40	17:26
52°	06:43	07:26	08:06	16:08	16:48	17:31
50°	06:38	07:19	07:57	16:17	16:55	17:35
45°	06:28	07:04	07:38	16:36	17:09	17:46
N 40°	06:18	06:52	07:22	16:52	17:22	17:56
35°	06:09	06:41	07:09	17:05	17:33	18:04
30°	06:01	06:31	06:57	17:17	17:43	18:12
20°	05:46	06:13	06:37	17:37	18:00	18:28
N 10°	05:31	05:57	06:20	17:54	18:17	18:43
0°	05:15	05:41	06:03	18:10	18:33	18:59
S 10°	04:57	05:24	05:46	18:27	18:50	19:17
20°	04:35	05:04	05:29	18:45	19:09	19:38
30°	04:08	04:41	05:08	19:06	19:33	20:05
35°	03:50	04:26	04:55	19:18	19:47	20:23
40°	03:28	04:09	04:41	19:32	20:04	20:45
45°	03:00	03:48	04:24	19:49	20:25	21:13
S 50°	02:19	03:20	04:03	20:10	20:52	21:53
52°	01:56	03:07	03:53	20:20	21:06	22:16
54°	01:22	02:50	03:42	20:31	21:22	22:49
56°	////	02:31	03:29	20:44	21:42	////
58°	////	02:06	03:14	20:59	22:06	////
S 60°	////	01:30	02:56	21:17	22:41	////

Lat.	Moonrise Wed	Moonrise Thu	Moonrise Fri	Moonset Wed	Moonset Thu	Moonset Fri
N 72°	▬	12:32	12:02	▬	15:46	18:06
N 70°	11:55	11:43	11:36	14:31	16:34	18:31
68°	11:02	11:12	11:17	15:23	17:04	18:49
66°	10:29	10:49	11:01	15:55	17:27	19:04
64°	10:05	10:30	10:48	16:19	17:45	19:16
62°	09:46	10:15	10:37	16:38	17:59	19:26
60°	09:30	10:03	10:27	16:53	18:11	19:35
N 58°	09:17	09:52	10:19	17:06	18:22	19:42
56°	09:05	09:42	10:11	17:17	18:31	19:49
54°	08:55	09:33	10:05	17:27	18:39	19:55
52°	08:46	09:26	09:59	17:36	18:46	20:00
50°	08:38	09:19	09:54	17:44	18:53	20:05
45°	08:21	09:04	09:42	18:00	19:06	20:15
N 40°	08:07	08:52	09:32	18:14	19:18	20:24
35°	07:55	08:41	09:24	18:26	19:28	20:31
30°	07:44	08:32	09:17	18:36	19:36	20:38
20°	07:26	08:17	09:04	18:53	19:51	20:49
N 10°	07:11	08:03	08:53	19:08	20:03	20:59
0°	06:56	07:50	08:43	19:22	20:15	21:07
S 10°	06:41	07:37	08:32	19:36	20:27	21:16
20°	06:26	07:23	08:21	19:51	20:39	21:26
30°	06:08	07:07	08:08	20:07	20:54	21:37
35°	05:57	06:58	08:01	20:17	21:02	21:43
40°	05:45	06:47	07:52	20:28	21:11	21:50
45°	05:31	06:35	07:42	20:42	21:22	21:58
S 50°	05:13	06:19	07:30	20:57	21:35	22:07
52°	05:05	06:12	07:25	21:05	21:41	22:12
54°	04:56	06:04	07:19	21:13	21:48	22:17
56°	04:46	05:56	07:12	21:22	21:55	22:22
58°	04:34	05:46	07:04	21:33	22:04	22:28
S 60°	04:20	05:34	06:55	21:45	22:13	22:35

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Age 1-3 1-8%
07	06:08	06:21	12:06	13:09	00:42	
08	06:34	06:47	12:07	14:02	01:36	
09	07:00	07:12	12:07	14:55	02:29	

January 10, 11, 12 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	109°25.7	201°10.3	S22°56.9	158°47.8	S19°22.5	279°40.2	S02°44.4	279°33.5	S01°38.7
1	124°28.2	216°09.4	57.1	173°48.3	21.9	294°42.5	44.4	294°35.9	38.7
2	139°30.6	231°08.5	57.2	188°48.7	21.4	309°44.9	44.5	309°38.4	38.7
3	154°33.1	246°07.5	·· 57.4	203°49.2	·· 20.9	324°47.2	·· 44.5	324°40.8	·· 38.7
4	169°35.6	261°06.6	57.5	218°49.6	20.4	339°49.6	44.5	339°43.2	38.7
5	184°38.0	276°05.7	57.7	233°50.1	19.9	354°51.9	44.6	354°45.6	38.7
6	199°40.5	291°04.8	S22°57.8	248°50.5	S19°19.4	9°54.3	S02°44.6	9°48.1	S01°38.7
7	214°43.0	306°03.8	57.9	263°51.0	18.9	24°56.7	44.6	24°50.5	38.7
8	229°45.4	321°02.9	58.1	278°51.4	18.3	39°59.0	44.7	39°52.9	38.7
9	244°47.9	336°02.0	·· 58.2	293°51.9	·· 17.8	55°01.4	·· 44.7	54°55.3	·· 38.7
10	259°50.4	351°01.0	58.3	308°52.3	17.3	70°03.7	44.7	69°57.8	38.7
11	274°52.8	6°00.1	58.5	323°52.8	16.8	85°06.1	44.8	85°00.2	38.7
12	289°55.3	20°59.2	S22°58.6	338°53.2	S19°16.3	100°08.4	S02°44.8	100°02.6	S01°38.7
13	304°57.7	35°58.2	58.7	353°53.7	15.8	115°10.8	44.8	115°05.0	38.8
14	320°00.2	50°57.3	58.9	8°54.1	15.2	130°13.1	44.9	130°07.5	38.8
15	335°02.7	65°56.4	·· 59.0	23°54.6	·· 14.7	145°15.5	·· 44.9	145°09.9	·· 38.8
16	350°05.1	80°55.4	59.1	38°55.0	14.2	160°17.9	44.9	160°12.3	38.8
17	5°07.6	95°54.5	59.3	53°55.5	13.7	175°20.2	45.0	175°14.7	38.8
18	20°10.1	110°53.6	S22°59.4	68°55.9	S19°13.2	190°22.6	S02°45.0	190°17.2	S01°38.8
19	35°12.5	125°52.6	59.5	83°56.4	12.6	205°24.9	45.0	205°19.6	38.8
20	50°15.0	140°51.7	59.6	98°56.8	12.1	220°27.3	45.1	220°22.0	38.8
21	65°17.5	155°50.8	·· 59.7	113°57.3	·· 11.6	235°29.7	·· 45.1	235°24.5	·· 38.8
22	80°19.9	170°49.8	22°59.9	128°57.7	11.1	250°32.0	45.1	250°26.9	38.8
23	95°22.4	185°48.9	23°00.0	143°58.2	10.6	265°34.4	45.2	265°29.3	38.8
Mer.pass. 16:40		ν -0.9′	d 0.1′	m -3.94	ν 0.4′	d 0.5′	m 1.18	ν 2.4′	d 0.0′ m -2.08	ν 2.4′	d 0.0′ m 0.79

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	110°24.9	200°48.0	S23°00.1	158°58.6	S19°10.0	280°36.7	S02°45.2	280°31.7	S01°38.8
1	125°27.3	215°47.0	00.2	173°59.1	09.5	295°39.1	45.2	295°34.2	38.8
2	140°29.8	230°46.1	00.3	188°59.6	09.0	310°41.5	45.3	310°36.6	38.8
3	155°32.2	245°45.2	·· 00.4	204°00.0	·· 08.5	325°43.8	·· 45.3	325°39.0	·· 38.8
4	170°34.7	260°44.2	00.6	219°00.5	07.9	340°46.2	45.3	340°41.4	38.8
5	185°37.2	275°43.3	00.7	234°00.9	07.4	355°48.5	45.4	355°43.9	38.8
6	200°39.6	290°42.4	S23°00.8	249°01.4	S19°06.9	10°50.9	S02°45.4	10°46.3	S01°38.8
7	215°42.1	305°41.4	00.9	264°01.8	06.4	25°53.3	45.4	25°48.7	38.8
8	230°44.6	320°40.5	01.0	279°02.3	05.8	40°55.6	45.5	40°51.2	38.8
9	245°47.0	335°39.6	·· 01.1	294°02.7	·· 05.3	55°58.0	·· 45.5	55°53.6	·· 38.8
10	260°49.5	350°38.6	01.2	309°03.2	04.8	71°00.4	45.5	70°56.0	38.8
11	275°52.0	5°37.7	01.3	324°03.6	04.3	86°02.7	45.6	85°58.4	38.8
12	290°54.4	20°36.8	S23°01.4	339°04.1	S19°03.7	101°05.1	S02°45.6	101°00.9	S01°38.8
13	305°56.9	35°35.8	01.5	354°04.6	03.2	116°07.4	45.6	116°03.3	38.8
14	320°59.3	50°34.9	01.6	9°05.0	02.7	131°09.8	45.6	131°05.7	38.8
15	336°01.8	65°34.0	·· 01.7	24°05.5	·· 02.2	146°12.2	·· 45.7	146°08.2	·· 38.8
16	351°04.3	80°33.0	01.8	39°05.9	01.6	161°14.5	45.7	161°10.6	38.8
17	6°06.7	95°32.1	01.9	54°06.4	01.1	176°16.9	45.7	176°13.0	38.8
18	21°09.2	110°31.2	S23°02.0	69°06.8	S19°00.6	191°19.3	S02°45.8	191°15.5	S01°38.8
19	36°11.7	125°30.2	02.1	84°07.3	19°00.0	206°21.6	45.8	206°17.9	38.8
20	51°14.1	140°29.3	02.2	99°07.7	18°59.5	221°24.0	45.8	221°20.3	38.8
21	66°16.6	155°28.4	·· 02.3	114°08.2	·· 59.0	236°26.4	·· 45.9	236°22.8	·· 38.8
22	81°19.1	170°27.4	02.4	129°08.7	58.4	251°28.7	45.9	251°25.2	38.8
23	96°21.5	185°26.5	02.5	144°09.1	57.9	266°31.1	45.9	266°27.6	38.8
Mer.pass. 16:36		ν -0.9′	d 0.1′	m -3.94	ν 0.5′	d 0.5′	m 1.18	ν 2.4′	d 0.0′ m -2.09	ν 2.4′	d 0.0′ m 0.79

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	111°24.0	200°25.5	S23°02.6	159°09.6	S18°57.4	281°33.5	S02°45.9	281°30.0	S01°38.8
1	126°26.5	215°24.6	02.6	174°10.0	56.9	296°35.8	46.0	296°32.5	38.8
2	141°28.9	230°23.7	02.7	189°10.5	56.3	311°38.2	46.0	311°34.9	38.8
3	156°31.4	245°22.7	·· 02.8	204°10.9	·· 55.8	326°40.6	·· 46.0	326°37.3	·· 38.8
4	171°33.8	260°21.8	02.9	219°11.4	55.3	341°42.9	46.1	341°39.8	38.8
5	186°36.3	275°20.9	03.0	234°11.9	54.7	356°45.3	46.1	356°42.2	38.8
6	201°38.8	290°19.9	S23°03.1	249°12.3	S18°54.2	11°47.7	S02°46.1	11°44.6	S01°38.8
7	216°41.2	305°19.0	03.1	264°12.8	53.7	26°50.0	46.1	26°47.1	38.8
8	231°43.7	320°18.1	03.2	279°13.2	53.1	41°52.4	46.2	41°49.5	38.8
9	246°46.2	335°17.1	·· 03.3	294°13.7	·· 52.6	56°54.8	·· 46.2	56°51.9	·· 38.8
10	261°48.6	350°16.2	03.4	309°14.2	52.1	71°57.2	46.2	71°54.4	38.8
11	276°51.1	5°15.3	03.4	324°14.6	51.5	86°59.5	46.3	86°56.8	38.8
12	291°53.6	20°14.3	S23°03.5	339°15.1	S18°51.0	102°01.9	S02°46.3	101°59.2	S01°38.8
13	306°56.0	35°13.4	03.6	354°15.5	50.5	117°04.3	46.3	117°01.7	38.8
14	321°58.5	50°12.4	03.7	9°16.0	49.9	132°06.6	46.3	132°04.1	38.8
15	337°00.9	65°11.5	·· 03.7	24°16.4	·· 49.4	147°09.0	·· 46.4	147°06.5	·· 38.8
16	352°03.4	80°10.6	03.8	39°16.9	48.8	162°11.4	46.4	162°09.0	38.8
17	7°05.9	95°09.6	03.9	54°17.4	48.3	177°13.8	46.4	177°11.4	38.8
18	22°08.3	110°08.7	S23°03.9	69°17.8	S18°47.8	192°16.1	S02°46.4	192°13.8	S01°38.8
19	37°10.8	125°07.8	04.0	84°18.3	47.2	207°18.5	46.5	207°16.3	38.8
20	52°13.3	140°06.8	04.1	99°18.8	46.7	222°20.9	46.5	222°18.7	38.8
21	67°15.7	155°05.9	·· 04.1	114°19.2	·· 46.2	237°23.2	·· 46.5	237°21.1	·· 38.8
22	82°18.2	170°05.0	04.2	129°19.7	45.6	252°25.6	46.5	252°23.6	38.8
23	97°20.7	185°04.0	04.2	144°20.1	45.1	267°28.0	46.6	267°26.0	38.8
Mer.pass. 16:32		ν -0.9′	d 0.1′	m -3.93	ν 0.5′	d 0.5′	m 1.18	ν 2.4′	d 0.0′ m -2.09	ν 2.4′	d 0.0′ m 0.78

Stars

	SHA	Dec
Alpheratz	358°09.2	28°59.2
Ankaa	353°40.1	-42°24.9
Schedar	350°08.8	56°26.2
Diphda	349°20.7	-18°05.7
Achernar	335°45.1	-57°20.4
Hamal	328°28.6	23°22.4
Polaris	326°40.5	89°10.9
Acamar	315°36.9	-40°23.2
Menkar	314°40.7	4°00.8
Mirfak	309°15.5	49°47.7
Aldebaran	291°17.5	16°28.2
Rigel	281°35.5	-8°13.6
Capella	281°10.5	45°58.8
Bellatrix	278°58.2	6°19.9
Elnath	278°43.5	28°35.5
Alnilam	276°11.1	-1°13.0
Betelgeuse	271°27.7	7°24.1
Canopus	264°06.6	-52°41.3
Sirius	258°55.1	-16°41.5
Adhara	255°31.5	-28°56.9
Procyon	245°25.2	5°16.4
Pollux	243°57.5	28°04.3
Avior	234°27.4	-59°26.9
Suhail	223°10.2	-43°21.3
Miaplacidus	221°44.0	-69°38.2
Alphard	218°20.0	-8°34.6
Regulus	208°09.5	12°03.5
Dubhe	194°21.5	61°51.0
Denebola	182°58.7	14°40.6
Gienah	176°17.6	-17°26.1
Acrux	173°36.8	-62°59.3
Gacrux	172°28.3	-57°00.1
Alioth	166°42.3	56°03.5
Spica	158°57.3	-11°03.6
Alkaid	153°18.4	49°24.3
Hadar	149°23.1	-60°16.5
Menkent	148°36.8	-36°16.3
Arcturus	146°18.4	19°16.8
Rigil Kent.	140°25.7	-60°44.9
Kochab	137°19.6	74°13.8
Zuben'ubi	137°32.9	-15°57.6
Alphecca	126°32.1	26°46.6
Antares	112°56.9	-26°23.3
Atria	108°21.4	-68°59.4
Sabik	102°41.2	-15°42.0
Shaula	96°55.8	-37°05.3
Rasalhague	96°29.7	12°34.4
Eltanin	90°58.1	51°29.4
Kaus Aust.	84°17.0	-34°23.6
Vega	80°56.1	38°45.9
Nunki	76°29.3	-26°19.2
Altair	62°32.6	8°49.1
Peacock	53°58.7	-56°47.9
Deneb	49°48.7	45°12.8
Enif	34°11.6	9°47.2
Al Na'ir	28°15.0	-47°03.4
Fomalhaut	15°51.4	-29°43.6
Scheat	14°17.5	27°58.8
Markab	14°03.1	15°06.2

Jan 10 Sat	SHA	Mer.pass
Venus	91°44.6	10:36
Mars	49°22.1	13:24
Jupiter	170°14.5	05:20
Saturn	170°07.8	05:21

Jan 11 Sun	SHA	Mer.pass
Venus	90°23.1	10:37
Mars	48°33.8	13:24
Jupiter	170°11.9	05:17
Saturn	170°06.9	05:17

Jan 12 Mon	SHA	Mer.pass
Venus	89°01.6	10:39
Mars	47°45.6	13:23
Jupiter	170°09.5	05:13
Saturn	170°06.1	05:13

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = -0.2168 sec ΔT = TT-UT1 = +51.4008 sec

1981 January 10 to Jan. 12 UT

h	Sun		Moon				
Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°08.9	S21°59.9	131°29.2	9.8′	S11°35.1	10.0′	58.3′
1	193°08.7	59.6	145°58.0	9.9′	11°25.1	10.1′	58.3′
2	208°08.4	59.2	160°26.9	9.9′	11°15.0	10.2′	58.3′
3	223°08.1	·· 58.8	174°55.8	9.9′	11°04.8	10.2′	58.3′
4	238°07.9	58.5	189°24.7	9.9′	10°54.6	10.3′	58.3′
5	253°07.6	58.1	203°53.6	10.0′	10°44.3	10.3′	58.3′
6	268°07.4	S21°57.7	218°22.6	10.0′	S10°34.0	10.4′	58.3′
7	283°07.1	57.4	232°51.6	10.0′	10°23.6	10.5′	58.4′
8	298°06.9	57.0	247°20.6	10.0′	10°13.1	10.6′	58.4′
9	313°06.6	·· 56.6	261°49.6	10.1′	10°02.5	10.6′	58.4′
10	328°06.4	56.2	276°18.7	10.1′	09°51.9	10.6′	58.4′
11	343°06.1	55.9	290°47.8	10.1′	09°41.3	10.7′	58.4′
12	358°05.9	S21°55.5	305°16.9	10.1′	S09°30.6	10.8′	58.4′
13	13°05.6	55.1	319°46.0	10.1′	09°19.8	10.8′	58.4′
14	28°05.4	54.7	334°15.1	10.2′	09°09.0	10.9′	58.5′
15	43°05.1	·· 54.3	348°44.3	10.2′	08°58.1	10.9′	58.5′
16	58°04.9	54.0	3°13.5	10.2′	08°47.2	11.0′	58.5′
17	73°04.6	53.6	17°42.7	10.2′	08°36.2	11.1′	58.5′
18	88°04.4	S21°53.2	32°11.9	10.2′	S08°25.1	11.1′	58.5′
19	103°04.1	52.8	46°41.2	10.3′	08°14.0	11.1′	58.5′
20	118°03.9	52.4	61°10.5	10.3′	08°02.9	11.2′	58.5′
21	133°03.6	·· 52.1	75°39.7	10.3′	07°51.7	11.2′	58.5′
22	148°03.4	51.7	90°09.0	10.3′	07°40.5	11.3′	58.6′
23	163°03.1	51.3	104°38.4	10.3′	07°29.2	11.3′	58.6′
	SD = 16.3′	d = 0.4′	SD = 15.9′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°02.9	S21°50.9	119°07.7	10.4′	S07°17.9	11.4′	58.6′
1	193°02.6	50.5	133°37.1	10.4′	07°06.5	11.4′	58.6′
2	208°02.4	50.1	148°06.4	10.4′	06°55.1	11.5′	58.6′
3	223°02.1	·· 49.7	162°35.8	10.4′	06°43.6	11.5′	58.6′
4	238°01.9	49.4	177°05.2	10.4′	06°32.1	11.5′	58.6′
5	253°01.6	49.0	191°34.6	10.4′	06°20.6	11.6′	58.6′
6	268°01.4	S21°48.6	206°04.1	10.4′	S06°09.0	11.6′	58.7′
7	283°01.1	48.2	220°33.5	10.5′	05°57.4	11.6′	58.7′
8	298°00.9	47.8	235°03.0	10.5′	05°45.8	11.7′	58.7′
9	313°00.6	·· 47.4	249°32.4	10.5′	05°34.1	11.7′	58.7′
10	328°00.4	47.0	264°01.9	10.5′	05°22.4	11.8′	58.7′
11	343°00.1	46.6	278°31.4	10.5′	05°10.6	11.8′	58.7′
12	357°59.9	S21°46.2	293°00.9	10.5′	S04°58.8	11.8′	58.7′
13	12°59.6	45.8	307°30.4	10.5′	04°47.0	11.8′	58.7′
14	27°59.4	45.4	321°59.9	10.5′	04°35.2	11.9′	58.7′
15	42°59.1	·· 45.0	336°29.4	10.5′	04°23.3	11.9′	58.8′
16	57°58.9	44.6	350°59.0	10.5′	04°11.4	11.9′	58.8′
17	72°58.7	44.2	5°28.5	10.5′	03°59.5	12.0′	58.8′
18	87°58.4	S21°43.8	19°58.0	10.5′	S03°47.5	12.0′	58.8′
19	102°58.2	43.4	34°27.6	10.6′	03°35.5	12.0′	58.8′
20	117°57.9	43.0	48°57.1	10.6′	03°23.5	12.0′	58.8′
21	132°57.7	·· 42.6	63°26.7	10.6′	03°11.5	12.0′	58.8′
22	147°57.4	42.2	77°56.3	10.6′	02°59.5	12.1′	58.8′
23	162°57.2	41.8	92°25.8	10.6′	02°47.4	12.1′	58.8′
	SD = 16.3′	d = 0.4′	SD = 16.0′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°57.0	S21°41.4	106°55.4	10.6′	S02°35.3	12.1′	58.8′
1	192°56.7	41.0	121°25.0	10.6′	02°23.2	12.1′	58.9′
2	207°56.5	40.6	135°54.5	10.6′	02°11.1	12.1′	58.9′
3	222°56.2	·· 40.2	150°24.1	10.6′	01°59.0	12.2′	58.9′
4	237°56.0	39.8	164°53.7	10.6′	01°46.8	12.1′	58.9′
5	252°55.7	39.4	179°23.2	10.6′	01°34.7	12.2′	58.9′
6	267°55.5	S21°39.0	193°52.8	10.6′	S01°22.5	12.2′	58.9′
7	282°55.3	38.6	208°22.4	10.6′	01°10.3	12.2′	58.9′
8	297°55.0	38.2	222°51.9	10.6′	00°58.1	12.2′	58.9′
9	312°54.8	·· 37.8	237°21.5	10.5′	00°45.9	12.2′	58.9′
10	327°54.5	37.4	251°51.0	10.5′	00°33.7	12.2′	58.9′
11	342°54.3	37.0	266°20.5	10.5′	00°21.5	12.2′	58.9′
12	357°54.1	S21°36.5	280°50.1	10.5′	S00°09.3	12.2′	59.0′
13	12°53.8	36.1	295°19.6	10.5′	N00°02.9	12.3′	59.0′
14	27°53.6	35.7	309°49.1	10.5′	00°15.2	12.2′	59.0′
15	42°53.3	·· 35.3	324°18.6	10.5′	00°27.4	12.2′	59.0′
16	57°53.1	34.9	338°48.1	10.5′	00°39.6	12.2′	59.0′
17	72°52.9	34.5	353°17.6	10.5′	00°51.8	12.3′	59.0′
18	87°52.6	S21°34.1	7°47.1	10.5′	N01°04.1	12.2′	59.0′
19	102°52.4	33.6	22°16.5	10.4′	01°16.3	12.2′	59.0′
20	117°52.2	33.2	36°46.0	10.4′	01°28.5	12.2′	59.0′
21	132°51.9	·· 32.8	51°15.4	10.4′	01°40.7	12.2′	59.0′
22	147°51.7	32.4	65°44.9	10.4′	01°52.9	12.2′	59.0′
23	162°51.4	32.0	80°14.3	10.4′	02°05.1	12.2′	59.0′
	SD = 16.3′	d = 0.4′	SD = 16.0′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	08:10	10:08	▬	▬	14:09	16:07
N 70°	07:53	09:29	▬	▬	14:48	16:23
68°	07:40	09:02	10:53	13:23	15:14	16:36
66°	07:29	08:42	10:05	14:12	15:35	16:47
64°	07:20	08:25	09:34	14:42	15:52	16:57
62°	07:12	08:11	09:12	15:05	16:05	17:05
60°	07:05	07:59	08:54	15:23	16:17	17:12
N 58°	06:58	07:49	08:38	15:38	16:27	17:18
56°	06:52	07:40	08:26	15:51	16:36	17:24
54°	06:47	07:32	08:14	16:02	16:44	17:29
52°	06:42	07:25	08:04	16:12	16:52	17:34
50°	06:37	07:18	07:56	16:21	16:58	17:39
45°	06:27	07:04	07:37	16:40	17:13	17:49
N 40°	06:18	06:51	07:21	16:55	17:25	17:58
35°	06:09	06:41	07:08	17:08	17:35	18:07
30°	06:02	06:31	06:57	17:19	17:45	18:15
20°	05:47	06:14	06:38	17:39	18:02	18:29
N 10°	05:32	05:58	06:20	17:56	18:18	18:44
0°	05:16	05:42	06:04	18:12	18:34	19:00
S 10°	04:59	05:25	05:48	18:28	18:51	19:17
20°	04:38	05:06	05:31	18:45	19:10	19:38
30°	04:11	04:43	05:10	19:06	19:32	20:05
35°	03:53	04:29	04:58	19:17	19:47	20:22
40°	03:32	04:12	04:44	19:31	20:03	20:43
45°	03:05	03:52	04:28	19:48	20:24	21:11
S 50°	02:25	03:25	04:07	20:08	20:50	21:49
52°	02:03	03:12	03:58	20:18	21:03	22:11
54°	01:32	02:56	03:47	20:28	21:19	22:41
56°	00:31	02:37	03:34	20:41	21:37	23:36
58°	////	02:13	03:19	20:55	22:01	////
S 60°	////	01:41	03:02	21:13	22:33	////

Lat.	**Moonrise** Sat	Sun	Mon	**Moonset** Sat	Sun	Mon
N 72°	11:45	11:32	11:21	20:11	22:10	·· ··
N 70°	11:30	11:25	11:20	20:24	22:15	·· ··
68°	11:18	11:19	11:20	20:34	22:18	·· ··
66°	11:09	11:14	11:19	20:42	22:21	·· ··
64°	11:00	11:10	11:19	20:50	22:24	23:58
62°	10:53	11:06	11:19	20:56	22:26	23:57
60°	10:47	11:03	11:18	21:01	22:28	23:56
N 58°	10:41	11:00	11:18	21:05	22:30	23:54
56°	10:36	10:58	11:18	21:10	22:31	23:53
54°	10:32	10:55	11:18	21:13	22:32	23:52
52°	10:28	10:53	11:18	21:17	22:34	23:51
50°	10:24	10:51	11:18	21:20	22:35	23:51
45°	10:16	10:47	11:17	21:26	22:37	23:49
N 40°	10:09	10:44	11:17	21:31	22:39	23:47
35°	10:04	10:41	11:17	21:36	22:41	23:46
30°	09:58	10:38	11:17	21:40	22:42	23:45
20°	09:50	10:33	11:16	21:47	22:45	23:43
N 10°	09:42	10:29	11:16	21:53	22:47	23:41
0°	09:34	10:25	11:16	21:59	22:49	23:40
S 10°	09:27	10:21	11:16	22:04	22:51	23:38
20°	09:19	10:17	11:15	22:10	22:54	23:36
30°	09:10	10:13	11:15	22:17	22:56	23:34
35°	09:05	10:10	11:15	22:21	22:57	23:33
40°	08:59	10:07	11:15	22:25	22:59	23:32
45°	08:52	10:03	11:15	22:30	23:01	23:30
S 50°	08:44	09:59	11:15	22:36	23:03	23:29
52°	08:40	09:57	11:14	22:39	23:04	23:28
54°	08:36	09:55	11:14	22:42	23:05	23:27
56°	08:31	09:52	11:14	22:45	23:06	23:26
58°	08:26	09:50	11:14	22:49	23:07	23:25
S 60°	08:20	09:47	11:14	22:53	23:09	23:24

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 4-6 15-34%
10	07:24	07:37	12:08	15:47	03:21	
11	07:49	08:00	12:08	16:37	04:12	
12	08:12	08:24	12:08	17:28	05:03	

January 13, 14, 15 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	112°23.1	200°03.1	S23°04.3	159°20.6	S18°44.5	282°30.4	S02°46.6	282°28.5	S01°38.8
1	127°25.6	215°02.1	04.4	174°21.1	44.0	297°32.7	46.6	297°30.9	38.8
2	142°28.1	230°01.2	04.4	189°21.5	43.5	312°35.1	46.7	312°33.3	38.8
3	157°30.5	245°00.3	·· 04.5	204°22.0	·· 42.9	327°37.5	·· 46.7	327°35.8	·· 38.8
4	172°33.0	259°59.3	04.5	219°22.4	42.4	342°39.9	46.7	342°38.2	38.8
5	187°35.4	274°58.4	04.6	234°22.9	41.8	357°42.2	46.7	357°40.6	38.8
6	202°37.9	289°57.5	S23°04.6	249°23.4	S18°41.3	12°44.6	S02°46.8	12°43.1	S01°38.8
7	217°40.4	304°56.5	04.7	264°23.8	40.7	27°47.0	46.8	27°45.5	38.8
8	232°42.8	319°55.6	04.7	279°24.3	40.2	42°49.4	46.8	42°47.9	38.8
9	247°45.3	334°54.6	·· 04.8	294°24.8	·· 39.7	57°51.7	·· 46.8	57°50.4	·· 38.8
10	262°47.8	349°53.7	04.8	309°25.2	39.1	72°54.1	46.9	72°52.8	38.8
11	277°50.2	4°52.8	04.9	324°25.7	38.6	87°56.5	46.9	87°55.3	38.8
12	292°52.7	19°51.8	S23°04.9	339°26.2	S18°38.0	102°58.9	S02°46.9	102°57.7	S01°38.8
13	307°55.2	34°50.9	05.0	354°26.6	37.5	118°01.3	46.9	118°00.1	38.8
14	322°57.6	49°50.0	05.0	9°27.1	36.9	133°03.6	46.9	133°02.6	38.8
15	338°00.1	64°49.0	·· 05.0	24°27.5	·· 36.4	148°06.0	·· 47.0	148°05.0	·· 38.8
16	353°02.6	79°48.1	05.1	39°28.0	35.9	163°08.4	47.0	163°07.5	38.8
17	8°05.0	94°47.1	05.1	54°28.5	35.3	178°10.8	47.0	178°09.9	38.8
18	23°07.5	109°46.2	S23°05.2	69°28.9	S18°34.8	193°13.2	S02°47.0	193°12.3	S01°38.8
19	38°09.9	124°45.3	05.2	84°29.4	34.2	208°15.5	47.1	208°14.8	38.8
20	53°12.4	139°44.3	05.2	99°29.9	33.7	223°17.9	47.1	223°17.2	38.8
21	68°14.9	154°43.4	·· 05.3	114°30.3	·· 33.1	238°20.3	·· 47.1	238°19.6	·· 38.8
22	83°17.3	169°42.5	05.3	129°30.8	32.6	253°22.7	47.1	253°22.1	38.8
23	98°19.8	184°41.5	05.3	144°31.3	32.0	268°25.1	47.2	268°24.5	38.8
Mer.pass. 16:28		ν -0.9′	d 0.1′	m -3.93	ν 0.5′	d 0.5′	m 1.18	ν 2.4′	d 0.0′ m -2.10	ν 2.4′	d 0.0′ m 0.78

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	113°22.3	199°40.6	S23°05.4	159°31.7	S18°31.5	283°27.4	S02°47.2	283°27.0	S01°38.8
1	128°24.7	214°39.6	05.4	174°32.2	30.9	298°29.8	47.2	298°29.4	38.8
2	143°27.2	229°38.7	05.4	189°32.7	30.4	313°32.2	47.2	313°31.8	38.8
3	158°29.7	244°37.8	·· 05.4	204°33.1	·· 29.8	328°34.6	·· 47.3	328°34.3	·· 38.8
4	173°32.1	259°36.8	05.5	219°33.6	29.3	343°37.0	47.3	343°36.7	38.8
5	188°34.6	274°35.9	05.5	234°34.1	28.7	358°39.3	47.3	358°39.2	38.8
6	203°37.0	289°34.9	S23°05.5	249°34.5	S18°28.2	13°41.7	S02°47.3	13°41.6	S01°38.8
7	218°39.5	304°34.0	05.5	264°35.0	27.6	28°44.1	47.3	28°44.1	38.8
8	233°42.0	319°33.1	05.5	279°35.5	27.1	43°46.5	47.4	43°46.5	38.8
9	248°44.4	334°32.1	·· 05.6	294°35.9	·· 26.5	58°48.9	·· 47.4	58°48.9	·· 38.7
10	263°46.9	349°31.2	05.6	309°36.4	26.0	73°51.3	47.4	73°51.4	38.7
11	278°49.4	4°30.3	05.6	324°36.9	25.4	88°53.7	47.4	88°53.8	38.7
12	293°51.8	19°29.3	S23°05.6	339°37.3	S18°24.9	103°56.0	S02°47.5	103°56.3	S01°38.7
13	308°54.3	34°28.4	05.6	354°37.8	24.3	118°58.4	47.5	118°58.7	38.7
14	323°56.8	49°27.4	05.6	9°38.3	23.8	134°00.8	47.5	134°01.1	38.7
15	338°59.2	64°26.5	·· 05.6	24°38.7	·· 23.2	149°03.2	·· 47.5	149°03.6	·· 38.7
16	354°01.7	79°25.6	05.7	39°39.2	22.7	164°05.6	47.5	164°06.0	38.7
17	9°04.2	94°24.6	05.7	54°39.7	22.1	179°08.0	47.6	179°08.5	38.7
18	24°06.6	109°23.7	S23°05.7	69°40.2	S18°21.6	194°10.4	S02°47.6	194°10.9	S01°38.7
19	39°09.1	124°22.8	05.7	84°40.6	21.0	209°12.7	47.6	209°13.4	38.7
20	54°11.5	139°21.8	05.7	99°41.1	20.5	224°15.1	47.6	224°15.8	38.7
21	69°14.0	154°20.9	·· 05.7	114°41.6	·· 19.9	239°17.5	·· 47.6	239°18.2	·· 38.7
22	84°16.5	169°19.9	05.7	129°42.0	19.3	254°19.9	47.7	254°20.7	38.7
23	99°18.9	184°19.0	05.7	144°42.5	18.8	269°22.3	47.7	269°23.1	38.7
Mer.pass. 16:24		ν -0.9′	d 0.0′	m -3.93	ν 0.5′	d 0.5′	m 1.18	ν 2.4′	d 0.0′ m -2.11	ν 2.4′	d 0.0′ m 0.77

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	114°21.4	199°18.1	S23°05.7	159°43.0	S18°18.2	284°24.7	S02°47.7	284°25.6	S01°38.7
1	129°23.9	214°17.1	05.7	174°43.4	17.7	299°27.1	47.7	299°28.0	38.7
2	144°26.3	229°16.2	05.7	189°43.9	17.1	314°29.5	47.7	314°30.5	38.7
3	159°28.8	244°15.2	·· 05.7	204°44.4	·· 16.6	329°31.8	·· 47.8	329°32.9	·· 38.7
4	174°31.3	259°14.3	05.7	219°44.9	16.0	344°34.2	47.8	344°35.4	38.7
5	189°33.7	274°13.4	05.7	234°45.3	15.4	359°36.6	47.8	359°37.8	38.7
6	204°36.2	289°12.4	S23°05.7	249°45.8	S18°14.9	14°39.0	S02°47.8	14°40.2	S01°38.7
7	219°38.7	304°11.5	05.7	264°46.3	14.3	29°41.4	47.8	29°42.7	38.7
8	234°41.1	319°10.6	05.6	279°46.7	13.8	44°43.8	47.9	44°45.1	38.7
9	249°43.6	334°09.6	·· 05.6	294°47.2	·· 13.2	59°46.2	·· 47.9	59°47.6	·· 38.6
10	264°46.0	349°08.7	05.6	309°47.7	12.6	74°48.6	47.9	74°50.0	38.6
11	279°48.5	4°07.7	05.6	324°48.2	12.1	89°51.0	47.9	89°52.5	38.6
12	294°51.0	19°06.8	S23°05.6	339°48.6	S18°11.5	104°53.4	S02°47.9	104°54.9	S01°38.6
13	309°53.4	34°05.9	05.6	354°49.1	11.0	119°55.8	47.9	119°57.4	38.6
14	324°55.9	49°04.9	05.6	9°49.6	10.4	134°58.1	48.0	134°59.8	38.6
15	339°58.4	64°04.0	·· 05.5	24°50.1	·· 09.8	150°00.5	·· 48.0	150°02.3	·· 38.6
16	355°00.8	79°03.0	05.5	39°50.5	09.3	165°02.9	48.0	165°04.7	38.6
17	10°03.3	94°02.1	05.5	54°51.0	08.7	180°05.3	48.0	180°07.2	38.6
18	25°05.8	109°01.2	S23°05.5	69°51.5	S18°08.2	195°07.7	S02°48.0	195°09.6	S01°38.6
19	40°08.2	124°00.2	05.5	84°52.0	07.6	210°10.1	48.1	210°12.0	38.6
20	55°10.7	138°59.3	05.4	99°52.4	07.0	225°12.5	48.1	225°14.5	38.6
21	70°13.1	153°58.4	·· 05.4	114°52.9	·· 06.5	240°14.9	·· 48.1	240°16.9	·· 38.6
22	85°15.6	168°57.4	05.4	129°53.4	05.9	255°17.3	48.1	255°19.4	38.6
23	100°18.1	183°56.5	05.3	144°53.9	05.3	270°19.7	48.1	270°21.8	38.6
Mer.pass. 16:20		ν -0.9′	d 0.0′	m -3.93	ν 0.5′	d 0.6′	m 1.18	ν 2.4′	d 0.0′ m -2.12	ν 2.4′	d 0.0′ m 0.77

Stars

	SHA	Dec
Alpheratz	358°09.2	28°59.2
Ankaa	353°40.2	-42°24.9
Schedar	350°08.8	56°26.2
Diphda	349°20.7	-18°05.7
Achernar	335°45.1	-57°20.4
Hamal	328°28.6	23°22.4
Polaris	326°41.7	89°10.9
Acamar	315°36.9	-40°23.2
Menkar	314°40.7	4°00.8
Mirfak	309°15.5	49°47.7
Aldebaran	291°17.5	16°28.2
Rigel	281°35.5	-8°13.6
Capella	281°10.5	45°58.8
Bellatrix	278°58.2	6°19.9
Elnath	278°43.5	28°35.5
Alnilam	276°11.1	-1°13.0
Betelgeuse	271°27.7	7°24.1
Canopus	264°06.6	-52°41.3
Sirius	258°55.1	-16°41.5
Adhara	255°31.5	-28°56.9
Procyon	245°25.2	5°16.4
Pollux	243°57.5	28°04.3
Avior	234°27.4	-59°26.9
Suhail	223°10.2	-43°21.3
Miaplacidus	221°44.0	-69°38.2
Alphard	218°20.0	-8°34.6
Regulus	208°09.5	12°03.5
Dubhe	194°21.5	61°51.0
Denebola	182°58.7	14°40.6
Gienah	176°17.6	-17°26.1
Acrux	173°36.8	-62°59.3
Gacrux	172°28.3	-57°00.1
Alioth	166°42.2	56°03.5
Spica	158°57.3	-11°03.6
Alkaid	153°18.4	49°24.3
Hadar	149°23.1	-60°16.5
Menkent	148°36.8	-36°16.4
Arcturus	146°18.3	19°16.8
Rigil Kent.	140°25.6	-60°44.9
Kochab	137°19.5	74°13.8
Zuben'ubi	137°32.9	-15°57.7
Alphecca	126°32.1	26°46.6
Antares	112°56.8	-26°23.3
Atria	108°21.3	-68°59.4
Sabik	102°41.2	-15°42.0
Shaula	96°55.8	-37°05.3
Rasalhague	96°29.7	12°34.4
Eltanin	90°58.1	51°29.4
Kaus Aust.	84°16.9	-34°23.6
Vega	80°56.1	38°45.9
Nunki	76°29.3	-26°19.2
Altair	62°32.6	8°49.1
Peacock	53°58.7	-56°47.9
Deneb	49°48.7	45°12.8
Enif	34°11.6	9°47.2
Al Na'ir	28°15.1	-47°03.4
Fomalhaut	15°51.4	-29°43.6
Scheat	14°17.6	27°58.8
Markab	14°03.1	15°06.1

Jan 13 Tue	SHA	Mer.pass
Venus	87°40.0	10:40
Mars	46°57.5	13:22
Jupiter	170°07.2	05:09
Saturn	170°05.3	05:09

Jan 14 Wed	SHA	Mer.pass
Venus	86°18.3	10:42
Mars	46°09.5	13:21
Jupiter	170°05.2	05:05
Saturn	170°04.7	05:05

Jan 15 Thu	SHA	Mer.pass
Venus	84°56.7	10:43
Mars	45°21.6	13:21
Jupiter	170°03.3	05:02
Saturn	170°04.2	05:01

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°51.2	S21°31.6	94°43.7	10.4′	N02°17.3	12.2′	59.0′
1	192°51.0	31.1	109°13.0	10.4′	02°29.5	12.1′	59.1′
2	207°50.7	30.7	123°42.4	10.3′	02°41.6	12.2′	59.1′
3	222°50.5	·· 30.3	138°11.7	10.3′	02°53.8	12.1′	59.1′
4	237°50.3	29.9	152°41.0	10.3′	03°05.9	12.2′	59.1′
5	252°50.0	29.4	167°10.3	10.3′	03°18.1	12.1′	59.1′
6	267°49.8	S21°29.0	181°39.6	10.3′	N03°30.2	12.1′	59.1′
7	282°49.6	28.6	196°08.9	10.2′	03°42.3	12.0′	59.1′
8	297°49.3	28.2	210°38.1	10.2′	03°54.3	12.1′	59.1′
9	312°49.1	·· 27.7	225°07.3	10.2′	04°06.4	12.0′	59.1′
10	327°48.9	27.3	239°36.5	10.2′	04°18.4	12.1′	59.1′
11	342°48.6	26.9	254°05.7	10.1′	04°30.5	11.9′	59.1′
12	357°48.4	S21°26.5	268°34.8	10.1′	N04°42.4	12.0′	59.1′
13	12°48.2	26.0	283°03.9	10.1′	04°54.4	11.9′	59.1′
14	27°47.9	25.6	297°33.0	10.1′	05°06.3	12.0′	59.1′
15	42°47.7	·· 25.2	312°02.1	10.0′	05°18.3	11.9′	59.1′
16	57°47.5	24.7	326°31.1	10.0′	05°30.2	11.8′	59.1′
17	72°47.2	24.3	341°00.1	10.0′	05°42.0	11.8′	59.1′
18	87°47.0	S21°23.9	355°29.1	9.9′	N05°53.8	11.8′	59.2′
19	102°46.8	23.4	9°58.0	9.9′	06°05.6	11.8′	59.2′
20	117°46.5	23.0	24°27.0	9.9′	06°17.4	11.7′	59.2′
21	132°46.3	·· 22.6	38°55.8	9.9′	06°29.1	11.7′	59.2′
22	147°46.1	22.1	53°24.7	9.8′	06°40.8	11.7′	59.2′
23	162°45.8	21.7	67°53.5	9.8′	06°52.5	11.6′	59.2′
	SD = 16.3′	d = 0.4′	SD = 16.1′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°45.6	S21°21.3	82°22.3	9.8′	N07°04.1	11.6′	59.2′
1	192°45.4	20.8	96°51.1	9.7′	07°15.7	11.5′	59.2′
2	207°45.2	20.4	111°19.8	9.7′	07°27.2	11.5′	59.2′
3	222°44.9	·· 19.9	125°48.5	9.7′	07°38.7	11.5′	59.2′
4	237°44.7	19.5	140°17.1	9.6′	07°50.2	11.4′	59.2′
5	252°44.5	19.1	154°45.7	9.6′	08°01.6	11.4′	59.2′
6	267°44.2	S21°18.6	169°14.3	9.5′	N08°13.0	11.3′	59.2′
7	282°44.0	18.2	183°42.8	9.5′	08°24.3	11.3′	59.2′
8	297°43.8	17.7	198°11.3	9.5′	08°35.6	11.2′	59.2′
9	312°43.6	·· 17.3	212°39.8	9.4′	08°46.8	11.2′	59.2′
10	327°43.3	16.8	227°08.2	9.4′	08°58.0	11.2′	59.2′
11	342°43.1	16.4	241°36.6	9.3′	09°09.2	11.0′	59.2′
12	357°42.9	S21°15.9	256°05.0	9.3′	N09°20.2	11.1′	59.2′
13	12°42.7	15.5	270°33.3	9.3′	09°31.3	10.9′	59.2′
14	27°42.4	15.1	285°01.5	9.2′	09°42.2	11.0′	59.2′
15	42°42.2	·· 14.6	299°29.8	9.2′	09°53.2	10.8′	59.2′
16	57°42.0	14.2	313°58.0	9.1′	10°04.0	10.8′	59.2′
17	72°41.8	13.7	328°26.1	9.1′	10°14.8	10.8′	59.2′
18	87°41.5	S21°13.3	342°54.2	9.1′	N10°25.6	10.7′	59.2′
19	102°41.3	12.8	357°22.3	9.0′	10°36.3	10.6′	59.2′
20	117°41.1	12.4	11°50.3	9.0′	10°46.9	10.5′	59.2′
21	132°40.9	·· 11.9	26°18.2	8.9′	10°57.4	10.5′	59.2′
22	147°40.6	11.4	40°46.2	8.9′	11°07.9	10.5′	59.2′
23	162°40.4	11.0	55°14.0	8.8′	11°18.4	10.3′	59.2′
	SD = 16.3′	d = 0.4′	SD = 16.1′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°40.2	S21°10.5	69°41.9	8.8′	N11°28.7	10.3′	59.2′
1	192°40.0	10.1	84°09.7	8.7′	11°39.0	10.3′	59.2′
2	207°39.8	09.6	98°37.4	8.7′	11°49.3	10.1′	59.2′
3	222°39.5	·· 09.2	113°05.1	8.7′	11°59.4	10.1′	59.2′
4	237°39.3	08.7	127°32.8	8.6′	12°09.5	10.1′	59.2′
5	252°39.1	08.3	142°00.4	8.6′	12°19.6	9.9′	59.2′
6	267°38.9	S21°07.8	156°28.0	8.5′	N12°29.5	9.9′	59.2′
7	282°38.7	07.3	170°55.5	8.5′	12°39.4	9.8′	59.2′
8	297°38.4	06.9	185°23.0	8.4′	12°49.2	9.7′	59.2′
9	312°38.2	·· 06.4	199°50.4	8.4′	12°58.9	9.6′	59.2′
10	327°38.0	06.0	214°17.8	8.3′	13°08.5	9.6′	59.2′
11	342°37.8	05.5	228°45.1	8.3′	13°18.1	9.5′	59.2′
12	357°37.6	S21°05.0	243°12.4	8.2′	N13°27.6	9.4′	59.2′
13	12°37.3	04.6	257°39.6	8.2′	13°37.0	9.3′	59.2′
14	27°37.1	04.1	272°06.8	8.1′	13°46.3	9.2′	59.2′
15	42°36.9	·· 03.6	286°34.0	8.1′	13°55.5	9.2′	59.2′
16	57°36.7	03.2	301°01.1	8.1′	14°04.7	9.0′	59.2′
17	72°36.5	02.7	315°28.1	8.0′	14°13.7	9.0′	59.2′
18	87°36.2	S21°02.2	329°55.1	8.0′	N14°22.7	8.9′	59.2′
19	102°36.0	01.8	344°22.1	7.9′	14°31.6	8.8′	59.2′
20	117°35.8	01.3	358°49.0	7.9′	14°40.4	8.7′	59.2′
21	132°35.6	·· 00.8	13°15.8	7.8′	14°49.1	8.6′	59.2′
22	147°35.4	21°00.4	27°42.7	7.8′	14°57.7	8.5′	59.2′
23	162°35.2	20°59.9	42°09.4	7.7′	15°06.2	8.5′	59.2′
	SD = 16.3′	d = 0.5′	SD = 16.2′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	08:03	09:56	▬	▬	14:23	16:16
N 70°	07:48	09:21	▬	▬	14:58	16:31
68°	07:36	08:56	10:38	13:41	15:23	16:43
66°	07:25	08:36	09:56	14:23	15:42	16:54
64°	07:17	08:21	09:28	14:51	15:58	17:02
62°	07:09	08:08	09:07	15:12	16:11	17:10
60°	07:02	07:56	08:49	15:29	16:23	17:17
N 58°	06:56	07:46	08:35	15:44	16:32	17:23
56°	06:50	07:38	08:23	15:56	16:41	17:28
54°	06:45	07:30	08:12	16:07	16:49	17:34
52°	06:41	07:23	08:02	16:17	16:56	17:38
50°	06:36	07:17	07:54	16:25	17:02	17:43
45°	06:26	07:03	07:35	16:43	17:16	17:52
N 40°	06:17	06:51	07:21	16:58	17:28	18:01
35°	06:09	06:40	07:08	17:11	17:38	18:09
30°	06:02	06:31	06:57	17:22	17:47	18:17
20°	05:47	06:14	06:38	17:41	18:04	18:31
N 10°	05:33	05:59	06:21	17:57	18:20	18:46
0°	05:17	05:43	06:05	18:13	18:35	19:01
S 10°	05:00	05:27	05:50	18:29	18:51	19:18
20°	04:40	05:08	05:33	18:46	19:10	19:38
30°	04:13	04:46	05:13	19:05	19:32	20:04
35°	03:57	04:32	05:01	19:17	19:46	20:21
40°	03:36	04:16	04:48	19:30	20:02	20:42
45°	03:09	03:56	04:32	19:46	20:22	21:08
S 50°	02:32	03:30	04:12	20:06	20:47	21:45
52°	02:11	03:17	04:02	20:15	21:00	22:06
54°	01:43	03:02	03:52	20:26	21:15	22:33
56°	00:57	02:44	03:40	20:38	21:33	23:16
58°	////	02:22	03:26	20:51	21:54	////
S 60°	////	01:52	03:09	21:08	22:24	////

Lat.	**Moonrise** Tue	Wed	Thu	**Moonset** Tue	Wed	Thu
N 72°	11:09	10:57	10:41	00:08	02:08	04:15
N 70°	11:15	11:10	11:05	00:05	01:57	03:52
68°	11:20	11:21	11:24	00:02	01:48	03:35
66°	11:24	11:30	11:39	00:00	01:40	03:21
64°	11:28	11:38	11:51	·· ··	01:34	03:10
62°	11:31	11:45	12:02	·· ··	01:28	03:00
60°	11:34	11:51	12:11	·· ··	01:24	02:52
N 58°	11:36	11:56	12:19	·· ··	01:20	02:45
56°	11:38	12:00	12:26	·· ··	01:16	02:39
54°	11:40	12:04	12:32	·· ··	01:13	02:33
52°	11:42	12:08	12:38	·· ··	01:10	02:28
50°	11:44	12:12	12:43	·· ··	01:07	02:23
45°	11:47	12:19	12:54	·· ··	01:01	02:14
N 40°	11:50	12:25	13:03	·· ··	00:56	02:05
35°	11:53	12:31	13:11	·· ··	00:52	01:58
30°	11:55	12:36	13:18	·· ··	00:48	01:52
20°	11:59	12:44	13:31	·· ··	00:42	01:42
N 10°	12:03	12:51	13:42	·· ··	00:36	01:32
0°	12:07	12:58	13:52	·· ··	00:31	01:24
S 10°	12:10	13:05	14:02	·· ··	00:26	01:15
20°	12:14	13:13	14:13	·· ··	00:20	01:06
30°	12:18	13:22	14:26	·· ··	00:14	00:55
35°	12:21	13:27	14:33	·· ··	00:10	00:49
40°	12:23	13:32	14:42	·· ··	00:06	00:42
45°	12:27	13:39	14:52	·· ··	00:01	00:34
S 50°	12:31	13:47	15:04	23:55	·· ··	00:25
52°	12:33	13:51	15:09	23:53	·· ··	00:20
54°	12:35	13:55	15:15	23:50	·· ··	00:15
56°	12:37	14:00	15:22	23:47	·· ··	00:10
58°	12:39	14:05	15:30	23:43	·· ··	00:04
S 60°	12:42	14:11	15:39	23:39	23:57	·· ··

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 7-9 45-68%
13	08:35	08:46	12:09	18:19	05:53	
14	08:58	09:08	12:09	19:11	06:45	
15	09:19	09:30	12:09	20:05	07:38	

January 16, 17, 18 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	115°20.5	198°55.5	S23°05.3	159°54.3	S18°04.8	285°22.1	S02°48.1	285°24.3	S01°38.6
1	130°23.0	213°54.6	05.3	174°54.8	04.2	300°24.5	48.2	300°26.7	38.6
2	145°25.5	228°53.7	05.3	189°55.3	03.6	315°26.9	48.2	315°29.2	38.5
3	160°27.9	243°52.7	·· 05.2	204°55.8	·· 03.1	330°29.3	·· 48.2	330°31.6	·· 38.5
4	175°30.4	258°51.8	05.2	219°56.2	02.5	345°31.7	48.2	345°34.1	38.5
5	190°32.9	273°50.8	05.2	234°56.7	02.0	0°34.1	48.2	0°36.5	38.5
6	205°35.3	288°49.9	S23°05.1	249°57.2	S18°01.4	15°36.5	S02°48.2	15°39.0	S01°38.5
7	220°37.8	303°49.0	05.1	264°57.7	00.8	30°38.9	48.3	30°41.4	38.5
8	235°40.3	318°48.0	05.0	279°58.1	18°00.3	45°41.3	48.3	45°43.9	38.5
9	250°42.7	333°47.1	·· 05.0	294°58.6	17°59.7	60°43.7	·· 48.3	60°46.3	·· 38.5
10	265°45.2	348°46.2	05.0	309°59.1	59.1	75°46.1	48.3	75°48.8	38.5
11	280°47.6	3°45.2	04.9	324°59.6	58.5	90°48.5	48.3	90°51.2	38.5
12	295°50.1	18°44.3	S23°04.9	340°00.0	S17°58.0	105°50.9	S02°48.3	105°53.7	S01°38.5
13	310°52.6	33°43.3	04.8	355°00.5	57.4	120°53.3	48.3	120°56.1	38.5
14	325°55.0	48°42.4	04.8	10°01.0	56.8	135°55.7	48.4	135°58.6	38.5
15	340°57.5	63°41.5	·· 04.7	25°01.5	·· 56.3	150°58.1	·· 48.4	151°01.0	·· 38.5
16	356°00.0	78°40.5	04.7	40°02.0	55.7	166°00.5	48.4	166°03.5	38.5
17	11°02.4	93°39.6	04.6	55°02.4	55.1	181°02.9	48.4	181°05.9	38.4
18	26°04.9	108°38.7	S23°04.6	70°02.9	S17°54.6	196°05.3	S02°48.4	196°08.4	S01°38.4
19	41°07.4	123°37.7	04.5	85°03.4	54.0	211°07.7	48.4	211°10.8	38.4
20	56°09.8	138°36.8	04.5	100°03.9	53.4	226°10.1	48.4	226°13.3	38.4
21	71°12.3	153°35.8	·· 04.4	115°04.4	·· 52.9	241°12.5	·· 48.5	241°15.7	·· 38.4
22	86°14.8	168°34.9	04.4	130°04.8	52.3	256°14.9	48.5	256°18.2	38.4
23	101°17.2	183°34.0	04.3	145°05.3	51.7	271°17.3	48.5	271°20.6	38.4
Mer.pass. 16:16		ν -0.9′	d 0.0′	m -3.93	ν 0.5′	d 0.6′	m 1.17	ν 2.4′	d 0.0′ m -2.12	ν 2.4′	d 0.0′ m 0.76

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	116°19.7	198°33.0	S23°04.2	160°05.8	S17°51.1	286°19.7	S02°48.5	286°23.1	S01°38.4
1	131°22.1	213°32.1	04.2	175°06.3	50.6	301°22.1	48.5	301°25.5	38.4
2	146°24.6	228°31.2	04.1	190°06.7	50.0	316°24.5	48.5	316°28.0	38.4
3	161°27.1	243°30.2	·· 04.1	205°07.2	·· 49.4	331°26.9	·· 48.5	331°30.5	·· 38.4
4	176°29.5	258°29.3	04.0	220°07.7	48.8	346°29.3	48.6	346°32.9	38.4
5	191°32.0	273°28.3	03.9	235°08.2	48.3	1°31.7	48.6	1°35.4	38.4
6	206°34.5	288°27.4	S23°03.9	250°08.7	S17°47.7	16°34.1	S02°48.6	16°37.8	S01°38.3
7	221°36.9	303°26.5	03.8	265°09.2	47.1	31°36.5	48.6	31°40.3	38.3
8	236°39.4	318°25.5	03.7	280°09.6	46.5	46°38.9	48.6	46°42.7	38.3
9	251°41.9	333°24.6	·· 03.7	295°10.1	·· 46.0	61°41.3	·· 48.6	61°45.2	·· 38.3
10	266°44.3	348°23.7	03.6	310°10.6	45.4	76°43.7	48.6	76°47.6	38.3
11	281°46.8	3°22.7	03.5	325°11.1	44.8	91°46.1	48.6	91°50.1	38.3
12	296°49.3	18°21.8	S23°03.4	340°11.6	S17°44.2	106°48.5	S02°48.7	106°52.5	S01°38.3
13	311°51.7	33°20.9	03.4	355°12.0	43.7	121°50.9	48.7	121°55.0	38.3
14	326°54.2	48°19.9	03.3	10°12.5	43.1	136°53.3	48.7	136°57.4	38.3
15	341°56.6	63°19.0	·· 03.2	25°13.0	·· 42.5	151°55.8	·· 48.7	151°59.9	·· 38.3
16	356°59.1	78°18.0	03.1	40°13.5	41.9	166°58.2	48.7	167°02.4	38.3
17	12°01.6	93°17.1	03.0	55°14.0	41.4	182°00.6	48.7	182°04.8	38.2
18	27°04.0	108°16.2	S23°03.0	70°14.5	S17°40.8	197°03.0	S02°48.7	197°07.3	S01°38.2
19	42°06.5	123°15.2	02.9	85°14.9	40.2	212°05.4	48.7	212°09.7	38.2
20	57°09.0	138°14.3	02.8	100°15.4	39.6	227°07.8	48.8	227°12.2	38.2
21	72°11.4	153°13.4	·· 02.7	115°15.9	·· 39.0	242°10.2	·· 48.8	242°14.6	·· 38.2
22	87°13.9	168°12.4	02.6	130°16.4	38.5	257°12.6	48.8	257°17.1	38.2
23	102°16.4	183°11.5	02.5	145°16.9	37.9	272°15.0	48.8	272°19.5	38.2
Mer.pass. 16:12		ν -0.9′	d 0.1′	m -3.93	ν 0.5′	d 0.6′	m 1.17	ν 2.4′	d 0.0′ m -2.13	ν 2.5′	d 0.0′ m 0.76

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	117°18.8	198°10.6	S23°02.5	160°17.4	S17°37.3	287°17.4	S02°48.8	287°22.0	S01°38.2
1	132°21.3	213°09.6	02.4	175°17.8	36.7	302°19.8	48.8	302°24.5	38.2
2	147°23.8	228°08.7	02.3	190°18.3	36.1	317°22.2	48.8	317°26.9	38.2
3	162°26.2	243°07.7	·· 02.2	205°18.8	·· 35.6	332°24.7	·· 48.8	332°29.4	·· 38.1
4	177°28.7	258°06.8	02.1	220°19.3	35.0	347°27.1	48.8	347°31.8	38.1
5	192°31.1	273°05.9	02.0	235°19.8	34.4	2°29.5	48.9	2°34.3	38.1
6	207°33.6	288°04.9	S23°01.9	250°20.3	S17°33.8	17°31.9	S02°48.9	17°36.7	S01°38.1
7	222°36.1	303°04.0	01.8	265°20.8	33.2	32°34.3	48.9	32°39.2	38.1
8	237°38.5	318°03.1	01.7	280°21.2	32.6	47°36.7	48.9	47°41.7	38.1
9	252°41.0	333°02.1	·· 01.6	295°21.7	·· 32.1	62°39.1	·· 48.9	62°44.1	·· 38.1
10	267°43.5	348°01.2	01.5	310°22.2	31.5	77°41.5	48.9	77°46.6	38.1
11	282°45.9	3°00.3	01.4	325°22.7	30.9	92°44.0	48.9	92°49.0	38.1
12	297°48.4	17°59.3	S23°01.3	340°23.2	S17°30.3	107°46.4	S02°48.9	107°51.5	S01°38.1
13	312°50.9	32°58.4	01.2	355°23.7	29.7	122°48.8	48.9	122°54.0	38.0
14	327°53.3	47°57.5	01.1	10°24.2	29.1	137°51.2	48.9	137°56.4	38.0
15	342°55.8	62°56.5	·· 01.0	25°24.6	·· 28.6	152°53.6	·· 48.9	152°58.9	·· 38.0
16	357°58.3	77°55.6	00.9	40°25.1	28.0	167°56.0	49.0	168°01.3	38.0
17	13°00.7	92°54.7	00.8	55°25.6	27.4	182°58.4	49.0	183°03.8	38.0
18	28°03.2	107°53.7	S23°00.7	70°26.1	S17°26.8	198°00.9	S02°49.0	198°06.3	S01°38.0
19	43°05.6	122°52.8	00.5	85°26.6	26.2	213°03.3	49.0	213°08.7	38.0
20	58°08.1	137°51.8	00.4	100°27.1	25.6	228°05.7	49.0	228°11.2	38.0
21	73°10.6	152°50.9	·· 00.3	115°27.6	·· 25.0	243°08.1	·· 49.0	243°13.6	·· 38.0
22	88°13.0	167°50.0	00.2	130°28.1	24.5	258°10.5	49.0	258°16.1	37.9
23	103°15.5	182°49.0	00.1	145°28.6	23.9	273°12.9	49.0	273°18.6	37.9
Mer.pass. 16:08		ν -0.9′	d 0.1′	m -3.93	ν 0.5′	d 0.6′	m 1.17	ν 2.4′	d 0.0′ m -2.14	ν 2.5′	d 0.0′ m 0.75

Stars

	SHA	Dec
Alpheratz	358°09.2	28°59.2
Ankaa	353°40.2	-42°24.9
Schedar	350°08.8	56°26.2
Diphda	349°20.7	-18°05.7
Achernar	335°45.1	-57°20.4
Hamal	328°28.6	23°22.4
Polaris	326°42.7	89°10.9
Acamar	315°36.9	-40°23.2
Menkar	314°40.8	4°00.8
Mirfak	309°15.5	49°47.7
Aldebaran	291°17.5	16°28.2
Rigel	281°35.5	-8°13.6
Capella	281°10.5	45°58.8
Bellatrix	278°58.2	6°19.9
Elnath	278°43.5	28°35.5
Alnilam	276°11.1	-1°13.0
Betelgeuse	271°27.7	7°24.1
Canopus	264°06.6	-52°41.3
Sirius	258°55.1	-16°41.5
Adhara	255°31.5	-28°56.9
Procyon	245°25.2	5°16.3
Pollux	243°57.5	28°04.3
Avior	234°27.4	-59°26.9
Suhail	223°10.2	-43°21.3
Miaplacidus	221°44.0	-69°38.2
Alphard	218°20.0	-8°34.6
Regulus	208°09.5	12°03.5
Dubhe	194°21.4	61°51.0
Denebola	182°58.6	14°40.6
Gienah	176°17.6	-17°26.1
Acrux	173°36.7	-62°59.3
Gacrux	172°28.2	-57°00.1
Alioth	166°42.2	56°03.5
Spica	158°57.3	-11°03.6
Alkaid	153°18.3	49°24.3
Hadar	149°23.0	-60°16.5
Menkent	148°36.8	-36°16.4
Arcturus	146°18.3	19°16.8
Rigil Kent.	140°25.6	-60°44.9
Kochab	137°19.4	74°13.8
Zuben'ubi	137°32.9	-15°57.7
Alphecca	126°32.1	26°46.6
Antares	112°56.8	-26°23.3
Atria	108°21.3	-68°59.4
Sabik	102°41.1	-15°42.0
Shaula	96°55.8	-37°05.3
Rasalhague	96°29.7	12°34.4
Eltanin	90°58.1	51°29.4
Kaus Aust.	84°16.9	-34°23.6
Vega	80°56.1	38°45.9
Nunki	76°29.2	-26°19.2
Altair	62°32.6	8°49.0
Peacock	53°58.6	-56°47.9
Deneb	49°48.7	45°12.8
Enif	34°11.6	9°47.2
Al Na'ir	28°15.1	-47°03.4
Fomalhaut	15°51.4	-29°43.6
Scheat	14°17.6	27°58.8
Markab	14°03.1	15°06.1

Jan 16 Fri	SHA	Mer.pass
Venus	83°35.0	10:45
Mars	44°33.8	13:20
Jupiter	170°01.5	04:58
Saturn	170°03.7	04:58

Jan 17 Sat	SHA	Mer.pass
Venus	82°13.3	10:46
Mars	43°46.1	13:19
Jupiter	170°00.0	04:54
Saturn	170°03.4	04:54

Jan 18 Sun	SHA	Mer.pass
Venus	80°51.7	10:48
Mars	42°58.5	13:18
Jupiter	169°58.6	04:50
Saturn	170°03.2	04:50

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°35.0	S20°59.4	56°36.2	7.7′	N15°14.7	8.3′	59.2′
1	192°34.7	58.9	71°02.9	7.6′	15°23.0	8.3′	59.2′
2	207°34.5	58.5	85°29.5	7.6′	15°31.3	8.1′	59.2′
3	222°34.3	·· 58.0	99°56.1	7.5′	15°39.4	8.0′	59.2′
4	237°34.1	57.5	114°22.6	7.5′	15°47.4	8.0′	59.2′
5	252°33.9	57.1	128°49.1	7.5′	15°55.4	7.8′	59.2′
6	267°33.7	S20°56.6	143°15.6	7.4′	N16°03.2	7.8′	59.2′
7	282°33.5	56.1	157°42.0	7.4′	16°11.0	7.6′	59.2′
8	297°33.2	55.6	172°08.4	7.3′	16°18.6	7.6′	59.2′
9	312°33.0	·· 55.1	186°34.7	7.3′	16°26.2	7.4′	59.2′
10	327°32.8	54.7	201°01.0	7.2′	16°33.6	7.3′	59.2′
11	342°32.6	54.2	215°27.2	7.2′	16°40.9	7.3′	59.2′
12	357°32.4	S20°53.7	229°53.4	7.2′	N16°48.2	7.1′	59.1′
13	12°32.2	53.2	244°19.6	7.1′	16°55.3	7.0′	59.1′
14	27°32.0	52.7	258°45.7	7.1′	17°02.3	6.9′	59.1′
15	42°31.8	·· 52.3	273°11.8	7.0′	17°09.2	6.8′	59.1′
16	57°31.6	51.8	287°37.8	7.0′	17°16.0	6.7′	59.1′
17	72°31.3	51.3	302°03.8	7.0′	17°22.7	6.5′	59.1′
18	87°31.1	S20°50.8	316°29.8	6.9′	N17°29.2	6.5′	59.1′
19	102°30.9	50.3	330°55.7	6.9′	17°35.7	6.3′	59.1′
20	117°30.7	49.8	345°21.6	6.9′	17°42.0	6.3′	59.1′
21	132°30.5	·· 49.4	359°47.5	6.8′	17°48.3	6.1′	59.1′
22	147°30.3	48.9	14°13.3	6.8′	17°54.4	6.0′	59.1′
23	162°30.1	48.4	28°39.1	6.8′	18°00.4	5.9′	59.1′
	SD = 16.3′	d = 0.5′	SD = 16.1′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°29.9	S20°47.9	43°04.8	6.7′	N18°06.3	5.8′	59.1′
1	192°29.7	47.4	57°30.5	6.7′	18°12.1	5.6′	59.1′
2	207°29.5	46.9	71°56.2	6.7′	18°17.7	5.5′	59.0′
3	222°29.3	·· 46.4	86°21.9	6.6′	18°23.2	5.4′	59.0′
4	237°29.1	45.9	100°47.5	6.6′	18°28.6	5.3′	59.0′
5	252°28.8	45.5	115°13.1	6.6′	18°33.9	5.2′	59.0′
6	267°28.6	S20°45.0	129°38.7	6.5′	N18°39.1	5.1′	59.0′
7	282°28.4	44.5	144°04.2	6.5′	18°44.2	4.9′	59.0′
8	297°28.2	44.0	158°29.7	6.5′	18°49.1	4.8′	59.0′
9	312°28.0	·· 43.5	172°55.2	6.5′	18°53.9	4.7′	59.0′
10	327°27.8	43.0	187°20.7	6.4′	18°58.6	4.5′	59.0′
11	342°27.6	42.5	201°46.1	6.4′	19°03.1	4.5′	59.0′
12	357°27.4	S20°42.0	216°11.5	6.4′	N19°07.6	4.3′	58.9′
13	12°27.2	41.5	230°36.9	6.4′	19°11.9	4.2′	58.9′
14	27°27.0	41.0	245°02.3	6.4′	19°16.1	4.0′	58.9′
15	42°26.8	·· 40.5	259°27.7	6.3′	19°20.1	4.0′	58.9′
16	57°26.6	40.0	273°53.0	6.3′	19°24.1	3.8′	58.9′
17	72°26.4	39.5	288°18.3	6.3′	19°27.9	3.6′	58.9′
18	87°26.2	S20°39.0	302°43.6	6.3′	N19°31.5	3.6′	58.9′
19	102°26.0	38.5	317°08.9	6.3′	19°35.1	3.4′	58.9′
20	117°25.8	38.0	331°34.2	6.3′	19°38.5	3.3′	58.8′
21	132°25.6	·· 37.5	345°59.5	6.3′	19°41.8	3.2′	58.8′
22	147°25.4	37.0	0°24.7	6.2′	19°45.0	3.0′	58.8′
23	162°25.2	36.5	14°50.0	6.2′	19°48.0	2.9′	58.8′
	SD = 16.3′	d = 0.5′	SD = 16.1′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°25.0	S20°36.0	29°15.2	6.2′	N19°50.9	2.8′	58.8′
1	192°24.8	35.5	43°40.5	6.2′	19°53.7	2.6′	58.8′
2	207°24.6	35.0	58°05.7	6.2′	19°56.3	2.6′	58.8′
3	222°24.4	·· 34.5	72°30.9	6.2′	19°58.9	2.3′	58.7′
4	237°24.2	34.0	86°56.1	6.2′	20°01.2	2.3′	58.7′
5	252°24.0	33.5	101°21.3	6.2′	20°03.5	2.1′	58.7′
6	267°23.8	S20°32.9	115°46.6	6.2′	N20°05.6	2.0′	58.7′
7	282°23.6	32.4	130°11.8	6.2′	20°07.6	1.9′	58.7′
8	297°23.4	31.9	144°37.0	6.2′	20°09.5	1.7′	58.7′
9	312°23.2	·· 31.4	159°02.2	6.2′	20°11.2	1.6′	58.7′
10	327°23.0	30.9	173°27.4	6.2′	20°12.8	1.5′	58.6′
11	342°22.8	30.4	187°52.7	6.2′	20°14.3	1.3′	58.6′
12	357°22.6	S20°29.9	202°17.9	6.3′	N20°15.6	1.2′	58.6′
13	12°22.4	29.4	216°43.2	6.3′	20°16.8	1.1′	58.6′
14	27°22.2	28.9	231°08.4	6.3′	20°17.9	0.9′	58.6′
15	42°22.0	·· 28.3	245°33.7	6.3′	20°18.8	0.8′	58.6′
16	57°21.8	27.8	259°59.0	6.3′	20°19.6	0.7′	58.5′
17	72°21.6	27.3	274°24.3	6.3′	20°20.3	0.6′	58.5′
18	87°21.4	S20°26.8	288°49.6	6.3′	N20°20.9	0.4′	58.5′
19	102°21.2	26.3	303°14.9	6.4′	20°21.3	0.3′	58.5′
20	117°21.1	25.8	317°40.3	6.4′	20°21.6	0.1′	58.5′
21	132°20.9	·· 25.2	332°05.7	6.4′	20°21.7	0.1′	58.4′
22	147°20.7	24.7	346°31.1	6.4′	20°21.8	0.2′	58.4′
23	162°20.5	24.2	0°56.5	6.4′	20°21.6	0.2′	58.4′
	SD = 16.2′	d = 0.5′	SD = 16.0′				

Lat.	**Twilight** Naut.	**Twilight** Civil	**Sunrise**	**Sunset**	**Twilight** Civil	**Twilight** Naut.
N 72°	07:56	09:44	▬	▬	14:38	16:25
N 70°	07:42	09:12	11:43	12:38	15:09	16:39
68°	07:31	08:49	10:24	13:57	15:32	16:51
66°	07:21	08:31	09:47	14:34	15:50	17:00
64°	07:13	08:16	09:21	15:00	16:05	17:08
62°	07:05	08:03	09:01	15:20	16:18	17:16
60°	06:59	07:53	08:45	15:36	16:28	17:22
N 58°	06:53	07:43	08:31	15:50	16:38	17:28
56°	06:48	07:35	08:19	16:02	16:46	17:33
54°	06:43	07:27	08:09	16:12	16:53	17:38
52°	06:39	07:21	07:59	16:21	17:00	17:42
50°	06:34	07:15	07:51	16:30	17:06	17:46
45°	06:25	07:01	07:34	16:47	17:20	17:56
N 40°	06:16	06:50	07:19	17:01	17:31	18:04
35°	06:09	06:40	07:07	17:14	17:41	18:12
30°	06:01	06:31	06:56	17:24	17:50	18:19
20°	05:47	06:14	06:38	17:43	18:06	18:33
N 10°	05:34	05:59	06:22	17:59	18:21	18:47
0°	05:19	05:44	06:07	18:14	18:36	19:02
S 10°	05:02	05:29	05:51	18:29	18:52	19:18
20°	04:42	05:11	05:35	18:46	19:10	19:38
30°	04:16	04:49	05:15	19:05	19:31	20:03
35°	04:00	04:35	05:04	19:16	19:45	20:20
40°	03:40	04:19	04:51	19:29	20:00	20:39
45°	03:14	04:00	04:36	19:44	20:19	21:05
S 50°	02:38	03:35	04:16	20:03	20:44	21:41
52°	02:19	03:23	04:07	20:12	20:56	22:00
54°	01:53	03:08	03:57	20:22	21:11	22:25
56°	01:15	02:51	03:45	20:34	21:27	23:01
58°	////	02:30	03:32	20:47	21:48	////
S 60°	////	02:03	03:16	21:03	22:14	////

Lat.	**Moonrise** Fri	**Moonrise** Sat	**Moonrise** Sun	**Moonset** Fri	**Moonset** Sat	**Moonset** Sun
N 72°	10:15	▭	▭	06:36	▭	▭
N 70°	11:00	10:52	▭	05:52	07:59	▭
68°	11:29	11:42	12:11	05:24	07:10	08:41
66°	11:52	12:13	12:51	05:02	06:39	08:01
64°	12:09	12:37	13:19	04:45	06:16	07:34
62°	12:24	12:56	13:40	04:31	05:57	07:12
60°	12:36	13:11	13:58	04:19	05:42	06:55
N 58°	12:47	13:24	14:12	04:09	05:29	06:41
56°	12:57	13:36	14:25	04:00	05:18	06:28
54°	13:05	13:46	14:36	03:53	05:08	06:17
52°	13:12	13:54	14:45	03:46	05:00	06:08
50°	13:19	14:03	14:54	03:39	04:52	05:59
45°	13:34	14:20	15:12	03:26	04:36	05:41
N 40°	13:46	14:34	15:27	03:14	04:22	05:26
35°	13:56	14:46	15:40	03:05	04:11	05:14
30°	14:05	14:56	15:51	02:57	04:01	05:03
20°	14:21	15:14	16:10	02:42	03:43	04:44
N 10°	14:34	15:30	16:27	02:30	03:28	04:27
0°	14:47	15:44	16:42	02:18	03:14	04:12
S 10°	15:00	15:59	16:58	02:06	03:00	03:57
20°	15:14	16:15	17:15	01:54	02:46	03:40
30°	15:30	16:34	17:34	01:40	02:28	03:22
35°	15:40	16:44	17:45	01:32	02:19	03:11
40°	15:50	16:56	17:58	01:22	02:07	02:58
45°	16:03	17:11	18:13	01:11	01:54	02:43
S 50°	16:18	17:29	18:32	00:58	01:38	02:25
52°	16:26	17:37	18:41	00:52	01:30	02:16
54°	16:34	17:47	18:51	00:45	01:22	02:07
56°	16:43	17:57	19:02	00:38	01:12	01:56
58°	16:53	18:09	19:15	00:29	01:02	01:44
S 60°	17:05	18:23	19:30	00:20	00:49	01:29

Day	**Sun** Eqn.of Time 00^h mm:ss	**Sun** Eqn.of Time 12^h mm:ss	**Sun** Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	**Moon** Mer.Pass. Lower hh:mm	**Moon** Age 10-12 78-93%
16	09:40	09:50	12:10	21:01	08:33	
17	10:00	10:10	12:10	21:58	09:29	
18	10:20	10:30	12:10	22:56	10:27	

January 19, 20, 21 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	118°18.0	197°48.1	S23°00.0	160°29.0	S17°23.3	288°15.4	S02°49.0	288°21.0	S01°37.9
1	133°20.4	212°47.2	22°59.8	175°29.5	22.7	303°17.8	49.0	303°23.5	37.9
2	148°22.9	227°46.2	59.7	190°30.0	22.1	318°20.2	49.0	318°25.9	37.9
3	163°25.4	242°45.3	·· 59.6	205°30.5	·· 21.5	333°22.6	·· 49.0	333°28.4	·· 37.9
4	178°27.8	257°44.4	59.5	220°31.0	20.9	348°25.0	49.0	348°30.9	37.9
5	193°30.3	272°43.4	59.4	235°31.5	20.3	3°27.4	49.1	3°33.3	37.9
6	208°32.7	287°42.5	S22°59.2	250°32.0	S17°19.7	18°29.9	S02°49.1	18°35.8	S01°37.9
7	223°35.2	302°41.6	59.1	265°32.5	19.2	33°32.3	49.1	33°38.2	37.8
8	238°37.7	317°40.6	59.0	280°33.0	18.6	48°34.7	49.1	48°40.7	37.8
9	253°40.1	332°39.7	·· 58.8	295°33.5	·· 18.0	63°37.1	·· 49.1	63°43.2	·· 37.8
10	268°42.6	347°38.8	58.7	310°33.9	17.4	78°39.5	49.1	78°45.6	37.8
11	283°45.1	2°37.8	58.6	325°34.4	16.8	93°42.0	49.1	93°48.1	37.8
12	298°47.5	17°36.9	S22°58.5	340°34.9	S17°16.2	108°44.4	S02°49.1	108°50.6	S01°37.8
13	313°50.0	32°36.0	58.3	355°35.4	15.6	123°46.8	49.1	123°53.0	37.8
14	328°52.5	47°35.0	58.2	10°35.9	15.0	138°49.2	49.1	138°55.5	37.8
15	343°54.9	62°34.1	·· 58.0	25°36.4	·· 14.4	153°51.7	·· 49.1	153°57.9	·· 37.7
16	358°57.4	77°33.2	57.9	40°36.9	13.8	168°54.1	49.1	169°00.4	37.7
17	13°59.9	92°32.2	57.8	55°37.4	13.2	183°56.5	49.1	184°02.9	37.7
18	29°02.3	107°31.3	S22°57.6	70°37.9	S17°12.6	198°58.9	S02°49.1	199°05.3	S01°37.7
19	44°04.8	122°30.4	57.5	85°38.4	12.0	214°01.3	49.1	214°07.8	37.7
20	59°07.2	137°29.5	57.3	100°38.9	11.5	229°03.8	49.1	229°10.3	37.7
21	74°09.7	152°28.5	·· 57.2	115°39.4	·· 10.9	244°06.2	·· 49.2	244°12.7	·· 37.7
22	89°12.2	167°27.6	57.1	130°39.8	10.3	259°08.6	49.2	259°15.2	37.7
23	104°14.6	182°26.7	56.9	145°40.3	09.7	274°11.0	49.2	274°17.7	37.6
Mer.pass. 16:04		ν -0.9′	d 0.1′	m -3.93	ν 0.5′	d 0.6′	m 1.17	ν 2.4′	d 0.0′ m -2.14	ν 2.5′	d 0.0′ m 0.75

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	119°17.1	197°25.7	S22°56.8	160°40.8	S17°09.1	289°13.5	S02°49.2	289°20.1	S01°37.6
1	134°19.6	212°24.8	56.6	175°41.3	08.5	304°15.9	49.2	304°22.6	37.6
2	149°22.0	227°23.9	56.5	190°41.8	07.9	319°18.3	49.2	319°25.0	37.6
3	164°24.5	242°22.9	·· 56.3	205°42.3	·· 07.3	334°20.7	·· 49.2	334°27.5	·· 37.6
4	179°27.0	257°22.0	56.2	220°42.8	06.7	349°23.2	49.2	349°30.0	37.6
5	194°29.4	272°21.1	56.0	235°43.3	06.1	4°25.6	49.2	4°32.4	37.6
6	209°31.9	287°20.1	S22°55.9	250°43.8	S17°05.5	19°28.0	S02°49.2	19°34.9	S01°37.5
7	224°34.4	302°19.2	55.7	265°44.3	04.9	34°30.4	49.2	34°37.4	37.5
8	239°36.8	317°18.3	55.5	280°44.8	04.3	49°32.9	49.2	49°39.8	37.5
9	254°39.3	332°17.4	·· 55.4	295°45.3	·· 03.7	64°35.3	·· 49.2	64°42.3	·· 37.5
10	269°41.7	347°16.4	55.2	310°45.8	03.1	79°37.7	49.2	79°44.8	37.5
11	284°44.2	2°15.5	55.1	325°46.3	02.5	94°40.1	49.2	94°47.2	37.5
12	299°46.7	17°14.6	S22°54.9	340°46.8	S17°01.9	109°42.6	S02°49.2	109°49.7	S01°37.5
13	314°49.1	32°13.6	54.7	355°47.3	01.3	124°45.0	49.2	124°52.2	37.5
14	329°51.6	47°12.7	54.6	10°47.8	00.7	139°47.4	49.2	139°54.6	37.4
15	344°54.1	62°11.8	·· 54.4	25°48.3	17°00.1	154°49.9	·· 49.2	154°57.1	·· 37.4
16	359°56.5	77°10.8	54.2	40°48.8	16°59.5	169°52.3	49.2	169°59.6	37.4
17	14°59.0	92°09.9	54.1	55°49.3	58.9	184°54.7	49.2	185°02.0	37.4
18	30°01.5	107°09.0	S22°53.9	70°49.8	S16°58.3	199°57.1	S02°49.2	200°04.5	S01°37.4
19	45°03.9	122°08.1	53.7	85°50.2	57.7	214°59.6	49.2	215°07.0	37.4
20	60°06.4	137°07.1	53.6	100°50.7	57.1	230°02.0	49.2	230°09.5	37.4
21	75°08.9	152°06.2	·· 53.4	115°51.2	·· 56.5	245°04.4	·· 49.2	245°11.9	·· 37.3
22	90°11.3	167°05.3	53.2	130°51.7	55.9	260°06.9	49.2	260°14.4	37.3
23	105°13.8	182°04.3	53.0	145°52.2	55.3	275°09.3	49.2	275°16.9	37.3
Mer.pass. 16:00		ν -0.9′	d 0.1′	m -3.93	ν 0.5′	d 0.6′	m 1.17	ν 2.4′	d 0.0′ m -2.15	ν 2.5′	d 0.0′ m 0.74

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	120°16.2	197°03.4	S22°52.9	160°52.7	S16°54.7	290°11.7	S02°49.2	290°19.3	S01°37.3
1	135°18.7	212°02.5	52.7	175°53.2	54.1	305°14.2	49.2	305°21.8	37.3
2	150°21.2	227°01.6	52.5	190°53.7	53.5	320°16.6	49.2	320°24.3	37.3
3	165°23.6	242°00.6	·· 52.3	205°54.2	·· 52.9	335°19.0	·· 49.2	335°26.7	·· 37.2
4	180°26.1	256°59.7	52.1	220°54.7	52.3	350°21.5	49.2	350°29.2	37.2
5	195°28.6	271°58.8	52.0	235°55.2	51.7	5°23.9	49.2	5°31.7	37.2
6	210°31.0	286°57.8	S22°51.8	250°55.7	S16°51.1	20°26.3	S02°49.2	20°34.1	S01°37.2
7	225°33.5	301°56.9	51.6	265°56.2	50.5	35°28.8	49.2	35°36.6	37.2
8	240°36.0	316°56.0	51.4	280°56.7	49.9	50°31.2	49.2	50°39.1	37.2
9	255°38.4	331°55.1	·· 51.2	295°57.2	·· 49.2	65°33.6	·· 49.2	65°41.6	·· 37.2
10	270°40.9	346°54.1	51.0	310°57.7	48.6	80°36.1	49.2	80°44.0	37.1
11	285°43.3	1°53.2	50.8	325°58.2	48.0	95°38.5	49.2	95°46.5	37.1
12	300°45.8	16°52.3	S22°50.7	340°58.7	S16°47.4	110°40.9	S02°49.2	110°49.0	S01°37.1
13	315°48.3	31°51.4	50.5	355°59.2	46.8	125°43.4	49.2	125°51.4	37.1
14	330°50.7	46°50.4	50.3	10°59.7	46.2	140°45.8	49.2	140°53.9	37.1
15	345°53.2	61°49.5	·· 50.1	26°00.2	·· 45.6	155°48.2	·· 49.2	155°56.4	·· 37.1
16	0°55.7	76°48.6	49.9	41°00.7	45.0	170°50.7	49.2	170°58.9	37.0
17	15°58.1	91°47.7	49.7	56°01.2	44.4	185°53.1	49.2	186°01.3	37.0
18	31°00.6	106°46.7	S22°49.5	71°01.7	S16°43.8	200°55.6	S02°49.2	201°03.8	S01°37.0
19	46°03.1	121°45.8	49.3	86°02.2	43.2	215°58.0	49.2	216°06.3	37.0
20	61°05.5	136°44.9	49.1	101°02.7	42.6	231°00.4	49.2	231°08.7	37.0
21	76°08.0	151°44.0	·· 48.9	116°03.2	·· 42.0	246°02.9	·· 49.2	246°11.2	·· 37.0
22	91°10.5	166°43.0	48.7	131°03.7	41.3	261°05.3	49.2	261°13.7	36.9
23	106°12.9	181°42.1	48.5	146°04.2	40.7	276°07.7	49.2	276°16.2	36.9
Mer.pass. 15:56		ν -0.9′	d 0.2′	m -3.92	ν 0.5′	d 0.6′	m 1.17	ν 2.4′	d 0.0′ m -2.16	ν 2.5′	d 0.0′ m 0.74

Stars

	SHA	Dec
Alpheratz	358°09.2	28°59.2
Ankaa	353°40.2	-42°24.9
Schedar	350°08.9	56°26.2
Diphda	349°20.7	-18°05.7
Achernar	335°45.2	-57°20.4
Hamal	328°28.6	23°22.4
Polaris	326°43.7	89°10.9
Acamar	315°36.9	-40°23.2
Menkar	314°40.8	4°00.8
Mirfak	309°15.5	49°47.8
Aldebaran	291°17.5	16°28.2
Rigel	281°35.5	-8°13.6
Capella	281°10.5	45°58.8
Bellatrix	278°58.2	6°19.8
Elnath	278°43.5	28°35.5
Alnilam	276°11.1	-1°13.0
Betelgeuse	271°27.7	7°24.1
Canopus	264°06.6	-52°41.3
Sirius	258°55.1	-16°41.5
Adhara	255°31.5	-28°56.9
Procyon	245°25.2	5°16.3
Pollux	243°57.5	28°04.3
Avior	234°27.4	-59°26.9
Suhail	223°10.1	-43°21.3
Miaplacidus	221°44.0	-69°38.3
Alphard	218°20.0	-8°34.6
Regulus	208°09.5	12°03.5
Dubhe	194°21.4	61°51.0
Denebola	182°58.6	14°40.6
Gienah	176°17.6	-17°26.1
Acrux	173°36.7	-62°59.3
Gacrux	172°28.2	-57°00.1
Alioth	166°42.2	56°03.5
Spica	158°57.2	-11°03.7
Alkaid	153°18.3	49°24.3
Hadar	149°23.0	-60°16.6
Menkent	148°36.7	-36°16.4
Arcturus	146°18.3	19°16.8
Rigil Kent.	140°25.5	-60°44.9
Kochab	137°19.4	74°13.8
Zuben'ubi	137°32.8	-15°57.7
Alphecca	126°32.1	26°46.6
Antares	112°56.8	-26°23.3
Atria	108°21.2	-68°59.4
Sabik	102°41.1	-15°42.0
Shaula	96°55.8	-37°05.3
Rasalhague	96°29.6	12°34.4
Eltanin	90°58.1	51°29.4
Kaus Aust.	84°16.9	-34°23.6
Vega	80°56.1	38°45.9
Nunki	76°29.2	-26°19.2
Altair	62°32.6	8°49.0
Peacock	53°58.6	-56°47.9
Deneb	49°48.7	45°12.8
Enif	34°11.6	9°47.2
Al Na'ir	28°15.1	-47°03.4
Fomalhaut	15°51.4	-29°43.6
Scheat	14°17.6	27°58.8
Markab	14°03.1	15°06.1

Jan 19 Mon	SHA	Mer.pass
Venus	79°30.1	10:49
Mars	42°11.1	13:18
Jupiter	169°57.4	04:46
Saturn	170°03.0	04:46

Jan 20 Tue	SHA	Mer.pass
Venus	78°08.6	10:51
Mars	41°23.7	13:17
Jupiter	169°56.4	04:42
Saturn	170°03.0	04:42

Jan 21 Wed	SHA	Mer.pass
Venus	76°47.2	10:52
Mars	40°36.5	13:16
Jupiter	169°55.5	04:38
Saturn	170°03.1	04:38

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h

Mon	Sun GHA	Sun Dec	Moon GHA	ν	Moon Dec	d	HP
0	177°20.3	S20°23.7	15°21.9	6.5′	N20°21.4	0.4′	58.4′
1	192°20.1	23.2	29°47.4	6.5′	20°21.0	0.4′	58.4′
2	207°19.9	22.6	44°12.9	6.5′	20°20.6	0.7′	58.4′
3	222°19.7	·· 22.1	58°38.4	6.5′	20°19.9	0.7′	58.3′
4	237°19.5	21.6	73°03.9	6.6′	20°19.2	0.9′	58.3′
5	252°19.3	21.1	87°29.5	6.6′	20°18.3	1.0′	58.3′
6	267°19.1	S20°20.5	101°55.1	6.6′	N20°17.3	1.1′	58.3′
7	282°18.9	20.0	116°20.8	6.7′	20°16.2	1.3′	58.3′
8	297°18.7	19.5	130°46.4	6.7′	20°14.9	1.4′	58.2′
9	312°18.6	·· 19.0	145°12.1	6.7′	20°13.5	1.5′	58.2′
10	327°18.4	18.4	159°37.9	6.8′	20°12.0	1.7′	58.2′
11	342°18.2	17.9	174°03.7	6.8′	20°10.3	1.7′	58.2′
12	357°18.0	S20°17.4	188°29.5	6.9′	N20°08.6	1.9′	58.1′
13	12°17.8	16.9	202°55.4	6.9′	20°06.7	2.0′	58.1′
14	27°17.6	16.3	217°21.3	7.0′	20°04.7	2.2′	58.1′
15	42°17.4	·· 15.8	231°47.2	7.0′	20°02.5	2.2′	58.1′
16	57°17.2	15.3	246°13.2	7.0′	20°00.3	2.4′	58.1′
17	72°17.1	14.7	260°39.3	7.1′	19°57.9	2.5′	58.0′
18	87°16.9	S20°14.2	275°05.4	7.1′	N19°55.4	2.7′	58.0′
19	102°16.7	13.7	289°31.5	7.2′	19°52.7	2.7′	58.0′
20	117°16.5	13.1	303°57.7	7.2′	19°50.0	2.9′	58.0′
21	132°16.3	·· 12.6	318°23.9	7.3′	19°47.1	3.0′	57.9′
22	147°16.1	12.1	332°50.2	7.3′	19°44.1	3.1′	57.9′
23	162°15.9	11.5	347°16.5	7.4′	19°41.0	3.2′	57.9′
	SD = 16.2′	d = 0.5′		SD = 15.9′			

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	177°15.8	S20°11.0	1°42.9	7.4′	N19°37.8	3.3′	57.9′
1	192°15.6	10.5	16°09.3	7.5′	19°34.5	3.5′	57.9′
2	207°15.4	09.9	30°35.8	7.5′	19°31.0	3.5′	57.8′
3	222°15.2	·· 09.4	45°02.4	7.6′	19°27.5	3.7′	57.8′
4	237°15.0	08.8	59°29.0	7.7′	19°23.8	3.8′	57.8′
5	252°14.8	08.3	73°55.6	7.7′	19°20.0	3.9′	57.8′
6	267°14.7	S20°07.8	88°22.4	7.8′	N19°16.1	4.1′	57.7′
7	282°14.5	07.2	102°49.1	7.8′	19°12.0	4.1′	57.7′
8	297°14.3	06.7	117°16.0	7.9′	19°07.9	4.3′	57.7′
9	312°14.1	·· 06.1	131°42.9	8.0′	19°03.6	4.3′	57.7′
10	327°13.9	05.6	146°09.9	8.0′	18°59.3	4.5′	57.6′
11	342°13.7	05.1	160°36.9	8.1′	18°54.8	4.5′	57.6′
12	357°13.6	S20°04.5	175°04.0	8.2′	N18°50.3	4.7′	57.6′
13	12°13.4	04.0	189°31.1	8.2′	18°45.6	4.8′	57.6′
14	27°13.2	03.4	203°58.3	8.3′	18°40.8	4.9′	57.5′
15	42°13.0	·· 02.9	218°25.6	8.3′	18°35.9	5.0′	57.5′
16	57°12.8	02.3	232°53.0	8.4′	18°30.9	5.1′	57.5′
17	72°12.7	01.8	247°20.4	8.5′	18°25.8	5.2′	57.5′
18	87°12.5	S20°01.2	261°47.8	8.5′	N18°20.6	5.3′	57.4′
19	102°12.3	00.7	276°15.4	8.6′	18°15.3	5.4′	57.4′
20	117°12.1	20°00.1	290°43.0	8.7′	18°09.9	5.5′	57.4′
21	132°11.9	19°59.6	305°10.7	8.8′	18°04.4	5.6′	57.3′
22	147°11.8	59.0	319°38.4	8.8′	17°58.8	5.7′	57.3′
23	162°11.6	58.5	334°06.3	8.9′	17°53.1	5.8′	57.3′
	SD = 16.2′	d = 0.5′		SD = 15.8′			

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	177°11.4	S19°57.9	348°34.2	9.0′	N17°47.3	5.9′	57.3′
1	192°11.2	57.4	3°02.1	9.0′	17°41.4	5.9′	57.2′
2	207°11.1	56.8	17°30.2	9.1′	17°35.5	6.1′	57.2′
3	222°10.9	·· 56.3	31°58.3	9.2′	17°29.4	6.2′	57.2′
4	237°10.7	55.7	46°26.4	9.2′	17°23.2	6.3′	57.2′
5	252°10.5	55.2	60°54.7	9.3′	17°16.9	6.3′	57.1′
6	267°10.4	S19°54.6	75°23.0	9.4′	N17°10.6	6.4′	57.1′
7	282°10.2	54.0	89°51.4	9.5′	17°04.2	6.6′	57.1′
8	297°10.0	53.5	104°19.9	9.5′	16°57.6	6.6′	57.1′
9	312°09.8	·· 52.9	118°48.4	9.6′	16°51.0	6.7′	57.0′
10	327°09.7	52.4	133°17.0	9.7′	16°44.3	6.8′	57.0′
11	342°09.5	51.8	147°45.7	9.8′	16°37.5	6.8′	57.0′
12	357°09.3	S19°51.3	162°14.5	9.8′	N16°30.7	7.0′	56.9′
13	12°09.1	50.7	176°43.3	9.9′	16°23.7	7.0′	56.9′
14	27°09.0	50.1	191°12.2	10.0′	16°16.7	7.1′	56.9′
15	42°08.8	·· 49.6	205°41.2	10.1′	16°09.6	7.2′	56.9′
16	57°08.6	49.0	220°10.2	10.1′	16°02.4	7.3′	56.8′
17	72°08.5	48.4	234°39.4	10.2′	15°55.1	7.3′	56.8′
18	87°08.3	S19°47.9	249°08.6	10.3′	N15°47.8	7.5′	56.8′
19	102°08.1	47.3	263°37.8	10.4′	15°40.3	7.5′	56.8′
20	117°07.9	46.8	278°07.2	10.4′	15°32.8	7.5′	56.7′
21	132°07.8	·· 46.2	292°36.6	10.5′	15°25.3	7.7′	56.7′
22	147°07.6	45.6	307°06.1	10.6′	15°17.6	7.7′	56.7′
23	162°07.4	45.1	321°35.7	10.6′	15°09.9	7.8′	56.6′
	SD = 16.2′	d = 0.6′		SD = 15.6′			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	07:48	09:31	▬	▬	14:52	16:35
N 70°	07:35	09:03	11:06	13:18	15:21	16:48
68°	07:25	08:41	10:10	14:13	15:42	16:59
66°	07:16	08:24	09:38	14:45	15:59	17:07
64°	07:08	08:10	09:14	15:09	16:13	17:15
62°	07:01	07:58	08:55	15:28	16:24	17:22
60°	06:55	07:48	08:39	15:43	16:35	17:28
N 58°	06:50	07:39	08:26	15:56	16:43	17:33
56°	06:45	07:32	08:15	16:08	16:51	17:38
54°	06:40	07:24	08:05	16:18	16:58	17:42
52°	06:36	07:18	07:56	16:26	17:05	17:47
50°	06:32	07:12	07:48	16:34	17:11	17:50
45°	06:23	06:59	07:32	16:51	17:23	17:59
N 40°	06:15	06:48	07:18	17:05	17:34	18:07
35°	06:08	06:39	07:06	17:16	17:44	18:15
30°	06:01	06:30	06:56	17:27	17:52	18:22
20°	05:48	06:14	06:38	17:44	18:08	18:35
N 10°	05:34	06:00	06:22	18:00	18:22	18:48
0°	05:20	05:45	06:07	18:15	18:37	19:02
S 10°	05:04	05:30	05:53	18:30	18:52	19:18
20°	04:44	05:13	05:37	18:45	19:09	19:38
30°	04:20	04:51	05:18	19:04	19:30	20:02
35°	04:04	04:39	05:07	19:15	19:43	20:18
40°	03:44	04:23	04:54	19:27	19:58	20:37
45°	03:20	04:05	04:40	19:42	20:17	21:02
S 50°	02:45	03:41	04:21	20:00	20:41	21:35
52°	02:27	03:29	04:12	20:09	20:52	21:53
54°	02:03	03:15	04:03	20:18	21:06	22:16
56°	01:30	02:59	03:52	20:29	21:22	22:48
58°	////	02:39	03:39	20:42	21:41	////
S 60°	////	02:14	03:24	20:57	22:05	////

Lat.	Moonrise Mon	Moonrise Tue	Moonrise Wed	Moonset Mon	Moonset Tue	Moonset Wed
N 72°	▭	▭	15:09	▭	▭	11:31
N 70°	▭	13:55	15:52	▭	10:54	10:47
68°	13:13	14:42	16:21	09:40	10:06	10:17
66°	13:52	15:13	16:43	09:00	09:35	09:55
64°	14:19	15:35	17:00	08:32	09:12	09:37
62°	14:40	15:53	17:14	08:11	08:54	09:23
60°	14:57	16:08	17:25	07:54	08:38	09:10
N 58°	15:12	16:21	17:36	07:40	08:25	09:00
56°	15:24	16:32	17:44	07:27	08:14	08:50
54°	15:35	16:42	17:52	07:16	08:04	08:42
52°	15:44	16:50	17:59	07:07	07:55	08:34
50°	15:53	16:58	18:06	06:58	07:47	08:28
45°	16:11	17:14	18:19	06:40	07:30	08:13
N 40°	16:26	17:28	18:30	06:25	07:16	08:01
35°	16:38	17:39	18:40	06:12	07:05	07:51
30°	16:49	17:49	18:48	06:01	06:54	07:42
20°	17:08	18:06	19:03	05:42	06:36	07:27
N 10°	17:24	18:21	19:15	05:25	06:21	07:13
0°	17:39	18:35	19:27	05:10	06:06	07:00
S 10°	17:55	18:48	19:39	04:54	05:51	06:47
20°	18:11	19:03	19:51	04:38	05:36	06:33
30°	18:30	19:20	20:05	04:18	05:18	06:17
35°	18:41	19:30	20:13	04:07	05:07	06:08
40°	18:53	19:41	20:23	03:54	04:55	05:58
45°	19:08	19:54	20:34	03:39	04:40	05:45
S 50°	19:26	20:10	20:47	03:20	04:23	05:30
52°	19:34	20:18	20:53	03:12	04:15	05:23
54°	19:44	20:26	21:00	03:02	04:05	05:15
56°	19:54	20:36	21:07	02:50	03:55	05:06
58°	20:07	20:46	21:16	02:38	03:43	04:56
S 60°	20:21	20:58	21:25	02:23	03:29	04:44

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 13-15 98-99%
19	10:39	10:48	12:11	23:53	11:25	
20	10:57	11:06	12:11	–:–	12:20	◯
21	11:14	11:23	12:11	00:47	13:14	

January 22, 23, 24 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	121°15.4	196°41.2	S22°48.3	161°04.8	S16°40.1	291°10.2	S02°49.2	291°18.6	S01°36.9
1	136°17.8	211°40.3	48.1	176°05.3	39.5	306°12.6	49.2	306°21.1	36.9
2	151°20.3	226°39.3	47.8	191°05.8	38.9	321°15.1	49.2	321°23.6	36.9
3	166°22.8	241°38.4	·· 47.6	206°06.3	·· 38.3	336°17.5	·· 49.2	336°26.1	·· 36.9
4	181°25.2	256°37.5	47.4	221°06.8	37.7	351°19.9	49.2	351°28.5	36.8
5	196°27.7	271°36.6	47.2	236°07.3	37.1	6°22.4	49.2	6°31.0	36.8
6	211°30.2	286°35.6	S22°47.0	251°07.8	S16°36.5	21°24.8	S02°49.2	21°33.5	S01°36.8
7	226°32.6	301°34.7	46.8	266°08.3	35.8	36°27.3	49.2	36°35.9	36.8
8	241°35.1	316°33.8	46.6	281°08.8	35.2	51°29.7	49.2	51°38.4	36.8
9	256°37.6	331°32.9	·· 46.4	296°09.3	·· 34.6	66°32.1	·· 49.2	66°40.9	·· 36.8
10	271°40.0	346°31.9	46.1	311°09.8	34.0	81°34.6	49.2	81°43.4	36.7
11	286°42.5	1°31.0	45.9	326°10.3	33.4	96°37.0	49.2	96°45.8	36.7
12	301°45.0	16°30.1	S22°45.7	341°10.8	S16°32.8	111°39.5	S02°49.2	111°48.3	S01°36.7
13	316°47.4	31°29.2	45.5	356°11.3	32.2	126°41.9	49.2	126°50.8	36.7
14	331°49.9	46°28.3	45.3	11°11.8	31.5	141°44.4	49.2	141°53.3	36.7
15	346°52.3	61°27.3	·· 45.0	26°12.3	·· 30.9	156°46.8	·· 49.2	156°55.7	·· 36.7
16	1°54.8	76°26.4	44.8	41°12.8	30.3	171°49.2	49.2	171°58.2	36.6
17	16°57.3	91°25.5	44.6	56°13.3	29.7	186°51.7	49.2	187°00.7	36.6
18	31°59.7	106°24.6	S22°44.4	71°13.8	S16°29.1	201°54.1	S02°49.2	202°03.2	S01°36.6
19	47°02.2	121°23.6	44.1	86°14.3	28.5	216°56.6	49.2	217°05.7	36.6
20	62°04.7	136°22.7	43.9	101°14.8	27.9	231°59.0	49.2	232°08.1	36.6
21	77°07.1	151°21.8	·· 43.7	116°15.4	·· 27.2	247°01.5	·· 49.2	247°10.6	·· 36.5
22	92°09.6	166°20.9	43.4	131°15.9	26.6	262°03.9	49.2	262°13.1	36.5
23	107°12.1	181°20.0	43.2	146°16.4	26.0	277°06.4	49.2	277°15.6	36.5
Mer.pass. 15:52		ν -0.9′	d 0.2′	m -3.92	ν 0.5′	d 0.6′	m 1.16	ν 2.4′	d 0.0′ m -2.17	ν 2.5′	d 0.0′ m 0.73

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	122°14.5	196°19.0	S22°43.0	161°16.9	S16°25.4	292°08.8	S02°49.2	292°18.0	S01°36.5
1	137°17.0	211°18.1	42.7	176°17.4	24.8	307°11.3	49.2	307°20.5	36.5
2	152°19.5	226°17.2	42.5	191°17.9	24.2	322°13.7	49.1	322°23.0	36.5
3	167°21.9	241°16.3	·· 42.2	206°18.4	·· 23.5	337°16.2	·· 49.1	337°25.5	·· 36.4
4	182°24.4	256°15.4	42.0	221°18.9	22.9	352°18.6	49.1	352°27.9	36.4
5	197°26.8	271°14.4	41.8	236°19.4	22.3	7°21.0	49.1	7°30.4	36.4
6	212°29.3	286°13.5	S22°41.5	251°19.9	S16°21.7	22°23.5	S02°49.1	22°32.9	S01°36.4
7	227°31.8	301°12.6	41.3	266°20.4	21.1	37°25.9	49.1	37°35.4	36.4
8	242°34.2	316°11.7	41.0	281°20.9	20.4	52°28.4	49.1	52°37.9	36.3
9	257°36.7	331°10.8	·· 40.8	296°21.4	·· 19.8	67°30.8	·· 49.1	67°40.3	·· 36.3
10	272°39.2	346°09.9	40.5	311°22.0	19.2	82°33.3	49.1	82°42.8	36.3
11	287°41.6	1°08.9	40.3	326°22.5	18.6	97°35.7	49.1	97°45.3	36.3
12	302°44.1	16°08.0	S22°40.0	341°23.0	S16°18.0	112°38.2	S02°49.1	112°47.8	S01°36.3
13	317°46.6	31°07.1	39.8	356°23.5	17.3	127°40.6	49.1	127°50.3	36.2
14	332°49.0	46°06.2	39.5	11°24.0	16.7	142°43.1	49.1	142°52.7	36.2
15	347°51.5	61°05.3	·· 39.3	26°24.5	·· 16.1	157°45.5	·· 49.1	157°55.2	·· 36.2
16	2°53.9	76°04.3	39.0	41°25.0	15.5	172°48.0	49.1	172°57.7	36.2
17	17°56.4	91°03.4	38.8	56°25.5	14.8	187°50.4	49.1	188°00.2	36.2
18	32°58.9	106°02.5	S22°38.5	71°26.0	S16°14.2	202°52.9	S02°49.1	203°02.7	S01°36.1
19	48°01.3	121°01.6	38.3	86°26.5	13.6	217°55.3	49.0	218°05.1	36.1
20	63°03.8	136°00.7	38.0	101°27.1	13.0	232°57.8	49.0	233°07.6	36.1
21	78°06.3	150°59.8	·· 37.8	116°27.6	·· 12.4	248°00.3	·· 49.0	248°10.1	·· 36.1
22	93°08.7	165°58.8	37.5	131°28.1	11.7	263°02.7	49.0	263°12.6	36.1
23	108°11.2	180°57.9	37.2	146°28.6	11.1	278°05.2	49.0	278°15.1	36.0
Mer.pass. 15:48		ν -0.9′	d 0.2′	m -3.92	ν 0.5′	d 0.6′	m 1.16	ν 2.4′	d 0.0′ m -2.17	ν 2.5′	d 0.0′ m 0.73

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	123°13.7	195°57.0	S22°37.0	161°29.1	S16°10.5	293°07.6	S02°49.0	293°17.5	S01°36.0
1	138°16.1	210°56.1	36.7	176°29.6	09.9	308°10.1	49.0	308°20.0	36.0
2	153°18.6	225°55.2	36.4	191°30.1	09.2	323°12.5	49.0	323°22.5	36.0
3	168°21.1	240°54.3	·· 36.2	206°30.6	·· 08.6	338°15.0	·· 49.0	338°25.0	·· 36.0
4	183°23.5	255°53.4	35.9	221°31.2	08.0	353°17.4	49.0	353°27.5	35.9
5	198°26.0	270°52.4	35.6	236°31.7	07.4	8°19.9	49.0	8°30.0	35.9
6	213°28.4	285°51.5	S22°35.4	251°32.2	S16°06.7	23°22.3	S02°49.0	23°32.4	S01°35.9
7	228°30.9	300°50.6	35.1	266°32.7	06.1	38°24.8	48.9	38°34.9	35.9
8	243°33.4	315°49.7	34.8	281°33.2	05.5	53°27.3	48.9	53°37.4	35.9
9	258°35.8	330°48.8	·· 34.5	296°33.7	·· 04.8	68°29.7	·· 48.9	68°39.9	·· 35.8
10	273°38.3	345°47.9	34.3	311°34.2	04.2	83°32.2	48.9	83°42.4	35.8
11	288°40.8	0°47.0	34.0	326°34.7	03.6	98°34.6	48.9	98°44.8	35.8
12	303°43.2	15°46.1	S22°33.7	341°35.3	S16°03.0	113°37.1	S02°48.9	113°47.3	S01°35.8
13	318°45.7	30°45.1	33.4	356°35.8	02.3	128°39.5	48.9	128°49.8	35.8
14	333°48.2	45°44.2	33.1	11°36.3	01.7	143°42.0	48.9	143°52.3	35.7
15	348°50.6	60°43.3	·· 32.9	26°36.8	·· 01.1	158°44.5	·· 48.9	158°54.8	·· 35.7
16	3°53.1	75°42.4	32.6	41°37.3	16°00.4	173°46.9	48.9	173°57.3	35.7
17	18°55.5	90°41.5	32.3	56°37.8	15°59.8	188°49.4	48.9	188°59.8	35.7
18	33°58.0	105°40.6	S22°32.0	71°38.4	S15°59.2	203°51.8	S02°48.8	204°02.2	S01°35.7
19	49°00.5	120°39.7	31.7	86°38.9	58.6	218°54.3	48.8	219°04.7	35.6
20	64°02.9	135°38.8	31.4	101°39.4	57.9	233°56.7	48.8	234°07.2	35.6
21	79°05.4	150°37.8	·· 31.1	116°39.9	·· 57.3	248°59.2	·· 48.8	249°09.7	·· 35.6
22	94°07.9	165°36.9	30.9	131°40.4	56.7	264°01.7	48.8	264°12.2	35.6
23	109°10.3	180°36.0	30.6	146°40.9	56.0	279°04.1	48.8	279°14.7	35.5
Mer.pass. 15:45		ν -0.9′	d 0.3′	m -3.92	ν 0.5′	d 0.6′	m 1.16	ν 2.5′	d 0.0′ m -2.18	ν 2.5′	d 0.0′ m 0.72

Stars

	SHA	Dec
Alpheratz	358°09.2	28°59.2
Ankaa	353°40.2	-42°24.9
Schedar	350°08.9	56°26.1
Diphda	349°20.7	-18°05.7
Achernar	335°45.2	-57°20.4
Hamal	328°28.6	23°22.4
Polaris	326°45.0	89°10.9
Acamar	315°36.9	-40°23.2
Menkar	314°40.8	4°00.8
Mirfak	309°15.5	49°47.8
Aldebaran	291°17.5	16°28.2
Rigel	281°35.5	-8°13.6
Capella	281°10.6	45°58.8
Bellatrix	278°58.2	6°19.8
Elnath	278°43.5	28°35.5
Alnilam	276°11.1	-1°13.0
Betelgeuse	271°27.7	7°24.1
Canopus	264°06.6	-52°41.3
Sirius	258°55.1	-16°41.5
Adhara	255°31.5	-28°56.9
Procyon	245°25.2	5°16.3
Pollux	243°57.5	28°04.3
Avior	234°27.4	-59°26.9
Suhail	223°10.1	-43°21.3
Miaplacidus	221°44.0	-69°38.3
Alphard	218°20.0	-8°34.6
Regulus	208°09.4	12°03.5
Dubhe	194°21.3	61°51.0
Denebola	182°58.6	14°40.6
Gienah	176°17.5	-17°26.1
Acrux	173°36.7	-62°59.3
Gacrux	172°28.2	-57°00.1
Alioth	166°42.1	56°03.5
Spica	158°57.2	-11°03.7
Alkaid	153°18.3	49°24.3
Hadar	149°23.0	-60°16.6
Menkent	148°36.7	-36°16.4
Arcturus	146°18.3	19°16.8
Rigil Kent.	140°25.5	-60°44.9
Kochab	137°19.3	74°13.8
Zuben'ubi	137°32.8	-15°57.7
Alphecca	126°32.0	26°46.6
Antares	112°56.8	-26°23.3
Atria	108°21.2	-68°59.4
Sabik	102°41.1	-15°42.0
Shaula	96°55.7	-37°05.3
Rasalhague	96°29.6	12°34.4
Eltanin	90°58.1	51°29.4
Kaus Aust.	84°16.9	-34°23.6
Vega	80°56.0	38°45.9
Nunki	76°29.2	-26°19.2
Altair	62°32.6	8°49.0
Peacock	53°58.6	-56°47.8
Deneb	49°48.7	45°12.7
Enif	34°11.6	9°47.2
Al Na'ir	28°15.1	-47°03.4
Fomalhaut	15°51.4	-29°43.6
Scheat	14°17.6	27°58.8
Markab	14°03.1	15°06.1

Jan 22 Thu	SHA	Mer.pass
Venus	75°25.8	10:54
Mars	39°49.4	13:15
Jupiter	169°54.8	04:35
Saturn	170°03.2	04:34

Jan 23 Fri	SHA	Mer.pass
Venus	74°04.5	10:55
Mars	39°02.4	13:14
Jupiter	169°54.3	04:31
Saturn	170°03.5	04:30

Jan 24 Sat	SHA	Mer.pass
Venus	72°43.4	10:57
Mars	38°15.4	13:14
Jupiter	169°54.0	04:27
Saturn	170°03.9	04:26

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°07.3	S19°44.5	336°05.3	10.7′	N15°02.1	7.9′	56.6′
1	192°07.1	43.9	350°35.1	10.8′	14°54.2	7.9′	56.6′
2	207°06.9	43.4	5°04.9	10.9′	14°46.3	8.0′	56.6′
3	222°06.8	·· 42.8	19°34.7	10.9′	14°38.3	8.1′	56.5′
4	237°06.6	42.2	34°04.7	11.0′	14°30.2	8.1′	56.5′
5	252°06.4	41.6	48°34.7	11.1′	14°22.1	8.2′	56.5′
6	267°06.3	S19°41.1	63°04.8	11.2′	N14°13.9	8.3′	56.5′
7	282°06.1	40.5	77°34.9	11.2′	14°05.6	8.3′	56.4′
8	297°05.9	39.9	92°05.2	11.3′	13°57.3	8.4′	56.4′
9	312°05.8	·· 39.4	106°35.5	11.4′	13°48.9	8.4′	56.4′
10	327°05.6	38.8	121°05.9	11.5′	13°40.5	8.5′	56.3′
11	342°05.4	38.2	135°36.3	11.5′	13°32.0	8.6′	56.3′
12	357°05.3	S19°37.6	150°06.8	11.6′	N13°23.4	8.6′	56.3′
13	12°05.1	37.1	164°37.4	11.7′	13°14.8	8.7′	56.3′
14	27°04.9	36.5	179°08.1	11.7′	13°06.1	8.7′	56.2′
15	42°04.8	·· 35.9	193°38.8	11.8′	12°57.4	8.8′	56.2′
16	57°04.6	35.3	208°09.6	11.9′	12°48.6	8.9′	56.2′
17	72°04.4	34.8	222°40.5	11.9′	12°39.7	8.9′	56.2′
18	87°04.3	S19°34.2	237°11.4	12.0′	N12°30.8	8.9′	56.1′
19	102°04.1	33.6	251°42.5	12.1′	12°21.9	9.0′	56.1′
20	117°03.9	33.0	266°13.5	12.1′	12°12.9	9.1′	56.1′
21	132°03.8	·· 32.4	280°44.7	12.2′	12°03.8	9.0′	56.0′
22	147°03.6	31.9	295°15.9	12.3′	11°54.8	9.2′	56.0′
23	162°03.5	31.3	309°47.2	12.4′	11°45.6	9.2′	56.0′
	SD = 16.2′	d = 0.6′	SD = 15.4′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°03.3	S19°30.7	324°18.5	12.4′	N11°36.4	9.2′	56.0′
1	192°03.1	30.1	338°50.0	12.5′	11°27.2	9.3′	55.9′
2	207°03.0	29.5	353°21.4	12.5′	11°17.9	9.3′	55.9′
3	222°02.8	·· 28.9	7°53.0	12.6′	11°08.6	9.4′	55.9′
4	237°02.7	28.4	22°24.6	12.7′	10°59.2	9.4′	55.9′
5	252°02.5	27.8	36°56.3	12.7′	10°49.8	9.5′	55.8′
6	267°02.3	S19°27.2	51°28.0	12.8′	N10°40.3	9.5′	55.8′
7	282°02.2	26.6	65°59.8	12.9′	10°30.8	9.5′	55.8′
8	297°02.0	26.0	80°31.7	12.9′	10°21.3	9.6′	55.8′
9	312°01.9	·· 25.4	95°03.6	13.0′	10°11.7	9.6′	55.7′
10	327°01.7	24.8	109°35.6	13.0′	10°02.1	9.6′	55.7′
11	342°01.6	24.2	124°07.6	13.1′	09°52.5	9.7′	55.7′
12	357°01.4	S19°23.6	138°39.8	13.2′	N09°42.8	9.7′	55.7′
13	12°01.2	23.1	153°11.9	13.2′	09°33.1	9.8′	55.6′
14	27°01.1	22.5	167°44.2	13.3′	09°23.3	9.7′	55.6′
15	42°00.9	·· 21.9	182°16.4	13.3′	09°13.6	9.9′	55.6′
16	57°00.8	21.3	196°48.8	13.4′	09°03.7	9.8′	55.6′
17	72°00.6	20.7	211°21.2	13.5′	08°53.9	9.9′	55.5′
18	87°00.5	S19°20.1	225°53.6	13.5′	N08°44.0	9.9′	55.5′
19	102°00.3	19.5	240°26.2	13.6′	08°34.1	9.9′	55.5′
20	117°00.1	18.9	254°58.7	13.6′	08°24.2	10.0′	55.5′
21	132°00.0	·· 18.3	269°31.3	13.7′	08°14.2	10.0′	55.4′
22	146°59.8	17.7	284°04.0	13.7′	08°04.2	10.0′	55.4′
23	161°59.7	17.1	298°36.8	13.8′	07°54.2	10.0′	55.4′
	SD = 16.2′	d = 0.6′	SD = 15.3′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°59.5	S19°16.5	313°09.5	13.8′	N07°44.2	10.1′	55.4′
1	191°59.4	15.9	327°42.4	13.9′	07°34.1	10.1′	55.3′
2	206°59.2	15.3	342°15.3	13.9′	07°24.0	10.1′	55.3′
3	221°59.1	·· 14.7	356°48.2	14.0′	07°13.9	10.1′	55.3′
4	236°58.9	14.1	11°21.2	14.0′	07°03.8	10.2′	55.3′
5	251°58.8	13.5	25°54.2	14.1′	06°53.6	10.2′	55.2′
6	266°58.6	S19°12.9	40°27.3	14.1′	N06°43.4	10.1′	55.2′
7	281°58.5	12.3	55°00.4	14.2′	06°33.3	10.3′	55.2′
8	296°58.3	11.7	69°33.6	14.2′	06°23.0	10.2′	55.2′
9	311°58.2	·· 11.1	84°06.8	14.3′	06°12.8	10.2′	55.2′
10	326°58.0	10.5	98°40.1	14.3′	06°02.6	10.3′	55.1′
11	341°57.9	09.9	113°13.4	14.4′	05°52.3	10.3′	55.1′
12	356°57.7	S19°09.3	127°46.7	14.4′	N05°42.0	10.3′	55.1′
13	11°57.6	08.7	142°20.1	14.4′	05°31.7	10.3′	55.1′
14	26°57.4	08.1	156°53.6	14.5′	05°21.4	10.3′	55.0′
15	41°57.3	·· 07.5	171°27.0	14.5′	05°11.1	10.4′	55.0′
16	56°57.1	06.9	186°00.6	14.6′	05°00.7	10.3′	55.0′
17	71°57.0	06.3	200°34.1	14.6′	04°50.4	10.4′	55.0′
18	86°56.8	S19°05.7	215°07.7	14.6′	N04°40.0	10.4′	55.0′
19	101°56.7	05.1	229°41.3	14.7′	04°29.6	10.4′	54.9′
20	116°56.5	04.4	244°15.0	14.7′	04°19.2	10.4′	54.9′
21	131°56.4	·· 03.8	258°48.7	14.7′	04°08.8	10.4′	54.9′
22	146°56.2	03.2	273°22.5	14.8′	03°58.4	10.4′	54.9′
23	161°56.1	02.6	287°56.2	14.8′	03°48.0	10.4′	54.9′
	SD = 16.2′	d = 0.6′	SD = 15.1′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	07:39	09:18	▬	▬	15:07	16:46
N 70°	07:28	08:53	10:41	13:43	15:32	16:57
68°	07:18	08:33	09:57	14:28	15:52	17:07
66°	07:10	08:17	09:28	14:57	16:08	17:15
64°	07:03	08:04	09:06	15:19	16:20	17:22
62°	06:57	07:53	08:48	15:36	16:31	17:28
60°	06:51	07:44	08:34	15:51	16:41	17:33
N 58°	06:46	07:35	08:21	16:03	16:49	17:38
56°	06:42	07:28	08:11	16:14	16:57	17:43
54°	06:37	07:21	08:01	16:23	17:03	17:47
52°	06:33	07:15	07:53	16:31	17:09	17:51
50°	06:30	07:09	07:45	16:39	17:15	17:55
45°	06:21	06:57	07:29	16:55	17:27	18:03
N 40°	06:14	06:47	07:16	17:08	17:37	18:10
35°	06:07	06:38	07:05	17:19	17:47	18:17
30°	06:00	06:29	06:55	17:29	17:55	18:24
20°	05:47	06:14	06:38	17:46	18:10	18:36
N 10°	05:35	06:00	06:23	18:01	18:24	18:49
0°	05:21	05:46	06:08	18:15	18:37	19:03
S 10°	05:05	05:32	05:54	18:30	18:52	19:18
20°	04:47	05:15	05:39	18:45	19:09	19:37
30°	04:23	04:54	05:21	19:03	19:29	20:01
35°	04:07	04:42	05:10	19:13	19:41	20:16
40°	03:49	04:27	04:58	19:25	19:56	20:34
45°	03:25	04:09	04:44	19:39	20:14	20:58
S 50°	02:52	03:46	04:26	19:57	20:37	21:30
52°	02:35	03:35	04:18	20:05	20:48	21:47
54°	02:14	03:22	04:08	20:14	21:00	22:08
56°	01:45	03:07	03:58	20:25	21:15	22:36
58°	00:54	02:48	03:46	20:37	21:33	23:21
S 60°	////	02:26	03:32	20:50	21:56	////

Lat.	**Moonrise** Thu	Fri	Sat	**Moonset** Thu	Fri	Sat
N 72°	17:18	19:10	20:54	11:06	10:51	10:40
N 70°	17:41	19:23	21:00	10:41	10:36	10:32
68°	17:59	19:34	21:05	10:22	10:24	10:25
66°	18:14	19:43	21:09	10:07	10:14	10:19
64°	18:26	19:50	21:12	09:54	10:06	10:15
62°	18:36	19:56	21:15	09:43	09:58	10:10
60°	18:44	20:02	21:18	09:34	09:52	10:07
N 58°	18:52	20:07	21:20	09:26	09:46	10:04
56°	18:58	20:11	21:22	09:19	09:41	10:01
54°	19:04	20:15	21:24	09:12	09:37	09:58
52°	19:09	20:18	21:25	09:06	09:33	09:56
50°	19:14	20:21	21:27	09:01	09:29	09:54
45°	19:24	20:28	21:30	08:50	09:21	09:49
N 40°	19:33	20:33	21:33	08:40	09:14	09:45
35°	19:40	20:38	21:35	08:32	09:08	09:41
30°	19:46	20:43	21:37	08:25	09:03	09:38
20°	19:57	20:50	21:40	08:12	08:54	09:33
N 10°	20:07	20:56	21:44	08:01	08:46	09:28
0°	20:16	21:02	21:47	07:51	08:39	09:24
S 10°	20:25	21:08	21:49	07:40	08:31	09:19
20°	20:35	21:15	21:53	07:29	08:23	09:15
30°	20:46	21:22	21:56	07:16	08:14	09:09
35°	20:52	21:26	21:58	07:09	08:08	09:06
40°	20:59	21:31	22:00	07:00	08:02	09:02
45°	21:07	21:36	22:03	06:50	07:55	08:58
S 50°	21:17	21:43	22:06	06:38	07:46	08:53
52°	21:22	21:46	22:08	06:33	07:42	08:50
54°	21:27	21:49	22:09	06:26	07:38	08:48
56°	21:32	21:53	22:11	06:19	07:33	08:45
58°	21:38	21:57	22:13	06:11	07:27	08:42
S 60°	21:45	22:01	22:15	06:02	07:21	08:38

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 16-18 97-86%
22	11:31	11:39	12:12	01:39	14:04	
23	11:47	11:54	12:12	02:27	14:51	
24	12:02	12:09	12:12	03:13	15:35	

January 25, 26, 27 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	124°12.8	195°35.1	S22°30.3	161°41.4	S15°55.4	294°06.6	S02°48.8	294°17.1	S01°35.5
1	139°15.3	210°34.2	30.0	176°42.0	54.8	309°09.0	48.8	309°19.6	35.5
2	154°17.7	225°33.3	29.7	191°42.5	54.1	324°11.5	48.8	324°22.1	35.5
3	169°20.2	240°32.4	·· 29.4	206°43.0	·· 53.5	339°14.0	·· 48.7	339°24.6	·· 35.5
4	184°22.7	255°31.5	29.1	221°43.5	52.9	354°16.4	48.7	354°27.1	35.4
5	199°25.1	270°30.6	28.8	236°44.0	52.2	9°18.9	48.7	9°29.6	35.4
6	214°27.6	285°29.7	S22°28.5	251°44.5	S15°51.6	24°21.4	S02°48.7	24°32.1	S01°35.4
7	229°30.0	300°28.8	28.2	266°45.1	51.0	39°23.8	48.7	39°34.5	35.4
8	244°32.5	315°27.8	27.9	281°45.6	50.3	54°26.3	48.7	54°37.0	35.3
9	259°35.0	330°26.9	·· 27.6	296°46.1	·· 49.7	69°28.8	·· 48.7	69°39.5	·· 35.3
10	274°37.4	345°26.0	27.3	311°46.6	49.1	84°31.2	48.7	84°42.0	35.3
11	289°39.9	0°25.1	27.0	326°47.1	48.4	99°33.7	48.7	99°44.5	35.3
12	304°42.4	15°24.2	S22°26.7	341°47.7	S15°47.8	114°36.1	S02°48.6	114°47.0	S01°35.3
13	319°44.8	30°23.3	26.4	356°48.2	47.2	129°38.6	48.6	129°49.5	35.2
14	334°47.3	45°22.4	26.1	11°48.7	46.5	144°41.1	48.6	144°52.0	35.2
15	349°49.8	60°21.5	·· 25.7	26°49.2	·· 45.9	159°43.5	·· 48.6	159°54.4	·· 35.2
16	4°52.2	75°20.6	25.4	41°49.7	45.3	174°46.0	48.6	174°56.9	35.2
17	19°54.7	90°19.7	25.1	56°50.3	44.6	189°48.5	48.6	189°59.4	35.1
18	34°57.2	105°18.8	S22°24.8	71°50.8	S15°44.0	204°50.9	S02°48.6	205°01.9	S01°35.1
19	49°59.6	120°17.9	24.5	86°51.3	43.3	219°53.4	48.5	220°04.4	35.1
20	65°02.1	135°17.0	24.2	101°51.8	42.7	234°55.9	48.5	235°06.9	35.1
21	80°04.5	150°16.1	·· 23.9	116°52.3	·· 42.1	249°58.3	·· 48.5	250°09.4	·· 35.1
22	95°07.0	165°15.2	23.5	131°52.9	41.4	265°00.8	48.5	265°11.9	35.0
23	110°09.5	180°14.3	23.2	146°53.4	40.8	280°03.3	48.5	280°14.4	35.0
Mer.pass. 15:41		ν -0.9′	d 0.3′	m -3.92	ν 0.5′	d 0.6′	m 1.16	ν 2.5′	d 0.0′ m -2.19	ν 2.5′	d 0.0′ m 0.72

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	125°11.9	195°13.4	S22°22.9	161°53.9	S15°40.2	295°05.7	S02°48.5	295°16.8	S01°35.0
1	140°14.4	210°12.4	22.6	176°54.4	39.5	310°08.2	48.5	310°19.3	35.0
2	155°16.9	225°11.5	22.3	191°54.9	38.9	325°10.7	48.4	325°21.8	34.9
3	170°19.3	240°10.6	·· 21.9	206°55.5	·· 38.2	340°13.1	·· 48.4	340°24.3	·· 34.9
4	185°21.8	255°09.7	21.6	221°56.0	37.6	355°15.6	48.4	355°26.8	34.9
5	200°24.3	270°08.8	21.3	236°56.5	37.0	10°18.1	48.4	10°29.3	34.9
6	215°26.7	285°07.9	S22°20.9	251°57.0	S15°36.3	25°20.6	S02°48.4	25°31.8	S01°34.8
7	230°29.2	300°07.0	20.6	266°57.5	35.7	40°23.0	48.4	40°34.3	34.8
8	245°31.6	315°06.1	20.3	281°58.1	35.0	55°25.5	48.4	55°36.8	34.8
9	260°34.1	330°05.2	·· 20.0	296°58.6	·· 34.4	70°28.0	·· 48.3	70°39.3	·· 34.8
10	275°36.6	345°04.3	19.6	311°59.1	33.8	85°30.4	48.3	85°41.8	34.7
11	290°39.0	0°03.4	19.3	326°59.6	33.1	100°32.9	48.3	100°44.2	34.7
12	305°41.5	15°02.5	S22°19.0	342°00.2	S15°32.5	115°35.4	S02°48.3	115°46.7	S01°34.7
13	320°44.0	30°01.6	18.6	357°00.7	31.8	130°37.9	48.3	130°49.2	34.7
14	335°46.4	45°00.7	18.3	12°01.2	31.2	145°40.3	48.3	145°51.7	34.6
15	350°48.9	59°59.8	·· 17.9	27°01.7	·· 30.6	160°42.8	·· 48.3	160°54.2	·· 34.6
16	5°51.4	74°58.9	17.6	42°02.3	29.9	175°45.3	48.2	175°56.7	34.6
17	20°53.8	89°58.0	17.3	57°02.8	29.3	190°47.7	48.2	190°59.2	34.6
18	35°56.3	104°57.1	S22°16.9	72°03.3	S15°28.6	205°50.2	S02°48.2	206°01.7	S01°34.5
19	50°58.8	119°56.2	16.6	87°03.8	28.0	220°52.7	48.2	221°04.2	34.5
20	66°01.2	134°55.3	16.2	102°04.4	27.3	235°55.2	48.2	236°06.7	34.5
21	81°03.7	149°54.4	·· 15.9	117°04.9	·· 26.7	250°57.6	·· 48.2	251°09.2	·· 34.5
22	96°06.1	164°53.5	15.5	132°05.4	26.0	266°00.1	48.1	266°11.7	34.4
23	111°08.6	179°52.6	15.2	147°05.9	25.4	281°02.6	48.1	281°14.2	34.4
Mer.pass. 15:37		ν -0.9′	d 0.3′	m -3.92	ν 0.5′	d 0.6′	m 1.16	ν 2.5′	d 0.0′ m -2.20	ν 2.5′	d 0.0′ m 0.72

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	126°11.1	194°51.7	S22°14.8	162°06.5	S15°24.8	296°05.1	S02°48.1	296°16.6	S01°34.4
1	141°13.5	209°50.8	14.5	177°07.0	24.1	311°07.5	48.1	311°19.1	34.4
2	156°16.0	224°49.9	14.1	192°07.5	23.5	326°10.0	48.1	326°21.6	34.3
3	171°18.5	239°49.0	·· 13.8	207°08.0	·· 22.8	341°12.5	·· 48.1	341°24.1	·· 34.3
4	186°20.9	254°48.1	13.4	222°08.6	22.2	356°15.0	48.0	356°26.6	34.3
5	201°23.4	269°47.3	13.1	237°09.1	21.5	11°17.5	48.0	11°29.1	34.3
6	216°25.9	284°46.4	S22°12.7	252°09.6	S15°20.9	26°19.9	S02°48.0	26°31.6	S01°34.2
7	231°28.3	299°45.5	12.4	267°10.1	20.2	41°22.4	48.0	41°34.1	34.2
8	246°30.8	314°44.6	12.0	282°10.7	19.6	56°24.9	48.0	56°36.6	34.2
9	261°33.2	329°43.7	·· 11.6	297°11.2	·· 18.9	71°27.4	·· 47.9	71°39.1	·· 34.2
10	276°35.7	344°42.8	11.3	312°11.7	18.3	86°29.8	47.9	86°41.6	34.1
11	291°38.2	359°41.9	10.9	327°12.2	17.6	101°32.3	47.9	101°44.1	34.1
12	306°40.6	14°41.0	S22°10.6	342°12.8	S15°17.0	116°34.8	S02°47.9	116°46.6	S01°34.1
13	321°43.1	29°40.1	10.2	357°13.3	16.3	131°37.3	47.9	131°49.1	34.1
14	336°45.6	44°39.2	09.8	12°13.8	15.7	146°39.8	47.8	146°51.6	34.0
15	351°48.0	59°38.3	·· 09.5	27°14.4	·· 15.1	161°42.2	·· 47.8	161°54.1	·· 34.0
16	6°50.5	74°37.4	09.1	42°14.9	14.4	176°44.7	47.8	176°56.6	34.0
17	21°53.0	89°36.5	08.7	57°15.4	13.8	191°47.2	47.8	191°59.1	34.0
18	36°55.4	104°35.6	S22°08.4	72°15.9	S15°13.1	206°49.7	S02°47.8	207°01.6	S01°33.9
19	51°57.9	119°34.7	08.0	87°16.5	12.5	221°52.2	47.8	222°04.1	33.9
20	67°00.4	134°33.8	07.6	102°17.0	11.8	236°54.6	47.7	237°06.6	33.9
21	82°02.8	149°33.0	·· 07.2	117°17.5	·· 11.2	251°57.1	·· 47.7	252°09.1	·· 33.9
22	97°05.3	164°32.1	06.9	132°18.1	10.5	266°59.6	47.7	267°11.5	33.8
23	112°07.7	179°31.2	06.5	147°18.6	09.8	282°02.1	47.7	282°14.0	33.8
Mer.pass. 15:33		ν -0.9′	d 0.4′	m -3.92	ν 0.5′	d 0.6′	m 1.16	ν 2.5′	d 0.0′ m -2.20	ν 2.5′	d 0.0′ m 0.71

Stars

	SHA	**Dec**
Alpheratz	358°09.2	28°59.1
Ankaa	353°40.2	-42°24.9
Schedar	350°08.9	56°26.1
Diphda	349°20.7	-18°05.7
Achernar	335°45.2	-57°20.4
Hamal	328°28.6	23°22.3
Polaris	326°46.2	89°10.9
Acamar	315°37.0	-40°23.2
Menkar	314°40.8	4°00.8
Mirfak	309°15.6	49°47.8
Aldebaran	291°17.5	16°28.2
Rigel	281°35.5	-8°13.6
Capella	281°10.6	45°58.8
Bellatrix	278°58.2	6°19.8
Elnath	278°43.5	28°35.5
Alnilam	276°11.1	-1°13.0
Betelgeuse	271°27.7	7°24.1
Canopus	264°06.6	-52°41.4
Sirius	258°55.1	-16°41.6
Adhara	255°31.5	-28°56.9
Procyon	245°25.2	5°16.3
Pollux	243°57.5	28°04.3
Avior	234°27.4	-59°27.0
Suhail	223°10.1	-43°21.4
Miaplacidus	221°43.9	-69°38.3
Alphard	218°20.0	-8°34.6
Regulus	208°09.4	12°03.5
Dubhe	194°21.3	61°51.0
Denebola	182°58.6	14°40.6
Gienah	176°17.5	-17°26.1
Acrux	173°36.6	-62°59.3
Gacrux	172°28.1	-57°00.1
Alioth	166°42.1	56°03.5
Spica	158°57.2	-11°03.7
Alkaid	153°18.2	49°24.3
Hadar	149°22.9	-60°16.6
Menkent	148°36.7	-36°16.4
Arcturus	146°18.2	19°16.8
Rigil Kent.	140°25.5	-60°45.0
Kochab	137°19.2	74°13.8
Zuben'ubi	137°32.8	-15°57.7
Alphecca	126°32.0	26°46.6
Antares	112°56.7	-26°23.3
Atria	108°21.1	-68°59.3
Sabik	102°41.1	-15°42.0
Shaula	96°55.7	-37°05.3
Rasalhague	96°29.6	12°34.4
Eltanin	90°58.0	51°29.3
Kaus Aust.	84°16.9	-34°23.6
Vega	80°56.0	38°45.9
Nunki	76°29.2	-26°19.2
Altair	62°32.6	8°49.0
Peacock	53°58.6	-56°47.8
Deneb	49°48.7	45°12.7
Enif	34°11.6	9°47.2
Al Na'ir	28°15.1	-47°03.4
Fomalhaut	15°51.4	-29°43.6
Scheat	14°17.6	27°58.8
Markab	14°03.2	15°06.1

Jan 25 Sun	**SHA**	**Mer.pass**
Venus	71°22.3	10:58
Mars	37°28.6	13:13
Jupiter	169°53.8	04:23
Saturn	170°04.3	04:22

Jan 26 Mon	**SHA**	**Mer.pass**
Venus	70°01.4	11:00
Mars	36°42.0	13:12
Jupiter	169°53.8	04:19
Saturn	170°04.9	04:18

Jan 27 Tue	**SHA**	**Mer.pass**
Venus	68°40.7	11:01
Mars	35°55.4	13:11
Jupiter	169°54.0	04:15
Saturn	170°05.6	04:14

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°56.0	S19°02.0	302°30.1	14.8′	N03°37.6	10.4′	54.8′
1	191°55.8	01.4	317°03.9	14.9′	03°27.2	10.5′	54.8′
2	206°55.7	00.8	331°37.8	14.9′	03°16.7	10.4′	54.8′
3	221°55.5	19°00.2	346°11.7	14.9′	03°06.3	10.4′	54.8′
4	236°55.4	18°59.5	0°45.6	15.0′	02°55.9	10.5′	54.8′
5	251°55.2	58.9	15°19.6	15.0′	02°45.4	10.4′	54.8′
6	266°55.1	S18°58.3	29°53.6	15.0′	N02°35.0	10.5′	54.7′
7	281°55.0	57.7	44°27.6	15.1′	02°24.5	10.4′	54.7′
8	296°54.8	57.1	59°01.7	15.1′	02°14.1	10.5′	54.7′
9	311°54.7	·· 56.5	73°35.8	15.1′	02°03.6	10.5′	54.7′
10	326°54.5	55.8	88°09.9	15.1′	01°53.1	10.4′	54.7′
11	341°54.4	55.2	102°44.0	15.2′	01°42.7	10.5′	54.6′
12	356°54.2	S18°54.6	117°18.2	15.2′	N01°32.2	10.4′	54.6′
13	11°54.1	54.0	131°52.4	15.2′	01°21.8	10.5′	54.6′
14	26°54.0	53.4	146°26.6	15.2′	01°11.3	10.5′	54.6′
15	41°53.8	·· 52.7	161°00.8	15.2′	01°00.8	10.4′	54.6′
16	56°53.7	52.1	175°35.1	15.3′	00°50.4	10.5′	54.6′
17	71°53.5	51.5	190°09.3	15.3′	00°39.9	10.4′	54.6′
18	86°53.4	S18°50.9	204°43.6	15.3′	N00°29.5	10.5′	54.5′
19	101°53.3	50.3	219°17.9	15.3′	00°19.0	10.4′	54.5′
20	116°53.1	49.6	233°52.3	15.3′	N00°08.6	10.4′	54.5′
21	131°53.0	·· 49.0	248°26.6	15.4′	S00°01.8	10.4′	54.5′
22	146°52.9	48.4	263°01.0	15.4′	00°12.2	10.5′	54.5′
23	161°52.7	47.8	277°35.3	15.4′	00°22.7	10.4′	54.5′
	SD = 16.2′	d = 0.6′	SD = 15.0′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°52.6	S18°47.1	292°09.7	15.4′	S00°33.1	10.4′	54.5′
1	191°52.4	46.5	306°44.1	15.4′	00°43.5	10.4′	54.4′
2	206°52.3	45.9	321°18.5	15.4′	00°53.9	10.4′	54.4′
3	221°52.2	·· 45.2	335°53.0	15.4′	01°04.3	10.3′	54.4′
4	236°52.0	44.6	350°27.4	15.5′	01°14.6	10.4′	54.4′
5	251°51.9	44.0	5°01.9	15.5′	01°25.0	10.4′	54.4′
6	266°51.8	S18°43.4	19°36.3	15.5′	S01°35.4	10.3′	54.4′
7	281°51.6	42.7	34°10.8	15.5′	01°45.7	10.3′	54.4′
8	296°51.5	42.1	48°45.3	15.5′	01°56.0	10.3′	54.4′
9	311°51.4	·· 41.5	63°19.7	15.5′	02°06.3	10.4′	54.3′
10	326°51.2	40.8	77°54.2	15.5′	02°16.7	10.2′	54.3′
11	341°51.1	40.2	92°28.7	15.5′	02°26.9	10.3′	54.3′
12	356°51.0	S18°39.6	107°03.2	15.5′	S02°37.2	10.3′	54.3′
13	11°50.8	38.9	121°37.7	15.5′	02°47.5	10.2′	54.3′
14	26°50.7	38.3	136°12.2	15.5′	02°57.7	10.3′	54.3′
15	41°50.6	·· 37.7	150°46.8	15.5′	03°08.0	10.2′	54.3′
16	56°50.4	37.0	165°21.3	15.5′	03°18.2	10.2′	54.3′
17	71°50.3	36.4	179°55.8	15.5′	03°28.4	10.2′	54.3′
18	86°50.2	S18°35.8	194°30.3	15.5′	S03°38.6	10.1′	54.3′
19	101°50.0	35.1	209°04.8	15.5′	03°48.7	10.2′	54.3′
20	116°49.9	34.5	223°39.3	15.5′	03°58.9	10.1′	54.3′
21	131°49.8	·· 33.8	238°13.8	15.5′	04°09.0	10.1′	54.2′
22	146°49.6	33.2	252°48.3	15.5′	04°19.1	10.1′	54.2′
23	161°49.5	32.6	267°22.8	15.5′	04°29.2	10.1′	54.2′
	SD = 16.2′	d = 0.6′	SD = 14.9′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°49.4	S18°31.9	281°57.3	15.5′	S04°39.3	10.0′	54.2′
1	191°49.3	31.3	296°31.8	15.5′	04°49.3	10.0′	54.2′
2	206°49.1	30.6	311°06.3	15.5′	04°59.3	10.0′	54.2′
3	221°49.0	·· 30.0	325°40.8	15.5′	05°09.3	10.0′	54.2′
4	236°48.9	29.3	340°15.2	15.5′	05°19.3	10.0′	54.2′
5	251°48.8	28.7	354°49.7	15.4′	05°29.3	9.9′	54.2′
6	266°48.6	S18°28.1	9°24.1	15.4′	S05°39.2	9.9′	54.2′
7	281°48.5	27.4	23°58.6	15.4′	05°49.1	9.9′	54.2′
8	296°48.4	26.8	38°33.0	15.4′	05°59.0	9.9′	54.2′
9	311°48.2	·· 26.1	53°07.4	15.4′	06°08.9	9.8′	54.2′
10	326°48.1	25.5	67°41.8	15.4′	06°18.7	9.8′	54.2′
11	341°48.0	24.8	82°16.2	15.4′	06°28.5	9.8′	54.2′
12	356°47.9	S18°24.2	96°50.6	15.4′	S06°38.3	9.7′	54.2′
13	11°47.7	23.5	111°24.9	15.3′	06°48.0	9.7′	54.2′
14	26°47.6	22.9	125°59.3	15.3′	06°57.7	9.7′	54.2′
15	41°47.5	·· 22.2	140°33.6	15.3′	07°07.4	9.7′	54.2′
16	56°47.4	21.6	155°07.9	15.3′	07°17.1	9.6′	54.2′
17	71°47.3	20.9	169°42.2	15.3′	07°26.7	9.6′	54.2′
18	86°47.1	S18°20.3	184°16.5	15.3′	S07°36.3	9.6′	54.2′
19	101°47.0	19.6	198°50.7	15.2′	07°45.9	9.6′	54.2′
20	116°46.9	19.0	213°24.9	15.2′	07°55.5	9.5′	54.2′
21	131°46.8	·· 18.3	227°59.1	15.2′	08°05.0	9.4′	54.2′
22	146°46.6	17.7	242°33.3	15.2′	08°14.4	9.5′	54.2′
23	161°46.5	17.0	257°07.5	15.1′	08°23.9	9.4′	54.2′
	SD = 16.2′	d = 0.6′	SD = 14.8′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	07:30	09:05	11:40	12:46	15:21	16:56
N 70°	07:20	08:42	10:21	14:05	15:44	17:07
68°	07:11	08:24	09:44	14:43	16:02	17:15
66°	07:04	08:10	09:17	15:09	16:16	17:23
64°	06:57	07:58	08:57	15:29	16:28	17:29
62°	06:52	07:47	08:41	15:45	16:39	17:34
60°	06:47	07:38	08:28	15:58	16:48	17:39
N 58°	06:42	07:31	08:16	16:10	16:55	17:44
56°	06:38	07:24	08:06	16:20	17:02	17:48
54°	06:34	07:17	07:57	16:29	17:09	17:52
52°	06:30	07:11	07:49	16:37	17:14	17:56
50°	06:27	07:06	07:42	16:44	17:20	17:59
45°	06:19	06:55	07:26	16:59	17:31	18:07
N 40°	06:12	06:45	07:14	17:12	17:41	18:14
35°	06:06	06:36	07:03	17:23	17:49	18:20
30°	05:59	06:28	06:54	17:32	17:57	18:26
20°	05:47	06:14	06:37	17:48	18:11	18:38
N 10°	05:35	06:01	06:23	18:03	18:25	18:50
0°	05:22	05:47	06:09	18:16	18:38	19:03
S 10°	05:07	05:33	05:55	18:30	18:52	19:18
20°	04:49	05:17	05:40	18:45	19:08	19:36
30°	04:26	04:57	05:23	19:02	19:28	19:59
35°	04:11	04:45	05:13	19:12	19:40	20:13
40°	03:53	04:31	05:02	19:23	19:53	20:31
45°	03:30	04:14	04:48	19:37	20:11	20:54
S 50°	02:59	03:52	04:31	19:53	20:32	21:24
52°	02:43	03:41	04:23	20:01	20:43	21:40
54°	02:24	03:29	04:14	20:10	20:55	21:59
56°	01:58	03:15	04:04	20:19	21:09	22:24
58°	01:19	02:58	03:53	20:31	21:25	23:00
S 60°	////	02:37	03:40	20:44	21:46	////

Lat.	**Moonrise** Sun	Mon	Tue	**Moonset** Sun	Mon	Tue
N 72°	22:34	·· ··	00:12	10:29	10:19	10:08
N 70°	22:33	·· ··	00:05	10:27	10:22	10:17
68°	22:33	·· ··	00:00	10:25	10:25	10:25
66°	22:32	23:55	·· ··	10:23	10:27	10:31
64°	22:32	23:51	·· ··	10:22	10:29	10:36
62°	22:32	23:48	·· ··	10:21	10:31	10:41
60°	22:32	23:45	·· ··	10:20	10:32	10:45
N 58°	22:31	23:42	·· ··	10:19	10:33	10:48
56°	22:31	23:40	·· ··	10:18	10:35	10:51
54°	22:31	23:38	·· ··	10:17	10:36	10:54
52°	22:31	23:36	·· ··	10:17	10:37	10:57
50°	22:31	23:34	·· ··	10:16	10:37	10:59
45°	22:30	23:30	·· ··	10:15	10:39	11:04
N 40°	22:30	23:27	·· ··	10:13	10:41	11:09
35°	22:30	23:24	·· ··	10:12	10:42	11:13
30°	22:30	23:22	·· ··	10:12	10:44	11:16
20°	22:30	23:18	·· ··	10:10	10:46	11:22
N 10°	22:29	23:14	·· ··	10:09	10:48	11:27
0°	22:29	23:11	23:53	10:07	10:49	11:31
S 10°	22:29	23:08	23:47	10:06	10:51	11:36
20°	22:29	23:04	23:41	10:04	10:53	11:41
30°	22:29	23:01	23:33	10:03	10:55	11:47
35°	22:28	22:58	23:29	10:02	10:56	11:51
40°	22:28	22:56	23:24	10:01	10:58	11:54
45°	22:28	22:53	23:18	09:59	10:59	11:59
S 50°	22:28	22:49	23:12	09:58	11:01	12:04
52°	22:28	22:48	23:09	09:57	11:02	12:07
54°	22:28	22:46	23:05	09:56	11:03	12:09
56°	22:28	22:44	23:02	09:55	11:04	12:12
58°	22:28	22:42	22:58	09:54	11:05	12:16
S 60°	22:27	22:40	22:53	09:53	11:07	12:19

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 19-21 79-61%
25	12:16	12:23	12:12	03:57	16:18	
26	12:30	12:36	12:13	04:39	17:00	
27	12:42	12:49	12:13	05:21	17:42	

January 28, 29, 30 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	127°10.2	194°30.3	S22°06.1	162°19.1	S15°09.2	297°04.6	S02°47.7	297°16.5	S01°33.8
1	142°12.7	209°29.4	05.7	177°19.6	08.5	312°07.1	47.6	312°19.0	33.7
2	157°15.1	224°28.5	05.3	192°20.2	07.9	327°09.5	47.6	327°21.5	33.7
3	172°17.6	239°27.6	·· 05.0	207°20.7	·· 07.2	342°12.0	·· 47.6	342°24.0	·· 33.7
4	187°20.1	254°26.7	04.6	222°21.2	06.6	357°14.5	47.6	357°26.5	33.7
5	202°22.5	269°25.8	04.2	237°21.8	05.9	12°17.0	47.6	12°29.0	33.6
6	217°25.0	284°24.9	S22°03.8	252°22.3	S15°05.3	27°19.5	S02°47.5	27°31.5	S01°33.6
7	232°27.5	299°24.1	03.4	267°22.8	04.6	42°22.0	47.5	42°34.0	33.6
8	247°29.9	314°23.2	03.0	282°23.4	04.0	57°24.5	47.5	57°36.5	33.6
9	262°32.4	329°22.3	·· 02.7	297°23.9	·· 03.3	72°26.9	·· 47.5	72°39.0	·· 33.5
10	277°34.9	344°21.4	02.3	312°24.4	02.7	87°29.4	47.4	87°41.5	33.5
11	292°37.3	359°20.5	01.9	327°25.0	02.0	102°31.9	47.4	102°44.0	33.5
12	307°39.8	14°19.6	S22°01.5	342°25.5	S15°01.4	117°34.4	S02°47.4	117°46.5	S01°33.4
13	322°42.2	29°18.7	01.1	357°26.0	00.7	132°36.9	47.4	132°49.0	33.4
14	337°44.7	44°17.8	00.7	12°26.6	15°00.0	147°39.4	47.4	147°51.5	33.4
15	352°47.2	59°17.0	22°00.3	27°27.1	14°59.4	162°41.9	·· 47.3	162°54.0	·· 33.4
16	7°49.6	74°16.1	21°59.9	42°27.6	58.7	177°44.3	47.3	177°56.5	33.3
17	22°52.1	89°15.2	59.5	57°28.2	58.1	192°46.8	47.3	192°59.0	33.3
18	37°54.6	104°14.3	S21°59.1	72°28.7	S14°57.4	207°49.3	S02°47.3	208°01.5	S01°33.3
19	52°57.0	119°13.4	58.7	87°29.2	56.8	222°51.8	47.2	223°04.0	33.2
20	67°59.5	134°12.5	58.3	102°29.8	56.1	237°54.3	47.2	238°06.5	33.2
21	83°02.0	149°11.6	·· 57.9	117°30.3	·· 55.5	252°56.8	·· 47.2	253°09.0	·· 33.2
22	98°04.4	164°10.8	57.5	132°30.8	54.8	267°59.3	47.2	268°11.5	33.2
23	113°06.9	179°09.9	57.1	147°31.4	54.1	283°01.8	47.2	283°14.0	33.1
Mer.pass. 15:29		ν -0.9′	d 0.4′	m -3.92	ν 0.5′	d 0.7′	m 1.15	ν 2.5′	d 0.0′ m -2.21	ν 2.5′	d 0.0′ m 0.71

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	128°09.3	194°09.0	S21°56.7	162°31.9	S14°53.5	298°04.3	S02°47.1	298°16.5	S01°33.1
1	143°11.8	209°08.1	56.3	177°32.4	52.8	313°06.8	47.1	313°19.0	33.1
2	158°14.3	224°07.2	55.9	192°33.0	52.2	328°09.2	47.1	328°21.5	33.0
3	173°16.7	239°06.4	·· 55.5	207°33.5	·· 51.5	343°11.7	·· 47.1	343°24.0	·· 33.0
4	188°19.2	254°05.5	55.1	222°34.0	50.8	358°14.2	47.0	358°26.5	33.0
5	203°21.7	269°04.6	54.7	237°34.6	50.2	13°16.7	47.0	13°29.1	33.0
6	218°24.1	284°03.7	S21°54.2	252°35.1	S14°49.5	28°19.2	S02°47.0	28°31.6	S01°32.9
7	233°26.6	299°02.8	53.8	267°35.6	48.9	43°21.7	47.0	43°34.1	32.9
8	248°29.1	314°01.9	53.4	282°36.2	48.2	58°24.2	46.9	58°36.6	32.9
9	263°31.5	329°01.1	·· 53.0	297°36.7	·· 47.6	73°26.7	·· 46.9	73°39.1	·· 32.8
10	278°34.0	344°00.2	52.6	312°37.2	46.9	88°29.2	46.9	88°41.6	32.8
11	293°36.5	358°59.3	52.2	327°37.8	46.2	103°31.7	46.9	103°44.1	32.8
12	308°38.9	13°58.4	S21°51.7	342°38.3	S14°45.6	118°34.2	S02°46.8	118°46.6	S01°32.8
13	323°41.4	28°57.5	51.3	357°38.9	44.9	133°36.7	46.8	133°49.1	32.7
14	338°43.8	43°56.7	50.9	12°39.4	44.2	148°39.2	46.8	148°51.6	32.7
15	353°46.3	58°55.8	·· 50.5	27°39.9	·· 43.6	163°41.7	·· 46.8	163°54.1	·· 32.7
16	8°48.8	73°54.9	50.1	42°40.5	42.9	178°44.2	46.7	178°56.6	32.6
17	23°51.2	88°54.0	49.6	57°41.0	42.3	193°46.6	46.7	193°59.1	32.6
18	38°53.7	103°53.2	S21°49.2	72°41.5	S14°41.6	208°49.1	S02°46.7	209°01.6	S01°32.6
19	53°56.2	118°52.3	48.8	87°42.1	40.9	223°51.6	46.7	224°04.1	32.6
20	68°58.6	133°51.4	48.3	102°42.6	40.3	238°54.1	46.6	239°06.6	32.5
21	84°01.1	148°50.5	·· 47.9	117°43.2	·· 39.6	253°56.6	·· 46.6	254°09.1	·· 32.5
22	99°03.6	163°49.7	47.5	132°43.7	38.9	268°59.1	46.6	269°11.6	32.5
23	114°06.0	178°48.8	47.1	147°44.2	38.3	284°01.6	46.6	284°14.1	32.4
Mer.pass. 15:25		ν -0.9′	d 0.4′	m -3.92	ν 0.5′	d 0.7′	m 1.15	ν 2.5′	d 0.0′ m -2.22	ν 2.5′	d 0.0′ m 0.70

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	129°08.5	193°47.9	S21°46.6	162°44.8	S14°37.6	299°04.1	S02°46.5	299°16.6	S01°32.4
1	144°11.0	208°47.0	46.2	177°45.3	37.0	314°06.6	46.5	314°19.1	32.4
2	159°13.4	223°46.2	45.8	192°45.8	36.3	329°09.1	46.5	329°21.6	32.3
3	174°15.9	238°45.3	·· 45.3	207°46.4	·· 35.6	344°11.6	·· 46.5	344°24.2	·· 32.3
4	189°18.3	253°44.4	44.9	222°46.9	35.0	359°14.1	46.4	359°26.7	32.3
5	204°20.8	268°43.5	44.4	237°47.5	34.3	14°16.6	46.4	14°29.2	32.3
6	219°23.3	283°42.7	S21°44.0	252°48.0	S14°33.6	29°19.1	S02°46.4	29°31.7	S01°32.2
7	234°25.7	298°41.8	43.6	267°48.5	33.0	44°21.6	46.3	44°34.2	32.2
8	249°28.2	313°40.9	43.1	282°49.1	32.3	59°24.1	46.3	59°36.7	32.2
9	264°30.7	328°40.0	·· 42.7	297°49.6	·· 31.6	74°26.6	·· 46.3	74°39.2	·· 32.1
10	279°33.1	343°39.2	42.2	312°50.2	31.0	89°29.1	46.3	89°41.7	32.1
11	294°35.6	358°38.3	41.8	327°50.7	30.3	104°31.6	46.2	104°44.2	32.1
12	309°38.1	13°37.4	S21°41.3	342°51.3	S14°29.6	119°34.1	S02°46.2	119°46.7	S01°32.0
13	324°40.5	28°36.6	40.9	357°51.8	29.0	134°36.6	46.2	134°49.2	32.0
14	339°43.0	43°35.7	40.4	12°52.3	28.3	149°39.1	46.1	149°51.7	32.0
15	354°45.5	58°34.8	·· 40.0	27°52.9	·· 27.6	164°41.6	·· 46.1	164°54.2	·· 31.9
16	9°47.9	73°33.9	39.5	42°53.4	27.0	179°44.1	46.1	179°56.8	31.9
17	24°50.4	88°33.1	39.1	57°54.0	26.3	194°46.6	46.1	194°59.3	31.9
18	39°52.8	103°32.2	S21°38.6	72°54.5	S14°25.6	209°49.1	S02°46.0	210°01.8	S01°31.8
19	54°55.3	118°31.3	38.2	87°55.0	25.0	224°51.6	46.0	225°04.3	31.8
20	69°57.8	133°30.5	37.7	102°55.6	24.3	239°54.1	46.0	240°06.8	31.8
21	85°00.2	148°29.6	·· 37.3	117°56.1	·· 23.6	254°56.7	·· 45.9	255°09.3	·· 31.8
22	100°02.7	163°28.7	36.8	132°56.7	22.9	269°59.2	45.9	270°11.8	31.7
23	115°05.2	178°27.9	36.4	147°57.2	22.3	285°01.7	45.9	285°14.3	31.7
Mer.pass. 15:21		ν -0.9′	d 0.4′	m -3.91	ν 0.5′	d 0.7′	m 1.15	ν 2.5′	d 0.0′ m -2.22	ν 2.5′	d 0.0′ m 0.70

Stars

	SHA	Dec
Alpheratz	358°09.2	28°59.1
Ankaa	353°40.2	-42°24.9
Schedar	350°08.9	56°26.1
Diphda	349°20.8	-18°05.7
Achernar	335°45.2	-57°20.4
Hamal	328°28.6	23°22.3
Polaris	326°47.4	89°10.9
Acamar	315°37.0	-40°23.2
Menkar	314°40.8	4°00.8
Mirfak	309°15.6	49°47.8
Aldebaran	291°17.5	16°28.2
Rigel	281°35.5	-8°13.6
Capella	281°10.6	45°58.8
Bellatrix	278°58.2	6°19.8
Elnath	278°43.5	28°35.5
Alnilam	276°11.1	-1°13.0
Betelgeuse	271°27.7	7°24.1
Canopus	264°06.6	-52°41.4
Sirius	258°55.1	-16°41.6
Adhara	255°31.5	-28°57.0
Procyon	245°25.2	5°16.3
Pollux	243°57.5	28°04.3
Avior	234°27.4	-59°27.0
Suhail	223°10.1	-43°21.4
Miaplacidus	221°43.9	-69°38.3
Alphard	218°20.0	-8°34.6
Regulus	208°09.4	12°03.5
Dubhe	194°21.3	61°51.0
Denebola	182°58.6	14°40.6
Gienah	176°17.5	-17°26.1
Acrux	173°36.6	-62°59.3
Gacrux	172°28.1	-57°00.2
Alioth	166°42.1	56°03.5
Spica	158°57.2	-11°03.7
Alkaid	153°18.2	49°24.3
Hadar	149°22.9	-60°16.6
Menkent	148°36.6	-36°16.4
Arcturus	146°18.2	19°16.8
Rigil Kent.	140°25.4	-60°45.0
Kochab	137°19.2	74°13.8
Zuben'ubi	137°32.8	-15°57.7
Alphecca	126°32.0	26°46.6
Antares	112°56.7	-26°23.3
Atria	108°21.1	-68°59.3
Sabik	102°41.1	-15°42.0
Shaula	96°55.7	-37°05.3
Rasalhague	96°29.6	12°34.4
Eltanin	90°58.0	51°29.3
Kaus Aust.	84°16.8	-34°23.6
Vega	80°56.0	38°45.8
Nunki	76°29.2	-26°19.2
Altair	62°32.6	8°49.0
Peacock	53°58.6	-56°47.8
Deneb	49°48.7	45°12.7
Enif	34°11.6	9°47.2
Al Na'ir	28°15.1	-47°03.4
Fomalhaut	15°51.4	-29°43.6
Scheat	14°17.6	27°58.8
Markab	14°03.2	15°06.1

Jan 28 Wed	SHA	Mer.pass
Venus	67°20.1	11:03
Mars	35°08.9	13:10
Jupiter	169°54.4	04:11
Saturn	170°06.3	04:10

Jan 29 Thu	SHA	Mer.pass
Venus	65°59.6	11:04
Mars	34°22.5	13:09
Jupiter	169°54.9	04:07
Saturn	170°07.2	04:06

Jan 30 Fri	SHA	Mer.pass
Venus	64°39.4	11:05
Mars	33°36.3	13:09
Jupiter	169°55.6	04:03
Saturn	170°08.1	04:02

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°46.4	S18°16.4	271°41.6	15.1′	S08°33.3	9.4′	54.2′
1	191°46.3	15.7	286°15.8	15.1′	08°42.7	9.3′	54.2′
2	206°46.2	15.1	300°49.8	15.1′	08°52.0	9.3′	54.2′
3	221°46.0	·· 14.4	315°23.9	15.0′	09°01.3	9.3′	54.2′
4	236°45.9	13.7	329°58.0	15.0′	09°10.6	9.2′	54.2′
5	251°45.8	13.1	344°32.0	15.0′	09°19.8	9.2′	54.2′
6	266°45.7	S18°12.4	359°05.9	15.0′	S09°29.0	9.2′	54.2′
7	281°45.6	11.8	13°39.9	14.9′	09°38.2	9.1′	54.2′
8	296°45.5	11.1	28°13.8	14.9′	09°47.3	9.1′	54.2′
9	311°45.3	·· 10.5	42°47.7	14.9′	09°56.4	9.1′	54.2′
10	326°45.2	09.8	57°21.6	14.8′	10°05.5	9.0′	54.2′
11	341°45.1	09.1	71°55.4	14.8′	10°14.5	8.9′	54.2′
12	356°45.0	S18°08.5	86°29.2	14.8′	S10°23.4	9.0′	54.2′
13	11°44.9	07.8	101°03.0	14.7′	10°32.4	8.8′	54.2′
14	26°44.8	07.1	115°36.7	14.7′	10°41.2	8.9′	54.2′
15	41°44.6	·· 06.5	130°10.4	14.7′	10°50.1	8.8′	54.2′
16	56°44.5	05.8	144°44.1	14.6′	10°58.9	8.7′	54.2′
17	71°44.4	05.2	159°17.7	14.6′	11°07.6	8.7′	54.2′
18	86°44.3	S18°04.5	173°51.3	14.6′	S11°16.3	8.7′	54.2′
19	101°44.2	03.8	188°24.9	14.5′	11°25.0	8.6′	54.2′
20	116°44.1	03.2	202°58.4	14.5′	11°33.6	8.6′	54.2′
21	131°44.0	·· 02.5	217°31.9	14.4′	11°42.2	8.6′	54.3′
22	146°43.8	01.8	232°05.3	14.4′	11°50.8	8.4′	54.3′
23	161°43.7	01.2	246°38.7	14.4′	11°59.2	8.5′	54.3′
	SD = 16.2′	d = 0.7′	SD = 14.8′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°43.6	S18°00.5	261°12.1	14.3′	S12°07.7	8.4′	54.3′
1	191°43.5	17°59.8	275°45.4	14.3′	12°16.1	8.3′	54.3′
2	206°43.4	59.2	290°18.7	14.2′	12°24.4	8.3′	54.3′
3	221°43.3	·· 58.5	304°52.0	14.2′	12°32.7	8.3′	54.3′
4	236°43.2	57.8	319°25.2	14.2′	12°41.0	8.1′	54.3′
5	251°43.1	57.1	333°58.3	14.1′	12°49.1	8.2′	54.3′
6	266°42.9	S17°56.5	348°31.4	14.1′	S12°57.3	8.1′	54.3′
7	281°42.8	55.8	3°04.5	14.0′	13°05.4	8.0′	54.3′
8	296°42.7	55.1	17°37.5	14.0′	13°13.4	8.0′	54.4′
9	311°42.6	·· 54.5	32°10.5	13.9′	13°21.4	7.9′	54.4′
10	326°42.5	53.8	46°43.4	13.9′	13°29.3	7.9′	54.4′
11	341°42.4	53.1	61°16.3	13.8′	13°37.2	7.8′	54.4′
12	356°42.3	S17°52.4	75°49.2	13.8′	S13°45.0	7.8′	54.4′
13	11°42.2	51.8	90°21.9	13.7′	13°52.8	7.7′	54.4′
14	26°42.1	51.1	104°54.7	13.7′	14°00.5	7.7′	54.4′
15	41°42.0	·· 50.4	119°27.4	13.6′	14°08.2	7.6′	54.4′
16	56°41.9	49.7	134°00.0	13.6′	14°15.8	7.5′	54.4′
17	71°41.8	49.0	148°32.6	13.5′	14°23.3	7.5′	54.5′
18	86°41.7	S17°48.4	163°05.2	13.5′	S14°30.8	7.4′	54.5′
19	101°41.5	47.7	177°37.7	13.4′	14°38.2	7.4′	54.5′
20	116°41.4	47.0	192°10.1	13.4′	14°45.6	7.3′	54.5′
21	131°41.3	·· 46.3	206°42.5	13.3′	14°52.9	7.3′	54.5′
22	146°41.2	45.6	221°14.9	13.3′	15°00.2	7.1′	54.5′
23	161°41.1	45.0	235°47.2	13.2′	15°07.3	7.2′	54.5′
	SD = 16.2′	d = 0.7′	SD = 14.8′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°41.0	S17°44.3	250°19.4	13.2′	S15°14.5	7.0′	54.6′
1	191°40.9	43.6	264°51.6	13.1′	15°21.5	7.0′	54.6′
2	206°40.8	42.9	279°23.7	13.1′	15°28.5	6.9′	54.6′
3	221°40.7	·· 42.2	293°55.8	13.0′	15°35.4	6.9′	54.6′
4	236°40.6	41.6	308°27.8	13.0′	15°42.3	6.8′	54.6′
5	251°40.5	40.9	322°59.8	12.9′	15°49.1	6.7′	54.6′
6	266°40.4	S17°40.2	337°31.7	12.9′	S15°55.8	6.7′	54.7′
7	281°40.3	39.5	352°03.6	12.8′	16°02.5	6.6′	54.7′
8	296°40.2	38.8	6°35.4	12.8′	16°09.1	6.5′	54.7′
9	311°40.1	·· 38.1	21°07.1	12.7′	16°15.6	6.5′	54.7′
10	326°40.0	37.4	35°38.8	12.6′	16°22.1	6.4′	54.7′
11	341°39.9	36.8	50°10.5	12.6′	16°28.5	6.3′	54.7′
12	356°39.8	S17°36.1	64°42.1	12.5′	S16°34.8	6.2′	54.8′
13	11°39.7	35.4	79°13.6	12.5′	16°41.0	6.2′	54.8′
14	26°39.6	34.7	93°45.1	12.4′	16°47.2	6.1′	54.8′
15	41°39.5	·· 34.0	108°16.5	12.4′	16°53.3	6.0′	54.8′
16	56°39.4	33.3	122°47.8	12.3′	16°59.3	6.0′	54.8′
17	71°39.3	32.6	137°19.1	12.2′	17°05.3	5.9′	54.9′
18	86°39.2	S17°31.9	151°50.4	12.2′	S17°11.2	5.8′	54.9′
19	101°39.1	31.2	166°21.5	12.1′	17°17.0	5.7′	54.9′
20	116°39.0	30.5	180°52.7	12.1′	17°22.7	5.6′	54.9′
21	131°38.9	·· 29.8	195°23.7	12.0′	17°28.3	5.6′	54.9′
22	146°38.8	29.2	209°54.7	11.9′	17°33.9	5.5′	55.0′
23	161°38.7	28.5	224°25.7	11.9′	17°39.4	5.4′	55.0′
	SD = 16.2′	d = 0.7′	SD = 14.9′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	07:20	08:52	10:56	13:31	15:36	17:08
N 70°	07:11	08:31	10:03	14:25	15:56	17:17
68°	07:03	08:15	09:31	14:57	16:12	17:24
66°	06:57	08:02	09:07	15:20	16:26	17:31
64°	06:51	07:51	08:49	15:39	16:37	17:36
62°	06:46	07:41	08:34	15:54	16:46	17:41
60°	06:42	07:33	08:21	16:06	16:54	17:46
N 58°	06:37	07:25	08:10	16:17	17:02	17:50
56°	06:34	07:19	08:01	16:26	17:08	17:54
54°	06:30	07:13	07:52	16:35	17:14	17:57
52°	06:27	07:08	07:45	16:42	17:19	18:00
50°	06:24	07:03	07:38	16:49	17:24	18:03
45°	06:17	06:52	07:23	17:03	17:35	18:10
N 40°	06:10	06:43	07:11	17:15	17:44	18:17
35°	06:04	06:34	07:01	17:26	17:52	18:23
30°	05:58	06:27	06:52	17:35	18:00	18:29
20°	05:47	06:13	06:36	17:50	18:13	18:40
N 10°	05:35	06:01	06:23	18:04	18:26	18:51
0°	05:23	05:48	06:10	18:17	18:38	19:04
S 10°	05:08	05:34	05:56	18:30	18:52	19:18
20°	04:51	05:19	05:42	18:44	19:07	19:35
30°	04:29	05:00	05:26	19:00	19:26	19:57
35°	04:15	04:48	05:16	19:10	19:37	20:11
40°	03:58	04:35	05:05	19:20	19:51	20:28
45°	03:36	04:19	04:52	19:33	20:07	20:49
S 50°	03:07	03:58	04:36	19:49	20:27	21:18
52°	02:52	03:48	04:29	19:56	20:37	21:33
54°	02:33	03:36	04:20	20:05	20:49	21:51
56°	02:10	03:23	04:11	20:14	21:02	22:13
58°	01:38	03:07	04:00	20:24	21:17	22:43
S 60°	////	02:47	03:48	20:37	21:36	23:42

Lat.	**Moonrise** Wed	Thu	Fri	**Moonset** Wed	Thu	Fri
N 72°	01:52	03:38	05:36	09:56	09:41	09:17
N 70°	01:38	03:14	04:54	10:12	10:07	10:00
68°	01:27	02:55	04:26	10:25	10:26	10:29
66°	01:17	02:40	04:04	10:35	10:42	10:51
64°	01:10	02:28	03:47	10:44	10:55	11:09
62°	01:03	02:18	03:34	10:52	11:06	11:23
60°	00:57	02:10	03:22	10:59	11:15	11:36
N 58°	00:52	02:02	03:12	11:04	11:23	11:46
56°	00:48	01:55	03:03	11:10	11:30	11:56
54°	00:44	01:49	02:55	11:14	11:37	12:04
52°	00:40	01:44	02:48	11:19	11:43	12:11
50°	00:37	01:39	02:42	11:22	11:48	12:18
45°	00:30	01:29	02:28	11:31	11:59	12:32
N 40°	00:24	01:20	02:17	11:38	12:09	12:44
35°	00:19	01:13	02:08	11:44	12:17	12:54
30°	00:14	01:06	02:00	11:49	12:24	13:03
20°	00:06	00:55	01:45	11:58	12:37	13:18
N 10°	00:00	00:46	01:33	12:06	12:48	13:32
0°	·· ··	00:37	01:22	12:14	12:58	13:44
S 10°	·· ··	00:28	01:10	12:22	13:08	13:57
20°	·· ··	00:18	00:58	12:30	13:19	14:10
30°	·· ··	00:07	00:44	12:39	13:32	14:26
35°	·· ··	00:01	00:36	12:45	13:39	14:35
40°	23:54	·· ··	00:27	12:51	13:48	14:45
45°	23:46	·· ··	00:16	12:58	13:57	14:57
S 50°	23:36	·· ··	00:04	13:07	14:09	15:12
52°	23:31	23:58	·· ··	13:11	14:15	15:18
54°	23:27	23:51	·· ··	13:15	14:21	15:26
56°	23:21	23:44	·· ··	13:20	14:28	15:35
58°	23:15	23:36	·· ··	13:26	14:35	15:44
S 60°	23:08	23:26	23:50	13:32	14:44	15:55

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 22-24 52-33%
28	12:54	13:00	12:13	06:04	18:25	
29	13:06	13:11	12:13	06:47	19:10	
30	13:16	13:21	12:13	07:33	19:56	

January 31, 01, 02 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	130°07.6	193°27.0	S21°35.9	162°57.8	S14°21.6	300°04.2	S02°45.9	300°16.8	S01°31.7
1	145°10.1	208°26.1	35.4	177°58.3	20.9	315°06.7	45.8	315°19.3	31.6
2	160°12.6	223°25.3	35.0	192°58.8	20.3	330°09.2	45.8	330°21.8	31.6
3	175°15.0	238°24.4	·· 34.5	207°59.4	·· 19.6	345°11.7	·· 45.8	345°24.4	·· 31.6
4	190°17.5	253°23.5	34.0	222°59.9	18.9	0°14.2	45.7	0°26.9	31.5
5	205°19.9	268°22.7	33.6	238°00.5	18.2	15°16.7	45.7	15°29.4	31.5
6	220°22.4	283°21.8	S21°33.1	253°01.0	S14°17.6	30°19.2	S02°45.7	30°31.9	S01°31.5
7	235°24.9	298°20.9	32.6	268°01.6	16.9	45°21.7	45.7	45°34.4	31.4
8	250°27.3	313°20.1	32.2	283°02.1	16.2	60°24.2	45.6	60°36.9	31.4
9	265°29.8	328°19.2	·· 31.7	298°02.7	·· 15.6	75°26.7	·· 45.6	75°39.4	·· 31.4
10	280°32.3	343°18.4	31.2	313°03.2	14.9	90°29.2	45.6	90°41.9	31.3
11	295°34.7	358°17.5	30.8	328°03.7	14.2	105°31.7	45.5	105°44.4	31.3
12	310°37.2	13°16.6	S21°30.3	343°04.3	S14°13.5	120°34.3	S02°45.5	120°47.0	S01°31.3
13	325°39.7	28°15.8	29.8	358°04.8	12.9	135°36.8	45.5	135°49.5	31.2
14	340°42.1	43°14.9	29.3	13°05.4	12.2	150°39.3	45.4	150°52.0	31.2
15	355°44.6	58°14.0	·· 28.9	28°05.9	·· 11.5	165°41.8	·· 45.4	165°54.5	·· 31.2
16	10°47.1	73°13.2	28.4	43°06.5	10.8	180°44.3	45.4	180°57.0	31.1
17	25°49.5	88°12.3	27.9	58°07.0	10.2	195°46.8	45.3	195°59.5	31.1
18	40°52.0	103°11.5	S21°27.4	73°07.6	S14°09.5	210°49.3	S02°45.3	211°02.0	S01°31.1
19	55°54.4	118°10.6	26.9	88°08.1	08.8	225°51.8	45.3	226°04.5	31.0
20	70°56.9	133°09.7	26.5	103°08.7	08.1	240°54.3	45.2	241°07.1	31.0
21	85°59.4	148°08.9	·· 26.0	118°09.2	·· 07.5	255°56.8	·· 45.2	256°09.6	·· 31.0
22	101°01.8	163°08.0	25.5	133°09.8	06.8	270°59.4	45.2	271°12.1	30.9
23	116°04.3	178°07.2	25.0	148°10.3	06.1	286°01.9	45.1	286°14.6	30.9
Mer.pass. 15:17		ν -0.9′	d 0.5′	m -3.91	ν 0.5′	d 0.7′	m 1.15	ν 2.5′	d 0.0′ m -2.23	ν 2.5′	d 0.0′ m 0.69

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	131°06.8	193°06.3	S21°24.5	163°10.8	S14°05.4	301°04.4	S02°45.1	301°17.1	S01°30.9
1	146°09.2	208°05.5	24.0	178°11.4	04.8	316°06.9	45.1	316°19.6	30.8
2	161°11.7	223°04.6	23.5	193°11.9	04.1	331°09.4	45.1	331°22.1	30.8
3	176°14.2	238°03.7	·· 23.0	208°12.5	·· 03.4	346°11.9	·· 45.0	346°24.7	·· 30.8
4	191°16.6	253°02.9	22.6	223°13.0	02.7	1°14.4	45.0	1°27.2	30.7
5	206°19.1	268°02.0	22.1	238°13.6	02.1	16°16.9	45.0	16°29.7	30.7
6	221°21.6	283°01.2	S21°21.6	253°14.1	S14°01.4	31°19.5	S02°44.9	31°32.2	S01°30.7
7	236°24.0	298°00.3	21.1	268°14.7	00.7	46°22.0	44.9	46°34.7	30.6
8	251°26.5	312°59.5	20.6	283°15.2	14°00.0	61°24.5	44.9	61°37.2	30.6
9	266°28.9	327°58.6	·· 20.1	298°15.8	13°59.3	76°27.0	·· 44.8	76°39.7	·· 30.6
10	281°31.4	342°57.8	19.6	313°16.3	58.7	91°29.5	44.8	91°42.3	30.5
11	296°33.9	357°56.9	19.1	328°16.9	58.0	106°32.0	44.8	106°44.8	30.5
12	311°36.3	12°56.0	S21°18.6	343°17.4	S13°57.3	121°34.6	S02°44.7	121°47.3	S01°30.5
13	326°38.8	27°55.2	18.1	358°18.0	56.6	136°37.1	44.7	136°49.8	30.4
14	341°41.3	42°54.3	17.6	13°18.5	56.0	151°39.6	44.6	151°52.3	30.4
15	356°43.7	57°53.5	·· 17.1	28°19.1	·· 55.3	166°42.1	·· 44.6	166°54.8	·· 30.4
16	11°46.2	72°52.6	16.6	43°19.6	54.6	181°44.6	44.6	181°57.4	30.3
17	26°48.7	87°51.8	16.1	58°20.2	53.9	196°47.1	44.5	196°59.9	30.3
18	41°51.1	102°50.9	S21°15.6	73°20.7	S13°53.2	211°49.7	S02°44.5	212°02.4	S01°30.3
19	56°53.6	117°50.1	15.0	88°21.3	52.6	226°52.2	44.5	227°04.9	30.2
20	71°56.1	132°49.2	14.5	103°21.8	51.9	241°54.7	44.4	242°07.4	30.2
21	86°58.5	147°48.4	·· 14.0	118°22.4	·· 51.2	256°57.2	·· 44.4	257°09.9	·· 30.2
22	102°01.0	162°47.5	13.5	133°22.9	50.5	271°59.7	44.4	272°12.5	30.1
23	117°03.4	177°46.7	13.0	148°23.5	49.8	287°02.3	44.3	287°15.0	30.1
Mer.pass. 15:13		ν -0.9′	d 0.5′	m -3.91	ν 0.5′	d 0.7′	m 1.15	ν 2.5′	d 0.0′ m -2.24	ν 2.5′	d 0.0′ m 0.69

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	132°05.9	192°45.8	S21°12.5	163°24.0	S13°49.1	302°04.8	S02°44.3	302°17.5	S01°30.1
1	147°08.4	207°45.0	12.0	178°24.6	48.5	317°07.3	44.3	317°20.0	30.0
2	162°10.8	222°44.1	11.5	193°25.2	47.8	332°09.8	44.2	332°22.5	30.0
3	177°13.3	237°43.3	·· 10.9	208°25.7	·· 47.1	347°12.3	·· 44.2	347°25.0	·· 29.9
4	192°15.8	252°42.4	10.4	223°26.3	46.4	2°14.9	44.2	2°27.6	29.9
5	207°18.2	267°41.6	09.9	238°26.8	45.7	17°17.4	44.1	17°30.1	29.9
6	222°20.7	282°40.8	S21°09.4	253°27.4	S13°45.0	32°19.9	S02°44.1	32°32.6	S01°29.8
7	237°23.2	297°39.9	08.9	268°27.9	44.4	47°22.4	44.0	47°35.1	29.8
8	252°25.6	312°39.1	08.3	283°28.5	43.7	62°24.9	44.0	62°37.6	29.8
9	267°28.1	327°38.2	·· 07.8	298°29.0	·· 43.0	77°27.5	·· 44.0	77°40.2	·· 29.7
10	282°30.5	342°37.4	07.3	313°29.6	42.3	92°30.0	43.9	92°42.7	29.7
11	297°33.0	357°36.5	06.8	328°30.1	41.6	107°32.5	43.9	107°45.2	29.7
12	312°35.5	12°35.7	S21°06.2	343°30.7	S13°40.9	122°35.0	S02°43.9	122°47.7	S01°29.6
13	327°37.9	27°34.8	05.7	358°31.2	40.3	137°37.6	43.8	137°50.2	29.6
14	342°40.4	42°34.0	05.2	13°31.8	39.6	152°40.1	43.8	152°52.8	29.6
15	357°42.9	57°33.2	·· 04.7	28°32.3	·· 38.9	167°42.6	·· 43.7	167°55.3	·· 29.5
16	12°45.3	72°32.3	04.1	43°32.9	38.2	182°45.1	43.7	182°57.8	29.5
17	27°47.8	87°31.5	03.6	58°33.5	37.5	197°47.7	43.7	198°00.3	29.4
18	42°50.3	102°30.6	S21°03.1	73°34.0	S13°36.8	212°50.2	S02°43.6	213°02.8	S01°29.4
19	57°52.7	117°29.8	02.5	88°34.6	36.1	227°52.7	43.6	228°05.4	29.4
20	72°55.2	132°28.9	02.0	103°35.1	35.5	242°55.2	43.6	243°07.9	29.3
21	87°57.7	147°28.1	·· 01.4	118°35.7	·· 34.8	257°57.8	·· 43.5	258°10.4	·· 29.3
22	103°00.1	162°27.3	00.9	133°36.2	34.1	273°00.3	43.5	273°12.9	29.3
23	118°02.6	177°26.4	00.4	148°36.8	33.4	288°02.8	43.4	288°15.5	29.2
Mer.pass. 15:09		ν -0.8′	d 0.5′	m -3.91	ν 0.6′	d 0.7′	m 1.15	ν 2.5′	d 0.0′ m -2.25	ν 2.5′	d 0.0′ m 0.68

Stars

	SHA	Dec
Alpheratz	358°09.3	28°59.1
Ankaa	353°40.2	-42°24.9
Schedar	350°09.0	56°26.1
Diphda	349°20.8	-18°05.7
Achernar	335°45.3	-57°20.4
Hamal	328°28.6	23°22.3
Polaris	326°48.4	89°10.9
Acamar	315°37.0	-40°23.2
Menkar	314°40.8	4°00.8
Mirfak	309°15.6	49°47.8
Aldebaran	291°17.5	16°28.2
Rigel	281°35.5	-8°13.6
Capella	281°10.6	45°58.8
Bellatrix	278°58.2	6°19.8
Elnath	278°43.5	28°35.5
Alnilam	276°11.1	-1°13.0
Betelgeuse	271°27.7	7°24.1
Canopus	264°06.6	-52°41.4
Sirius	258°55.1	-16°41.6
Adhara	255°31.5	-28°57.0
Procyon	245°25.2	5°16.3
Pollux	243°57.5	28°04.3
Avior	234°27.4	-59°27.0
Suhail	223°10.1	-43°21.4
Miaplacidus	221°43.9	-69°38.3
Alphard	218°20.0	-8°34.6
Regulus	208°09.4	12°03.5
Dubhe	194°21.3	61°51.0
Denebola	182°58.5	14°40.6
Gienah	176°17.5	-17°26.1
Acrux	173°36.6	-62°59.4
Gacrux	172°28.1	-57°00.2
Alioth	166°42.0	56°03.5
Spica	158°57.1	-11°03.7
Alkaid	153°18.2	49°24.3
Hadar	149°22.8	-60°16.6
Menkent	148°36.6	-36°16.4
Arcturus	146°18.2	19°16.8
Rigil Kent.	140°25.4	-60°45.0
Kochab	137°19.1	74°13.8
Zuben'ubi	137°32.7	-15°57.7
Alphecca	126°32.0	26°46.6
Antares	112°56.7	-26°23.3
Atria	108°21.0	-68°59.3
Sabik	102°41.0	-15°42.1
Shaula	96°55.7	-37°05.3
Rasalhague	96°29.6	12°34.3
Eltanin	90°58.0	51°29.3
Kaus Aust.	84°16.8	-34°23.6
Vega	80°56.0	38°45.8
Nunki	76°29.2	-26°19.2
Altair	62°32.6	8°49.0
Peacock	53°58.6	-56°47.8
Deneb	49°48.7	45°12.7
Enif	34°11.6	9°47.2
Al Na'ir	28°15.1	-47°03.4
Fomalhaut	15°51.4	-29°43.6
Scheat	14°17.6	27°58.8
Markab	14°03.2	15°06.1

Jan 31 Sat	SHA	Mer.pass
Venus	63°19.4	11:07
Mars	32°50.1	13:08
Jupiter	169°56.5	03:59
Saturn	170°09.2	03:58

Feb 01 Sun	SHA	Mer.pass
Venus	61°59.5	11:08
Mars	32°04.1	13:07
Jupiter	169°57.6	03:55
Saturn	170°10.3	03:54

Feb 02 Mon	SHA	Mer.pass
Venus	60°39.9	11:10
Mars	31°18.1	13:06
Jupiter	169°58.9	03:51
Saturn	170°11.6	03:50

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°38.6	S17°27.8	238°56.6	11.8′	S17°44.8	5.4′	55.0′
1	191°38.5	27.1	253°27.4	11.8′	17°50.2	5.2′	55.0′
2	206°38.4	26.4	267°58.2	11.7′	17°55.4	5.2′	55.1′
3	221°38.3	·· 25.7	282°28.9	11.7′	18°00.6	5.1′	55.1′
4	236°38.3	25.0	296°59.5	11.6′	18°05.7	5.0′	55.1′
5	251°38.2	24.3	311°30.1	11.5′	18°10.7	4.9′	55.1′
6	266°38.1	S17°23.6	326°00.7	11.5′	S18°15.6	4.9′	55.1′
7	281°38.0	22.9	340°31.1	11.4′	18°20.5	4.7′	55.2′
8	296°37.9	22.2	355°01.5	11.4′	18°25.2	4.7′	55.2′
9	311°37.8	·· 21.5	9°31.9	11.3′	18°29.9	4.6′	55.2′
10	326°37.7	20.8	24°02.2	11.2′	18°34.5	4.5′	55.2′
11	341°37.6	20.1	38°32.4	11.2′	18°39.0	4.4′	55.3′
12	356°37.5	S17°19.4	53°02.6	11.1′	S18°43.4	4.3′	55.3′
13	11°37.4	18.7	67°32.7	11.1′	18°47.7	4.2′	55.3′
14	26°37.3	18.0	82°02.8	11.0′	18°51.9	4.2′	55.3′
15	41°37.2	·· 17.3	96°32.8	10.9′	18°56.1	4.0′	55.4′
16	56°37.2	16.6	111°02.7	10.9′	19°00.1	4.0′	55.4′
17	71°37.1	15.9	125°32.6	10.8′	19°04.1	3.9′	55.4′
18	86°37.0	S17°15.2	140°02.5	10.8′	S19°08.0	3.8′	55.4′
19	101°36.9	14.5	154°32.2	10.7′	19°11.8	3.7′	55.5′
20	116°36.8	13.8	169°01.9	10.7′	19°15.5	3.5′	55.5′
21	131°36.7	·· 13.1	183°31.6	10.6′	19°19.0	3.5′	55.5′
22	146°36.6	12.3	198°01.2	10.5′	19°22.5	3.5′	55.5′
23	161°36.5	11.6	212°30.7	10.5′	19°26.0	3.3′	55.6′
	SD = 16.2′	d = 0.7′	SD = 15.0′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°36.4	S17°10.9	227°00.2	10.4′	S19°29.3	3.2′	55.6′
1	191°36.4	10.2	241°29.7	10.4′	19°32.5	3.1′	55.6′
2	206°36.3	09.5	255°59.0	10.3′	19°35.6	3.0′	55.6′
3	221°36.2	·· 08.8	270°28.4	10.3′	19°38.6	2.9′	55.7′
4	236°36.1	08.1	284°57.6	10.2′	19°41.5	2.9′	55.7′
5	251°36.0	07.4	299°26.8	10.2′	19°44.4	2.7′	55.7′
6	266°35.9	S17°06.7	313°56.0	10.1′	S19°47.1	2.6′	55.7′
7	281°35.8	06.0	328°25.1	10.0′	19°49.7	2.5′	55.8′
8	296°35.8	05.3	342°54.1	10.0′	19°52.2	2.4′	55.8′
9	311°35.7	·· 04.5	357°23.1	9.9′	19°54.6	2.4′	55.8′
10	326°35.6	03.8	11°52.1	9.9′	19°57.0	2.2′	55.9′
11	341°35.5	03.1	26°21.0	9.8′	19°59.2	2.1′	55.9′
12	356°35.4	S17°02.4	40°49.8	9.8′	S20°01.3	2.0′	55.9′
13	11°35.3	01.7	55°18.6	9.7′	20°03.3	1.9′	55.9′
14	26°35.3	01.0	69°47.3	9.7′	20°05.2	1.8′	56.0′
15	41°35.2	17°00.3	84°16.0	9.6′	20°07.0	1.7′	56.0′
16	56°35.1	16°59.5	98°44.6	9.6′	20°08.7	1.6′	56.0′
17	71°35.0	58.8	113°13.2	9.5′	20°10.3	1.5′	56.0′
18	86°34.9	S16°58.1	127°41.8	9.5′	S20°11.8	1.3′	56.1′
19	101°34.9	57.4	142°10.2	9.4′	20°13.1	1.3′	56.1′
20	116°34.8	56.7	156°38.7	9.4′	20°14.4	1.1′	56.1′
21	131°34.7	·· 56.0	171°07.1	9.3′	20°15.5	1.1′	56.2′
22	146°34.6	55.2	185°35.4	9.3′	20°16.6	0.9′	56.2′
23	161°34.5	54.5	200°03.7	9.3′	20°17.5	0.9′	56.2′
	SD = 16.2′	d = 0.7′	SD = 15.2′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°34.5	S16°53.8	214°32.0	9.2′	S20°18.4	0.7′	56.3′
1	191°34.4	53.1	229°00.2	9.2′	20°19.1	0.6′	56.3′
2	206°34.3	52.4	243°28.4	9.1′	20°19.7	0.5′	56.3′
3	221°34.2	·· 51.6	257°56.5	9.1′	20°20.2	0.4′	56.3′
4	236°34.1	50.9	272°24.6	9.0′	20°20.6	0.3′	56.4′
5	251°34.1	50.2	286°52.6	9.0′	20°20.9	0.1′	56.4′
6	266°34.0	S16°49.5	301°20.6	9.0′	S20°21.0	0.1′	56.4′
7	281°33.9	48.7	315°48.6	8.9′	20°21.1	0.1′	56.5′
8	296°33.8	48.0	330°16.5	8.9′	20°21.0	0.2′	56.5′
9	311°33.8	·· 47.3	344°44.4	8.9′	20°20.8	0.2′	56.5′
10	326°33.7	46.6	359°12.3	8.8′	20°20.6	0.5′	56.5′
11	341°33.6	45.8	13°40.1	8.8′	20°20.1	0.5′	56.6′
12	356°33.5	S16°45.1	28°07.9	8.7′	S20°19.6	0.6′	56.6′
13	11°33.5	44.4	42°35.6	8.7′	20°19.0	0.7′	56.6′
14	26°33.4	43.7	57°03.3	8.7′	20°18.3	0.9′	56.7′
15	41°33.3	·· 42.9	71°31.0	8.6′	20°17.4	1.0′	56.7′
16	56°33.2	42.2	85°58.7	8.6′	20°16.4	1.1′	56.7′
17	71°33.2	41.5	100°26.3	8.6′	20°15.3	1.2′	56.8′
18	86°33.1	S16°40.8	114°53.9	8.6′	S20°14.1	1.3′	56.8′
19	101°33.0	40.0	129°21.4	8.5′	20°12.8	1.5′	56.8′
20	116°32.9	39.3	143°48.9	8.5′	20°11.3	1.5′	56.8′
21	131°32.9	·· 38.6	158°16.4	8.5′	20°09.8	1.7′	56.9′
22	146°32.8	37.8	172°43.9	8.4′	20°08.1	1.8′	56.9′
23	161°32.7	37.1	187°11.4	8.4′	20°06.3	1.9′	56.9′
	SD = 16.2′	d = 0.7′	SD = 15.3′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	07:10	08:39	10:28	14:01	15:50	17:19
N 70°	07:02	08:20	09:46	14:43	16:08	17:27
68°	06:55	08:05	09:18	15:11	16:23	17:33
66°	06:50	07:53	08:57	15:32	16:35	17:39
64°	06:45	07:43	08:40	15:48	16:45	17:44
62°	06:40	07:34	08:26	16:02	16:54	17:48
60°	06:36	07:27	08:14	16:14	17:01	17:52
N 58°	06:32	07:20	08:04	16:24	17:08	17:56
56°	06:29	07:14	07:55	16:33	17:14	17:59
54°	06:26	07:09	07:47	16:41	17:19	18:02
52°	06:23	07:04	07:40	16:48	17:24	18:05
50°	06:20	06:59	07:34	16:54	17:29	18:08
45°	06:14	06:49	07:20	17:08	17:39	18:14
N 40°	06:08	06:40	07:09	17:19	17:48	18:20
35°	06:02	06:32	06:59	17:29	17:55	18:26
30°	05:57	06:25	06:50	17:37	18:02	18:31
20°	05:46	06:13	06:36	17:52	18:15	18:41
N 10°	05:35	06:01	06:23	18:05	18:27	18:52
0°	05:23	05:48	06:10	18:17	18:39	19:04
S 10°	05:10	05:36	05:58	18:30	18:52	19:17
20°	04:53	05:21	05:44	18:43	19:06	19:34
30°	04:32	05:03	05:29	18:58	19:24	19:55
35°	04:18	04:52	05:19	19:07	19:35	20:08
40°	04:02	04:39	05:09	19:18	19:48	20:24
45°	03:41	04:23	04:57	19:30	20:03	20:45
S 50°	03:14	04:04	04:42	19:45	20:22	21:12
52°	03:00	03:54	04:34	19:52	20:32	21:25
54°	02:43	03:43	04:27	19:59	20:43	21:42
56°	02:22	03:31	04:18	20:08	20:55	22:02
58°	01:54	03:16	04:08	20:18	21:09	22:29
S 60°	01:10	02:58	03:56	20:29	21:27	23:09

Lat.	**Moonrise** Sat	Sun	Mon	**Moonset** Sat	Sun	Mon
N 72°	▬	▬	▬	▬	▬	▬
N 70°	06:42	▬	▬	09:51	▬	▬
68°	05:57	07:23	08:30	10:37	10:55	11:37
66°	05:27	06:44	07:46	11:07	11:34	12:21
64°	05:05	06:17	07:17	11:30	12:02	12:50
62°	04:47	05:56	06:55	11:48	12:23	13:12
60°	04:32	05:39	06:37	12:03	12:40	13:30
N 58°	04:20	05:24	06:22	12:16	12:55	13:45
56°	04:09	05:12	06:09	12:27	13:07	13:58
54°	04:00	05:02	05:58	12:37	13:18	14:09
52°	03:51	04:52	05:48	12:45	13:27	14:18
50°	03:44	04:44	05:40	12:53	13:36	14:27
45°	03:28	04:26	05:21	13:10	13:54	14:46
N 40°	03:15	04:11	05:06	13:24	14:09	15:01
35°	03:03	03:59	04:53	13:35	14:22	15:14
30°	02:54	03:48	04:42	13:45	14:33	15:25
20°	02:37	03:30	04:23	14:03	14:51	15:44
N 10°	02:22	03:13	04:06	14:18	15:08	16:01
0°	02:09	02:59	03:51	14:32	15:23	16:16
S 10°	01:55	02:44	03:35	14:47	15:39	16:32
20°	01:41	02:28	03:18	15:02	15:55	16:48
30°	01:25	02:09	02:59	15:20	16:14	17:07
35°	01:15	01:59	02:48	15:30	16:25	17:18
40°	01:04	01:47	02:36	15:42	16:37	17:31
45°	00:51	01:33	02:21	15:56	16:52	17:46
S 50°	00:36	01:15	02:02	16:12	17:11	18:04
52°	00:29	01:07	01:54	16:20	17:19	18:12
54°	00:21	00:58	01:44	16:29	17:29	18:22
56°	00:12	00:48	01:33	16:39	17:40	18:33
58°	00:02	00:36	01:20	16:51	17:52	18:45
S 60°	·· ··	00:22	01:06	17:04	18:07	19:00

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 25-27 24-10%
31	13:25	13:30	12:13	08:21	20:45	
01	13:34	13:38	12:14	09:11	21:37	
02	13:42	13:46	12:14	10:03	22:30	

February 03, 04, 05 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	133°05.0	192°25.6	S20°59.8	163°37.3	S13°32.7	303°05.3	S02°43.4	303°18.0	S01°29.2
1	148°07.5	207°24.8	59.3	178°37.9	32.0	318°07.9	43.4	318°20.5	29.2
2	163°10.0	222°23.9	58.7	193°38.5	31.3	333°10.4	43.3	333°23.0	29.1
3	178°12.4	237°23.1	·· 58.2	208°39.0	·· 30.6	348°12.9	·· 43.3	348°25.5	·· 29.1
4	193°14.9	252°22.2	57.7	223°39.6	30.0	3°15.5	43.3	3°28.1	29.0
5	208°17.4	267°21.4	57.1	238°40.1	29.3	18°18.0	43.2	18°30.6	29.0
6	223°19.8	282°20.6	S20°56.6	253°40.7	S13°28.6	33°20.5	S02°43.2	33°33.1	S01°29.0
7	238°22.3	297°19.7	56.0	268°41.2	27.9	48°23.0	43.1	48°35.6	28.9
8	253°24.8	312°18.9	55.5	283°41.8	27.2	63°25.6	43.1	63°38.2	28.9
9	268°27.2	327°18.1	·· 54.9	298°42.4	·· 26.5	78°28.1	·· 43.1	78°40.7	·· 28.9
10	283°29.7	342°17.2	54.4	313°42.9	25.8	93°30.6	43.0	93°43.2	28.8
11	298°32.2	357°16.4	53.8	328°43.5	25.1	108°33.2	43.0	108°45.7	28.8
12	313°34.6	12°15.6	S20°53.3	343°44.0	S13°24.4	123°35.7	S02°42.9	123°48.2	S01°28.8
13	328°37.1	27°14.7	52.7	358°44.6	23.8	138°38.2	42.9	138°50.8	28.7
14	343°39.5	42°13.9	52.2	13°45.2	23.1	153°40.8	42.9	153°53.3	28.7
15	358°42.0	57°13.1	·· 51.6	28°45.7	·· 22.4	168°43.3	·· 42.8	168°55.8	·· 28.6
16	13°44.5	72°12.2	51.0	43°46.3	21.7	183°45.8	42.8	183°58.3	28.6
17	28°46.9	87°11.4	50.5	58°46.8	21.0	198°48.3	42.7	199°00.9	28.6
18	43°49.4	102°10.6	S20°49.9	73°47.4	S13°20.3	213°50.9	S02°42.7	214°03.4	S01°28.5
19	58°51.9	117°09.7	49.4	88°48.0	19.6	228°53.4	42.6	229°05.9	28.5
20	73°54.3	132°08.9	48.8	103°48.5	18.9	243°55.9	42.6	244°08.4	28.4
21	88°56.8	147°08.1	·· 48.2	118°49.1	·· 18.2	258°58.5	·· 42.6	259°11.0	·· 28.4
22	103°59.3	162°07.2	47.7	133°49.6	17.5	274°01.0	42.5	274°13.5	28.4
23	119°01.7	177°06.4	47.1	148°50.2	16.8	289°03.5	42.5	289°16.0	28.3
Mer.pass. 15:05		ν -0.8′	d 0.5′	m -3.91	ν 0.6′	d 0.7′	m 1.14	ν 2.5′	d 0.0′ m -2.25	ν 2.5′	d 0.0′ m 0.68

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	134°04.2	192°05.6	S20°46.5	163°50.8	S13°16.1	304°06.1	S02°42.4	304°18.5	S01°28.3
1	149°06.7	207°04.8	46.0	178°51.3	15.4	319°08.6	42.4	319°21.1	28.3
2	164°09.1	222°03.9	45.4	193°51.9	14.8	334°11.2	42.4	334°23.6	28.2
3	179°11.6	237°03.1	·· 44.8	208°52.4	·· 14.1	349°13.7	·· 42.3	349°26.1	·· 28.2
4	194°14.0	252°02.3	44.3	223°53.0	13.4	4°16.2	42.3	4°28.7	28.1
5	209°16.5	267°01.4	43.7	238°53.6	12.7	19°18.8	42.2	19°31.2	28.1
6	224°19.0	282°00.6	S20°43.1	253°54.1	S13°12.0	34°21.3	S02°42.2	34°33.7	S01°28.1
7	239°21.4	296°59.8	42.6	268°54.7	11.3	49°23.8	42.1	49°36.2	28.0
8	254°23.9	311°59.0	42.0	283°55.2	10.6	64°26.4	42.1	64°38.8	28.0
9	269°26.4	326°58.1	·· 41.4	298°55.8	·· 09.9	79°28.9	·· 42.1	79°41.3	·· 28.0
10	284°28.8	341°57.3	40.8	313°56.4	09.2	94°31.4	42.0	94°43.8	27.9
11	299°31.3	356°56.5	40.2	328°56.9	08.5	109°34.0	42.0	109°46.3	27.9
12	314°33.8	11°55.7	S20°39.7	343°57.5	S13°07.8	124°36.5	S02°41.9	124°48.9	S01°27.8
13	329°36.2	26°54.8	39.1	358°58.1	07.1	139°39.1	41.9	139°51.4	27.8
14	344°38.7	41°54.0	38.5	13°58.6	06.4	154°41.6	41.8	154°53.9	27.8
15	359°41.1	56°53.2	·· 37.9	28°59.2	·· 05.7	169°44.1	·· 41.8	169°56.5	·· 27.7
16	14°43.6	71°52.4	37.3	43°59.7	05.0	184°46.7	41.8	184°59.0	27.7
17	29°46.1	86°51.6	36.8	59°00.3	04.3	199°49.2	41.7	200°01.5	27.6
18	44°48.5	101°50.7	S20°36.2	74°00.9	S13°03.6	214°51.8	S02°41.7	215°04.0	S01°27.6
19	59°51.0	116°49.9	35.6	89°01.4	02.9	229°54.3	41.6	230°06.6	27.6
20	74°53.5	131°49.1	35.0	104°02.0	02.2	244°56.8	41.6	245°09.1	27.5
21	89°55.9	146°48.3	·· 34.4	119°02.6	·· 01.5	259°59.4	·· 41.5	260°11.6	·· 27.5
22	104°58.4	161°47.5	33.8	134°03.1	00.8	275°01.9	41.5	275°14.2	27.4
23	120°00.9	176°46.6	33.2	149°03.7	00.1	290°04.5	41.4	290°16.7	27.4
Mer.pass. 15:01		ν -0.8′	d 0.6′	m -3.91	ν 0.6′	d 0.7′	m 1.14	ν 2.5′	d 0.0′ m -2.26	ν 2.5′	d 0.0′ m 0.67

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	135°03.3	191°45.8	S20°32.6	164°04.3	S12°59.4	305°07.0	S02°41.4	305°19.2	S01°27.4
1	150°05.8	206°45.0	32.0	179°04.8	58.7	320°09.5	41.4	320°21.7	27.3
2	165°08.3	221°44.2	31.5	194°05.4	58.0	335°12.1	41.3	335°24.3	27.3
3	180°10.7	236°43.4	·· 30.9	209°06.0	·· 57.3	350°14.6	·· 41.3	350°26.8	·· 27.2
4	195°13.2	251°42.5	30.3	224°06.5	56.6	5°17.2	41.2	5°29.3	27.2
5	210°15.6	266°41.7	29.7	239°07.1	55.9	20°19.7	41.2	20°31.9	27.2
6	225°18.1	281°40.9	S20°29.1	254°07.7	S12°55.2	35°22.3	S02°41.1	35°34.4	S01°27.1
7	240°20.6	296°40.1	28.5	269°08.2	54.5	50°24.8	41.1	50°36.9	27.1
8	255°23.0	311°39.3	27.9	284°08.8	53.8	65°27.3	41.0	65°39.5	27.0
9	270°25.5	326°38.5	·· 27.3	299°09.4	·· 53.1	80°29.9	·· 41.0	80°42.0	·· 27.0
10	285°28.0	341°37.7	26.7	314°09.9	52.4	95°32.4	41.0	95°44.5	27.0
11	300°30.4	356°36.8	26.1	329°10.5	51.7	110°35.0	40.9	110°47.0	26.9
12	315°32.9	11°36.0	S20°25.5	344°11.1	S12°51.0	125°37.5	S02°40.9	125°49.6	S01°26.9
13	330°35.4	26°35.2	24.9	359°11.6	50.3	140°40.1	40.8	140°52.1	26.8
14	345°37.8	41°34.4	24.2	14°12.2	49.6	155°42.6	40.8	155°54.6	26.8
15	0°40.3	56°33.6	·· 23.6	29°12.8	·· 48.9	170°45.2	·· 40.7	170°57.2	·· 26.8
16	15°42.8	71°32.8	23.0	44°13.3	48.2	185°47.7	40.7	185°59.7	26.7
17	30°45.2	86°32.0	22.4	59°13.9	47.5	200°50.3	40.6	201°02.2	26.7
18	45°47.7	101°31.2	S20°21.8	74°14.5	S12°46.8	215°52.8	S02°40.6	216°04.8	S01°26.6
19	60°50.1	116°30.3	21.2	89°15.0	46.1	230°55.4	40.5	231°07.3	26.6
20	75°52.6	131°29.5	20.6	104°15.6	45.4	245°57.9	40.5	246°09.8	26.6
21	90°55.1	146°28.7	·· 20.0	119°16.2	·· 44.7	261°00.4	·· 40.4	261°12.4	·· 26.5
22	105°57.5	161°27.9	19.4	134°16.7	44.0	276°03.0	40.4	276°14.9	26.5
23	121°00.0	176°27.1	18.7	149°17.3	43.3	291°05.5	40.3	291°17.4	26.4
Mer.pass. 14:57		ν -0.8′	d 0.6′	m -3.91	ν 0.6′	d 0.7′	m 1.14	ν 2.5′	d 0.0′ m -2.27	ν 2.5′	d 0.0′ m 0.67

Stars

	SHA	Dec
Alpheratz	358°09.3	28°59.1
Ankaa	353°40.2	-42°24.9
Schedar	350°09.0	56°26.1
Diphda	349°20.8	-18°05.7
Achernar	335°45.3	-57°20.4
Hamal	328°28.7	23°22.3
Polaris	326°49.6	89°10.9
Acamar	315°37.0	-40°23.2
Menkar	314°40.8	4°00.8
Mirfak	309°15.6	49°47.8
Aldebaran	291°17.5	16°28.2
Rigel	281°35.5	-8°13.6
Capella	281°10.6	45°58.8
Bellatrix	278°58.2	6°19.8
Elnath	278°43.5	28°35.5
Alnilam	276°11.2	-1°13.0
Betelgeuse	271°27.7	7°24.1
Canopus	264°06.6	-52°41.4
Sirius	258°55.1	-16°41.6
Adhara	255°31.5	-28°57.0
Procyon	245°25.2	5°16.3
Pollux	243°57.5	28°04.3
Avior	234°27.4	-59°27.0
Suhail	223°10.1	-43°21.4
Miaplacidus	221°43.9	-69°38.4
Alphard	218°20.0	-8°34.7
Regulus	208°09.4	12°03.5
Dubhe	194°21.2	61°51.0
Denebola	182°58.5	14°40.6
Gienah	176°17.5	-17°26.2
Acrux	173°36.5	-62°59.4
Gacrux	172°28.1	-57°00.2
Alioth	166°42.0	56°03.5
Spica	158°57.1	-11°03.7
Alkaid	153°18.2	49°24.2
Hadar	149°22.8	-60°16.6
Menkent	148°36.6	-36°16.4
Arcturus	146°18.2	19°16.7
Rigil Kent.	140°25.3	-60°45.0
Kochab	137°19.1	74°13.7
Zuben'ubi	137°32.7	-15°57.7
Alphecca	126°31.9	26°46.6
Antares	112°56.7	-26°23.3
Atria	108°21.0	-68°59.3
Sabik	102°41.0	-15°42.1
Shaula	96°55.6	-37°05.3
Rasalhague	96°29.5	12°34.3
Eltanin	90°58.0	51°29.3
Kaus Aust.	84°16.8	-34°23.6
Vega	80°56.0	38°45.8
Nunki	76°29.1	-26°19.2
Altair	62°32.6	8°49.0
Peacock	53°58.6	-56°47.8
Deneb	49°48.7	45°12.7
Enif	34°11.6	9°47.2
Al Na'ir	28°15.1	-47°03.4
Fomalhaut	15°51.4	-29°43.6
Scheat	14°17.6	27°58.8
Markab	14°03.2	15°06.1

Feb 03 Tue	SHA	Mer.pass
Venus	59°20.5	11:11
Mars	30°32.3	13:05
Jupiter	170°00.3	03:47
Saturn	170°12.9	03:46

Feb 04 Wed	SHA	Mer.pass
Venus	58°01.4	11:12
Mars	29°46.6	13:04
Jupiter	170°01.9	03:43
Saturn	170°14.4	03:42

Feb 05 Thu	SHA	Mer.pass
Venus	56°42.5	11:14
Mars	29°00.9	13:03
Jupiter	170°03.7	03:39
Saturn	170°15.9	03:38

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°32.7	S16°36.4	201°38.8	8.4′	S20°04.4	2.0′	57.0′
1	191°32.6	35.6	216°06.2	8.4′	20°02.4	2.2′	57.0′
2	206°32.5	34.9	230°33.6	8.4′	20°00.2	2.3′	57.0′
3	221°32.5	·· 34.2	245°00.9	8.3′	19°57.9	2.3′	57.1′
4	236°32.4	33.4	259°28.2	8.3′	19°55.6	2.5′	57.1′
5	251°32.3	32.7	273°55.5	8.3′	19°53.1	2.7′	57.1′
6	266°32.3	S16°32.0	288°22.8	8.3′	S19°50.4	2.7′	57.1′
7	281°32.2	31.2	302°50.1	8.3′	19°47.7	2.8′	57.2′
8	296°32.1	30.5	317°17.3	8.2′	19°44.9	3.0′	57.2′
9	311°32.0	·· 29.8	331°44.6	8.2′	19°41.9	3.1′	57.2′
10	326°32.0	29.0	346°11.8	8.2′	19°38.8	3.2′	57.3′
11	341°31.9	28.3	0°39.0	8.2′	19°35.6	3.3′	57.3′
12	356°31.8	S16°27.5	15°06.2	8.2′	S19°32.3	3.5′	57.3′
13	11°31.8	26.8	29°33.4	8.2′	19°28.8	3.5′	57.3′
14	26°31.7	26.1	44°00.5	8.2′	19°25.3	3.7′	57.4′
15	41°31.7	·· 25.3	58°27.7	8.1′	19°21.6	3.8′	57.4′
16	56°31.6	24.6	72°54.8	8.1′	19°17.8	3.9′	57.4′
17	71°31.5	23.8	87°22.0	8.1′	19°13.9	4.1′	57.5′
18	86°31.5	S16°23.1	101°49.1	8.1′	S19°09.8	4.1′	57.5′
19	101°31.4	22.4	116°16.2	8.1′	19°05.7	4.3′	57.5′
20	116°31.3	21.6	130°43.3	8.1′	19°01.4	4.4′	57.5′
21	131°31.3	·· 20.9	145°10.4	8.1′	18°57.0	4.5′	57.6′
22	146°31.2	20.1	159°37.5	8.1′	18°52.5	4.6′	57.6′
23	161°31.1	19.4	174°04.6	8.1′	18°47.9	4.7′	57.6′
	SD = 16.2′	d = 0.7′	SD = 15.5′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°31.1	S16°18.7	188°31.7	8.1′	S18°43.2	4.8′	57.7′
1	191°31.0	17.9	202°58.8	8.1′	18°38.4	5.0′	57.7′
2	206°31.0	17.2	217°25.9	8.1′	18°33.4	5.1′	57.7′
3	221°30.9	·· 16.4	231°53.0	8.1′	18°28.3	5.2′	57.7′
4	236°30.8	15.7	246°20.0	8.1′	18°23.1	5.3′	57.8′
5	251°30.8	14.9	260°47.1	8.1′	18°17.8	5.4′	57.8′
6	266°30.7	S16°14.2	275°14.2	8.1′	S18°12.4	5.5′	57.8′
7	281°30.7	13.4	289°41.3	8.1′	18°06.9	5.7′	57.9′
8	296°30.6	12.7	304°08.4	8.1′	18°01.2	5.7′	57.9′
9	311°30.5	·· 11.9	318°35.5	8.1′	17°55.5	5.9′	57.9′
10	326°30.5	11.2	333°02.6	8.1′	17°49.6	6.0′	57.9′
11	341°30.4	10.4	347°29.7	8.1′	17°43.6	6.1′	58.0′
12	356°30.4	S16°09.7	1°56.8	8.1′	S17°37.5	6.2′	58.0′
13	11°30.3	08.9	16°24.0	8.1′	17°31.3	6.3′	58.0′
14	26°30.2	08.2	30°51.1	8.1′	17°25.0	6.4′	58.0′
15	41°30.2	·· 07.4	45°18.2	8.1′	17°18.6	6.5′	58.1′
16	56°30.1	06.7	59°45.4	8.2′	17°12.1	6.7′	58.1′
17	71°30.1	05.9	74°12.5	8.2′	17°05.4	6.7′	58.1′
18	86°30.0	S16°05.2	88°39.7	8.2′	S16°58.7	6.9′	58.1′
19	101°30.0	04.4	103°06.9	8.2′	16°51.8	6.9′	58.2′
20	116°29.9	03.7	117°34.1	8.2′	16°44.9	7.1′	58.2′
21	131°29.9	·· 02.9	132°01.3	8.2′	16°37.8	7.2′	58.2′
22	146°29.8	02.2	146°28.5	8.2′	16°30.6	7.2′	58.2′
23	161°29.7	01.4	160°55.8	8.2′	16°23.4	7.4′	58.3′
	SD = 16.2′	d = 0.7′	SD = 15.7′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°29.7	S16°00.6	175°23.0	8.3′	S16°16.0	7.5′	58.3′
1	191°29.6	15°59.9	189°50.3	8.3′	16°08.5	7.6′	58.3′
2	206°29.6	59.1	204°17.5	8.3′	16°00.9	7.7′	58.3′
3	221°29.5	·· 58.4	218°44.8	8.3′	15°53.2	7.8′	58.4′
4	236°29.5	57.6	233°12.1	8.3′	15°45.4	7.9′	58.4′
5	251°29.4	56.9	247°39.5	8.3′	15°37.5	7.9′	58.4′
6	266°29.4	S15°56.1	262°06.8	8.4′	S15°29.6	8.1′	58.4′
7	281°29.3	55.3	276°34.2	8.4′	15°21.5	8.2′	58.5′
8	296°29.3	54.6	291°01.6	8.4′	15°13.3	8.3′	58.5′
9	311°29.2	·· 53.8	305°29.0	8.4′	15°05.0	8.4′	58.5′
10	326°29.2	53.1	319°56.4	8.4′	14°56.6	8.4′	58.5′
11	341°29.1	52.3	334°23.8	8.5′	14°48.2	8.6′	58.6′
12	356°29.1	S15°51.5	348°51.3	8.5′	S14°39.6	8.7′	58.6′
13	11°29.0	50.8	3°18.8	8.5′	14°30.9	8.7′	58.6′
14	26°29.0	50.0	17°46.3	8.5′	14°22.2	8.9′	58.6′
15	41°28.9	·· 49.3	32°13.8	8.5′	14°13.3	8.9′	58.6′
16	56°28.9	48.5	46°41.3	8.6′	14°04.4	9.0′	58.7′
17	71°28.8	47.7	61°08.9	8.6′	13°55.4	9.2′	58.7′
18	86°28.8	S15°47.0	75°36.5	8.6′	S13°46.2	9.2′	58.7′
19	101°28.7	46.2	90°04.1	8.6′	13°37.0	9.2′	58.7′
20	116°28.7	45.4	104°31.7	8.7′	13°27.8	9.4′	58.7′
21	131°28.7	·· 44.7	118°59.4	8.7′	13°18.4	9.5′	58.8′
22	146°28.6	43.9	133°27.1	8.7′	13°08.9	9.5′	58.8′
23	161°28.6	43.1	147°54.8	8.7′	12°59.4	9.7′	58.8′
	SD = 16.2′	d = 0.8′	SD = 15.9′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	06:59	08:25	10:04	14:25	16:04	17:31
N 70°	06:52	08:09	09:30	15:00	16:20	17:37
68°	06:47	07:56	09:05	15:24	16:34	17:43
66°	06:42	07:45	08:46	15:43	16:44	17:47
64°	06:38	07:35	08:31	15:58	16:54	17:52
62°	06:34	07:27	08:18	16:11	17:01	17:55
60°	06:30	07:20	08:07	16:22	17:08	17:59
N 58°	06:27	07:14	07:58	16:31	17:15	18:02
56°	06:24	07:09	07:49	16:39	17:20	18:05
54°	06:21	07:04	07:42	16:47	17:25	18:07
52°	06:19	06:59	07:35	16:53	17:30	18:10
50°	06:16	06:55	07:29	16:59	17:34	18:12
45°	06:11	06:45	07:17	17:12	17:43	18:18
N 40°	06:05	06:37	07:06	17:23	17:51	18:23
35°	06:00	06:30	06:57	17:32	17:58	18:28
30°	05:55	06:24	06:49	17:40	18:05	18:33
20°	05:45	06:12	06:35	17:54	18:16	18:43
N 10°	05:35	06:00	06:22	18:06	18:28	18:53
0°	05:24	05:49	06:10	18:17	18:39	19:04
S 10°	05:11	05:37	05:59	18:29	18:51	19:17
20°	04:55	05:23	05:46	18:42	19:05	19:32
30°	04:35	05:06	05:31	18:56	19:22	19:52
35°	04:22	04:55	05:23	19:05	19:32	20:05
40°	04:07	04:43	05:13	19:15	19:44	20:20
45°	03:47	04:28	05:01	19:26	19:59	20:40
S 50°	03:21	04:09	04:47	19:40	20:17	21:05
52°	03:08	04:00	04:40	19:47	20:26	21:18
54°	02:52	03:50	04:33	19:54	20:36	21:33
56°	02:34	03:39	04:25	20:02	20:48	21:52
58°	02:09	03:25	04:15	20:11	21:01	22:15
S 60°	01:34	03:09	04:04	20:22	21:17	22:48

Lat.	**Moonrise** Tue	Wed	Thu	**Moonset** Tue	Wed	Thu
N 72°	▬	11:18	10:24	▬	12:37	15:25
N 70°	10:19	10:00	09:51	11:42	13:55	15:56
68°	09:06	09:21	09:28	12:54	14:33	16:19
66°	08:29	08:54	09:09	13:31	14:59	16:37
64°	08:02	08:33	08:54	13:57	15:19	16:51
62°	07:42	08:16	08:41	14:17	15:36	17:03
60°	07:25	08:02	08:30	14:34	15:49	17:13
N 58°	07:11	07:50	08:21	14:47	16:01	17:22
56°	06:59	07:39	08:12	14:59	16:11	17:30
54°	06:48	07:30	08:05	15:10	16:20	17:36
52°	06:39	07:22	07:58	15:19	16:28	17:43
50°	06:30	07:14	07:52	15:27	16:35	17:48
45°	06:12	06:58	07:39	15:45	16:50	18:00
N 40°	05:58	06:45	07:29	15:59	17:03	18:10
35°	05:45	06:34	07:19	16:11	17:13	18:18
30°	05:34	06:24	07:11	16:22	17:23	18:25
20°	05:16	06:07	06:57	16:40	17:38	18:38
N 10°	04:59	05:53	06:45	16:56	17:52	18:49
0°	04:44	05:39	06:33	17:10	18:05	18:59
S 10°	04:29	05:25	06:22	17:25	18:18	19:09
20°	04:13	05:10	06:09	17:41	18:31	19:20
30°	03:54	04:53	05:55	17:58	18:47	19:32
35°	03:43	04:43	05:47	18:09	18:56	19:39
40°	03:31	04:32	05:38	18:20	19:06	19:47
45°	03:16	04:19	05:26	18:34	19:18	19:56
S 50°	02:58	04:02	05:13	18:51	19:32	20:07
52°	02:50	03:55	05:07	18:59	19:39	20:13
54°	02:40	03:46	05:00	19:08	19:46	20:18
56°	02:29	03:37	04:52	19:18	19:54	20:24
58°	02:17	03:26	04:43	19:29	20:04	20:31
S 60°	02:03	03:13	04:33	19:42	20:14	20:39

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 28-1 4-0%
03	13:49	13:53	12:14	10:57	23:25	
04	13:56	13:59	12:14	11:52	–:–	
05	14:01	14:04	12:14	12:46	00:19	

February 06, 07, 08 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	136°02.5	191°26.3	S20°18.1	164°17.9	S12°42.6	306°08.1	S02°40.3	306°20.0	S01°26.4
1	151°04.9	206°25.5	17.5	179°18.4	41.9	321°10.6	40.2	321°22.5	26.3
2	166°07.4	221°24.7	16.9	194°19.0	41.2	336°13.2	40.2	336°25.0	26.3
3	181°09.9	236°23.9	·· 16.3	209°19.6	·· 40.5	351°15.7	·· 40.2	351°27.6	·· 26.3
4	196°12.3	251°23.1	15.7	224°20.2	39.8	6°18.3	40.1	6°30.1	26.2
5	211°14.8	266°22.3	15.0	239°20.7	39.1	21°20.8	40.1	21°32.6	26.2
6	226°17.2	281°21.5	S20°14.4	254°21.3	S12°38.4	36°23.4	S02°40.0	36°35.2	S01°26.1
7	241°19.7	296°20.7	13.8	269°21.9	37.7	51°25.9	40.0	51°37.7	26.1
8	256°22.2	311°19.9	13.2	284°22.4	37.0	66°28.5	39.9	66°40.2	26.1
9	271°24.6	326°19.1	·· 12.5	299°23.0	·· 36.3	81°31.0	·· 39.9	81°42.8	·· 26.0
10	286°27.1	341°18.3	11.9	314°23.6	35.6	96°33.6	39.8	96°45.3	26.0
11	301°29.6	356°17.5	11.3	329°24.2	34.9	111°36.2	39.8	111°47.9	25.9
12	316°32.0	11°16.6	S20°10.6	344°24.7	S12°34.2	126°38.7	S02°39.7	126°50.4	S01°25.9
13	331°34.5	26°15.8	10.0	359°25.3	33.5	141°41.3	39.7	141°52.9	25.8
14	346°37.0	41°15.0	09.4	14°25.9	32.7	156°43.8	39.6	156°55.5	25.8
15	1°39.4	56°14.2	·· 08.8	29°26.4	·· 32.0	171°46.4	·· 39.6	171°58.0	·· 25.8
16	16°41.9	71°13.4	08.1	44°27.0	31.3	186°48.9	39.5	187°00.5	25.7
17	31°44.4	86°12.6	07.5	59°27.6	30.6	201°51.5	39.5	202°03.1	25.7
18	46°46.8	101°11.8	S20°06.8	74°28.2	S12°29.9	216°54.0	S02°39.4	217°05.6	S01°25.6
19	61°49.3	116°11.0	06.2	89°28.7	29.2	231°56.6	39.4	232°08.1	25.6
20	76°51.7	131°10.2	05.6	104°29.3	28.5	246°59.1	39.3	247°10.7	25.5
21	91°54.2	146°09.4	·· 04.9	119°29.9	·· 27.8	262°01.7	·· 39.3	262°13.2	·· 25.5
22	106°56.7	161°08.7	04.3	134°30.4	27.1	277°04.2	39.2	277°15.8	25.5
23	121°59.1	176°07.9	03.7	149°31.0	26.4	292°06.8	39.2	292°18.3	25.4
Mer.pass. 14:53		ν -0.8′	d 0.6′	m -3.91	ν 0.6′	d 0.7′	m 1.14	ν 2.5′	d 0.0′ m -2.27	ν 2.5′	d 0.0′ m 0.66

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	137°01.6	191°07.1	S20°03.0	164°31.6	S12°25.7	307°09.4	S02°39.1	307°20.8	S01°25.4
1	152°04.1	206°06.3	02.4	179°32.2	25.0	322°11.9	39.1	322°23.4	25.3
2	167°06.5	221°05.5	01.7	194°32.7	24.3	337°14.5	39.0	337°25.9	25.3
3	182°09.0	236°04.7	·· 01.1	209°33.3	·· 23.5	352°17.0	·· 39.0	352°28.4	·· 25.2
4	197°11.5	251°03.9	20°00.4	224°33.9	22.8	7°19.6	38.9	7°31.0	25.2
5	212°13.9	266°03.1	19°59.8	239°34.5	22.1	22°22.1	38.9	22°33.5	25.2
6	227°16.4	281°02.3	S19°59.1	254°35.0	S12°21.4	37°24.7	S02°38.8	37°36.1	S01°25.1
7	242°18.9	296°01.5	58.5	269°35.6	20.7	52°27.3	38.8	52°38.6	25.1
8	257°21.3	311°00.7	57.8	284°36.2	20.0	67°29.8	38.7	67°41.1	25.0
9	272°23.8	325°59.9	·· 57.2	299°36.8	·· 19.3	82°32.4	·· 38.7	82°43.7	·· 25.0
10	287°26.2	340°59.1	56.5	314°37.3	18.6	97°34.9	38.6	97°46.2	24.9
11	302°28.7	355°58.3	55.9	329°37.9	17.9	112°37.5	38.5	112°48.7	24.9
12	317°31.2	10°57.5	S19°55.2	344°38.5	S12°17.2	127°40.1	S02°38.5	127°51.3	S01°24.9
13	332°33.6	25°56.7	54.6	359°39.1	16.4	142°42.6	38.4	142°53.8	24.8
14	347°36.1	40°56.0	53.9	14°39.6	15.7	157°45.2	38.4	157°56.4	24.8
15	2°38.6	55°55.2	·· 53.3	29°40.2	·· 15.0	172°47.7	·· 38.3	172°58.9	·· 24.7
16	17°41.0	70°54.4	52.6	44°40.8	14.3	187°50.3	38.3	188°01.4	24.7
17	32°43.5	85°53.6	52.0	59°41.4	13.6	202°52.9	38.2	203°04.0	24.6
18	47°46.0	100°52.8	S19°51.3	74°41.9	S12°12.9	217°55.4	S02°38.2	218°06.5	S01°24.6
19	62°48.4	115°52.0	50.6	89°42.5	12.2	232°58.0	38.1	233°09.1	24.6
20	77°50.9	130°51.2	50.0	104°43.1	11.5	248°00.5	38.1	248°11.6	24.5
21	92°53.3	145°50.4	·· 49.3	119°43.7	·· 10.7	263°03.1	·· 38.0	263°14.1	·· 24.5
22	107°55.8	160°49.6	48.6	134°44.3	10.0	278°05.7	38.0	278°16.7	24.4
23	122°58.3	175°48.9	48.0	149°44.8	09.3	293°08.2	37.9	293°19.2	24.4
Mer.pass. 14:49		ν -0.8′	d 0.6′	m -3.91	ν 0.6′	d 0.7′	m 1.14	ν 2.6′	d 0.1′ m -2.28	ν 2.5′	d 0.0′ m 0.66

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	138°00.7	190°48.1	S19°47.3	164°45.4	S12°08.6	308°10.8	S02°37.9	308°21.8	S01°24.3
1	153°03.2	205°47.3	46.6	179°46.0	07.9	323°13.4	37.8	323°24.3	24.3
2	168°05.7	220°46.5	46.0	194°46.6	07.2	338°15.9	37.8	338°26.9	24.2
3	183°08.1	235°45.7	·· 45.3	209°47.1	·· 06.5	353°18.5	·· 37.7	353°29.4	·· 24.2
4	198°10.6	250°44.9	44.6	224°47.7	05.8	8°21.0	37.6	8°31.9	24.2
5	213°13.1	265°44.2	44.0	239°48.3	05.0	23°23.6	37.6	23°34.5	24.1
6	228°15.5	280°43.4	S19°43.3	254°48.9	S12°04.3	38°26.2	S02°37.5	38°37.0	S01°24.1
7	243°18.0	295°42.6	42.6	269°49.5	03.6	53°28.7	37.5	53°39.6	24.0
8	258°20.5	310°41.8	42.0	284°50.0	02.9	68°31.3	37.4	68°42.1	24.0
9	273°22.9	325°41.0	·· 41.3	299°50.6	·· 02.2	83°33.9	·· 37.4	83°44.6	·· 23.9
10	288°25.4	340°40.2	40.6	314°51.2	01.5	98°36.4	37.3	98°47.2	23.9
11	303°27.8	355°39.5	39.9	329°51.8	00.7	113°39.0	37.3	113°49.7	23.8
12	318°30.3	10°38.7	S19°39.2	344°52.4	S12°00.0	128°41.6	S02°37.2	128°52.3	S01°23.8
13	333°32.8	25°37.9	38.6	359°52.9	11°59.3	143°44.1	37.2	143°54.8	23.7
14	348°35.2	40°37.1	37.9	14°53.5	58.6	158°46.7	37.1	158°57.4	23.7
15	3°37.7	55°36.4	·· 37.2	29°54.1	·· 57.9	173°49.3	·· 37.0	173°59.9	·· 23.7
16	18°40.2	70°35.6	36.5	44°54.7	57.2	188°51.8	37.0	189°02.4	23.6
17	33°42.6	85°34.8	35.8	59°55.3	56.4	203°54.4	36.9	204°05.0	23.6
18	48°45.1	100°34.0	S19°35.2	74°55.8	S11°55.7	218°57.0	S02°36.9	219°07.5	S01°23.5
19	63°47.6	115°33.2	34.5	89°56.4	55.0	233°59.5	36.8	234°10.1	23.5
20	78°50.0	130°32.5	33.8	104°57.0	54.3	249°02.1	36.8	249°12.6	23.4
21	93°52.5	145°31.7	·· 33.1	119°57.6	·· 53.6	264°04.7	·· 36.7	264°15.2	·· 23.4
22	108°54.9	160°30.9	32.4	134°58.2	52.9	279°07.3	36.7	279°17.7	23.3
23	123°57.4	175°30.1	31.7	149°58.8	52.1	294°09.8	36.6	294°20.3	23.3
Mer.pass. 14:46		ν -0.8′	d 0.7′	m -3.90	ν 0.6′	d 0.7′	m 1.14	ν 2.6′	d 0.1′ m -2.29	ν 2.5′	d 0.0′ m 0.65

Stars

	SHA	Dec
Alpheratz	358°09.3	28°59.1
Ankaa	353°40.3	-42°24.9
Schedar	350°09.0	56°26.1
Diphda	349°20.8	-18°05.7
Achernar	335°45.3	-57°20.4
Hamal	328°28.7	23°22.3
Polaris	326°50.8	89°10.9
Acamar	315°37.0	-40°23.2
Menkar	314°40.8	4°00.8
Mirfak	309°15.6	49°47.8
Aldebaran	291°17.5	16°28.2
Rigel	281°35.6	-8°13.6
Capella	281°10.6	45°58.8
Bellatrix	278°58.2	6°19.8
Elnath	278°43.6	28°35.5
Alnilam	276°11.2	-1°13.0
Betelgeuse	271°27.7	7°24.1
Canopus	264°06.7	-52°41.4
Sirius	258°55.1	-16°41.6
Adhara	255°31.6	-28°57.0
Procyon	245°25.2	5°16.3
Pollux	243°57.5	28°04.3
Avior	234°27.4	-59°27.0
Suhail	223°10.1	-43°21.4
Miaplacidus	221°43.9	-69°38.4
Alphard	218°19.9	-8°34.7
Regulus	208°09.4	12°03.5
Dubhe	194°21.2	61°51.0
Denebola	182°58.5	14°40.6
Gienah	176°17.4	-17°26.2
Acrux	173°36.5	-62°59.4
Gacrux	172°28.0	-57°00.2
Alioth	166°42.0	56°03.5
Spica	158°57.1	-11°03.7
Alkaid	153°18.1	49°24.2
Hadar	149°22.8	-60°16.6
Menkent	148°36.6	-36°16.4
Arcturus	146°18.1	19°16.7
Rigil Kent.	140°25.3	-60°45.0
Kochab	137°19.0	74°13.7
Zuben'ubi	137°32.7	-15°57.7
Alphecca	126°31.9	26°46.5
Antares	112°56.6	-26°23.3
Atria	108°20.9	-68°59.3
Sabik	102°41.0	-15°42.1
Shaula	96°55.6	-37°05.3
Rasalhague	96°29.5	12°34.3
Eltanin	90°57.9	51°29.3
Kaus Aust.	84°16.8	-34°23.6
Vega	80°56.0	38°45.8
Nunki	76°29.1	-26°19.2
Altair	62°32.6	8°49.0
Peacock	53°58.5	-56°47.8
Deneb	49°48.7	45°12.7
Enif	34°11.6	9°47.2
Al Na'ir	28°15.1	-47°03.3
Fomalhaut	15°51.4	-29°43.6
Scheat	14°17.6	27°58.7
Markab	14°03.2	15°06.1

Feb 06 Fri	SHA	Mer.pass
Venus	55°23.8	11:15
Mars	28°15.4	13:02
Jupiter	170°05.6	03:35
Saturn	170°17.5	03:34

Feb 07 Sat	SHA	Mer.pass
Venus	54°05.5	11:16
Mars	27°30.0	13:01
Jupiter	170°07.8	03:31
Saturn	170°19.2	03:30

Feb 08 Sun	SHA	Mer.pass
Venus	52°47.3	11:17
Mars	26°44.7	13:00
Jupiter	170°10.1	03:27
Saturn	170°21.0	03:26

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°28.5	S15°42.4	162°22.5	8.7′	S12°49.7	9.7′	58.8′
1	191°28.5	41.6	176°50.2	8.8′	12°40.0	9.8′	58.8′
2	206°28.4	40.8	191°18.0	8.8′	12°30.2	9.8′	58.9′
3	221°28.4	·· 40.1	205°45.8	8.8′	12°20.4	10.0′	58.9′
4	236°28.3	39.3	220°13.6	8.8′	12°10.4	10.0′	58.9′
5	251°28.3	38.5	234°41.5	8.9′	12°00.4	10.1′	58.9′
6	266°28.3	S15°37.8	249°09.3	8.9′	S11°50.3	10.2′	58.9′
7	281°28.2	37.0	263°37.2	8.9′	11°40.1	10.2′	58.9′
8	296°28.2	36.2	278°05.1	8.9′	11°29.9	10.4′	59.0′
9	311°28.1	·· 35.4	292°33.1	9.0′	11°19.5	10.4′	59.0′
10	326°28.1	34.7	307°01.1	9.0′	11°09.1	10.4′	59.0′
11	341°28.0	33.9	321°29.0	9.0′	10°58.7	10.6′	59.0′
12	356°28.0	S15°33.1	335°57.1	9.0′	S10°48.1	10.6′	59.0′
13	11°28.0	32.4	350°25.1	9.1′	10°37.5	10.7′	59.0′
14	26°27.9	31.6	4°53.1	9.1′	10°26.8	10.7′	59.1′
15	41°27.9	·· 30.8	19°21.2	9.1′	10°16.1	10.8′	59.1′
16	56°27.8	30.0	33°49.3	9.1′	10°05.3	10.9′	59.1′
17	71°27.8	29.3	48°17.5	9.2′	09°54.4	10.9′	59.1′
18	86°27.8	S15°28.5	62°45.6	9.2′	S09°43.5	11.0′	59.1′
19	101°27.7	27.7	77°13.8	9.2′	09°32.5	11.1′	59.1′
20	116°27.7	26.9	91°42.0	9.2′	09°21.4	11.1′	59.1′
21	131°27.6	·· 26.2	106°10.2	9.2′	09°10.3	11.1′	59.2′
22	146°27.6	25.4	120°38.5	9.3′	08°59.2	11.3′	59.2′
23	161°27.6	24.6	135°06.7	9.3′	08°47.9	11.3′	59.2′
	SD = 16.2′	d = 0.8′	SD = 16.0′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°27.5	S15°23.8	149°35.0	9.3′	S08°36.6	11.3′	59.2′
1	191°27.5	23.0	164°03.3	9.3′	08°25.3	11.4′	59.2′
2	206°27.5	22.3	178°31.7	9.4′	08°13.9	11.4′	59.2′
3	221°27.4	·· 21.5	193°00.0	9.4′	08°02.5	11.5′	59.2′
4	236°27.4	20.7	207°28.4	9.4′	07°51.0	11.6′	59.2′
5	251°27.4	19.9	221°56.8	9.4′	07°39.4	11.6′	59.3′
6	266°27.3	S15°19.1	236°25.2	9.4′	S07°27.8	11.6′	59.3′
7	281°27.3	18.4	250°53.6	9.5′	07°16.2	11.7′	59.3′
8	296°27.3	17.6	265°22.1	9.5′	07°04.5	11.7′	59.3′
9	311°27.2	·· 16.8	279°50.6	9.5′	06°52.8	11.8′	59.3′
10	326°27.2	16.0	294°19.1	9.5′	06°41.0	11.8′	59.3′
11	341°27.2	15.2	308°47.6	9.5′	06°29.2	11.9′	59.3′
12	356°27.1	S15°14.5	323°16.1	9.5′	S06°17.3	11.9′	59.3′
13	11°27.1	13.7	337°44.7	9.6′	06°05.4	11.9′	59.3′
14	26°27.1	12.9	352°13.2	9.6′	05°53.5	12.0′	59.3′
15	41°27.0	·· 12.1	6°41.8	9.6′	05°41.5	12.0′	59.3′
16	56°27.0	11.3	21°10.4	9.6′	05°29.5	12.0′	59.4′
17	71°27.0	10.5	35°39.0	9.6′	05°17.5	12.1′	59.4′
18	86°26.9	S15°09.7	50°07.7	9.6′	S05°05.4	12.1′	59.4′
19	101°26.9	09.0	64°36.3	9.7′	04°53.3	12.1′	59.4′
20	116°26.9	08.2	79°05.0	9.7′	04°41.2	12.2′	59.4′
21	131°26.8	·· 07.4	93°33.6	9.7′	04°29.0	12.2′	59.4′
22	146°26.8	06.6	108°02.3	9.7′	04°16.8	12.2′	59.4′
23	161°26.8	05.8	122°31.0	9.7′	04°04.6	12.2′	59.4′
	SD = 16.2′	d = 0.8′	SD = 16.1′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°26.8	S15°05.0	136°59.8	9.7′	S03°52.4	12.3′	59.4′
1	191°26.7	04.2	151°28.5	9.7′	03°40.1	12.3′	59.4′
2	206°26.7	03.4	165°57.2	9.8′	03°27.8	12.3′	59.4′
3	221°26.7	·· 02.6	180°26.0	9.8′	03°15.5	12.3′	59.4′
4	236°26.7	01.9	194°54.7	9.8′	03°03.2	12.3′	59.4′
5	251°26.6	01.1	209°23.5	9.8′	02°50.9	12.4′	59.4′
6	266°26.6	S15°00.3	223°52.3	9.8′	S02°38.5	12.4′	59.4′
7	281°26.6	14°59.5	238°21.1	9.8′	02°26.1	12.4′	59.4′
8	296°26.5	58.7	252°49.9	9.8′	02°13.7	12.4′	59.4′
9	311°26.5	·· 57.9	267°18.7	9.8′	02°01.3	12.4′	59.5′
10	326°26.5	57.1	281°47.5	9.8′	01°48.9	12.4′	59.5′
11	341°26.5	56.3	296°16.4	9.8′	01°36.5	12.5′	59.5′
12	356°26.4	S14°55.5	310°45.2	9.8′	S01°24.0	12.4′	59.5′
13	11°26.4	54.7	325°14.0	9.8′	01°11.6	12.5′	59.5′
14	26°26.4	53.9	339°42.9	9.8′	00°59.1	12.5′	59.5′
15	41°26.4	·· 53.1	354°11.7	9.8′	00°46.6	12.4′	59.5′
16	56°26.4	52.3	8°40.6	9.9′	00°34.2	12.5′	59.5′
17	71°26.3	51.5	23°09.4	9.9′	00°21.7	12.5′	59.5′
18	86°26.3	S14°50.7	37°38.3	9.9′	S00°09.2	12.4′	59.5′
19	101°26.3	49.9	52°07.1	9.9′	N00°03.2	12.5′	59.5′
20	116°26.3	49.1	66°36.0	9.9′	00°15.7	12.5′	59.5′
21	131°26.2	·· 48.4	81°04.8	9.9′	00°28.2	12.4′	59.5′
22	146°26.2	47.6	95°33.7	9.9′	00°40.6	12.5′	59.5′
23	161°26.2	46.8	110°02.6	9.9′	00°53.1	12.5′	59.5′
	SD = 16.2′	d = 0.8′	SD = 16.2′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	06:48	08:12	09:44	14:46	16:18	17:43
N 70°	06:42	07:57	09:14	15:16	16:33	17:48
68°	06:38	07:45	08:52	15:37	16:44	17:52
66°	06:34	07:36	08:35	15:54	16:54	17:56
64°	06:30	07:27	08:21	16:08	17:02	17:59
62°	06:27	07:20	08:09	16:20	17:09	18:03
60°	06:24	07:14	08:00	16:30	17:16	18:05
N 58°	06:21	07:08	07:51	16:38	17:21	18:08
56°	06:19	07:03	07:43	16:46	17:26	18:10
54°	06:17	06:59	07:36	16:53	17:31	18:13
52°	06:14	06:54	07:30	16:59	17:35	18:15
50°	06:12	06:50	07:25	17:04	17:39	18:17
45°	06:07	06:42	07:13	17:16	17:47	18:22
N 40°	06:02	06:34	07:03	17:26	17:54	18:27
35°	05:58	06:28	06:54	17:35	18:01	18:31
30°	05:53	06:22	06:47	17:42	18:07	18:35
20°	05:44	06:11	06:33	17:55	18:18	18:44
N 10°	05:35	06:00	06:22	18:07	18:28	18:54
0°	05:24	05:49	06:11	18:18	18:39	19:04
S 10°	05:12	05:38	06:00	18:29	18:50	19:16
20°	04:57	05:25	05:48	18:41	19:04	19:31
30°	04:38	05:08	05:34	18:54	19:20	19:50
35°	04:26	04:58	05:26	19:02	19:29	20:02
40°	04:11	04:47	05:16	19:11	19:41	20:16
45°	03:53	04:33	05:05	19:22	19:54	20:35
S 50°	03:28	04:15	04:52	19:35	20:12	20:59
52°	03:16	04:07	04:46	19:41	20:20	21:11
54°	03:02	03:57	04:39	19:48	20:29	21:25
56°	02:44	03:46	04:31	19:56	20:40	21:41
58°	02:23	03:34	04:23	20:04	20:52	22:02
S 60°	01:54	03:19	04:13	20:14	21:07	22:30

Lat.	**Moonrise** Fri	Sat	Sun	**Moonset** Fri	Sat	Sun
N 72°	10:04	09:49	09:37	17:37	19:42	21:43
N 70°	09:45	09:40	09:35	17:54	19:49	21:42
68°	09:31	09:32	09:32	18:07	19:55	21:42
66°	09:18	09:25	09:31	18:18	20:00	21:41
64°	09:08	09:19	09:29	18:27	20:04	21:41
62°	09:00	09:15	09:28	18:34	20:07	21:40
60°	08:52	09:10	09:26	18:41	20:10	21:40
N 58°	08:46	09:06	09:25	18:47	20:13	21:40
56°	08:40	09:03	09:24	18:52	20:15	21:40
54°	08:34	09:00	09:23	18:56	20:18	21:39
52°	08:30	08:57	09:22	19:00	20:20	21:39
50°	08:25	08:55	09:22	19:04	20:21	21:39
45°	08:16	08:49	09:20	19:12	20:25	21:39
N 40°	08:08	08:44	09:19	19:19	20:28	21:38
35°	08:01	08:40	09:18	19:24	20:31	21:38
30°	07:55	08:37	09:17	19:29	20:34	21:38
20°	07:45	08:30	09:15	19:38	20:38	21:37
N 10°	07:36	08:25	09:13	19:45	20:41	21:37
0°	07:27	08:20	09:12	19:52	20:45	21:36
S 10°	07:18	08:15	09:10	19:59	20:48	21:36
20°	07:09	08:09	09:09	20:06	20:51	21:35
30°	06:59	08:03	09:07	20:15	20:55	21:35
35°	06:53	07:59	09:06	20:19	20:58	21:34
40°	06:46	07:55	09:05	20:25	21:00	21:34
45°	06:38	07:50	09:04	20:31	21:03	21:34
S 50°	06:28	07:45	09:02	20:38	21:06	21:33
52°	06:23	07:42	09:01	20:42	21:08	21:33
54°	06:18	07:39	09:01	20:45	21:10	21:33
56°	06:13	07:36	09:00	20:49	21:12	21:32
58°	06:07	07:32	08:59	20:54	21:14	21:32
S 60°	05:59	07:28	08:58	20:59	21:16	21:32

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 2-4 1-12%
06	14:06	14:08	12:14	13:40	01:13	
07	14:10	14:12	12:14	14:32	02:06	
08	14:13	14:14	12:14	15:24	02:58	

February 09, 10, 11 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	138°59.9	190°29.4	S19°31.0	164°59.3	S11°51.4	309°12.4	S02°36.5	309°22.8	S01°23.2
1	154°02.3	205°28.6	30.3	179°59.9	50.7	324°15.0	36.5	324°25.3	23.2
2	169°04.8	220°27.8	29.7	195°00.5	50.0	339°17.5	36.4	339°27.9	23.2
3	184°07.3	235°27.0	·· 29.0	210°01.1	·· 49.3	354°20.1	·· 36.4	354°30.4	·· 23.1
4	199°09.7	250°26.3	28.3	225°01.7	48.6	9°22.7	36.3	9°33.0	23.1
5	214°12.2	265°25.5	27.6	240°02.2	47.8	24°25.3	36.3	24°35.5	23.0
6	229°14.7	280°24.7	S19°26.9	255°02.8	S11°47.1	39°27.8	S02°36.2	39°38.1	S01°23.0
7	244°17.1	295°24.0	26.2	270°03.4	46.4	54°30.4	36.1	54°40.6	22.9
8	259°19.6	310°23.2	25.5	285°04.0	45.7	69°33.0	36.1	69°43.2	22.9
9	274°22.1	325°22.4	·· 24.8	300°04.6	·· 45.0	84°35.5	·· 36.0	84°45.7	·· 22.8
10	289°24.5	340°21.7	24.1	315°05.2	44.2	99°38.1	36.0	99°48.3	22.8
11	304°27.0	355°20.9	23.4	330°05.7	43.5	114°40.7	35.9	114°50.8	22.7
12	319°29.4	10°20.1	S19°22.7	345°06.3	S11°42.8	129°43.3	S02°35.9	129°53.4	S01°22.7
13	334°31.9	25°19.4	22.0	0°06.9	42.1	144°45.8	35.8	144°55.9	22.6
14	349°34.4	40°18.6	21.3	15°07.5	41.4	159°48.4	35.7	159°58.4	22.6
15	4°36.8	55°17.8	·· 20.6	30°08.1	·· 40.6	174°51.0	·· 35.7	175°01.0	·· 22.6
16	19°39.3	70°17.1	19.9	45°08.7	39.9	189°53.6	35.6	190°03.5	22.5
17	34°41.8	85°16.3	19.2	60°09.3	39.2	204°56.1	35.6	205°06.1	22.5
18	49°44.2	100°15.5	S19°18.4	75°09.8	S11°38.5	219°58.7	S02°35.5	220°08.6	S01°22.4
19	64°46.7	115°14.8	17.7	90°10.4	37.7	235°01.3	35.4	235°11.2	22.4
20	79°49.2	130°14.0	17.0	105°11.0	37.0	250°03.9	35.4	250°13.7	22.3
21	94°51.6	145°13.2	·· 16.3	120°11.6	·· 36.3	265°06.4	·· 35.3	265°16.3	·· 22.3
22	109°54.1	160°12.5	15.6	135°12.2	35.6	280°09.0	35.3	280°18.8	22.2
23	124°56.6	175°11.7	14.9	150°12.8	34.9	295°11.6	35.2	295°21.4	22.2
Mer.pass. 14:42		ν -0.8′	d 0.7′	m -3.90	ν 0.6′	d 0.7′	m 1.13	ν 2.6′	d 0.1′ m -2.29	ν 2.5′	d 0.0′ m 0.65

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	139°59.0	190°10.9	S19°14.2	165°13.4	S11°34.1	310°14.2	S02°35.1	310°23.9	S01°22.1
1	155°01.5	205°10.2	13.5	180°13.9	33.4	325°16.7	35.1	325°26.5	22.1
2	170°03.9	220°09.4	12.8	195°14.5	32.7	340°19.3	35.0	340°29.0	22.0
3	185°06.4	235°08.7	·· 12.0	210°15.1	·· 32.0	355°21.9	·· 35.0	355°31.6	·· 22.0
4	200°08.9	250°07.9	11.3	225°15.7	31.2	10°24.5	34.9	10°34.1	21.9
5	215°11.3	265°07.1	10.6	240°16.3	30.5	25°27.1	34.8	25°36.7	21.9
6	230°13.8	280°06.4	S19°09.9	255°16.9	S11°29.8	40°29.6	S02°34.8	40°39.2	S01°21.8
7	245°16.3	295°05.6	09.2	270°17.5	29.1	55°32.2	34.7	55°41.8	21.8
8	260°18.7	310°04.9	08.4	285°18.1	28.3	70°34.8	34.7	70°44.3	21.8
9	275°21.2	325°04.1	·· 07.7	300°18.6	·· 27.6	85°37.4	·· 34.6	85°46.9	·· 21.7
10	290°23.7	340°03.3	07.0	315°19.2	26.9	100°40.0	34.5	100°49.4	21.7
11	305°26.1	355°02.6	06.3	330°19.8	26.2	115°42.5	34.5	115°52.0	21.6
12	320°28.6	10°01.8	S19°05.5	345°20.4	S11°25.4	130°45.1	S02°34.4	130°54.5	S01°21.6
13	335°31.0	25°01.1	04.8	0°21.0	24.7	145°47.7	34.4	145°57.1	21.5
14	350°33.5	40°00.3	04.1	15°21.6	24.0	160°50.3	34.3	160°59.6	21.5
15	5°36.0	54°59.6	·· 03.4	30°22.2	·· 23.3	175°52.9	·· 34.2	176°02.2	·· 21.4
16	20°38.4	69°58.8	02.6	45°22.8	22.5	190°55.4	34.2	191°04.7	21.4
17	35°40.9	84°58.1	01.9	60°23.3	21.8	205°58.0	34.1	206°07.3	21.3
18	50°43.4	99°57.3	S19°01.2	75°23.9	S11°21.1	221°00.6	S02°34.1	221°09.8	S01°21.3
19	65°45.8	114°56.6	19°00.4	90°24.5	20.4	236°03.2	34.0	236°12.4	21.2
20	80°48.3	129°55.8	18°59.7	105°25.1	19.6	251°05.8	33.9	251°14.9	21.2
21	95°50.8	144°55.1	·· 59.0	120°25.7	·· 18.9	266°08.4	·· 33.9	266°17.5	·· 21.1
22	110°53.2	159°54.3	58.2	135°26.3	18.2	281°10.9	33.8	281°20.0	21.1
23	125°55.7	174°53.5	57.5	150°26.9	17.5	296°13.5	33.8	296°22.6	21.0
Mer.pass. 14:38		ν -0.8′	d 0.7′	m -3.90	ν 0.6′	d 0.7′	m 1.13	ν 2.6′	d 0.1′ m -2.30	ν 2.5′	d 0.0′ m 0.64

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	140°58.2	189°52.8	S18°56.8	165°27.5	S11°16.7	311°16.1	S02°33.7	311°25.1	S01°21.0
1	156°00.6	204°52.0	56.0	180°28.1	16.0	326°18.7	33.6	326°27.7	20.9
2	171°03.1	219°51.3	55.3	195°28.7	15.3	341°21.3	33.6	341°30.2	20.9
3	186°05.5	234°50.5	·· 54.6	210°29.2	·· 14.6	356°23.9	·· 33.5	356°32.8	·· 20.8
4	201°08.0	249°49.8	53.8	225°29.8	13.8	11°26.5	33.4	11°35.3	20.8
5	216°10.5	264°49.1	53.1	240°30.4	13.1	26°29.0	33.4	26°37.9	20.7
6	231°12.9	279°48.3	S18°52.3	255°31.0	S11°12.4	41°31.6	S02°33.3	41°40.4	S01°20.7
7	246°15.4	294°47.6	51.6	270°31.6	11.6	56°34.2	33.2	56°43.0	20.6
8	261°17.9	309°46.8	50.8	285°32.2	10.9	71°36.8	33.2	71°45.6	20.6
9	276°20.3	324°46.1	·· 50.1	300°32.8	·· 10.2	86°39.4	·· 33.1	86°48.1	·· 20.5
10	291°22.8	339°45.3	49.4	315°33.4	09.5	101°42.0	33.1	101°50.7	20.5
11	306°25.3	354°44.6	48.6	330°34.0	08.7	116°44.6	33.0	116°53.2	20.4
12	321°27.7	9°43.8	S18°47.9	345°34.6	S11°08.0	131°47.1	S02°32.9	131°55.8	S01°20.4
13	336°30.2	24°43.1	47.1	0°35.2	07.3	146°49.7	32.9	146°58.3	20.3
14	351°32.6	39°42.3	46.4	15°35.8	06.5	161°52.3	32.8	162°00.9	20.3
15	6°35.1	54°41.6	·· 45.6	30°36.4	·· 05.8	176°54.9	·· 32.7	177°03.4	·· 20.2
16	21°37.6	69°40.9	44.9	45°36.9	05.1	191°57.5	32.7	192°06.0	20.2
17	36°40.0	84°40.1	44.1	60°37.5	04.3	207°00.1	32.6	207°08.5	20.1
18	51°42.5	99°39.4	S18°43.4	75°38.1	S11°03.6	222°02.7	S02°32.5	222°11.1	S01°20.1
19	66°45.0	114°38.6	42.6	90°38.7	02.9	237°05.3	32.5	237°13.6	20.0
20	81°47.4	129°37.9	41.8	105°39.3	02.2	252°07.9	32.4	252°16.2	20.0
21	96°49.9	144°37.2	·· 41.1	120°39.9	·· 01.4	267°10.4	·· 32.4	267°18.8	·· 19.9
22	111°52.4	159°36.4	40.3	135°40.5	00.7	282°13.0	32.3	282°21.3	19.9
23	126°54.8	174°35.7	39.6	150°41.1	00.0	297°15.6	32.2	297°23.9	19.8
Mer.pass. 14:34		ν -0.7′	d 0.7′	m -3.90	ν 0.6′	d 0.7′	m 1.13	ν 2.6′	d 0.1′ m -2.31	ν 2.6′	d 0.0′ m 0.64

Stars

	SHA	Dec
Alpheratz	358°09.3	28°59.1
Ankaa	353°40.3	-42°24.9
Schedar	350°09.0	56°26.1
Diphda	349°20.8	-18°05.7
Achernar	335°45.3	-57°20.4
Hamal	328°28.7	23°22.3
Polaris	326°52.0	89°10.9
Acamar	315°37.0	-40°23.2
Menkar	314°40.8	4°00.8
Mirfak	309°15.7	49°47.8
Aldebaran	291°17.5	16°28.2
Rigel	281°35.6	-8°13.6
Capella	281°10.6	45°58.8
Bellatrix	278°58.3	6°19.8
Elnath	278°43.6	28°35.5
Alnilam	276°11.2	-1°13.0
Betelgeuse	271°27.8	7°24.1
Canopus	264°06.7	-52°41.4
Sirius	258°55.1	-16°41.6
Adhara	255°31.6	-28°57.0
Procyon	245°25.2	5°16.3
Pollux	243°57.5	28°04.3
Avior	234°27.4	-59°27.1
Suhail	223°10.1	-43°21.4
Miaplacidus	221°43.9	-69°38.4
Alphard	218°19.9	-8°34.7
Regulus	208°09.4	12°03.5
Dubhe	194°21.2	61°51.1
Denebola	182°58.5	14°40.6
Gienah	176°17.4	-17°26.2
Acrux	173°36.5	-62°59.4
Gacrux	172°28.0	-57°00.2
Alioth	166°41.9	56°03.5
Spica	158°57.1	-11°03.7
Alkaid	153°18.1	49°24.2
Hadar	149°22.7	-60°16.6
Menkent	148°36.5	-36°16.4
Arcturus	146°18.1	19°16.7
Rigil Kent.	140°25.3	-60°45.0
Kochab	137°18.9	74°13.7
Zuben'ubi	137°32.7	-15°57.7
Alphecca	126°31.9	26°46.5
Antares	112°56.6	-26°23.3
Atria	108°20.9	-68°59.3
Sabik	102°41.0	-15°42.1
Shaula	96°55.6	-37°05.3
Rasalhague	96°29.5	12°34.3
Eltanin	90°57.9	51°29.3
Kaus Aust.	84°16.8	-34°23.6
Vega	80°55.9	38°45.8
Nunki	76°29.1	-26°19.2
Altair	62°32.5	8°49.0
Peacock	53°58.5	-56°47.8
Deneb	49°48.7	45°12.7
Enif	34°11.6	9°47.2
Al Na'ir	28°15.1	-47°03.3
Fomalhaut	15°51.4	-29°43.6
Scheat	14°17.6	27°58.7
Markab	14°03.2	15°06.1

Feb 09 Mon	SHA	Mer.pass
Venus	51°29.5	11:19
Mars	25°59.5	13:00
Jupiter	170°12.5	03:23
Saturn	170°22.9	03:22

Feb 10 Tue	SHA	Mer.pass
Venus	50°11.9	11:20
Mars	25°14.3	12:59
Jupiter	170°15.2	03:18
Saturn	170°24.9	03:18

Feb 11 Wed	SHA	Mer.pass
Venus	48°54.6	11:21
Mars	24°29.3	12:58
Jupiter	170°18.0	03:14
Saturn	170°27.0	03:14

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°26.2	S14°46.0	124°31.4	9.9′	N01°05.6	12.4′	59.5′
1	191°26.2	45.2	139°00.3	9.9′	01°18.0	12.4′	59.5′
2	206°26.1	44.4	153°29.1	9.9′	01°30.4	12.5′	59.5′
3	221°26.1	·· 43.6	167°58.0	9.8′	01°42.9	12.4′	59.5′
4	236°26.1	42.8	182°26.8	9.8′	01°55.3	12.4′	59.5′
5	251°26.1	42.0	196°55.7	9.8′	02°07.7	12.4′	59.5′
6	266°26.1	S14°41.1	211°24.5	9.8′	N02°20.1	12.4′	59.5′
7	281°26.1	40.3	225°53.3	9.8′	02°32.5	12.3′	59.5′
8	296°26.0	39.5	240°22.2	9.8′	02°44.8	12.4′	59.5′
9	311°26.0	·· 38.7	254°51.0	9.8′	02°57.2	12.3′	59.5′
10	326°26.0	37.9	269°19.8	9.8′	03°09.5	12.3′	59.5′
11	341°26.0	37.1	283°48.6	9.8′	03°21.8	12.3′	59.5′
12	356°26.0	S14°36.3	298°17.4	9.8′	N03°34.1	12.2′	59.5′
13	11°26.0	35.5	312°46.2	9.8′	03°46.3	12.3′	59.4′
14	26°25.9	34.7	327°14.9	9.8′	03°58.6	12.2′	59.4′
15	41°25.9	·· 33.9	341°43.7	9.8′	04°10.8	12.2′	59.4′
16	56°25.9	33.1	356°12.5	9.7′	04°23.0	12.1′	59.4′
17	71°25.9	32.3	10°41.2	9.7′	04°35.1	12.2′	59.4′
18	86°25.9	S14°31.5	25°09.9	9.7′	N04°47.3	12.0′	59.4′
19	101°25.9	30.7	39°38.6	9.7′	04°59.3	12.1′	59.4′
20	116°25.9	29.9	54°07.3	9.7′	05°11.4	12.1′	59.4′
21	131°25.8	·· 29.1	68°36.0	9.7′	05°23.5	12.0′	59.4′
22	146°25.8	28.3	83°04.7	9.7′	05°35.5	11.9′	59.4′
23	161°25.8	27.5	97°33.4	9.6′	05°47.4	12.0′	59.4′
	SD = 16.2′	d = 0.8′	SD = 16.2′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°25.8	S14°26.6	112°02.0	9.6′	N05°59.4	11.8′	59.4′
1	191°25.8	25.8	126°30.6	9.6′	06°11.2	11.9′	59.4′
2	206°25.8	25.0	140°59.2	9.6′	06°23.1	11.8′	59.4′
3	221°25.8	·· 24.2	155°27.8	9.6′	06°34.9	11.8′	59.4′
4	236°25.8	23.4	169°56.4	9.6′	06°46.7	11.7′	59.4′
5	251°25.8	22.6	184°25.0	9.5′	06°58.4	11.7′	59.4′
6	266°25.8	S14°21.8	198°53.5	9.5′	N07°10.1	11.7′	59.4′
7	281°25.7	21.0	213°22.0	9.5′	07°21.8	11.6′	59.4′
8	296°25.7	20.2	227°50.5	9.5′	07°33.4	11.5′	59.4′
9	311°25.7	·· 19.3	242°19.0	9.5′	07°44.9	11.5′	59.3′
10	326°25.7	18.5	256°47.4	9.4′	07°56.4	11.5′	59.3′
11	341°25.7	17.7	271°15.8	9.4′	08°07.9	11.4′	59.3′
12	356°25.7	S14°16.9	285°44.2	9.4′	N08°19.3	11.3′	59.3′
13	11°25.7	16.1	300°12.6	9.4′	08°30.6	11.3′	59.3′
14	26°25.7	15.3	314°41.0	9.3′	08°41.9	11.3′	59.3′
15	41°25.7	·· 14.5	329°09.3	9.3′	08°53.2	11.2′	59.3′
16	56°25.7	13.6	343°37.6	9.3′	09°04.4	11.1′	59.3′
17	71°25.7	12.8	358°05.9	9.3′	09°15.5	11.1′	59.3′
18	86°25.7	S14°12.0	12°34.2	9.2′	N09°26.6	11.0′	59.3′
19	101°25.7	11.2	27°02.4	9.2′	09°37.6	10.9′	59.3′
20	116°25.7	10.4	41°30.6	9.2′	09°48.5	10.9′	59.3′
21	131°25.7	·· 09.6	55°58.8	9.2′	09°59.4	10.9′	59.3′
22	146°25.6	08.7	70°27.0	9.1′	10°10.3	10.7′	59.2′
23	161°25.6	07.9	84°55.1	9.1′	10°21.0	10.8′	59.2′
	SD = 16.2′	d = 0.8′	SD = 16.2′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°25.6	S14°07.1	99°23.2	9.1′	N10°31.8	10.6′	59.2′
1	191°25.6	06.3	113°51.3	9.0′	10°42.4	10.6′	59.2′
2	206°25.6	05.5	128°19.3	9.0′	10°53.0	10.5′	59.2′
3	221°25.6	·· 04.6	142°47.3	9.0′	11°03.5	10.4′	59.2′
4	236°25.6	03.8	157°15.3	9.0′	11°13.9	10.4′	59.2′
5	251°25.6	03.0	171°43.3	8.9′	11°24.3	10.3′	59.2′
6	266°25.6	S14°02.2	186°11.2	8.9′	N11°34.6	10.2′	59.2′
7	281°25.6	01.3	200°39.1	8.9′	11°44.8	10.2′	59.2′
8	296°25.6	14°00.5	215°06.9	8.8′	11°55.0	10.1′	59.1′
9	311°25.6	13°59.7	229°34.8	8.8′	12°05.1	10.0′	59.1′
10	326°25.6	58.9	244°02.6	8.8′	12°15.1	9.9′	59.1′
11	341°25.6	58.1	258°30.4	8.7′	12°25.0	9.8′	59.1′
12	356°25.6	S13°57.2	272°58.1	8.7′	N12°34.8	9.8′	59.1′
13	11°25.6	56.4	287°25.8	8.7′	12°44.6	9.7′	59.1′
14	26°25.6	55.6	301°53.5	8.6′	12°54.3	9.6′	59.1′
15	41°25.6	·· 54.8	316°21.1	8.6′	13°03.9	9.6′	59.1′
16	56°25.6	53.9	330°48.7	8.6′	13°13.5	9.4′	59.1′
17	71°25.6	53.1	345°16.3	8.6′	13°22.9	9.4′	59.1′
18	86°25.6	S13°52.3	359°43.9	8.5′	N13°32.3	9.3′	59.0′
19	101°25.6	51.5	14°11.4	8.5′	13°41.6	9.2′	59.0′
20	116°25.6	50.6	28°38.9	8.5′	13°50.8	9.1′	59.0′
21	131°25.6	·· 49.8	43°06.3	8.4′	13°59.9	9.0′	59.0′
22	146°25.7	49.0	57°33.8	8.4′	14°08.9	8.9′	59.0′
23	161°25.7	48.1	72°01.2	8.4′	14°17.8	8.9′	59.0′
	SD = 16.2′	d = 0.8′	SD = 16.2′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	06:36	07:58	09:24	15:06	16:32	17:55
N 70°	06:32	07:45	08:59	15:31	16:45	17:59
68°	06:28	07:35	08:40	15:50	16:55	18:02
66°	06:25	07:26	08:24	16:06	17:04	18:05
64°	06:22	07:19	08:12	16:18	17:11	18:08
62°	06:20	07:13	08:01	16:29	17:17	18:10
60°	06:18	07:07	07:52	16:38	17:23	18:12
N 58°	06:15	07:02	07:44	16:46	17:28	18:14
56°	06:13	06:57	07:37	16:53	17:32	18:16
54°	06:11	06:53	07:31	16:59	17:36	18:18
52°	06:10	06:49	07:25	17:04	17:40	18:20
50°	06:08	06:46	07:20	17:10	17:43	18:22
45°	06:03	06:38	07:09	17:21	17:51	18:26
N 40°	05:59	06:31	06:59	17:30	17:58	18:30
35°	05:55	06:25	06:51	17:38	18:04	18:34
30°	05:51	06:20	06:44	17:45	18:09	18:38
20°	05:43	06:09	06:32	17:57	18:19	18:46
N 10°	05:34	06:00	06:21	18:08	18:29	18:54
0°	05:25	05:50	06:11	18:18	18:39	19:04
S 10°	05:13	05:39	06:00	18:28	18:50	19:15
20°	04:59	05:26	05:49	18:39	19:02	19:29
30°	04:41	05:11	05:36	18:52	19:17	19:47
35°	04:29	05:02	05:29	18:59	19:26	19:58
40°	04:16	04:51	05:20	19:08	19:37	20:12
45°	03:58	04:38	05:10	19:18	19:50	20:29
S 50°	03:35	04:21	04:58	19:30	20:06	20:52
52°	03:24	04:13	04:52	19:36	20:14	21:03
54°	03:11	04:04	04:45	19:42	20:23	21:16
56°	02:55	03:54	04:38	19:49	20:32	21:31
58°	02:35	03:43	04:30	19:57	20:44	21:50
S 60°	02:10	03:29	04:21	20:06	20:57	22:14

Lat.	**Moonrise** Mon	Tue	Wed	**Moonset** Mon	Tue	Wed
N 72°	09:26	09:14	08:59	23:44	·· ··	01:48
N 70°	09:30	09:25	09:20	23:35	·· ··	01:30
68°	09:33	09:34	09:36	23:28	·· ··	01:15
66°	09:36	09:41	09:49	23:22	·· ··	01:04
64°	09:38	09:48	10:00	23:17	·· ··	00:54
62°	09:40	09:53	10:09	23:13	·· ··	00:46
60°	09:42	09:58	10:17	23:10	·· ··	00:39
N 58°	09:43	10:02	10:24	23:06	·· ··	00:32
56°	09:45	10:06	10:30	23:03	·· ··	00:27
54°	09:46	10:10	10:36	23:01	·· ··	00:22
52°	09:47	10:13	10:41	22:59	·· ··	00:17
50°	09:48	10:16	10:46	22:56	·· ··	00:13
45°	09:51	10:22	10:56	22:52	·· ··	00:05
N 40°	09:53	10:27	11:04	22:48	23:57	·· ··
35°	09:54	10:32	11:12	22:45	23:51	·· ··
30°	09:56	10:36	11:18	22:42	23:46	·· ··
20°	09:59	10:43	11:29	22:37	23:36	·· ··
N 10°	10:01	10:49	11:39	22:32	23:28	·· ··
0°	10:03	10:55	11:48	22:28	23:20	·· ··
S 10°	10:06	11:01	11:58	22:24	23:13	·· ··
20°	10:08	11:08	12:08	22:19	23:05	23:52
30°	10:11	11:15	12:19	22:14	22:55	23:39
35°	10:13	11:20	12:26	22:12	22:50	23:31
40°	10:15	11:24	12:34	22:08	22:44	23:22
45°	10:17	11:30	12:43	22:04	22:37	23:12
S 50°	10:20	11:37	12:53	22:00	22:28	23:00
52°	10:21	11:40	12:59	21:58	22:25	22:55
54°	10:22	11:44	13:04	21:56	22:20	22:48
56°	10:24	11:48	13:10	21:53	22:16	22:42
58°	10:26	11:52	13:17	21:50	22:10	22:34
S 60°	10:27	11:57	13:25	21:47	22:05	22:25

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 5-7 21-42%
09	14:15	14:16	12:14	16:16	03:50	
10	14:17	14:17	12:14	17:08	04:42	
11	14:17	14:17	12:14	18:01	05:34	

February 12, 13, 14 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	141°57.3	189°34.9	S18°38.8	165°41.7	S10°59.2	312°18.2	S02°32.2	312°26.4	S01°19.8
1	156°59.8	204°34.2	38.1	180°42.3	58.5	327°20.8	32.1	327°29.0	19.7
2	172°02.2	219°33.5	37.3	195°42.9	57.8	342°23.4	32.0	342°31.5	19.7
3	187°04.7	234°32.7	·· 36.5	210°43.5	·· 57.0	357°26.0	·· 32.0	357°34.1	·· 19.6
4	202°07.1	249°32.0	35.8	225°44.1	56.3	12°28.6	31.9	12°36.7	19.6
5	217°09.6	264°31.3	35.0	240°44.7	55.6	27°31.2	31.8	27°39.2	19.5
6	232°12.1	279°30.5	S18°34.2	255°45.3	S10°54.8	42°33.8	S02°31.8	42°41.8	S01°19.5
7	247°14.5	294°29.8	33.5	270°45.9	54.1	57°36.4	31.7	57°44.3	19.4
8	262°17.0	309°29.1	32.7	285°46.5	53.4	72°39.0	31.6	72°46.9	19.4
9	277°19.5	324°28.3	·· 31.9	300°47.1	·· 52.6	87°41.5	·· 31.6	87°49.4	·· 19.3
10	292°21.9	339°27.6	31.2	315°47.7	51.9	102°44.1	31.5	102°52.0	19.3
11	307°24.4	354°26.9	30.4	330°48.2	51.2	117°46.7	31.4	117°54.5	19.2
12	322°26.9	9°26.1	S18°29.6	345°48.8	S10°50.4	132°49.3	S02°31.4	132°57.1	S01°19.2
13	337°29.3	24°25.4	28.9	0°49.4	49.7	147°51.9	31.3	147°59.7	19.1
14	352°31.8	39°24.7	28.1	15°50.0	49.0	162°54.5	31.2	163°02.2	19.1
15	7°34.3	54°23.9	·· 27.3	30°50.6	·· 48.2	177°57.1	·· 31.2	178°04.8	·· 19.0
16	22°36.7	69°23.2	26.5	45°51.2	47.5	192°59.7	31.1	193°07.3	19.0
17	37°39.2	84°22.5	25.8	60°51.8	46.8	208°02.3	31.0	208°09.9	18.9
18	52°41.6	99°21.7	S18°25.0	75°52.4	S10°46.0	223°04.9	S02°31.0	223°12.5	S01°18.9
19	67°44.1	114°21.0	24.2	90°53.0	45.3	238°07.5	30.9	238°15.0	18.8
20	82°46.6	129°20.3	23.4	105°53.6	44.6	253°10.1	30.8	253°17.6	18.8
21	97°49.0	144°19.6	·· 22.7	120°54.2	·· 43.8	268°12.7	·· 30.8	268°20.1	·· 18.7
22	112°51.5	159°18.8	21.9	135°54.8	43.1	283°15.3	30.7	283°22.7	18.7
23	127°54.0	174°18.1	21.1	150°55.4	42.4	298°17.9	30.6	298°25.2	18.6
Mer.pass. 14:30		ν -0.7′ d 0.8′		m -3.90	ν 0.6′ d 0.7′		m 1.13	ν 2.6′ d 0.1′	m -2.31	ν 2.6′ d 0.1′	m 0.63

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	142°56.4	189°17.4	S18°20.3	165°56.0	S10°41.6	313°20.5	S02°30.6	313°27.8	S01°18.6
1	157°58.9	204°16.7	19.5	180°56.6	40.9	328°23.1	30.5	328°30.4	18.5
2	173°01.4	219°15.9	18.8	195°57.2	40.2	343°25.7	30.4	343°32.9	18.5
3	188°03.8	234°15.2	·· 18.0	210°57.8	·· 39.4	358°28.3	·· 30.4	358°35.5	·· 18.4
4	203°06.3	249°14.5	17.2	225°58.4	38.7	13°30.9	30.3	13°38.0	18.4
5	218°08.8	264°13.8	16.4	240°59.0	37.9	28°33.5	30.2	28°40.6	18.3
6	233°11.2	279°13.0	S18°15.6	255°59.6	S10°37.2	43°36.1	S02°30.2	43°43.2	S01°18.3
7	248°13.7	294°12.3	14.8	271°00.2	36.5	58°38.7	30.1	58°45.7	18.2
8	263°16.1	309°11.6	14.0	286°00.8	35.7	73°41.3	30.0	73°48.3	18.2
9	278°18.6	324°10.9	·· 13.2	301°01.4	·· 35.0	88°43.9	·· 30.0	88°50.8	·· 18.1
10	293°21.1	339°10.1	12.5	316°02.0	34.3	103°46.5	29.9	103°53.4	18.1
11	308°23.5	354°09.4	11.7	331°02.6	33.5	118°49.1	29.8	118°56.0	18.0
12	323°26.0	9°08.7	S18°10.9	346°03.2	S10°32.8	133°51.7	S02°29.7	133°58.5	S01°18.0
13	338°28.5	24°08.0	10.1	1°03.8	32.0	148°54.3	29.7	149°01.1	17.9
14	353°30.9	39°07.3	09.3	16°04.4	31.3	163°56.9	29.6	164°03.7	17.9
15	8°33.4	54°06.5	·· 08.5	31°05.0	·· 30.6	178°59.5	·· 29.5	179°06.2	·· 17.8
16	23°35.9	69°05.8	07.7	46°05.6	29.8	194°02.1	29.5	194°08.8	17.7
17	38°38.3	84°05.1	06.9	61°06.2	29.1	209°04.7	29.4	209°11.3	17.7
18	53°40.8	99°04.4	S18°06.1	76°06.8	S10°28.4	224°07.3	S02°29.3	224°13.9	S01°17.6
19	68°43.2	114°03.7	05.3	91°07.4	27.6	239°09.9	29.3	239°16.5	17.6
20	83°45.7	129°03.0	04.5	106°08.0	26.9	254°12.5	29.2	254°19.0	17.5
21	98°48.2	144°02.2	·· 03.7	121°08.6	·· 26.1	269°15.1	·· 29.1	269°21.6	·· 17.5
22	113°50.6	159°01.5	02.9	136°09.2	25.4	284°17.7	29.0	284°24.1	17.4
23	128°53.1	174°00.8	02.1	151°09.8	24.7	299°20.3	29.0	299°26.7	17.4
Mer.pass. 14:26		ν -0.7′ d 0.8′		m -3.90	ν 0.6′ d 0.7′		m 1.13	ν 2.6′ d 0.1′	m -2.32	ν 2.6′ d 0.1′	m 0.63

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	143°55.6	189°00.1	S18°01.3	166°10.4	S10°23.9	314°22.9	S02°28.9	314°29.3	S01°17.3
1	158°58.0	203°59.4	18°00.5	181°11.0	23.2	329°25.5	28.8	329°31.8	17.3
2	174°00.5	218°58.7	17°59.7	196°11.6	22.4	344°28.1	28.8	344°34.4	17.2
3	189°03.0	233°58.0	·· 58.9	211°12.2	·· 21.7	359°30.7	·· 28.7	359°37.0	·· 17.2
4	204°05.4	248°57.3	58.1	226°12.8	21.0	14°33.3	28.6	14°39.5	17.1
5	219°07.9	263°56.5	57.3	241°13.4	20.2	29°35.9	28.6	29°42.1	17.1
6	234°10.4	278°55.8	S17°56.5	256°14.1	S10°19.5	44°38.5	S02°28.5	44°44.7	S01°17.0
7	249°12.8	293°55.1	55.7	271°14.7	18.7	59°41.2	28.4	59°47.2	17.0
8	264°15.3	308°54.4	54.8	286°15.3	18.0	74°43.8	28.3	74°49.8	16.9
9	279°17.7	323°53.7	·· 54.0	301°15.9	·· 17.3	89°46.4	·· 28.3	89°52.3	·· 16.8
10	294°20.2	338°53.0	53.2	316°16.5	16.5	104°49.0	28.2	104°54.9	16.8
11	309°22.7	353°52.3	52.4	331°17.1	15.8	119°51.6	28.1	119°57.5	16.7
12	324°25.1	8°51.6	S17°51.6	346°17.7	S10°15.0	134°54.2	S02°28.1	135°00.0	S01°16.7
13	339°27.6	23°50.9	50.8	1°18.3	14.3	149°56.8	28.0	150°02.6	16.6
14	354°30.1	38°50.2	50.0	16°18.9	13.5	164°59.4	27.9	165°05.2	16.6
15	9°32.5	53°49.5	·· 49.1	31°19.5	·· 12.8	180°02.0	·· 27.8	180°07.7	·· 16.5
16	24°35.0	68°48.8	48.3	46°20.1	12.1	195°04.6	27.8	195°10.3	16.5
17	39°37.5	83°48.0	47.5	61°20.7	11.3	210°07.2	27.7	210°12.9	16.4
18	54°39.9	98°47.3	S17°46.7	76°21.3	S10°10.6	225°09.8	S02°27.6	225°15.4	S01°16.4
19	69°42.4	113°46.6	45.9	91°21.9	09.8	240°12.4	27.5	240°18.0	16.3
20	84°44.9	128°45.9	45.1	106°22.5	09.1	255°15.1	27.5	255°20.6	16.3
21	99°47.3	143°45.2	·· 44.2	121°23.1	·· 08.4	270°17.7	·· 27.4	270°23.1	·· 16.2
22	114°49.8	158°44.5	43.4	136°23.7	07.6	285°20.3	27.3	285°25.7	16.2
23	129°52.2	173°43.8	42.6	151°24.3	06.9	300°22.9	27.3	300°28.3	16.1
Mer.pass. 14:22		ν -0.7′ d 0.8′		m -3.90	ν 0.6′ d 0.7′		m 1.13	ν 2.6′ d 0.1′	m -2.33	ν 2.6′ d 0.1′	m 0.62

Stars

	SHA	Dec
Alpheratz	358°09.3	28°59.1
Ankaa	353°40.3	-42°24.8
Schedar	350°09.0	56°26.1
Diphda	349°20.8	-18°05.7
Achernar	335°45.4	-57°20.4
Hamal	328°28.7	23°22.3
Polaris	326°53.0	89°10.9
Acamar	315°37.1	-40°23.2
Menkar	314°40.9	4°00.8
Mirfak	309°15.7	49°47.8
Aldebaran	291°17.6	16°28.2
Rigel	281°35.6	-8°13.6
Capella	281°10.6	45°58.8
Bellatrix	278°58.3	6°19.8
Elnath	278°43.6	28°35.5
Alnilam	276°11.2	-1°13.0
Betelgeuse	271°27.8	7°24.1
Canopus	264°06.7	-52°41.4
Sirius	258°55.1	-16°41.6
Adhara	255°31.6	-28°57.0
Procyon	245°25.2	5°16.3
Pollux	243°57.5	28°04.3
Avior	234°27.4	-59°27.1
Suhail	223°10.1	-43°21.5
Miaplacidus	221°43.9	-69°38.4
Alphard	218°19.9	-8°34.7
Regulus	208°09.4	12°03.5
Dubhe	194°21.2	61°51.1
Denebola	182°58.5	14°40.6
Gienah	176°17.4	-17°26.2
Acrux	173°36.4	-62°59.4
Gacrux	172°28.0	-57°00.2
Alioth	166°41.9	56°03.6
Spica	158°57.1	-11°03.7
Alkaid	153°18.1	49°24.2
Hadar	149°22.7	-60°16.6
Menkent	148°36.5	-36°16.4
Arcturus	146°18.1	19°16.7
Rigil Kent.	140°25.2	-60°45.0
Kochab	137°18.9	74°13.7
Zuben'ubi	137°32.7	-15°57.7
Alphecca	126°31.9	26°46.5
Antares	112°56.6	-26°23.3
Atria	108°20.8	-68°59.3
Sabik	102°40.9	-15°42.1
Shaula	96°55.6	-37°05.3
Rasalhague	96°29.5	12°34.3
Eltanin	90°57.9	51°29.3
Kaus Aust.	84°16.7	-34°23.6
Vega	80°55.9	38°45.8
Nunki	76°29.1	-26°19.2
Altair	62°32.5	8°49.0
Peacock	53°58.5	-56°47.8
Deneb	49°48.7	45°12.6
Enif	34°11.6	9°47.2
Al Na'ir	28°15.1	-47°03.3
Fomalhaut	15°51.4	-29°43.6
Scheat	14°17.6	27°58.7
Markab	14°03.2	15°06.1

Feb 12 Thu	SHA	Mer.pass
Venus	47°37.7	11:22
Mars	23°44.4	12:57
Jupiter	170°20.9	03:10
Saturn	170°29.1	03:10

Feb 13 Fri	SHA	Mer.pass
Venus	46°20.9	11:23
Mars	22°59.6	12:56
Jupiter	170°24.1	03:06
Saturn	170°31.4	03:06

Feb 14 Sat	SHA	Mer.pass
Venus	45°04.5	11:25
Mars	22°14.9	12:55
Jupiter	170°27.3	03:02
Saturn	170°33.7	03:02

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°25.7	S13°47.3	86°28.5	8.3′	N14°26.7	8.7′	59.0′
1	191°25.7	46.5	100°55.8	8.3′	14°35.4	8.7′	59.0′
2	206°25.7	45.7	115°23.1	8.3′	14°44.1	8.6′	58.9′
3	221°25.7	·· 44.8	129°50.4	8.2′	14°52.7	8.4′	58.9′
4	236°25.7	44.0	144°17.6	8.2′	15°01.1	8.4′	58.9′
5	251°25.7	43.2	158°44.8	8.2′	15°09.5	8.3′	58.9′
6	266°25.7	S13°42.3	173°12.0	8.1′	N15°17.8	8.2′	58.9′
7	281°25.7	41.5	187°39.1	8.1′	15°26.0	8.1′	58.9′
8	296°25.7	40.7	202°06.2	8.1′	15°34.1	8.0′	58.9′
9	311°25.7	·· 39.8	216°33.3	8.0′	15°42.1	7.9′	58.9′
10	326°25.7	39.0	231°00.3	8.0′	15°50.0	7.8′	58.8′
11	341°25.7	38.2	245°27.3	8.0′	15°57.8	7.7′	58.8′
12	356°25.7	S13°37.3	259°54.3	7.9′	N16°05.5	7.6′	58.8′
13	11°25.8	36.5	274°21.3	7.9′	16°13.1	7.5′	58.8′
14	26°25.8	35.7	288°48.2	7.9′	16°20.6	7.4′	58.8′
15	41°25.8	·· 34.8	303°15.1	7.9′	16°28.0	7.3′	58.8′
16	56°25.8	34.0	317°41.9	7.8′	16°35.3	7.2′	58.8′
17	71°25.8	33.2	332°08.7	7.8′	16°42.5	7.1′	58.8′
18	86°25.8	S13°32.3	346°35.5	7.8′	N16°49.6	7.0′	58.7′
19	101°25.8	31.5	1°02.3	7.7′	16°56.6	6.9′	58.7′
20	116°25.8	30.7	15°29.0	7.7′	17°03.5	6.7′	58.7′
21	131°25.8	·· 29.8	29°55.7	7.7′	17°10.2	6.7′	58.7′
22	146°25.9	29.0	44°22.4	7.7′	17°16.9	6.5′	58.7′
23	161°25.9	28.1	58°49.1	7.6′	17°23.4	6.5′	58.7′
	SD = 16.2′	d = 0.8′	SD = 16.1′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°25.9	S13°27.3	73°15.7	7.6′	N17°29.9	6.3′	58.7′
1	191°25.9	26.5	87°42.3	7.6′	17°36.2	6.2′	58.6′
2	206°25.9	25.6	102°08.9	7.6′	17°42.4	6.1′	58.6′
3	221°25.9	·· 24.8	116°35.4	7.5′	17°48.5	6.0′	58.6′
4	236°25.9	23.9	131°02.0	7.5′	17°54.5	5.9′	58.6′
5	251°26.0	23.1	145°28.5	7.5′	18°00.4	5.8′	58.6′
6	266°26.0	S13°22.3	159°55.0	7.5′	N18°06.2	5.6′	58.6′
7	281°26.0	21.4	174°21.4	7.4′	18°11.8	5.6′	58.6′
8	296°26.0	20.6	188°47.8	7.4′	18°17.4	5.4′	58.5′
9	311°26.0	·· 19.7	203°14.3	7.4′	18°22.8	5.3′	58.5′
10	326°26.0	18.9	217°40.6	7.4′	18°28.1	5.2′	58.5′
11	341°26.0	18.1	232°07.0	7.4′	18°33.3	5.1′	58.5′
12	356°26.1	S13°17.2	246°33.4	7.3′	N18°38.4	5.0′	58.5′
13	11°26.1	16.4	260°59.7	7.3′	18°43.4	4.8′	58.5′
14	26°26.1	15.5	275°26.0	7.3′	18°48.2	4.7′	58.4′
15	41°26.1	·· 14.7	289°52.3	7.3′	18°52.9	4.6′	58.4′
16	56°26.1	13.8	304°18.6	7.3′	18°57.5	4.5′	58.4′
17	71°26.2	13.0	318°44.8	7.2′	19°02.0	4.4′	58.4′
18	86°26.2	S13°12.2	333°11.1	7.2′	N19°06.4	4.2′	58.4′
19	101°26.2	11.3	347°37.3	7.2′	19°10.6	4.2′	58.4′
20	116°26.2	10.5	2°03.5	7.2′	19°14.8	4.0′	58.4′
21	131°26.2	·· 09.6	16°29.8	7.2′	19°18.8	3.9′	58.3′
22	146°26.3	08.8	30°55.9	7.2′	19°22.7	3.7′	58.3′
23	161°26.3	07.9	45°22.1	7.2′	19°26.4	3.7′	58.3′
	SD = 16.2′	d = 0.8′	SD = 16.0′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°26.3	S13°07.1	59°48.3	7.2′	N19°30.1	3.5′	58.3′
1	191°26.3	06.2	74°14.5	7.2′	19°33.6	3.4′	58.3′
2	206°26.3	05.4	88°40.6	7.1′	19°37.0	3.3′	58.3′
3	221°26.4	·· 04.5	103°06.8	7.1′	19°40.3	3.1′	58.2′
4	236°26.4	03.7	117°32.9	7.1′	19°43.4	3.0′	58.2′
5	251°26.4	02.8	131°59.0	7.1′	19°46.4	2.9′	58.2′
6	266°26.4	S13°02.0	146°25.2	7.1′	N19°49.3	2.8′	58.2′
7	281°26.5	01.1	160°51.3	7.1′	19°52.1	2.7′	58.2′
8	296°26.5	13°00.3	175°17.4	7.1′	19°54.8	2.5′	58.2′
9	311°26.5	12°59.4	189°43.5	7.1′	19°57.3	2.4′	58.1′
10	326°26.5	58.6	204°09.7	7.1′	19°59.7	2.3′	58.1′
11	341°26.5	57.7	218°35.8	7.1′	20°02.0	2.1′	58.1′
12	356°26.6	S12°56.9	233°01.9	7.1′	N20°04.1	2.1′	58.1′
13	11°26.6	56.0	247°28.0	7.1′	20°06.2	1.9′	58.1′
14	26°26.6	55.2	261°54.1	7.1′	20°08.1	1.8′	58.1′
15	41°26.6	·· 54.3	276°20.3	7.1′	20°09.9	1.6′	58.0′
16	56°26.7	53.5	290°46.4	7.1′	20°11.5	1.5′	58.0′
17	71°26.7	52.6	305°12.5	7.1′	20°13.0	1.5′	58.0′
18	86°26.7	S12°51.8	319°38.7	7.2′	N20°14.5	1.2′	58.0′
19	101°26.8	50.9	334°04.8	7.2′	20°15.7	1.2′	58.0′
20	116°26.8	50.1	348°31.0	7.2′	20°16.9	1.0′	58.0′
21	131°26.8	·· 49.2	2°57.2	7.2′	20°17.9	0.9′	57.9′
22	146°26.8	48.3	17°23.4	7.2′	20°18.8	0.8′	57.9′
23	161°26.9	47.5	31°49.6	7.2′	20°19.6	0.7′	57.9′
	SD = 16.2′	d = 0.8′	SD = 15.9′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	06:23	07:44	09:06	15:24	16:46	18:07
N 70°	06:21	07:33	08:44	15:46	16:57	18:10
68°	06:18	07:24	08:27	16:03	17:06	18:12
66°	06:16	07:17	08:13	16:17	17:13	18:14
64°	06:14	07:10	08:02	16:28	17:20	18:16
62°	06:12	07:05	07:52	16:37	17:25	18:17
60°	06:11	07:00	07:44	16:46	17:30	18:19
N 58°	06:09	06:55	07:37	16:53	17:34	18:21
56°	06:07	06:51	07:30	16:59	17:38	18:22
54°	06:06	06:47	07:24	17:05	17:42	18:24
52°	06:04	06:44	07:19	17:10	17:45	18:25
50°	06:03	06:41	07:14	17:15	17:48	18:26
45°	05:59	06:34	07:04	17:25	17:55	18:30
N 40°	05:56	06:28	06:56	17:33	18:01	18:33
35°	05:53	06:22	06:48	17:41	18:07	18:36
30°	05:49	06:17	06:42	17:47	18:12	18:40
20°	05:42	06:08	06:30	17:58	18:21	18:47
N 10°	05:34	05:59	06:20	18:08	18:30	18:55
0°	05:25	05:50	06:11	18:18	18:39	19:04
S 10°	05:14	05:40	06:01	18:27	18:49	19:14
20°	05:01	05:28	05:51	18:37	19:00	19:27
30°	04:44	05:14	05:39	18:49	19:14	19:44
35°	04:33	05:05	05:32	18:56	19:23	19:55
40°	04:20	04:55	05:24	19:04	19:33	20:08
45°	04:03	04:42	05:14	19:13	19:45	20:24
S 50°	03:42	04:27	05:03	19:25	20:00	20:45
52°	03:31	04:20	04:57	19:30	20:07	20:55
54°	03:19	04:11	04:52	19:36	20:15	21:07
56°	03:05	04:02	04:45	19:42	20:25	21:21
58°	02:47	03:51	04:38	19:49	20:35	21:38
S 60°	02:25	03:39	04:29	19:57	20:47	21:59

Lat.	**Moonrise** Thu	Fri	Sat	**Moonset** Thu	Fri	Sat
N 72°	08:38			04:02		
N 70°	09:14	09:08	08:53	03:28	05:30	07:41
68°	09:40	09:49	10:10	03:03	04:49	06:25
66°	10:00	10:17	10:48	02:44	04:21	05:47
64°	10:16	10:39	11:14	02:29	04:00	05:21
62°	10:29	10:56	11:35	02:17	03:43	05:01
60°	10:40	11:11	11:52	02:06	03:29	04:44
N 58°	10:50	11:23	12:06	01:57	03:17	04:30
56°	10:59	11:34	12:19	01:48	03:07	04:18
54°	11:07	11:44	12:29	01:41	02:57	04:07
52°	11:14	11:52	12:39	01:35	02:49	03:58
50°	11:20	12:00	12:47	01:29	02:42	03:50
45°	11:33	12:16	13:05	01:17	02:26	03:32
N 40°	11:45	12:30	13:20	01:06	02:13	03:17
35°	11:54	12:41	13:33	00:57	02:02	03:05
30°	12:03	12:51	13:44	00:50	01:53	02:54
20°	12:18	13:09	14:02	00:36	01:37	02:36
N 10°	12:30	13:24	14:19	00:25	01:22	02:20
0°	12:43	13:38	14:34	00:14	01:09	02:05
S 10°	12:55	13:52	14:50	00:03	00:56	01:50
20°	13:08	14:08	15:06	·· ··	00:41	01:34
30°	13:23	14:25	15:25	·· ··	00:25	01:16
35°	13:32	14:36	15:36	·· ··	00:16	01:05
40°	13:42	14:48	15:49	·· ··	00:05	00:53
45°	13:54	15:01	16:04	23:52	·· ··	00:38
S 50°	14:08	15:19	16:23	23:37	·· ··	00:21
52°	14:15	15:27	16:32	23:30	·· ··	00:12
54°	14:22	15:36	16:41	23:22	·· ··	00:03
56°	14:31	15:46	16:52	23:13	23:53	·· ··
58°	14:40	15:57	17:05	23:03	23:41	·· ··
S 60°	14:51	16:11	17:20	22:52	23:27	·· ··

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 8-10 53-74%
12	14:17	14:17	12:14	18:56	06:28	
13	14:16	14:16	12:14	19:51	07:23	
14	14:15	14:14	12:14	20:48	08:20	

February 15, 16, 17 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	144°54.7	188°43.1	S17°41.8	166°24.9	S10°06.1	315°25.5	S02°27.2	315°30.8	S01°16.0
1	159°57.2	203°42.4	40.9	181°25.5	05.4	330°28.1	27.1	330°33.4	16.0
2	174°59.6	218°41.7	40.1	196°26.2	04.6	345°30.7	27.0	345°36.0	15.9
3	190°02.1	233°41.0	·· 39.3	211°26.8	·· 03.9	0°33.3	·· 27.0	0°38.5	·· 15.9
4	205°04.6	248°40.3	38.5	226°27.4	03.1	15°35.9	26.9	15°41.1	15.8
5	220°07.0	263°39.6	37.6	241°28.0	02.4	30°38.6	26.8	30°43.7	15.8
6	235°09.5	278°38.9	S17°36.8	256°28.6	S10°01.7	45°41.2	S02°26.7	45°46.2	S01°15.7
7	250°12.0	293°38.2	36.0	271°29.2	00.9	60°43.8	26.7	60°48.8	15.7
8	265°14.4	308°37.5	35.1	286°29.8	10°00.2	75°46.4	26.6	75°51.4	15.6
9	280°16.9	323°36.8	·· 34.3	301°30.4	09°59.4	90°49.0	·· 26.5	90°53.9	·· 15.6
10	295°19.4	338°36.1	33.5	316°31.0	58.7	105°51.6	26.4	105°56.5	15.5
11	310°21.8	353°35.4	32.6	331°31.6	57.9	120°54.2	26.4	120°59.1	15.4
12	325°24.3	8°34.7	S17°31.8	346°32.2	S09°57.2	135°56.9	S02°26.3	136°01.6	S01°15.4
13	340°26.7	23°34.1	31.0	1°32.8	56.4	150°59.5	26.2	151°04.2	15.3
14	355°29.2	38°33.4	30.1	16°33.4	55.7	166°02.1	26.1	166°06.8	15.3
15	10°31.7	53°32.7	·· 29.3	31°34.1	·· 55.0	181°04.7	·· 26.1	181°09.3	·· 15.2
16	25°34.1	68°32.0	28.5	46°34.7	54.2	196°07.3	26.0	196°11.9	15.2
17	40°36.6	83°31.3	27.6	61°35.3	53.5	211°09.9	25.9	211°14.5	15.1
18	55°39.1	98°30.6	S17°26.8	76°35.9	S09°52.7	226°12.5	S02°25.8	226°17.0	S01°15.1
19	70°41.5	113°29.9	25.9	91°36.5	52.0	241°15.2	25.8	241°19.6	15.0
20	85°44.0	128°29.2	25.1	106°37.1	51.2	256°17.8	25.7	256°22.2	15.0
21	100°46.5	143°28.5	·· 24.3	121°37.7	·· 50.5	271°20.4	·· 25.6	271°24.7	·· 14.9
22	115°48.9	158°27.8	23.4	136°38.3	49.7	286°23.0	25.5	286°27.3	14.8
23	130°51.4	173°27.1	22.6	151°38.9	49.0	301°25.6	25.5	301°29.9	14.8
Mer.pass. 14:18		ν -0.7′	d 0.8′	m -3.90	ν 0.6′	d 0.7′	m 1.13	ν 2.6′	d 0.1′ m -2.33	ν 2.6′	d 0.1′ m 0.62

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	145°53.9	188°26.4	S17°21.7	166°39.5	S09°48.2	316°28.2	S02°25.4	316°32.4	S01°14.7
1	160°56.3	203°25.8	20.9	181°40.2	47.5	331°30.9	25.3	331°35.0	14.7
2	175°58.8	218°25.1	20.0	196°40.8	46.7	346°33.5	25.2	346°37.6	14.6
3	191°01.2	233°24.4	·· 19.2	211°41.4	·· 46.0	1°36.1	·· 25.2	1°40.2	·· 14.6
4	206°03.7	248°23.7	18.3	226°42.0	45.2	16°38.7	25.1	16°42.7	14.5
5	221°06.2	263°23.0	17.5	241°42.6	44.5	31°41.3	25.0	31°45.3	14.5
6	236°08.6	278°22.3	S17°16.6	256°43.2	S09°43.8	46°44.0	S02°24.9	46°47.9	S01°14.4
7	251°11.1	293°21.6	15.8	271°43.8	43.0	61°46.6	24.9	61°50.4	14.3
8	266°13.6	308°20.9	14.9	286°44.4	42.3	76°49.2	24.8	76°53.0	14.3
9	281°16.0	323°20.3	·· 14.1	301°45.0	·· 41.5	91°51.8	·· 24.7	91°55.6	·· 14.2
10	296°18.5	338°19.6	13.2	316°45.7	40.8	106°54.4	24.6	106°58.2	14.2
11	311°21.0	353°18.9	12.4	331°46.3	40.0	121°57.1	24.6	122°00.7	14.1
12	326°23.4	8°18.2	S17°11.5	346°46.9	S09°39.3	136°59.7	S02°24.5	137°03.3	S01°14.1
13	341°25.9	23°17.5	10.7	1°47.5	38.5	152°02.3	24.4	152°05.9	14.0
14	356°28.3	38°16.8	09.8	16°48.1	37.8	167°04.9	24.3	167°08.4	13.9
15	11°30.8	53°16.2	·· 08.9	31°48.7	·· 37.0	182°07.5	·· 24.2	182°11.0	·· 13.9
16	26°33.3	68°15.5	08.1	46°49.3	36.3	197°10.2	24.2	197°13.6	13.8
17	41°35.7	83°14.8	07.2	61°49.9	35.5	212°12.8	24.1	212°16.2	13.8
18	56°38.2	98°14.1	S17°06.4	76°50.6	S09°34.8	227°15.4	S02°24.0	227°18.7	S01°13.7
19	71°40.7	113°13.4	05.5	91°51.2	34.0	242°18.0	23.9	242°21.3	13.7
20	86°43.1	128°12.8	04.6	106°51.8	33.3	257°20.7	23.9	257°23.9	13.6
21	101°45.6	143°12.1	·· 03.8	121°52.4	·· 32.5	272°23.3	·· 23.8	272°26.4	·· 13.6
22	116°48.1	158°11.4	02.9	136°53.0	31.8	287°25.9	23.7	287°29.0	13.5
23	131°50.5	173°10.7	02.1	151°53.6	31.0	302°28.5	23.6	302°31.6	13.4
Mer.pass. 14:14		ν -0.7′	d 0.8′	m -3.90	ν 0.6′	d 0.7′	m 1.12	ν 2.6′	d 0.1′ m -2.34	ν 2.6′	d 0.1′ m 0.61

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	146°53.0	188°10.1	S17°01.2	166°54.2	S09°30.3	317°31.1	S02°23.5	317°34.2	S01°13.4
1	161°55.5	203°09.4	17°00.3	181°54.9	29.5	332°33.8	23.5	332°36.7	13.3
2	176°57.9	218°08.7	16°59.5	196°55.5	28.8	347°36.4	23.4	347°39.3	13.3
3	192°00.4	233°08.0	·· 58.6	211°56.1	·· 28.0	2°39.0	·· 23.3	2°41.9	·· 13.2
4	207°02.8	248°07.3	57.7	226°56.7	27.3	17°41.6	23.2	17°44.4	13.2
5	222°05.3	263°06.7	56.9	241°57.3	26.5	32°44.3	23.2	32°47.0	13.1
6	237°07.8	278°06.0	S16°56.0	256°57.9	S09°25.8	47°46.9	S02°23.1	47°49.6	S01°13.0
7	252°10.2	293°05.3	55.1	271°58.5	25.0	62°49.5	23.0	62°52.2	13.0
8	267°12.7	308°04.7	54.2	286°59.2	24.3	77°52.1	22.9	77°54.7	12.9
9	282°15.2	323°04.0	·· 53.4	301°59.8	·· 23.5	92°54.8	·· 22.8	92°57.3	·· 12.9
10	297°17.6	338°03.3	52.5	317°00.4	22.7	107°57.4	22.8	107°59.9	12.8
11	312°20.1	353°02.6	51.6	332°01.0	22.0	123°00.0	22.7	123°02.5	12.8
12	327°22.6	8°02.0	S16°50.7	347°01.6	S09°21.2	138°02.7	S02°22.6	138°05.0	S01°12.7
13	342°25.0	23°01.3	49.9	2°02.2	20.5	153°05.3	22.5	153°07.6	12.6
14	357°27.5	38°00.6	49.0	17°02.9	19.7	168°07.9	22.4	168°10.2	12.6
15	12°30.0	53°00.0	·· 48.1	32°03.5	·· 19.0	183°10.5	·· 22.4	183°12.8	·· 12.5
16	27°32.4	67°59.3	47.2	47°04.1	18.2	198°13.2	22.3	198°15.3	12.5
17	42°34.9	82°58.6	46.4	62°04.7	17.5	213°15.8	22.2	213°17.9	12.4
18	57°37.3	97°58.0	S16°45.5	77°05.3	S09°16.7	228°18.4	S02°22.1	228°20.5	S01°12.4
19	72°39.8	112°57.3	44.6	92°05.9	16.0	243°21.1	22.0	243°23.1	12.3
20	87°42.3	127°56.6	43.7	107°06.6	15.2	258°23.7	22.0	258°25.6	12.2
21	102°44.7	142°56.0	·· 42.8	122°07.2	·· 14.5	273°26.3	·· 21.9	273°28.2	·· 12.2
22	117°47.2	157°55.3	41.9	137°07.8	13.7	288°28.9	21.8	288°30.8	12.1
23	132°49.7	172°54.6	41.1	152°08.4	13.0	303°31.6	21.7	303°33.4	12.1
Mer.pass. 14:10		ν -0.7′	d 0.9′	m -3.90	ν 0.6′	d 0.8′	m 1.12	ν 2.6′	d 0.1′ m -2.35	ν 2.6′	d 0.1′ m 0.61

Stars

	SHA	**Dec**
Alpheratz	358°09.3	28°59.1
Ankaa	353°40.3	-42°24.8
Schedar	350°09.0	56°26.1
Diphda	349°20.8	-18°05.7
Achernar	335°45.4	-57°20.3
Hamal	328°28.7	23°22.3
Polaris	326°54.0	89°10.9
Acamar	315°37.1	-40°23.2
Menkar	314°40.9	4°00.8
Mirfak	309°15.7	49°47.8
Aldebaran	291°17.6	16°28.2
Rigel	281°35.6	-8°13.6
Capella	281°10.7	45°58.8
Bellatrix	278°58.3	6°19.8
Elnath	278°43.6	28°35.5
Alnilam	276°11.2	-1°13.0
Betelgeuse	271°27.8	7°24.1
Canopus	264°06.7	-52°41.4
Sirius	258°55.2	-16°41.6
Adhara	255°31.6	-28°57.0
Procyon	245°25.2	5°16.3
Pollux	243°57.5	28°04.3
Avior	234°27.5	-59°27.1
Suhail	223°10.1	-43°21.5
Miaplacidus	221°44.0	-69°38.4
Alphard	218°19.9	-8°34.7
Regulus	208°09.4	12°03.5
Dubhe	194°21.1	61°51.1
Denebola	182°58.5	14°40.6
Gienah	176°17.4	-17°26.2
Acrux	173°36.4	-62°59.4
Gacrux	172°27.9	-57°00.2
Alioth	166°41.9	56°03.6
Spica	158°57.0	-11°03.7
Alkaid	153°18.0	49°24.2
Hadar	149°22.6	-60°16.6
Menkent	148°36.5	-36°16.5
Arcturus	146°18.1	19°16.7
Rigil Kent.	140°25.2	-60°45.0
Kochab	137°18.8	74°13.7
Zuben'ubi	137°32.6	-15°57.7
Alphecca	126°31.8	26°46.5
Antares	112°56.6	-26°23.3
Atria	108°20.7	-68°59.3
Sabik	102°40.9	-15°42.1
Shaula	96°55.5	-37°05.3
Rasalhague	96°29.5	12°34.3
Eltanin	90°57.9	51°29.3
Kaus Aust.	84°16.7	-34°23.6
Vega	80°55.9	38°45.8
Nunki	76°29.1	-26°19.2
Altair	62°32.5	8°49.0
Peacock	53°58.5	-56°47.8
Deneb	49°48.7	45°12.6
Enif	34°11.6	9°47.2
Al Na'ir	28°15.0	-47°03.3
Fomalhaut	15°51.4	-29°43.6
Scheat	14°17.6	27°58.7
Markab	14°03.2	15°06.1

Feb 15 Sun	**SHA**	**Mer.pass**
Venus	43°48.4	11:26
Mars	21°30.2	12:54
Jupiter	170°30.8	02:58
Saturn	170°36.1	02:57

Feb 16 Mon	**SHA**	**Mer.pass**
Venus	42°32.6	11:27
Mars	20°45.7	12:53
Jupiter	170°34.4	02:54
Saturn	170°38.6	02:53

Feb 17 Tue	**SHA**	**Mer.pass**
Venus	41°17.1	11:28
Mars	20°01.3	12:52
Jupiter	170°38.2	02:49
Saturn	170°41.2	02:49

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°26.9	S12°46.6	46°15.8	7.2′	N20°20.3	0.5′	57.9′
1	191°26.9	45.8	60°42.0	7.2′	20°20.8	0.4′	57.9′
2	206°27.0	44.9	75°08.2	7.3′	20°21.2	0.3′	57.9′
3	221°27.0	·· 44.1	89°34.5	7.3′	20°21.5	0.1′	57.8′
4	236°27.0	43.2	104°00.8	7.3′	20°21.6	0.1′	57.8′
5	251°27.0	42.4	118°27.1	7.3′	20°21.7	0.1′	57.8′
6	266°27.1	S12°41.5	132°53.4	7.3′	N20°21.6	0.3′	57.8′
7	281°27.1	40.6	147°19.7	7.4′	20°21.3	0.3′	57.8′
8	296°27.1	39.8	161°46.1	7.4′	20°21.0	0.5′	57.8′
9	311°27.2	·· 38.9	176°12.5	7.4′	20°20.5	0.6′	57.7′
10	326°27.2	38.1	190°38.9	7.4′	20°19.9	0.7′	57.7′
11	341°27.2	37.2	205°05.3	7.5′	20°19.2	0.8′	57.7′
12	356°27.3	S12°36.3	219°31.7	7.5′	N20°18.4	1.0′	57.7′
13	11°27.3	35.5	233°58.2	7.5′	20°17.4	1.0′	57.7′
14	26°27.3	34.6	248°24.7	7.5′	20°16.4	1.2′	57.6′
15	41°27.4	·· 33.8	262°51.3	7.6′	20°15.2	1.4′	57.6′
16	56°27.4	32.9	277°17.8	7.6′	20°13.8	1.4′	57.6′
17	71°27.4	32.0	291°44.4	7.6′	20°12.4	1.6′	57.6′
18	86°27.5	S12°31.2	306°11.0	7.7′	N20°10.8	1.6′	57.6′
19	101°27.5	30.3	320°37.7	7.7′	20°09.2	1.8′	57.6′
20	116°27.5	29.4	335°04.4	7.7′	20°07.4	2.0′	57.5′
21	131°27.6	·· 28.6	349°31.1	7.8′	20°05.4	2.0′	57.5′
22	146°27.6	27.7	3°57.9	7.8′	20°03.4	2.2′	57.5′
23	161°27.6	26.9	18°24.7	7.8′	20°01.2	2.2′	57.5′
	SD = 16.2′	d = 0.9′	SD = 15.8′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°27.7	S12°26.0	32°51.5	7.9′	N19°59.0	2.4′	57.5′
1	191°27.7	25.1	47°18.4	7.9′	19°56.6	2.5′	57.4′
2	206°27.8	24.3	61°45.3	8.0′	19°54.1	2.7′	57.4′
3	221°27.8	·· 23.4	76°12.3	8.0′	19°51.4	2.7′	57.4′
4	236°27.8	22.5	90°39.3	8.0′	19°48.7	2.9′	57.4′
5	251°27.9	21.7	105°06.3	8.1′	19°45.8	2.9′	57.4′
6	266°27.9	S12°20.8	119°33.4	8.1′	N19°42.9	3.1′	57.3′
7	281°27.9	19.9	134°00.5	8.2′	19°39.8	3.2′	57.3′
8	296°28.0	19.1	148°27.7	8.2′	19°36.6	3.3′	57.3′
9	311°28.0	·· 18.2	162°54.9	8.3′	19°33.3	3.4′	57.3′
10	326°28.1	17.3	177°22.2	8.3′	19°29.9	3.6′	57.3′
11	341°28.1	16.5	191°49.5	8.4′	19°26.3	3.6′	57.2′
12	356°28.1	S12°15.6	206°16.8	8.4′	N19°22.7	3.8′	57.2′
13	11°28.2	14.7	220°44.2	8.5′	19°18.9	3.8′	57.2′
14	26°28.2	13.9	235°11.7	8.5′	19°15.1	4.0′	57.2′
15	41°28.3	·· 13.0	249°39.2	8.6′	19°11.1	4.1′	57.2′
16	56°28.3	12.1	264°06.8	8.6′	19°07.0	4.2′	57.1′
17	71°28.4	11.2	278°34.4	8.7′	19°02.8	4.3′	57.1′
18	86°28.4	S12°10.4	293°02.0	8.7′	N18°58.5	4.3′	57.1′
19	101°28.4	09.5	307°29.7	8.8′	18°54.2	4.6′	57.1′
20	116°28.5	08.6	321°57.5	8.8′	18°49.6	4.6′	57.1′
21	131°28.5	·· 07.8	336°25.3	8.9′	18°45.0	4.7′	57.0′
22	146°28.6	06.9	350°53.2	8.9′	18°40.3	4.8′	57.0′
23	161°28.6	06.0	5°21.1	9.0′	18°35.5	4.9′	57.0′
	SD = 16.2′	d = 0.9′	SD = 15.7′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°28.7	S12°05.1	19°49.1	9.0′	N18°30.6	5.0′	57.0′
1	191°28.7	04.3	34°17.1	9.1′	18°25.6	5.1′	57.0′
2	206°28.7	03.4	48°45.2	9.1′	18°20.5	5.2′	56.9′
3	221°28.8	·· 02.5	63°13.3	9.2′	18°15.3	5.4′	56.9′
4	236°28.8	01.7	77°41.5	9.3′	18°09.9	5.4′	56.9′
5	251°28.9	12°00.8	92°09.8	9.3′	18°04.5	5.5′	56.9′
6	266°28.9	S11°59.9	106°38.1	9.4′	N17°59.0	5.6′	56.9′
7	281°29.0	59.0	121°06.5	9.4′	17°53.4	5.7′	56.8′
8	296°29.0	58.2	135°35.0	9.5′	17°47.7	5.8′	56.8′
9	311°29.1	·· 57.3	150°03.5	9.6′	17°41.9	5.8′	56.8′
10	326°29.1	56.4	164°32.0	9.6′	17°36.1	6.0′	56.8′
11	341°29.2	55.5	179°00.6	9.7′	17°30.1	6.1′	56.8′
12	356°29.2	S11°54.7	193°29.3	9.7′	N17°24.0	6.2′	56.7′
13	11°29.3	53.8	207°58.0	9.8′	17°17.8	6.2′	56.7′
14	26°29.3	52.9	222°26.8	9.9′	17°11.6	6.3′	56.7′
15	41°29.3	·· 52.0	236°55.7	9.9′	17°05.3	6.5′	56.7′
16	56°29.4	51.1	251°24.6	10.0′	16°58.8	6.5′	56.7′
17	71°29.4	50.3	265°53.6	10.0′	16°52.3	6.6′	56.6′
18	86°29.5	S11°49.4	280°22.7	10.1′	N16°45.7	6.7′	56.6′
19	101°29.5	48.5	294°51.8	10.2′	16°39.0	6.7′	56.6′
20	116°29.6	47.6	309°20.9	10.2′	16°32.3	6.9′	56.6′
21	131°29.6	·· 46.8	323°50.2	10.3′	16°25.4	6.9′	56.6′
22	146°29.7	45.9	338°19.5	10.4′	16°18.5	7.0′	56.5′
23	161°29.7	45.0	352°48.8	10.4′	16°11.5	7.1′	56.5′
	SD = 16.2′	d = 0.9′	SD = 15.5′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	06:11	07:30	08:48	15:41	17:00	18:20
N 70°	06:09	07:21	08:29	16:00	17:09	18:21
68°	06:08	07:13	08:14	16:15	17:16	18:22
66°	06:07	07:07	08:02	16:27	17:23	18:23
64°	06:06	07:01	07:52	16:37	17:28	18:24
62°	06:05	06:56	07:43	16:46	17:33	18:25
60°	06:03	06:52	07:36	16:54	17:37	18:26
N 58°	06:02	06:48	07:29	17:00	17:41	18:27
56°	06:01	06:45	07:23	17:06	17:45	18:28
54°	06:00	06:41	07:18	17:11	17:48	18:29
52°	05:59	06:39	07:13	17:16	17:51	18:30
50°	05:58	06:36	07:09	17:20	17:53	18:31
45°	05:55	06:30	07:00	17:29	17:59	18:34
N 40°	05:53	06:24	06:52	17:37	18:05	18:36
35°	05:50	06:19	06:45	17:44	18:09	18:39
30°	05:47	06:15	06:39	17:49	18:14	18:42
20°	05:40	06:06	06:29	18:00	18:22	18:48
N 10°	05:33	05:58	06:20	18:09	18:30	18:55
0°	05:25	05:50	06:11	18:18	18:39	19:03
S 10°	05:15	05:40	06:02	18:26	18:48	19:13
20°	05:03	05:30	05:52	18:36	18:58	19:25
30°	04:47	05:16	05:41	18:47	19:11	19:41
35°	04:36	05:08	05:35	18:53	19:19	19:51
40°	04:24	04:59	05:27	19:00	19:29	20:03
45°	04:09	04:47	05:19	19:09	19:40	20:18
S 50°	03:49	04:33	05:08	19:19	19:54	20:38
52°	03:39	04:26	05:03	19:24	20:01	20:48
54°	03:28	04:18	04:58	19:29	20:08	20:59
56°	03:14	04:10	04:52	19:35	20:17	21:11
58°	02:59	04:00	04:45	19:42	20:26	21:27
S 60°	02:39	03:48	04:37	19:49	20:38	21:46

Lat.	**Moonrise** Sun	Mon	Tue	**Moonset** Sun	Mon	Tue
N 72°	▭	▭	12:15	▭	▭	10:05
N 70°	▭	11:17	13:17	▭	09:11	09:02
68°	10:57	12:17	13:52	07:35	08:11	08:26
66°	11:39	12:51	14:17	06:54	07:36	08:00
64°	12:07	13:16	14:36	06:26	07:11	07:40
62°	12:28	13:35	14:52	06:04	06:51	07:24
60°	12:46	13:51	15:05	05:46	06:35	07:11
N 58°	13:00	14:05	15:16	05:32	06:21	06:59
56°	13:13	14:16	15:26	05:19	06:09	06:49
54°	13:24	14:26	15:35	05:08	05:59	06:40
52°	13:33	14:36	15:42	04:59	05:50	06:32
50°	13:42	14:44	15:49	04:50	05:41	06:24
45°	14:01	15:01	16:04	04:31	05:24	06:09
N 40°	14:15	15:15	16:16	04:16	05:09	05:56
35°	14:28	15:27	16:27	04:04	04:57	05:45
30°	14:39	15:37	16:36	03:52	04:46	05:35
20°	14:58	15:55	16:51	03:33	04:28	05:19
N 10°	15:15	16:10	17:05	03:17	04:12	05:04
0°	15:30	16:25	17:18	03:01	03:57	04:50
S 10°	15:46	16:39	17:30	02:46	03:42	04:37
20°	16:02	16:55	17:44	02:29	03:25	04:22
30°	16:21	17:13	17:59	02:10	03:07	04:05
35°	16:33	17:23	18:08	01:58	02:56	03:55
40°	16:45	17:35	18:18	01:46	02:43	03:44
45°	17:00	17:49	18:30	01:30	02:28	03:31
S 50°	17:19	18:06	18:45	01:12	02:10	03:14
52°	17:27	18:14	18:51	01:03	02:02	03:07
54°	17:37	18:22	18:59	00:53	01:52	02:58
56°	17:48	18:32	19:07	00:42	01:41	02:48
58°	18:01	18:44	19:16	00:29	01:29	02:37
S 60°	18:15	18:57	19:27	00:14	01:14	02:25

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 11-13 83-96%
15	14:12	14:11	12:14	21:44	09:16	
16	14:09	14:07	12:14	22:38	10:11	
17	14:05	14:03	12:14	23:30	11:04	

February 18, 19, 20 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	147°52.1	187°54.0	S16°40.2	167°09.0	S09°12.2	318°34.2	S02°21.6	318°35.9	S01°12.0
1	162°54.6	202°53.3	39.3	182°09.6	11.5	333°36.8	21.6	333°38.5	12.0
2	177°57.1	217°52.6	38.4	197°10.3	10.7	348°39.5	21.5	348°41.1	11.9
3	192°59.5	232°52.0	·· 37.5	212°10.9	·· 09.9	3°42.1	·· 21.4	3°43.7	·· 11.8
4	208°02.0	247°51.3	36.6	227°11.5	09.2	18°44.7	21.3	18°46.2	11.8
5	223°04.4	262°50.6	35.7	242°12.1	08.4	33°47.4	21.2	33°48.8	11.7
6	238°06.9	277°50.0	S16°34.9	257°12.7	S09°07.7	48°50.0	S02°21.1	48°51.4	S01°11.7
7	253°09.4	292°49.3	34.0	272°13.4	06.9	63°52.6	21.1	63°54.0	11.6
8	268°11.8	307°48.7	33.1	287°14.0	06.2	78°55.3	21.0	78°56.6	11.5
9	283°14.3	322°48.0	·· 32.2	302°14.6	·· 05.4	93°57.9	·· 20.9	93°59.1	·· 11.5
10	298°16.8	337°47.3	31.3	317°15.2	04.7	109°00.5	20.8	109°01.7	11.4
11	313°19.2	352°46.7	30.4	332°15.8	03.9	124°03.2	20.7	124°04.3	11.4
12	328°21.7	7°46.0	S16°29.5	347°16.4	S09°03.1	139°05.8	S02°20.7	139°06.9	S01°11.3
13	343°24.2	22°45.4	28.6	2°17.1	02.4	154°08.4	20.6	154°09.4	11.3
14	358°26.6	37°44.7	27.7	17°17.7	01.6	169°11.1	20.5	169°12.0	11.2
15	13°29.1	52°44.0	·· 26.8	32°18.3	·· 00.9	184°13.7	·· 20.4	184°14.6	·· 11.1
16	28°31.6	67°43.4	25.9	47°18.9	09°00.1	199°16.3	20.3	199°17.2	11.1
17	43°34.0	82°42.7	25.0	62°19.5	08°59.4	214°19.0	20.2	214°19.8	11.0
18	58°36.5	97°42.1	S16°24.1	77°20.2	S08°58.6	229°21.6	S02°20.2	229°22.3	S01°11.0
19	73°38.9	112°41.4	23.2	92°20.8	57.9	244°24.2	20.1	244°24.9	10.9
20	88°41.4	127°40.8	22.3	107°21.4	57.1	259°26.9	20.0	259°27.5	10.8
21	103°43.9	142°40.1	·· 21.4	122°22.0	·· 56.3	274°29.5	·· 19.9	274°30.1	·· 10.8
22	118°46.3	157°39.5	20.5	137°22.7	55.6	289°32.1	19.8	289°32.7	10.7
23	133°48.8	172°38.8	19.6	152°23.3	54.8	304°34.8	19.7	304°35.2	10.7
Mer.pass. 14:06		ν -0.7′	d 0.9′	m -3.89	ν 0.6′	d 0.8′	m 1.12	ν 2.6′	d 0.1′ m -2.35	ν 2.6′	d 0.1′ m 0.60

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	148°51.3	187°38.2	S16°18.7	167°23.9	S08°54.1	319°37.4	S02°19.7	319°37.8	S01°10.6
1	163°53.7	202°37.5	17.8	182°24.5	53.3	334°40.0	19.6	334°40.4	10.5
2	178°56.2	217°36.8	16.9	197°25.1	52.6	349°42.7	19.5	349°43.0	10.5
3	193°58.7	232°36.2	·· 16.0	212°25.8	·· 51.8	4°45.3	·· 19.4	4°45.5	·· 10.4
4	209°01.1	247°35.5	15.1	227°26.4	51.0	19°48.0	19.3	19°48.1	10.4
5	224°03.6	262°34.9	14.2	242°27.0	50.3	34°50.6	19.2	34°50.7	10.3
6	239°06.1	277°34.2	S16°13.3	257°27.6	S08°49.5	49°53.2	S02°19.2	49°53.3	S01°10.3
7	254°08.5	292°33.6	12.4	272°28.2	48.8	64°55.9	19.1	64°55.9	10.2
8	269°11.0	307°32.9	11.4	287°28.9	48.0	79°58.5	19.0	79°58.4	10.1
9	284°13.4	322°32.3	·· 10.5	302°29.5	·· 47.3	95°01.1	·· 18.9	95°01.0	·· 10.1
10	299°15.9	337°31.7	09.6	317°30.1	46.5	110°03.8	18.8	110°03.6	10.0
11	314°18.4	352°31.0	08.7	332°30.7	45.7	125°06.4	18.7	125°06.2	10.0
12	329°20.8	7°30.4	S16°07.8	347°31.4	S08°45.0	140°09.1	S02°18.6	140°08.8	S01°09.9
13	344°23.3	22°29.7	06.9	2°32.0	44.2	155°11.7	18.6	155°11.4	09.8
14	359°25.8	37°29.1	06.0	17°32.6	43.5	170°14.3	18.5	170°13.9	09.8
15	14°28.2	52°28.4	·· 05.0	32°33.2	·· 42.7	185°17.0	·· 18.4	185°16.5	·· 09.7
16	29°30.7	67°27.8	04.1	47°33.9	41.9	200°19.6	18.3	200°19.1	09.7
17	44°33.2	82°27.1	03.2	62°34.5	41.2	215°22.3	18.2	215°21.7	09.6
18	59°35.6	97°26.5	S16°02.3	77°35.1	S08°40.4	230°24.9	S02°18.1	230°24.3	S01°09.5
19	74°38.1	112°25.8	01.4	92°35.7	39.7	245°27.5	18.1	245°26.8	09.5
20	89°40.5	127°25.2	16°00.5	107°36.4	38.9	260°30.2	18.0	260°29.4	09.4
21	104°43.0	142°24.6	15°59.5	122°37.0	·· 38.1	275°32.8	·· 17.9	275°32.0	·· 09.4
22	119°45.5	157°23.9	58.6	137°37.6	37.4	290°35.5	17.8	290°34.6	09.3
23	134°47.9	172°23.3	57.7	152°38.2	36.6	305°38.1	17.7	305°37.2	09.2
Mer.pass. 14:02		ν -0.7′	d 0.9′	m -3.89	ν 0.6′	d 0.8′	m 1.12	ν 2.6′	d 0.1′ m -2.36	ν 2.6′	d 0.1′ m 0.60

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	149°50.4	187°22.6	S15°56.8	167°38.9	S08°35.9	320°40.8	S02°17.6	320°39.8	S01°09.2
1	164°52.9	202°22.0	55.8	182°39.5	35.1	335°43.4	17.5	335°42.3	09.1
2	179°55.3	217°21.4	54.9	197°40.1	34.3	350°46.0	17.5	350°44.9	09.1
3	194°57.8	232°20.7	·· 54.0	212°40.7	·· 33.6	5°48.7	·· 17.4	5°47.5	·· 09.0
4	210°00.3	247°20.1	53.1	227°41.4	32.8	20°51.3	17.3	20°50.1	08.9
5	225°02.7	262°19.4	52.1	242°42.0	32.1	35°54.0	17.2	35°52.7	08.9
6	240°05.2	277°18.8	S15°51.2	257°42.6	S08°31.3	50°56.6	S02°17.1	50°55.2	S01°08.8
7	255°07.7	292°18.2	50.3	272°43.2	30.5	65°59.3	17.0	65°57.8	08.7
8	270°10.1	307°17.5	49.4	287°43.9	29.8	81°01.9	16.9	81°00.4	08.7
9	285°12.6	322°16.9	·· 48.4	302°44.5	·· 29.0	96°04.6	·· 16.8	96°03.0	·· 08.6
10	300°15.0	337°16.3	47.5	317°45.1	28.2	111°07.2	16.8	111°05.6	08.6
11	315°17.5	352°15.6	46.6	332°45.7	27.5	126°09.8	16.7	126°08.2	08.5
12	330°20.0	7°15.0	S15°45.6	347°46.4	S08°26.7	141°12.5	S02°16.6	141°10.7	S01°08.4
13	345°22.4	22°14.4	44.7	2°47.0	26.0	156°15.1	16.5	156°13.3	08.4
14	0°24.9	37°13.7	43.8	17°47.6	25.2	171°17.8	16.4	171°15.9	08.3
15	15°27.4	52°13.1	·· 42.8	32°48.2	·· 24.4	186°20.4	·· 16.3	186°18.5	·· 08.3
16	30°29.8	67°12.5	41.9	47°48.9	23.7	201°23.1	16.2	201°21.1	08.2
17	45°32.3	82°11.8	41.0	62°49.5	22.9	216°25.7	16.1	216°23.7	08.1
18	60°34.8	97°11.2	S15°40.0	77°50.1	S08°22.2	231°28.4	S02°16.1	231°26.3	S01°08.1
19	75°37.2	112°10.6	39.1	92°50.8	21.4	246°31.0	16.0	246°28.8	08.0
20	90°39.7	127°09.9	38.1	107°51.4	20.6	261°33.7	15.9	261°31.4	08.0
21	105°42.1	142°09.3	·· 37.2	122°52.0	·· 19.9	276°36.3	·· 15.8	276°34.0	·· 07.9
22	120°44.6	157°08.7	36.3	137°52.6	19.1	291°39.0	15.7	291°36.6	07.8
23	135°47.1	172°08.0	35.3	152°53.3	18.3	306°41.6	15.6	306°39.2	07.8
Mer.pass. 13:58		ν -0.6′	d 0.9′	m -3.89	ν 0.6′	d 0.8′	m 1.12	ν 2.6′	d 0.1′ m -2.36	ν 2.6′	d 0.1′ m 0.60

Stars

	SHA	Dec
Alpheratz	358°09.3	28°59.1
Ankaa	353°40.3	-42°24.8
Schedar	350°09.1	56°26.1
Diphda	349°20.8	-18°05.7
Achernar	335°45.4	-57°20.3
Hamal	328°28.7	23°22.3
Polaris	326°55.2	89°10.9
Acamar	315°37.1	-40°23.2
Menkar	314°40.9	4°00.8
Mirfak	309°15.7	49°47.8
Aldebaran	291°17.6	16°28.2
Rigel	281°35.6	-8°13.6
Capella	281°10.7	45°58.8
Bellatrix	278°58.3	6°19.8
Elnath	278°43.6	28°35.5
Alnilam	276°11.2	-1°13.0
Betelgeuse	271°27.8	7°24.1
Canopus	264°06.7	-52°41.5
Sirius	258°55.2	-16°41.6
Adhara	255°31.6	-28°57.0
Procyon	245°25.2	5°16.3
Pollux	243°57.5	28°04.3
Avior	234°27.5	-59°27.1
Suhail	223°10.1	-43°21.5
Miaplacidus	221°44.0	-69°38.5
Alphard	218°19.9	-8°34.7
Regulus	208°09.3	12°03.5
Dubhe	194°21.1	61°51.1
Denebola	182°58.4	14°40.6
Gienah	176°17.4	-17°26.2
Acrux	173°36.4	-62°59.5
Gacrux	172°27.9	-57°00.3
Alioth	166°41.8	56°03.6
Spica	158°57.0	-11°03.8
Alkaid	153°18.0	49°24.2
Hadar	149°22.6	-60°16.7
Menkent	148°36.5	-36°16.5
Arcturus	146°18.0	19°16.7
Rigil Kent.	140°25.1	-60°45.0
Kochab	137°18.7	74°13.7
Zuben'ubi	137°32.6	-15°57.8
Alphecca	126°31.8	26°46.5
Antares	112°56.5	-26°23.3
Atria	108°20.7	-68°59.3
Sabik	102°40.9	-15°42.1
Shaula	96°55.5	-37°05.3
Rasalhague	96°29.4	12°34.3
Eltanin	90°57.8	51°29.2
Kaus Aust.	84°16.7	-34°23.6
Vega	80°55.9	38°45.8
Nunki	76°29.0	-26°19.2
Altair	62°32.5	8°49.0
Peacock	53°58.5	-56°47.7
Deneb	49°48.7	45°12.6
Enif	34°11.6	9°47.1
Al Na'ir	28°15.0	-47°03.3
Fomalhaut	15°51.4	-29°43.5
Scheat	14°17.6	27°58.7
Markab	14°03.2	15°06.1

Feb 18 Wed	SHA	Mer.pass
Venus	40°01.8	11:29
Mars	19°16.9	12:51
Jupiter	170°42.1	02:45
Saturn	170°43.8	02:45

Feb 19 Thu	SHA	Mer.pass
Venus	38°46.9	11:30
Mars	18°32.6	12:50
Jupiter	170°46.1	02:41
Saturn	170°46.5	02:41

Feb 20 Fri	SHA	Mer.pass
Venus	37°32.2	11:31
Mars	17°48.4	12:49
Jupiter	170°50.4	02:37
Saturn	170°49.3	02:37

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h — Sun — Moon

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	176°29.8	S11°44.1	7°18.3	10.5′	N16°04.4	7.2′	56.5′
1	191°29.8	43.2	21°47.8	10.6′	15°57.2	7.2′	56.5′
2	206°29.9	42.4	36°17.3	10.6′	15°50.0	7.4′	56.4′
3	221°30.0	·· 41.5	50°46.9	10.7′	15°42.6	7.4′	56.4′
4	236°30.0	40.6	65°16.6	10.7′	15°35.2	7.5′	56.4′
5	251°30.1	39.7	79°46.3	10.8′	15°27.7	7.5′	56.4′
6	266°30.1	S11°38.8	94°16.1	10.9′	N15°20.2	7.6′	56.4′
7	281°30.2	37.9	108°46.0	10.9′	15°12.6	7.7′	56.3′
8	296°30.2	37.1	123°15.9	11.0′	15°04.9	7.8′	56.3′
9	311°30.3	·· 36.2	137°45.9	11.1′	14°57.1	7.9′	56.3′
10	326°30.3	35.3	152°16.0	11.1′	14°49.2	7.9′	56.3′
11	341°30.4	34.4	166°46.1	11.2′	14°41.3	8.0′	56.3′
12	356°30.4	S11°33.5	181°16.3	11.2′	N14°33.3	8.0′	56.2′
13	11°30.5	32.6	195°46.5	11.3′	14°25.3	8.1′	56.2′
14	26°30.5	31.8	210°16.8	11.4′	14°17.2	8.2′	56.2′
15	41°30.6	·· 30.9	224°47.2	11.4′	14°09.0	8.3′	56.2′
16	56°30.7	30.0	239°17.7	11.5′	14°00.7	8.3′	56.2′
17	71°30.7	29.1	253°48.2	11.6′	13°52.4	8.3′	56.1′
18	86°30.8	S11°28.2	268°18.7	11.6′	N13°44.1	8.5′	56.1′
19	101°30.8	27.3	282°49.3	11.7′	13°35.6	8.5′	56.1′
20	116°30.9	26.4	297°20.0	11.7′	13°27.1	8.5′	56.1′
21	131°30.9	·· 25.6	311°50.8	11.8′	13°18.6	8.7′	56.0′
22	146°31.0	24.7	326°21.6	11.9′	13°09.9	8.6′	56.0′
23	161°31.1	23.8	340°52.4	11.9′	13°01.3	8.8′	56.0′
	SD = 16.2′	d = 0.9′		SD = 15.4′			

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	176°31.1	S11°22.9	355°23.4	12.0′	N12°52.5	8.8′	56.0′
1	191°31.2	22.0	9°54.4	12.1′	12°43.7	8.8′	56.0′
2	206°31.2	21.1	24°25.4	12.1′	12°34.9	8.9′	55.9′
3	221°31.3	·· 20.2	38°56.5	12.2′	12°26.0	9.0′	55.9′
4	236°31.4	19.3	53°27.7	12.2′	12°17.0	9.0′	55.9′
5	251°31.4	18.5	67°58.9	12.3′	12°08.0	9.0′	55.9′
6	266°31.5	S11°17.6	82°30.2	12.3′	N11°59.0	9.1′	55.9′
7	281°31.5	16.7	97°01.6	12.4′	11°49.9	9.2′	55.8′
8	296°31.6	15.8	111°33.0	12.5′	11°40.7	9.2′	55.8′
9	311°31.7	·· 14.9	126°04.4	12.5′	11°31.5	9.2′	55.8′
10	326°31.7	14.0	140°36.0	12.6′	11°22.3	9.3′	55.8′
11	341°31.8	13.1	155°07.5	12.6′	11°13.0	9.4′	55.7′
12	356°31.8	S11°12.2	169°39.2	12.7′	N11°03.6	9.4′	55.7′
13	11°31.9	11.3	184°10.9	12.8′	10°54.2	9.4′	55.7′
14	26°32.0	10.4	198°42.6	12.8′	10°44.8	9.5′	55.7′
15	41°32.0	·· 09.5	213°14.4	12.9′	10°35.3	9.5′	55.7′
16	56°32.1	08.7	227°46.3	12.9′	10°25.8	9.5′	55.6′
17	71°32.2	07.8	242°18.2	13.0′	10°16.3	9.6′	55.6′
18	86°32.2	S11°06.9	256°50.2	13.0′	N10°06.7	9.7′	55.6′
19	101°32.3	06.0	271°22.2	13.1′	09°57.0	9.7′	55.6′
20	116°32.3	05.1	285°54.3	13.1′	09°47.3	9.7′	55.6′
21	131°32.4	·· 04.2	300°26.4	13.2′	09°37.6	9.7′	55.5′
22	146°32.5	03.3	314°58.6	13.2′	09°27.9	9.8′	55.5′
23	161°32.5	02.4	329°30.8	13.3′	09°18.1	9.8′	55.5′
	SD = 16.2′	d = 0.9′		SD = 15.3′			

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	176°32.6	S11°01.5	344°03.1	13.3′	N09°08.3	9.9′	55.5′
1	191°32.7	11°00.6	358°35.5	13.4′	08°58.4	9.9′	55.5′
2	206°32.7	10°59.7	13°07.9	13.4′	08°48.5	9.9′	55.4′
3	221°32.8	·· 58.8	27°40.3	13.5′	08°38.6	10.0′	55.4′
4	236°32.9	57.9	42°12.8	13.5′	08°28.6	9.9′	55.4′
5	251°32.9	57.0	56°45.3	13.6′	08°18.7	10.1′	55.4′
6	266°33.0	S10°56.1	71°17.9	13.6′	N08°08.6	10.0′	55.4′
7	281°33.1	55.2	85°50.5	13.7′	07°58.6	10.1′	55.3′
8	296°33.1	54.3	100°23.2	13.7′	07°48.5	10.1′	55.3′
9	311°33.2	·· 53.4	114°56.0	13.8′	07°38.4	10.1′	55.3′
10	326°33.3	52.5	129°28.7	13.8′	07°28.3	10.1′	55.3′
11	341°33.3	51.6	144°01.5	13.9′	07°18.2	10.2′	55.3′
12	356°33.4	S10°50.7	158°34.4	13.9′	N07°08.0	10.2′	55.2′
13	11°33.5	49.8	173°07.3	14.0′	06°57.8	10.2′	55.2′
14	26°33.5	48.9	187°40.3	14.0′	06°47.6	10.3′	55.2′
15	41°33.6	·· 48.0	202°13.3	14.0′	06°37.3	10.2′	55.2′
16	56°33.7	47.1	216°46.3	14.1′	06°27.1	10.3′	55.2′
17	71°33.8	46.2	231°19.4	14.1′	06°16.8	10.3′	55.1′
18	86°33.8	S10°45.3	245°52.5	14.2′	N06°06.5	10.4′	55.1′
19	101°33.9	44.4	260°25.7	14.2′	05°56.1	10.3′	55.1′
20	116°34.0	43.5	274°58.9	14.2′	05°45.8	10.4′	55.1′
21	131°34.0	·· 42.6	289°32.1	14.3′	05°35.4	10.3′	55.1′
22	146°34.1	41.7	304°05.4	14.3′	05°25.1	10.4′	55.1′
23	161°34.2	40.8	318°38.7	14.4′	05°14.7	10.4′	55.0′
	SD = 16.2′	d = 0.9′		SD = 15.1′			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	05:58	07:16	08:31	15:58	17:13	18:33
N 70°	05:58	07:09	08:15	16:14	17:21	18:32
68°	05:57	07:02	08:02	16:27	17:27	18:32
66°	05:57	06:57	07:51	16:38	17:32	18:32
64°	05:57	06:52	07:42	16:47	17:37	18:32
62°	05:56	06:48	07:34	16:55	17:41	18:33
60°	05:56	06:44	07:27	17:01	17:45	18:33
N 58°	05:55	06:41	07:22	17:07	17:48	18:33
56°	05:55	06:38	07:16	17:12	17:51	18:34
54°	05:54	06:35	07:12	17:17	17:53	18:35
52°	05:54	06:33	07:07	17:21	17:56	18:35
50°	05:53	06:30	07:03	17:25	17:58	18:36
45°	05:51	06:25	06:55	17:33	18:03	18:38
N 40°	05:49	06:20	06:48	17:40	18:08	18:40
35°	05:47	06:16	06:42	17:46	18:12	18:42
30°	05:44	06:12	06:36	17:52	18:16	18:44
20°	05:39	06:05	06:27	18:01	18:23	18:49
N 10°	05:32	05:57	06:19	18:09	18:31	18:55
0°	05:25	05:49	06:11	18:17	18:38	19:03
S 10°	05:16	05:41	06:02	18:25	18:47	19:12
20°	05:04	05:31	05:54	18:34	18:56	19:23
30°	04:49	05:19	05:43	18:44	19:08	19:38
35°	04:40	05:11	05:38	18:50	19:16	19:47
40°	04:28	05:02	05:31	18:56	19:25	19:58
45°	04:14	04:52	05:23	19:04	19:35	20:13
S 50°	03:55	04:39	05:13	19:13	19:48	20:31
52°	03:46	04:32	05:09	19:18	19:54	20:40
54°	03:36	04:25	05:04	19:22	20:01	20:50
56°	03:24	04:17	04:59	19:28	20:09	21:02
58°	03:09	04:08	04:52	19:34	20:18	21:16
S 60°	02:52	03:58	04:46	19:40	20:28	21:32

Lat.	Moonrise Wed	Moonrise Thu	Moonrise Fri	Moonset Wed	Moonset Thu	Moonset Fri
N 72°	14:38	16:35	18:22	09:27	09:09	08:56
N 70°	15:08	16:52	18:31	08:56	08:50	08:46
68°	15:30	17:06	18:38	08:33	08:36	08:37
66°	15:47	17:17	18:44	08:15	08:23	08:29
64°	16:01	17:26	18:49	08:00	08:13	08:23
62°	16:13	17:34	18:54	07:47	08:04	08:17
60°	16:23	17:41	18:57	07:37	07:57	08:13
N 58°	16:31	17:47	19:01	07:28	07:50	08:08
56°	16:39	17:52	19:04	07:19	07:44	08:05
54°	16:45	17:56	19:06	07:12	07:39	08:01
52°	16:51	18:01	19:09	07:06	07:34	07:58
50°	16:57	18:04	19:11	07:00	07:30	07:55
45°	17:09	18:13	19:16	06:47	07:20	07:49
N 40°	17:18	18:20	19:20	06:36	07:12	07:44
35°	17:27	18:25	19:23	06:27	07:05	07:40
30°	17:34	18:31	19:26	06:19	06:59	07:36
20°	17:46	18:40	19:31	06:05	06:49	07:29
N 10°	17:57	18:47	19:36	05:53	06:39	07:22
0°	18:07	18:55	19:40	05:42	06:30	07:17
S 10°	18:18	19:02	19:44	05:30	06:22	07:11
20°	18:28	19:10	19:49	05:18	06:12	07:05
30°	18:41	19:19	19:54	05:04	06:01	06:57
35°	18:48	19:24	19:57	04:55	05:55	06:53
40°	18:56	19:30	20:00	04:46	05:48	06:49
45°	19:05	19:36	20:04	04:35	05:39	06:43
S 50°	19:17	19:44	20:08	04:21	05:29	06:36
52°	19:22	19:48	20:11	04:15	05:25	06:33
54°	19:28	19:52	20:13	04:08	05:19	06:30
56°	19:34	19:56	20:15	04:00	05:14	06:26
58°	19:41	20:01	20:18	03:51	05:07	06:22
S 60°	19:49	20:07	20:21	03:41	05:00	06:17

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Age 14-16 99-99%
18	14:01	13:58	12:14	–:–	11:55	
19	13:56	13:53	12:14	00:19	12:43	
20	13:50	13:46	12:14	01:06	13:28	

February 21, 22, 23 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	150°49.5	187°07.4	S15°34.4	167°53.9	S08°17.6	321°44.3	S02°15.5	321°41.8	S01°07.7
1	165°52.0	202°06.8	33.4	182°54.5	16.8	336°46.9	15.4	336°44.4	07.7
2	180°54.5	217°06.2	32.5	197°55.1	16.0	351°49.6	15.4	351°46.9	07.6
3	195°56.9	232°05.5	·· 31.6	212°55.8	·· 15.3	6°52.2	·· 15.3	6°49.5	·· 07.5
4	210°59.4	247°04.9	30.6	227°56.4	14.5	21°54.9	15.2	21°52.1	07.5
5	226°01.9	262°04.3	29.7	242°57.0	13.8	36°57.5	15.1	36°54.7	07.4
6	241°04.3	277°03.7	S15°28.7	257°57.7	S08°13.0	52°00.2	S02°15.0	51°57.3	S01°07.3
7	256°06.8	292°03.0	27.8	272°58.3	12.2	67°02.8	14.9	66°59.9	07.3
8	271°09.3	307°02.4	26.8	287°58.9	11.5	82°05.5	14.8	82°02.5	07.2
9	286°11.7	322°01.8	·· 25.9	302°59.6	·· 10.7	97°08.1	·· 14.7	97°05.0	·· 07.2
10	301°14.2	337°01.2	24.9	318°00.2	09.9	112°10.8	14.6	112°07.6	07.1
11	316°16.6	352°00.5	24.0	333°00.8	09.2	127°13.4	14.6	127°10.2	07.0
12	331°19.1	6°59.9	S15°23.0	348°01.4	S08°08.4	142°16.1	S02°14.5	142°12.8	S01°07.0
13	346°21.6	21°59.3	22.1	3°02.1	07.6	157°18.7	14.4	157°15.4	06.9
14	1°24.0	36°58.7	21.1	18°02.7	06.9	172°21.4	14.3	172°18.0	06.8
15	16°26.5	51°58.1	·· 20.2	33°03.3	·· 06.1	187°24.0	·· 14.2	187°20.6	·· 06.8
16	31°29.0	66°57.4	19.2	48°04.0	05.3	202°26.7	14.1	202°23.2	06.7
17	46°31.4	81°56.8	18.3	63°04.6	04.6	217°29.3	14.0	217°25.7	06.7
18	61°33.9	96°56.2	S15°17.3	78°05.2	S08°03.8	232°32.0	S02°13.9	232°28.3	S01°06.6
19	76°36.4	111°55.6	16.4	93°05.9	03.0	247°34.6	13.8	247°30.9	06.5
20	91°38.8	126°55.0	15.4	108°06.5	02.3	262°37.3	13.7	262°33.5	06.5
21	106°41.3	141°54.3	·· 14.5	123°07.1	·· 01.5	277°39.9	·· 13.7	277°36.1	·· 06.4
22	121°43.7	156°53.7	13.5	138°07.7	00.8	292°42.6	13.6	292°38.7	06.3
23	136°46.2	171°53.1	12.5	153°08.4	00.0	307°45.2	13.5	307°41.3	06.3
Mer.pass. 13:54		ν -0.6′	d 0.9′	m -3.89	ν 0.6′	d 0.8′	m 1.12	ν 2.6′	d 0.1′ m -2.37	ν 2.6′	d 0.1′ m 0.59

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	151°48.7	186°52.5	S15°11.6	168°09.0	S07°59.2	322°47.9	S02°13.4	322°43.9	S01°06.2
1	166°51.1	201°51.9	10.6	183°09.6	58.5	337°50.6	13.3	337°46.4	06.2
2	181°53.6	216°51.3	09.7	198°10.3	57.7	352°53.2	13.2	352°49.0	06.1
3	196°56.1	231°50.6	·· 08.7	213°10.9	·· 56.9	7°55.9	·· 13.1	7°51.6	·· 06.0
4	211°58.5	246°50.0	07.7	228°11.5	56.2	22°58.5	13.0	22°54.2	06.0
5	227°01.0	261°49.4	06.8	243°12.2	55.4	38°01.2	12.9	37°56.8	05.9
6	242°03.5	276°48.8	S15°05.8	258°12.8	S07°54.6	53°03.8	S02°12.8	52°59.4	S01°05.8
7	257°05.9	291°48.2	04.8	273°13.4	53.9	68°06.5	12.7	68°02.0	05.8
8	272°08.4	306°47.6	03.9	288°14.1	53.1	83°09.1	12.6	83°04.6	05.7
9	287°10.9	321°47.0	·· 02.9	303°14.7	·· 52.3	98°11.8	·· 12.6	98°07.2	·· 05.7
10	302°13.3	336°46.3	01.9	318°15.3	51.6	113°14.5	12.5	113°09.7	05.6
11	317°15.8	351°45.7	01.0	333°16.0	50.8	128°17.1	12.4	128°12.3	05.5
12	332°18.2	6°45.1	S15°00.0	348°16.6	S07°50.0	143°19.8	S02°12.3	143°14.9	S01°05.5
13	347°20.7	21°44.5	14°59.0	3°17.2	49.2	158°22.4	12.2	158°17.5	05.4
14	2°23.2	36°43.9	58.1	18°17.9	48.5	173°25.1	12.1	173°20.1	05.3
15	17°25.6	51°43.3	·· 57.1	33°18.5	·· 47.7	188°27.7	·· 12.0	188°22.7	·· 05.3
16	32°28.1	66°42.7	56.1	48°19.1	46.9	203°30.4	11.9	203°25.3	05.2
17	47°30.6	81°42.1	55.2	63°19.8	46.2	218°33.1	11.8	218°27.9	05.2
18	62°33.0	96°41.5	S14°54.2	78°20.4	S07°45.4	233°35.7	S02°11.7	233°30.5	S01°05.1
19	77°35.5	111°40.9	53.2	93°21.0	44.6	248°38.4	11.6	248°33.1	05.0
20	92°38.0	126°40.3	52.2	108°21.7	43.9	263°41.0	11.5	263°35.7	05.0
21	107°40.4	141°39.7	·· 51.3	123°22.3	·· 43.1	278°43.7	·· 11.5	278°38.2	·· 04.9
22	122°42.9	156°39.0	50.3	138°22.9	42.3	293°46.4	11.4	293°40.8	04.8
23	137°45.4	171°38.4	49.3	153°23.6	41.6	308°49.0	11.3	308°43.4	04.8
Mer.pass. 13:50		ν -0.6′	d 1.0′	m -3.89	ν 0.6′	d 0.8′	m 1.11	ν 2.7′	d 0.1′ m -2.38	ν 2.6′	d 0.1′ m 0.59

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	152°47.8	186°37.8	S14°48.3	168°24.2	S07°40.8	323°51.7	S02°11.2	323°46.0	S01°04.7
1	167°50.3	201°37.2	47.4	183°24.8	40.0	338°54.3	11.1	338°48.6	04.6
2	182°52.7	216°36.6	46.4	198°25.5	39.3	353°57.0	11.0	353°51.2	04.6
3	197°55.2	231°36.0	·· 45.4	213°26.1	·· 38.5	8°59.7	·· 10.9	8°53.8	·· 04.5
4	212°57.7	246°35.4	44.4	228°26.8	37.7	24°02.3	10.8	23°56.4	04.5
5	228°00.1	261°34.8	43.5	243°27.4	37.0	39°05.0	10.7	38°59.0	04.4
6	243°02.6	276°34.2	S14°42.5	258°28.0	S07°36.2	54°07.7	S02°10.6	54°01.6	S01°04.3
7	258°05.1	291°33.6	41.5	273°28.7	35.4	69°10.3	10.5	69°04.2	04.3
8	273°07.5	306°33.0	40.5	288°29.3	34.6	84°13.0	10.4	84°06.8	04.2
9	288°10.0	321°32.4	·· 39.5	303°29.9	·· 33.9	99°15.6	·· 10.3	99°09.3	·· 04.1
10	303°12.5	336°31.8	38.5	318°30.6	33.1	114°18.3	10.2	114°11.9	04.1
11	318°14.9	351°31.2	37.6	333°31.2	32.3	129°21.0	10.1	129°14.5	04.0
12	333°17.4	6°30.6	S14°36.6	348°31.8	S07°31.6	144°23.6	S02°10.0	144°17.1	S01°03.9
13	348°19.8	21°30.0	35.6	3°32.5	30.8	159°26.3	10.0	159°19.7	03.9
14	3°22.3	36°29.4	34.6	18°33.1	30.0	174°29.0	09.9	174°22.3	03.8
15	18°24.8	51°28.8	·· 33.6	33°33.8	·· 29.3	189°31.6	·· 09.8	189°24.9	·· 03.7
16	33°27.2	66°28.2	32.6	48°34.4	28.5	204°34.3	09.7	204°27.5	03.7
17	48°29.7	81°27.6	31.6	63°35.0	27.7	219°36.9	09.6	219°30.1	03.6
18	63°32.2	96°27.0	S14°30.7	78°35.7	S07°26.9	234°39.6	S02°09.5	234°32.7	S01°03.6
19	78°34.6	111°26.4	29.7	93°36.3	26.2	249°42.3	09.4	249°35.3	03.5
20	93°37.1	126°25.8	28.7	108°36.9	25.4	264°44.9	09.3	264°37.9	03.4
21	108°39.6	141°25.2	·· 27.7	123°37.6	·· 24.6	279°47.6	·· 09.2	279°40.5	·· 03.4
22	123°42.0	156°24.7	26.7	138°38.2	23.9	294°50.3	09.1	294°43.1	03.3
23	138°44.5	171°24.1	25.7	153°38.9	23.1	309°52.9	09.0	309°45.7	03.2
Mer.pass. 13:47		ν -0.6′	d 1.0′	m -3.89	ν 0.6′	d 0.8′	m 1.11	ν 2.7′	d 0.1′ m -2.38	ν 2.6′	d 0.1′ m 0.58

Stars

	SHA	Dec
Alpheratz	358°09.3	28°59.1
Ankaa	353°40.3	-42°24.8
Schedar	350°09.1	56°26.1
Diphda	349°20.8	-18°05.7
Achernar	335°45.4	-57°20.3
Hamal	328°28.7	23°22.3
Polaris	326°56.4	89°10.9
Acamar	315°37.1	-40°23.2
Menkar	314°40.9	4°00.8
Mirfak	309°15.7	49°47.7
Aldebaran	291°17.6	16°28.2
Rigel	281°35.6	-8°13.6
Capella	281°10.7	45°58.8
Bellatrix	278°58.3	6°19.8
Elnath	278°43.6	28°35.5
Alnilam	276°11.2	-1°13.0
Betelgeuse	271°27.8	7°24.1
Canopus	264°06.8	-52°41.5
Sirius	258°55.2	-16°41.6
Adhara	255°31.6	-28°57.0
Procyon	245°25.2	5°16.3
Pollux	243°57.5	28°04.3
Avior	234°27.5	-59°27.1
Suhail	223°10.1	-43°21.5
Miaplacidus	221°44.0	-69°38.5
Alphard	218°19.9	-8°34.7
Regulus	208°09.3	12°03.5
Dubhe	194°21.1	61°51.1
Denebola	182°58.4	14°40.6
Gienah	176°17.4	-17°26.2
Acrux	173°36.4	-62°59.5
Gacrux	172°27.9	-57°00.3
Alioth	166°41.8	56°03.6
Spica	158°57.0	-11°03.8
Alkaid	153°18.0	49°24.3
Hadar	149°22.6	-60°16.7
Menkent	148°36.4	-36°16.5
Arcturus	146°18.0	19°16.7
Rigil Kent.	140°25.1	-60°45.0
Kochab	137°18.7	74°13.7
Zuben'ubi	137°32.6	-15°57.8
Alphecca	126°31.8	26°46.5
Antares	112°56.5	-26°23.3
Atria	108°20.6	-68°59.3
Sabik	102°40.9	-15°42.1
Shaula	96°55.5	-37°05.3
Rasalhague	96°29.4	12°34.3
Eltanin	90°57.8	51°29.2
Kaus Aust.	84°16.7	-34°23.6
Vega	80°55.9	38°45.8
Nunki	76°29.0	-26°19.2
Altair	62°32.5	8°49.0
Peacock	53°58.4	-56°47.7
Deneb	49°48.7	45°12.6
Enif	34°11.6	9°47.1
Al Na'ir	28°15.0	-47°03.3
Fomalhaut	15°51.4	-29°43.5
Scheat	14°17.6	27°58.7
Markab	14°03.2	15°06.1

Feb 21 Sat	SHA	Mer.pass
Venus	36°17.9	11:32
Mars	17°04.4	12:48
Jupiter	170°54.7	02:33
Saturn	170°52.2	02:33

Feb 22 Sun	SHA	Mer.pass
Venus	35°03.8	11:33
Mars	16°20.3	12:47
Jupiter	170°59.2	02:28
Saturn	170°55.2	02:29

Feb 23 Mon	SHA	Mer.pass
Venus	33°50.0	11:34
Mars	15°36.4	12:46
Jupiter	171°03.9	02:24
Saturn	170°58.2	02:25

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = -0.3129 sec ΔT = TT-UT1 = +51.4969 sec

1981 February 21 to Feb. 23 UT

h	Sun		Moon				
Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	176°34.3	S10°39.9	333°12.1	14.4′	N05°04.3	10.5′	55.0′
1	191°34.3	39.0	347°45.5	14.4′	04°53.8	10.4′	55.0′
2	206°34.4	38.1	2°18.9	14.5′	04°43.4	10.4′	55.0′
3	221°34.5	·· 37.2	16°52.4	14.5′	04°33.0	10.5′	55.0′
4	236°34.5	36.3	31°25.9	14.5′	04°22.5	10.5′	54.9′
5	251°34.6	35.4	45°59.4	14.6′	04°12.0	10.5′	54.9′
6	266°34.7	S10°34.5	60°33.0	14.6′	N04°01.5	10.4′	54.9′
7	281°34.8	33.6	75°06.6	14.6′	03°51.1	10.5′	54.9′
8	296°34.8	32.7	89°40.2	14.7′	03°40.6	10.6′	54.9′
9	311°34.9	·· 31.8	104°13.9	14.7′	03°30.0	10.5′	54.9′
10	326°35.0	30.9	118°47.6	14.7′	03°19.5	10.5′	54.8′
11	341°35.1	30.0	133°21.3	14.8′	03°09.0	10.5′	54.8′
12	356°35.1	S10°29.1	147°55.0	14.8′	N02°58.5	10.5′	54.8′
13	11°35.2	28.2	162°28.8	14.8′	02°48.0	10.6′	54.8′
14	26°35.3	27.3	177°02.6	14.8′	02°37.4	10.5′	54.8′
15	41°35.4	·· 26.4	191°36.5	14.9′	02°26.9	10.6′	54.8′
16	56°35.4	25.5	206°10.3	14.9′	02°16.3	10.5′	54.7′
17	71°35.5	24.6	220°44.2	14.9′	02°05.8	10.6′	54.7′
18	86°35.6	S10°23.6	235°18.1	14.9′	N01°55.2	10.5′	54.7′
19	101°35.7	22.7	249°52.1	15.0′	01°44.7	10.6′	54.7′
20	116°35.8	21.8	264°26.1	15.0′	01°34.1	10.5′	54.7′
21	131°35.8	·· 20.9	279°00.0	15.0′	01°23.6	10.6′	54.7′
22	146°35.9	20.0	293°34.1	15.0′	01°13.0	10.5′	54.6′
23	161°36.0	19.1	308°08.1	15.1′	01°02.5	10.6′	54.6′
	SD = 16.2′	d = 0.9′	SD = 15.0′				

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	176°36.1	S10°18.2	322°42.2	15.1′	N00°51.9	10.5′	54.6′
1	191°36.1	17.3	337°16.2	15.1′	00°41.4	10.6′	54.6′
2	206°36.2	16.4	351°50.3	15.1′	00°30.8	10.5′	54.6′
3	221°36.3	·· 15.5	6°24.4	15.1′	00°20.3	10.5′	54.6′
4	236°36.4	14.6	20°58.6	15.2′	N00°09.8	10.5′	54.6′
5	251°36.5	13.7	35°32.7	15.2′	S00°00.7	10.6′	54.5′
6	266°36.5	S10°12.7	50°06.9	15.2′	S00°11.3	10.5′	54.5′
7	281°36.6	11.8	64°41.1	15.2′	00°21.8	10.5′	54.5′
8	296°36.7	10.9	79°15.3	15.2′	00°32.3	10.5′	54.5′
9	311°36.8	·· 10.0	93°49.5	15.2′	00°42.8	10.5′	54.5′
10	326°36.9	09.1	108°23.7	15.2′	00°53.3	10.4′	54.5′
11	341°37.0	08.2	122°58.0	15.3′	01°03.7	10.5′	54.5′
12	356°37.0	S10°07.3	137°32.2	15.3′	S01°14.2	10.5′	54.5′
13	11°37.1	06.4	152°06.5	15.3′	01°24.7	10.4′	54.4′
14	26°37.2	05.4	166°40.8	15.3′	01°35.1	10.4′	54.4′
15	41°37.3	·· 04.5	181°15.1	15.3′	01°45.5	10.5′	54.4′
16	56°37.4	03.6	195°49.4	15.3′	01°56.0	10.4′	54.4′
17	71°37.4	02.7	210°23.7	15.3′	02°06.4	10.4′	54.4′
18	86°37.5	S10°01.8	224°58.0	15.3′	S02°16.8	10.4′	54.4′
19	101°37.6	00.9	239°32.3	15.3′	02°27.2	10.3′	54.4′
20	116°37.7	10°00.0	254°06.6	15.3′	02°37.5	10.4′	54.4′
21	131°37.8	09°59.1	268°41.0	15.3′	02°47.9	10.3′	54.3′
22	146°37.9	58.1	283°15.3	15.3′	02°58.2	10.3′	54.3′
23	161°38.0	57.2	297°49.7	15.4′	03°08.5	10.3′	54.3′
	SD = 16.2′	d = 0.9′	SD = 14.9′				

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	176°38.0	S09°56.3	312°24.0	15.4′	S03°18.8	10.3′	54.3′
1	191°38.1	55.4	326°58.4	15.4′	03°29.1	10.3′	54.3′
2	206°38.2	54.5	341°32.7	15.4′	03°39.4	10.2′	54.3′
3	221°38.3	·· 53.6	356°07.1	15.4′	03°49.6	10.2′	54.3′
4	236°38.4	52.6	10°41.4	15.4′	03°59.8	10.2′	54.3′
5	251°38.5	51.7	25°15.8	15.4′	04°10.0	10.2′	54.3′
6	266°38.6	S09°50.8	39°50.2	15.4′	S04°20.2	10.2′	54.3′
7	281°38.6	49.9	54°24.5	15.4′	04°30.4	10.1′	54.2′
8	296°38.7	49.0	68°58.9	15.4′	04°40.5	10.1′	54.2′
9	311°38.8	·· 48.1	83°33.3	15.4′	04°50.6	10.1′	54.2′
10	326°38.9	47.1	98°07.6	15.4′	05°00.7	10.1′	54.2′
11	341°39.0	46.2	112°42.0	15.3′	05°10.8	10.0′	54.2′
12	356°39.1	S09°45.3	127°16.3	15.3′	S05°20.8	10.1′	54.2′
13	11°39.2	44.4	141°50.6	15.3′	05°30.9	10.0′	54.2′
14	26°39.3	43.5	156°25.0	15.3′	05°40.9	9.9′	54.2′
15	41°39.3	·· 42.5	170°59.3	15.3′	05°50.8	10.0′	54.2′
16	56°39.4	41.6	185°33.6	15.3′	06°00.8	9.9′	54.2′
17	71°39.5	40.7	200°07.9	15.3′	06°10.7	9.9′	54.2′
18	86°39.6	S09°39.8	214°42.3	15.3′	S06°20.6	9.8′	54.2′
19	101°39.7	38.9	229°16.5	15.3′	06°30.4	9.9′	54.2′
20	116°39.8	37.9	243°50.8	15.3′	06°40.3	9.8′	54.2′
21	131°39.9	·· 37.0	258°25.1	15.3′	06°50.1	9.7′	54.2′
22	146°40.0	36.1	272°59.4	15.3′	06°59.8	9.8′	54.1′
23	161°40.1	35.2	287°33.6	15.2′	07°09.6	9.7′	54.1′
	SD = 16.2′	d = 0.9′	SD = 14.8′				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	05:44	07:02	08:15	16:14	17:27	18:46
N 70°	05:45	06:56	08:01	16:28	17:33	18:44
68°	05:47	06:51	07:49	16:39	17:38	18:42
66°	05:47	06:46	07:40	16:49	17:42	18:42
64°	05:48	06:43	07:32	16:57	17:46	18:41
62°	05:48	06:39	07:25	17:03	17:49	18:40
60°	05:48	06:36	07:19	17:09	17:52	18:40
N 58°	05:48	06:34	07:14	17:14	17:54	18:40
56°	05:48	06:31	07:09	17:19	17:57	18:40
54°	05:48	06:29	07:05	17:23	17:59	18:40
52°	05:48	06:27	07:01	17:27	18:01	18:40
50°	05:47	06:25	06:58	17:30	18:03	18:41
45°	05:46	06:20	06:50	17:38	18:07	18:41
N 40°	05:45	06:16	06:44	17:44	18:11	18:43
35°	05:43	06:13	06:38	17:49	18:15	18:44
30°	05:41	06:09	06:34	17:54	18:18	18:46
20°	05:37	06:03	06:25	18:02	18:25	18:50
N 10°	05:31	05:56	06:17	18:10	18:31	18:56
0°	05:25	05:49	06:10	18:17	18:38	19:02
S 10°	05:17	05:41	06:03	18:24	18:45	19:10
20°	05:06	05:32	05:55	18:32	18:54	19:21
30°	04:52	05:21	05:46	18:41	19:05	19:34
35°	04:43	05:14	05:40	18:46	19:12	19:43
40°	04:32	05:06	05:34	18:52	19:20	19:54
45°	04:19	04:56	05:27	18:59	19:30	20:07
S 50°	04:02	04:44	05:19	19:07	19:42	20:24
52°	03:53	04:38	05:15	19:11	19:47	20:32
54°	03:44	04:32	05:10	19:16	19:54	20:41
56°	03:33	04:25	05:05	19:20	20:01	20:52
58°	03:20	04:16	05:00	19:26	20:09	21:05
S 60°	03:04	04:07	04:54	19:32	20:18	21:20

Lat.	Moonrise Sat	Moonrise Sun	Moonrise Mon	Moonset Sat	Moonset Sun	Moonset Mon
N 72°	20:04	21:44	23:24	08:45	08:35	08:24
N 70°	20:06	21:40	23:12	08:41	08:36	08:31
68°	20:08	21:36	23:03	08:37	08:37	08:36
66°	20:10	21:33	22:56	08:34	08:37	08:41
64°	20:11	21:31	22:50	08:31	08:38	08:45
62°	20:12	21:29	22:44	08:28	08:38	08:48
60°	20:13	21:27	22:40	08:26	08:39	08:51
N 58°	20:14	21:25	22:36	08:24	08:39	08:54
56°	20:14	21:24	22:32	08:23	08:40	08:56
54°	20:15	21:22	22:29	08:21	08:40	08:58
52°	20:16	21:21	22:26	08:20	08:40	09:00
50°	20:16	21:20	22:23	08:19	08:40	09:02
45°	20:17	21:18	22:17	08:16	08:41	09:06
N 40°	20:18	21:16	22:13	08:13	08:41	09:09
35°	20:19	21:14	22:09	08:11	08:42	09:12
30°	20:20	21:13	22:05	08:10	08:42	09:14
20°	20:21	21:10	21:59	08:06	08:43	09:19
N 10°	20:22	21:08	21:53	08:04	08:43	09:23
0°	20:23	21:06	21:48	08:01	08:44	09:26
S 10°	20:24	21:04	21:43	07:58	08:44	09:30
20°	20:26	21:02	21:38	07:55	08:45	09:34
30°	20:27	20:59	21:32	07:52	08:45	09:38
35°	20:28	20:58	21:28	07:50	08:46	09:40
40°	20:29	20:56	21:24	07:48	08:46	09:43
45°	20:30	20:54	21:20	07:45	08:46	09:47
S 50°	20:31	20:52	21:14	07:42	08:47	09:51
52°	20:31	20:51	21:12	07:41	08:47	09:52
54°	20:32	20:50	21:09	07:39	08:47	09:54
56°	20:33	20:49	21:06	07:38	08:48	09:57
58°	20:33	20:48	21:03	07:36	08:48	09:59
S 60°	20:34	20:46	20:59	07:34	08:48	10:02

Day	Sun Eqn.of Time 00h	Sun Eqn.of Time 12h	Sun Mer. Pass	Moon Mer.Pass. Upper	Moon Mer.Pass. Lower	Age 17-19 96-85%
	mm:ss	mm:ss	hh:mm	hh:mm	hh:mm	
21	13:43	13:39	12:14	01:50	14:12	
22	13:36	13:32	12:14	02:34	14:55	
23	13:28	13:24	12:13	03:16	15:37	

February 24, 25, 26 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	153°47.0	186°23.5	S14°24.7	168°39.5	S07°22.3	324°55.6	S02°08.9	324°48.2	S01°03.2
1	168°49.4	201°22.9	23.7	183°40.1	21.5	339°58.3	08.8	339°50.8	03.1
2	183°51.9	216°22.3	22.7	198°40.8	20.8	355°00.9	08.7	354°53.4	03.0
3	198°54.3	231°21.7	·· 21.7	213°41.4	·· 20.0	10°03.6	·· 08.6	9°56.0	·· 03.0
4	213°56.8	246°21.1	20.7	228°42.0	19.2	25°06.3	08.5	24°58.6	02.9
5	228°59.3	261°20.5	19.7	243°42.7	18.5	40°08.9	08.4	40°01.2	02.8
6	244°01.7	276°19.9	S14°18.7	258°43.3	S07°17.7	55°11.6	S02°08.3	55°03.8	S01°02.8
7	259°04.2	291°19.3	17.7	273°44.0	16.9	70°14.3	08.2	70°06.4	02.7
8	274°06.7	306°18.7	16.7	288°44.6	16.1	85°16.9	08.1	85°09.0	02.6
9	289°09.1	321°18.1	·· 15.7	303°45.2	·· 15.4	100°19.6	·· 08.0	100°11.6	·· 02.6
10	304°11.6	336°17.6	14.7	318°45.9	14.6	115°22.3	08.0	115°14.2	02.5
11	319°14.1	351°17.0	13.7	333°46.5	13.8	130°25.0	07.9	130°16.8	02.5
12	334°16.5	6°16.4	S14°12.7	348°47.2	S07°13.0	145°27.6	S02°07.8	145°19.4	S01°02.4
13	349°19.0	21°15.8	11.7	3°47.8	12.3	160°30.3	07.7	160°22.0	02.3
14	4°21.4	36°15.2	10.7	18°48.4	11.5	175°33.0	07.6	175°24.6	02.3
15	19°23.9	51°14.6	·· 09.7	33°49.1	·· 10.7	190°35.6	·· 07.5	190°27.2	·· 02.2
16	34°26.4	66°14.0	08.7	48°49.7	10.0	205°38.3	07.4	205°29.8	02.1
17	49°28.8	81°13.5	07.7	63°50.4	09.2	220°41.0	07.3	220°32.4	02.1
18	64°31.3	96°12.9	S14°06.7	78°51.0	S07°08.4	235°43.6	S02°07.2	235°35.0	S01°02.0
19	79°33.8	111°12.3	05.7	93°51.6	07.6	250°46.3	07.1	250°37.6	01.9
20	94°36.2	126°11.7	04.7	108°52.3	06.9	265°49.0	07.0	265°40.2	01.9
21	109°38.7	141°11.1	·· 03.7	123°52.9	·· 06.1	280°51.7	·· 06.9	280°42.8	·· 01.8
22	124°41.2	156°10.5	02.7	138°53.6	05.3	295°54.3	06.8	295°45.4	01.7
23	139°43.6	171°10.0	01.7	153°54.2	04.5	310°57.0	06.7	310°48.0	01.7
Mer.pass. 13:43		ν -0.6′	d 1.0′	m -3.89	ν 0.6′	d 0.8′	m 1.11	ν 2.7′	d 0.1′ m -2.39	ν 2.6′	d 0.1′ m 0.58

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	154°46.1	186°09.4	S14°00.7	168°54.8	S07°03.8	325°59.7	S02°06.6	325°50.5	S01°01.6
1	169°48.6	201°08.8	13°59.7	183°55.5	03.0	341°02.3	06.5	340°53.1	01.5
2	184°51.0	216°08.2	58.6	198°56.1	02.2	356°05.0	06.4	355°55.7	01.5
3	199°53.5	231°07.6	·· 57.6	213°56.8	·· 01.4	11°07.7	·· 06.3	10°58.3	·· 01.4
4	214°55.9	246°07.0	56.6	228°57.4	07°00.7	26°10.4	06.2	26°00.9	01.3
5	229°58.4	261°06.5	55.6	243°58.0	06°59.9	41°13.0	06.1	41°03.5	01.3
6	245°00.9	276°05.9	S13°54.6	258°58.7	S06°59.1	56°15.7	S02°06.0	56°06.1	S01°01.2
7	260°03.3	291°05.3	53.6	273°59.3	58.3	71°18.4	05.9	71°08.7	01.1
8	275°05.8	306°04.7	52.6	289°00.0	57.6	86°21.0	05.8	86°11.3	01.1
9	290°08.3	321°04.2	·· 51.6	304°00.6	·· 56.8	101°23.7	·· 05.7	101°13.9	·· 01.0
10	305°10.7	336°03.6	50.5	319°01.3	56.0	116°26.4	05.6	116°16.5	00.9
11	320°13.2	351°03.0	49.5	334°01.9	55.2	131°29.1	05.5	131°19.1	00.9
12	335°15.7	6°02.4	S13°48.5	349°02.5	S06°54.5	146°31.7	S02°05.4	146°21.7	S01°00.8
13	350°18.1	21°01.9	47.5	4°03.2	53.7	161°34.4	05.3	161°24.3	00.7
14	5°20.6	36°01.3	46.5	19°03.8	52.9	176°37.1	05.2	176°26.9	00.7
15	20°23.1	51°00.7	·· 45.4	34°04.5	·· 52.1	191°39.8	·· 05.1	191°29.5	·· 00.6
16	35°25.5	66°00.1	44.4	49°05.1	51.4	206°42.4	05.0	206°32.1	00.5
17	50°28.0	80°59.6	43.4	64°05.8	50.6	221°45.1	04.9	221°34.7	00.5
18	65°30.4	95°59.0	S13°42.4	79°06.4	S06°49.8	236°47.8	S02°04.8	236°37.3	S01°00.4
19	80°32.9	110°58.4	41.4	94°07.0	49.0	251°50.5	04.7	251°39.9	00.3
20	95°35.4	125°57.8	40.3	109°07.7	48.3	266°53.2	04.6	266°42.5	00.3
21	110°37.8	140°57.3	·· 39.3	124°08.3	·· 47.5	281°55.8	·· 04.5	281°45.1	·· 00.2
22	125°40.3	155°56.7	38.3	139°09.0	46.7	296°58.5	04.4	296°47.7	00.1
23	140°42.8	170°56.1	37.3	154°09.6	45.9	312°01.2	04.3	311°50.3	00.1
Mer.pass. 13:39		ν -0.6′	d 1.0′	m -3.89	ν 0.6′	d 0.8′	m 1.11	ν 2.7′	d 0.1′ m -2.39	ν 2.6′	d 0.1′ m 0.57

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	155°45.2	185°55.5	S13°36.2	169°10.3	S06°45.2	327°03.9	S02°04.2	326°52.9	S01°00.0
1	170°47.7	200°55.0	35.2	184°10.9	44.4	342°06.5	04.1	341°55.5	00°59.9
2	185°50.2	215°54.4	34.2	199°11.6	43.6	357°09.2	04.0	356°58.1	59.9
3	200°52.6	230°53.8	·· 33.2	214°12.2	·· 42.8	12°11.9	·· 03.9	12°00.7	·· 59.8
4	215°55.1	245°53.3	32.1	229°12.8	42.1	27°14.6	03.8	27°03.3	59.7
5	230°57.5	260°52.7	31.1	244°13.5	41.3	42°17.2	03.7	42°05.9	59.7
6	246°00.0	275°52.1	S13°30.1	259°14.1	S06°40.5	57°19.9	S02°03.6	57°08.5	S00°59.6
7	261°02.5	290°51.6	29.1	274°14.8	39.7	72°22.6	03.5	72°11.1	59.5
8	276°04.9	305°51.0	28.0	289°15.4	39.0	87°25.3	03.4	87°13.7	59.5
9	291°07.4	320°50.4	·· 27.0	304°16.1	·· 38.2	102°28.0	·· 03.3	102°16.3	·· 59.4
10	306°09.9	335°49.9	26.0	319°16.7	37.4	117°30.6	03.2	117°18.9	59.3
11	321°12.3	350°49.3	24.9	334°17.4	36.6	132°33.3	03.1	132°21.5	59.3
12	336°14.8	5°48.7	S13°23.9	349°18.0	S06°35.8	147°36.0	S02°03.0	147°24.1	S00°59.2
13	351°17.3	20°48.2	22.9	4°18.7	35.1	162°38.7	02.9	162°26.7	59.1
14	6°19.7	35°47.6	21.8	19°19.3	34.3	177°41.4	02.8	177°29.3	59.1
15	21°22.2	50°47.0	·· 20.8	34°19.9	·· 33.5	192°44.0	·· 02.7	192°31.9	·· 59.0
16	36°24.7	65°46.5	19.8	49°20.6	32.7	207°46.7	02.6	207°34.5	58.9
17	51°27.1	80°45.9	18.7	64°21.2	32.0	222°49.4	02.5	222°37.1	58.9
18	66°29.6	95°45.4	S13°17.7	79°21.9	S06°31.2	237°52.1	S02°02.4	237°39.7	S00°58.8
19	81°32.0	110°44.8	16.7	94°22.5	30.4	252°54.8	02.3	252°42.3	58.7
20	96°34.5	125°44.2	15.6	109°23.2	29.6	267°57.5	02.2	267°44.9	58.7
21	111°37.0	140°43.7	·· 14.6	124°23.8	·· 28.8	283°00.1	·· 02.1	282°47.5	·· 58.6
22	126°39.4	155°43.1	13.5	139°24.5	28.1	298°02.8	02.0	297°50.1	58.5
23	141°41.9	170°42.6	12.5	154°25.1	27.3	313°05.5	01.9	312°52.7	58.5
Mer.pass. 13:35		ν -0.6′	d 1.0′	m -3.89	ν 0.6′	d 0.8′	m 1.11	ν 2.7′	d 0.1′ m -2.40	ν 2.6′	d 0.1′ m 0.57

Stars

	SHA	Dec
Alpheratz	358°09.3	28°59.1
Ankaa	353°40.3	-42°24.8
Schedar	350°09.1	56°26.0
Diphda	349°20.8	-18°05.7
Achernar	335°45.4	-57°20.3
Hamal	328°28.7	23°22.3
Polaris	326°57.4	89°10.9
Acamar	315°37.1	-40°23.2
Menkar	314°40.9	4°00.8
Mirfak	309°15.8	49°47.7
Aldebaran	291°17.6	16°28.2
Rigel	281°35.6	-8°13.6
Capella	281°10.7	45°58.8
Bellatrix	278°58.3	6°19.8
Elnath	278°43.6	28°35.5
Alnilam	276°11.2	-1°13.0
Betelgeuse	271°27.8	7°24.1
Canopus	264°06.8	-52°41.5
Sirius	258°55.2	-16°41.6
Adhara	255°31.6	-28°57.0
Procyon	245°25.2	5°16.3
Pollux	243°57.5	28°04.3
Avior	234°27.5	-59°27.1
Suhail	223°10.1	-43°21.5
Miaplacidus	221°44.0	-69°38.5
Alphard	218°19.9	-8°34.7
Regulus	208°09.3	12°03.5
Dubhe	194°21.1	61°51.1
Denebola	182°58.4	14°40.6
Gienah	176°17.3	-17°26.2
Acrux	173°36.3	-62°59.5
Gacrux	172°27.9	-57°00.3
Alioth	166°41.8	56°03.6
Spica	158°57.0	-11°03.8
Alkaid	153°18.0	49°24.3
Hadar	149°22.5	-60°16.7
Menkent	148°36.4	-36°16.5
Arcturus	146°18.0	19°16.7
Rigil Kent.	140°25.1	-60°45.0
Kochab	137°18.6	74°13.8
Zuben'ubi	137°32.6	-15°57.8
Alphecca	126°31.8	26°46.5
Antares	112°56.5	-26°23.3
Atria	108°20.6	-68°59.3
Sabik	102°40.8	-15°42.1
Shaula	96°55.5	-37°05.3
Rasalhague	96°29.4	12°34.3
Eltanin	90°57.8	51°29.2
Kaus Aust.	84°16.6	-34°23.6
Vega	80°55.8	38°45.7
Nunki	76°29.0	-26°19.2
Altair	62°32.5	8°49.0
Peacock	53°58.4	-56°47.7
Deneb	49°48.7	45°12.6
Enif	34°11.6	9°47.1
Al Na'ir	28°15.0	-47°03.3
Fomalhaut	15°51.4	-29°43.5
Scheat	14°17.6	27°58.7
Markab	14°03.2	15°06.1

Feb 24 Tue	SHA	Mer.pass
Venus	32°36.5	11:35
Mars	14°52.5	12:45
Jupiter	171°08.7	02:20
Saturn	171°01.3	02:20

Feb 25 Wed	SHA	Mer.pass
Venus	31°23.3	11:36
Mars	14°08.8	12:44
Jupiter	171°13.6	02:16
Saturn	171°04.5	02:16

Feb 26 Thu	SHA	Mer.pass
Venus	30°10.3	11:37
Mars	13°25.0	12:43
Jupiter	171°18.6	02:11
Saturn	171°07.7	02:12

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°40.2	S09°34.3	302°07.9	15.2′	S07°19.3	9.7′	54.1′
1	191°40.2	33.3	316°42.1	15.2′	07°29.0	9.6′	54.1′
2	206°40.3	32.4	331°16.3	15.2′	07°38.6	9.6′	54.1′
3	221°40.4	·· 31.5	345°50.5	15.2′	07°48.2	9.6′	54.1′
4	236°40.5	30.6	0°24.7	15.2′	07°57.8	9.6′	54.1′
5	251°40.6	29.7	14°58.9	15.1′	08°07.4	9.5′	54.1′
6	266°40.7	S09°28.7	29°33.0	15.1′	S08°16.9	9.5′	54.1′
7	281°40.8	27.8	44°07.1	15.1′	08°26.4	9.4′	54.1′
8	296°40.9	26.9	58°41.2	15.1′	08°35.8	9.4′	54.1′
9	311°41.0	·· 26.0	73°15.3	15.1′	08°45.2	9.4′	54.1′
10	326°41.1	25.0	87°49.4	15.1′	08°54.6	9.3′	54.1′
11	341°41.2	24.1	102°23.5	15.0′	09°03.9	9.3′	54.1′
12	356°41.3	S09°23.2	116°57.5	15.0′	S09°13.2	9.2′	54.1′
13	11°41.4	22.3	131°31.5	15.0′	09°22.4	9.3′	54.1′
14	26°41.5	21.3	146°05.5	15.0′	09°31.7	9.1′	54.1′
15	41°41.6	·· 20.4	160°39.5	14.9′	09°40.8	9.2′	54.1′
16	56°41.6	19.5	175°13.4	14.9′	09°50.0	9.1′	54.1′
17	71°41.7	18.6	189°47.4	14.9′	09°59.1	9.0′	54.1′
18	86°41.8	S09°17.6	204°21.3	14.9′	S10°08.1	9.0′	54.1′
19	101°41.9	16.7	218°55.1	14.8′	10°17.1	9.0′	54.1′
20	116°42.0	15.8	233°29.0	14.8′	10°26.1	9.0′	54.1′
21	131°42.1	·· 14.9	248°02.8	14.8′	10°35.1	8.8′	54.1′
22	146°42.2	13.9	262°36.6	14.8′	10°43.9	8.9′	54.1′
23	161°42.3	13.0	277°10.4	14.7′	10°52.8	8.8′	54.1′
	SD = 16.2′	d = 0.9′	SD = 14.8′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°42.4	S09°12.1	291°44.1	14.7′	S11°01.6	8.7′	54.1′
1	191°42.5	11.1	306°17.8	14.7′	11°10.3	8.7′	54.1′
2	206°42.6	10.2	320°51.5	14.6′	11°19.0	8.7′	54.1′
3	221°42.7	·· 09.3	335°25.1	14.6′	11°27.7	8.6′	54.1′
4	236°42.8	08.4	349°58.7	14.6′	11°36.3	8.6′	54.1′
5	251°42.9	07.4	4°32.3	14.6′	11°44.9	8.5′	54.1′
6	266°43.0	S09°06.5	19°05.9	14.5′	S11°53.4	8.5′	54.1′
7	281°43.1	05.6	33°39.4	14.5′	12°01.9	8.4′	54.1′
8	296°43.2	04.6	48°12.9	14.5′	12°10.3	8.4′	54.1′
9	311°43.3	·· 03.7	62°46.4	14.4′	12°18.7	8.3′	54.1′
10	326°43.4	02.8	77°19.8	14.4′	12°27.0	8.3′	54.1′
11	341°43.5	01.9	91°53.2	14.4′	12°35.3	8.2′	54.1′
12	356°43.6	S09°00.9	106°26.5	14.3′	S12°43.5	8.2′	54.2′
13	11°43.7	09°00.0	120°59.8	14.3′	12°51.7	8.1′	54.2′
14	26°43.8	08°59.1	135°33.1	14.2′	12°59.8	8.0′	54.2′
15	41°43.9	·· 58.1	150°06.4	14.2′	13°07.8	8.1′	54.2′
16	56°44.0	57.2	164°39.6	14.2′	13°15.9	7.9′	54.2′
17	71°44.1	56.3	179°12.7	14.1′	13°23.8	7.9′	54.2′
18	86°44.2	S08°55.3	193°45.9	14.1′	S13°31.7	7.9′	54.2′
19	101°44.3	54.4	208°19.0	14.1′	13°39.6	7.8′	54.2′
20	116°44.4	53.5	222°52.0	14.0′	13°47.4	7.7′	54.2′
21	131°44.5	·· 52.5	237°25.0	14.0′	13°55.1	7.7′	54.2′
22	146°44.6	51.6	251°58.0	13.9′	14°02.8	7.6′	54.2′
23	161°44.7	50.7	266°30.9	13.9′	14°10.4	7.6′	54.2′
	SD = 16.1′	d = 0.9′	SD = 14.8′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°44.8	S08°49.7	281°03.8	13.8′	S14°18.0	7.5′	54.2′
1	191°44.9	48.8	295°36.7	13.8′	14°25.5	7.4′	54.2′
2	206°45.0	47.9	310°09.5	13.8′	14°32.9	7.4′	54.3′
3	221°45.1	·· 46.9	324°42.2	13.7′	14°40.3	7.3′	54.3′
4	236°45.2	46.0	339°14.9	13.7′	14°47.6	7.3′	54.3′
5	251°45.3	45.1	353°47.6	13.6′	14°54.9	7.2′	54.3′
6	266°45.4	S08°44.1	8°20.2	13.6′	S15°02.1	7.1′	54.3′
7	281°45.6	43.2	22°52.8	13.5′	15°09.2	7.1′	54.3′
8	296°45.7	42.3	37°25.4	13.5′	15°16.3	7.0′	54.3′
9	311°45.8	·· 41.3	51°57.9	13.4′	15°23.3	7.0′	54.3′
10	326°45.9	40.4	66°30.3	13.4′	15°30.3	6.8′	54.3′
11	341°46.0	39.5	81°02.7	13.4′	15°37.1	6.9′	54.4′
12	356°46.1	S08°38.5	95°35.1	13.3′	S15°44.0	6.7′	54.4′
13	11°46.2	37.6	110°07.4	13.3′	15°50.7	6.7′	54.4′
14	26°46.3	36.7	124°39.6	13.2′	15°57.4	6.6′	54.4′
15	41°46.4	·· 35.7	139°11.9	13.2′	16°04.0	6.6′	54.4′
16	56°46.5	34.8	153°44.0	13.1′	16°10.6	6.5′	54.4′
17	71°46.6	33.8	168°16.1	13.1′	16°17.1	6.4′	54.4′
18	86°46.7	S08°32.9	182°48.2	13.0′	S16°23.5	6.3′	54.5′
19	101°46.8	32.0	197°20.2	13.0′	16°29.8	6.3′	54.5′
20	116°46.9	31.0	211°52.2	12.9′	16°36.1	6.2′	54.5′
21	131°47.0	·· 30.1	226°24.1	12.9′	16°42.3	6.1′	54.5′
22	146°47.2	29.2	240°56.0	12.8′	16°48.4	6.1′	54.5′
23	161°47.3	28.2	255°27.8	12.8′	16°54.5	6.0′	54.5′
	SD = 16.1′	d = 0.9′	SD = 14.8′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	05:30	06:48	07:59	16:29	17:41	18:59
N 70°	05:33	06:43	07:46	16:41	17:45	18:56
68°	05:35	06:39	07:37	16:51	17:49	18:53
66°	05:37	06:36	07:29	16:59	17:52	18:51
64°	05:38	06:33	07:22	17:06	17:55	18:50
62°	05:39	06:31	07:16	17:12	17:57	18:48
60°	05:40	06:28	07:11	17:17	17:59	18:47
N 58°	05:41	06:26	07:06	17:21	18:01	18:47
56°	05:41	06:24	07:02	17:25	18:03	18:46
54°	05:42	06:22	06:58	17:29	18:05	18:46
52°	05:42	06:21	06:55	17:32	18:06	18:45
50°	05:42	06:19	06:52	17:35	18:08	18:45
45°	05:42	06:16	06:45	17:42	18:11	18:45
N 40°	05:41	06:12	06:40	17:47	18:15	18:46
35°	05:40	06:09	06:35	17:52	18:17	18:47
30°	05:39	06:06	06:30	17:56	18:20	18:48
20°	05:35	06:01	06:23	18:04	18:26	18:51
N 10°	05:30	05:55	06:16	18:10	18:31	18:56
0°	05:25	05:49	06:10	18:16	18:37	19:02
S 10°	05:17	05:42	06:03	18:23	18:44	19:09
20°	05:08	05:34	05:56	18:30	18:52	19:18
30°	04:55	05:24	05:48	18:38	19:02	19:31
35°	04:46	05:17	05:43	18:42	19:08	19:39
40°	04:36	05:10	05:38	18:48	19:16	19:49
45°	04:24	05:01	05:31	18:54	19:24	20:01
S 50°	04:08	04:50	05:24	19:01	19:35	20:17
52°	04:00	04:44	05:20	19:05	19:40	20:24
54°	03:51	04:39	05:16	19:09	19:46	20:33
56°	03:41	04:32	05:12	19:13	19:53	20:43
58°	03:29	04:24	05:07	19:18	20:00	20:54
S 60°	03:15	04:16	05:01	19:23	20:08	21:08

Lat.	**Moonrise** Tue	Wed	Thu	**Moonset** Tue	Wed	Thu
N 72°	·· ··	01:06	02:58	08:13	07:59	07:40
N 70°	·· ··	00:47	02:24	08:26	08:20	08:14
68°	·· ··	00:31	02:01	08:36	08:37	08:39
66°	·· ··	00:19	01:42	08:45	08:50	08:58
64°	·· ··	00:09	01:27	08:52	09:02	09:14
62°	·· ··	00:00	01:15	08:59	09:11	09:27
60°	23:52	·· ··	01:04	09:04	09:20	09:38
N 58°	23:46	·· ··	00:55	09:09	09:27	09:48
56°	23:40	·· ··	00:47	09:14	09:33	09:56
54°	23:35	·· ··	00:40	09:18	09:39	10:04
52°	23:30	·· ··	00:34	09:21	09:44	10:10
50°	23:26	·· ··	00:28	09:25	09:49	10:16
45°	23:17	·· ··	00:16	09:32	09:59	10:30
N 40°	23:09	·· ··	00:06	09:38	10:08	10:41
35°	23:03	23:57	·· ··	09:43	10:15	10:50
30°	22:57	23:50	·· ··	09:47	10:21	10:58
20°	22:47	23:37	·· ··	09:55	10:33	11:12
N 10°	22:39	23:25	·· ··	10:02	10:43	11:25
0°	22:31	23:15	·· ··	10:09	10:52	11:37
S 10°	22:23	23:04	23:48	10:15	11:01	11:48
20°	22:14	22:53	23:34	10:22	11:11	12:01
30°	22:05	22:40	23:19	10:30	11:22	12:15
35°	21:59	22:33	23:10	10:35	11:29	12:24
40°	21:53	22:25	23:00	10:40	11:37	12:33
45°	21:46	22:15	22:48	10:46	11:45	12:44
S 50°	21:38	22:03	22:33	10:53	11:56	12:58
52°	21:34	21:58	22:27	10:57	12:01	13:04
54°	21:29	21:52	22:19	11:01	12:06	13:11
56°	21:24	21:46	22:11	11:05	12:12	13:19
58°	21:19	21:38	22:02	11:09	12:19	13:28
S 60°	21:13	21:30	21:51	11:15	12:27	13:38

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 20-22 77-60%
24	13:19	13:15	12:13	03:58	16:20	
25	13:10	13:06	12:13	04:41	17:03	
26	13:01	12:56	12:13	05:26	17:48	

February 27, 28, 01 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	156°44.4	185°42.0	S13°11.5	169°25.8	S06°26.5	328°08.2	S02°01.8	327°55.3	S00°58.4
1	171°46.8	200°41.4	10.4	184°26.4	25.7	343°10.9	01.7	342°58.0	58.3
2	186°49.3	215°40.9	09.4	199°27.1	25.0	358°13.5	01.6	358°00.6	58.3
3	201°51.8	230°40.3	·· 08.3	214°27.7	·· 24.2	13°16.2	·· 01.5	13°03.2	·· 58.2
4	216°54.2	245°39.8	07.3	229°28.4	23.4	28°18.9	01.4	28°05.8	58.1
5	231°56.7	260°39.2	06.2	244°29.0	22.6	43°21.6	01.3	43°08.4	58.1
6	246°59.2	275°38.6	S13°05.2	259°29.6	S06°21.8	58°24.3	S02°01.2	58°11.0	S00°58.0
7	262°01.6	290°38.1	04.2	274°30.3	21.1	73°27.0	01.1	73°13.6	57.9
8	277°04.1	305°37.5	03.1	289°30.9	20.3	88°29.6	01.0	88°16.2	57.9
9	292°06.5	320°37.0	·· 02.1	304°31.6	·· 19.5	103°32.3	·· 00.9	103°18.8	·· 57.8
10	307°09.0	335°36.4	01.0	319°32.2	18.7	118°35.0	00.8	118°21.4	57.7
11	322°11.5	350°35.9	13°00.0	334°32.9	17.9	133°37.7	00.7	133°24.0	57.7
12	337°13.9	5°35.3	S12°58.9	349°33.5	S06°17.2	148°40.4	S02°00.6	148°26.6	S00°57.6
13	352°16.4	20°34.8	57.9	4°34.2	16.4	163°43.1	00.5	163°29.2	57.5
14	7°18.9	35°34.2	56.8	19°34.8	15.6	178°45.8	00.4	178°31.8	57.4
15	22°21.3	50°33.7	·· 55.8	34°35.5	·· 14.8	193°48.4	·· 00.3	193°34.4	·· 57.4
16	37°23.8	65°33.1	54.7	49°36.1	14.0	208°51.1	00.2	208°37.0	57.3
17	52°26.3	80°32.6	53.7	64°36.8	13.3	223°53.8	00.1	223°39.6	57.2
18	67°28.7	95°32.0	S12°52.6	79°37.4	S06°12.5	238°56.5	S02°00.0	238°42.2	S00°57.2
19	82°31.2	110°31.5	51.6	94°38.1	11.7	253°59.2	01°59.9	253°44.8	57.1
20	97°33.6	125°30.9	50.5	109°38.7	10.9	269°01.9	59.8	268°47.4	57.0
21	112°36.1	140°30.4	·· 49.5	124°39.4	·· 10.1	284°04.6	·· 59.6	283°50.0	·· 57.0
22	127°38.6	155°29.8	48.4	139°40.0	09.4	299°07.3	59.5	298°52.6	56.9
23	142°41.0	170°29.3	47.4	154°40.7	08.6	314°09.9	59.4	313°55.2	56.8
Mer.pass. 13:31		ν -0.6′	d 1.0′	m -3.89	ν 0.6′	d 0.8′	m 1.11	ν 2.7′	d 0.1′ m -2.40	ν 2.6′	d 0.1′ m 0.56

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	157°43.5	185°28.7	S12°46.3	169°41.3	S06°07.8	329°12.6	S01°59.3	328°57.8	S00°56.8
1	172°46.0	200°28.2	45.3	184°42.0	07.0	344°15.3	59.2	344°00.5	56.7
2	187°48.4	215°27.6	44.2	199°42.6	06.2	359°18.0	59.1	359°03.1	56.6
3	202°50.9	230°27.1	·· 43.1	214°43.3	·· 05.5	14°20.7	·· 59.0	14°05.7	·· 56.6
4	217°53.4	245°26.5	42.1	229°43.9	04.7	29°23.4	58.9	29°08.3	56.5
5	232°55.8	260°26.0	41.0	244°44.6	03.9	44°26.1	58.8	44°10.9	56.4
6	247°58.3	275°25.4	S12°40.0	259°45.2	S06°03.1	59°28.8	S01°58.7	59°13.5	S00°56.4
7	263°00.8	290°24.9	38.9	274°45.9	02.3	74°31.4	58.6	74°16.1	56.3
8	278°03.2	305°24.3	37.8	289°46.5	01.6	89°34.1	58.5	89°18.7	56.2
9	293°05.7	320°23.8	·· 36.8	304°47.2	·· 00.8	104°36.8	·· 58.4	104°21.3	·· 56.1
10	308°08.1	335°23.2	35.7	319°47.8	06°00.0	119°39.5	58.3	119°23.9	56.1
11	323°10.6	350°22.7	34.7	334°48.5	05°59.2	134°42.2	58.2	134°26.5	56.0
12	338°13.1	5°22.2	S12°33.6	349°49.1	S05°58.4	149°44.9	S01°58.1	149°29.1	S00°55.9
13	353°15.5	20°21.6	32.5	4°49.8	57.7	164°47.6	58.0	164°31.7	55.9
14	8°18.0	35°21.1	31.5	19°50.4	56.9	179°50.3	57.9	179°34.3	55.8
15	23°20.5	50°20.5	·· 30.4	34°51.1	·· 56.1	194°53.0	·· 57.8	194°36.9	·· 55.7
16	38°22.9	65°20.0	29.3	49°51.7	55.3	209°55.7	57.7	209°39.5	55.7
17	53°25.4	80°19.4	28.3	64°52.4	54.5	224°58.4	57.6	224°42.2	55.6
18	68°27.9	95°18.9	S12°27.2	79°53.0	S05°53.7	240°01.0	S01°57.5	239°44.8	S00°55.5
19	83°30.3	110°18.4	26.2	94°53.7	53.0	255°03.7	57.4	254°47.4	55.5
20	98°32.8	125°17.8	25.1	109°54.3	52.2	270°06.4	57.2	269°50.0	55.4
21	113°35.3	140°17.3	·· 24.0	124°55.0	·· 51.4	285°09.1	·· 57.1	284°52.6	·· 55.3
22	128°37.7	155°16.7	23.0	139°55.7	50.6	300°11.8	57.0	299°55.2	55.2
23	143°40.2	170°16.2	21.9	154°56.3	49.8	315°14.5	56.9	314°57.8	55.2
Mer.pass. 13:27		ν -0.5′	d 1.1′	m -3.89	ν 0.6′	d 0.8′	m 1.11	ν 2.7′	d 0.1′ m -2.41	ν 2.6′	d 0.1′ m 0.56

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	158°42.6	185°15.7	S12°20.8	169°57.0	S05°49.1	330°17.2	S01°56.8	330°00.4	S00°55.1
1	173°45.1	200°15.1	19.7	184°57.6	48.3	345°19.9	56.7	345°03.0	55.0
2	188°47.6	215°14.6	18.7	199°58.3	47.5	0°22.6	56.6	0°05.6	55.0
3	203°50.0	230°14.1	·· 17.6	214°58.9	·· 46.7	15°25.3	·· 56.5	15°08.2	·· 54.9
4	218°52.5	245°13.5	16.5	229°59.6	45.9	30°28.0	56.4	30°10.8	54.8
5	233°55.0	260°13.0	15.5	245°00.2	45.1	45°30.7	56.3	45°13.4	54.8
6	248°57.4	275°12.5	S12°14.4	260°00.9	S05°44.4	60°33.4	S01°56.2	60°16.1	S00°54.7
7	263°59.9	290°11.9	13.3	275°01.5	43.6	75°36.1	56.1	75°18.7	54.6
8	279°02.4	305°11.4	12.2	290°02.2	42.8	90°38.8	56.0	90°21.3	54.5
9	294°04.8	320°10.9	·· 11.2	305°02.8	·· 42.0	105°41.4	·· 55.9	105°23.9	·· 54.5
10	309°07.3	335°10.3	10.1	320°03.5	41.2	120°44.1	55.8	120°26.5	54.4
11	324°09.7	350°09.8	09.0	335°04.1	40.4	135°46.8	55.7	135°29.1	54.3
12	339°12.2	5°09.3	S12°07.9	350°04.8	S05°39.7	150°49.5	S01°55.5	150°31.7	S00°54.3
13	354°14.7	20°08.7	06.9	5°05.5	38.9	165°52.2	55.4	165°34.3	54.2
14	9°17.1	35°08.2	05.8	20°06.1	38.1	180°54.9	55.3	180°36.9	54.1
15	24°19.6	50°07.7	·· 04.7	35°06.8	·· 37.3	195°57.6	·· 55.2	195°39.5	·· 54.1
16	39°22.1	65°07.1	03.6	50°07.4	36.5	211°00.3	55.1	210°42.1	54.0
17	54°24.5	80°06.6	02.6	65°08.1	35.7	226°03.0	55.0	225°44.8	53.9
18	69°27.0	95°06.1	S12°01.5	80°08.7	S05°35.0	241°05.7	S01°54.9	240°47.4	S00°53.8
19	84°29.5	110°05.5	12°00.4	95°09.4	34.2	256°08.4	54.8	255°50.0	53.8
20	99°31.9	125°05.0	11°59.3	110°10.0	33.4	271°11.1	54.7	270°52.6	53.7
21	114°34.4	140°04.5	·· 58.2	125°10.7	·· 32.6	286°13.8	·· 54.6	285°55.2	·· 53.6
22	129°36.9	155°03.9	57.1	140°11.3	31.8	301°16.5	54.5	300°57.8	53.6
23	144°39.3	170°03.4	56.1	155°12.0	31.0	316°19.2	54.4	316°00.4	53.5
Mer.pass. 13:23		ν -0.5′	d 1.1′	m -3.89	ν 0.7′	d 0.8′	m 1.10	ν 2.7′	d 0.1′ m -2.41	ν 2.6′	d 0.1′ m 0.56

Stars

	SHA	Dec
Alpheratz	358°09.3	28°59.1
Ankaa	353°40.3	-42°24.8
Schedar	350°09.1	56°26.0
Diphda	349°20.8	-18°05.7
Achernar	335°45.5	-57°20.3
Hamal	328°28.8	23°22.3
Polaris	326°58.2	89°10.9
Acamar	315°37.2	-40°23.2
Menkar	314°40.9	4°00.8
Mirfak	309°15.8	49°47.7
Aldebaran	291°17.6	16°28.2
Rigel	281°35.6	-8°13.6
Capella	281°10.7	45°58.8
Bellatrix	278°58.3	6°19.8
Elnath	278°43.6	28°35.5
Alnilam	276°11.2	-1°13.0
Betelgeuse	271°27.8	7°24.1
Canopus	264°06.8	-52°41.5
Sirius	258°55.2	-16°41.6
Adhara	255°31.6	-28°57.0
Procyon	245°25.2	5°16.3
Pollux	243°57.5	28°04.3
Avior	234°27.5	-59°27.1
Suhail	223°10.1	-43°21.5
Miaplacidus	221°44.0	-69°38.5
Alphard	218°19.9	-8°34.7
Regulus	208°09.3	12°03.5
Dubhe	194°21.1	61°51.1
Denebola	182°58.4	14°40.6
Gienah	176°17.3	-17°26.2
Acrux	173°36.3	-62°59.5
Gacrux	172°27.9	-57°00.3
Alioth	166°41.8	56°03.6
Spica	158°57.0	-11°03.8
Alkaid	153°17.9	49°24.3
Hadar	149°22.5	-60°16.7
Menkent	148°36.4	-36°16.5
Arcturus	146°18.0	19°16.7
Rigil Kent.	140°25.0	-60°45.0
Kochab	137°18.5	74°13.8
Zuben'ubi	137°32.5	-15°57.8
Alphecca	126°31.8	26°46.5
Antares	112°56.5	-26°23.3
Atria	108°20.5	-68°59.3
Sabik	102°40.8	-15°42.1
Shaula	96°55.4	-37°05.3
Rasalhague	96°29.4	12°34.3
Eltanin	90°57.8	51°29.2
Kaus Aust.	84°16.6	-34°23.5
Vega	80°55.8	38°45.7
Nunki	76°29.0	-26°19.2
Altair	62°32.5	8°48.9
Peacock	53°58.4	-56°47.7
Deneb	49°48.6	45°12.6
Enif	34°11.6	9°47.1
Al Na'ir	28°15.0	-47°03.3
Fomalhaut	15°51.4	-29°43.5
Scheat	14°17.6	27°58.7
Markab	14°03.2	15°06.1

Feb 27 Fri	SHA	Mer.pass
Venus	28°57.6	11:38
Mars	12°41.4	12:42
Jupiter	171°23.8	02:07
Saturn	171°11.0	02:08

Feb 28 Sat	SHA	Mer.pass
Venus	27°45.2	11:39
Mars	11°57.8	12:41
Jupiter	171°29.1	02:03
Saturn	171°14.3	02:04

Mar 01 Sun	SHA	Mer.pass
Venus	26°33.0	11:39
Mars	11°14.3	12:40
Jupiter	171°34.6	01:58
Saturn	171°17.8	02:00

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h

Fri	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	176°47.4	S08°27.3	269°59.6	12.7′	S17°00.5	5.9′	54.5′
1	191°47.5	26.3	284°31.3	12.7′	17°06.4	5.8′	54.6′
2	206°47.6	25.4	299°03.0	12.6′	17°12.2	5.8′	54.6′
3	221°47.7	·· 24.5	313°34.6	12.6′	17°18.0	5.7′	54.6′
4	236°47.8	23.5	328°06.1	12.5′	17°23.7	5.6′	54.6′
5	251°47.9	22.6	342°37.7	12.5′	17°29.3	5.6′	54.6′
6	266°48.0	S08°21.6	357°09.1	12.4′	S17°34.9	5.4′	54.6′
7	281°48.1	20.7	11°40.5	12.4′	17°40.3	5.4′	54.7′
8	296°48.2	19.8	26°11.9	12.3′	17°45.7	5.3′	54.7′
9	311°48.4	·· 18.8	40°43.2	12.3′	17°51.0	5.2′	54.7′
10	326°48.5	17.9	55°14.4	12.2′	17°56.2	5.2′	54.7′
11	341°48.6	16.9	69°45.6	12.1′	18°01.4	5.1′	54.7′
12	356°48.7	S08°16.0	84°16.8	12.1′	S18°06.5	4.9′	54.8′
13	11°48.8	15.1	98°47.9	12.0′	18°11.4	5.0′	54.8′
14	26°48.9	14.1	113°18.9	12.0′	18°16.4	4.8′	54.8′
15	41°49.0	·· 13.2	127°49.9	11.9′	18°21.2	4.7′	54.8′
16	56°49.1	12.2	142°20.8	11.9′	18°25.9	4.7′	54.8′
17	71°49.3	11.3	156°51.7	11.8′	18°30.6	4.6′	54.9′
18	86°49.4	S08°10.4	171°22.5	11.8′	S18°35.2	4.4′	54.9′
19	101°49.5	09.4	185°53.3	11.7′	18°39.6	4.4′	54.9′
20	116°49.6	08.5	200°24.0	11.7′	18°44.0	4.4′	54.9′
21	131°49.7	·· 07.5	214°54.7	11.6′	18°48.4	4.2′	55.0′
22	146°49.8	06.6	229°25.3	11.6′	18°52.6	4.1′	55.0′
23	161°49.9	05.6	243°55.8	11.5′	18°56.7	4.1′	55.0′
	SD = 16.1′	d = 0.9′		SD = 14.9′			

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	176°50.0	S08°04.7	258°26.3	11.4′	S19°00.8	4.0′	55.0′
1	191°50.2	03.8	272°56.8	11.4′	19°04.8	3.9′	55.0′
2	206°50.3	02.8	287°27.2	11.3′	19°08.7	3.8′	55.1′
3	221°50.4	·· 01.9	301°57.5	11.3′	19°12.5	3.7′	55.1′
4	236°50.5	00.9	316°27.8	11.2′	19°16.2	3.6′	55.1′
5	251°50.6	08°00.0	330°58.0	11.2′	19°19.8	3.5′	55.1′
6	266°50.7	S07°59.0	345°28.2	11.1′	S19°23.3	3.4′	55.2′
7	281°50.8	58.1	359°58.4	11.1′	19°26.7	3.4′	55.2′
8	296°51.0	57.1	14°28.4	11.0′	19°30.1	3.2′	55.2′
9	311°51.1	·· 56.2	28°58.5	11.0′	19°33.3	3.1′	55.2′
10	326°51.2	55.3	43°28.4	10.9′	19°36.4	3.1′	55.3′
11	341°51.3	54.3	57°58.3	10.9′	19°39.5	3.0′	55.3′
12	356°51.4	S07°53.4	72°28.2	10.8′	S19°42.5	2.8′	55.3′
13	11°51.5	52.4	86°58.0	10.8′	19°45.3	2.8′	55.3′
14	26°51.7	51.5	101°27.8	10.7′	19°48.1	2.7′	55.4′
15	41°51.8	·· 50.5	115°57.5	10.7′	19°50.8	2.5′	55.4′
16	56°51.9	49.6	130°27.1	10.6′	19°53.3	2.5′	55.4′
17	71°52.0	48.6	144°56.7	10.6′	19°55.8	2.4′	55.5′
18	86°52.1	S07°47.7	159°26.3	10.5′	S19°58.2	2.3′	55.5′
19	101°52.3	46.7	173°55.8	10.4′	20°00.5	2.2′	55.5′
20	116°52.4	45.8	188°25.2	10.4′	20°02.7	2.0′	55.5′
21	131°52.5	·· 44.8	202°54.6	10.3′	20°04.7	2.0′	55.6′
22	146°52.6	43.9	217°24.0	10.3′	20°06.7	1.9′	55.6′
23	161°52.7	42.9	231°53.3	10.2′	20°08.6	1.8′	55.6′
	SD = 16.1′	d = 0.9′		SD = 15.0′			

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	176°52.8	S07°42.0	246°22.5	10.2′	S20°10.4	1.6′	55.7′
1	191°53.0	41.0	260°51.7	10.2′	20°12.0	1.6′	55.7′
2	206°53.1	40.1	275°20.9	10.1′	20°13.6	1.5′	55.7′
3	221°53.2	·· 39.1	289°50.0	10.1′	20°15.1	1.3′	55.7′
4	236°53.3	38.2	304°19.0	10.0′	20°16.4	1.3′	55.8′
5	251°53.4	37.2	318°48.0	10.0′	20°17.7	1.2′	55.8′
6	266°53.6	S07°36.3	333°17.0	9.9′	S20°18.9	1.0′	55.8′
7	281°53.7	35.3	347°45.9	9.9′	20°19.9	1.0′	55.9′
8	296°53.8	34.4	2°14.8	9.8′	20°20.9	0.8′	55.9′
9	311°53.9	·· 33.4	16°43.6	9.8′	20°21.7	0.7′	55.9′
10	326°54.1	32.5	31°12.4	9.7′	20°22.4	0.6′	56.0′
11	341°54.2	31.5	45°41.1	9.7′	20°23.0	0.6′	56.0′
12	356°54.3	S07°30.6	60°09.8	9.6′	S20°23.6	0.4′	56.0′
13	11°54.4	29.6	74°38.4	9.6′	20°24.0	0.3′	56.0′
14	26°54.5	28.7	89°07.0	9.6′	20°24.3	0.2′	56.1′
15	41°54.7	·· 27.7	103°35.6	9.5′	20°24.5	0.0′	56.1′
16	56°54.8	26.8	118°04.1	9.5′	20°24.5	0.0′	56.1′
17	71°54.9	25.8	132°32.5	9.4′	20°24.5	0.1′	56.2′
18	86°55.0	S07°24.9	147°01.0	9.4′	S20°24.4	0.3′	56.2′
19	101°55.2	23.9	161°29.4	9.3′	20°24.1	0.3′	56.2′
20	116°55.3	23.0	175°57.7	9.3′	20°23.8	0.5′	56.3′
21	131°55.4	·· 22.0	190°26.0	9.3′	20°23.3	0.6′	56.3′
22	146°55.5	21.1	204°54.3	9.2′	20°22.7	0.7′	56.3′
23	161°55.7	20.1	219°22.5	9.2′	20°22.0	0.8′	56.4′
	SD = 16.1′	d = 0.9′		SD = 15.2′			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	05:15	06:33	07:43	16:44	17:54	19:12
N 70°	05:20	06:30	07:32	16:54	17:57	19:08
68°	05:23	06:28	07:24	17:03	17:59	19:04
66°	05:26	06:25	07:17	17:09	18:01	19:01
64°	05:29	06:23	07:11	17:15	18:03	18:58
62°	05:30	06:22	07:06	17:20	18:05	18:56
60°	05:32	06:20	07:02	17:24	18:07	18:55
N 58°	05:33	06:18	06:58	17:28	18:08	18:53
56°	05:34	06:17	06:54	17:32	18:09	18:52
54°	05:35	06:16	06:51	17:35	18:10	18:51
52°	05:35	06:14	06:48	17:38	18:12	18:51
50°	05:36	06:13	06:46	17:40	18:13	18:50
45°	05:37	06:11	06:40	17:46	18:15	18:49
N 40°	05:37	06:08	06:35	17:51	18:18	18:49
35°	05:36	06:06	06:31	17:55	18:20	18:49
30°	05:35	06:03	06:27	17:58	18:22	18:50
20°	05:33	05:59	06:21	18:05	18:27	18:52
N 10°	05:29	05:54	06:15	18:10	18:32	18:56
0°	05:24	05:48	06:09	18:16	18:37	19:01
S 10°	05:18	05:42	06:04	18:21	18:43	19:07
20°	05:09	05:35	05:57	18:28	18:50	19:16
30°	04:57	05:26	05:50	18:35	18:59	19:27
35°	04:50	05:20	05:46	18:39	19:04	19:35
40°	04:40	05:13	05:41	18:43	19:11	19:44
45°	04:29	05:05	05:36	18:49	19:19	19:55
S 50°	04:14	04:55	05:29	18:55	19:29	20:10
52°	04:07	04:50	05:26	18:58	19:33	20:17
54°	03:59	04:45	05:22	19:02	19:39	20:24
56°	03:50	04:39	05:18	19:05	19:45	20:33
58°	03:39	04:32	05:14	19:10	19:51	20:44
S 60°	03:26	04:24	05:09	19:14	19:59	20:56

Lat.	Moonrise Fri	Moonrise Sat	Moonrise Sun	Moonset Fri	Moonset Sat	Moonset Sun
N 72°	05:21	▬	▬	06:52	▬	▬
N 70°	04:08	06:04	▬	08:06	07:50	▬
68°	03:31	04:59	06:16	08:44	08:55	09:24
66°	03:05	04:24	05:33	09:11	09:31	10:07
64°	02:45	03:59	05:04	09:31	09:57	10:36
62°	02:29	03:39	04:42	09:48	10:17	10:58
60°	02:15	03:23	04:24	10:02	10:33	11:16
N 58°	02:04	03:09	04:09	10:14	10:47	11:31
56°	01:54	02:57	03:56	10:24	10:59	11:44
54°	01:45	02:47	03:45	10:33	11:10	11:55
52°	01:37	02:38	03:36	10:41	11:19	12:05
50°	01:30	02:30	03:27	10:49	11:27	12:14
45°	01:15	02:13	03:08	11:05	11:45	12:32
N 40°	01:02	01:58	02:53	11:17	12:00	12:48
35°	00:52	01:46	02:40	11:29	12:12	13:00
30°	00:43	01:36	02:29	11:38	12:23	13:12
20°	00:27	01:18	02:10	11:55	12:41	13:31
N 10°	00:13	01:03	01:54	12:10	12:57	13:48
0°	00:00	00:48	01:38	12:23	13:12	14:03
S 10°	·· ··	00:34	01:23	12:37	13:27	14:19
20°	·· ··	00:18	01:06	12:52	13:43	14:35
30°	·· ··	00:01	00:48	13:08	14:02	14:54
35°	23:51	·· ··	00:37	13:18	14:12	15:06
40°	23:39	·· ··	00:24	13:29	14:25	15:18
45°	23:25	·· ··	00:09	13:43	14:39	15:33
S 50°	23:09	23:51	·· ··	13:59	14:57	15:52
52°	23:01	23:43	·· ··	14:06	15:06	16:01
54°	22:52	23:33	·· ··	14:15	15:15	16:10
56°	22:42	23:22	·· ··	14:24	15:26	16:21
58°	22:31	23:10	·· ··	14:35	15:38	16:34
S 60°	22:18	22:56	23:45	14:47	15:52	16:49

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 23-25 51-32%
27	12:51	12:45	12:13	06:12	18:36	
28	12:40	12:34	12:13	07:00	19:25	
01	12:29	12:23	12:12	07:51	20:17	

March 02, 03, 04 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	159°41.8	185°02.9	S11°55.0	170°12.7	S05°30.3	331°21.9	S01°54.3	331°03.0	S00°53.4
1	174°44.2	200°02.4	53.9	185°13.3	29.5	346°24.6	54.2	346°05.6	53.4
2	189°46.7	215°01.8	52.8	200°14.0	28.7	1°27.3	54.0	1°08.2	53.3
3	204°49.2	230°01.3	·· 51.7	215°14.6	·· 27.9	16°30.0	·· 53.9	16°10.9	·· 53.2
4	219°51.6	245°00.8	50.6	230°15.3	27.1	31°32.7	53.8	31°13.5	53.1
5	234°54.1	260°00.3	49.6	245°15.9	26.3	46°35.4	53.7	46°16.1	53.1
6	249°56.6	274°59.7	S11°48.5	260°16.6	S05°25.6	61°38.1	S01°53.6	61°18.7	S00°53.0
7	264°59.0	289°59.2	47.4	275°17.2	24.8	76°40.8	53.5	76°21.3	52.9
8	280°01.5	304°58.7	46.3	290°17.9	24.0	91°43.5	53.4	91°23.9	52.9
9	295°04.0	319°58.2	·· 45.2	305°18.6	·· 23.2	106°46.2	·· 53.3	106°26.5	·· 52.8
10	310°06.4	334°57.6	44.1	320°19.2	22.4	121°48.9	53.2	121°29.1	52.7
11	325°08.9	349°57.1	43.0	335°19.9	21.6	136°51.6	53.1	136°31.7	52.7
12	340°11.4	4°56.6	S11°41.9	350°20.5	S05°20.8	151°54.3	S01°53.0	151°34.4	S00°52.6
13	355°13.8	19°56.1	40.9	5°21.2	20.1	166°57.0	52.9	166°37.0	52.5
14	10°16.3	34°55.6	39.8	20°21.8	19.3	181°59.7	52.7	181°39.6	52.4
15	25°18.7	49°55.0	·· 38.7	35°22.5	·· 18.5	197°02.4	·· 52.6	196°42.2	·· 52.4
16	40°21.2	64°54.5	37.6	50°23.2	17.7	212°05.1	52.5	211°44.8	52.3
17	55°23.7	79°54.0	36.5	65°23.8	16.9	227°07.8	52.4	226°47.4	52.2
18	70°26.1	94°53.5	S11°35.4	80°24.5	S05°16.1	242°10.5	S01°52.3	241°50.0	S00°52.2
19	85°28.6	109°53.0	34.3	95°25.1	15.4	257°13.2	52.2	256°52.6	52.1
20	100°31.1	124°52.4	33.2	110°25.8	14.6	272°15.9	52.1	271°55.3	52.0
21	115°33.5	139°51.9	·· 32.1	125°26.4	·· 13.8	287°18.6	·· 52.0	286°57.9	·· 51.9
22	130°36.0	154°51.4	31.0	140°27.1	13.0	302°21.3	51.9	302°00.5	51.9
23	145°38.5	169°50.9	29.9	155°27.8	12.2	317°24.0	51.8	317°03.1	51.8
Mer.pass. 13:19		ν -0.5′	d 1.1′	m -3.88	ν 0.7′	d 0.8′	m 1.10	ν 2.7′	d 0.1′ m -2.42	ν 2.6′	d 0.1′ m 0.55

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	160°40.9	184°50.4	S11°28.8	170°28.4	S05°11.4	332°26.7	S01°51.7	332°05.7	S00°51.7
1	175°43.4	199°49.8	27.7	185°29.1	10.6	347°29.4	51.5	347°08.3	51.7
2	190°45.9	214°49.3	26.6	200°29.7	09.9	2°32.1	51.4	2°10.9	51.6
3	205°48.3	229°48.8	·· 25.5	215°30.4	·· 09.1	17°34.8	·· 51.3	17°13.5	·· 51.5
4	220°50.8	244°48.3	24.4	230°31.0	08.3	32°37.5	51.2	32°16.2	51.4
5	235°53.2	259°47.8	23.3	245°31.7	07.5	47°40.2	51.1	47°18.8	51.4
6	250°55.7	274°47.3	S11°22.2	260°32.4	S05°06.7	62°42.9	S01°51.0	62°21.4	S00°51.3
7	265°58.2	289°46.7	21.1	275°33.0	05.9	77°45.6	50.9	77°24.0	51.2
8	281°00.6	304°46.2	20.0	290°33.7	05.1	92°48.3	50.8	92°26.6	51.2
9	296°03.1	319°45.7	·· 18.9	305°34.3	·· 04.4	107°51.0	·· 50.7	107°29.2	·· 51.1
10	311°05.6	334°45.2	17.8	320°35.0	03.6	122°53.7	50.6	122°31.8	51.0
11	326°08.0	349°44.7	16.7	335°35.7	02.8	137°56.4	50.4	137°34.4	50.9
12	341°10.5	4°44.2	S11°15.6	350°36.3	S05°02.0	152°59.1	S01°50.3	152°37.1	S00°50.9
13	356°13.0	19°43.7	14.5	5°37.0	01.2	168°01.9	50.2	167°39.7	50.8
14	11°15.4	34°43.2	13.4	20°37.6	05°00.4	183°04.6	50.1	182°42.3	50.7
15	26°17.9	49°42.6	·· 12.3	35°38.3	04°59.6	198°07.3	·· 50.0	197°44.9	·· 50.7
16	41°20.3	64°42.1	11.2	50°39.0	58.9	213°10.0	49.9	212°47.5	50.6
17	56°22.8	79°41.6	10.1	65°39.6	58.1	228°12.7	49.8	227°50.1	50.5
18	71°25.3	94°41.1	S11°09.0	80°40.3	S04°57.3	243°15.4	S01°49.7	242°52.7	S00°50.4
19	86°27.7	109°40.6	07.9	95°40.9	56.5	258°18.1	49.6	257°55.4	50.4
20	101°30.2	124°40.1	06.8	110°41.6	55.7	273°20.8	49.4	272°58.0	50.3
21	116°32.7	139°39.6	·· 05.7	125°42.3	·· 54.9	288°23.5	·· 49.3	288°00.6	·· 50.2
22	131°35.1	154°39.1	04.6	140°42.9	54.1	303°26.2	49.2	303°03.2	50.2
23	146°37.6	169°38.6	03.5	155°43.6	53.3	318°28.9	49.1	318°05.8	50.1
Mer.pass. 13:15		ν -0.5′	d 1.1′	m -3.88	ν 0.7′	d 0.8′	m 1.10	ν 2.7′	d 0.1′ m -2.42	ν 2.6′	d 0.1′ m 0.55

Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	161°40.1	184°38.1	S11°02.4	170°44.2	S04°52.6	333°31.6	S01°49.0	333°08.4	S00°50.0
1	176°42.5	199°37.6	01.3	185°44.9	51.8	348°34.3	48.9	348°11.1	49.9
2	191°45.0	214°37.1	11°00.2	200°45.6	51.0	3°37.0	48.8	3°13.7	49.9
3	206°47.5	229°36.5	10°59.0	215°46.2	·· 50.2	18°39.7	·· 48.7	18°16.3	·· 49.8
4	221°49.9	244°36.0	57.9	230°46.9	49.4	33°42.5	48.6	33°18.9	49.7
5	236°52.4	259°35.5	56.8	245°47.5	48.6	48°45.2	48.4	48°21.5	49.7
6	251°54.8	274°35.0	S10°55.7	260°48.2	S04°47.8	63°47.9	S01°48.3	63°24.1	S00°49.6
7	266°57.3	289°34.5	54.6	275°48.9	47.0	78°50.6	48.2	78°26.7	49.5
8	281°59.8	304°34.0	53.5	290°49.5	46.3	93°53.3	48.1	93°29.4	49.4
9	297°02.2	319°33.5	·· 52.4	305°50.2	·· 45.5	108°56.0	·· 48.0	108°32.0	·· 49.4
10	312°04.7	334°33.0	51.3	320°50.8	44.7	123°58.7	47.9	123°34.6	49.3
11	327°07.2	349°32.5	50.2	335°51.5	43.9	139°01.4	47.8	138°37.2	49.2
12	342°09.6	4°32.0	S10°49.0	350°52.2	S04°43.1	154°04.1	S01°47.7	153°39.8	S00°49.1
13	357°12.1	19°31.5	47.9	5°52.8	42.3	169°06.8	47.5	168°42.4	49.1
14	12°14.6	34°31.0	46.8	20°53.5	41.5	184°09.5	47.4	183°45.1	49.0
15	27°17.0	49°30.5	·· 45.7	35°54.2	·· 40.7	199°12.3	·· 47.3	198°47.7	·· 48.9
16	42°19.5	64°30.0	44.6	50°54.8	40.0	214°15.0	47.2	213°50.3	48.9
17	57°22.0	79°29.5	43.5	65°55.5	39.2	229°17.7	47.1	228°52.9	48.8
18	72°24.4	94°29.0	S10°42.3	80°56.1	S04°38.4	244°20.4	S01°47.0	243°55.5	S00°48.7
19	87°26.9	109°28.5	41.2	95°56.8	37.6	259°23.1	46.9	258°58.1	48.6
20	102°29.3	124°28.0	40.1	110°57.5	36.8	274°25.8	46.8	274°00.8	48.6
21	117°31.8	139°27.5	·· 39.0	125°58.1	·· 36.0	289°28.5	·· 46.6	289°03.4	·· 48.5
22	132°34.3	154°27.0	37.9	140°58.8	35.2	304°31.2	46.5	304°06.0	48.4
23	147°36.7	169°26.5	36.7	155°59.5	34.4	319°33.9	46.4	319°08.6	48.3
Mer.pass. 13:11		ν -0.5′	d 1.1′	m -3.88	ν 0.7′	d 0.8′	m 1.10	ν 2.7′	d 0.1′ m -2.42	ν 2.6′	d 0.1′ m 0.54

Stars

	SHA	**Dec**
Alpheratz	358°09.3	28°59.0
Ankaa	353°40.3	-42°24.8
Schedar	350°09.1	56°26.0
Diphda	349°20.8	-18°05.7
Achernar	335°45.5	-57°20.3
Hamal	328°28.8	23°22.3
Polaris	326°59.1	89°10.9
Acamar	315°37.2	-40°23.2
Menkar	314°40.9	4°00.8
Mirfak	309°15.8	49°47.7
Aldebaran	291°17.6	16°28.2
Rigel	281°35.7	-8°13.6
Capella	281°10.8	45°58.8
Bellatrix	278°58.3	6°19.8
Elnath	278°43.7	28°35.5
Alnilam	276°11.3	-1°13.0
Betelgeuse	271°27.8	7°24.1
Canopus	264°06.8	-52°41.5
Sirius	258°55.2	-16°41.6
Adhara	255°31.6	-28°57.1
Procyon	245°25.2	5°16.3
Pollux	243°57.5	28°04.3
Avior	234°27.5	-59°27.2
Suhail	223°10.1	-43°21.5
Miaplacidus	221°44.0	-69°38.5
Alphard	218°19.9	-8°34.7
Regulus	208°09.3	12°03.5
Dubhe	194°21.1	61°51.1
Denebola	182°58.4	14°40.6
Gienah	176°17.3	-17°26.2
Acrux	173°36.3	-62°59.5
Gacrux	172°27.8	-57°00.3
Alioth	166°41.8	56°03.6
Spica	158°56.9	-11°03.8
Alkaid	153°17.9	49°24.3
Hadar	149°22.5	-60°16.7
Menkent	148°36.4	-36°16.5
Arcturus	146°18.0	19°16.7
Rigil Kent.	140°25.0	-60°45.1
Kochab	137°18.5	74°13.8
Zuben'ubi	137°32.5	-15°57.8
Alphecca	126°31.7	26°46.5
Antares	112°56.4	-26°23.3
Atria	108°20.5	-68°59.3
Sabik	102°40.8	-15°42.1
Shaula	96°55.4	-37°05.3
Rasalhague	96°29.4	12°34.3
Eltanin	90°57.7	51°29.2
Kaus Aust.	84°16.6	-34°23.5
Vega	80°55.8	38°45.7
Nunki	76°29.0	-26°19.2
Altair	62°32.4	8°48.9
Peacock	53°58.4	-56°47.7
Deneb	49°48.6	45°12.6
Enif	34°11.6	9°47.1
Al Na'ir	28°15.0	-47°03.2
Fomalhaut	15°51.4	-29°43.5
Scheat	14°17.6	27°58.7
Markab	14°03.2	15°06.0

Mar 02 Mon	**SHA**	**Mer.pass**
Venus	25°21.1	11:40
Mars	10°30.9	12:39
Jupiter	171°40.1	01:54
Saturn	171°21.2	01:55

Mar 03 Tue	**SHA**	**Mer.pass**
Venus	24°09.4	11:41
Mars	9°47.5	12:38
Jupiter	171°45.8	01:50
Saturn	171°24.8	01:51

Mar 04 Wed	**SHA**	**Mer.pass**
Venus	22°58.0	11:42
Mars	9°04.2	12:36
Jupiter	171°51.6	01:46
Saturn	171°28.4	01:47

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = -0.3344 sec ΔT = TT-UT1 = +51.5184 sec

1981 March 02 to Mar. 04 UT

h	Sun		Moon				
Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°55.8	S07°19.2	233°50.7	9.2′	S20°21.2	0.9′	56.4′
1	191°55.9	18.2	248°18.9	9.1′	20°20.3	1.0′	56.4′
2	206°56.0	17.3	262°47.0	9.1′	20°19.3	1.2′	56.5′
3	221°56.2	·· 16.3	277°15.1	9.0′	20°18.1	1.3′	56.5′
4	236°56.3	15.4	291°43.1	9.0′	20°16.8	1.3′	56.5′
5	251°56.4	14.4	306°11.1	9.0′	20°15.5	1.5′	56.6′
6	266°56.5	S07°13.5	320°39.1	8.9′	S20°14.0	1.6′	56.6′
7	281°56.7	12.5	335°07.0	8.9′	20°12.4	1.7′	56.6′
8	296°56.8	11.5	349°35.0	8.9′	20°10.7	1.9′	56.7′
9	311°56.9	·· 10.6	4°02.8	8.8′	20°08.8	1.9′	56.7′
10	326°57.0	09.6	18°30.7	8.8′	20°06.9	2.1′	56.8′
11	341°57.2	08.7	32°58.5	8.8′	20°04.8	2.2′	56.8′
12	356°57.3	S07°07.7	47°26.3	8.8′	S20°02.6	2.3′	56.8′
13	11°57.4	06.8	61°54.0	8.7′	20°00.3	2.4′	56.9′
14	26°57.5	05.8	76°21.8	8.7′	19°57.9	2.5′	56.9′
15	41°57.7	·· 04.9	90°49.5	8.7′	19°55.4	2.6′	56.9′
16	56°57.8	03.9	105°17.2	8.6′	19°52.8	2.8′	57.0′
17	71°57.9	02.9	119°44.8	8.6′	19°50.0	2.9′	57.0′
18	86°58.1	S07°02.0	134°12.4	8.6′	S19°47.1	3.0′	57.0′
19	101°58.2	01.0	148°40.0	8.6′	19°44.1	3.1′	57.1′
20	116°58.3	07°00.1	163°07.6	8.5′	19°41.0	3.2′	57.1′
21	131°58.4	06°59.1	177°35.1	8.5′	19°37.8	3.4′	57.1′
22	146°58.6	58.2	192°02.7	8.5′	19°34.4	3.4′	57.2′
23	161°58.7	57.2	206°30.2	8.5′	19°31.0	3.6′	57.2′
	SD = 16.1′	d = 1.0′	SD = 15.4′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°58.8	S06°56.2	220°57.7	8.5′	S19°27.4	3.7′	57.3′
1	191°59.0	55.3	235°25.1	8.4′	19°23.7	3.8′	57.3′
2	206°59.1	54.3	249°52.6	8.4′	19°19.9	3.9′	57.3′
3	221°59.2	·· 53.4	264°20.0	8.4′	19°16.0	4.1′	57.4′
4	236°59.3	52.4	278°47.4	8.4′	19°11.9	4.1′	57.4′
5	251°59.5	51.5	293°14.8	8.4′	19°07.8	4.3′	57.4′
6	266°59.6	S06°50.5	307°42.1	8.4′	S19°03.5	4.4′	57.5′
7	281°59.7	49.5	322°09.5	8.3′	18°59.1	4.5′	57.5′
8	296°59.9	48.6	336°36.8	8.3′	18°54.6	4.7′	57.5′
9	312°00.0	·· 47.6	351°04.2	8.3′	18°49.9	4.7′	57.6′
10	327°00.1	46.7	5°31.5	8.3′	18°45.2	4.9′	57.6′
11	342°00.3	45.7	19°58.8	8.3′	18°40.3	4.9′	57.6′
12	357°00.4	S06°44.7	34°26.0	8.3′	S18°35.4	5.1′	57.7′
13	12°00.5	43.8	48°53.3	8.3′	18°30.3	5.2′	57.7′
14	27°00.7	42.8	63°20.6	8.2′	18°25.1	5.4′	57.8′
15	42°00.8	·· 41.9	77°47.8	8.2′	18°19.7	5.4′	57.8′
16	57°00.9	40.9	92°15.1	8.2′	18°14.3	5.5′	57.8′
17	72°01.1	40.0	106°42.3	8.2′	18°08.8	5.7′	57.9′
18	87°01.2	S06°39.0	121°09.5	8.2′	S18°03.1	5.8′	57.9′
19	102°01.3	38.0	135°36.7	8.2′	17°57.3	5.9′	57.9′
20	117°01.5	37.1	150°03.9	8.2′	17°51.4	6.0′	58.0′
21	132°01.6	·· 36.1	164°31.1	8.2′	17°45.4	6.1′	58.0′
22	147°01.7	35.1	178°58.3	8.2′	17°39.3	6.3′	58.0′
23	162°01.9	34.2	193°25.5	8.2′	17°33.0	6.3′	58.1′
	SD = 16.1′	d = 1.0′	SD = 15.6′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°02.0	S06°33.2	207°52.7	8.2′	S17°26.7	6.5′	58.1′
1	192°02.1	32.3	222°19.9	8.2′	17°20.2	6.5′	58.1′
2	207°02.3	31.3	236°47.0	8.2′	17°13.7	6.7′	58.2′
3	222°02.4	·· 30.3	251°14.2	8.2′	17°07.0	6.8′	58.2′
4	237°02.5	29.4	265°41.4	8.2′	17°00.2	6.9′	58.3′
5	252°02.7	28.4	280°08.5	8.2′	16°53.3	7.0′	58.3′
6	267°02.8	S06°27.5	294°35.7	8.2′	S16°46.3	7.2′	58.3′
7	282°02.9	26.5	309°02.9	8.2′	16°39.1	7.2′	58.4′
8	297°03.1	25.5	323°30.0	8.2′	16°31.9	7.3′	58.4′
9	312°03.2	·· 24.6	337°57.2	8.2′	16°24.6	7.5′	58.4′
10	327°03.3	23.6	352°24.4	8.2′	16°17.1	7.5′	58.5′
11	342°03.5	22.6	6°51.5	8.2′	16°09.6	7.7′	58.5′
12	357°03.6	S06°21.7	21°18.7	8.2′	S16°01.9	7.8′	58.5′
13	12°03.8	20.7	35°45.9	8.2′	15°54.1	7.8′	58.6′
14	27°03.9	19.8	50°13.0	8.2′	15°46.3	8.0′	58.6′
15	42°04.0	·· 18.8	64°40.2	8.2′	15°38.3	8.1′	58.6′
16	57°04.2	17.8	79°07.4	8.2′	15°30.2	8.2′	58.7′
17	72°04.3	16.9	93°34.6	8.2′	15°22.0	8.3′	58.7′
18	87°04.4	S06°15.9	108°01.8	8.2′	S15°13.7	8.3′	58.7′
19	102°04.6	14.9	122°29.0	8.2′	15°05.4	8.5′	58.8′
20	117°04.7	14.0	136°56.2	8.2′	14°56.9	8.6′	58.8′
21	132°04.9	·· 13.0	151°23.4	8.2′	14°48.3	8.7′	58.8′
22	147°05.0	12.0	165°50.6	8.2′	14°39.6	8.8′	58.9′
23	162°05.1	11.1	180°17.8	8.2′	14°30.8	8.9′	58.9′
	SD = 16.1′	d = 1.0′	SD = 15.8′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	05:00	06:19	07:27	16:59	18:08	19:26
N 70°	05:07	06:17	07:18	17:07	18:09	19:20
68°	05:11	06:16	07:12	17:14	18:10	19:15
66°	05:15	06:14	07:06	17:20	18:11	19:11
64°	05:19	06:13	07:01	17:24	18:12	19:07
62°	05:21	06:12	06:57	17:28	18:13	19:04
60°	05:23	06:11	06:53	17:32	18:14	19:02
N 58°	05:25	06:10	06:50	17:35	18:15	19:00
56°	05:27	06:10	06:47	17:38	18:15	18:58
54°	05:28	06:09	06:44	17:41	18:16	18:57
52°	05:29	06:08	06:42	17:43	18:17	18:56
50°	05:30	06:07	06:40	17:45	18:18	18:55
45°	05:31	06:05	06:35	17:50	18:19	18:53
N 40°	05:32	06:04	06:31	17:54	18:21	18:52
35°	05:33	06:02	06:27	17:57	18:23	18:52
30°	05:32	06:00	06:24	18:00	18:24	18:52
20°	05:31	05:56	06:18	18:06	18:28	18:53
N 10°	05:28	05:52	06:13	18:11	18:32	18:56
0°	05:24	05:48	06:09	18:15	18:36	19:00
S 10°	05:18	05:43	06:04	18:20	18:41	19:06
20°	05:10	05:36	05:58	18:25	18:47	19:13
30°	05:00	05:28	05:52	18:31	18:55	19:24
35°	04:53	05:23	05:49	18:35	19:00	19:31
40°	04:44	05:17	05:45	18:39	19:06	19:39
45°	04:34	05:10	05:40	18:43	19:13	19:49
S 50°	04:20	05:01	05:34	18:49	19:22	20:02
52°	04:14	04:56	05:31	18:52	19:26	20:09
54°	04:06	04:51	05:28	18:55	19:31	20:16
56°	03:58	04:46	05:25	18:58	19:36	20:24
58°	03:48	04:40	05:21	19:01	19:42	20:34
S 60°	03:37	04:33	05:17	19:05	19:49	20:45

Lat.	**Moonrise** Mon	Tue	Wed	**Moonset** Mon	Tue	Wed
N 72°	▬	▬	08:53	▬	▬	12:24
N 70°	▬	08:19	08:07	▬	11:03	13:09
68°	07:06	07:28	07:37	10:24	11:54	13:38
66°	06:24	06:56	07:15	11:05	12:25	14:00
64°	05:55	06:32	06:57	11:34	12:49	14:17
62°	05:34	06:13	06:42	11:55	13:07	14:31
60°	05:16	05:57	06:29	12:13	13:22	14:43
N 58°	05:01	05:44	06:19	12:27	13:35	14:53
56°	04:49	05:33	06:09	12:40	13:47	15:02
54°	04:38	05:23	06:01	12:51	13:56	15:10
52°	04:28	05:14	05:53	13:00	14:05	15:17
50°	04:19	05:06	05:46	13:09	14:13	15:24
45°	04:01	04:49	05:32	13:27	14:29	15:37
N 40°	03:46	04:35	05:20	13:42	14:43	15:48
35°	03:33	04:23	05:10	13:55	14:54	15:58
30°	03:22	04:12	05:01	14:06	15:04	16:06
20°	03:03	03:54	04:45	14:24	15:21	16:21
N 10°	02:46	03:39	04:31	14:41	15:36	16:33
0°	02:30	03:24	04:19	14:56	15:50	16:45
S 10°	02:15	03:09	04:06	15:11	16:04	16:56
20°	01:58	02:54	03:52	15:27	16:19	17:08
30°	01:39	02:36	03:36	15:46	16:35	17:22
35°	01:28	02:25	03:27	15:57	16:45	17:30
40°	01:16	02:13	03:17	16:09	16:56	17:39
45°	01:00	01:59	03:04	16:24	17:09	17:50
S 50°	00:42	01:42	02:49	16:41	17:25	18:03
52°	00:33	01:34	02:42	16:50	17:32	18:09
54°	00:24	01:24	02:35	16:59	17:40	18:15
56°	00:13	01:14	02:26	17:09	17:50	18:22
58°	00:00	01:02	02:16	17:21	18:00	18:31
S 60°	·· ··	00:49	02:05	17:35	18:12	18:40

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 26-28 22-8%
02	12:17	12:11	12:12	08:43	21:10	
03	12:05	11:58	12:12	09:37	22:04	
04	11:52	11:46	12:12	10:32	22:59	

March 05, 06, 07 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	162°39.2	184°26.0	S10°35.6	171°00.1	S04°33.7	334°36.7	S01°46.3	334°11.2	S00°48.3
1	177°41.7	199°25.5	34.5	186°00.8	32.9	349°39.4	46.2	349°13.8	48.2
2	192°44.1	214°25.0	33.4	201°01.4	32.1	4°42.1	46.1	4°16.5	48.1
3	207°46.6	229°24.5	·· 32.3	216°02.1	·· 31.3	19°44.8	·· 46.0	19°19.1	·· 48.1
4	222°49.1	244°24.0	31.1	231°02.8	30.5	34°47.5	45.9	34°21.7	48.0
5	237°51.5	259°23.5	30.0	246°03.4	29.7	49°50.2	45.7	49°24.3	47.9
6	252°54.0	274°23.0	S10°28.9	261°04.1	S04°28.9	64°52.9	S01°45.6	64°26.9	S00°47.8
7	267°56.4	289°22.5	27.8	276°04.8	28.1	79°55.6	45.5	79°29.5	47.8
8	282°58.9	304°22.0	26.6	291°05.4	27.3	94°58.4	45.4	94°32.2	47.7
9	298°01.4	319°21.5	·· 25.5	306°06.1	·· 26.6	110°01.1	·· 45.3	109°34.8	·· 47.6
10	313°03.8	334°21.0	24.4	321°06.7	25.8	125°03.8	45.2	124°37.4	47.5
11	328°06.3	349°20.6	23.3	336°07.4	25.0	140°06.5	45.1	139°40.0	47.5
12	343°08.8	4°20.1	S10°22.1	351°08.1	S04°24.2	155°09.2	S01°44.9	154°42.6	S00°47.4
13	358°11.2	19°19.6	21.0	6°08.7	23.4	170°11.9	44.8	169°45.3	47.3
14	13°13.7	34°19.1	19.9	21°09.4	22.6	185°14.6	44.7	184°47.9	47.3
15	28°16.2	49°18.6	·· 18.8	36°10.1	·· 21.8	200°17.3	·· 44.6	199°50.5	·· 47.2
16	43°18.6	64°18.1	17.6	51°10.7	21.0	215°20.1	44.5	214°53.1	47.1
17	58°21.1	79°17.6	16.5	66°11.4	20.2	230°22.8	44.4	229°55.7	47.0
18	73°23.6	94°17.1	S10°15.4	81°12.1	S04°19.5	245°25.5	S01°44.3	244°58.4	S00°47.0
19	88°26.0	109°16.6	14.2	96°12.7	18.7	260°28.2	44.2	260°01.0	46.9
20	103°28.5	124°16.1	13.1	111°13.4	17.9	275°30.9	44.0	275°03.6	46.8
21	118°30.9	139°15.6	·· 12.0	126°14.1	·· 17.1	290°33.6	·· 43.9	290°06.2	·· 46.7
22	133°33.4	154°15.2	10.9	141°14.7	16.3	305°36.4	43.8	305°08.8	46.7
23	148°35.9	169°14.7	09.7	156°15.4	15.5	320°39.1	43.7	320°11.4	46.6
Mer.pass. 13:07		ν -0.5′ d 1.1′		m -3.88	ν 0.7′ d 0.8′		m 1.10	ν 2.7′ d 0.1′	m -2.43	ν 2.6′ d 0.1′	m 0.54

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	163°38.3	184°14.2	S10°08.6	171°16.1	S04°14.7	335°41.8	S01°43.6	335°14.1	S00°46.5
1	178°40.8	199°13.7	07.5	186°16.7	13.9	350°44.5	43.5	350°16.7	46.4
2	193°43.3	214°13.2	06.3	201°17.4	13.1	5°47.2	43.3	5°19.3	46.4
3	208°45.7	229°12.7	·· 05.2	216°18.0	·· 12.4	20°49.9	·· 43.2	20°21.9	·· 46.3
4	223°48.2	244°12.2	04.1	231°18.7	11.6	35°52.7	43.1	35°24.5	46.2
5	238°50.7	259°11.7	02.9	246°19.4	10.8	50°55.4	43.0	50°27.2	46.2
6	253°53.1	274°11.2	S10°01.8	261°20.0	S04°10.0	65°58.1	S01°42.9	65°29.8	S00°46.1
7	268°55.6	289°10.8	10°00.7	276°20.7	09.2	81°00.8	42.8	80°32.4	46.0
8	283°58.0	304°10.3	09°59.5	291°21.4	08.4	96°03.5	42.7	95°35.0	45.9
9	299°00.5	319°09.8	·· 58.4	306°22.0	·· 07.6	111°06.2	·· 42.5	110°37.6	·· 45.9
10	314°03.0	334°09.3	57.2	321°22.7	06.8	126°09.0	42.4	125°40.3	45.8
11	329°05.4	349°08.8	56.1	336°23.4	06.0	141°11.7	42.3	140°42.9	45.7
12	344°07.9	4°08.3	S09°55.0	351°24.0	S04°05.2	156°14.4	S01°42.2	155°45.5	S00°45.6
13	359°10.4	19°07.9	53.8	6°24.7	04.5	171°17.1	42.1	170°48.1	45.6
14	14°12.8	34°07.4	52.7	21°25.4	03.7	186°19.8	42.0	185°50.7	45.5
15	29°15.3	49°06.9	·· 51.6	36°26.0	·· 02.9	201°22.5	·· 41.9	200°53.4	·· 45.4
16	44°17.8	64°06.4	50.4	51°26.7	02.1	216°25.3	41.7	215°56.0	45.3
17	59°20.2	79°05.9	49.3	66°27.4	01.3	231°28.0	41.6	230°58.6	45.3
18	74°22.7	94°05.4	S09°48.1	81°28.0	S04°00.5	246°30.7	S01°41.5	246°01.2	S00°45.2
19	89°25.2	109°05.0	47.0	96°28.7	03°59.7	261°33.4	41.4	261°03.9	45.1
20	104°27.6	124°04.5	45.8	111°29.4	58.9	276°36.1	41.3	276°06.5	45.0
21	119°30.1	139°04.0	·· 44.7	126°30.0	·· 58.1	291°38.9	·· 41.2	291°09.1	·· 45.0
22	134°32.5	154°03.5	43.6	141°30.7	57.3	306°41.6	41.0	306°11.7	44.9
23	149°35.0	169°03.0	42.4	156°31.4	56.6	321°44.3	40.9	321°14.3	44.8
Mer.pass. 13:03		ν -0.5′ d 1.1′		m -3.88	ν 0.7′ d 0.8′		m 1.10	ν 2.7′ d 0.1′	m -2.43	ν 2.6′ d 0.1′	m 0.53

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	164°37.5	184°02.6	S09°41.3	171°32.0	S03°55.8	336°47.0	S01°40.8	336°17.0	S00°44.7
1	179°39.9	199°02.1	40.1	186°32.7	55.0	351°49.7	40.7	351°19.6	44.7
2	194°42.4	214°01.6	39.0	201°33.4	54.2	6°52.5	40.6	6°22.2	44.6
3	209°44.9	229°01.1	·· 37.8	216°34.1	·· 53.4	21°55.2	·· 40.5	21°24.8	·· 44.5
4	224°47.3	244°00.6	36.7	231°34.7	52.6	36°57.9	40.3	36°27.4	44.5
5	239°49.8	259°00.2	35.6	246°35.4	51.8	52°00.6	40.2	51°30.1	44.4
6	254°52.3	273°59.7	S09°34.4	261°36.1	S03°51.0	67°03.3	S01°40.1	66°32.7	S00°44.3
7	269°54.7	288°59.2	33.3	276°36.7	50.2	82°06.1	40.0	81°35.3	44.2
8	284°57.2	303°58.7	32.1	291°37.4	49.4	97°08.8	39.9	96°37.9	44.2
9	299°59.7	318°58.3	·· 31.0	306°38.1	·· 48.7	112°11.5	·· 39.8	111°40.6	·· 44.1
10	315°02.1	333°57.8	29.8	321°38.7	47.9	127°14.2	39.6	126°43.2	44.0
11	330°04.6	348°57.3	28.7	336°39.4	47.1	142°16.9	39.5	141°45.8	43.9
12	345°07.0	3°56.8	S09°27.5	351°40.1	S03°46.3	157°19.7	S01°39.4	156°48.4	S00°43.9
13	0°09.5	18°56.4	26.4	6°40.7	45.5	172°22.4	39.3	171°51.0	43.8
14	15°12.0	33°55.9	25.2	21°41.4	44.7	187°25.1	39.2	186°53.7	43.7
15	30°14.4	48°55.4	·· 24.1	36°42.1	·· 43.9	202°27.8	·· 39.1	201°56.3	·· 43.6
16	45°16.9	63°54.9	22.9	51°42.7	43.1	217°30.6	38.9	216°58.9	43.6
17	60°19.4	78°54.5	21.8	66°43.4	42.3	232°33.3	38.8	232°01.5	43.5
18	75°21.8	93°54.0	S09°20.6	81°44.1	S03°41.5	247°36.0	S01°38.7	247°04.2	S00°43.4
19	90°24.3	108°53.5	19.5	96°44.7	40.7	262°38.7	38.6	262°06.8	43.3
20	105°26.8	123°53.0	18.3	111°45.4	40.0	277°41.5	38.5	277°09.4	43.3
21	120°29.2	138°52.6	·· 17.2	126°46.1	·· 39.2	292°44.2	·· 38.4	292°12.0	·· 43.2
22	135°31.7	153°52.1	16.0	141°46.8	38.4	307°46.9	38.2	307°14.7	43.1
23	150°34.1	168°51.6	14.9	156°47.4	37.6	322°49.6	38.1	322°17.3	43.0
Mer.pass. 12:59		ν -0.5′ d 1.1′		m -3.88	ν 0.7′ d 0.8′		m 1.10	ν 2.7′ d 0.1′	m -2.44	ν 2.6′ d 0.1′	m 0.53

Stars

	SHA	Dec
Alpheratz	358°09.3	28°59.0
Ankaa	353°40.3	-42°24.8
Schedar	350°09.1	56°26.0
Diphda	349°20.8	-18°05.7
Achernar	335°45.5	-57°20.3
Hamal	328°28.8	23°22.3
Polaris	327°00.2	89°10.9
Acamar	315°37.2	-40°23.2
Menkar	314°40.9	4°00.8
Mirfak	309°15.8	49°47.7
Aldebaran	291°17.6	16°28.2
Rigel	281°35.7	-8°13.6
Capella	281°10.8	45°58.8
Bellatrix	278°58.3	6°19.8
Elnath	278°43.7	28°35.5
Alnilam	276°11.3	-1°13.0
Betelgeuse	271°27.8	7°24.1
Canopus	264°06.9	-52°41.5
Sirius	258°55.2	-16°41.6
Adhara	255°31.7	-28°57.1
Procyon	245°25.2	5°16.3
Pollux	243°57.5	28°04.3
Avior	234°27.6	-59°27.2
Suhail	223°10.1	-43°21.6
Miaplacidus	221°44.1	-69°38.5
Alphard	218°19.9	-8°34.7
Regulus	208°09.3	12°03.5
Dubhe	194°21.1	61°51.2
Denebola	182°58.4	14°40.6
Gienah	176°17.3	-17°26.3
Acrux	173°36.3	-62°59.5
Gacrux	172°27.8	-57°00.3
Alioth	166°41.7	56°03.6
Spica	158°56.9	-11°03.8
Alkaid	153°17.9	49°24.3
Hadar	149°22.4	-60°16.7
Menkent	148°36.4	-36°16.5
Arcturus	146°18.0	19°16.7
Rigil Kent.	140°25.0	-60°45.1
Kochab	137°18.4	74°13.8
Zuben'ubi	137°32.5	-15°57.8
Alphecca	126°31.7	26°46.5
Antares	112°56.4	-26°23.3
Atria	108°20.4	-68°59.3
Sabik	102°40.8	-15°42.1
Shaula	96°55.4	-37°05.3
Rasalhague	96°29.3	12°34.3
Eltanin	90°57.7	51°29.2
Kaus Aust.	84°16.6	-34°23.5
Vega	80°55.8	38°45.7
Nunki	76°28.9	-26°19.2
Altair	62°32.4	8°48.9
Peacock	53°58.3	-56°47.7
Deneb	49°48.6	45°12.6
Enif	34°11.6	9°47.1
Al Na'ir	28°15.0	-47°03.2
Fomalhaut	15°51.4	-29°43.5
Scheat	14°17.6	27°58.7
Markab	14°03.2	15°06.0

Mar 05 Thu	SHA	Mer.pass
Venus	21°46.8	11:43
Mars	8°20.9	12:35
Jupiter	171°57.5	01:41
Saturn	171°32.0	01:43

Mar 06 Fri	SHA	Mer.pass
Venus	20°35.8	11:43
Mars	7°37.7	12:34
Jupiter	172°03.4	01:37
Saturn	171°35.7	01:39

Mar 07 Sat	SHA	Mer.pass
Venus	19°25.1	11:44
Mars	6°54.6	12:33
Jupiter	172°09.5	01:33
Saturn	171°39.5	01:35

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = -0.3423 sec ΔT = TT-UT1 = +51.5263 sec

1981 March 05 to Mar. 07 UT

h	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°05.3	S06°10.1	194°45.0	8.2′	S14°21.9	9.0′	58.9′
1	192°05.4	09.1	209°12.3	8.2′	14°12.9	9.0′	59.0′
2	207°05.5	08.2	223°39.5	8.3′	14°03.9	9.2′	59.0′
3	222°05.7	·· 07.2	238°06.8	8.3′	13°54.7	9.3′	59.0′
4	237°05.8	06.2	252°34.0	8.3′	13°45.4	9.4′	59.0′
5	252°06.0	05.3	267°01.3	8.3′	13°36.0	9.4′	59.1′
6	267°06.1	S06°04.3	281°28.6	8.3′	S13°26.6	9.6′	59.1′
7	282°06.2	03.4	295°55.9	8.3′	13°17.0	9.6′	59.1′
8	297°06.4	02.4	310°23.1	8.3′	13°07.4	9.7′	59.2′
9	312°06.5	·· 01.4	324°50.5	8.3′	12°57.7	9.8′	59.2′
10	327°06.7	06°00.5	339°17.8	8.3′	12°47.9	9.9′	59.2′
11	342°06.8	05°59.5	353°45.1	8.3′	12°38.0	10.0′	59.3′
12	357°06.9	S05°58.5	8°12.4	8.3′	S12°28.0	10.1′	59.3′
13	12°07.1	57.6	22°39.8	8.4′	12°17.9	10.2′	59.3′
14	27°07.2	56.6	37°07.1	8.4′	12°07.7	10.2′	59.3′
15	42°07.4	·· 55.6	51°34.5	8.4′	11°57.5	10.3′	59.4′
16	57°07.5	54.7	66°01.9	8.4′	11°47.2	10.5′	59.4′
17	72°07.7	53.7	80°29.3	8.4′	11°36.7	10.4′	59.4′
18	87°07.8	S05°52.7	94°56.7	8.4′	S11°26.3	10.6′	59.5′
19	102°07.9	51.8	109°24.1	8.4′	11°15.7	10.7′	59.5′
20	117°08.1	50.8	123°51.5	8.4′	11°05.0	10.7′	59.5′
21	132°08.2	·· 49.8	138°18.9	8.4′	10°54.3	10.8′	59.5′
22	147°08.4	48.8	152°46.4	8.5′	10°43.5	10.9′	59.6′
23	162°08.5	47.9	167°13.8	8.5′	10°32.6	10.9′	59.6′
	SD = 16.1′	d = 1.0′	SD = 16.1′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°08.7	S05°46.9	181°41.3	8.5′	S10°21.7	11.0′	59.6′
1	192°08.8	45.9	196°08.8	8.5′	10°10.7	11.1′	59.6′
2	207°08.9	45.0	210°36.2	8.5′	09°59.6	11.2′	59.7′
3	222°09.1	·· 44.0	225°03.7	8.5′	09°48.4	11.2′	59.7′
4	237°09.2	43.0	239°31.2	8.5′	09°37.2	11.3′	59.7′
5	252°09.4	42.1	253°58.8	8.5′	09°25.9	11.4′	59.7′
6	267°09.5	S05°41.1	268°26.3	8.5′	S09°14.5	11.4′	59.7′
7	282°09.7	40.1	282°53.8	8.6′	09°03.1	11.5′	59.8′
8	297°09.8	39.2	297°21.4	8.6′	08°51.6	11.6′	59.8′
9	312°09.9	·· 38.2	311°49.0	8.6′	08°40.0	11.6′	59.8′
10	327°10.1	37.2	326°16.5	8.6′	08°28.4	11.7′	59.8′
11	342°10.2	36.2	340°44.1	8.6′	08°16.7	11.7′	59.9′
12	357°10.4	S05°35.3	355°11.7	8.6′	S08°05.0	11.8′	59.9′
13	12°10.5	34.3	9°39.3	8.6′	07°53.2	11.9′	59.9′
14	27°10.7	33.3	24°06.9	8.6′	07°41.3	11.9′	59.9′
15	42°10.8	·· 32.4	38°34.6	8.6′	07°29.4	12.0′	59.9′
16	57°11.0	31.4	53°02.2	8.6′	07°17.4	12.0′	60.0′
17	72°11.1	30.4	67°29.9	8.7′	07°05.4	12.1′	60.0′
18	87°11.3	S05°29.5	81°57.5	8.7′	S06°53.3	12.1′	60.0′
19	102°11.4	28.5	96°25.2	8.7′	06°41.2	12.1′	60.0′
20	117°11.6	27.5	110°52.8	8.7′	06°29.1	12.2′	60.0′
21	132°11.7	·· 26.5	125°20.5	8.7′	06°16.9	12.3′	60.0′
22	147°11.8	25.6	139°48.2	8.7′	06°04.6	12.3′	60.1′
23	162°12.0	24.6	154°15.9	8.7′	05°52.3	12.3′	60.1′
	SD = 16.1′	d = 1.0′	SD = 16.3′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°12.1	S05°23.6	168°43.6	8.7′	S05°40.0	12.4′	60.1′
1	192°12.3	22.7	183°11.3	8.7′	05°27.6	12.4′	60.1′
2	207°12.4	21.7	197°39.1	8.7′	05°15.2	12.5′	60.1′
3	222°12.6	·· 20.7	212°06.8	8.7′	05°02.7	12.5′	60.1′
4	237°12.7	19.7	226°34.5	8.7′	04°50.2	12.5′	60.2′
5	252°12.9	18.8	241°02.3	8.7′	04°37.7	12.6′	60.2′
6	267°13.0	S05°17.8	255°30.0	8.8′	S04°25.1	12.6′	60.2′
7	282°13.2	16.8	269°57.7	8.8′	04°12.5	12.6′	60.2′
8	297°13.3	15.9	284°25.5	8.8′	03°59.9	12.7′	60.2′
9	312°13.5	·· 14.9	298°53.3	8.8′	03°47.2	12.7′	60.2′
10	327°13.6	13.9	313°21.0	8.8′	03°34.5	12.7′	60.2′
11	342°13.8	12.9	327°48.8	8.8′	03°21.8	12.7′	60.2′
12	357°13.9	S05°12.0	342°16.6	8.8′	S03°09.1	12.8′	60.3′
13	12°14.1	11.0	356°44.4	8.8′	02°56.3	12.8′	60.3′
14	27°14.2	10.0	11°12.1	8.8′	02°43.5	12.8′	60.3′
15	42°14.4	·· 09.0	25°39.9	8.8′	02°30.7	12.8′	60.3′
16	57°14.5	08.1	40°07.7	8.8′	02°17.9	12.8′	60.3′
17	72°14.7	07.1	54°35.5	8.8′	02°05.1	12.9′	60.3′
18	87°14.8	S05°06.1	69°03.3	8.8′	S01°52.2	12.9′	60.3′
19	102°15.0	05.1	83°31.1	8.8′	01°39.3	12.8′	60.3′
20	117°15.1	04.2	97°58.9	8.8′	01°26.5	12.9′	60.3′
21	132°15.3	·· 03.2	112°26.6	8.8′	01°13.6	12.9′	60.3′
22	147°15.4	02.2	126°54.4	8.8′	01°00.7	13.0′	60.3′
23	162°15.6	01.3	141°22.2	8.8′	00°47.7	12.9′	60.3′
	SD = 16.1′	d = 1.0′	SD = 16.4′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	04:45	06:04	07:11	17:13	18:21	19:41
N 70°	04:53	06:04	07:05	17:20	18:21	19:33
68°	04:59	06:04	06:59	17:25	18:21	19:26
66°	05:04	06:03	06:55	17:30	18:21	19:21
64°	05:08	06:03	06:51	17:33	18:21	19:16
62°	05:12	06:03	06:47	17:37	18:21	19:13
60°	05:15	06:03	06:44	17:40	18:21	19:10
N 58°	05:17	06:02	06:42	17:42	18:21	19:07
56°	05:19	06:02	06:39	17:44	18:22	19:05
54°	05:21	06:02	06:37	17:47	18:22	19:03
52°	05:22	06:01	06:35	17:48	18:22	19:01
50°	05:24	06:01	06:33	17:50	18:22	19:00
45°	05:26	06:00	06:29	17:54	18:23	18:57
N 40°	05:28	05:59	06:26	17:57	18:24	18:56
35°	05:29	05:58	06:23	18:00	18:25	18:55
30°	05:29	05:57	06:21	18:02	18:26	18:54
20°	05:28	05:54	06:16	18:07	18:29	18:54
N 10°	05:26	05:51	06:12	18:11	18:32	18:56
0°	05:23	05:47	06:08	18:15	18:35	18:59
S 10°	05:18	05:43	06:04	18:19	18:40	19:04
20°	05:11	05:37	06:00	18:23	18:45	19:11
30°	05:02	05:30	05:54	18:28	18:52	19:20
35°	04:56	05:26	05:51	18:31	18:56	19:26
40°	04:48	05:20	05:48	18:34	19:01	19:34
45°	04:38	05:14	05:44	18:38	19:08	19:43
S 50°	04:26	05:06	05:39	18:43	19:16	19:55
52°	04:20	05:02	05:37	18:45	19:19	20:01
54°	04:13	04:58	05:34	18:47	19:24	20:08
56°	04:06	04:53	05:31	18:50	19:28	20:15
58°	03:57	04:47	05:28	18:53	19:33	20:24
S 60°	03:46	04:41	05:25	18:56	19:39	20:34

Lat.	**Moonrise** Thu	Fri	Sat	**Moonset** Thu	Fri	Sat
N 72°	08:24	08:07	07:54	14:47	16:58	19:04
N 70°	08:00	07:54	07:49	15:10	17:09	19:06
68°	07:41	07:43	07:44	15:27	17:18	19:08
66°	07:26	07:34	07:40	15:41	17:25	19:10
64°	07:14	07:26	07:37	15:53	17:31	19:12
62°	07:03	07:20	07:34	16:02	17:37	19:13
60°	06:54	07:14	07:31	16:10	17:41	19:14
N 58°	06:46	07:09	07:29	16:18	17:45	19:15
56°	06:39	07:04	07:27	16:24	17:49	19:16
54°	06:33	07:00	07:25	16:30	17:52	19:17
52°	06:27	06:56	07:23	16:35	17:55	19:17
50°	06:22	06:53	07:22	16:39	17:58	19:18
45°	06:11	06:46	07:18	16:49	18:04	19:19
N 40°	06:01	06:39	07:16	16:57	18:08	19:20
35°	05:53	06:34	07:13	17:04	18:13	19:21
30°	05:46	06:29	07:11	17:11	18:16	19:22
20°	05:34	06:21	07:07	17:21	18:22	19:24
N 10°	05:23	06:14	07:04	17:30	18:28	19:25
0°	05:13	06:07	07:01	17:39	18:33	19:26
S 10°	05:03	06:00	06:58	17:47	18:38	19:27
20°	04:52	05:53	06:54	17:56	18:43	19:29
30°	04:40	05:45	06:51	18:07	18:49	19:30
35°	04:32	05:40	06:49	18:12	18:52	19:31
40°	04:24	05:34	06:46	18:19	18:56	19:31
45°	04:15	05:28	06:43	18:27	19:00	19:32
S 50°	04:03	05:20	06:40	18:36	19:06	19:33
52°	03:58	05:17	06:38	18:40	19:08	19:34
54°	03:52	05:13	06:37	18:45	19:11	19:34
56°	03:45	05:09	06:35	18:50	19:13	19:35
58°	03:37	05:04	06:33	18:55	19:17	19:36
S 60°	03:29	04:58	06:30	19:02	19:20	19:36

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 29-1 3-1%
05	11:39	11:32	12:12	11:26	23:53	
06	11:25	11:18	12:11	12:20	–:–	
07	11:11	11:04	12:11	13:14	00:47	

March 08, 09, 10 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	165°36.6	183°51.2	S09°13.7	171°48.1	S03°36.8	337°52.3	S01°38.0	337°19.9	S00°43.0
1	180°39.1	198°50.7	12.6	186°48.8	36.0	352°55.1	37.9	352°22.5	42.9
2	195°41.5	213°50.2	11.4	201°49.4	35.2	7°57.8	37.8	7°25.1	42.8
3	210°44.0	228°49.8	·· 10.3	216°50.1	·· 34.4	23°00.5	·· 37.7	22°27.8	·· 42.7
4	225°46.5	243°49.3	09.1	231°50.8	33.6	38°03.2	37.5	37°30.4	42.7
5	240°48.9	258°48.8	07.9	246°51.4	32.8	53°06.0	37.4	52°33.0	42.6
6	255°51.4	273°48.3	S09°06.8	261°52.1	S03°32.0	68°08.7	S01°37.3	67°35.6	S00°42.5
7	270°53.9	288°47.9	05.6	276°52.8	31.2	83°11.4	37.2	82°38.3	42.4
8	285°56.3	303°47.4	04.5	291°53.5	30.5	98°14.1	37.1	97°40.9	42.4
9	300°58.8	318°46.9	·· 03.3	306°54.1	·· 29.7	113°16.9	·· 36.9	112°43.5	·· 42.3
10	316°01.3	333°46.5	02.2	321°54.8	28.9	128°19.6	36.8	127°46.1	42.2
11	331°03.7	348°46.0	09°01.0	336°55.5	28.1	143°22.3	36.7	142°48.8	42.1
12	346°06.2	3°45.5	S08°59.8	351°56.1	S03°27.3	158°25.0	S01°36.6	157°51.4	S00°42.1
13	1°08.6	18°45.1	58.7	6°56.8	26.5	173°27.8	36.5	172°54.0	42.0
14	16°11.1	33°44.6	57.5	21°57.5	25.7	188°30.5	36.4	187°56.6	41.9
15	31°13.6	48°44.1	·· 56.4	36°58.2	·· 24.9	203°33.2	·· 36.2	202°59.3	·· 41.8
16	46°16.0	63°43.7	55.2	51°58.8	24.1	218°36.0	36.1	218°01.9	41.8
17	61°18.5	78°43.2	54.0	66°59.5	23.3	233°38.7	36.0	233°04.5	41.7
18	76°21.0	93°42.8	S08°52.9	82°00.2	S03°22.5	248°41.4	S01°35.9	248°07.1	S00°41.6
19	91°23.4	108°42.3	51.7	97°00.8	21.8	263°44.1	35.8	263°09.8	41.5
20	106°25.9	123°41.8	50.6	112°01.5	21.0	278°46.9	35.6	278°12.4	41.5
21	121°28.4	138°41.4	·· 49.4	127°02.2	·· 20.2	293°49.6	·· 35.5	293°15.0	·· 41.4
22	136°30.8	153°40.9	48.2	142°02.9	19.4	308°52.3	35.4	308°17.6	41.3
23	151°33.3	168°40.4	47.1	157°03.5	18.6	323°55.0	35.3	323°20.3	41.2
Mer.pass. 12:55		ν -0.5′	d 1.2′	m -3.88	ν 0.7′	d 0.8′	m 1.09	ν 2.7′	d 0.1′ m -2.44	ν 2.6′	d 0.1′ m 0.53

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	166°35.7	183°40.0	S08°45.9	172°04.2	S03°17.8	338°57.8	S01°35.2	338°22.9	S00°41.2
1	181°38.2	198°39.5	44.7	187°04.9	17.0	354°00.5	35.0	353°25.5	41.1
2	196°40.7	213°39.1	43.6	202°05.5	16.2	9°03.2	34.9	8°28.1	41.0
3	211°43.1	228°38.6	·· 42.4	217°06.2	·· 15.4	24°06.0	·· 34.8	23°30.8	·· 40.9
4	226°45.6	243°38.1	41.2	232°06.9	14.6	39°08.7	34.7	38°33.4	40.9
5	241°48.1	258°37.7	40.1	247°07.6	13.8	54°11.4	34.6	53°36.0	40.8
6	256°50.5	273°37.2	S08°38.9	262°08.2	S03°13.0	69°14.1	S01°34.4	68°38.6	S00°40.7
7	271°53.0	288°36.7	37.8	277°08.9	12.2	84°16.9	34.3	83°41.3	40.6
8	286°55.5	303°36.3	36.6	292°09.6	11.5	99°19.6	34.2	98°43.9	40.6
9	301°57.9	318°35.8	·· 35.4	307°10.3	·· 10.7	114°22.3	·· 34.1	113°46.5	·· 40.5
10	317°00.4	333°35.4	34.2	322°10.9	09.9	129°25.1	34.0	128°49.1	40.4
11	332°02.9	348°34.9	33.1	337°11.6	09.1	144°27.8	33.9	143°51.8	40.3
12	347°05.3	3°34.5	S08°31.9	352°12.3	S03°08.3	159°30.5	S01°33.7	158°54.4	S00°40.3
13	2°07.8	18°34.0	30.7	7°12.9	07.5	174°33.2	33.6	173°57.0	40.2
14	17°10.2	33°33.5	29.6	22°13.6	06.7	189°36.0	33.5	188°59.6	40.1
15	32°12.7	48°33.1	·· 28.4	37°14.3	·· 05.9	204°38.7	·· 33.4	204°02.3	·· 40.0
16	47°15.2	63°32.6	27.2	52°15.0	05.1	219°41.4	33.3	219°04.9	40.0
17	62°17.6	78°32.2	26.1	67°15.6	04.3	234°44.2	33.1	234°07.5	39.9
18	77°20.1	93°31.7	S08°24.9	82°16.3	S03°03.5	249°46.9	S01°33.0	249°10.2	S00°39.8
19	92°22.6	108°31.3	23.7	97°17.0	02.7	264°49.6	32.9	264°12.8	39.7
20	107°25.0	123°30.8	22.6	112°17.7	01.9	279°52.4	32.8	279°15.4	39.7
21	122°27.5	138°30.3	·· 21.4	127°18.3	·· 01.2	294°55.1	·· 32.7	294°18.0	·· 39.6
22	137°30.0	153°29.9	20.2	142°19.0	03°00.4	309°57.8	32.5	309°20.7	39.5
23	152°32.4	168°29.4	19.0	157°19.7	02°59.6	325°00.5	32.4	324°23.3	39.4
Mer.pass. 12:52		ν -0.5′	d 1.2′	m -3.88	ν 0.7′	d 0.8′	m 1.09	ν 2.7′	d 0.1′ m -2.44	ν 2.6′	d 0.1′ m 0.52

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	167°34.9	183°29.0	S08°17.9	172°20.4	S02°58.8	340°03.3	S01°32.3	339°25.9	S00°39.3
1	182°37.3	198°28.5	16.7	187°21.0	58.0	355°06.0	32.2	354°28.5	39.3
2	197°39.8	213°28.1	15.5	202°21.7	57.2	10°08.7	32.1	9°31.2	39.2
3	212°42.3	228°27.6	·· 14.3	217°22.4	·· 56.4	25°11.5	·· 31.9	24°33.8	·· 39.1
4	227°44.7	243°27.2	13.2	232°23.1	55.6	40°14.2	31.8	39°36.4	39.0
5	242°47.2	258°26.7	12.0	247°23.7	54.8	55°16.9	31.7	54°39.1	39.0
6	257°49.7	273°26.3	S08°10.8	262°24.4	S02°54.0	70°19.7	S01°31.6	69°41.7	S00°38.9
7	272°52.1	288°25.8	09.6	277°25.1	53.2	85°22.4	31.5	84°44.3	38.8
8	287°54.6	303°25.4	08.5	292°25.8	52.4	100°25.1	31.3	99°46.9	38.7
9	302°57.1	318°24.9	·· 07.3	307°26.4	·· 51.6	115°27.9	·· 31.2	114°49.6	·· 38.7
10	317°59.5	333°24.5	06.1	322°27.1	50.9	130°30.6	31.1	129°52.2	38.6
11	333°02.0	348°24.0	04.9	337°27.8	50.1	145°33.3	31.0	144°54.8	38.5
12	348°04.5	3°23.6	S08°03.8	352°28.5	S02°49.3	160°36.1	S01°30.8	159°57.4	S00°38.4
13	3°06.9	18°23.1	02.6	7°29.1	48.5	175°38.8	30.7	175°00.1	38.4
14	18°09.4	33°22.7	01.4	22°29.8	47.7	190°41.5	30.6	190°02.7	38.3
15	33°11.8	48°22.2	08°00.2	37°30.5	·· 46.9	205°44.3	·· 30.5	205°05.3	·· 38.2
16	48°14.3	63°21.8	07°59.0	52°31.2	46.1	220°47.0	30.4	220°08.0	38.1
17	63°16.8	78°21.3	57.9	67°31.8	45.3	235°49.7	30.2	235°10.6	38.1
18	78°19.2	93°20.9	S07°56.7	82°32.5	S02°44.5	250°52.5	S01°30.1	250°13.2	S00°38.0
19	93°21.7	108°20.4	55.5	97°33.2	43.7	265°55.2	30.0	265°15.8	37.9
20	108°24.2	123°20.0	54.3	112°33.9	42.9	280°57.9	29.9	280°18.5	37.8
21	123°26.6	138°19.5	·· 53.1	127°34.5	·· 42.1	296°00.7	·· 29.8	295°21.1	·· 37.8
22	138°29.1	153°19.1	52.0	142°35.2	41.3	311°03.4	29.6	310°23.7	37.7
23	153°31.6	168°18.6	50.8	157°35.9	40.5	326°06.1	29.5	325°26.4	37.6
Mer.pass. 12:48		ν -0.5′	d 1.2′	m -3.88	ν 0.7′	d 0.8′	m 1.09	ν 2.7′	d 0.1′ m -2.45	ν 2.6′	d 0.1′ m 0.52

Stars

	SHA	**Dec**
Alpheratz	358°09.3	28°59.0
Ankaa	353°40.3	-42°24.8
Schedar	350°09.1	56°26.0
Diphda	349°20.8	-18°05.6
Achernar	335°45.5	-57°20.3
Hamal	328°28.8	23°22.3
Polaris	327°01.1	89°10.8
Acamar	315°37.2	-40°23.2
Menkar	314°40.9	4°00.8
Mirfak	309°15.8	49°47.7
Aldebaran	291°17.7	16°28.2
Rigel	281°35.7	-8°13.6
Capella	281°10.8	45°58.8
Bellatrix	278°58.4	6°19.8
Elnath	278°43.7	28°35.5
Alnilam	276°11.3	-1°13.0
Betelgeuse	271°27.9	7°24.1
Canopus	264°06.9	-52°41.5
Sirius	258°55.2	-16°41.6
Adhara	255°31.7	-28°57.1
Procyon	245°25.2	5°16.3
Pollux	243°57.5	28°04.3
Avior	234°27.6	-59°27.2
Suhail	223°10.2	-43°21.6
Miaplacidus	221°44.1	-69°38.6
Alphard	218°19.9	-8°34.7
Regulus	208°09.3	12°03.5
Dubhe	194°21.1	61°51.2
Denebola	182°58.4	14°40.6
Gienah	176°17.3	-17°26.3
Acrux	173°36.3	-62°59.6
Gacrux	172°27.8	-57°00.4
Alioth	166°41.7	56°03.6
Spica	158°56.9	-11°03.8
Alkaid	153°17.9	49°24.3
Hadar	149°22.4	-60°16.7
Menkent	148°36.3	-36°16.5
Arcturus	146°17.9	19°16.7
Rigil Kent.	140°24.9	-60°45.1
Kochab	137°18.4	74°13.8
Zuben'ubi	137°32.5	-15°57.8
Alphecca	126°31.7	26°46.5
Antares	112°56.4	-26°23.3
Atria	108°20.3	-68°59.3
Sabik	102°40.8	-15°42.1
Shaula	96°55.4	-37°05.3
Rasalhague	96°29.3	12°34.3
Eltanin	90°57.7	51°29.2
Kaus Aust.	84°16.5	-34°23.5
Vega	80°55.7	38°45.7
Nunki	76°28.9	-26°19.2
Altair	62°32.4	8°48.9
Peacock	53°58.3	-56°47.7
Deneb	49°48.6	45°12.5
Enif	34°11.6	9°47.1
Al Na'ir	28°15.0	-47°03.2
Fomalhaut	15°51.4	-29°43.5
Scheat	14°17.6	27°58.6
Markab	14°03.2	15°06.0

Mar 08 Sun	**SHA**	**Mer.pass**
Venus	18°14.6	11:45
Mars	6°11.5	12:32
Jupiter	172°15.7	01:28
Saturn	171°43.3	01:30

Mar 09 Mon	**SHA**	**Mer.pass**
Venus	17°04.2	11:46
Mars	5°28.5	12:31
Jupiter	172°22.0	01:24
Saturn	171°47.1	01:26

Mar 10 Tue	**SHA**	**Mer.pass**
Venus	15°54.1	11:46
Mars	4°45.5	12:30
Jupiter	172°28.4	01:20
Saturn	171°51.0	01:22

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°15.7	S05°00.3	155°50.0	8.8′	S00°34.8	12.9′	60.3′
1	192°15.9	04°59.3	170°17.8	8.8′	00°21.9	12.9′	60.4′
2	207°16.0	58.3	184°45.6	8.8′	S00°09.0	13.0′	60.4′
3	222°16.2	·· 57.4	199°13.4	8.8′	N00°04.0	12.9′	60.4′
4	237°16.3	56.4	213°41.1	8.8′	00°16.9	12.9′	60.4′
5	252°16.5	55.4	228°08.9	8.8′	00°29.8	13.0′	60.4′
6	267°16.6	S04°54.4	242°36.7	8.8′	N00°42.8	12.9′	60.4′
7	282°16.8	53.5	257°04.5	8.8′	00°55.7	12.9′	60.4′
8	297°17.0	52.5	271°32.2	8.8′	01°08.6	12.9′	60.4′
9	312°17.1	·· 51.5	286°00.0	8.8′	01°21.5	12.9′	60.4′
10	327°17.3	50.5	300°27.7	8.7′	01°34.4	12.9′	60.4′
11	342°17.4	49.6	314°55.5	8.7′	01°47.3	12.9′	60.4′
12	357°17.6	S04°48.6	329°23.2	8.7′	N02°00.2	12.9′	60.4′
13	12°17.7	47.6	343°51.0	8.7′	02°13.1	12.8′	60.4′
14	27°17.9	46.6	358°18.7	8.7′	02°25.9	12.9′	60.4′
15	42°18.0	·· 45.7	12°46.4	8.7′	02°38.8	12.8′	60.4′
16	57°18.2	44.7	27°14.1	8.7′	02°51.6	12.8′	60.4′
17	72°18.3	43.7	41°41.8	8.7′	03°04.4	12.8′	60.4′
18	87°18.5	S04°42.7	56°09.5	8.7′	N03°17.2	12.8′	60.4′
19	102°18.6	41.7	70°37.2	8.7′	03°30.0	12.7′	60.4′
20	117°18.8	40.8	85°04.9	8.7′	03°42.7	12.7′	60.4′
21	132°19.0	·· 39.8	99°32.5	8.7′	03°55.4	12.7′	60.4′
22	147°19.1	38.8	114°00.2	8.6′	04°08.1	12.7′	60.4′
23	162°19.3	37.8	128°27.8	8.6′	04°20.8	12.6′	60.4′
	SD = 16.1′	d = 1.0′	SD = 16.5′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°19.4	S04°36.9	142°55.4	8.6′	N04°33.4	12.6′	60.3′
1	192°19.6	35.9	157°23.0	8.6′	04°46.0	12.6′	60.3′
2	207°19.7	34.9	171°50.6	8.6′	04°58.6	12.5′	60.3′
3	222°19.9	·· 33.9	186°18.2	8.6′	05°11.1	12.5′	60.3′
4	237°20.0	33.0	200°45.8	8.6′	05°23.6	12.5′	60.3′
5	252°20.2	32.0	215°13.4	8.5′	05°36.1	12.4′	60.3′
6	267°20.4	S04°31.0	229°40.9	8.5′	N05°48.5	12.4′	60.3′
7	282°20.5	30.0	244°08.5	8.5′	06°00.9	12.3′	60.3′
8	297°20.7	29.0	258°36.0	8.5′	06°13.2	12.3′	60.3′
9	312°20.8	·· 28.1	273°03.5	8.5′	06°25.5	12.3′	60.3′
10	327°21.0	27.1	287°31.0	8.5′	06°37.8	12.2′	60.3′
11	342°21.1	26.1	301°58.4	8.5′	06°50.0	12.2′	60.3′
12	357°21.3	S04°25.1	316°25.9	8.4′	N07°02.2	12.1′	60.3′
13	12°21.5	24.2	330°53.3	8.4′	07°14.3	12.1′	60.3′
14	27°21.6	23.2	345°20.7	8.4′	07°26.4	12.0′	60.2′
15	42°21.8	·· 22.2	359°48.1	8.4′	07°38.4	12.0′	60.2′
16	57°21.9	21.2	14°15.5	8.4′	07°50.4	11.9′	60.2′
17	72°22.1	20.2	28°42.9	8.3′	08°02.3	11.9′	60.2′
18	87°22.2	S04°19.3	43°10.2	8.3′	N08°14.2	11.8′	60.2′
19	102°22.4	18.3	57°37.6	8.3′	08°26.0	11.7′	60.2′
20	117°22.6	17.3	72°04.9	8.3′	08°37.7	11.7′	60.2′
21	132°22.7	·· 16.3	86°32.2	8.3′	08°49.4	11.6′	60.2′
22	147°22.9	15.3	100°59.4	8.3′	09°01.0	11.6′	60.1′
23	162°23.0	14.4	115°26.7	8.2′	09°12.6	11.5′	60.1′
	SD = 16.1′	d = 1.0′	SD = 16.5′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°23.2	S04°13.4	129°53.9	8.2′	N09°24.1	11.4′	60.1′
1	192°23.4	12.4	144°21.1	8.2′	09°35.5	11.4′	60.1′
2	207°23.5	11.4	158°48.3	8.2′	09°46.9	11.3′	60.1′
3	222°23.7	·· 10.4	173°15.5	8.1′	09°58.2	11.3′	60.1′
4	237°23.8	09.5	187°42.6	8.1′	10°09.5	11.1′	60.1′
5	252°24.0	08.5	202°09.8	8.1′	10°20.6	11.1′	60.0′
6	267°24.2	S04°07.5	216°36.9	8.1′	N10°31.7	11.1′	60.0′
7	282°24.3	06.5	231°03.9	8.1′	10°42.8	10.9′	60.0′
8	297°24.5	05.5	245°31.0	8.0′	10°53.7	10.9′	60.0′
9	312°24.6	·· 04.6	259°58.0	8.0′	11°04.6	10.8′	60.0′
10	327°24.8	03.6	274°25.1	8.0′	11°15.4	10.7′	60.0′
11	342°25.0	02.6	288°52.0	8.0′	11°26.1	10.7′	60.0′
12	357°25.1	S04°01.6	303°19.0	7.9′	N11°36.8	10.6′	59.9′
13	12°25.3	04°00.6	317°46.0	7.9′	11°47.4	10.5′	59.9′
14	27°25.4	03°59.7	332°12.9	7.9′	11°57.9	10.4′	59.9′
15	42°25.6	·· 58.7	346°39.8	7.9′	12°08.3	10.3′	59.9′
16	57°25.8	57.7	1°06.7	7.9′	12°18.6	10.3′	59.9′
17	72°25.9	56.7	15°33.5	7.8′	12°28.9	10.1′	59.8′
18	87°26.1	S03°55.7	30°00.4	7.8′	N12°39.0	10.1′	59.8′
19	102°26.3	54.8	44°27.2	7.8′	12°49.1	10.0′	59.8′
20	117°26.4	53.8	58°54.0	7.8′	12°59.1	9.9′	59.8′
21	132°26.6	·· 52.8	73°20.8	7.7′	13°09.0	9.8′	59.8′
22	147°26.7	51.8	87°47.5	7.7′	13°18.8	9.7′	59.8′
23	162°26.9	50.8	102°14.2	7.7′	13°28.5	9.7′	59.7′
	SD = 16.1′	d = 1.0′	SD = 16.4′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	04:29	05:49	06:56	17:28	18:35	19:56
N 70°	04:38	05:50	06:51	17:32	18:33	19:46
68°	04:46	05:51	06:47	17:36	18:32	19:38
66°	04:52	05:52	06:43	17:40	18:31	19:31
64°	04:58	05:53	06:40	17:43	18:30	19:26
62°	05:02	05:54	06:38	17:45	18:29	19:21
60°	05:06	05:54	06:35	17:47	18:29	19:17
N 58°	05:09	05:54	06:33	17:49	18:28	19:14
56°	05:11	05:55	06:31	17:51	18:28	19:11
54°	05:14	05:55	06:30	17:52	18:28	19:09
52°	05:16	05:55	06:28	17:54	18:27	19:07
50°	05:17	05:55	06:27	17:55	18:27	19:05
45°	05:21	05:55	06:24	17:58	18:27	19:01
N 40°	05:23	05:54	06:21	18:00	18:27	18:59
35°	05:25	05:54	06:19	18:02	18:28	18:57
30°	05:26	05:53	06:17	18:04	18:28	18:56
20°	05:26	05:52	06:14	18:08	18:30	18:55
N 10°	05:25	05:49	06:10	18:11	18:32	18:56
0°	05:23	05:47	06:07	18:14	18:35	18:59
S 10°	05:18	05:43	06:04	18:17	18:38	19:03
20°	05:13	05:38	06:01	18:20	18:42	19:08
30°	05:04	05:32	05:56	18:24	18:48	19:17
35°	04:58	05:28	05:54	18:27	18:52	19:22
40°	04:51	05:24	05:51	18:29	18:57	19:29
45°	04:43	05:18	05:48	18:33	19:02	19:37
S 50°	04:32	05:11	05:44	18:36	19:09	19:48
52°	04:26	05:08	05:42	18:38	19:12	19:54
54°	04:20	05:04	05:40	18:40	19:16	19:59
56°	04:13	05:00	05:38	18:42	19:20	20:06
58°	04:05	04:55	05:35	18:45	19:25	20:14
S 60°	03:56	04:49	05:32	18:47	19:30	20:23

Lat.	**Moonrise** Sun	Mon	Tue	**Moonset** Sun	Mon	Tue
N 72°	07:42	07:30	07:16	21:09	23:17	·· ··
N 70°	07:43	07:38	07:33	21:04	23:02	·· ··
68°	07:44	07:45	07:46	20:59	22:50	·· ··
66°	07:45	07:51	07:57	20:55	22:41	·· ··
64°	07:46	07:55	08:07	20:52	22:33	·· ··
62°	07:47	08:00	08:15	20:49	22:26	·· ··
60°	07:47	08:03	08:22	20:47	22:20	23:51
N 58°	07:48	08:07	08:28	20:45	22:14	23:42
56°	07:48	08:10	08:33	20:43	22:10	23:35
54°	07:48	08:12	08:38	20:41	22:06	23:28
52°	07:49	08:15	08:43	20:40	22:02	23:23
50°	07:49	08:17	08:47	20:38	21:59	23:17
45°	07:50	08:22	08:56	20:35	21:51	23:06
N 40°	07:51	08:26	09:03	20:33	21:45	22:56
35°	07:51	08:30	09:10	20:31	21:40	22:48
30°	07:52	08:33	09:15	20:29	21:35	22:41
20°	07:53	08:38	09:25	20:25	21:27	22:29
N 10°	07:54	08:43	09:34	20:22	21:20	22:18
0°	07:54	08:48	09:42	20:20	21:14	22:08
S 10°	07:55	08:53	09:51	20:17	21:07	21:59
20°	07:56	08:58	10:00	20:14	21:00	21:48
30°	07:57	09:04	10:10	20:11	20:52	21:36
35°	07:58	09:07	10:16	20:09	20:48	21:29
40°	07:58	09:11	10:23	20:06	20:43	21:21
45°	07:59	09:15	10:31	20:04	20:37	21:12
S 50°	08:00	09:21	10:40	20:01	20:30	21:01
52°	08:01	09:23	10:45	20:00	20:26	20:56
54°	08:01	09:26	10:50	19:58	20:23	20:50
56°	08:02	09:29	10:55	19:56	20:19	20:44
58°	08:03	09:32	11:01	19:55	20:14	20:37
S 60°	08:03	09:36	11:08	19:52	20:09	20:29

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 2-4 4-17%
08	10:57	10:50	12:11	14:07	01:40	
09	10:42	10:35	12:11	15:01	02:34	
10	10:27	10:19	12:10	15:55	03:28	

March 11, 12, 13 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	168°34.0	183°18.2	S07°49.6	172°36.6	S02°39.8	341°08.9	S01°29.4	340°29.0	S00°37.5
1	183°36.5	198°17.7	48.4	187°37.2	39.0	356°11.6	29.3	355°31.6	37.4
2	198°39.0	213°17.3	47.2	202°37.9	38.2	11°14.3	29.2	10°34.2	37.4
3	213°41.4	228°16.8	·· 46.1	217°38.6	·· 37.4	26°17.1	·· 29.0	25°36.9	·· 37.3
4	228°43.9	243°16.4	44.9	232°39.3	36.6	41°19.8	28.9	40°39.5	37.2
5	243°46.3	258°16.0	43.7	247°39.9	35.8	56°22.5	28.8	55°42.1	37.1
6	258°48.8	273°15.5	S07°42.5	262°40.6	S02°35.0	71°25.3	S01°28.7	70°44.8	S00°37.1
7	273°51.3	288°15.1	41.3	277°41.3	34.2	86°28.0	28.5	85°47.4	37.0
8	288°53.7	303°14.6	40.1	292°42.0	33.4	101°30.7	28.4	100°50.0	36.9
9	303°56.2	318°14.2	·· 38.9	307°42.7	·· 32.6	116°33.5	·· 28.3	115°52.6	·· 36.8
10	318°58.7	333°13.7	37.8	322°43.3	31.8	131°36.2	28.2	130°55.3	36.8
11	334°01.1	348°13.3	36.6	337°44.0	31.0	146°38.9	28.1	145°57.9	36.7
12	349°03.6	3°12.8	S07°35.4	352°44.7	S02°30.2	161°41.7	S01°27.9	161°00.5	S00°36.6
13	4°06.1	18°12.4	34.2	7°45.4	29.4	176°44.4	27.8	176°03.2	36.5
14	19°08.5	33°12.0	33.0	22°46.0	28.6	191°47.2	27.7	191°05.8	36.5
15	34°11.0	48°11.5	·· 31.8	37°46.7	·· 27.9	206°49.9	·· 27.6	206°08.4	·· 36.4
16	49°13.4	63°11.1	30.6	52°47.4	27.1	221°52.6	27.4	221°11.1	36.3
17	64°15.9	78°10.6	29.5	67°48.1	26.3	236°55.4	27.3	236°13.7	36.2
18	79°18.4	93°10.2	S07°28.3	82°48.8	S02°25.5	251°58.1	S01°27.2	251°16.3	S00°36.1
19	94°20.8	108°09.8	27.1	97°49.4	24.7	267°00.8	27.1	266°18.9	36.1
20	109°23.3	123°09.3	25.9	112°50.1	23.9	282°03.6	27.0	281°21.6	36.0
21	124°25.8	138°08.9	·· 24.7	127°50.8	·· 23.1	297°06.3	·· 26.8	296°24.2	·· 35.9
22	139°28.2	153°08.4	23.5	142°51.5	22.3	312°09.1	26.7	311°26.8	35.8
23	154°30.7	168°08.0	22.3	157°52.1	21.5	327°11.8	26.6	326°29.5	35.8
Mer.pass. 12:44		ν -0.4′	d 1.2′	m -3.88	ν 0.7′	d 0.8′	m 1.09	ν 2.7′	d 0.1′ m -2.45	ν 2.6′	d 0.1′ m 0.52

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	169°33.2	183°07.6	S07°21.1	172°52.8	S02°20.7	342°14.5	S01°26.5	341°32.1	S00°35.7
1	184°35.6	198°07.1	19.9	187°53.5	19.9	357°17.3	26.3	356°34.7	35.6
2	199°38.1	213°06.7	18.7	202°54.2	19.1	12°20.0	26.2	11°37.4	35.5
3	214°40.6	228°06.2	·· 17.6	217°54.9	·· 18.3	27°22.7	·· 26.1	26°40.0	·· 35.5
4	229°43.0	243°05.8	16.4	232°55.5	17.5	42°25.5	26.0	41°42.6	35.4
5	244°45.5	258°05.4	15.2	247°56.2	16.7	57°28.2	25.9	56°45.2	35.3
6	259°47.9	273°04.9	S07°14.0	262°56.9	S02°16.0	72°31.0	S01°25.7	71°47.9	S00°35.2
7	274°50.4	288°04.5	12.8	277°57.6	15.2	87°33.7	25.6	86°50.5	35.1
8	289°52.9	303°04.1	11.6	292°58.2	14.4	102°36.4	25.5	101°53.1	35.1
9	304°55.3	318°03.6	·· 10.4	307°58.9	·· 13.6	117°39.2	·· 25.4	116°55.8	·· 35.0
10	319°57.8	333°03.2	09.2	322°59.6	12.8	132°41.9	25.2	131°58.4	34.9
11	335°00.3	348°02.8	08.0	338°00.3	12.0	147°44.6	25.1	147°01.0	34.8
12	350°02.7	3°02.3	S07°06.8	353°01.0	S02°11.2	162°47.4	S01°25.0	162°03.7	S00°34.8
13	5°05.2	18°01.9	05.6	8°01.6	10.4	177°50.1	24.9	177°06.3	34.7
14	20°07.7	33°01.4	04.4	23°02.3	09.6	192°52.9	24.7	192°08.9	34.6
15	35°10.1	48°01.0	·· 03.2	38°03.0	·· 08.8	207°55.6	·· 24.6	207°11.6	·· 34.5
16	50°12.6	63°00.6	02.0	53°03.7	08.0	222°58.3	24.5	222°14.2	34.5
17	65°15.1	78°00.1	07°00.8	68°04.4	07.2	238°01.1	24.4	237°16.8	34.4
18	80°17.5	92°59.7	S06°59.6	83°05.0	S02°06.4	253°03.8	S01°24.3	252°19.5	S00°34.3
19	95°20.0	107°59.3	58.5	98°05.7	05.6	268°06.6	24.1	267°22.1	34.2
20	110°22.4	122°58.8	57.3	113°06.4	04.8	283°09.3	24.0	282°24.7	34.1
21	125°24.9	137°58.4	·· 56.1	128°07.1	·· 04.1	298°12.0	·· 23.9	297°27.3	·· 34.1
22	140°27.4	152°58.0	54.9	143°07.8	03.3	313°14.8	23.8	312°30.0	34.0
23	155°29.8	167°57.5	53.7	158°08.4	02.5	328°17.5	23.6	327°32.6	33.9
Mer.pass. 12:40		ν -0.4′	d 1.2′	m -3.88	ν 0.7′	d 0.8′	m 1.09	ν 2.7′	d 0.1′ m -2.45	ν 2.6′	d 0.1′ m 0.51

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	170°32.3	182°57.1	S06°52.5	173°09.1	S02°01.7	343°20.3	S01°23.5	342°35.2	S00°33.8
1	185°34.8	197°56.7	51.3	188°09.8	00.9	358°23.0	23.4	357°37.9	33.8
2	200°37.2	212°56.3	50.1	203°10.5	02°00.1	13°25.7	23.3	12°40.5	33.7
3	215°39.7	227°55.8	·· 48.9	218°11.2	01°59.3	28°28.5	·· 23.1	27°43.1	·· 33.6
4	230°42.2	242°55.4	47.7	233°11.8	58.5	43°31.2	23.0	42°45.8	33.5
5	245°44.6	257°55.0	46.5	248°12.5	57.7	58°34.0	22.9	57°48.4	33.5
6	260°47.1	272°54.5	S06°45.3	263°13.2	S01°56.9	73°36.7	S01°22.8	72°51.0	S00°33.4
7	275°49.6	287°54.1	44.1	278°13.9	56.1	88°39.5	22.7	87°53.7	33.3
8	290°52.0	302°53.7	42.9	293°14.6	55.3	103°42.2	22.5	102°56.3	33.2
9	305°54.5	317°53.2	·· 41.7	308°15.2	·· 54.5	118°44.9	·· 22.4	117°58.9	·· 33.1
10	320°56.9	332°52.8	40.5	323°15.9	53.7	133°47.7	22.3	133°01.6	33.1
11	335°59.4	347°52.4	39.3	338°16.6	52.9	148°50.4	22.2	148°04.2	33.0
12	351°01.9	2°52.0	S06°38.1	353°17.3	S01°52.2	163°53.2	S01°22.0	163°06.8	S00°32.9
13	6°04.3	17°51.5	36.9	8°18.0	51.4	178°55.9	21.9	178°09.5	32.8
14	21°06.8	32°51.1	35.7	23°18.7	50.6	193°58.6	21.8	193°12.1	32.8
15	36°09.3	47°50.7	·· 34.5	38°19.3	·· 49.8	209°01.4	·· 21.7	208°14.7	·· 32.7
16	51°11.7	62°50.2	33.3	53°20.0	49.0	224°04.1	21.5	223°17.4	32.6
17	66°14.2	77°49.8	32.0	68°20.7	48.2	239°06.9	21.4	238°20.0	32.5
18	81°16.7	92°49.4	S06°30.8	83°21.4	S01°47.4	254°09.6	S01°21.3	253°22.6	S00°32.4
19	96°19.1	107°49.0	29.6	98°22.1	46.6	269°12.4	21.2	268°25.3	32.4
20	111°21.6	122°48.5	28.4	113°22.7	45.8	284°15.1	21.0	283°27.9	32.3
21	126°24.0	137°48.1	·· 27.2	128°23.4	·· 45.0	299°17.8	·· 20.9	298°30.5	·· 32.2
22	141°26.5	152°47.7	26.0	143°24.1	44.2	314°20.6	20.8	313°33.2	32.1
23	156°29.0	167°47.3	24.8	158°24.8	43.4	329°23.3	20.7	328°35.8	32.1
Mer.pass. 12:36		ν -0.4′	d 1.2′	m -3.88	ν 0.7′	d 0.8′	m 1.09	ν 2.7′	d 0.1′ m -2.46	ν 2.6′	d 0.1′ m 0.51

Stars

	SHA	Dec
Alpheratz	358°09.3	28°59.0
Ankaa	353°40.3	-42°24.7
Schedar	350°09.2	56°26.0
Diphda	349°20.8	-18°05.6
Achernar	335°45.5	-57°20.3
Hamal	328°28.8	23°22.3
Polaris	327°01.8	89°10.8
Acamar	315°37.2	-40°23.2
Menkar	314°41.0	4°00.8
Mirfak	309°15.9	49°47.7
Aldebaran	291°17.7	16°28.2
Rigel	281°35.7	-8°13.6
Capella	281°10.8	45°58.8
Bellatrix	278°58.4	6°19.8
Elnath	278°43.7	28°35.5
Alnilam	276°11.3	-1°13.0
Betelgeuse	271°27.9	7°24.1
Canopus	264°06.9	-52°41.5
Sirius	258°55.3	-16°41.6
Adhara	255°31.7	-28°57.1
Procyon	245°25.3	5°16.3
Pollux	243°57.6	28°04.3
Avior	234°27.6	-59°27.2
Suhail	223°10.2	-43°21.6
Miaplacidus	221°44.1	-69°38.6
Alphard	218°20.0	-8°34.7
Regulus	208°09.3	12°03.5
Dubhe	194°21.1	61°51.2
Denebola	182°58.4	14°40.6
Gienah	176°17.3	-17°26.3
Acrux	173°36.2	-62°59.6
Gacrux	172°27.8	-57°00.4
Alioth	166°41.7	56°03.6
Spica	158°56.9	-11°03.8
Alkaid	153°17.8	49°24.3
Hadar	149°22.4	-60°16.7
Menkent	148°36.3	-36°16.5
Arcturus	146°17.9	19°16.7
Rigil Kent.	140°24.9	-60°45.1
Kochab	137°18.3	74°13.8
Zuben'ubi	137°32.5	-15°57.8
Alphecca	126°31.7	26°46.5
Antares	112°56.4	-26°23.3
Atria	108°20.3	-68°59.3
Sabik	102°40.7	-15°42.1
Shaula	96°55.3	-37°05.3
Rasalhague	96°29.3	12°34.3
Eltanin	90°57.6	51°29.2
Kaus Aust.	84°16.5	-34°23.5
Vega	80°55.7	38°45.7
Nunki	76°28.9	-26°19.2
Altair	62°32.4	8°48.9
Peacock	53°58.3	-56°47.7
Deneb	49°48.6	45°12.5
Enif	34°11.5	9°47.1
Al Na'ir	28°15.0	-47°03.2
Fomalhaut	15°51.4	-29°43.5
Scheat	14°17.6	27°58.6
Markab	14°03.2	15°06.0

Mar 11 Wed	SHA	Mer.pass
Venus	14°44.2	11:47
Mars	4°02.5	12:29
Jupiter	172°34.8	01:15
Saturn	171°55.0	01:18

Mar 12 Thu	SHA	Mer.pass
Venus	13°34.4	11:48
Mars	3°19.7	12:28
Jupiter	172°41.4	01:11
Saturn	171°58.9	01:14

Mar 13 Fri	SHA	Mer.pass
Venus	12°24.8	11:49
Mars	2°36.8	12:27
Jupiter	172°48.0	01:06
Saturn	172°02.9	01:09

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h — Sun — Moon

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	177°27.1	S03°49.9	116°40.9	7.7′	N13°38.2	9.5′	59.7′
1	192°27.2	48.9	131°07.6	7.7′	13°47.7	9.4′	59.7′
2	207°27.4	47.9	145°34.3	7.6′	13°57.1	9.4′	59.7′
3	222°27.6	·· 46.9	160°00.9	7.6′	14°06.5	9.3′	59.7′
4	237°27.7	45.9	174°27.5	7.6′	14°15.8	9.1′	59.6′
5	252°27.9	44.9	188°54.1	7.6′	14°24.9	9.1′	59.6′
6	267°28.1	S03°44.0	203°20.7	7.5′	N14°34.0	8.9′	59.6′
7	282°28.2	43.0	217°47.2	7.5′	14°42.9	8.9′	59.6′
8	297°28.4	42.0	232°13.8	7.5′	14°51.8	8.8′	59.5′
9	312°28.5	·· 41.0	246°40.3	7.5′	15°00.6	8.6′	59.5′
10	327°28.7	40.0	261°06.7	7.5′	15°09.2	8.6′	59.5′
11	342°28.9	39.1	275°33.2	7.4′	15°17.8	8.5′	59.5′
12	357°29.0	S03°38.1	289°59.7	7.4′	N15°26.3	8.3′	59.5′
13	12°29.2	37.1	304°26.1	7.4′	15°34.6	8.3′	59.4′
14	27°29.4	36.1	318°52.5	7.4′	15°42.9	8.1′	59.4′
15	42°29.5	·· 35.1	333°18.9	7.4′	15°51.0	8.1′	59.4′
16	57°29.7	34.1	347°45.2	7.3′	15°59.1	7.9′	59.4′
17	72°29.9	33.2	2°11.6	7.3′	16°07.0	7.8′	59.3′
18	87°30.0	S03°32.2	16°37.9	7.3′	N16°14.8	7.8′	59.3′
19	102°30.2	31.2	31°04.2	7.3′	16°22.6	7.6′	59.3′
20	117°30.4	30.2	45°30.5	7.3′	16°30.2	7.5′	59.3′
21	132°30.5	·· 29.2	59°56.8	7.3′	16°37.7	7.4′	59.3′
22	147°30.7	28.3	74°23.0	7.2′	16°45.1	7.3′	59.2′
23	162°30.9	27.3	88°49.3	7.2′	16°52.4	7.1′	59.2′
	SD = 16.1′	d = 1.0′	SD = 16.3′				

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	177°31.0	S03°26.3	103°15.5	7.2′	N16°59.5	7.1′	59.2′
1	192°31.2	25.3	117°41.7	7.2′	17°06.6	6.9′	59.2′
2	207°31.4	24.3	132°07.9	7.2′	17°13.5	6.8′	59.1′
3	222°31.5	·· 23.3	146°34.1	7.2′	17°20.3	6.8′	59.1′
4	237°31.7	22.4	161°00.3	7.2′	17°27.1	6.6′	59.1′
5	252°31.9	21.4	175°26.4	7.1′	17°33.7	6.4′	59.1′
6	267°32.0	S03°20.4	189°52.6	7.1′	N17°40.1	6.4′	59.0′
7	282°32.2	19.4	204°18.7	7.1′	17°46.5	6.2′	59.0′
8	297°32.4	18.4	218°44.8	7.1′	17°52.7	6.2′	59.0′
9	312°32.5	·· 17.4	233°10.9	7.1′	17°58.9	6.0′	59.0′
10	327°32.7	16.5	247°37.0	7.1′	18°04.9	5.9′	58.9′
11	342°32.9	15.5	262°03.1	7.1′	18°10.8	5.8′	58.9′
12	357°33.0	S03°14.5	276°29.2	7.1′	N18°16.6	5.6′	58.9′
13	12°33.2	13.5	290°55.3	7.1′	18°22.2	5.5′	58.9′
14	27°33.4	12.5	305°21.3	7.1′	18°27.7	5.5′	58.8′
15	42°33.5	·· 11.5	319°47.4	7.1′	18°33.2	5.3′	58.8′
16	57°33.7	10.5	334°13.4	7.0′	18°38.5	5.1′	58.8′
17	72°33.9	09.6	348°39.5	7.0′	18°43.6	5.1′	58.8′
18	87°34.0	S03°08.6	3°05.5	7.0′	N18°48.7	4.9′	58.7′
19	102°34.2	07.6	17°31.6	7.0′	18°53.6	4.8′	58.7′
20	117°34.4	06.6	31°57.6	7.0′	18°58.4	4.7′	58.7′
21	132°34.6	·· 05.6	46°23.6	7.0′	19°03.1	4.6′	58.7′
22	147°34.7	04.6	60°49.7	7.0′	19°07.7	4.4′	58.6′
23	162°34.9	03.7	75°15.7	7.0′	19°12.1	4.3′	58.6′
	SD = 16.1′	d = 1.0′	SD = 16.1′				

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	177°35.1	S03°02.7	89°41.7	7.0′	N19°16.4	4.2′	58.6′
1	192°35.2	01.7	104°07.7	7.0′	19°20.6	4.1′	58.6′
2	207°35.4	03°00.7	118°33.8	7.0′	19°24.7	3.9′	58.5′
3	222°35.6	02°59.7	132°59.8	7.0′	19°28.6	3.8′	58.5′
4	237°35.7	58.7	147°25.8	7.0′	19°32.4	3.7′	58.5′
5	252°35.9	57.7	161°51.9	7.0′	19°36.1	3.6′	58.5′
6	267°36.1	S02°56.8	176°17.9	7.0′	N19°39.7	3.4′	58.4′
7	282°36.3	55.8	190°43.9	7.1′	19°43.1	3.3′	58.4′
8	297°36.4	54.8	205°10.0	7.1′	19°46.4	3.2′	58.4′
9	312°36.6	·· 53.8	219°36.0	7.1′	19°49.6	3.1′	58.4′
10	327°36.8	52.8	234°02.1	7.1′	19°52.7	2.9′	58.3′
11	342°36.9	51.8	248°28.2	7.1′	19°55.6	2.8′	58.3′
12	357°37.1	S02°50.9	262°54.3	7.1′	N19°58.4	2.7′	58.3′
13	12°37.3	49.9	277°20.4	7.1′	20°01.1	2.6′	58.3′
14	27°37.5	48.9	291°46.5	7.1′	20°03.7	2.4′	58.2′
15	42°37.6	·· 47.9	306°12.6	7.1′	20°06.1	2.3′	58.2′
16	57°37.8	46.9	320°38.7	7.1′	20°08.4	2.2′	58.2′
17	72°38.0	45.9	335°04.9	7.2′	20°10.6	2.0′	58.2′
18	87°38.1	S02°44.9	349°31.0	7.2′	N20°12.6	2.0′	58.1′
19	102°38.3	44.0	3°57.2	7.2′	20°14.6	1.8′	58.1′
20	117°38.5	43.0	18°23.4	7.2′	20°16.4	1.6′	58.1′
21	132°38.7	·· 42.0	32°49.6	7.2′	20°18.0	1.6′	58.0′
22	147°38.8	41.0	47°15.8	7.2′	20°19.6	1.4′	58.0′
23	162°39.0	40.0	61°42.1	7.3′	20°21.0	1.3′	58.0′
	SD = 16.1′	d = 1.0′	SD = 16.0′				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	04:12	05:33	06:40	17:42	18:49	20:11
N 70°	04:24	05:36	06:37	17:45	18:46	19:59
68°	04:33	05:39	06:34	17:47	18:43	19:49
66°	04:41	05:41	06:32	17:50	18:41	19:41
64°	04:47	05:43	06:30	17:51	18:39	19:35
62°	04:52	05:44	06:28	17:53	18:37	19:29
60°	04:56	05:45	06:26	17:55	18:36	19:25
N 58°	05:00	05:46	06:25	17:56	18:35	19:21
56°	05:04	05:47	06:24	17:57	18:34	19:17
54°	05:06	05:47	06:23	17:58	18:33	19:15
52°	05:09	05:48	06:22	17:59	18:33	19:12
50°	05:11	05:48	06:21	18:00	18:32	19:10
45°	05:15	05:49	06:19	18:02	18:31	19:05
N 40°	05:18	05:50	06:17	18:04	18:31	19:02
35°	05:21	05:50	06:15	18:05	18:30	19:00
30°	05:22	05:50	06:14	18:06	18:30	18:58
20°	05:24	05:49	06:11	18:09	18:31	18:56
N 10°	05:23	05:48	06:09	18:11	18:32	18:56
0°	05:22	05:46	06:07	18:13	18:34	18:58
S 10°	05:19	05:43	06:04	18:15	18:36	19:01
20°	05:14	05:39	06:01	18:18	18:40	19:06
30°	05:06	05:34	05:58	18:21	18:45	19:13
35°	05:01	05:31	05:56	18:23	18:48	19:18
40°	04:55	05:27	05:54	18:25	18:52	19:24
45°	04:47	05:22	05:52	18:27	18:56	19:31
S 50°	04:37	05:16	05:49	18:30	19:02	19:41
52°	04:32	05:13	05:47	18:31	19:05	19:46
54°	04:27	05:10	05:46	18:33	19:08	19:51
56°	04:20	05:06	05:44	18:34	19:12	19:57
58°	04:13	05:02	05:42	18:36	19:16	20:04
S 60°	04:05	04:57	05:40	18:38	19:20	20:12

Lat.	Moonrise Wed	Moonrise Thu	Moonrise Fri	Moonset Wed	Moonset Thu	Moonset Fri
N 72°	06:57	06:14	▭	01:31	04:11	▭
N 70°	07:27	07:19	07:06	01:03	03:07	05:19
68°	07:49	07:56	08:12	00:42	02:32	04:14
66°	08:07	08:22	08:47	00:25	02:06	03:38
64°	08:21	08:42	09:13	00:12	01:47	03:13
62°	08:33	08:58	09:33	00:00	01:31	02:53
60°	08:44	09:12	09:50	·· ··	01:18	02:36
N 58°	08:53	09:24	10:04	·· ··	01:06	02:23
56°	09:01	09:34	10:16	·· ··	00:56	02:11
54°	09:08	09:43	10:26	·· ··	00:48	02:01
52°	09:14	09:52	10:36	·· ··	00:40	01:51
50°	09:20	09:59	10:44	·· ··	00:33	01:43
45°	09:33	10:15	11:02	·· ··	00:18	01:26
N 40°	09:43	10:28	11:17	·· ··	00:06	01:12
35°	09:52	10:39	11:29	23:55	·· ··	01:00
30°	10:00	10:48	11:40	23:46	·· ··	00:49
20°	10:14	11:05	11:59	23:31	·· ··	00:31
N 10°	10:26	11:20	12:15	23:17	·· ··	00:15
0°	10:38	11:34	12:30	23:04	·· ··	00:01
S 10°	10:49	11:48	12:45	22:52	23:46	·· ··
20°	11:01	12:02	13:02	22:38	23:30	·· ··
30°	11:16	12:20	13:21	22:22	23:12	·· ··
35°	11:24	12:30	13:32	22:13	23:02	23:54
40°	11:33	12:41	13:44	22:03	22:50	23:41
45°	11:44	12:55	13:59	21:51	22:36	23:26
S 50°	11:58	13:11	14:18	21:37	22:19	23:08
52°	12:04	13:19	14:27	21:30	22:10	22:59
54°	12:11	13:28	14:36	21:23	22:02	22:49
56°	12:19	13:37	14:47	21:14	21:51	22:38
58°	12:28	13:49	15:00	21:05	21:40	22:25
S 60°	12:38	14:01	15:15	20:54	21:27	22:10

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 5-7 27-49%
11	10:12	10:04	12:10	16:51	04:23	
12	09:56	09:48	12:10	17:47	05:19	
13	09:40	09:32	12:10	18:44	06:15	

March 14, 15, 16 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	171°31.4	182°46.8	S06°23.6	173°25.5	S01°42.6	344°26.1	S01°20.5	343°38.4	S00°32.0
1	186°33.9	197°46.4	22.4	188°26.2	41.8	359°28.8	20.4	358°41.1	31.9
2	201°36.4	212°46.0	21.2	203°26.8	41.0	14°31.6	20.3	13°43.7	31.8
3	216°38.8	227°45.6	·· 20.0	218°27.5	·· 40.3	29°34.3	·· 20.2	28°46.3	·· 31.8
4	231°41.3	242°45.1	18.8	233°28.2	39.5	44°37.0	20.0	43°49.0	31.7
5	246°43.8	257°44.7	17.6	248°28.9	38.7	59°39.8	19.9	58°51.6	31.6
6	261°46.2	272°44.3	S06°16.4	263°29.6	S01°37.9	74°42.5	S01°19.8	73°54.2	S00°31.5
7	276°48.7	287°43.9	15.2	278°30.2	37.1	89°45.3	19.7	88°56.9	31.4
8	291°51.2	302°43.4	14.0	293°30.9	36.3	104°48.0	19.5	103°59.5	31.4
9	306°53.6	317°43.0	·· 12.8	308°31.6	·· 35.5	119°50.8	·· 19.4	119°02.1	·· 31.3
10	321°56.1	332°42.6	11.5	323°32.3	34.7	134°53.5	19.3	134°04.8	31.2
11	336°58.5	347°42.2	10.3	338°33.0	33.9	149°56.3	19.2	149°07.4	31.1
12	352°01.0	2°41.8	S06°09.1	353°33.7	S01°33.1	164°59.0	S01°19.0	164°10.0	S00°31.1
13	7°03.5	17°41.3	07.9	8°34.3	32.3	180°01.7	18.9	179°12.7	31.0
14	22°05.9	32°40.9	06.7	23°35.0	31.5	195°04.5	18.8	194°15.3	30.9
15	37°08.4	47°40.5	·· 05.5	38°35.7	·· 30.7	210°07.2	·· 18.7	209°17.9	·· 30.8
16	52°10.9	62°40.1	04.3	53°36.4	29.9	225°10.0	18.5	224°20.6	30.7
17	67°13.3	77°39.6	03.1	68°37.1	29.1	240°12.7	18.4	239°23.2	30.7
18	82°15.8	92°39.2	S06°01.9	83°37.8	S01°28.4	255°15.5	S01°18.3	254°25.8	S00°30.6
19	97°18.3	107°38.8	06°00.7	98°38.4	27.6	270°18.2	18.2	269°28.5	30.5
20	112°20.7	122°38.4	05°59.4	113°39.1	26.8	285°21.0	18.0	284°31.1	30.4
21	127°23.2	137°38.0	·· 58.2	128°39.8	·· 26.0	300°23.7	·· 17.9	299°33.7	·· 30.4
22	142°25.7	152°37.5	57.0	143°40.5	25.2	315°26.4	17.8	314°36.4	30.3
23	157°28.1	167°37.1	55.8	158°41.2	24.4	330°29.2	17.7	329°39.0	30.2
Mer.pass. 12:32		ν -0.4′	d 1.2′	m -3.88	ν 0.7′	d 0.8′	m 1.09	ν 2.7′	d 0.1′ m -2.46	ν 2.6′	d 0.1′ m 0.50

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	172°30.6	182°36.7	S05°54.6	173°41.9	S01°23.6	345°31.9	S01°17.5	344°41.6	S00°30.1
1	187°33.0	197°36.3	53.4	188°42.5	22.8	0°34.7	17.4	359°44.3	30.0
2	202°35.5	212°35.9	52.2	203°43.2	22.0	15°37.4	17.3	14°46.9	30.0
3	217°38.0	227°35.5	·· 51.0	218°43.9	·· 21.2	30°40.2	·· 17.2	29°49.5	·· 29.9
4	232°40.4	242°35.0	49.7	233°44.6	20.4	45°42.9	17.0	44°52.2	29.8
5	247°42.9	257°34.6	48.5	248°45.3	19.6	60°45.7	16.9	59°54.8	29.7
6	262°45.4	272°34.2	S05°47.3	263°46.0	S01°18.8	75°48.4	S01°16.8	74°57.4	S00°29.7
7	277°47.8	287°33.8	46.1	278°46.6	18.0	90°51.2	16.7	90°00.1	29.6
8	292°50.3	302°33.4	44.9	293°47.3	17.2	105°53.9	16.5	105°02.7	29.5
9	307°52.8	317°33.0	·· 43.7	308°48.0	·· 16.5	120°56.7	·· 16.4	120°05.3	·· 29.4
10	322°55.2	332°32.5	42.5	323°48.7	15.7	135°59.4	16.3	135°08.0	29.3
11	337°57.7	347°32.1	41.2	338°49.4	14.9	151°02.1	16.2	150°10.6	29.3
12	353°00.2	2°31.7	S05°40.0	353°50.1	S01°14.1	166°04.9	S01°16.0	165°13.3	S00°29.2
13	8°02.6	17°31.3	38.8	8°50.8	13.3	181°07.6	15.9	180°15.9	29.1
14	23°05.1	32°30.9	37.6	23°51.4	12.5	196°10.4	15.8	195°18.5	29.0
15	38°07.5	47°30.5	·· 36.4	38°52.1	·· 11.7	211°13.1	·· 15.7	210°21.2	·· 29.0
16	53°10.0	62°30.0	35.2	53°52.8	10.9	226°15.9	15.5	225°23.8	28.9
17	68°12.5	77°29.6	33.9	68°53.5	10.1	241°18.6	15.4	240°26.4	28.8
18	83°14.9	92°29.2	S05°32.7	83°54.2	S01°09.3	256°21.4	S01°15.3	255°29.1	S00°28.7
19	98°17.4	107°28.8	31.5	98°54.9	08.5	271°24.1	15.2	270°31.7	28.6
20	113°19.9	122°28.4	30.3	113°55.5	07.7	286°26.9	15.0	285°34.3	28.6
21	128°22.3	137°28.0	·· 29.1	128°56.2	·· 06.9	301°29.6	·· 14.9	300°37.0	·· 28.5
22	143°24.8	152°27.6	27.9	143°56.9	06.1	316°32.4	14.8	315°39.6	28.4
23	158°27.3	167°27.1	26.6	158°57.6	05.3	331°35.1	14.7	330°42.2	28.3
Mer.pass. 12:28		ν -0.4′	d 1.2′	m -3.88	ν 0.7′	d 0.8′	m 1.09	ν 2.7′	d 0.1′ m -2.46	ν 2.6′	d 0.1′ m 0.50

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	173°29.7	182°26.7	S05°25.4	173°58.3	S01°04.6	346°37.9	S01°14.5	345°44.9	S00°28.2
1	188°32.2	197°26.3	24.2	188°59.0	03.8	1°40.6	14.4	0°47.5	28.2
2	203°34.6	212°25.9	23.0	203°59.7	03.0	16°43.4	14.3	15°50.1	28.1
3	218°37.1	227°25.5	·· 21.8	219°00.3	·· 02.2	31°46.1	·· 14.2	30°52.8	·· 28.0
4	233°39.6	242°25.1	20.5	234°01.0	01.4	46°48.9	14.0	45°55.4	27.9
5	248°42.0	257°24.7	19.3	249°01.7	01°00.6	61°51.6	13.9	60°58.1	27.9
6	263°44.5	272°24.3	S05°18.1	264°02.4	S00°59.8	76°54.4	S01°13.8	76°00.7	S00°27.8
7	278°47.0	287°23.8	16.9	279°03.1	59.0	91°57.1	13.7	91°03.3	27.7
8	293°49.4	302°23.4	15.7	294°03.8	58.2	106°59.8	13.5	106°06.0	27.6
9	308°51.9	317°23.0	·· 14.4	309°04.5	·· 57.4	122°02.6	·· 13.4	121°08.6	·· 27.5
10	323°54.4	332°22.6	13.2	324°05.1	56.6	137°05.3	13.3	136°11.2	27.5
11	338°56.8	347°22.2	12.0	339°05.8	55.8	152°08.1	13.1	151°13.9	27.4
12	353°59.3	2°21.8	S05°10.8	354°06.5	S00°55.0	167°10.8	S01°13.0	166°16.5	S00°27.3
13	9°01.8	17°21.4	09.6	9°07.2	54.2	182°13.6	12.9	181°19.1	27.2
14	24°04.2	32°21.0	08.3	24°07.9	53.5	197°16.3	12.8	196°21.8	27.2
15	39°06.7	47°20.6	·· 07.1	39°08.6	·· 52.7	212°19.1	·· 12.6	211°24.4	·· 27.1
16	54°09.1	62°20.2	05.9	54°09.3	51.9	227°21.8	12.5	226°27.1	27.0
17	69°11.6	77°19.7	04.7	69°10.0	51.1	242°24.6	12.4	241°29.7	26.9
18	84°14.1	92°19.3	S05°03.4	84°10.6	S00°50.3	257°27.3	S01°12.3	256°32.3	S00°26.8
19	99°16.5	107°18.9	02.2	99°11.3	49.5	272°30.1	12.1	271°35.0	26.8
20	114°19.0	122°18.5	05°01.0	114°12.0	48.7	287°32.8	12.0	286°37.6	26.7
21	129°21.5	137°18.1	04°59.8	129°12.7	·· 47.9	302°35.6	·· 11.9	301°40.2	·· 26.6
22	144°23.9	152°17.7	58.5	144°13.4	47.1	317°38.3	11.8	316°42.9	26.5
23	159°26.4	167°17.3	57.3	159°14.1	46.3	332°41.1	11.6	331°45.5	26.4
Mer.pass. 12:24		ν -0.4′	d 1.2′	m -3.88	ν 0.7′	d 0.8′	m 1.08	ν 2.7′	d 0.1′ m -2.46	ν 2.6′	d 0.1′ m 0.50

Stars

	SHA	Dec
Alpheratz	358°09.3	28°59.0
Ankaa	353°40.3	-42°24.7
Schedar	350°09.2	56°26.0
Diphda	349°20.8	-18°05.6
Achernar	335°45.5	-57°20.2
Hamal	328°28.8	23°22.3
Polaris	327°02.4	89°10.8
Acamar	315°37.2	-40°23.2
Menkar	314°41.0	4°00.8
Mirfak	309°15.9	49°47.7
Aldebaran	291°17.7	16°28.2
Rigel	281°35.7	-8°13.6
Capella	281°10.8	45°58.8
Bellatrix	278°58.4	6°19.8
Elnath	278°43.7	28°35.5
Alnilam	276°11.3	-1°13.0
Betelgeuse	271°27.9	7°24.1
Canopus	264°06.9	-52°41.5
Sirius	258°55.3	-16°41.7
Adhara	255°31.7	-28°57.1
Procyon	245°25.3	5°16.3
Pollux	243°57.6	28°04.3
Avior	234°27.6	-59°27.2
Suhail	223°10.2	-43°21.6
Miaplacidus	221°44.2	-69°38.6
Alphard	218°20.0	-8°34.7
Regulus	208°09.3	12°03.5
Dubhe	194°21.1	61°51.2
Denebola	182°58.4	14°40.6
Gienah	176°17.3	-17°26.3
Acrux	173°36.2	-62°59.6
Gacrux	172°27.8	-57°00.4
Alioth	166°41.7	56°03.6
Spica	158°56.9	-11°03.8
Alkaid	153°17.8	49°24.3
Hadar	149°22.4	-60°16.8
Menkent	148°36.3	-36°16.6
Arcturus	146°17.9	19°16.7
Rigil Kent.	140°24.9	-60°45.1
Kochab	137°18.3	74°13.8
Zuben'ubi	137°32.4	-15°57.8
Alphecca	126°31.6	26°46.5
Antares	112°56.3	-26°23.4
Atria	108°20.2	-68°59.4
Sabik	102°40.7	-15°42.1
Shaula	96°55.3	-37°05.3
Rasalhague	96°29.3	12°34.3
Eltanin	90°57.6	51°29.2
Kaus Aust.	84°16.5	-34°23.5
Vega	80°55.7	38°45.7
Nunki	76°28.9	-26°19.2
Altair	62°32.4	8°48.9
Peacock	53°58.3	-56°47.7
Deneb	49°48.5	45°12.5
Enif	34°11.5	9°47.1
Al Na'ir	28°14.9	-47°03.2
Fomalhaut	15°51.4	-29°43.5
Scheat	14°17.6	27°58.6
Markab	14°03.1	15°06.0

Mar 14 Sat	SHA	Mer.pass
Venus	11°15.4	11:49
Mars	1°54.0	12:26
Jupiter	172°54.6	01:02
Saturn	172°07.0	01:05

Mar 15 Sun	SHA	Mer.pass
Venus	10°06.1	11:50
Mars	1°11.3	12:25
Jupiter	173°01.4	00:58
Saturn	172°11.1	01:01

Mar 16 Mon	SHA	Mer.pass
Venus	8°57.0	11:51
Mars	0°28.6	12:24
Jupiter	173°08.1	00:53
Saturn	172°15.2	00:57

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = -0.3703 sec ΔT = TT-UT1 = +51.5543 sec

1981 March 14 to Mar. 16 UT

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	Sun		Moon				
Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°39.2	S02°39.0	76°08.4	7.3′	N20°22.3	1.2′	58.0′
1	192°39.3	38.0	90°34.7	7.3′	20°23.5	1.0′	57.9′
2	207°39.5	37.1	105°01.0	7.3′	20°24.5	1.0′	57.9′
3	222°39.7	·· 36.1	119°27.3	7.4′	20°25.5	0.8′	57.9′
4	237°39.9	35.1	133°53.7	7.4′	20°26.3	0.6′	57.9′
5	252°40.0	34.1	148°20.0	7.4′	20°26.9	0.6′	57.8′
6	267°40.2	S02°33.1	162°46.5	7.4′	N20°27.5	0.4′	57.8′
7	282°40.4	32.1	177°12.9	7.5′	20°27.9	0.3′	57.8′
8	297°40.6	31.1	191°39.4	7.5′	20°28.2	0.2′	57.8′
9	312°40.7	·· 30.2	206°05.9	7.5′	20°28.4	0.1′	57.7′
10	327°40.9	29.2	220°32.4	7.6′	20°28.5	0.1′	57.7′
11	342°41.1	28.2	234°58.9	7.6′	20°28.4	0.2′	57.7′
12	357°41.3	S02°27.2	249°25.5	7.6′	N20°28.2	0.3′	57.7′
13	12°41.4	26.2	263°52.1	7.6′	20°27.9	0.5′	57.6′
14	27°41.6	25.2	278°18.8	7.7′	20°27.4	0.5′	57.6′
15	42°41.8	·· 24.2	292°45.4	7.7′	20°26.9	0.7′	57.6′
16	57°42.0	23.2	307°12.2	7.7′	20°26.2	0.8′	57.6′
17	72°42.1	22.3	321°38.9	7.8′	20°25.4	0.9′	57.5′
18	87°42.3	S02°21.3	336°05.7	7.8′	N20°24.5	1.1′	57.5′
19	102°42.5	20.3	350°32.5	7.9′	20°23.4	1.1′	57.5′
20	117°42.7	19.3	4°59.4	7.9′	20°22.3	1.3′	57.5′
21	132°42.8	·· 18.3	19°26.3	7.9′	20°21.0	1.4′	57.4′
22	147°43.0	17.3	33°53.2	8.0′	20°19.6	1.5′	57.4′
23	162°43.2	16.3	48°20.2	8.0′	20°18.1	1.7′	57.4′
	SD = 16.1′	d = 1.0′	SD = 15.8′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°43.4	S02°15.4	62°47.2	8.1′	N20°16.4	1.7′	57.4′
1	192°43.5	14.4	77°14.3	8.1′	20°14.7	1.9′	57.3′
2	207°43.7	13.4	91°41.4	8.1′	20°12.8	2.0′	57.3′
3	222°43.9	·· 12.4	106°08.5	8.2′	20°10.8	2.1′	57.3′
4	237°44.1	11.4	120°35.7	8.2′	20°08.7	2.2′	57.3′
5	252°44.2	10.4	135°02.9	8.3′	20°06.5	2.3′	57.2′
6	267°44.4	S02°09.4	149°30.2	8.3′	N20°04.2	2.5′	57.2′
7	282°44.6	08.4	163°57.5	8.4′	20°01.7	2.5′	57.2′
8	297°44.8	07.5	178°24.9	8.4′	19°59.2	2.7′	57.2′
9	312°44.9	·· 06.5	192°52.3	8.5′	19°56.5	2.8′	57.1′
10	327°45.1	05.5	207°19.8	8.5′	19°53.7	2.9′	57.1′
11	342°45.3	04.5	221°47.3	8.6′	19°50.8	3.0′	57.1′
12	357°45.5	S02°03.5	236°14.8	8.6′	N19°47.8	3.1′	57.1′
13	12°45.6	02.5	250°42.4	8.7′	19°44.7	3.2′	57.0′
14	27°45.8	01.5	265°10.1	8.7′	19°41.5	3.4′	57.0′
15	42°46.0	02°00.6	279°37.8	8.8′	19°38.1	3.4′	57.0′
16	57°46.2	01°59.6	294°05.6	8.8′	19°34.7	3.6′	57.0′
17	72°46.4	58.6	308°33.4	8.9′	19°31.1	3.6′	57.0′
18	87°46.5	S01°57.6	323°01.2	8.9′	N19°27.5	3.8′	56.9′
19	102°46.7	56.6	337°29.1	9.0′	19°23.7	3.9′	56.9′
20	117°46.9	55.6	351°57.1	9.0′	19°19.8	4.0′	56.9′
21	132°47.1	·· 54.6	6°25.1	9.1′	19°15.8	4.0′	56.9′
22	147°47.2	53.6	20°53.2	9.1′	19°11.8	4.2′	56.8′
23	162°47.4	52.7	35°21.3	9.2′	19°07.6	4.3′	56.8′
	SD = 16.1′	d = 1.0′	SD = 15.6′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°47.6	S01°51.7	49°49.5	9.2′	N19°03.3	4.4′	56.8′
1	192°47.8	50.7	64°17.7	9.3′	18°58.9	4.5′	56.8′
2	207°48.0	49.7	78°46.0	9.4′	18°54.4	4.6′	56.7′
3	222°48.1	·· 48.7	93°14.4	9.4′	18°49.8	4.7′	56.7′
4	237°48.3	47.7	107°42.8	9.5′	18°45.1	4.8′	56.7′
5	252°48.5	46.7	122°11.3	9.5′	18°40.3	4.9′	56.7′
6	267°48.7	S01°45.7	136°39.8	9.6′	N18°35.4	5.0′	56.7′
7	282°48.8	44.8	151°08.4	9.6′	18°30.4	5.1′	56.6′
8	297°49.0	43.8	165°37.0	9.7′	18°25.3	5.2′	56.6′
9	312°49.2	·· 42.8	180°05.7	9.8′	18°20.1	5.2′	56.6′
10	327°49.4	41.8	194°34.4	9.8′	18°14.9	5.4′	56.6′
11	342°49.6	40.8	209°03.3	9.9′	18°09.5	5.5′	56.5′
12	357°49.7	S01°39.8	223°32.1	9.9′	N18°04.0	5.6′	56.5′
13	12°49.9	38.8	238°01.0	10.0′	17°58.4	5.6′	56.5′
14	27°50.1	37.8	252°30.0	10.0′	17°52.8	5.8′	56.5′
15	42°50.3	·· 36.9	266°59.1	10.1′	17°47.0	5.8′	56.5′
16	57°50.5	35.9	281°28.2	10.2′	17°41.2	5.9′	56.4′
17	72°50.6	34.9	295°57.3	10.2′	17°35.3	6.0′	56.4′
18	87°50.8	S01°33.9	310°26.6	10.3′	N17°29.3	6.1′	56.4′
19	102°51.0	32.9	324°55.9	10.3′	17°23.2	6.2′	56.4′
20	117°51.2	31.9	339°25.2	10.4′	17°17.0	6.3′	56.3′
21	132°51.4	·· 30.9	353°54.6	10.5′	17°10.7	6.4′	56.3′
22	147°51.5	29.9	8°24.1	10.5′	17°04.3	6.4′	56.3′
23	162°51.7	29.0	22°53.6	10.6′	16°57.9	6.5′	56.3′
	SD = 16.1′	d = 1.0′	SD = 15.5′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	03:54	05:18	06:25	17:56	19:03	20:28
N 70°	04:08	05:22	06:23	17:57	18:58	20:13
68°	04:19	05:26	06:21	17:58	18:54	20:02
66°	04:28	05:29	06:20	17:59	18:51	19:52
64°	04:36	05:32	06:19	18:00	18:48	19:45
62°	04:42	05:34	06:18	18:01	18:45	19:38
60°	04:47	05:36	06:17	18:02	18:43	19:33
N 58°	04:52	05:38	06:17	18:03	18:42	19:28
56°	04:55	05:39	06:16	18:03	18:40	19:24
54°	04:59	05:40	06:15	18:04	18:39	19:20
52°	05:02	05:41	06:15	18:04	18:38	19:17
50°	05:04	05:42	06:14	18:05	18:37	19:15
45°	05:10	05:44	06:13	18:06	18:35	19:09
N 40°	05:14	05:45	06:12	18:07	18:34	19:05
35°	05:16	05:46	06:11	18:07	18:33	19:02
30°	05:19	05:46	06:10	18:08	18:32	19:00
20°	05:21	05:47	06:09	18:10	18:32	18:57
N 10°	05:22	05:46	06:07	18:11	18:32	18:56
0°	05:21	05:45	06:06	18:12	18:33	18:57
S 10°	05:19	05:43	06:04	18:14	18:35	18:59
20°	05:15	05:40	06:02	18:15	18:37	19:03
30°	05:08	05:36	06:00	18:17	18:41	19:09
35°	05:04	05:34	05:59	18:18	18:44	19:13
40°	04:58	05:30	05:57	18:20	18:47	19:19
45°	04:51	05:26	05:56	18:21	18:51	19:25
S 50°	04:42	05:21	05:54	18:23	18:56	19:34
52°	04:38	05:19	05:53	18:24	18:58	19:38
54°	04:33	05:16	05:51	18:25	19:01	19:43
56°	04:28	05:13	05:50	18:26	19:04	19:49
58°	04:21	05:09	05:49	18:28	19:07	19:55
S 60°	04:14	05:05	05:47	18:29	19:11	20:02

Lat.	**Moonrise** Sat	Sun	Mon	**Moonset** Sat	Sun	Mon
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	08:39	10:49	▭	07:39	07:19
68°	08:49	09:59	11:31	05:34	06:18	06:37
66°	09:31	10:37	11:59	04:51	05:40	06:08
64°	10:00	11:04	12:21	04:23	05:13	05:46
62°	10:22	11:24	12:38	04:01	04:52	05:28
60°	10:40	11:41	12:52	03:43	04:35	05:14
N 58°	10:54	11:55	13:04	03:28	04:21	05:01
56°	11:07	12:07	13:15	03:16	04:09	04:50
54°	11:18	12:18	13:24	03:05	03:58	04:41
52°	11:28	12:27	13:32	02:55	03:48	04:32
50°	11:37	12:36	13:39	02:46	03:40	04:24
45°	11:55	12:54	13:55	02:27	03:22	04:08
N 40°	12:10	13:08	14:08	02:12	03:07	03:54
35°	12:23	13:20	14:19	02:00	02:54	03:43
30°	12:34	13:31	14:29	01:48	02:43	03:33
20°	12:54	13:50	14:45	01:29	02:24	03:16
N 10°	13:10	14:06	15:00	01:13	02:08	03:00
0°	13:26	14:21	15:13	00:57	01:52	02:46
S 10°	13:42	14:36	15:26	00:41	01:37	02:32
20°	13:59	14:52	15:41	00:25	01:20	02:16
30°	14:18	15:10	15:57	00:05	01:01	01:59
35°	14:29	15:21	16:07	·· ··	00:50	01:48
40°	14:42	15:33	16:17	·· ··	00:37	01:36
45°	14:57	15:47	16:30	·· ··	00:22	01:22
S 50°	15:16	16:05	16:45	·· ··	00:04	01:05
52°	15:25	16:13	16:53	23:55	·· ··	00:57
54°	15:35	16:23	17:01	23:45	·· ··	00:48
56°	15:46	16:33	17:09	23:34	·· ··	00:38
58°	15:59	16:45	17:20	23:21	·· ··	00:27
S 60°	16:14	16:59	17:31	23:06	·· ··	00:13

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 8-10 60-80%
14	09:23	09:15	12:09	19:39	07:12	
15	09:07	08:58	12:09	20:33	08:07	
16	08:50	08:41	12:09	21:25	09:00	

March 17, 18, 19 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	174°28.9	182°16.9	S04°56.1	174°14.8	S00°45.5	347°43.8	S01°11.5	346°48.1	S00°26.4
1	189°31.3	197°16.5	54.9	189°15.4	44.7	2°46.6	11.4	1°50.8	26.3
2	204°33.8	212°16.1	53.6	204°16.1	43.9	17°49.3	11.2	16°53.4	26.2
3	219°36.3	227°15.7	·· 52.4	219°16.8	·· 43.1	32°52.1	·· 11.1	31°56.1	·· 26.1
4	234°38.7	242°15.3	51.2	234°17.5	42.4	47°54.8	11.0	46°58.7	26.1
5	249°41.2	257°14.8	50.0	249°18.2	41.6	62°57.6	10.9	62°01.3	26.0
6	264°43.6	272°14.4	S04°48.7	264°18.9	S00°40.8	78°00.3	S01°10.7	77°04.0	S00°25.9
7	279°46.1	287°14.0	47.5	279°19.6	40.0	93°03.1	10.6	92°06.6	25.8
8	294°48.6	302°13.6	46.3	294°20.3	39.2	108°05.8	10.5	107°09.2	25.7
9	309°51.0	317°13.2	·· 45.1	309°20.9	·· 38.4	123°08.6	·· 10.4	122°11.9	·· 25.7
10	324°53.5	332°12.8	43.8	324°21.6	37.6	138°11.3	10.2	137°14.5	25.6
11	339°56.0	347°12.4	42.6	339°22.3	36.8	153°14.1	10.1	152°17.2	25.5
12	354°58.4	2°12.0	S04°41.4	354°23.0	S00°36.0	168°16.8	S01°10.0	167°19.8	S00°25.4
13	10°00.9	17°11.6	40.2	9°23.7	35.2	183°19.6	09.9	182°22.4	25.4
14	25°03.4	32°11.2	38.9	24°24.4	34.4	198°22.3	09.7	197°25.1	25.3
15	40°05.8	47°10.8	·· 37.7	39°25.1	·· 33.6	213°25.1	·· 09.6	212°27.7	·· 25.2
16	55°08.3	62°10.4	36.5	54°25.8	32.8	228°27.9	09.5	227°30.3	25.1
17	70°10.7	77°10.0	35.2	69°26.4	32.1	243°30.6	09.3	242°33.0	25.0
18	85°13.2	92°09.6	S04°34.0	84°27.1	S00°31.3	258°33.4	S01°09.2	257°35.6	S00°25.0
19	100°15.7	107°09.2	32.8	99°27.8	30.5	273°36.1	09.1	272°38.3	24.9
20	115°18.1	122°08.8	31.6	114°28.5	29.7	288°38.9	09.0	287°40.9	24.8
21	130°20.6	137°08.4	·· 30.3	129°29.2	·· 28.9	303°41.6	·· 08.8	302°43.5	·· 24.7
22	145°23.1	152°08.0	29.1	144°29.9	28.1	318°44.4	08.7	317°46.2	24.6
23	160°25.5	167°07.6	27.9	159°30.6	27.3	333°47.1	08.6	332°48.8	24.6
Mer.pass. 12:20		ν -0.4′	d 1.2′	m -3.88	ν 0.7′	d 0.8′	m 1.08	ν 2.8′	d 0.1′ m -2.46	ν 2.6′	d 0.1′ m 0.49

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	175°28.0	182°07.2	S04°26.6	174°31.3	S00°26.5	348°49.9	S01°08.5	347°51.4	S00°24.5
1	190°30.5	197°06.8	25.4	189°32.0	25.7	3°52.6	08.3	2°54.1	24.4
2	205°32.9	212°06.4	24.2	204°32.6	24.9	18°55.4	08.2	17°56.7	24.3
3	220°35.4	227°06.0	·· 22.9	219°33.3	·· 24.1	33°58.1	·· 08.1	32°59.4	·· 24.3
4	235°37.9	242°05.6	21.7	234°34.0	23.3	49°00.9	07.9	48°02.0	24.2
5	250°40.3	257°05.2	20.5	249°34.7	22.5	64°03.6	07.8	63°04.6	24.1
6	265°42.8	272°04.8	S04°19.3	264°35.4	S00°21.8	79°06.4	S01°07.7	78°07.3	S00°24.0
7	280°45.2	287°04.4	18.0	279°36.1	21.0	94°09.1	07.6	93°09.9	23.9
8	295°47.7	302°03.9	16.8	294°36.8	20.2	109°11.9	07.4	108°12.5	23.9
9	310°50.2	317°03.5	·· 15.6	309°37.5	·· 19.4	124°14.6	·· 07.3	123°15.2	·· 23.8
10	325°52.6	332°03.1	14.3	324°38.1	18.6	139°17.4	07.2	138°17.8	23.7
11	340°55.1	347°02.7	13.1	339°38.8	17.8	154°20.1	07.1	153°20.5	23.6
12	355°57.6	2°02.3	S04°11.9	354°39.5	S00°17.0	169°22.9	S01°06.9	168°23.1	S00°23.5
13	11°00.0	17°01.9	10.6	9°40.2	16.2	184°25.6	06.8	183°25.7	23.5
14	26°02.5	32°01.5	09.4	24°40.9	15.4	199°28.4	06.7	198°28.4	23.4
15	41°05.0	47°01.1	·· 08.2	39°41.6	·· 14.6	214°31.2	·· 06.5	213°31.0	·· 23.3
16	56°07.4	62°00.7	06.9	54°42.3	13.8	229°33.9	06.4	228°33.7	23.2
17	71°09.9	77°00.3	05.7	69°43.0	13.0	244°36.7	06.3	243°36.3	23.2
18	86°12.3	91°59.9	S04°04.5	84°43.7	S00°12.2	259°39.4	S01°06.2	258°38.9	S00°23.1
19	101°14.8	106°59.6	03.2	99°44.4	11.5	274°42.2	06.0	273°41.6	23.0
20	116°17.3	121°59.2	02.0	114°45.0	10.7	289°44.9	05.9	288°44.2	22.9
21	131°19.7	136°58.8	04°00.8	129°45.7	·· 09.9	304°47.7	·· 05.8	303°46.8	·· 22.8
22	146°22.2	151°58.4	03°59.5	144°46.4	09.1	319°50.4	05.7	318°49.5	22.8
23	161°24.7	166°58.0	58.3	159°47.1	08.3	334°53.2	05.5	333°52.1	22.7
Mer.pass. 12:16		ν -0.4′	d 1.2′	m -3.88	ν 0.7′	d 0.8′	m 1.08	ν 2.8′	d 0.1′ m -2.47	ν 2.6′	d 0.1′ m 0.49

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	176°27.1	181°57.6	S03°57.1	174°47.8	S00°07.5	349°55.9	S01°05.4	348°54.8	S00°22.6
1	191°29.6	196°57.2	55.8	189°48.5	06.7	4°58.7	05.3	3°57.4	22.5
2	206°32.1	211°56.8	54.6	204°49.2	05.9	20°01.4	05.1	19°00.0	22.4
3	221°34.5	226°56.4	·· 53.4	219°49.9	·· 05.1	35°04.2	·· 05.0	34°02.7	·· 22.4
4	236°37.0	241°56.0	52.1	234°50.6	04.3	50°07.0	04.9	49°05.3	22.3
5	251°39.5	256°55.6	50.9	249°51.2	03.5	65°09.7	04.8	64°08.0	22.2
6	266°41.9	271°55.2	S03°49.6	264°51.9	S00°02.8	80°12.5	S01°04.6	79°10.6	S00°22.1
7	281°44.4	286°54.8	48.4	279°52.6	02.0	95°15.2	04.5	94°13.2	22.0
8	296°46.8	301°54.4	47.2	294°53.3	01.2	110°18.0	04.4	109°15.9	22.0
9	311°49.3	316°54.0	·· 45.9	309°54.0	S00°00.4	125°20.7	·· 04.2	124°18.5	·· 21.9
10	326°51.8	331°53.6	44.7	324°54.7	N00°00.4	140°23.5	04.1	139°21.2	21.8
11	341°54.2	346°53.2	43.5	339°55.4	01.2	155°26.2	04.0	154°23.8	21.7
12	356°56.7	1°52.8	S03°42.2	354°56.1	N00°02.0	170°29.0	S01°03.9	169°26.4	S00°21.7
13	11°59.2	16°52.4	41.0	9°56.8	02.8	185°31.7	03.7	184°29.1	21.6
14	27°01.6	31°52.0	39.8	24°57.5	03.6	200°34.5	03.6	199°31.7	21.5
15	42°04.1	46°51.6	·· 38.5	39°58.2	·· 04.4	215°37.3	·· 03.5	214°34.3	·· 21.4
16	57°06.6	61°51.2	37.3	54°58.8	05.2	230°40.0	03.4	229°37.0	21.3
17	72°09.0	76°50.8	36.0	69°59.5	06.0	245°42.8	03.2	244°39.6	21.3
18	87°11.5	91°50.4	S03°34.8	85°00.2	N00°06.7	260°45.5	S01°03.1	259°42.3	S00°21.2
19	102°13.9	106°50.0	33.6	100°00.9	07.5	275°48.3	03.0	274°44.9	21.1
20	117°16.4	121°49.6	32.3	115°01.6	08.3	290°51.0	02.8	289°47.5	21.0
21	132°18.9	136°49.2	·· 31.1	130°02.3	·· 09.1	305°53.8	·· 02.7	304°50.2	·· 20.9
22	147°21.3	151°48.8	29.9	145°03.0	09.9	320°56.5	02.6	319°52.8	20.9
23	162°23.8	166°48.5	28.6	160°03.7	10.7	335°59.3	02.5	334°55.5	20.8
Mer.pass. 12:12		ν -0.4′	d 1.2′	m -3.87	ν 0.7′	d 0.8′	m 1.08	ν 2.8′	d 0.1′ m -2.47	ν 2.6′	d 0.1′ m 0.49

Stars

	SHA	Dec
Alpheratz	358°09.3	28°59.0
Ankaa	353°40.3	-42°24.7
Schedar	350°09.2	56°26.0
Diphda	349°20.8	-18°05.6
Achernar	335°45.5	-57°20.2
Hamal	328°28.8	23°22.3
Polaris	327°03.2	89°10.8
Acamar	315°37.2	-40°23.1
Menkar	314°41.0	4°00.8
Mirfak	309°15.9	49°47.7
Aldebaran	291°17.7	16°28.2
Rigel	281°35.7	-8°13.6
Capella	281°10.8	45°58.8
Bellatrix	278°58.4	6°19.8
Elnath	278°43.7	28°35.5
Alnilam	276°11.3	-1°13.0
Betelgeuse	271°27.9	7°24.1
Canopus	264°07.0	-52°41.5
Sirius	258°55.3	-16°41.7
Adhara	255°31.7	-28°57.1
Procyon	245°25.3	5°16.3
Pollux	243°57.6	28°04.3
Avior	234°27.7	-59°27.2
Suhail	223°10.2	-43°21.6
Miaplacidus	221°44.2	-69°38.6
Alphard	218°20.0	-8°34.7
Regulus	208°09.3	12°03.5
Dubhe	194°21.1	61°51.2
Denebola	182°58.4	14°40.6
Gienah	176°17.3	-17°26.3
Acrux	173°36.2	-62°59.6
Gacrux	172°27.8	-57°00.4
Alioth	166°41.7	56°03.7
Spica	158°56.9	-11°03.8
Alkaid	153°17.8	49°24.3
Hadar	149°22.3	-60°16.8
Menkent	148°36.3	-36°16.6
Arcturus	146°17.9	19°16.7
Rigil Kent.	140°24.8	-60°45.1
Kochab	137°18.2	74°13.8
Zuben'ubi	137°32.4	-15°57.8
Alphecca	126°31.6	26°46.5
Antares	112°56.3	-26°23.4
Atria	108°20.2	-68°59.4
Sabik	102°40.7	-15°42.1
Shaula	96°55.3	-37°05.3
Rasalhague	96°29.2	12°34.3
Eltanin	90°57.6	51°29.2
Kaus Aust.	84°16.5	-34°23.5
Vega	80°55.7	38°45.7
Nunki	76°28.8	-26°19.2
Altair	62°32.3	8°48.9
Peacock	53°58.2	-56°47.6
Deneb	49°48.5	45°12.5
Enif	34°11.5	9°47.1
Al Na'ir	28°14.9	-47°03.2
Fomalhaut	15°51.4	-29°43.5
Scheat	14°17.6	27°58.6
Markab	14°03.1	15°06.0

Mar 17 Tue	SHA	Mer.pass
Venus	7°48.0	11:51
Mars	359°45.9	12:22
Jupiter	173°15.0	00:49
Saturn	172°19.3	00:53

Mar 18 Wed	SHA	Mer.pass
Venus	6°39.2	11:52
Mars	359°03.3	12:21
Jupiter	173°21.9	00:45
Saturn	172°23.4	00:48

Mar 19 Thu	SHA	Mer.pass
Venus	5°30.4	11:52
Mars	358°20.7	12:20
Jupiter	173°28.8	00:40
Saturn	172°27.6	00:44

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°51.9	S01°28.0	37°23.2	10.6′	N16°51.4	6.6′	56.3′
1	192°52.1	27.0	51°52.8	10.7′	16°44.8	6.7′	56.2′
2	207°52.3	26.0	66°22.5	10.8′	16°38.1	6.8′	56.2′
3	222°52.4	·· 25.0	80°52.3	10.8′	16°31.3	6.9′	56.2′
4	237°52.6	24.0	95°22.1	10.9′	16°24.4	6.9′	56.2′
5	252°52.8	23.0	109°52.0	10.9′	16°17.5	7.0′	56.2′
6	267°53.0	S01°22.0	124°22.0	11.0′	N16°10.5	7.1′	56.1′
7	282°53.2	21.0	138°52.0	11.1′	16°03.4	7.2′	56.1′
8	297°53.3	20.1	153°22.0	11.1′	15°56.2	7.2′	56.1′
9	312°53.5	·· 19.1	167°52.2	11.2′	15°49.0	7.3′	56.1′
10	327°53.7	18.1	182°22.4	11.2′	15°41.7	7.4′	56.0′
11	342°53.9	17.1	196°52.6	11.3′	15°34.3	7.5′	56.0′
12	357°54.1	S01°16.1	211°22.9	11.4′	N15°26.8	7.5′	56.0′
13	12°54.3	15.1	225°53.3	11.4′	15°19.3	7.7′	56.0′
14	27°54.4	14.1	240°23.7	11.5′	15°11.6	7.6′	56.0′
15	42°54.6	·· 13.1	254°54.2	11.5′	15°04.0	7.8′	55.9′
16	57°54.8	12.2	269°24.8	11.6′	14°56.2	7.8′	55.9′
17	72°55.0	11.2	283°55.4	11.7′	14°48.4	7.9′	55.9′
18	87°55.2	S01°10.2	298°26.0	11.7′	N14°40.5	8.0′	55.9′
19	102°55.3	09.2	312°56.8	11.8′	14°32.5	8.0′	55.9′
20	117°55.5	08.2	327°27.5	11.8′	14°24.5	8.1′	55.8′
21	132°55.7	·· 07.2	341°58.4	11.9′	14°16.4	8.1′	55.8′
22	147°55.9	06.2	356°29.3	12.0′	14°08.3	8.2′	55.8′
23	162°56.1	05.2	11°00.2	12.0′	14°00.1	8.3′	55.8′
	SD = 16.1′	d = 1.0′	SD = 15.3′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°56.3	S01°04.3	25°31.3	12.1′	N13°51.8	8.3′	55.8′
1	192°56.4	03.3	40°02.3	12.1′	13°43.5	8.4′	55.7′
2	207°56.6	02.3	54°33.5	12.2′	13°35.1	8.5′	55.7′
3	222°56.8	·· 01.3	69°04.7	12.2′	13°26.6	8.5′	55.7′
4	237°57.0	01°00.3	83°35.9	12.3′	13°18.1	8.6′	55.7′
5	252°57.2	00°59.3	98°07.2	12.4′	13°09.5	8.6′	55.7′
6	267°57.4	S00°58.3	112°38.5	12.4′	N13°00.9	8.7′	55.6′
7	282°57.5	57.3	127°10.0	12.5′	12°52.2	8.8′	55.6′
8	297°57.7	56.3	141°41.4	12.5′	12°43.4	8.8′	55.6′
9	312°57.9	·· 55.4	156°12.9	12.6′	12°34.6	8.8′	55.6′
10	327°58.1	54.4	170°44.5	12.6′	12°25.8	9.0′	55.6′
11	342°58.3	53.4	185°16.2	12.7′	12°16.8	8.9′	55.6′
12	357°58.5	S00°52.4	199°47.8	12.7′	N12°07.9	9.0′	55.5′
13	12°58.6	51.4	214°19.6	12.8′	11°58.9	9.1′	55.5′
14	27°58.8	50.4	228°51.4	12.8′	11°49.8	9.1′	55.5′
15	42°59.0	·· 49.4	243°23.2	12.9′	11°40.7	9.2′	55.5′
16	57°59.2	48.4	257°55.1	12.9′	11°31.5	9.2′	55.5′
17	72°59.4	47.5	272°27.1	13.0′	11°22.3	9.2′	55.4′
18	87°59.6	S00°46.5	286°59.0	13.0′	N11°13.1	9.3′	55.4′
19	102°59.7	45.5	301°31.1	13.1′	11°03.8	9.4′	55.4′
20	117°59.9	44.5	316°03.2	13.1′	10°54.4	9.4′	55.4′
21	133°00.1	·· 43.5	330°35.3	13.2′	10°45.0	9.4′	55.4′
22	148°00.3	42.5	345°07.5	13.2′	10°35.6	9.5′	55.4′
23	163°00.5	41.5	359°39.8	13.3′	10°26.1	9.5′	55.3′
	SD = 16.1′	d = 1.0′	SD = 15.2′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°00.7	S00°40.5	14°12.1	13.3′	N10°16.6	9.6′	55.3′
1	193°00.8	39.5	28°44.4	13.4′	10°07.0	9.6′	55.3′
2	208°01.0	38.6	43°16.8	13.4′	09°57.4	9.6′	55.3′
3	223°01.2	·· 37.6	57°49.3	13.5′	09°47.8	9.7′	55.3′
4	238°01.4	36.6	72°21.8	13.5′	09°38.1	9.7′	55.2′
5	253°01.6	35.6	86°54.3	13.6′	09°28.4	9.8′	55.2′
6	268°01.8	S00°34.6	101°26.9	13.6′	N09°18.6	9.8′	55.2′
7	283°01.9	33.6	115°59.5	13.7′	09°08.8	9.8′	55.2′
8	298°02.1	32.6	130°32.2	13.7′	08°59.0	9.9′	55.2′
9	313°02.3	·· 31.6	145°04.9	13.8′	08°49.1	9.9′	55.2′
10	328°02.5	30.7	159°37.6	13.8′	08°39.2	9.9′	55.1′
11	343°02.7	29.7	174°10.4	13.8′	08°29.3	9.9′	55.1′
12	358°02.9	S00°28.7	188°43.3	13.9′	N08°19.4	10.0′	55.1′
13	13°03.1	27.7	203°16.2	13.9′	08°09.4	10.1′	55.1′
14	28°03.2	26.7	217°49.1	14.0′	07°59.3	10.0′	55.1′
15	43°03.4	·· 25.7	232°22.1	14.0′	07°49.3	10.1′	55.1′
16	58°03.6	24.7	246°55.1	14.0′	07°39.2	10.1′	55.0′
17	73°03.8	23.7	261°28.1	14.1′	07°29.1	10.1′	55.0′
18	88°04.0	S00°22.8	276°01.2	14.1′	N07°19.0	10.2′	55.0′
19	103°04.2	21.8	290°34.3	14.2′	07°08.8	10.2′	55.0′
20	118°04.4	20.8	305°07.5	14.2′	06°58.6	10.2′	55.0′
21	133°04.5	·· 19.8	319°40.7	14.2′	06°48.4	10.2′	55.0′
22	148°04.7	18.8	334°13.9	14.3′	06°38.2	10.3′	54.9′
23	163°04.9	17.8	348°47.2	14.3′	06°27.9	10.3′	54.9′
	SD = 16.1′	d = 1.0′	SD = 15.1′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	03:35	05:02	06:09	18:09	19:17	20:45
N 70°	03:52	05:08	06:09	18:09	19:11	20:28
68°	04:05	05:13	06:09	18:09	19:05	20:14
66°	04:16	05:18	06:09	18:09	19:01	20:03
64°	04:24	05:21	06:09	18:09	18:57	19:54
62°	04:31	05:24	06:08	18:09	18:54	19:47
60°	04:37	05:27	06:08	18:09	18:51	19:41
N 58°	04:43	05:29	06:08	18:09	18:49	19:35
56°	04:47	05:31	06:08	18:09	18:47	19:31
54°	04:51	05:33	06:08	18:09	18:45	19:26
52°	04:55	05:34	06:08	18:09	18:43	19:23
50°	04:58	05:35	06:08	18:10	18:42	19:20
45°	05:04	05:38	06:07	18:10	18:39	19:13
N 40°	05:09	05:40	06:07	18:10	18:37	19:08
35°	05:12	05:42	06:07	18:10	18:35	19:05
30°	05:15	05:43	06:07	18:10	18:34	19:02
20°	05:19	05:44	06:06	18:10	18:32	18:58
N 10°	05:20	05:45	06:05	18:11	18:32	18:56
0°	05:20	05:44	06:05	18:11	18:32	18:56
S 10°	05:19	05:43	06:04	18:12	18:33	18:57
20°	05:16	05:41	06:03	18:13	18:35	19:00
30°	05:10	05:38	06:02	18:14	18:38	19:05
35°	05:07	05:36	06:01	18:14	18:39	19:09
40°	05:02	05:33	06:01	18:15	18:42	19:14
45°	04:56	05:30	06:00	18:16	18:45	19:20
S 50°	04:48	05:26	05:58	18:17	18:49	19:27
52°	04:44	05:24	05:58	18:17	18:51	19:31
54°	04:39	05:22	05:57	18:18	18:53	19:35
56°	04:34	05:19	05:56	18:19	18:56	19:40
58°	04:29	05:16	05:56	18:19	18:58	19:46
S 60°	04:22	05:13	05:55	18:20	19:02	19:52

Lat.	**Moonrise** Tue	Wed	Thu	**Moonset** Tue	Wed	Thu
N 72°	12:05	14:06	15:56	07:50	07:28	07:13
N 70°	12:42	14:27	16:07	07:11	07:05	07:00
68°	13:08	14:44	16:17	06:44	06:48	06:49
66°	13:28	14:57	16:24	06:24	06:33	06:40
64°	13:43	15:08	16:31	06:07	06:22	06:32
62°	13:57	15:17	16:37	05:53	06:12	06:25
60°	14:08	15:25	16:41	05:42	06:03	06:20
N 58°	14:17	15:32	16:46	05:32	05:55	06:14
56°	14:26	15:38	16:49	05:23	05:49	06:10
54°	14:33	15:43	16:53	05:15	05:43	06:06
52°	14:40	15:48	16:56	05:08	05:37	06:02
50°	14:46	15:52	16:59	05:01	05:32	05:59
45°	14:59	16:02	17:05	04:47	05:21	05:51
N 40°	15:09	16:10	17:10	04:36	05:12	05:45
35°	15:18	16:17	17:14	04:26	05:05	05:40
30°	15:26	16:23	17:18	04:18	04:58	05:35
20°	15:40	16:33	17:24	04:03	04:46	05:27
N 10°	15:52	16:42	17:30	03:50	04:36	05:19
0°	16:03	16:50	17:36	03:37	04:26	05:12
S 10°	16:14	16:59	17:41	03:25	04:16	05:05
20°	16:26	17:08	17:47	03:12	04:06	04:58
30°	16:39	17:18	17:53	02:56	03:53	04:49
35°	16:47	17:24	17:57	02:47	03:46	04:44
40°	16:56	17:30	18:01	02:37	03:38	04:39
45°	17:06	17:38	18:06	02:25	03:29	04:32
S 50°	17:19	17:47	18:12	02:11	03:18	04:24
52°	17:25	17:51	18:15	02:04	03:12	04:21
54°	17:31	17:56	18:18	01:56	03:06	04:17
56°	17:38	18:01	18:21	01:48	03:00	04:12
58°	17:46	18:07	18:24	01:38	02:52	04:07
S 60°	17:55	18:13	18:28	01:27	02:44	04:01

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 11-13 87-97%
17	08:32	08:24	12:08	22:15	09:50	
18	08:15	08:06	12:08	23:01	10:38	
19	07:57	07:49	12:08	23:46	11:24	

March 20, 21, 22 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	177°26.3	181°48.1	S03°27.4	175°04.4	N00°11.5	351°02.0	S01°02.3	349°58.1	S00°20.7
1	192°28.7	196°47.7	26.1	190°05.1	12.3	6°04.8	02.2	5°00.7	20.6
2	207°31.2	211°47.3	24.9	205°05.7	13.1	21°07.6	02.1	20°03.4	20.6
3	222°33.7	226°46.9	·· 23.7	220°06.4	·· 13.9	36°10.3	·· 01.9	35°06.0	·· 20.5
4	237°36.1	241°46.5	22.4	235°07.1	14.7	51°13.1	01.8	50°08.7	20.4
5	252°38.6	256°46.1	21.2	250°07.8	15.4	66°15.8	01.7	65°11.3	20.3
6	267°41.1	271°45.7	S03°19.9	265°08.5	N00°16.2	81°18.6	S01°01.6	80°13.9	S00°20.2
7	282°43.5	286°45.3	18.7	280°09.2	17.0	96°21.3	01.4	95°16.6	20.2
8	297°46.0	301°44.9	17.5	295°09.9	17.8	111°24.1	01.3	110°19.2	20.1
9	312°48.4	316°44.5	·· 16.2	310°10.6	·· 18.6	126°26.8	·· 01.2	125°21.9	·· 20.0
10	327°50.9	331°44.1	15.0	325°11.3	19.4	141°29.6	01.0	140°24.5	19.9
11	342°53.4	346°43.7	13.7	340°12.0	20.2	156°32.4	00.9	155°27.1	19.8
12	357°55.8	1°43.3	S03°12.5	355°12.7	N00°21.0	171°35.1	S01°00.8	170°29.8	S00°19.8
13	12°58.3	16°43.0	11.3	10°13.4	21.8	186°37.9	00.7	185°32.4	19.7
14	28°00.8	31°42.6	10.0	25°14.0	22.6	201°40.6	00.5	200°35.1	19.6
15	43°03.2	46°42.2	·· 08.8	40°14.7	·· 23.3	216°43.4	·· 00.4	215°37.7	·· 19.5
16	58°05.7	61°41.8	07.5	55°15.4	24.1	231°46.1	00.3	230°40.3	19.4
17	73°08.2	76°41.4	06.3	70°16.1	24.9	246°48.9	00.1	245°43.0	19.4
18	88°10.6	91°41.0	S03°05.0	85°16.8	N00°25.7	261°51.7	S01°00.0	260°45.6	S00°19.3
19	103°13.1	106°40.6	03.8	100°17.5	26.5	276°54.4	00°59.9	275°48.3	19.2
20	118°15.6	121°40.2	02.6	115°18.2	27.3	291°57.2	59.8	290°50.9	19.1
21	133°18.0	136°39.8	·· 01.3	130°18.9	·· 28.1	306°59.9	·· 59.6	305°53.5	·· 19.1
22	148°20.5	151°39.4	03°00.1	145°19.6	28.9	322°02.7	59.5	320°56.2	19.0
23	163°22.9	166°39.0	02°58.8	160°20.3	29.7	337°05.4	59.4	335°58.8	18.9
Mer.pass. 12:08		ν -0.4′	d 1.2′	m -3.87	ν 0.7′	d 0.8′	m 1.08	ν 2.8′	d 0.1′ m -2.47	ν 2.6′	d 0.1′ m 0.48

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	178°25.4	181°38.7	S02°57.6	175°21.0	N00°30.5	352°08.2	S00°59.2	351°01.5	S00°18.8
1	193°27.9	196°38.3	56.3	190°21.7	31.2	7°10.9	59.1	6°04.1	18.7
2	208°30.3	211°37.9	55.1	205°22.3	32.0	22°13.7	59.0	21°06.7	18.7
3	223°32.8	226°37.5	·· 53.9	220°23.0	·· 32.8	37°16.5	·· 58.9	36°09.4	·· 18.6
4	238°35.3	241°37.1	52.6	235°23.7	33.6	52°19.2	58.7	51°12.0	18.5
5	253°37.7	256°36.7	51.4	250°24.4	34.4	67°22.0	58.6	66°14.7	18.4
6	268°40.2	271°36.3	S02°50.1	265°25.1	N00°35.2	82°24.7	S00°58.5	81°17.3	S00°18.3
7	283°42.7	286°35.9	48.9	280°25.8	36.0	97°27.5	58.4	96°19.9	18.3
8	298°45.1	301°35.5	47.6	295°26.5	36.8	112°30.2	58.2	111°22.6	18.2
9	313°47.6	316°35.1	·· 46.4	310°27.2	·· 37.6	127°33.0	·· 58.1	126°25.2	·· 18.1
10	328°50.0	331°34.8	45.1	325°27.9	38.4	142°35.8	58.0	141°27.9	18.0
11	343°52.5	346°34.4	43.9	340°28.6	39.1	157°38.5	57.8	156°30.5	17.9
12	358°55.0	1°34.0	S02°42.7	355°29.3	N00°39.9	172°41.3	S00°57.7	171°33.1	S00°17.9
13	13°57.4	16°33.6	41.4	10°30.0	40.7	187°44.0	57.6	186°35.8	17.8
14	28°59.9	31°33.2	40.2	25°30.7	41.5	202°46.8	57.5	201°38.4	17.7
15	44°02.4	46°32.8	·· 38.9	40°31.4	·· 42.3	217°49.5	·· 57.3	216°41.1	·· 17.6
16	59°04.8	61°32.4	37.7	55°32.0	43.1	232°52.3	57.2	231°43.7	17.6
17	74°07.3	76°32.0	36.4	70°32.7	43.9	247°55.1	57.1	246°46.4	17.5
18	89°09.8	91°31.7	S02°35.2	85°33.4	N00°44.7	262°57.8	S00°56.9	261°49.0	S00°17.4
19	104°12.2	106°31.3	33.9	100°34.1	45.5	278°00.6	56.8	276°51.6	17.3
20	119°14.7	121°30.9	32.7	115°34.8	46.2	293°03.3	56.7	291°54.3	17.2
21	134°17.2	136°30.5	·· 31.5	130°35.5	·· 47.0	308°06.1	·· 56.6	306°56.9	·· 17.2
22	149°19.6	151°30.1	30.2	145°36.2	47.8	323°08.9	56.4	321°59.6	17.1
23	164°22.1	166°29.7	29.0	160°36.9	48.6	338°11.6	56.3	337°02.2	17.0
Mer.pass. 12:04		ν -0.4′	d 1.2′	m -3.87	ν 0.7′	d 0.8′	m 1.08	ν 2.8′	d 0.1′ m -2.47	ν 2.6′	d 0.1′ m 0.48

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	179°24.5	181°29.3	S02°27.7	175°37.6	N00°49.4	353°14.4	S00°56.2	352°04.8	S00°16.9
1	194°27.0	196°28.9	26.5	190°38.3	50.2	8°17.1	56.0	7°07.5	16.8
2	209°29.5	211°28.6	25.2	205°39.0	51.0	23°19.9	55.9	22°10.1	16.8
3	224°31.9	226°28.2	·· 24.0	220°39.7	·· 51.8	38°22.6	·· 55.8	37°12.8	·· 16.7
4	239°34.4	241°27.8	22.7	235°40.4	52.6	53°25.4	55.7	52°15.4	16.6
5	254°36.9	256°27.4	21.5	250°41.1	53.3	68°28.2	55.5	67°18.0	16.5
6	269°39.3	271°27.0	S02°20.2	265°41.7	N00°54.1	83°30.9	S00°55.4	82°20.7	S00°16.4
7	284°41.8	286°26.6	19.0	280°42.4	54.9	98°33.7	55.3	97°23.3	16.4
8	299°44.3	301°26.2	17.7	295°43.1	55.7	113°36.4	55.1	112°26.0	16.3
9	314°46.7	316°25.9	·· 16.5	310°43.8	·· 56.5	128°39.2	·· 55.0	127°28.6	·· 16.2
10	329°49.2	331°25.5	15.2	325°44.5	57.3	143°41.9	54.9	142°31.2	16.1
11	344°51.6	346°25.1	14.0	340°45.2	58.1	158°44.7	54.8	157°33.9	16.1
12	359°54.1	1°24.7	S02°12.7	355°45.9	N00°58.9	173°47.5	S00°54.6	172°36.5	S00°16.0
13	14°56.6	16°24.3	11.5	10°46.6	00°59.7	188°50.2	54.5	187°39.2	15.9
14	29°59.0	31°23.9	10.3	25°47.3	01°00.4	203°53.0	54.4	202°41.8	15.8
15	45°01.5	46°23.5	·· 09.0	40°48.0	·· 01.2	218°55.7	·· 54.2	217°44.5	·· 15.7
16	60°04.0	61°23.2	07.8	55°48.7	02.0	233°58.5	54.1	232°47.1	15.7
17	75°06.4	76°22.8	06.5	70°49.4	02.8	249°01.3	54.0	247°49.7	15.6
18	90°08.9	91°22.4	S02°05.3	85°50.1	N01°03.6	264°04.0	S00°53.8	262°52.4	S00°15.5
19	105°11.4	106°22.0	04.0	100°50.8	04.4	279°06.8	53.7	277°55.0	15.4
20	120°13.8	121°21.6	02.8	115°51.5	05.2	294°09.5	53.6	292°57.7	15.3
21	135°16.3	136°21.2	·· 01.5	130°52.2	·· 06.0	309°12.3	·· 53.5	308°00.3	·· 15.3
22	150°18.8	151°20.8	02°00.3	145°52.8	06.7	324°15.0	53.3	323°02.9	15.2
23	165°21.2	166°20.5	01°59.0	160°53.5	07.5	339°17.8	53.2	338°05.6	15.1
Mer.pass. 12:00		ν -0.4′	d 1.2′	m -3.87	ν 0.7′	d 0.8′	m 1.08	ν 2.8′	d 0.1′ m -2.47	ν 2.6′	d 0.1′ m 0.47

Stars

	SHA	Dec
Alpheratz	358°09.3	28°59.0
Ankaa	353°40.3	-42°24.7
Schedar	350°09.2	56°25.9
Diphda	349°20.8	-18°05.6
Achernar	335°45.5	-57°20.2
Hamal	328°28.8	23°22.3
Polaris	327°04.0	89°10.8
Acamar	315°37.3	-40°23.1
Menkar	314°41.0	4°00.8
Mirfak	309°15.9	49°47.7
Aldebaran	291°17.7	16°28.2
Rigel	281°35.7	-8°13.6
Capella	281°10.9	45°58.8
Bellatrix	278°58.4	6°19.8
Elnath	278°43.7	28°35.5
Alnilam	276°11.3	-1°13.0
Betelgeuse	271°27.9	7°24.1
Canopus	264°07.0	-52°41.5
Sirius	258°55.3	-16°41.7
Adhara	255°31.7	-28°57.1
Procyon	245°25.3	5°16.3
Pollux	243°57.6	28°04.3
Avior	234°27.7	-59°27.2
Suhail	223°10.2	-43°21.6
Miaplacidus	221°44.2	-69°38.6
Alphard	218°20.0	-8°34.7
Regulus	208°09.4	12°03.5
Dubhe	194°21.1	61°51.2
Denebola	182°58.4	14°40.6
Gienah	176°17.3	-17°26.3
Acrux	173°36.2	-62°59.6
Gacrux	172°27.8	-57°00.4
Alioth	166°41.7	56°03.7
Spica	158°56.9	-11°03.8
Alkaid	153°17.8	49°24.3
Hadar	149°22.3	-60°16.8
Menkent	148°36.3	-36°16.6
Arcturus	146°17.9	19°16.7
Rigil Kent.	140°24.8	-60°45.1
Kochab	137°18.2	74°13.8
Zuben'ubi	137°32.4	-15°57.8
Alphecca	126°31.6	26°46.5
Antares	112°56.3	-26°23.4
Atria	108°20.1	-68°59.4
Sabik	102°40.7	-15°42.1
Shaula	96°55.2	-37°05.3
Rasalhague	96°29.2	12°34.3
Eltanin	90°57.5	51°29.2
Kaus Aust.	84°16.4	-34°23.5
Vega	80°55.6	38°45.7
Nunki	76°28.8	-26°19.2
Altair	62°32.3	8°48.9
Peacock	53°58.2	-56°47.6
Deneb	49°48.5	45°12.5
Enif	34°11.5	9°47.1
Al Na'ir	28°14.9	-47°03.2
Fomalhaut	15°51.4	-29°43.5
Scheat	14°17.6	27°58.6
Markab	14°03.1	15°06.0

Mar 20 Fri	SHA	Mer.pass
Venus	4°21.8	11:53
Mars	357°38.1	12:19
Jupiter	173°35.8	00:36
Saturn	172°31.8	00:40

Mar 21 Sat	SHA	Mer.pass
Venus	3°13.2	11:54
Mars	356°55.6	12:18
Jupiter	173°42.8	00:31
Saturn	172°36.1	00:36

Mar 22 Sun	SHA	Mer.pass
Venus	2°04.8	11:54
Mars	356°13.0	12:17
Jupiter	173°49.8	00:27
Saturn	172°40.3	00:32

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h

	Sun		Moon				
Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°05.1	S00°16.8	3°20.5	14.3′	N06°17.6	10.3′	54.9′
1	193°05.3	15.8	17°53.9	14.4′	06°07.3	10.3′	54.9′
2	208°05.5	14.9	32°27.3	14.4′	05°57.0	10.3′	54.9′
3	223°05.7	·· 13.9	47°00.7	14.5′	05°46.7	10.4′	54.9′
4	238°05.8	12.9	61°34.1	14.5′	05°36.3	10.4′	54.9′
5	253°06.0	11.9	76°07.6	14.5′	05°25.9	10.4′	54.8′
6	268°06.2	S00°10.9	90°41.1	14.5′	N05°15.5	10.4′	54.8′
7	283°06.4	09.9	105°14.7	14.6′	05°05.1	10.4′	54.8′
8	298°06.6	08.9	119°48.3	14.6′	04°54.7	10.5′	54.8′
9	313°06.8	·· 07.9	134°21.9	14.6′	04°44.2	10.4′	54.8′
10	328°07.0	07.0	148°55.5	14.7′	04°33.8	10.5′	54.8′
11	343°07.1	06.0	163°29.2	14.7′	04°23.3	10.5′	54.8′
12	358°07.3	S00°05.0	178°02.9	14.7′	N04°12.8	10.5′	54.7′
13	13°07.5	04.0	192°36.6	14.8′	04°02.3	10.5′	54.7′
14	28°07.7	03.0	207°10.3	14.8′	03°51.8	10.5′	54.7′
15	43°07.9	·· 02.0	221°44.1	14.8′	03°41.3	10.6′	54.7′
16	58°08.1	01.0	236°17.9	14.8′	03°30.7	10.5′	54.7′
17	73°08.3	S00°00.0	250°51.8	14.9′	03°20.2	10.6′	54.7′
18	88°08.5	N00°00.9	265°25.6	14.9′	N03°09.6	10.5′	54.7′
19	103°08.6	01.9	279°59.5	14.9′	02°59.1	10.6′	54.6′
20	118°08.8	02.9	294°33.4	14.9′	02°48.5	10.6′	54.6′
21	133°09.0	·· 03.9	309°07.3	15.0′	02°37.9	10.5′	54.6′
22	148°09.2	04.9	323°41.3	15.0′	02°27.4	10.6′	54.6′
23	163°09.4	05.9	338°15.3	15.0′	02°16.8	10.6′	54.6′
	SD = 16.1′	d = 1.0′	SD = 15.0′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°09.6	N00°06.9	352°49.2	15.0′	N02°06.2	10.6′	54.6′
1	193°09.8	07.9	7°23.3	15.0′	01°55.6	10.6′	54.6′
2	208°10.0	08.8	21°57.3	15.1′	01°45.0	10.6′	54.5′
3	223°10.1	·· 09.8	36°31.4	15.1′	01°34.4	10.6′	54.5′
4	238°10.3	10.8	51°05.4	15.1′	01°23.8	10.6′	54.5′
5	253°10.5	11.8	65°39.5	15.1′	01°13.2	10.6′	54.5′
6	268°10.7	N00°12.8	80°13.6	15.1′	N01°02.6	10.6′	54.5′
7	283°10.9	13.8	94°47.8	15.1′	00°52.0	10.6′	54.5′
8	298°11.1	14.8	109°21.9	15.2′	00°41.4	10.6′	54.5′
9	313°11.3	·· 15.8	123°56.1	15.2′	00°30.8	10.6′	54.5′
10	328°11.5	16.7	138°30.2	15.2′	00°20.2	10.6′	54.4′
11	343°11.6	17.7	153°04.4	15.2′	N00°09.6	10.6′	54.4′
12	358°11.8	N00°18.7	167°38.6	15.2′	S00°01.0	10.6′	54.4′
13	13°12.0	19.7	182°12.8	15.2′	00°11.6	10.6′	54.4′
14	28°12.2	20.7	196°47.1	15.2′	00°22.2	10.5′	54.4′
15	43°12.4	·· 21.7	211°21.3	15.2′	00°32.7	10.6′	54.4′
16	58°12.6	22.7	225°55.5	15.3′	00°43.3	10.6′	54.4′
17	73°12.8	23.7	240°29.8	15.3′	00°53.9	10.5′	54.4′
18	88°13.0	N00°24.6	255°04.1	15.3′	S01°04.4	10.5′	54.4′
19	103°13.1	25.6	269°38.3	15.3′	01°14.9	10.6′	54.3′
20	118°13.3	26.6	284°12.6	15.3′	01°25.5	10.5′	54.3′
21	133°13.5	·· 27.6	298°46.9	15.3′	01°36.0	10.5′	54.3′
22	148°13.7	28.6	313°21.2	15.3′	01°46.5	10.5′	54.3′
23	163°13.9	29.6	327°55.5	15.3′	01°57.0	10.5′	54.3′
	SD = 16.0′	d = 1.0′	SD = 14.9′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°14.1	N00°30.6	342°29.9	15.3′	S02°07.5	10.5′	54.3′
1	193°14.3	31.5	357°04.2	15.3′	02°18.0	10.4′	54.3′
2	208°14.5	32.5	11°38.5	15.3′	02°28.4	10.5′	54.3′
3	223°14.7	·· 33.5	26°12.8	15.3′	02°38.9	10.4′	54.3′
4	238°14.8	34.5	40°47.2	15.3′	02°49.3	10.4′	54.3′
5	253°15.0	35.5	55°21.5	15.3′	02°59.7	10.4′	54.2′
6	268°15.2	N00°36.5	69°55.9	15.3′	S03°10.1	10.4′	54.2′
7	283°15.4	37.5	84°30.2	15.3′	03°20.5	10.4′	54.2′
8	298°15.6	38.4	99°04.5	15.3′	03°30.9	10.4′	54.2′
9	313°15.8	·· 39.4	113°38.9	15.3′	03°41.3	10.3′	54.2′
10	328°16.0	40.4	128°13.2	15.3′	03°51.6	10.3′	54.2′
11	343°16.2	41.4	142°47.6	15.3′	04°01.9	10.3′	54.2′
12	358°16.3	N00°42.4	157°21.9	15.3′	S04°12.2	10.3′	54.2′
13	13°16.5	43.4	171°56.3	15.3′	04°22.5	10.2′	54.2′
14	28°16.7	44.4	186°30.6	15.3′	04°32.7	10.3′	54.2′
15	43°16.9	·· 45.3	201°04.9	15.3′	04°43.0	10.2′	54.2′
16	58°17.1	46.3	215°39.3	15.3′	04°53.2	10.2′	54.1′
17	73°17.3	47.3	230°13.6	15.3′	05°03.4	10.1′	54.1′
18	88°17.5	N00°48.3	244°47.9	15.3′	S05°13.5	10.2′	54.1′
19	103°17.7	49.3	259°22.2	15.3′	05°23.7	10.1′	54.1′
20	118°17.9	50.3	273°56.5	15.3′	05°33.8	10.1′	54.1′
21	133°18.0	·· 51.3	288°30.8	15.3′	05°43.9	10.0′	54.1′
22	148°18.2	52.2	303°05.1	15.3′	05°53.9	10.1′	54.1′
23	163°18.4	53.2	317°39.4	15.3′	06°04.0	10.0′	54.1′
	SD = 16.0′	d = 1.0′	SD = 14.8′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	03:15	04:46	05:54	18:23	19:32	21:04
N 70°	03:35	04:54	05:55	18:21	19:23	20:43
68°	03:50	05:00	05:56	18:20	19:16	20:27
66°	04:02	05:06	05:57	18:19	19:11	20:15
64°	04:12	05:10	05:58	18:18	19:06	20:05
62°	04:21	05:14	05:59	18:17	19:02	19:56
60°	04:28	05:18	05:59	18:17	18:58	19:49
N 58°	04:34	05:20	06:00	18:16	18:55	19:43
56°	04:39	05:23	06:00	18:16	18:53	19:37
54°	04:43	05:25	06:00	18:15	18:50	19:33
52°	04:47	05:27	06:01	18:15	18:48	19:28
50°	04:51	05:29	06:01	18:14	18:47	19:25
45°	04:58	05:32	06:02	18:13	18:43	19:17
N 40°	05:04	05:35	06:02	18:13	18:40	19:12
35°	05:08	05:37	06:03	18:12	18:38	19:07
30°	05:11	05:39	06:03	18:12	18:36	19:04
20°	05:16	05:41	06:03	18:11	18:33	18:59
N 10°	05:18	05:43	06:04	18:11	18:32	18:56
0°	05:19	05:43	06:04	18:10	18:31	18:55
S 10°	05:19	05:43	06:04	18:10	18:31	18:56
20°	05:16	05:42	06:04	18:10	18:32	18:58
30°	05:12	05:40	06:04	18:10	18:34	19:02
35°	05:09	05:39	06:04	18:10	18:35	19:05
40°	05:05	05:37	06:04	18:10	18:37	19:09
45°	05:00	05:34	06:03	18:10	18:39	19:14
S 50°	04:53	05:31	06:03	18:10	18:43	19:20
52°	04:49	05:29	06:03	18:10	18:44	19:24
54°	04:46	05:27	06:03	18:11	18:46	19:27
56°	04:41	05:25	06:03	18:11	18:48	19:32
58°	04:36	05:23	06:02	18:11	18:50	19:36
S 60°	04:30	05:20	06:02	18:11	18:52	19:42

Lat.	**Moonrise** Fri	Sat	Sun	**Moonset** Fri	Sat	Sun
N 72°	17:39	19:19	20:59	07:01	06:50	06:40
N 70°	17:43	19:17	20:50	06:54	06:49	06:44
68°	17:47	19:16	20:43	06:49	06:48	06:48
66°	17:50	19:14	20:38	06:44	06:48	06:51
64°	17:53	19:13	20:33	06:40	06:47	06:54
62°	17:55	19:12	20:29	06:37	06:46	06:56
60°	17:57	19:11	20:25	06:33	06:46	06:58
N 58°	17:59	19:11	20:22	06:31	06:46	07:00
56°	18:00	19:10	20:19	06:28	06:45	07:01
54°	18:02	19:09	20:16	06:26	06:45	07:03
52°	18:03	19:09	20:14	06:24	06:44	07:04
50°	18:04	19:08	20:12	06:22	06:44	07:06
45°	18:06	19:07	20:07	06:18	06:43	07:08
N 40°	18:08	19:06	20:04	06:15	06:43	07:10
35°	18:10	19:06	20:00	06:12	06:42	07:12
30°	18:12	19:05	19:57	06:09	06:42	07:14
20°	18:15	19:04	19:52	06:05	06:41	07:17
N 10°	18:17	19:03	19:48	06:01	06:41	07:20
0°	18:19	19:02	19:44	05:57	06:40	07:22
S 10°	18:21	19:01	19:40	05:53	06:39	07:25
20°	18:24	19:00	19:36	05:49	06:38	07:27
30°	18:27	18:59	19:31	05:44	06:38	07:30
35°	18:28	18:58	19:28	05:41	06:37	07:32
40°	18:30	18:58	19:25	05:38	06:37	07:34
45°	18:32	18:57	19:22	05:35	06:36	07:36
S 50°	18:34	18:56	19:17	05:30	06:35	07:39
52°	18:36	18:56	19:16	05:28	06:35	07:40
54°	18:37	18:55	19:13	05:26	06:34	07:42
56°	18:38	18:55	19:11	05:23	06:34	07:43
58°	18:40	18:54	19:09	05:21	06:33	07:45
S 60°	18:41	18:53	19:06	05:18	06:33	07:47

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 14-16 100-98%
20	07:40	07:31	12:08	–:–	12:08	
21	07:22	07:13	12:07	00:30	12:51	
22	07:04	06:55	12:07	01:12	13:33	

March 23, 24, 25 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	180°23.7	181°20.1	S01°57.8	175°54.2	N01°08.3	354°20.6	S00°53.1	353°08.2	S00°15.0
1	195°26.1	196°19.7	56.5	190°54.9	09.1	9°23.3	52.9	8°10.9	14.9
2	210°28.6	211°19.3	55.3	205°55.6	09.9	24°26.1	52.8	23°13.5	14.9
3	225°31.1	226°18.9	·· 54.0	220°56.3	·· 10.7	39°28.8	·· 52.7	38°16.2	·· 14.8
4	240°33.5	241°18.5	52.8	235°57.0	11.5	54°31.6	52.6	53°18.8	14.7
5	255°36.0	256°18.2	51.5	250°57.7	12.3	69°34.4	52.4	68°21.4	14.6
6	270°38.5	271°17.8	S01°50.3	265°58.4	N01°13.1	84°37.1	S00°52.3	83°24.1	S00°14.6
7	285°40.9	286°17.4	49.0	280°59.1	13.8	99°39.9	52.2	98°26.7	14.5
8	300°43.4	301°17.0	47.8	295°59.8	14.6	114°42.6	52.0	113°29.4	14.4
9	315°45.9	316°16.6	·· 46.5	311°00.5	·· 15.4	129°45.4	·· 51.9	128°32.0	·· 14.3
10	330°48.3	331°16.2	45.3	326°01.2	16.2	144°48.2	51.8	143°34.6	14.2
11	345°50.8	346°15.9	44.0	341°01.9	17.0	159°50.9	51.7	158°37.3	14.2
12	0°53.2	1°15.5	S01°42.8	356°02.6	N01°17.8	174°53.7	S00°51.5	173°39.9	S00°14.1
13	15°55.7	16°15.1	41.5	11°03.3	18.6	189°56.4	51.4	188°42.6	14.0
14	30°58.2	31°14.7	40.3	26°04.0	19.3	204°59.2	51.3	203°45.2	13.9
15	46°00.6	46°14.3	·· 39.0	41°04.6	·· 20.1	220°01.9	·· 51.1	218°47.9	·· 13.8
16	61°03.1	61°13.9	37.8	56°05.3	20.9	235°04.7	51.0	233°50.5	13.8
17	76°05.6	76°13.6	36.5	71°06.0	21.7	250°07.5	50.9	248°53.1	13.7
18	91°08.0	91°13.2	S01°35.3	86°06.7	N01°22.5	265°10.2	S00°50.8	263°55.8	S00°13.6
19	106°10.5	106°12.8	34.0	101°07.4	23.3	280°13.0	50.6	278°58.4	13.5
20	121°13.0	121°12.4	32.8	116°08.1	24.1	295°15.7	50.5	294°01.1	13.4
21	136°15.4	136°12.0	·· 31.5	131°08.8	·· 24.9	310°18.5	·· 50.4	309°03.7	·· 13.4
22	151°17.9	151°11.7	30.3	146°09.5	25.6	325°21.3	50.2	324°06.3	13.3
23	166°20.4	166°11.3	29.0	161°10.2	26.4	340°24.0	50.1	339°09.0	13.2
Mer.pass. 11:56		ν -0.4′	d 1.2′	m -3.87	ν 0.7′	d 0.8′	m 1.07	ν 2.8′	d 0.1′ m -2.47	ν 2.6′	d 0.1′ m 0.47

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	181°22.8	181°10.9	S01°27.8	176°10.9	N01°27.2	355°26.8	S00°50.0	354°11.6	S00°13.1
1	196°25.3	196°10.5	26.5	191°11.6	28.0	10°29.5	49.9	9°14.3	13.1
2	211°27.7	211°10.1	25.3	206°12.3	28.8	25°32.3	49.7	24°16.9	13.0
3	226°30.2	226°09.7	·· 24.0	221°13.0	·· 29.6	40°35.1	·· 49.6	39°19.6	·· 12.9
4	241°32.7	241°09.4	22.8	236°13.7	30.4	55°37.8	49.5	54°22.2	12.8
5	256°35.1	256°09.0	21.5	251°14.4	31.2	70°40.6	49.3	69°24.8	12.7
6	271°37.6	271°08.6	S01°20.2	266°15.1	N01°31.9	85°43.3	S00°49.2	84°27.5	S00°12.7
7	286°40.1	286°08.2	19.0	281°15.8	32.7	100°46.1	49.1	99°30.1	12.6
8	301°42.5	301°07.8	17.7	296°16.5	33.5	115°48.9	49.0	114°32.8	12.5
9	316°45.0	316°07.5	·· 16.5	311°17.2	·· 34.3	130°51.6	·· 48.8	129°35.4	·· 12.4
10	331°47.5	331°07.1	15.2	326°17.9	35.1	145°54.4	48.7	144°38.1	12.3
11	346°49.9	346°06.7	14.0	341°18.5	35.9	160°57.1	48.6	159°40.7	12.3
12	1°52.4	1°06.3	S01°12.7	356°19.2	N01°36.7	175°59.9	S00°48.4	174°43.3	S00°12.2
13	16°54.8	16°05.9	11.5	11°19.9	37.4	191°02.7	48.3	189°46.0	12.1
14	31°57.3	31°05.6	10.2	26°20.6	38.2	206°05.4	48.2	204°48.6	12.0
15	46°59.8	46°05.2	·· 09.0	41°21.3	·· 39.0	221°08.2	·· 48.1	219°51.3	·· 11.9
16	62°02.2	61°04.8	07.7	56°22.0	39.8	236°10.9	47.9	234°53.9	11.9
17	77°04.7	76°04.4	06.5	71°22.7	40.6	251°13.7	47.8	249°56.5	11.8
18	92°07.2	91°04.0	S01°05.2	86°23.4	N01°41.4	266°16.5	S00°47.7	264°59.2	S00°11.7
19	107°09.6	106°03.7	04.0	101°24.1	42.2	281°19.2	47.5	280°01.8	11.6
20	122°12.1	121°03.3	02.7	116°24.8	42.9	296°22.0	47.4	295°04.5	11.6
21	137°14.6	136°02.9	·· 01.5	131°25.5	·· 43.7	311°24.7	·· 47.3	310°07.1	·· 11.5
22	152°17.0	151°02.5	01°00.2	146°26.2	44.5	326°27.5	47.2	325°09.8	11.4
23	167°19.5	166°02.1	00°59.0	161°26.9	45.3	341°30.3	47.0	340°12.4	11.3
Mer.pass. 11:53		ν -0.4′	d 1.3′	m -3.87	ν 0.7′	d 0.8′	m 1.07	ν 2.8′	d 0.1′ m -2.47	ν 2.6′	d 0.1′ m 0.46

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	182°22.0	181°01.8	S00°57.7	176°27.6	N01°46.1	356°33.0	S00°46.9	355°15.0	S00°11.2
1	197°24.4	196°01.4	56.4	191°28.3	46.9	11°35.8	46.8	10°17.7	11.2
2	212°26.9	211°01.0	55.2	206°29.0	47.7	26°38.5	46.6	25°20.3	11.1
3	227°29.3	226°00.6	·· 53.9	221°29.7	·· 48.4	41°41.3	·· 46.5	40°23.0	·· 11.0
4	242°31.8	241°00.2	52.7	236°30.4	49.2	56°44.1	46.4	55°25.6	10.9
5	257°34.3	255°59.9	51.4	251°31.1	50.0	71°46.8	46.3	70°28.3	10.8
6	272°36.7	270°59.5	S00°50.2	266°31.8	N01°50.8	86°49.6	S00°46.1	85°30.9	S00°10.8
7	287°39.2	285°59.1	48.9	281°32.5	51.6	101°52.3	46.0	100°33.5	10.7
8	302°41.7	300°58.7	47.7	296°33.2	52.4	116°55.1	45.9	115°36.2	10.6
9	317°44.1	315°58.3	·· 46.4	311°33.9	·· 53.1	131°57.9	·· 45.7	130°38.8	·· 10.5
10	332°46.6	330°58.0	45.2	326°34.5	53.9	147°00.6	45.6	145°41.5	10.4
11	347°49.1	345°57.6	43.9	341°35.2	54.7	162°03.4	45.5	160°44.1	10.4
12	2°51.5	0°57.2	S00°42.7	356°35.9	N01°55.5	177°06.1	S00°45.4	175°46.8	S00°10.3
13	17°54.0	15°56.8	41.4	11°36.6	56.3	192°08.9	45.2	190°49.4	10.2
14	32°56.5	30°56.4	40.1	26°37.3	57.1	207°11.7	45.1	205°52.0	10.1
15	47°58.9	45°56.1	·· 38.9	41°38.0	·· 57.9	222°14.4	·· 45.0	220°54.7	·· 10.1
16	63°01.4	60°55.7	37.6	56°38.7	58.6	237°17.2	44.8	235°57.3	10.0
17	78°03.8	75°55.3	36.4	71°39.4	01°59.4	252°19.9	44.7	251°00.0	09.9
18	93°06.3	90°54.9	S00°35.1	86°40.1	N02°00.2	267°22.7	S00°44.6	266°02.6	S00°09.8
19	108°08.8	105°54.5	33.9	101°40.8	01.0	282°25.5	44.5	281°05.3	09.7
20	123°11.2	120°54.2	32.6	116°41.5	01.8	297°28.2	44.3	296°07.9	09.7
21	138°13.7	135°53.8	·· 31.4	131°42.2	·· 02.6	312°31.0	·· 44.2	311°10.5	·· 09.6
22	153°16.2	150°53.4	30.1	146°42.9	03.3	327°33.7	44.1	326°13.2	09.5
23	168°18.6	165°53.0	28.9	161°43.6	04.1	342°36.5	43.9	341°15.8	09.4
Mer.pass. 11:49		ν -0.4′	d 1.3′	m -3.87	ν 0.7′	d 0.8′	m 1.07	ν 2.8′	d 0.1′ m -2.47	ν 2.6′	d 0.1′ m 0.46

Stars

	SHA	Dec
Alpheratz	358°09.3	28°59.0
Ankaa	353°40.3	-42°24.7
Schedar	350°09.2	56°25.9
Diphda	349°20.8	-18°05.6
Achernar	335°45.6	-57°20.2
Hamal	328°28.8	23°22.3
Polaris	327°04.6	89°10.8
Acamar	315°37.3	-40°23.1
Menkar	314°41.0	4°00.8
Mirfak	309°15.9	49°47.7
Aldebaran	291°17.7	16°28.2
Rigel	281°35.8	-8°13.6
Capella	281°10.9	45°58.8
Bellatrix	278°58.4	6°19.8
Elnath	278°43.8	28°35.5
Alnilam	276°11.4	-1°13.0
Betelgeuse	271°27.9	7°24.1
Canopus	264°07.0	-52°41.5
Sirius	258°55.3	-16°41.7
Adhara	255°31.8	-28°57.1
Procyon	245°25.3	5°16.3
Pollux	243°57.6	28°04.3
Avior	234°27.7	-59°27.2
Suhail	223°10.2	-43°21.6
Miaplacidus	221°44.3	-69°38.6
Alphard	218°20.0	-8°34.7
Regulus	208°09.4	12°03.5
Dubhe	194°21.1	61°51.2
Denebola	182°58.4	14°40.6
Gienah	176°17.3	-17°26.3
Acrux	173°36.2	-62°59.7
Gacrux	172°27.8	-57°00.4
Alioth	166°41.7	56°03.7
Spica	158°56.9	-11°03.8
Alkaid	153°17.8	49°24.3
Hadar	149°22.3	-60°16.8
Menkent	148°36.3	-36°16.6
Arcturus	146°17.9	19°16.7
Rigil Kent.	140°24.8	-60°45.2
Kochab	137°18.1	74°13.8
Zuben'ubi	137°32.4	-15°57.8
Alphecca	126°31.6	26°46.5
Antares	112°56.3	-26°23.4
Atria	108°20.1	-68°59.4
Sabik	102°40.6	-15°42.1
Shaula	96°55.2	-37°05.3
Rasalhague	96°29.2	12°34.3
Eltanin	90°57.5	51°29.2
Kaus Aust.	84°16.4	-34°23.5
Vega	80°55.6	38°45.7
Nunki	76°28.8	-26°19.2
Altair	62°32.3	8°48.9
Peacock	53°58.2	-56°47.6
Deneb	49°48.5	45°12.5
Enif	34°11.5	9°47.1
Al Na'ir	28°14.9	-47°03.2
Fomalhaut	15°51.4	-29°43.5
Scheat	14°17.6	27°58.6
Markab	14°03.1	15°06.0

Mar 23 Mon	SHA	Mer.pass
Venus	0°56.4	11:55
Mars	355°30.6	12:16
Jupiter	173°56.9	00:23
Saturn	172°44.5	00:27

Mar 24 Tue	SHA	Mer.pass
Venus	359°48.1	11:56
Mars	354°48.1	12:15
Jupiter	174°04.0	00:18
Saturn	172°48.8	00:23

Mar 25 Wed	SHA	Mer.pass
Venus	358°39.8	11:56
Mars	354°05.6	12:14
Jupiter	174°11.1	00:14
Saturn	172°53.1	00:19

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h — Sun — Moon

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	178°18.6	N00°54.2	332°13.7	15.3′	S06°14.0	10.0′	54.1′
1	193°18.8	55.2	346°48.0	15.3′	06°24.0	9.9′	54.1′
2	208°19.0	56.2	1°22.2	15.3′	06°33.9	9.9′	54.1′
3	223°19.2	·· 57.2	15°56.5	15.2′	06°43.8	9.9′	54.1′
4	238°19.4	58.2	30°30.7	15.2′	06°53.7	9.9′	54.1′
5	253°19.6	00°59.1	45°05.0	15.2′	07°03.6	9.8′	54.1′
6	268°19.8	N01°00.1	59°39.2	15.2′	S07°13.4	9.8′	54.1′
7	283°19.9	01.1	74°13.4	15.2′	07°23.2	9.8′	54.1′
8	298°20.1	02.1	88°47.6	15.2′	07°33.0	9.8′	54.0′
9	313°20.3	·· 03.1	103°21.7	15.2′	07°42.8	9.7′	54.0′
10	328°20.5	04.1	117°55.9	15.1′	07°52.5	9.6′	54.0′
11	343°20.7	05.1	132°30.1	15.1′	08°02.1	9.7′	54.0′
12	358°20.9	N01°06.0	147°04.2	15.1′	S08°11.8	9.6′	54.0′
13	13°21.1	07.0	161°38.3	15.1′	08°21.4	9.5′	54.0′
14	28°21.3	08.0	176°12.4	15.1′	08°30.9	9.6′	54.0′
15	43°21.5	·· 09.0	190°46.5	15.1′	08°40.5	9.5′	54.0′
16	58°21.6	10.0	205°20.5	15.0′	08°50.0	9.4′	54.0′
17	73°21.8	11.0	219°54.6	15.0′	08°59.4	9.4′	54.0′
18	88°22.0	N01°12.0	234°28.6	15.0′	S09°08.8	9.4′	54.0′
19	103°22.2	12.9	249°02.6	15.0′	09°18.2	9.4′	54.0′
20	118°22.4	13.9	263°36.6	15.0′	09°27.6	9.3′	54.0′
21	133°22.6	·· 14.9	278°10.6	14.9′	09°36.9	9.2′	54.0′
22	148°22.8	15.9	292°44.5	14.9′	09°46.1	9.3′	54.0′
23	163°23.0	16.9	307°18.5	14.9′	09°55.4	9.1′	54.0′
	SD = 16.0′	d = 1.0′	SD = 14.8′				

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	178°23.2	N01°17.9	321°52.4	14.9′	S10°04.5	9.2′	54.0′
1	193°23.4	18.8	336°26.2	14.9′	10°13.7	9.1′	54.0′
2	208°23.5	19.8	351°00.1	14.8′	10°22.8	9.0′	54.0′
3	223°23.7	·· 20.8	5°33.9	14.8′	10°31.8	9.0′	54.0′
4	238°23.9	21.8	20°07.7	14.8′	10°40.8	9.0′	54.0′
5	253°24.1	22.8	34°41.5	14.8′	10°49.8	8.9′	54.0′
6	268°24.3	N01°23.8	49°15.3	14.7′	S10°58.7	8.9′	54.0′
7	283°24.5	24.7	63°49.0	14.7′	11°07.6	8.8′	54.0′
8	298°24.7	25.7	78°22.7	14.7′	11°16.4	8.8′	54.0′
9	313°24.9	·· 26.7	92°56.4	14.7′	11°25.2	8.7′	54.0′
10	328°25.1	27.7	107°30.1	14.6′	11°33.9	8.7′	54.0′
11	343°25.3	28.7	122°03.7	14.6′	11°42.6	8.6′	54.0′
12	358°25.4	N01°29.7	136°37.3	14.6′	S11°51.2	8.6′	54.0′
13	13°25.6	30.6	151°10.9	14.5′	11°59.8	8.6′	54.0′
14	28°25.8	31.6	165°44.4	14.5′	12°08.4	8.5′	54.0′
15	43°26.0	·· 32.6	180°17.9	14.5′	12°16.9	8.4′	54.0′
16	58°26.2	33.6	194°51.4	14.5′	12°25.3	8.4′	54.0′
17	73°26.4	34.6	209°24.9	14.4′	12°33.7	8.3′	54.0′
18	88°26.6	N01°35.6	223°58.3	14.4′	S12°42.0	8.3′	54.0′
19	103°26.8	36.5	238°31.7	14.4′	12°50.3	8.2′	54.0′
20	118°27.0	37.5	253°05.0	14.3′	12°58.5	8.2′	54.0′
21	133°27.2	·· 38.5	267°38.4	14.3′	13°06.7	8.1′	54.0′
22	148°27.3	39.5	282°11.7	14.3′	13°14.8	8.1′	54.0′
23	163°27.5	40.5	296°44.9	14.2′	13°22.9	8.0′	54.0′
	SD = 16.0′	d = 1.0′	SD = 14.7′				

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	178°27.7	N01°41.5	311°18.2	14.2′	S13°30.9	7.9′	54.0′
1	193°27.9	42.4	325°51.4	14.2′	13°38.8	7.9′	54.0′
2	208°28.1	43.4	340°24.5	14.1′	13°46.7	7.9′	54.0′
3	223°28.3	·· 44.4	354°57.6	14.1′	13°54.6	7.8′	54.0′
4	238°28.5	45.4	9°30.7	14.1′	14°02.4	7.7′	54.0′
5	253°28.7	46.4	24°03.8	14.0′	14°10.1	7.7′	54.0′
6	268°28.9	N01°47.4	38°36.8	14.0′	S14°17.8	7.6′	54.0′
7	283°29.1	48.3	53°09.8	13.9′	14°25.4	7.5′	54.0′
8	298°29.2	49.3	67°42.7	13.9′	14°32.9	7.5′	54.0′
9	313°29.4	·· 50.3	82°15.7	13.9′	14°40.4	7.4′	54.1′
10	328°29.6	51.3	96°48.5	13.8′	14°47.8	7.4′	54.1′
11	343°29.8	52.3	111°21.4	13.8′	14°55.2	7.3′	54.1′
12	358°30.0	N01°53.2	125°54.2	13.8′	S15°02.5	7.2′	54.1′
13	13°30.2	54.2	140°26.9	13.7′	15°09.7	7.2′	54.1′
14	28°30.4	55.2	154°59.6	13.7′	15°16.9	7.1′	54.1′
15	43°30.6	·· 56.2	169°32.3	13.6′	15°24.0	7.0′	54.1′
16	58°30.8	57.2	184°05.0	13.6′	15°31.0	7.0′	54.1′
17	73°31.0	58.2	198°37.6	13.6′	15°38.0	6.9′	54.1′
18	88°31.1	N01°59.1	213°10.1	13.5′	S15°44.9	6.9′	54.1′
19	103°31.3	02°00.1	227°42.7	13.5′	15°51.8	6.8′	54.1′
20	118°31.5	01.1	242°15.2	13.4′	15°58.6	6.7′	54.1′
21	133°31.7	·· 02.1	256°47.6	13.4′	16°05.3	6.6′	54.1′
22	148°31.9	03.1	271°20.0	13.4′	16°11.9	6.6′	54.1′
23	163°32.1	04.0	285°52.4	13.3′	16°18.5	6.5′	54.2′
	SD = 16.0′	d = 1.0′	SD = 14.7′				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	02:54	04:29	05:38	18:37	19:47	21:25
N 70°	03:17	04:39	05:41	18:34	19:36	21:00
68°	03:35	04:47	05:44	18:31	19:28	20:41
66°	03:49	04:54	05:46	18:29	19:21	20:27
64°	04:00	04:59	05:47	18:27	19:15	20:15
62°	04:10	05:04	05:49	18:25	19:10	20:05
60°	04:18	05:08	05:50	18:24	19:06	19:57
N 58°	04:24	05:12	05:51	18:23	19:02	19:50
56°	04:30	05:15	05:52	18:22	18:59	19:44
54°	04:35	05:18	05:53	18:21	18:56	19:39
52°	04:40	05:20	05:54	18:20	18:54	19:34
50°	04:44	05:22	05:55	18:19	18:51	19:30
45°	04:52	05:27	05:56	18:17	18:47	19:21
N 40°	04:59	05:30	05:57	18:16	18:43	19:15
35°	05:04	05:33	05:58	18:15	18:40	19:10
30°	05:08	05:35	05:59	18:14	18:38	19:06
20°	05:13	05:39	06:01	18:12	18:34	19:00
N 10°	05:17	05:41	06:02	18:11	18:32	18:56
0°	05:18	05:42	06:03	18:10	18:30	18:54
S 10°	05:19	05:43	06:04	18:08	18:29	18:54
20°	05:17	05:43	06:05	18:07	18:29	18:55
30°	05:14	05:42	06:06	18:06	18:30	18:58
35°	05:12	05:41	06:06	18:06	18:31	19:00
40°	05:08	05:40	06:07	18:05	18:32	19:04
45°	05:04	05:38	06:07	18:05	18:34	19:08
S 50°	04:58	05:36	06:08	18:04	18:36	19:14
52°	04:55	05:34	06:08	18:03	18:37	19:16
54°	04:52	05:33	06:08	18:03	18:38	19:20
56°	04:48	05:32	06:09	18:03	18:40	19:23
58°	04:43	05:30	06:09	18:02	18:41	19:27
S 60°	04:38	05:28	06:09	18:02	18:43	19:32

Lat.	Moonrise Mon	Moonrise Tue	Moonrise Wed	Moonset Mon	Moonset Tue	Moonset Wed
N 72°	22:41	·· ··	00:29	06:28	06:15	05:57
N 70°	22:25	·· ··	00:02	06:39	06:33	06:26
68°	22:12	23:41	·· ··	06:47	06:47	06:48
66°	22:01	23:25	·· ··	06:54	06:59	07:05
64°	21:52	23:11	·· ··	07:01	07:09	07:19
62°	21:45	23:00	·· ··	07:06	07:17	07:31
60°	21:38	22:51	·· ··	07:11	07:25	07:41
N 58°	21:32	22:42	23:51	07:15	07:31	07:50
56°	21:27	22:35	23:42	07:18	07:37	07:58
54°	21:23	22:29	23:34	07:22	07:42	08:05
52°	21:19	22:23	23:26	07:25	07:47	08:11
50°	21:15	22:18	23:20	07:27	07:51	08:17
45°	21:07	22:06	23:05	07:33	08:00	08:29
N 40°	21:00	21:57	22:54	07:38	08:08	08:39
35°	20:55	21:49	22:44	07:43	08:14	08:48
30°	20:50	21:42	22:35	07:47	08:20	08:56
20°	20:41	21:30	22:20	07:53	08:30	09:09
N 10°	20:34	21:20	22:07	07:59	08:39	09:21
0°	20:27	21:10	21:55	08:05	08:48	09:32
S 10°	20:20	21:00	21:43	08:10	08:56	09:43
20°	20:12	20:50	21:30	08:16	09:05	09:54
30°	20:04	20:38	21:15	08:23	09:15	10:08
35°	19:59	20:32	21:07	08:27	09:21	10:16
40°	19:54	20:24	20:57	08:31	09:28	10:24
45°	19:47	20:15	20:46	08:36	09:36	10:35
S 50°	19:40	20:05	20:32	08:42	09:45	10:48
52°	19:37	20:00	20:26	08:45	09:50	10:53
54°	19:33	19:54	20:19	08:48	09:55	11:00
56°	19:29	19:48	20:11	08:52	10:00	11:07
58°	19:24	19:42	20:03	08:56	10:06	11:15
S 60°	19:19	19:34	19:53	09:00	10:13	11:25

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 17-19 95-83%
23	06:46	06:36	12:07	01:54	14:16	
24	06:27	06:18	12:06	02:37	14:59	
25	06:09	06:00	12:06	03:21	15:43	

March 26, 27, 28 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	183°21.1	180°52.7	S00°27.6	176°44.3	N02°04.9	357°39.3	S00°43.8	356°18.5	S00°09.3
1	198°23.6	195°52.3	26.3	191°45.0	05.7	12°42.0	43.7	11°21.1	09.3
2	213°26.0	210°51.9	25.1	206°45.7	06.5	27°44.8	43.6	26°23.8	09.2
3	228°28.5	225°51.5	·· 23.8	221°46.4	·· 07.3	42°47.5	·· 43.4	41°26.4	·· 09.1
4	243°30.9	240°51.1	22.6	236°47.1	08.0	57°50.3	43.3	56°29.0	09.0
5	258°33.4	255°50.8	21.3	251°47.8	08.8	72°53.1	43.2	71°31.7	09.0
6	273°35.9	270°50.4	S00°20.1	266°48.5	N02°09.6	87°55.8	S00°43.0	86°34.3	S00°08.9
7	288°38.3	285°50.0	18.8	281°49.2	10.4	102°58.6	42.9	101°37.0	08.8
8	303°40.8	300°49.6	17.6	296°49.9	11.2	118°01.3	42.8	116°39.6	08.7
9	318°43.3	315°49.3	·· 16.3	311°50.6	·· 12.0	133°04.1	·· 42.7	131°42.3	·· 08.6
10	333°45.7	330°48.9	15.1	326°51.3	12.7	148°06.9	42.5	146°44.9	08.6
11	348°48.2	345°48.5	13.8	341°52.0	13.5	163°09.6	42.4	161°47.5	08.5
12	3°50.7	0°48.1	S00°12.5	356°52.7	N02°14.3	178°12.4	S00°42.3	176°50.2	S00°08.4
13	18°53.1	15°47.7	11.3	11°53.3	15.1	193°15.1	42.1	191°52.8	08.3
14	33°55.6	30°47.4	10.0	26°54.0	15.9	208°17.9	42.0	206°55.5	08.2
15	48°58.1	45°47.0	·· 08.8	41°54.7	·· 16.7	223°20.7	·· 41.9	221°58.1	·· 08.2
16	64°00.5	60°46.6	07.5	56°55.4	17.4	238°23.4	41.8	237°00.7	08.1
17	79°03.0	75°46.2	06.3	71°56.1	18.2	253°26.2	41.6	252°03.4	08.0
18	94°05.4	90°45.9	S00°05.0	86°56.8	N02°19.0	268°28.9	S00°41.5	267°06.0	S00°07.9
19	109°07.9	105°45.5	03.8	101°57.5	19.8	283°31.7	41.4	282°08.7	07.9
20	124°10.4	120°45.1	02.5	116°58.2	20.6	298°34.5	41.2	297°11.3	07.8
21	139°12.8	135°44.7	S00°01.2	131°58.9	·· 21.4	313°37.2	·· 41.1	312°14.0	·· 07.7
22	154°15.3	150°44.3	N00°00.0	146°59.6	22.1	328°40.0	41.0	327°16.6	07.6
23	169°17.8	165°44.0	01.3	162°00.3	22.9	343°42.8	40.9	342°19.2	07.5
Mer.pass. 11:45		ν -0.4′	d 1.3′	m -3.87	ν 0.7′	d 0.8′	m 1.07	ν 2.8′	d 0.1′ m -2.47	ν 2.6′	d 0.1′ m 0.45

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	184°20.2	180°43.6	N00°02.5	177°01.0	N02°23.7	358°45.5	S00°40.7	357°21.9	S00°07.5
1	199°22.7	195°43.2	03.8	192°01.7	24.5	13°48.3	40.6	12°24.5	07.4
2	214°25.2	210°42.8	05.0	207°02.4	25.3	28°51.0	40.5	27°27.2	07.3
3	229°27.6	225°42.5	·· 06.3	222°03.1	·· 26.0	43°53.8	·· 40.3	42°29.8	·· 07.2
4	244°30.1	240°42.1	07.5	237°03.8	26.8	58°56.6	40.2	57°32.5	07.1
5	259°32.6	255°41.7	08.8	252°04.5	27.6	73°59.3	40.1	72°35.1	07.1
6	274°35.0	270°41.3	N00°10.1	267°05.2	N02°28.4	89°02.1	S00°40.0	87°37.7	S00°07.0
7	289°37.5	285°40.9	11.3	282°05.9	29.2	104°04.8	39.8	102°40.4	06.9
8	304°39.9	300°40.6	12.6	297°06.6	30.0	119°07.6	39.7	117°43.0	06.8
9	319°42.4	315°40.2	·· 13.8	312°07.3	·· 30.7	134°10.4	·· 39.6	132°45.7	·· 06.8
10	334°44.9	330°39.8	15.1	327°08.0	31.5	149°13.1	39.4	147°48.3	06.7
11	349°47.3	345°39.4	16.3	342°08.7	32.3	164°15.9	39.3	162°51.0	06.6
12	4°49.8	0°39.1	N00°17.6	357°09.4	N02°33.1	179°18.6	S00°39.2	177°53.6	S00°06.5
13	19°52.3	15°38.7	18.8	12°10.1	33.9	194°21.4	39.1	192°56.3	06.4
14	34°54.7	30°38.3	20.1	27°10.8	34.6	209°24.2	38.9	207°58.9	06.4
15	49°57.2	45°37.9	·· 21.4	42°11.5	·· 35.4	224°26.9	·· 38.8	223°01.5	·· 06.3
16	64°59.7	60°37.6	22.6	57°12.2	36.2	239°29.7	38.7	238°04.2	06.2
17	80°02.1	75°37.2	23.9	72°12.9	37.0	254°32.4	38.5	253°06.8	06.1
18	95°04.6	90°36.8	N00°25.1	87°13.6	N02°37.8	269°35.2	S00°38.4	268°09.5	S00°06.1
19	110°07.0	105°36.4	26.4	102°14.3	38.5	284°38.0	38.3	283°12.1	06.0
20	125°09.5	120°36.0	27.6	117°15.0	39.3	299°40.7	38.2	298°14.8	05.9
21	140°12.0	135°35.7	·· 28.9	132°15.7	·· 40.1	314°43.5	·· 38.0	313°17.4	·· 05.8
22	155°14.4	150°35.3	30.2	147°16.3	40.9	329°46.2	37.9	328°20.0	05.7
23	170°16.9	165°34.9	31.4	162°17.0	41.7	344°49.0	37.8	343°22.7	05.7
Mer.pass. 11:41		ν -0.4′	d 1.3′	m -3.87	ν 0.7′	d 0.8′	m 1.07	ν 2.8′	d 0.1′ m -2.47	ν 2.6′	d 0.1′ m 0.45

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	185°19.4	180°34.5	N00°32.7	177°17.7	N02°42.5	359°51.8	S00°37.7	358°25.3	S00°05.6
1	200°21.8	195°34.2	33.9	192°18.4	43.2	14°54.5	37.5	13°28.0	05.5
2	215°24.3	210°33.8	35.2	207°19.1	44.0	29°57.3	37.4	28°30.6	05.4
3	230°26.8	225°33.4	·· 36.4	222°19.8	·· 44.8	45°00.0	·· 37.3	43°33.3	·· 05.3
4	245°29.2	240°33.0	37.7	237°20.5	45.6	60°02.8	37.1	58°35.9	05.3
5	260°31.7	255°32.7	38.9	252°21.2	46.4	75°05.6	37.0	73°38.5	05.2
6	275°34.2	270°32.3	N00°40.2	267°21.9	N02°47.1	90°08.3	S00°36.9	88°41.2	S00°05.1
7	290°36.6	285°31.9	41.5	282°22.6	47.9	105°11.1	36.8	103°43.8	05.0
8	305°39.1	300°31.5	42.7	297°23.3	48.7	120°13.8	36.6	118°46.5	05.0
9	320°41.5	315°31.2	·· 44.0	312°24.0	·· 49.5	135°16.6	·· 36.5	133°49.1	·· 04.9
10	335°44.0	330°30.8	45.2	327°24.7	50.3	150°19.4	36.4	148°51.8	04.8
11	350°46.5	345°30.4	46.5	342°25.4	51.0	165°22.1	36.2	163°54.4	04.7
12	5°48.9	0°30.0	N00°47.7	357°26.1	N02°51.8	180°24.9	S00°36.1	178°57.0	S00°04.6
13	20°51.4	15°29.6	49.0	12°26.8	52.6	195°27.6	36.0	193°59.7	04.6
14	35°53.9	30°29.3	50.2	27°27.5	53.4	210°30.4	35.9	209°02.3	04.5
15	50°56.3	45°28.9	·· 51.5	42°28.2	·· 54.1	225°33.2	·· 35.7	224°05.0	·· 04.4
16	65°58.8	60°28.5	52.8	57°28.9	54.9	240°35.9	35.6	239°07.6	04.3
17	81°01.3	75°28.1	54.0	72°29.6	55.7	255°38.7	35.5	254°10.3	04.3
18	96°03.7	90°27.8	N00°55.3	87°30.3	N02°56.5	270°41.4	S00°35.3	269°12.9	S00°04.2
19	111°06.2	105°27.4	56.5	102°31.0	57.3	285°44.2	35.2	284°15.5	04.1
20	126°08.7	120°27.0	57.8	117°31.7	58.0	300°47.0	35.1	299°18.2	04.0
21	141°11.1	135°26.6	00°59.0	132°32.4	·· 58.8	315°49.7	·· 35.0	314°20.8	·· 03.9
22	156°13.6	150°26.3	01°00.3	147°33.1	02°59.6	330°52.5	34.8	329°23.5	03.9
23	171°16.0	165°25.9	01.5	162°33.8	03°00.4	345°55.2	34.7	344°26.1	03.8
Mer.pass. 11:37		ν -0.4′	d 1.3′	m -3.87	ν 0.7′	d 0.8′	m 1.07	ν 2.8′	d 0.1′ m -2.47	ν 2.6′	d 0.1′ m 0.45

Stars

	SHA	Dec
Alpheratz	358°09.3	28°59.0
Ankaa	353°40.3	-42°24.7
Schedar	350°09.2	56°25.9
Diphda	349°20.8	-18°05.6
Achernar	335°45.6	-57°20.2
Hamal	328°28.8	23°22.3
Polaris	327°05.0	89°10.8
Acamar	315°37.3	-40°23.1
Menkar	314°41.0	4°00.8
Mirfak	309°15.9	49°47.7
Aldebaran	291°17.7	16°28.2
Rigel	281°35.8	-8°13.6
Capella	281°10.9	45°58.8
Bellatrix	278°58.4	6°19.8
Elnath	278°43.8	28°35.5
Alnilam	276°11.4	-1°13.0
Betelgeuse	271°27.9	7°24.1
Canopus	264°07.1	-52°41.5
Sirius	258°55.3	-16°41.7
Adhara	255°31.8	-28°57.1
Procyon	245°25.3	5°16.3
Pollux	243°57.6	28°04.3
Avior	234°27.7	-59°27.2
Suhail	223°10.2	-43°21.6
Miaplacidus	221°44.3	-69°38.6
Alphard	218°20.0	-8°34.7
Regulus	208°09.4	12°03.5
Dubhe	194°21.1	61°51.3
Denebola	182°58.4	14°40.6
Gienah	176°17.3	-17°26.3
Acrux	173°36.2	-62°59.7
Gacrux	172°27.8	-57°00.5
Alioth	166°41.6	56°03.7
Spica	158°56.9	-11°03.8
Alkaid	153°17.8	49°24.3
Hadar	149°22.3	-60°16.8
Menkent	148°36.2	-36°16.6
Arcturus	146°17.9	19°16.7
Rigil Kent.	140°24.8	-60°45.2
Kochab	137°18.1	74°13.8
Zuben'ubi	137°32.4	-15°57.8
Alphecca	126°31.6	26°46.5
Antares	112°56.2	-26°23.4
Atria	108°20.0	-68°59.4
Sabik	102°40.6	-15°42.1
Shaula	96°55.2	-37°05.3
Rasalhague	96°29.2	12°34.3
Eltanin	90°57.5	51°29.2
Kaus Aust.	84°16.4	-34°23.5
Vega	80°55.6	38°45.7
Nunki	76°28.8	-26°19.2
Altair	62°32.3	8°48.9
Peacock	53°58.1	-56°47.6
Deneb	49°48.5	45°12.5
Enif	34°11.5	9°47.1
Al Na'ir	28°14.9	-47°03.1
Fomalhaut	15°51.4	-29°43.4
Scheat	14°17.6	27°58.6
Markab	14°03.1	15°06.0

Mar 26 Thu	SHA	Mer.pass
Venus	357°31.6	11:57
Mars	353°23.2	12:12
Jupiter	174°18.2	00:09
Saturn	172°57.4	00:15

Mar 27 Fri	SHA	Mer.pass
Venus	356°23.4	11:57
Mars	352°40.8	12:11
Jupiter	174°25.3	00:05
Saturn	173°01.7	00:11

Mar 28 Sat	SHA	Mer.pass
Venus	355°15.2	11:58
Mars	351°58.4	12:10
Jupiter	174°32.4	00:01
Saturn	173°06.0	00:06

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h

Thu	Sun GHA	Sun Dec	Moon GHA	ν	Moon Dec	d	HP
0	178°32.3	N02°05.0	300°24.7	13.3′	S16°25.0	6.4′	54.2′
1	193°32.5	06.0	314°57.0	13.2′	16°31.4	6.4′	54.2′
2	208°32.7	07.0	329°29.2	13.2′	16°37.8	6.3′	54.2′
3	223°32.9	·· 08.0	344°01.4	13.2′	16°44.1	6.2′	54.2′
4	238°33.0	09.0	358°33.6	13.1′	16°50.3	6.2′	54.2′
5	253°33.2	09.9	13°05.7	13.1′	16°56.5	6.1′	54.2′
6	268°33.4	N02°10.9	27°37.7	13.0′	S17°02.6	6.0′	54.2′
7	283°33.6	11.9	42°09.8	13.0′	17°08.6	5.9′	54.2′
8	298°33.8	12.9	56°41.7	12.9′	17°14.5	5.9′	54.2′
9	313°34.0	·· 13.9	71°13.7	12.9′	17°20.4	5.7′	54.3′
10	328°34.2	14.8	85°45.6	12.9′	17°26.1	5.7′	54.3′
11	343°34.4	15.8	100°17.4	12.8′	17°31.8	5.7′	54.3′
12	358°34.6	N02°16.8	114°49.2	12.8′	S17°37.5	5.5′	54.3′
13	13°34.8	17.8	129°21.0	12.7′	17°43.0	5.5′	54.3′
14	28°34.9	18.8	143°52.7	12.7′	17°48.5	5.4′	54.3′
15	43°35.1	·· 19.7	158°24.4	12.6′	17°53.9	5.3′	54.3′
16	58°35.3	20.7	172°56.0	12.6′	17°59.2	5.3′	54.4′
17	73°35.5	21.7	187°27.6	12.5′	18°04.5	5.1′	54.4′
18	88°35.7	N02°22.7	201°59.1	12.5′	S18°09.6	5.1′	54.4′
19	103°35.9	23.7	216°30.6	12.5′	18°14.7	5.0′	54.4′
20	118°36.1	24.6	231°02.1	12.4′	18°19.7	4.9′	54.4′
21	133°36.3	·· 25.6	245°33.5	12.4′	18°24.6	4.9′	54.4′
22	148°36.5	26.6	260°04.9	12.3′	18°29.5	4.7′	54.4′
23	163°36.7	27.6	274°36.2	12.3′	18°34.2	4.7′	54.5′
	SD = 16.0′	d = 1.0′		SD = 14.8′			

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	178°36.8	N02°28.6	289°07.5	12.2′	S18°38.9	4.6′	54.5′
1	193°37.0	29.5	303°38.7	12.2′	18°43.5	4.5′	54.5′
2	208°37.2	30.5	318°09.9	12.1′	18°48.0	4.5′	54.5′
3	223°37.4	·· 31.5	332°41.0	12.1′	18°52.5	4.3′	54.5′
4	238°37.6	32.5	347°12.1	12.0′	18°56.8	4.2′	54.5′
5	253°37.8	33.4	1°43.2	12.0′	19°01.0	4.2′	54.6′
6	268°38.0	N02°34.4	16°14.2	12.0′	S19°05.2	4.1′	54.6′
7	283°38.2	35.4	30°45.1	11.9′	19°09.3	4.0′	54.6′
8	298°38.4	36.4	45°16.0	11.9′	19°13.3	3.9′	54.6′
9	313°38.6	·· 37.4	59°46.9	11.8′	19°17.2	3.8′	54.6′
10	328°38.8	38.3	74°17.7	11.8′	19°21.0	3.7′	54.6′
11	343°38.9	39.3	88°48.5	11.7′	19°24.7	3.7′	54.7′
12	358°39.1	N02°40.3	103°19.2	11.7′	S19°28.4	3.5′	54.7′
13	13°39.3	41.3	117°49.9	11.6′	19°31.9	3.5′	54.7′
14	28°39.5	42.3	132°20.6	11.6′	19°35.4	3.4′	54.7′
15	43°39.7	·· 43.2	146°51.2	11.6′	19°38.8	3.2′	54.7′
16	58°39.9	44.2	161°21.7	11.5′	19°42.0	3.2′	54.8′
17	73°40.1	45.2	175°52.2	11.5′	19°45.2	3.1′	54.8′
18	88°40.3	N02°46.2	190°22.7	11.4′	S19°48.3	3.0′	54.8′
19	103°40.5	47.1	204°53.1	11.4′	19°51.3	2.9′	54.8′
20	118°40.6	48.1	219°23.5	11.3′	19°54.2	2.9′	54.8′
21	133°40.8	·· 49.1	233°53.8	11.3′	19°57.1	2.7′	54.9′
22	148°41.0	50.1	248°24.1	11.2′	19°59.8	2.6′	54.9′
23	163°41.2	51.0	262°54.4	11.2′	20°02.4	2.5′	54.9′
	SD = 16.0′	d = 1.0′		SD = 14.9′			

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	178°41.4	N02°52.0	277°24.6	11.2′	S20°04.9	2.5′	54.9′
1	193°41.6	53.0	291°54.8	11.1′	20°07.4	2.3′	55.0′
2	208°41.8	54.0	306°24.9	11.1′	20°09.7	2.3′	55.0′
3	223°42.0	·· 55.0	320°55.0	11.0′	20°12.0	2.1′	55.0′
4	238°42.2	55.9	335°25.0	11.0′	20°14.1	2.1′	55.0′
5	253°42.4	56.9	349°55.0	11.0′	20°16.2	1.9′	55.1′
6	268°42.5	N02°57.9	4°24.9	10.9′	S20°18.1	1.9′	55.1′
7	283°42.7	58.9	18°54.9	10.9′	20°20.0	1.7′	55.1′
8	298°42.9	02°59.8	33°24.7	10.8′	20°21.7	1.7′	55.1′
9	313°43.1	03°00.8	47°54.5	10.8′	20°23.4	1.5′	55.2′
10	328°43.3	01.8	62°24.3	10.7′	20°24.9	1.5′	55.2′
11	343°43.5	02.8	76°54.1	10.7′	20°26.4	1.3′	55.2′
12	358°43.7	N03°03.7	91°23.8	10.7′	S20°27.7	1.3′	55.2′
13	13°43.9	04.7	105°53.5	10.6′	20°29.0	1.1′	55.3′
14	28°44.1	05.7	120°23.1	10.6′	20°30.1	1.1′	55.3′
15	43°44.3	·· 06.7	134°52.7	10.5′	20°31.2	0.9′	55.3′
16	58°44.4	07.6	149°22.2	10.5′	20°32.1	0.9′	55.3′
17	73°44.6	08.6	163°51.7	10.5′	20°33.0	0.7′	55.4′
18	88°44.8	N03°09.6	178°21.2	10.4′	S20°33.7	0.6′	55.4′
19	103°45.0	10.6	192°50.6	10.4′	20°34.3	0.6′	55.4′
20	118°45.2	11.5	207°20.0	10.4′	20°34.9	0.4′	55.4′
21	133°45.4	·· 12.5	221°49.4	10.3′	20°35.3	0.3′	55.5′
22	148°45.6	13.5	236°18.7	10.3′	20°35.6	0.2′	55.5′
23	163°45.8	14.5	250°48.0	10.3′	20°35.8	0.1′	55.5′
	SD = 16.0′	d = 1.0′		SD = 15.0′			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	02:30	04:12	05:23	18:51	20:02	21:48
N 70°	02:58	04:24	05:27	18:46	19:50	21:18
68°	03:19	04:34	05:31	18:42	19:40	20:56
66°	03:35	04:42	05:34	18:39	19:31	20:39
64°	03:48	04:48	05:37	18:36	19:24	20:26
62°	03:58	04:54	05:39	18:33	19:19	20:15
60°	04:07	04:59	05:41	18:31	19:14	20:06
N 58°	04:15	05:03	05:43	18:29	19:09	19:58
56°	04:22	05:07	05:44	18:28	19:05	19:51
54°	04:27	05:10	05:46	18:26	19:02	19:45
52°	04:32	05:13	05:47	18:25	18:59	19:40
50°	04:37	05:16	05:48	18:24	18:56	19:35
45°	04:46	05:21	05:50	18:21	18:51	19:26
N 40°	04:53	05:25	05:52	18:19	18:46	19:18
35°	04:59	05:29	05:54	18:17	18:43	19:12
30°	05:04	05:32	05:56	18:16	18:40	19:08
20°	05:10	05:36	05:58	18:13	18:35	19:01
N 10°	05:15	05:39	06:00	18:11	18:32	18:56
0°	05:17	05:41	06:02	18:09	18:29	18:53
S 10°	05:19	05:43	06:04	18:07	18:28	18:52
20°	05:18	05:44	06:06	18:05	18:27	18:52
30°	05:16	05:44	06:08	18:03	18:27	18:54
35°	05:14	05:43	06:09	18:02	18:27	18:56
40°	05:11	05:43	06:10	18:00	18:27	18:59
45°	05:08	05:42	06:11	17:59	18:28	19:02
S 50°	05:03	05:40	06:13	17:57	18:29	19:07
52°	05:00	05:40	06:13	17:57	18:30	19:09
54°	04:57	05:39	06:14	17:56	18:31	19:12
56°	04:54	05:38	06:15	17:55	18:32	19:15
58°	04:51	05:37	06:16	17:54	18:33	19:19
S 60°	04:46	05:35	06:17	17:53	18:34	19:23

Lat.	Moonrise Thu	Moonrise Fri	Moonrise Sat	Moonset Thu	Moonset Fri	Moonset Sat
N 72°	02:36	▬	▬	05:25	▬	▬
N 70°	01:43	03:35	▬	06:18	06:03	▬
68°	01:11	02:41	04:05	06:51	06:58	07:16
66°	00:48	02:09	03:22	07:15	07:31	07:59
64°	00:30	01:45	02:53	07:34	07:55	08:27
62°	00:15	01:26	02:32	07:49	08:14	08:49
60°	00:02	01:11	02:14	08:02	08:30	09:07
N 58°	·· ··	00:58	01:59	08:14	08:43	09:22
56°	·· ··	00:46	01:47	08:23	08:55	09:35
54°	·· ··	00:36	01:36	08:32	09:05	09:46
52°	·· ··	00:28	01:26	08:40	09:14	09:56
50°	·· ··	00:20	01:17	08:47	09:22	10:04
45°	·· ··	00:03	00:59	09:02	09:39	10:23
N 40°	23:49	·· ··	00:44	09:14	09:54	10:38
35°	23:38	·· ··	00:31	09:25	10:06	10:51
30°	23:28	·· ··	00:20	09:34	10:16	11:02
20°	23:10	·· ··	00:01	09:50	10:34	11:21
N 10°	22:55	23:45	·· ··	10:04	10:50	11:38
0°	22:41	23:30	·· ··	10:17	11:05	11:54
S 10°	22:27	23:15	·· ··	10:30	11:19	12:09
20°	22:13	22:58	23:47	10:44	11:35	12:26
30°	21:55	22:40	23:28	11:00	11:53	12:45
35°	21:46	22:29	23:17	11:10	12:04	12:56
40°	21:34	22:16	23:04	11:21	12:16	13:09
45°	21:21	22:02	22:49	11:33	12:30	13:24
S 50°	21:05	21:44	22:30	11:49	12:48	13:43
52°	20:58	21:35	22:21	11:56	12:56	13:52
54°	20:49	21:26	22:11	12:04	13:05	14:02
56°	20:40	21:15	22:00	12:13	13:15	14:13
58°	20:29	21:03	21:48	12:23	13:27	14:25
S 60°	20:17	20:49	21:33	12:35	13:41	14:40

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 20-22 76-58%
26	05:51	05:42	12:06	04:06	16:29	
27	05:33	05:23	12:05	04:53	17:17	
28	05:14	05:05	12:05	05:42	18:07	

March 29, 30, 31 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	186°18.5	180°25.5	N01°02.8	177°34.5	N03°01.2	0°58.0	S00°34.6	359°28.8	S00°03.7
1	201°21.0	195°25.1	04.1	192°35.2	01.9	16°00.8	34.5	14°31.4	03.6
2	216°23.4	210°24.7	05.3	207°35.9	02.7	31°03.5	34.3	29°34.0	03.5
3	231°25.9	225°24.4	·· 06.6	222°36.6	·· 03.5	46°06.3	·· 34.2	44°36.7	·· 03.5
4	246°28.4	240°24.0	07.8	237°37.3	04.3	61°09.0	34.1	59°39.3	03.4
5	261°30.8	255°23.6	09.1	252°38.0	05.1	76°11.8	33.9	74°42.0	03.3
6	276°33.3	270°23.2	N01°10.3	267°38.7	N03°05.8	91°14.6	S00°33.8	89°44.6	S00°03.2
7	291°35.8	285°22.9	11.6	282°39.4	06.6	106°17.3	33.7	104°47.3	03.2
8	306°38.2	300°22.5	12.9	297°40.1	07.4	121°20.1	33.6	119°49.9	03.1
9	321°40.7	315°22.1	·· 14.1	312°40.8	·· 08.2	136°22.8	·· 33.4	134°52.5	·· 03.0
10	336°43.2	330°21.7	15.4	327°41.5	08.9	151°25.6	33.3	149°55.2	02.9
11	351°45.6	345°21.4	16.6	342°42.2	09.7	166°28.4	33.2	164°57.8	02.8
12	6°48.1	0°21.0	N01°17.9	357°42.9	N03°10.5	181°31.1	S00°33.1	180°00.5	S00°02.8
13	21°50.5	15°20.6	19.1	12°43.6	11.3	196°33.9	32.9	195°03.1	02.7
14	36°53.0	30°20.2	20.4	27°44.3	12.1	211°36.6	32.8	210°05.8	02.6
15	51°55.5	45°19.9	·· 21.6	42°45.0	·· 12.8	226°39.4	·· 32.7	225°08.4	·· 02.5
16	66°57.9	60°19.5	22.9	57°45.7	13.6	241°42.2	32.5	240°11.0	02.5
17	82°00.4	75°19.1	24.1	72°46.3	14.4	256°44.9	32.4	255°13.7	02.4
18	97°02.9	90°18.7	N01°25.4	87°47.0	N03°15.2	271°47.7	S00°32.3	270°16.3	S00°02.3
19	112°05.3	105°18.3	26.7	102°47.7	15.9	286°50.4	32.2	285°19.0	02.2
20	127°07.8	120°18.0	27.9	117°48.4	16.7	301°53.2	32.0	300°21.6	02.1
21	142°10.3	135°17.6	·· 29.2	132°49.1	·· 17.5	316°56.0	·· 31.9	315°24.3	·· 02.1
22	157°12.7	150°17.2	30.4	147°49.8	18.3	331°58.7	31.8	330°26.9	02.0
23	172°15.2	165°16.8	31.7	162°50.5	19.0	347°01.5	31.7	345°29.5	01.9
Mer.pass. 11:33		ν -0.4′	d 1.3′	m -3.87	ν 0.7′	d 0.8′	m 1.07	ν 2.8′	d 0.1′ m -2.47	ν 2.6′	d 0.1′ m 0.46

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	187°17.6	180°16.5	N01°32.9	177°51.2	N03°19.8	2°04.2	S00°31.5	0°32.2	S00°01.8
1	202°20.1	195°16.1	34.2	192°51.9	20.6	17°07.0	31.4	15°34.8	01.8
2	217°22.6	210°15.7	35.4	207°52.6	21.4	32°09.8	31.3	30°37.5	01.7
3	232°25.0	225°15.3	·· 36.7	222°53.3	·· 22.2	47°12.5	·· 31.1	45°40.1	·· 01.6
4	247°27.5	240°15.0	38.0	237°54.0	22.9	62°15.3	31.0	60°42.8	01.5
5	262°30.0	255°14.6	39.2	252°54.7	23.7	77°18.0	30.9	75°45.4	01.4
6	277°32.4	270°14.2	N01°40.5	267°55.4	N03°24.5	92°20.8	S00°30.8	90°48.0	S00°01.4
7	292°34.9	285°13.8	41.7	282°56.1	25.3	107°23.6	30.6	105°50.7	01.3
8	307°37.4	300°13.4	43.0	297°56.8	26.0	122°26.3	30.5	120°53.3	01.2
9	322°39.8	315°13.1	·· 44.2	312°57.5	·· 26.8	137°29.1	·· 30.4	135°56.0	·· 01.1
10	337°42.3	330°12.7	45.5	327°58.2	27.6	152°31.8	30.3	150°58.6	01.1
11	352°44.8	345°12.3	46.7	342°58.9	28.4	167°34.6	30.1	166°01.3	01.0
12	7°47.2	0°11.9	N01°48.0	357°59.6	N03°29.1	182°37.4	S00°30.0	181°03.9	S00°00.9
13	22°49.7	15°11.6	49.3	13°00.3	29.9	197°40.1	29.9	196°06.5	00.8
14	37°52.1	30°11.2	50.5	28°01.0	30.7	212°42.9	29.8	211°09.2	00.8
15	52°54.6	45°10.8	·· 51.8	43°01.7	·· 31.5	227°45.6	·· 29.6	226°11.8	·· 00.7
16	67°57.1	60°10.4	53.0	58°02.4	32.2	242°48.4	29.5	241°14.5	00.6
17	82°59.5	75°10.1	54.3	73°03.1	33.0	257°51.2	29.4	256°17.1	00.5
18	98°02.0	90°09.7	N01°55.5	88°03.8	N03°33.8	272°53.9	S00°29.2	271°19.8	S00°00.4
19	113°04.5	105°09.3	56.8	103°04.5	34.6	287°56.7	29.1	286°22.4	00.4
20	128°06.9	120°08.9	58.0	118°05.2	35.3	302°59.4	29.0	301°25.0	00.3
21	143°09.4	135°08.5	01°59.3	133°05.9	·· 36.1	318°02.2	·· 28.9	316°27.7	·· 00.2
22	158°11.9	150°08.2	02°00.5	148°06.6	36.9	333°04.9	28.7	331°30.3	00.1
23	173°14.3	165°07.8	01.8	163°07.3	37.7	348°07.7	28.6	346°33.0	00.1
Mer.pass. 11:29		ν -0.4′	d 1.3′	m -3.87	ν 0.7′	d 0.8′	m 1.07	ν 2.8′	d 0.1′ m -2.47	ν 2.6′	d 0.1′ m 0.46

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	188°16.8	180°07.4	N02°03.0	178°08.0	N03°38.4	3°10.5	S00°28.5	1°35.6	N00°00.0
1	203°19.3	195°07.0	04.3	193°08.7	39.2	18°13.2	28.4	16°38.3	00.1
2	218°21.7	210°06.7	05.6	208°09.4	40.0	33°16.0	28.2	31°40.9	00.2
3	233°24.2	225°06.3	·· 06.8	223°10.1	·· 40.8	48°18.7	·· 28.1	46°43.5	·· 00.3
4	248°26.6	240°05.9	08.1	238°10.8	41.5	63°21.5	28.0	61°46.2	00.3
5	263°29.1	255°05.5	09.3	253°11.5	42.3	78°24.3	27.9	76°48.8	00.4
6	278°31.6	270°05.1	N02°10.6	268°12.2	N03°43.1	93°27.0	S00°27.7	91°51.5	N00°00.5
7	293°34.0	285°04.8	11.8	283°12.9	43.9	108°29.8	27.6	106°54.1	00.6
8	308°36.5	300°04.4	13.1	298°13.6	44.6	123°32.5	27.5	121°56.7	00.6
9	323°39.0	315°04.0	·· 14.3	313°14.3	·· 45.4	138°35.3	·· 27.3	136°59.4	·· 00.7
10	338°41.4	330°03.6	15.6	328°15.0	46.2	153°38.1	27.2	152°02.0	00.8
11	353°43.9	345°03.3	16.8	343°15.7	47.0	168°40.8	27.1	167°04.7	00.9
12	8°46.4	0°02.9	N02°18.1	358°16.4	N03°47.7	183°43.6	S00°27.0	182°07.3	N00°01.0
13	23°48.8	15°02.5	19.3	13°17.1	48.5	198°46.3	26.8	197°10.0	01.0
14	38°51.3	30°02.1	20.6	28°17.8	49.3	213°49.1	26.7	212°12.6	01.1
15	53°53.7	45°01.7	·· 21.9	43°18.5	·· 50.0	228°51.8	·· 26.6	227°15.2	·· 01.2
16	68°56.2	60°01.4	23.1	58°19.2	50.8	243°54.6	26.5	242°17.9	01.3
17	83°58.7	75°01.0	24.4	73°19.9	51.6	258°57.4	26.3	257°20.5	01.3
18	99°01.1	90°00.6	N02°25.6	88°20.6	N03°52.4	274°00.1	S00°26.2	272°23.2	N00°01.4
19	114°03.6	105°00.2	26.9	103°21.3	53.1	289°02.9	26.1	287°25.8	01.5
20	129°06.1	119°59.8	28.1	118°22.0	53.9	304°05.6	26.0	302°28.5	01.6
21	144°08.5	134°59.5	·· 29.4	133°22.7	·· 54.7	319°08.4	·· 25.8	317°31.1	·· 01.6
22	159°11.0	149°59.1	30.6	148°23.4	55.5	334°11.1	25.7	332°33.7	01.7
23	174°13.5	164°58.7	31.9	163°24.1	56.2	349°13.9	25.6	347°36.4	01.8
Mer.pass. 11:25		ν -0.4′	d 1.3′	m -3.87	ν 0.7′	d 0.8′	m 1.07	ν 2.8′	d 0.1′ m -2.47	ν 2.6′	d 0.1′ m 0.47

Stars

	SHA	**Dec**
Alpheratz	358°09.3	28°59.0
Ankaa	353°40.3	-42°24.7
Schedar	350°09.2	56°25.9
Diphda	349°20.8	-18°05.6
Achernar	335°45.6	-57°20.2
Hamal	328°28.8	23°22.3
Polaris	327°05.4	89°10.8
Acamar	315°37.3	-40°23.1
Menkar	314°41.0	4°00.8
Mirfak	309°15.9	49°47.7
Aldebaran	291°17.8	16°28.2
Rigel	281°35.8	-8°13.6
Capella	281°10.9	45°58.8
Bellatrix	278°58.5	6°19.8
Elnath	278°43.8	28°35.5
Alnilam	276°11.4	-1°13.0
Betelgeuse	271°27.9	7°24.1
Canopus	264°07.1	-52°41.5
Sirius	258°55.3	-16°41.7
Adhara	255°31.8	-28°57.1
Procyon	245°25.3	5°16.3
Pollux	243°57.6	28°04.3
Avior	234°27.8	-59°27.3
Suhail	223°10.3	-43°21.6
Miaplacidus	221°44.3	-69°38.7
Alphard	218°20.0	-8°34.8
Regulus	208°09.4	12°03.5
Dubhe	194°21.1	61°51.3
Denebola	182°58.4	14°40.6
Gienah	176°17.3	-17°26.3
Acrux	173°36.2	-62°59.7
Gacrux	172°27.8	-57°00.5
Alioth	166°41.6	56°03.7
Spica	158°56.8	-11°03.8
Alkaid	153°17.8	49°24.4
Hadar	149°22.3	-60°16.8
Menkent	148°36.2	-36°16.6
Arcturus	146°17.8	19°16.7
Rigil Kent.	140°24.7	-60°45.2
Kochab	137°18.0	74°13.9
Zuben'ubi	137°32.4	-15°57.8
Alphecca	126°31.6	26°46.5
Antares	112°56.2	-26°23.4
Atria	108°20.0	-68°59.4
Sabik	102°40.6	-15°42.1
Shaula	96°55.2	-37°05.3
Rasalhague	96°29.2	12°34.3
Eltanin	90°57.5	51°29.2
Kaus Aust.	84°16.4	-34°23.5
Vega	80°55.6	38°45.7
Nunki	76°28.7	-26°19.2
Altair	62°32.3	8°48.9
Peacock	53°58.1	-56°47.6
Deneb	49°48.4	45°12.5
Enif	34°11.5	9°47.1
Al Na'ir	28°14.9	-47°03.1
Fomalhaut	15°51.3	-29°43.4
Scheat	14°17.5	27°58.6
Markab	14°03.1	15°06.0

Mar 29 Sun	**SHA**	**Mer.pass**
Venus	354°07.0	11:59
Mars	351°16.0	12:09
Jupiter	174°39.5	23:52
Saturn	173°10.2	00:02

Mar 30 Mon	**SHA**	**Mer.pass**
Venus	352°58.8	11:59
Mars	350°33.6	12:08
Jupiter	174°46.6	23:47
Saturn	173°14.5	23:54

Mar 31 Tue	**SHA**	**Mer.pass**
Venus	351°50.6	12:00
Mars	349°51.2	12:07
Jupiter	174°53.7	23:43
Saturn	173°18.8	23:49

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h

Sun	Sun GHA	Sun Dec	Moon GHA	ν	Moon Dec	d	HP
0	178°46.0	N03°15.4	265°17.3	10.2′	S20°35.9	0.1′	55.6′
1	193°46.1	16.4	279°46.5	10.2′	20°36.0	0.1′	55.6′
2	208°46.3	17.4	294°15.7	10.1′	20°35.9	0.2′	55.6′
3	223°46.5	·· 18.4	308°44.8	10.1′	20°35.7	0.4′	55.7′
4	238°46.7	19.3	323°13.9	10.1′	20°35.3	0.4′	55.7′
5	253°46.9	20.3	337°43.0	10.0′	20°34.9	0.5′	55.7′
6	268°47.1	N03°21.3	352°12.0	10.0′	S20°34.4	0.6′	55.7′
7	283°47.3	22.3	6°41.1	10.0′	20°33.8	0.8′	55.8′
8	298°47.5	23.2	21°10.0	9.9′	20°33.0	0.8′	55.8′
9	313°47.7	·· 24.2	35°39.0	9.9′	20°32.2	1.0′	55.8′
10	328°47.9	25.2	50°07.9	9.9′	20°31.2	1.1′	55.9′
11	343°48.0	26.2	64°36.8	9.9′	20°30.1	1.1′	55.9′
12	358°48.2	N03°27.1	79°05.6	9.8′	S20°29.0	1.3′	55.9′
13	13°48.4	28.1	93°34.5	9.8′	20°27.7	1.4′	56.0′
14	28°48.6	29.1	108°03.3	9.8′	20°26.3	1.5′	56.0′
15	43°48.8	·· 30.0	122°32.0	9.7′	20°24.8	1.6′	56.0′
16	58°49.0	31.0	137°00.7	9.7′	20°23.2	1.8′	56.1′
17	73°49.2	32.0	151°29.5	9.7′	20°21.4	1.8′	56.1′
18	88°49.4	N03°33.0	165°58.1	9.7′	S20°19.6	1.9′	56.1′
19	103°49.5	33.9	180°26.8	9.6′	20°17.7	2.1′	56.2′
20	118°49.7	34.9	194°55.4	9.6′	20°15.6	2.2′	56.2′
21	133°49.9	·· 35.9	209°24.0	9.6′	20°13.4	2.3′	56.2′
22	148°50.1	36.9	223°52.6	9.5′	20°11.1	2.3′	56.3′
23	163°50.3	37.8	238°21.1	9.5′	20°08.8	2.5′	56.3′
	SD = 16.0′	d = 1.0′		SD = 15.2′			

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	178°50.5	N03°38.8	252°49.6	9.5′	S20°06.3	2.7′	56.3′
1	193°50.7	39.8	267°18.1	9.5′	20°03.6	2.7′	56.4′
2	208°50.9	40.7	281°46.6	9.4′	20°00.9	2.8′	56.4′
3	223°51.1	·· 41.7	296°15.0	9.4′	19°58.1	3.0′	56.4′
4	238°51.2	42.7	310°43.5	9.4′	19°55.1	3.0′	56.5′
5	253°51.4	43.7	325°11.9	9.4′	19°52.1	3.2′	56.5′
6	268°51.6	N03°44.6	339°40.3	9.4′	S19°48.9	3.3′	56.5′
7	283°51.8	45.6	354°08.6	9.3′	19°45.6	3.4′	56.6′
8	298°52.0	46.6	8°36.9	9.3′	19°42.2	3.5′	56.6′
9	313°52.2	·· 47.5	23°05.3	9.3′	19°38.7	3.6′	56.7′
10	328°52.4	48.5	37°33.6	9.3′	19°35.1	3.8′	56.7′
11	343°52.6	49.5	52°01.8	9.3′	19°31.3	3.8′	56.7′
12	358°52.8	N03°50.5	66°30.1	9.2′	S19°27.5	4.0′	56.8′
13	13°52.9	51.4	80°58.3	9.2′	19°23.5	4.0′	56.8′
14	28°53.1	52.4	95°26.5	9.2′	19°19.5	4.2′	56.8′
15	43°53.3	·· 53.4	109°54.7	9.2′	19°15.3	4.3′	56.9′
16	58°53.5	54.3	124°22.9	9.2′	19°11.0	4.4′	56.9′
17	73°53.7	55.3	138°51.1	9.2′	19°06.6	4.6′	56.9′
18	88°53.9	N03°56.3	153°19.3	9.1′	S19°02.0	4.6′	57.0′
19	103°54.1	57.2	167°47.4	9.1′	18°57.4	4.7′	57.0′
20	118°54.3	58.2	182°15.5	9.1′	18°52.7	4.9′	57.1′
21	133°54.4	03°59.2	196°43.6	9.1′	18°47.8	5.0′	57.1′
22	148°54.6	04°00.2	211°11.7	9.1′	18°42.8	5.0′	57.1′
23	163°54.8	01.1	225°39.8	9.1′	18°37.8	5.2′	57.2′
	SD = 16.0′	d = 1.0′		SD = 15.4′			

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	178°55.0	N04°02.1	240°07.8	9.0′	S18°32.6	5.3′	57.2′
1	193°55.2	03.1	254°35.9	9.0′	18°27.3	5.5′	57.3′
2	208°55.4	04.0	269°03.9	9.0′	18°21.8	5.5′	57.3′
3	223°55.6	·· 05.0	283°31.9	9.0′	18°16.3	5.6′	57.3′
4	238°55.8	06.0	298°00.0	9.0′	18°10.7	5.8′	57.4′
5	253°55.9	06.9	312°28.0	9.0′	18°04.9	5.8′	57.4′
6	268°56.1	N04°07.9	326°55.9	9.0′	S17°59.1	6.0′	57.4′
7	283°56.3	08.9	341°23.9	9.0′	17°53.1	6.1′	57.5′
8	298°56.5	09.8	355°51.9	9.0′	17°47.0	6.2′	57.5′
9	313°56.7	·· 10.8	10°19.8	8.9′	17°40.8	6.3′	57.6′
10	328°56.9	11.8	24°47.8	8.9′	17°34.5	6.4′	57.6′
11	343°57.1	12.7	39°15.7	8.9′	17°28.1	6.5′	57.6′
12	358°57.3	N04°13.7	53°43.7	8.9′	S17°21.6	6.6′	57.7′
13	13°57.4	14.7	68°11.6	8.9′	17°15.0	6.7′	57.7′
14	28°57.6	15.6	82°39.5	8.9′	17°08.3	6.9′	57.8′
15	43°57.8	·· 16.6	97°07.4	8.9′	17°01.4	6.9′	57.8′
16	58°58.0	17.6	111°35.3	8.9′	16°54.5	7.1′	57.8′
17	73°58.2	18.5	126°03.2	8.9′	16°47.4	7.1′	57.9′
18	88°58.4	N04°19.5	140°31.1	8.9′	S16°40.3	7.3′	57.9′
19	103°58.6	20.5	154°59.0	8.9′	16°33.0	7.4′	58.0′
20	118°58.8	21.4	169°26.8	8.9′	16°25.6	7.5′	58.0′
21	133°58.9	·· 22.4	183°54.7	8.9′	16°18.1	7.6′	58.0′
22	148°59.1	23.4	198°22.6	8.9′	16°10.5	7.6′	58.1′
23	163°59.3	24.3	212°50.4	8.8′	16°02.9	7.8′	58.1′
	SD = 16.0′	d = 1.0′		SD = 15.6′			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	02:02	03:54	05:07	19:05	20:19	22:16
N 70°	02:37	04:09	05:13	18:58	20:04	21:37
68°	03:02	04:20	05:18	18:53	19:52	21:12
66°	03:20	04:29	05:23	18:48	19:42	20:52
64°	03:35	04:37	05:26	18:45	19:34	20:37
62°	03:47	04:44	05:29	18:41	19:27	20:25
60°	03:57	04:49	05:32	18:39	19:21	20:14
N 58°	04:05	04:54	05:34	18:36	19:16	20:06
56°	04:13	04:59	05:36	18:34	19:12	19:58
54°	04:19	05:02	05:38	18:32	19:08	19:51
52°	04:25	05:06	05:40	18:30	19:04	19:46
50°	04:30	05:09	05:41	18:28	19:01	19:40
45°	04:40	05:15	05:45	18:25	18:55	19:30
N 40°	04:48	05:20	05:48	18:22	18:49	19:21
35°	04:55	05:25	05:50	18:20	18:45	19:15
30°	05:00	05:28	05:52	18:17	18:41	19:10
20°	05:08	05:33	05:56	18:14	18:36	19:02
N 10°	05:13	05:37	05:59	18:11	18:32	18:56
0°	05:16	05:41	06:01	18:08	18:28	18:53
S 10°	05:18	05:43	06:04	18:05	18:26	18:50
20°	05:19	05:44	06:06	18:02	18:24	18:50
30°	05:18	05:45	06:09	17:59	18:23	18:51
35°	05:16	05:46	06:11	17:57	18:23	18:52
40°	05:14	05:46	06:13	17:56	18:22	18:54
45°	05:12	05:46	06:15	17:53	18:23	18:57
S 50°	05:08	05:45	06:17	17:51	18:23	19:00
52°	05:05	05:45	06:18	17:50	18:23	19:02
54°	05:03	05:44	06:20	17:48	18:24	19:05
56°	05:01	05:44	06:21	17:47	18:24	19:07
58°	04:57	05:43	06:22	17:45	18:24	19:10
S 60°	04:54	05:42	06:24	17:44	18:25	19:13

Lat.	Moonrise Sun	Moonrise Mon	Moonrise Tue	Moonset Sun	Moonset Mon	Moonset Tue
N 72°	▬	▬	07:54	▬	▬	08:52
N 70°	▬	06:57	06:28	▬	07:57	10:17
68°	05:06	05:36	05:48	08:00	09:18	10:56
66°	04:20	04:58	05:21	08:46	09:55	11:23
64°	03:50	04:31	05:00	09:16	10:22	11:43
62°	03:27	04:11	04:43	09:38	10:42	12:00
60°	03:09	03:54	04:29	09:56	10:59	12:13
N 58°	02:54	03:39	04:16	10:12	11:13	12:25
56°	02:41	03:27	04:06	10:25	11:25	12:35
54°	02:29	03:16	03:56	10:36	11:36	12:44
52°	02:19	03:07	03:48	10:46	11:45	12:52
50°	02:11	02:58	03:41	10:55	11:53	12:59
45°	01:52	02:40	03:24	11:13	12:11	13:15
N 40°	01:36	02:26	03:11	11:29	12:25	13:27
35°	01:23	02:13	03:00	11:42	12:38	13:38
30°	01:12	02:02	02:50	11:53	12:48	13:47
20°	00:53	01:43	02:33	12:12	13:06	14:03
N 10°	00:36	01:27	02:18	12:29	13:22	14:17
0°	00:20	01:12	02:04	12:45	13:37	14:30
S 10°	00:04	00:56	01:51	13:00	13:52	14:43
20°	·· ··	00:40	01:36	13:17	14:07	14:56
30°	·· ··	00:21	01:19	13:36	14:25	15:12
35°	·· ··	00:10	01:09	13:47	14:36	15:21
40°	23:58	·· ··	00:57	14:00	14:47	15:31
45°	23:43	·· ··	00:44	14:15	15:01	15:43
S 50°	23:25	·· ··	00:27	14:34	15:18	15:58
52°	23:16	·· ··	00:20	14:42	15:26	16:04
54°	23:07	·· ··	00:11	14:52	15:35	16:12
56°	22:56	·· ··	00:01	15:03	15:45	16:20
58°	22:43	23:50	·· ··	15:15	15:57	16:29
S 60°	22:29	23:38	·· ··	15:30	16:10	16:40

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Age 23-25 48-28%
29	04:56	04:47	12:05	06:32	18:58	
30	04:38	04:29	12:04	07:24	19:51	
31	04:20	04:11	12:04	08:17	20:44	

April 01, 02, 03 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	189°15.9	179°58.3	N02°33.1	178°24.8	N03°57.0	4°16.7	S00°25.5	2°39.0	N00°01.9
1	204°18.4	194°58.0	34.4	193°25.5	57.8	19°19.4	25.3	17°41.7	02.0
2	219°20.9	209°57.6	35.6	208°26.1	58.5	34°22.2	25.2	32°44.3	02.0
3	234°23.3	224°57.2	·· 36.9	223°26.8	03°59.3	49°24.9	·· 25.1	47°47.0	·· 02.1
4	249°25.8	239°56.8	38.1	238°27.5	04°00.1	64°27.7	25.0	62°49.6	02.2
5	264°28.2	254°56.4	39.4	253°28.2	00.9	79°30.5	24.8	77°52.2	02.3
6	279°30.7	269°56.1	N02°40.6	268°28.9	N04°01.6	94°33.2	S00°24.7	92°54.9	N00°02.3
7	294°33.2	284°55.7	41.9	283°29.6	02.4	109°36.0	24.6	107°57.5	02.4
8	309°35.6	299°55.3	43.1	298°30.3	03.2	124°38.7	24.5	123°00.2	02.5
9	324°38.1	314°54.9	·· 44.4	313°31.0	·· 03.9	139°41.5	·· 24.3	138°02.8	·· 02.6
10	339°40.6	329°54.5	45.6	328°31.7	04.7	154°44.2	24.2	153°05.5	02.6
11	354°43.0	344°54.2	46.9	343°32.4	05.5	169°47.0	24.1	168°08.1	02.7
12	9°45.5	359°53.8	N02°48.1	358°33.1	N04°06.3	184°49.8	S00°23.9	183°10.7	N00°02.8
13	24°48.0	14°53.4	49.4	13°33.8	07.0	199°52.5	23.8	198°13.4	02.9
14	39°50.4	29°53.0	50.7	28°34.5	07.8	214°55.3	23.7	213°16.0	03.0
15	54°52.9	44°52.6	·· 51.9	43°35.2	·· 08.6	229°58.0	·· 23.6	228°18.7	·· 03.0
16	69°55.4	59°52.3	53.2	58°35.9	09.3	245°00.8	23.4	243°21.3	03.1
17	84°57.8	74°51.9	54.4	73°36.6	10.1	260°03.5	23.3	258°23.9	03.2
18	100°00.3	89°51.5	N02°55.7	88°37.3	N04°10.9	275°06.3	S00°23.2	273°26.6	N00°03.3
19	115°02.7	104°51.1	56.9	103°38.0	11.7	290°09.1	23.1	288°29.2	03.3
20	130°05.2	119°50.7	58.2	118°38.7	12.4	305°11.8	22.9	303°31.9	03.4
21	145°07.7	134°50.4	02°59.4	133°39.4	·· 13.2	320°14.6	·· 22.8	318°34.5	·· 03.5
22	160°10.1	149°50.0	03°00.7	148°40.1	14.0	335°17.3	22.7	333°37.2	03.6
23	175°12.6	164°49.6	01.9	163°40.8	14.7	350°20.1	22.6	348°39.8	03.6
Mer.pass. 11:21		ν -0.4′	d 1.3′	m -3.87	ν 0.7′	d 0.8′	m 1.07	ν 2.8′	d 0.1′ m -2.47	ν 2.6′	d 0.1′ m 0.47

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	190°15.1	179°49.2	N03°03.2	178°41.5	N04°15.5	5°22.8	S00°22.4	3°42.4	N00°03.7
1	205°17.5	194°48.8	04.4	193°42.2	16.3	20°25.6	22.3	18°45.1	03.8
2	220°20.0	209°48.5	05.7	208°42.9	17.0	35°28.4	22.2	33°47.7	03.9
3	235°22.5	224°48.1	·· 06.9	223°43.6	·· 17.8	50°31.1	·· 22.1	48°50.4	·· 03.9
4	250°24.9	239°47.7	08.2	238°44.3	18.6	65°33.9	21.9	63°53.0	04.0
5	265°27.4	254°47.3	09.4	253°45.0	19.4	80°36.6	21.8	78°55.6	04.1
6	280°29.8	269°46.9	N03°10.7	268°45.7	N04°20.1	95°39.4	S00°21.7	93°58.3	N00°04.2
7	295°32.3	284°46.6	11.9	283°46.4	20.9	110°42.1	21.6	109°00.9	04.3
8	310°34.8	299°46.2	13.2	298°47.1	21.7	125°44.9	21.4	124°03.6	04.3
9	325°37.2	314°45.8	·· 14.4	313°47.8	·· 22.4	140°47.7	·· 21.3	139°06.2	·· 04.4
10	340°39.7	329°45.4	15.7	328°48.5	23.2	155°50.4	21.2	154°08.9	04.5
11	355°42.2	344°45.0	16.9	343°49.2	24.0	170°53.2	21.1	169°11.5	04.6
12	10°44.6	359°44.7	N03°18.2	358°49.9	N04°24.7	185°55.9	S00°20.9	184°14.1	N00°04.6
13	25°47.1	14°44.3	19.4	13°50.6	25.5	200°58.7	20.8	199°16.8	04.7
14	40°49.6	29°43.9	20.7	28°51.3	26.3	216°01.4	20.7	214°19.4	04.8
15	55°52.0	44°43.5	·· 21.9	43°52.0	·· 27.0	231°04.2	·· 20.6	229°22.1	·· 04.9
16	70°54.5	59°43.1	23.1	58°52.7	27.8	246°06.9	20.4	244°24.7	04.9
17	85°57.0	74°42.7	24.4	73°53.4	28.6	261°09.7	20.3	259°27.3	05.0
18	100°59.4	89°42.4	N03°25.6	88°54.1	N04°29.3	276°12.5	S00°20.2	274°30.0	N00°05.1
19	116°01.9	104°42.0	26.9	103°54.8	30.1	291°15.2	20.1	289°32.6	05.2
20	131°04.3	119°41.6	28.1	118°55.5	30.9	306°18.0	20.0	304°35.3	05.2
21	146°06.8	134°41.2	·· 29.4	133°56.2	·· 31.7	321°20.7	·· 19.8	319°37.9	·· 05.3
22	161°09.3	149°40.8	30.6	148°56.9	32.4	336°23.5	19.7	334°40.6	05.4
23	176°11.7	164°40.5	31.9	163°57.6	33.2	351°26.2	19.6	349°43.2	05.5
Mer.pass. 11:17		ν -0.4′	d 1.3′	m -3.87	ν 0.7′	d 0.8′	m 1.07	ν 2.8′	d 0.1′ m -2.47	ν 2.6′	d 0.1′ m 0.48

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	191°14.2	179°40.1	N03°33.1	178°58.3	N04°34.0	6°29.0	S00°19.5	4°45.8	N00°05.6
1	206°16.7	194°39.7	34.4	193°59.0	34.7	21°31.7	19.3	19°48.5	05.6
2	221°19.1	209°39.3	35.6	208°59.7	35.5	36°34.5	19.2	34°51.1	05.7
3	236°21.6	224°38.9	·· 36.9	224°00.4	·· 36.3	51°37.3	·· 19.1	49°53.8	·· 05.8
4	251°24.1	239°38.5	38.1	239°01.1	37.0	66°40.0	19.0	64°56.4	05.9
5	266°26.5	254°38.2	39.4	254°01.8	37.8	81°42.8	18.8	79°59.0	05.9
6	281°29.0	269°37.8	N03°40.6	269°02.5	N04°38.6	96°45.5	S00°18.7	95°01.7	N00°06.0
7	296°31.4	284°37.4	41.9	284°03.2	39.3	111°48.3	18.6	110°04.3	06.1
8	311°33.9	299°37.0	43.1	299°03.9	40.1	126°51.0	18.5	125°07.0	06.2
9	326°36.4	314°36.6	·· 44.4	314°04.6	·· 40.9	141°53.8	·· 18.3	140°09.6	·· 06.2
10	341°38.8	329°36.2	45.6	329°05.3	41.6	156°56.5	18.2	155°12.3	06.3
11	356°41.3	344°35.9	46.8	344°06.0	42.4	171°59.3	18.1	170°14.9	06.4
12	11°43.8	359°35.5	N03°48.1	359°06.7	N04°43.2	187°02.0	S00°18.0	185°17.5	N00°06.5
13	26°46.2	14°35.1	49.3	14°07.4	43.9	202°04.8	17.8	200°20.2	06.5
14	41°48.7	29°34.7	50.6	29°08.1	44.7	217°07.6	17.7	215°22.8	06.6
15	56°51.2	44°34.3	·· 51.8	44°08.8	·· 45.5	232°10.3	·· 17.6	230°25.5	·· 06.7
16	71°53.6	59°33.9	53.1	59°09.5	46.2	247°13.1	17.5	245°28.1	06.8
17	86°56.1	74°33.6	54.3	74°10.2	47.0	262°15.8	17.3	260°30.7	06.8
18	101°58.6	89°33.2	N03°55.6	89°10.9	N04°47.8	277°18.6	S00°17.2	275°33.4	N00°06.9
19	117°01.0	104°32.8	56.8	104°11.6	48.5	292°21.3	17.1	290°36.0	07.0
20	132°03.5	119°32.4	58.1	119°12.3	49.3	307°24.1	17.0	305°38.7	07.1
21	147°05.9	134°32.0	03°59.3	134°13.0	·· 50.1	322°26.8	·· 16.9	320°41.3	·· 07.1
22	162°08.4	149°31.6	04°00.5	149°13.7	50.8	337°29.6	16.7	335°43.9	07.2
23	177°10.9	164°31.3	01.8	164°14.4	51.6	352°32.3	16.6	350°46.6	07.3
Mer.pass. 11:13		ν -0.4′	d 1.2′	m -3.87	ν 0.7′	d 0.8′	m 1.07	ν 2.8′	d 0.1′ m -2.47	ν 2.6′	d 0.1′ m 0.48

Stars

	SHA	Dec
Alpheratz	358°09.3	28°59.0
Ankaa	353°40.3	-42°24.7
Schedar	350°09.2	56°25.9
Diphda	349°20.8	-18°05.6
Achernar	335°45.6	-57°20.1
Hamal	328°28.8	23°22.3
Polaris	327°05.9	89°10.7
Acamar	315°37.3	-40°23.1
Menkar	314°41.0	4°00.8
Mirfak	309°16.0	49°47.7
Aldebaran	291°17.8	16°28.2
Rigel	281°35.8	-8°13.6
Capella	281°10.9	45°58.8
Bellatrix	278°58.5	6°19.8
Elnath	278°43.8	28°35.5
Alnilam	276°11.4	-1°13.0
Betelgeuse	271°28.0	7°24.1
Canopus	264°07.1	-52°41.5
Sirius	258°55.4	-16°41.7
Adhara	255°31.8	-28°57.1
Procyon	245°25.3	5°16.3
Pollux	243°57.6	28°04.3
Avior	234°27.8	-59°27.3
Suhail	223°10.3	-43°21.6
Miaplacidus	221°44.4	-69°38.7
Alphard	218°20.0	-8°34.8
Regulus	208°09.4	12°03.5
Dubhe	194°21.1	61°51.3
Denebola	182°58.4	14°40.6
Gienah	176°17.3	-17°26.3
Acrux	173°36.2	-62°59.7
Gacrux	172°27.8	-57°00.5
Alioth	166°41.6	56°03.7
Spica	158°56.8	-11°03.8
Alkaid	153°17.7	49°24.4
Hadar	149°22.2	-60°16.9
Menkent	148°36.2	-36°16.6
Arcturus	146°17.8	19°16.7
Rigil Kent.	140°24.7	-60°45.2
Kochab	137°18.0	74°13.9
Zuben'ubi	137°32.3	-15°57.8
Alphecca	126°31.5	26°46.5
Antares	112°56.2	-26°23.4
Atria	108°19.9	-68°59.4
Sabik	102°40.6	-15°42.1
Shaula	96°55.1	-37°05.3
Rasalhague	96°29.1	12°34.3
Eltanin	90°57.4	51°29.2
Kaus Aust.	84°16.3	-34°23.5
Vega	80°55.5	38°45.7
Nunki	76°28.7	-26°19.2
Altair	62°32.2	8°48.9
Peacock	53°58.1	-56°47.6
Deneb	49°48.4	45°12.5
Enif	34°11.4	9°47.1
Al Na'ir	28°14.8	-47°03.1
Fomalhaut	15°51.3	-29°43.4
Scheat	14°17.5	27°58.6
Markab	14°03.1	15°06.0

Apr 01 Wed	SHA	Mer.pass
Venus	350°42.4	12:00
Mars	349°08.8	12:06
Jupiter	175°00.7	23:39
Saturn	173°23.1	23:45

Apr 02 Thu	SHA	Mer.pass
Venus	349°34.2	12:01
Mars	348°26.5	12:05
Jupiter	175°07.8	23:34
Saturn	173°27.4	23:41

Apr 03 Fri	SHA	Mer.pass
Venus	348°25.9	12:02
Mars	347°44.1	12:04
Jupiter	175°14.8	23:30
Saturn	173°31.6	23:37

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = -0.4145 sec ΔT = TT-UT1 = +51.5985 sec

1981 April 01 to Apr. 03 UT

h

	Sun		Moon				
Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°59.5	N04°25.3	227°18.3	8.8′	S15°55.1	7.9′	58.2′
1	193°59.7	26.3	241°46.1	8.8′	15°47.2	8.0′	58.2′
2	208°59.9	27.2	256°13.9	8.8′	15°39.2	8.1′	58.2′
3	224°00.1	·· 28.2	270°41.8	8.8′	15°31.1	8.2′	58.3′
4	239°00.2	29.2	285°09.6	8.8′	15°22.9	8.3′	58.3′
5	254°00.4	30.1	299°37.4	8.8′	15°14.6	8.4′	58.4′
6	269°00.6	N04°31.1	314°05.3	8.8′	S15°06.2	8.6′	58.4′
7	284°00.8	32.1	328°33.1	8.8′	14°57.6	8.6′	58.4′
8	299°01.0	33.0	343°00.9	8.8′	14°49.0	8.7′	58.5′
9	314°01.2	·· 34.0	357°28.7	8.8′	14°40.3	8.8′	58.5′
10	329°01.4	35.0	11°56.5	8.8′	14°31.5	8.9′	58.6′
11	344°01.5	35.9	26°24.3	8.8′	14°22.6	9.0′	58.6′
12	359°01.7	N04°36.9	40°52.1	8.8′	S14°13.6	9.1′	58.6′
13	14°01.9	37.9	55°19.9	8.8′	14°04.5	9.2′	58.7′
14	29°02.1	38.8	69°47.7	8.8′	13°55.3	9.2′	58.7′
15	44°02.3	·· 39.8	84°15.5	8.8′	13°46.1	9.4′	58.8′
16	59°02.5	40.7	98°43.3	8.8′	13°36.7	9.5′	58.8′
17	74°02.7	41.7	113°11.1	8.8′	13°27.2	9.6′	58.8′
18	89°02.8	N04°42.7	127°38.9	8.8′	S13°17.6	9.6′	58.9′
19	104°03.0	43.6	142°06.7	8.8′	13°08.0	9.8′	58.9′
20	119°03.2	44.6	156°34.5	8.8′	12°58.2	9.8′	58.9′
21	134°03.4	·· 45.6	171°02.2	8.8′	12°48.4	9.9′	59.0′
22	149°03.6	46.5	185°30.0	8.8′	12°38.5	10.0′	59.0′
23	164°03.8	47.5	199°57.8	8.8′	12°28.5	10.1′	59.1′
	SD = 16.0′	d = 1.0′	SD = 15.9′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°04.0	N04°48.4	214°25.6	8.8′	S12°18.4	10.2′	59.1′
1	194°04.1	49.4	228°53.3	8.8′	12°08.2	10.3′	59.1′
2	209°04.3	50.4	243°21.1	8.8′	11°57.9	10.4′	59.2′
3	224°04.5	·· 51.3	257°48.9	8.8′	11°47.5	10.4′	59.2′
4	239°04.7	52.3	272°16.7	8.8′	11°37.1	10.6′	59.2′
5	254°04.9	53.3	286°44.4	8.8′	11°26.5	10.6′	59.3′
6	269°05.1	N04°54.2	301°12.2	8.8′	S11°15.9	10.7′	59.3′
7	284°05.3	55.2	315°39.9	8.8′	11°05.2	10.7′	59.4′
8	299°05.4	56.1	330°07.7	8.8′	10°54.5	10.9′	59.4′
9	314°05.6	·· 57.1	344°35.5	8.8′	10°43.6	10.9′	59.4′
10	329°05.8	58.1	359°03.2	8.7′	10°32.7	11.0′	59.5′
11	344°06.0	04°59.0	13°31.0	8.7′	10°21.7	11.1′	59.5′
12	359°06.2	N05°00.0	27°58.7	8.7′	S10°10.6	11.2′	59.5′
13	14°06.4	00.9	42°26.4	8.7′	09°59.4	11.2′	59.6′
14	29°06.5	01.9	56°54.2	8.7′	09°48.2	11.3′	59.6′
15	44°06.7	·· 02.9	71°21.9	8.7′	09°36.9	11.4′	59.6′
16	59°06.9	03.8	85°49.7	8.7′	09°25.5	11.4′	59.7′
17	74°07.1	04.8	100°17.4	8.7′	09°14.1	11.6′	59.7′
18	89°07.3	N05°05.7	114°45.1	8.7′	S09°02.5	11.6′	59.7′
19	104°07.5	06.7	129°12.8	8.7′	08°50.9	11.6′	59.8′
20	119°07.6	07.7	143°40.5	8.7′	08°39.3	11.7′	59.8′
21	134°07.8	·· 08.6	158°08.3	8.7′	08°27.6	11.8′	59.8′
22	149°08.0	09.6	172°36.0	8.7′	08°15.8	11.9′	59.9′
23	164°08.2	10.5	187°03.7	8.7′	08°03.9	11.9′	59.9′
	SD = 16.0′	d = 1.0′	SD = 16.1′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°08.4	N05°11.5	201°31.4	8.7′	S07°52.0	12.0′	59.9′
1	194°08.6	12.5	215°59.1	8.7′	07°40.0	12.0′	60.0′
2	209°08.8	13.4	230°26.7	8.7′	07°28.0	12.1′	60.0′
3	224°08.9	·· 14.4	244°54.4	8.7′	07°15.9	12.2′	60.0′
4	239°09.1	15.3	259°22.1	8.7′	07°03.7	12.2′	60.1′
5	254°09.3	16.3	273°49.8	8.7′	06°51.5	12.2′	60.1′
6	269°09.5	N05°17.3	288°17.4	8.7′	S06°39.3	12.3′	60.1′
7	284°09.7	18.2	302°45.1	8.6′	06°27.0	12.4′	60.2′
8	299°09.9	19.2	317°12.7	8.6′	06°14.6	12.4′	60.2′
9	314°10.0	·· 20.1	331°40.4	8.6′	06°02.2	12.5′	60.2′
10	329°10.2	21.1	346°08.0	8.6′	05°49.7	12.5′	60.2′
11	344°10.4	22.0	0°35.6	8.6′	05°37.2	12.6′	60.3′
12	359°10.6	N05°23.0	15°03.2	8.6′	S05°24.6	12.6′	60.3′
13	14°10.8	24.0	29°30.8	8.6′	05°12.0	12.7′	60.3′
14	29°10.9	24.9	43°58.4	8.6′	04°59.3	12.7′	60.4′
15	44°11.1	·· 25.9	58°26.0	8.6′	04°46.6	12.7′	60.4′
16	59°11.3	26.8	72°53.6	8.6′	04°33.9	12.8′	60.4′
17	74°11.5	27.8	87°21.1	8.6′	04°21.1	12.8′	60.4′
18	89°11.7	N05°28.7	101°48.7	8.5′	S04°08.3	12.9′	60.5′
19	104°11.9	29.7	116°16.2	8.5′	03°55.4	12.8′	60.5′
20	119°12.0	30.6	130°43.8	8.5′	03°42.6	13.0′	60.5′
21	134°12.2	·· 31.6	145°11.3	8.5′	03°29.6	12.9′	60.5′
22	149°12.4	32.6	159°38.8	8.5′	03°16.7	13.0′	60.6′
23	164°12.6	33.5	174°06.3	8.5′	03°03.7	13.0′	60.6′
	SD = 16.0′	d = 1.0′	SD = 16.3′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	01:27	03:36	04:51	19:19	20:36	22:54
N 70°	02:14	03:53	04:59	19:11	20:18	22:00
68°	02:43	04:06	05:06	19:04	20:04	21:29
66°	03:05	04:17	05:11	18:58	19:53	21:06
64°	03:21	04:26	05:15	18:54	19:44	20:49
62°	03:35	04:33	05:19	18:49	19:36	20:35
60°	03:46	04:40	05:23	18:46	19:29	20:23
N 58°	03:56	04:45	05:26	18:43	19:23	20:14
56°	04:04	04:50	05:28	18:40	19:18	20:05
54°	04:11	04:55	05:31	18:37	19:14	19:58
52°	04:17	04:59	05:33	18:35	19:10	19:51
50°	04:23	05:02	05:35	18:33	19:06	19:46
45°	04:34	05:10	05:39	18:29	18:59	19:34
N 40°	04:43	05:15	05:43	18:25	18:52	19:25
35°	04:50	05:20	05:46	18:22	18:47	19:18
30°	04:56	05:24	05:48	18:19	18:43	19:12
20°	05:05	05:31	05:53	18:15	18:37	19:03
N 10°	05:11	05:36	05:57	18:11	18:32	18:56
0°	05:16	05:40	06:00	18:07	18:28	18:52
S 10°	05:18	05:43	06:04	18:03	18:24	18:49
20°	05:20	05:45	06:07	18:00	18:22	18:47
30°	05:20	05:47	06:11	17:56	18:19	18:47
35°	05:19	05:48	06:13	17:53	18:19	18:48
40°	05:17	05:49	06:16	17:51	18:18	18:49
45°	05:15	05:49	06:19	17:48	18:17	18:51
S 50°	05:12	05:50	06:22	17:44	18:17	18:54
52°	05:11	05:50	06:23	17:43	18:16	18:55
54°	05:09	05:50	06:25	17:41	18:16	18:57
56°	05:07	05:50	06:27	17:39	18:16	18:59
58°	05:04	05:50	06:29	17:37	18:16	19:02
S 60°	05:01	05:50	06:31	17:35	18:16	19:04

Lat.	**Moonrise** Wed	Thu	Fri	**Moonset** Wed	Thu	Fri
N 72°	06:51	06:29	06:13	11:47	14:02	16:10
N 70°	06:17	06:10	06:04	12:19	14:18	16:17
68°	05:53	05:55	05:56	12:42	14:31	16:23
66°	05:34	05:43	05:49	13:00	14:42	16:27
64°	05:19	05:33	05:44	13:14	14:51	16:31
62°	05:06	05:24	05:39	13:26	14:59	16:35
60°	04:55	05:17	05:34	13:36	15:05	16:38
N 58°	04:46	05:10	05:31	13:45	15:11	16:40
56°	04:37	05:04	05:27	13:53	15:16	16:42
54°	04:30	04:59	05:24	14:00	15:21	16:45
52°	04:23	04:54	05:22	14:06	15:25	16:46
50°	04:17	04:50	05:19	14:12	15:28	16:48
45°	04:04	04:40	05:14	14:24	15:36	16:52
N 40°	03:53	04:32	05:09	14:34	15:43	16:55
35°	03:44	04:25	05:05	14:42	15:49	16:57
30°	03:36	04:19	05:01	14:49	15:54	17:00
20°	03:22	04:09	04:55	15:02	16:02	17:04
N 10°	03:09	04:00	04:50	15:13	16:10	17:07
0°	02:58	03:51	04:45	15:23	16:17	17:10
S 10°	02:46	03:43	04:40	15:33	16:24	17:13
20°	02:34	03:33	04:34	15:44	16:31	17:17
30°	02:19	03:23	04:28	15:56	16:39	17:20
35°	02:11	03:17	04:25	16:04	16:44	17:23
40°	02:02	03:10	04:20	16:12	16:49	17:25
45°	01:50	03:01	04:16	16:21	16:55	17:28
S 50°	01:37	02:52	04:10	16:32	17:03	17:31
52°	01:31	02:47	04:07	16:37	17:06	17:32
54°	01:24	02:42	04:05	16:43	17:10	17:34
56°	01:16	02:36	04:01	16:49	17:14	17:36
58°	01:07	02:30	03:58	16:56	17:18	17:38
S 60°	00:57	02:23	03:54	17:04	17:23	17:40

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 26-28 19-5%
01	04:02	03:53	12:04	09:10	21:37	
02	03:44	03:35	12:04	10:04	22:31	
03	03:26	03:18	12:03	10:58	23:24	

April 04, 05, 06 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	192°13.3	179°30.9	N04°03.0	179°15.1	N04°52.3	7°35.1	S00°16.5	5°49.2	N00°07.4
1	207°15.8	194°30.5	04.3	194°15.7	53.1	22°37.9	16.4	20°51.9	07.5
2	222°18.3	209°30.1	05.5	209°16.4	53.9	37°40.6	16.2	35°54.5	07.5
3	237°20.7	224°29.7	·· 06.8	224°17.1	·· 54.6	52°43.4	·· 16.1	50°57.1	·· 07.6
4	252°23.2	239°29.3	08.0	239°17.8	55.4	67°46.1	16.0	65°59.8	07.7
5	267°25.7	254°28.9	09.3	254°18.5	56.2	82°48.9	15.9	81°02.4	07.8
6	282°28.1	269°28.6	N04°10.5	269°19.2	N04°56.9	97°51.6	S00°15.7	96°05.1	N00°07.8
7	297°30.6	284°28.2	11.7	284°19.9	57.7	112°54.4	15.6	111°07.7	07.9
8	312°33.1	299°27.8	13.0	299°20.6	58.5	127°57.1	15.5	126°10.4	08.0
9	327°35.5	314°27.4	·· 14.2	314°21.3	04°59.2	142°59.9	·· 15.4	141°13.0	·· 08.1
10	342°38.0	329°27.0	15.5	329°22.0	05°00.0	158°02.6	15.3	156°15.6	08.1
11	357°40.4	344°26.6	16.7	344°22.7	00.8	173°05.4	15.1	171°18.3	08.2
12	12°42.9	359°26.2	N04°18.0	359°23.4	N05°01.5	188°08.1	S00°15.0	186°20.9	N00°08.3
13	27°45.4	14°25.9	19.2	14°24.1	02.3	203°10.9	14.9	201°23.6	08.4
14	42°47.8	29°25.5	20.4	29°24.8	03.0	218°13.6	14.8	216°26.2	08.4
15	57°50.3	44°25.1	·· 21.7	44°25.5	·· 03.8	233°16.4	·· 14.6	231°28.8	·· 08.5
16	72°52.8	59°24.7	22.9	59°26.2	04.6	248°19.2	14.5	246°31.5	08.6
17	87°55.2	74°24.3	24.2	74°26.9	05.3	263°21.9	14.4	261°34.1	08.7
18	102°57.7	89°23.9	N04°25.4	89°27.6	N05°06.1	278°24.7	S00°14.3	276°36.8	N00°08.7
19	118°00.2	104°23.5	26.7	104°28.3	06.9	293°27.4	14.1	291°39.4	08.8
20	133°02.6	119°23.2	27.9	119°29.0	07.6	308°30.2	14.0	306°42.0	08.9
21	148°05.1	134°22.8	·· 29.1	134°29.7	·· 08.4	323°32.9	·· 13.9	321°44.7	·· 09.0
22	163°07.5	149°22.4	30.4	149°30.4	09.2	338°35.7	13.8	336°47.3	09.0
23	178°10.0	164°22.0	31.6	164°31.1	09.9	353°38.4	13.7	351°50.0	09.1
Mer.pass. 11:09		ν -0.4′	d 1.2′	m -3.87	ν 0.7′	d 0.8′	m 1.07	ν 2.8′	d 0.1′ m -2.47	ν 2.6′	d 0.1′ m 0.49

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	193°12.5	179°21.6	N04°32.9	179°31.8	N05°10.7	8°41.2	S00°13.5	6°52.6	N00°09.2
1	208°14.9	194°21.2	34.1	194°32.5	11.4	23°43.9	13.4	21°55.2	09.3
2	223°17.4	209°20.8	35.3	209°33.2	12.2	38°46.7	13.3	36°57.9	09.3
3	238°19.9	224°20.4	·· 36.6	224°33.9	·· 13.0	53°49.4	·· 13.2	52°00.5	·· 09.4
4	253°22.3	239°20.1	37.8	239°34.6	13.7	68°52.2	13.0	67°03.2	09.5
5	268°24.8	254°19.7	39.1	254°35.3	14.5	83°54.9	12.9	82°05.8	09.6
6	283°27.3	269°19.3	N04°40.3	269°36.0	N05°15.2	98°57.7	S00°12.8	97°08.4	N00°09.6
7	298°29.7	284°18.9	41.5	284°36.7	16.0	114°00.4	12.7	112°11.1	09.7
8	313°32.2	299°18.5	42.8	299°37.4	16.8	129°03.2	12.6	127°13.7	09.8
9	328°34.7	314°18.1	·· 44.0	314°38.1	·· 17.5	144°05.9	·· 12.4	142°16.4	·· 09.9
10	343°37.1	329°17.7	45.3	329°38.8	18.3	159°08.7	12.3	157°19.0	09.9
11	358°39.6	344°17.3	46.5	344°39.5	19.1	174°11.4	12.2	172°21.6	10.0
12	13°42.0	359°16.9	N04°47.7	359°40.2	N05°19.8	189°14.2	S00°12.1	187°24.3	N00°10.1
13	28°44.5	14°16.6	49.0	14°40.9	20.6	204°16.9	12.0	202°26.9	10.2
14	43°47.0	29°16.2	50.2	29°41.6	21.3	219°19.7	11.8	217°29.6	10.2
15	58°49.4	44°15.8	·· 51.5	44°42.3	·· 22.1	234°22.4	·· 11.7	232°32.2	·· 10.3
16	73°51.9	59°15.4	52.7	59°43.0	22.9	249°25.2	11.6	247°34.8	10.4
17	88°54.4	74°15.0	53.9	74°43.7	23.6	264°27.9	11.5	262°37.5	10.5
18	103°56.8	89°14.6	N04°55.2	89°44.4	N05°24.4	279°30.7	S00°11.3	277°40.1	N00°10.5
19	118°59.3	104°14.2	56.4	104°45.1	25.1	294°33.4	11.2	292°42.8	10.6
20	134°01.8	119°13.8	57.6	119°45.8	25.9	309°36.2	11.1	307°45.4	10.7
21	149°04.2	134°13.4	04°58.9	134°46.5	·· 26.7	324°38.9	·· 11.0	322°48.0	·· 10.8
22	164°06.7	149°13.0	05°00.1	149°47.2	27.4	339°41.7	10.9	337°50.7	10.8
23	179°09.1	164°12.7	01.4	164°47.9	28.2	354°44.4	10.7	352°53.3	10.9
Mer.pass. 11:05		ν -0.4′	d 1.2′	m -3.87	ν 0.7′	d 0.8′	m 1.08	ν 2.8′	d 0.1′ m -2.47	ν 2.6′	d 0.1′ m 0.49

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	194°11.6	179°12.3	N05°02.6	179°48.6	N05°28.9	9°47.2	S00°10.6	7°55.9	N00°11.0
1	209°14.1	194°11.9	03.8	194°49.3	29.7	24°49.9	10.5	22°58.6	11.1
2	224°16.5	209°11.5	05.1	209°50.0	30.5	39°52.7	10.4	38°01.2	11.1
3	239°19.0	224°11.1	·· 06.3	224°50.7	·· 31.2	54°55.4	·· 10.3	53°03.9	·· 11.2
4	254°21.5	239°10.7	07.5	239°51.4	32.0	69°58.2	10.1	68°06.5	11.3
5	269°23.9	254°10.3	08.8	254°52.1	32.7	85°00.9	10.0	83°09.1	11.4
6	284°26.4	269°09.9	N05°10.0	269°52.8	N05°33.5	100°03.7	S00°09.9	98°11.8	N00°11.4
7	299°28.9	284°09.5	11.2	284°53.5	34.3	115°06.4	09.8	113°14.4	11.5
8	314°31.3	299°09.1	12.5	299°54.2	35.0	130°09.2	09.7	128°17.1	11.6
9	329°33.8	314°08.7	·· 13.7	314°54.9	·· 35.8	145°11.9	·· 09.5	143°19.7	·· 11.6
10	344°36.3	329°08.4	14.9	329°55.6	36.5	160°14.7	09.4	158°22.3	11.7
11	359°38.7	344°08.0	16.2	344°56.3	37.3	175°17.4	09.3	173°25.0	11.8
12	14°41.2	359°07.6	N05°17.4	359°57.0	N05°38.0	190°20.2	S00°09.2	188°27.6	N00°11.9
13	29°43.6	14°07.2	18.6	14°57.7	38.8	205°22.9	09.0	203°30.3	11.9
14	44°46.1	29°06.8	19.9	29°58.4	39.6	220°25.7	08.9	218°32.9	12.0
15	59°48.6	44°06.4	·· 21.1	44°59.1	·· 40.3	235°28.4	·· 08.8	233°35.5	·· 12.1
16	74°51.0	59°06.0	22.3	59°59.7	41.1	250°31.2	08.7	248°38.2	12.2
17	89°53.5	74°05.6	23.6	75°00.4	41.8	265°33.9	08.6	263°40.8	12.2
18	104°56.0	89°05.2	N05°24.8	90°01.1	N05°42.6	280°36.7	S00°08.4	278°43.5	N00°12.3
19	119°58.4	104°04.8	26.0	105°01.8	43.3	295°39.4	08.3	293°46.1	12.4
20	135°00.9	119°04.4	27.3	120°02.5	44.1	310°42.2	08.2	308°48.7	12.5
21	150°03.4	134°04.0	·· 28.5	135°03.2	·· 44.9	325°44.9	·· 08.1	323°51.4	·· 12.5
22	165°05.8	149°03.6	29.7	150°03.9	45.6	340°47.7	08.0	338°54.0	12.6
23	180°08.3	164°03.2	31.0	165°04.6	46.4	355°50.4	07.8	353°56.6	12.7
Mer.pass. 11:01		ν -0.4′	d 1.2′	m -3.87	ν 0.7′	d 0.8′	m 1.08	ν 2.7′	d 0.1′ m -2.46	ν 2.6′	d 0.1′ m 0.50

Stars	SHA	Dec
Alpheratz	358°09.3	28°59.0
Ankaa	353°40.3	-42°24.6
Schedar	350°09.2	56°25.9
Diphda	349°20.8	-18°05.6
Achernar	335°45.6	-57°20.1
Hamal	328°28.8	23°22.3
Polaris	327°06.4	89°10.7
Acamar	315°37.3	-40°23.1
Menkar	314°41.0	4°00.8
Mirfak	309°16.0	49°47.7
Aldebaran	291°17.8	16°28.2
Rigel	281°35.8	-8°13.6
Capella	281°11.0	45°58.8
Bellatrix	278°58.5	6°19.8
Elnath	278°43.8	28°35.5
Alnilam	276°11.4	-1°13.0
Betelgeuse	271°28.0	7°24.1
Canopus	264°07.1	-52°41.5
Sirius	258°55.4	-16°41.6
Adhara	255°31.8	-28°57.1
Procyon	245°25.4	5°16.3
Pollux	243°57.7	28°04.3
Avior	234°27.8	-59°27.3
Suhail	223°10.3	-43°21.7
Miaplacidus	221°44.4	-69°38.7
Alphard	218°20.0	-8°34.8
Regulus	208°09.4	12°03.5
Dubhe	194°21.1	61°51.3
Denebola	182°58.4	14°40.6
Gienah	176°17.3	-17°26.3
Acrux	173°36.2	-62°59.7
Gacrux	172°27.8	-57°00.5
Alioth	166°41.6	56°03.7
Spica	158°56.8	-11°03.8
Alkaid	153°17.7	49°24.4
Hadar	149°22.2	-60°16.9
Menkent	148°36.2	-36°16.6
Arcturus	146°17.8	19°16.7
Rigil Kent.	140°24.7	-60°45.2
Kochab	137°18.0	74°13.9
Zuben'ubi	137°32.3	-15°57.8
Alphecca	126°31.5	26°46.5
Antares	112°56.2	-26°23.4
Atria	108°19.9	-68°59.4
Sabik	102°40.6	-15°42.1
Shaula	96°55.1	-37°05.3
Rasalhague	96°29.1	12°34.3
Eltanin	90°57.4	51°29.2
Kaus Aust.	84°16.3	-34°23.5
Vega	80°55.5	38°45.7
Nunki	76°28.7	-26°19.2
Altair	62°32.2	8°48.9
Peacock	53°58.0	-56°47.6
Deneb	49°48.4	45°12.5
Enif	34°11.4	9°47.1
Al Na'ir	28°14.8	-47°03.1
Fomalhaut	15°51.3	-29°43.4
Scheat	14°17.5	27°58.6
Markab	14°03.1	15°06.0

Apr 04 Sat	SHA	Mer.pass
Venus	347°17.5	12:02
Mars	347°01.7	12:02
Jupiter	175°21.8	23:25
Saturn	173°35.9	23:33

Apr 05 Sun	SHA	Mer.pass
Venus	346°09.1	12:03
Mars	346°19.3	12:01
Jupiter	175°28.7	23:21
Saturn	173°40.1	23:28

Apr 06 Mon	SHA	Mer.pass
Venus	345°00.7	12:03
Mars	345°37.0	12:00
Jupiter	175°35.6	23:17
Saturn	173°44.3	23:24

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h

Sat	Sun GHA	Sun Dec	Moon GHA	ν	Moon Dec	d	HP
0	179°12.8	N05°34.5	188°33.8	8.5′	S02°50.7	13.1′	60.6′
1	194°13.0	35.4	203°01.2	8.5′	02°37.6	13.1′	60.6′
2	209°13.1	36.4	217°28.7	8.4′	02°24.5	13.1′	60.6′
3	224°13.3	·· 37.3	231°56.1	8.4′	02°11.4	13.1′	60.7′
4	239°13.5	38.3	246°23.6	8.4′	01°58.3	13.1′	60.7′
5	254°13.7	39.2	260°51.0	8.4′	01°45.2	13.2′	60.7′
6	269°13.9	N05°40.2	275°18.4	8.4′	S01°32.0	13.2′	60.7′
7	284°14.0	41.1	289°45.7	8.4′	01°18.8	13.2′	60.7′
8	299°14.2	42.1	304°13.1	8.3′	01°05.6	13.2′	60.8′
9	314°14.4	·· 43.1	318°40.4	8.3′	00°52.4	13.2′	60.8′
10	329°14.6	44.0	333°07.8	8.3′	00°39.2	13.3′	60.8′
11	344°14.8	45.0	347°35.1	8.3′	00°25.9	13.2′	60.8′
12	359°15.0	N05°45.9	2°02.4	8.3′	S00°12.7	13.3′	60.8′
13	14°15.1	46.9	16°29.6	8.3′	N00°00.6	13.2′	60.8′
14	29°15.3	47.8	30°56.9	8.2′	00°13.8	13.3′	60.9′
15	44°15.5	·· 48.8	45°24.1	8.2′	00°27.1	13.3′	60.9′
16	59°15.7	49.7	59°51.3	8.2′	00°40.4	13.3′	60.9′
17	74°15.9	50.7	74°18.5	8.2′	00°53.7	13.3′	60.9′
18	89°16.0	N05°51.6	88°45.7	8.2′	N01°07.0	13.2′	60.9′
19	104°16.2	52.6	103°12.9	8.1′	01°20.2	13.3′	60.9′
20	119°16.4	53.5	117°40.0	8.1′	01°33.5	13.3′	60.9′
21	134°16.6	·· 54.5	132°07.1	8.1′	01°46.8	13.3′	61.0′
22	149°16.8	55.4	146°34.2	8.1′	02°00.1	13.2′	61.0′
23	164°16.9	56.4	161°01.2	8.0′	02°13.3	13.3′	61.0′
	SD = 16.0′	d = 1.0′		SD = 16.5′			

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	179°17.1	N05°57.3	175°28.3	8.0′	N02°26.6	13.2′	61.0′
1	194°17.3	58.3	189°55.3	8.0′	02°39.8	13.3′	61.0′
2	209°17.5	05°59.2	204°22.3	8.0′	02°53.1	13.2′	61.0′
3	224°17.7	06°00.2	218°49.3	7.9′	03°06.3	13.2′	61.0′
4	239°17.8	01.1	233°16.2	7.9′	03°19.5	13.2′	61.0′
5	254°18.0	02.1	247°43.2	7.9′	03°32.7	13.1′	61.0′
6	269°18.2	N06°03.0	262°10.0	7.9′	N03°45.8	13.2′	61.0′
7	284°18.4	04.0	276°36.9	7.8′	03°59.0	13.1′	61.0′
8	299°18.6	04.9	291°03.8	7.8′	04°12.1	13.1′	61.1′
9	314°18.7	·· 05.9	305°30.6	7.8′	04°25.2	13.0′	61.1′
10	329°18.9	06.8	319°57.4	7.8′	04°38.2	13.1′	61.1′
11	344°19.1	07.8	334°24.2	7.7′	04°51.3	13.0′	61.1′
12	359°19.3	N06°08.7	348°50.9	7.7′	N05°04.3	13.0′	61.1′
13	14°19.5	09.7	3°17.6	7.7′	05°17.3	12.9′	61.1′
14	29°19.6	10.6	17°44.3	7.7′	05°30.2	12.9′	61.1′
15	44°19.8	·· 11.6	32°11.0	7.6′	05°43.1	12.9′	61.1′
16	59°20.0	12.5	46°37.6	7.6′	05°56.0	12.9′	61.1′
17	74°20.2	13.5	61°04.2	7.6′	06°08.9	12.8′	61.1′
18	89°20.4	N06°14.4	75°30.8	7.5′	N06°21.7	12.7′	61.1′
19	104°20.5	15.4	89°57.3	7.5′	06°34.4	12.7′	61.1′
20	119°20.7	16.3	104°23.8	7.5′	06°47.1	12.7′	61.1′
21	134°20.9	·· 17.3	118°50.3	7.5′	06°59.8	12.6′	61.1′
22	149°21.1	18.2	133°16.8	7.4′	07°12.4	12.6′	61.1′
23	164°21.2	19.2	147°43.2	7.4′	07°25.0	12.5′	61.1′
	SD = 16.0′	d = 1.0′		SD = 16.6′			

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	179°21.4	N06°20.1	162°09.6	7.4′	N07°37.5	12.5′	61.1′
1	194°21.6	21.0	176°35.9	7.3′	07°50.0	12.4′	61.1′
2	209°21.8	22.0	191°02.3	7.3′	08°02.4	12.4′	61.1′
3	224°22.0	·· 22.9	205°28.6	7.3′	08°14.8	12.3′	61.1′
4	239°22.1	23.9	219°54.9	7.2′	08°27.1	12.3′	61.1′
5	254°22.3	24.8	234°21.1	7.2′	08°39.4	12.2′	61.1′
6	269°22.5	N06°25.8	248°47.3	7.2′	N08°51.6	12.1′	61.0′
7	284°22.7	26.7	263°13.5	7.2′	09°03.7	12.1′	61.0′
8	299°22.9	27.7	277°39.7	7.1′	09°15.8	12.0′	61.0′
9	314°23.0	·· 28.6	292°05.8	7.1′	09°27.8	12.0′	61.0′
10	329°23.2	29.6	306°31.9	7.1′	09°39.8	11.8′	61.0′
11	344°23.4	30.5	320°57.9	7.0′	09°51.6	11.8′	61.0′
12	359°23.6	N06°31.4	335°23.9	7.0′	N10°03.4	11.8′	61.0′
13	14°23.7	32.4	349°49.9	7.0′	10°15.2	11.6′	61.0′
14	29°23.9	33.3	4°15.9	6.9′	10°26.8	11.6′	61.0′
15	44°24.1	·· 34.3	18°41.8	6.9′	10°38.4	11.6′	61.0′
16	59°24.3	35.2	33°07.7	6.9′	10°50.0	11.4′	61.0′
17	74°24.4	36.2	47°33.6	6.8′	11°01.4	11.4′	60.9′
18	89°24.6	N06°37.1	61°59.5	6.8′	N11°12.8	11.3′	60.9′
19	104°24.8	38.0	76°25.3	6.8′	11°24.1	11.2′	60.9′
20	119°25.0	39.0	90°51.0	6.7′	11°35.3	11.1′	60.9′
21	134°25.2	·· 39.9	105°16.8	6.7′	11°46.4	11.0′	60.9′
22	149°25.3	40.9	119°42.5	6.7′	11°57.4	11.0′	60.9′
23	164°25.5	41.8	134°08.2	6.7′	12°08.4	10.8′	60.9′
	SD = 16.0′	d = 0.9′		SD = 16.7′			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	00:19	03:16	04:35	19:33	20:54	////
N 70°	01:47	03:36	04:45	19:23	20:33	22:28
68°	02:23	03:52	04:53	19:15	20:17	21:48
66°	02:48	04:04	04:59	19:08	20:04	21:21
64°	03:08	04:14	05:05	19:02	19:53	21:01
62°	03:23	04:23	05:10	18:58	19:45	20:46
60°	03:35	04:30	05:14	18:53	19:37	20:33
N 58°	03:46	04:37	05:17	18:49	19:30	20:22
56°	03:55	04:42	05:21	18:46	19:25	20:13
54°	04:03	04:47	05:24	18:43	19:20	20:04
52°	04:09	04:52	05:26	18:40	19:15	19:57
50°	04:16	04:56	05:29	18:38	19:11	19:51
45°	04:28	05:04	05:34	18:33	19:03	19:38
N 40°	04:38	05:11	05:38	18:28	18:56	19:28
35°	04:46	05:16	05:42	18:24	18:50	19:20
30°	04:52	05:21	05:45	18:21	18:45	19:14
20°	05:02	05:28	05:50	18:15	18:38	19:03
N 10°	05:09	05:34	05:55	18:10	18:32	18:56
0°	05:15	05:39	05:59	18:06	18:27	18:51
S 10°	05:18	05:43	06:04	18:02	18:23	18:47
20°	05:20	05:46	06:08	17:57	18:19	18:45
30°	05:21	05:49	06:13	17:52	18:16	18:44
35°	05:21	05:50	06:16	17:49	18:14	18:44
40°	05:20	05:52	06:19	17:46	18:13	18:44
45°	05:19	05:53	06:22	17:42	18:12	18:46
S 50°	05:17	05:54	06:27	17:38	18:10	18:48
52°	05:16	05:55	06:29	17:36	18:10	18:49
54°	05:14	05:55	06:31	17:34	18:09	18:50
56°	05:13	05:56	06:33	17:31	18:09	18:51
58°	05:11	05:56	06:36	17:29	18:08	18:53
S 60°	05:08	05:57	06:38	17:26	18:07	18:55

Lat.	Moonrise Sat	Moonrise Sun	Moonrise Mon	Moonset Sat	Moonset Sun	Moonset Mon
N 72°	06:00	05:47	05:33	18:18	20:28	22:45
N 70°	05:58	05:52	05:46	18:17	20:18	22:23
68°	05:56	05:56	05:56	18:15	20:10	22:06
66°	05:54	05:59	06:05	18:14	20:03	21:52
64°	05:53	06:02	06:12	18:13	19:57	21:41
62°	05:52	06:04	06:18	18:13	19:52	21:32
60°	05:51	06:07	06:24	18:12	19:48	21:23
N 58°	05:50	06:09	06:29	18:12	19:44	21:16
56°	05:49	06:10	06:33	18:11	19:41	21:10
54°	05:48	06:12	06:37	18:11	19:38	21:05
52°	05:48	06:13	06:41	18:10	19:35	21:00
50°	05:47	06:15	06:44	18:10	19:32	20:55
45°	05:46	06:18	06:51	18:09	19:27	20:45
N 40°	05:44	06:20	06:57	18:08	19:23	20:37
35°	05:43	06:22	07:02	18:08	19:19	20:30
30°	05:43	06:24	07:07	18:07	19:15	20:24
20°	05:41	06:27	07:15	18:06	19:09	20:14
N 10°	05:40	06:30	07:22	18:05	19:04	20:04
0°	05:39	06:33	07:29	18:04	18:59	19:56
S 10°	05:38	06:36	07:36	18:04	18:55	19:47
20°	05:36	06:39	07:43	18:03	18:49	19:38
30°	05:35	06:43	07:51	18:02	18:44	19:28
35°	05:34	06:45	07:56	18:01	18:40	19:22
40°	05:33	06:47	08:02	18:00	18:36	19:15
45°	05:32	06:50	08:08	18:00	18:32	19:07
S 50°	05:31	06:53	08:16	17:59	18:27	18:58
52°	05:30	06:55	08:20	17:58	18:24	18:53
54°	05:30	06:57	08:24	17:58	18:22	18:48
56°	05:29	06:58	08:28	17:57	18:19	18:43
58°	05:28	07:00	08:33	17:56	18:16	18:37
S 60°	05:27	07:03	08:39	17:56	18:12	18:31

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Age 0-2 1-2%
04	03:09	03:00	12:03	11:52	–:–	
05	02:52	02:43	12:03	12:46	00:19	
06	02:34	02:26	12:02	13:42	01:14	

April 07, 08, 09 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	195°10.7	179°02.8	N05°32.2	180°05.3	N05°47.1	10°53.2	S00°07.7	8°59.3	N00°12.8
1	210°13.2	194°02.5	33.4	195°06.0	47.9	25°55.9	07.6	24°01.9	12.8
2	225°15.7	209°02.1	34.7	210°06.7	48.6	40°58.7	07.5	39°04.6	12.9
3	240°18.1	224°01.7	·· 35.9	225°07.4	·· 49.4	56°01.4	·· 07.4	54°07.2	·· 13.0
4	255°20.6	239°01.3	37.1	240°08.1	50.2	71°04.2	07.2	69°09.8	13.1
5	270°23.1	254°00.9	38.4	255°08.8	50.9	86°06.9	07.1	84°12.5	13.1
6	285°25.5	269°00.5	N05°39.6	270°09.5	N05°51.7	101°09.7	S00°07.0	99°15.1	N00°13.2
7	300°28.0	284°00.1	40.8	285°10.2	52.4	116°12.4	06.9	114°17.7	13.3
8	315°30.5	298°59.7	42.1	300°10.9	53.2	131°15.1	06.8	129°20.4	13.3
9	330°32.9	313°59.3	·· 43.3	315°11.6	·· 53.9	146°17.9	·· 06.6	144°23.0	·· 13.4
10	345°35.4	328°58.9	44.5	330°12.3	54.7	161°20.6	06.5	159°25.7	13.5
11	0°37.9	343°58.5	45.7	345°13.0	55.4	176°23.4	06.4	174°28.3	13.6
12	15°40.3	358°58.1	N05°47.0	0°13.7	N05°56.2	191°26.1	S00°06.3	189°30.9	N00°13.6
13	30°42.8	13°57.7	48.2	15°14.4	57.0	206°28.9	06.2	204°33.6	13.7
14	45°45.2	28°57.3	49.4	30°15.1	57.7	221°31.6	06.1	219°36.2	13.8
15	60°47.7	43°56.9	·· 50.7	45°15.8	·· 58.5	236°34.4	·· 05.9	234°38.9	·· 13.9
16	75°50.2	58°56.5	51.9	60°16.5	05°59.2	251°37.1	05.8	249°41.5	13.9
17	90°52.6	73°56.1	53.1	75°17.2	06°00.0	266°39.9	05.7	264°44.1	14.0
18	105°55.1	88°55.7	N05°54.3	90°17.9	N06°00.7	281°42.6	S00°05.6	279°46.8	N00°14.1
19	120°57.6	103°55.3	55.6	105°18.6	01.5	296°45.4	05.5	294°49.4	14.2
20	136°00.0	118°54.9	56.8	120°19.3	02.2	311°48.1	05.3	309°52.0	14.2
21	151°02.5	133°54.5	·· 58.0	135°20.0	·· 03.0	326°50.9	·· 05.2	324°54.7	·· 14.3
22	166°05.0	148°54.1	05°59.3	150°20.7	03.7	341°53.6	05.1	339°57.3	14.4
23	181°07.4	163°53.7	06°00.5	165°21.4	04.5	356°56.3	05.0	355°00.0	14.4
Mer.pass. 10:57		ν -0.4′	d 1.2′	ν 0.7′	d 0.8′	ν 2.7′	d 0.1′	ν 2.6′	d 0.1′
		m -3.87		m 1.08		m -2.46		m 0.50	

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	196°09.9	178°53.3	N06°01.7	180°22.1	N06°05.2	11°59.1	S00°04.9	10°02.6	N00°14.5
1	211°12.4	193°52.9	02.9	195°22.8	06.0	27°01.8	04.7	25°05.2	14.6
2	226°14.8	208°52.5	04.2	210°23.5	06.8	42°04.6	04.6	40°07.9	14.7
3	241°17.3	223°52.1	·· 05.4	225°24.2	·· 07.5	57°07.3	·· 04.5	55°10.5	·· 14.7
4	256°19.7	238°51.7	06.6	240°24.9	08.3	72°10.1	04.4	70°13.1	14.8
5	271°22.2	253°51.3	07.8	255°25.6	09.0	87°12.8	04.3	85°15.8	14.9
6	286°24.7	268°50.9	N06°09.1	270°26.3	N06°09.8	102°15.6	S00°04.2	100°18.4	N00°15.0
7	301°27.1	283°50.5	10.3	285°27.0	10.5	117°18.3	04.0	115°21.1	15.0
8	316°29.6	298°50.1	11.5	300°27.7	11.3	132°21.0	03.9	130°23.7	15.1
9	331°32.1	313°49.7	·· 12.7	315°28.4	·· 12.0	147°23.8	·· 03.8	145°26.3	·· 15.2
10	346°34.5	328°49.3	14.0	330°29.1	12.8	162°26.5	03.7	160°29.0	15.3
11	1°37.0	343°48.9	15.2	345°29.8	13.5	177°29.3	03.6	175°31.6	15.3
12	16°39.5	358°48.5	N06°16.4	0°30.5	N06°14.3	192°32.0	S00°03.4	190°34.2	N00°15.4
13	31°41.9	13°48.1	17.6	15°31.2	15.0	207°34.8	03.3	205°36.9	15.5
14	46°44.4	28°47.7	18.9	30°31.9	15.8	222°37.5	03.2	220°39.5	15.5
15	61°46.9	43°47.3	·· 20.1	45°32.6	·· 16.5	237°40.3	·· 03.1	235°42.1	·· 15.6
16	76°49.3	58°46.9	21.3	60°33.2	17.3	252°43.0	03.0	250°44.8	15.7
17	91°51.8	73°46.5	22.5	75°33.9	18.0	267°45.7	02.9	265°47.4	15.8
18	106°54.2	88°46.1	N06°23.8	90°34.6	N06°18.8	282°48.5	S00°02.7	280°50.1	N00°15.8
19	121°56.7	103°45.7	25.0	105°35.3	19.5	297°51.2	02.6	295°52.7	15.9
20	136°59.2	118°45.3	26.2	120°36.0	20.3	312°54.0	02.5	310°55.3	16.0
21	152°01.6	133°44.9	·· 27.4	135°36.7	·· 21.0	327°56.7	·· 02.4	325°58.0	·· 16.1
22	167°04.1	148°44.5	28.6	150°37.4	21.8	342°59.5	02.3	341°00.6	16.1
23	182°06.6	163°44.1	29.9	165°38.1	22.5	358°02.2	02.2	356°03.2	16.2
Mer.pass. 10:54		ν -0.4′	d 1.2′	ν 0.7′	d 0.8′	ν 2.7′	d 0.1′	ν 2.6′	d 0.1′
		m -3.87		m 1.09		m -2.46		m 0.51	

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	197°09.0	178°43.7	N06°31.1	180°38.8	N06°23.3	13°04.9	S00°02.0	11°05.9	N00°16.3
1	212°11.5	193°43.3	32.3	195°39.5	24.0	28°07.7	01.9	26°08.5	16.3
2	227°14.0	208°42.9	33.5	210°40.2	24.8	43°10.4	01.8	41°11.1	16.4
3	242°16.4	223°42.5	·· 34.7	225°40.9	·· 25.5	58°13.2	·· 01.7	56°13.8	·· 16.5
4	257°18.9	238°42.1	36.0	240°41.6	26.3	73°15.9	01.6	71°16.4	16.6
5	272°21.3	253°41.7	37.2	255°42.3	27.0	88°18.7	01.5	86°19.1	16.6
6	287°23.8	268°41.3	N06°38.4	270°43.0	N06°27.8	103°21.4	S00°01.3	101°21.7	N00°16.7
7	302°26.3	283°40.9	39.6	285°43.7	28.5	118°24.1	01.2	116°24.3	16.8
8	317°28.7	298°40.5	40.8	300°44.4	29.3	133°26.9	01.1	131°27.0	16.8
9	332°31.2	313°40.1	·· 42.1	315°45.1	·· 30.0	148°29.6	·· 01.0	146°29.6	·· 16.9
10	347°33.7	328°39.7	43.3	330°45.8	30.8	163°32.4	00.9	161°32.2	17.0
11	2°36.1	343°39.3	44.5	345°46.5	31.5	178°35.1	00.8	176°34.9	17.1
12	17°38.6	358°38.9	N06°45.7	0°47.2	N06°32.3	193°37.9	S00°00.6	191°37.5	N00°17.1
13	32°41.1	13°38.5	46.9	15°47.9	33.0	208°40.6	00.5	206°40.1	17.2
14	47°43.5	28°38.1	48.2	30°48.6	33.8	223°43.3	00.4	221°42.8	17.3
15	62°46.0	43°37.7	·· 49.4	45°49.3	·· 34.5	238°46.1	·· 00.3	236°45.4	·· 17.4
16	77°48.5	58°37.3	50.6	60°50.0	35.3	253°48.8	00.2	251°48.0	17.4
17	92°50.9	73°36.9	51.8	75°50.7	36.0	268°51.6	S00°00.1	266°50.7	17.5
18	107°53.4	88°36.4	N06°53.0	90°51.4	N06°36.8	283°54.3	N00°00.1	281°53.3	N00°17.6
19	122°55.8	103°36.0	54.2	105°52.1	37.5	298°57.0	00.2	296°56.0	17.6
20	137°58.3	118°35.6	55.5	120°52.8	38.3	313°59.8	00.3	311°58.6	17.7
21	153°00.8	133°35.2	·· 56.7	135°53.5	·· 39.0	329°02.5	·· 00.4	327°01.2	·· 17.8
22	168°03.2	148°34.8	57.9	150°54.2	39.8	344°05.3	00.5	342°03.9	17.9
23	183°05.7	163°34.4	59.1	165°54.9	40.5	359°08.0	00.6	357°06.5	17.9
Mer.pass. 10:50		ν -0.4′	d 1.2′	ν 0.7′	d 0.8′	ν 2.7′	d 0.1′	ν 2.6′	d 0.1′
		m -3.87		m 1.10		m -2.46		m 0.51	

Stars

	SHA	Dec
Alpheratz	358°09.3	28°59.0
Ankaa	353°40.3	-42°24.6
Schedar	350°09.1	56°25.9
Diphda	349°20.8	-18°05.6
Achernar	335°45.6	-57°20.1
Hamal	328°28.8	23°22.2
Polaris	327°06.6	89°10.7
Acamar	315°37.3	-40°23.1
Menkar	314°41.0	4°00.8
Mirfak	309°16.0	49°47.6
Aldebaran	291°17.8	16°28.2
Rigel	281°35.8	-8°13.6
Capella	281°11.0	45°58.8
Bellatrix	278°58.5	6°19.8
Elnath	278°43.8	28°35.5
Alnilam	276°11.4	-1°13.0
Betelgeuse	271°28.0	7°24.1
Canopus	264°07.2	-52°41.5
Sirius	258°55.4	-16°41.6
Adhara	255°31.8	-28°57.1
Procyon	245°25.4	5°16.3
Pollux	243°57.7	28°04.3
Avior	234°27.9	-59°27.3
Suhail	223°10.3	-43°21.7
Miaplacidus	221°44.4	-69°38.7
Alphard	218°20.0	-8°34.8
Regulus	208°09.4	12°03.5
Dubhe	194°21.1	61°51.3
Denebola	182°58.4	14°40.6
Gienah	176°17.3	-17°26.3
Acrux	173°36.2	-62°59.7
Gacrux	172°27.8	-57°00.5
Alioth	166°41.6	56°03.7
Spica	158°56.8	-11°03.8
Alkaid	153°17.7	49°24.4
Hadar	149°22.2	-60°16.9
Menkent	148°36.2	-36°16.6
Arcturus	146°17.8	19°16.7
Rigil Kent.	140°24.7	-60°45.2
Kochab	137°17.9	74°13.9
Zuben'ubi	137°32.3	-15°57.8
Alphecca	126°31.5	26°46.6
Antares	112°56.2	-26°23.4
Atria	108°19.8	-68°59.4
Sabik	102°40.5	-15°42.1
Shaula	96°55.1	-37°05.3
Rasalhague	96°29.1	12°34.3
Eltanin	90°57.4	51°29.2
Kaus Aust.	84°16.3	-34°23.5
Vega	80°55.5	38°45.7
Nunki	76°28.7	-26°19.2
Altair	62°32.2	8°48.9
Peacock	53°58.0	-56°47.6
Deneb	49°48.4	45°12.5
Enif	34°11.4	9°47.1
Al Na'ir	28°14.8	-47°03.1
Fomalhaut	15°51.3	-29°43.4
Scheat	14°17.5	27°58.6
Markab	14°03.1	15°06.0

Apr 07 Tue	SHA	Mer.pass
Venus	343°52.1	12:04
Mars	344°54.6	11:59
Jupiter	175°42.4	23:12
Saturn	173°48.5	23:20

Apr 08 Wed	SHA	Mer.pass
Venus	342°43.4	12:05
Mars	344°12.2	11:58
Jupiter	175°49.2	23:08
Saturn	173°52.7	23:16

Apr 09 Thu	SHA	Mer.pass
Venus	341°34.7	12:05
Mars	343°29.8	11:57
Jupiter	175°55.9	23:03
Saturn	173°56.8	23:12

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°25.7	N06°42.8	148°33.9	6.6′	N12°19.2	10.8′	60.9′
1	194°25.9	43.7	162°59.5	6.6′	12°30.0	10.7′	60.8′
2	209°26.0	44.6	177°25.1	6.6′	12°40.7	10.6′	60.8′
3	224°26.2	·· 45.6	191°50.6	6.5′	12°51.3	10.5′	60.8′
4	239°26.4	46.5	206°16.2	6.5′	13°01.8	10.4′	60.8′
5	254°26.6	47.5	220°41.7	6.5′	13°12.2	10.3′	60.8′
6	269°26.7	N06°48.4	235°07.2	6.5′	N13°22.5	10.3′	60.8′
7	284°26.9	49.3	249°32.6	6.4′	13°32.8	10.1′	60.7′
8	299°27.1	50.3	263°58.1	6.4′	13°42.9	10.0′	60.7′
9	314°27.3	·· 51.2	278°23.5	6.4′	13°52.9	9.9′	60.7′
10	329°27.4	52.2	292°48.8	6.3′	14°02.8	9.9′	60.7′
11	344°27.6	53.1	307°14.2	6.3′	14°12.7	9.7′	60.7′
12	359°27.8	N06°54.0	321°39.5	6.3′	N14°22.4	9.6′	60.6′
13	14°28.0	55.0	336°04.8	6.3′	14°32.0	9.5′	60.6′
14	29°28.1	55.9	350°30.0	6.2′	14°41.5	9.4′	60.6′
15	44°28.3	·· 56.9	4°55.3	6.2′	14°50.9	9.3′	60.6′
16	59°28.5	57.8	19°20.5	6.2′	15°00.2	9.2′	60.6′
17	74°28.7	58.7	33°45.7	6.2′	15°09.4	9.1′	60.5′
18	89°28.8	N06°59.7	48°10.9	6.1′	N15°18.5	9.0′	60.5′
19	104°29.0	07°00.6	62°36.0	6.1′	15°27.5	8.9′	60.5′
20	119°29.2	01.5	77°01.1	6.1′	15°36.4	8.7′	60.5′
21	134°29.4	·· 02.5	91°26.2	6.1′	15°45.1	8.7′	60.4′
22	149°29.5	03.4	105°51.3	6.1′	15°53.8	8.5′	60.4′
23	164°29.7	04.4	120°16.4	6.0′	16°02.3	8.4′	60.4′
	SD = 16.0′	d = 0.9′	SD = 16.6′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°29.9	N07°05.3	134°41.4	6.0′	N16°10.7	8.3′	60.4′
1	194°30.1	06.2	149°06.5	6.0′	16°19.0	8.2′	60.3′
2	209°30.2	07.2	163°31.5	6.0′	16°27.2	8.0′	60.3′
3	224°30.4	·· 08.1	177°56.5	6.0′	16°35.2	7.9′	60.3′
4	239°30.6	09.0	192°21.4	6.0′	16°43.1	7.9′	60.3′
5	254°30.8	10.0	206°46.4	5.9′	16°51.0	7.7′	60.2′
6	269°30.9	N07°10.9	221°11.3	5.9′	N16°58.7	7.5′	60.2′
7	284°31.1	11.8	235°36.2	5.9′	17°06.2	7.5′	60.2′
8	299°31.3	12.8	250°01.1	5.9′	17°13.7	7.3′	60.2′
9	314°31.5	·· 13.7	264°26.0	5.9′	17°21.0	7.2′	60.1′
10	329°31.6	14.6	278°50.9	5.9′	17°28.2	7.1′	60.1′
11	344°31.8	15.6	293°15.8	5.9′	17°35.3	7.0′	60.1′
12	359°32.0	N07°16.5	307°40.7	5.9′	N17°42.3	6.8′	60.0′
13	14°32.1	17.5	322°05.5	5.8′	17°49.1	6.7′	60.0′
14	29°32.3	18.4	336°30.4	5.8′	17°55.8	6.6′	60.0′
15	44°32.5	·· 19.3	350°55.2	5.8′	18°02.4	6.4′	60.0′
16	59°32.7	20.3	5°20.0	5.8′	18°08.8	6.4′	59.9′
17	74°32.8	21.2	19°44.9	5.8′	18°15.2	6.2′	59.9′
18	89°33.0	N07°22.1	34°09.7	5.8′	N18°21.4	6.0′	59.9′
19	104°33.2	23.1	48°34.5	5.8′	18°27.4	5.9′	59.8′
20	119°33.4	24.0	62°59.3	5.8′	18°33.3	5.8′	59.8′
21	134°33.5	·· 24.9	77°24.1	5.8′	18°39.1	5.7′	59.8′
22	149°33.7	25.8	91°48.9	5.8′	18°44.8	5.6′	59.7′
23	164°33.9	26.8	106°13.7	5.8′	18°50.4	5.4′	59.7′
	SD = 16.0′	d = 0.9′	SD = 16.5′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°34.0	N07°27.7	120°38.5	5.8′	N18°55.8	5.2′	59.7′
1	194°34.2	28.6	135°03.4	5.8′	19°01.0	5.2′	59.7′
2	209°34.4	29.6	149°28.2	5.8′	19°06.2	5.0′	59.6′
3	224°34.6	·· 30.5	163°53.0	5.8′	19°11.2	4.9′	59.6′
4	239°34.7	31.4	178°17.8	5.8′	19°16.1	4.7′	59.6′
5	254°34.9	32.4	192°42.6	5.8′	19°20.8	4.6′	59.5′
6	269°35.1	N07°33.3	207°07.5	5.8′	N19°25.4	4.5′	59.5′
7	284°35.2	34.2	221°32.3	5.9′	19°29.9	4.3′	59.5′
8	299°35.4	35.2	235°57.2	5.9′	19°34.2	4.2′	59.4′
9	314°35.6	·· 36.1	250°22.0	5.9′	19°38.4	4.1′	59.4′
10	329°35.8	37.0	264°46.9	5.9′	19°42.5	3.9′	59.4′
11	344°35.9	37.9	279°11.8	5.9′	19°46.4	3.8′	59.3′
12	359°36.1	N07°38.9	293°36.7	5.9′	N19°50.2	3.7′	59.3′
13	14°36.3	39.8	308°01.6	5.9′	19°53.9	3.5′	59.3′
14	29°36.4	40.7	322°26.6	6.0′	19°57.4	3.4′	59.2′
15	44°36.6	·· 41.7	336°51.5	6.0′	20°00.8	3.3′	59.2′
16	59°36.8	42.6	351°16.5	6.0′	20°04.1	3.1′	59.2′
17	74°36.9	43.5	5°41.5	6.0′	20°07.2	3.0′	59.1′
18	89°37.1	N07°44.4	20°06.5	6.0′	N20°10.2	2.9′	59.1′
19	104°37.3	45.4	34°31.5	6.1′	20°13.1	2.7′	59.1′
20	119°37.5	46.3	48°56.6	6.1′	20°15.8	2.6′	59.0′
21	134°37.6	·· 47.2	63°21.6	6.1′	20°18.4	2.4′	59.0′
22	149°37.8	48.2	77°46.7	6.1′	20°20.8	2.3′	59.0′
23	164°38.0	49.1	92°11.9	6.2′	20°23.1	2.2′	58.9′
	SD = 16.0′	d = 0.9′	SD = 16.3′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	////	02:56	04:19	19:48	21:13	////
N 70°	01:11	03:19	04:31	19:36	20:49	23:08
68°	02:01	03:37	04:40	19:26	20:30	22:10
66°	02:31	03:51	04:48	19:18	20:15	21:37
64°	02:53	04:03	04:54	19:11	20:04	21:14
62°	03:10	04:12	05:00	19:06	19:54	20:57
60°	03:24	04:21	05:05	19:01	19:45	20:42
N 58°	03:36	04:28	05:09	18:56	19:38	20:30
56°	03:46	04:34	05:13	18:52	19:31	20:20
54°	03:54	04:39	05:16	18:49	19:26	20:11
52°	04:02	04:44	05:19	18:45	19:21	20:04
50°	04:08	04:49	05:22	18:43	19:16	19:57
45°	04:22	04:58	05:28	18:36	19:07	19:43
N 40°	04:33	05:06	05:33	18:31	18:59	19:32
35°	04:42	05:12	05:38	18:27	18:52	19:23
30°	04:49	05:17	05:41	18:23	18:47	19:16
20°	05:00	05:26	05:48	18:16	18:38	19:05
N 10°	05:08	05:32	05:53	18:10	18:32	18:56
0°	05:14	05:38	05:59	18:05	18:26	18:50
S 10°	05:18	05:42	06:04	18:00	18:21	18:46
20°	05:21	05:47	06:09	17:55	18:17	18:42
30°	05:23	05:51	06:15	17:49	18:13	18:40
35°	05:23	05:53	06:18	17:45	18:11	18:40
40°	05:23	05:55	06:22	17:41	18:08	18:40
45°	05:23	05:57	06:26	17:37	18:06	18:40
S 50°	05:21	05:59	06:31	17:32	18:04	18:41
52°	05:21	06:00	06:34	17:29	18:03	18:42
54°	05:20	06:01	06:36	17:27	18:02	18:43
56°	05:19	06:02	06:39	17:24	18:01	18:44
58°	05:17	06:03	06:42	17:21	18:00	18:45
S 60°	05:16	06:04	06:46	17:17	17:59	18:47

Lat.	**Moonrise** Tue	Wed	Thu	**Moonset** Tue	Wed	Thu
N 72°	05:15	04:44	▭	·· ··	01:18	▭
N 70°	05:39	05:31	05:17	·· ··	00:32	02:49
68°	05:58	06:02	06:12	·· ··	00:02	01:54
66°	06:12	06:25	06:45	23:40	·· ··	01:21
64°	06:25	06:43	07:10	23:23	·· ··	00:57
62°	06:35	06:58	07:29	23:09	·· ··	00:38
60°	06:44	07:11	07:45	22:57	·· ··	00:23
N 58°	06:52	07:22	07:59	22:46	·· ··	00:10
56°	06:59	07:31	08:11	22:37	23:58	·· ··
54°	07:06	07:40	08:21	22:29	23:48	·· ··
52°	07:11	07:47	08:30	22:22	23:39	·· ··
50°	07:17	07:54	08:38	22:16	23:31	·· ··
45°	07:28	08:09	08:56	22:02	23:15	·· ··
N 40°	07:37	08:21	09:10	21:51	23:01	·· ··
35°	07:45	08:32	09:22	21:41	22:49	23:53
30°	07:52	08:41	09:33	21:32	22:39	23:42
20°	08:05	08:57	09:51	21:18	22:21	23:23
N 10°	08:16	09:11	10:07	21:05	22:06	23:06
0°	08:26	09:24	10:22	20:53	21:52	22:50
S 10°	08:36	09:37	10:38	20:41	21:37	22:35
20°	08:47	09:51	10:54	20:29	21:22	22:18
30°	09:00	10:08	11:12	20:14	21:05	21:59
35°	09:08	10:17	11:23	20:06	20:55	21:47
40°	09:16	10:28	11:36	19:57	20:43	21:35
45°	09:26	10:41	11:51	19:46	20:30	21:19
S 50°	09:38	10:57	12:09	19:32	20:13	21:01
52°	09:44	11:04	12:18	19:26	20:05	20:52
54°	09:50	11:12	12:27	19:19	19:57	20:42
56°	09:57	11:22	12:38	19:12	19:47	20:31
58°	10:05	11:32	12:51	19:03	19:36	20:19
S 60°	10:14	11:44	13:05	18:53	19:23	20:04

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 3-5 7-24%
07	02:17	02:09	12:02	14:40	02:11	
08	02:00	01:52	12:02	15:38	03:09	
09	01:44	01:36	12:02	16:36	04:07	

April 10, 11, 12 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	198°08.2	178°34.0	N07°00.3	180°55.6	N06°41.3	14°10.7	N00°00.8	12°09.1	N00°18.0
1	213°10.6	193°33.6	01.5	195°56.3	42.0	29°13.5	00.9	27°11.8	18.1
2	228°13.1	208°33.2	02.7	210°57.0	42.8	44°16.2	01.0	42°14.4	18.1
3	243°15.6	223°32.8	·· 04.0	225°57.7	·· 43.5	59°19.0	·· 01.1	57°17.0	·· 18.2
4	258°18.0	238°32.4	05.2	240°58.4	44.2	74°21.7	01.2	72°19.7	18.3
5	273°20.5	253°32.0	06.4	255°59.1	45.0	89°24.4	01.3	87°22.3	18.4
6	288°23.0	268°31.6	N07°07.6	270°59.7	N06°45.7	104°27.2	N00°01.4	102°24.9	N00°18.4
7	303°25.4	283°31.2	08.8	286°00.4	46.5	119°29.9	01.6	117°27.6	18.5
8	318°27.9	298°30.7	10.0	301°01.1	47.2	134°32.7	01.7	132°30.2	18.6
9	333°30.3	313°30.3	·· 11.2	316°01.8	·· 48.0	149°35.4	·· 01.8	147°32.8	·· 18.6
10	348°32.8	328°29.9	12.4	331°02.5	48.7	164°38.1	01.9	162°35.5	18.7
11	3°35.3	343°29.5	13.7	346°03.2	49.5	179°40.9	02.0	177°38.1	18.8
12	18°37.7	358°29.1	N07°14.9	1°03.9	N06°50.2	194°43.6	N00°02.1	192°40.7	N00°18.9
13	33°40.2	13°28.7	16.1	16°04.6	51.0	209°46.3	02.3	207°43.4	18.9
14	48°42.7	28°28.3	17.3	31°05.3	51.7	224°49.1	02.4	222°46.0	19.0
15	63°45.1	43°27.9	·· 18.5	46°06.0	·· 52.5	239°51.8	·· 02.5	237°48.6	·· 19.1
16	78°47.6	58°27.5	19.7	61°06.7	53.2	254°54.6	02.6	252°51.3	19.1
17	93°50.1	73°27.1	20.9	76°07.4	53.9	269°57.3	02.7	267°53.9	19.2
18	108°52.5	88°26.6	N07°22.1	91°08.1	N06°54.7	285°00.0	N00°02.8	282°56.6	N00°19.3
19	123°55.0	103°26.2	23.3	106°08.8	55.4	300°02.8	02.9	297°59.2	19.4
20	138°57.5	118°25.8	24.6	121°09.5	56.2	315°05.5	03.1	313°01.8	19.4
21	153°59.9	133°25.4	·· 25.8	136°10.2	·· 56.9	330°08.3	·· 03.2	328°04.5	·· 19.5
22	169°02.4	148°25.0	27.0	151°10.9	57.7	345°11.0	03.3	343°07.1	19.6
23	184°04.8	163°24.6	28.2	166°11.6	58.4	0°13.7	03.4	358°09.7	19.6
Mer.pass. 10:46		ν -0.4′	d 1.2′	ν 0.7′	d 0.7′	ν 2.7′	d 0.1′	ν 2.6′	d 0.1′
		m -3.87		m 1.10		m -2.45		m 0.52	

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	199°07.3	178°24.2	N07°29.4	181°12.3	N06°59.1	15°16.5	N00°03.5	13°12.4	N00°19.7
1	214°09.8	193°23.8	30.6	196°13.0	06°59.9	30°19.2	03.6	28°15.0	19.8
2	229°12.2	208°23.3	31.8	211°13.7	07°00.6	45°21.9	03.7	43°17.6	19.8
3	244°14.7	223°22.9	·· 33.0	226°14.4	·· 01.4	60°24.7	·· 03.9	58°20.3	·· 19.9
4	259°17.2	238°22.5	34.2	241°15.1	02.1	75°27.4	04.0	73°22.9	20.0
5	274°19.6	253°22.1	35.4	256°15.8	02.9	90°30.1	04.1	88°25.5	20.1
6	289°22.1	268°21.7	N07°36.6	271°16.5	N07°03.6	105°32.9	N00°04.2	103°28.2	N00°20.1
7	304°24.6	283°21.3	37.8	286°17.2	04.3	120°35.6	04.3	118°30.8	20.2
8	319°27.0	298°20.9	39.0	301°17.9	05.1	135°38.4	04.4	133°33.4	20.3
9	334°29.5	313°20.4	·· 40.2	316°18.6	·· 05.8	150°41.1	·· 04.5	148°36.1	·· 20.3
10	349°31.9	328°20.0	41.5	331°19.3	06.6	165°43.8	04.6	163°38.7	20.4
11	4°34.4	343°19.6	42.7	346°20.0	07.3	180°46.6	04.8	178°41.3	20.5
12	19°36.9	358°19.2	N07°43.9	1°20.7	N07°08.1	195°49.3	N00°04.9	193°44.0	N00°20.6
13	34°39.3	13°18.8	45.1	16°21.3	08.8	210°52.0	05.0	208°46.6	20.6
14	49°41.8	28°18.4	46.3	31°22.0	09.5	225°54.8	05.1	223°49.2	20.7
15	64°44.3	43°18.0	·· 47.5	46°22.7	·· 10.3	240°57.5	·· 05.2	238°51.9	·· 20.8
16	79°46.7	58°17.5	48.7	61°23.4	11.0	256°00.2	05.3	253°54.5	20.8
17	94°49.2	73°17.1	49.9	76°24.1	11.8	271°03.0	05.4	268°57.1	20.9
18	109°51.7	88°16.7	N07°51.1	91°24.8	N07°12.5	286°05.7	N00°05.6	283°59.8	N00°21.0
19	124°54.1	103°16.3	52.3	106°25.5	13.2	301°08.4	05.7	299°02.4	21.0
20	139°56.6	118°15.9	53.5	121°26.2	14.0	316°11.2	05.8	314°05.0	21.1
21	154°59.1	133°15.5	·· 54.7	136°26.9	·· 14.7	331°13.9	·· 05.9	329°07.7	·· 21.2
22	170°01.5	148°15.0	55.9	151°27.6	15.5	346°16.6	06.0	344°10.3	21.3
23	185°04.0	163°14.6	57.1	166°28.3	16.2	1°19.4	06.1	359°12.9	21.3
Mer.pass. 10:42		ν -0.4′	d 1.2′	ν 0.7′	d 0.7′	ν 2.7′	d 0.1′	ν 2.6′	d 0.1′
		m -3.87		m 1.11		m -2.45		m 0.52	

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	200°06.4	178°14.2	N07°58.3	181°29.0	N07°17.0	16°22.1	N00°06.2	14°15.5	N00°21.4
1	215°08.9	193°13.8	07°59.5	196°29.7	17.7	31°24.8	06.3	29°18.2	21.5
2	230°11.4	208°13.4	08°00.7	211°30.4	18.4	46°27.6	06.5	44°20.8	21.5
3	245°13.8	223°12.9	·· 01.9	226°31.1	·· 19.2	61°30.3	·· 06.6	59°23.4	·· 21.6
4	260°16.3	238°12.5	03.1	241°31.8	19.9	76°33.0	06.7	74°26.1	21.7
5	275°18.8	253°12.1	04.3	256°32.5	20.6	91°35.8	06.8	89°28.7	21.7
6	290°21.2	268°11.7	N08°05.5	271°33.2	N07°21.4	106°38.5	N00°06.9	104°31.3	N00°21.8
7	305°23.7	283°11.3	06.7	286°33.9	22.1	121°41.2	07.0	119°34.0	21.9
8	320°26.2	298°10.8	07.9	301°34.6	22.9	136°44.0	07.1	134°36.6	22.0
9	335°28.6	313°10.4	·· 09.1	316°35.3	·· 23.6	151°46.7	·· 07.2	149°39.2	·· 22.0
10	350°31.1	328°10.0	10.3	331°36.0	24.3	166°49.4	07.4	164°41.9	22.1
11	5°33.6	343°09.6	11.5	346°36.7	25.1	181°52.2	07.5	179°44.5	22.2
12	20°36.0	358°09.2	N08°12.7	1°37.4	N07°25.8	196°54.9	N00°07.6	194°47.1	N00°22.2
13	35°38.5	13°08.7	13.9	16°38.1	26.6	211°57.6	07.7	209°49.8	22.3
14	50°40.9	28°08.3	15.1	31°38.8	27.3	227°00.4	07.8	224°52.4	22.4
15	65°43.4	43°07.9	·· 16.3	46°39.4	·· 28.0	242°03.1	·· 07.9	239°55.0	·· 22.4
16	80°45.9	58°07.5	17.5	61°40.1	28.8	257°05.8	08.0	254°57.7	22.5
17	95°48.3	73°07.1	18.7	76°40.8	29.5	272°08.6	08.1	270°00.3	22.6
18	110°50.8	88°06.6	N08°19.9	91°41.5	N07°30.2	287°11.3	N00°08.2	285°02.9	N00°22.7
19	125°53.3	103°06.2	21.0	106°42.2	31.0	302°14.0	08.4	300°05.6	22.7
20	140°55.7	118°05.8	22.2	121°42.9	31.7	317°16.8	08.5	315°08.2	22.8
21	155°58.2	133°05.4	·· 23.4	136°43.6	·· 32.5	332°19.5	·· 08.6	330°10.8	·· 22.9
22	171°00.7	148°04.9	24.6	151°44.3	33.2	347°22.2	08.7	345°13.4	22.9
23	186°03.1	163°04.5	25.8	166°45.0	33.9	2°25.0	08.8	0°16.1	23.0
Mer.pass. 10:38		ν -0.4′	d 1.2′	ν 0.7′	d 0.7′	ν 2.7′	d 0.1′	ν 2.6′	d 0.1′
		m -3.87		m 1.11		m -2.45		m 0.53	

Stars

	SHA	Dec
Alpheratz	358°09.3	28°59.0
Ankaa	353°40.3	-42°24.6
Schedar	350°09.1	56°25.9
Diphda	349°20.8	-18°05.6
Achernar	335°45.6	-57°20.1
Hamal	328°28.8	23°22.2
Polaris	327°06.7	89°10.7
Acamar	315°37.3	-40°23.1
Menkar	314°41.0	4°00.8
Mirfak	309°16.0	49°47.6
Aldebaran	291°17.8	16°28.2
Rigel	281°35.8	-8°13.6
Capella	281°11.0	45°58.8
Bellatrix	278°58.5	6°19.8
Elnath	278°43.8	28°35.5
Alnilam	276°11.4	-1°13.0
Betelgeuse	271°28.0	7°24.1
Canopus	264°07.2	-52°41.5
Sirius	258°55.4	-16°41.6
Adhara	255°31.9	-28°57.1
Procyon	245°25.4	5°16.3
Pollux	243°57.7	28°04.3
Avior	234°27.9	-59°27.3
Suhail	223°10.3	-43°21.7
Miaplacidus	221°44.5	-69°38.7
Alphard	218°20.0	-8°34.8
Regulus	208°09.4	12°03.5
Dubhe	194°21.1	61°51.3
Denebola	182°58.4	14°40.6
Gienah	176°17.3	-17°26.3
Acrux	173°36.2	-62°59.8
Gacrux	172°27.8	-57°00.5
Alioth	166°41.6	56°03.8
Spica	158°56.8	-11°03.8
Alkaid	153°17.7	49°24.4
Hadar	149°22.2	-60°16.9
Menkent	148°36.2	-36°16.6
Arcturus	146°17.8	19°16.8
Rigil Kent.	140°24.7	-60°45.2
Kochab	137°17.9	74°13.9
Zuben'ubi	137°32.3	-15°57.8
Alphecca	126°31.5	26°46.6
Antares	112°56.1	-26°23.4
Atria	108°19.8	-68°59.4
Sabik	102°40.5	-15°42.1
Shaula	96°55.1	-37°05.3
Rasalhague	96°29.1	12°34.3
Eltanin	90°57.3	51°29.2
Kaus Aust.	84°16.2	-34°23.5
Vega	80°55.5	38°45.7
Nunki	76°28.6	-26°19.2
Altair	62°32.2	8°48.9
Peacock	53°57.9	-56°47.6
Deneb	49°48.3	45°12.5
Enif	34°11.4	9°47.1
Al Na'ir	28°14.8	-47°03.1
Fomalhaut	15°51.3	-29°43.4
Scheat	14°17.5	27°58.6
Markab	14°03.0	15°06.0

Apr 10 Fri	SHA	Mer.pass
Venus	340°25.8	12:06
Mars	342°47.4	11:56
Jupiter	176°02.6	22:59
Saturn	174°01.0	23:07

Apr 11 Sat	SHA	Mer.pass
Venus	339°16.9	12:07
Mars	342°05.0	11:55
Jupiter	176°09.2	22:55
Saturn	174°05.0	23:03

Apr 12 Sun	SHA	Mer.pass
Venus	338°07.8	12:07
Mars	341°22.6	11:54
Jupiter	176°15.7	22:50
Saturn	174°09.1	22:59

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°38.1	N07°50.0	106°37.0	6.2′	N20°25.3	2.0′	58.9′
1	194°38.3	50.9	121°02.2	6.2′	20°27.3	2.0′	58.9′
2	209°38.5	51.9	135°27.4	6.2′	20°29.3	1.7′	58.8′
3	224°38.6	·· 52.8	149°52.7	6.3′	20°31.0	1.7′	58.8′
4	239°38.8	53.7	164°17.9	6.3′	20°32.7	1.5′	58.7′
5	254°39.0	54.6	178°43.2	6.3′	20°34.2	1.4′	58.7′
6	269°39.2	N07°55.6	193°08.6	6.4′	N20°35.6	1.2′	58.7′
7	284°39.3	56.5	207°34.0	6.4′	20°36.8	1.1′	58.6′
8	299°39.5	57.4	221°59.4	6.4′	20°37.9	1.0′	58.6′
9	314°39.7	·· 58.3	236°24.8	6.5′	20°38.9	0.8′	58.6′
10	329°39.8	07°59.3	250°50.3	6.5′	20°39.7	0.7′	58.5′
11	344°40.0	08°00.2	265°15.8	6.6′	20°40.4	0.6′	58.5′
12	359°40.2	N08°01.1	279°41.4	6.6′	N20°41.0	0.4′	58.5′
13	14°40.3	02.0	294°07.0	6.6′	20°41.4	0.4′	58.4′
14	29°40.5	02.9	308°32.6	6.7′	20°41.8	0.1′	58.4′
15	44°40.7	·· 03.9	322°58.3	6.7′	20°41.9	0.1′	58.4′
16	59°40.8	04.8	337°24.1	6.8′	20°42.0	0.1′	58.3′
17	74°41.0	05.7	351°49.8	6.8′	20°41.9	0.2′	58.3′
18	89°41.2	N08°06.6	6°15.7	6.9′	N20°41.7	0.3′	58.3′
19	104°41.3	07.6	20°41.5	6.9′	20°41.4	0.5′	58.2′
20	119°41.5	08.5	35°07.4	7.0′	20°40.9	0.6′	58.2′
21	134°41.7	·· 09.4	49°33.4	7.0′	20°40.3	0.7′	58.2′
22	149°41.8	10.3	63°59.4	7.1′	20°39.6	0.8′	58.1′
23	164°42.0	11.2	78°25.5	7.1′	20°38.8	1.0′	58.1′
	SD = 16.0′	d = 0.9′	SD = 16.1′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°42.2	N08°12.2	92°51.6	7.2′	N20°37.8	1.1′	58.1′
1	194°42.3	13.1	107°17.8	7.2′	20°36.7	1.2′	58.0′
2	209°42.5	14.0	121°44.0	7.3′	20°35.5	1.3′	58.0′
3	224°42.7	·· 14.9	136°10.3	7.3′	20°34.2	1.5′	58.0′
4	239°42.8	15.8	150°36.6	7.4′	20°32.7	1.6′	57.9′
5	254°43.0	16.8	165°03.0	7.4′	20°31.1	1.7′	57.9′
6	269°43.2	N08°17.7	179°29.4	7.5′	N20°29.4	1.8′	57.8′
7	284°43.3	18.6	193°55.9	7.6′	20°27.6	2.0′	57.8′
8	299°43.5	19.5	208°22.5	7.6′	20°25.6	2.0′	57.8′
9	314°43.7	·· 20.4	222°49.1	7.7′	20°23.6	2.2′	57.7′
10	329°43.8	21.4	237°15.8	7.7′	20°21.4	2.3′	57.7′
11	344°44.0	22.3	251°42.5	7.8′	20°19.1	2.5′	57.7′
12	359°44.2	N08°23.2	266°09.3	7.8′	N20°16.6	2.5′	57.6′
13	14°44.3	24.1	280°36.1	7.9′	20°14.1	2.7′	57.6′
14	29°44.5	25.0	295°03.0	8.0′	20°11.4	2.8′	57.6′
15	44°44.7	·· 25.9	309°30.0	8.0′	20°08.6	2.8′	57.5′
16	59°44.8	26.9	323°57.0	8.1′	20°05.8	3.1′	57.5′
17	74°45.0	27.8	338°24.1	8.2′	20°02.7	3.1′	57.5′
18	89°45.2	N08°28.7	352°51.3	8.2′	N19°59.6	3.2′	57.4′
19	104°45.3	29.6	7°18.5	8.3′	19°56.4	3.3′	57.4′
20	119°45.5	30.5	21°45.8	8.4′	19°53.1	3.5′	57.4′
21	134°45.6	·· 31.4	36°13.2	8.4′	19°49.6	3.6′	57.3′
22	149°45.8	32.4	50°40.6	8.5′	19°46.0	3.6′	57.3′
23	164°46.0	33.3	65°08.1	8.6′	19°42.4	3.8′	57.3′
	SD = 16.0′	d = 0.9′	SD = 15.8′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°46.1	N08°34.2	79°35.6	8.6′	N19°38.6	3.9′	57.2′
1	194°46.3	35.1	94°03.3	8.7′	19°34.7	4.0′	57.2′
2	209°46.5	36.0	108°30.9	8.8′	19°30.7	4.1′	57.2′
3	224°46.6	·· 36.9	122°58.7	8.8′	19°26.6	4.2′	57.2′
4	239°46.8	37.8	137°26.5	8.9′	19°22.4	4.3′	57.1′
5	254°47.0	38.8	151°54.4	9.0′	19°18.1	4.5′	57.1′
6	269°47.1	N08°39.7	166°22.4	9.0′	N19°13.6	4.5′	57.1′
7	284°47.3	40.6	180°50.4	9.1′	19°09.1	4.6′	57.0′
8	299°47.4	41.5	195°18.5	9.2′	19°04.5	4.7′	57.0′
9	314°47.6	·· 42.4	209°46.7	9.2′	18°59.8	4.9′	57.0′
10	329°47.8	43.3	224°14.9	9.3′	18°54.9	4.9′	56.9′
11	344°47.9	44.2	238°43.2	9.4′	18°50.0	5.0′	56.9′
12	359°48.1	N08°45.1	253°11.6	9.4′	N18°45.0	5.1′	56.9′
13	14°48.3	46.0	267°40.0	9.5′	18°39.9	5.2′	56.8′
14	29°48.4	47.0	282°08.5	9.6′	18°34.7	5.3′	56.8′
15	44°48.6	·· 47.9	296°37.1	9.7′	18°29.4	5.4′	56.8′
16	59°48.7	48.8	311°05.8	9.7′	18°24.0	5.5′	56.7′
17	74°48.9	49.7	325°34.5	9.8′	18°18.5	5.6′	56.7′
18	89°49.1	N08°50.6	340°03.3	9.9′	N18°12.9	5.7′	56.7′
19	104°49.2	51.5	354°32.2	9.9′	18°07.2	5.8′	56.7′
20	119°49.4	52.4	9°01.1	10.0′	18°01.4	5.9′	56.6′
21	134°49.6	·· 53.3	23°30.1	10.1′	17°55.5	5.9′	56.6′
22	149°49.7	54.2	37°59.2	10.1′	17°49.6	6.1′	56.6′
23	164°49.9	55.1	52°28.3	10.2′	17°43.5	6.1′	56.5′
	SD = 15.9′	d = 0.9′	SD = 15.6′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	////	02:33	04:03	20:03	21:35	////
N 70°	////	03:01	04:16	19:49	21:05	////
68°	01:34	03:22	04:27	19:38	20:44	22:37
66°	02:12	03:38	04:36	19:28	20:27	21:56
64°	02:38	03:51	04:44	19:20	20:14	21:29
62°	02:57	04:02	04:50	19:14	20:03	21:08
60°	03:12	04:11	04:56	19:08	19:53	20:52
N 58°	03:25	04:19	05:01	19:03	19:45	20:39
56°	03:36	04:26	05:05	18:58	19:38	20:28
54°	03:46	04:32	05:09	18:54	19:32	20:18
52°	03:54	04:37	05:13	18:51	19:26	20:10
50°	04:01	04:42	05:16	18:47	19:21	20:02
45°	04:16	04:53	05:23	18:40	19:11	19:47
N 40°	04:28	05:01	05:29	18:34	19:02	19:35
35°	04:37	05:08	05:34	18:29	18:55	19:26
30°	04:45	05:14	05:38	18:25	18:49	19:18
20°	04:57	05:23	05:45	18:17	18:39	19:06
N 10°	05:06	05:31	05:52	18:10	18:32	18:56
0°	05:13	05:37	05:58	18:04	18:25	18:50
S 10°	05:18	05:42	06:04	17:58	18:20	18:44
20°	05:22	05:48	06:10	17:52	18:14	18:40
30°	05:25	05:52	06:17	17:45	18:09	18:37
35°	05:26	05:55	06:20	17:41	18:07	18:36
40°	05:26	05:58	06:25	17:37	18:04	18:35
45°	05:26	06:00	06:30	17:32	18:01	18:35
S 50°	05:26	06:03	06:36	17:25	17:58	18:35
52°	05:26	06:05	06:39	17:23	17:57	18:36
54°	05:25	06:06	06:42	17:20	17:55	18:36
56°	05:24	06:07	06:45	17:16	17:54	18:37
58°	05:24	06:09	06:49	17:12	17:52	18:37
S 60°	05:22	06:11	06:53	17:08	17:50	18:38

Lat.	**Moonrise** Fri	Sat	Sun	**Moonset** Fri	Sat	Sun
N 72°						
N 70°			08:18			05:43
68°	06:39	07:41	09:10	03:29	04:26	04:50
66°	07:23	08:23	09:43	02:46	03:44	04:17
64°	07:52	08:52	10:06	02:17	03:15	03:53
62°	08:14	09:14	10:25	01:55	02:53	03:34
60°	08:32	09:31	10:41	01:37	02:35	03:18
N 58°	08:47	09:46	10:54	01:22	02:20	03:05
56°	09:00	09:59	11:05	01:09	02:07	02:53
54°	09:11	10:10	11:15	00:58	01:56	02:43
52°	09:21	10:19	11:24	00:48	01:46	02:34
50°	09:30	10:28	11:31	00:39	01:38	02:26
45°	09:49	10:47	11:48	00:21	01:19	02:08
N 40°	10:04	11:02	12:02	00:06	01:04	01:54
35°	10:17	11:14	12:13	·· ··	00:51	01:42
30°	10:28	11:25	12:24	·· ··	00:40	01:32
20°	10:48	11:44	12:41	·· ··	00:20	01:13
N 10°	11:04	12:01	12:56	·· ··	00:03	00:58
0°	11:20	12:17	13:10	23:48	·· ··	00:43
S 10°	11:36	12:32	13:24	23:32	·· ··	00:28
20°	11:53	12:49	13:39	23:15	·· ··	00:12
30°	12:13	13:08	13:57	22:55	23:53	·· ··
35°	12:24	13:19	14:07	22:44	23:42	·· ··
40°	12:37	13:31	14:18	22:31	23:30	·· ··
45°	12:53	13:47	14:32	22:15	23:15	·· ··
S 50°	13:12	14:05	14:48	21:56	22:57	·· ··
52°	13:21	14:14	14:56	21:47	22:49	23:55
54°	13:31	14:23	15:04	21:37	22:39	23:47
56°	13:43	14:34	15:14	21:25	22:29	23:38
58°	13:56	14:47	15:25	21:12	22:16	23:27
S 60°	14:11	15:01	15:37	20:57	22:02	23:15

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 6-8 34-56%
10	01:27	01:19	12:01	17:34	05:05	
11	01:11	01:03	12:01	18:30	06:02	
12	00:55	00:48	12:01	19:23	06:57	

April 13, 14, 15 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	201°05.6	178°04.1	N08°27.0	181°45.7	N07°34.7	17°27.7	N00°08.9	15°18.7	N00°23.1
1	216°08.1	193°03.7	28.2	196°46.4	35.4	32°30.4	09.0	30°21.3	23.1
2	231°10.5	208°03.2	29.4	211°47.1	36.1	47°33.1	09.1	45°24.0	23.2
3	246°13.0	223°02.8	·· 30.6	226°47.8	·· 36.9	62°35.9	·· 09.2	60°26.6	·· 23.3
4	261°15.4	238°02.4	31.8	241°48.5	37.6	77°38.6	09.4	75°29.2	23.3
5	276°17.9	253°02.0	33.0	256°49.2	38.3	92°41.3	09.5	90°31.9	23.4
6	291°20.4	268°01.5	N08°34.2	271°49.9	N07°39.1	107°44.1	N00°09.6	105°34.5	N00°23.5
7	306°22.8	283°01.1	35.4	286°50.6	39.8	122°46.8	09.7	120°37.1	23.6
8	321°25.3	298°00.7	36.6	301°51.3	40.6	137°49.5	09.8	135°39.8	23.6
9	336°27.8	313°00.3	·· 37.7	316°52.0	·· 41.3	152°52.3	·· 09.9	150°42.4	·· 23.7
10	351°30.2	327°59.8	38.9	331°52.7	42.0	167°55.0	10.0	165°45.0	23.8
11	6°32.7	342°59.4	40.1	346°53.4	42.8	182°57.7	10.1	180°47.6	23.8
12	21°35.2	357°59.0	N08°41.3	1°54.1	N07°43.5	198°00.4	N00°10.2	195°50.3	N00°23.9
13	36°37.6	12°58.6	42.5	16°54.8	44.2	213°03.2	10.3	210°52.9	24.0
14	51°40.1	27°58.1	43.7	31°55.4	45.0	228°05.9	10.5	225°55.5	24.0
15	66°42.5	42°57.7	·· 44.9	46°56.1	·· 45.7	243°08.6	·· 10.6	240°58.2	·· 24.1
16	81°45.0	57°57.3	46.1	61°56.8	46.4	258°11.4	10.7	256°00.8	24.2
17	96°47.5	72°56.9	47.2	76°57.5	47.2	273°14.1	10.8	271°03.4	24.2
18	111°49.9	87°56.4	N08°48.4	91°58.2	N07°47.9	288°16.8	N00°10.9	286°06.1	N00°24.3
19	126°52.4	102°56.0	49.6	106°58.9	48.6	303°19.5	11.0	301°08.7	24.4
20	141°54.9	117°55.6	50.8	121°59.6	49.4	318°22.3	11.1	316°11.3	24.4
21	156°57.3	132°55.1	·· 52.0	137°00.3	·· 50.1	333°25.0	·· 11.2	331°13.9	·· 24.5
22	171°59.8	147°54.7	53.2	152°01.0	50.8	348°27.7	11.3	346°16.6	24.6
23	187°02.3	162°54.3	54.4	167°01.7	51.6	3°30.4	11.4	1°19.2	24.7
Mer.pass. 10:34		ν -0.4′	d 1.2′	m -3.87	ν 0.7′	d 0.7′	m 1.12	ν 2.7′	d 0.1′ m -2.45	ν 2.6′	d 0.1′ m 0.53

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	202°04.7	177°53.8	N08°55.6	182°02.4	N07°52.3	18°33.2	N00°11.5	16°21.8	N00°24.7
1	217°07.2	192°53.4	56.7	197°03.1	53.0	33°35.9	11.7	31°24.5	24.8
2	232°09.7	207°53.0	57.9	212°03.8	53.8	48°38.6	11.8	46°27.1	24.9
3	247°12.1	222°52.6	08°59.1	227°04.5	·· 54.5	63°41.4	·· 11.9	61°29.7	·· 24.9
4	262°14.6	237°52.1	09°00.3	242°05.2	55.2	78°44.1	12.0	76°32.3	25.0
5	277°17.0	252°51.7	01.5	257°05.9	56.0	93°46.8	12.1	91°35.0	25.1
6	292°19.5	267°51.3	N09°02.7	272°06.6	N07°56.7	108°49.5	N00°12.2	106°37.6	N00°25.1
7	307°22.0	282°50.8	03.8	287°07.3	57.4	123°52.3	12.3	121°40.2	25.2
8	322°24.4	297°50.4	05.0	302°08.0	58.1	138°55.0	12.4	136°42.9	25.3
9	337°26.9	312°50.0	·· 06.2	317°08.7	·· 58.9	153°57.7	·· 12.5	151°45.5	·· 25.3
10	352°29.4	327°49.5	07.4	332°09.3	07°59.6	169°00.4	12.6	166°48.1	25.4
11	7°31.8	342°49.1	08.6	347°10.0	08°00.3	184°03.2	12.7	181°50.8	25.5
12	22°34.3	357°48.7	N09°09.7	2°10.7	N08°01.1	199°05.9	N00°12.8	196°53.4	N00°25.5
13	37°36.8	12°48.2	10.9	17°11.4	01.8	214°08.6	13.0	211°56.0	25.6
14	52°39.2	27°47.8	12.1	32°12.1	02.5	229°11.3	13.1	226°58.6	25.7
15	67°41.7	42°47.4	·· 13.3	47°12.8	·· 03.3	244°14.1	·· 13.2	242°01.3	·· 25.7
16	82°44.1	57°46.9	14.5	62°13.5	04.0	259°16.8	13.3	257°03.9	25.8
17	97°46.6	72°46.5	15.6	77°14.2	04.7	274°19.5	13.4	272°06.5	25.9
18	112°49.1	87°46.1	N09°16.8	92°14.9	N08°05.5	289°22.2	N00°13.5	287°09.1	N00°25.9
19	127°51.5	102°45.6	18.0	107°15.6	06.2	304°25.0	13.6	302°11.8	26.0
20	142°54.0	117°45.2	19.2	122°16.3	06.9	319°27.7	13.7	317°14.4	26.1
21	157°56.5	132°44.7	·· 20.3	137°17.0	·· 07.6	334°30.4	·· 13.8	332°17.0	·· 26.1
22	172°58.9	147°44.3	21.5	152°17.7	08.4	349°33.1	13.9	347°19.7	26.2
23	188°01.4	162°43.9	22.7	167°18.4	09.1	4°35.9	14.0	2°22.3	26.3
Mer.pass. 10:30		ν -0.4′	d 1.2′	m -3.87	ν 0.7′	d 0.7′	m 1.12	ν 2.7′	d 0.1′ m -2.44	ν 2.6′	d 0.1′ m 0.54

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	203°03.9	177°43.4	N09°23.9	182°19.1	N08°09.8	19°38.6	N00°14.1	17°24.9	N00°26.3
1	218°06.3	192°43.0	25.1	197°19.8	10.6	34°41.3	14.2	32°27.5	26.4
2	233°08.8	207°42.6	26.2	212°20.5	11.3	49°44.0	14.4	47°30.2	26.5
3	248°11.3	222°42.1	·· 27.4	227°21.2	·· 12.0	64°46.7	·· 14.5	62°32.8	·· 26.5
4	263°13.7	237°41.7	28.6	242°21.8	12.7	79°49.5	14.6	77°35.4	26.6
5	278°16.2	252°41.2	29.8	257°22.5	13.5	94°52.2	14.7	92°38.1	26.7
6	293°18.6	267°40.8	N09°30.9	272°23.2	N08°14.2	109°54.9	N00°14.8	107°40.7	N00°26.8
7	308°21.1	282°40.4	32.1	287°23.9	14.9	124°57.6	14.9	122°43.3	26.8
8	323°23.6	297°39.9	33.3	302°24.6	15.6	140°00.4	15.0	137°45.9	26.9
9	338°26.0	312°39.5	·· 34.4	317°25.3	·· 16.4	155°03.1	·· 15.1	152°48.6	·· 27.0
10	353°28.5	327°39.1	35.6	332°26.0	17.1	170°05.8	15.2	167°51.2	27.0
11	8°31.0	342°38.6	36.8	347°26.7	17.8	185°08.5	15.3	182°53.8	27.1
12	23°33.4	357°38.2	N09°38.0	2°27.4	N08°18.6	200°11.2	N00°15.4	197°56.4	N00°27.2
13	38°35.9	12°37.7	39.1	17°28.1	19.3	215°14.0	15.5	212°59.1	27.2
14	53°38.4	27°37.3	40.3	32°28.8	20.0	230°16.7	15.6	228°01.7	27.3
15	68°40.8	42°36.8	·· 41.5	47°29.5	·· 20.7	245°19.4	·· 15.7	243°04.3	·· 27.4
16	83°43.3	57°36.4	42.6	62°30.2	21.5	260°22.1	15.8	258°07.0	27.4
17	98°45.8	72°36.0	43.8	77°30.9	22.2	275°24.8	15.9	273°09.6	27.5
18	113°48.2	87°35.5	N09°45.0	92°31.6	N08°22.9	290°27.6	N00°16.1	288°12.2	N00°27.6
19	128°50.7	102°35.1	46.1	107°32.3	23.6	305°30.3	16.2	303°14.8	27.6
20	143°53.1	117°34.6	47.3	122°32.9	24.4	320°33.0	16.3	318°17.5	27.7
21	158°55.6	132°34.2	·· 48.5	137°33.6	·· 25.1	335°35.7	·· 16.4	333°20.1	·· 27.8
22	173°58.1	147°33.7	49.7	152°34.3	25.8	350°38.4	16.5	348°22.7	27.8
23	189°00.5	162°33.3	50.8	167°35.0	26.5	5°41.2	16.6	3°25.3	27.9
Mer.pass. 10:26		ν -0.4′	d 1.2′	m -3.87	ν 0.7′	d 0.7′	m 1.13	ν 2.7′	d 0.1′ m -2.44	ν 2.6′	d 0.1′ m 0.54

Stars

	SHA	Dec
Alpheratz	358°09.2	28°59.0
Ankaa	353°40.3	-42°24.6
Schedar	350°09.1	56°25.8
Diphda	349°20.8	-18°05.6
Achernar	335°45.6	-57°20.1
Hamal	328°28.8	23°22.2
Polaris	327°06.9	89°10.7
Acamar	315°37.3	-40°23.0
Menkar	314°41.0	4°00.8
Mirfak	309°16.0	49°47.6
Aldebaran	291°17.8	16°28.2
Rigel	281°35.8	-8°13.6
Capella	281°11.0	45°58.8
Bellatrix	278°58.5	6°19.8
Elnath	278°43.9	28°35.5
Alnilam	276°11.4	-1°13.0
Betelgeuse	271°28.0	7°24.1
Canopus	264°07.2	-52°41.5
Sirius	258°55.4	-16°41.6
Adhara	255°31.9	-28°57.1
Procyon	245°25.4	5°16.3
Pollux	243°57.7	28°04.4
Avior	234°27.9	-59°27.3
Suhail	223°10.3	-43°21.7
Miaplacidus	221°44.5	-69°38.7
Alphard	218°20.0	-8°34.8
Regulus	208°09.4	12°03.5
Dubhe	194°21.1	61°51.3
Denebola	182°58.4	14°40.6
Gienah	176°17.3	-17°26.3
Acrux	173°36.2	-62°59.8
Gacrux	172°27.8	-57°00.6
Alioth	166°41.6	56°03.8
Spica	158°56.8	-11°03.8
Alkaid	153°17.7	49°24.4
Hadar	149°22.2	-60°16.9
Menkent	148°36.2	-36°16.7
Arcturus	146°17.8	19°16.8
Rigil Kent.	140°24.6	-60°45.3
Kochab	137°17.9	74°13.9
Zuben'ubi	137°32.3	-15°57.8
Alphecca	126°31.5	26°46.6
Antares	112°56.1	-26°23.4
Atria	108°19.7	-68°59.4
Sabik	102°40.5	-15°42.1
Shaula	96°55.0	-37°05.3
Rasalhague	96°29.1	12°34.3
Eltanin	90°57.3	51°29.2
Kaus Aust.	84°16.2	-34°23.5
Vega	80°55.4	38°45.7
Nunki	76°28.6	-26°19.2
Altair	62°32.2	8°48.9
Peacock	53°57.9	-56°47.6
Deneb	49°48.3	45°12.5
Enif	34°11.4	9°47.1
Al Na'ir	28°14.7	-47°03.1
Fomalhaut	15°51.3	-29°43.4
Scheat	14°17.5	27°58.6
Markab	14°03.0	15°06.0

Apr 13 Mon	SHA	Mer.pass
Venus	336°58.5	12:08
Mars	340°40.1	11:52
Jupiter	176°22.1	22:46
Saturn	174°13.1	22:55

Apr 14 Tue	SHA	Mer.pass
Venus	335°49.1	12:09
Mars	339°57.7	11:51
Jupiter	176°28.4	22:42
Saturn	174°17.1	22:51

Apr 15 Wed	SHA	Mer.pass
Venus	334°39.6	12:09
Mars	339°15.2	11:50
Jupiter	176°34.7	22:37
Saturn	174°21.1	22:46

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Mon	**GHA**	**Dec**	**GHA**	*ν*	**Dec**	*d*	**HP**
0	179°50.0	N08°56.1	66°57.5	10.3′	N17°37.4	6.2′	56.5′
1	194°50.2	57.0	81°26.8	10.4′	17°31.2	6.3′	56.5′
2	209°50.4	57.9	95°56.2	10.4′	17°24.9	6.4′	56.5′
3	224°50.5	·· 58.8	110°25.6	10.5′	17°18.5	6.5′	56.4′
4	239°50.7	08°59.7	124°55.1	10.6′	17°12.0	6.5′	56.4′
5	254°50.8	09°00.6	139°24.7	10.6′	17°05.5	6.7′	56.4′
6	269°51.0	N09°01.5	153°54.3	10.7′	N16°58.8	6.7′	56.3′
7	284°51.2	02.4	168°24.0	10.8′	16°52.1	6.8′	56.3′
8	299°51.3	03.3	182°53.8	10.9′	16°45.3	6.9′	56.3′
9	314°51.5	·· 04.2	197°23.7	10.9′	16°38.4	6.9′	56.3′
10	329°51.6	05.1	211°53.6	11.0′	16°31.5	7.1′	56.2′
11	344°51.8	06.0	226°23.6	11.1′	16°24.4	7.1′	56.2′
12	359°52.0	N09°06.9	240°53.6	11.1′	N16°17.3	7.2′	56.2′
13	14°52.1	07.8	255°23.8	11.2′	16°10.1	7.2′	56.1′
14	29°52.3	08.7	269°54.0	11.3′	16°02.9	7.4′	56.1′
15	44°52.4	·· 09.7	284°24.2	11.3′	15°55.5	7.4′	56.1′
16	59°52.6	10.6	298°54.6	11.4′	15°48.1	7.4′	56.1′
17	74°52.7	11.5	313°25.0	11.5′	15°40.7	7.6′	56.0′
18	89°52.9	N09°12.4	327°55.4	11.5′	N15°33.1	7.6′	56.0′
19	104°53.1	13.3	342°26.0	11.6′	15°25.5	7.7′	56.0′
20	119°53.2	14.2	356°56.6	11.7′	15°17.8	7.8′	56.0′
21	134°53.4	·· 15.1	11°27.2	11.7′	15°10.0	7.8′	55.9′
22	149°53.5	16.0	25°58.0	11.8′	15°02.2	7.9′	55.9′
23	164°53.7	16.9	40°28.8	11.9′	14°54.3	8.0′	55.9′
	SD = 15.9′	*d* = 0.9′	SD = 15.4′				

Tue	**GHA**	**Dec**	**GHA**	*ν*	**Dec**	*d*	**HP**
0	179°53.9	N09°17.8	54°59.6	11.9′	N14°46.3	8.0′	55.9′
1	194°54.0	18.7	69°30.6	12.0′	14°38.3	8.1′	55.8′
2	209°54.2	19.6	84°01.5	12.1′	14°30.2	8.1′	55.8′
3	224°54.3	·· 20.5	98°32.6	12.1′	14°22.1	8.2′	55.8′
4	239°54.5	21.4	113°03.7	12.2′	14°13.9	8.3′	55.8′
5	254°54.6	22.3	127°34.9	12.2′	14°05.6	8.4′	55.7′
6	269°54.8	N09°23.2	142°06.2	12.3′	N13°57.2	8.4′	55.7′
7	284°55.0	24.1	156°37.5	12.4′	13°48.8	8.4′	55.7′
8	299°55.1	25.0	171°08.8	12.4′	13°40.4	8.5′	55.7′
9	314°55.3	·· 25.9	185°40.3	12.5′	13°31.9	8.6′	55.6′
10	329°55.4	26.8	200°11.8	12.6′	13°23.3	8.6′	55.6′
11	344°55.6	27.7	214°43.3	12.6′	13°14.7	8.7′	55.6′
12	359°55.7	N09°28.6	229°14.9	12.7′	N13°06.0	8.8′	55.6′
13	14°55.9	29.5	243°46.6	12.7′	12°57.2	8.7′	55.5′
14	29°56.0	30.4	258°18.3	12.8′	12°48.5	8.9′	55.5′
15	44°56.2	·· 31.3	272°50.1	12.9′	12°39.6	8.9′	55.5′
16	59°56.4	32.2	287°22.0	12.9′	12°30.7	8.9′	55.5′
17	74°56.5	33.1	301°53.9	13.0′	12°21.8	9.0′	55.5′
18	89°56.7	N09°34.0	316°25.9	13.0′	N12°12.8	9.1′	55.4′
19	104°56.8	34.9	330°57.9	13.1′	12°03.7	9.1′	55.4′
20	119°57.0	35.8	345°30.0	13.1′	11°54.6	9.1′	55.4′
21	134°57.1	·· 36.7	0°02.1	13.2′	11°45.5	9.2′	55.4′
22	149°57.3	37.6	14°34.3	13.2′	11°36.3	9.3′	55.3′
23	164°57.4	38.5	29°06.5	13.3′	11°27.0	9.3′	55.3′
	SD = 15.9′	*d* = 0.9′	SD = 15.2′				

Wed	**GHA**	**Dec**	**GHA**	*ν*	**Dec**	*d*	**HP**
0	179°57.6	N09°39.3	43°38.8	13.3′	N11°17.7	9.3′	55.3′
1	194°57.8	40.2	58°11.2	13.4′	11°08.4	9.4′	55.3′
2	209°57.9	41.1	72°43.6	13.5′	10°59.0	9.4′	55.3′
3	224°58.1	·· 42.0	87°16.0	13.5′	10°49.6	9.4′	55.2′
4	239°58.2	42.9	101°48.5	13.6′	10°40.2	9.5′	55.2′
5	254°58.4	43.8	116°21.1	13.6′	10°30.7	9.6′	55.2′
6	269°58.5	N09°44.7	130°53.7	13.7′	N10°21.1	9.6′	55.2′
7	284°58.7	45.6	145°26.3	13.7′	10°11.5	9.6′	55.2′
8	299°58.8	46.5	159°59.0	13.8′	10°01.9	9.6′	55.1′
9	314°59.0	·· 47.4	174°31.8	13.8′	09°52.3	9.7′	55.1′
10	329°59.1	48.3	189°04.6	13.8′	09°42.6	9.8′	55.1′
11	344°59.3	49.2	203°37.4	13.9′	09°32.8	9.7′	55.1′
12	359°59.4	N09°50.1	218°10.3	13.9′	N09°23.1	9.8′	55.1′
13	14°59.6	51.0	232°43.3	14.0′	09°13.3	9.9′	55.0′
14	29°59.7	51.9	247°16.3	14.0′	09°03.4	9.9′	55.0′
15	44°59.9	·· 52.7	261°49.3	14.1′	08°53.5	9.9′	55.0′
16	60°00.0	53.6	276°22.4	14.1′	08°43.6	9.9′	55.0′
17	75°00.2	54.5	290°55.5	14.2′	08°33.7	10.0′	55.0′
18	90°00.4	N09°55.4	305°28.6	14.2′	N08°23.7	10.0′	55.0′
19	105°00.5	56.3	320°01.8	14.2′	08°13.7	10.0′	54.9′
20	120°00.7	57.2	334°35.1	14.3′	08°03.7	10.1′	54.9′
21	135°00.8	·· 58.1	349°08.4	14.3′	07°53.6	10.1′	54.9′
22	150°01.0	59.0	3°41.7	14.4′	07°43.5	10.1′	54.9′
23	165°01.1	59.9	18°15.0	14.4′	07°33.4	10.1′	54.9′
	SD = 15.9′	*d* = 0.9′	SD = 15.1′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	////	02:08	03:46	20:19	22:00	////
N 70°	////	02:42	04:02	20:02	21:24	////
68°	00:58	03:06	04:14	19:49	20:59	23:18
66°	01:51	03:24	04:24	19:38	20:40	22:17
64°	02:21	03:39	04:33	19:30	20:24	21:44
62°	02:43	03:51	04:40	19:22	20:12	21:21
60°	03:01	04:01	04:47	19:15	20:01	21:03
N 58°	03:15	04:10	04:52	19:10	19:52	20:48
56°	03:27	04:18	04:57	19:04	19:45	20:36
54°	03:37	04:24	05:02	19:00	19:38	20:25
52°	03:46	04:30	05:06	18:56	19:32	20:16
50°	03:54	04:36	05:10	18:52	19:26	20:08
45°	04:10	04:47	05:17	18:44	19:15	19:52
N 40°	04:23	04:56	05:24	18:37	19:05	19:39
35°	04:33	05:04	05:30	18:31	18:58	19:28
30°	04:41	05:10	05:35	18:26	18:51	19:20
20°	04:54	05:21	05:43	18:18	18:40	19:07
N 10°	05:04	05:29	05:50	18:10	18:32	18:57
0°	05:12	05:36	05:57	18:04	18:25	18:49
S 10°	05:18	05:42	06:04	17:57	18:18	18:43
20°	05:23	05:48	06:11	17:50	18:12	18:38
30°	05:26	05:54	06:18	17:42	18:06	18:34
35°	05:28	05:57	06:23	17:37	18:03	18:32
40°	05:29	06:00	06:28	17:32	18:00	18:31
45°	05:30	06:04	06:34	17:26	17:56	18:30
S 50°	05:30	06:08	06:41	17:19	17:52	18:29
52°	05:30	06:09	06:44	17:16	17:50	18:29
54°	05:30	06:11	06:47	17:13	17:48	18:29
56°	05:30	06:13	06:51	17:09	17:46	18:29
58°	05:30	06:15	06:55	17:04	17:44	18:30
S 60°	05:29	06:17	07:00	16:59	17:42	18:30

Lat.	**Moonrise** Mon	Tue	Wed	**Moonset** Mon	Tue	Wed
N 72°	09:29	11:41	13:33	06:19	05:49	05:32
N 70°	10:18	12:06	13:48	05:30	05:22	05:16
68°	10:48	12:25	13:59	04:59	05:02	05:03
66°	11:11	12:41	14:09	04:35	04:46	04:52
64°	11:29	12:53	14:16	04:17	04:32	04:43
62°	11:43	13:04	14:23	04:01	04:21	04:35
60°	11:56	13:13	14:29	03:49	04:11	04:28
N 58°	12:06	13:20	14:34	03:38	04:03	04:22
56°	12:15	13:27	14:39	03:28	03:55	04:17
54°	12:24	13:33	14:43	03:19	03:48	04:12
52°	12:31	13:39	14:47	03:12	03:42	04:08
50°	12:37	13:44	14:50	03:05	03:37	04:04
45°	12:51	13:55	14:57	02:50	03:25	03:56
N 40°	13:03	14:04	15:03	02:38	03:15	03:48
35°	13:13	14:11	15:08	02:27	03:07	03:42
30°	13:21	14:18	15:13	02:18	02:59	03:37
20°	13:36	14:29	15:21	02:02	02:46	03:27
N 10°	13:49	14:39	15:28	01:48	02:35	03:19
0°	14:01	14:49	15:34	01:35	02:24	03:11
S 10°	14:13	14:58	15:41	01:22	02:13	03:03
20°	14:26	15:08	15:47	01:08	02:02	02:54
30°	14:40	15:19	15:55	00:51	01:49	02:45
35°	14:49	15:26	16:00	00:42	01:41	02:39
40°	14:58	15:33	16:05	00:31	01:32	02:32
45°	15:10	15:42	16:11	00:18	01:22	02:25
S 50°	15:23	15:52	16:18	00:02	01:09	02:16
52°	15:29	15:57	16:21	·· ··	01:03	02:11
54°	15:36	16:02	16:24	·· ··	00:57	02:07
56°	15:44	16:08	16:28	·· ··	00:49	02:01
58°	15:53	16:15	16:33	·· ··	00:41	01:56
S 60°	16:03	16:22	16:37	·· ··	00:32	01:49

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 9-11 66-83%
13	00:40	00:32	12:01	20:13	07:48	
14	00:25	00:17	12:00	21:00	08:37	
15	00:10	00:02	12:00	21:45	09:23	

April 16, 17, 18 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	204°03.0	177°32.9	N09°52.0	182°35.7	N08°27.3	20°43.9	N00°16.7	18°28.0	N00°28.0
1	219°05.5	192°32.4	53.2	197°36.4	28.0	35°46.6	16.8	33°30.6	28.0
2	234°07.9	207°32.0	54.3	212°37.1	28.7	50°49.3	16.9	48°33.2	28.1
3	249°10.4	222°31.5	·· 55.5	227°37.8	·· 29.4	65°52.0	·· 17.0	63°35.8	·· 28.2
4	264°12.9	237°31.1	56.7	242°38.5	30.2	80°54.8	17.1	78°38.5	28.2
5	279°15.3	252°30.6	57.8	257°39.2	30.9	95°57.5	17.2	93°41.1	28.3
6	294°17.8	267°30.2	N09°59.0	272°39.9	N08°31.6	111°00.2	N00°17.3	108°43.7	N00°28.4
7	309°20.2	282°29.7	10°00.1	287°40.6	32.3	126°02.9	17.4	123°46.3	28.4
8	324°22.7	297°29.3	01.3	302°41.3	33.1	141°05.6	17.5	138°49.0	28.5
9	339°25.2	312°28.9	·· 02.5	317°42.0	·· 33.8	156°08.4	·· 17.6	153°51.6	·· 28.5
10	354°27.6	327°28.4	03.6	332°42.7	34.5	171°11.1	17.7	168°54.2	28.6
11	9°30.1	342°28.0	04.8	347°43.3	35.2	186°13.8	17.8	183°56.8	28.7
12	24°32.6	357°27.5	N10°06.0	2°44.0	N08°35.9	201°16.5	N00°17.9	198°59.5	N00°28.7
13	39°35.0	12°27.1	07.1	17°44.7	36.7	216°19.2	18.1	214°02.1	28.8
14	54°37.5	27°26.6	08.3	32°45.4	37.4	231°21.9	18.2	229°04.7	28.9
15	69°40.0	42°26.2	·· 09.4	47°46.1	·· 38.1	246°24.7	·· 18.3	244°07.3	·· 28.9
16	84°42.4	57°25.7	10.6	62°46.8	38.8	261°27.4	18.4	259°10.0	29.0
17	99°44.9	72°25.3	11.8	77°47.5	39.6	276°30.1	18.5	274°12.6	29.1
18	114°47.4	87°24.8	N10°12.9	92°48.2	N08°40.3	291°32.8	N00°18.6	289°15.2	N00°29.1
19	129°49.8	102°24.4	14.1	107°48.9	41.0	306°35.5	18.7	304°17.8	29.2
20	144°52.3	117°23.9	15.2	122°49.6	41.7	321°38.2	18.8	319°20.5	29.3
21	159°54.7	132°23.5	·· 16.4	137°50.3	·· 42.4	336°41.0	·· 18.9	334°23.1	·· 29.3
22	174°57.2	147°23.0	17.6	152°51.0	43.2	351°43.7	19.0	349°25.7	29.4
23	189°59.7	162°22.6	18.7	167°51.7	43.9	6°46.4	19.1	4°28.3	29.5
Mer.pass. 10:22		ν -0.4′	d 1.2′	m -3.87	ν 0.7′	d 0.7′	m 1.13	ν 2.7′	d 0.1′ m -2.43	ν 2.6′	d 0.1′ m 0.54

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	205°02.1	177°22.1	N10°19.9	182°52.4	N08°44.6	21°49.1	N00°19.2	19°31.0	N00°29.5
1	220°04.6	192°21.7	21.0	197°53.0	45.3	36°51.8	19.3	34°33.6	29.6
2	235°07.1	207°21.2	22.2	212°53.7	46.0	51°54.5	19.4	49°36.2	29.7
3	250°09.5	222°20.8	·· 23.3	227°54.4	·· 46.8	66°57.3	·· 19.5	64°38.8	·· 29.7
4	265°12.0	237°20.3	24.5	242°55.1	47.5	82°00.0	19.6	79°41.5	29.8
5	280°14.5	252°19.8	25.6	257°55.8	48.2	97°02.7	19.7	94°44.1	29.9
6	295°16.9	267°19.4	N10°26.8	272°56.5	N08°48.9	112°05.4	N00°19.8	109°46.7	N00°29.9
7	310°19.4	282°18.9	28.0	287°57.2	49.6	127°08.1	19.9	124°49.3	30.0
8	325°21.8	297°18.5	29.1	302°57.9	50.4	142°10.8	20.0	139°52.0	30.1
9	340°24.3	312°18.0	·· 30.3	317°58.6	·· 51.1	157°13.5	·· 20.1	154°54.6	·· 30.1
10	355°26.8	327°17.6	31.4	332°59.3	51.8	172°16.3	20.2	169°57.2	30.2
11	10°29.2	342°17.1	32.6	348°00.0	52.5	187°19.0	20.3	184°59.8	30.3
12	25°31.7	357°16.7	N10°33.7	3°00.7	N08°53.2	202°21.7	N00°20.4	200°02.5	N00°30.3
13	40°34.2	12°16.2	34.9	18°01.4	54.0	217°24.4	20.5	215°05.1	30.4
14	55°36.6	27°15.8	36.0	33°02.0	54.7	232°27.1	20.6	230°07.7	30.4
15	70°39.1	42°15.3	·· 37.2	48°02.7	·· 55.4	247°29.8	·· 20.7	245°10.3	·· 30.5
16	85°41.6	57°14.8	38.3	63°03.4	56.1	262°32.5	20.8	260°12.9	30.6
17	100°44.0	72°14.4	39.5	78°04.1	56.8	277°35.2	20.9	275°15.6	30.6
18	115°46.5	87°13.9	N10°40.6	93°04.8	N08°57.5	292°38.0	N00°21.0	290°18.2	N00°30.7
19	130°49.0	102°13.5	41.8	108°05.5	58.3	307°40.7	21.1	305°20.8	30.8
20	145°51.4	117°13.0	42.9	123°06.2	59.0	322°43.4	21.2	320°23.4	30.8
21	160°53.9	132°12.6	·· 44.1	138°06.9	08°59.7	337°46.1	·· 21.3	335°26.1	·· 30.9
22	175°56.3	147°12.1	45.2	153°07.6	09°00.4	352°48.8	21.4	350°28.7	31.0
23	190°58.8	162°11.6	46.4	168°08.3	01.1	7°51.5	21.5	5°31.3	31.0
Mer.pass. 10:18		ν -0.5′	d 1.2′	m -3.87	ν 0.7′	d 0.7′	m 1.14	ν 2.7′	d 0.1′ m -2.43	ν 2.6′	d 0.1′ m 0.55

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	206°01.3	177°11.2	N10°47.5	183°09.0	N09°01.9	22°54.2	N00°21.6	20°33.9	N00°31.1
1	221°03.7	192°10.7	48.7	198°09.7	02.6	37°56.9	21.7	35°36.5	31.2
2	236°06.2	207°10.3	49.8	213°10.3	03.3	52°59.7	21.8	50°39.2	31.2
3	251°08.7	222°09.8	·· 50.9	228°11.0	·· 04.0	68°02.4	·· 21.9	65°41.8	·· 31.3
4	266°11.1	237°09.3	52.1	243°11.7	04.7	83°05.1	22.1	80°44.4	31.4
5	281°13.6	252°08.9	53.2	258°12.4	05.4	98°07.8	22.2	95°47.0	31.4
6	296°16.1	267°08.4	N10°54.4	273°13.1	N09°06.1	113°10.5	N00°22.3	110°49.7	N00°31.5
7	311°18.5	282°08.0	55.5	288°13.8	06.9	128°13.2	22.4	125°52.3	31.5
8	326°21.0	297°07.5	56.7	303°14.5	07.6	143°15.9	22.5	140°54.9	31.6
9	341°23.4	312°07.0	·· 57.8	318°15.2	·· 08.3	158°18.6	·· 22.6	155°57.5	·· 31.7
10	356°25.9	327°06.6	10°58.9	333°15.9	09.0	173°21.3	22.7	171°00.1	31.7
11	11°28.4	342°06.1	11°00.1	348°16.6	09.7	188°24.0	22.8	186°02.8	31.8
12	26°30.8	357°05.6	N11°01.2	3°17.3	N09°10.4	203°26.8	N00°22.9	201°05.4	N00°31.9
13	41°33.3	12°05.2	02.4	18°18.0	11.1	218°29.5	23.0	216°08.0	31.9
14	56°35.8	27°04.7	03.5	33°18.6	11.9	233°32.2	23.1	231°10.6	32.0
15	71°38.2	42°04.2	·· 04.7	48°19.3	·· 12.6	248°34.9	·· 23.2	246°13.3	·· 32.1
16	86°40.7	57°03.8	05.8	63°20.0	13.3	263°37.6	23.3	261°15.9	32.1
17	101°43.2	72°03.3	06.9	78°20.7	14.0	278°40.3	23.4	276°18.5	32.2
18	116°45.6	87°02.9	N11°08.1	93°21.4	N09°14.7	293°43.0	N00°23.5	291°21.1	N00°32.2
19	131°48.1	102°02.4	09.2	108°22.1	15.4	308°45.7	23.6	306°23.7	32.3
20	146°50.6	117°01.9	10.3	123°22.8	16.1	323°48.4	23.7	321°26.4	32.4
21	161°53.0	132°01.5	·· 11.5	138°23.5	·· 16.9	338°51.1	·· 23.8	336°29.0	·· 32.4
22	176°55.5	147°01.0	12.6	153°24.2	17.6	353°53.8	23.9	351°31.6	32.5
23	191°57.9	162°00.5	13.8	168°24.9	18.3	8°56.5	24.0	6°34.2	32.6
Mer.pass. 10:14		ν -0.5′	d 1.1′	m -3.87	ν 0.7′	d 0.7′	m 1.15	ν 2.7′	d 0.1′ m -2.43	ν 2.6′	d 0.1′ m 0.55

Stars

	SHA	Dec
Alpheratz	358°09.2	28°59.0
Ankaa	353°40.3	-42°24.6
Schedar	350°09.1	56°25.8
Diphda	349°20.8	-18°05.5
Achernar	335°45.6	-57°20.1
Hamal	328°28.8	23°22.2
Polaris	327°07.1	89°10.7
Acamar	315°37.3	-40°23.0
Menkar	314°41.0	4°00.8
Mirfak	309°16.0	49°47.6
Aldebaran	291°17.8	16°28.2
Rigel	281°35.8	-8°13.6
Capella	281°11.0	45°58.8
Bellatrix	278°58.5	6°19.8
Elnath	278°43.9	28°35.5
Alnilam	276°11.4	-1°13.0
Betelgeuse	271°28.0	7°24.1
Canopus	264°07.2	-52°41.5
Sirius	258°55.4	-16°41.6
Adhara	255°31.9	-28°57.1
Procyon	245°25.4	5°16.3
Pollux	243°57.7	28°04.4
Avior	234°28.0	-59°27.3
Suhail	223°10.4	-43°21.7
Miaplacidus	221°44.6	-69°38.7
Alphard	218°20.1	-8°34.8
Regulus	208°09.4	12°03.5
Dubhe	194°21.2	61°51.3
Denebola	182°58.4	14°40.6
Gienah	176°17.3	-17°26.3
Acrux	173°36.2	-62°59.8
Gacrux	172°27.8	-57°00.6
Alioth	166°41.6	56°03.8
Spica	158°56.8	-11°03.8
Alkaid	153°17.7	49°24.4
Hadar	149°22.2	-60°16.9
Menkent	148°36.2	-36°16.7
Arcturus	146°17.8	19°16.8
Rigil Kent.	140°24.6	-60°45.3
Kochab	137°17.9	74°13.9
Zuben'ubi	137°32.3	-15°57.8
Alphecca	126°31.5	26°46.6
Antares	112°56.1	-26°23.4
Atria	108°19.7	-68°59.4
Sabik	102°40.5	-15°42.1
Shaula	96°55.0	-37°05.3
Rasalhague	96°29.0	12°34.3
Eltanin	90°57.3	51°29.2
Kaus Aust.	84°16.2	-34°23.5
Vega	80°55.4	38°45.7
Nunki	76°28.6	-26°19.2
Altair	62°32.1	8°48.9
Peacock	53°57.9	-56°47.6
Deneb	49°48.3	45°12.5
Enif	34°11.3	9°47.1
Al Na'ir	28°14.7	-47°03.1
Fomalhaut	15°51.3	-29°43.4
Scheat	14°17.5	27°58.6
Markab	14°03.0	15°06.0

Apr 16 Thu	SHA	Mer.pass
Venus	333°29.9	12:10
Mars	338°32.7	11:49
Jupiter	176°40.9	22:33
Saturn	174°25.0	22:42

Apr 17 Fri	SHA	Mer.pass
Venus	332°20.0	12:11
Mars	337°50.2	11:48
Jupiter	176°47.0	22:29
Saturn	174°28.8	22:38

Apr 18 Sat	SHA	Mer.pass
Venus	331°09.9	12:12
Mars	337°07.7	11:47
Jupiter	176°53.0	22:24
Saturn	174°32.7	22:34

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h

	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°01.3	N10°00.8	32°48.4	14.4′	N07°23.3	10.2′	54.8′
1	195°01.4	01.6	47°21.9	14.5′	07°13.1	10.2′	54.8′
2	210°01.6	02.5	61°55.4	14.5′	07°02.9	10.2′	54.8′
3	225°01.7	·· 03.4	76°28.9	14.5′	06°52.7	10.2′	54.8′
4	240°01.9	04.3	91°02.4	14.6′	06°42.5	10.3′	54.8′
5	255°02.0	05.2	105°36.0	14.6′	06°32.2	10.3′	54.8′
6	270°02.2	N10°06.1	120°09.6	14.7′	N06°21.9	10.3′	54.7′
7	285°02.3	07.0	134°43.3	14.7′	06°11.6	10.3′	54.7′
8	300°02.5	07.9	149°17.0	14.7′	06°01.3	10.4′	54.7′
9	315°02.6	·· 08.7	163°50.7	14.8′	05°50.9	10.3′	54.7′
10	330°02.8	09.6	178°24.4	14.8′	05°40.6	10.4′	54.7′
11	345°02.9	10.5	192°58.2	14.8′	05°30.2	10.4′	54.7′
12	0°03.1	N10°11.4	207°32.0	14.8′	N05°19.8	10.5′	54.7′
13	15°03.2	12.3	222°05.9	14.9′	05°09.3	10.4′	54.6′
14	30°03.4	13.2	236°39.7	14.9′	04°58.9	10.5′	54.6′
15	45°03.5	·· 14.0	251°13.6	14.9′	04°48.4	10.4′	54.6′
16	60°03.6	14.9	265°47.6	15.0′	04°38.0	10.5′	54.6′
17	75°03.8	15.8	280°21.5	15.0′	04°27.5	10.5′	54.6′
18	90°03.9	N10°16.7	294°55.5	15.0′	N04°17.0	10.6′	54.6′
19	105°04.1	17.6	309°29.5	15.0′	04°06.4	10.5′	54.6′
20	120°04.2	18.5	324°03.6	15.1′	03°55.9	10.5′	54.5′
21	135°04.4	·· 19.3	338°37.6	15.1′	03°45.4	10.6′	54.5′
22	150°04.5	20.2	353°11.7	15.1′	03°34.8	10.5′	54.5′
23	165°04.7	21.1	7°45.8	15.1′	03°24.3	10.6′	54.5′
	SD = 15.9′	d = 0.9′	SD = 15.0′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°04.8	N10°22.0	22°19.9	15.2′	N03°13.7	10.6′	54.5′
1	195°05.0	22.9	36°54.1	15.2′	03°03.1	10.6′	54.5′
2	210°05.1	23.8	51°28.3	15.2′	02°52.5	10.6′	54.5′
3	225°05.3	·· 24.6	66°02.4	15.2′	02°41.9	10.6′	54.4′
4	240°05.4	25.5	80°36.7	15.2′	02°31.3	10.6′	54.4′
5	255°05.6	26.4	95°10.9	15.2′	02°20.7	10.6′	54.4′
6	270°05.7	N10°27.3	109°45.1	15.3′	N02°10.1	10.6′	54.4′
7	285°05.9	28.2	124°19.4	15.3′	01°59.5	10.6′	54.4′
8	300°06.0	29.0	138°53.7	15.3′	01°48.9	10.7′	54.4′
9	315°06.1	·· 29.9	153°28.0	15.3′	01°38.2	10.6′	54.4′
10	330°06.3	30.8	168°02.3	15.3′	01°27.6	10.6′	54.4′
11	345°06.4	31.7	182°36.6	15.3′	01°17.0	10.7′	54.3′
12	0°06.6	N10°32.5	197°11.0	15.4′	N01°06.3	10.6′	54.3′
13	15°06.7	33.4	211°45.3	15.4′	00°55.7	10.6′	54.3′
14	30°06.9	34.3	226°19.7	15.4′	00°45.1	10.7′	54.3′
15	45°07.0	·· 35.2	240°54.1	15.4′	00°34.4	10.6′	54.3′
16	60°07.2	36.1	255°28.5	15.4′	00°23.8	10.6′	54.3′
17	75°07.3	36.9	270°02.9	15.4′	00°13.2	10.7′	54.3′
18	90°07.4	N10°37.8	284°37.3	15.4′	N00°02.5	10.6′	54.3′
19	105°07.6	38.7	299°11.8	15.4′	S00°08.1	10.6′	54.3′
20	120°07.7	39.6	313°46.2	15.4′	00°18.7	10.6′	54.3′
21	135°07.9	·· 40.4	328°20.6	15.5′	00°29.3	10.6′	54.2′
22	150°08.0	41.3	342°55.1	15.5′	00°39.9	10.7′	54.2′
23	165°08.2	42.2	357°29.6	15.5′	00°50.6	10.6′	54.2′
	SD = 15.9′	d = 0.9′	SD = 14.9′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°08.3	N10°43.1	12°04.0	15.5′	S01°01.2	10.6′	54.2′
1	195°08.5	43.9	26°38.5	15.5′	01°11.8	10.5′	54.2′
2	210°08.6	44.8	41°13.0	15.5′	01°22.3	10.6′	54.2′
3	225°08.7	·· 45.7	55°47.5	15.5′	01°32.9	10.6′	54.2′
4	240°08.9	46.6	70°21.9	15.5′	01°43.5	10.6′	54.2′
5	255°09.0	47.4	84°56.4	15.5′	01°54.1	10.5′	54.2′
6	270°09.2	N10°48.3	99°30.9	15.5′	S02°04.6	10.5′	54.2′
7	285°09.3	49.2	114°05.4	15.5′	02°15.1	10.6′	54.1′
8	300°09.4	50.0	128°39.9	15.5′	02°25.7	10.5′	54.1′
9	315°09.6	·· 50.9	143°14.4	15.5′	02°36.2	10.5′	54.1′
10	330°09.7	51.8	157°48.9	15.5′	02°46.7	10.5′	54.1′
11	345°09.9	52.7	172°23.4	15.5′	02°57.2	10.5′	54.1′
12	0°10.0	N10°53.5	186°57.9	15.5′	S03°07.7	10.4′	54.1′
13	15°10.2	54.4	201°32.4	15.5′	03°18.1	10.5′	54.1′
14	30°10.3	55.3	216°06.9	15.5′	03°28.6	10.4′	54.1′
15	45°10.4	·· 56.1	230°41.4	15.5′	03°39.0	10.4′	54.1′
16	60°10.6	57.0	245°15.9	15.5′	03°49.4	10.4′	54.1′
17	75°10.7	57.9	259°50.4	15.5′	03°59.8	10.4′	54.1′
18	90°10.9	N10°58.7	274°24.8	15.5′	S04°10.2	10.3′	54.1′
19	105°11.0	10°59.6	288°59.3	15.5′	04°20.5	10.4′	54.1′
20	120°11.1	11°00.5	303°33.8	15.5′	04°30.9	10.3′	54.0′
21	135°11.3	·· 01.3	318°08.2	15.5′	04°41.2	10.3′	54.0′
22	150°11.4	02.2	332°42.7	15.4′	04°51.5	10.3′	54.0′
23	165°11.5	03.1	347°17.1	15.4′	05°01.8	10.2′	54.0′
	SD = 15.9′	d = 0.9′	SD = 14.8′				

Lat.	**Twilight** Naut.	**Twilight** Civil	**Sunrise**	**Sunset**	**Twilight** Civil	**Twilight** Naut.
N 72°	////	01:39	03:28	20:35	22:30	////
N 70°	////	02:21	03:47	20:16	21:44	////
68°	////	02:49	04:01	20:01	21:14	////
66°	01:25	03:10	04:13	19:49	20:52	22:43
64°	02:03	03:27	04:23	19:39	20:35	22:01
62°	02:29	03:40	04:31	19:30	20:21	21:34
60°	02:48	03:51	04:38	19:23	20:10	21:14
N 58°	03:04	04:01	04:44	19:16	20:00	20:57
56°	03:17	04:09	04:50	19:11	19:51	20:44
54°	03:29	04:17	04:55	19:05	19:44	20:32
52°	03:38	04:23	04:59	19:01	19:37	20:23
50°	03:47	04:29	05:03	18:57	19:31	20:14
45°	04:04	04:41	05:12	18:48	19:19	19:56
N 40°	04:18	04:51	05:20	18:40	19:08	19:42
35°	04:29	05:00	05:26	18:34	19:00	19:31
30°	04:38	05:07	05:31	18:28	18:53	19:22
20°	04:52	05:18	05:41	18:19	18:41	19:08
N 10°	05:02	05:27	05:49	18:11	18:32	18:57
0°	05:11	05:35	05:56	18:03	18:24	18:48
S 10°	05:18	05:42	06:04	17:55	18:17	18:41
20°	05:23	05:49	06:11	17:47	18:10	18:36
30°	05:28	05:56	06:20	17:39	18:03	18:31
35°	05:30	06:00	06:25	17:33	17:59	18:29
40°	05:32	06:03	06:31	17:28	17:55	18:27
45°	05:33	06:07	06:37	17:21	17:51	18:25
S 50°	05:35	06:12	06:45	17:13	17:46	18:24
52°	05:35	06:14	06:49	17:10	17:44	18:23
54°	05:35	06:16	06:53	17:06	17:42	18:23
56°	05:36	06:19	06:57	17:01	17:39	18:22
58°	05:36	06:21	07:02	16:56	17:37	18:22
S 60°	05:36	06:24	07:07	16:51	17:34	18:22

Lat.	**Moonrise** Thu	Fri	Sat	**Moonset** Thu	Fri	Sat
N 72°	15:18	16:58	18:38	05:19	05:07	04:56
N 70°	15:24	16:58	18:32	05:10	05:04	04:58
68°	15:30	16:59	18:26	05:02	05:02	05:00
66°	15:34	16:59	18:22	04:56	04:59	05:02
64°	15:38	16:59	18:19	04:51	04:58	05:04
62°	15:42	16:59	18:15	04:46	04:56	05:05
60°	15:45	16:59	18:13	04:42	04:55	05:06
N 58°	15:47	16:59	18:10	04:39	04:54	05:07
56°	15:49	16:59	18:08	04:36	04:52	05:08
54°	15:51	16:59	18:06	04:33	04:51	05:09
52°	15:53	16:59	18:05	04:30	04:51	05:10
50°	15:55	16:59	18:03	04:28	04:50	05:11
45°	15:59	16:59	18:00	04:23	04:48	05:12
N 40°	16:02	17:00	17:57	04:18	04:46	05:14
35°	16:04	17:00	17:54	04:15	04:45	05:15
30°	16:07	17:00	17:52	04:11	04:44	05:16
20°	16:11	17:00	17:48	04:05	04:42	05:18
N 10°	16:14	17:00	17:45	04:00	04:40	05:19
0°	16:18	17:00	17:42	03:55	04:38	05:20
S 10°	16:21	17:00	17:39	03:50	04:37	05:22
20°	16:25	17:01	17:36	03:45	04:35	05:23
30°	16:29	17:01	17:33	03:39	04:32	05:25
35°	16:31	17:01	17:30	03:36	04:31	05:26
40°	16:34	17:01	17:28	03:32	04:30	05:27
45°	16:37	17:01	17:26	03:27	04:28	05:28
S 50°	16:40	17:01	17:22	03:21	04:26	05:30
52°	16:42	17:02	17:21	03:19	04:25	05:31
54°	16:44	17:02	17:19	03:16	04:24	05:32
56°	16:46	17:02	17:18	03:13	04:23	05:32
58°	16:48	17:02	17:16	03:09	04:22	05:33
S 60°	16:50	17:02	17:14	03:05	04:20	05:34

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 12-14 90-98%
16	00:05	00:12	12:00	22:28	10:07	
17	00:19	00:26	12:00	23:10	10:49	
18	00:33	00:40	11:59	23:52	11:31	

April 19, 20, 21 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	207°00.4	177°00.1	N11°14.9	183°25.6	N09°19.0	23°59.2	N00°24.1	21°36.8	N00°32.6
1	222°02.9	191°59.6	16.0	198°26.2	19.7	39°02.0	24.2	36°39.5	32.7
2	237°05.3	206°59.1	17.2	213°26.9	20.4	54°04.7	24.2	51°42.1	32.8
3	252°07.8	221°58.6	·· 18.3	228°27.6	·· 21.1	69°07.4	·· 24.3	66°44.7	·· 32.8
4	267°10.3	236°58.2	19.4	243°28.3	21.8	84°10.1	24.4	81°47.3	32.9
5	282°12.7	251°57.7	20.6	258°29.0	22.6	99°12.8	24.5	96°49.9	32.9
6	297°15.2	266°57.2	N11°21.7	273°29.7	N09°23.3	114°15.5	N00°24.6	111°52.6	N00°33.0
7	312°17.7	281°56.8	22.8	288°30.4	24.0	129°18.2	24.7	126°55.2	33.1
8	327°20.1	296°56.3	24.0	303°31.1	24.7	144°20.9	24.8	141°57.8	33.1
9	342°22.6	311°55.8	·· 25.1	318°31.8	·· 25.4	159°23.6	·· 24.9	157°00.4	·· 33.2
10	357°25.1	326°55.4	26.2	333°32.5	26.1	174°26.3	25.0	172°03.0	33.3
11	12°27.5	341°54.9	27.4	348°33.1	26.8	189°29.0	25.1	187°05.7	33.3
12	27°30.0	356°54.4	N11°28.5	3°33.8	N09°27.5	204°31.7	N00°25.2	202°08.3	N00°33.4
13	42°32.4	11°53.9	29.6	18°34.5	28.2	219°34.4	25.3	217°10.9	33.4
14	57°34.9	26°53.5	30.7	33°35.2	28.9	234°37.1	25.4	232°13.5	33.5
15	72°37.4	41°53.0	·· 31.9	48°35.9	·· 29.7	249°39.8	·· 25.5	247°16.1	·· 33.6
16	87°39.8	56°52.5	33.0	63°36.6	30.4	264°42.5	25.6	262°18.8	33.6
17	102°42.3	71°52.0	34.1	78°37.3	31.1	279°45.2	25.7	277°21.4	33.7
18	117°44.8	86°51.6	N11°35.3	93°38.0	N09°31.8	294°47.9	N00°25.8	292°24.0	N00°33.8
19	132°47.2	101°51.1	36.4	108°38.7	32.5	309°50.7	25.9	307°26.6	33.8
20	147°49.7	116°50.6	37.5	123°39.4	33.2	324°53.4	26.0	322°29.2	33.9
21	162°52.2	131°50.1	·· 38.6	138°40.0	·· 33.9	339°56.1	·· 26.1	337°31.9	·· 33.9
22	177°54.6	146°49.7	39.8	153°40.7	34.6	354°58.8	26.2	352°34.5	34.0
23	192°57.1	161°49.2	40.9	168°41.4	35.3	10°01.5	26.3	7°37.1	34.1
Mer.pass. 10:10		ν -0.5′	d 1.1′	ν 0.7′	d 0.7′	ν 2.7′	d 0.1′	ν 2.6′	d 0.1′
		m -3.87		m 1.15		m -2.42		m 0.56	

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	207°59.5	176°48.7	N11°42.0	183°42.1	N09°36.0	25°04.2	N00°26.4	22°39.7	N00°34.1
1	223°02.0	191°48.2	43.1	198°42.8	36.7	40°06.9	26.5	37°42.3	34.2
2	238°04.5	206°47.8	44.3	213°43.5	37.4	55°09.6	26.6	52°44.9	34.3
3	253°06.9	221°47.3	·· 45.4	228°44.2	·· 38.2	70°12.3	·· 26.7	67°47.6	·· 34.3
4	268°09.4	236°46.8	46.5	243°44.9	38.9	85°15.0	26.8	82°50.2	34.4
5	283°11.9	251°46.3	47.6	258°45.6	39.6	100°17.7	26.9	97°52.8	34.4
6	298°14.3	266°45.9	N11°48.8	273°46.2	N09°40.3	115°20.4	N00°27.0	112°55.4	N00°34.5
7	313°16.8	281°45.4	49.9	288°46.9	41.0	130°23.1	27.1	127°58.0	34.6
8	328°19.3	296°44.9	51.0	303°47.6	41.7	145°25.8	27.2	143°00.7	34.6
9	343°21.7	311°44.4	·· 52.1	318°48.3	·· 42.4	160°28.5	·· 27.3	158°03.3	·· 34.7
10	358°24.2	326°43.9	53.2	333°49.0	43.1	175°31.2	27.4	173°05.9	34.8
11	13°26.7	341°43.5	54.4	348°49.7	43.8	190°33.9	27.5	188°08.5	34.8
12	28°29.1	356°43.0	N11°55.5	3°50.4	N09°44.5	205°36.6	N00°27.6	203°11.1	N00°34.9
13	43°31.6	11°42.5	56.6	18°51.1	45.2	220°39.3	27.7	218°13.7	34.9
14	58°34.0	26°42.0	57.7	33°51.8	45.9	235°42.0	27.8	233°16.4	35.0
15	73°36.5	41°41.5	·· 58.8	48°52.4	·· 46.6	250°44.7	·· 27.9	248°19.0	·· 35.1
16	88°39.0	56°41.1	11°59.9	63°53.1	47.3	265°47.4	27.9	263°21.6	35.1
17	103°41.4	71°40.6	12°01.1	78°53.8	48.0	280°50.1	28.0	278°24.2	35.2
18	118°43.9	86°40.1	N12°02.2	93°54.5	N09°48.7	295°52.8	N00°28.1	293°26.8	N00°35.2
19	133°46.4	101°39.6	03.3	108°55.2	49.4	310°55.5	28.2	308°29.4	35.3
20	148°48.8	116°39.1	04.4	123°55.9	50.1	325°58.2	28.3	323°32.1	35.4
21	163°51.3	131°38.6	·· 05.5	138°56.6	·· 50.9	341°00.9	·· 28.4	338°34.7	·· 35.4
22	178°53.8	146°38.2	06.6	153°57.3	51.6	356°03.6	28.5	353°37.3	35.5
23	193°56.2	161°37.7	07.7	168°58.0	52.3	11°06.3	28.6	8°39.9	35.6
Mer.pass. 10:06		ν -0.5′	d 1.1′	ν 0.7′	d 0.7′	ν 2.7′	d 0.1′	ν 2.6′	d 0.1′
		m -3.88		m 1.16		m -2.42		m 0.56	

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	208°58.7	176°37.2	N12°08.9	183°58.6	N09°53.0	26°09.0	N00°28.7	23°42.5	N00°35.6
1	224°01.1	191°36.7	10.0	198°59.3	53.7	41°11.7	28.8	38°45.1	35.7
2	239°03.6	206°36.2	11.1	214°00.0	54.4	56°14.4	28.9	53°47.8	35.7
3	254°06.1	221°35.7	·· 12.2	229°00.7	·· 55.1	71°17.1	·· 29.0	68°50.4	·· 35.8
4	269°08.5	236°35.2	13.3	244°01.4	55.8	86°19.8	29.1	83°53.0	35.9
5	284°11.0	251°34.8	14.4	259°02.1	56.5	101°22.5	29.2	98°55.6	35.9
6	299°13.5	266°34.3	N12°15.5	274°02.8	N09°57.2	116°25.2	N00°29.3	113°58.2	N00°36.0
7	314°15.9	281°33.8	16.6	289°03.5	57.9	131°27.9	29.4	129°00.8	36.0
8	329°18.4	296°33.3	17.7	304°04.2	58.6	146°30.6	29.5	144°03.5	36.1
9	344°20.9	311°32.8	·· 18.8	319°04.8	09°59.3	161°33.2	·· 29.6	159°06.1	·· 36.2
10	359°23.3	326°32.3	20.0	334°05.5	10°00.0	176°35.9	29.7	174°08.7	36.2
11	14°25.8	341°31.8	21.1	349°06.2	00.7	191°38.6	29.7	189°11.3	36.3
12	29°28.3	356°31.3	N12°22.2	4°06.9	N10°01.4	206°41.3	N00°29.8	204°13.9	N00°36.3
13	44°30.7	11°30.8	23.3	19°07.6	02.1	221°44.0	29.9	219°16.5	36.4
14	59°33.2	26°30.4	24.4	34°08.3	02.8	236°46.7	30.0	234°19.1	36.5
15	74°35.6	41°29.9	·· 25.5	49°09.0	·· 03.5	251°49.4	·· 30.1	249°21.8	·· 36.5
16	89°38.1	56°29.4	26.6	64°09.7	04.2	266°52.1	30.2	264°24.4	36.6
17	104°40.6	71°28.9	27.7	79°10.3	04.9	281°54.8	30.3	279°27.0	36.6
18	119°43.0	86°28.4	N12°28.8	94°11.0	N10°05.6	296°57.5	N00°30.4	294°29.6	N00°36.7
19	134°45.5	101°27.9	29.9	109°11.7	06.3	312°00.2	30.5	309°32.2	36.8
20	149°48.0	116°27.4	31.0	124°12.4	07.0	327°02.9	30.6	324°34.8	36.8
21	164°50.4	131°26.9	·· 32.1	139°13.1	·· 07.7	342°05.6	·· 30.7	339°37.4	·· 36.9
22	179°52.9	146°26.4	33.2	154°13.8	08.4	357°08.3	30.8	354°40.1	36.9
23	194°55.4	161°25.9	34.3	169°14.5	09.1	12°11.0	30.9	9°42.7	37.0
Mer.pass. 10:02		ν -0.5′	d 1.1′	ν 0.7′	d 0.7′	ν 2.7′	d 0.1′	ν 2.6′	d 0.1′
		m -3.88		m 1.16		m -2.41		m 0.57	

Stars

	SHA	**Dec**
Alpheratz	358°09.2	28°59.0
Ankaa	353°40.3	-42°24.6
Schedar	350°09.1	56°25.8
Diphda	349°20.8	-18°05.5
Achernar	335°45.6	-57°20.0
Hamal	328°28.8	23°22.2
Polaris	327°07.1	89°10.6
Acamar	315°37.3	-40°23.0
Menkar	314°41.0	4°00.8
Mirfak	309°16.0	49°47.6
Aldebaran	291°17.8	16°28.2
Rigel	281°35.9	-8°13.6
Capella	281°11.0	45°58.8
Bellatrix	278°58.5	6°19.8
Elnath	278°43.9	28°35.5
Alnilam	276°11.5	-1°13.0
Betelgeuse	271°28.0	7°24.1
Canopus	264°07.3	-52°41.5
Sirius	258°55.4	-16°41.6
Adhara	255°31.9	-28°57.1
Procyon	245°25.4	5°16.3
Pollux	243°57.7	28°04.4
Avior	234°28.0	-59°27.3
Suhail	223°10.4	-43°21.7
Miaplacidus	221°44.6	-69°38.7
Alphard	218°20.1	-8°34.8
Regulus	208°09.4	12°03.5
Dubhe	194°21.2	61°51.3
Denebola	182°58.4	14°40.6
Gienah	176°17.3	-17°26.3
Acrux	173°36.2	-62°59.8
Gacrux	172°27.8	-57°00.6
Alioth	166°41.6	56°03.8
Spica	158°56.8	-11°03.8
Alkaid	153°17.7	49°24.4
Hadar	149°22.2	-60°16.9
Menkent	148°36.2	-36°16.7
Arcturus	146°17.8	19°16.8
Rigil Kent.	140°24.6	-60°45.3
Kochab	137°17.9	74°14.0
Zuben'ubi	137°32.3	-15°57.9
Alphecca	126°31.5	26°46.6
Antares	112°56.1	-26°23.4
Atria	108°19.6	-68°59.4
Sabik	102°40.5	-15°42.1
Shaula	96°55.0	-37°05.3
Rasalhague	96°29.0	12°34.3
Eltanin	90°57.3	51°29.2
Kaus Aust.	84°16.2	-34°23.5
Vega	80°55.4	38°45.7
Nunki	76°28.6	-26°19.2
Altair	62°32.1	8°49.0
Peacock	53°57.8	-56°47.6
Deneb	49°48.3	45°12.5
Enif	34°11.3	9°47.1
Al Na'ir	28°14.7	-47°03.1
Fomalhaut	15°51.2	-29°43.4
Scheat	14°17.4	27°58.6
Markab	14°03.0	15°06.0

Apr 19 Sun	**SHA**	**Mer.pass**
Venus	329°59.6	12:12
Mars	336°25.1	11:46
Jupiter	176°58.8	22:20
Saturn	174°36.4	22:30

Apr 20 Mon	**SHA**	**Mer.pass**
Venus	328°49.2	12:13
Mars	335°42.6	11:45
Jupiter	177°04.6	22:16
Saturn	174°40.2	22:25

Apr 21 Tue	**SHA**	**Mer.pass**
Venus	327°38.5	12:14
Mars	335°00.0	11:44
Jupiter	177°10.3	22:11
Saturn	174°43.8	22:21

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°11.7	N11°04.0	1°51.6	15.4′	S05°12.0	10.3′	54.0′
1	195°11.8	04.8	16°26.0	15.4′	05°22.3	10.2′	54.0′
2	210°12.0	05.7	31°00.4	15.4′	05°32.5	10.2′	54.0′
3	225°12.1	·· 06.5	45°34.8	15.4′	05°42.7	10.1′	54.0′
4	240°12.2	07.4	60°09.2	15.4′	05°52.8	10.2′	54.0′
5	255°12.4	08.3	74°43.6	15.4′	06°03.0	10.1′	54.0′
6	270°12.5	N11°09.1	89°18.0	15.4′	S06°13.1	10.1′	54.0′
7	285°12.7	10.0	103°52.3	15.3′	06°23.2	10.0′	54.0′
8	300°12.8	10.9	118°26.7	15.3′	06°33.2	10.0′	54.0′
9	315°12.9	·· 11.7	133°01.0	15.3′	06°43.2	10.0′	54.0′
10	330°13.1	12.6	147°35.3	15.3′	06°53.2	10.0′	54.0′
11	345°13.2	13.5	162°09.6	15.3′	07°03.2	10.0′	54.0′
12	0°13.3	N11°14.3	176°43.9	15.3′	S07°13.2	9.9′	54.0′
13	15°13.5	15.2	191°18.2	15.3′	07°23.1	9.9′	54.0′
14	30°13.6	16.1	205°52.5	15.2′	07°33.0	9.8′	54.0′
15	45°13.8	·· 16.9	220°26.7	15.2′	07°42.8	9.8′	53.9′
16	60°13.9	17.8	235°00.9	15.2′	07°52.6	9.8′	53.9′
17	75°14.0	18.6	249°35.1	15.2′	08°02.4	9.8′	53.9′
18	90°14.2	N11°19.5	264°09.3	15.2′	S08°12.2	9.7′	53.9′
19	105°14.3	20.4	278°43.5	15.1′	08°21.9	9.7′	53.9′
20	120°14.4	21.2	293°17.6	15.1′	08°31.6	9.6′	53.9′
21	135°14.6	·· 22.1	307°51.8	15.1′	08°41.2	9.7′	53.9′
22	150°14.7	22.9	322°25.9	15.1′	08°50.9	9.5′	53.9′
23	165°14.8	23.8	337°00.0	15.1′	09°00.4	9.6′	53.9′
	SD = 15.9′	d = 0.9′	SD = 14.7′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°15.0	N11°24.7	351°34.0	15.0′	S09°10.0	9.5′	53.9′
1	195°15.1	25.5	6°08.1	15.0′	09°19.5	9.4′	53.9′
2	210°15.2	26.4	20°42.1	15.0′	09°28.9	9.5′	53.9′
3	225°15.4	·· 27.2	35°16.1	15.0′	09°38.4	9.4′	53.9′
4	240°15.5	28.1	49°50.1	15.0′	09°47.8	9.3′	53.9′
5	255°15.6	28.9	64°24.0	14.9′	09°57.1	9.3′	53.9′
6	270°15.8	N11°29.8	78°58.0	14.9′	S10°06.4	9.3′	53.9′
7	285°15.9	30.7	93°31.9	14.9′	10°15.7	9.2′	53.9′
8	300°16.0	31.5	108°05.7	14.9′	10°24.9	9.2′	53.9′
9	315°16.2	·· 32.4	122°39.6	14.8′	10°34.1	9.1′	53.9′
10	330°16.3	33.2	137°13.4	14.8′	10°43.2	9.1′	53.9′
11	345°16.4	34.1	151°47.2	14.8′	10°52.3	9.1′	53.9′
12	0°16.6	N11°34.9	166°21.0	14.7′	S11°01.4	9.0′	53.9′
13	15°16.7	35.8	180°54.7	14.7′	11°10.4	8.9′	53.9′
14	30°16.8	36.7	195°28.5	14.7′	11°19.3	8.9′	53.9′
15	45°17.0	·· 37.5	210°02.1	14.7′	11°28.2	8.9′	53.9′
16	60°17.1	38.4	224°35.8	14.6′	11°37.1	8.8′	53.9′
17	75°17.2	39.2	239°09.4	14.6′	11°45.9	8.8′	53.9′
18	90°17.4	N11°40.1	253°43.0	14.6′	S11°54.7	8.7′	53.9′
19	105°17.5	40.9	268°16.6	14.5′	12°03.4	8.7′	53.9′
20	120°17.6	41.8	282°50.2	14.5′	12°12.1	8.6′	53.9′
21	135°17.8	·· 42.6	297°23.7	14.5′	12°20.7	8.6′	53.9′
22	150°17.9	43.5	311°57.2	14.5′	12°29.3	8.5′	53.9′
23	165°18.0	44.3	326°30.6	14.4′	12°37.8	8.5′	53.9′
	SD = 15.9′	d = 0.9′	SD = 14.7′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°18.1	N11°45.2	341°04.0	14.4′	S12°46.3	8.4′	53.9′
1	195°18.3	46.0	355°37.4	14.4′	12°54.7	8.3′	53.9′
2	210°18.4	46.9	10°10.8	14.3′	13°03.0	8.3′	53.9′
3	225°18.5	·· 47.7	24°44.1	14.3′	13°11.3	8.3′	53.9′
4	240°18.7	48.6	39°17.4	14.3′	13°19.6	8.2′	53.9′
5	255°18.8	49.4	53°50.6	14.2′	13°27.8	8.1′	53.9′
6	270°18.9	N11°50.3	68°23.8	14.2′	S13°35.9	8.1′	53.9′
7	285°19.0	51.1	82°57.0	14.2′	13°44.0	8.0′	53.9′
8	300°19.2	52.0	97°30.2	14.1′	13°52.0	8.0′	53.9′
9	315°19.3	·· 52.8	112°03.3	14.1′	14°00.0	7.9′	53.9′
10	330°19.4	53.7	126°36.4	14.0′	14°07.9	7.9′	53.9′
11	345°19.6	54.5	141°09.4	14.0′	14°15.8	7.8′	53.9′
12	0°19.7	N11°55.4	155°42.4	14.0′	S14°23.6	7.7′	53.9′
13	15°19.8	56.2	170°15.4	13.9′	14°31.3	7.7′	53.9′
14	30°19.9	57.1	184°48.4	13.9′	14°39.0	7.6′	53.9′
15	45°20.1	·· 57.9	199°21.3	13.9′	14°46.6	7.5′	53.9′
16	60°20.2	58.8	213°54.1	13.8′	14°54.1	7.5′	53.9′
17	75°20.3	11°59.6	228°27.0	13.8′	15°01.6	7.5′	53.9′
18	90°20.5	N12°00.4	242°59.8	13.8′	S15°09.1	7.3′	54.0′
19	105°20.6	01.3	257°32.5	13.7′	15°16.4	7.3′	54.0′
20	120°20.7	02.1	272°05.2	13.7′	15°23.7	7.3′	54.0′
21	135°20.8	·· 03.0	286°37.9	13.6′	15°31.0	7.1′	54.0′
22	150°21.0	03.8	301°10.6	13.6′	15°38.1	7.1′	54.0′
23	165°21.1	04.7	315°43.2	13.6′	15°45.2	7.1′	54.0′
	SD = 15.9′	d = 0.9′	SD = 14.7′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	////	00:58	03:10	20:52	23:19	////
N 70°	////	01:58	03:31	20:30	22:06	////
68°	////	02:32	03:48	20:13	21:31	////
66°	00:50	02:56	04:01	19:59	21:06	23:25
64°	01:43	03:14	04:12	19:48	20:47	22:21
62°	02:14	03:29	04:21	19:38	20:31	21:48
60°	02:36	03:42	04:29	19:30	20:18	21:25
N 58°	02:53	03:52	04:36	19:23	20:08	21:07
56°	03:08	04:01	04:42	19:17	19:58	20:52
54°	03:20	04:09	04:48	19:11	19:50	20:40
52°	03:30	04:16	04:53	19:06	19:43	20:29
50°	03:40	04:23	04:57	19:01	19:36	20:20
45°	03:58	04:36	05:07	18:51	19:23	20:01
N 40°	04:13	04:47	05:15	18:43	19:12	19:46
35°	04:24	04:56	05:22	18:36	19:03	19:34
30°	04:34	05:03	05:28	18:30	18:55	19:24
20°	04:49	05:16	05:38	18:20	18:42	19:09
N 10°	05:01	05:26	05:47	18:11	18:32	18:57
0°	05:10	05:34	05:56	18:02	18:23	18:48
S 10°	05:18	05:42	06:04	17:54	18:15	18:40
20°	05:24	05:50	06:12	17:45	18:08	18:34
30°	05:30	05:58	06:22	17:35	18:00	18:28
35°	05:32	06:02	06:28	17:30	17:56	18:25
40°	05:35	06:06	06:34	17:23	17:51	18:23
45°	05:37	06:11	06:41	17:16	17:46	18:20
S 50°	05:39	06:17	06:50	17:07	17:40	18:18
52°	05:40	06:19	06:54	17:03	17:38	18:17
54°	05:40	06:22	06:58	16:59	17:35	18:16
56°	05:41	06:24	07:03	16:54	17:32	18:16
58°	05:42	06:28	07:08	16:49	17:29	18:15
S 60°	05:42	06:31	07:14	16:42	17:26	18:14

Lat.	**Moonrise** Sun	Mon	Tue	**Moonset** Sun	Mon	Tue
N 72°	20:19	22:06	·· ··	04:44	04:31	04:14
N 70°	20:06	21:42	23:24	04:52	04:46	04:39
68°	19:55	21:24	22:55	04:59	04:58	04:58
66°	19:46	21:10	22:34	05:05	05:09	05:14
64°	19:38	20:58	22:17	05:10	05:17	05:26
62°	19:32	20:48	22:03	05:14	05:25	05:37
60°	19:26	20:39	21:52	05:18	05:31	05:46
N 58°	19:21	20:32	21:42	05:22	05:37	05:55
56°	19:17	20:25	21:33	05:25	05:42	06:02
54°	19:13	20:19	21:25	05:27	05:47	06:08
52°	19:09	20:14	21:18	05:30	05:51	06:14
50°	19:06	20:09	21:12	05:32	05:54	06:19
45°	18:59	19:59	20:58	05:37	06:03	06:31
N 40°	18:54	19:51	20:47	05:41	06:09	06:40
35°	18:49	19:43	20:38	05:45	06:15	06:48
30°	18:44	19:37	20:30	05:48	06:21	06:55
20°	18:37	19:26	20:16	05:53	06:30	07:08
N 10°	18:31	19:16	20:03	05:58	06:38	07:18
0°	18:24	19:07	19:52	06:03	06:45	07:29
S 10°	18:18	18:59	19:40	06:07	06:53	07:39
20°	18:12	18:49	19:28	06:12	07:01	07:50
30°	18:05	18:38	19:14	06:17	07:10	08:02
35°	18:01	18:32	19:06	06:21	07:15	08:10
40°	17:56	18:25	18:57	06:24	07:21	08:18
45°	17:51	18:17	18:47	06:28	07:28	08:28
S 50°	17:44	18:08	18:34	06:34	07:37	08:39
52°	17:41	18:03	18:28	06:36	07:41	08:45
54°	17:38	17:58	18:22	06:38	07:45	08:51
56°	17:34	17:53	18:14	06:41	07:50	08:58
58°	17:30	17:47	18:06	06:44	07:55	09:05
S 60°	17:26	17:40	17:57	06:48	08:01	09:14

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 15-17 100-97%
19	00:47	00:53	11:59	–:–	12:13	
20	01:00	01:06	11:59	00:35	12:56	
21	01:13	01:19	11:59	01:18	13:40	

April 22, 23, 24 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	209°57.8	176°25.4	N12°35.4	184°15.2	N10°09.8	27°13.7	N00°31.0	24°45.3	N00°37.1
1	225°00.3	191°24.9	36.5	199°15.8	10.5	42°16.4	31.0	39°47.9	37.1
2	240°02.8	206°24.4	37.6	214°16.5	11.2	57°19.1	31.1	54°50.5	37.2
3	255°05.2	221°23.9	·· 38.7	229°17.2	·· 11.9	72°21.8	·· 31.2	69°53.1	·· 37.2
4	270°07.7	236°23.5	39.8	244°17.9	12.6	87°24.4	31.3	84°55.7	37.3
5	285°10.1	251°23.0	40.9	259°18.6	13.3	102°27.1	31.4	99°58.4	37.4
6	300°12.6	266°22.5	N12°42.0	274°19.3	N10°14.0	117°29.8	N00°31.5	115°01.0	N00°37.4
7	315°15.1	281°22.0	43.1	289°20.0	14.7	132°32.5	31.6	130°03.6	37.5
8	330°17.5	296°21.5	44.2	304°20.6	15.4	147°35.2	31.7	145°06.2	37.5
9	345°20.0	311°21.0	·· 45.3	319°21.3	·· 16.1	162°37.9	·· 31.8	160°08.8	·· 37.6
10	0°22.5	326°20.5	46.4	334°22.0	16.8	177°40.6	31.9	175°11.4	37.7
11	15°24.9	341°20.0	47.5	349°22.7	17.5	192°43.3	32.0	190°14.0	37.7
12	30°27.4	356°19.5	N12°48.6	4°23.4	N10°18.2	207°46.0	N00°32.1	205°16.7	N00°37.8
13	45°29.9	11°19.0	49.7	19°24.1	18.8	222°48.7	32.2	220°19.3	37.8
14	60°32.3	26°18.5	50.8	34°24.8	19.5	237°51.4	32.2	235°21.9	37.9
15	75°34.8	41°18.0	·· 51.9	49°25.5	·· 20.2	252°54.0	·· 32.3	250°24.5	·· 38.0
16	90°37.2	56°17.5	52.9	64°26.1	20.9	267°56.7	32.4	265°27.1	38.0
17	105°39.7	71°17.0	54.0	79°26.8	21.6	282°59.4	32.5	280°29.7	38.1
18	120°42.2	86°16.5	N12°55.1	94°27.5	N10°22.3	298°02.1	N00°32.6	295°32.3	N00°38.1
19	135°44.6	101°16.0	56.2	109°28.2	23.0	313°04.8	32.7	310°34.9	38.2
20	150°47.1	116°15.5	57.3	124°28.9	23.7	328°07.5	32.8	325°37.6	38.3
21	165°49.6	131°15.0	·· 58.4	139°29.6	·· 24.4	343°10.2	·· 32.9	340°40.2	·· 38.3
22	180°52.0	146°14.5	12°59.5	154°30.3	25.1	358°12.9	33.0	355°42.8	38.4
23	195°54.5	161°14.0	13°00.6	169°30.9	25.8	13°15.6	33.1	10°45.4	38.4
Mer.pass. 09:59		ν -0.5′	d 1.1′	m -3.88	ν 0.7′	d 0.7′	m 1.17	ν 2.7′	d 0.1′ m -2.41	ν 2.6′	d 0.1′ m 0.57

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	210°57.0	176°13.5	N13°01.7	184°31.6	N10°26.5	28°18.3	N00°33.1	25°48.0	N00°38.5
1	225°59.4	191°13.0	02.7	199°32.3	27.2	43°20.9	33.2	40°50.6	38.6
2	241°01.9	206°12.4	03.8	214°33.0	27.9	58°23.6	33.3	55°53.2	38.6
3	256°04.4	221°11.9	·· 04.9	229°33.7	·· 28.6	73°26.3	·· 33.4	70°55.8	·· 38.7
4	271°06.8	236°11.4	06.0	244°34.4	29.3	88°29.0	33.5	85°58.5	38.7
5	286°09.3	251°10.9	07.1	259°35.1	30.0	103°31.7	33.6	101°01.1	38.8
6	301°11.7	266°10.4	N13°08.2	274°35.7	N10°30.7	118°34.4	N00°33.7	116°03.7	N00°38.8
7	316°14.2	281°09.9	09.3	289°36.4	31.3	133°37.1	33.8	131°06.3	38.9
8	331°16.7	296°09.4	10.3	304°37.1	32.0	148°39.8	33.9	146°08.9	39.0
9	346°19.1	311°08.9	·· 11.4	319°37.8	·· 32.7	163°42.4	·· 34.0	161°11.5	·· 39.0
10	1°21.6	326°08.4	12.5	334°38.5	33.4	178°45.1	34.0	176°14.1	39.1
11	16°24.1	341°07.9	13.6	349°39.2	34.1	193°47.8	34.1	191°16.7	39.1
12	31°26.5	356°07.4	N13°14.7	4°39.9	N10°34.8	208°50.5	N00°34.2	206°19.3	N00°39.2
13	46°29.0	11°06.9	15.7	19°40.5	35.5	223°53.2	34.3	221°22.0	39.3
14	61°31.5	26°06.4	16.8	34°41.2	36.2	238°55.9	34.4	236°24.6	39.3
15	76°33.9	41°05.9	·· 17.9	49°41.9	·· 36.9	253°58.6	·· 34.5	251°27.2	·· 39.4
16	91°36.4	56°05.3	19.0	64°42.6	37.6	269°01.2	34.6	266°29.8	39.4
17	106°38.9	71°04.8	20.1	79°43.3	38.3	284°03.9	34.7	281°32.4	39.5
18	121°41.3	86°04.3	N13°21.1	94°44.0	N10°39.0	299°06.6	N00°34.8	296°35.0	N00°39.5
19	136°43.8	101°03.8	22.2	109°44.6	39.6	314°09.3	34.8	311°37.6	39.6
20	151°46.2	116°03.3	23.3	124°45.3	40.3	329°12.0	34.9	326°40.2	39.7
21	166°48.7	131°02.8	·· 24.4	139°46.0	·· 41.0	344°14.7	·· 35.0	341°42.8	·· 39.7
22	181°51.2	146°02.3	25.4	154°46.7	41.7	359°17.4	35.1	356°45.4	39.8
23	196°53.6	161°01.8	26.5	169°47.4	42.4	14°20.0	35.2	11°48.1	39.8
Mer.pass. 09:55		ν -0.5′	d 1.1′	m -3.88	ν 0.7′	d 0.7′	m 1.17	ν 2.7′	d 0.1′ m -2.40	ν 2.6′	d 0.1′ m 0.58

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	211°56.1	176°01.2	N13°27.6	184°48.1	N10°43.1	29°22.7	N00°35.3	26°50.7	N00°39.9
1	226°58.6	191°00.7	28.7	199°48.8	43.8	44°25.4	35.4	41°53.3	39.9
2	242°01.0	206°00.2	29.7	214°49.4	44.5	59°28.1	35.5	56°55.9	40.0
3	257°03.5	220°59.7	·· 30.8	229°50.1	·· 45.2	74°30.8	·· 35.5	71°58.5	·· 40.1
4	272°06.0	235°59.2	31.9	244°50.8	45.8	89°33.5	35.6	87°01.1	40.1
5	287°08.4	250°58.7	33.0	259°51.5	46.5	104°36.1	35.7	102°03.7	40.2
6	302°10.9	265°58.2	N13°34.0	274°52.2	N10°47.2	119°38.8	N00°35.8	117°06.3	N00°40.2
7	317°13.4	280°57.6	35.1	289°52.9	47.9	134°41.5	35.9	132°08.9	40.3
8	332°15.8	295°57.1	36.2	304°53.5	48.6	149°44.2	36.0	147°11.5	40.3
9	347°18.3	310°56.6	·· 37.2	319°54.2	·· 49.3	164°46.9	·· 36.1	162°14.1	·· 40.4
10	2°20.7	325°56.1	38.3	334°54.9	50.0	179°49.5	36.2	177°16.8	40.5
11	17°23.2	340°55.6	39.4	349°55.6	50.7	194°52.2	36.2	192°19.4	40.5
12	32°25.7	355°55.1	N13°40.4	4°56.3	N10°51.3	209°54.9	N00°36.3	207°22.0	N00°40.6
13	47°28.1	10°54.5	41.5	19°57.0	52.0	224°57.6	36.4	222°24.6	40.6
14	62°30.6	25°54.0	42.6	34°57.6	52.7	240°00.3	36.5	237°27.2	40.7
15	77°33.1	40°53.5	·· 43.6	49°58.3	·· 53.4	255°02.9	·· 36.6	252°29.8	·· 40.7
16	92°35.5	55°53.0	44.7	64°59.0	54.1	270°05.6	36.7	267°32.4	40.8
17	107°38.0	70°52.5	45.8	79°59.7	54.8	285°08.3	36.8	282°35.0	40.9
18	122°40.5	85°51.9	N13°46.8	95°00.4	N10°55.5	300°11.0	N00°36.9	297°37.6	N00°40.9
19	137°42.9	100°51.4	47.9	110°01.1	56.1	315°13.7	36.9	312°40.2	41.0
20	152°45.4	115°50.9	49.0	125°01.7	56.8	330°16.3	37.0	327°42.8	41.0
21	167°47.8	130°50.4	·· 50.0	140°02.4	·· 57.5	345°19.0	·· 37.1	342°45.4	·· 41.1
22	182°50.3	145°49.8	51.1	155°03.1	58.2	0°21.7	37.2	357°48.1	41.1
23	197°52.8	160°49.3	52.1	170°03.8	58.9	15°24.4	37.3	12°50.7	41.2
Mer.pass. 09:51		ν -0.5′	d 1.1′	m -3.88	ν 0.7′	d 0.7′	m 1.18	ν 2.7′	d 0.1′ m -2.40	ν 2.6′	d 0.1′ m 0.58

Stars

	SHA	Dec
Alpheratz	358°09.2	28°58.9
Ankaa	353°40.2	-42°24.5
Schedar	350°09.1	56°25.8
Diphda	349°20.8	-18°05.5
Achernar	335°45.6	-57°20.0
Hamal	328°28.8	23°22.2
Polaris	327°07.0	89°10.6
Acamar	315°37.4	-40°23.0
Menkar	314°41.0	4°00.8
Mirfak	309°16.0	49°47.6
Aldebaran	291°17.8	16°28.2
Rigel	281°35.9	-8°13.6
Capella	281°11.1	45°58.8
Bellatrix	278°58.5	6°19.8
Elnath	278°43.9	28°35.5
Alnilam	276°11.5	-1°13.0
Betelgeuse	271°28.0	7°24.1
Canopus	264°07.3	-52°41.5
Sirius	258°55.5	-16°41.6
Adhara	255°31.9	-28°57.1
Procyon	245°25.4	5°16.3
Pollux	243°57.7	28°04.4
Avior	234°28.0	-59°27.3
Suhail	223°10.4	-43°21.7
Miaplacidus	221°44.7	-69°38.7
Alphard	218°20.1	-8°34.8
Regulus	208°09.4	12°03.5
Dubhe	194°21.2	61°51.4
Denebola	182°58.4	14°40.6
Gienah	176°17.3	-17°26.3
Acrux	173°36.2	-62°59.8
Gacrux	172°27.8	-57°00.6
Alioth	166°41.6	56°03.8
Spica	158°56.8	-11°03.8
Alkaid	153°17.7	49°24.5
Hadar	149°22.2	-60°17.0
Menkent	148°36.2	-36°16.7
Arcturus	146°17.8	19°16.8
Rigil Kent.	140°24.6	-60°45.3
Kochab	137°17.9	74°14.0
Zuben'ubi	137°32.3	-15°57.9
Alphecca	126°31.4	26°46.6
Antares	112°56.1	-26°23.4
Atria	108°19.6	-68°59.5
Sabik	102°40.4	-15°42.1
Shaula	96°55.0	-37°05.3
Rasalhague	96°29.0	12°34.3
Eltanin	90°57.2	51°29.3
Kaus Aust.	84°16.1	-34°23.5
Vega	80°55.4	38°45.7
Nunki	76°28.6	-26°19.2
Altair	62°32.1	8°49.0
Peacock	53°57.8	-56°47.6
Deneb	49°48.2	45°12.5
Enif	34°11.3	9°47.1
Al Na'ir	28°14.7	-47°03.0
Fomalhaut	15°51.2	-29°43.3
Scheat	14°17.4	27°58.6
Markab	14°03.0	15°06.0

Apr 22 Wed	SHA	Mer.pass
Venus	326°27.6	12:15
Mars	334°17.3	11:42
Jupiter	177°15.8	22:07
Saturn	174°47.5	22:17

Apr 23 Thu	SHA	Mer.pass
Venus	325°16.5	12:16
Mars	333°34.7	11:41
Jupiter	177°21.3	22:03
Saturn	174°51.0	22:13

Apr 24 Fri	SHA	Mer.pass
Venus	324°05.1	12:16
Mars	332°52.0	11:40
Jupiter	177°26.6	21:59
Saturn	174°54.6	22:09

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h

	Sun		Moon				
Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°21.2	N12°05.5	330°15.7	13.5′	S15°52.3	6.9′	54.0′
1	195°21.3	06.3	344°48.3	13.5′	15°59.2	6.9′	54.0′
2	210°21.5	07.2	359°20.8	13.5′	16°06.1	6.9′	54.0′
3	225°21.6	·· 08.0	13°53.2	13.4′	16°13.0	6.7′	54.0′
4	240°21.7	08.9	28°25.6	13.4′	16°19.7	6.7′	54.0′
5	255°21.8	09.7	42°58.0	13.3′	16°26.4	6.6′	54.0′
6	270°22.0	N12°10.6	57°30.3	13.3′	S16°33.0	6.6′	54.0′
7	285°22.1	11.4	72°02.6	13.3′	16°39.6	6.5′	54.0′
8	300°22.2	12.2	86°34.9	13.2′	16°46.1	6.4′	54.0′
9	315°22.3	·· 13.1	101°07.1	13.2′	16°52.5	6.3′	54.0′
10	330°22.5	13.9	115°39.3	13.1′	16°58.8	6.3′	54.0′
11	345°22.6	14.8	130°11.4	13.1′	17°05.1	6.2′	54.1′
12	0°22.7	N12°15.6	144°43.5	13.1′	S17°11.3	6.1′	54.1′
13	15°22.8	16.4	159°15.6	13.0′	17°17.4	6.0′	54.1′
14	30°22.9	17.3	173°47.6	13.0′	17°23.4	6.0′	54.1′
15	45°23.1	·· 18.1	188°19.5	12.9′	17°29.4	5.9′	54.1′
16	60°23.2	18.9	202°51.5	12.9′	17°35.3	5.8′	54.1′
17	75°23.3	19.8	217°23.4	12.9′	17°41.1	5.7′	54.1′
18	90°23.4	N12°20.6	231°55.2	12.8′	S17°46.8	5.7′	54.1′
19	105°23.6	21.5	246°27.1	12.8′	17°52.5	5.6′	54.1′
20	120°23.7	22.3	260°58.8	12.7′	17°58.1	5.5′	54.1′
21	135°23.8	·· 23.1	275°30.6	12.7′	18°03.6	5.4′	54.1′
22	150°23.9	24.0	290°02.3	12.7′	18°09.0	5.3′	54.2′
23	165°24.0	24.8	304°33.9	12.6′	18°14.3	5.3′	54.2′
	SD = 15.9′	d = 0.8′	SD = 14.7′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°24.2	N12°25.6	319°05.5	12.6′	S18°19.6	5.2′	54.2′
1	195°24.3	26.5	333°37.1	12.5′	18°24.8	5.1′	54.2′
2	210°24.4	27.3	348°08.6	12.5′	18°29.9	5.0′	54.2′
3	225°24.5	·· 28.1	2°40.1	12.5′	18°34.9	4.9′	54.2′
4	240°24.6	29.0	17°11.6	12.4′	18°39.8	4.9′	54.2′
5	255°24.8	29.8	31°43.0	12.4′	18°44.7	4.8′	54.2′
6	270°24.9	N12°30.6	46°14.4	12.3′	S18°49.5	4.7′	54.2′
7	285°25.0	31.5	60°45.7	12.3′	18°54.2	4.6′	54.2′
8	300°25.1	32.3	75°17.0	12.3′	18°58.8	4.5′	54.3′
9	315°25.2	·· 33.1	89°48.3	12.2′	19°03.3	4.4′	54.3′
10	330°25.4	34.0	104°19.5	12.2′	19°07.7	4.3′	54.3′
11	345°25.5	34.8	118°50.7	12.1′	19°12.0	4.3′	54.3′
12	0°25.6	N12°35.6	133°21.8	12.1′	S19°16.3	4.2′	54.3′
13	15°25.7	36.5	147°52.9	12.1′	19°20.5	4.1′	54.3′
14	30°25.8	37.3	162°24.0	12.0′	19°24.6	3.9′	54.3′
15	45°25.9	·· 38.1	176°55.0	12.0′	19°28.5	4.0′	54.4′
16	60°26.1	38.9	191°26.0	11.9′	19°32.5	3.8′	54.4′
17	75°26.2	39.8	205°56.9	11.9′	19°36.3	3.7′	54.4′
18	90°26.3	N12°40.6	220°27.8	11.9′	S19°40.0	3.6′	54.4′
19	105°26.4	41.4	234°58.7	11.8′	19°43.6	3.6′	54.4′
20	120°26.5	42.3	249°29.5	11.8′	19°47.2	3.4′	54.4′
21	135°26.6	·· 43.1	264°00.3	11.8′	19°50.6	3.4′	54.4′
22	150°26.8	43.9	278°31.1	11.7′	19°54.0	3.3′	54.5′
23	165°26.9	44.7	293°01.8	11.7′	19°57.3	3.2′	54.5′
	SD = 15.9′	d = 0.8′	SD = 14.8′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°27.0	N12°45.6	307°32.5	11.6′	S20°00.5	3.0′	54.5′
1	195°27.1	46.4	322°03.1	11.6′	20°03.5	3.0′	54.5′
2	210°27.2	47.2	336°33.8	11.6′	20°06.5	2.9′	54.5′
3	225°27.3	·· 48.0	351°04.3	11.5′	20°09.4	2.9′	54.5′
4	240°27.5	48.9	5°34.9	11.5′	20°12.3	2.7′	54.5′
5	255°27.6	49.7	20°05.4	11.5′	20°15.0	2.6′	54.6′
6	270°27.7	N12°50.5	34°35.8	11.4′	S20°17.6	2.5′	54.6′
7	285°27.8	51.3	49°06.3	11.4′	20°20.1	2.4′	54.6′
8	300°27.9	52.2	63°36.7	11.4′	20°22.5	2.4′	54.6′
9	315°28.0	·· 53.0	78°07.0	11.3′	20°24.9	2.2′	54.6′
10	330°28.1	53.8	92°37.4	11.3′	20°27.1	2.1′	54.6′
11	345°28.3	54.6	107°07.7	11.3′	20°29.2	2.1′	54.7′
12	0°28.4	N12°55.4	121°37.9	11.2′	S20°31.3	1.9′	54.7′
13	15°28.5	56.3	136°08.2	11.2′	20°33.2	1.9′	54.7′
14	30°28.6	57.1	150°38.4	11.2′	20°35.1	1.7′	54.7′
15	45°28.7	·· 57.9	165°08.5	11.1′	20°36.8	1.7′	54.7′
16	60°28.8	58.7	179°38.7	11.1′	20°38.5	1.5′	54.8′
17	75°28.9	12°59.5	194°08.8	11.1′	20°40.0	1.4′	54.8′
18	90°29.0	N13°00.4	208°38.8	11.0′	S20°41.4	1.4′	54.8′
19	105°29.2	01.2	223°08.9	11.0′	20°42.8	1.2′	54.8′
20	120°29.3	02.0	237°38.9	11.0′	20°44.0	1.2′	54.8′
21	135°29.4	·· 02.8	252°08.9	11.0′	20°45.2	1.0′	54.9′
22	150°29.5	03.6	266°38.8	10.9′	20°46.2	1.0′	54.9′
23	165°29.6	04.5	281°08.7	10.9′	20°47.2	0.8′	54.9′
	SD = 15.9′	d = 0.8′	SD = 14.9′				

Lat.	**Twilight** Naut.	**Twilight** Civil	**Sunrise**	**Sunset**	**Twilight** Civil	**Twilight** Naut.
N 72°	////	////	02:51	21:10	////	////
N 70°	////	01:31	03:16	20:44	22:35	////
68°	////	02:13	03:34	20:25	21:49	////
66°	////	02:41	03:49	20:10	21:20	////
64°	01:19	03:01	04:02	19:57	20:58	22:45
62°	01:57	03:18	04:12	19:47	20:41	22:04
60°	02:23	03:32	04:21	19:38	20:27	21:38
N 58°	02:42	03:43	04:28	19:30	20:15	21:17
56°	02:58	03:53	04:35	19:23	20:05	21:01
54°	03:11	04:02	04:41	19:17	19:56	20:47
52°	03:22	04:10	04:47	19:11	19:48	20:36
50°	03:32	04:16	04:52	19:06	19:41	20:26
45°	03:52	04:31	05:02	18:55	19:27	20:05
N 40°	04:08	04:42	05:11	18:46	19:15	19:50
35°	04:20	04:52	05:18	18:39	19:05	19:37
30°	04:31	05:00	05:25	18:32	18:57	19:27
20°	04:47	05:13	05:36	18:21	18:43	19:10
N 10°	04:59	05:24	05:46	18:11	18:32	18:58
0°	05:09	05:34	05:55	18:02	18:23	18:47
S 10°	05:18	05:42	06:04	17:53	18:14	18:39
20°	05:25	05:51	06:13	17:43	18:06	18:32
30°	05:31	05:59	06:24	17:32	17:57	18:25
35°	05:34	06:04	06:30	17:26	17:52	18:22
40°	05:37	06:09	06:37	17:19	17:47	18:19
45°	05:40	06:15	06:45	17:11	17:41	18:16
S 50°	05:43	06:21	06:54	17:02	17:35	18:13
52°	05:44	06:24	06:59	16:57	17:32	18:12
54°	05:45	06:27	07:03	16:52	17:29	18:10
56°	05:46	06:30	07:09	16:47	17:26	18:09
58°	05:48	06:34	07:15	16:41	17:22	18:08
S 60°	05:49	06:38	07:22	16:34	17:18	18:07

Lat.	**Moonrise** Wed	Thu	Fri	**Moonset** Wed	Thu	Fri
N 72°	00:06	▬	▬	03:46	▬	▬
N 70°	·· ··	01:14	▬	04:30	04:15	▬
68°	·· ··	00:27	01:56	04:59	05:03	05:13
66°	23:57	·· ··	01:15	05:21	05:33	05:55
64°	23:35	·· ··	00:46	05:39	05:56	06:24
62°	23:17	·· ··	00:25	05:53	06:15	06:45
60°	23:02	·· ··	00:08	06:05	06:30	07:03
N 58°	22:49	23:53	·· ··	06:16	06:43	07:18
56°	22:39	23:41	·· ··	06:25	06:54	07:30
54°	22:29	23:30	·· ··	06:33	07:04	07:41
52°	22:21	23:20	·· ··	06:41	07:13	07:51
50°	22:13	23:12	·· ··	06:47	07:20	08:00
45°	21:57	22:53	23:47	07:02	07:37	08:18
N 40°	21:44	22:39	23:31	07:13	07:51	08:33
35°	21:32	22:26	23:18	07:24	08:03	08:46
30°	21:23	22:15	23:07	07:32	08:13	08:57
20°	21:06	21:57	22:47	07:48	08:31	09:16
N 10°	20:51	21:40	22:30	08:01	08:46	09:33
0°	20:38	21:25	22:14	08:14	09:00	09:49
S 10°	20:24	21:10	21:58	08:26	09:15	10:04
20°	20:10	20:54	21:42	08:40	09:30	10:21
30°	19:53	20:36	21:22	08:55	09:48	10:40
35°	19:44	20:25	21:11	09:04	09:58	10:51
40°	19:33	20:13	20:58	09:15	10:10	11:04
45°	19:20	19:58	20:42	09:27	10:24	11:19
S 50°	19:05	19:41	20:24	09:41	10:41	11:38
52°	18:57	19:32	20:15	09:48	10:49	11:47
54°	18:49	19:23	20:05	09:56	10:58	11:57
56°	18:40	19:13	19:54	10:05	11:09	12:08
58°	18:30	19:01	19:41	10:14	11:20	12:20
S 60°	18:19	18:47	19:26	10:25	11:34	12:35

Day	**Sun** Eqn.of Time 00^h mm:ss	Eqn.of Time 12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 18-20 94-82%
22	01:25	01:31	11:58	02:03	14:26	
23	01:37	01:42	11:58	02:49	15:13	
24	01:48	01:53	11:58	03:37	16:01	

April 25, 26, 27 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	212°55.2	175°48.8	N13°53.2	185°04.5	N10°59.6	30°27.1	N00°37.4	27°53.3	N00°41.3
1	227°57.7	190°48.3	54.3	200°05.2	11°00.3	45°29.7	37.5	42°55.9	41.3
2	243°00.2	205°47.8	55.3	215°05.8	00.9	60°32.4	37.5	57°58.5	41.4
3	258°02.6	220°47.2	·· 56.4	230°06.5	·· 01.6	75°35.1	·· 37.6	73°01.1	·· 41.4
4	273°05.1	235°46.7	57.4	245°07.2	02.3	90°37.8	37.7	88°03.7	41.5
5	288°07.6	250°46.2	58.5	260°07.9	03.0	105°40.5	37.8	103°06.3	41.5
6	303°10.0	265°45.7	N13°59.6	275°08.6	N11°03.7	120°43.1	N00°37.9	118°08.9	N00°41.6
7	318°12.5	280°45.1	14°00.6	290°09.3	04.4	135°45.8	38.0	133°11.5	41.6
8	333°15.0	295°44.6	01.7	305°09.9	05.0	150°48.5	38.0	148°14.1	41.7
9	348°17.4	310°44.1	·· 02.7	320°10.6	·· 05.7	165°51.2	·· 38.1	163°16.7	·· 41.8
10	3°19.9	325°43.5	03.8	335°11.3	06.4	180°53.8	38.2	178°19.3	41.8
11	18°22.3	340°43.0	04.8	350°12.0	07.1	195°56.5	38.3	193°21.9	41.9
12	33°24.8	355°42.5	N14°05.9	5°12.7	N11°07.8	210°59.2	N00°38.4	208°24.6	N00°41.9
13	48°27.3	10°42.0	06.9	20°13.3	08.4	226°01.9	38.5	223°27.2	42.0
14	63°29.7	25°41.4	08.0	35°14.0	09.1	241°04.5	38.6	238°29.8	42.0
15	78°32.2	40°40.9	·· 09.0	50°14.7	·· 09.8	256°07.2	·· 38.6	253°32.4	·· 42.1
16	93°34.7	55°40.4	10.1	65°15.4	10.5	271°09.9	38.7	268°35.0	42.1
17	108°37.1	70°39.8	11.1	80°16.1	11.2	286°12.6	38.8	283°37.6	42.2
18	123°39.6	85°39.3	N14°12.2	95°16.8	N11°11.9	301°15.2	N00°38.9	298°40.2	N00°42.3
19	138°42.1	100°38.8	13.2	110°17.4	12.5	316°17.9	39.0	313°42.8	42.3
20	153°44.5	115°38.2	14.3	125°18.1	13.2	331°20.6	39.1	328°45.4	42.4
21	168°47.0	130°37.7	·· 15.3	140°18.8	·· 13.9	346°23.3	·· 39.1	343°48.0	·· 42.4
22	183°49.5	145°37.2	16.4	155°19.5	14.6	1°25.9	39.2	358°50.6	42.5
23	198°51.9	160°36.6	17.4	170°20.2	15.3	16°28.6	39.3	13°53.2	42.5
Mer.pass. 09:47		ν -0.5′	d 1.1′	m -3.88	ν 0.7′	d 0.7′	m 1.18	ν 2.7′	d 0.1′ m -2.39	ν 2.6′	d 0.1′ m 0.59

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	213°54.4	175°36.1	N14°18.5	185°20.9	N11°15.9	31°31.3	N00°39.4	28°55.8	N00°42.6
1	228°56.8	190°35.6	19.5	200°21.5	16.6	46°34.0	39.5	43°58.4	42.6
2	243°59.3	205°35.0	20.6	215°22.2	17.3	61°36.6	39.6	59°01.0	42.7
3	259°01.8	220°34.5	·· 21.6	230°22.9	·· 18.0	76°39.3	·· 39.6	74°03.6	·· 42.8
4	274°04.2	235°34.0	22.7	245°23.6	18.6	91°42.0	39.7	89°06.2	42.8
5	289°06.7	250°33.4	23.7	260°24.3	19.3	106°44.6	39.8	104°08.8	42.9
6	304°09.2	265°32.9	N14°24.7	275°24.9	N11°20.0	121°47.3	N00°39.9	119°11.4	N00°42.9
7	319°11.6	280°32.4	25.8	290°25.6	20.7	136°50.0	40.0	134°14.0	43.0
8	334°14.1	295°31.8	26.8	305°26.3	21.4	151°52.7	40.0	149°16.7	43.0
9	349°16.6	310°31.3	·· 27.9	320°27.0	·· 22.0	166°55.3	·· 40.1	164°19.3	·· 43.1
10	4°19.0	325°30.8	28.9	335°27.7	22.7	181°58.0	40.2	179°21.9	43.1
11	19°21.5	340°30.2	29.9	350°28.3	23.4	197°00.7	40.3	194°24.5	43.2
12	34°24.0	355°29.7	N14°31.0	5°29.0	N11°24.1	212°03.3	N00°40.4	209°27.1	N00°43.2
13	49°26.4	10°29.1	32.0	20°29.7	24.7	227°06.0	40.5	224°29.7	43.3
14	64°28.9	25°28.6	33.1	35°30.4	25.4	242°08.7	40.5	239°32.3	43.4
15	79°31.3	40°28.1	·· 34.1	50°31.1	·· 26.1	257°11.4	·· 40.6	254°34.9	·· 43.4
16	94°33.8	55°27.5	35.1	65°31.7	26.8	272°14.0	40.7	269°37.5	43.5
17	109°36.3	70°27.0	36.2	80°32.4	27.5	287°16.7	40.8	284°40.1	43.5
18	124°38.7	85°26.4	N14°37.2	95°33.1	N11°28.1	302°19.4	N00°40.9	299°42.7	N00°43.6
19	139°41.2	100°25.9	38.2	110°33.8	28.8	317°22.0	40.9	314°45.3	43.6
20	154°43.7	115°25.3	39.3	125°34.5	29.5	332°24.7	41.0	329°47.9	43.7
21	169°46.1	130°24.8	·· 40.3	140°35.1	·· 30.2	347°27.4	·· 41.1	344°50.5	·· 43.7
22	184°48.6	145°24.3	41.3	155°35.8	30.8	2°30.0	41.2	359°53.1	43.8
23	199°51.1	160°23.7	42.4	170°36.5	31.5	17°32.7	41.3	14°55.7	43.8
Mer.pass. 09:43		ν -0.5′	d 1.0′	m -3.88	ν 0.7′	d 0.7′	m 1.19	ν 2.7′	d 0.1′ m -2.39	ν 2.6′	d 0.1′ m 0.59

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	214°53.5	175°23.2	N14°43.4	185°37.2	N11°32.2	32°35.4	N00°41.3	29°58.3	N00°43.9
1	229°56.0	190°22.6	44.4	200°37.9	32.9	47°38.0	41.4	45°00.9	44.0
2	244°58.4	205°22.1	45.5	215°38.5	33.5	62°40.7	41.5	60°03.5	44.0
3	260°00.9	220°21.5	·· 46.5	230°39.2	·· 34.2	77°43.4	·· 41.6	75°06.1	·· 44.1
4	275°03.4	235°21.0	47.5	245°39.9	34.9	92°46.1	41.7	90°08.7	44.1
5	290°05.8	250°20.4	48.5	260°40.6	35.5	107°48.7	41.7	105°11.3	44.2
6	305°08.3	265°19.9	N14°49.6	275°41.3	N11°36.2	122°51.4	N00°41.8	120°13.9	N00°44.2
7	320°10.8	280°19.3	50.6	290°41.9	36.9	137°54.1	41.9	135°16.5	44.3
8	335°13.2	295°18.8	51.6	305°42.6	37.6	152°56.7	42.0	150°19.1	44.3
9	350°15.7	310°18.3	·· 52.6	320°43.3	·· 38.2	167°59.4	·· 42.1	165°21.7	·· 44.4
10	5°18.2	325°17.7	53.7	335°44.0	38.9	183°02.0	42.1	180°24.3	44.4
11	20°20.6	340°17.2	54.7	350°44.7	39.6	198°04.7	42.2	195°26.9	44.5
12	35°23.1	355°16.6	N14°55.7	5°45.3	N11°40.3	213°07.4	N00°42.3	210°29.5	N00°44.5
13	50°25.6	10°16.1	56.7	20°46.0	40.9	228°10.0	42.4	225°32.1	44.6
14	65°28.0	25°15.5	57.8	35°46.7	41.6	243°12.7	42.5	240°34.7	44.6
15	80°30.5	40°15.0	·· 58.8	50°47.4	·· 42.3	258°15.4	·· 42.5	255°37.3	·· 44.7
16	95°32.9	55°14.4	14°59.8	65°48.1	42.9	273°18.0	42.6	270°39.9	44.8
17	110°35.4	70°13.9	15°00.8	80°48.7	43.6	288°20.7	42.7	285°42.5	44.8
18	125°37.9	85°13.3	N15°01.8	95°49.4	N11°44.3	303°23.4	N00°42.8	300°45.1	N00°44.9
19	140°40.3	100°12.7	02.9	110°50.1	44.9	318°26.0	42.9	315°47.7	44.9
20	155°42.8	115°12.2	03.9	125°50.8	45.6	333°28.7	42.9	330°50.3	45.0
21	170°45.3	130°11.6	·· 04.9	140°51.5	·· 46.3	348°31.4	·· 43.0	345°52.9	·· 45.0
22	185°47.7	145°11.1	05.9	155°52.1	47.0	3°34.0	43.1	0°55.5	45.1
23	200°50.2	160°10.5	06.9	170°52.8	47.6	18°36.7	43.2	15°58.1	45.1
Mer.pass. 09:39		ν -0.5′	d 1.0′	m -3.88	ν 0.7′	d 0.7′	m 1.20	ν 2.7′	d 0.1′ m -2.38	ν 2.6′	d 0.1′ m 0.60

Stars

	SHA	Dec
Alpheratz	358°09.2	28°58.9
Ankaa	353°40.2	-42°24.5
Schedar	350°09.1	56°25.8
Diphda	349°20.8	-18°05.5
Achernar	335°45.6	-57°20.0
Hamal	328°28.8	23°22.2
Polaris	327°06.8	89°10.6
Acamar	315°37.4	-40°23.0
Menkar	314°41.0	4°00.8
Mirfak	309°16.0	49°47.6
Aldebaran	291°17.8	16°28.2
Rigel	281°35.9	-8°13.6
Capella	281°11.1	45°58.8
Bellatrix	278°58.6	6°19.8
Elnath	278°43.9	28°35.5
Alnilam	276°11.5	-1°13.0
Betelgeuse	271°28.1	7°24.1
Canopus	264°07.3	-52°41.5
Sirius	258°55.5	-16°41.6
Adhara	255°31.9	-28°57.1
Procyon	245°25.4	5°16.3
Pollux	243°57.8	28°04.4
Avior	234°28.0	-59°27.3
Suhail	223°10.4	-43°21.7
Miaplacidus	221°44.7	-69°38.7
Alphard	218°20.1	-8°34.8
Regulus	208°09.5	12°03.5
Dubhe	194°21.2	61°51.4
Denebola	182°58.4	14°40.6
Gienah	176°17.3	-17°26.3
Acrux	173°36.2	-62°59.8
Gacrux	172°27.8	-57°00.6
Alioth	166°41.6	56°03.8
Spica	158°56.8	-11°03.8
Alkaid	153°17.7	49°24.5
Hadar	149°22.1	-60°17.0
Menkent	148°36.1	-36°16.7
Arcturus	146°17.8	19°16.8
Rigil Kent.	140°24.6	-60°45.3
Kochab	137°17.8	74°14.0
Zuben'ubi	137°32.3	-15°57.9
Alphecca	126°31.4	26°46.6
Antares	112°56.1	-26°23.4
Atria	108°19.5	-68°59.5
Sabik	102°40.4	-15°42.1
Shaula	96°54.9	-37°05.3
Rasalhague	96°29.0	12°34.3
Eltanin	90°57.2	51°29.3
Kaus Aust.	84°16.1	-34°23.5
Vega	80°55.4	38°45.7
Nunki	76°28.5	-26°19.2
Altair	62°32.1	8°49.0
Peacock	53°57.8	-56°47.5
Deneb	49°48.2	45°12.5
Enif	34°11.3	9°47.1
Al Na'ir	28°14.6	-47°03.0
Fomalhaut	15°51.2	-29°43.3
Scheat	14°17.4	27°58.6
Markab	14°03.0	15°06.0

Apr 25 Sat	SHA	Mer.pass
Venus	322°53.6	12:17
Mars	332°09.2	11:39
Jupiter	177°31.8	21:54
Saturn	174°58.0	22:05

Apr 26 Sun	SHA	Mer.pass
Venus	321°41.7	12:18
Mars	331°26.5	11:38
Jupiter	177°36.9	21:50
Saturn	175°01.4	22:00

Apr 27 Mon	SHA	Mer.pass
Venus	320°29.7	12:19
Mars	330°43.7	11:37
Jupiter	177°41.9	21:46
Saturn	175°04.8	21:56

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°29.7	N13°05.3	295°38.6	10.9′	S20°48.0	0.8′	54.9′
1	195°29.8	06.1	310°08.5	10.8′	20°48.8	0.6′	54.9′
2	210°29.9	06.9	324°38.3	10.8′	20°49.4	0.5′	55.0′
3	225°30.0	·· 07.7	339°08.1	10.8′	20°49.9	0.5′	55.0′
4	240°30.1	08.5	353°37.9	10.8′	20°50.4	0.3′	55.0′
5	255°30.3	09.4	8°07.7	10.7′	20°50.7	0.2′	55.0′
6	270°30.4	N13°10.2	22°37.4	10.7′	S20°50.9	0.2′	55.1′
7	285°30.5	11.0	37°07.1	10.7′	20°51.1	0.0′	55.1′
8	300°30.6	11.8	51°36.8	10.6′	20°51.1	0.1′	55.1′
9	315°30.7	·· 12.6	66°06.4	10.6′	20°51.0	0.2′	55.1′
10	330°30.8	13.4	80°36.0	10.6′	20°50.8	0.3′	55.1′
11	345°30.9	14.2	95°05.6	10.6′	20°50.5	0.4′	55.2′
12	0°31.0	N13°15.1	109°35.2	10.6′	S20°50.1	0.5′	55.2′
13	15°31.1	15.9	124°04.8	10.5′	20°49.6	0.6′	55.2′
14	30°31.2	16.7	138°34.3	10.5′	20°49.0	0.7′	55.2′
15	45°31.3	·· 17.5	153°03.8	10.5′	20°48.3	0.8′	55.3′
16	60°31.4	18.3	167°33.3	10.5′	20°47.5	0.9′	55.3′
17	75°31.6	19.1	182°02.8	10.4′	20°46.6	1.0′	55.3′
18	90°31.7	N13°19.9	196°32.2	10.4′	S20°45.6	1.2′	55.3′
19	105°31.8	20.7	211°01.6	10.4′	20°44.4	1.2′	55.4′
20	120°31.9	21.5	225°31.0	10.4′	20°43.2	1.4′	55.4′
21	135°32.0	·· 22.4	240°00.4	10.4′	20°41.8	1.4′	55.4′
22	150°32.1	23.2	254°29.8	10.3′	20°40.4	1.6′	55.4′
23	165°32.2	24.0	268°59.1	10.3′	20°38.8	1.6′	55.5′
	SD = 15.9′	d = 0.8′	SD = 15.0′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°32.3	N13°24.8	283°28.4	10.3′	S20°37.2	1.8′	55.5′
1	195°32.4	25.6	297°57.7	10.3′	20°35.4	1.9′	55.5′
2	210°32.5	26.4	312°27.0	10.3′	20°33.5	2.0′	55.6′
3	225°32.6	·· 27.2	326°56.3	10.3′	20°31.5	2.1′	55.6′
4	240°32.7	28.0	341°25.6	10.2′	20°29.4	2.2′	55.6′
5	255°32.8	28.8	355°54.8	10.2′	20°27.2	2.3′	55.6′
6	270°32.9	N13°29.6	10°24.0	10.2′	S20°24.9	2.4′	55.7′
7	285°33.0	30.4	24°53.2	10.2′	20°22.5	2.5′	55.7′
8	300°33.1	31.2	39°22.4	10.2′	20°20.0	2.6′	55.7′
9	315°33.2	·· 32.0	53°51.6	10.2′	20°17.4	2.8′	55.8′
10	330°33.3	32.8	68°20.8	10.1′	20°14.6	2.8′	55.8′
11	345°33.4	33.6	82°49.9	10.1′	20°11.8	3.0′	55.8′
12	0°33.5	N13°34.4	97°19.0	10.1′	S20°08.8	3.0′	55.8′
13	15°33.6	35.3	111°48.2	10.1′	20°05.8	3.2′	55.9′
14	30°33.8	36.1	126°17.3	10.1′	20°02.6	3.3′	55.9′
15	45°33.9	·· 36.9	140°46.4	10.1′	19°59.3	3.4′	55.9′
16	60°34.0	37.7	155°15.5	10.1′	19°55.9	3.4′	56.0′
17	75°34.1	38.5	169°44.5	10.1′	19°52.5	3.6′	56.0′
18	90°34.2	N13°39.3	184°13.6	10.1′	S19°48.9	3.8′	56.0′
19	105°34.3	40.1	198°42.7	10.0′	19°45.1	3.8′	56.1′
20	120°34.4	40.9	213°11.7	10.0′	19°41.3	3.9′	56.1′
21	135°34.5	·· 41.7	227°40.7	10.0′	19°37.4	4.0′	56.1′
22	150°34.6	42.5	242°09.8	10.0′	19°33.4	4.1′	56.1′
23	165°34.7	43.3	256°38.8	10.0′	19°29.3	4.3′	56.2′
	SD = 15.9′	d = 0.8′	SD = 15.1′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°34.8	N13°44.1	271°07.8	10.0′	S19°25.0	4.3′	56.2′
1	195°34.9	44.9	285°36.8	10.0′	19°20.7	4.5′	56.2′
2	210°35.0	45.7	300°05.8	10.0′	19°16.2	4.5′	56.3′
3	225°35.1	·· 46.5	314°34.7	10.0′	19°11.7	4.7′	56.3′
4	240°35.2	47.3	329°03.7	10.0′	19°07.0	4.8′	56.3′
5	255°35.3	48.1	343°32.7	10.0′	19°02.2	4.9′	56.4′
6	270°35.4	N13°48.8	358°01.6	10.0′	S18°57.3	5.0′	56.4′
7	285°35.5	49.6	12°30.6	9.9′	18°52.3	5.1′	56.4′
8	300°35.6	50.4	26°59.5	9.9′	18°47.2	5.2′	56.5′
9	315°35.7	·· 51.2	41°28.5	9.9′	18°42.0	5.3′	56.5′
10	330°35.7	52.0	55°57.4	9.9′	18°36.7	5.4′	56.5′
11	345°35.8	52.8	70°26.3	9.9′	18°31.3	5.5′	56.6′
12	0°35.9	N13°53.6	84°55.3	9.9′	S18°25.8	5.6′	56.6′
13	15°36.0	54.4	99°24.2	9.9′	18°20.2	5.7′	56.6′
14	30°36.1	55.2	113°53.1	9.9′	18°14.5	5.9′	56.7′
15	45°36.2	·· 56.0	128°22.0	9.9′	18°08.6	5.9′	56.7′
16	60°36.3	56.8	142°50.9	9.9′	18°02.7	6.0′	56.8′
17	75°36.4	57.6	157°19.8	9.9′	17°56.7	6.2′	56.8′
18	90°36.5	N13°58.4	171°48.7	9.9′	S17°50.5	6.2′	56.8′
19	105°36.6	13°59.2	186°17.6	9.9′	17°44.3	6.4′	56.9′
20	120°36.7	14°00.0	200°46.5	9.9′	17°37.9	6.4′	56.9′
21	135°36.8	·· 00.8	215°15.4	9.9′	17°31.5	6.6′	56.9′
22	150°36.9	01.5	229°44.3	9.9′	17°24.9	6.6′	57.0′
23	165°37.0	02.3	244°13.1	9.9′	17°18.3	6.8′	57.0′
	SD = 15.9′	d = 0.8′	SD = 15.3′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	////	////	02:31	21:30	////	////
N 70°	////	00:54	03:00	21:00	23:19	////
68°	////	01:52	03:21	20:38	22:10	////
66°	////	02:25	03:38	20:21	21:35	////
64°	00:47	02:48	03:51	20:07	21:10	23:24
62°	01:39	03:07	04:03	19:55	20:51	22:22
60°	02:09	03:22	04:12	19:45	20:36	21:51
N 58°	02:31	03:34	04:21	19:36	20:23	21:28
56°	02:48	03:45	04:28	19:29	20:12	21:10
54°	03:02	03:55	04:35	19:22	20:03	20:55
52°	03:15	04:03	04:41	19:16	19:54	20:43
50°	03:25	04:10	04:46	19:11	19:47	20:32
45°	03:47	04:26	04:57	18:59	19:31	20:10
N 40°	04:03	04:38	05:07	18:49	19:18	19:53
35°	04:16	04:48	05:15	18:41	19:08	19:40
30°	04:27	04:57	05:22	18:34	18:59	19:29
20°	04:44	05:11	05:34	18:22	18:45	19:11
N 10°	04:58	05:23	05:45	18:11	18:33	18:58
0°	05:08	05:33	05:54	18:01	18:22	18:47
S 10°	05:18	05:42	06:04	17:51	18:13	18:38
20°	05:26	05:52	06:14	17:41	18:04	18:30
30°	05:33	06:01	06:26	17:29	17:54	18:22
35°	05:36	06:06	06:32	17:23	17:49	18:19
40°	05:40	06:12	06:40	17:15	17:43	18:15
45°	05:43	06:18	06:48	17:07	17:37	18:11
S 50°	05:47	06:25	06:59	16:56	17:30	18:08
52°	05:49	06:28	07:04	16:51	17:26	18:06
54°	05:50	06:32	07:09	16:46	17:23	18:04
56°	05:52	06:36	07:15	16:40	17:19	18:03
58°	05:53	06:40	07:21	16:33	17:15	18:01
S 60°	05:55	06:44	07:29	16:26	17:10	17:59

Lat.	**Moonrise** Sat	Sun	Mon	**Moonset** Sat	Sun	Mon
N 72°	▬	▬	▬	▬	▬	▬
N 70°	▬	▬	04:56	▬	▬	07:29
68°	03:09	03:48	04:03	05:44	06:49	08:22
66°	02:19	03:03	03:30	06:33	07:34	08:54
64°	01:47	02:34	03:06	07:05	08:03	09:18
62°	01:24	02:11	02:46	07:28	08:26	09:36
60°	01:05	01:53	02:31	07:47	08:43	09:52
N 58°	00:50	01:38	02:17	08:02	08:58	10:05
56°	00:37	01:25	02:06	08:16	09:11	10:16
54°	00:25	01:14	01:55	08:27	09:22	10:26
52°	00:15	01:04	01:46	08:37	09:32	10:35
50°	00:06	00:55	01:38	08:46	09:41	10:43
45°	·· ··	00:36	01:21	09:06	09:59	10:59
N 40°	·· ··	00:21	01:07	09:21	10:14	11:13
35°	·· ··	00:08	00:55	09:34	10:27	11:24
30°	23:57	·· ··	00:44	09:46	10:38	11:34
20°	23:37	·· ··	00:26	10:05	10:57	11:52
N 10°	23:20	·· ··	00:11	10:23	11:14	12:07
0°	23:05	23:56	·· ··	10:38	11:29	12:21
S 10°	22:49	23:41	·· ··	10:54	11:45	12:34
20°	22:32	23:25	·· ··	11:11	12:01	12:49
30°	22:13	23:07	·· ··	11:31	12:20	13:06
35°	22:01	22:57	23:56	11:42	12:31	13:16
40°	21:48	22:44	23:45	11:55	12:43	13:27
45°	21:33	22:30	23:33	12:11	12:58	13:40
S 50°	21:14	22:13	23:18	12:30	13:16	13:56
52°	21:05	22:04	23:11	12:39	13:24	14:03
54°	20:55	21:55	23:03	12:49	13:34	14:12
56°	20:44	21:45	22:54	13:00	13:44	14:21
58°	20:31	21:33	22:44	13:13	13:57	14:31
S 60°	20:16	21:19	22:32	13:28	14:11	14:43

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 21-23 73-55%
25	01:59	02:04	11:58	04:26	16:52	
26	02:09	02:14	11:58	05:17	17:42	
27	02:19	02:24	11:58	06:08	18:34	

April 28, 29, 30 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	215°52.7	175°10.0	N15°07.9	185°53.5	N11°48.3	33°39.3	N00°43.2	31°00.7	N00°45.2
1	230°55.1	190°09.4	09.0	200°54.2	49.0	48°42.0	43.3	46°03.3	45.2
2	245°57.6	205°08.9	10.0	215°54.8	49.6	63°44.7	43.4	61°05.9	45.3
3	261°00.1	220°08.3	·· 11.0	230°55.5	·· 50.3	78°47.3	·· 43.5	76°08.5	·· 45.3
4	276°02.5	235°07.7	12.0	245°56.2	51.0	93°50.0	43.6	91°11.1	45.4
5	291°05.0	250°07.2	13.0	260°56.9	51.6	108°52.7	43.6	106°13.7	45.4
6	306°07.4	265°06.6	N15°14.0	275°57.6	N11°52.3	123°55.3	N00°43.7	121°16.3	N00°45.5
7	321°09.9	280°06.1	15.0	290°58.2	53.0	138°58.0	43.8	136°18.9	45.5
8	336°12.4	295°05.5	16.0	305°58.9	53.6	154°00.6	43.9	151°21.5	45.6
9	351°14.8	310°05.0	·· 17.1	320°59.6	·· 54.3	169°03.3	·· 43.9	166°24.1	·· 45.6
10	6°17.3	325°04.4	18.1	336°00.3	55.0	184°06.0	44.0	181°26.7	45.7
11	21°19.8	340°03.8	19.1	351°00.9	55.6	199°08.6	44.1	196°29.3	45.7
12	36°22.2	355°03.3	N15°20.1	6°01.6	N11°56.3	214°11.3	N00°44.2	211°31.9	N00°45.8
13	51°24.7	10°02.7	21.1	21°02.3	57.0	229°13.9	44.3	226°34.5	45.9
14	66°27.2	25°02.2	22.1	36°03.0	57.6	244°16.6	44.3	241°37.1	45.9
15	81°29.6	40°01.6	·· 23.1	51°03.7	·· 58.3	259°19.3	·· 44.4	256°39.7	·· 46.0
16	96°32.1	55°01.0	24.1	66°04.3	59.0	274°21.9	44.5	271°42.3	46.0
17	111°34.5	70°00.5	25.1	81°05.0	11°59.6	289°24.6	44.6	286°44.9	46.1
18	126°37.0	84°59.9	N15°26.1	96°05.7	N12°00.3	304°27.2	N00°44.6	301°47.5	N00°46.1
19	141°39.5	99°59.3	27.1	111°06.4	01.0	319°29.9	44.7	316°50.1	46.2
20	156°41.9	114°58.8	28.1	126°07.0	01.6	334°32.5	44.8	331°52.7	46.2
21	171°44.4	129°58.2	·· 29.1	141°07.7	·· 02.3	349°35.2	·· 44.9	346°55.3	·· 46.3
22	186°46.9	144°57.6	30.1	156°08.4	03.0	4°37.9	44.9	1°57.9	46.3
23	201°49.3	159°57.1	31.1	171°09.1	03.6	19°40.5	45.0	17°00.5	46.4
Mer.pass. 09:35		ν -0.6′	d 1.0′	m -3.88	ν 0.7′	d 0.7′	m 1.20	ν 2.7′	d 0.1′ m -2.38	ν 2.6′	d 0.1′ m 0.60

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	216°51.8	174°56.5	N15°32.1	186°09.8	N12°04.3	34°43.2	N00°45.1	32°03.1	N00°46.4
1	231°54.3	189°56.0	33.1	201°10.4	05.0	49°45.8	45.2	47°05.7	46.5
2	246°56.7	204°55.4	34.1	216°11.1	05.6	64°48.5	45.2	62°08.3	46.5
3	261°59.2	219°54.8	·· 35.1	231°11.8	·· 06.3	79°51.1	·· 45.3	77°10.9	·· 46.6
4	277°01.7	234°54.2	36.1	246°12.5	06.9	94°53.8	45.4	92°13.5	46.6
5	292°04.1	249°53.7	37.1	261°13.1	07.6	109°56.5	45.5	107°16.1	46.7
6	307°06.6	264°53.1	N15°38.1	276°13.8	N12°08.3	124°59.1	N00°45.5	122°18.7	N00°46.7
7	322°09.0	279°52.5	39.1	291°14.5	08.9	140°01.8	45.6	137°21.3	46.8
8	337°11.5	294°52.0	40.1	306°15.2	09.6	155°04.4	45.7	152°23.9	46.8
9	352°14.0	309°51.4	·· 41.1	321°15.8	·· 10.3	170°07.1	·· 45.8	167°26.5	·· 46.9
10	7°16.4	324°50.8	42.1	336°16.5	10.9	185°09.7	45.8	182°29.1	46.9
11	22°18.9	339°50.3	43.1	351°17.2	11.6	200°12.4	45.9	197°31.7	47.0
12	37°21.4	354°49.7	N15°44.1	6°17.9	N12°12.2	215°15.0	N00°46.0	212°34.2	N00°47.0
13	52°23.8	9°49.1	45.1	21°18.5	12.9	230°17.7	46.1	227°36.8	47.1
14	67°26.3	24°48.5	46.1	36°19.2	13.6	245°20.4	46.1	242°39.4	47.1
15	82°28.8	39°48.0	·· 47.0	51°19.9	·· 14.2	260°23.0	·· 46.2	257°42.0	·· 47.2
16	97°31.2	54°47.4	48.0	66°20.6	14.9	275°25.7	46.3	272°44.6	47.2
17	112°33.7	69°46.8	49.0	81°21.2	15.5	290°28.3	46.4	287°47.2	47.3
18	127°36.2	84°46.3	N15°50.0	96°21.9	N12°16.2	305°31.0	N00°46.4	302°49.8	N00°47.3
19	142°38.6	99°45.7	51.0	111°22.6	16.9	320°33.6	46.5	317°52.4	47.4
20	157°41.1	114°45.1	52.0	126°23.3	17.5	335°36.3	46.6	332°55.0	47.4
21	172°43.5	129°44.5	·· 53.0	141°23.9	·· 18.2	350°38.9	·· 46.6	347°57.6	·· 47.5
22	187°46.0	144°43.9	53.9	156°24.6	18.8	5°41.6	46.7	3°00.2	47.5
23	202°48.5	159°43.4	54.9	171°25.3	19.5	20°44.2	46.8	18°02.8	47.6
Mer.pass. 09:31		ν -0.6′	d 1.0′	m -3.88	ν 0.7′	d 0.7′	m 1.21	ν 2.7′	d 0.1′ m -2.37	ν 2.6′	d 0.1′ m 0.61

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	217°50.9	174°42.8	N15°55.9	186°26.0	N12°20.2	35°46.9	N00°46.9	33°05.4	N00°47.6
1	232°53.4	189°42.2	56.9	201°26.6	20.8	50°49.5	46.9	48°08.0	47.7
2	247°55.9	204°41.6	57.9	216°27.3	21.5	65°52.2	47.0	63°10.6	47.7
3	262°58.3	219°41.1	·· 58.9	231°28.0	·· 22.1	80°54.8	·· 47.1	78°13.2	·· 47.8
4	278°00.8	234°40.5	15°59.8	246°28.7	22.8	95°57.5	47.2	93°15.8	47.8
5	293°03.3	249°39.9	16°00.8	261°29.3	23.4	111°00.1	47.2	108°18.4	47.9
6	308°05.7	264°39.3	N16°01.8	276°30.0	N12°24.1	126°02.8	N00°47.3	123°21.0	N00°47.9
7	323°08.2	279°38.7	02.8	291°30.7	24.8	141°05.4	47.4	138°23.5	48.0
8	338°10.6	294°38.2	03.8	306°31.4	25.4	156°08.1	47.4	153°26.1	48.0
9	353°13.1	309°37.6	·· 04.7	321°32.0	·· 26.1	171°10.7	·· 47.5	168°28.7	·· 48.1
10	8°15.6	324°37.0	05.7	336°32.7	26.7	186°13.4	47.6	183°31.3	48.1
11	23°18.0	339°36.4	06.7	351°33.4	27.4	201°16.0	47.7	198°33.9	48.2
12	38°20.5	354°35.8	N16°07.7	6°34.1	N12°28.0	216°18.7	N00°47.7	213°36.5	N00°48.2
13	53°23.0	9°35.3	08.6	21°34.7	28.7	231°21.3	47.8	228°39.1	48.3
14	68°25.4	24°34.7	09.6	36°35.4	29.3	246°24.0	47.9	243°41.7	48.3
15	83°27.9	39°34.1	·· 10.6	51°36.1	·· 30.0	261°26.6	·· 47.9	258°44.3	·· 48.4
16	98°30.4	54°33.5	11.6	66°36.8	30.7	276°29.3	48.0	273°46.9	48.4
17	113°32.8	69°32.9	12.5	81°37.4	31.3	291°31.9	48.1	288°49.5	48.5
18	128°35.3	84°32.3	N16°13.5	96°38.1	N12°32.0	306°34.6	N00°48.2	303°52.1	N00°48.5
19	143°37.8	99°31.7	14.5	111°38.8	32.6	321°37.2	48.2	318°54.7	48.6
20	158°40.2	114°31.2	15.4	126°39.5	33.3	336°39.9	48.3	333°57.3	48.6
21	173°42.7	129°30.6	·· 16.4	141°40.1	·· 33.9	351°42.5	·· 48.4	348°59.8	·· 48.7
22	188°45.1	144°30.0	17.4	156°40.8	34.6	6°45.1	48.4	4°02.4	48.7
23	203°47.6	159°29.4	18.3	171°41.5	35.2	21°47.8	48.5	19°05.0	48.8
Mer.pass. 09:27		ν -0.6′	d 1.0′	m -3.88	ν 0.7′	d 0.7′	m 1.21	ν 2.7′	d 0.1′ m -2.37	ν 2.6′	d 0.0′ m 0.61

Stars

	SHA	Dec
Alpheratz	358°09.2	28°58.9
Ankaa	353°40.2	-42°24.5
Schedar	350°09.0	56°25.8
Diphda	349°20.8	-18°05.5
Achernar	335°45.6	-57°20.0
Hamal	328°28.8	23°22.2
Polaris	327°06.7	89°10.6
Acamar	315°37.3	-40°23.0
Menkar	314°41.0	4°00.8
Mirfak	309°16.0	49°47.6
Aldebaran	291°17.8	16°28.2
Rigel	281°35.9	-8°13.6
Capella	281°11.1	45°58.8
Bellatrix	278°58.6	6°19.8
Elnath	278°43.9	28°35.5
Alnilam	276°11.5	-1°13.0
Betelgeuse	271°28.1	7°24.1
Canopus	264°07.3	-52°41.5
Sirius	258°55.5	-16°41.6
Adhara	255°32.0	-28°57.1
Procyon	245°25.5	5°16.3
Pollux	243°57.8	28°04.4
Avior	234°28.1	-59°27.3
Suhail	223°10.4	-43°21.7
Miaplacidus	221°44.8	-69°38.7
Alphard	218°20.1	-8°34.8
Regulus	208°09.5	12°03.5
Dubhe	194°21.2	61°51.4
Denebola	182°58.4	14°40.6
Gienah	176°17.3	-17°26.4
Acrux	173°36.2	-62°59.8
Gacrux	172°27.8	-57°00.6
Alioth	166°41.6	56°03.8
Spica	158°56.8	-11°03.9
Alkaid	153°17.7	49°24.5
Hadar	149°22.1	-60°17.0
Menkent	148°36.1	-36°16.7
Arcturus	146°17.8	19°16.8
Rigil Kent.	140°24.6	-60°45.3
Kochab	137°17.8	74°14.0
Zuben'ubi	137°32.3	-15°57.9
Alphecca	126°31.4	26°46.6
Antares	112°56.0	-26°23.4
Atria	108°19.5	-68°59.5
Sabik	102°40.4	-15°42.1
Shaula	96°54.9	-37°05.3
Rasalhague	96°29.0	12°34.3
Eltanin	90°57.2	51°29.3
Kaus Aust.	84°16.1	-34°23.5
Vega	80°55.3	38°45.8
Nunki	76°28.5	-26°19.2
Altair	62°32.1	8°49.0
Peacock	53°57.7	-56°47.5
Deneb	49°48.2	45°12.5
Enif	34°11.3	9°47.1
Al Na'ir	28°14.6	-47°03.0
Fomalhaut	15°51.2	-29°43.3
Scheat	14°17.4	27°58.6
Markab	14°03.0	15°06.0

Apr 28 Tue	SHA	Mer.pass
Venus	319°17.3	12:20
Mars	330°00.8	11:36
Jupiter	177°46.7	21:42
Saturn	175°08.1	21:52

Apr 29 Wed	SHA	Mer.pass
Venus	318°04.7	12:21
Mars	329°18.0	11:35
Jupiter	177°51.4	21:37
Saturn	175°11.3	21:48

Apr 30 Thu	SHA	Mer.pass
Venus	316°51.9	12:22
Mars	328°35.0	11:34
Jupiter	177°55.9	21:33
Saturn	175°14.5	21:44

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h

Tue	Sun GHA	Sun Dec	Moon GHA	ν	Moon Dec	d	HP
0	180°37.1	N14°03.1	258°42.0	9.9′	S17°11.5	6.8′	57.0′
1	195°37.2	03.9	273°10.9	9.9′	17°04.7	7.0′	57.1′
2	210°37.3	04.7	287°39.8	9.9′	16°57.7	7.1′	57.1′
3	225°37.4	·· 05.5	302°08.6	9.9′	16°50.6	7.1′	57.2′
4	240°37.5	06.3	316°37.5	9.9′	16°43.5	7.3′	57.2′
5	255°37.6	07.1	331°06.4	9.9′	16°36.2	7.3′	57.2′
6	270°37.7	N14°07.9	345°35.2	9.9′	S16°28.9	7.5′	57.3′
7	285°37.8	08.6	0°04.1	9.9′	16°21.4	7.6′	57.3′
8	300°37.8	09.4	14°33.0	9.9′	16°13.8	7.6′	57.3′
9	315°37.9	·· 10.2	29°01.8	9.9′	16°06.2	7.8′	57.4′
10	330°38.0	11.0	43°30.7	9.9′	15°58.4	7.8′	57.4′
11	345°38.1	11.8	57°59.5	9.9′	15°50.6	8.0′	57.5′
12	0°38.2	N14°12.6	72°28.4	9.9′	S15°42.6	8.0′	57.5′
13	15°38.3	13.3	86°57.2	9.8′	15°34.6	8.2′	57.5′
14	30°38.4	14.1	101°26.1	9.8′	15°26.4	8.2′	57.6′
15	45°38.5	·· 14.9	115°54.9	9.8′	15°18.2	8.4′	57.6′
16	60°38.6	15.7	130°23.8	9.8′	15°09.8	8.4′	57.6′
17	75°38.7	16.5	144°52.6	9.8′	15°01.4	8.5′	57.7′
18	90°38.8	N14°17.3	159°21.5	9.8′	S14°52.9	8.6′	57.7′
19	105°38.8	18.0	173°50.3	9.8′	14°44.3	8.7′	57.8′
20	120°38.9	18.8	188°19.2	9.8′	14°35.6	8.8′	57.8′
21	135°39.0	·· 19.6	202°48.0	9.8′	14°26.8	8.9′	57.8′
22	150°39.1	20.4	217°16.8	9.8′	14°17.9	9.0′	57.9′
23	165°39.2	21.2	231°45.7	9.8′	14°08.9	9.1′	57.9′
	SD = 15.9′	d = 0.8′		SD = 15.6′			

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	180°39.3	N14°22.0	246°14.5	9.8′	S13°59.8	9.2′	58.0′
1	195°39.4	22.7	260°43.3	9.8′	13°50.6	9.2′	58.0′
2	210°39.5	23.5	275°12.1	9.8′	13°41.4	9.4′	58.0′
3	225°39.6	·· 24.3	289°41.0	9.8′	13°32.0	9.4′	58.1′
4	240°39.7	25.1	304°09.8	9.8′	13°22.6	9.5′	58.1′
5	255°39.7	25.8	318°38.6	9.8′	13°13.1	9.6′	58.2′
6	270°39.8	N14°26.6	333°07.4	9.8′	S13°03.5	9.7′	58.2′
7	285°39.9	27.4	347°36.2	9.8′	12°53.8	9.8′	58.2′
8	300°40.0	28.2	2°05.0	9.8′	12°44.0	9.9′	58.3′
9	315°40.1	·· 29.0	16°33.8	9.8′	12°34.1	9.9′	58.3′
10	330°40.2	29.7	31°02.6	9.8′	12°24.2	10.0′	58.3′
11	345°40.3	30.5	45°31.4	9.8′	12°14.2	10.2′	58.4′
12	0°40.3	N14°31.3	60°00.2	9.8′	S12°04.0	10.2′	58.4′
13	15°40.4	32.1	74°29.0	9.8′	11°53.8	10.2′	58.5′
14	30°40.5	32.8	88°57.7	9.8′	11°43.6	10.4′	58.5′
15	45°40.6	·· 33.6	103°26.5	9.8′	11°33.2	10.4′	58.5′
16	60°40.7	34.4	117°55.3	9.8′	11°22.8	10.6′	58.6′
17	75°40.8	35.1	132°24.0	9.8′	11°12.2	10.6′	58.6′
18	90°40.9	N14°35.9	146°52.8	9.7′	S11°01.6	10.6′	58.7′
19	105°40.9	36.7	161°21.5	9.7′	10°51.0	10.8′	58.7′
20	120°41.0	37.5	175°50.3	9.7′	10°40.2	10.8′	58.7′
21	135°41.1	·· 38.2	190°19.0	9.7′	10°29.4	10.9′	58.8′
22	150°41.2	39.0	204°47.7	9.7′	10°18.5	11.0′	58.8′
23	165°41.3	39.8	219°16.4	9.7′	10°07.5	11.0′	58.9′
	SD = 15.9′	d = 0.8′		SD = 15.8′			

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	180°41.4	N14°40.5	233°45.1	9.7′	S09°56.5	11.1′	58.9′
1	195°41.4	41.3	248°13.8	9.7′	09°45.4	11.2′	58.9′
2	210°41.5	42.1	262°42.5	9.7′	09°34.2	11.3′	59.0′
3	225°41.6	·· 42.9	277°11.2	9.7′	09°22.9	11.3′	59.0′
4	240°41.7	43.6	291°39.9	9.7′	09°11.6	11.4′	59.1′
5	255°41.8	44.4	306°08.5	9.6′	09°00.2	11.5′	59.1′
6	270°41.9	N14°45.2	320°37.2	9.6′	S08°48.7	11.5′	59.1′
7	285°41.9	45.9	335°05.8	9.6′	08°37.2	11.6′	59.2′
8	300°42.0	46.7	349°34.5	9.6′	08°25.6	11.7′	59.2′
9	315°42.1	·· 47.5	4°03.1	9.6′	08°13.9	11.7′	59.2′
10	330°42.2	48.2	18°31.7	9.6′	08°02.2	11.8′	59.3′
11	345°42.3	49.0	33°00.3	9.6′	07°50.4	11.8′	59.3′
12	0°42.3	N14°49.8	47°28.8	9.6′	S07°38.6	11.9′	59.4′
13	15°42.4	50.5	61°57.4	9.5′	07°26.7	12.0′	59.4′
14	30°42.5	51.3	76°25.9	9.5′	07°14.7	12.0′	59.4′
15	45°42.6	·· 52.0	90°54.5	9.5′	07°02.7	12.1′	59.5′
16	60°42.7	52.8	105°23.0	9.5′	06°50.6	12.2′	59.5′
17	75°42.7	53.6	119°51.5	9.5′	06°38.4	12.1′	59.5′
18	90°42.8	N14°54.3	134°20.0	9.5′	S06°26.3	12.3′	59.6′
19	105°42.9	55.1	148°48.4	9.4′	06°14.0	12.3′	59.6′
20	120°43.0	55.9	163°16.9	9.4′	06°01.7	12.3′	59.7′
21	135°43.1	·· 56.6	177°45.3	9.4′	05°49.4	12.4′	59.7′
22	150°43.1	57.4	192°13.7	9.4′	05°37.0	12.5′	59.7′
23	165°43.2	58.1	206°42.1	9.4′	05°24.5	12.5′	59.8′
	SD = 15.9′	d = 0.8′		SD = 16.1′			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	////	////	02:10	21:51	////	////
N 70°	////	////	02:43	21:16	////	////
68°	////	01:28	03:07	20:51	22:35	////
66°	////	02:08	03:26	20:31	21:51	////
64°	////	02:35	03:41	20:16	21:23	////
62°	01:18	02:56	03:53	20:03	21:02	22:44
60°	01:54	03:12	04:04	19:52	20:45	22:05
N 58°	02:19	03:26	04:13	19:43	20:31	21:39
56°	02:38	03:37	04:21	19:35	20:19	21:19
54°	02:54	03:47	04:28	19:28	20:09	21:03
52°	03:07	03:56	04:35	19:21	20:00	20:50
50°	03:18	04:04	04:40	19:15	19:52	20:38
45°	03:41	04:21	04:53	19:03	19:35	20:15
N 40°	03:58	04:34	05:03	18:52	19:22	19:57
35°	04:12	04:45	05:12	18:44	19:11	19:43
30°	04:24	04:54	05:19	18:36	19:01	19:31
20°	04:42	05:09	05:32	18:23	18:46	19:13
N 10°	04:56	05:22	05:43	18:11	18:33	18:59
0°	05:08	05:33	05:54	18:01	18:22	18:47
S 10°	05:18	05:43	06:04	17:50	18:12	18:37
20°	05:26	05:53	06:15	17:39	18:02	18:28
30°	05:35	06:03	06:28	17:27	17:51	18:20
35°	05:39	06:08	06:35	17:20	17:46	18:16
40°	05:43	06:15	06:43	17:11	17:39	18:11
45°	05:47	06:21	06:52	17:02	17:33	18:07
S 50°	05:51	06:29	07:03	16:51	17:25	18:03
52°	05:53	06:33	07:09	16:45	17:21	18:01
54°	05:55	06:37	07:14	16:40	17:17	17:59
56°	05:57	06:41	07:21	16:33	17:13	17:57
58°	05:59	06:46	07:28	16:26	17:08	17:55
S 60°	06:01	06:51	07:36	16:18	17:03	17:52

Lat.	Moonrise Tue	Moonrise Wed	Moonrise Thu	Moonset Tue	Moonset Wed	Moonset Thu
N 72°	05:25	04:53	04:35	08:48	11:09	13:16
N 70°	04:38	04:29	04:21	09:34	11:32	13:28
68°	04:08	04:09	04:10	10:04	11:50	13:38
66°	03:45	03:54	04:00	10:26	12:04	13:45
64°	03:27	03:41	03:52	10:43	12:16	13:52
62°	03:12	03:31	03:45	10:58	12:25	13:57
60°	02:59	03:21	03:39	11:10	12:34	14:02
N 58°	02:48	03:13	03:34	11:20	12:41	14:06
56°	02:39	03:06	03:30	11:29	12:48	14:10
54°	02:30	03:00	03:25	11:37	12:53	14:14
52°	02:23	02:54	03:21	11:44	12:58	14:17
50°	02:16	02:49	03:18	11:50	13:03	14:19
45°	02:01	02:37	03:10	12:04	13:13	14:25
N 40°	01:49	02:28	03:04	12:15	13:22	14:30
35°	01:39	02:20	02:59	12:25	13:29	14:35
30°	01:30	02:13	02:54	12:33	13:35	14:38
20°	01:14	02:00	02:45	12:48	13:46	14:45
N 10°	01:00	01:49	02:38	13:00	13:55	14:50
0°	00:47	01:39	02:31	13:12	14:04	14:56
S 10°	00:34	01:29	02:24	13:24	14:12	15:01
20°	00:21	01:18	02:16	13:36	14:22	15:06
30°	00:05	01:05	02:08	13:50	14:32	15:12
35°	·· ··	00:58	02:03	13:58	14:38	15:16
40°	·· ··	00:50	01:57	14:07	14:45	15:20
45°	·· ··	00:40	01:51	14:18	14:52	15:24
S 50°	·· ··	00:28	01:43	14:31	15:02	15:30
52°	·· ··	00:23	01:39	14:37	15:06	15:32
54°	·· ··	00:17	01:35	14:44	15:11	15:35
56°	·· ··	00:10	01:31	14:51	15:16	15:38
58°	·· ··	00:02	01:26	14:59	15:22	15:41
S 60°	23:54	·· ··	01:20	15:08	15:28	15:45

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 24-26 44-24%
28	02:28	02:33	11:57	07:00	19:26	
29	02:37	02:41	11:57	07:51	20:17	
30	02:45	02:49	11:57	08:43	21:09	

May 01, 02, 03 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	218°50.1	174°28.8	N16°19.3	186°42.2	N12°35.9	36°50.4	N00°48.6	34°07.6	N00°48.8
1	233°52.5	189°28.2	20.3	201°42.8	36.5	51°53.1	48.6	49°10.2	48.9
2	248°55.0	204°27.6	21.2	216°43.5	37.2	66°55.7	48.7	64°12.8	48.9
3	263°57.5	219°27.0	·· 22.2	231°44.2	·· 37.8	81°58.4	·· 48.8	79°15.4	·· 49.0
4	278°59.9	234°26.4	23.2	246°44.8	38.5	97°01.0	48.9	94°18.0	49.0
5	294°02.4	249°25.9	24.1	261°45.5	39.1	112°03.7	48.9	109°20.6	49.1
6	309°04.9	264°25.3	N16°25.1	276°46.2	N12°39.8	127°06.3	N00°49.0	124°23.2	N00°49.1
7	324°07.3	279°24.7	26.0	291°46.9	40.5	142°08.9	49.1	139°25.8	49.2
8	339°09.8	294°24.1	27.0	306°47.5	41.1	157°11.6	49.1	154°28.3	49.2
9	354°12.2	309°23.5	·· 28.0	321°48.2	·· 41.8	172°14.2	·· 49.2	169°30.9	·· 49.2
10	9°14.7	324°22.9	28.9	336°48.9	42.4	187°16.9	49.3	184°33.5	49.3
11	24°17.2	339°22.3	29.9	351°49.6	43.1	202°19.5	49.3	199°36.1	49.3
12	39°19.6	354°21.7	N16°30.8	6°50.2	N12°43.7	217°22.2	N00°49.4	214°38.7	N00°49.4
13	54°22.1	9°21.1	31.8	21°50.9	44.4	232°24.8	49.5	229°41.3	49.4
14	69°24.6	24°20.5	32.8	36°51.6	45.0	247°27.4	49.5	244°43.9	49.5
15	84°27.0	39°19.9	·· 33.7	51°52.3	·· 45.7	262°30.1	·· 49.6	259°46.5	·· 49.5
16	99°29.5	54°19.3	34.7	66°52.9	46.3	277°32.7	49.7	274°49.1	49.6
17	114°32.0	69°18.7	35.6	81°53.6	47.0	292°35.4	49.8	289°51.7	49.6
18	129°34.4	84°18.1	N16°36.6	96°54.3	N12°47.6	307°38.0	N00°49.8	304°54.3	N00°49.7
19	144°36.9	99°17.5	37.5	111°54.9	48.2	322°40.7	49.9	319°56.8	49.7
20	159°39.4	114°16.9	38.5	126°55.6	48.9	337°43.3	50.0	334°59.4	49.8
21	174°41.8	129°16.3	·· 39.4	141°56.3	·· 49.5	352°45.9	·· 50.0	350°02.0	·· 49.8
22	189°44.3	144°15.7	40.4	156°57.0	50.2	7°48.6	50.1	5°04.6	49.9
23	204°46.7	159°15.1	41.3	171°57.6	50.8	22°51.2	50.2	20°07.2	49.9
Mer.pass. 09:23		ν -0.6′	d 1.0′	ν 0.7′	d 0.7′	ν 2.6′	d 0.1′	ν 2.6′	d 0.0′
		m -3.88		m 1.22		m -2.36		m 0.62	

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	219°49.2	174°14.5	N16°42.3	186°58.3	N12°51.5	37°53.9	N00°50.2	35°09.8	N00°50.0
1	234°51.7	189°13.9	43.2	201°59.0	52.1	52°56.5	50.3	50°12.4	50.0
2	249°54.1	204°13.3	44.2	216°59.6	52.8	67°59.1	50.4	65°15.0	50.1
3	264°56.6	219°12.7	·· 45.1	232°00.3	·· 53.4	83°01.8	·· 50.4	80°17.6	·· 50.1
4	279°59.1	234°12.1	46.1	247°01.0	54.1	98°04.4	50.5	95°20.1	50.1
5	295°01.5	249°11.5	47.0	262°01.7	54.7	113°07.0	50.6	110°22.7	50.2
6	310°04.0	264°10.9	N16°48.0	277°02.3	N12°55.4	128°09.7	N00°50.6	125°25.3	N00°50.2
7	325°06.5	279°10.3	48.9	292°03.0	56.0	143°12.3	50.7	140°27.9	50.3
8	340°08.9	294°09.7	49.8	307°03.7	56.7	158°15.0	50.8	155°30.5	50.3
9	355°11.4	309°09.1	·· 50.8	322°04.3	·· 57.3	173°17.6	·· 50.8	170°33.1	·· 50.4
10	10°13.9	324°08.5	51.7	337°05.0	57.9	188°20.2	50.9	185°35.7	50.4
11	25°16.3	339°07.9	52.7	352°05.7	58.6	203°22.9	51.0	200°38.3	50.5
12	40°18.8	354°07.3	N16°53.6	7°06.4	N12°59.2	218°25.5	N00°51.0	215°40.8	N00°50.5
13	55°21.2	9°06.7	54.5	22°07.0	12°59.9	233°28.1	51.1	230°43.4	50.6
14	70°23.7	24°06.1	55.5	37°07.7	13°00.5	248°30.8	51.2	245°46.0	50.6
15	85°26.2	39°05.5	·· 56.4	52°08.4	·· 01.2	263°33.4	·· 51.2	260°48.6	·· 50.7
16	100°28.6	54°04.9	57.4	67°09.0	01.8	278°36.1	51.3	275°51.2	50.7
17	115°31.1	69°04.3	58.3	82°09.7	02.5	293°38.7	51.4	290°53.8	50.8
18	130°33.6	84°03.7	N16°59.2	97°10.4	N13°03.1	308°41.3	N00°51.4	305°56.4	N00°50.8
19	145°36.0	99°03.1	17°00.2	112°11.0	03.7	323°44.0	51.5	320°58.9	50.8
20	160°38.5	114°02.4	01.1	127°11.7	04.4	338°46.6	51.5	336°01.5	50.9
21	175°41.0	129°01.8	·· 02.0	142°12.4	·· 05.0	353°49.2	·· 51.6	351°04.1	·· 50.9
22	190°43.4	144°01.2	03.0	157°13.1	05.7	8°51.9	51.7	6°06.7	51.0
23	205°45.9	159°00.6	03.9	172°13.7	06.3	23°54.5	51.7	21°09.3	51.0
Mer.pass. 09:19		ν -0.6′	d 0.9′	ν 0.7′	d 0.6′	ν 2.6′	d 0.1′	ν 2.6′	d 0.0′
		m -3.88		m 1.22		m -2.36		m 0.62	

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	220°48.3	174°00.0	N17°04.8	187°14.4	N13°07.0	38°57.1	N00°51.8	36°11.9	N00°51.1
1	235°50.8	188°59.4	05.8	202°15.1	07.6	53°59.8	51.9	51°14.5	51.1
2	250°53.3	203°58.8	06.7	217°15.7	08.2	69°02.4	51.9	66°17.1	51.2
3	265°55.7	218°58.2	·· 07.6	232°16.4	·· 08.9	84°05.0	·· 52.0	81°19.6	·· 51.2
4	280°58.2	233°57.6	08.5	247°17.1	09.5	99°07.7	52.1	96°22.2	51.3
5	296°00.7	248°56.9	09.5	262°17.7	10.2	114°10.3	52.1	111°24.8	51.3
6	311°03.1	263°56.3	N17°10.4	277°18.4	N13°10.8	129°12.9	N00°52.2	126°27.4	N00°51.3
7	326°05.6	278°55.7	11.3	292°19.1	11.4	144°15.6	52.3	141°30.0	51.4
8	341°08.1	293°55.1	12.2	307°19.8	12.1	159°18.2	52.3	156°32.6	51.4
9	356°10.5	308°54.5	·· 13.2	322°20.4	·· 12.7	174°20.8	·· 52.4	171°35.1	·· 51.5
10	11°13.0	323°53.9	14.1	337°21.1	13.4	189°23.5	52.4	186°37.7	51.5
11	26°15.5	338°53.2	15.0	352°21.8	14.0	204°26.1	52.5	201°40.3	51.6
12	41°17.9	353°52.6	N17°15.9	7°22.4	N13°14.6	219°28.7	N00°52.6	216°42.9	N00°51.6
13	56°20.4	8°52.0	16.9	22°23.1	15.3	234°31.3	52.6	231°45.5	51.7
14	71°22.8	23°51.4	17.8	37°23.8	15.9	249°34.0	52.7	246°48.1	51.7
15	86°25.3	38°50.8	·· 18.7	52°24.4	·· 16.6	264°36.6	·· 52.8	261°50.7	·· 51.7
16	101°27.8	53°50.2	19.6	67°25.1	17.2	279°39.2	52.8	276°53.2	51.8
17	116°30.2	68°49.5	20.5	82°25.8	17.8	294°41.9	52.9	291°55.8	51.8
18	131°32.7	83°48.9	N17°21.4	97°26.4	N13°18.5	309°44.5	N00°52.9	306°58.4	N00°51.9
19	146°35.2	98°48.3	22.4	112°27.1	19.1	324°47.1	53.0	322°01.0	51.9
20	161°37.6	113°47.7	23.3	127°27.8	19.7	339°49.8	53.1	337°03.6	52.0
21	176°40.1	128°47.1	·· 24.2	142°28.5	·· 20.4	354°52.4	·· 53.1	352°06.2	·· 52.0
22	191°42.6	143°46.4	25.1	157°29.1	21.0	9°55.0	53.2	7°08.7	52.1
23	206°45.0	158°45.8	26.0	172°29.8	21.6	24°57.6	53.3	22°11.3	52.1
Mer.pass. 09:15		ν -0.6′	d 0.9′	ν 0.7′	d 0.6′	ν 2.6′	d 0.1′	ν 2.6′	d 0.0′
		m -3.88		m 1.23		m -2.35		m 0.63	

Stars

	SHA	Dec
Alpheratz	358°09.2	28°58.9
Ankaa	353°40.2	-42°24.5
Schedar	350°09.0	56°25.8
Diphda	349°20.7	-18°05.5
Achernar	335°45.5	-57°20.0
Hamal	328°28.8	23°22.2
Polaris	327°06.6	89°10.6
Acamar	315°37.3	-40°23.0
Menkar	314°41.0	4°00.8
Mirfak	309°16.0	49°47.6
Aldebaran	291°17.8	16°28.2
Rigel	281°35.9	-8°13.6
Capella	281°11.1	45°58.8
Bellatrix	278°58.6	6°19.8
Elnath	278°43.9	28°35.5
Alnilam	276°11.5	-1°13.0
Betelgeuse	271°28.1	7°24.1
Canopus	264°07.4	-52°41.4
Sirius	258°55.5	-16°41.6
Adhara	255°32.0	-28°57.0
Procyon	245°25.5	5°16.3
Pollux	243°57.8	28°04.4
Avior	234°28.1	-59°27.3
Suhail	223°10.5	-43°21.7
Miaplacidus	221°44.8	-69°38.7
Alphard	218°20.1	-8°34.7
Regulus	208°09.5	12°03.5
Dubhe	194°21.3	61°51.4
Denebola	182°58.4	14°40.6
Gienah	176°17.3	-17°26.4
Acrux	173°36.3	-62°59.9
Gacrux	172°27.8	-57°00.6
Alioth	166°41.7	56°03.9
Spica	158°56.8	-11°03.9
Alkaid	153°17.7	49°24.5
Hadar	149°22.1	-60°17.0
Menkent	148°36.1	-36°16.7
Arcturus	146°17.8	19°16.8
Rigil Kent.	140°24.6	-60°45.3
Kochab	137°17.8	74°14.0
Zuben'ubi	137°32.2	-15°57.9
Alphecca	126°31.4	26°46.6
Antares	112°56.0	-26°23.4
Atria	108°19.5	-68°59.5
Sabik	102°40.4	-15°42.1
Shaula	96°54.9	-37°05.3
Rasalhague	96°28.9	12°34.3
Eltanin	90°57.2	51°29.3
Kaus Aust.	84°16.1	-34°23.5
Vega	80°55.3	38°45.8
Nunki	76°28.5	-26°19.2
Altair	62°32.0	8°49.0
Peacock	53°57.7	-56°47.5
Deneb	49°48.1	45°12.5
Enif	34°11.2	9°47.1
Al Na'ir	28°14.6	-47°03.0
Fomalhaut	15°51.2	-29°43.3
Scheat	14°17.4	27°58.6
Markab	14°02.9	15°06.0

May 01 Fri	SHA	Mer.pass
Venus	315°38.7	12:23
Mars	327°52.1	11:33
Jupiter	178°00.4	21:29
Saturn	175°17.5	21:40

May 02 Sat	SHA	Mer.pass
Venus	314°25.3	12:24
Mars	327°09.1	11:32
Jupiter	178°04.6	21:25
Saturn	175°20.6	21:36

May 03 Sun	SHA	Mer.pass
Venus	313°11.7	12:25
Mars	326°26.1	11:31
Jupiter	178°08.8	21:20
Saturn	175°23.5	21:31

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = -0.4969 sec ΔT = TT-UT1 = +51.6809 sec

1981 May 01 to May. 03 UT

h	Sun		Moon				
Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°43.3	N14°58.9	221°10.5	9.4′	S05°12.0	12.5′	59.8′
1	195°43.4	14°59.7	235°38.9	9.3′	04°59.5	12.6′	59.8′
2	210°43.5	15°00.4	250°07.2	9.3′	04°46.9	12.7′	59.9′
3	225°43.5	·· 01.2	264°35.5	9.3′	04°34.2	12.6′	59.9′
4	240°43.6	01.9	279°03.8	9.3′	04°21.6	12.8′	59.9′
5	255°43.7	02.7	293°32.1	9.2′	04°08.8	12.7′	60.0′
6	270°43.8	N15°03.4	308°00.3	9.2′	S03°56.1	12.8′	60.0′
7	285°43.8	04.2	322°28.5	9.2′	03°43.3	12.8′	60.0′
8	300°43.9	05.0	336°56.7	9.2′	03°30.5	12.9′	60.1′
9	315°44.0	·· 05.7	351°24.9	9.1′	03°17.6	12.9′	60.1′
10	330°44.1	06.5	5°53.1	9.1′	03°04.7	13.0′	60.1′
11	345°44.1	07.2	20°21.2	9.1′	02°51.7	12.9′	60.2′
12	0°44.2	N15°08.0	34°49.3	9.1′	S02°38.8	13.0′	60.2′
13	15°44.3	08.7	49°17.3	9.0′	02°25.8	13.1′	60.2′
14	30°44.4	09.5	63°45.4	9.0′	02°12.7	13.0′	60.3′
15	45°44.4	·· 10.2	78°13.4	9.0′	01°59.7	13.1′	60.3′
16	60°44.5	11.0	92°41.4	9.0′	01°46.6	13.1′	60.3′
17	75°44.6	11.7	107°09.4	8.9′	01°33.5	13.2′	60.4′
18	90°44.7	N15°12.5	121°37.3	8.9′	S01°20.3	13.1′	60.4′
19	105°44.7	13.3	136°05.2	8.9′	01°07.2	13.2′	60.4′
20	120°44.8	14.0	150°33.0	8.8′	00°54.0	13.2′	60.5′
21	135°44.9	·· 14.8	165°00.9	8.8′	00°40.8	13.2′	60.5′
22	150°44.9	15.5	179°28.7	8.8′	00°27.6	13.3′	60.5′
23	165°45.0	16.3	193°56.5	8.7′	00°14.3	13.2′	60.5′
	SD = 15.9′	d = 0.8′	SD = 16.3′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°45.1	N15°17.0	208°24.2	8.7′	S00°01.1	13.3′	60.6′
1	195°45.2	17.8	222°51.9	8.7′	N00°12.2	13.2′	60.6′
2	210°45.2	18.5	237°19.6	8.6′	00°25.4	13.3′	60.6′
3	225°45.3	·· 19.3	251°47.2	8.6′	00°38.7	13.3′	60.6′
4	240°45.4	20.0	266°14.8	8.6′	00°52.0	13.3′	60.7′
5	255°45.4	20.7	280°42.4	8.5′	01°05.3	13.3′	60.7′
6	270°45.5	N15°21.5	295°09.9	8.5′	N01°18.6	13.3′	60.7′
7	285°45.6	22.2	309°37.4	8.5′	01°31.9	13.3′	60.7′
8	300°45.7	23.0	324°04.8	8.4′	01°45.2	13.4′	60.8′
9	315°45.7	·· 23.7	338°32.2	8.4′	01°58.6	13.3′	60.8′
10	330°45.8	24.5	352°59.6	8.3′	02°11.9	13.3′	60.8′
11	345°45.9	25.2	7°27.0	8.3′	02°25.2	13.3′	60.8′
12	0°45.9	N15°26.0	21°54.3	8.3′	N02°38.5	13.3′	60.9′
13	15°46.0	26.7	36°21.5	8.2′	02°51.8	13.3′	60.9′
14	30°46.1	27.5	50°48.7	8.2′	03°05.1	13.3′	60.9′
15	45°46.1	·· 28.2	65°15.9	8.1′	03°18.4	13.2′	60.9′
16	60°46.2	28.9	79°43.0	8.1′	03°31.6	13.3′	61.0′
17	75°46.3	29.7	94°10.1	8.0′	03°44.9	13.2′	61.0′
18	90°46.3	N15°30.4	108°37.2	8.0′	N03°58.1	13.3′	61.0′
19	105°46.4	31.2	123°04.2	8.0′	04°11.4	13.2′	61.0′
20	120°46.5	31.9	137°31.1	7.9′	04°24.6	13.2′	61.0′
21	135°46.5	·· 32.6	151°58.1	7.9′	04°37.8	13.1′	61.0′
22	150°46.6	33.4	166°24.9	7.8′	04°50.9	13.2′	61.1′
23	165°46.7	34.1	180°51.8	7.8′	05°04.1	13.1′	61.1′
	SD = 15.9′	d = 0.7′	SD = 16.5′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°46.7	N15°34.9	195°18.5	7.7′	N05°17.2	13.1′	61.1′
1	195°46.8	35.6	209°45.3	7.7′	05°30.3	13.1′	61.1′
2	210°46.9	36.3	224°12.0	7.6′	05°43.4	13.0′	61.1′
3	225°46.9	·· 37.1	238°38.6	7.6′	05°56.4	13.1′	61.1′
4	240°47.0	37.8	253°05.2	7.6′	06°09.5	12.9′	61.2′
5	255°47.1	38.5	267°31.8	7.5′	06°22.4	13.0′	61.2′
6	270°47.1	N15°39.3	281°58.3	7.5′	N06°35.4	12.9′	61.2′
7	285°47.2	40.0	296°24.7	7.4′	06°48.3	12.9′	61.2′
8	300°47.3	40.8	310°51.1	7.4′	07°01.2	12.8′	61.2′
9	315°47.3	·· 41.5	325°17.5	7.3′	07°14.0	12.8′	61.2′
10	330°47.4	42.2	339°43.8	7.3′	07°26.8	12.7′	61.2′
11	345°47.5	43.0	354°10.1	7.2′	07°39.5	12.7′	61.2′
12	0°47.5	N15°43.7	8°36.3	7.2′	N07°52.2	12.7′	61.3′
13	15°47.6	44.4	23°02.4	7.1′	08°04.9	12.6′	61.3′
14	30°47.6	45.2	37°28.5	7.1′	08°17.5	12.5′	61.3′
15	45°47.7	·· 45.9	51°54.6	7.0′	08°30.0	12.5′	61.3′
16	60°47.8	46.6	66°20.6	7.0′	08°42.5	12.5′	61.3′
17	75°47.8	47.4	80°46.6	6.9′	08°55.0	12.3′	61.3′
18	90°47.9	N15°48.1	95°12.5	6.9′	N09°07.3	12.4′	61.3′
19	105°48.0	48.8	109°38.4	6.8′	09°19.7	12.2′	61.3′
20	120°48.0	49.5	124°04.2	6.8′	09°31.9	12.3′	61.3′
21	135°48.1	·· 50.3	138°29.9	6.7′	09°44.2	12.1′	61.3′
22	150°48.1	51.0	152°55.7	6.7′	09°56.3	12.1′	61.3′
23	165°48.2	51.7	167°21.3	6.6′	10°08.4	12.0′	61.3′
	SD = 15.9′	d = 0.7′	SD = 16.7′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	////	////	01:45	22:17	////	////
N 70°	////	////	02:26	21:33	////	////
68°	////	00:57	02:53	21:04	23:10	////
66°	////	01:50	03:14	20:43	22:09	////
64°	////	02:21	03:31	20:26	21:36	////
62°	00:50	02:44	03:44	20:12	21:13	23:16
60°	01:38	03:02	03:56	20:00	20:54	22:21
N 58°	02:06	03:17	04:06	19:50	20:39	21:51
56°	02:28	03:29	04:14	19:41	20:26	21:29
54°	02:45	03:40	04:22	19:33	20:15	21:11
52°	02:59	03:50	04:29	19:26	20:05	20:57
50°	03:11	03:58	04:35	19:20	19:57	20:44
45°	03:35	04:16	04:48	19:06	19:39	20:20
N 40°	03:54	04:30	04:59	18:55	19:25	20:01
35°	04:09	04:41	05:08	18:46	19:13	19:46
30°	04:21	04:51	05:16	18:38	19:03	19:34
20°	04:40	05:07	05:30	18:24	18:47	19:14
N 10°	04:55	05:21	05:42	18:12	18:34	18:59
0°	05:07	05:32	05:54	18:00	18:22	18:47
S 10°	05:18	05:43	06:05	17:49	18:11	18:36
20°	05:27	05:53	06:16	17:37	18:00	18:26
30°	05:36	06:05	06:29	17:24	17:49	18:17
35°	05:41	06:11	06:37	17:16	17:43	18:13
40°	05:45	06:17	06:46	17:08	17:36	18:08
45°	05:50	06:25	06:56	16:58	17:28	18:03
S 50°	05:55	06:34	07:08	16:45	17:20	17:58
52°	05:57	06:37	07:13	16:40	17:16	17:56
54°	06:00	06:42	07:20	16:34	17:11	17:54
56°	06:02	06:46	07:26	16:27	17:07	17:51
58°	06:04	06:51	07:34	16:19	17:02	17:48
S 60°	06:07	06:57	07:43	16:10	16:56	17:46

Lat.	**Moonrise** Fri	Sat	Sun	**Moonset** Fri	Sat	Sun
N 72°	04:20	04:06	03:53	15:22	17:30	19:44
N 70°	04:14	04:07	04:01	15:25	17:25	19:29
68°	04:09	04:08	04:08	15:28	17:20	19:17
66°	04:05	04:09	04:13	15:30	17:17	19:07
64°	04:01	04:09	04:18	15:31	17:14	18:58
62°	03:58	04:10	04:23	15:33	17:11	18:51
60°	03:55	04:10	04:26	15:34	17:09	18:45
N 58°	03:53	04:11	04:30	15:35	17:06	18:40
56°	03:51	04:11	04:33	15:36	17:05	18:35
54°	03:49	04:12	04:35	15:37	17:03	18:31
52°	03:47	04:12	04:38	15:38	17:02	18:27
50°	03:45	04:12	04:40	15:39	17:00	18:23
45°	03:42	04:13	04:45	15:40	16:57	18:16
N 40°	03:39	04:13	04:49	15:42	16:55	18:10
35°	03:36	04:14	04:53	15:43	16:53	18:04
30°	03:34	04:14	04:56	15:44	16:51	18:00
20°	03:30	04:15	05:01	15:45	16:48	17:51
N 10°	03:26	04:16	05:06	15:47	16:45	17:44
0°	03:23	04:16	05:11	15:48	16:42	17:38
S 10°	03:20	04:17	05:16	15:49	16:39	17:31
20°	03:16	04:18	05:21	15:51	16:36	17:24
30°	03:12	04:19	05:27	15:52	16:33	17:16
35°	03:10	04:19	05:30	15:53	16:31	17:11
40°	03:07	04:20	05:34	15:54	16:29	17:06
45°	03:04	04:20	05:39	15:55	16:27	17:00
S 50°	03:01	04:21	05:44	15:57	16:24	16:53
52°	02:59	04:22	05:47	15:57	16:22	16:49
54°	02:57	04:22	05:49	15:58	16:21	16:46
56°	02:55	04:23	05:52	15:59	16:19	16:41
58°	02:53	04:23	05:56	15:59	16:17	16:37
S 60°	02:50	04:24	06:00	16:00	16:15	16:32

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 27-29 15-2%
01	02:53	02:57	11:57	09:36	22:02	
02	03:00	03:04	11:57	10:29	22:56	
03	03:07	03:10	11:57	11:24	23:53	

May 04, 05, 06 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	221°47.5	173°45.2	N17°26.9	187°30.5	N13°22.3	40°00.3	N00°53.3	37°13.9	N00°52.1
1	236°49.9	188°44.6	27.8	202°31.1	22.9	55°02.9	53.4	52°16.5	52.2
2	251°52.4	203°43.9	28.8	217°31.8	23.6	70°05.5	53.4	67°19.1	52.2
3	266°54.9	218°43.3	·· 29.7	232°32.5	·· 24.2	85°08.1	·· 53.5	82°21.7	·· 52.3
4	281°57.3	233°42.7	30.6	247°33.1	24.8	100°10.8	53.6	97°24.2	52.3
5	296°59.8	248°42.1	31.5	262°33.8	25.5	115°13.4	53.6	112°26.8	52.4
6	312°02.3	263°41.4	N17°32.4	277°34.5	N13°26.1	130°16.0	N00°53.7	127°29.4	N00°52.4
7	327°04.7	278°40.8	33.3	292°35.1	26.7	145°18.6	53.8	142°32.0	52.5
8	342°07.2	293°40.2	34.2	307°35.8	27.4	160°21.3	53.8	157°34.6	52.5
9	357°09.7	308°39.6	·· 35.1	322°36.5	·· 28.0	175°23.9	·· 53.9	172°37.1	·· 52.5
10	12°12.1	323°38.9	36.0	337°37.1	28.6	190°26.5	53.9	187°39.7	52.6
11	27°14.6	338°38.3	36.9	352°37.8	29.3	205°29.1	54.0	202°42.3	52.6
12	42°17.1	353°37.7	N17°37.8	7°38.5	N13°29.9	220°31.8	N00°54.1	217°44.9	N00°52.7
13	57°19.5	8°37.0	38.7	22°39.1	30.5	235°34.4	54.1	232°47.5	52.7
14	72°22.0	23°36.4	39.6	37°39.8	31.2	250°37.0	54.2	247°50.1	52.8
15	87°24.4	38°35.8	·· 40.5	52°40.5	·· 31.8	265°39.6	·· 54.2	262°52.6	·· 52.8
16	102°26.9	53°35.2	41.4	67°41.1	32.4	280°42.3	54.3	277°55.2	52.8
17	117°29.4	68°34.5	42.3	82°41.8	33.1	295°44.9	54.4	292°57.8	52.9
18	132°31.8	83°33.9	N17°43.2	97°42.5	N13°33.7	310°47.5	N00°54.4	308°00.4	N00°52.9
19	147°34.3	98°33.3	44.1	112°43.1	34.3	325°50.1	54.5	323°03.0	53.0
20	162°36.8	113°32.6	45.0	127°43.8	34.9	340°52.8	54.5	338°05.5	53.0
21	177°39.2	128°32.0	·· 45.9	142°44.5	·· 35.6	355°55.4	·· 54.6	353°08.1	·· 53.1
22	192°41.7	143°31.4	46.8	157°45.1	36.2	10°58.0	54.6	8°10.7	53.1
23	207°44.2	158°30.7	47.7	172°45.8	36.8	26°00.6	54.7	23°13.3	53.1
Mer.pass. 09:11		ν -0.6′	d 0.9′	m -3.88	ν 0.7′	d 0.6′	m 1.23	ν 2.6′	d 0.1′ m -2.34	ν 2.6′	d 0.0′ m 0.63

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	222°46.6	173°30.1	N17°48.6	187°46.5	N13°37.5	41°03.2	N00°54.8	38°15.9	N00°53.2
1	237°49.1	188°29.5	49.5	202°47.1	38.1	56°05.9	54.8	53°18.4	53.2
2	252°51.6	203°28.8	50.4	217°47.8	38.7	71°08.5	54.9	68°21.0	53.3
3	267°54.0	218°28.2	·· 51.3	232°48.5	·· 39.4	86°11.1	·· 54.9	83°23.6	·· 53.3
4	282°56.5	233°27.5	52.2	247°49.1	40.0	101°13.7	55.0	98°26.2	53.4
5	297°58.9	248°26.9	53.0	262°49.8	40.6	116°16.3	55.1	113°28.8	53.4
6	313°01.4	263°26.3	N17°53.9	277°50.5	N13°41.2	131°19.0	N00°55.1	128°31.3	N00°53.4
7	328°03.9	278°25.6	54.8	292°51.1	41.9	146°21.6	55.2	143°33.9	53.5
8	343°06.3	293°25.0	55.7	307°51.8	42.5	161°24.2	55.2	158°36.5	53.5
9	358°08.8	308°24.4	·· 56.6	322°52.5	·· 43.1	176°26.8	·· 55.3	173°39.1	·· 53.6
10	13°11.3	323°23.7	57.5	337°53.1	43.8	191°29.4	55.4	188°41.6	53.6
11	28°13.7	338°23.1	58.4	352°53.8	44.4	206°32.1	55.4	203°44.2	53.7
12	43°16.2	353°22.4	N17°59.2	7°54.5	N13°45.0	221°34.7	N00°55.5	218°46.8	N00°53.7
13	58°18.7	8°21.8	18°00.1	22°55.1	45.6	236°37.3	55.5	233°49.4	53.7
14	73°21.1	23°21.2	01.0	37°55.8	46.3	251°39.9	55.6	248°52.0	53.8
15	88°23.6	38°20.5	·· 01.9	52°56.5	·· 46.9	266°42.5	·· 55.6	263°54.5	·· 53.8
16	103°26.1	53°19.9	02.8	67°57.1	47.5	281°45.2	55.7	278°57.1	53.9
17	118°28.5	68°19.2	03.7	82°57.8	48.1	296°47.8	55.8	293°59.7	53.9
18	133°31.0	83°18.6	N18°04.5	97°58.5	N13°48.8	311°50.4	N00°55.8	309°02.3	N00°53.9
19	148°33.4	98°17.9	05.4	112°59.1	49.4	326°53.0	55.9	324°04.9	54.0
20	163°35.9	113°17.3	06.3	127°59.8	50.0	341°55.6	55.9	339°07.4	54.0
21	178°38.4	128°16.7	·· 07.2	143°00.5	·· 50.6	356°58.2	·· 56.0	354°10.0	·· 54.1
22	193°40.8	143°16.0	08.0	158°01.1	51.3	12°00.8	56.0	9°12.6	54.1
23	208°43.3	158°15.4	08.9	173°01.8	51.9	27°03.5	56.1	24°15.2	54.2
Mer.pass. 09:07		ν -0.6′	d 0.9′	m -3.88	ν 0.7′	d 0.6′	m 1.24	ν 2.6′	d 0.1′ m -2.34	ν 2.6′	d 0.0′ m 0.64

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	223°45.8	173°14.7	N18°09.8	188°02.5	N13°52.5	42°06.1	N00°56.1	39°17.7	N00°54.2
1	238°48.2	188°14.1	10.7	203°03.1	53.1	57°08.7	56.2	54°20.3	54.2
2	253°50.7	203°13.4	11.5	218°03.8	53.8	72°11.3	56.3	69°22.9	54.3
3	268°53.2	218°12.8	·· 12.4	233°04.4	·· 54.4	87°13.9	·· 56.3	84°25.5	·· 54.3
4	283°55.6	233°12.1	13.3	248°05.1	55.0	102°16.5	56.4	99°28.0	54.4
5	298°58.1	248°11.5	14.1	263°05.8	55.6	117°19.1	56.4	114°30.6	54.4
6	314°00.5	263°10.8	N18°15.0	278°06.4	N13°56.3	132°21.8	N00°56.5	129°33.2	N00°54.4
7	329°03.0	278°10.2	15.9	293°07.1	56.9	147°24.4	56.5	144°35.8	54.5
8	344°05.5	293°09.5	16.7	308°07.8	57.5	162°27.0	56.6	159°38.3	54.5
9	359°07.9	308°08.9	·· 17.6	323°08.4	·· 58.1	177°29.6	·· 56.6	174°40.9	·· 54.6
10	14°10.4	323°08.2	18.5	338°09.1	58.7	192°32.2	56.7	189°43.5	54.6
11	29°12.9	338°07.6	19.3	353°09.8	13°59.4	207°34.8	56.8	204°46.1	54.6
12	44°15.3	353°06.9	N18°20.2	8°10.4	N14°00.0	222°37.4	N00°56.8	219°48.6	N00°54.7
13	59°17.8	8°06.3	21.1	23°11.1	00.6	237°40.0	56.9	234°51.2	54.7
14	74°20.3	23°05.6	21.9	38°11.8	01.2	252°42.7	56.9	249°53.8	54.8
15	89°22.7	38°05.0	·· 22.8	53°12.4	·· 01.8	267°45.3	·· 57.0	264°56.4	·· 54.8
16	104°25.2	53°04.3	23.7	68°13.1	02.5	282°47.9	57.0	279°58.9	54.8
17	119°27.7	68°03.7	24.5	83°13.7	03.1	297°50.5	57.1	295°01.5	54.9
18	134°30.1	83°03.0	N18°25.4	98°14.4	N14°03.7	312°53.1	N00°57.1	310°04.1	N00°54.9
19	149°32.6	98°02.4	26.2	113°15.1	04.3	327°55.7	57.2	325°06.7	55.0
20	164°35.0	113°01.7	27.1	128°15.7	04.9	342°58.3	57.2	340°09.2	55.0
21	179°37.5	128°01.0	·· 27.9	143°16.4	·· 05.6	358°00.9	·· 57.3	355°11.8	·· 55.0
22	194°40.0	143°00.4	28.8	158°17.1	06.2	13°03.5	57.3	10°14.4	55.1
23	209°42.4	157°59.7	29.7	173°17.7	06.8	28°06.2	57.4	25°17.0	55.1
Mer.pass. 09:03		ν -0.6′	d 0.9′	m -3.88	ν 0.7′	d 0.6′	m 1.25	ν 2.6′	d 0.1′ m -2.33	ν 2.6′	d 0.0′ m 0.64

Stars

	SHA	Dec
Alpheratz	358°09.2	28°58.9
Ankaa	353°40.2	-42°24.5
Schedar	350°09.0	56°25.8
Diphda	349°20.7	-18°05.5
Achernar	335°45.5	-57°20.0
Hamal	328°28.8	23°22.2
Polaris	327°06.3	89°10.6
Acamar	315°37.3	-40°22.9
Menkar	314°41.0	4°00.8
Mirfak	309°16.0	49°47.6
Aldebaran	291°17.8	16°28.2
Rigel	281°35.9	-8°13.6
Capella	281°11.1	45°58.8
Bellatrix	278°58.6	6°19.8
Elnath	278°43.9	28°35.5
Alnilam	276°11.5	-1°13.0
Betelgeuse	271°28.1	7°24.1
Canopus	264°07.4	-52°41.4
Sirius	258°55.5	-16°41.6
Adhara	255°32.0	-28°57.0
Procyon	245°25.5	5°16.3
Pollux	243°57.8	28°04.4
Avior	234°28.1	-59°27.3
Suhail	223°10.5	-43°21.7
Miaplacidus	221°44.8	-69°38.7
Alphard	218°20.1	-8°34.7
Regulus	208°09.5	12°03.6
Dubhe	194°21.3	61°51.4
Denebola	182°58.4	14°40.7
Gienah	176°17.3	-17°26.4
Acrux	173°36.3	-62°59.9
Gacrux	172°27.8	-57°00.6
Alioth	166°41.7	56°03.9
Spica	158°56.8	-11°03.9
Alkaid	153°17.7	49°24.5
Hadar	149°22.1	-60°17.0
Menkent	148°36.1	-36°16.7
Arcturus	146°17.8	19°16.8
Rigil Kent.	140°24.6	-60°45.3
Kochab	137°17.8	74°14.0
Zuben'ubi	137°32.2	-15°57.9
Alphecca	126°31.4	26°46.6
Antares	112°56.0	-26°23.4
Atria	108°19.4	-68°59.5
Sabik	102°40.4	-15°42.1
Shaula	96°54.9	-37°05.3
Rasalhague	96°28.9	12°34.3
Eltanin	90°57.1	51°29.3
Kaus Aust.	84°16.1	-34°23.5
Vega	80°55.3	38°45.8
Nunki	76°28.5	-26°19.2
Altair	62°32.0	8°49.0
Peacock	53°57.6	-56°47.5
Deneb	49°48.1	45°12.5
Enif	34°11.2	9°47.2
Al Na'ir	28°14.6	-47°03.0
Fomalhaut	15°51.1	-29°43.3
Scheat	14°17.3	27°58.6
Markab	14°02.9	15°06.0

May 04 Mon	SHA	Mer.pass
Venus	311°57.7	12:26
Mars	325°43.0	11:29
Jupiter	178°12.8	21:16
Saturn	175°26.4	21:27

May 05 Tue	SHA	Mer.pass
Venus	310°43.5	12:27
Mars	324°59.9	11:28
Jupiter	178°16.6	21:12
Saturn	175°29.2	21:23

May 06 Wed	SHA	Mer.pass
Venus	309°29.0	12:28
Mars	324°16.7	11:27
Jupiter	178°20.3	21:08
Saturn	175°32.0	21:19

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°48.3	N15°52.5	181°46.9	6.6′	N10°20.4	12.0′	61.3′
1	195°48.3	53.2	196°12.5	6.5′	10°32.4	11.8′	61.3′
2	210°48.4	53.9	210°38.0	6.5′	10°44.2	11.8′	61.3′
3	225°48.4	·· 54.6	225°03.5	6.4′	10°56.0	11.8′	61.3′
4	240°48.5	55.4	239°28.9	6.4′	11°07.8	11.6′	61.3′
5	255°48.6	56.1	253°54.2	6.3′	11°19.4	11.6′	61.3′
6	270°48.6	N15°56.8	268°19.5	6.3′	N11°31.0	11.5′	61.3′
7	285°48.7	57.5	282°44.8	6.2′	11°42.5	11.4′	61.3′
8	300°48.7	58.3	297°10.0	6.2′	11°53.9	11.4′	61.3′
9	315°48.8	·· 59.0	311°35.2	6.1′	12°05.3	11.2′	61.3′
10	330°48.9	15°59.7	326°00.3	6.1′	12°16.5	11.2′	61.3′
11	345°48.9	16°00.4	340°25.3	6.0′	12°27.7	11.1′	61.3′
12	0°49.0	N16°01.2	354°50.4	6.0′	N12°38.8	11.0′	61.3′
13	15°49.0	01.9	9°15.3	5.9′	12°49.8	10.9′	61.3′
14	30°49.1	02.6	23°40.2	5.9′	13°00.7	10.8′	61.3′
15	45°49.1	·· 03.3	38°05.1	5.8′	13°11.5	10.7′	61.3′
16	60°49.2	04.0	52°29.9	5.8′	13°22.2	10.7′	61.3′
17	75°49.3	04.8	66°54.7	5.7′	13°32.9	10.5′	61.3′
18	90°49.3	N16°05.5	81°19.4	5.7′	N13°43.4	10.4′	61.3′
19	105°49.4	06.2	95°44.1	5.6′	13°53.8	10.3′	61.3′
20	120°49.4	06.9	110°08.8	5.6′	14°04.1	10.3′	61.3′
21	135°49.5	·· 07.6	124°33.4	5.5′	14°14.4	10.1′	61.3′
22	150°49.5	08.4	138°57.9	5.5′	14°24.5	10.0′	61.3′
23	165°49.6	09.1	153°22.4	5.5′	14°34.5	10.0′	61.2′
	SD = 15.9′	d = 0.7′	SD = 16.7′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°49.6	N16°09.8	167°46.9	5.4′	N14°44.5	9.8′	61.2′
1	195°49.7	10.5	182°11.3	5.4′	14°54.3	9.7′	61.2′
2	210°49.8	11.2	196°35.7	5.3′	15°04.0	9.6′	61.2′
3	225°49.8	·· 11.9	211°00.0	5.3′	15°13.6	9.4′	61.2′
4	240°49.9	12.7	225°24.3	5.3′	15°23.0	9.4′	61.2′
5	255°49.9	13.4	239°48.6	5.2′	15°32.4	9.3′	61.2′
6	270°50.0	N16°14.1	254°12.8	5.2′	N15°41.7	9.1′	61.2′
7	285°50.0	14.8	268°37.0	5.1′	15°50.8	9.0′	61.1′
8	300°50.1	15.5	283°01.1	5.1′	15°59.8	8.9′	61.1′
9	315°50.1	·· 16.2	297°25.2	5.1′	16°08.7	8.8′	61.1′
10	330°50.2	16.9	311°49.3	5.0′	16°17.5	8.7′	61.1′
11	345°50.2	17.7	326°13.3	5.0′	16°26.2	8.6′	61.1′
12	0°50.3	N16°18.4	340°37.3	5.0′	N16°34.8	8.4′	61.1′
13	15°50.3	19.1	355°01.3	4.9′	16°43.2	8.3′	61.0′
14	30°50.4	19.8	9°25.2	4.9′	16°51.5	8.2′	61.0′
15	45°50.4	·· 20.5	23°49.1	4.9′	16°59.7	8.0′	61.0′
16	60°50.5	21.2	38°13.0	4.9′	17°07.7	7.9′	61.0′
17	75°50.5	21.9	52°36.9	4.8′	17°15.6	7.8′	61.0′
18	90°50.6	N16°22.6	67°00.7	4.8′	N17°23.4	7.7′	60.9′
19	105°50.6	23.3	81°24.5	4.8′	17°31.1	7.5′	60.9′
20	120°50.7	24.0	95°48.3	4.7′	17°38.6	7.4′	60.9′
21	135°50.7	·· 24.7	110°12.0	4.7′	17°46.0	7.3′	60.9′
22	150°50.8	25.5	124°35.7	4.7′	17°53.3	7.1′	60.9′
23	165°50.8	26.2	138°59.4	4.7′	18°00.4	7.0′	60.8′
	SD = 15.8′	d = 0.7′	SD = 16.7′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°50.9	N16°26.9	153°23.1	4.7′	N18°07.4	6.9′	60.8′
1	195°50.9	27.6	167°46.8	4.6′	18°14.3	6.7′	60.8′
2	210°51.0	28.3	182°10.4	4.6′	18°21.0	6.6′	60.8′
3	225°51.0	·· 29.0	196°34.1	4.6′	18°27.6	6.5′	60.7′
4	240°51.1	29.7	210°57.7	4.6′	18°34.1	6.3′	60.7′
5	255°51.1	30.4	225°21.3	4.6′	18°40.4	6.2′	60.7′
6	270°51.2	N16°31.1	239°44.9	4.6′	N18°46.6	6.1′	60.7′
7	285°51.2	31.8	254°08.4	4.6′	18°52.7	5.9′	60.6′
8	300°51.3	32.5	268°32.0	4.6′	18°58.6	5.7′	60.6′
9	315°51.3	·· 33.2	282°55.6	4.6′	19°04.3	5.6′	60.6′
10	330°51.4	33.9	297°19.1	4.5′	19°09.9	5.5′	60.6′
11	345°51.4	34.6	311°42.7	4.5′	19°15.4	5.4′	60.5′
12	0°51.5	N16°35.3	326°06.2	4.5′	N19°20.8	5.2′	60.5′
13	15°51.5	36.0	340°29.8	4.5′	19°26.0	5.0′	60.5′
14	30°51.5	36.7	354°53.3	4.5′	19°31.0	4.9′	60.4′
15	45°51.6	·· 37.4	9°16.8	4.5′	19°35.9	4.8′	60.4′
16	60°51.6	38.1	23°40.4	4.5′	19°40.7	4.6′	60.4′
17	75°51.7	38.8	38°03.9	4.5′	19°45.3	4.5′	60.3′
18	90°51.7	N16°39.5	52°27.5	4.6′	N19°49.8	4.3′	60.3′
19	105°51.8	40.2	66°51.0	4.6′	19°54.1	4.2′	60.3′
20	120°51.8	40.9	81°14.6	4.6′	19°58.3	4.1′	60.3′
21	135°51.9	·· 41.6	95°38.2	4.6′	20°02.4	3.9′	60.2′
22	150°51.9	42.3	110°01.7	4.6′	20°06.3	3.7′	60.2′
23	165°51.9	43.0	124°25.3	4.6′	20°10.0	3.6′	60.2′
	SD = 15.8′	d = 0.7′	SD = 16.6′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	////	////	01:15	22:49	////	////
N 70°	////	////	02:07	21:51	////	////
68°	////	////	02:39	21:18	////	////
66°	////	01:29	03:02	20:54	22:30	////
64°	////	02:07	03:20	20:35	21:51	////
62°	////	02:32	03:35	20:20	21:24	////
60°	01:20	02:52	03:48	20:07	21:04	22:40
N 58°	01:53	03:08	03:58	19:56	20:47	22:04
56°	02:17	03:22	04:08	19:47	20:33	21:39
54°	02:36	03:33	04:16	19:39	20:21	21:20
52°	02:51	03:44	04:23	19:31	20:11	21:04
50°	03:04	03:52	04:30	19:25	20:02	20:51
45°	03:30	04:11	04:44	19:10	19:43	20:24
N 40°	03:50	04:26	04:55	18:58	19:28	20:05
35°	04:05	04:38	05:05	18:48	19:16	19:49
30°	04:18	04:48	05:14	18:40	19:05	19:36
20°	04:38	05:05	05:29	18:25	18:48	19:16
N 10°	04:54	05:19	05:41	18:12	18:34	19:00
0°	05:07	05:32	05:53	18:00	18:22	18:47
S 10°	05:18	05:43	06:05	17:48	18:10	18:35
20°	05:28	05:54	06:17	17:36	17:59	18:25
30°	05:38	06:06	06:31	17:22	17:47	18:15
35°	05:43	06:13	06:39	17:13	17:40	18:10
40°	05:48	06:20	06:49	17:04	17:33	18:05
45°	05:53	06:28	06:59	16:53	17:24	17:59
S 50°	05:59	06:38	07:12	16:40	17:15	17:54
52°	06:01	06:42	07:18	16:34	17:11	17:51
54°	06:04	06:47	07:25	16:28	17:06	17:48
56°	06:07	06:52	07:32	16:20	17:01	17:46
58°	06:10	06:57	07:41	16:12	16:55	17:43
S 60°	06:13	07:03	07:50	16:02	16:49	17:39

Lat.	**Moonrise** Mon	Tue	Wed	**Moonset** Mon	Tue	Wed
N 72°	03:36	03:12	▭	22:10	▭	▭
N 70°	03:54	03:45	03:32	21:39	23:58	▭
68°	04:08	04:09	04:15	21:16	23:16	·· ··
66°	04:19	04:28	04:43	20:59	22:48	·· ··
64°	04:29	04:44	05:05	20:44	22:27	23:59
62°	04:37	04:56	05:23	20:32	22:10	23:37
60°	04:45	05:07	05:38	20:22	21:56	23:20
N 58°	04:51	05:17	05:51	20:13	21:44	23:05
56°	04:57	05:25	06:01	20:06	21:33	22:52
54°	05:02	05:33	06:11	19:59	21:24	22:42
52°	05:06	05:40	06:20	19:53	21:16	22:32
50°	05:11	05:46	06:27	19:47	21:08	22:23
45°	05:20	05:59	06:44	19:35	20:53	22:05
N 40°	05:27	06:10	06:58	19:25	20:40	21:50
35°	05:34	06:19	07:09	19:17	20:29	21:37
30°	05:40	06:28	07:19	19:10	20:19	21:26
20°	05:50	06:42	07:37	18:57	20:03	21:08
N 10°	05:59	06:55	07:52	18:46	19:48	20:51
0°	06:08	07:07	08:07	18:35	19:35	20:36
S 10°	06:16	07:19	08:21	18:25	19:22	20:20
20°	06:26	07:31	08:37	18:14	19:07	20:04
30°	06:36	07:46	08:55	18:01	18:51	19:45
35°	06:42	07:55	09:05	17:54	18:42	19:34
40°	06:50	08:05	09:18	17:46	18:31	19:22
45°	06:58	08:16	09:32	17:36	18:18	19:07
S 50°	07:08	08:31	09:49	17:25	18:03	18:49
52°	07:12	08:37	09:58	17:20	17:56	18:40
54°	07:18	08:45	10:07	17:14	17:48	18:31
56°	07:23	08:53	10:17	17:07	17:39	18:20
58°	07:30	09:02	10:29	17:00	17:29	18:08
S 60°	07:37	09:13	10:43	16:52	17:18	17:54

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 0-2 0-5%
04	03:13	03:16	11:57	12:21	–:–	
05	03:19	03:21	11:57	13:21	00:51	
06	03:24	03:26	11:57	14:21	01:51	

May 07, 08, 09 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	224°44.9	172°59.1	N18°30.5	188°18.4	N14°07.4	43°08.8	N00°57.5	40°19.5	N00°55.2
1	239°47.4	187°58.4	31.4	203°19.1	08.0	58°11.4	57.5	55°22.1	55.2
2	254°49.8	202°57.8	32.2	218°19.7	08.7	73°14.0	57.6	70°24.7	55.2
3	269°52.3	217°57.1	·· 33.1	233°20.4	·· 09.3	88°16.6	·· 57.6	85°27.3	·· 55.3
4	284°54.8	232°56.4	33.9	248°21.0	09.9	103°19.2	57.7	100°29.8	55.3
5	299°57.2	247°55.8	34.8	263°21.7	10.5	118°21.8	57.7	115°32.4	55.4
6	314°59.7	262°55.1	N18°35.6	278°22.4	N14°11.1	133°24.4	N00°57.8	130°35.0	N00°55.4
7	330°02.2	277°54.4	36.5	293°23.0	11.7	148°27.0	57.8	145°37.6	55.4
8	345°04.6	292°53.8	37.3	308°23.7	12.4	163°29.6	57.9	160°40.1	55.5
9	0°07.1	307°53.1	·· 38.2	323°24.4	·· 13.0	178°32.2	·· 57.9	175°42.7	·· 55.5
10	15°09.5	322°52.5	39.0	338°25.0	13.6	193°34.8	58.0	190°45.3	55.6
11	30°12.0	337°51.8	39.8	353°25.7	14.2	208°37.4	58.0	205°47.8	55.6
12	45°14.5	352°51.1	N18°40.7	8°26.3	N14°14.8	223°40.0	N00°58.1	220°50.4	N00°55.6
13	60°16.9	7°50.5	41.5	23°27.0	15.4	238°42.6	58.1	235°53.0	55.7
14	75°19.4	22°49.8	42.4	38°27.7	16.0	253°45.3	58.2	250°55.6	55.7
15	90°21.9	37°49.1	·· 43.2	53°28.3	·· 16.7	268°47.9	·· 58.2	265°58.1	·· 55.8
16	105°24.3	52°48.5	44.1	68°29.0	17.3	283°50.5	58.3	281°00.7	55.8
17	120°26.8	67°47.8	44.9	83°29.7	17.9	298°53.1	58.3	296°03.3	55.8
18	135°29.3	82°47.1	N18°45.7	98°30.3	N14°18.5	313°55.7	N00°58.4	311°05.8	N00°55.9
19	150°31.7	97°46.5	46.6	113°31.0	19.1	328°58.3	58.4	326°08.4	55.9
20	165°34.2	112°45.8	47.4	128°31.6	19.7	344°00.9	58.5	341°11.0	55.9
21	180°36.7	127°45.1	·· 48.2	143°32.3	·· 20.3	359°03.5	·· 58.5	356°13.6	·· 56.0
22	195°39.1	142°44.5	49.1	158°33.0	21.0	14°06.1	58.6	11°16.1	56.0
23	210°41.6	157°43.8	49.9	173°33.6	21.6	29°08.7	58.6	26°18.7	56.1
Mer.pass. 09:00		ν -0.7′ d 0.9′		m -3.88	ν 0.7′ d 0.6′		m 1.25	ν 2.6′ d 0.1′	m -2.33	ν 2.6′ d 0.0′	m 0.65

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	225°44.0	172°43.1	N18°50.7	188°34.3	N14°22.2	44°11.3	N00°58.7	41°21.3	N00°56.1
1	240°46.5	187°42.5	51.6	203°34.9	22.8	59°13.9	58.7	56°23.8	56.1
2	255°49.0	202°41.8	52.4	218°35.6	23.4	74°16.5	58.8	71°26.4	56.2
3	270°51.4	217°41.1	·· 53.2	233°36.3	·· 24.0	89°19.1	·· 58.8	86°29.0	·· 56.2
4	285°53.9	232°40.5	54.1	248°36.9	24.6	104°21.7	58.9	101°31.5	56.2
5	300°56.4	247°39.8	54.9	263°37.6	25.2	119°24.3	58.9	116°34.1	56.3
6	315°58.8	262°39.1	N18°55.7	278°38.2	N14°25.8	134°26.9	N00°59.0	131°36.7	N00°56.3
7	331°01.3	277°38.4	56.6	293°38.9	26.5	149°29.5	59.0	146°39.3	56.4
8	346°03.8	292°37.8	57.4	308°39.6	27.1	164°32.1	59.1	161°41.8	56.4
9	1°06.2	307°37.1	·· 58.2	323°40.2	·· 27.7	179°34.7	·· 59.1	176°44.4	·· 56.4
10	16°08.7	322°36.4	59.0	338°40.9	28.3	194°37.3	59.2	191°47.0	56.5
11	31°11.2	337°35.7	18°59.9	353°41.6	28.9	209°39.9	59.2	206°49.5	56.5
12	46°13.6	352°35.1	N19°00.7	8°42.2	N14°29.5	224°42.5	N00°59.3	221°52.1	N00°56.6
13	61°16.1	7°34.4	01.5	23°42.9	30.1	239°45.1	59.3	236°54.7	56.6
14	76°18.5	22°33.7	02.3	38°43.5	30.7	254°47.7	59.4	251°57.2	56.6
15	91°21.0	37°33.0	·· 03.1	53°44.2	·· 31.3	269°50.3	·· 59.4	266°59.8	·· 56.7
16	106°23.5	52°32.4	04.0	68°44.9	31.9	284°52.9	59.5	282°02.4	56.7
17	121°25.9	67°31.7	04.8	83°45.5	32.5	299°55.5	59.5	297°04.9	56.7
18	136°28.4	82°31.0	N19°05.6	98°46.2	N14°33.1	314°58.1	N00°59.6	312°07.5	N00°56.8
19	151°30.9	97°30.3	06.4	113°46.8	33.8	330°00.7	59.6	327°10.1	56.8
20	166°33.3	112°29.6	07.2	128°47.5	34.4	345°03.3	59.7	342°12.6	56.8
21	181°35.8	127°29.0	·· 08.0	143°48.2	·· 35.0	0°05.9	·· 59.7	357°15.2	·· 56.9
22	196°38.3	142°28.3	08.9	158°48.8	35.6	15°08.5	59.8	12°17.8	56.9
23	211°40.7	157°27.6	09.7	173°49.5	36.2	30°11.1	59.8	27°20.3	57.0
Mer.pass. 08:56		ν -0.7′ d 0.8′		m -3.89	ν 0.7′ d 0.6′		m 1.26	ν 2.6′ d 0.1′	m -2.32	ν 2.6′ d 0.0′	m 0.65

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	226°43.2	172°26.9	N19°10.5	188°50.1	N14°36.8	45°13.7	N00°59.9	42°22.9	N00°57.0
1	241°45.6	187°26.2	11.3	203°50.8	37.4	60°16.3	00°59.9	57°25.5	57.0
2	256°48.1	202°25.6	12.1	218°51.5	38.0	75°18.8	01°00.0	72°28.0	57.1
3	271°50.6	217°24.9	·· 12.9	233°52.1	·· 38.6	90°21.4	·· 00.0	87°30.6	·· 57.1
4	286°53.0	232°24.2	13.7	248°52.8	39.2	105°24.0	00.0	102°33.2	57.1
5	301°55.5	247°23.5	14.5	263°53.4	39.8	120°26.6	00.1	117°35.7	57.2
6	316°58.0	262°22.8	N19°15.3	278°54.1	N14°40.4	135°29.2	N01°00.1	132°38.3	N00°57.2
7	332°00.4	277°22.1	16.1	293°54.7	41.0	150°31.8	00.2	147°40.9	57.2
8	347°02.9	292°21.5	16.9	308°55.4	41.6	165°34.4	00.2	162°43.4	57.3
9	2°05.4	307°20.8	·· 17.8	323°56.1	·· 42.2	180°37.0	·· 00.3	177°46.0	·· 57.3
10	17°07.8	322°20.1	18.6	338°56.7	42.8	195°39.6	00.3	192°48.6	57.4
11	32°10.3	337°19.4	19.4	353°57.4	43.4	210°42.2	00.4	207°51.1	57.4
12	47°12.8	352°18.7	N19°20.2	8°58.0	N14°44.0	225°44.8	N01°00.4	222°53.7	N00°57.4
13	62°15.2	7°18.0	21.0	23°58.7	44.6	240°47.4	00.5	237°56.3	57.5
14	77°17.7	22°17.3	21.8	38°59.4	45.2	255°50.0	00.5	252°58.8	57.5
15	92°20.1	37°16.7	·· 22.6	54°00.0	·· 45.8	270°52.6	·· 00.6	268°01.4	·· 57.5
16	107°22.6	52°16.0	23.4	69°00.7	46.4	285°55.2	00.6	283°04.0	57.6
17	122°25.1	67°15.3	24.2	84°01.3	47.0	300°57.7	00.6	298°06.5	57.6
18	137°27.5	82°14.6	N19°24.9	99°02.0	N14°47.6	316°00.3	N01°00.7	313°09.1	N00°57.6
19	152°30.0	97°13.9	25.7	114°02.7	48.2	331°02.9	00.7	328°11.7	57.7
20	167°32.5	112°13.2	26.5	129°03.3	48.8	346°05.5	00.8	343°14.2	57.7
21	182°34.9	127°12.5	·· 27.3	144°04.0	·· 49.4	1°08.1	·· 00.8	358°16.8	·· 57.7
22	197°37.4	142°11.8	28.1	159°04.6	50.0	16°10.7	00.9	13°19.4	57.8
23	212°39.9	157°11.1	28.9	174°05.3	50.6	31°13.3	00.9	28°21.9	57.8
Mer.pass. 08:52		ν -0.7′ d 0.8′		m -3.89	ν 0.7′ d 0.6′		m 1.26	ν 2.6′ d 0.0′	m -2.31	ν 2.6′ d 0.0′	m 0.66

Stars

	SHA	Dec
Alpheratz	358°09.1	28°58.9
Ankaa	353°40.2	-42°24.5
Schedar	350°09.0	56°25.8
Diphda	349°20.7	-18°05.5
Achernar	335°45.5	-57°19.9
Hamal	328°28.8	23°22.2
Polaris	327°05.7	89°10.6
Acamar	315°37.3	-40°22.9
Menkar	314°41.0	4°00.8
Mirfak	309°16.0	49°47.6
Aldebaran	291°17.8	16°28.2
Rigel	281°35.9	-8°13.6
Capella	281°11.1	45°58.8
Bellatrix	278°58.6	6°19.8
Elnath	278°43.9	28°35.5
Alnilam	276°11.5	-1°13.0
Betelgeuse	271°28.1	7°24.1
Canopus	264°07.4	-52°41.4
Sirius	258°55.5	-16°41.6
Adhara	255°32.0	-28°57.0
Procyon	245°25.5	5°16.3
Pollux	243°57.8	28°04.4
Avior	234°28.2	-59°27.3
Suhail	223°10.5	-43°21.7
Miaplacidus	221°44.9	-69°38.7
Alphard	218°20.1	-8°34.7
Regulus	208°09.5	12°03.6
Dubhe	194°21.3	61°51.4
Denebola	182°58.4	14°40.7
Gienah	176°17.3	-17°26.4
Acrux	173°36.3	-62°59.9
Gacrux	172°27.8	-57°00.7
Alioth	166°41.7	56°03.9
Spica	158°56.8	-11°03.9
Alkaid	153°17.7	49°24.5
Hadar	149°22.1	-60°17.0
Menkent	148°36.1	-36°16.7
Arcturus	146°17.8	19°16.8
Rigil Kent.	140°24.6	-60°45.4
Kochab	137°17.8	74°14.1
Zuben'ubi	137°32.2	-15°57.9
Alphecca	126°31.4	26°46.6
Antares	112°56.0	-26°23.4
Atria	108°19.4	-68°59.5
Sabik	102°40.3	-15°42.1
Shaula	96°54.8	-37°05.3
Rasalhague	96°28.9	12°34.3
Eltanin	90°57.1	51°29.3
Kaus Aust.	84°16.0	-34°23.5
Vega	80°55.3	38°45.8
Nunki	76°28.4	-26°19.2
Altair	62°32.0	8°49.0
Peacock	53°57.6	-56°47.5
Deneb	49°48.1	45°12.5
Enif	34°11.2	9°47.2
Al Na'ir	28°14.5	-47°03.0
Fomalhaut	15°51.1	-29°43.3
Scheat	14°17.3	27°58.6
Markab	14°02.9	15°06.0

May 07 Thu	SHA	Mer.pass
Venus	308°14.2	12:29
Mars	323°33.5	11:26
Jupiter	178°23.9	21:04
Saturn	175°34.6	21:15

May 08 Fri	SHA	Mer.pass
Venus	306°59.1	12:30
Mars	322°50.2	11:25
Jupiter	178°27.2	21:00
Saturn	175°37.2	21:11

May 09 Sat	SHA	Mer.pass
Venus	305°43.7	12:31
Mars	322°06.9	11:24
Jupiter	178°30.5	20:55
Saturn	175°39.7	21:07

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°52.0	N16°43.7	138°48.9	4.6′	N20°13.6	3.5′	60.1′
1	195°52.0	44.4	153°12.6	4.6′	20°17.1	3.3′	60.1′
2	210°52.1	45.0	167°36.2	4.7′	20°20.4	3.1′	60.1′
3	225°52.1	·· 45.7	181°59.9	4.7′	20°23.5	3.1′	60.0′
4	240°52.2	46.4	196°23.6	4.7′	20°26.6	2.8′	60.0′
5	255°52.2	47.1	210°47.3	4.7′	20°29.4	2.8′	60.0′
6	270°52.2	N16°47.8	225°11.0	4.8′	N20°32.2	2.5′	59.9′
7	285°52.3	48.5	239°34.7	4.8′	20°34.7	2.5′	59.9′
8	300°52.3	49.2	253°58.5	4.8′	20°37.2	2.3′	59.9′
9	315°52.4	·· 49.9	268°22.3	4.8′	20°39.5	2.1′	59.8′
10	330°52.4	50.6	282°46.2	4.9′	20°41.6	2.0′	59.8′
11	345°52.4	51.3	297°10.0	4.9′	20°43.6	1.9′	59.7′
12	0°52.5	N16°52.0	311°33.9	4.9′	N20°45.5	1.7′	59.7′
13	15°52.5	52.6	325°57.8	5.0′	20°47.2	1.5′	59.7′
14	30°52.6	53.3	340°21.8	5.0′	20°48.7	1.4′	59.6′
15	45°52.6	·· 54.0	354°45.8	5.0′	20°50.1	1.3′	59.6′
16	60°52.6	54.7	9°09.9	5.1′	20°51.4	1.1′	59.6′
17	75°52.7	55.4	23°33.9	5.1′	20°52.5	1.0′	59.5′
18	90°52.7	N16°56.1	37°58.1	5.2′	N20°53.5	0.9′	59.5′
19	105°52.8	56.8	52°22.2	5.2′	20°54.4	0.7′	59.5′
20	120°52.8	57.4	66°46.4	5.3′	20°55.1	0.5′	59.4′
21	135°52.8	·· 58.1	81°10.7	5.3′	20°55.6	0.4′	59.4′
22	150°52.9	58.8	95°35.0	5.3′	20°56.0	0.3′	59.3′
23	165°52.9	59.5	109°59.3	5.4′	20°56.3	0.1′	59.3′
	SD = 15.8′	d = 0.7′	SD = 16.4′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°52.9	N17°00.2	124°23.7	5.5′	N20°56.4	0.0′	59.3′
1	195°53.0	00.9	138°48.2	5.5′	20°56.4	0.1′	59.2′
2	210°53.0	01.5	153°12.7	5.6′	20°56.3	0.3′	59.2′
3	225°53.1	·· 02.2	167°37.3	5.6′	20°56.0	0.4′	59.2′
4	240°53.1	02.9	182°01.9	5.7′	20°55.6	0.6′	59.1′
5	255°53.1	03.6	196°26.5	5.7′	20°55.0	0.7′	59.1′
6	270°53.2	N17°04.3	210°51.3	5.8′	N20°54.3	0.8′	59.0′
7	285°53.2	04.9	225°16.0	5.8′	20°53.5	1.0′	59.0′
8	300°53.2	05.6	239°40.9	5.9′	20°52.5	1.1′	59.0′
9	315°53.3	·· 06.3	254°05.8	6.0′	20°51.4	1.3′	58.9′
10	330°53.3	07.0	268°30.7	6.0′	20°50.1	1.3′	58.9′
11	345°53.3	07.6	282°55.8	6.1′	20°48.8	1.6′	58.8′
12	0°53.4	N17°08.3	297°20.9	6.2′	N20°47.2	1.6′	58.8′
13	15°53.4	09.0	311°46.0	6.2′	20°45.6	1.8′	58.8′
14	30°53.4	09.7	326°11.2	6.3′	20°43.8	1.9′	58.7′
15	45°53.5	·· 10.4	340°36.5	6.4′	20°41.9	2.0′	58.7′
16	60°53.5	11.0	355°01.9	6.4′	20°39.9	2.2′	58.6′
17	75°53.5	11.7	9°27.3	6.5′	20°37.7	2.3′	58.6′
18	90°53.6	N17°12.4	23°52.8	6.6′	N20°35.4	2.4′	58.6′
19	105°53.6	13.0	38°18.4	6.6′	20°33.0	2.5′	58.5′
20	120°53.6	13.7	52°44.0	6.7′	20°30.5	2.7′	58.5′
21	135°53.7	·· 14.4	67°09.7	6.8′	20°27.8	2.8′	58.5′
22	150°53.7	15.1	81°35.5	6.9′	20°25.0	2.9′	58.4′
23	165°53.7	15.7	96°01.4	6.9′	20°22.1	3.0′	58.4′
	SD = 15.8′	d = 0.7′	SD = 16.2′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°53.8	N17°16.4	110°27.3	7.0′	N20°19.1	3.2′	58.3′
1	195°53.8	17.1	124°53.3	7.1′	20°15.9	3.3′	58.3′
2	210°53.8	17.7	139°19.4	7.2′	20°12.6	3.4′	58.3′
3	225°53.9	·· 18.4	153°45.6	7.2′	20°09.2	3.5′	58.2′
4	240°53.9	19.1	168°11.8	7.3′	20°05.7	3.6′	58.2′
5	255°53.9	19.7	182°38.1	7.4′	20°02.1	3.8′	58.1′
6	270°54.0	N17°20.4	197°04.5	7.5′	N19°58.3	3.9′	58.1′
7	285°54.0	21.1	211°31.0	7.6′	19°54.4	4.0′	58.1′
8	300°54.0	21.8	225°57.6	7.6′	19°50.4	4.0′	58.0′
9	315°54.0	·· 22.4	240°24.2	7.7′	19°46.4	4.3′	58.0′
10	330°54.1	23.1	254°50.9	7.8′	19°42.1	4.3′	57.9′
11	345°54.1	23.7	269°17.7	7.9′	19°37.8	4.4′	57.9′
12	0°54.1	N17°24.4	283°44.6	8.0′	N19°33.4	4.6′	57.9′
13	15°54.2	25.1	298°11.6	8.0′	19°28.8	4.6′	57.8′
14	30°54.2	25.7	312°38.6	8.1′	19°24.2	4.8′	57.8′
15	45°54.2	·· 26.4	327°05.7	8.2′	19°19.4	4.8′	57.7′
16	60°54.2	27.1	341°33.0	8.3′	19°14.6	5.0′	57.7′
17	75°54.3	27.7	356°00.3	8.4′	19°09.6	5.1′	57.7′
18	90°54.3	N17°28.4	10°27.6	8.5′	N19°04.5	5.2′	57.6′
19	105°54.3	29.0	24°55.1	8.6′	18°59.3	5.2′	57.6′
20	120°54.4	29.7	39°22.7	8.6′	18°54.1	5.4′	57.6′
21	135°54.4	·· 30.4	53°50.3	8.7′	18°48.7	5.5′	57.5′
22	150°54.4	31.0	68°18.0	8.8′	18°43.2	5.6′	57.5′
23	165°54.4	31.7	82°45.8	8.9′	18°37.6	5.7′	57.4′
	SD = 15.8′	d = 0.7′	SD = 15.9′				

Lat.	**Twilight** Naut.	**Twilight** Civil	**Sunrise**	**Sunset**	**Twilight** Civil	**Twilight** Naut.
N 72°	////	////	00:28	////	////	////
N 70°	////	////	01:47	22:12	////	////
68°	////	////	02:24	21:32	////	////
66°	////	01:05	02:50	21:05	22:57	////
64°	////	01:51	03:10	20:45	22:06	////
62°	////	02:21	03:26	20:28	21:36	////
60°	00:57	02:42	03:40	20:15	21:13	23:04
N 58°	01:40	03:00	03:51	20:03	20:55	22:17
56°	02:07	03:14	04:01	19:53	20:40	21:49
54°	02:27	03:27	04:10	19:44	20:28	21:28
52°	02:44	03:37	04:18	19:36	20:17	21:11
50°	02:58	03:47	04:25	19:29	20:07	20:57
45°	03:25	04:07	04:40	19:14	19:47	20:29
N 40°	03:45	04:22	04:52	19:01	19:31	20:08
35°	04:02	04:35	05:02	18:51	19:19	19:52
30°	04:15	04:46	05:12	18:42	19:08	19:38
20°	04:36	05:04	05:27	18:26	18:49	19:17
N 10°	04:53	05:18	05:41	18:12	18:35	19:00
0°	05:06	05:31	05:53	18:00	18:22	18:47
S 10°	05:18	05:43	06:05	17:47	18:09	18:35
20°	05:29	05:55	06:18	17:34	17:57	18:24
30°	05:40	06:08	06:33	17:19	17:44	18:13
35°	05:45	06:15	06:42	17:11	17:37	18:08
40°	05:50	06:23	06:52	17:01	17:30	18:02
45°	05:56	06:32	07:03	16:49	17:21	17:56
S 50°	06:03	06:42	07:17	16:36	17:11	17:49
52°	06:06	06:46	07:23	16:29	17:06	17:47
54°	06:09	06:51	07:30	16:22	17:01	17:44
56°	06:12	06:57	07:38	16:14	16:55	17:40
58°	06:15	07:03	07:47	16:05	16:49	17:37
S 60°	06:19	07:10	07:57	15:55	16:42	17:33

Lat.	**Moonrise** Thu	Fri	Sat	**Moonset** Thu	Fri	Sat
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	05:16	▭	▭	04:28
68°	04:30	05:16	06:41	01:08	02:28	03:02
66°	05:12	06:03	07:20	00:27	01:40	02:24
64°	05:40	06:34	07:47	·· ··	01:10	01:57
62°	06:02	06:57	08:07	·· ··	00:46	01:36
60°	06:20	07:16	08:24	·· ··	00:28	01:18
N 58°	06:35	07:31	08:38	·· ··	00:12	01:04
56°	06:47	07:44	08:50	23:59	·· ··	00:52
54°	06:59	07:56	09:01	23:48	·· ··	00:41
52°	07:08	08:06	09:10	23:38	·· ··	00:31
50°	07:17	08:15	09:19	23:29	·· ··	00:23
45°	07:36	08:34	09:37	23:09	·· ··	00:04
N 40°	07:51	08:49	09:51	22:54	23:49	·· ··
35°	08:04	09:03	10:03	22:41	23:37	·· ··
30°	08:15	09:14	10:14	22:29	23:26	·· ··
20°	08:35	09:34	10:33	22:09	23:07	23:58
N 10°	08:52	09:51	10:49	21:52	22:50	23:44
0°	09:07	10:07	11:04	21:36	22:34	23:29
S 10°	09:23	10:23	11:18	21:20	22:19	23:15
20°	09:40	10:40	11:34	21:03	22:02	23:00
30°	10:00	11:00	11:53	20:43	21:43	22:43
35°	10:12	11:11	12:03	20:31	21:31	22:33
40°	10:25	11:24	12:16	20:18	21:18	22:21
45°	10:40	11:40	12:30	20:02	21:03	22:07
S 50°	11:00	11:59	12:48	19:43	20:44	21:50
52°	11:09	12:08	12:56	19:34	20:35	21:42
54°	11:19	12:19	13:05	19:23	20:25	21:33
56°	11:31	12:30	13:15	19:12	20:14	21:23
58°	11:44	12:43	13:27	18:58	20:01	21:12
S 60°	12:00	12:59	13:41	18:42	19:45	20:59

Day	**Sun** Eqn.of Time 00^h mm:ss	Eqn.of Time 12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 3-5 12-30%
07	03:28	03:30	11:57	15:22	02:52	
08	03:32	03:34	11:56	16:21	03:52	
09	03:35	03:37	11:56	17:17	04:49	

May 10, 11, 12 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	227°42.3	172°10.4	N19°29.7	189°05.9	N14°51.2	46°15.9	N01°01.0	43°24.5	N00°57.9
1	242°44.8	187°09.8	30.5	204°06.6	51.8	61°18.5	01.0	58°27.1	57.9
2	257°47.3	202°09.1	31.3	219°07.3	52.4	76°21.1	01.0	73°29.6	57.9
3	272°49.7	217°08.4	·· 32.1	234°07.9	·· 53.0	91°23.6	·· 01.1	88°32.2	·· 58.0
4	287°52.2	232°07.7	32.9	249°08.6	53.6	106°26.2	01.1	103°34.7	58.0
5	302°54.6	247°07.0	33.6	264°09.2	54.2	121°28.8	01.2	118°37.3	58.0
6	317°57.1	262°06.3	N19°34.4	279°09.9	N14°54.8	136°31.4	N01°01.2	133°39.9	N00°58.1
7	332°59.6	277°05.6	35.2	294°10.5	55.4	151°34.0	01.3	148°42.4	58.1
8	348°02.0	292°04.9	36.0	309°11.2	56.0	166°36.6	01.3	163°45.0	58.1
9	3°04.5	307°04.2	·· 36.8	324°11.9	·· 56.6	181°39.2	·· 01.4	178°47.6	·· 58.2
10	18°07.0	322°03.5	37.6	339°12.5	57.2	196°41.8	01.4	193°50.1	58.2
11	33°09.4	337°02.8	38.3	354°13.2	57.8	211°44.3	01.4	208°52.7	58.2
12	48°11.9	352°02.1	N19°39.1	9°13.8	N14°58.4	226°46.9	N01°01.5	223°55.2	N00°58.3
13	63°14.4	7°01.4	39.9	24°14.5	59.0	241°49.5	01.5	238°57.8	58.3
14	78°16.8	22°00.7	40.7	39°15.1	14°59.6	256°52.1	01.6	254°00.4	58.3
15	93°19.3	37°00.0	·· 41.5	54°15.8	15°00.2	271°54.7	·· 01.6	269°02.9	·· 58.4
16	108°21.8	51°59.3	42.2	69°16.5	00.8	286°57.3	01.6	284°05.5	58.4
17	123°24.2	66°58.6	43.0	84°17.1	01.4	301°59.8	01.7	299°08.1	58.4
18	138°26.7	81°57.9	N19°43.8	99°17.8	N15°02.0	317°02.4	N01°01.7	314°10.6	N00°58.5
19	153°29.1	96°57.2	44.6	114°18.4	02.6	332°05.0	01.8	329°13.2	58.5
20	168°31.6	111°56.5	45.3	129°19.1	03.2	347°07.6	01.8	344°15.7	58.5
21	183°34.1	126°55.8	·· 46.1	144°19.7	·· 03.8	2°10.2	·· 01.9	359°18.3	·· 58.6
22	198°36.5	141°55.1	46.9	159°20.4	04.3	17°12.8	01.9	14°20.9	58.6
23	213°39.0	156°54.4	47.6	174°21.1	04.9	32°15.3	01.9	29°23.4	58.6
Mer.pass. 08:48		ν -0.7′ d 0.8′	m -3.89	ν 0.7′ d 0.6′	m 1.27	ν 2.6′ d 0.0′	m -2.31	ν 2.6′ d 0.0′	m 0.66

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	228°41.5	171°53.7	N19°48.4	189°21.7	N15°05.5	47°17.9	N01°02.0	44°26.0	N00°58.7
1	243°43.9	186°53.0	49.2	204°22.4	06.1	62°20.5	02.0	59°28.5	58.7
2	258°46.4	201°52.3	49.9	219°23.0	06.7	77°23.1	02.1	74°31.1	58.7
3	273°48.9	216°51.6	·· 50.7	234°23.7	·· 07.3	92°25.7	·· 02.1	89°33.7	·· 58.8
4	288°51.3	231°50.9	51.5	249°24.3	07.9	107°28.3	02.1	104°36.2	58.8
5	303°53.8	246°50.2	52.2	264°25.0	08.5	122°30.8	02.2	119°38.8	58.8
6	318°56.2	261°49.5	N19°53.0	279°25.6	N15°09.1	137°33.4	N01°02.2	134°41.3	N00°58.9
7	333°58.7	276°48.7	53.8	294°26.3	09.7	152°36.0	02.3	149°43.9	58.9
8	349°01.2	291°48.0	54.5	309°27.0	10.3	167°38.6	02.3	164°46.5	58.9
9	4°03.6	306°47.3	·· 55.3	324°27.6	·· 10.9	182°41.2	·· 02.4	179°49.0	·· 59.0
10	19°06.1	321°46.6	56.0	339°28.3	11.4	197°43.7	02.4	194°51.6	59.0
11	34°08.6	336°45.9	56.8	354°28.9	12.0	212°46.3	02.4	209°54.1	59.0
12	49°11.0	351°45.2	N19°57.6	9°29.6	N15°12.6	227°48.9	N01°02.5	224°56.7	N00°59.1
13	64°13.5	6°44.5	58.3	24°30.2	13.2	242°51.5	02.5	239°59.3	59.1
14	79°16.0	21°43.8	59.1	39°30.9	13.8	257°54.1	02.5	255°01.8	59.1
15	94°18.4	36°43.1	19°59.8	54°31.5	·· 14.4	272°56.6	·· 02.6	270°04.4	·· 59.2
16	109°20.9	51°42.4	20°00.6	69°32.2	15.0	287°59.2	02.6	285°06.9	59.2
17	124°23.4	66°41.6	01.3	84°32.8	15.6	303°01.8	02.7	300°09.5	59.2
18	139°25.8	81°40.9	N20°02.1	99°33.5	N15°16.2	318°04.4	N01°02.7	315°12.0	N00°59.3
19	154°28.3	96°40.2	02.8	114°34.2	16.7	333°06.9	02.7	330°14.6	59.3
20	169°30.7	111°39.5	03.6	129°34.8	17.3	348°09.5	02.8	345°17.2	59.3
21	184°33.2	126°38.8	·· 04.3	144°35.5	·· 17.9	3°12.1	·· 02.8	0°19.7	·· 59.4
22	199°35.7	141°38.1	05.1	159°36.1	18.5	18°14.7	02.9	15°22.3	59.4
23	214°38.1	156°37.4	05.8	174°36.8	19.1	33°17.3	02.9	30°24.8	59.4
Mer.pass. 08:44		ν -0.7′ d 0.8′	m -3.89	ν 0.7′ d 0.6′	m 1.27	ν 2.6′ d 0.0′	m -2.30	ν 2.6′ d 0.0′	m 0.67

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	229°40.6	171°36.7	N20°06.6	189°37.4	N15°19.7	48°19.8	N01°02.9	45°27.4	N00°59.5
1	244°43.1	186°35.9	07.3	204°38.1	20.3	63°22.4	03.0	60°29.9	59.5
2	259°45.5	201°35.2	08.1	219°38.7	20.9	78°25.0	03.0	75°32.5	59.5
3	274°48.0	216°34.5	·· 08.8	234°39.4	·· 21.4	93°27.6	·· 03.1	90°35.1	·· 59.6
4	289°50.5	231°33.8	09.6	249°40.0	22.0	108°30.1	03.1	105°37.6	59.6
5	304°52.9	246°33.1	10.3	264°40.7	22.6	123°32.7	03.1	120°40.2	59.6
6	319°55.4	261°32.4	N20°11.0	279°41.4	N15°23.2	138°35.3	N01°03.2	135°42.7	N00°59.6
7	334°57.9	276°31.6	11.8	294°42.0	23.8	153°37.9	03.2	150°45.3	59.7
8	350°00.3	291°30.9	12.5	309°42.7	24.4	168°40.4	03.2	165°47.8	59.7
9	5°02.8	306°30.2	·· 13.3	324°43.3	·· 24.9	183°43.0	·· 03.3	180°50.4	·· 59.7
10	20°05.2	321°29.5	14.0	339°44.0	25.5	198°45.6	03.3	195°53.0	59.8
11	35°07.7	336°28.8	14.7	354°44.6	26.1	213°48.1	03.4	210°55.5	59.8
12	50°10.2	351°28.0	N20°15.5	9°45.3	N15°26.7	228°50.7	N01°03.4	225°58.1	N00°59.8
13	65°12.6	6°27.3	16.2	24°45.9	27.3	243°53.3	03.4	241°00.6	59.9
14	80°15.1	21°26.6	16.9	39°46.6	27.9	258°55.9	03.5	256°03.2	59.9
15	95°17.6	36°25.9	·· 17.7	54°47.2	·· 28.4	273°58.4	·· 03.5	271°05.7	00°59.9
16	110°20.0	51°25.1	18.4	69°47.9	29.0	289°01.0	03.5	286°08.3	01°00.0
17	125°22.5	66°24.4	19.1	84°48.5	29.6	304°03.6	03.6	301°10.8	00.0
18	140°25.0	81°23.7	N20°19.8	99°49.2	N15°30.2	319°06.2	N01°03.6	316°13.4	N01°00.0
19	155°27.4	96°23.0	20.6	114°49.8	30.8	334°08.7	03.6	331°15.9	00.0
20	170°29.9	111°22.3	21.3	129°50.5	31.3	349°11.3	03.7	346°18.5	00.1
21	185°32.3	126°21.5	·· 22.0	144°51.2	·· 31.9	4°13.9	·· 03.7	1°21.1	·· 00.1
22	200°34.8	141°20.8	22.8	159°51.8	32.5	19°16.4	03.8	16°23.6	00.1
23	215°37.3	156°20.1	23.5	174°52.5	33.1	34°19.0	03.8	31°26.2	00.2
Mer.pass. 08:40		ν -0.7′ d 0.7′	m -3.89	ν 0.7′ d 0.6′	m 1.28	ν 2.6′ d 0.0′	m -2.29	ν 2.6′ d 0.0′	m 0.67

Stars

	SHA	**Dec**
Alpheratz	358°09.1	28°59.0
Ankaa	353°40.1	-42°24.5
Schedar	350°08.9	56°25.8
Diphda	349°20.7	-18°05.5
Achernar	335°45.5	-57°19.9
Hamal	328°28.8	23°22.2
Polaris	327°05.4	89°10.5
Acamar	315°37.3	-40°22.9
Menkar	314°41.0	4°00.8
Mirfak	309°16.0	49°47.6
Aldebaran	291°17.8	16°28.2
Rigel	281°35.9	-8°13.6
Capella	281°11.1	45°58.8
Bellatrix	278°58.6	6°19.9
Elnath	278°43.9	28°35.5
Alnilam	276°11.5	-1°13.0
Betelgeuse	271°28.1	7°24.1
Canopus	264°07.4	-52°41.4
Sirius	258°55.5	-16°41.6
Adhara	255°32.0	-28°57.0
Procyon	245°25.5	5°16.3
Pollux	243°57.8	28°04.4
Avior	234°28.2	-59°27.3
Suhail	223°10.5	-43°21.7
Miaplacidus	221°44.9	-69°38.7
Alphard	218°20.1	-8°34.7
Regulus	208°09.5	12°03.6
Dubhe	194°21.3	61°51.4
Denebola	182°58.4	14°40.7
Gienah	176°17.3	-17°26.4
Acrux	173°36.3	-62°59.9
Gacrux	172°27.8	-57°00.7
Alioth	166°41.7	56°03.9
Spica	158°56.8	-11°03.9
Alkaid	153°17.7	49°24.5
Hadar	149°22.1	-60°17.0
Menkent	148°36.1	-36°16.7
Arcturus	146°17.8	19°16.8
Rigil Kent.	140°24.6	-60°45.4
Kochab	137°17.8	74°14.1
Zuben'ubi	137°32.2	-15°57.9
Alphecca	126°31.4	26°46.7
Antares	112°56.0	-26°23.4
Atria	108°19.3	-68°59.5
Sabik	102°40.3	-15°42.1
Shaula	96°54.8	-37°05.4
Rasalhague	96°28.9	12°34.3
Eltanin	90°57.1	51°29.3
Kaus Aust.	84°16.0	-34°23.5
Vega	80°55.2	38°45.8
Nunki	76°28.4	-26°19.2
Altair	62°32.0	8°49.0
Peacock	53°57.6	-56°47.5
Deneb	49°48.1	45°12.5
Enif	34°11.2	9°47.2
Al Na'ir	28°14.5	-47°03.0
Fomalhaut	15°51.1	-29°43.3
Scheat	14°17.3	27°58.6
Markab	14°02.9	15°06.0

May 10 Sun	**SHA**	**Mer.pass**
Venus	304°28.1	12:32
Mars	321°23.6	11:23
Jupiter	178°33.5	20:51
Saturn	175°42.2	21:03

May 11 Mon	**SHA**	**Mer.pass**
Venus	303°12.2	12:33
Mars	320°40.2	11:22
Jupiter	178°36.5	20:47
Saturn	175°44.5	20:59

May 12 Tue	**SHA**	**Mer.pass**
Venus	301°56.1	12:34
Mars	319°56.8	11:21
Jupiter	178°39.2	20:43
Saturn	175°46.8	20:55

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Sun	**GHA**	**Dec**	**GHA**	*ν*	**Dec**	*d*	**HP**
0	180°54.5	N17°32.3	97°13.7	9.0′	N18°31.9	5.7′	57.4′
1	195°54.5	33.0	111°41.7	9.1′	18°26.2	5.9′	57.4′
2	210°54.5	33.7	126°09.7	9.1′	18°20.3	6.0′	57.3′
3	225°54.5	·· 34.3	140°37.9	9.2′	18°14.3	6.0′	57.3′
4	240°54.6	35.0	155°06.1	9.3′	18°08.3	6.2′	57.3′
5	255°54.6	35.6	169°34.4	9.4′	18°02.1	6.2′	57.2′
6	270°54.6	N17°36.3	184°02.8	9.5′	N17°55.9	6.3′	57.2′
7	285°54.6	36.9	198°31.3	9.6′	17°49.6	6.5′	57.1′
8	300°54.7	37.6	212°59.9	9.7′	17°43.1	6.5′	57.1′
9	315°54.7	·· 38.2	227°28.6	9.7′	17°36.6	6.6′	57.1′
10	330°54.7	38.9	241°57.3	9.8′	17°30.0	6.7′	57.0′
11	345°54.7	39.6	256°26.1	9.9′	17°23.3	6.7′	57.0′
12	0°54.8	N17°40.2	270°55.0	10.0′	N17°16.6	6.9′	57.0′
13	15°54.8	40.9	285°24.0	10.1′	17°09.7	6.9′	56.9′
14	30°54.8	41.5	299°53.1	10.2′	17°02.8	7.0′	56.9′
15	45°54.8	·· 42.2	314°22.3	10.2′	16°55.8	7.1′	56.8′
16	60°54.8	42.8	328°51.5	10.3′	16°48.7	7.2′	56.8′
17	75°54.9	43.5	343°20.9	10.4′	16°41.5	7.2′	56.8′
18	90°54.9	N17°44.1	357°50.3	10.5′	N16°34.3	7.4′	56.7′
19	105°54.9	44.8	12°19.8	10.6′	16°26.9	7.4′	56.7′
20	120°54.9	45.4	26°49.4	10.7′	16°19.5	7.5′	56.7′
21	135°55.0	·· 46.1	41°19.0	10.7′	16°12.0	7.5′	56.6′
22	150°55.0	46.7	55°48.8	10.8′	16°04.5	7.7′	56.6′
23	165°55.0	47.3	70°18.6	10.9′	15°56.8	7.7′	56.6′
	SD = 15.8′	*d* = 0.7′	SD = 15.7′				

Mon	**GHA**	**Dec**	**GHA**	*ν*	**Dec**	*d*	**HP**
0	180°55.0	N17°48.0	84°48.5	11.0′	N15°49.1	7.7′	56.5′
1	195°55.0	48.6	99°18.5	11.1′	15°41.4	7.9′	56.5′
2	210°55.1	49.3	113°48.5	11.1′	15°33.5	7.9′	56.5′
3	225°55.1	·· 49.9	128°18.7	11.2′	15°25.6	8.0′	56.4′
4	240°55.1	50.6	142°48.9	11.3′	15°17.6	8.0′	56.4′
5	255°55.1	51.2	157°19.2	11.4′	15°09.6	8.2′	56.4′
6	270°55.1	N17°51.9	171°49.6	11.5′	N15°01.4	8.1′	56.3′
7	285°55.1	52.5	186°20.1	11.5′	14°53.3	8.3′	56.3′
8	300°55.2	53.1	200°50.6	11.6′	14°45.0	8.3′	56.3′
9	315°55.2	·· 53.8	215°21.2	11.7′	14°36.7	8.4′	56.2′
10	330°55.2	54.4	229°51.9	11.8′	14°28.3	8.4′	56.2′
11	345°55.2	55.1	244°22.7	11.8′	14°19.9	8.5′	56.2′
12	0°55.2	N17°55.7	258°53.5	11.9′	N14°11.4	8.5′	56.1′
13	15°55.3	56.3	273°24.5	12.0′	14°02.9	8.7′	56.1′
14	30°55.3	57.0	287°55.4	12.1′	13°54.2	8.6′	56.1′
15	45°55.3	·· 57.6	302°26.5	12.1′	13°45.6	8.8′	56.0′
16	60°55.3	58.3	316°57.7	12.2′	13°36.8	8.7′	56.0′
17	75°55.3	58.9	331°28.9	12.3′	13°28.1	8.9′	56.0′
18	90°55.3	N17°59.5	346°00.2	12.4′	N13°19.2	8.9′	56.0′
19	105°55.3	18°00.2	0°31.5	12.4′	13°10.3	8.9′	55.9′
20	120°55.4	00.8	15°02.9	12.5′	13°01.4	9.0′	55.9′
21	135°55.4	·· 01.4	29°34.4	12.6′	12°52.4	9.0′	55.9′
22	150°55.4	02.1	44°06.0	12.6′	12°43.4	9.1′	55.8′
23	165°55.4	02.7	58°37.6	12.7′	12°34.3	9.2′	55.8′
	SD = 15.8′	*d* = 0.6′	SD = 15.4′				

Tue	**GHA**	**Dec**	**GHA**	*ν*	**Dec**	*d*	**HP**
0	180°55.4	N18°03.3	73°09.3	12.8′	N12°25.1	9.2′	55.8′
1	195°55.4	04.0	87°41.1	12.8′	12°15.9	9.2′	55.7′
2	210°55.5	04.6	102°12.9	12.9′	12°06.7	9.3′	55.7′
3	225°55.5	·· 05.2	116°44.8	13.0′	11°57.4	9.4′	55.7′
4	240°55.5	05.9	131°16.8	13.0′	11°48.0	9.3′	55.7′
5	255°55.5	06.5	145°48.8	13.1′	11°38.7	9.5′	55.6′
6	270°55.5	N18°07.1	160°20.9	13.2′	N11°29.2	9.4′	55.6′
7	285°55.5	07.8	174°53.1	13.2′	11°19.8	9.5′	55.6′
8	300°55.5	08.4	189°25.3	13.3′	11°10.3	9.6′	55.5′
9	315°55.5	·· 09.0	203°57.6	13.3′	11°00.7	9.6′	55.5′
10	330°55.6	09.6	218°29.9	13.4′	10°51.1	9.6′	55.5′
11	345°55.6	10.3	233°02.3	13.5′	10°41.5	9.7′	55.5′
12	0°55.6	N18°10.9	247°34.8	13.5′	N10°31.8	9.7′	55.4′
13	15°55.6	11.5	262°07.3	13.6′	10°22.1	9.8′	55.4′
14	30°55.6	12.1	276°39.9	13.6′	10°12.3	9.7′	55.4′
15	45°55.6	·· 12.8	291°12.5	13.7′	10°02.6	9.9′	55.4′
16	60°55.6	13.4	305°45.2	13.7′	09°52.7	9.8′	55.3′
17	75°55.6	14.0	320°17.9	13.8′	09°42.9	9.9′	55.3′
18	90°55.6	N18°14.6	334°50.7	13.9′	N09°33.0	9.9′	55.3′
19	105°55.7	15.3	349°23.6	13.9′	09°23.1	10.0′	55.3′
20	120°55.7	15.9	3°56.5	14.0′	09°13.1	10.0′	55.2′
21	135°55.7	·· 16.5	18°29.5	14.0′	09°03.1	10.0′	55.2′
22	150°55.7	17.1	33°02.5	14.1′	08°53.1	10.0′	55.2′
23	165°55.7	17.8	47°35.5	14.1′	08°43.1	10.1′	55.2′
	SD = 15.8′	*d* = 0.6′	SD = 15.2′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	▭	▭	▭	▭	▭	▭
N 70°	////	////	01:24	22:36	////	////
68°	////	////	02:09	21:48	////	////
66°	////	00:27	02:39	21:17	////	////
64°	////	01:35	03:00	20:55	22:23	////
62°	////	02:08	03:18	20:37	21:48	////
60°	00:24	02:33	03:32	20:22	21:23	////
N 58°	01:25	02:51	03:45	20:10	21:03	22:32
56°	01:56	03:07	03:55	19:59	20:47	22:00
54°	02:18	03:20	04:04	19:49	20:34	21:37
52°	02:36	03:32	04:13	19:41	20:22	21:18
50°	02:51	03:42	04:20	19:33	20:12	21:03
45°	03:20	04:02	04:36	19:17	19:51	20:34
N 40°	03:41	04:19	04:49	19:04	19:35	20:12
35°	03:58	04:32	05:00	18:53	19:21	19:55
30°	04:12	04:43	05:09	18:44	19:10	19:41
20°	04:34	05:02	05:26	18:27	18:51	19:18
N 10°	04:52	05:18	05:40	18:13	18:35	19:01
0°	05:06	05:31	05:53	18:00	18:22	18:47
S 10°	05:18	05:44	06:06	17:47	18:09	18:34
20°	05:30	05:56	06:20	17:33	17:56	18:23
30°	05:41	06:10	06:35	17:17	17:42	18:11
35°	05:47	06:17	06:44	17:08	17:35	18:05
40°	05:53	06:26	06:54	16:58	17:27	17:59
45°	05:59	06:35	07:06	16:46	17:17	17:53
S 50°	06:06	06:46	07:21	16:31	17:06	17:46
52°	06:10	06:51	07:28	16:24	17:01	17:42
54°	06:13	06:56	07:35	16:17	16:56	17:39
56°	06:16	07:02	07:44	16:08	16:50	17:36
58°	06:20	07:08	07:53	15:59	16:44	17:32
S 60°	06:24	07:16	08:04	15:48	16:36	17:28

Lat.	**Moonrise** Sun	Mon	Tue	**Moonset** Sun	Mon	Tue
N 72°	06:23	09:08	11:08	05:15	04:15	03:53
N 70°	07:44	09:40	11:26	03:53	03:42	03:34
68°	08:23	10:04	11:40	03:14	03:17	03:18
66°	08:49	10:22	11:52	02:46	02:58	03:05
64°	09:10	10:36	12:01	02:25	02:43	02:55
62°	09:26	10:48	12:09	02:08	02:30	02:46
60°	09:40	10:58	12:16	01:54	02:19	02:38
N 58°	09:52	11:07	12:22	01:42	02:10	02:31
56°	10:02	11:15	12:28	01:31	02:01	02:25
54°	10:11	11:22	12:33	01:22	01:54	02:19
52°	10:19	11:28	12:37	01:14	01:47	02:14
50°	10:26	11:34	12:41	01:06	01:41	02:10
45°	10:41	11:46	12:50	00:50	01:28	02:00
N 40°	10:54	11:56	12:57	00:37	01:17	01:52
35°	11:04	12:04	13:03	00:25	01:08	01:45
30°	11:14	12:12	13:08	00:16	01:00	01:39
20°	11:30	12:25	13:17	·· ··	00:45	01:28
N 10°	11:44	12:36	13:25	·· ··	00:33	01:18
0°	11:57	12:46	13:33	·· ··	00:21	01:09
S 10°	12:10	12:57	13:40	·· ··	00:09	01:00
20°	12:24	13:08	13:49	23:56	·· ··	00:50
30°	12:39	13:21	13:58	23:42	·· ··	00:39
35°	12:49	13:28	14:03	23:33	·· ··	00:33
40°	12:59	13:36	14:09	23:24	·· ··	00:25
45°	13:11	13:46	14:16	23:12	·· ··	00:17
S 50°	13:26	13:58	14:24	22:58	·· ··	00:06
52°	13:33	14:03	14:28	22:52	·· ··	00:01
54°	13:41	14:09	14:32	22:44	23:56	·· ··
56°	13:49	14:16	14:37	22:36	23:50	·· ··
58°	13:59	14:23	14:42	22:27	23:43	·· ··
S 60°	14:10	14:31	14:47	22:17	23:35	·· ··

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 6-8 40-61%
10	03:38	03:39	11:56	18:09	05:43	
11	03:40	03:41	11:56	18:58	06:34	
12	03:42	03:42	11:56	19:44	07:21	

May 13, 14, 15 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	230°39.7	171°19.4	N20°24.2	189°53.1	N15°33.7	49°21.6	N01°03.8	46°28.7	N01°00.2
1	245°42.2	186°18.6	24.9	204°53.8	34.2	64°24.1	03.9	61°31.3	00.2
2	260°44.7	201°17.9	25.6	219°54.4	34.8	79°26.7	03.9	76°33.8	00.3
3	275°47.1	216°17.2	·· 26.4	234°55.1	·· 35.4	94°29.3	·· 03.9	91°36.4	·· 00.3
4	290°49.6	231°16.4	27.1	249°55.7	36.0	109°31.8	04.0	106°38.9	00.3
5	305°52.1	246°15.7	27.8	264°56.4	36.6	124°34.4	04.0	121°41.5	00.4
6	320°54.5	261°15.0	N20°28.5	279°57.0	N15°37.1	139°37.0	N01°04.0	136°44.0	N01°00.4
7	335°57.0	276°14.3	29.2	294°57.7	37.7	154°39.5	04.1	151°46.6	00.4
8	350°59.5	291°13.5	30.0	309°58.3	38.3	169°42.1	04.1	166°49.1	00.4
9	6°01.9	306°12.8	·· 30.7	324°59.0	·· 38.9	184°44.7	·· 04.1	181°51.7	·· 00.5
10	21°04.4	321°12.1	31.4	339°59.6	39.4	199°47.2	04.2	196°54.2	00.5
11	36°06.8	336°11.3	32.1	355°00.3	40.0	214°49.8	04.2	211°56.8	00.5
12	51°09.3	351°10.6	N20°32.8	10°00.9	N15°40.6	229°52.4	N01°04.2	226°59.4	N01°00.6
13	66°11.8	6°09.9	33.5	25°01.6	41.2	244°54.9	04.3	242°01.9	00.6
14	81°14.2	21°09.1	34.2	40°02.2	41.7	259°57.5	04.3	257°04.5	00.6
15	96°16.7	36°08.4	·· 34.9	55°02.9	·· 42.3	275°00.1	·· 04.3	272°07.0	·· 00.6
16	111°19.2	51°07.7	35.6	70°03.5	42.9	290°02.6	04.4	287°09.6	00.7
17	126°21.6	66°06.9	36.4	85°04.2	43.5	305°05.2	04.4	302°12.1	00.7
18	141°24.1	81°06.2	N20°37.1	100°04.8	N15°44.0	320°07.8	N01°04.4	317°14.7	N01°00.7
19	156°26.6	96°05.5	37.8	115°05.5	44.6	335°10.3	04.5	332°17.2	00.8
20	171°29.0	111°04.7	38.5	130°06.1	45.2	350°12.9	04.5	347°19.8	00.8
21	186°31.5	126°04.0	·· 39.2	145°06.8	·· 45.8	5°15.5	·· 04.5	2°22.3	·· 00.8
22	201°33.9	141°03.3	39.9	160°07.4	46.3	20°18.0	04.6	17°24.9	00.8
23	216°36.4	156°02.5	40.6	175°08.1	46.9	35°20.6	04.6	32°27.4	00.9
Mer.pass. 08:36		ν -0.7′	d 0.7′	m -3.89	ν 0.7′	d 0.6′	m 1.28	ν 2.6′	d 0.0′ m -2.29	ν 2.6′	d 0.0′ m 0.68

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	231°38.9	171°01.8	N20°41.3	190°08.7	N15°47.5	50°23.1	N01°04.6	47°30.0	N01°00.9
1	246°41.3	186°01.0	42.0	205°09.4	48.1	65°25.7	04.7	62°32.5	00.9
2	261°43.8	201°00.3	42.7	220°10.0	48.6	80°28.3	04.7	77°35.1	01.0
3	276°46.3	215°59.6	·· 43.4	235°10.7	·· 49.2	95°30.8	·· 04.7	92°37.6	·· 01.0
4	291°48.7	230°58.8	44.1	250°11.3	49.8	110°33.4	04.8	107°40.2	01.0
5	306°51.2	245°58.1	44.8	265°12.0	50.4	125°36.0	04.8	122°42.7	01.0
6	321°53.7	260°57.3	N20°45.5	280°12.6	N15°50.9	140°38.5	N01°04.8	137°45.3	N01°01.1
7	336°56.1	275°56.6	46.1	295°13.3	51.5	155°41.1	04.9	152°47.8	01.1
8	351°58.6	290°55.9	46.8	310°13.9	52.1	170°43.6	04.9	167°50.4	01.1
9	7°01.1	305°55.1	·· 47.5	325°14.6	·· 52.6	185°46.2	·· 04.9	182°52.9	·· 01.2
10	22°03.5	320°54.4	48.2	340°15.2	53.2	200°48.8	05.0	197°55.5	01.2
11	37°06.0	335°53.6	48.9	355°15.9	53.8	215°51.3	05.0	212°58.0	01.2
12	52°08.4	350°52.9	N20°49.6	10°16.5	N15°54.3	230°53.9	N01°05.0	228°00.6	N01°01.2
13	67°10.9	5°52.2	50.3	25°17.2	54.9	245°56.4	05.0	243°03.1	01.3
14	82°13.4	20°51.4	51.0	40°17.8	55.5	260°59.0	05.1	258°05.7	01.3
15	97°15.8	35°50.7	·· 51.7	55°18.5	·· 56.0	276°01.6	·· 05.1	273°08.2	·· 01.3
16	112°18.3	50°49.9	52.3	70°19.1	56.6	291°04.1	05.1	288°10.8	01.4
17	127°20.8	65°49.2	53.0	85°19.8	57.2	306°06.7	05.2	303°13.3	01.4
18	142°23.2	80°48.4	N20°53.7	100°20.4	N15°57.8	321°09.2	N01°05.2	318°15.8	N01°01.4
19	157°25.7	95°47.7	54.4	115°21.1	58.3	336°11.8	05.2	333°18.4	01.4
20	172°28.2	110°46.9	55.1	130°21.7	58.9	351°14.3	05.3	348°20.9	01.5
21	187°30.6	125°46.2	·· 55.7	145°22.4	15°59.5	6°16.9	·· 05.3	3°23.5	·· 01.5
22	202°33.1	140°45.4	56.4	160°23.0	16°00.0	21°19.5	05.3	18°26.0	01.5
23	217°35.6	155°44.7	57.1	175°23.7	00.6	36°22.0	05.3	33°28.6	01.5
Mer.pass. 08:32		ν -0.7′	d 0.7′	m -3.89	ν 0.7′	d 0.6′	m 1.29	ν 2.6′	d 0.0′ m -2.28	ν 2.6′	d 0.0′ m 0.68

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	232°38.0	170°43.9	N20°57.8	190°24.3	N16°01.2	51°24.6	N01°05.4	48°31.1	N01°01.6
1	247°40.5	185°43.2	58.5	205°25.0	01.7	66°27.1	05.4	63°33.7	01.6
2	262°42.9	200°42.5	59.1	220°25.6	02.3	81°29.7	05.4	78°36.2	01.6
3	277°45.4	215°41.7	20°59.8	235°26.3	·· 02.9	96°32.2	·· 05.5	93°38.8	·· 01.7
4	292°47.9	230°41.0	21°00.5	250°26.9	03.4	111°34.8	05.5	108°41.3	01.7
5	307°50.3	245°40.2	01.1	265°27.6	04.0	126°37.3	05.5	123°43.9	01.7
6	322°52.8	260°39.5	N21°01.8	280°28.2	N16°04.5	141°39.9	N01°05.5	138°46.4	N01°01.7
7	337°55.3	275°38.7	02.5	295°28.9	05.1	156°42.4	05.6	153°49.0	01.8
8	352°57.7	290°37.9	03.1	310°29.5	05.7	171°45.0	05.6	168°51.5	01.8
9	8°00.2	305°37.2	·· 03.8	325°30.2	·· 06.2	186°47.6	·· 05.6	183°54.0	·· 01.8
10	23°02.7	320°36.4	04.5	340°30.8	06.8	201°50.1	05.7	198°56.6	01.8
11	38°05.1	335°35.7	05.1	355°31.5	07.4	216°52.7	05.7	213°59.1	01.9
12	53°07.6	350°34.9	N21°05.8	10°32.1	N16°07.9	231°55.2	N01°05.7	229°01.7	N01°01.9
13	68°10.0	5°34.2	06.5	25°32.8	08.5	246°57.8	05.7	244°04.2	01.9
14	83°12.5	20°33.4	07.1	40°33.4	09.0	262°00.3	05.8	259°06.8	01.9
15	98°15.0	35°32.7	·· 07.8	55°34.1	·· 09.6	277°02.9	·· 05.8	274°09.3	·· 02.0
16	113°17.4	50°31.9	08.5	70°34.7	10.2	292°05.4	05.8	289°11.9	02.0
17	128°19.9	65°31.2	09.1	85°35.3	10.7	307°08.0	05.9	304°14.4	02.0
18	143°22.4	80°30.4	N21°09.8	100°36.0	N16°11.3	322°10.5	N01°05.9	319°17.0	N01°02.0
19	158°24.8	95°29.6	10.4	115°36.6	11.9	337°13.1	05.9	334°19.5	02.1
20	173°27.3	110°28.9	11.1	130°37.3	12.4	352°15.6	05.9	349°22.0	02.1
21	188°29.8	125°28.1	·· 11.7	145°37.9	·· 13.0	7°18.2	·· 06.0	4°24.6	·· 02.1
22	203°32.2	140°27.4	12.4	160°38.6	13.5	22°20.7	06.0	19°27.1	02.2
23	218°34.7	155°26.6	13.0	175°39.2	14.1	37°23.3	06.0	34°29.7	02.2
Mer.pass. 08:28		ν -0.7′	d 0.7′	m -3.89	ν 0.6′	d 0.6′	m 1.29	ν 2.6′	d 0.0′ m -2.27	ν 2.5′	d 0.0′ m 0.69

Stars

	SHA	Dec
Alpheratz	358°09.1	28°59.0
Ankaa	353°40.1	-42°24.4
Schedar	350°08.9	56°25.8
Diphda	349°20.7	-18°05.4
Achernar	335°45.5	-57°19.9
Hamal	328°28.8	23°22.2
Polaris	327°05.0	89°10.5
Acamar	315°37.3	-40°22.9
Menkar	314°41.0	4°00.8
Mirfak	309°16.0	49°47.5
Aldebaran	291°17.8	16°28.2
Rigel	281°35.9	-8°13.5
Capella	281°11.1	45°58.8
Bellatrix	278°58.6	6°19.9
Elnath	278°43.9	28°35.5
Alnilam	276°11.5	-1°13.0
Betelgeuse	271°28.1	7°24.1
Canopus	264°07.4	-52°41.4
Sirius	258°55.5	-16°41.6
Adhara	255°32.0	-28°57.0
Procyon	245°25.5	5°16.3
Pollux	243°57.8	28°04.4
Avior	234°28.2	-59°27.3
Suhail	223°10.5	-43°21.7
Miaplacidus	221°45.0	-69°38.7
Alphard	218°20.2	-8°34.7
Regulus	208°09.5	12°03.6
Dubhe	194°21.4	61°51.4
Denebola	182°58.4	14°40.7
Gienah	176°17.3	-17°26.4
Acrux	173°36.3	-62°59.9
Gacrux	172°27.8	-57°00.7
Alioth	166°41.7	56°03.9
Spica	158°56.8	-11°03.9
Alkaid	153°17.7	49°24.6
Hadar	149°22.1	-60°17.1
Menkent	148°36.1	-36°16.7
Arcturus	146°17.8	19°16.8
Rigil Kent.	140°24.6	-60°45.4
Kochab	137°17.8	74°14.1
Zuben'ubi	137°32.2	-15°57.9
Alphecca	126°31.4	26°46.7
Antares	112°56.0	-26°23.4
Atria	108°19.3	-68°59.5
Sabik	102°40.3	-15°42.1
Shaula	96°54.8	-37°05.4
Rasalhague	96°28.9	12°34.3
Eltanin	90°57.1	51°29.3
Kaus Aust.	84°16.0	-34°23.5
Vega	80°55.2	38°45.8
Nunki	76°28.4	-26°19.2
Altair	62°31.9	8°49.0
Peacock	53°57.5	-56°47.5
Deneb	49°48.0	45°12.5
Enif	34°11.2	9°47.2
Al Na'ir	28°14.5	-47°03.0
Fomalhaut	15°51.1	-29°43.3
Scheat	14°17.3	27°58.6
Markab	14°02.8	15°06.1

May 13 Wed	SHA	Mer.pass
Venus	300°39.6	12:35
Mars	319°13.4	11:20
Jupiter	178°41.8	20:39
Saturn	175°49.0	20:51

May 14 Thu	SHA	Mer.pass
Venus	299°22.9	12:37
Mars	318°29.9	11:19
Jupiter	178°44.3	20:35
Saturn	175°51.1	20:46

May 15 Fri	SHA	Mer.pass
Venus	298°05.9	12:38
Mars	317°46.3	11:18
Jupiter	178°46.6	20:31
Saturn	175°53.1	20:42

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = -0.5276 sec ΔT = TT-UT1 = +51.7116 sec

1981 May 13 to May. 15 UT

h	Sun		Moon				
Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°55.7	N18°18.4	62°08.6	14.2′	N08°33.0	10.1′	55.1′
1	195°55.7	19.0	76°41.8	14.2′	08°22.9	10.2′	55.1′
2	210°55.7	19.6	91°15.0	14.3′	08°12.7	10.1′	55.1′
3	225°55.7	·· 20.2	105°48.3	14.3′	08°02.6	10.2′	55.1′
4	240°55.7	20.9	120°21.6	14.3′	07°52.4	10.2′	55.0′
5	255°55.7	21.5	134°54.9	14.4′	07°42.2	10.3′	55.0′
6	270°55.7	N18°22.1	149°28.3	14.4′	N07°31.9	10.3′	55.0′
7	285°55.7	22.7	164°01.8	14.5′	07°21.6	10.2′	55.0′
8	300°55.8	23.3	178°35.2	14.5′	07°11.4	10.4′	55.0′
9	315°55.8	·· 23.9	193°08.8	14.6′	07°01.0	10.3′	54.9′
10	330°55.8	24.6	207°42.3	14.6′	06°50.7	10.4′	54.9′
11	345°55.8	25.2	222°16.0	14.6′	06°40.3	10.3′	54.9′
12	0°55.8	N18°25.8	236°49.6	14.7′	N06°30.0	10.4′	54.9′
13	15°55.8	26.4	251°23.3	14.7′	06°19.6	10.4′	54.9′
14	30°55.8	27.0	265°57.0	14.8′	06°09.2	10.5′	54.8′
15	45°55.8	·· 27.6	280°30.8	14.8′	05°58.7	10.4′	54.8′
16	60°55.8	28.2	295°04.6	14.8′	05°48.3	10.5′	54.8′
17	75°55.8	28.8	309°38.4	14.9′	05°37.8	10.5′	54.8′
18	90°55.8	N18°29.5	324°12.3	14.9′	N05°27.3	10.5′	54.8′
19	105°55.8	30.1	338°46.2	14.9′	05°16.8	10.5′	54.7′
20	120°55.8	30.7	353°20.1	15.0′	05°06.3	10.6′	54.7′
21	135°55.8	·· 31.3	7°54.1	15.0′	04°55.7	10.5′	54.7′
22	150°55.8	31.9	22°28.1	15.0′	04°45.2	10.6′	54.7′
23	165°55.8	32.5	37°02.2	15.1′	04°34.6	10.6′	54.7′
	SD = 15.8′	d = 0.6′	SD = 15.0′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°55.8	N18°33.1	51°36.2	15.1′	N04°24.0	10.5′	54.6′
1	195°55.8	33.7	66°10.3	15.1′	04°13.5	10.6′	54.6′
2	210°55.8	34.3	80°44.5	15.2′	04°02.9	10.7′	54.6′
3	225°55.8	·· 34.9	95°18.6	15.2′	03°52.2	10.6′	54.6′
4	240°55.8	35.5	109°52.8	15.2′	03°41.6	10.6′	54.6′
5	255°55.8	36.1	124°27.0	15.2′	03°31.0	10.6′	54.6′
6	270°55.8	N18°36.7	139°01.3	15.3′	N03°20.4	10.7′	54.5′
7	285°55.8	37.4	153°35.5	15.3′	03°09.7	10.6′	54.5′
8	300°55.8	38.0	168°09.8	15.3′	02°59.1	10.7′	54.5′
9	315°55.8	·· 38.6	182°44.1	15.3′	02°48.4	10.7′	54.5′
10	330°55.8	39.2	197°18.5	15.4′	02°37.7	10.6′	54.5′
11	345°55.8	39.8	211°52.8	15.4′	02°27.1	10.7′	54.5′
12	0°55.8	N18°40.4	226°27.2	15.4′	N02°16.4	10.7′	54.4′
13	15°55.8	41.0	241°01.6	15.4′	02°05.7	10.7′	54.4′
14	30°55.8	41.6	255°36.0	15.4′	01°55.0	10.7′	54.4′
15	45°55.8	·· 42.2	270°10.4	15.5′	01°44.3	10.7′	54.4′
16	60°55.8	42.8	284°44.9	15.5′	01°33.6	10.7′	54.4′
17	75°55.8	43.4	299°19.4	15.5′	01°22.9	10.7′	54.4′
18	90°55.8	N18°44.0	313°53.8	15.5′	N01°12.2	10.7′	54.4′
19	105°55.8	44.6	328°28.3	15.5′	01°01.5	10.7′	54.3′
20	120°55.8	45.1	343°02.9	15.5′	00°50.8	10.6′	54.3′
21	135°55.8	·· 45.7	357°37.4	15.5′	00°40.2	10.7′	54.3′
22	150°55.8	46.3	12°11.9	15.6′	00°29.5	10.7′	54.3′
23	165°55.8	46.9	26°46.5	15.6′	00°18.8	10.7′	54.3′
	SD = 15.8′	d = 0.6′	SD = 14.9′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°55.8	N18°47.5	41°21.1	15.6′	N00°08.1	10.7′	54.3′
1	195°55.8	48.1	55°55.6	15.6′	S00°02.6	10.7′	54.3′
2	210°55.8	48.7	70°30.2	15.6′	00°13.3	10.7′	54.3′
3	225°55.8	·· 49.3	85°04.8	15.6′	00°24.0	10.6′	54.2′
4	240°55.8	49.9	99°39.4	15.6′	00°34.6	10.7′	54.2′
5	255°55.8	50.5	114°14.0	15.6′	00°45.3	10.7′	54.2′
6	270°55.8	N18°51.1	128°48.7	15.6′	S00°56.0	10.6′	54.2′
7	285°55.8	51.7	143°23.3	15.6′	01°06.6	10.7′	54.2′
8	300°55.8	52.3	157°57.9	15.6′	01°17.3	10.6′	54.2′
9	315°55.8	·· 52.9	172°32.6	15.6′	01°27.9	10.6′	54.2′
10	330°55.8	53.4	187°07.2	15.6′	01°38.5	10.6′	54.2′
11	345°55.8	54.0	201°41.9	15.7′	01°49.1	10.7′	54.2′
12	0°55.8	N18°54.6	216°16.5	15.7′	S01°59.8	10.6′	54.1′
13	15°55.8	55.2	230°51.2	15.7′	02°10.4	10.5′	54.1′
14	30°55.8	55.8	245°25.8	15.7′	02°20.9	10.6′	54.1′
15	45°55.8	·· 56.4	260°00.5	15.7′	02°31.5	10.6′	54.1′
16	60°55.7	57.0	274°35.1	15.7′	02°42.1	10.5′	54.1′
17	75°55.7	57.6	289°09.8	15.7′	02°52.6	10.6′	54.1′
18	90°55.7	N18°58.1	303°44.4	15.6′	S03°03.2	10.5′	54.1′
19	105°55.7	58.7	318°19.1	15.6′	03°13.7	10.5′	54.1′
20	120°55.7	59.3	332°53.7	15.6′	03°24.2	10.5′	54.1′
21	135°55.7	18°59.9	347°28.4	15.6′	03°34.7	10.5′	54.1′
22	150°55.7	19°00.5	2°03.0	15.6′	03°45.2	10.4′	54.1′
23	165°55.7	01.0	16°37.6	15.6′	03°55.6	10.5′	54.0′
	SD = 15.8′	d = 0.6′	SD = 14.8′				

Lat.	**Twilight** Naut.	**Twilight** Civil	**Sunrise**	**Sunset**	**Twilight** Civil	**Twilight** Naut.
N 72°	▭	▭	▭	▭	▭	▭
N 70°	////	////	00:55	23:09	////	////
68°	////	////	01:53	22:04	////	////
66°	////	////	02:27	21:29	////	////
64°	////	01:16	02:51	21:04	22:43	////
62°	////	01:56	03:10	20:45	22:00	////
60°	////	02:23	03:25	20:29	21:32	////
N 58°	01:08	02:43	03:38	20:16	21:11	22:50
56°	01:45	03:00	03:49	20:04	20:54	22:11
54°	02:10	03:14	03:59	19:55	20:40	21:45
52°	02:29	03:26	04:08	19:46	20:28	21:26
50°	02:45	03:37	04:16	19:38	20:17	21:09
45°	03:15	03:58	04:32	19:21	19:55	20:38
N 40°	03:38	04:15	04:46	19:07	19:38	20:16
35°	03:55	04:29	04:57	18:56	19:24	19:58
30°	04:10	04:41	05:07	18:46	19:12	19:43
20°	04:33	05:01	05:24	18:28	18:52	19:20
N 10°	04:51	05:17	05:39	18:14	18:36	19:02
0°	05:06	05:31	05:53	18:00	18:22	18:47
S 10°	05:19	05:44	06:06	17:46	18:08	18:34
20°	05:31	05:57	06:21	17:32	17:55	18:22
30°	05:43	06:12	06:37	17:15	17:41	18:09
35°	05:49	06:20	06:46	17:06	17:33	18:03
40°	05:55	06:28	06:57	16:55	17:24	17:57
45°	06:02	06:38	07:10	16:42	17:14	17:50
S 50°	06:10	06:49	07:25	16:27	17:03	17:42
52°	06:13	06:55	07:32	16:20	16:57	17:39
54°	06:17	07:00	07:40	16:12	16:52	17:35
56°	06:21	07:07	07:49	16:03	16:45	17:31
58°	06:25	07:14	07:59	15:53	16:38	17:27
S 60°	06:30	07:21	08:11	15:41	16:30	17:22

Lat.	**Moonrise** Wed	Thu	Fri	**Moonset** Wed	Thu	Fri
N 72°	12:56	14:38	16:17	03:38	03:25	03:13
N 70°	13:05	14:40	16:13	03:27	03:20	03:14
68°	13:13	14:42	16:10	03:18	03:16	03:15
66°	13:19	14:44	16:07	03:10	03:13	03:15
64°	13:24	14:45	16:05	03:03	03:10	03:16
62°	13:29	14:46	16:03	02:58	03:07	03:16
60°	13:33	14:47	16:01	02:53	03:05	03:16
N 58°	13:36	14:48	16:00	02:48	03:03	03:17
56°	13:39	14:49	15:58	02:44	03:01	03:17
54°	13:42	14:50	15:57	02:41	02:59	03:17
52°	13:44	14:51	15:56	02:37	02:58	03:17
50°	13:47	14:51	15:55	02:35	02:57	03:17
45°	13:52	14:53	15:53	02:28	02:54	03:18
N 40°	13:56	14:54	15:51	02:23	02:51	03:18
35°	13:59	14:55	15:49	02:18	02:49	03:18
30°	14:02	14:56	15:48	02:14	02:47	03:19
20°	14:08	14:57	15:46	02:07	02:44	03:19
N 10°	14:13	14:58	15:43	02:00	02:41	03:20
0°	14:17	15:00	15:41	01:54	02:38	03:20
S 10°	14:22	15:01	15:40	01:48	02:35	03:20
20°	14:26	15:02	15:38	01:42	02:32	03:21
30°	14:32	15:04	15:35	01:34	02:28	03:21
35°	14:35	15:05	15:34	01:30	02:26	03:21
40°	14:38	15:06	15:33	01:25	02:24	03:21
45°	14:42	15:07	15:31	01:20	02:21	03:22
S 50°	14:47	15:08	15:29	01:13	02:18	03:22
52°	14:49	15:09	15:28	01:09	02:16	03:22
54°	14:52	15:10	15:27	01:06	02:15	03:22
56°	14:54	15:10	15:26	01:02	02:13	03:22
58°	14:57	15:11	15:25	00:58	02:11	03:23
S 60°	15:01	15:12	15:23	00:53	02:09	03:23

Day	**Sun** Eqn.of Time 00^h mm:ss	Eqn.of Time 12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 9-11 70-86%
13	03:43	03:43	11:56	20:27	08:06	
14	03:43	03:43	11:56	21:10	08:49	
15	03:43	03:43	11:56	21:52	09:31	

May 16, 17, 18 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	233°37.2	170°25.9	N21°13.7	190°39.9	N16°14.7	52°25.8	N01°06.0	49°32.2	N01°02.2
1	248°39.6	185°25.1	14.4	205°40.5	15.2	67°28.4	06.1	64°34.8	02.2
2	263°42.1	200°24.3	15.0	220°41.2	15.8	82°30.9	06.1	79°37.3	02.3
3	278°44.5	215°23.6	·· 15.7	235°41.8	·· 16.3	97°33.5	·· 06.1	94°39.8	·· 02.3
4	293°47.0	230°22.8	16.3	250°42.5	16.9	112°36.0	06.1	109°42.4	02.3
5	308°49.5	245°22.1	16.9	265°43.1	17.4	127°38.6	06.2	124°44.9	02.3
6	323°51.9	260°21.3	N21°17.6	280°43.8	N16°18.0	142°41.1	N01°06.2	139°47.5	N01°02.4
7	338°54.4	275°20.5	18.2	295°44.4	18.6	157°43.7	06.2	154°50.0	02.4
8	353°56.9	290°19.8	18.9	310°45.0	19.1	172°46.2	06.2	169°52.6	02.4
9	8°59.3	305°19.0	·· 19.5	325°45.7	·· 19.7	187°48.7	·· 06.3	184°55.1	·· 02.4
10	24°01.8	320°18.2	20.2	340°46.3	20.2	202°51.3	06.3	199°57.6	02.5
11	39°04.3	335°17.5	20.8	355°47.0	20.8	217°53.8	06.3	215°00.2	02.5
12	54°06.7	350°16.7	N21°21.4	10°47.6	N16°21.3	232°56.4	N01°06.3	230°02.7	N01°02.5
13	69°09.2	5°16.0	22.1	25°48.3	21.9	247°58.9	06.4	245°05.3	02.5
14	84°11.7	20°15.2	22.7	40°48.9	22.5	263°01.5	06.4	260°07.8	02.6
15	99°14.1	35°14.4	·· 23.4	55°49.6	·· 23.0	278°04.0	·· 06.4	275°10.3	·· 02.6
16	114°16.6	50°13.7	24.0	70°50.2	23.6	293°06.6	06.4	290°12.9	02.6
17	129°19.0	65°12.9	24.6	85°50.9	24.1	308°09.1	06.5	305°15.4	02.6
18	144°21.5	80°12.1	N21°25.3	100°51.5	N16°24.7	323°11.7	N01°06.5	320°18.0	N01°02.6
19	159°24.0	95°11.4	25.9	115°52.1	25.2	338°14.2	06.5	335°20.5	02.7
20	174°26.4	110°10.6	26.5	130°52.8	25.8	353°16.7	06.5	350°23.0	02.7
21	189°28.9	125°09.8	·· 27.2	145°53.4	·· 26.3	8°19.3	·· 06.6	5°25.6	·· 02.7
22	204°31.4	140°09.1	27.8	160°54.1	26.9	23°21.8	06.6	20°28.1	02.7
23	219°33.8	155°08.3	28.4	175°54.7	27.4	38°24.4	06.6	35°30.7	02.8
Mer.pass. 08:24		ν -0.8′	d 0.7′	m -3.89	ν 0.6′	d 0.6′	m 1.30	ν 2.5′	d 0.0′ m -2.27	ν 2.5′	d 0.0′ m 0.69

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	234°36.3	170°07.5	N21°29.0	190°55.4	N16°28.0	53°26.9	N01°06.6	50°33.2	N01°02.8
1	249°38.8	185°06.7	29.7	205°56.0	28.5	68°29.5	06.7	65°35.7	02.8
2	264°41.2	200°06.0	30.3	220°56.7	29.1	83°32.0	06.7	80°38.3	02.8
3	279°43.7	215°05.2	·· 30.9	235°57.3	·· 29.6	98°34.5	·· 06.7	95°40.8	·· 02.9
4	294°46.1	230°04.4	31.5	250°57.9	30.2	113°37.1	06.7	110°43.4	02.9
5	309°48.6	245°03.7	32.2	265°58.6	30.7	128°39.6	06.7	125°45.9	02.9
6	324°51.1	260°02.9	N21°32.8	280°59.2	N16°31.3	143°42.2	N01°06.8	140°48.4	N01°02.9
7	339°53.5	275°02.1	33.4	295°59.9	31.8	158°44.7	06.8	155°51.0	03.0
8	354°56.0	290°01.3	34.0	311°00.5	32.4	173°47.2	06.8	170°53.5	03.0
9	9°58.5	305°00.6	·· 34.6	326°01.2	·· 32.9	188°49.8	·· 06.8	185°56.1	·· 03.0
10	25°00.9	319°59.8	35.3	341°01.8	33.5	203°52.3	06.9	200°58.6	03.0
11	40°03.4	334°59.0	35.9	356°02.5	34.0	218°54.9	06.9	216°01.1	03.0
12	55°05.9	349°58.2	N21°36.5	11°03.1	N16°34.6	233°57.4	N01°06.9	231°03.7	N01°03.1
13	70°08.3	4°57.5	37.1	26°03.7	35.1	248°59.9	06.9	246°06.2	03.1
14	85°10.8	19°56.7	37.7	41°04.4	35.7	264°02.5	06.9	261°08.8	03.1
15	100°13.3	34°55.9	·· 38.3	56°05.0	·· 36.2	279°05.0	·· 07.0	276°11.3	·· 03.1
16	115°15.7	49°55.1	38.9	71°05.7	36.8	294°07.6	07.0	291°13.8	03.2
17	130°18.2	64°54.4	39.5	86°06.3	37.3	309°10.1	07.0	306°16.4	03.2
18	145°20.6	79°53.6	N21°40.2	101°07.0	N16°37.9	324°12.6	N01°07.0	321°18.9	N01°03.2
19	160°23.1	94°52.8	40.8	116°07.6	38.4	339°15.2	07.1	336°21.4	03.2
20	175°25.6	109°52.0	41.4	131°08.3	39.0	354°17.7	07.1	351°24.0	03.3
21	190°28.0	124°51.3	·· 42.0	146°08.9	·· 39.5	9°20.2	·· 07.1	6°26.5	·· 03.3
22	205°30.5	139°50.5	42.6	161°09.5	40.1	24°22.8	07.1	21°29.0	03.3
23	220°33.0	154°49.7	43.2	176°10.2	40.6	39°25.3	07.1	36°31.6	03.3
Mer.pass. 08:20		ν -0.8′	d 0.6′	m -3.89	ν 0.6′	d 0.6′	m 1.30	ν 2.5′	d 0.0′ m -2.26	ν 2.5′	d 0.0′ m 0.70

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	235°35.4	169°48.9	N21°43.8	191°10.8	N16°41.2	54°27.8	N01°07.2	51°34.1	N01°03.3
1	250°37.9	184°48.1	44.4	206°11.5	41.7	69°30.4	07.2	66°36.7	03.4
2	265°40.4	199°47.4	45.0	221°12.1	42.2	84°32.9	07.2	81°39.2	03.4
3	280°42.8	214°46.6	·· 45.6	236°12.8	·· 42.8	99°35.4	·· 07.2	96°41.7	·· 03.4
4	295°45.3	229°45.8	46.2	251°13.4	43.3	114°38.0	07.2	111°44.3	03.4
5	310°47.7	244°45.0	46.8	266°14.0	43.9	129°40.5	07.3	126°46.8	03.5
6	325°50.2	259°44.2	N21°47.4	281°14.7	N16°44.4	144°43.0	N01°07.3	141°49.3	N01°03.5
7	340°52.7	274°43.4	48.0	296°15.3	45.0	159°45.6	07.3	156°51.9	03.5
8	355°55.1	289°42.7	48.6	311°16.0	45.5	174°48.1	07.3	171°54.4	03.5
9	10°57.6	304°41.9	·· 49.2	326°16.6	·· 46.0	189°50.6	·· 07.3	186°56.9	·· 03.5
10	26°00.1	319°41.1	49.7	341°17.2	46.6	204°53.2	07.3	201°59.5	03.6
11	41°02.5	334°40.3	50.3	356°17.9	47.1	219°55.7	07.4	217°02.0	03.6
12	56°05.0	349°39.5	N21°50.9	11°18.5	N16°47.7	234°58.2	N01°07.4	232°04.5	N01°03.6
13	71°07.5	4°38.7	51.5	26°19.2	48.2	250°00.8	07.4	247°07.1	03.6
14	86°09.9	19°38.0	52.1	41°19.8	48.8	265°03.3	07.4	262°09.6	03.6
15	101°12.4	34°37.2	·· 52.7	56°20.5	·· 49.3	280°05.8	·· 07.4	277°12.1	·· 03.7
16	116°14.9	49°36.4	53.3	71°21.1	49.8	295°08.4	07.5	292°14.7	03.7
17	131°17.3	64°35.6	53.9	86°21.7	50.4	310°10.9	07.5	307°17.2	03.7
18	146°19.8	79°34.8	N21°54.4	101°22.4	N16°50.9	325°13.4	N01°07.5	322°19.7	N01°03.7
19	161°22.2	94°34.0	55.0	116°23.0	51.5	340°16.0	07.5	337°22.3	03.7
20	176°24.7	109°33.2	55.6	131°23.7	52.0	355°18.5	07.5	352°24.8	03.8
21	191°27.2	124°32.5	·· 56.2	146°24.3	·· 52.5	10°21.0	·· 07.6	7°27.3	·· 03.8
22	206°29.6	139°31.7	56.8	161°24.9	53.1	25°23.6	07.6	22°29.9	03.8
23	221°32.1	154°30.9	57.3	176°25.6	53.6	40°26.1	07.6	37°32.4	03.8
Mer.pass. 08:16		ν -0.8′	d 0.6′	m -3.89	ν 0.6′	d 0.5′	m 1.31	ν 2.5′	d 0.0′ m -2.25	ν 2.5′	d 0.0′ m 0.70

Stars

	SHA	Dec
Alpheratz	358°09.1	28°59.0
Ankaa	353°40.1	-42°24.4
Schedar	350°08.9	56°25.8
Diphda	349°20.7	-18°05.4
Achernar	335°45.5	-57°19.9
Hamal	328°28.7	23°22.2
Polaris	327°04.5	89°10.5
Acamar	315°37.3	-40°22.9
Menkar	314°41.0	4°00.8
Mirfak	309°16.0	49°47.5
Aldebaran	291°17.8	16°28.2
Rigel	281°35.9	-8°13.5
Capella	281°11.1	45°58.7
Bellatrix	278°58.6	6°19.9
Elnath	278°43.9	28°35.5
Alnilam	276°11.5	-1°13.0
Betelgeuse	271°28.1	7°24.1
Canopus	264°07.4	-52°41.4
Sirius	258°55.5	-16°41.6
Adhara	255°32.0	-28°57.0
Procyon	245°25.5	5°16.3
Pollux	243°57.8	28°04.4
Avior	234°28.3	-59°27.3
Suhail	223°10.5	-43°21.7
Miaplacidus	221°45.0	-69°38.7
Alphard	218°20.2	-8°34.7
Regulus	208°09.5	12°03.6
Dubhe	194°21.4	61°51.4
Denebola	182°58.4	14°40.7
Gienah	176°17.3	-17°26.4
Acrux	173°36.3	-62°59.9
Gacrux	172°27.9	-57°00.7
Alioth	166°41.7	56°03.9
Spica	158°56.8	-11°03.9
Alkaid	153°17.7	49°24.6
Hadar	149°22.1	-60°17.1
Menkent	148°36.1	-36°16.7
Arcturus	146°17.8	19°16.8
Rigil Kent.	140°24.6	-60°45.4
Kochab	137°17.9	74°14.1
Zuben'ubi	137°32.2	-15°57.9
Alphecca	126°31.4	26°46.7
Antares	112°56.0	-26°23.4
Atria	108°19.3	-68°59.6
Sabik	102°40.3	-15°42.1
Shaula	96°54.8	-37°05.4
Rasalhague	96°28.9	12°34.4
Eltanin	90°57.1	51°29.4
Kaus Aust.	84°16.0	-34°23.5
Vega	80°55.2	38°45.8
Nunki	76°28.4	-26°19.2
Altair	62°31.9	8°49.0
Peacock	53°57.5	-56°47.5
Deneb	49°48.0	45°12.5
Enif	34°11.1	9°47.2
Al Na'ir	28°14.4	-47°03.0
Fomalhaut	15°51.0	-29°43.3
Scheat	14°17.3	27°58.6
Markab	14°02.8	15°06.1

May 16 Sat	SHA	Mer.pass
Venus	296°48.7	12:39
Mars	317°02.7	11:17
Jupiter	178°48.7	20:27
Saturn	175°55.1	20:38

May 17 Sun	SHA	Mer.pass
Venus	295°31.2	12:40
Mars	316°19.1	11:16
Jupiter	178°50.6	20:23
Saturn	175°56.9	20:34

May 18 Mon	SHA	Mer.pass
Venus	294°13.5	12:41
Mars	315°35.4	11:15
Jupiter	178°52.4	20:19
Saturn	175°58.7	20:30

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = -0.5349 sec ΔT = TT-UT1 = +51.7189 sec

1981 May 16 to May. 18 UT

h	Sun		Moon				
Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°55.7	N19°01.6	31°12.3	15.6′	S04°06.1	10.4′	54.0′
1	195°55.7	02.2	45°46.9	15.6′	04°16.5	10.4′	54.0′
2	210°55.7	02.8	60°21.5	15.6′	04°26.9	10.4′	54.0′
3	225°55.7	·· 03.4	74°56.1	15.6′	04°37.3	10.4′	54.0′
4	240°55.6	03.9	89°30.7	15.6′	04°47.7	10.3′	54.0′
5	255°55.6	04.5	104°05.3	15.6′	04°58.0	10.3′	54.0′
6	270°55.6	N19°05.1	118°39.9	15.6′	S05°08.3	10.3′	54.0′
7	285°55.6	05.7	133°14.5	15.6′	05°18.6	10.3′	54.0′
8	300°55.6	06.3	147°49.0	15.5′	05°28.9	10.3′	54.0′
9	315°55.6	·· 06.8	162°23.6	15.5′	05°39.2	10.2′	54.0′
10	330°55.6	07.4	176°58.1	15.5′	05°49.4	10.2′	54.0′
11	345°55.6	08.0	191°32.6	15.5′	05°59.6	10.2′	54.0′
12	0°55.6	N19°08.6	206°07.1	15.5′	S06°09.8	10.2′	54.0′
13	15°55.5	09.1	220°41.6	15.5′	06°20.0	10.1′	54.0′
14	30°55.5	09.7	235°16.1	15.5′	06°30.1	10.1′	54.0′
15	45°55.5	·· 10.3	249°50.6	15.4′	06°40.2	10.1′	54.0′
16	60°55.5	10.9	264°25.0	15.4′	06°50.3	10.1′	53.9′
17	75°55.5	11.4	278°59.4	15.4′	07°00.4	10.0′	53.9′
18	90°55.5	N19°12.0	293°33.8	15.4′	S07°10.4	10.0′	53.9′
19	105°55.5	12.6	308°08.2	15.4′	07°20.4	10.0′	53.9′
20	120°55.5	13.1	322°42.6	15.4′	07°30.4	9.9′	53.9′
21	135°55.4	·· 13.7	337°17.0	15.3′	07°40.3	9.9′	53.9′
22	150°55.4	14.3	351°51.3	15.3′	07°50.2	9.9′	53.9′
23	165°55.4	14.8	6°25.6	15.3′	08°00.1	9.8′	53.9′
	SD = 15.8′	d = 0.6′	SD = 14.7′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°55.4	N19°15.4	20°59.9	15.3′	S08°09.9	9.8′	53.9′
1	195°55.4	16.0	35°34.2	15.3′	08°19.7	9.8′	53.9′
2	210°55.4	16.5	50°08.4	15.2′	08°29.5	9.8′	53.9′
3	225°55.4	·· 17.1	64°42.7	15.2′	08°39.3	9.7′	53.9′
4	240°55.3	17.7	79°16.9	15.2′	08°49.0	9.6′	53.9′
5	255°55.3	18.2	93°51.1	15.2′	08°58.6	9.7′	53.9′
6	270°55.3	N19°18.8	108°25.2	15.1′	S09°08.3	9.6′	53.9′
7	285°55.3	19.4	122°59.4	15.1′	09°17.9	9.6′	53.9′
8	300°55.3	19.9	137°33.5	15.1′	09°27.5	9.5′	53.9′
9	315°55.3	·· 20.5	152°07.6	15.1′	09°37.0	9.5′	53.9′
10	330°55.2	21.1	166°41.6	15.0′	09°46.5	9.4′	53.9′
11	345°55.2	21.6	181°15.6	15.0′	09°55.9	9.4′	53.9′
12	0°55.2	N19°22.2	195°49.6	15.0′	S10°05.3	9.4′	53.9′
13	15°55.2	22.7	210°23.6	14.9′	10°14.7	9.3′	53.9′
14	30°55.2	23.3	224°57.6	14.9′	10°24.0	9.3′	53.9′
15	45°55.1	·· 23.9	239°31.5	14.9′	10°33.3	9.3′	53.9′
16	60°55.1	24.4	254°05.4	14.9′	10°42.6	9.2′	53.9′
17	75°55.1	25.0	268°39.2	14.8′	10°51.8	9.1′	53.9′
18	90°55.1	N19°25.5	283°13.1	14.8′	S11°00.9	9.2′	53.9′
19	105°55.1	26.1	297°46.9	14.8′	11°10.1	9.0′	53.9′
20	120°55.1	26.6	312°20.6	14.7′	11°19.1	9.1′	53.9′
21	135°55.0	·· 27.2	326°54.4	14.7′	11°28.2	8.9′	53.9′
22	150°55.0	27.8	341°28.1	14.7′	11°37.1	9.0′	53.9′
23	165°55.0	28.3	356°01.7	14.6′	11°46.1	8.9′	53.9′
	SD = 15.8′	d = 0.6′	SD = 14.7′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°55.0	N19°28.9	10°35.4	14.6′	S11°55.0	8.8′	53.9′
1	195°55.0	29.4	25°09.0	14.6′	12°03.8	8.8′	53.9′
2	210°54.9	30.0	39°42.6	14.5′	12°12.6	8.7′	53.9′
3	225°54.9	·· 30.5	54°16.1	14.5′	12°21.3	8.7′	53.9′
4	240°54.9	31.1	68°49.6	14.5′	12°30.0	8.7′	53.9′
5	255°54.9	31.6	83°23.1	14.4′	12°38.7	8.5′	53.9′
6	270°54.8	N19°32.2	97°56.5	14.4′	S12°47.2	8.6′	53.9′
7	285°54.8	32.7	112°29.9	14.4′	12°55.8	8.5′	53.9′
8	300°54.8	33.3	127°03.3	14.3′	13°04.3	8.4′	53.9′
9	315°54.8	·· 33.8	141°36.6	14.3′	13°12.7	8.4′	53.9′
10	330°54.8	34.4	156°09.9	14.3′	13°21.1	8.3′	53.9′
11	345°54.7	34.9	170°43.1	14.2′	13°29.4	8.3′	53.9′
12	0°54.7	N19°35.5	185°16.3	14.2′	S13°37.7	8.2′	53.9′
13	15°54.7	36.0	199°49.5	14.1′	13°45.9	8.1′	53.9′
14	30°54.7	36.6	214°22.7	14.1′	13°54.0	8.1′	53.9′
15	45°54.6	·· 37.1	228°55.8	14.1′	14°02.1	8.1′	53.9′
16	60°54.6	37.6	243°28.8	14.0′	14°10.2	8.0′	53.9′
17	75°54.6	38.2	258°01.9	14.0′	14°18.2	7.9′	53.9′
18	90°54.6	N19°38.7	272°34.8	13.9′	S14°26.1	7.9′	53.9′
19	105°54.5	39.3	287°07.8	13.9′	14°34.0	7.8′	53.9′
20	120°54.5	39.8	301°40.7	13.9′	14°41.8	7.7′	53.9′
21	135°54.5	·· 40.4	316°13.6	13.8′	14°49.5	7.7′	53.9′
22	150°54.5	40.9	330°46.4	13.8′	14°57.2	7.6′	54.0′
23	165°54.4	41.4	345°19.2	13.7′	15°04.8	7.6′	54.0′
	SD = 15.8′	d = 0.6′	SD = 14.7′				

Lat.	**Twilight** Naut.	**Twilight** Civil	**Sunrise**	**Sunset**	**Twilight** Civil	**Twilight** Naut.
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	////	////	01:36	22:22	////	////
66°	////	////	02:15	21:41	////	////
64°	////	00:53	02:41	21:14	23:08	////
62°	////	01:43	03:02	20:53	22:13	////
60°	////	02:13	03:18	20:36	21:42	////
N 58°	00:48	02:35	03:32	20:22	21:19	23:13
56°	01:33	02:53	03:44	20:10	21:01	22:23
54°	02:01	03:08	03:54	20:00	20:46	21:54
52°	02:22	03:21	04:03	19:50	20:33	21:33
50°	02:39	03:32	04:12	19:42	20:22	21:16
45°	03:11	03:55	04:29	19:24	19:59	20:43
N 40°	03:34	04:12	04:43	19:10	19:41	20:19
35°	03:53	04:27	04:55	18:58	19:26	20:01
30°	04:08	04:39	05:05	18:48	19:14	19:45
20°	04:31	05:00	05:23	18:30	18:53	19:21
N 10°	04:50	05:16	05:39	18:14	18:37	19:03
0°	05:05	05:31	05:53	18:00	18:22	18:47
S 10°	05:19	05:45	06:07	17:46	18:08	18:34
20°	05:32	05:59	06:22	17:31	17:54	18:21
30°	05:44	06:13	06:39	17:14	17:39	18:08
35°	05:51	06:22	06:49	17:04	17:31	18:01
40°	05:58	06:31	07:00	16:52	17:22	17:54
45°	06:05	06:41	07:13	16:39	17:11	17:47
S 50°	06:14	06:53	07:29	16:23	16:59	17:39
52°	06:17	06:59	07:37	16:15	16:53	17:35
54°	06:21	07:05	07:45	16:07	16:47	17:31
56°	06:25	07:11	07:54	15:58	16:41	17:27
58°	06:30	07:19	08:05	15:47	16:33	17:22
S 60°	06:35	07:27	08:17	15:35	16:25	17:17

Lat.	**Moonrise** Sat	Sun	Mon	**Moonset** Sat	Sun	Mon
N 72°	17:58	19:43	21:38	03:01	02:48	02:32
N 70°	17:47	19:23	21:03	03:08	03:01	02:54
68°	17:38	19:07	20:39	03:13	03:12	03:10
66°	17:31	18:55	20:20	03:18	03:20	03:24
64°	17:25	18:44	20:05	03:21	03:28	03:36
62°	17:19	18:36	19:52	03:25	03:34	03:45
60°	17:15	18:28	19:41	03:28	03:40	03:54
N 58°	17:11	18:21	19:32	03:30	03:45	04:01
56°	17:07	18:16	19:24	03:32	03:49	04:07
54°	17:04	18:10	19:17	03:35	03:53	04:13
52°	17:01	18:06	19:10	03:36	03:56	04:18
50°	16:58	18:01	19:04	03:38	04:00	04:23
45°	16:52	17:52	18:52	03:42	04:07	04:34
N 40°	16:48	17:45	18:42	03:45	04:13	04:42
35°	16:44	17:38	18:33	03:48	04:18	04:50
30°	16:40	17:32	18:25	03:50	04:22	04:56
20°	16:34	17:23	18:12	03:54	04:30	05:08
N 10°	16:28	17:14	18:00	03:58	04:37	05:18
0°	16:23	17:06	17:50	04:02	04:44	05:27
S 10°	16:18	16:58	17:39	04:05	04:50	05:36
20°	16:13	16:49	17:28	04:09	04:57	05:46
30°	16:07	16:40	17:15	04:13	05:05	05:58
35°	16:04	16:34	17:07	04:16	05:10	06:05
40°	16:00	16:28	16:59	04:18	05:15	06:12
45°	15:55	16:21	16:49	04:22	05:21	06:21
S 50°	15:50	16:12	16:37	04:25	05:29	06:32
52°	15:47	16:08	16:32	04:27	05:32	06:37
54°	15:45	16:04	16:26	04:29	05:36	06:42
56°	15:42	15:59	16:19	04:31	05:40	06:48
58°	15:39	15:54	16:12	04:34	05:45	06:55
S 60°	15:35	15:48	16:03	04:36	05:50	07:03

Day	**Sun** Eqn.of Time 00^h mm:ss	Eqn.of Time 12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 12-14 92-99%
16	03:43	03:42	11:56	22:34	10:12	
17	03:42	03:41	11:56	23:16	10:55	
18	03:40	03:39	11:56	–:–	11:38	

May 19, 20, 21 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	236°34.6	169°30.1	N21°57.9	191°26.2	N16°54.2	55°28.6	N01°07.6	52°34.9	N01°03.9
1	251°37.0	184°29.3	58.5	206°26.9	54.7	70°31.1	07.6	67°37.5	03.9
2	266°39.5	199°28.5	59.1	221°27.5	55.2	85°33.7	07.6	82°40.0	03.9
3	281°42.0	214°27.7	21°59.6	236°28.1	·· 55.8	100°36.2	·· 07.7	97°42.5	·· 03.9
4	296°44.4	229°26.9	22°00.2	251°28.8	56.3	115°38.7	07.7	112°45.1	03.9
5	311°46.9	244°26.1	00.8	266°29.4	56.8	130°41.2	07.7	127°47.6	04.0
6	326°49.4	259°25.3	N22°01.4	281°30.1	N16°57.4	145°43.8	N01°07.7	142°50.1	N01°04.0
7	341°51.8	274°24.5	01.9	296°30.7	57.9	160°46.3	07.7	157°52.7	04.0
8	356°54.3	289°23.8	02.5	311°31.4	58.4	175°48.8	07.7	172°55.2	04.0
9	11°56.7	304°23.0	·· 03.1	326°32.0	·· 59.0	190°51.4	·· 07.8	187°57.7	·· 04.0
10	26°59.2	319°22.2	03.6	341°32.6	16°59.5	205°53.9	07.8	203°00.3	04.1
11	42°01.7	334°21.4	04.2	356°33.3	17°00.1	220°56.4	07.8	218°02.8	04.1
12	57°04.1	349°20.6	N22°04.8	11°33.9	N17°00.6	235°58.9	N01°07.8	233°05.3	N01°04.1
13	72°06.6	4°19.8	05.3	26°34.6	01.1	251°01.5	07.8	248°07.9	04.1
14	87°09.1	19°19.0	05.9	41°35.2	01.7	266°04.0	07.8	263°10.4	04.1
15	102°11.5	34°18.2	·· 06.4	56°35.8	·· 02.2	281°06.5	·· 07.8	278°12.9	·· 04.1
16	117°14.0	49°17.4	07.0	71°36.5	02.7	296°09.0	07.9	293°15.4	04.2
17	132°16.5	64°16.6	07.6	86°37.1	03.3	311°11.6	07.9	308°18.0	04.2
18	147°18.9	79°15.8	N22°08.1	101°37.7	N17°03.8	326°14.1	N01°07.9	323°20.5	N01°04.2
19	162°21.4	94°15.0	08.7	116°38.4	04.3	341°16.6	07.9	338°23.0	04.2
20	177°23.9	109°14.2	09.2	131°39.0	04.9	356°19.1	07.9	353°25.6	04.2
21	192°26.3	124°13.4	·· 09.8	146°39.7	·· 05.4	11°21.6	·· 07.9	8°28.1	·· 04.3
22	207°28.8	139°12.6	10.3	161°40.3	05.9	26°24.2	07.9	23°30.6	04.3
23	222°31.2	154°11.8	10.9	176°40.9	06.4	41°26.7	08.0	38°33.2	04.3
Mer.pass. 08:12		ν -0.8′ d 0.6′	m -3.89	ν 0.6′ d 0.5′	m 1.31	ν 2.5′ d 0.0′	m -2.25	ν 2.5′ d 0.0′	m 0.71

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	237°33.7	169°11.0	N22°11.4	191°41.6	N17°07.0	56°29.2	N01°08.0	53°35.7	N01°04.3
1	252°36.2	184°10.2	12.0	206°42.2	07.5	71°31.7	08.0	68°38.2	04.3
2	267°38.6	199°09.4	12.5	221°42.9	08.0	86°34.3	08.0	83°40.7	04.4
3	282°41.1	214°08.6	·· 13.1	236°43.5	·· 08.6	101°36.8	·· 08.0	98°43.3	·· 04.4
4	297°43.6	229°07.8	13.6	251°44.1	09.1	116°39.3	08.0	113°45.8	04.4
5	312°46.0	244°07.0	14.2	266°44.8	09.6	131°41.8	08.0	128°48.3	04.4
6	327°48.5	259°06.2	N22°14.7	281°45.4	N17°10.2	146°44.3	N01°08.1	143°50.9	N01°04.4
7	342°51.0	274°05.4	15.3	296°46.1	10.7	161°46.9	08.1	158°53.4	04.4
8	357°53.4	289°04.6	15.8	311°46.7	11.2	176°49.4	08.1	173°55.9	04.5
9	12°55.9	304°03.8	·· 16.3	326°47.3	·· 11.7	191°51.9	·· 08.1	188°58.4	·· 04.5
10	27°58.3	319°03.0	16.9	341°48.0	12.3	206°54.4	08.1	204°01.0	04.5
11	43°00.8	334°02.2	17.4	356°48.6	12.8	221°56.9	08.1	219°03.5	04.5
12	58°03.3	349°01.4	N22°18.0	11°49.2	N17°13.3	236°59.4	N01°08.1	234°06.0	N01°04.5
13	73°05.7	4°00.6	18.5	26°49.9	13.9	252°02.0	08.1	249°08.6	04.6
14	88°08.2	18°59.8	19.0	41°50.5	14.4	267°04.5	08.2	264°11.1	04.6
15	103°10.7	33°59.0	·· 19.6	56°51.2	·· 14.9	282°07.0	·· 08.2	279°13.6	·· 04.6
16	118°13.1	48°58.2	20.1	71°51.8	15.4	297°09.5	08.2	294°16.1	04.6
17	133°15.6	63°57.4	20.6	86°52.4	16.0	312°12.0	08.2	309°18.7	04.6
18	148°18.1	78°56.6	N22°21.2	101°53.1	N17°16.5	327°14.6	N01°08.2	324°21.2	N01°04.6
19	163°20.5	93°55.8	21.7	116°53.7	17.0	342°17.1	08.2	339°23.7	04.7
20	178°23.0	108°54.9	22.2	131°54.3	17.5	357°19.6	08.2	354°26.2	04.7
21	193°25.5	123°54.1	·· 22.8	146°55.0	·· 18.1	12°22.1	·· 08.2	9°28.8	·· 04.7
22	208°27.9	138°53.3	23.3	161°55.6	18.6	27°24.6	08.3	24°31.3	04.7
23	223°30.4	153°52.5	23.8	176°56.3	19.1	42°27.1	08.3	39°33.8	04.7
Mer.pass. 08:08		ν -0.8′ d 0.5′	m -3.89	ν 0.6′ d 0.5′	m 1.32	ν 2.5′ d 0.0′	m -2.24	ν 2.5′ d 0.0′	m 0.71

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	238°32.8	168°51.7	N22°24.3	191°56.9	N17°19.6	57°29.6	N01°08.3	54°36.3	N01°04.7
1	253°35.3	183°50.9	24.9	206°57.5	20.2	72°32.2	08.3	69°38.9	04.8
2	268°37.8	198°50.1	25.4	221°58.2	20.7	87°34.7	08.3	84°41.4	04.8
3	283°40.2	213°49.3	·· 25.9	236°58.8	·· 21.2	102°37.2	·· 08.3	99°43.9	·· 04.8
4	298°42.7	228°48.5	26.4	251°59.4	21.7	117°39.7	08.3	114°46.4	04.8
5	313°45.2	243°47.7	26.9	267°00.1	22.3	132°42.2	08.3	129°49.0	04.8
6	328°47.6	258°46.9	N22°27.5	282°00.7	N17°22.8	147°44.7	N01°08.3	144°51.5	N01°04.8
7	343°50.1	273°46.0	28.0	297°01.4	23.3	162°47.2	08.4	159°54.0	04.9
8	358°52.6	288°45.2	28.5	312°02.0	23.8	177°49.8	08.4	174°56.5	04.9
9	13°55.0	303°44.4	·· 29.0	327°02.6	·· 24.3	192°52.3	·· 08.4	189°59.1	·· 04.9
10	28°57.5	318°43.6	29.5	342°03.3	24.9	207°54.8	08.4	205°01.6	04.9
11	44°00.0	333°42.8	30.0	357°03.9	25.4	222°57.3	08.4	220°04.1	04.9
12	59°02.4	348°42.0	N22°30.5	12°04.5	N17°25.9	237°59.8	N01°08.4	235°06.6	N01°04.9
13	74°04.9	3°41.2	31.1	27°05.2	26.4	253°02.3	08.4	250°09.2	05.0
14	89°07.3	18°40.4	31.6	42°05.8	26.9	268°04.8	08.4	265°11.7	05.0
15	104°09.8	33°39.5	·· 32.1	57°06.4	·· 27.5	283°07.3	·· 08.4	280°14.2	·· 05.0
16	119°12.3	48°38.7	32.6	72°07.1	28.0	298°09.8	08.4	295°16.7	05.0
17	134°14.7	63°37.9	33.1	87°07.7	28.5	313°12.4	08.4	310°19.2	05.0
18	149°17.2	78°37.1	N22°33.6	102°08.3	N17°29.0	328°14.9	N01°08.5	325°21.8	N01°05.0
19	164°19.7	93°36.3	34.1	117°09.0	29.5	343°17.4	08.5	340°24.3	05.1
20	179°22.1	108°35.5	34.6	132°09.6	30.0	358°19.9	08.5	355°26.8	05.1
21	194°24.6	123°34.6	·· 35.1	147°10.3	·· 30.6	13°22.4	·· 08.5	10°29.3	·· 05.1
22	209°27.1	138°33.8	35.6	162°10.9	31.1	28°24.9	08.5	25°31.9	05.1
23	224°29.5	153°33.0	36.1	177°11.5	31.6	43°27.4	08.5	40°34.4	05.1
Mer.pass. 08:04		ν -0.8′ d 0.5′	m -3.89	ν 0.6′ d 0.5′	m 1.32	ν 2.5′ d 0.0′	m -2.23	ν 2.5′ d 0.0′	m 0.72

Stars

	SHA	Dec
Alpheratz	358°09.0	28°59.0
Ankaa	353°40.1	-42°24.4
Schedar	350°08.9	56°25.8
Diphda	349°20.6	-18°05.4
Achernar	335°45.5	-57°19.9
Hamal	328°28.7	23°22.2
Polaris	327°03.9	89°10.5
Acamar	315°37.3	-40°22.9
Menkar	314°41.0	4°00.8
Mirfak	309°16.0	49°47.5
Aldebaran	291°17.8	16°28.2
Rigel	281°35.9	-8°13.5
Capella	281°11.1	45°58.7
Bellatrix	278°58.6	6°19.9
Elnath	278°43.9	28°35.5
Alnilam	276°11.5	-1°12.9
Betelgeuse	271°28.1	7°24.1
Canopus	264°07.5	-52°41.4
Sirius	258°55.5	-16°41.6
Adhara	255°32.0	-28°57.0
Procyon	245°25.5	5°16.3
Pollux	243°57.8	28°04.4
Avior	234°28.3	-59°27.3
Suhail	223°10.6	-43°21.7
Miaplacidus	221°45.1	-69°38.7
Alphard	218°20.2	-8°34.7
Regulus	208°09.5	12°03.6
Dubhe	194°21.4	61°51.4
Denebola	182°58.4	14°40.7
Gienah	176°17.3	-17°26.4
Acrux	173°36.4	-62°59.9
Gacrux	172°27.9	-57°00.7
Alioth	166°41.7	56°03.9
Spica	158°56.8	-11°03.8
Alkaid	153°17.7	49°24.6
Hadar	149°22.1	-60°17.1
Menkent	148°36.1	-36°16.8
Arcturus	146°17.8	19°16.9
Rigil Kent.	140°24.6	-60°45.4
Kochab	137°17.9	74°14.1
Zuben'ubi	137°32.2	-15°57.9
Alphecca	126°31.4	26°46.7
Antares	112°55.9	-26°23.4
Atria	108°19.3	-68°59.6
Sabik	102°40.3	-15°42.1
Shaula	96°54.8	-37°05.4
Rasalhague	96°28.9	12°34.4
Eltanin	90°57.0	51°29.4
Kaus Aust.	84°15.9	-34°23.5
Vega	80°55.2	38°45.8
Nunki	76°28.4	-26°19.2
Altair	62°31.9	8°49.0
Peacock	53°57.5	-56°47.5
Deneb	49°48.0	45°12.5
Enif	34°11.1	9°47.2
Al Na'ir	28°14.4	-47°03.0
Fomalhaut	15°51.0	-29°43.2
Scheat	14°17.2	27°58.6
Markab	14°02.8	15°06.1

May 19 Tue	SHA	Mer.pass
Venus	292°55.5	12:43
Mars	314°51.7	11:14
Jupiter	178°54.0	20:15
Saturn	176°00.4	20:26

May 20 Wed	SHA	Mer.pass
Venus	291°37.3	12:44
Mars	314°07.9	11:13
Jupiter	178°55.5	20:11
Saturn	176°02.0	20:22

May 21 Thu	SHA	Mer.pass
Venus	290°18.9	12:45
Mars	313°24.0	11:12
Jupiter	178°56.8	20:07
Saturn	176°03.5	20:18

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = -0.5418 sec ΔT = TT-UT1 = +51.7258 sec

1981 May 19 to May. 21 UT

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°54.4	N19°42.0	359°51.9	13.7′	S15°12.4	7.5′	54.0′
1	195°54.4	42.5	14°24.6	13.7′	15°19.9	7.4′	54.0′
2	210°54.4	43.1	28°57.3	13.6′	15°27.3	7.4′	54.0′
3	225°54.3	·· 43.6	43°29.9	13.6′	15°34.7	7.3′	54.0′
4	240°54.3	44.1	58°02.5	13.5′	15°42.0	7.2′	54.0′
5	255°54.3	44.7	72°35.1	13.5′	15°49.2	7.2′	54.0′
6	270°54.3	N19°45.2	87°07.6	13.5′	S15°56.4	7.1′	54.0′
7	285°54.2	45.7	101°40.0	13.4′	16°03.5	7.0′	54.0′
8	300°54.2	46.3	116°12.4	13.4′	16°10.5	7.0′	54.0′
9	315°54.2	·· 46.8	130°44.8	13.3′	16°17.5	6.9′	54.0′
10	330°54.1	47.3	145°17.2	13.3′	16°24.4	6.8′	54.0′
11	345°54.1	47.9	159°49.5	13.3′	16°31.2	6.7′	54.0′
12	0°54.1	N19°48.4	174°21.7	13.2′	S16°37.9	6.7′	54.0′
13	15°54.1	48.9	188°53.9	13.2′	16°44.6	6.6′	54.0′
14	30°54.0	49.5	203°26.1	13.1′	16°51.2	6.6′	54.0′
15	45°54.0	·· 50.0	217°58.2	13.1′	16°57.8	6.4′	54.0′
16	60°54.0	50.5	232°30.3	13.0′	17°04.2	6.4′	54.1′
17	75°53.9	51.1	247°02.4	13.0′	17°10.6	6.4′	54.1′
18	90°53.9	N19°51.6	261°34.4	13.0′	S17°17.0	6.2′	54.1′
19	105°53.9	52.1	276°06.3	12.9′	17°23.2	6.2′	54.1′
20	120°53.8	52.7	290°38.2	12.9′	17°29.4	6.1′	54.1′
21	135°53.8	·· 53.2	305°10.1	12.8′	17°35.5	6.0′	54.1′
22	150°53.8	53.7	319°41.9	12.8′	17°41.5	5.9′	54.1′
23	165°53.8	54.2	334°13.7	12.7′	17°47.4	5.9′	54.1′
	SD = 15.8′	d = 0.5′	SD = 14.7′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°53.7	N19°54.8	348°45.5	12.7′	S17°53.3	5.8′	54.1′
1	195°53.7	55.3	3°17.2	12.7′	17°59.1	5.7′	54.1′
2	210°53.7	55.8	17°48.8	12.6′	18°04.8	5.6′	54.1′
3	225°53.6	·· 56.3	32°20.5	12.6′	18°10.4	5.6′	54.1′
4	240°53.6	56.9	46°52.1	12.5′	18°16.0	5.4′	54.1′
5	255°53.6	57.4	61°23.6	12.5′	18°21.4	5.4′	54.2′
6	270°53.5	N19°57.9	75°55.1	12.5′	S18°26.8	5.3′	54.2′
7	285°53.5	58.4	90°26.5	12.4′	18°32.1	5.2′	54.2′
8	300°53.5	58.9	104°58.0	12.4′	18°37.3	5.2′	54.2′
9	315°53.4	19°59.5	119°29.3	12.3′	18°42.5	5.0′	54.2′
10	330°53.4	20°00.0	134°00.7	12.3′	18°47.5	5.0′	54.2′
11	345°53.4	00.5	148°32.0	12.3′	18°52.5	4.9′	54.2′
12	0°53.3	N20°01.0	163°03.2	12.2′	S18°57.4	4.8′	54.2′
13	15°53.3	01.5	177°34.4	12.2′	19°02.2	4.7′	54.2′
14	30°53.2	02.1	192°05.6	12.1′	19°06.9	4.6′	54.2′
15	45°53.2	·· 02.6	206°36.7	12.1′	19°11.5	4.5′	54.3′
16	60°53.2	03.1	221°07.8	12.1′	19°16.0	4.5′	54.3′
17	75°53.1	03.6	235°38.9	12.0′	19°20.5	4.4′	54.3′
18	90°53.1	N20°04.1	250°09.9	12.0′	S19°24.9	4.2′	54.3′
19	105°53.1	04.6	264°40.9	11.9′	19°29.1	4.2′	54.3′
20	120°53.0	05.2	279°11.8	11.9′	19°33.3	4.1′	54.3′
21	135°53.0	·· 05.7	293°42.7	11.9′	19°37.4	4.0′	54.3′
22	150°53.0	06.2	308°13.6	11.8′	19°41.4	3.9′	54.3′
23	165°52.9	06.7	322°44.4	11.8′	19°45.3	3.9′	54.3′
	SD = 15.8′	d = 0.5′	SD = 14.8′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°52.9	N20°07.2	337°15.2	11.7′	S19°49.2	3.7′	54.4′
1	195°52.8	07.7	351°45.9	11.7′	19°52.9	3.6′	54.4′
2	210°52.8	08.2	6°16.6	11.7′	19°56.5	3.6′	54.4′
3	225°52.8	·· 08.7	20°47.3	11.6′	20°00.1	3.5′	54.4′
4	240°52.7	09.2	35°18.0	11.6′	20°03.6	3.3′	54.4′
5	255°52.7	09.8	49°48.6	11.6′	20°06.9	3.3′	54.4′
6	270°52.7	N20°10.3	64°19.1	11.5′	S20°10.2	3.2′	54.4′
7	285°52.6	10.8	78°49.7	11.5′	20°13.4	3.1′	54.4′
8	300°52.6	11.3	93°20.2	11.5′	20°16.5	2.9′	54.5′
9	315°52.5	·· 11.8	107°50.6	11.4′	20°19.4	2.9′	54.5′
10	330°52.5	12.3	122°21.1	11.4′	20°22.3	2.8′	54.5′
11	345°52.5	12.8	136°51.5	11.4′	20°25.1	2.7′	54.5′
12	0°52.4	N20°13.3	151°21.8	11.3′	S20°27.8	2.6′	54.5′
13	15°52.4	13.8	165°52.2	11.3′	20°30.4	2.5′	54.5′
14	30°52.3	14.3	180°22.5	11.3′	20°32.9	2.4′	54.5′
15	45°52.3	·· 14.8	194°52.7	11.2′	20°35.3	2.3′	54.6′
16	60°52.3	15.3	209°23.0	11.2′	20°37.6	2.3′	54.6′
17	75°52.2	15.8	223°53.2	11.2′	20°39.9	2.1′	54.6′
18	90°52.2	N20°16.3	238°23.4	11.1′	S20°42.0	2.0′	54.6′
19	105°52.1	16.8	252°53.5	11.1′	20°44.0	1.9′	54.6′
20	120°52.1	17.3	267°23.6	11.1′	20°45.9	1.8′	54.6′
21	135°52.0	·· 17.8	281°53.7	11.1′	20°47.7	1.7′	54.6′
22	150°52.0	18.3	296°23.8	11.0′	20°49.4	1.6′	54.7′
23	165°52.0	18.8	310°53.8	11.0′	20°51.0	1.6′	54.7′
	SD = 15.8′	d = 0.5′	SD = 14.8′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	////	////	01:17	22:42	////	////
66°	////	////	02:03	21:54	////	////
64°	////	00:16	02:32	21:24	////	////
62°	////	01:30	02:54	21:01	22:27	////
60°	////	02:03	03:11	20:43	21:52	////
N 58°	00:14	02:28	03:26	20:28	21:27	////
56°	01:21	02:47	03:39	20:15	21:08	22:36
54°	01:52	03:02	03:50	20:04	20:52	22:03
52°	02:15	03:16	03:59	19:55	20:38	21:40
50°	02:33	03:27	04:08	19:46	20:27	21:22
45°	03:06	03:51	04:26	19:28	20:03	20:47
N 40°	03:31	04:10	04:41	19:13	19:44	20:23
35°	03:50	04:25	04:53	19:00	19:29	20:03
30°	04:06	04:37	05:04	18:49	19:16	19:48
20°	04:30	04:58	05:22	18:31	18:55	19:23
N 10°	04:49	05:16	05:38	18:15	18:37	19:04
0°	05:05	05:31	05:53	18:00	18:22	18:48
S 10°	05:19	05:45	06:08	17:45	18:08	18:33
20°	05:33	06:00	06:23	17:30	17:53	18:20
30°	05:46	06:15	06:41	17:12	17:38	18:07
35°	05:53	06:24	06:51	17:02	17:29	18:00
40°	06:00	06:33	07:03	16:50	17:19	17:52
45°	06:08	06:44	07:16	16:36	17:08	17:44
S 50°	06:17	06:57	07:33	16:19	16:56	17:36
52°	06:21	07:03	07:41	16:11	16:50	17:32
54°	06:25	07:09	07:50	16:03	16:43	17:27
56°	06:29	07:16	07:59	15:53	16:36	17:23
58°	06:34	07:24	08:11	15:42	16:29	17:18
S 60°	06:40	07:33	08:24	15:29	16:20	17:13

Lat.	**Moonrise** Tue	Wed	Thu	**Moonset** Tue	Wed	Thu
N 72°	▬	▬	▬	02:09	▬	▬
N 70°	22:52	▬	▬	02:45	02:31	▬
68°	22:12	23:45	·· ··	03:10	03:12	03:17
66°	21:45	23:06	·· ··	03:30	03:40	03:57
64°	21:24	22:39	23:45	03:46	04:01	04:24
62°	21:07	22:18	23:22	03:59	04:18	04:45
60°	20:53	22:01	23:03	04:11	04:33	05:02
N 58°	20:41	21:47	22:47	04:20	04:45	05:17
56°	20:31	21:35	22:34	04:29	04:56	05:29
54°	20:22	21:24	22:22	04:37	05:05	05:40
52°	20:14	21:15	22:12	04:44	05:14	05:50
50°	20:07	21:07	22:03	04:50	05:21	05:58
45°	19:51	20:49	21:44	05:03	05:37	06:16
N 40°	19:38	20:34	21:28	05:14	05:51	06:31
35°	19:28	20:22	21:15	05:24	06:02	06:44
30°	19:18	20:11	21:04	05:32	06:12	06:55
20°	19:02	19:53	20:44	05:47	06:29	07:14
N 10°	18:48	19:37	20:27	06:00	06:44	07:30
0°	18:35	19:22	20:11	06:11	06:58	07:46
S 10°	18:22	19:08	19:55	06:23	07:12	08:01
20°	18:08	18:52	19:38	06:36	07:27	08:18
30°	17:53	18:34	19:19	06:51	07:44	08:37
35°	17:43	18:23	19:08	06:59	07:54	08:48
40°	17:33	18:11	18:55	07:09	08:06	09:01
45°	17:21	17:57	18:39	07:21	08:19	09:16
S 50°	17:06	17:40	18:21	07:34	08:36	09:34
52°	16:59	17:32	18:12	07:41	08:43	09:43
54°	16:52	17:23	18:02	07:48	08:52	09:52
56°	16:43	17:13	17:51	07:56	09:02	10:04
58°	16:34	17:02	17:38	08:05	09:13	10:16
S 60°	16:23	16:48	17:23	08:16	09:26	10:31

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 15-17 100-96%
19	03:38	03:36	11:56	00:01	12:23	
20	03:35	03:33	11:56	00:46	13:10	
21	03:32	03:30	11:57	01:34	13:58	

May 22, 23, 24 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	239°32.0	168°32.2	N22°36.6	192°12.2	N17°32.1	58°29.9	N01°08.5	55°36.9	N01°05.1
1	254°34.5	183°31.4	37.1	207°12.8	32.6	73°32.4	08.5	70°39.4	05.2
2	269°36.9	198°30.6	37.6	222°13.4	33.1	88°34.9	08.5	85°41.9	05.2
3	284°39.4	213°29.7	·· 38.1	237°14.1	·· 33.7	103°37.4	·· 08.5	100°44.5	·· 05.2
4	299°41.8	228°28.9	38.6	252°14.7	34.2	118°39.9	08.5	115°47.0	05.2
5	314°44.3	243°28.1	39.1	267°15.3	34.7	133°42.5	08.5	130°49.5	05.2
6	329°46.8	258°27.3	N22°39.6	282°16.0	N17°35.2	148°45.0	N01°08.6	145°52.0	N01°05.2
7	344°49.2	273°26.5	40.1	297°16.6	35.7	163°47.5	08.6	160°54.6	05.2
8	359°51.7	288°25.6	40.5	312°17.2	36.2	178°50.0	08.6	175°57.1	05.3
9	14°54.2	303°24.8	·· 41.0	327°17.9	·· 36.8	193°52.5	·· 08.6	190°59.6	·· 05.3
10	29°56.6	318°24.0	41.5	342°18.5	37.3	208°55.0	08.6	206°02.1	05.3
11	44°59.1	333°23.2	42.0	357°19.1	37.8	223°57.5	08.6	221°04.6	05.3
12	60°01.6	348°22.4	N22°42.5	12°19.8	N17°38.3	239°00.0	N01°08.6	236°07.2	N01°05.3
13	75°04.0	3°21.5	43.0	27°20.4	38.8	254°02.5	08.6	251°09.7	05.3
14	90°06.5	18°20.7	43.5	42°21.0	39.3	269°05.0	08.6	266°12.2	05.3
15	105°08.9	33°19.9	·· 43.9	57°21.7	·· 39.8	284°07.5	·· 08.6	281°14.7	·· 05.4
16	120°11.4	48°19.1	44.4	72°22.3	40.3	299°10.0	08.6	296°17.2	05.4
17	135°13.9	63°18.2	44.9	87°22.9	40.9	314°12.5	08.6	311°19.8	05.4
18	150°16.3	78°17.4	N22°45.4	102°23.6	N17°41.4	329°15.0	N01°08.6	326°22.3	N01°05.4
19	165°18.8	93°16.6	45.9	117°24.2	41.9	344°17.5	08.6	341°24.8	05.4
20	180°21.3	108°15.8	46.3	132°24.8	42.4	359°20.0	08.6	356°27.3	05.4
21	195°23.7	123°14.9	·· 46.8	147°25.5	·· 42.9	14°22.5	·· 08.6	11°29.8	·· 05.4
22	210°26.2	138°14.1	47.3	162°26.1	43.4	29°25.0	08.7	26°32.3	05.5
23	225°28.7	153°13.3	47.7	177°26.7	43.9	44°27.5	08.7	41°34.9	05.5
Mer.pass. 08:01		ν -0.8′	d 0.5′	m -3.89	ν 0.6′	d 0.5′	m 1.33	ν 2.5′	d 0.0′ m -2.22	ν 2.5′	d 0.0′ m 0.72

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	240°31.1	168°12.5	N22°48.2	192°27.4	N17°44.4	59°30.0	N01°08.7	56°37.4	N01°05.5
1	255°33.6	183°11.6	48.7	207°28.0	44.9	74°32.5	08.7	71°39.9	05.5
2	270°36.1	198°10.8	49.2	222°28.6	45.4	89°35.0	08.7	86°42.4	05.5
3	285°38.5	213°10.0	·· 49.6	237°29.3	·· 45.9	104°37.5	·· 08.7	101°44.9	·· 05.5
4	300°41.0	228°09.2	50.1	252°29.9	46.5	119°40.0	08.7	116°47.5	05.5
5	315°43.4	243°08.3	50.6	267°30.5	47.0	134°42.5	08.7	131°50.0	05.6
6	330°45.9	258°07.5	N22°51.0	282°31.2	N17°47.5	149°45.0	N01°08.7	146°52.5	N01°05.6
7	345°48.4	273°06.7	51.5	297°31.8	48.0	164°47.5	08.7	161°55.0	05.6
8	0°50.8	288°05.8	51.9	312°32.4	48.5	179°50.0	08.7	176°57.5	05.6
9	15°53.3	303°05.0	·· 52.4	327°33.1	·· 49.0	194°52.5	·· 08.7	192°00.0	·· 05.6
10	30°55.8	318°04.2	52.9	342°33.7	49.5	209°55.0	08.7	207°02.6	05.6
11	45°58.2	333°03.3	53.3	357°34.3	50.0	224°57.5	08.7	222°05.1	05.6
12	61°00.7	348°02.5	N22°53.8	12°35.0	N17°50.5	240°00.0	N01°08.7	237°07.6	N01°05.6
13	76°03.2	3°01.7	54.2	27°35.6	51.0	255°02.5	08.7	252°10.1	05.7
14	91°05.6	18°00.9	54.7	42°36.2	51.5	270°05.0	08.7	267°12.6	05.7
15	106°08.1	33°00.0	·· 55.2	57°36.9	·· 52.0	285°07.5	·· 08.7	282°15.1	·· 05.7
16	121°10.6	47°59.2	55.6	72°37.5	52.5	300°10.0	08.7	297°17.6	05.7
17	136°13.0	62°58.4	56.1	87°38.1	53.0	315°12.5	08.7	312°20.2	05.7
18	151°15.5	77°57.5	N22°56.5	102°38.8	N17°53.5	330°15.0	N01°08.7	327°22.7	N01°05.7
19	166°17.9	92°56.7	57.0	117°39.4	54.0	345°17.5	08.7	342°25.2	05.7
20	181°20.4	107°55.9	57.4	132°40.0	54.5	0°20.0	08.7	357°27.7	05.7
21	196°22.9	122°55.0	·· 57.9	147°40.7	·· 55.0	15°22.5	·· 08.7	12°30.2	·· 05.8
22	211°25.3	137°54.2	58.3	162°41.3	55.5	30°25.0	08.7	27°32.7	05.8
23	226°27.8	152°53.4	58.7	177°41.9	56.0	45°27.5	08.7	42°35.3	05.8
Mer.pass. 07:57		ν -0.8′	d 0.5′	m -3.89	ν 0.6′	d 0.5′	m 1.33	ν 2.5′	d 0.0′ m -2.22	ν 2.5′	d 0.0′ m 0.73

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	241°30.3	167°52.5	N22°59.2	192°42.5	N17°56.5	60°30.0	N01°08.7	57°37.8	N01°05.8
1	256°32.7	182°51.7	22°59.6	207°43.2	57.1	75°32.5	08.7	72°40.3	05.8
2	271°35.2	197°50.9	23°00.1	222°43.8	57.6	90°35.0	08.7	87°42.8	05.8
3	286°37.7	212°50.0	·· 00.5	237°44.4	·· 58.1	105°37.5	·· 08.8	102°45.3	·· 05.8
4	301°40.1	227°49.2	01.0	252°45.1	58.6	120°39.9	08.8	117°47.8	05.8
5	316°42.6	242°48.3	01.4	267°45.7	59.1	135°42.4	08.8	132°50.3	05.9
6	331°45.1	257°47.5	N23°01.8	282°46.3	N17°59.6	150°44.9	N01°08.8	147°52.9	N01°05.9
7	346°47.5	272°46.7	02.3	297°47.0	18°00.1	165°47.4	08.8	162°55.4	05.9
8	1°50.0	287°45.8	02.7	312°47.6	00.6	180°49.9	08.8	177°57.9	05.9
9	16°52.4	302°45.0	·· 03.1	327°48.2	·· 01.1	195°52.4	·· 08.8	193°00.4	·· 05.9
10	31°54.9	317°44.2	03.6	342°48.9	01.5	210°54.9	08.8	208°02.9	05.9
11	46°57.4	332°43.3	04.0	357°49.5	02.0	225°57.4	08.8	223°05.4	05.9
12	61°59.8	347°42.5	N23°04.4	12°50.1	N18°02.5	240°59.9	N01°08.8	238°07.9	N01°05.9
13	77°02.3	2°41.6	04.9	27°50.7	03.0	256°02.4	08.8	253°10.4	05.9
14	92°04.8	17°40.8	05.3	42°51.4	03.5	271°04.9	08.8	268°13.0	06.0
15	107°07.2	32°40.0	·· 05.7	57°52.0	·· 04.0	286°07.3	·· 08.8	283°15.5	·· 06.0
16	122°09.7	47°39.1	06.1	72°52.6	04.5	301°09.8	08.8	298°18.0	06.0
17	137°12.2	62°38.3	06.6	87°53.3	05.0	316°12.3	08.8	313°20.5	06.0
18	152°14.6	77°37.4	N23°07.0	102°53.9	N18°05.5	331°14.8	N01°08.8	328°23.0	N01°06.0
19	167°17.1	92°36.6	07.4	117°54.5	06.0	346°17.3	08.8	343°25.5	06.0
20	182°19.6	107°35.8	07.8	132°55.1	06.5	1°19.8	08.8	358°28.0	06.0
21	197°22.0	122°34.9	·· 08.3	147°55.8	·· 07.0	16°22.3	·· 08.8	13°30.5	·· 06.0
22	212°24.5	137°34.1	08.7	162°56.4	07.5	31°24.8	08.8	28°33.0	06.0
23	227°26.9	152°33.2	09.1	177°57.0	08.0	46°27.3	08.8	43°35.6	06.0
Mer.pass. 07:53		ν -0.8′	d 0.4′	m -3.89	ν 0.6′	d 0.5′	m 1.34	ν 2.5′	d 0.0′ m -2.21	ν 2.5′	d 0.0′ m 0.73

Stars

	SHA	Dec
Alpheratz	358°09.0	28°59.0
Ankaa	353°40.1	-42°24.4
Schedar	350°08.8	56°25.8
Diphda	349°20.6	-18°05.4
Achernar	335°45.4	-57°19.8
Hamal	328°28.7	23°22.2
Polaris	327°03.2	89°10.5
Acamar	315°37.3	-40°22.8
Menkar	314°41.0	4°00.8
Mirfak	309°15.9	49°47.5
Aldebaran	291°17.8	16°28.2
Rigel	281°35.9	-8°13.5
Capella	281°11.1	45°58.7
Bellatrix	278°58.6	6°19.9
Elnath	278°43.9	28°35.5
Alnilam	276°11.5	-1°12.9
Betelgeuse	271°28.1	7°24.1
Canopus	264°07.5	-52°41.4
Sirius	258°55.5	-16°41.6
Adhara	255°32.0	-28°57.0
Procyon	245°25.5	5°16.3
Pollux	243°57.9	28°04.4
Avior	234°28.3	-59°27.3
Suhail	223°10.6	-43°21.7
Miaplacidus	221°45.1	-69°38.7
Alphard	218°20.2	-8°34.7
Regulus	208°09.5	12°03.6
Dubhe	194°21.4	61°51.4
Denebola	182°58.5	14°40.7
Gienah	176°17.3	-17°26.4
Acrux	173°36.4	-62°59.9
Gacrux	172°27.9	-57°00.7
Alioth	166°41.7	56°03.9
Spica	158°56.8	-11°03.9
Alkaid	153°17.7	49°24.6
Hadar	149°22.1	-60°17.1
Menkent	148°36.1	-36°16.8
Arcturus	146°17.8	19°16.9
Rigil Kent.	140°24.6	-60°45.4
Kochab	137°17.9	74°14.1
Zuben'ubi	137°32.2	-15°57.9
Alphecca	126°31.4	26°46.7
Antares	112°55.9	-26°23.4
Atria	108°19.2	-68°59.6
Sabik	102°40.3	-15°42.1
Shaula	96°54.8	-37°05.4
Rasalhague	96°28.8	12°34.4
Eltanin	90°57.0	51°29.4
Kaus Aust.	84°15.9	-34°23.5
Vega	80°55.2	38°45.8
Nunki	76°28.3	-26°19.2
Altair	62°31.9	8°49.0
Peacock	53°57.4	-56°47.5
Deneb	49°48.0	45°12.5
Enif	34°11.1	9°47.2
Al Na'ir	28°14.4	-47°02.9
Fomalhaut	15°51.0	-29°43.2
Scheat	14°17.2	27°58.6
Markab	14°02.8	15°06.1

May 22 Fri	SHA	Mer.pass
Venus	289°00.2	12:47
Mars	312°40.2	11:11
Jupiter	178°57.9	20:03
Saturn	176°04.9	20:14

May 23 Sat	SHA	Mer.pass
Venus	287°41.3	12:48
Mars	311°56.2	11:10
Jupiter	178°58.9	19:59
Saturn	176°06.3	20:10

May 24 Sun	SHA	Mer.pass
Venus	286°22.3	12:49
Mars	311°12.3	11:09
Jupiter	178°59.7	19:55
Saturn	176°07.5	20:06

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°51.9	N20°19.3	325°23.8	11.0′	S20°52.6	1.4′	54.7′
1	195°51.9	19.8	339°53.8	11.0′	20°54.0	1.3′	54.7′
2	210°51.8	20.3	354°23.8	10.9′	20°55.3	1.2′	54.7′
3	225°51.8	·· 20.8	8°53.7	10.9′	20°56.5	1.1′	54.7′
4	240°51.7	21.3	23°23.6	10.9′	20°57.6	1.0′	54.8′
5	255°51.7	21.8	37°53.5	10.9′	20°58.6	0.9′	54.8′
6	270°51.7	N20°22.3	52°23.3	10.8′	S20°59.5	0.8′	54.8′
7	285°51.6	22.8	66°53.2	10.8′	21°00.3	0.7′	54.8′
8	300°51.6	23.3	81°23.0	10.8′	21°01.0	0.6′	54.8′
9	315°51.5	·· 23.8	95°52.8	10.8′	21°01.6	0.5′	54.8′
10	330°51.5	24.2	110°22.5	10.7′	21°02.1	0.4′	54.9′
11	345°51.4	24.7	124°52.3	10.7′	21°02.5	0.3′	54.9′
12	0°51.4	N20°25.2	139°22.0	10.7′	S21°02.8	0.1′	54.9′
13	15°51.3	25.7	153°51.7	10.7′	21°02.9	0.1′	54.9′
14	30°51.3	26.2	168°21.4	10.7′	21°03.0	0.0′	54.9′
15	45°51.2	·· 26.7	182°51.0	10.6′	21°03.0	0.2′	54.9′
16	60°51.2	27.2	197°20.7	10.6′	21°02.8	0.2′	55.0′
17	75°51.1	27.7	211°50.3	10.6′	21°02.6	0.3′	55.0′
18	90°51.1	N20°28.2	226°19.9	10.6′	S21°02.3	0.5′	55.0′
19	105°51.1	28.6	240°49.5	10.6′	21°01.8	0.6′	55.0′
20	120°51.0	29.1	255°19.1	10.6′	21°01.2	0.6′	55.0′
21	135°51.0	·· 29.6	269°48.7	10.5′	21°00.6	0.8′	55.1′
22	150°50.9	30.1	284°18.2	10.5′	20°59.8	0.9′	55.1′
23	165°50.9	30.6	298°47.7	10.5′	20°58.9	0.9′	55.1′
	SD = 15.8′	d = 0.5′	SD = 14.9′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°50.8	N20°31.1	313°17.3	10.5′	S20°58.0	1.1′	55.1′
1	195°50.8	31.5	327°46.8	10.5′	20°56.9	1.2′	55.1′
2	210°50.7	32.0	342°16.3	10.5′	20°55.7	1.3′	55.2′
3	225°50.7	·· 32.5	356°45.8	10.5′	20°54.4	1.4′	55.2′
4	240°50.6	33.0	11°15.2	10.5′	20°53.0	1.5′	55.2′
5	255°50.6	33.5	25°44.7	10.4′	20°51.5	1.6′	55.2′
6	270°50.5	N20°33.9	40°14.1	10.4′	S20°49.9	1.7′	55.2′
7	285°50.5	34.4	54°43.6	10.4′	20°48.2	1.9′	55.3′
8	300°50.4	34.9	69°13.0	10.4′	20°46.3	1.9′	55.3′
9	315°50.4	·· 35.4	83°42.4	10.4′	20°44.4	2.1′	55.3′
10	330°50.3	35.9	98°11.8	10.4′	20°42.3	2.1′	55.3′
11	345°50.3	36.3	112°41.2	10.4′	20°40.2	2.2′	55.3′
12	0°50.2	N20°36.8	127°10.6	10.4′	S20°38.0	2.4′	55.4′
13	15°50.2	37.3	141°40.0	10.4′	20°35.6	2.5′	55.4′
14	30°50.1	37.8	156°09.4	10.4′	20°33.1	2.5′	55.4′
15	45°50.1	·· 38.2	170°38.8	10.4′	20°30.6	2.7′	55.4′
16	60°50.0	38.7	185°08.2	10.4′	20°27.9	2.8′	55.4′
17	75°49.9	39.2	199°37.6	10.4′	20°25.1	2.9′	55.5′
18	90°49.9	N20°39.6	214°06.9	10.4′	S20°22.2	3.0′	55.5′
19	105°49.8	40.1	228°36.3	10.4′	20°19.2	3.1′	55.5′
20	120°49.8	40.6	243°05.6	10.4′	20°16.1	3.2′	55.5′
21	135°49.7	·· 41.1	257°35.0	10.4′	20°12.9	3.3′	55.6′
22	150°49.7	41.5	272°04.4	10.4′	20°09.6	3.4′	55.6′
23	165°49.6	42.0	286°33.7	10.4′	20°06.2	3.6′	55.6′
	SD = 15.8′	d = 0.5′	SD = 15.0′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°49.6	N20°42.5	301°03.1	10.4′	S20°02.6	3.6′	55.6′
1	195°49.5	42.9	315°32.4	10.4′	19°59.0	3.7′	55.7′
2	210°49.5	43.4	330°01.8	10.4′	19°55.3	3.9′	55.7′
3	225°49.4	·· 43.9	344°31.1	10.4′	19°51.4	3.9′	55.7′
4	240°49.4	44.3	359°00.5	10.4′	19°47.5	4.0′	55.7′
5	255°49.3	44.8	13°29.8	10.4′	19°43.5	4.2′	55.8′
6	270°49.2	N20°45.3	27°59.2	10.4′	S19°39.3	4.3′	55.8′
7	285°49.2	45.7	42°28.5	10.4′	19°35.0	4.3′	55.8′
8	300°49.1	46.2	56°57.9	10.4′	19°30.7	4.5′	55.8′
9	315°49.1	·· 46.7	71°27.3	10.4′	19°26.2	4.5′	55.9′
10	330°49.0	47.1	85°56.6	10.4′	19°21.7	4.7′	55.9′
11	345°49.0	47.6	100°26.0	10.4′	19°17.0	4.8′	55.9′
12	0°48.9	N20°48.0	114°55.4	10.4′	S19°12.2	4.9′	55.9′
13	15°48.8	48.5	129°24.7	10.4′	19°07.3	5.0′	56.0′
14	30°48.8	49.0	143°54.1	10.4′	19°02.3	5.0′	56.0′
15	45°48.7	·· 49.4	158°23.5	10.4′	18°57.3	5.2′	56.0′
16	60°48.7	49.9	172°52.9	10.4′	18°52.1	5.3′	56.0′
17	75°48.6	50.3	187°22.3	10.4′	18°46.8	5.4′	56.1′
18	90°48.6	N20°50.8	201°51.7	10.4′	S18°41.4	5.5′	56.1′
19	105°48.5	51.2	216°21.1	10.4′	18°35.9	5.6′	56.1′
20	120°48.4	51.7	230°50.5	10.4′	18°30.3	5.7′	56.1′
21	135°48.4	·· 52.2	245°19.9	10.4′	18°24.6	5.8′	56.2′
22	150°48.3	52.6	259°49.3	10.4′	18°18.8	5.8′	56.2′
23	165°48.3	53.1	274°18.8	10.4′	18°13.0	6.0′	56.2′
	SD = 15.8′	d = 0.5′	SD = 15.2′				

Lat.	**Twilight** Naut.	**Twilight** Civil	**Sunrise**	**Sunset**	**Twilight** Civil	**Twilight** Naut.
N 72°						
N 70°						
68°	////	////	00:55	23:07	////	////
66°	////	////	01:50	22:06	////	////
64°	////	////	02:23	21:33	////	////
62°	////	01:15	02:46	21:09	22:43	////
60°	////	01:54	03:05	20:50	22:02	////
N 58°	////	02:20	03:21	20:34	21:35	////
56°	01:08	02:41	03:34	20:21	21:14	22:50
54°	01:44	02:57	03:45	20:09	20:58	22:12
52°	02:08	03:11	03:55	19:59	20:43	21:47
50°	02:27	03:23	04:04	19:50	20:31	21:28
45°	03:03	03:48	04:23	19:31	20:06	20:52
N 40°	03:28	04:07	04:38	19:15	19:47	20:26
35°	03:48	04:23	04:51	19:02	19:31	20:06
30°	04:04	04:36	05:02	18:51	19:18	19:50
20°	04:29	04:57	05:21	18:32	18:56	19:24
N 10°	04:49	05:15	05:38	18:16	18:38	19:05
0°	05:05	05:31	05:53	18:00	18:22	18:48
S 10°	05:20	05:46	06:08	17:45	18:07	18:33
20°	05:34	06:01	06:24	17:29	17:52	18:19
30°	05:48	06:17	06:43	17:11	17:36	18:06
35°	05:55	06:26	06:53	17:00	17:27	17:58
40°	06:02	06:36	07:05	16:48	17:17	17:51
45°	06:11	06:47	07:19	16:34	17:06	17:42
S 50°	06:20	07:00	07:37	16:16	16:53	17:33
52°	06:24	07:06	07:45	16:08	16:47	17:29
54°	06:29	07:13	07:54	15:59	16:40	17:24
56°	06:33	07:20	08:04	15:48	16:33	17:19
58°	06:38	07:29	08:16	15:37	16:24	17:14
S 60°	06:44	07:38	08:30	15:23	16:15	17:09

Lat.	**Moonrise** Fri	**Moonrise** Sat	**Moonrise** Sun	**Moonset** Fri	**Moonset** Sat	**Moonset** Sun
N 72°						
N 70°			03:42			04:33
68°	01:08	01:59	02:18	03:37	04:30	05:57
66°	00:17	01:08	01:39	04:28	05:20	06:35
64°	·· ··	00:37	01:12	05:00	05:52	07:01
62°	·· ··	00:13	00:52	05:23	06:16	07:22
60°	23:54	·· ··	00:35	05:42	06:34	07:39
N 58°	23:39	·· ··	00:20	05:58	06:50	07:53
56°	23:25	·· ··	00:08	06:11	07:03	08:05
54°	23:14	23:57	·· ··	06:23	07:15	08:15
52°	23:03	23:48	·· ··	06:33	07:25	08:24
50°	22:54	23:39	·· ··	06:42	07:34	08:33
45°	22:35	23:21	·· ··	07:02	07:53	08:50
N 40°	22:19	23:06	23:49	07:17	08:09	09:05
35°	22:06	22:54	23:38	07:31	08:22	09:17
30°	21:54	22:43	23:28	07:42	08:33	09:28
20°	21:35	22:24	23:11	08:02	08:53	09:46
N 10°	21:17	22:07	22:56	08:19	09:10	10:02
0°	21:01	21:52	22:43	08:35	09:26	10:16
S 10°	20:45	21:37	22:29	08:51	09:41	10:31
20°	20:28	21:20	22:14	09:08	09:58	10:47
30°	20:08	21:01	21:57	09:28	10:18	11:04
35°	19:57	20:50	21:47	09:40	10:29	11:15
40°	19:44	20:37	21:36	09:53	10:42	11:27
45°	19:28	20:22	21:23	10:09	10:57	11:41
S 50°	19:09	20:04	21:06	10:28	11:16	11:58
52°	19:00	19:55	20:59	10:37	11:25	12:06
54°	18:49	19:46	20:50	10:47	11:35	12:14
56°	18:38	19:35	20:40	10:59	11:46	12:24
58°	18:25	19:22	20:30	11:12	11:58	12:36
S 60°	18:09	19:07	20:17	11:27	12:13	12:49

Day	**Sun** Eqn.of Time 00^h mm:ss	**Sun** Eqn.of Time 12^h mm:ss	**Sun** Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	**Moon** Mer.Pass. Lower hh:mm	**Moon** Age 18-20 92-78%
22	03:28	03:26	11:57	02:23	14:48	
23	03:23	03:21	11:57	03:13	15:39	
24	03:18	03:16	11:57	04:04	16:29	

May 25, 26, 27 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	242°29.4	167°32.4	N23°09.5	192°57.7	N18°08.5	61°29.7	N01°08.8	58°38.1	N01°06.1
1	257°31.9	182°31.6	09.9	207°58.3	09.0	76°32.2	08.8	73°40.6	06.1
2	272°34.3	197°30.7	10.3	222°58.9	09.5	91°34.7	08.8	88°43.1	06.1
3	287°36.8	212°29.9	·· 10.7	237°59.6	·· 10.0	106°37.2	·· 08.8	103°45.6	·· 06.1
4	302°39.3	227°29.0	11.2	253°00.2	10.5	121°39.7	08.7	118°48.1	06.1
5	317°41.7	242°28.2	11.6	268°00.8	11.0	136°42.2	08.7	133°50.6	06.1
6	332°44.2	257°27.3	N23°12.0	283°01.4	N18°11.5	151°44.7	N01°08.7	148°53.1	N01°06.1
7	347°46.7	272°26.5	12.4	298°02.1	11.9	166°47.1	08.7	163°55.6	06.1
8	2°49.1	287°25.7	12.8	313°02.7	12.4	181°49.6	08.7	178°58.1	06.1
9	17°51.6	302°24.8	·· 13.2	328°03.3	·· 12.9	196°52.1	·· 08.7	194°00.7	·· 06.1
10	32°54.0	317°24.0	13.6	343°04.0	13.4	211°54.6	08.7	209°03.2	06.2
11	47°56.5	332°23.1	14.0	358°04.6	13.9	226°57.1	08.7	224°05.7	06.2
12	62°59.0	347°22.3	N23°14.4	13°05.2	N18°14.4	241°59.6	N01°08.7	239°08.2	N01°06.2
13	78°01.4	2°21.4	14.8	28°05.8	14.9	257°02.1	08.7	254°10.7	06.2
14	93°03.9	17°20.6	15.2	43°06.5	15.4	272°04.5	08.7	269°13.2	06.2
15	108°06.4	32°19.7	·· 15.6	58°07.1	·· 15.9	287°07.0	·· 08.7	284°15.7	·· 06.2
16	123°08.8	47°18.9	16.0	73°07.7	16.4	302°09.5	08.7	299°18.2	06.2
17	138°11.3	62°18.0	16.4	88°08.4	16.9	317°12.0	08.7	314°20.7	06.2
18	153°13.8	77°17.2	N23°16.8	103°09.0	N18°17.3	332°14.5	N01°08.7	329°23.2	N01°06.2
19	168°16.2	92°16.3	17.2	118°09.6	17.8	347°17.0	08.7	344°25.7	06.2
20	183°18.7	107°15.5	17.6	133°10.2	18.3	2°19.4	08.7	359°28.2	06.3
21	198°21.2	122°14.6	·· 18.0	148°10.9	·· 18.8	17°21.9	·· 08.7	14°30.8	·· 06.3
22	213°23.6	137°13.8	18.4	163°11.5	19.3	32°24.4	08.7	29°33.3	06.3
23	228°26.1	152°12.9	18.8	178°12.1	19.8	47°26.9	08.7	44°35.8	06.3
Mer.pass. 07:49		ν -0.8′	d 0.4′	ν 0.6′	d 0.5′	ν 2.5′	d 0.0′	ν 2.5′	d 0.0′
		m -3.89		m 1.34		m -2.20		m 0.74	

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	243°28.5	167°12.1	N23°19.2	193°12.7	N18°20.3	62°29.4	N01°08.7	59°38.3	N01°06.3
1	258°31.0	182°11.2	19.5	208°13.4	20.8	77°31.8	08.7	74°40.8	06.3
2	273°33.5	197°10.4	19.9	223°14.0	21.2	92°34.3	08.7	89°43.3	06.3
3	288°35.9	212°09.5	·· 20.3	238°14.6	·· 21.7	107°36.8	·· 08.7	104°45.8	·· 06.3
4	303°38.4	227°08.7	20.7	253°15.3	22.2	122°39.3	08.7	119°48.3	06.3
5	318°40.9	242°07.8	21.1	268°15.9	22.7	137°41.8	08.7	134°50.8	06.3
6	333°43.3	257°07.0	N23°21.5	283°16.5	N18°23.2	152°44.2	N01°08.7	149°53.3	N01°06.3
7	348°45.8	272°06.1	21.8	298°17.1	23.7	167°46.7	08.7	164°55.8	06.3
8	3°48.3	287°05.3	22.2	313°17.8	24.1	182°49.2	08.7	179°58.3	06.4
9	18°50.7	302°04.4	·· 22.6	328°18.4	·· 24.6	197°51.7	·· 08.7	195°00.8	·· 06.4
10	33°53.2	317°03.6	23.0	343°19.0	25.1	212°54.1	08.6	210°03.3	06.4
11	48°55.7	332°02.7	23.4	358°19.6	25.6	227°56.6	08.6	225°05.8	06.4
12	63°58.1	347°01.9	N23°23.7	13°20.3	N18°26.1	242°59.1	N01°08.6	240°08.3	N01°06.4
13	79°00.6	2°01.0	24.1	28°20.9	26.6	258°01.6	08.6	255°10.9	06.4
14	94°03.0	17°00.2	24.5	43°21.5	27.0	273°04.1	08.6	270°13.4	06.4
15	109°05.5	31°59.3	·· 24.8	58°22.1	·· 27.5	288°06.5	·· 08.6	285°15.9	·· 06.4
16	124°08.0	46°58.5	25.2	73°22.8	28.0	303°09.0	08.6	300°18.4	06.4
17	139°10.4	61°57.6	25.6	88°23.4	28.5	318°11.5	08.6	315°20.9	06.4
18	154°12.9	76°56.7	N23°26.0	103°24.0	N18°29.0	333°14.0	N01°08.6	330°23.4	N01°06.4
19	169°15.4	91°55.9	26.3	118°24.6	29.5	348°16.4	08.6	345°25.9	06.4
20	184°17.8	106°55.0	26.7	133°25.3	29.9	3°18.9	08.6	0°28.4	06.4
21	199°20.3	121°54.2	·· 27.0	148°25.9	·· 30.4	18°21.4	·· 08.6	15°30.9	·· 06.5
22	214°22.8	136°53.3	27.4	163°26.5	30.9	33°23.9	08.6	30°33.4	06.5
23	229°25.2	151°52.5	27.8	178°27.1	31.4	48°26.3	08.6	45°35.9	06.5
Mer.pass. 07:45		ν -0.8′	d 0.4′	ν 0.6′	d 0.5′	ν 2.5′	d 0.0′	ν 2.5′	d 0.0′
		m -3.90		m 1.35		m -2.20		m 0.74	

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	244°27.7	166°51.6	N23°28.1	193°27.8	N18°31.9	63°28.8	N01°08.6	60°38.4	N01°06.5
1	259°30.1	181°50.8	28.5	208°28.4	32.3	78°31.3	08.6	75°40.9	06.5
2	274°32.6	196°49.9	28.8	223°29.0	32.8	93°33.8	08.5	90°43.4	06.5
3	289°35.1	211°49.0	·· 29.2	238°29.6	·· 33.3	108°36.2	·· 08.5	105°45.9	·· 06.5
4	304°37.5	226°48.2	29.6	253°30.3	33.8	123°38.7	08.5	120°48.4	06.5
5	319°40.0	241°47.3	29.9	268°30.9	34.2	138°41.2	08.5	135°50.9	06.5
6	334°42.5	256°46.5	N23°30.3	283°31.5	N18°34.7	153°43.6	N01°08.5	150°53.4	N01°06.5
7	349°44.9	271°45.6	30.6	298°32.1	35.2	168°46.1	08.5	165°55.9	06.5
8	4°47.4	286°44.8	31.0	313°32.8	35.7	183°48.6	08.5	180°58.4	06.5
9	19°49.9	301°43.9	·· 31.3	328°33.4	·· 36.1	198°51.1	·· 08.5	196°00.9	·· 06.5
10	34°52.3	316°43.0	31.7	343°34.0	36.6	213°53.5	08.5	211°03.4	06.5
11	49°54.8	331°42.2	32.0	358°34.6	37.1	228°56.0	08.5	226°05.9	06.5
12	64°57.3	346°41.3	N23°32.4	13°35.3	N18°37.6	243°58.5	N01°08.5	241°08.4	N01°06.6
13	79°59.7	1°40.5	32.7	28°35.9	38.0	259°00.9	08.5	256°10.9	06.6
14	95°02.2	16°39.6	33.1	43°36.5	38.5	274°03.4	08.4	271°13.4	06.6
15	110°04.6	31°38.7	·· 33.4	58°37.1	·· 39.0	289°05.9	·· 08.4	286°15.9	·· 06.6
16	125°07.1	46°37.9	33.7	73°37.8	39.5	304°08.3	08.4	301°18.4	06.6
17	140°09.6	61°37.0	34.1	88°38.4	39.9	319°10.8	08.4	316°20.9	06.6
18	155°12.0	76°36.1	N23°34.4	103°39.0	N18°40.4	334°13.3	N01°08.4	331°23.4	N01°06.6
19	170°14.5	91°35.3	34.8	118°39.6	40.9	349°15.7	08.4	346°25.9	06.6
20	185°17.0	106°34.4	35.1	133°40.3	41.4	4°18.2	08.4	1°28.4	06.6
21	200°19.4	121°33.6	·· 35.4	148°40.9	·· 41.8	19°20.7	·· 08.4	16°30.9	·· 06.6
22	215°21.9	136°32.7	35.8	163°41.5	42.3	34°23.2	08.4	31°33.4	06.6
23	230°24.4	151°31.8	36.1	178°42.1	42.8	49°25.6	08.4	46°35.9	06.6
Mer.pass. 07:41		ν -0.9′	d 0.4′	ν 0.6′	d 0.5′	ν 2.5′	d 0.0′	ν 2.5′	d 0.0′
		m -3.90		m 1.35		m -2.19		m 0.75	

Stars

	SHA	Dec
Alpheratz	358°09.0	28°59.0
Ankaa	353°40.0	-42°24.4
Schedar	350°08.8	56°25.8
Diphda	349°20.6	-18°05.4
Achernar	335°45.4	-57°19.8
Hamal	328°28.7	23°22.2
Polaris	327°02.6	89°10.5
Acamar	315°37.3	-40°22.8
Menkar	314°41.0	4°00.8
Mirfak	309°15.9	49°47.5
Aldebaran	291°17.8	16°28.2
Rigel	281°35.9	-8°13.5
Capella	281°11.1	45°58.7
Bellatrix	278°58.6	6°19.9
Elnath	278°43.9	28°35.5
Alnilam	276°11.5	-1°12.9
Betelgeuse	271°28.1	7°24.1
Canopus	264°07.5	-52°41.4
Sirius	258°55.5	-16°41.6
Adhara	255°32.0	-28°57.0
Procyon	245°25.5	5°16.3
Pollux	243°57.9	28°04.4
Avior	234°28.3	-59°27.3
Suhail	223°10.6	-43°21.7
Miaplacidus	221°45.2	-69°38.7
Alphard	218°20.2	-8°34.7
Regulus	208°09.5	12°03.6
Dubhe	194°21.5	61°51.4
Denebola	182°58.5	14°40.7
Gienah	176°17.3	-17°26.4
Acrux	173°36.4	-62°59.9
Gacrux	172°27.9	-57°00.7
Alioth	166°41.8	56°03.9
Spica	158°56.8	-11°03.9
Alkaid	153°17.7	49°24.6
Hadar	149°22.1	-60°17.1
Menkent	148°36.1	-36°16.8
Arcturus	146°17.8	19°16.9
Rigil Kent.	140°24.6	-60°45.4
Kochab	137°17.9	74°14.1
Zuben'ubi	137°32.2	-15°57.9
Alphecca	126°31.4	26°46.7
Antares	112°55.9	-26°23.4
Atria	108°19.2	-68°59.6
Sabik	102°40.3	-15°42.1
Shaula	96°54.7	-37°05.4
Rasalhague	96°28.8	12°34.4
Eltanin	90°57.0	51°29.4
Kaus Aust.	84°15.9	-34°23.5
Vega	80°55.1	38°45.9
Nunki	76°28.3	-26°19.2
Altair	62°31.9	8°49.0
Peacock	53°57.4	-56°47.5
Deneb	49°47.9	45°12.6
Enif	34°11.1	9°47.2
Al Na'ir	28°14.3	-47°02.9
Fomalhaut	15°51.0	-29°43.2
Scheat	14°17.2	27°58.6
Markab	14°02.8	15°06.1

May 25 Mon	SHA	Mer.pass
Venus	285°03.0	12:51
Mars	310°28.3	11:08
Jupiter	179°00.3	19:51
Saturn	176°08.7	20:02

May 26 Tue	SHA	Mer.pass
Venus	283°43.5	12:52
Mars	309°44.2	11:07
Jupiter	179°00.8	19:47
Saturn	176°09.7	19:58

May 27 Wed	SHA	Mer.pass
Venus	282°23.9	12:53
Mars	309°00.1	11:06
Jupiter	179°01.1	19:43
Saturn	176°10.7	19:54

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = -0.5544 sec ΔT = TT-UT1 = +51.7384 sec

1981 May 25 to May. 27 UT

h	Sun		Moon				
Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	180°48.2	N20°53.5	288°48.2	10.4′	S18°07.0	6.1′	56.3′
1	195°48.1	54.0	303°17.6	10.5′	18°00.9	6.2′	56.3′
2	210°48.1	54.4	317°47.1	10.5′	17°54.7	6.3′	56.3′
3	225°48.0	·· 54.9	332°16.6	10.5′	17°48.4	6.4′	56.3′
4	240°48.0	55.3	346°46.0	10.5′	17°42.0	6.5′	56.4′
5	255°47.9	55.8	1°15.5	10.5′	17°35.5	6.6′	56.4′
6	270°47.8	N20°56.2	15°45.0	10.5′	S17°28.9	6.6′	56.4′
7	285°47.8	56.7	30°14.5	10.5′	17°22.3	6.8′	56.5′
8	300°47.7	57.1	44°44.0	10.5′	17°15.5	6.9′	56.5′
9	315°47.7	·· 57.6	59°13.5	10.5′	17°08.6	6.9′	56.5′
10	330°47.6	58.0	73°43.0	10.5′	17°01.7	7.1′	56.5′
11	345°47.5	58.5	88°12.5	10.5′	16°54.6	7.2′	56.6′
12	0°47.5	N20°58.9	102°42.0	10.5′	S16°47.4	7.2′	56.6′
13	15°47.4	59.4	117°11.6	10.5′	16°40.2	7.4′	56.6′
14	30°47.3	20°59.8	131°41.1	10.6′	16°32.8	7.4′	56.7′
15	45°47.3	21°00.2	146°10.7	10.6′	16°25.4	7.5′	56.7′
16	60°47.2	00.7	160°40.2	10.6′	16°17.9	7.7′	56.7′
17	75°47.2	01.1	175°09.8	10.6′	16°10.2	7.7′	56.8′
18	90°47.1	N21°01.6	189°39.4	10.6′	S16°02.5	7.8′	56.8′
19	105°47.0	02.0	204°09.0	10.6′	15°54.7	7.9′	56.8′
20	120°47.0	02.4	218°38.6	10.6′	15°46.8	8.0′	56.8′
21	135°46.9	·· 02.9	233°08.2	10.6′	15°38.8	8.0′	56.9′
22	150°46.8	03.3	247°37.8	10.6′	15°30.8	8.2′	56.9′
23	165°46.8	03.8	262°07.4	10.6′	15°22.6	8.3′	56.9′
	SD = 15.8′	d = 0.5′	SD = 15.3′				

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	180°46.7	N21°04.2	276°37.0	10.6′	S15°14.3	8.3′	57.0′
1	195°46.6	04.6	291°06.7	10.6′	15°06.0	8.4′	57.0′
2	210°46.6	05.1	305°36.3	10.7′	14°57.6	8.6′	57.0′
3	225°46.5	·· 05.5	320°06.0	10.7′	14°49.0	8.6′	57.1′
4	240°46.4	06.0	334°35.6	10.7′	14°40.4	8.7′	57.1′
5	255°46.4	06.4	349°05.3	10.7′	14°31.7	8.7′	57.1′
6	270°46.3	N21°06.8	3°35.0	10.7′	S14°23.0	8.9′	57.2′
7	285°46.2	07.3	18°04.7	10.7′	14°14.1	9.0′	57.2′
8	300°46.2	07.7	32°34.3	10.7′	14°05.1	9.0′	57.2′
9	315°46.1	·· 08.1	47°04.0	10.7′	13°56.1	9.1′	57.3′
10	330°46.0	08.6	61°33.7	10.7′	13°47.0	9.2′	57.3′
11	345°46.0	09.0	76°03.4	10.7′	13°37.8	9.3′	57.3′
12	0°45.9	N21°09.4	90°33.2	10.7′	S13°28.5	9.3′	57.4′
13	15°45.8	09.8	105°02.9	10.7′	13°19.2	9.5′	57.4′
14	30°45.8	10.3	119°32.6	10.7′	13°09.7	9.5′	57.4′
15	45°45.7	·· 10.7	134°02.3	10.7′	13°00.2	9.6′	57.5′
16	60°45.6	11.1	148°32.0	10.7′	12°50.6	9.7′	57.5′
17	75°45.6	11.6	163°01.8	10.7′	12°40.9	9.7′	57.5′
18	90°45.5	N21°12.0	177°31.5	10.7′	S12°31.2	9.9′	57.6′
19	105°45.4	12.4	192°01.3	10.7′	12°21.3	9.9′	57.6′
20	120°45.4	12.8	206°31.0	10.7′	12°11.4	10.0′	57.6′
21	135°45.3	·· 13.3	221°00.8	10.7′	12°01.4	10.0′	57.7′
22	150°45.2	13.7	235°30.5	10.8′	11°51.4	10.2′	57.7′
23	165°45.2	14.1	250°00.2	10.8′	11°41.2	10.2′	57.7′
	SD = 15.8′	d = 0.4′	SD = 15.5′				

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	180°45.1	N21°14.5	264°30.0	10.8′	S11°31.0	10.3′	57.8′
1	195°45.0	15.0	278°59.8	10.8′	11°20.7	10.3′	57.8′
2	210°44.9	15.4	293°29.5	10.8′	11°10.4	10.5′	57.8′
3	225°44.9	·· 15.8	307°59.3	10.8′	10°59.9	10.5′	57.9′
4	240°44.8	16.2	322°29.0	10.8′	10°49.4	10.5′	57.9′
5	255°44.7	16.6	336°58.8	10.8′	10°38.9	10.7′	57.9′
6	270°44.7	N21°17.1	351°28.5	10.7′	S10°28.2	10.7′	58.0′
7	285°44.6	17.5	5°58.3	10.7′	10°17.5	10.8′	58.0′
8	300°44.5	17.9	20°28.0	10.7′	10°06.7	10.8′	58.0′
9	315°44.4	·· 18.3	34°57.8	10.7′	09°55.9	10.9′	58.1′
10	330°44.4	18.7	49°27.5	10.7′	09°45.0	11.0′	58.1′
11	345°44.3	19.1	63°57.2	10.7′	09°34.0	11.0′	58.1′
12	0°44.2	N21°19.6	78°27.0	10.7′	S09°23.0	11.1′	58.2′
13	15°44.2	20.0	92°56.7	10.7′	09°11.9	11.2′	58.2′
14	30°44.1	20.4	107°26.4	10.7′	09°00.7	11.2′	58.2′
15	45°44.0	·· 20.8	121°56.1	10.7′	08°49.5	11.3′	58.3′
16	60°43.9	21.2	136°25.8	10.7′	08°38.2	11.3′	58.3′
17	75°43.9	21.6	150°55.5	10.7′	08°26.9	11.4′	58.3′
18	90°43.8	N21°22.0	165°25.2	10.7′	S08°15.5	11.5′	58.4′
19	105°43.7	22.5	179°54.9	10.7′	08°04.0	11.5′	58.4′
20	120°43.6	22.9	194°24.6	10.7′	07°52.5	11.6′	58.5′
21	135°43.6	·· 23.3	208°54.3	10.7′	07°40.9	11.6′	58.5′
22	150°43.5	23.7	223°23.9	10.6′	07°29.3	11.7′	58.5′
23	165°43.4	24.1	237°53.6	10.6′	07°17.6	11.8′	58.6′
	SD = 15.8′	d = 0.4′	SD = 15.8′				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	////	////	00:19	////	////	////
66°	////	////	01:38	22:19	////	////
64°	////	////	02:14	21:42	////	////
62°	////	00:59	02:40	21:16	23:00	////
60°	////	01:45	02:59	20:56	22:12	////
N 58°	////	02:13	03:16	20:39	21:43	////
56°	00:53	02:35	03:29	20:25	21:21	23:06
54°	01:35	02:52	03:41	20:13	21:03	22:21
52°	02:02	03:07	03:52	20:03	20:48	21:54
50°	02:22	03:20	04:01	19:53	20:35	21:33
45°	02:59	03:45	04:21	19:34	20:10	20:56
N 40°	03:25	04:05	04:36	19:18	19:50	20:29
35°	03:46	04:21	04:50	19:05	19:33	20:09
30°	04:02	04:34	05:01	18:53	19:20	19:52
20°	04:28	04:57	05:21	18:33	18:57	19:26
N 10°	04:48	05:15	05:38	18:16	18:39	19:06
0°	05:05	05:31	05:53	18:01	18:23	18:49
S 10°	05:21	05:46	06:09	17:45	18:07	18:33
20°	05:35	06:02	06:25	17:28	17:52	18:19
30°	05:49	06:18	06:44	17:09	17:35	18:05
35°	05:57	06:28	06:55	16:58	17:26	17:57
40°	06:05	06:38	07:08	16:46	17:16	17:49
45°	06:13	06:50	07:22	16:31	17:04	17:40
S 50°	06:23	07:03	07:40	16:13	16:50	17:30
52°	06:27	07:10	07:49	16:05	16:44	17:26
54°	06:32	07:17	07:58	15:55	16:37	17:21
56°	06:37	07:24	08:09	15:44	16:29	17:16
58°	06:43	07:33	08:21	15:32	16:20	17:11
S 60°	06:49	07:43	08:36	15:18	16:11	17:05

Lat.	Moonrise Mon	Moonrise Tue	Moonrise Wed	Moonset Mon	Moonset Tue	Moonset Wed
N 72°	04:17	03:20	02:57	05:45	08:27	10:35
N 70°	03:02	02:48	02:39	06:59	08:58	10:51
68°	02:24	02:25	02:25	07:36	09:20	11:04
66°	01:57	02:07	02:13	08:03	09:37	11:15
64°	01:36	01:52	02:03	08:23	09:51	11:23
62°	01:19	01:39	01:54	08:39	10:03	11:31
60°	01:05	01:29	01:47	08:52	10:13	11:37
N 58°	00:53	01:19	01:41	09:04	10:21	11:43
56°	00:43	01:11	01:35	09:14	10:29	11:48
54°	00:33	01:04	01:30	09:23	10:36	11:52
52°	00:25	00:57	01:25	09:31	10:42	11:56
50°	00:18	00:51	01:21	09:38	10:47	12:00
45°	00:02	00:38	01:11	09:53	10:59	12:08
N 40°	·· ··	00:28	01:04	10:05	11:08	12:14
35°	·· ··	00:19	00:57	10:16	11:17	12:20
30°	·· ··	00:11	00:51	10:25	11:24	12:25
20°	23:57	·· ··	00:41	10:40	11:36	12:33
N 10°	23:45	·· ··	00:32	10:54	11:47	12:40
0°	23:33	·· ··	00:23	11:07	11:57	12:47
S 10°	23:22	·· ··	00:15	11:20	12:07	12:54
20°	23:09	·· ··	00:06	11:33	12:18	13:01
30°	22:55	23:55	·· ··	11:48	12:30	13:09
35°	22:47	23:49	·· ··	11:57	12:37	13:14
40°	22:38	23:43	·· ··	12:07	12:45	13:19
45°	22:27	23:35	·· ··	12:19	12:54	13:25
S 50°	22:14	23:25	·· ··	12:33	13:05	13:32
52°	22:07	23:21	·· ··	12:40	13:10	13:36
54°	22:01	23:16	·· ··	12:47	13:15	13:39
56°	21:53	23:10	·· ··	12:56	13:21	13:43
58°	21:44	23:04	·· ··	13:05	13:28	13:48
S 60°	21:34	22:57	·· ··	13:15	13:36	13:53

Day	Sun Eqn.of Time 00h	Sun Eqn.of Time 12h	Sun Mer. Pass	Moon Mer.Pass. Upper	Moon Mer.Pass. Lower	Moon Age 21-23 69-49%
	mm:ss	mm:ss	hh:mm	hh:mm	hh:mm	
25	03:13	03:10	11:57	04:55	17:20	
26	03:07	03:04	11:57	05:45	18:10	
27	03:00	02:57	11:57	06:35	19:00	

May 28, 29, 30 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	245°26.8	166°31.0	N23°36.4	193°42.8	N18°43.3	64°28.1	N01°08.4	61°38.4	N01°06.6
1	260°29.3	181°30.1	36.8	208°43.4	43.7	79°30.6	08.3	76°40.9	06.6
2	275°31.8	196°29.2	37.1	223°44.0	44.2	94°33.0	08.3	91°43.4	06.6
3	290°34.2	211°28.4	·· 37.4	238°44.6	·· 44.7	109°35.5	·· 08.3	106°45.9	·· 06.6
4	305°36.7	226°27.5	37.7	253°45.2	45.1	124°37.9	08.3	121°48.4	06.6
5	320°39.1	241°26.7	38.1	268°45.9	45.6	139°40.4	08.3	136°50.9	06.6
6	335°41.6	256°25.8	N23°38.4	283°46.5	N18°46.1	154°42.9	N01°08.3	151°53.4	N01°06.6
7	350°44.1	271°24.9	38.7	298°47.1	46.5	169°45.3	08.3	166°55.9	06.7
8	5°46.5	286°24.1	39.0	313°47.7	47.0	184°47.8	08.3	181°58.4	06.7
9	20°49.0	301°23.2	·· 39.4	328°48.4	·· 47.5	199°50.3	·· 08.3	197°00.9	·· 06.7
10	35°51.5	316°22.3	39.7	343°49.0	47.9	214°52.7	08.2	212°03.4	06.7
11	50°53.9	331°21.5	40.0	358°49.6	48.4	229°55.2	08.2	227°05.9	06.7
12	65°56.4	346°20.6	N23°40.3	13°50.2	N18°48.9	244°57.7	N01°08.2	242°08.4	N01°06.7
13	80°58.9	1°19.7	40.6	28°50.9	49.4	260°00.1	08.2	257°10.9	06.7
14	96°01.3	16°18.9	41.0	43°51.5	49.8	275°02.6	08.2	272°13.4	06.7
15	111°03.8	31°18.0	·· 41.3	58°52.1	·· 50.3	290°05.1	·· 08.2	287°15.9	·· 06.7
16	126°06.2	46°17.1	41.6	73°52.7	50.7	305°07.5	08.2	302°18.4	06.7
17	141°08.7	61°16.3	41.9	88°53.3	51.2	320°10.0	08.2	317°20.9	06.7
18	156°11.2	76°15.4	N23°42.2	103°54.0	N18°51.7	335°12.4	N01°08.1	332°23.4	N01°06.7
19	171°13.6	91°14.5	42.5	118°54.6	52.1	350°14.9	08.1	347°25.9	06.7
20	186°16.1	106°13.7	42.8	133°55.2	52.6	5°17.4	08.1	2°28.4	06.7
21	201°18.6	121°12.8	·· 43.1	148°55.8	·· 53.1	20°19.8	·· 08.1	17°30.9	·· 06.7
22	216°21.0	136°11.9	43.4	163°56.4	53.5	35°22.3	08.1	32°33.4	06.7
23	231°23.5	151°11.1	43.7	178°57.1	54.0	50°24.7	08.1	47°35.9	06.7
Mer.pass. 07:37		ν -0.9′ d 0.3′		m -3.90	ν 0.6′ d 0.5′		m 1.36	ν 2.5′ d 0.0′	m -2.18	ν 2.5′ d 0.0′	m 0.75

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	246°26.0	166°10.2	N23°44.0	193°57.7	N18°54.5	65°27.2	N01°08.1	62°38.4	N01°06.7
1	261°28.4	181°09.3	44.3	208°58.3	54.9	80°29.7	08.1	77°40.9	06.7
2	276°30.9	196°08.4	44.7	223°58.9	55.4	95°32.1	08.0	92°43.3	06.7
3	291°33.4	211°07.6	·· 45.0	238°59.6	·· 55.9	110°34.6	·· 08.0	107°45.8	·· 06.7
4	306°35.8	226°06.7	45.2	254°00.2	56.3	125°37.0	08.0	122°48.3	06.7
5	321°38.3	241°05.8	45.5	269°00.8	56.8	140°39.5	08.0	137°50.8	06.7
6	336°40.7	256°05.0	N23°45.8	284°01.4	N18°57.2	155°42.0	N01°08.0	152°53.3	N01°06.7
7	351°43.2	271°04.1	46.1	299°02.0	57.7	170°44.4	08.0	167°55.8	06.7
8	6°45.7	286°03.2	46.4	314°02.7	58.2	185°46.9	08.0	182°58.3	06.7
9	21°48.1	301°02.4	·· 46.7	329°03.3	·· 58.6	200°49.3	·· 07.9	198°00.8	·· 06.8
10	36°50.6	316°01.5	47.0	344°03.9	59.1	215°51.8	07.9	213°03.3	06.8
11	51°53.1	331°00.6	47.3	359°04.5	18°59.5	230°54.2	07.9	228°05.8	06.8
12	66°55.5	345°59.7	N23°47.6	14°05.1	N19°00.0	245°56.7	N01°07.9	243°08.3	N01°06.8
13	81°58.0	0°58.9	47.9	29°05.8	00.5	260°59.2	07.9	258°10.8	06.8
14	97°00.5	15°58.0	48.2	44°06.4	00.9	276°01.6	07.9	273°13.3	06.8
15	112°02.9	30°57.1	·· 48.5	59°07.0	·· 01.4	291°04.1	·· 07.9	288°15.8	·· 06.8
16	127°05.4	45°56.3	48.7	74°07.6	01.8	306°06.5	07.8	303°18.3	06.8
17	142°07.8	60°55.4	49.0	89°08.2	02.3	321°09.0	07.8	318°20.8	06.8
18	157°10.3	75°54.5	N23°49.3	104°08.9	N19°02.8	336°11.4	N01°07.8	333°23.3	N01°06.8
19	172°12.8	90°53.6	49.6	119°09.5	03.2	351°13.9	07.8	348°25.7	06.8
20	187°15.2	105°52.8	49.9	134°10.1	03.7	6°16.3	07.8	3°28.2	06.8
21	202°17.7	120°51.9	·· 50.1	149°10.7	·· 04.1	21°18.8	·· 07.8	18°30.7	·· 06.8
22	217°20.2	135°51.0	50.4	164°11.3	04.6	36°21.2	07.8	33°33.2	06.8
23	232°22.6	150°50.1	50.7	179°12.0	05.0	51°23.7	07.7	48°35.7	06.8
Mer.pass. 07:33		ν -0.9′ d 0.3′		m -3.90	ν 0.6′ d 0.5′		m 1.36	ν 2.5′ d 0.0′	m -2.17	ν 2.5′ d 0.0′	m 0.76

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	247°25.1	165°49.3	N23°51.0	194°12.6	N19°05.5	66°26.1	N01°07.7	63°38.2	N01°06.8
1	262°27.6	180°48.4	51.2	209°13.2	06.0	81°28.6	07.7	78°40.7	06.8
2	277°30.0	195°47.5	51.5	224°13.8	06.4	96°31.1	07.7	93°43.2	06.8
3	292°32.5	210°46.6	·· 51.8	239°14.4	·· 06.9	111°33.5	·· 07.7	108°45.7	·· 06.8
4	307°35.0	225°45.8	52.1	254°15.1	07.3	126°36.0	07.7	123°48.2	06.8
5	322°37.4	240°44.9	52.3	269°15.7	07.8	141°38.4	07.6	138°50.7	06.8
6	337°39.9	255°44.0	N23°52.6	284°16.3	N19°08.2	156°40.9	N01°07.6	153°53.2	N01°06.8
7	352°42.3	270°43.1	52.9	299°16.9	08.7	171°43.3	07.6	168°55.6	06.8
8	7°44.8	285°42.3	53.1	314°17.5	09.1	186°45.8	07.6	183°58.1	06.8
9	22°47.3	300°41.4	·· 53.4	329°18.2	·· 09.6	201°48.2	·· 07.6	199°00.6	·· 06.8
10	37°49.7	315°40.5	53.7	344°18.8	10.0	216°50.7	07.6	214°03.1	06.8
11	52°52.2	330°39.6	53.9	359°19.4	10.5	231°53.1	07.5	229°05.6	06.8
12	67°54.7	345°38.8	N23°54.2	14°20.0	N19°10.9	246°55.6	N01°07.5	244°08.1	N01°06.8
13	82°57.1	0°37.9	54.4	29°20.6	11.4	261°58.0	07.5	259°10.6	06.8
14	97°59.6	15°37.0	54.7	44°21.3	11.8	277°00.5	07.5	274°13.1	06.8
15	113°02.1	30°36.1	·· 54.9	59°21.9	·· 12.3	292°02.9	·· 07.5	289°15.6	·· 06.8
16	128°04.5	45°35.3	55.2	74°22.5	12.7	307°05.4	07.4	304°18.0	06.8
17	143°07.0	60°34.4	55.5	89°23.1	13.2	322°07.8	07.4	319°20.5	06.8
18	158°09.5	75°33.5	N23°55.7	104°23.7	N19°13.6	337°10.3	N01°07.4	334°23.0	N01°06.8
19	173°11.9	90°32.6	56.0	119°24.3	14.1	352°12.7	07.4	349°25.5	06.8
20	188°14.4	105°31.7	56.2	134°25.0	14.5	7°15.1	07.4	4°28.0	06.8
21	203°16.8	120°30.9	·· 56.5	149°25.6	·· 15.0	22°17.6	·· 07.4	19°30.5	·· 06.8
22	218°19.3	135°30.0	56.7	164°26.2	15.4	37°20.0	07.3	34°33.0	06.8
23	233°21.8	150°29.1	57.0	179°26.8	15.9	52°22.5	07.3	49°35.5	06.8
Mer.pass. 07:29		ν -0.9′ d 0.3′		m -3.90	ν 0.6′ d 0.5′		m 1.37	ν 2.5′ d 0.0′	m -2.17	ν 2.5′ d 0.0′	m 0.76

Stars

	SHA	Dec
Alpheratz	358°09.0	28°59.0
Ankaa	353°40.0	-42°24.4
Schedar	350°08.8	56°25.8
Diphda	349°20.6	-18°05.4
Achernar	335°45.4	-57°19.8
Hamal	328°28.7	23°22.2
Polaris	327°02.0	89°10.5
Acamar	315°37.3	-40°22.8
Menkar	314°40.9	4°00.9
Mirfak	309°15.9	49°47.5
Aldebaran	291°17.8	16°28.2
Rigel	281°35.9	-8°13.5
Capella	281°11.1	45°58.7
Bellatrix	278°58.6	6°19.9
Elnath	278°43.9	28°35.5
Alnilam	276°11.5	-1°12.9
Betelgeuse	271°28.1	7°24.1
Canopus	264°07.5	-52°41.3
Sirius	258°55.6	-16°41.6
Adhara	255°32.1	-28°57.0
Procyon	245°25.5	5°16.3
Pollux	243°57.9	28°04.4
Avior	234°28.4	-59°27.2
Suhail	223°10.6	-43°21.7
Miaplacidus	221°45.2	-69°38.7
Alphard	218°20.2	-8°34.7
Regulus	208°09.6	12°03.6
Dubhe	194°21.5	61°51.4
Denebola	182°58.5	14°40.7
Gienah	176°17.3	-17°26.4
Acrux	173°36.4	-62°59.9
Gacrux	172°27.9	-57°00.7
Alioth	166°41.8	56°04.0
Spica	158°56.8	-11°03.8
Alkaid	153°17.8	49°24.6
Hadar	149°22.2	-60°17.1
Menkent	148°36.1	-36°16.8
Arcturus	146°17.8	19°16.9
Rigil Kent.	140°24.6	-60°45.5
Kochab	137°17.9	74°14.2
Zuben'ubi	137°32.2	-15°57.9
Alphecca	126°31.4	26°46.7
Antares	112°55.9	-26°23.4
Atria	108°19.2	-68°59.6
Sabik	102°40.3	-15°42.1
Shaula	96°54.7	-37°05.4
Rasalhague	96°28.8	12°34.4
Eltanin	90°57.0	51°29.4
Kaus Aust.	84°15.9	-34°23.6
Vega	80°55.1	38°45.9
Nunki	76°28.3	-26°19.2
Altair	62°31.8	8°49.1
Peacock	53°57.3	-56°47.5
Deneb	49°47.9	45°12.6
Enif	34°11.0	9°47.2
Al Na'ir	28°14.3	-47°02.9
Fomalhaut	15°50.9	-29°43.2
Scheat	14°17.2	27°58.6
Markab	14°02.7	15°06.1

May 28 Thu	SHA	Mer.pass
Venus	281°04.2	12:55
Mars	308°15.9	11:05
Jupiter	179°01.3	19:39
Saturn	176°11.6	19:50

May 29 Fri	SHA	Mer.pass
Venus	279°44.2	12:56
Mars	307°31.7	11:04
Jupiter	179°01.2	19:35
Saturn	176°12.4	19:46

May 30 Sat	SHA	Mer.pass
Venus	278°24.2	12:57
Mars	306°47.5	11:03
Jupiter	179°01.1	19:31
Saturn	176°13.1	19:42

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = -0.5618 sec ΔT = TT-UT1 = +51.7458 sec

1981 May 28 to May. 30 UT

h	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°43.3	N21°24.5	252°23.2	10.6′	S07°05.8	11.8′	58.6′
1	195°43.3	24.9	266°52.8	10.6′	06°54.0	11.8′	58.6′
2	210°43.2	25.3	281°22.4	10.6′	06°42.2	11.9′	58.7′
3	225°43.1	· · 25.7	295°52.0	10.6′	06°30.3	12.0′	58.7′
4	240°43.0	26.1	310°21.6	10.6′	06°18.3	12.0′	58.7′
5	255°43.0	26.5	324°51.2	10.6′	06°06.3	12.0′	58.8′
6	270°42.9	N21°26.9	339°20.7	10.5′	S05°54.3	12.1′	58.8′
7	285°42.8	27.3	353°50.3	10.5′	05°42.2	12.1′	58.8′
8	300°42.7	27.7	8°19.8	10.5′	05°30.1	12.2′	58.9′
9	315°42.7	· · 28.1	22°49.3	10.5′	05°17.9	12.3′	58.9′
10	330°42.6	28.5	37°18.8	10.5′	05°05.6	12.2′	58.9′
11	345°42.5	28.9	51°48.3	10.4′	04°53.4	12.3′	59.0′
12	0°42.4	N21°29.3	66°17.7	10.4′	S04°41.1	12.4′	59.0′
13	15°42.3	29.7	80°47.1	10.4′	04°28.7	12.4′	59.0′
14	30°42.3	30.1	95°16.5	10.4′	04°16.3	12.4′	59.1′
15	45°42.2	· · 30.5	109°45.9	10.4′	04°03.9	12.5′	59.1′
16	60°42.1	30.9	124°15.3	10.3′	03°51.4	12.5′	59.1′
17	75°42.0	31.3	138°44.6	10.3′	03°38.9	12.5′	59.2′
18	90°41.9	N21°31.7	153°13.9	10.3′	S03°26.4	12.6′	59.2′
19	105°41.9	32.1	167°43.2	10.3′	03°13.8	12.6′	59.2′
20	120°41.8	32.5	182°12.5	10.2′	03°01.2	12.7′	59.3′
21	135°41.7	· · 32.9	196°41.7	10.2′	02°48.5	12.6′	59.3′
22	150°41.6	33.3	211°10.9	10.2′	02°35.9	12.7′	59.3′
23	165°41.5	33.7	225°40.1	10.2′	02°23.2	12.8′	59.4′
	SD = 15.8′	d = 0.4′	SD = 16.0′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°41.5	N21°34.1	240°09.2	10.1′	S02°10.4	12.7′	59.4′
1	195°41.4	34.5	254°38.3	10.1′	01°57.7	12.8′	59.4′
2	210°41.3	34.9	269°07.4	10.1′	01°44.9	12.8′	59.5′
3	225°41.2	· · 35.3	283°36.5	10.0′	01°32.1	12.9′	59.5′
4	240°41.1	35.7	298°05.5	10.0′	01°19.2	12.8′	59.5′
5	255°41.1	36.0	312°34.5	10.0′	01°06.4	12.9′	59.6′
6	270°41.0	N21°36.4	327°03.5	9.9′	S00°53.5	12.9′	59.6′
7	285°40.9	36.8	341°32.4	9.9′	00°40.6	12.9′	59.6′
8	300°40.8	37.2	356°01.3	9.9′	00°27.7	12.9′	59.7′
9	315°40.7	· · 37.6	10°30.2	9.8′	00°14.8	13.0′	59.7′
10	330°40.7	38.0	24°59.0	9.8′	S00°01.8	12.9′	59.7′
11	345°40.6	38.4	39°27.8	9.7′	N00°11.1	13.0′	59.8′
12	0°40.5	N21°38.7	53°56.5	9.7′	N00°24.1	13.0′	59.8′
13	15°40.4	39.1	68°25.2	9.7′	00°37.1	13.0′	59.8′
14	30°40.3	39.5	82°53.9	9.6′	00°50.1	13.0′	59.9′
15	45°40.2	· · 39.9	97°22.5	9.6′	01°03.1	13.0′	59.9′
16	60°40.2	40.3	111°51.1	9.5′	01°16.1	13.1′	59.9′
17	75°40.1	40.7	126°19.7	9.5′	01°29.2	13.0′	59.9′
18	90°40.0	N21°41.0	140°48.2	9.5′	N01°42.2	13.0′	60.0′
19	105°39.9	41.4	155°16.6	9.4′	01°55.2	13.1′	60.0′
20	120°39.8	41.8	169°45.0	9.4′	02°08.3	13.0′	60.0′
21	135°39.7	· · 42.2	184°13.4	9.3′	02°21.3	13.0′	60.1′
22	150°39.7	42.6	198°41.7	9.3′	02°34.3	13.1′	60.1′
23	165°39.6	42.9	213°10.0	9.2′	02°47.4	13.0′	60.1′
	SD = 15.8′	d = 0.4′	SD = 16.2′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°39.5	N21°43.3	227°38.2	9.2′	N03°00.4	13.0′	60.1′
1	195°39.4	43.7	242°06.4	9.1′	03°13.4	13.0′	60.2′
2	210°39.3	44.1	256°34.6	9.1′	03°26.4	13.0′	60.2′
3	225°39.2	· · 44.4	271°02.7	9.0′	03°39.4	13.0′	60.2′
4	240°39.1	44.8	285°30.7	9.0′	03°52.4	13.0′	60.3′
5	255°39.1	45.2	299°58.7	8.9′	04°05.4	13.0′	60.3′
6	270°39.0	N21°45.6	314°26.6	8.9′	N04°18.4	13.0′	60.3′
7	285°38.9	45.9	328°54.5	8.8′	04°31.4	12.9′	60.3′
8	300°38.8	46.3	343°22.3	8.8′	04°44.3	13.0′	60.4′
9	315°38.7	· · 46.7	357°50.1	8.7′	04°57.3	12.9′	60.4′
10	330°38.6	47.0	12°17.9	8.7′	05°10.2	12.9′	60.4′
11	345°38.5	47.4	26°45.5	8.6′	05°23.1	12.8′	60.4′
12	0°38.4	N21°47.8	41°13.1	8.6′	N05°35.9	12.9′	60.5′
13	15°38.4	48.1	55°40.7	8.5′	05°48.8	12.8′	60.5′
14	30°38.3	48.5	70°08.2	8.5′	06°01.6	12.8′	60.5′
15	45°38.2	· · 48.9	84°35.7	8.4′	06°14.4	12.8′	60.5′
16	60°38.1	49.2	99°03.1	8.3′	06°27.2	12.7′	60.5′
17	75°38.0	49.6	113°30.4	8.3′	06°39.9	12.7′	60.6′
18	90°37.9	N21°50.0	127°57.7	8.2′	N06°52.6	12.7′	60.6′
19	105°37.8	50.3	142°24.9	8.2′	07°05.3	12.7′	60.6′
20	120°37.7	50.7	156°52.0	8.1′	07°18.0	12.6′	60.6′
21	135°37.7	· · 51.1	171°19.1	8.0′	07°30.6	12.6′	60.7′
22	150°37.6	51.4	185°46.2	8.0′	07°43.2	12.5′	60.7′
23	165°37.5	51.8	200°13.2	7.9′	07°55.7	12.5′	60.7′
	SD = 15.8′	d = 0.4′	SD = 16.4′				

Lat.	**Twilight** Naut.	**Twilight** Civil	**Sunrise**	**Sunset**	**Twilight** Civil	**Twilight** Naut.
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	▭	▭	▭	▭	▭	▭
66°	////	////	01:26	22:33	////	////
64°	////	////	02:06	21:51	////	////
62°	////	00:40	02:33	21:23	23:23	////
60°	////	01:35	02:54	21:02	22:22	////
N 58°	////	02:07	03:11	20:44	21:50	////
56°	00:36	02:29	03:26	20:30	21:27	23:26
54°	01:27	02:48	03:38	20:18	21:08	22:30
52°	01:56	03:03	03:49	20:07	20:53	22:01
50°	02:17	03:16	03:58	19:57	20:39	21:39
45°	02:56	03:42	04:18	19:37	20:13	21:00
N 40°	03:23	04:03	04:35	19:20	19:52	20:32
35°	03:44	04:19	04:48	19:07	19:36	20:11
30°	04:01	04:33	05:00	18:55	19:22	19:54
20°	04:27	04:56	05:20	18:34	18:59	19:27
N 10°	04:48	05:15	05:38	18:17	18:40	19:07
0°	05:06	05:31	05:54	18:01	18:23	18:49
S 10°	05:21	05:47	06:10	17:45	18:07	18:33
20°	05:36	06:03	06:27	17:28	17:52	18:19
30°	05:51	06:20	06:46	17:08	17:34	18:04
35°	05:58	06:30	06:57	16:57	17:25	17:56
40°	06:07	06:40	07:10	16:44	17:14	17:48
45°	06:16	06:52	07:25	16:29	17:02	17:39
S 50°	06:26	07:06	07:44	16:11	16:48	17:28
52°	06:30	07:13	07:53	16:02	16:41	17:24
54°	06:35	07:20	08:02	15:52	16:34	17:19
56°	06:40	07:28	08:13	15:41	16:26	17:14
58°	06:46	07:37	08:26	15:28	16:17	17:08
S 60°	06:53	07:47	08:41	15:13	16:07	17:02

Lat.	**Moonrise** Thu	Fri	Sat	**Moonset** Thu	Fri	Sat
N 72°	02:41	02:27	02:13	12:37	14:40	16:47
N 70°	02:31	02:24	02:17	12:44	14:39	16:37
68°	02:24	02:22	02:21	12:50	14:38	16:29
66°	02:17	02:21	02:24	12:54	14:37	16:23
64°	02:12	02:19	02:27	12:58	14:36	16:17
62°	02:07	02:18	02:29	13:02	14:36	16:12
60°	02:03	02:17	02:31	13:05	14:35	16:08
N 58°	01:59	02:16	02:33	13:07	14:35	16:04
56°	01:56	02:15	02:35	13:10	14:34	16:01
54°	01:53	02:14	02:36	13:12	14:34	15:58
52°	01:50	02:14	02:38	13:14	14:33	15:56
50°	01:47	02:13	02:39	13:15	14:33	15:53
45°	01:42	02:12	02:42	13:19	14:32	15:48
N 40°	01:37	02:10	02:44	13:22	14:32	15:44
35°	01:33	02:09	02:46	13:25	14:31	15:40
30°	01:30	02:08	02:48	13:27	14:31	15:37
20°	01:24	02:07	02:51	13:31	14:30	15:31
N 10°	01:19	02:06	02:54	13:34	14:29	15:26
0°	01:14	02:04	02:56	13:38	14:29	15:22
S 10°	01:08	02:03	02:59	13:41	14:28	15:17
20°	01:03	02:02	03:02	13:44	14:27	15:12
30°	00:57	02:00	03:05	13:48	14:26	15:07
35°	00:53	01:59	03:07	13:50	14:26	15:03
40°	00:49	01:58	03:09	13:52	14:25	15:00
45°	00:45	01:57	03:12	13:55	14:25	14:55
S 50°	00:39	01:56	03:15	13:58	14:24	14:50
52°	00:37	01:55	03:17	14:00	14:23	14:48
54°	00:34	01:55	03:18	14:02	14:23	14:46
56°	00:31	01:54	03:20	14:03	14:23	14:43
58°	00:27	01:53	03:22	14:05	14:22	14:40
S 60°	00:23	01:52	03:24	14:08	14:22	14:36

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 24-26 38-17%
28	02:53	02:50	11:57	07:26	19:51	
29	02:46	02:42	11:57	08:16	20:42	
30	02:38	02:34	11:57	09:09	21:36	

May 31, 01, 02 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	248°24.2	165°28.2	N23°57.2	194°27.4	N19°16.3	67°24.9	N01°07.3	64°38.0	N01°06.8
1	263°26.7	180°27.3	57.4	209°28.1	16.8	82°27.4	07.3	79°40.4	06.8
2	278°29.2	195°26.5	57.7	224°28.7	17.2	97°29.8	07.3	94°42.9	06.8
3	293°31.6	210°25.6	·· 57.9	239°29.3	·· 17.7	112°32.3	·· 07.2	109°45.4	·· 06.8
4	308°34.1	225°24.7	58.2	254°29.9	18.1	127°34.7	07.2	124°47.9	06.8
5	323°36.6	240°23.8	58.4	269°30.5	18.6	142°37.2	07.2	139°50.4	06.8
6	338°39.0	255°22.9	N23°58.6	284°31.1	N19°19.0	157°39.6	N01°07.2	154°52.9	N01°06.8
7	353°41.5	270°22.1	58.9	299°31.8	19.5	172°42.0	07.2	169°55.4	06.8
8	8°43.9	285°21.2	59.1	314°32.4	19.9	187°44.5	07.1	184°57.9	06.8
9	23°46.4	300°20.3	·· 59.4	329°33.0	·· 20.3	202°46.9	·· 07.1	200°00.3	·· 06.8
10	38°48.9	315°19.4	59.6	344°33.6	20.8	217°49.4	07.1	215°02.8	06.8
11	53°51.3	330°18.5	23°59.8	359°34.2	21.2	232°51.8	07.1	230°05.3	06.8
12	68°53.8	345°17.7	N24°00.1	14°34.8	N19°21.7	247°54.3	N01°07.1	245°07.8	N01°06.8
13	83°56.3	0°16.8	00.3	29°35.5	22.1	262°56.7	07.0	260°10.3	06.8
14	98°58.7	15°15.9	00.5	44°36.1	22.6	277°59.1	07.0	275°12.8	06.8
15	114°01.2	30°15.0	·· 00.7	59°36.7	·· 23.0	293°01.6	·· 07.0	290°15.3	·· 06.8
16	129°03.7	45°14.1	01.0	74°37.3	23.5	308°04.0	07.0	305°17.7	06.8
17	144°06.1	60°13.3	01.2	89°37.9	23.9	323°06.5	07.0	320°20.2	06.8
18	159°08.6	75°12.4	N24°01.4	104°38.5	N19°24.3	338°08.9	N01°06.9	335°22.7	N01°06.8
19	174°11.1	90°11.5	01.6	119°39.2	24.8	353°11.4	06.9	350°25.2	06.8
20	189°13.5	105°10.6	01.9	134°39.8	25.2	8°13.8	06.9	5°27.7	06.8
21	204°16.0	120°09.7	·· 02.1	149°40.4	·· 25.7	23°16.2	·· 06.9	20°30.2	·· 06.8
22	219°18.4	135°08.8	02.3	164°41.0	26.1	38°18.7	06.8	35°32.6	06.8
23	234°20.9	150°08.0	02.5	179°41.6	26.5	53°21.1	06.8	50°35.1	06.8
Mer.pass. 07:25		ν -0.9′	d 0.2′	m -3.90	ν 0.6′	d 0.4′	m 1.37	ν 2.4′	d 0.0′ m -2.16	ν 2.5′	d 0.0′ m 0.77

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	249°23.4	165°07.1	N24°02.7	194°42.2	N19°27.0	68°23.5	N01°06.8	65°37.6	N01°06.8
1	264°25.8	180°06.2	02.9	209°42.9	27.4	83°26.0	06.8	80°40.1	06.8
2	279°28.3	195°05.3	03.2	224°43.5	27.9	98°28.4	06.8	95°42.6	06.8
3	294°30.8	210°04.4	·· 03.4	239°44.1	·· 28.3	113°30.9	·· 06.7	110°45.1	·· 06.8
4	309°33.2	225°03.5	03.6	254°44.7	28.7	128°33.3	06.7	125°47.6	06.8
5	324°35.7	240°02.7	03.8	269°45.3	29.2	143°35.7	06.7	140°50.0	06.8
6	339°38.2	255°01.8	N24°04.0	284°45.9	N19°29.6	158°38.2	N01°06.7	155°52.5	N01°06.8
7	354°40.6	270°00.9	04.2	299°46.6	30.1	173°40.6	06.6	170°55.0	06.8
8	9°43.1	285°00.0	04.4	314°47.2	30.5	188°43.1	06.6	185°57.5	06.8
9	24°45.6	299°59.1	·· 04.6	329°47.8	·· 30.9	203°45.5	·· 06.6	201°00.0	·· 06.8
10	39°48.0	314°58.2	04.8	344°48.4	31.4	218°47.9	06.6	216°02.4	06.8
11	54°50.5	329°57.4	05.0	359°49.0	31.8	233°50.4	06.5	231°04.9	06.8
12	69°52.9	344°56.5	N24°05.2	14°49.6	N19°32.2	248°52.8	N01°06.5	246°07.4	N01°06.8
13	84°55.4	359°55.6	05.4	29°50.3	32.7	263°55.2	06.5	261°09.9	06.8
14	99°57.9	14°54.7	05.6	44°50.9	33.1	278°57.7	06.5	276°12.4	06.8
15	115°00.3	29°53.8	·· 05.8	59°51.5	·· 33.5	294°00.1	·· 06.5	291°14.9	·· 06.8
16	130°02.8	44°52.9	06.0	74°52.1	34.0	309°02.5	06.4	306°17.3	06.8
17	145°05.3	59°52.0	06.2	89°52.7	34.4	324°05.0	06.4	321°19.8	06.7
18	160°07.7	74°51.2	N24°06.4	104°53.3	N19°34.8	339°07.4	N01°06.4	336°22.3	N01°06.7
19	175°10.2	89°50.3	06.6	119°53.9	35.3	354°09.8	06.4	351°24.8	06.7
20	190°12.7	104°49.4	06.8	134°54.6	35.7	9°12.3	06.3	6°27.3	06.7
21	205°15.1	119°48.5	·· 07.0	149°55.2	·· 36.1	24°14.7	·· 06.3	21°29.7	·· 06.7
22	220°17.6	134°47.6	07.2	164°55.8	36.6	39°17.1	06.3	36°32.2	06.7
23	235°20.1	149°46.7	07.4	179°56.4	37.0	54°19.6	06.3	51°34.7	06.7
Mer.pass. 07:21		ν -0.9′	d 0.2′	m -3.90	ν 0.6′	d 0.4′	m 1.38	ν 2.4′	d 0.0′ m -2.15	ν 2.5′	d 0.0′ m 0.77

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	250°22.5	164°45.8	N24°07.6	194°57.0	N19°37.4	69°22.0	N01°06.2	66°37.2	N01°06.7
1	265°25.0	179°44.9	07.7	209°57.6	37.9	84°24.4	06.2	81°39.7	06.7
2	280°27.4	194°44.1	07.9	224°58.2	38.3	99°26.9	06.2	96°42.1	06.7
3	295°29.9	209°43.2	·· 08.1	239°58.9	·· 38.7	114°29.3	·· 06.2	111°44.6	·· 06.7
4	310°32.4	224°42.3	08.3	254°59.5	39.2	129°31.7	06.1	126°47.1	06.7
5	325°34.8	239°41.4	08.5	270°00.1	39.6	144°34.2	06.1	141°49.6	06.7
6	340°37.3	254°40.5	N24°08.7	285°00.7	N19°40.0	159°36.6	N01°06.1	156°52.1	N01°06.7
7	355°39.8	269°39.6	08.8	300°01.3	40.5	174°39.0	06.1	171°54.5	06.7
8	10°42.2	284°38.7	09.0	315°01.9	40.9	189°41.4	06.0	186°57.0	06.7
9	25°44.7	299°37.9	·· 09.2	330°02.5	·· 41.3	204°43.9	·· 06.0	201°59.5	·· 06.7
10	40°47.2	314°37.0	09.4	345°03.2	41.7	219°46.3	06.0	217°02.0	06.7
11	55°49.6	329°36.1	09.5	0°03.8	42.2	234°48.7	05.9	232°04.5	06.7
12	70°52.1	344°35.2	N24°09.7	15°04.4	N19°42.6	249°51.2	N01°05.9	247°06.9	N01°06.7
13	85°54.6	359°34.3	09.9	30°05.0	43.0	264°53.6	05.9	262°09.4	06.7
14	100°57.0	14°33.4	10.0	45°05.6	43.5	279°56.0	05.9	277°11.9	06.7
15	115°59.5	29°32.5	·· 10.2	60°06.2	·· 43.9	294°58.5	·· 05.8	292°14.4	·· 06.7
16	131°01.9	44°31.6	10.4	75°06.8	44.3	310°00.9	05.8	307°16.8	06.7
17	146°04.4	59°30.7	10.5	90°07.5	44.7	325°03.3	05.8	322°19.3	06.7
18	161°06.9	74°29.9	N24°10.7	105°08.1	N19°45.2	340°05.7	N01°05.8	337°21.8	N01°06.7
19	176°09.3	89°29.0	10.9	120°08.7	45.6	355°08.2	05.7	352°24.3	06.6
20	191°11.8	104°28.1	11.0	135°09.3	46.0	10°10.6	05.7	7°26.8	06.6
21	206°14.3	119°27.2	·· 11.2	150°09.9	·· 46.4	25°13.0	·· 05.7	22°29.2	·· 06.6
22	221°16.7	134°26.3	11.4	165°10.5	46.9	40°15.4	05.6	37°31.7	06.6
23	236°19.2	149°25.4	11.5	180°11.1	47.3	55°17.9	05.6	52°34.2	06.6
Mer.pass. 07:17		ν -0.9′	d 0.2′	m -3.90	ν 0.6′	d 0.4′	m 1.38	ν 2.4′	d 0.0′ m -2.15	ν 2.5′	d 0.0′ m 0.78

Stars

	SHA	**Dec**
Alpheratz	358°09.0	28°59.0
Ankaa	353°40.0	-42°24.4
Schedar	350°08.7	56°25.7
Diphda	349°20.6	-18°05.4
Achernar	335°45.4	-57°19.8
Hamal	328°28.7	23°22.2
Polaris	327°01.2	89°10.5
Acamar	315°37.3	-40°22.8
Menkar	314°40.9	4°00.9
Mirfak	309°15.9	49°47.5
Aldebaran	291°17.8	16°28.2
Rigel	281°35.9	-8°13.5
Capella	281°11.1	45°58.7
Bellatrix	278°58.6	6°19.9
Elnath	278°43.9	28°35.5
Alnilam	276°11.5	-1°12.9
Betelgeuse	271°28.1	7°24.1
Canopus	264°07.5	-52°41.3
Sirius	258°55.6	-16°41.5
Adhara	255°32.1	-28°57.0
Procyon	245°25.5	5°16.3
Pollux	243°57.9	28°04.4
Avior	234°28.4	-59°27.2
Suhail	223°10.6	-43°21.7
Miaplacidus	221°45.2	-69°38.7
Alphard	218°20.2	-8°34.7
Regulus	208°09.6	12°03.6
Dubhe	194°21.5	61°51.4
Denebola	182°58.5	14°40.7
Gienah	176°17.3	-17°26.4
Acrux	173°36.4	-63°00.0
Gacrux	172°27.9	-57°00.7
Alioth	166°41.8	56°04.0
Spica	158°56.8	-11°03.8
Alkaid	153°17.8	49°24.6
Hadar	149°22.2	-60°17.1
Menkent	148°36.1	-36°16.8
Arcturus	146°17.8	19°16.9
Rigil Kent.	140°24.6	-60°45.5
Kochab	137°18.0	74°14.2
Zuben'ubi	137°32.2	-15°57.9
Alphecca	126°31.4	26°46.7
Antares	112°55.9	-26°23.4
Atria	108°19.2	-68°59.6
Sabik	102°40.2	-15°42.1
Shaula	96°54.7	-37°05.4
Rasalhague	96°28.8	12°34.4
Eltanin	90°57.0	51°29.4
Kaus Aust.	84°15.9	-34°23.6
Vega	80°55.1	38°45.9
Nunki	76°28.3	-26°19.1
Altair	62°31.8	8°49.1
Peacock	53°57.3	-56°47.5
Deneb	49°47.9	45°12.6
Enif	34°11.0	9°47.2
Al Na'ir	28°14.3	-47°02.9
Fomalhaut	15°50.9	-29°43.2
Scheat	14°17.1	27°58.6
Markab	14°02.7	15°06.1

May 31 Sun	**SHA**	**Mer.pass**
Venus	277°04.0	12:59
Mars	306°03.2	11:02
Jupiter	179°00.7	19:27
Saturn	176°13.7	19:38

Jun 01 Mon	**SHA**	**Mer.pass**
Venus	275°43.7	13:00
Mars	305°18.9	11:01
Jupiter	179°00.2	19:23
Saturn	176°14.2	19:34

Jun 02 Tue	**SHA**	**Mer.pass**
Venus	274°23.3	13:02
Mars	304°34.5	11:00
Jupiter	178°59.5	19:19
Saturn	176°14.7	19:30

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h

Sun	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	180°37.4	N21°52.2	214°40.1	7.9′	N08°08.2	12.4′	60.7′
1	195°37.3	52.5	229°06.9	7.8′	08°20.6	12.4′	60.7′
2	210°37.2	52.9	243°33.7	7.7′	08°33.0	12.4′	60.7′
3	225°37.1	·· 53.2	258°00.5	7.7′	08°45.4	12.3′	60.8′
4	240°37.0	53.6	272°27.1	7.6′	08°57.7	12.3′	60.8′
5	255°36.9	53.9	286°53.7	7.5′	09°10.0	12.2′	60.8′
6	270°36.8	N21°54.3	301°20.3	7.5′	N09°22.2	12.1′	60.8′
7	285°36.8	54.7	315°46.8	7.4′	09°34.3	12.1′	60.8′
8	300°36.7	55.0	330°13.2	7.4′	09°46.4	12.1′	60.9′
9	315°36.6	·· 55.4	344°39.5	7.3′	09°58.5	12.0′	60.9′
10	330°36.5	55.7	359°05.8	7.2′	10°10.5	11.9′	60.9′
11	345°36.4	56.1	13°32.0	7.2′	10°22.4	11.9′	60.9′
12	0°36.3	N21°56.4	27°58.2	7.1′	N10°34.3	11.8′	60.9′
13	15°36.2	56.8	42°24.3	7.0′	10°46.1	11.7′	60.9′
14	30°36.1	57.1	56°50.3	7.0′	10°57.8	11.7′	60.9′
15	45°36.0	·· 57.5	71°16.3	6.9′	11°09.5	11.6′	60.9′
16	60°35.9	57.8	85°42.2	6.8′	11°21.1	11.5′	61.0′
17	75°35.8	58.2	100°08.0	6.8′	11°32.6	11.5′	61.0′
18	90°35.7	N21°58.5	114°33.8	6.7′	N11°44.1	11.4′	61.0′
19	105°35.6	58.9	128°59.5	6.6′	11°55.5	11.3′	61.0′
20	120°35.6	59.2	143°25.1	6.6′	12°06.8	11.2′	61.0′
21	135°35.5	·· 59.6	157°50.7	6.5′	12°18.0	11.2′	61.0′
22	150°35.4	21°59.9	172°16.2	6.4′	12°29.2	11.1′	61.0′
23	165°35.3	22°00.3	186°41.6	6.4′	12°40.3	11.0′	61.0′
	SD = 15.8′	d = 0.4′		SD = 16.6′			

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	180°35.2	N22°00.6	201°07.0	6.3′	N12°51.3	10.9′	61.0′
1	195°35.1	01.0	215°32.3	6.2′	13°02.2	10.8′	61.0′
2	210°35.0	01.3	229°57.5	6.2′	13°13.0	10.8′	61.1′
3	225°34.9	·· 01.6	244°22.7	6.1′	13°23.8	10.6′	61.1′
4	240°34.8	02.0	258°47.8	6.1′	13°34.4	10.6′	61.1′
5	255°34.7	02.3	273°12.9	6.0′	13°45.0	10.4′	61.1′
6	270°34.6	N22°02.7	287°37.9	5.9′	N13°55.4	10.4′	61.1′
7	285°34.5	03.0	302°02.8	5.9′	14°05.8	10.3′	61.1′
8	300°34.4	03.4	316°27.7	5.8′	14°16.1	10.2′	61.1′
9	315°34.3	·· 03.7	330°52.5	5.7′	14°26.3	10.1′	61.1′
10	330°34.2	04.0	345°17.2	5.7′	14°36.4	10.0′	61.1′
11	345°34.1	04.4	359°41.9	5.6′	14°46.4	9.9′	61.1′
12	0°34.0	N22°04.7	14°06.5	5.6′	N14°56.3	9.8′	61.1′
13	15°33.9	05.0	28°31.0	5.5′	15°06.1	9.6′	61.1′
14	30°33.8	05.4	42°55.5	5.4′	15°15.7	9.6′	61.1′
15	45°33.7	·· 05.7	57°20.0	5.4′	15°25.3	9.5′	61.1′
16	60°33.6	06.0	71°44.3	5.3′	15°34.8	9.3′	61.1′
17	75°33.6	06.4	86°08.7	5.3′	15°44.1	9.3′	61.1′
18	90°33.5	N22°06.7	100°32.9	5.2′	N15°53.4	9.1′	61.1′
19	105°33.4	07.0	114°57.1	5.1′	16°02.5	9.1′	61.1′
20	120°33.3	07.4	129°21.3	5.1′	16°11.6	8.9′	61.1′
21	135°33.2	·· 07.7	143°45.4	5.0′	16°20.5	8.8′	61.1′
22	150°33.1	08.0	158°09.4	5.0′	16°29.3	8.6′	61.1′
23	165°33.0	08.4	172°33.4	4.9′	16°37.9	8.6′	61.1′
	SD = 15.8′	d = 0.3′		SD = 16.6′			

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	180°32.9	N22°08.7	186°57.3	4.9′	N16°46.5	8.4′	61.1′
1	195°32.8	09.0	201°21.2	4.8′	16°54.9	8.3′	61.1′
2	210°32.7	09.4	215°45.0	4.8′	17°03.2	8.2′	61.1′
3	225°32.6	·· 09.7	230°08.8	4.7′	17°11.4	8.1′	61.0′
4	240°32.5	10.0	244°32.6	4.7′	17°19.5	7.9′	61.0′
5	255°32.4	10.3	258°56.2	4.6′	17°27.4	7.8′	61.0′
6	270°32.3	N22°10.7	273°19.9	4.6′	N17°35.2	7.7′	61.0′
7	285°32.2	11.0	287°43.5	4.6′	17°42.9	7.6′	61.0′
8	300°32.1	11.3	302°07.0	4.5′	17°50.5	7.4′	61.0′
9	315°32.0	·· 11.6	316°30.5	4.5′	17°57.9	7.3′	61.0′
10	330°31.9	12.0	330°54.0	4.4′	18°05.2	7.2′	61.0′
11	345°31.8	12.3	345°17.4	4.4′	18°12.4	7.0′	61.0′
12	0°31.7	N22°12.6	359°40.8	4.4′	N18°19.4	6.9′	61.0′
13	15°31.6	12.9	14°04.2	4.3′	18°26.3	6.7′	61.0′
14	30°31.5	13.2	28°27.5	4.3′	18°33.0	6.7′	60.9′
15	45°31.4	·· 13.6	42°50.8	4.3′	18°39.7	6.4′	60.9′
16	60°31.3	13.9	57°14.0	4.2′	18°46.1	6.4′	60.9′
17	75°31.2	14.2	71°37.3	4.2′	18°52.5	6.2′	60.9′
18	90°31.1	N22°14.5	86°00.4	4.2′	N18°58.7	6.0′	60.9′
19	105°31.0	14.8	100°23.6	4.1′	19°04.7	6.0′	60.9′
20	120°30.9	15.1	114°46.7	4.1′	19°10.7	5.7′	60.9′
21	135°30.8	·· 15.5	129°09.9	4.1′	19°16.4	5.7′	60.8′
22	150°30.7	15.8	143°32.9	4.1′	19°22.1	5.5′	60.8′
23	165°30.6	16.1	157°56.0	4.0′	19°27.6	5.3′	60.8′
	SD = 15.8′	d = 0.3′		SD = 16.7′			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	▭	▭	▭	▭	▭	▭
66°	////	////	01:13	22:47	////	////
64°	////	////	01:58	21:59	////	////
62°	////	////	02:27	21:30	////	////
60°	////	01:26	02:49	21:07	22:32	////
N 58°	////	02:00	03:07	20:49	21:57	////
56°	////	02:25	03:22	20:34	21:32	////
54°	01:19	02:44	03:35	20:21	21:13	22:39
52°	01:50	03:00	03:46	20:10	20:57	22:07
50°	02:13	03:13	03:56	20:00	20:43	21:44
45°	02:53	03:40	04:17	19:39	20:16	21:03
N 40°	03:21	04:01	04:33	19:23	19:55	20:35
35°	03:42	04:18	04:47	19:08	19:38	20:14
30°	04:00	04:32	04:59	18:56	19:23	19:56
20°	04:27	04:56	05:20	18:36	19:00	19:29
N 10°	04:48	05:15	05:38	18:18	18:41	19:07
0°	05:06	05:32	05:54	18:01	18:24	18:50
S 10°	05:22	05:48	06:10	17:45	18:08	18:34
20°	05:37	06:04	06:28	17:28	17:51	18:19
30°	05:52	06:21	06:48	17:08	17:34	18:03
35°	06:00	06:31	06:59	16:56	17:24	17:55
40°	06:08	06:42	07:12	16:43	17:13	17:47
45°	06:18	06:55	07:28	16:27	17:01	17:37
S 50°	06:28	07:09	07:47	16:08	16:46	17:27
52°	06:33	07:16	07:56	15:59	16:39	17:22
54°	06:38	07:24	08:06	15:49	16:32	17:17
56°	06:44	07:32	08:17	15:38	16:23	17:11
58°	06:50	07:41	08:31	15:24	16:14	17:05
S 60°	06:56	07:51	08:46	15:09	16:04	16:59

Lat.	Moonrise Sun	Moonrise Mon	Moonrise Tue	Moonset Sun	Moonset Mon	Moonset Tue
N 72°	01:58	01:39	01:03	19:04	21:42	▭
N 70°	02:10	02:02	01:51	18:42	20:56	23:28
68°	02:20	02:20	02:22	18:25	20:26	22:26
66°	02:29	02:35	02:46	18:12	20:03	21:51
64°	02:36	02:47	03:04	18:01	19:46	21:26
62°	02:42	02:58	03:19	17:52	19:31	21:06
60°	02:47	03:07	03:32	17:44	19:19	20:50
N 58°	02:52	03:15	03:43	17:37	19:09	20:37
56°	02:56	03:22	03:53	17:30	19:00	20:25
54°	03:00	03:28	04:02	17:25	18:52	20:15
52°	03:04	03:33	04:09	17:20	18:44	20:06
50°	03:07	03:39	04:16	17:16	18:38	19:57
45°	03:14	03:50	04:31	17:06	18:24	19:40
N 40°	03:20	03:59	04:44	16:58	18:13	19:26
35°	03:25	04:07	04:54	16:51	18:03	19:14
30°	03:29	04:14	05:03	16:45	17:55	19:04
20°	03:37	04:26	05:19	16:35	17:40	18:46
N 10°	03:44	04:37	05:34	16:26	17:27	18:30
0°	03:51	04:47	05:47	16:17	17:15	18:16
S 10°	03:57	04:58	06:00	16:09	17:03	18:01
20°	04:04	05:09	06:15	16:00	16:51	17:46
30°	04:12	05:21	06:31	15:49	16:36	17:28
35°	04:17	05:29	06:41	15:44	16:28	17:18
40°	04:23	05:37	06:52	15:37	16:19	17:06
45°	04:29	05:47	07:05	15:29	16:07	16:52
S 50°	04:37	05:59	07:21	15:20	15:54	16:35
52°	04:40	06:05	07:28	15:16	15:48	16:27
54°	04:44	06:11	07:37	15:11	15:41	16:19
56°	04:48	06:18	07:46	15:06	15:33	16:09
58°	04:53	06:26	07:57	15:00	15:25	15:58
S 60°	04:59	06:35	08:09	14:53	15:15	15:45

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 27-0 9-0%
31	02:30	02:25	11:58	10:04	22:32	
01	02:21	02:16	11:58	11:01	23:31	
02	02:11	02:07	11:58	12:01	–:–	

June 03, 04, 05 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	251°21.7	164°24.5	N24°11.7	195°11.7	N19°47.7	70°20.3	N01°05.6	67°36.7	N01°06.6
1	266°24.1	179°23.6	11.8	210°12.4	48.1	85°22.7	05.6	82°39.1	06.6
2	281°26.6	194°22.7	12.0	225°13.0	48.6	100°25.1	05.5	97°41.6	06.6
3	296°29.0	209°21.8	·· 12.1	240°13.6	·· 49.0	115°27.6	·· 05.5	112°44.1	·· 06.6
4	311°31.5	224°21.0	12.3	255°14.2	49.4	130°30.0	05.5	127°46.6	06.6
5	326°34.0	239°20.1	12.4	270°14.8	49.8	145°32.4	05.4	142°49.0	06.6
6	341°36.4	254°19.2	N24°12.6	285°15.4	N19°50.2	160°34.8	N01°05.4	157°51.5	N01°06.6
7	356°38.9	269°18.3	12.7	300°16.0	50.7	175°37.3	05.4	172°54.0	06.6
8	11°41.4	284°17.4	12.9	315°16.6	51.1	190°39.7	05.4	187°56.5	06.6
9	26°43.8	299°16.5	·· 13.0	330°17.3	·· 51.5	205°42.1	·· 05.3	202°58.9	·· 06.6
10	41°46.3	314°15.6	13.2	345°17.9	51.9	220°44.5	05.3	218°01.4	06.6
11	56°48.8	329°14.7	13.3	0°18.5	52.3	235°46.9	05.3	233°03.9	06.6
12	71°51.2	344°13.8	N24°13.5	15°19.1	N19°52.8	250°49.4	N01°05.2	248°06.4	N01°06.6
13	86°53.7	359°12.9	13.6	30°19.7	53.2	265°51.8	05.2	263°08.8	06.6
14	101°56.2	14°12.1	13.8	45°20.3	53.6	280°54.2	05.2	278°11.3	06.5
15	116°58.6	29°11.2	·· 13.9	60°20.9	·· 54.0	295°56.6	·· 05.2	293°13.8	·· 06.5
16	132°01.1	44°10.3	14.0	75°21.5	54.4	310°59.1	05.1	308°16.3	06.5
17	147°03.5	59°09.4	14.2	90°22.2	54.9	326°01.5	05.1	323°18.7	06.5
18	162°06.0	74°08.5	N24°14.3	105°22.8	N19°55.3	341°03.9	N01°05.1	338°21.2	N01°06.5
19	177°08.5	89°07.6	14.4	120°23.4	55.7	356°06.3	05.0	353°23.7	06.5
20	192°10.9	104°06.7	14.6	135°24.0	56.1	11°08.7	05.0	8°26.1	06.5
21	207°13.4	119°05.8	·· 14.7	150°24.6	·· 56.5	26°11.2	·· 05.0	23°28.6	·· 06.5
22	222°15.9	134°04.9	14.8	165°25.2	56.9	41°13.6	04.9	38°31.1	06.5
23	237°18.3	149°04.0	15.0	180°25.8	57.4	56°16.0	04.9	53°33.6	06.5
Mer.pass. 07:13		ν -0.9′	d 0.2′	m -3.90	ν 0.6′	d 0.4′	m 1.39	ν 2.4′	d 0.0′ m -2.14	ν 2.5′	d 0.0′ m 0.78

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	252°20.8	164°03.1	N24°15.1	195°26.4	N19°57.8	71°18.4	N01°04.9	68°36.0	N01°06.5
1	267°23.3	179°02.2	15.2	210°27.0	58.2	86°20.8	04.8	83°38.5	06.5
2	282°25.7	194°01.4	15.3	225°27.7	58.6	101°23.2	04.8	98°41.0	06.5
3	297°28.2	209°00.5	·· 15.5	240°28.3	·· 59.0	116°25.7	·· 04.8	113°43.5	·· 06.5
4	312°30.7	223°59.6	15.6	255°28.9	59.4	131°28.1	04.8	128°45.9	06.5
5	327°33.1	238°58.7	15.7	270°29.5	19°59.8	146°30.5	04.7	143°48.4	06.4
6	342°35.6	253°57.8	N24°15.8	285°30.1	N20°00.3	161°32.9	N01°04.7	158°50.9	N01°06.4
7	357°38.0	268°56.9	15.9	300°30.7	00.7	176°35.3	04.7	173°53.3	06.4
8	12°40.5	283°56.0	16.1	315°31.3	01.1	191°37.7	04.6	188°55.8	06.4
9	27°43.0	298°55.1	·· 16.2	330°31.9	·· 01.5	206°40.2	·· 04.6	203°58.3	·· 06.4
10	42°45.4	313°54.2	16.3	345°32.5	01.9	221°42.6	04.6	219°00.8	06.4
11	57°47.9	328°53.3	16.4	0°33.2	02.3	236°45.0	04.5	234°03.2	06.4
12	72°50.4	343°52.4	N24°16.5	15°33.8	N20°02.7	251°47.4	N01°04.5	249°05.7	N01°06.4
13	87°52.8	358°51.5	16.6	30°34.4	03.1	266°49.8	04.5	264°08.2	06.4
14	102°55.3	13°50.6	16.7	45°35.0	03.6	281°52.2	04.4	279°10.6	06.4
15	117°57.8	28°49.8	·· 16.9	60°35.6	·· 04.0	296°54.7	·· 04.4	294°13.1	·· 06.4
16	133°00.2	43°48.9	17.0	75°36.2	04.4	311°57.1	04.4	309°15.6	06.4
17	148°02.7	58°48.0	17.1	90°36.8	04.8	326°59.5	04.3	324°18.0	06.4
18	163°05.2	73°47.1	N24°17.2	105°37.4	N20°05.2	342°01.9	N01°04.3	339°20.5	N01°06.3
19	178°07.6	88°46.2	17.3	120°38.0	05.6	357°04.3	04.3	354°23.0	06.3
20	193°10.1	103°45.3	17.4	135°38.7	06.0	12°06.7	04.2	9°25.5	06.3
21	208°12.5	118°44.4	·· 17.5	150°39.3	·· 06.4	27°09.1	·· 04.2	24°27.9	·· 06.3
22	223°15.0	133°43.5	17.6	165°39.9	06.8	42°11.5	04.2	39°30.4	06.3
23	238°17.5	148°42.6	17.7	180°40.5	07.2	57°14.0	04.1	54°32.9	06.3
Mer.pass. 07:09		ν -0.9′	d 0.1′	m -3.90	ν 0.6′	d 0.4′	m 1.39	ν 2.4′	d 0.0′ m -2.13	ν 2.5′	d 0.0′ m 0.78

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	253°19.9	163°41.7	N24°17.8	195°41.1	N20°07.6	72°16.4	N01°04.1	69°35.3	N01°06.3
1	268°22.4	178°40.8	17.9	210°41.7	08.1	87°18.8	04.1	84°37.8	06.3
2	283°24.9	193°39.9	18.0	225°42.3	08.5	102°21.2	04.0	99°40.3	06.3
3	298°27.3	208°39.0	·· 18.1	240°42.9	·· 08.9	117°23.6	·· 04.0	114°42.7	·· 06.3
4	313°29.8	223°38.1	18.2	255°43.5	09.3	132°26.0	04.0	129°45.2	06.3
5	328°32.3	238°37.2	18.2	270°44.1	09.7	147°28.4	03.9	144°47.7	06.2
6	343°34.7	253°36.4	N24°18.3	285°44.8	N20°10.1	162°30.8	N01°03.9	159°50.1	N01°06.2
7	358°37.2	268°35.5	18.4	300°45.4	10.5	177°33.2	03.9	174°52.6	06.2
8	13°39.7	283°34.6	18.5	315°46.0	10.9	192°35.7	03.8	189°55.1	06.2
9	28°42.1	298°33.7	·· 18.6	330°46.6	·· 11.3	207°38.1	·· 03.8	204°57.5	·· 06.2
10	43°44.6	313°32.8	18.7	345°47.2	11.7	222°40.5	03.7	220°00.0	06.2
11	58°47.0	328°31.9	18.8	0°47.8	12.1	237°42.9	03.7	235°02.5	06.2
12	73°49.5	343°31.0	N24°18.9	15°48.4	N20°12.5	252°45.3	N01°03.7	250°04.9	N01°06.2
13	88°52.0	358°30.1	18.9	30°49.0	12.9	267°47.7	03.6	265°07.4	06.2
14	103°54.4	13°29.2	19.0	45°49.6	13.3	282°50.1	03.6	280°09.9	06.2
15	118°56.9	28°28.3	·· 19.1	60°50.2	·· 13.7	297°52.5	·· 03.6	295°12.3	·· 06.2
16	133°59.4	43°27.4	19.2	75°50.8	14.1	312°54.9	03.5	310°14.8	06.1
17	149°01.8	58°26.5	19.3	90°51.5	14.5	327°57.3	03.5	325°17.3	06.1
18	164°04.3	73°25.6	N24°19.3	105°52.1	N20°14.9	342°59.7	N01°03.5	340°19.7	N01°06.1
19	179°06.8	88°24.7	19.4	120°52.7	15.3	358°02.1	03.4	355°22.2	06.1
20	194°09.2	103°23.8	19.5	135°53.3	15.7	13°04.5	03.4	10°24.7	06.1
21	209°11.7	118°22.9	·· 19.5	150°53.9	·· 16.1	28°07.0	·· 03.4	25°27.1	·· 06.1
22	224°14.2	133°22.0	19.6	165°54.5	16.5	43°09.4	03.3	40°29.6	06.1
23	239°16.6	148°21.2	19.7	180°55.1	16.9	58°11.8	03.3	55°32.1	06.1
Mer.pass. 07:06		ν -0.9′	d 0.1′	m -3.90	ν 0.6′	d 0.4′	m 1.40	ν 2.4′	d 0.0′ m -2.12	ν 2.5′	d 0.0′ m 0.79

Stars

	SHA	Dec
Alpheratz	358°08.9	28°59.0
Ankaa	353°40.0	-42°24.3
Schedar	350°08.7	56°25.8
Diphda	349°20.5	-18°05.4
Achernar	335°45.3	-57°19.8
Hamal	328°28.6	23°22.2
Polaris	327°00.2	89°10.4
Acamar	315°37.3	-40°22.8
Menkar	314°40.9	4°00.9
Mirfak	309°15.9	49°47.5
Aldebaran	291°17.8	16°28.2
Rigel	281°35.9	-8°13.5
Capella	281°11.1	45°58.7
Bellatrix	278°58.6	6°19.9
Elnath	278°43.9	28°35.5
Alnilam	276°11.5	-1°12.9
Betelgeuse	271°28.1	7°24.1
Canopus	264°07.5	-52°41.3
Sirius	258°55.6	-16°41.5
Adhara	255°32.1	-28°56.9
Procyon	245°25.5	5°16.4
Pollux	243°57.9	28°04.4
Avior	234°28.4	-59°27.2
Suhail	223°10.6	-43°21.7
Miaplacidus	221°45.3	-69°38.7
Alphard	218°20.2	-8°34.7
Regulus	208°09.6	12°03.6
Dubhe	194°21.5	61°51.4
Denebola	182°58.5	14°40.7
Gienah	176°17.4	-17°26.4
Acrux	173°36.5	-63°00.0
Gacrux	172°27.9	-57°00.7
Alioth	166°41.8	56°04.0
Spica	158°56.8	-11°03.8
Alkaid	153°17.8	49°24.6
Hadar	149°22.2	-60°17.1
Menkent	148°36.1	-36°16.8
Arcturus	146°17.8	19°16.9
Rigil Kent.	140°24.6	-60°45.5
Kochab	137°18.0	74°14.2
Zuben'ubi	137°32.2	-15°57.9
Alphecca	126°31.4	26°46.7
Antares	112°55.9	-26°23.4
Atria	108°19.2	-68°59.6
Sabik	102°40.2	-15°42.1
Shaula	96°54.7	-37°05.4
Rasalhague	96°28.8	12°34.4
Eltanin	90°57.0	51°29.4
Kaus Aust.	84°15.8	-34°23.6
Vega	80°55.1	38°45.9
Nunki	76°28.2	-26°19.1
Altair	62°31.8	8°49.1
Peacock	53°57.3	-56°47.5
Deneb	49°47.9	45°12.6
Enif	34°11.0	9°47.2
Al Na'ir	28°14.2	-47°02.9
Fomalhaut	15°50.9	-29°43.2
Scheat	14°17.1	27°58.6
Markab	14°02.7	15°06.1

Jun 03 Wed	SHA	Mer.pass
Venus	273°02.9	13:03
Mars	303°50.1	10:59
Jupiter	178°58.6	19:16
Saturn	176°15.0	19:26

Jun 04 Thu	SHA	Mer.pass
Venus	271°42.3	13:05
Mars	303°05.6	10:58
Jupiter	178°57.6	19:12
Saturn	176°15.2	19:22

Jun 05 Fri	SHA	Mer.pass
Venus	270°21.8	13:06
Mars	302°21.2	10:57
Jupiter	178°56.4	19:08
Saturn	176°15.4	19:18

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h

Wed	Sun GHA	Sun Dec	Moon GHA	ν	Moon Dec	d	HP
0	180°30.5	N22°16.4	172°19.0	4.0′	N19°32.9	5.2′	60.8′
1	195°30.4	16.7	186°42.1	4.0′	19°38.1	5.1′	60.8′
2	210°30.3	17.0	201°05.1	4.0′	19°43.2	4.9′	60.7′
3	225°30.2	·· 17.3	215°28.1	4.0′	19°48.1	4.7′	60.7′
4	240°30.0	17.6	229°51.0	4.0′	19°52.8	4.6′	60.7′
5	255°29.9	17.9	244°14.0	4.0′	19°57.4	4.5′	60.7′
6	270°29.8	N22°18.3	258°37.0	3.9′	N20°01.9	4.3′	60.7′
7	285°29.7	18.6	272°59.9	3.9′	20°06.2	4.2′	60.6′
8	300°29.6	18.9	287°22.8	3.9′	20°10.4	4.0′	60.6′
9	315°29.5	·· 19.2	301°45.8	3.9′	20°14.4	3.9′	60.6′
10	330°29.4	19.5	316°08.7	3.9′	20°18.3	3.7′	60.6′
11	345°29.3	19.8	330°31.6	3.9′	20°22.0	3.5′	60.6′
12	0°29.2	N22°20.1	344°54.6	3.9′	N20°25.5	3.4′	60.5′
13	15°29.1	20.4	359°17.5	3.9′	20°28.9	3.3′	60.5′
14	30°29.0	20.7	13°40.4	3.9′	20°32.2	3.1′	60.5′
15	45°28.9	·· 21.0	28°03.4	4.0′	20°35.3	3.0′	60.5′
16	60°28.8	21.3	42°26.3	4.0′	20°38.3	2.8′	60.4′
17	75°28.7	21.6	56°49.3	4.0′	20°41.1	2.6′	60.4′
18	90°28.6	N22°21.9	71°12.3	4.0′	N20°43.7	2.5′	60.4′
19	105°28.5	22.2	85°35.2	4.0′	20°46.2	2.4′	60.4′
20	120°28.4	22.5	99°58.2	4.0′	20°48.6	2.2′	60.3′
21	135°28.3	·· 22.8	114°21.3	4.0′	20°50.8	2.0′	60.3′
22	150°28.2	23.1	128°44.3	4.1′	20°52.8	1.9′	60.3′
23	165°28.1	23.4	143°07.4	4.1′	20°54.7	1.7′	60.2′
	SD = 15.8′	d = 0.3′		SD = 16.6′			

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	180°28.0	N22°23.7	157°30.4	4.1′	N20°56.4	1.6′	60.2′
1	195°27.9	24.0	171°53.5	4.1′	20°58.0	1.5′	60.2′
2	210°27.7	24.3	186°16.7	4.2′	20°59.5	1.2′	60.2′
3	225°27.6	·· 24.6	200°39.8	4.2′	21°00.7	1.2′	60.1′
4	240°27.5	24.9	215°03.0	4.2′	21°01.9	1.0′	60.1′
5	255°27.4	25.2	229°26.2	4.3′	21°02.9	0.8′	60.1′
6	270°27.3	N22°25.5	243°49.5	4.3′	N21°03.7	0.7′	60.0′
7	285°27.2	25.8	258°12.8	4.3′	21°04.4	0.5′	60.0′
8	300°27.1	26.1	272°36.1	4.4′	21°04.9	0.4′	60.0′
9	315°27.0	·· 26.3	286°59.5	4.4′	21°05.3	0.2′	59.9′
10	330°26.9	26.6	301°22.9	4.5′	21°05.5	0.1′	59.9′
11	345°26.8	26.9	315°46.3	4.5′	21°05.6	0.1′	59.9′
12	0°26.7	N22°27.2	330°09.8	4.5′	N21°05.5	0.2′	59.8′
13	15°26.6	27.5	344°33.4	4.6′	21°05.3	0.3′	59.8′
14	30°26.5	27.8	358°57.0	4.6′	21°05.0	0.5′	59.8′
15	45°26.4	·· 28.1	13°20.6	4.7′	21°04.5	0.7′	59.7′
16	60°26.2	28.4	27°44.3	4.7′	21°03.8	0.8′	59.7′
17	75°26.1	28.6	42°08.0	4.8′	21°03.0	0.9′	59.7′
18	90°26.0	N22°28.9	56°31.8	4.9′	N21°02.1	1.1′	59.6′
19	105°25.9	29.2	70°55.7	4.9′	21°01.0	1.2′	59.6′
20	120°25.8	29.5	85°19.6	5.0′	20°59.8	1.4′	59.6′
21	135°25.7	·· 29.8	99°43.6	5.0′	20°58.4	1.5′	59.5′
22	150°25.6	30.1	114°07.6	5.1′	20°56.9	1.7′	59.5′
23	165°25.5	30.3	128°31.7	5.2′	20°55.2	1.8′	59.5′
	SD = 15.8′	d = 0.3′		SD = 16.4′			

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	180°25.4	N22°30.6	142°55.8	5.2′	N20°53.4	1.9′	59.4′
1	195°25.3	30.9	157°20.0	5.3′	20°51.5	2.1′	59.4′
2	210°25.2	31.2	171°44.3	5.3′	20°49.4	2.2′	59.4′
3	225°25.0	·· 31.5	186°08.7	5.4′	20°47.2	2.3′	59.3′
4	240°24.9	31.7	200°33.1	5.5′	20°44.9	2.5′	59.3′
5	255°24.8	32.0	214°57.6	5.6′	20°42.4	2.6′	59.3′
6	270°24.7	N22°32.3	229°22.1	5.6′	N20°39.8	2.8′	59.2′
7	285°24.6	32.6	243°46.8	5.7′	20°37.0	2.9′	59.2′
8	300°24.5	32.8	258°11.5	5.8′	20°34.1	3.0′	59.1′
9	315°24.4	·· 33.1	272°36.3	5.9′	20°31.1	3.1′	59.1′
10	330°24.3	33.4	287°01.1	5.9′	20°28.0	3.3′	59.1′
11	345°24.2	33.7	301°26.0	6.0′	20°24.7	3.4′	59.0′
12	0°24.1	N22°33.9	315°51.1	6.1′	N20°21.3	3.6′	59.0′
13	15°23.9	34.2	330°16.1	6.2′	20°17.7	3.6′	59.0′
14	30°23.8	34.5	344°41.3	6.2′	20°14.1	3.8′	58.9′
15	45°23.7	·· 34.7	359°06.6	6.3′	20°10.3	3.9′	58.9′
16	60°23.6	35.0	13°31.9	6.4′	20°06.4	4.0′	58.8′
17	75°23.5	35.3	27°57.3	6.5′	20°02.4	4.2′	58.8′
18	90°23.4	N22°35.5	42°22.8	6.6′	N19°58.2	4.3′	58.8′
19	105°23.3	35.8	56°48.4	6.7′	19°53.9	4.4′	58.7′
20	120°23.2	36.1	71°14.0	6.8′	19°49.5	4.5′	58.7′
21	135°23.0	·· 36.3	85°39.8	6.8′	19°45.0	4.6′	58.6′
22	150°22.9	36.6	100°05.6	6.9′	19°40.4	4.8′	58.6′
23	165°22.8	36.9	114°31.6	7.0′	19°35.6	4.8′	58.6′
	SD = 15.8′	d = 0.3′		SD = 16.2′			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	▭	▭	▭	▭	▭	▭
66°	////	////	01:00	23:01	////	////
64°	////	////	01:51	22:07	////	////
62°	////	////	02:22	21:36	////	////
60°	////	01:18	02:45	21:12	22:41	////
N 58°	////	01:55	03:04	20:54	22:03	////
56°	////	02:20	03:19	20:38	21:37	////
54°	01:11	02:40	03:32	20:25	21:17	22:48
52°	01:45	02:57	03:44	20:13	21:00	22:13
50°	02:09	03:11	03:54	20:03	20:46	21:48
45°	02:50	03:39	04:15	19:42	20:18	21:07
N 40°	03:19	04:00	04:32	19:25	19:57	20:38
35°	03:41	04:17	04:46	19:10	19:40	20:16
30°	03:59	04:32	04:59	18:58	19:25	19:58
20°	04:26	04:55	05:20	18:37	19:01	19:30
N 10°	04:48	05:15	05:38	18:19	18:42	19:08
0°	05:06	05:32	05:55	18:02	18:24	18:50
S 10°	05:22	05:49	06:11	17:45	18:08	18:34
20°	05:38	06:05	06:29	17:27	17:51	18:19
30°	05:53	06:23	06:49	17:07	17:33	18:03
35°	06:01	06:33	07:01	16:55	17:23	17:55
40°	06:10	06:44	07:14	16:42	17:12	17:46
45°	06:20	06:57	07:30	16:26	16:59	17:36
S 50°	06:31	07:12	07:50	16:06	16:44	17:25
52°	06:36	07:19	07:59	15:57	16:37	17:20
54°	06:41	07:27	08:09	15:47	16:30	17:15
56°	06:47	07:35	08:21	15:35	16:21	17:10
58°	06:53	07:44	08:35	15:21	16:12	17:03
S 60°	07:00	07:55	08:51	15:05	16:01	16:56

Lat.	Moonrise Wed	Moonrise Thu	Moonrise Fri	Moonset Wed	Moonset Thu	Moonset Fri
N 72°	▭	▭	▭	▭	▭	▭
N 70°	01:28	▭	▭	▭	▭	▭
68°	02:30	02:55	04:04	·· ··	00:10	01:08
66°	03:05	03:44	04:50	23:22	·· ··	00:22
64°	03:31	04:15	05:20	22:51	23:52	·· ··
62°	03:51	04:38	05:43	22:28	23:29	·· ··
60°	04:08	04:57	06:01	22:09	23:10	23:54
N 58°	04:21	05:12	06:16	21:54	22:55	23:40
56°	04:33	05:26	06:29	21:40	22:42	23:29
54°	04:44	05:37	06:41	21:29	22:30	23:19
52°	04:53	05:47	06:51	21:19	22:20	23:10
50°	05:02	05:56	06:59	21:10	22:11	23:01
45°	05:20	06:16	07:18	20:51	21:52	22:44
N 40°	05:34	06:32	07:34	20:35	21:37	22:30
35°	05:47	06:45	07:47	20:22	21:23	22:17
30°	05:58	06:56	07:58	20:10	21:12	22:07
20°	06:16	07:16	08:17	19:51	20:52	21:48
N 10°	06:33	07:34	08:34	19:34	20:35	21:32
0°	06:48	07:50	08:50	19:18	20:19	21:17
S 10°	07:04	08:06	09:06	19:02	20:03	21:02
20°	07:20	08:24	09:22	18:45	19:45	20:46
30°	07:39	08:44	09:42	18:25	19:25	20:27
35°	07:51	08:55	09:53	18:13	19:14	20:17
40°	08:03	09:09	10:06	18:00	19:00	20:04
45°	08:19	09:25	10:21	17:45	18:44	19:49
S 50°	08:37	09:44	10:40	17:25	18:25	19:31
52°	08:46	09:54	10:49	17:16	18:15	19:22
54°	08:56	10:04	10:59	17:06	18:05	19:13
56°	09:07	10:16	11:10	16:55	17:53	19:02
58°	09:20	10:30	11:23	16:42	17:39	18:49
S 60°	09:35	10:46	11:38	16:26	17:23	18:35

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Age 1-3 1-9%
03	02:02	01:57	11:58	13:03	00:32	
04	01:52	01:47	11:58	14:04	01:34	
05	01:41	01:36	11:58	15:04	02:34	

June 06, 07, 08 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	254°19.1	163°20.3	N24°19.8	195°55.7	N20°17.3	73°14.2	N01°03.2	70°34.5	N01°06.1
1	269°21.5	178°19.4	19.8	210°56.3	17.7	88°16.6	03.2	85°37.0	06.1
2	284°24.0	193°18.5	19.9	225°56.9	18.1	103°19.0	03.2	100°39.4	06.0
3	299°26.5	208°17.6	·· 20.0	240°57.5	·· 18.5	118°21.4	·· 03.1	115°41.9	·· 06.0
4	314°28.9	223°16.7	20.0	255°58.1	18.9	133°23.8	03.1	130°44.4	06.0
5	329°31.4	238°15.8	20.1	270°58.8	19.3	148°26.2	03.1	145°46.8	06.0
6	344°33.9	253°14.9	N24°20.1	285°59.4	N20°19.7	163°28.6	N01°03.0	160°49.3	N01°06.0
7	359°36.3	268°14.0	20.2	301°00.0	20.1	178°31.0	03.0	175°51.8	06.0
8	14°38.8	283°13.1	20.3	316°00.6	20.5	193°33.4	02.9	190°54.2	06.0
9	29°41.3	298°12.2	·· 20.3	331°01.2	·· 20.9	208°35.8	·· 02.9	205°56.7	·· 06.0
10	44°43.7	313°11.3	20.4	346°01.8	21.3	223°38.2	02.9	220°59.2	06.0
11	59°46.2	328°10.4	20.4	1°02.4	21.7	238°40.6	02.8	236°01.6	05.9
12	74°48.6	343°09.5	N24°20.5	16°03.0	N20°22.1	253°43.0	N01°02.8	251°04.1	N01°05.9
13	89°51.1	358°08.6	20.5	31°03.6	22.5	268°45.4	02.7	266°06.5	05.9
14	104°53.6	13°07.7	20.6	46°04.2	22.9	283°47.8	02.7	281°09.0	05.9
15	119°56.0	28°06.8	·· 20.6	61°04.8	·· 23.3	298°50.2	·· 02.7	296°11.5	·· 05.9
16	134°58.5	43°05.9	20.7	76°05.4	23.7	313°52.6	02.6	311°13.9	05.9
17	150°01.0	58°05.0	20.7	91°06.1	24.1	328°55.0	02.6	326°16.4	05.9
18	165°03.4	73°04.2	N24°20.8	106°06.7	N20°24.4	343°57.4	N01°02.6	341°18.9	N01°05.9
19	180°05.9	88°03.3	20.8	121°07.3	24.8	358°59.8	02.5	356°21.3	05.9
20	195°08.4	103°02.4	20.9	136°07.9	25.2	14°02.2	02.5	11°23.8	05.8
21	210°10.8	118°01.5	·· 20.9	151°08.5	·· 25.6	29°04.6	·· 02.4	26°26.2	·· 05.8
22	225°13.3	133°00.6	20.9	166°09.1	26.0	44°07.0	02.4	41°28.7	05.8
23	240°15.8	147°59.7	21.0	181°09.7	26.4	59°09.4	02.4	56°31.2	05.8
Mer.pass. 07:02		ν -0.9′	d 0.1′	m -3.90	ν 0.6′	d 0.4′	m 1.40	ν 2.4′	d 0.0′ m -2.12	ν 2.5′	d 0.0′ m 0.79

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	255°18.2	162°58.8	N24°21.0	196°10.3	N20°26.8	74°11.8	N01°02.3	71°33.6	N01°05.8
1	270°20.7	177°57.9	21.1	211°10.9	27.2	89°14.2	02.3	86°36.1	05.8
2	285°23.1	192°57.0	21.1	226°11.5	27.6	104°16.6	02.2	101°38.5	05.8
3	300°25.6	207°56.1	·· 21.1	241°12.1	·· 28.0	119°19.0	·· 02.2	116°41.0	·· 05.8
4	315°28.1	222°55.2	21.2	256°12.7	28.4	134°21.4	02.2	131°43.5	05.7
5	330°30.5	237°54.3	21.2	271°13.3	28.7	149°23.8	02.1	146°45.9	05.7
6	345°33.0	252°53.4	N24°21.2	286°13.9	N20°29.1	164°26.2	N01°02.1	161°48.4	N01°05.7
7	0°35.5	267°52.5	21.3	301°14.6	29.5	179°28.6	02.0	176°50.8	05.7
8	15°37.9	282°51.6	21.3	316°15.2	29.9	194°31.0	02.0	191°53.3	05.7
9	30°40.4	297°50.7	·· 21.3	331°15.8	·· 30.3	209°33.4	·· 02.0	206°55.8	·· 05.7
10	45°42.9	312°49.8	21.3	346°16.4	30.7	224°35.8	01.9	221°58.2	05.7
11	60°45.3	327°48.9	21.4	1°17.0	31.1	239°38.2	01.9	237°00.7	05.7
12	75°47.8	342°48.1	N24°21.4	16°17.6	N20°31.5	254°40.6	N01°01.8	252°03.1	N01°05.6
13	90°50.3	357°47.2	21.4	31°18.2	31.8	269°42.9	01.8	267°05.6	05.6
14	105°52.7	12°46.3	21.4	46°18.8	32.2	284°45.3	01.7	282°08.1	05.6
15	120°55.2	27°45.4	·· 21.4	61°19.4	·· 32.6	299°47.7	·· 01.7	297°10.5	·· 05.6
16	135°57.6	42°44.5	21.5	76°20.0	33.0	314°50.1	01.7	312°13.0	05.6
17	151°00.1	57°43.6	21.5	91°20.6	33.4	329°52.5	01.6	327°15.4	05.6
18	166°02.6	72°42.7	N24°21.5	106°21.2	N20°33.8	344°54.9	N01°01.6	342°17.9	N01°05.6
19	181°05.0	87°41.8	21.5	121°21.8	34.2	359°57.3	01.5	357°20.3	05.6
20	196°07.5	102°40.9	21.5	136°22.4	34.5	14°59.7	01.5	12°22.8	05.5
21	211°10.0	117°40.0	·· 21.5	151°23.0	·· 34.9	30°02.1	·· 01.5	27°25.3	·· 05.5
22	226°12.4	132°39.1	21.5	166°23.6	35.3	45°04.5	01.4	42°27.7	05.5
23	241°14.9	147°38.2	21.6	181°24.3	35.7	60°06.9	01.4	57°30.2	05.5
Mer.pass. 06:58		ν -0.9′	d 0.0′	m -3.90	ν 0.6′	d 0.4′	m 1.41	ν 2.4′	d 0.0′ m -2.11	ν 2.5′	d 0.0′ m 0.80

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	256°17.4	162°37.3	N24°21.6	196°24.9	N20°36.1	75°09.3	N01°01.3	72°32.6	N01°05.5
1	271°19.8	177°36.4	21.6	211°25.5	36.5	90°11.7	01.3	87°35.1	05.5
2	286°22.3	192°35.5	21.6	226°26.1	36.8	105°14.1	01.2	102°37.5	05.5
3	301°24.8	207°34.6	·· 21.6	241°26.7	·· 37.2	120°16.4	·· 01.2	117°40.0	·· 05.4
4	316°27.2	222°33.7	21.6	256°27.3	37.6	135°18.8	01.2	132°42.5	05.4
5	331°29.7	237°32.8	21.6	271°27.9	38.0	150°21.2	01.1	147°44.9	05.4
6	346°32.1	252°32.0	N24°21.6	286°28.5	N20°38.4	165°23.6	N01°01.1	162°47.4	N01°05.4
7	1°34.6	267°31.1	21.6	301°29.1	38.7	180°26.0	01.0	177°49.8	05.4
8	16°37.1	282°30.2	21.6	316°29.7	39.1	195°28.4	01.0	192°52.3	05.4
9	31°39.5	297°29.3	·· 21.6	331°30.3	·· 39.5	210°30.8	·· 00.9	207°54.7	·· 05.4
10	46°42.0	312°28.4	21.6	346°30.9	39.9	225°33.2	00.9	222°57.2	05.3
11	61°44.5	327°27.5	21.6	1°31.5	40.3	240°35.6	00.8	237°59.6	05.3
12	76°46.9	342°26.6	N24°21.6	16°32.1	N20°40.6	255°37.9	N01°00.8	253°02.1	N01°05.3
13	91°49.4	357°25.7	21.6	31°32.7	41.0	270°40.3	00.8	268°04.6	05.3
14	106°51.9	12°24.8	21.5	46°33.3	41.4	285°42.7	00.7	283°07.0	05.3
15	121°54.3	27°23.9	·· 21.5	61°33.9	·· 41.8	300°45.1	·· 00.7	298°09.5	·· 05.3
16	136°56.8	42°23.0	21.5	76°34.5	42.1	315°47.5	00.6	313°11.9	05.3
17	151°59.2	57°22.1	21.5	91°35.2	42.5	330°49.9	00.6	328°14.4	05.2
18	167°01.7	72°21.2	N24°21.5	106°35.8	N20°42.9	345°52.3	N01°00.5	343°16.8	N01°05.2
19	182°04.2	87°20.3	21.5	121°36.4	43.3	0°54.7	00.5	358°19.3	05.2
20	197°06.6	102°19.4	21.5	136°37.0	43.7	15°57.0	00.4	13°21.7	05.2
21	212°09.1	117°18.5	·· 21.4	151°37.6	·· 44.0	30°59.4	·· 00.4	28°24.2	·· 05.2
22	227°11.6	132°17.7	21.4	166°38.2	44.4	46°01.8	00.4	43°26.6	05.2
23	242°14.0	147°16.8	21.4	181°38.8	44.8	61°04.2	00.3	58°29.1	05.2
Mer.pass. 06:54		ν -0.9′	d 0.0′	m -3.90	ν 0.6′	d 0.4′	m 1.41	ν 2.4′	d 0.0′ m -2.10	ν 2.5′	d 0.0′ m 0.80

Stars

	SHA	Dec
Alpheratz	358°08.9	28°59.0
Ankaa	353°39.9	-42°24.3
Schedar	350°08.7	56°25.8
Diphda	349°20.5	-18°05.3
Achernar	335°45.3	-57°19.8
Hamal	328°28.6	23°22.3
Polaris	326°59.4	89°10.4
Acamar	315°37.2	-40°22.8
Menkar	314°40.9	4°00.9
Mirfak	309°15.9	49°47.5
Aldebaran	291°17.8	16°28.2
Rigel	281°35.9	-8°13.5
Capella	281°11.1	45°58.7
Bellatrix	278°58.6	6°19.9
Elnath	278°43.9	28°35.5
Alnilam	276°11.5	-1°12.9
Betelgeuse	271°28.1	7°24.2
Canopus	264°07.5	-52°41.3
Sirius	258°55.6	-16°41.5
Adhara	255°32.1	-28°56.9
Procyon	245°25.5	5°16.4
Pollux	243°57.9	28°04.4
Avior	234°28.4	-59°27.2
Suhail	223°10.6	-43°21.6
Miaplacidus	221°45.3	-69°38.7
Alphard	218°20.2	-8°34.7
Regulus	208°09.6	12°03.6
Dubhe	194°21.6	61°51.4
Denebola	182°58.5	14°40.7
Gienah	176°17.4	-17°26.4
Acrux	173°36.5	-63°00.0
Gacrux	172°28.0	-57°00.7
Alioth	166°41.8	56°04.0
Spica	158°56.8	-11°03.8
Alkaid	153°17.8	49°24.6
Hadar	149°22.2	-60°17.1
Menkent	148°36.1	-36°16.8
Arcturus	146°17.8	19°16.9
Rigil Kent.	140°24.6	-60°45.5
Kochab	137°18.0	74°14.2
Zuben'ubi	137°32.2	-15°57.9
Alphecca	126°31.4	26°46.8
Antares	112°55.9	-26°23.4
Atria	108°19.1	-68°59.6
Sabik	102°40.2	-15°42.1
Shaula	96°54.7	-37°05.4
Rasalhague	96°28.8	12°34.4
Eltanin	90°57.0	51°29.5
Kaus Aust.	84°15.8	-34°23.6
Vega	80°55.1	38°45.9
Nunki	76°28.2	-26°19.1
Altair	62°31.8	8°49.1
Peacock	53°57.2	-56°47.5
Deneb	49°47.8	45°12.6
Enif	34°11.0	9°47.2
Al Na'ir	28°14.2	-47°02.9
Fomalhaut	15°50.9	-29°43.2
Scheat	14°17.1	27°58.7
Markab	14°02.7	15°06.1

Jun 06 Sat	SHA	Mer.pass
Venus	269°01.2	13:07
Mars	301°36.6	10:56
Jupiter	178°55.1	19:04
Saturn	176°15.4	19:15

Jun 07 Sun	SHA	Mer.pass
Venus	267°40.6	13:09
Mars	300°52.1	10:55
Jupiter	178°53.6	19:00
Saturn	176°15.4	19:11

Jun 08 Mon	SHA	Mer.pass
Venus	266°20.0	13:10
Mars	300°07.5	10:54
Jupiter	178°51.9	18:56
Saturn	176°15.3	19:07

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h

Sat	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	180°22.7	N22°37.1	128°57.6	7.1′	N19°30.8	5.0′	58.5′
1	195°22.6	37.4	143°23.7	7.2′	19°25.8	5.1′	58.5′
2	210°22.5	37.7	157°49.9	7.3′	19°20.7	5.2′	58.4′
3	225°22.4	·· 37.9	172°16.2	7.4′	19°15.5	5.3′	58.4′
4	240°22.3	38.2	186°42.5	7.5′	19°10.2	5.5′	58.4′
5	255°22.1	38.4	201°09.0	7.6′	19°04.7	5.5′	58.3′
6	270°22.0	N22°38.7	215°35.5	7.6′	N18°59.2	5.6′	58.3′
7	285°21.9	39.0	230°02.2	7.7′	18°53.6	5.8′	58.2′
8	300°21.8	39.2	244°28.9	7.8′	18°47.8	5.8′	58.2′
9	315°21.7	·· 39.5	258°55.7	7.9′	18°42.0	6.0′	58.2′
10	330°21.6	39.7	273°22.7	8.0′	18°36.0	6.1′	58.1′
11	345°21.5	40.0	287°49.7	8.1′	18°29.9	6.1′	58.1′
12	0°21.3	N22°40.3	302°16.8	8.2′	N18°23.8	6.3′	58.1′
13	15°21.2	40.5	316°44.0	8.3′	18°17.5	6.3′	58.0′
14	30°21.1	40.8	331°11.3	8.4′	18°11.2	6.5′	58.0′
15	45°21.0	·· 41.0	345°38.6	8.5′	18°04.7	6.5′	57.9′
16	60°20.9	41.3	0°06.1	8.6′	17°58.2	6.7′	57.9′
17	75°20.8	41.5	14°33.7	8.7′	17°51.5	6.7′	57.9′
18	90°20.7	N22°41.8	29°01.4	8.8′	N17°44.8	6.8′	57.8′
19	105°20.5	42.0	43°29.1	8.9′	17°38.0	6.9′	57.8′
20	120°20.4	42.3	57°57.0	8.9′	17°31.1	7.0′	57.7′
21	135°20.3	·· 42.5	72°24.9	9.0′	17°24.1	7.1′	57.7′
22	150°20.2	42.8	86°53.0	9.1′	17°17.0	7.2′	57.7′
23	165°20.1	43.0	101°21.1	9.2′	17°09.8	7.3′	57.6′
	SD = 15.8′	d = 0.3′		SD = 16.0′			

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	180°20.0	N22°43.3	115°49.3	9.3′	N17°02.5	7.4′	57.6′
1	195°19.9	43.5	130°17.6	9.4′	16°55.1	7.4′	57.5′
2	210°19.7	43.8	144°46.0	9.5′	16°47.7	7.5′	57.5′
3	225°19.6	·· 44.0	159°14.5	9.6′	16°40.2	7.6′	57.5′
4	240°19.5	44.2	173°43.1	9.7′	16°32.6	7.7′	57.4′
5	255°19.4	44.5	188°11.8	9.8′	16°24.9	7.7′	57.4′
6	270°19.3	N22°44.7	202°40.6	9.9′	N16°17.2	7.9′	57.3′
7	285°19.2	45.0	217°09.5	10.0′	16°09.3	7.9′	57.3′
8	300°19.0	45.2	231°38.5	10.1′	16°01.4	8.0′	57.3′
9	315°18.9	·· 45.5	246°07.5	10.1′	15°53.4	8.0′	57.2′
10	330°18.8	45.7	260°36.7	10.2′	15°45.4	8.2′	57.2′
11	345°18.7	45.9	275°05.9	10.3′	15°37.2	8.2′	57.2′
12	0°18.6	N22°46.2	289°35.2	10.4′	N15°29.0	8.3′	57.1′
13	15°18.5	46.4	304°04.7	10.5′	15°20.7	8.3′	57.1′
14	30°18.3	46.7	318°34.2	10.6′	15°12.4	8.4′	57.0′
15	45°18.2	·· 46.9	333°03.8	10.7′	15°04.0	8.5′	57.0′
16	60°18.1	47.1	347°33.4	10.8′	14°55.5	8.6′	57.0′
17	75°18.0	47.4	2°03.2	10.9′	14°46.9	8.6′	56.9′
18	90°17.9	N22°47.6	16°33.1	10.9′	N14°38.3	8.6′	56.9′
19	105°17.8	47.8	31°03.0	11.0′	14°29.7	8.8′	56.9′
20	120°17.6	48.1	45°33.1	11.1′	14°20.9	8.8′	56.8′
21	135°17.5	·· 48.3	60°03.2	11.2′	14°12.1	8.8′	56.8′
22	150°17.4	48.5	74°33.4	11.3′	14°03.3	9.0′	56.7′
23	165°17.3	48.8	89°03.7	11.4′	13°54.3	8.9′	56.7′
	SD = 15.8′	d = 0.2′		SD = 15.7′			

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	180°17.2	N22°49.0	103°34.1	11.5′	N13°45.4	9.1′	56.7′
1	195°17.0	49.2	118°04.5	11.5′	13°36.3	9.1′	56.6′
2	210°16.9	49.4	132°35.1	11.6′	13°27.2	9.1′	56.6′
3	225°16.8	·· 49.7	147°05.7	11.7′	13°18.1	9.2′	56.6′
4	240°16.7	49.9	161°36.4	11.8′	13°08.9	9.2′	56.5′
5	255°16.6	50.1	176°07.2	11.9′	12°59.7	9.3′	56.5′
6	270°16.4	N22°50.4	190°38.0	11.9′	N12°50.4	9.4′	56.5′
7	285°16.3	50.6	205°09.0	12.0′	12°41.0	9.4′	56.4′
8	300°16.2	50.8	219°40.0	12.1′	12°31.6	9.5′	56.4′
9	315°16.1	·· 51.0	234°11.1	12.2′	12°22.1	9.4′	56.3′
10	330°16.0	51.3	248°42.3	12.3′	12°12.7	9.6′	56.3′
11	345°15.9	51.5	263°13.6	12.3′	12°03.1	9.6′	56.3′
12	0°15.7	N22°51.7	277°44.9	12.4′	N11°53.5	9.6′	56.2′
13	15°15.6	51.9	292°16.3	12.5′	11°43.9	9.7′	56.2′
14	30°15.5	52.1	306°47.8	12.6′	11°34.2	9.7′	56.2′
15	45°15.4	·· 52.4	321°19.3	12.6′	11°24.5	9.8′	56.1′
16	60°15.3	52.6	335°51.0	12.7′	11°14.7	9.8′	56.1′
17	75°15.1	52.8	350°22.7	12.8′	11°04.9	9.8′	56.1′
18	90°15.0	N22°53.0	4°54.4	12.8′	N10°55.1	9.9′	56.0′
19	105°14.9	53.2	19°26.3	12.9′	10°45.2	9.9′	56.0′
20	120°14.8	53.5	33°58.2	13.0′	10°35.3	10.0′	56.0′
21	135°14.6	·· 53.7	48°30.2	13.0′	10°25.3	10.0′	55.9′
22	150°14.5	53.9	63°02.2	13.1′	10°15.3	10.0′	55.9′
23	165°14.4	54.1	77°34.3	13.2′	10°05.3	10.1′	55.9′
	SD = 15.7′	d = 0.2′		SD = 15.5′			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	▭	▭	▭	▭	▭	▭
66°	////	////	00:45	23:17	////	////
64°	////	////	01:45	22:15	////	////
62°	////	////	02:18	21:41	////	////
60°	////	01:10	02:42	21:17	22:50	////
N 58°	////	01:50	03:01	20:57	22:09	////
56°	////	02:17	03:17	20:41	21:42	////
54°	01:04	02:37	03:30	20:28	21:21	22:56
52°	01:41	02:54	03:42	20:16	21:04	22:18
50°	02:06	03:09	03:52	20:06	20:49	21:53
45°	02:49	03:37	04:14	19:44	20:21	21:10
N 40°	03:18	03:59	04:31	19:26	19:59	20:40
35°	03:40	04:16	04:46	19:12	19:41	20:18
30°	03:58	04:31	04:58	18:59	19:27	20:00
20°	04:26	04:55	05:20	18:38	19:02	19:31
N 10°	04:48	05:15	05:38	18:19	18:42	19:09
0°	05:07	05:33	05:55	18:02	18:25	18:51
S 10°	05:23	05:49	06:12	17:45	18:08	18:34
20°	05:39	06:06	06:30	17:27	17:51	18:19
30°	05:55	06:24	06:50	17:07	17:33	18:03
35°	06:03	06:34	07:02	16:55	17:23	17:54
40°	06:12	06:46	07:16	16:41	17:12	17:45
45°	06:22	06:59	07:32	16:25	16:59	17:36
S 50°	06:33	07:14	07:52	16:05	16:43	17:24
52°	06:38	07:21	08:02	15:56	16:36	17:19
54°	06:43	07:29	08:12	15:45	16:28	17:14
56°	06:49	07:38	08:24	15:33	16:19	17:08
58°	06:56	07:48	08:38	15:19	16:10	17:02
S 60°	07:03	07:59	08:55	15:02	15:59	16:55

Lat.	Moonrise Sat	Moonrise Sun	Moonrise Mon	Moonset Sat	Moonset Sun	Moonset Mon
N 72°	▭	06:19	08:33	▭	02:48	02:17
N 70°	04:53	07:03	08:57	02:21	02:02	01:52
68°	05:46	07:32	09:14	01:27	01:32	01:33
66°	06:19	07:54	09:28	00:53	01:09	01:18
64°	06:42	08:11	09:40	00:29	00:51	01:05
62°	07:01	08:25	09:50	00:10	00:37	00:55
60°	07:17	08:37	09:58	·· ··	00:24	00:46
N 58°	07:30	08:48	10:05	·· ··	00:13	00:38
56°	07:41	08:57	10:12	·· ··	00:04	00:30
54°	07:51	09:04	10:18	23:55	·· ··	00:24
52°	08:00	09:11	10:23	23:48	·· ··	00:18
50°	08:08	09:18	10:27	23:41	·· ··	00:13
45°	08:24	09:32	10:37	23:26	·· ··	00:02
N 40°	08:38	09:43	10:46	23:14	23:52	·· ··
35°	08:50	09:52	10:53	23:04	23:44	·· ··
30°	09:00	10:01	10:59	22:55	23:37	·· ··
20°	09:17	10:15	11:10	22:39	23:25	·· ··
N 10°	09:32	10:28	11:20	22:25	23:14	23:58
0°	09:47	10:39	11:28	22:12	23:03	23:51
S 10°	10:01	10:51	11:37	21:59	22:53	23:44
20°	10:16	11:04	11:47	21:45	22:42	23:36
30°	10:33	11:18	11:57	21:29	22:29	23:27
35°	10:43	11:26	12:04	21:20	22:22	23:21
40°	10:55	11:35	12:11	21:09	22:13	23:15
45°	11:08	11:46	12:19	20:56	22:03	23:08
S 50°	11:24	12:00	12:28	20:41	21:51	23:00
52°	11:32	12:06	12:33	20:34	21:45	22:56
54°	11:40	12:12	12:38	20:25	21:39	22:52
56°	11:50	12:20	12:43	20:16	21:32	22:47
58°	12:01	12:28	12:49	20:06	21:24	22:42
S 60°	12:13	12:38	12:56	19:54	21:16	22:36

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 4-6 17-35%
06	01:31	01:25	11:59	16:00	03:32	
07	01:20	01:14	11:59	16:51	04:26	
08	01:09	01:03	11:59	17:40	05:16	

June 09, 10, 11 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	257°16.5	162°15.9	N24°21.4	196°39.4	N20°45.1	76°06.6	N01°00.3	73°31.5	N01°05.1
1	272°19.0	177°15.0	21.4	211°40.0	45.5	91°09.0	00.2	88°34.0	05.1
2	287°21.4	192°14.1	21.3	226°40.6	45.9	106°11.4	00.2	103°36.4	05.1
3	302°23.9	207°13.2	·· 21.3	241°41.2	·· 46.3	121°13.7	·· 00.1	118°38.9	·· 05.1
4	317°26.4	222°12.3	21.3	256°41.8	46.6	136°16.1	00.1	133°41.4	05.1
5	332°28.8	237°11.4	21.3	271°42.4	47.0	151°18.5	00.0	148°43.8	05.1
6	347°31.3	252°10.5	N24°21.2	286°43.0	N20°47.4	166°20.9	N01°00.0	163°46.3	N01°05.0
7	2°33.7	267°09.6	21.2	301°43.6	47.8	181°23.3	00°59.9	178°48.7	05.0
8	17°36.2	282°08.7	21.2	316°44.2	48.1	196°25.7	59.9	193°51.2	05.0
9	32°38.7	297°07.8	·· 21.1	331°44.8	·· 48.5	211°28.0	·· 59.8	208°53.6	·· 05.0
10	47°41.1	312°06.9	21.1	346°45.4	48.9	226°30.4	59.8	223°56.1	05.0
11	62°43.6	327°06.0	21.1	1°46.0	49.2	241°32.8	59.8	238°58.5	05.0
12	77°46.1	342°05.2	N24°21.0	16°46.6	N20°49.6	256°35.2	N00°59.7	254°01.0	N01°05.0
13	92°48.5	357°04.3	21.0	31°47.2	50.0	271°37.6	59.7	269°03.4	04.9
14	107°51.0	12°03.4	20.9	46°47.8	50.3	286°39.9	59.6	284°05.9	04.9
15	122°53.5	27°02.5	·· 20.9	61°48.5	·· 50.7	301°42.3	·· 59.6	299°08.3	·· 04.9
16	137°55.9	42°01.6	20.9	76°49.1	51.1	316°44.7	59.5	314°10.8	04.9
17	152°58.4	57°00.7	20.8	91°49.7	51.5	331°47.1	59.5	329°13.2	04.9
18	168°00.9	71°59.8	N24°20.8	106°50.3	N20°51.8	346°49.5	N00°59.4	344°15.7	N01°04.9
19	183°03.3	86°58.9	20.7	121°50.9	52.2	1°51.8	59.4	359°18.1	04.8
20	198°05.8	101°58.0	20.7	136°51.5	52.6	16°54.2	59.3	14°20.6	04.8
21	213°08.2	116°57.1	·· 20.6	151°52.1	·· 52.9	31°56.6	·· 59.3	29°23.0	·· 04.8
22	228°10.7	131°56.2	20.6	166°52.7	53.3	46°59.0	59.2	44°25.5	04.8
23	243°13.2	146°55.3	20.5	181°53.3	53.7	62°01.4	59.2	59°27.9	04.8
Mer.pass. 06:50		ν -0.9′	d 0.0′	m -3.90	ν 0.6′	d 0.4′	m 1.42	ν 2.4′	d 0.0′ m -2.10	ν 2.5′	d 0.0′ m 0.81

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	258°15.6	161°54.5	N24°20.5	196°53.9	N20°54.0	77°03.7	N00°59.1	74°30.4	N01°04.8
1	273°18.1	176°53.6	20.4	211°54.5	54.4	92°06.1	59.1	89°32.8	04.7
2	288°20.6	191°52.7	20.4	226°55.1	54.8	107°08.5	59.0	104°35.3	04.7
3	303°23.0	206°51.8	·· 20.3	241°55.7	·· 55.1	122°10.9	·· 59.0	119°37.7	·· 04.7
4	318°25.5	221°50.9	20.3	256°56.3	55.5	137°13.2	58.9	134°40.2	04.7
5	333°28.0	236°50.0	20.2	271°56.9	55.8	152°15.6	58.9	149°42.6	04.7
6	348°30.4	251°49.1	N24°20.2	286°57.5	N20°56.2	167°18.0	N00°58.8	164°45.1	N01°04.6
7	3°32.9	266°48.2	20.1	301°58.1	56.6	182°20.4	58.8	179°47.5	04.6
8	18°35.3	281°47.3	20.0	316°58.7	56.9	197°22.7	58.7	194°49.9	04.6
9	33°37.8	296°46.4	·· 20.0	331°59.3	·· 57.3	212°25.1	·· 58.7	209°52.4	·· 04.6
10	48°40.3	311°45.5	19.9	346°59.9	57.7	227°27.5	58.6	224°54.8	04.6
11	63°42.7	326°44.7	19.8	2°00.5	58.0	242°29.9	58.6	239°57.3	04.6
12	78°45.2	341°43.8	N24°19.8	17°01.1	N20°58.4	257°32.3	N00°58.5	254°59.7	N01°04.5
13	93°47.7	356°42.9	19.7	32°01.7	58.7	272°34.6	58.5	270°02.2	04.5
14	108°50.1	11°42.0	19.6	47°02.3	59.1	287°37.0	58.4	285°04.6	04.5
15	123°52.6	26°41.1	·· 19.6	62°02.9	·· 59.5	302°39.4	·· 58.4	300°07.1	·· 04.5
16	138°55.1	41°40.2	19.5	77°03.5	20°59.8	317°41.7	58.3	315°09.5	04.5
17	153°57.5	56°39.3	19.4	92°04.1	21°00.2	332°44.1	58.3	330°12.0	04.5
18	169°00.0	71°38.4	N24°19.3	107°04.7	N21°00.5	347°46.5	N00°58.2	345°14.4	N01°04.4
19	184°02.5	86°37.5	19.3	122°05.3	00.9	2°48.9	58.2	0°16.9	04.4
20	199°04.9	101°36.6	19.2	137°05.9	01.3	17°51.2	58.1	15°19.3	04.4
21	214°07.4	116°35.8	·· 19.1	152°06.5	·· 01.6	32°53.6	·· 58.1	30°21.8	·· 04.4
22	229°09.8	131°34.9	19.0	167°07.2	02.0	47°56.0	58.0	45°24.2	04.4
23	244°12.3	146°34.0	19.0	182°07.8	02.3	62°58.4	58.0	60°26.6	04.3
Mer.pass. 06:46		ν -0.9′	d 0.1′	m -3.90	ν 0.6′	d 0.4′	m 1.42	ν 2.4′	d 0.0′ m -2.09	ν 2.4′	d 0.0′ m 0.81

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	259°14.8	161°33.1	N24°18.9	197°08.4	N21°02.7	78°00.7	N00°57.9	75°29.1	N01°04.3
1	274°17.2	176°32.2	18.8	212°09.0	03.0	93°03.1	57.9	90°31.5	04.3
2	289°19.7	191°31.3	18.7	227°09.6	03.4	108°05.5	57.8	105°34.0	04.3
3	304°22.2	206°30.4	·· 18.6	242°10.2	·· 03.8	123°07.8	·· 57.8	120°36.4	·· 04.3
4	319°24.6	221°29.5	18.5	257°10.8	04.1	138°10.2	57.7	135°38.9	04.2
5	334°27.1	236°28.6	18.4	272°11.4	04.5	153°12.6	57.7	150°41.3	04.2
6	349°29.6	251°27.8	N24°18.4	287°12.0	N21°04.8	168°15.0	N00°57.6	165°43.8	N01°04.2
7	4°32.0	266°26.9	18.3	302°12.6	05.2	183°17.3	57.6	180°46.2	04.2
8	19°34.5	281°26.0	18.2	317°13.2	05.5	198°19.7	57.5	195°48.6	04.2
9	34°36.9	296°25.1	·· 18.1	332°13.8	·· 05.9	213°22.1	·· 57.5	210°51.1	·· 04.1
10	49°39.4	311°24.2	18.0	347°14.4	06.2	228°24.4	57.4	225°53.5	04.1
11	64°41.9	326°23.3	17.9	2°15.0	06.6	243°26.8	57.4	240°56.0	04.1
12	79°44.3	341°22.4	N24°17.8	17°15.6	N21°06.9	258°29.2	N00°57.3	255°58.4	N01°04.1
13	94°46.8	356°21.5	17.7	32°16.2	07.3	273°31.5	57.3	271°00.9	04.1
14	109°49.3	11°20.6	17.6	47°16.8	07.7	288°33.9	57.2	286°03.3	04.1
15	124°51.7	26°19.8	·· 17.5	62°17.4	·· 08.0	303°36.3	·· 57.2	301°05.7	·· 04.0
16	139°54.2	41°18.9	17.4	77°18.0	08.4	318°38.6	57.1	316°08.2	04.0
17	154°56.7	56°18.0	17.3	92°18.6	08.7	333°41.0	57.0	331°10.6	04.0
18	169°59.1	71°17.1	N24°17.2	107°19.2	N21°09.1	348°43.4	N00°57.0	346°13.1	N01°04.0
19	185°01.6	86°16.2	17.1	122°19.8	09.4	3°45.7	56.9	1°15.5	04.0
20	200°04.1	101°15.3	17.0	137°20.4	09.8	18°48.1	56.9	16°18.0	03.9
21	215°06.5	116°14.4	·· 16.9	152°21.0	·· 10.1	33°50.5	·· 56.8	31°20.4	·· 03.9
22	230°09.0	131°13.6	16.8	167°21.6	10.5	48°52.8	56.8	46°22.8	03.9
23	245°11.4	146°12.7	16.7	182°22.2	10.8	63°55.2	56.7	61°25.3	03.9
Mer.pass. 06:42		ν -0.9′	d 0.1′	m -3.90	ν 0.6′	d 0.4′	m 1.42	ν 2.4′	d 0.1′ m -2.08	ν 2.4′	d 0.0′ m 0.81

Stars

	SHA	Dec
Alpheratz	358°08.9	28°59.0
Ankaa	353°39.9	-42°24.3
Schedar	350°08.6	56°25.8
Diphda	349°20.5	-18°05.3
Achernar	335°45.3	-57°19.8
Hamal	328°28.6	23°22.3
Polaris	326°58.6	89°10.4
Acamar	315°37.2	-40°22.7
Menkar	314°40.9	4°00.9
Mirfak	309°15.8	49°47.5
Aldebaran	291°17.8	16°28.2
Rigel	281°35.9	-8°13.5
Capella	281°11.0	45°58.7
Bellatrix	278°58.6	6°19.9
Elnath	278°43.9	28°35.5
Alnilam	276°11.5	-1°12.9
Betelgeuse	271°28.1	7°24.2
Canopus	264°07.5	-52°41.3
Sirius	258°55.6	-16°41.5
Adhara	255°32.1	-28°56.9
Procyon	245°25.5	5°16.4
Pollux	243°57.9	28°04.4
Avior	234°28.4	-59°27.2
Suhail	223°10.7	-43°21.6
Miaplacidus	221°45.4	-69°38.7
Alphard	218°20.2	-8°34.7
Regulus	208°09.6	12°03.6
Dubhe	194°21.6	61°51.4
Denebola	182°58.5	14°40.7
Gienah	176°17.4	-17°26.4
Acrux	173°36.5	-63°00.0
Gacrux	172°28.0	-57°00.7
Alioth	166°41.8	56°04.0
Spica	158°56.8	-11°03.8
Alkaid	153°17.8	49°24.7
Hadar	149°22.2	-60°17.1
Menkent	148°36.1	-36°16.8
Arcturus	146°17.8	19°16.9
Rigil Kent.	140°24.6	-60°45.5
Kochab	137°18.0	74°14.2
Zuben'ubi	137°32.2	-15°57.9
Alphecca	126°31.4	26°46.8
Antares	112°55.9	-26°23.4
Atria	108°19.1	-68°59.7
Sabik	102°40.2	-15°42.1
Shaula	96°54.7	-37°05.4
Rasalhague	96°28.8	12°34.4
Eltanin	90°57.0	51°29.5
Kaus Aust.	84°15.8	-34°23.6
Vega	80°55.1	38°45.9
Nunki	76°28.2	-26°19.1
Altair	62°31.8	8°49.1
Peacock	53°57.2	-56°47.5
Deneb	49°47.8	45°12.6
Enif	34°11.0	9°47.3
Al Na'ir	28°14.2	-47°02.9
Fomalhaut	15°50.8	-29°43.2
Scheat	14°17.0	27°58.7
Markab	14°02.6	15°06.1

Jun 09 Tue	SHA	Mer.pass
Venus	264°59.4	13:12
Mars	299°22.9	10:53
Jupiter	178°50.1	18:53
Saturn	176°15.0	19:03

Jun 10 Wed	SHA	Mer.pass
Venus	263°38.8	13:13
Mars	298°38.3	10:52
Jupiter	178°48.1	18:49
Saturn	176°14.7	18:59

Jun 11 Thu	SHA	Mer.pass
Venus	262°18.3	13:15
Mars	297°53.6	10:51
Jupiter	178°46.0	18:45
Saturn	176°14.3	18:55

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	*ν*	**Dec**	*d*	**HP**
0	180°14.3	N22°54.3	92°06.5	13.2′	N09°55.2	10.1′	55.9′
1	195°14.2	54.5	106°38.8	13.3′	09°45.1	10.1′	55.8′
2	210°14.0	54.7	121°11.1	13.4′	09°35.0	10.2′	55.8′
3	225°13.9	·· 54.9	135°43.5	13.4′	09°24.8	10.2′	55.8′
4	240°13.8	55.2	150°15.9	13.5′	09°14.6	10.2′	55.7′
5	255°13.7	55.4	164°48.4	13.6′	09°04.4	10.3′	55.7′
6	270°13.6	N22°55.6	179°21.0	13.6′	N08°54.1	10.3′	55.7′
7	285°13.4	55.8	193°53.6	13.7′	08°43.8	10.3′	55.6′
8	300°13.3	56.0	208°26.3	13.7′	08°33.5	10.3′	55.6′
9	315°13.2	·· 56.2	222°59.0	13.8′	08°23.2	10.4′	55.6′
10	330°13.1	56.4	237°31.8	13.9′	08°12.8	10.4′	55.6′
11	345°13.0	56.6	252°04.7	13.9′	08°02.4	10.4′	55.5′
12	0°12.8	N22°56.8	266°37.6	14.0′	N07°52.0	10.4′	55.5′
13	15°12.7	57.0	281°10.6	14.0′	07°41.6	10.5′	55.5′
14	30°12.6	57.2	295°43.6	14.1′	07°31.1	10.4′	55.4′
15	45°12.5	·· 57.4	310°16.7	14.1′	07°20.7	10.6′	55.4′
16	60°12.3	57.6	324°49.8	14.2′	07°10.1	10.5′	55.4′
17	75°12.2	57.8	339°23.0	14.2′	06°59.6	10.5′	55.4′
18	90°12.1	N22°58.0	353°56.2	14.3′	N06°49.1	10.6′	55.3′
19	105°12.0	58.2	8°29.5	14.3′	06°38.5	10.6′	55.3′
20	120°11.8	58.4	23°02.8	14.4′	06°27.9	10.6′	55.3′
21	135°11.7	·· 58.6	37°36.2	14.4′	06°17.3	10.6′	55.2′
22	150°11.6	58.8	52°09.6	14.5′	06°06.7	10.6′	55.2′
23	165°11.5	59.0	66°43.1	14.5′	05°56.1	10.7′	55.2′
	SD = 15.7′	*d* = 0.2′	SD = 15.2′				

Wed	**GHA**	**Dec**	**GHA**	*ν*	**Dec**	*d*	**HP**
0	180°11.4	N22°59.2	81°16.6	14.6′	N05°45.4	10.6′	55.2′
1	195°11.2	59.4	95°50.1	14.6′	05°34.8	10.7′	55.1′
2	210°11.1	59.6	110°23.7	14.6′	05°24.1	10.7′	55.1′
3	225°11.0	22°59.8	124°57.4	14.7′	05°13.4	10.7′	55.1′
4	240°10.9	23°00.0	139°31.1	14.7′	05°02.7	10.7′	55.1′
5	255°10.7	00.2	154°04.8	14.8′	04°52.0	10.7′	55.0′
6	270°10.6	N23°00.4	168°38.5	14.8′	N04°41.3	10.8′	55.0′
7	285°10.5	00.6	183°12.3	14.8′	04°30.5	10.7′	55.0′
8	300°10.4	00.8	197°46.2	14.9′	04°19.8	10.8′	55.0′
9	315°10.2	·· 01.0	212°20.1	14.9′	04°09.0	10.7′	55.0′
10	330°10.1	01.2	226°54.0	14.9′	03°58.3	10.8′	54.9′
11	345°10.0	01.4	241°27.9	15.0′	03°47.5	10.8′	54.9′
12	0°09.9	N23°01.5	256°01.9	15.0′	N03°36.7	10.8′	54.9′
13	15°09.7	01.7	270°35.9	15.0′	03°25.9	10.8′	54.9′
14	30°09.6	01.9	285°10.0	15.1′	03°15.1	10.8′	54.8′
15	45°09.5	·· 02.1	299°44.1	15.1′	03°04.3	10.8′	54.8′
16	60°09.4	02.3	314°18.2	15.1′	02°53.5	10.8′	54.8′
17	75°09.2	02.5	328°52.3	15.2′	02°42.7	10.8′	54.8′
18	90°09.1	N23°02.7	343°26.5	15.2′	N02°31.9	10.8′	54.8′
19	105°09.0	02.8	358°00.7	15.2′	02°21.1	10.8′	54.7′
20	120°08.9	03.0	12°34.9	15.3′	02°10.3	10.8′	54.7′
21	135°08.7	·· 03.2	27°09.2	15.3′	01°59.5	10.8′	54.7′
22	150°08.6	03.4	41°43.4	15.3′	01°48.7	10.8′	54.7′
23	165°08.5	03.6	56°17.7	15.3′	01°37.9	10.9′	54.7′
	SD = 15.7′	*d* = 0.2′	SD = 15.0′				

Thu	**GHA**	**Dec**	**GHA**	*ν*	**Dec**	*d*	**HP**
0	180°08.4	N23°03.7	70°52.1	15.3′	N01°27.0	10.8′	54.6′
1	195°08.2	03.9	85°26.4	15.4′	01°16.2	10.8′	54.6′
2	210°08.1	04.1	100°00.8	15.4′	01°05.4	10.8′	54.6′
3	225°08.0	·· 04.3	114°35.2	15.4′	00°54.6	10.8′	54.6′
4	240°07.9	04.5	129°09.6	15.4′	00°43.8	10.8′	54.6′
5	255°07.7	04.6	143°44.0	15.4′	00°33.0	10.8′	54.5′
6	270°07.6	N23°04.8	158°18.4	15.5′	N00°22.2	10.8′	54.5′
7	285°07.5	05.0	172°52.9	15.5′	00°11.4	10.8′	54.5′
8	300°07.4	05.2	187°27.4	15.5′	N00°00.6	10.8′	54.5′
9	315°07.2	·· 05.3	202°01.9	15.5′	S00°10.2	10.7′	54.5′
10	330°07.1	05.5	216°36.4	15.5′	00°20.9	10.8′	54.5′
11	345°07.0	05.7	231°10.9	15.5′	00°31.7	10.8′	54.4′
12	0°06.9	N23°05.9	245°45.5	15.5′	S00°42.5	10.7′	54.4′
13	15°06.7	06.0	260°20.0	15.6′	00°53.2	10.8′	54.4′
14	30°06.6	06.2	274°54.6	15.6′	01°04.0	10.7′	54.4′
15	45°06.5	·· 06.4	289°29.1	15.6′	01°14.7	10.7′	54.4′
16	60°06.4	06.5	304°03.7	15.6′	01°25.4	10.8′	54.4′
17	75°06.2	06.7	318°38.3	15.6′	01°36.2	10.7′	54.4′
18	90°06.1	N23°06.9	333°12.9	15.6′	S01°46.9	10.7′	54.3′
19	105°06.0	07.0	347°47.5	15.6′	01°57.6	10.6′	54.3′
20	120°05.8	07.2	2°22.1	15.6′	02°08.2	10.7′	54.3′
21	135°05.7	·· 07.4	16°56.7	15.6′	02°18.9	10.7′	54.3′
22	150°05.6	07.5	31°31.4	15.6′	02°29.6	10.6′	54.3′
23	165°05.5	07.7	46°06.0	15.6′	02°40.2	10.6′	54.3′
	SD = 15.7′	*d* = 0.2′	SD = 14.9′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°						
N 70°						
68°						
66°	////	////	00:29	23:36	////	////
64°	////	////	01:39	22:21	////	////
62°	////	////	02:14	21:45	////	////
60°	////	01:03	02:39	21:20	22:58	////
N 58°	////	01:46	02:59	21:01	22:14	////
56°	////	02:14	03:15	20:44	21:46	////
54°	00:57	02:35	03:29	20:31	21:24	23:03
52°	01:37	02:53	03:41	20:18	21:07	22:22
50°	02:03	03:07	03:51	20:08	20:52	21:56
45°	02:47	03:36	04:13	19:46	20:23	21:12
N 40°	03:17	03:58	04:31	19:28	20:01	20:42
35°	03:39	04:16	04:45	19:13	19:43	20:19
30°	03:58	04:31	04:58	19:01	19:28	20:01
20°	04:26	04:55	05:20	18:39	19:03	19:33
N 10°	04:48	05:15	05:38	18:20	18:43	19:10
0°	05:07	05:33	05:56	18:03	18:25	18:52
S 10°	05:24	05:50	06:13	17:46	18:09	18:35
20°	05:40	06:07	06:31	17:28	17:52	18:19
30°	05:56	06:25	06:52	17:07	17:33	18:03
35°	06:04	06:36	07:04	16:55	17:23	17:54
40°	06:13	06:47	07:18	16:41	17:11	17:45
45°	06:23	07:01	07:34	16:24	16:58	17:35
S 50°	06:35	07:16	07:54	16:04	16:42	17:24
52°	06:40	07:24	08:04	15:54	16:35	17:18
54°	06:46	07:31	08:15	15:44	16:27	17:13
56°	06:51	07:40	08:27	15:31	16:18	17:07
58°	06:58	07:50	08:42	15:17	16:08	17:00
S 60°	07:05	08:02	08:58	15:00	15:57	16:53

Lat.	**Moonrise** Tue	Wed	Thu	**Moonset** Tue	Wed	Thu
N 72°	10:28	12:13	13:54	01:59	01:45	01:32
N 70°	10:40	12:18	13:53	01:44	01:38	01:31
68°	10:50	12:22	13:51	01:33	01:31	01:30
66°	10:59	12:26	13:50	01:23	01:26	01:29
64°	11:06	12:29	13:49	01:15	01:22	01:28
62°	11:12	12:31	13:49	01:08	01:18	01:27
60°	11:17	12:33	13:48	01:02	01:15	01:26
N 58°	11:21	12:35	13:47	00:56	01:12	01:26
56°	11:25	12:37	13:47	00:52	01:09	01:25
54°	11:29	12:38	13:46	00:47	01:07	01:25
52°	11:32	12:40	13:46	00:43	01:05	01:24
50°	11:35	12:41	13:45	00:40	01:03	01:24
45°	11:42	12:44	13:45	00:32	00:58	01:23
N 40°	11:47	12:46	13:44	00:25	00:55	01:22
35°	11:51	12:48	13:43	00:20	00:52	01:22
30°	11:56	12:50	13:43	00:15	00:49	01:21
20°	12:03	12:53	13:42	00:06	00:44	01:20
N 10°	12:09	12:55	13:41	·· ··	00:40	01:19
0°	12:14	12:58	13:40	·· ··	00:36	01:18
S 10°	12:20	13:00	13:39	·· ··	00:31	01:17
20°	12:26	13:03	13:39	·· ··	00:27	01:17
30°	12:33	13:06	13:38	·· ··	00:22	01:15
35°	12:37	13:08	13:37	·· ··	00:19	01:15
40°	12:42	13:10	13:37	·· ··	00:16	01:14
45°	12:47	13:12	13:36	·· ··	00:12	01:13
S 50°	12:53	13:15	13:36	·· ··	00:07	01:12
52°	12:56	13:16	13:35	·· ··	00:05	01:12
54°	12:59	13:17	13:35	·· ··	00:02	01:11
56°	13:02	13:19	13:34	·· ··	00:00	01:11
58°	13:06	13:21	13:34	23:57	·· ··	01:10
S 60°	13:10	13:22	13:34	23:54	·· ··	01:09

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 7-9 45-65%
09	00:57	00:51	11:59	18:25	06:03	
10	00:45	00:39	11:59	19:08	06:47	
11	00:33	00:27	12:00	19:50	07:29	

June 12, 13, 14 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	260°13.9	161°11.8	N24°16.5	197°22.8	N21°11.2	78°57.6	N00°56.7	76°27.7	N01°03.9
1	275°16.4	176°10.9	16.4	212°23.4	11.5	93°59.9	56.6	91°30.2	03.8
2	290°18.8	191°10.0	16.3	227°24.0	11.8	109°02.3	56.6	106°32.6	03.8
3	305°21.3	206°09.1	·· 16.2	242°24.6	·· 12.2	124°04.7	·· 56.5	121°35.0	·· 03.8
4	320°23.8	221°08.2	16.1	257°25.2	12.5	139°07.0	56.5	136°37.5	03.8
5	335°26.2	236°07.4	16.0	272°25.8	12.9	154°09.4	56.4	151°39.9	03.7
6	350°28.7	251°06.5	N24°15.8	287°26.4	N21°13.2	169°11.7	N00°56.3	166°42.4	N01°03.7
7	5°31.2	266°05.6	15.7	302°27.0	13.6	184°14.1	56.3	181°44.8	03.7
8	20°33.6	281°04.7	15.6	317°27.6	13.9	199°16.5	56.2	196°47.2	03.7
9	35°36.1	296°03.8	·· 15.5	332°28.2	·· 14.3	214°18.8	·· 56.2	211°49.7	·· 03.7
10	50°38.6	311°02.9	15.4	347°28.8	14.6	229°21.2	56.1	226°52.1	03.6
11	65°41.0	326°02.0	15.2	2°29.4	15.0	244°23.6	56.1	241°54.6	03.6
12	80°43.5	341°01.2	N24°15.1	17°30.0	N21°15.3	259°25.9	N00°56.0	256°57.0	N01°03.6
13	95°45.9	356°00.3	15.0	32°30.6	15.7	274°28.3	56.0	271°59.4	03.6
14	110°48.4	10°59.4	14.8	47°31.2	16.0	289°30.6	55.9	287°01.9	03.6
15	125°50.9	25°58.5	·· 14.7	62°31.8	·· 16.3	304°33.0	·· 55.8	302°04.3	·· 03.5
16	140°53.3	40°57.6	14.6	77°32.4	16.7	319°35.4	55.8	317°06.8	03.5
17	155°55.8	55°56.7	14.5	92°33.0	17.0	334°37.7	55.7	332°09.2	03.5
18	170°58.3	70°55.9	N24°14.3	107°33.6	N21°17.4	349°40.1	N00°55.7	347°11.6	N01°03.5
19	186°00.7	85°55.0	14.2	122°34.2	17.7	4°42.4	55.6	2°14.1	03.4
20	201°03.2	100°54.1	14.0	137°34.8	18.0	19°44.8	55.6	17°16.5	03.4
21	216°05.7	115°53.2	·· 13.9	152°35.4	·· 18.4	34°47.2	·· 55.5	32°19.0	·· 03.4
22	231°08.1	130°52.3	13.8	167°36.0	18.7	49°49.5	55.4	47°21.4	03.4
23	246°10.6	145°51.4	13.6	182°36.6	19.1	64°51.9	55.4	62°23.8	03.4
Mer.pass. 06:38		ν -0.9′	d 0.1′	m -3.90	ν 0.6′	d 0.3′	m 1.43	ν 2.4′	d 0.1′ m -2.08	ν 2.4′	d 0.0′ m 0.82

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	261°13.0	160°50.6	N24°13.5	197°37.2	N21°19.4	79°54.2	N00°55.3	77°26.3	N01°03.3
1	276°15.5	175°49.7	13.3	212°37.8	19.8	94°56.6	55.3	92°28.7	03.3
2	291°18.0	190°48.8	13.2	227°38.4	20.1	109°59.0	55.2	107°31.1	03.3
3	306°20.4	205°47.9	·· 13.1	242°39.0	·· 20.4	125°01.3	·· 55.2	122°33.6	·· 03.3
4	321°22.9	220°47.0	12.9	257°39.6	20.8	140°03.7	55.1	137°36.0	03.3
5	336°25.4	235°46.1	12.8	272°40.2	21.1	155°06.0	55.0	152°38.5	03.2
6	351°27.8	250°45.3	N24°12.6	287°40.8	N21°21.4	170°08.4	N00°55.0	167°40.9	N01°03.2
7	6°30.3	265°44.4	12.5	302°41.4	21.8	185°10.7	54.9	182°43.3	03.2
8	21°32.8	280°43.5	12.3	317°42.0	22.1	200°13.1	54.9	197°45.8	03.2
9	36°35.2	295°42.6	·· 12.2	332°42.6	·· 22.5	215°15.5	·· 54.8	212°48.2	·· 03.1
10	51°37.7	310°41.7	12.0	347°43.2	22.8	230°17.8	54.8	227°50.6	03.1
11	66°40.2	325°40.9	11.9	2°43.8	23.1	245°20.2	54.7	242°53.1	03.1
12	81°42.6	340°40.0	N24°11.7	17°44.4	N21°23.5	260°22.5	N00°54.6	257°55.5	N01°03.1
13	96°45.1	355°39.1	11.5	32°45.0	23.8	275°24.9	54.6	272°57.9	03.0
14	111°47.5	10°38.2	11.4	47°45.6	24.1	290°27.2	54.5	288°00.4	03.0
15	126°50.0	25°37.3	·· 11.2	62°46.2	·· 24.5	305°29.6	·· 54.5	303°02.8	·· 03.0
16	141°52.5	40°36.5	11.1	77°46.8	24.8	320°31.9	54.4	318°05.2	03.0
17	156°54.9	55°35.6	10.9	92°47.4	25.1	335°34.3	54.4	333°07.7	03.0
18	171°57.4	70°34.7	N24°10.7	107°48.0	N21°25.5	350°36.7	N00°54.3	348°10.1	N01°02.9
19	186°59.9	85°33.8	10.6	122°48.6	25.8	5°39.0	54.2	3°12.5	02.9
20	202°02.3	100°32.9	10.4	137°49.2	26.1	20°41.4	54.2	18°15.0	02.9
21	217°04.8	115°32.1	·· 10.2	152°49.8	·· 26.5	35°43.7	·· 54.1	33°17.4	·· 02.9
22	232°07.3	130°31.2	10.1	167°50.4	26.8	50°46.1	54.1	48°19.8	02.8
23	247°09.7	145°30.3	09.9	182°51.0	27.1	65°48.4	54.0	63°22.3	02.8
Mer.pass. 06:34		ν -0.9′	d 0.1′	m -3.90	ν 0.6′	d 0.3′	m 1.43	ν 2.4′	d 0.1′ m -2.07	ν 2.4′	d 0.0′ m 0.82

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	262°12.2	160°29.4	N24°09.7	197°51.6	N21°27.5	80°50.8	N00°53.9	78°24.7	N01°02.8
1	277°14.7	175°28.5	09.6	212°52.2	27.8	95°53.1	53.9	93°27.1	02.8
2	292°17.1	190°27.7	09.4	227°52.8	28.1	110°55.5	53.8	108°29.6	02.7
3	307°19.6	205°26.8	·· 09.2	242°53.4	·· 28.5	125°57.8	·· 53.8	123°32.0	·· 02.7
4	322°22.0	220°25.9	09.0	257°54.0	28.8	141°00.2	53.7	138°34.4	02.7
5	337°24.5	235°25.0	08.9	272°54.6	29.1	156°02.5	53.6	153°36.9	02.7
6	352°27.0	250°24.2	N24°08.7	287°55.2	N21°29.4	171°04.9	N00°53.6	168°39.3	N01°02.6
7	7°29.4	265°23.3	08.5	302°55.8	29.8	186°07.2	53.5	183°41.7	02.6
8	22°31.9	280°22.4	08.3	317°56.4	30.1	201°09.6	53.5	198°44.2	02.6
9	37°34.4	295°21.5	·· 08.1	332°57.0	·· 30.4	216°11.9	·· 53.4	213°46.6	·· 02.6
10	52°36.8	310°20.7	08.0	347°57.6	30.8	231°14.3	53.3	228°49.0	02.5
11	67°39.3	325°19.8	07.8	2°58.2	31.1	246°16.6	53.3	243°51.5	02.5
12	82°41.8	340°18.9	N24°07.6	17°58.8	N21°31.4	261°19.0	N00°53.2	258°53.9	N01°02.5
13	97°44.2	355°18.0	07.4	32°59.4	31.7	276°21.3	53.2	273°56.3	02.5
14	112°46.7	10°17.2	07.2	48°00.0	32.1	291°23.7	53.1	288°58.8	02.4
15	127°49.1	25°16.3	·· 07.0	63°00.6	·· 32.4	306°26.0	·· 53.0	304°01.2	·· 02.4
16	142°51.6	40°15.4	06.8	78°01.2	32.7	321°28.4	53.0	319°03.6	02.4
17	157°54.1	55°14.5	06.6	93°01.8	33.0	336°30.7	52.9	334°06.1	02.4
18	172°56.5	70°13.7	N24°06.4	108°02.4	N21°33.4	351°33.1	N00°52.8	349°08.5	N01°02.3
19	187°59.0	85°12.8	06.2	123°03.0	33.7	6°35.4	52.8	4°10.9	02.3
20	203°01.5	100°11.9	06.1	138°03.6	34.0	21°37.8	52.7	19°13.4	02.3
21	218°03.9	115°11.0	·· 05.9	153°04.2	·· 34.3	36°40.1	·· 52.7	34°15.8	·· 02.3
22	233°06.4	130°10.2	05.7	168°04.8	34.7	51°42.4	52.6	49°18.2	02.2
23	248°08.9	145°09.3	05.5	183°05.4	35.0	66°44.8	52.5	64°20.6	02.2
Mer.pass. 06:30		ν -0.9′	d 0.2′	m -3.90	ν 0.6′	d 0.3′	m 1.44	ν 2.4′	d 0.1′ m -2.06	ν 2.4′	d 0.0′ m 0.83

Stars

	SHA	Dec
Alpheratz	358°08.9	28°59.0
Ankaa	353°39.9	-42°24.3
Schedar	350°08.6	56°25.8
Diphda	349°20.5	-18°05.3
Achernar	335°45.2	-57°19.7
Hamal	328°28.6	23°22.3
Polaris	326°57.7	89°10.4
Acamar	315°37.2	-40°22.7
Menkar	314°40.9	4°00.9
Mirfak	309°15.8	49°47.5
Aldebaran	291°17.8	16°28.2
Rigel	281°35.9	-8°13.5
Capella	281°11.0	45°58.7
Bellatrix	278°58.5	6°19.9
Elnath	278°43.9	28°35.5
Alnilam	276°11.5	-1°12.9
Betelgeuse	271°28.1	7°24.2
Canopus	264°07.5	-52°41.3
Sirius	258°55.6	-16°41.5
Adhara	255°32.1	-28°56.9
Procyon	245°25.6	5°16.4
Pollux	243°57.9	28°04.4
Avior	234°28.5	-59°27.2
Suhail	223°10.7	-43°21.6
Miaplacidus	221°45.4	-69°38.7
Alphard	218°20.2	-8°34.7
Regulus	208°09.6	12°03.6
Dubhe	194°21.6	61°51.4
Denebola	182°58.5	14°40.7
Gienah	176°17.4	-17°26.4
Acrux	173°36.5	-63°00.0
Gacrux	172°28.0	-57°00.7
Alioth	166°41.9	56°04.0
Spica	158°56.8	-11°03.8
Alkaid	153°17.8	49°24.7
Hadar	149°22.2	-60°17.2
Menkent	148°36.2	-36°16.8
Arcturus	146°17.8	19°16.9
Rigil Kent.	140°24.6	-60°45.5
Kochab	137°18.1	74°14.2
Zuben'ubi	137°32.2	-15°57.9
Alphecca	126°31.4	26°46.8
Antares	112°55.9	-26°23.4
Atria	108°19.1	-68°59.7
Sabik	102°40.2	-15°42.1
Shaula	96°54.7	-37°05.4
Rasalhague	96°28.8	12°34.4
Eltanin	90°56.9	51°29.5
Kaus Aust.	84°15.8	-34°23.6
Vega	80°55.1	38°45.9
Nunki	76°28.2	-26°19.1
Altair	62°31.8	8°49.1
Peacock	53°57.2	-56°47.5
Deneb	49°47.8	45°12.6
Enif	34°10.9	9°47.3
Al Na'ir	28°14.1	-47°02.9
Fomalhaut	15°50.8	-29°43.2
Scheat	14°17.0	27°58.7
Markab	14°02.6	15°06.1

Jun 12 Fri	SHA	Mer.pass
Venus	260°57.9	13:16
Mars	297°08.9	10:50
Jupiter	178°43.7	18:41
Saturn	176°13.8	18:51

Jun 13 Sat	SHA	Mer.pass
Venus	259°37.5	13:17
Mars	296°24.2	10:49
Jupiter	178°41.2	18:37
Saturn	176°13.2	18:47

Jun 14 Sun	SHA	Mer.pass
Venus	258°17.2	13:19
Mars	295°39.4	10:48
Jupiter	178°38.6	18:34
Saturn	176°12.5	18:43

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = -0.5976 sec ΔT = TT-UT1 = +51.7816 sec

1981 June 12 to Jun. 14 UT

h	Sun		Moon				
Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°05.3	N23°07.9	60°40.6	15.6′	S02°50.8	10.6′	54.3′
1	195°05.2	08.0	75°15.3	15.6′	03°01.4	10.6′	54.3′
2	210°05.1	08.2	89°49.9	15.6′	03°12.0	10.6′	54.2′
3	225°05.0	·· 08.3	104°24.5	15.6′	03°22.6	10.6′	54.2′
4	240°04.8	08.5	118°59.1	15.6′	03°33.2	10.5′	54.2′
5	255°04.7	08.7	133°33.8	15.6′	03°43.7	10.5′	54.2′
6	270°04.6	N23°08.8	148°08.4	15.6′	S03°54.2	10.6′	54.2′
7	285°04.4	09.0	162°43.0	15.6′	04°04.8	10.4′	54.2′
8	300°04.3	09.1	177°17.7	15.6′	04°15.2	10.5′	54.2′
9	315°04.2	·· 09.3	191°52.3	15.6′	04°25.7	10.5′	54.2′
10	330°04.1	09.4	206°26.9	15.6′	04°36.2	10.4′	54.2′
11	345°03.9	09.6	221°01.5	15.6′	04°46.6	10.4′	54.1′
12	0°03.8	N23°09.8	235°36.1	15.6′	S04°57.0	10.4′	54.1′
13	15°03.7	09.9	250°10.7	15.6′	05°07.4	10.3′	54.1′
14	30°03.5	10.1	264°45.3	15.6′	05°17.7	10.4′	54.1′
15	45°03.4	·· 10.2	279°19.9	15.6′	05°28.1	10.3′	54.1′
16	60°03.3	10.4	293°54.4	15.6′	05°38.4	10.3′	54.1′
17	75°03.2	10.5	308°29.0	15.5′	05°48.7	10.3′	54.1′
18	90°03.0	N23°10.7	323°03.5	15.5′	S05°59.0	10.2′	54.1′
19	105°02.9	10.8	337°38.1	15.5′	06°09.2	10.2′	54.1′
20	120°02.8	11.0	352°12.6	15.5′	06°19.4	10.2′	54.1′
21	135°02.6	·· 11.1	6°47.1	15.5′	06°29.6	10.2′	54.1′
22	150°02.5	11.3	21°21.6	15.5′	06°39.8	10.1′	54.1′
23	165°02.4	11.4	35°56.1	15.5′	06°49.9	10.1′	54.1′
	SD = 15.7′	d = 0.2′	SD = 14.8′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°02.3	N23°11.6	50°30.5	15.4′	S07°00.0	10.1′	54.0′
1	195°02.1	11.7	65°05.0	15.4′	07°10.1	10.0′	54.0′
2	210°02.0	11.8	79°39.4	15.4′	07°20.1	10.0′	54.0′
3	225°01.9	·· 12.0	94°13.8	15.4′	07°30.1	10.0′	54.0′
4	240°01.7	12.1	108°48.2	15.4′	07°40.1	10.0′	54.0′
5	255°01.6	12.3	123°22.6	15.4′	07°50.1	9.9′	54.0′
6	270°01.5	N23°12.4	137°57.0	15.3′	S08°00.0	9.9′	54.0′
7	285°01.4	12.6	152°31.3	15.3′	08°09.9	9.9′	54.0′
8	300°01.2	12.7	167°05.6	15.3′	08°19.8	9.8′	54.0′
9	315°01.1	·· 12.8	181°39.9	15.3′	08°29.6	9.8′	54.0′
10	330°01.0	13.0	196°14.2	15.3′	08°39.4	9.7′	54.0′
11	345°00.8	13.1	210°48.4	15.2′	08°49.1	9.7′	54.0′
12	0°00.7	N23°13.3	225°22.7	15.2′	S08°58.8	9.7′	54.0′
13	15°00.6	13.4	239°56.9	15.2′	09°08.5	9.7′	54.0′
14	30°00.4	13.5	254°31.0	15.2′	09°18.2	9.6′	54.0′
15	45°00.3	·· 13.7	269°05.2	15.1′	09°27.8	9.6′	54.0′
16	60°00.2	13.8	283°39.3	15.1′	09°37.4	9.5′	54.0′
17	75°00.1	13.9	298°13.4	15.1′	09°46.9	9.5′	54.0′
18	89°59.9	N23°14.1	312°47.5	15.0′	S09°56.4	9.4′	54.0′
19	104°59.8	14.2	327°21.5	15.0′	10°05.8	9.5′	54.0′
20	119°59.7	14.3	341°55.6	15.0′	10°15.3	9.3′	54.0′
21	134°59.5	·· 14.5	356°29.5	15.0′	10°24.6	9.4′	54.0′
22	149°59.4	14.6	11°03.5	14.9′	10°34.0	9.3′	54.0′
23	164°59.3	14.7	25°37.4	14.9′	10°43.3	9.2′	54.0′
	SD = 15.7′	d = 0.1′	SD = 14.7′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°59.1	N23°14.8	40°11.3	14.9′	S10°52.5	9.2′	54.0′
1	194°59.0	15.0	54°45.2	14.8′	11°01.7	9.2′	54.0′
2	209°58.9	15.1	69°19.0	14.8′	11°10.9	9.1′	54.0′
3	224°58.8	·· 15.2	83°52.8	14.8′	11°20.0	9.1′	54.0′
4	239°58.6	15.4	98°26.6	14.7′	11°29.1	9.0′	54.0′
5	254°58.5	15.5	113°00.3	14.7′	11°38.1	9.0′	54.0′
6	269°58.4	N23°15.6	127°34.0	14.7′	S11°47.1	8.9′	54.0′
7	284°58.2	15.7	142°07.7	14.6′	11°56.0	8.9′	54.0′
8	299°58.1	15.9	156°41.3	14.6′	12°04.9	8.8′	54.0′
9	314°58.0	·· 16.0	171°14.9	14.6′	12°13.7	8.8′	54.0′
10	329°57.8	16.1	185°48.5	14.5′	12°22.5	8.8′	54.0′
11	344°57.7	16.2	200°22.0	14.5′	12°31.3	8.6′	54.0′
12	359°57.6	N23°16.3	214°55.5	14.5′	S12°39.9	8.7′	54.0′
13	14°57.4	16.5	229°29.0	14.4′	12°48.6	8.6′	54.0′
14	29°57.3	16.6	244°02.4	14.4′	12°57.2	8.5′	54.0′
15	44°57.2	·· 16.7	258°35.8	14.3′	13°05.7	8.5′	54.0′
16	59°57.1	16.8	273°09.1	14.3′	13°14.2	8.4′	54.0′
17	74°56.9	16.9	287°42.4	14.3′	13°22.6	8.4′	54.0′
18	89°56.8	N23°17.0	302°15.7	14.2′	S13°31.0	8.3′	54.0′
19	104°56.7	17.2	316°48.9	14.2′	13°39.3	8.3′	54.0′
20	119°56.5	17.3	331°22.1	14.1′	13°47.6	8.2′	54.0′
21	134°56.4	·· 17.4	345°55.2	14.1′	13°55.8	8.1′	54.0′
22	149°56.3	17.5	0°28.3	14.1′	14°03.9	8.1′	54.0′
23	164°56.1	17.6	15°01.4	14.0′	14°12.0	8.1′	54.0′
	SD = 15.7′	d = 0.1′	SD = 14.7′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	▭	▭	▭	▭	▭	▭
66°	▭	▭	▭	▭	▭	▭
64°	////	////	01:35	22:26	////	////
62°	////	////	02:11	21:49	////	////
60°	////	00:57	02:37	21:23	23:05	////
N 58°	////	01:43	02:57	21:03	22:18	////
56°	////	02:12	03:14	20:47	21:49	////
54°	00:52	02:34	03:28	20:33	21:27	23:10
52°	01:35	02:51	03:40	20:20	21:09	22:26
50°	02:01	03:06	03:50	20:10	20:54	21:59
45°	02:46	03:35	04:13	19:47	20:25	21:14
N 40°	03:16	03:58	04:30	19:30	20:02	20:44
35°	03:39	04:16	04:45	19:15	19:44	20:21
30°	03:58	04:31	04:58	19:02	19:29	20:02
20°	04:26	04:56	05:20	18:40	19:04	19:34
N 10°	04:49	05:16	05:39	18:21	18:44	19:11
0°	05:08	05:34	05:56	18:04	18:26	18:52
S 10°	05:24	05:51	06:14	17:46	18:09	18:35
20°	05:40	06:08	06:32	17:28	17:52	18:19
30°	05:57	06:27	06:53	17:07	17:33	18:03
35°	06:05	06:37	07:05	16:55	17:23	17:54
40°	06:15	06:49	07:19	16:41	17:11	17:45
45°	06:25	07:02	07:36	16:24	16:58	17:35
S 50°	06:37	07:18	07:56	16:03	16:42	17:23
52°	06:42	07:25	08:06	15:54	16:34	17:18
54°	06:47	07:33	08:17	15:43	16:26	17:12
56°	06:53	07:42	08:30	15:30	16:17	17:06
58°	07:00	07:53	08:44	15:16	16:07	17:00
S 60°	07:07	08:04	09:01	14:58	15:56	16:52

Lat.	**Moonrise** Fri	Sat	Sun	**Moonset** Fri	Sat	Sun
N 72°	15:35	17:18	19:09	01:20	01:07	00:52
N 70°	15:26	17:01	18:40	01:24	01:18	01:10
68°	15:20	16:48	18:19	01:28	01:26	01:25
66°	15:14	16:38	18:03	01:31	01:33	01:36
64°	15:09	16:29	17:49	01:33	01:39	01:46
62°	15:05	16:22	17:38	01:36	01:44	01:55
60°	15:02	16:15	17:29	01:38	01:49	02:02
N 58°	14:59	16:09	17:20	01:39	01:53	02:08
56°	14:56	16:04	17:13	01:41	01:57	02:14
54°	14:53	16:00	17:07	01:42	02:00	02:19
52°	14:51	15:56	17:01	01:43	02:03	02:24
50°	14:49	15:52	16:55	01:45	02:06	02:28
45°	14:45	15:44	16:44	01:47	02:11	02:37
N 40°	14:41	15:38	16:35	01:49	02:16	02:45
35°	14:38	15:32	16:27	01:51	02:21	02:52
30°	14:35	15:27	16:20	01:53	02:24	02:57
20°	14:30	15:19	16:08	01:56	02:31	03:08
N 10°	14:26	15:11	15:57	01:58	02:37	03:16
0°	14:22	15:04	15:47	02:00	02:42	03:25
S 10°	14:18	14:57	15:38	02:03	02:48	03:33
20°	14:14	14:50	15:27	02:05	02:53	03:42
30°	14:09	14:42	15:16	02:08	03:00	03:52
35°	14:07	14:37	15:09	02:10	03:04	03:58
40°	14:04	14:31	15:01	02:11	03:08	04:05
45°	14:00	14:25	14:52	02:14	03:13	04:13
S 50°	13:56	14:18	14:41	02:16	03:19	04:23
52°	13:54	14:14	14:37	02:17	03:22	04:27
54°	13:52	14:11	14:31	02:19	03:25	04:32
56°	13:50	14:06	14:25	02:20	03:29	04:37
58°	13:47	14:02	14:18	02:22	03:33	04:43
S 60°	13:45	13:57	14:11	02:23	03:37	04:50

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 10-12 74-88%
12	00:21	00:15	12:00	20:32	08:11	
13	00:09	00:03	12:00	21:14	08:53	
14	00:03	00:10	12:00	21:58	09:36	

June 15, 16, 17 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	263°11.3	160°08.4	N24°05.3	198°06.0	N21°35.3	81°47.1	N00°52.5	79°23.1	N01°02.2
1	278°13.8	175°07.5	05.1	213°06.6	35.6	96°49.5	52.4	94°25.5	02.2
2	293°16.3	190°06.7	04.9	228°07.2	36.0	111°51.8	52.3	109°27.9	02.1
3	308°18.7	205°05.8	·· 04.6	243°07.8	·· 36.3	126°54.2	·· 52.3	124°30.4	·· 02.1
4	323°21.2	220°04.9	04.4	258°08.4	36.6	141°56.5	52.2	139°32.8	02.1
5	338°23.6	235°04.0	04.2	273°09.0	36.9	156°58.9	52.2	154°35.2	02.1
6	353°26.1	250°03.2	N24°04.0	288°09.6	N21°37.2	172°01.2	N00°52.1	169°37.6	N01°02.0
7	8°28.6	265°02.3	03.8	303°10.2	37.6	187°03.6	52.0	184°40.1	02.0
8	23°31.0	280°01.4	03.6	318°10.8	37.9	202°05.9	52.0	199°42.5	02.0
9	38°33.5	295°00.6	·· 03.4	333°11.4	·· 38.2	217°08.2	·· 51.9	214°44.9	·· 02.0
10	53°36.0	309°59.7	03.2	348°12.0	38.5	232°10.6	51.8	229°47.4	01.9
11	68°38.4	324°58.8	03.0	3°12.6	38.8	247°12.9	51.8	244°49.8	01.9
12	83°40.9	339°57.9	N24°02.8	18°13.2	N21°39.1	262°15.3	N00°51.7	259°52.2	N01°01.9
13	98°43.4	354°57.1	02.5	33°13.8	39.5	277°17.6	51.6	274°54.6	01.9
14	113°45.8	9°56.2	02.3	48°14.4	39.8	292°20.0	51.6	289°57.1	01.8
15	128°48.3	24°55.3	·· 02.1	63°15.0	·· 40.1	307°22.3	·· 51.5	304°59.5	·· 01.8
16	143°50.8	39°54.5	01.9	78°15.6	40.4	322°24.6	51.5	320°01.9	01.8
17	158°53.2	54°53.6	01.7	93°16.2	40.7	337°27.0	51.4	335°04.4	01.8
18	173°55.7	69°52.7	N24°01.4	108°16.7	N21°41.1	352°29.3	N00°51.3	350°06.8	N01°01.7
19	188°58.1	84°51.9	01.2	123°17.3	41.4	7°31.7	51.3	5°09.2	01.7
20	204°00.6	99°51.0	01.0	138°17.9	41.7	22°34.0	51.2	20°11.6	01.7
21	219°03.1	114°50.1	·· 00.8	153°18.5	·· 42.0	37°36.3	·· 51.1	35°14.1	·· 01.6
22	234°05.5	129°49.2	00.5	168°19.1	42.3	52°38.7	51.1	50°16.5	01.6
23	249°08.0	144°48.4	00.3	183°19.7	42.6	67°41.0	51.0	65°18.9	01.6
Mer.pass. 06:26		ν -0.9′	d 0.2′	ν 0.6′	d 0.3′	ν 2.3′	d 0.1′	ν 2.4′	d 0.0′
		m -3.91		m 1.44		m -2.06		m 0.83	

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	264°10.5	159°47.5	N24°00.1	198°20.3	N21°42.9	82°43.4	N00°50.9	80°21.3	N01°01.6
1	279°12.9	174°46.6	23°59.8	213°20.9	43.3	97°45.7	50.9	95°23.8	01.5
2	294°15.4	189°45.8	59.6	228°21.5	43.6	112°48.0	50.8	110°26.2	01.5
3	309°17.9	204°44.9	·· 59.4	243°22.1	·· 43.9	127°50.4	·· 50.7	125°28.6	·· 01.5
4	324°20.3	219°44.0	59.1	258°22.7	44.2	142°52.7	50.7	140°31.0	01.5
5	339°22.8	234°43.2	58.9	273°23.3	44.5	157°55.1	50.6	155°33.5	01.4
6	354°25.3	249°42.3	N23°58.7	288°23.9	N21°44.8	172°57.4	N00°50.5	170°35.9	N01°01.4
7	9°27.7	264°41.4	58.4	303°24.5	45.1	187°59.7	50.5	185°38.3	01.4
8	24°30.2	279°40.6	58.2	318°25.1	45.4	203°02.1	50.4	200°40.7	01.3
9	39°32.6	294°39.7	·· 57.9	333°25.7	·· 45.8	218°04.4	·· 50.3	215°43.2	·· 01.3
10	54°35.1	309°38.8	57.7	348°26.3	46.1	233°06.7	50.3	230°45.6	01.3
11	69°37.6	324°38.0	57.5	3°26.9	46.4	248°09.1	50.2	245°48.0	01.3
12	84°40.0	339°37.1	N23°57.2	18°27.5	N21°46.7	263°11.4	N00°50.1	260°50.4	N01°01.2
13	99°42.5	354°36.2	57.0	33°28.1	47.0	278°13.7	50.1	275°52.9	01.2
14	114°45.0	9°35.4	56.7	48°28.7	47.3	293°16.1	50.0	290°55.3	01.2
15	129°47.4	24°34.5	·· 56.5	63°29.3	·· 47.6	308°18.4	·· 49.9	305°57.7	·· 01.2
16	144°49.9	39°33.7	56.2	78°29.9	47.9	323°20.8	49.9	321°00.1	01.1
17	159°52.4	54°32.8	56.0	93°30.5	48.2	338°23.1	49.8	336°02.6	01.1
18	174°54.8	69°31.9	N23°55.7	108°31.1	N21°48.5	353°25.4	N00°49.7	351°05.0	N01°01.1
19	189°57.3	84°31.1	55.5	123°31.7	48.8	8°27.8	49.7	6°07.4	01.0
20	204°59.7	99°30.2	55.2	138°32.3	49.1	23°30.1	49.6	21°09.8	01.0
21	220°02.2	114°29.3	·· 55.0	153°32.9	·· 49.5	38°32.4	·· 49.5	36°12.2	·· 01.0
22	235°04.7	129°28.5	54.7	168°33.5	49.8	53°34.8	49.5	51°14.7	01.0
23	250°07.1	144°27.6	54.4	183°34.1	50.1	68°37.1	49.4	66°17.1	00.9
Mer.pass. 06:22		ν -0.9′	d 0.2′	ν 0.6′	d 0.3′	ν 2.3′	d 0.1′	ν 2.4′	d 0.0′
		m -3.91		m 1.45		m -2.05		m 0.83	

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	265°09.6	159°26.7	N23°54.2	198°34.7	N21°50.4	83°39.4	N00°49.3	81°19.5	N01°00.9
1	280°12.1	174°25.9	53.9	213°35.3	50.7	98°41.8	49.3	96°21.9	00.9
2	295°14.5	189°25.0	53.7	228°35.9	51.0	113°44.1	49.2	111°24.4	00.8
3	310°17.0	204°24.2	·· 53.4	243°36.5	·· 51.3	128°46.4	·· 49.1	126°26.8	·· 00.8
4	325°19.5	219°23.3	53.1	258°37.0	51.6	143°48.8	49.1	141°29.2	00.8
5	340°21.9	234°22.4	52.9	273°37.6	51.9	158°51.1	49.0	156°31.6	00.8
6	355°24.4	249°21.6	N23°52.6	288°38.2	N21°52.2	173°53.4	N00°48.9	171°34.0	N01°00.7
7	10°26.9	264°20.7	52.3	303°38.8	52.5	188°55.8	48.9	186°36.5	00.7
8	25°29.3	279°19.9	52.1	318°39.4	52.8	203°58.1	48.8	201°38.9	00.7
9	40°31.8	294°19.0	·· 51.8	333°40.0	·· 53.1	219°00.4	·· 48.7	216°41.3	·· 00.6
10	55°34.2	309°18.1	51.5	348°40.6	53.4	234°02.7	48.7	231°43.7	00.6
11	70°36.7	324°17.3	51.3	3°41.2	53.7	249°05.1	48.6	246°46.1	00.6
12	85°39.2	339°16.4	N23°51.0	18°41.8	N21°54.0	264°07.4	N00°48.5	261°48.6	N01°00.5
13	100°41.6	354°15.6	50.7	33°42.4	54.3	279°09.7	48.5	276°51.0	00.5
14	115°44.1	9°14.7	50.4	48°43.0	54.6	294°12.1	48.4	291°53.4	00.5
15	130°46.6	24°13.8	·· 50.2	63°43.6	·· 54.9	309°14.4	·· 48.3	306°55.8	·· 00.5
16	145°49.0	39°13.0	49.9	78°44.2	55.2	324°16.7	48.2	321°58.2	00.4
17	160°51.5	54°12.1	49.6	93°44.8	55.5	339°19.1	48.2	337°00.7	00.4
18	175°54.0	69°11.3	N23°49.3	108°45.4	N21°55.8	354°21.4	N00°48.1	352°03.1	N01°00.4
19	190°56.4	84°10.4	49.0	123°46.0	56.1	9°23.7	48.0	7°05.5	00.3
20	205°58.9	99°09.6	48.7	138°46.6	56.4	24°26.0	48.0	22°07.9	00.3
21	221°01.4	114°08.7	·· 48.5	153°47.2	·· 56.7	39°28.4	·· 47.9	37°10.3	·· 00.3
22	236°03.8	129°07.9	48.2	168°47.8	57.0	54°30.7	47.8	52°12.8	00.2
23	251°06.3	144°07.0	47.9	183°48.4	57.3	69°33.0	47.8	67°15.2	00.2
Mer.pass. 06:18		ν -0.9′	d 0.3′	ν 0.6′	d 0.3′	ν 2.3′	d 0.1′	ν 2.4′	d 0.0′
		m -3.91		m 1.45		m -2.04		m 0.84	

Stars

	SHA	Dec
Alpheratz	358°08.8	28°59.0
Ankaa	353°39.8	-42°24.3
Schedar	350°08.6	56°25.8
Diphda	349°20.5	-18°05.3
Achernar	335°45.2	-57°19.7
Hamal	328°28.6	23°22.3
Polaris	326°56.7	89°10.4
Acamar	315°37.2	-40°22.7
Menkar	314°40.9	4°00.9
Mirfak	309°15.8	49°47.5
Aldebaran	291°17.8	16°28.2
Rigel	281°35.9	-8°13.5
Capella	281°11.0	45°58.7
Bellatrix	278°58.5	6°19.9
Elnath	278°43.9	28°35.4
Alnilam	276°11.5	-1°12.9
Betelgeuse	271°28.1	7°24.2
Canopus	264°07.5	-52°41.2
Sirius	258°55.6	-16°41.5
Adhara	255°32.1	-28°56.9
Procyon	245°25.6	5°16.4
Pollux	243°57.9	28°04.3
Avior	234°28.5	-59°27.2
Suhail	223°10.7	-43°21.6
Miaplacidus	221°45.4	-69°38.7
Alphard	218°20.3	-8°34.7
Regulus	208°09.6	12°03.6
Dubhe	194°21.6	61°51.4
Denebola	182°58.5	14°40.7
Gienah	176°17.4	-17°26.3
Acrux	173°36.6	-63°00.0
Gacrux	172°28.0	-57°00.7
Alioth	166°41.9	56°04.0
Spica	158°56.9	-11°03.8
Alkaid	153°17.8	49°24.7
Hadar	149°22.2	-60°17.2
Menkent	148°36.2	-36°16.8
Arcturus	146°17.8	19°16.9
Rigil Kent.	140°24.6	-60°45.5
Kochab	137°18.1	74°14.2
Zuben'ubi	137°32.2	-15°57.9
Alphecca	126°31.4	26°46.8
Antares	112°55.9	-26°23.4
Atria	108°19.1	-68°59.7
Sabik	102°40.2	-15°42.1
Shaula	96°54.6	-37°05.4
Rasalhague	96°28.8	12°34.5
Eltanin	90°56.9	51°29.5
Kaus Aust.	84°15.8	-34°23.6
Vega	80°55.1	38°46.0
Nunki	76°28.2	-26°19.1
Altair	62°31.7	8°49.1
Peacock	53°57.1	-56°47.5
Deneb	49°47.8	45°12.6
Enif	34°10.9	9°47.3
Al Na'ir	28°14.1	-47°02.9
Fomalhaut	15°50.8	-29°43.2
Scheat	14°17.0	27°58.7
Markab	14°02.6	15°06.1

Jun 15 Mon	SHA	Mer.pass
Venus	256°57.1	13:20
Mars	294°54.7	10:47
Jupiter	178°35.8	18:30
Saturn	176°11.7	18:39

Jun 16 Tue	SHA	Mer.pass
Venus	255°37.0	13:22
Mars	294°09.9	10:46
Jupiter	178°32.9	18:26
Saturn	176°10.9	18:36

Jun 17 Wed	SHA	Mer.pass
Venus	254°17.1	13:23
Mars	293°25.1	10:45
Jupiter	178°29.8	18:23
Saturn	176°09.9	18:32

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°56.0	N23°17.7	29°34.4	14.0′	S14°20.1	7.9′	54.0′
1	194°55.9	17.8	44°07.3	13.9′	14°28.0	8.0′	54.0′
2	209°55.7	17.9	58°40.3	13.9′	14°36.0	7.8′	54.0′
3	224°55.6	·· 18.1	73°13.2	13.8′	14°43.8	7.8′	54.0′
4	239°55.5	18.2	87°46.0	13.8′	14°51.6	7.8′	54.0′
5	254°55.3	18.3	102°18.8	13.8′	14°59.4	7.6′	54.0′
6	269°55.2	N23°18.4	116°51.6	13.7′	S15°07.0	7.7′	54.0′
7	284°55.1	18.5	131°24.3	13.7′	15°14.7	7.5′	54.0′
8	299°54.9	18.6	145°57.0	13.6′	15°22.2	7.5′	54.1′
9	314°54.8	·· 18.7	160°29.6	13.6′	15°29.7	7.4′	54.1′
10	329°54.7	18.8	175°02.2	13.5′	15°37.1	7.4′	54.1′
11	344°54.5	18.9	189°34.7	13.5′	15°44.5	7.3′	54.1′
12	359°54.4	N23°19.0	204°07.2	13.5′	S15°51.8	7.2′	54.1′
13	14°54.3	19.1	218°39.7	13.4′	15°59.0	7.1′	54.1′
14	29°54.2	19.2	233°12.1	13.4′	16°06.1	7.1′	54.1′
15	44°54.0	·· 19.3	247°44.4	13.3′	16°13.2	7.1′	54.1′
16	59°53.9	19.4	262°16.8	13.3′	16°20.3	6.9′	54.1′
17	74°53.8	19.5	276°49.0	13.2′	16°27.2	6.9′	54.1′
18	89°53.6	N23°19.6	291°21.2	13.2′	S16°34.1	6.8′	54.1′
19	104°53.5	19.7	305°53.4	13.1′	16°40.9	6.8′	54.1′
20	119°53.4	19.8	320°25.6	13.1′	16°47.7	6.6′	54.1′
21	134°53.2	·· 19.9	334°57.6	13.0′	16°54.3	6.6′	54.1′
22	149°53.1	20.0	349°29.7	13.0′	17°00.9	6.6′	54.2′
23	164°53.0	20.1	4°01.7	12.9′	17°07.5	6.4′	54.2′
	SD = 15.7′	d = 0.1′	SD = 14.7′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°52.8	N23°20.2	18°33.6	12.9′	S17°13.9	6.4′	54.2′
1	194°52.7	20.3	33°05.5	12.9′	17°20.3	6.3′	54.2′
2	209°52.6	20.4	47°37.4	12.8′	17°26.6	6.2′	54.2′
3	224°52.4	·· 20.5	62°09.2	12.8′	17°32.8	6.2′	54.2′
4	239°52.3	20.6	76°40.9	12.7′	17°39.0	6.0′	54.2′
5	254°52.2	20.7	91°12.7	12.7′	17°45.0	6.0′	54.2′
6	269°52.0	N23°20.7	105°44.3	12.6′	S17°51.0	6.0′	54.2′
7	284°51.9	20.8	120°16.0	12.6′	17°57.0	5.8′	54.2′
8	299°51.8	20.9	134°47.5	12.5′	18°02.8	5.8′	54.2′
9	314°51.6	·· 21.0	149°19.1	12.5′	18°08.6	5.6′	54.3′
10	329°51.5	21.1	163°50.6	12.4′	18°14.2	5.6′	54.3′
11	344°51.4	21.2	178°22.0	12.4′	18°19.8	5.6′	54.3′
12	359°51.2	N23°21.3	192°53.4	12.3′	S18°25.4	5.4′	54.3′
13	14°51.1	21.4	207°24.7	12.3′	18°30.8	5.4′	54.3′
14	29°51.0	21.4	221°56.0	12.3′	18°36.2	5.2′	54.3′
15	44°50.8	·· 21.5	236°27.3	12.2′	18°41.4	5.2′	54.3′
16	59°50.7	21.6	250°58.5	12.2′	18°46.6	5.1′	54.3′
17	74°50.6	21.7	265°29.7	12.1′	18°51.7	5.0′	54.3′
18	89°50.4	N23°21.8	280°00.8	12.1′	S18°56.7	5.0′	54.3′
19	104°50.3	21.9	294°31.9	12.0′	19°01.7	4.8′	54.4′
20	119°50.2	21.9	309°02.9	12.0′	19°06.5	4.8′	54.4′
21	134°50.0	·· 22.0	323°33.9	11.9′	19°11.3	4.7′	54.4′
22	149°49.9	22.1	338°04.8	11.9′	19°16.0	4.5′	54.4′
23	164°49.8	22.2	352°35.7	11.9′	19°20.5	4.5′	54.4′
	SD = 15.7′	d = 0.1′	SD = 14.8′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°49.6	N23°22.3	7°06.6	11.8′	S19°25.0	4.5′	54.4′
1	194°49.5	22.3	21°37.4	11.8′	19°29.5	4.3′	54.4′
2	209°49.4	22.4	36°08.2	11.7′	19°33.8	4.2′	54.4′
3	224°49.2	·· 22.5	50°38.9	11.7′	19°38.0	4.1′	54.4′
4	239°49.1	22.6	65°09.6	11.6′	19°42.1	4.1′	54.5′
5	254°49.0	22.6	79°40.2	11.6′	19°46.2	3.9′	54.5′
6	269°48.8	N23°22.7	94°10.8	11.6′	S19°50.1	3.9′	54.5′
7	284°48.7	22.8	108°41.4	11.5′	19°54.0	3.8′	54.5′
8	299°48.6	22.8	123°11.9	11.5′	19°57.8	3.7′	54.5′
9	314°48.4	·· 22.9	137°42.4	11.4′	20°01.5	3.5′	54.5′
10	329°48.3	23.0	152°12.8	11.4′	20°05.0	3.5′	54.5′
11	344°48.2	23.1	166°43.2	11.4′	20°08.5	3.4′	54.6′
12	359°48.0	N23°23.1	181°13.6	11.3′	S20°11.9	3.3′	54.6′
13	14°47.9	23.2	195°43.9	11.3′	20°15.2	3.2′	54.6′
14	29°47.7	23.3	210°14.2	11.2′	20°18.4	3.1′	54.6′
15	44°47.6	·· 23.3	224°44.4	11.2′	20°21.5	3.0′	54.6′
16	59°47.5	23.4	239°14.6	11.2′	20°24.5	3.0′	54.6′
17	74°47.3	23.5	253°44.8	11.1′	20°27.5	2.8′	54.6′
18	89°47.2	N23°23.5	268°14.9	11.1′	S20°30.3	2.7′	54.6′
19	104°47.1	23.6	282°45.0	11.1′	20°33.0	2.6′	54.7′
20	119°46.9	23.7	297°15.1	11.0′	20°35.6	2.5′	54.7′
21	134°46.8	·· 23.7	311°45.1	11.0′	20°38.1	2.4′	54.7′
22	149°46.7	23.8	326°15.1	11.0′	20°40.5	2.4′	54.7′
23	164°46.5	23.8	340°45.1	10.9′	20°42.9	2.2′	54.7′
	SD = 15.7′	d = 0.1′	SD = 14.8′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	▭	▭	▭	▭	▭	▭
66°	▭	▭	▭	▭	▭	▭
64°	////	////	01:32	22:30	////	////
62°	////	////	02:10	21:52	////	////
60°	////	00:52	02:36	21:26	23:10	////
N 58°	////	01:41	02:56	21:05	22:21	////
56°	////	02:11	03:13	20:49	21:51	////
54°	00:48	02:33	03:27	20:34	21:29	23:15
52°	01:33	02:51	03:39	20:22	21:11	22:29
50°	02:00	03:06	03:50	20:11	20:56	22:01
45°	02:46	03:35	04:13	19:49	20:26	21:16
N 40°	03:16	03:58	04:31	19:31	20:04	20:45
35°	03:39	04:16	04:46	19:16	19:45	20:22
30°	03:58	04:31	04:58	19:03	19:30	20:04
20°	04:27	04:56	05:20	18:41	19:05	19:35
N 10°	04:49	05:16	05:39	18:22	18:45	19:12
0°	05:08	05:34	05:57	18:04	18:27	18:53
S 10°	05:25	05:51	06:14	17:47	18:10	18:36
20°	05:41	06:09	06:33	17:28	17:52	18:20
30°	05:58	06:28	06:54	17:07	17:34	18:03
35°	06:06	06:38	07:06	16:55	17:23	17:55
40°	06:16	06:50	07:20	16:41	17:11	17:45
45°	06:26	07:03	07:37	16:24	16:58	17:35
S 50°	06:38	07:19	07:58	16:03	16:42	17:23
52°	06:43	07:27	08:08	15:53	16:34	17:18
54°	06:49	07:35	08:19	15:42	16:26	17:12
56°	06:55	07:44	08:31	15:30	16:17	17:06
58°	07:02	07:54	08:46	15:15	16:07	16:59
S 60°	07:09	08:06	09:04	14:58	15:55	16:52

Lat.	**Moonrise** Mon	Tue	Wed	**Moonset** Mon	Tue	Wed
N 72°	21:23	▬	▬	00:32 23:51	▬	▬
N 70°	20:26	22:30	▬	01:01	00:49	00:24
68°	19:53	21:27	22:58	01:24	01:24	01:27
66°	19:28	20:53	22:09	01:41	01:49	02:02
64°	19:10	20:27	21:38	01:55	02:08	02:28
62°	18:54	20:08	21:15	02:07	02:24	02:47
60°	18:41	19:52	20:57	02:17	02:37	03:04
N 58°	18:31	19:38	20:41	02:26	02:49	03:18
56°	18:21	19:27	20:28	02:34	02:59	03:30
54°	18:13	19:17	20:17	02:41	03:08	03:40
52°	18:05	19:08	20:07	02:48	03:16	03:49
50°	17:58	19:00	19:58	02:53	03:23	03:58
45°	17:44	18:42	19:39	03:06	03:38	04:15
N 40°	17:32	18:29	19:24	03:16	03:51	04:30
35°	17:22	18:17	19:11	03:25	04:01	04:42
30°	17:13	18:06	18:59	03:33	04:11	04:53
20°	16:58	17:49	18:40	03:46	04:27	05:11
N 10°	16:45	17:33	18:23	03:58	04:41	05:27
0°	16:32	17:19	18:08	04:09	04:55	05:42
S 10°	16:20	17:05	17:52	04:20	05:08	05:57
20°	16:07	16:50	17:35	04:32	05:22	06:13
30°	15:52	16:32	17:16	04:45	05:39	06:32
35°	15:44	16:22	17:05	04:53	05:48	06:43
40°	15:34	16:11	16:52	05:02	05:59	06:55
45°	15:22	15:57	16:37	05:13	06:12	07:10
S 50°	15:09	15:41	16:19	05:26	06:28	07:28
52°	15:02	15:33	16:10	05:32	06:35	07:36
54°	14:55	15:24	16:01	05:38	06:43	07:46
56°	14:47	15:15	15:50	05:46	06:53	07:57
58°	14:39	15:04	15:37	05:54	07:03	08:09
S 60°	14:28	14:51	15:23	06:04	07:15	08:23

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 13-15 94-100%
15	00:16	00:22	12:00	22:43	10:20	
16	00:29	00:35	12:01	23:31	11:07	
17	00:42	00:48	12:01	–:–	11:55	

June 18, 19, 20 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	266°08.7	159°06.1	N23°47.6	198°49.0	N21°57.6	84°35.3	N00°47.7	82°17.6	N01°00.2
1	281°11.2	174°05.3	47.3	213°49.6	57.9	99°37.7	47.6	97°20.0	00.2
2	296°13.7	189°04.4	47.0	228°50.2	58.2	114°40.0	47.5	112°22.4	00.1
3	311°16.1	204°03.6	·· 46.7	243°50.8	·· 58.5	129°42.3	·· 47.5	127°24.9	·· 00.1
4	326°18.6	219°02.7	46.4	258°51.4	58.8	144°44.6	47.4	142°27.3	00.1
5	341°21.1	234°01.9	46.1	273°52.0	59.1	159°47.0	47.3	157°29.7	00.0
6	356°23.5	249°01.0	N23°45.8	288°52.5	N21°59.4	174°49.3	N00°47.3	172°32.1	N01°00.0
7	11°26.0	264°00.2	45.6	303°53.1	59.7	189°51.6	47.2	187°34.5	01°00.0
8	26°28.5	278°59.3	45.3	318°53.7	21°59.9	204°54.0	47.1	202°36.9	00°59.9
9	41°30.9	293°58.5	·· 45.0	333°54.3	22°00.2	219°56.3	·· 47.0	217°39.4	·· 59.9
10	56°33.4	308°57.6	44.7	348°54.9	00.5	234°58.6	47.0	232°41.8	59.9
11	71°35.9	323°56.7	44.4	3°55.5	00.8	250°00.9	46.9	247°44.2	59.8
12	86°38.3	338°55.9	N23°44.0	18°56.1	N22°01.1	265°03.2	N00°46.8	262°46.6	N00°59.8
13	101°40.8	353°55.0	43.7	33°56.7	01.4	280°05.6	46.8	277°49.0	59.8
14	116°43.2	8°54.2	43.4	48°57.3	01.7	295°07.9	46.7	292°51.4	59.8
15	131°45.7	23°53.3	·· 43.1	63°57.9	·· 02.0	310°10.2	·· 46.6	307°53.9	·· 59.7
16	146°48.2	38°52.5	42.8	78°58.5	02.3	325°12.5	46.5	322°56.3	59.7
17	161°50.6	53°51.6	42.5	93°59.1	02.6	340°14.9	46.5	337°58.7	59.7
18	176°53.1	68°50.8	N23°42.2	108°59.7	N22°02.9	355°17.2	N00°46.4	353°01.1	N00°59.6
19	191°55.6	83°49.9	41.9	124°00.3	03.2	10°19.5	46.3	8°03.5	59.6
20	206°58.0	98°49.1	41.6	139°00.9	03.4	25°21.8	46.2	23°05.9	59.6
21	222°00.5	113°48.2	·· 41.3	154°01.5	·· 03.7	40°24.1	·· 46.2	38°08.4	·· 59.5
22	237°03.0	128°47.4	41.0	169°02.1	04.0	55°26.5	46.1	53°10.8	59.5
23	252°05.4	143°46.5	40.6	184°02.7	04.3	70°28.8	46.0	68°13.2	59.5
Mer.pass. 06:14		ν -0.9′ d 0.3′		m -3.91	ν 0.6′ d 0.3′		m 1.46	ν 2.3′ d 0.1′	m -2.04	ν 2.4′ d 0.0′	m 0.84

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	267°07.9	158°45.7	N23°40.3	199°03.3	N22°04.6	85°31.1	N00°46.0	83°15.6	N00°59.4
1	282°10.4	173°44.8	40.0	214°03.9	04.9	100°33.4	45.9	98°18.0	59.4
2	297°12.8	188°44.0	39.7	229°04.5	05.2	115°35.8	45.8	113°20.4	59.4
3	312°15.3	203°43.2	·· 39.4	244°05.1	·· 05.5	130°38.1	·· 45.7	128°22.8	·· 59.3
4	327°17.7	218°42.3	39.0	259°05.6	05.7	145°40.4	45.7	143°25.3	59.3
5	342°20.2	233°41.5	38.7	274°06.2	06.0	160°42.7	45.6	158°27.7	59.3
6	357°22.7	248°40.6	N23°38.4	289°06.8	N22°06.3	175°45.0	N00°45.5	173°30.1	N00°59.2
7	12°25.1	263°39.8	38.1	304°07.4	06.6	190°47.4	45.4	188°32.5	59.2
8	27°27.6	278°38.9	37.7	319°08.0	06.9	205°49.7	45.4	203°34.9	59.2
9	42°30.1	293°38.1	·· 37.4	334°08.6	·· 07.2	220°52.0	·· 45.3	218°37.3	·· 59.1
10	57°32.5	308°37.2	37.1	349°09.2	07.5	235°54.3	45.2	233°39.7	59.1
11	72°35.0	323°36.4	36.8	4°09.8	07.7	250°56.6	45.1	248°42.1	59.1
12	87°37.5	338°35.5	N23°36.4	19°10.4	N22°08.0	265°58.9	N00°45.1	263°44.6	N00°59.0
13	102°39.9	353°34.7	36.1	34°11.0	08.3	281°01.3	45.0	278°47.0	59.0
14	117°42.4	8°33.8	35.8	49°11.6	08.6	296°03.6	44.9	293°49.4	59.0
15	132°44.8	23°33.0	·· 35.4	64°12.2	·· 08.9	311°05.9	·· 44.8	308°51.8	·· 58.9
16	147°47.3	38°32.2	35.1	79°12.8	09.2	326°08.2	44.8	323°54.2	58.9
17	162°49.8	53°31.3	34.7	94°13.4	09.4	341°10.5	44.7	338°56.6	58.9
18	177°52.2	68°30.5	N23°34.4	109°14.0	N22°09.7	356°12.8	N00°44.6	353°59.0	N00°58.8
19	192°54.7	83°29.6	34.1	124°14.6	10.0	11°15.2	44.5	9°01.4	58.8
20	207°57.2	98°28.8	33.7	139°15.2	10.3	26°17.5	44.5	24°03.9	58.8
21	222°59.6	113°27.9	·· 33.4	154°15.8	·· 10.6	41°19.8	·· 44.4	39°06.3	·· 58.7
22	238°02.1	128°27.1	33.0	169°16.4	10.8	56°22.1	44.3	54°08.7	58.7
23	253°04.6	143°26.3	32.7	184°16.9	11.1	71°24.4	44.2	69°11.1	58.7
Mer.pass. 06:10		ν -0.8′ d 0.3′		m -3.91	ν 0.6′ d 0.3′		m 1.46	ν 2.3′ d 0.1′	m -2.03	ν 2.4′ d 0.0′	m 0.85

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	268°07.0	158°25.4	N23°32.4	199°17.5	N22°11.4	86°26.7	N00°44.2	84°13.5	N00°58.6
1	283°09.5	173°24.6	32.0	214°18.1	11.7	101°29.0	44.1	99°15.9	58.6
2	298°12.0	188°23.7	31.7	229°18.7	12.0	116°31.4	44.0	114°18.3	58.6
3	313°14.4	203°22.9	·· 31.3	244°19.3	·· 12.2	131°33.7	·· 43.9	129°20.7	·· 58.5
4	328°16.9	218°22.1	31.0	259°19.9	12.5	146°36.0	43.9	144°23.1	58.5
5	343°19.3	233°21.2	30.6	274°20.5	12.8	161°38.3	43.8	159°25.5	58.5
6	358°21.8	248°20.4	N23°30.3	289°21.1	N22°13.1	176°40.6	N00°43.7	174°28.0	N00°58.4
7	13°24.3	263°19.5	29.9	304°21.7	13.3	191°42.9	43.6	189°30.4	58.4
8	28°26.7	278°18.7	29.5	319°22.3	13.6	206°45.2	43.6	204°32.8	58.4
9	43°29.2	293°17.9	·· 29.2	334°22.9	·· 13.9	221°47.6	·· 43.5	219°35.2	·· 58.3
10	58°31.7	308°17.0	28.8	349°23.5	14.2	236°49.9	43.4	234°37.6	58.3
11	73°34.1	323°16.2	28.5	4°24.1	14.4	251°52.2	43.3	249°40.0	58.3
12	88°36.6	338°15.4	N23°28.1	19°24.7	N22°14.7	266°54.5	N00°43.3	264°42.4	N00°58.2
13	103°39.1	353°14.5	27.7	34°25.3	15.0	281°56.8	43.2	279°44.8	58.2
14	118°41.5	8°13.7	27.4	49°25.9	15.3	296°59.1	43.1	294°47.2	58.2
15	133°44.0	23°12.9	·· 27.0	64°26.5	·· 15.5	312°01.4	·· 43.0	309°49.6	·· 58.1
16	148°46.5	38°12.0	26.7	79°27.1	15.8	327°03.7	42.9	324°52.0	58.1
17	163°48.9	53°11.2	26.3	94°27.6	16.1	342°06.0	42.9	339°54.5	58.1
18	178°51.4	68°10.3	N23°25.9	109°28.2	N22°16.4	357°08.4	N00°42.8	354°56.9	N00°58.0
19	193°53.8	83°09.5	25.6	124°28.8	16.6	12°10.7	42.7	9°59.3	58.0
20	208°56.3	98°08.7	25.2	139°29.4	16.9	27°13.0	42.6	25°01.7	58.0
21	223°58.8	113°07.8	·· 24.8	154°30.0	·· 17.2	42°15.3	·· 42.6	40°04.1	·· 57.9
22	239°01.2	128°07.0	24.4	169°30.6	17.4	57°17.6	42.5	55°06.5	57.9
23	254°03.7	143°06.2	24.1	184°31.2	17.7	72°19.9	42.4	70°08.9	57.9
Mer.pass. 06:07		ν -0.8′ d 0.3′		m -3.91	ν 0.6′ d 0.3′		m 1.46	ν 2.3′ d 0.1′	m -2.02	ν 2.4′ d 0.0′	m 0.85

Stars	SHA	Dec
Alpheratz	358°08.8	28°59.0
Ankaa	353°39.8	-42°24.3
Schedar	350°08.5	56°25.8
Diphda	349°20.4	-18°05.3
Achernar	335°45.2	-57°19.7
Hamal	328°28.5	23°22.3
Polaris	326°55.6	89°10.4
Acamar	315°37.2	-40°22.7
Menkar	314°40.8	4°00.9
Mirfak	309°15.8	49°47.5
Aldebaran	291°17.7	16°28.2
Rigel	281°35.9	-8°13.4
Capella	281°11.0	45°58.7
Bellatrix	278°58.5	6°19.9
Elnath	278°43.9	28°35.4
Alnilam	276°11.5	-1°12.9
Betelgeuse	271°28.1	7°24.2
Canopus	264°07.5	-52°41.2
Sirius	258°55.6	-16°41.5
Adhara	255°32.1	-28°56.9
Procyon	245°25.6	5°16.4
Pollux	243°57.9	28°04.3
Avior	234°28.5	-59°27.2
Suhail	223°10.7	-43°21.6
Miaplacidus	221°45.5	-69°38.7
Alphard	218°20.3	-8°34.7
Regulus	208°09.6	12°03.6
Dubhe	194°21.7	61°51.4
Denebola	182°58.5	14°40.7
Gienah	176°17.4	-17°26.3
Acrux	173°36.6	-63°00.0
Gacrux	172°28.0	-57°00.7
Alioth	166°41.9	56°04.0
Spica	158°56.9	-11°03.8
Alkaid	153°17.8	49°24.7
Hadar	149°22.2	-60°17.2
Menkent	148°36.2	-36°16.8
Arcturus	146°17.8	19°16.9
Rigil Kent.	140°24.6	-60°45.5
Kochab	137°18.2	74°14.2
Zuben'ubi	137°32.2	-15°57.9
Alphecca	126°31.4	26°46.8
Antares	112°55.9	-26°23.4
Atria	108°19.1	-68°59.7
Sabik	102°40.2	-15°42.1
Shaula	96°54.6	-37°05.4
Rasalhague	96°28.8	12°34.5
Eltanin	90°56.9	51°29.5
Kaus Aust.	84°15.8	-34°23.6
Vega	80°55.0	38°46.0
Nunki	76°28.2	-26°19.1
Altair	62°31.7	8°49.1
Peacock	53°57.1	-56°47.5
Deneb	49°47.7	45°12.7
Enif	34°10.9	9°47.3
Al Na'ir	28°14.1	-47°02.9
Fomalhaut	15°50.8	-29°43.2
Scheat	14°17.0	27°58.7
Markab	14°02.6	15°06.2

Jun 18 Thu	SHA	Mer.pass
Venus	252°57.4	13:24
Mars	292°40.2	10:44
Jupiter	178°26.6	18:19
Saturn	176°08.9	18:28

Jun 19 Fri	SHA	Mer.pass
Venus	251°37.8	13:26
Mars	291°55.4	10:43
Jupiter	178°23.2	18:15
Saturn	176°07.7	18:24

Jun 20 Sat	SHA	Mer.pass
Venus	250°18.4	13:27
Mars	291°10.5	10:42
Jupiter	178°19.7	18:11
Saturn	176°06.5	18:20

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°46.4	N23°23.9	355°15.0	10.9′	S20°45.1	2.1′	54.7′
1	194°46.3	24.0	9°44.9	10.9′	20°47.2	2.0′	54.7′
2	209°46.1	24.0	24°14.8	10.8′	20°49.2	1.9′	54.8′
3	224°46.0	·· 24.1	38°44.6	10.8′	20°51.1	1.8′	54.8′
4	239°45.9	24.1	53°14.4	10.8′	20°52.9	1.8′	54.8′
5	254°45.7	24.2	67°44.2	10.7′	20°54.7	1.6′	54.8′
6	269°45.6	N23°24.2	82°13.9	10.7′	S20°56.3	1.5′	54.8′
7	284°45.5	24.3	96°43.6	10.7′	20°57.8	1.4′	54.8′
8	299°45.3	24.4	111°13.3	10.7′	20°59.2	1.3′	54.9′
9	314°45.2	·· 24.4	125°42.9	10.6′	21°00.5	1.2′	54.9′
10	329°45.1	24.5	140°12.6	10.6′	21°01.7	1.1′	54.9′
11	344°44.9	24.5	154°42.2	10.6′	21°02.8	1.0′	54.9′
12	359°44.8	N23°24.6	169°11.7	10.5′	S21°03.8	0.8′	54.9′
13	14°44.7	24.6	183°41.3	10.5′	21°04.6	0.8′	54.9′
14	29°44.5	24.7	198°10.8	10.5′	21°05.4	0.7′	55.0′
15	44°44.4	·· 24.7	212°40.3	10.5′	21°06.1	0.5′	55.0′
16	59°44.3	24.8	227°09.8	10.5′	21°06.6	0.5′	55.0′
17	74°44.1	24.8	241°39.3	10.4′	21°07.1	0.4′	55.0′
18	89°44.0	N23°24.9	256°08.7	10.4′	S21°07.5	0.2′	55.0′
19	104°43.8	24.9	270°38.1	10.4′	21°07.7	0.1′	55.0′
20	119°43.7	25.0	285°07.5	10.4′	21°07.8	0.1′	55.0′
21	134°43.6	·· 25.0	299°36.9	10.4′	21°07.9	0.1′	55.1′
22	149°43.4	25.0	314°06.2	10.3′	21°07.8	0.2′	55.1′
23	164°43.3	25.1	328°35.6	10.3′	21°07.6	0.3′	55.1′
	SD = 15.7′	d = 0.1′	SD = 14.9′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°43.2	N23°25.1	343°04.9	10.3′	S21°07.3	0.4′	55.1′
1	194°43.0	25.2	357°34.2	10.3′	21°06.9	0.5′	55.1′
2	209°42.9	25.2	12°03.5	10.3′	21°06.4	0.6′	55.2′
3	224°42.8	·· 25.3	26°32.7	10.3′	21°05.8	0.7′	55.2′
4	239°42.6	25.3	41°02.0	10.2′	21°05.1	0.8′	55.2′
5	254°42.5	25.3	55°31.2	10.2′	21°04.3	0.9′	55.2′
6	269°42.4	N23°25.4	70°00.5	10.2′	S21°03.4	1.1′	55.2′
7	284°42.2	25.4	84°29.7	10.2′	21°02.3	1.1′	55.2′
8	299°42.1	25.5	98°58.9	10.2′	21°01.2	1.3′	55.3′
9	314°42.0	·· 25.5	113°28.1	10.2′	20°59.9	1.4′	55.3′
10	329°41.8	25.5	127°57.3	10.2′	20°58.5	1.4′	55.3′
11	344°41.7	25.6	142°26.5	10.2′	20°57.1	1.6′	55.3′
12	359°41.6	N23°25.6	156°55.6	10.2′	S20°55.5	1.7′	55.3′
13	14°41.4	25.6	171°24.8	10.2′	20°53.8	1.8′	55.3′
14	29°41.3	25.7	185°53.9	10.1′	20°52.0	1.9′	55.4′
15	44°41.2	·· 25.7	200°23.1	10.1′	20°50.1	2.0′	55.4′
16	59°41.0	25.7	214°52.2	10.1′	20°48.1	2.2′	55.4′
17	74°40.9	25.8	229°21.3	10.1′	20°45.9	2.2′	55.4′
18	89°40.7	N23°25.8	243°50.5	10.1′	S20°43.7	2.3′	55.4′
19	104°40.6	25.8	258°19.6	10.1′	20°41.4	2.5′	55.5′
20	119°40.5	25.8	272°48.7	10.1′	20°38.9	2.5′	55.5′
21	134°40.3	·· 25.9	287°17.8	10.1′	20°36.4	2.7′	55.5′
22	149°40.2	25.9	301°47.0	10.1′	20°33.7	2.8′	55.5′
23	164°40.1	25.9	316°16.1	10.1′	20°30.9	2.9′	55.5′
	SD = 15.7′	d = 0.0′	SD = 15.0′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°39.9	N23°26.0	330°45.2	10.1′	S20°28.0	2.9′	55.6′
1	194°39.8	26.0	345°14.3	10.1′	20°25.1	3.1′	55.6′
2	209°39.7	26.0	359°43.4	10.1′	20°22.0	3.2′	55.6′
3	224°39.5	·· 26.0	14°12.5	10.1′	20°18.8	3.4′	55.6′
4	239°39.4	26.0	28°41.7	10.1′	20°15.4	3.4′	55.6′
5	254°39.3	26.1	43°10.8	10.1′	20°12.0	3.5′	55.7′
6	269°39.1	N23°26.1	57°39.9	10.1′	S20°08.5	3.6′	55.7′
7	284°39.0	26.1	72°09.0	10.1′	20°04.9	3.8′	55.7′
8	299°38.9	26.1	86°38.2	10.1′	20°01.1	3.8′	55.7′
9	314°38.7	·· 26.2	101°07.3	10.1′	19°57.3	4.0′	55.7′
10	329°38.6	26.2	115°36.5	10.2′	19°53.3	4.0′	55.8′
11	344°38.5	26.2	130°05.6	10.2′	19°49.3	4.2′	55.8′
12	359°38.3	N23°26.2	144°34.8	10.2′	S19°45.1	4.2′	55.8′
13	14°38.2	26.2	159°03.9	10.2′	19°40.9	4.4′	55.8′
14	29°38.0	26.2	173°33.1	10.2′	19°36.5	4.5′	55.8′
15	44°37.9	·· 26.3	188°02.3	10.2′	19°32.0	4.6′	55.9′
16	59°37.8	26.3	202°31.5	10.2′	19°27.4	4.7′	55.9′
17	74°37.6	26.3	217°00.7	10.2′	19°22.7	4.7′	55.9′
18	89°37.5	N23°26.3	231°29.9	10.2′	S19°18.0	4.9′	55.9′
19	104°37.4	26.3	245°59.1	10.2′	19°13.1	5.0′	55.9′
20	119°37.2	26.3	260°28.4	10.2′	19°08.1	5.1′	56.0′
21	134°37.1	·· 26.3	274°57.6	10.3′	19°03.0	5.2′	56.0′
22	149°37.0	26.3	289°26.9	10.3′	18°57.8	5.3′	56.0′
23	164°36.8	26.3	303°56.1	10.3′	18°52.5	5.4′	56.0′
	SD = 15.7′	d = 0.0′	SD = 15.2′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	▭	▭	▭	▭	▭	▭
66°	▭	▭	▭	▭	▭	▭
64°	////	////	01:31	22:32	////	////
62°	////	////	02:09	21:54	////	////
60°	////	00:49	02:35	21:27	23:14	////
N 58°	////	01:40	02:56	21:07	22:23	////
56°	////	02:10	03:13	20:50	21:53	////
54°	00:45	02:32	03:27	20:36	21:30	23:18
52°	01:32	02:50	03:39	20:23	21:12	22:31
50°	02:00	03:06	03:50	20:12	20:57	22:03
45°	02:46	03:35	04:13	19:50	20:27	21:17
N 40°	03:16	03:58	04:31	19:32	20:05	20:46
35°	03:39	04:16	04:46	19:17	19:46	20:23
30°	03:58	04:31	04:59	19:04	19:31	20:04
20°	04:27	04:56	05:21	18:41	19:06	19:35
N 10°	04:50	05:17	05:40	18:23	18:46	19:13
0°	05:09	05:35	05:58	18:05	18:27	18:54
S 10°	05:26	05:52	06:15	17:47	18:10	18:37
20°	05:42	06:10	06:34	17:29	17:53	18:20
30°	05:59	06:28	06:55	17:08	17:34	18:04
35°	06:07	06:39	07:07	16:55	17:23	17:55
40°	06:17	06:51	07:21	16:41	17:12	17:46
45°	06:27	07:04	07:38	16:24	16:58	17:35
S 50°	06:39	07:20	07:59	16:03	16:42	17:24
52°	06:44	07:28	08:09	15:54	16:34	17:18
54°	06:50	07:36	08:20	15:42	16:26	17:13
56°	06:56	07:45	08:33	15:30	16:17	17:06
58°	07:03	07:56	08:47	15:15	16:07	17:00
S 60°	07:10	08:07	09:05	14:57	15:55	16:52

Lat.	**Moonrise** Thu	Fri	Sat	**Moonset** Thu	Fri	Sat
N 72°	▬	▬	▬	▬	▬	▬
N 70°	▬	▬	▬	▬	▬	▬
68°	·· ··	00:04	00:30	01:38	02:17	03:37
66°	23:09	23:47	·· ··	02:27	03:12	04:20
64°	22:36	23:17	23:44	02:58	03:45	04:49
62°	22:12	22:55	23:26	03:21	04:09	05:11
60°	21:53	22:37	23:11	03:40	04:28	05:29
N 58°	21:37	22:22	22:58	03:55	04:44	05:44
56°	21:23	22:09	22:47	04:09	04:58	05:56
54°	21:11	21:58	22:37	04:20	05:09	06:07
52°	21:01	21:48	22:28	04:30	05:20	06:17
50°	20:52	21:39	22:20	04:39	05:29	06:26
45°	20:32	21:20	22:03	04:59	05:48	06:44
N 40°	20:16	21:05	21:50	05:14	06:04	06:59
35°	20:03	20:52	21:38	05:27	06:17	07:12
30°	19:51	20:41	21:28	05:39	06:29	07:23
20°	19:31	20:21	21:10	05:59	06:49	07:42
N 10°	19:14	20:05	20:54	06:16	07:06	07:58
0°	18:58	19:49	20:40	06:32	07:22	08:13
S 10°	18:42	19:33	20:25	06:48	07:38	08:29
20°	18:24	19:16	20:10	07:05	07:56	08:45
30°	18:05	18:57	19:52	07:25	08:15	09:03
35°	17:53	18:45	19:42	07:36	08:27	09:14
40°	17:40	18:32	19:30	07:49	08:40	09:27
45°	17:24	18:17	19:16	08:05	08:56	09:41
S 50°	17:05	17:58	18:59	08:24	09:15	09:59
52°	16:56	17:49	18:51	08:33	09:24	10:07
54°	16:45	17:39	18:41	08:43	09:34	10:17
56°	16:34	17:28	18:31	08:55	09:45	10:27
58°	16:20	17:15	18:20	09:08	09:58	10:39
S 60°	16:05	17:00	18:06	09:24	10:14	10:53

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 16-18 100-95%
18	00:54	01:01	12:01	00:20	12:45	
19	01:07	01:14	12:01	01:10	13:36	
20	01:20	01:27	12:01	02:01	14:27	

June 21, 22, 23 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	269°06.2	158°05.3	N23°23.7	199°31.8	N22°18.0	87°22.2	N00°42.3	85°11.3	N00°57.8
1	284°08.6	173°04.5	23.3	214°32.4	18.3	102°24.5	42.2	100°13.7	57.8
2	299°11.1	188°03.7	22.9	229°33.0	18.5	117°26.8	42.2	115°16.1	57.8
3	314°13.6	203°02.8	·· 22.6	244°33.6	·· 18.8	132°29.1	·· 42.1	130°18.5	·· 57.7
4	329°16.0	218°02.0	22.2	259°34.2	19.1	147°31.4	42.0	145°20.9	57.7
5	344°18.5	233°01.2	21.8	274°34.8	19.3	162°33.7	41.9	160°23.3	57.6
6	359°21.0	248°00.4	N23°21.4	289°35.4	N22°19.6	177°36.1	N00°41.8	175°25.7	N00°57.6
7	14°23.4	262°59.5	21.0	304°36.0	19.9	192°38.4	41.8	190°28.2	57.6
8	29°25.9	277°58.7	20.7	319°36.6	20.1	207°40.7	41.7	205°30.6	57.5
9	44°28.3	292°57.9	·· 20.3	334°37.1	·· 20.4	222°43.0	·· 41.6	220°33.0	·· 57.5
10	59°30.8	307°57.0	19.9	349°37.7	20.7	237°45.3	41.5	235°35.4	57.5
11	74°33.3	322°56.2	19.5	4°38.3	20.9	252°47.6	41.5	250°37.8	57.4
12	89°35.7	337°55.4	N23°19.1	19°38.9	N22°21.2	267°49.9	N00°41.4	265°40.2	N00°57.4
13	104°38.2	352°54.6	18.7	34°39.5	21.5	282°52.2	41.3	280°42.6	57.4
14	119°40.7	7°53.7	18.3	49°40.1	21.7	297°54.5	41.2	295°45.0	57.3
15	134°43.1	22°52.9	·· 17.9	64°40.7	·· 22.0	312°56.8	·· 41.1	310°47.4	·· 57.3
16	149°45.6	37°52.1	17.5	79°41.3	22.3	327°59.1	41.1	325°49.8	57.3
17	164°48.1	52°51.2	17.2	94°41.9	22.5	343°01.4	41.0	340°52.2	57.2
18	179°50.5	67°50.4	N23°16.8	109°42.5	N22°22.8	358°03.7	N00°40.9	355°54.6	N00°57.2
19	194°53.0	82°49.6	16.4	124°43.1	23.0	13°06.0	40.8	10°57.0	57.1
20	209°55.5	97°48.8	16.0	139°43.7	23.3	28°08.3	40.7	25°59.4	57.1
21	224°57.9	112°47.9	·· 15.6	154°44.3	·· 23.6	43°10.6	·· 40.7	41°01.8	·· 57.1
22	240°00.4	127°47.1	15.2	169°44.9	23.8	58°12.9	40.6	56°04.2	57.0
23	255°02.8	142°46.3	14.8	184°45.5	24.1	73°15.2	40.5	71°06.6	57.0
Mer.pass. 06:03		ν -0.8′	d 0.4′	m -3.91	ν 0.6′	d 0.3′	m 1.47	ν 2.3′	d 0.1′ m -2.02	ν 2.4′	d 0.0′ m 0.85

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	270°05.3	157°45.5	N23°14.4	199°46.1	N22°24.4	88°17.5	N00°40.4	86°09.0	N00°57.0
1	285°07.8	172°44.6	14.0	214°46.6	24.6	103°19.8	40.3	101°11.4	56.9
2	300°10.2	187°43.8	13.6	229°47.2	24.9	118°22.1	40.2	116°13.8	56.9
3	315°12.7	202°43.0	·· 13.1	244°47.8	·· 25.1	133°24.4	·· 40.2	131°16.2	·· 56.8
4	330°15.2	217°42.2	12.7	259°48.4	25.4	148°26.7	40.1	146°18.6	56.8
5	345°17.6	232°41.4	12.3	274°49.0	25.7	163°29.0	40.0	161°21.0	56.8
6	0°20.1	247°40.5	N23°11.9	289°49.6	N22°25.9	178°31.3	N00°39.9	176°23.4	N00°56.7
7	15°22.6	262°39.7	11.5	304°50.2	26.2	193°33.6	39.8	191°25.9	56.7
8	30°25.0	277°38.9	11.1	319°50.8	26.4	208°35.9	39.8	206°28.3	56.7
9	45°27.5	292°38.1	·· 10.7	334°51.4	·· 26.7	223°38.2	·· 39.7	221°30.7	·· 56.6
10	60°29.9	307°37.2	10.3	349°52.0	27.0	238°40.5	39.6	236°33.1	56.6
11	75°32.4	322°36.4	09.9	4°52.6	27.2	253°42.8	39.5	251°35.5	56.5
12	90°34.9	337°35.6	N23°09.4	19°53.2	N22°27.5	268°45.1	N00°39.4	266°37.9	N00°56.5
13	105°37.3	352°34.8	09.0	34°53.8	27.7	283°47.4	39.3	281°40.3	56.5
14	120°39.8	7°34.0	08.6	49°54.4	28.0	298°49.7	39.3	296°42.7	56.4
15	135°42.3	22°33.2	·· 08.2	64°55.0	·· 28.2	313°52.0	·· 39.2	311°45.1	·· 56.4
16	150°44.7	37°32.3	07.8	79°55.5	28.5	328°54.3	39.1	326°47.5	56.4
17	165°47.2	52°31.5	07.3	94°56.1	28.7	343°56.6	39.0	341°49.9	56.3
18	180°49.7	67°30.7	N23°06.9	109°56.7	N22°29.0	358°58.9	N00°38.9	356°52.3	N00°56.3
19	195°52.1	82°29.9	06.5	124°57.3	29.3	14°01.2	38.9	11°54.7	56.2
20	210°54.6	97°29.1	06.1	139°57.9	29.5	29°03.5	38.8	26°57.1	56.2
21	225°57.1	112°28.2	·· 05.6	154°58.5	·· 29.8	44°05.8	·· 38.7	41°59.5	·· 56.2
22	240°59.5	127°27.4	05.2	169°59.1	30.0	59°08.1	38.6	57°01.9	56.1
23	256°02.0	142°26.6	04.8	184°59.7	30.3	74°10.4	38.5	72°04.3	56.1
Mer.pass. 05:59		ν -0.8′	d 0.4′	m -3.91	ν 0.6′	d 0.3′	m 1.47	ν 2.3′	d 0.1′ m -2.01	ν 2.4′	d 0.0′ m 0.86

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	271°04.4	157°25.8	N23°04.4	200°00.3	N22°30.5	89°12.7	N00°38.4	87°06.7	N00°56.1
1	286°06.9	172°25.0	03.9	215°00.9	30.8	104°15.0	38.4	102°09.1	56.0
2	301°09.4	187°24.2	03.5	230°01.5	31.0	119°17.3	38.3	117°11.5	56.0
3	316°11.8	202°23.4	·· 03.1	245°02.1	·· 31.3	134°19.6	·· 38.2	132°13.9	·· 55.9
4	331°14.3	217°22.5	02.6	260°02.7	31.5	149°21.9	38.1	147°16.3	55.9
5	346°16.8	232°21.7	02.2	275°03.3	31.8	164°24.2	38.0	162°18.7	55.9
6	1°19.2	247°20.9	N23°01.7	290°03.8	N22°32.0	179°26.5	N00°37.9	177°21.1	N00°55.8
7	16°21.7	262°20.1	01.3	305°04.4	32.3	194°28.8	37.9	192°23.5	55.8
8	31°24.2	277°19.3	00.9	320°05.0	32.5	209°31.1	37.8	207°25.9	55.7
9	46°26.6	292°18.5	·· 00.4	335°05.6	·· 32.8	224°33.4	·· 37.7	222°28.3	·· 55.7
10	61°29.1	307°17.7	23°00.0	350°06.2	33.0	239°35.7	37.6	237°30.7	55.7
11	76°31.6	322°16.9	22°59.5	5°06.8	33.3	254°38.0	37.5	252°33.1	55.6
12	91°34.0	337°16.1	N22°59.1	20°07.4	N22°33.5	269°40.3	N00°37.4	267°35.4	N00°55.6
13	106°36.5	352°15.2	58.7	35°08.0	33.8	284°42.5	37.3	282°37.8	55.6
14	121°38.9	7°14.4	58.2	50°08.6	34.0	299°44.8	37.3	297°40.2	55.5
15	136°41.4	22°13.6	·· 57.8	65°09.2	·· 34.3	314°47.1	·· 37.2	312°42.6	·· 55.5
16	151°43.9	37°12.8	57.3	80°09.8	34.5	329°49.4	37.1	327°45.0	55.4
17	166°46.3	52°12.0	56.9	95°10.4	34.8	344°51.7	37.0	342°47.4	55.4
18	181°48.8	67°11.2	N22°56.4	110°11.0	N22°35.0	359°54.0	N00°36.9	357°49.8	N00°55.4
19	196°51.3	82°10.4	56.0	125°11.6	35.3	14°56.3	36.8	12°52.2	55.3
20	211°53.7	97°09.6	55.5	140°12.1	35.5	29°58.6	36.7	27°54.6	55.3
21	226°56.2	112°08.8	·· 55.1	155°12.7	·· 35.7	45°00.9	·· 36.7	42°57.0	·· 55.2
22	241°58.7	127°08.0	54.6	170°13.3	36.0	60°03.2	36.6	57°59.4	55.2
23	257°01.1	142°07.2	54.1	185°13.9	36.2	75°05.5	36.5	73°01.8	55.2
Mer.pass. 05:55		ν -0.8′	d 0.4′	m -3.91	ν 0.6′	d 0.3′	m 1.48	ν 2.3′	d 0.1′ m -2.00	ν 2.4′	d 0.0′ m 0.86

Stars

	SHA	**Dec**
Alpheratz	358°08.8	28°59.0
Ankaa	353°39.8	-42°24.3
Schedar	350°08.5	56°25.8
Diphda	349°20.4	-18°05.3
Achernar	335°45.2	-57°19.7
Hamal	328°28.5	23°22.3
Polaris	326°54.6	89°10.4
Acamar	315°37.1	-40°22.7
Menkar	314°40.8	4°00.9
Mirfak	309°15.7	49°47.5
Aldebaran	291°17.7	16°28.2
Rigel	281°35.8	-8°13.4
Capella	281°11.0	45°58.7
Bellatrix	278°58.5	6°19.9
Elnath	278°43.8	28°35.4
Alnilam	276°11.5	-1°12.9
Betelgeuse	271°28.0	7°24.2
Canopus	264°07.5	-52°41.2
Sirius	258°55.5	-16°41.5
Adhara	255°32.1	-28°56.9
Procyon	245°25.5	5°16.4
Pollux	243°57.9	28°04.3
Avior	234°28.5	-59°27.2
Suhail	223°10.7	-43°21.6
Miaplacidus	221°45.5	-69°38.7
Alphard	218°20.3	-8°34.7
Regulus	208°09.6	12°03.6
Dubhe	194°21.7	61°51.4
Denebola	182°58.5	14°40.7
Gienah	176°17.4	-17°26.3
Acrux	173°36.6	-63°00.0
Gacrux	172°28.1	-57°00.7
Alioth	166°41.9	56°04.0
Spica	158°56.9	-11°03.8
Alkaid	153°17.9	49°24.7
Hadar	149°22.3	-60°17.2
Menkent	148°36.2	-36°16.8
Arcturus	146°17.8	19°16.9
Rigil Kent.	140°24.7	-60°45.5
Kochab	137°18.2	74°14.2
Zuben'ubi	137°32.2	-15°57.9
Alphecca	126°31.4	26°46.8
Antares	112°55.9	-26°23.5
Atria	108°19.1	-68°59.7
Sabik	102°40.2	-15°42.1
Shaula	96°54.6	-37°05.4
Rasalhague	96°28.7	12°34.5
Eltanin	90°56.9	51°29.5
Kaus Aust.	84°15.7	-34°23.6
Vega	80°55.0	38°46.0
Nunki	76°28.1	-26°19.1
Altair	62°31.7	8°49.1
Peacock	53°57.1	-56°47.6
Deneb	49°47.7	45°12.7
Enif	34°10.9	9°47.3
Al Na'ir	28°14.0	-47°02.9
Fomalhaut	15°50.7	-29°43.1
Scheat	14°16.9	27°58.7
Markab	14°02.5	15°06.2

Jun 21 Sun	**SHA**	**Mer.pass**
Venus	248°59.2	13:28
Mars	290°25.6	10:41
Jupiter	178°16.0	18:08
Saturn	176°05.1	18:16

Jun 22 Mon	**SHA**	**Mer.pass**
Venus	247°40.2	13:30
Mars	289°40.7	10:41
Jupiter	178°12.2	18:04
Saturn	176°03.7	18:12

Jun 23 Tue	**SHA**	**Mer.pass**
Venus	246°21.4	13:31
Mars	288°55.8	10:40
Jupiter	178°08.3	18:00
Saturn	176°02.2	18:09

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h — Sun — Moon

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	179°36.7	N23°26.4	318°25.4	10.3′	S18°47.1	5.5′	56.0′
1	194°36.6	26.4	332°54.7	10.3′	18°41.6	5.6′	56.1′
2	209°36.4	26.4	347°24.0	10.3′	18°36.0	5.7′	56.1′
3	224°36.3	·· 26.4	1°53.3	10.3′	18°30.3	5.8′	56.1′
4	239°36.2	26.4	16°22.6	10.3′	18°24.5	5.9′	56.1′
5	254°36.0	26.4	30°52.0	10.4′	18°18.6	6.0′	56.2′
6	269°35.9	N23°26.4	45°21.4	10.4′	S18°12.6	6.1′	56.2′
7	284°35.7	26.4	59°50.7	10.4′	18°06.5	6.2′	56.2′
8	299°35.6	26.4	74°20.1	10.4′	18°00.3	6.3′	56.2′
9	314°35.5	·· 26.4	88°49.5	10.4′	17°54.0	6.4′	56.2′
10	329°35.3	26.4	103°19.0	10.4′	17°47.6	6.5′	56.3′
11	344°35.2	26.4	117°48.4	10.5′	17°41.1	6.6′	56.3′
12	359°35.1	N23°26.4	132°17.9	10.5′	S17°34.5	6.7′	56.3′
13	14°34.9	26.4	146°47.3	10.5′	17°27.8	6.8′	56.3′
14	29°34.8	26.4	161°16.8	10.5′	17°21.0	6.9′	56.4′
15	44°34.7	·· 26.4	175°46.3	10.5′	17°14.1	6.9′	56.4′
16	59°34.5	26.4	190°15.9	10.5′	17°07.2	7.1′	56.4′
17	74°34.4	26.4	204°45.4	10.6′	17°00.1	7.1′	56.4′
18	89°34.3	N23°26.4	219°15.0	10.6′	S16°53.0	7.3′	56.4′
19	104°34.1	26.4	233°44.5	10.6′	16°45.7	7.3′	56.5′
20	119°34.0	26.4	248°14.1	10.6′	16°38.4	7.5′	56.5′
21	134°33.9	·· 26.4	262°43.7	10.6′	16°30.9	7.5′	56.5′
22	149°33.7	26.4	277°13.4	10.6′	16°23.4	7.6′	56.5′
23	164°33.6	26.4	291°43.0	10.7′	16°15.8	7.7′	56.6′
	SD = 15.7′	d = 0.0′		SD = 15.3′			

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	179°33.5	N23°26.4	306°12.7	10.7′	S16°08.1	7.8′	56.6′
1	194°33.3	26.3	320°42.4	10.7′	16°00.3	7.9′	56.6′
2	209°33.2	26.3	335°12.1	10.7′	15°52.4	7.9′	56.6′
3	224°33.0	·· 26.3	349°41.8	10.7′	15°44.5	8.1′	56.7′
4	239°32.9	26.3	4°11.5	10.8′	15°36.4	8.1′	56.7′
5	254°32.8	26.3	18°41.3	10.8′	15°28.3	8.3′	56.7′
6	269°32.6	N23°26.3	33°11.1	10.8′	S15°20.0	8.3′	56.7′
7	284°32.5	26.3	47°40.9	10.8′	15°11.7	8.4′	56.8′
8	299°32.4	26.3	62°10.7	10.8′	15°03.3	8.5′	56.8′
9	314°32.2	·· 26.2	76°40.5	10.8′	14°54.8	8.5′	56.8′
10	329°32.1	26.2	91°10.3	10.9′	14°46.3	8.7′	56.8′
11	344°32.0	26.2	105°40.2	10.9′	14°37.6	8.7′	56.8′
12	359°31.8	N23°26.2	120°10.1	10.9′	S14°28.9	8.8′	56.9′
13	14°31.7	26.2	134°40.0	10.9′	14°20.1	8.9′	56.9′
14	29°31.6	26.2	149°09.9	10.9′	14°11.2	9.0′	56.9′
15	44°31.4	·· 26.1	163°39.8	11.0′	14°02.2	9.0′	56.9′
16	59°31.3	26.1	178°09.8	11.0′	13°53.2	9.2′	57.0′
17	74°31.2	26.1	192°39.8	11.0′	13°44.0	9.2′	57.0′
18	89°31.0	N23°26.1	207°09.7	11.0′	S13°34.8	9.3′	57.0′
19	104°30.9	26.1	221°39.7	11.0′	13°25.5	9.3′	57.0′
20	119°30.8	26.0	236°09.8	11.0′	13°16.2	9.5′	57.1′
21	134°30.6	·· 26.0	250°39.8	11.0′	13°06.7	9.5′	57.1′
22	149°30.5	26.0	265°09.8	11.1′	12°57.2	9.6′	57.1′
23	164°30.4	26.0	279°39.9	11.1′	12°47.6	9.6′	57.1′
	SD = 15.7′	d = 0.0′		SD = 15.4′			

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	179°30.2	N23°25.9	294°10.0	11.1′	S12°38.0	9.8′	57.2′
1	194°30.1	25.9	308°40.1	11.1′	12°28.2	9.8′	57.2′
2	209°29.9	25.9	323°10.2	11.1′	12°18.4	9.8′	57.2′
3	224°29.8	·· 25.9	337°40.3	11.1′	12°08.6	10.0′	57.2′
4	239°29.7	25.8	352°10.4	11.1′	11°58.6	10.0′	57.3′
5	254°29.5	25.8	6°40.6	11.2′	11°48.6	10.1′	57.3′
6	269°29.4	N23°25.8	21°10.7	11.2′	S11°38.5	10.2′	57.3′
7	284°29.3	25.7	35°40.9	11.2′	11°28.3	10.2′	57.3′
8	299°29.1	25.7	50°11.1	11.2′	11°18.1	10.3′	57.4′
9	314°29.0	·· 25.7	64°41.3	11.2′	11°07.8	10.3′	57.4′
10	329°28.9	25.6	79°11.5	11.2′	10°57.5	10.5′	57.4′
11	344°28.7	25.6	93°41.7	11.2′	10°47.0	10.4′	57.4′
12	359°28.6	N23°25.6	108°11.9	11.2′	S10°36.6	10.6′	57.5′
13	14°28.5	25.5	122°42.1	11.2′	10°26.0	10.6′	57.5′
14	29°28.3	25.5	137°12.4	11.3′	10°15.4	10.7′	57.5′
15	44°28.2	·· 25.5	151°42.6	11.3′	10°04.7	10.7′	57.6′
16	59°28.1	25.4	166°12.9	11.3′	09°54.0	10.8′	57.6′
17	74°27.9	25.4	180°43.2	11.3′	09°43.2	10.9′	57.6′
18	89°27.8	N23°25.3	195°13.4	11.3′	S09°32.3	10.9′	57.6′
19	104°27.7	25.3	209°43.7	11.3′	09°21.4	10.9′	57.7′
20	119°27.5	25.3	224°14.0	11.3′	09°10.5	11.1′	57.7′
21	134°27.4	·· 25.2	238°44.3	11.3′	08°59.4	11.1′	57.7′
22	149°27.3	25.2	253°14.6	11.3′	08°48.3	11.1′	57.7′
23	164°27.1	25.1	267°44.9	11.3′	08°37.2	11.2′	57.8′
	SD = 15.7′	d = 0.0′		SD = 15.6′			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	▭	▭	▭	▭	▭	▭
66°	▭	▭	▭	▭	▭	▭
64°	////	////	01:31	22:32	////	////
62°	////	////	02:09	21:54	////	////
60°	////	00:49	02:36	21:28	23:14	////
N 58°	////	01:40	02:56	21:07	22:23	////
56°	////	02:10	03:13	20:50	21:53	////
54°	00:45	02:33	03:27	20:36	21:31	23:18
52°	01:32	02:51	03:40	20:24	21:13	22:31
50°	02:00	03:06	03:51	20:13	20:58	22:03
45°	02:46	03:36	04:13	19:50	20:28	21:18
N 40°	03:17	03:58	04:31	19:32	20:05	20:47
35°	03:40	04:17	04:46	19:17	19:47	20:24
30°	03:59	04:32	05:00	19:04	19:32	20:05
20°	04:28	04:57	05:22	18:42	19:07	19:36
N 10°	04:50	05:18	05:41	18:23	18:46	19:13
0°	05:09	05:36	05:58	18:06	18:28	18:54
S 10°	05:26	05:53	06:16	17:48	18:11	18:37
20°	05:43	06:10	06:34	17:30	17:54	18:21
30°	05:59	06:29	06:56	17:08	17:35	18:05
35°	06:08	06:40	07:08	16:56	17:24	17:56
40°	06:17	06:52	07:22	16:42	17:12	17:46
45°	06:28	07:05	07:39	16:25	16:59	17:36
S 50°	06:40	07:21	08:00	16:04	16:43	17:24
52°	06:45	07:29	08:10	15:54	16:35	17:19
54°	06:51	07:37	08:21	15:43	16:27	17:13
56°	06:57	07:46	08:33	15:30	16:18	17:07
58°	07:04	07:56	08:48	15:16	16:07	17:00
S 60°	07:11	08:08	09:06	14:58	15:56	16:53

Lat.	Moonrise Sun	Moonrise Mon	Moonrise Tue	Moonset Sun	Moonset Mon	Moonset Tue
N 72°	▬	01:47	01:19	▬	05:53	08:06
N 70°	01:25	01:07	00:57	04:29	06:32	08:26
68°	00:38	00:40	00:40	05:15	06:58	08:42
66°	00:07	00:19	00:26	05:45	07:19	08:55
64°	·· ··	00:02	00:14	06:08	07:35	09:05
62°	23:48	·· ··	00:04	06:26	07:48	09:14
60°	23:36	23:56	·· ··	06:41	07:59	09:22
N 58°	23:26	23:48	·· ··	06:53	08:09	09:28
56°	23:17	23:42	·· ··	07:04	08:17	09:34
54°	23:09	23:36	23:59	07:13	08:25	09:39
52°	23:02	23:30	23:56	07:22	08:31	09:44
50°	22:55	23:25	23:52	07:29	08:37	09:48
45°	22:41	23:15	23:46	07:45	08:50	09:58
N 40°	22:30	23:06	23:40	07:59	09:01	10:05
35°	22:20	22:59	23:35	08:10	09:10	10:12
30°	22:11	22:52	23:31	08:20	09:18	10:18
20°	21:56	22:40	23:23	08:36	09:32	10:28
N 10°	21:43	22:30	23:16	08:51	09:44	10:36
0°	21:31	22:21	23:10	09:04	09:55	10:44
S 10°	21:18	22:11	23:04	09:18	10:06	10:52
20°	21:05	22:01	22:57	09:32	10:17	11:01
30°	20:50	21:49	22:49	09:49	10:31	11:10
35°	20:41	21:42	22:45	09:58	10:38	11:16
40°	20:31	21:34	22:40	10:09	10:47	11:22
45°	20:19	21:25	22:34	10:21	10:57	11:29
S 50°	20:05	21:14	22:27	10:37	11:09	11:38
52°	19:58	21:09	22:23	10:44	11:15	11:41
54°	19:50	21:04	22:20	10:52	11:21	11:46
56°	19:42	20:57	22:16	11:01	11:28	11:51
58°	19:32	20:50	22:11	11:11	11:36	11:56
S 60°	19:22	20:42	22:06	11:22	11:44	12:02

Day	Sun Eqn.of Time 00h	Sun Eqn.of Time 12h	Sun Mer. Pass	Moon Mer.Pass. Upper	Moon Mer.Pass. Lower	Age 19-21 / 89-73%
	mm:ss	mm:ss	hh:mm	hh:mm	hh:mm	
21	01:33	01:40	12:02	02:52	15:18	
22	01:46	01:53	12:02	03:43	16:08	
23	01:59	02:06	12:02	04:32	16:57	

June 24, 25, 26 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	272°03.6	157°06.4	N22°53.7	200°14.5	N22°36.5	90°07.8	N00°36.4	88°04.2	N00°55.1
1	287°06.0	172°05.6	53.2	215°15.1	36.7	105°10.0	36.3	103°06.6	55.1
2	302°08.5	187°04.7	52.8	230°15.7	37.0	120°12.3	36.2	118°09.0	55.0
3	317°11.0	202°03.9	·· 52.3	245°16.3	·· 37.2	135°14.6	·· 36.1	133°11.4	·· 55.0
4	332°13.4	217°03.1	51.8	260°16.9	37.4	150°16.9	36.1	148°13.8	55.0
5	347°15.9	232°02.3	51.4	275°17.5	37.7	165°19.2	36.0	163°16.2	54.9
6	2°18.4	247°01.5	N22°50.9	290°18.1	N22°37.9	180°21.5	N00°35.9	178°18.6	N00°54.9
7	17°20.8	262°00.7	50.4	305°18.7	38.2	195°23.8	35.8	193°21.0	54.8
8	32°23.3	276°59.9	50.0	320°19.3	38.4	210°26.1	35.7	208°23.4	54.8
9	47°25.8	291°59.1	·· 49.5	335°19.8	·· 38.7	225°28.4	·· 35.6	223°25.8	·· 54.8
10	62°28.2	306°58.3	49.0	350°20.4	38.9	240°30.6	35.5	238°28.2	54.7
11	77°30.7	321°57.5	48.6	5°21.0	39.1	255°32.9	35.5	253°30.6	54.7
12	92°33.2	336°56.7	N22°48.1	20°21.6	N22°39.4	270°35.2	N00°35.4	268°32.9	N00°54.6
13	107°35.6	351°55.9	47.6	35°22.2	39.6	285°37.5	35.3	283°35.3	54.6
14	122°38.1	6°55.1	47.2	50°22.8	39.8	300°39.8	35.2	298°37.7	54.6
15	137°40.5	21°54.3	·· 46.7	65°23.4	·· 40.1	315°42.1	·· 35.1	313°40.1	·· 54.5
16	152°43.0	36°53.5	46.2	80°24.0	40.3	330°44.4	35.0	328°42.5	54.5
17	167°45.5	51°52.7	45.7	95°24.6	40.6	345°46.7	34.9	343°44.9	54.4
18	182°47.9	66°51.9	N22°45.2	110°25.2	N22°40.8	0°48.9	N00°34.8	358°47.3	N00°54.4
19	197°50.4	81°51.1	44.8	125°25.8	41.0	15°51.2	34.8	13°49.7	54.3
20	212°52.9	96°50.3	44.3	140°26.4	41.3	30°53.5	34.7	28°52.1	54.3
21	227°55.3	111°49.5	·· 43.8	155°27.0	·· 41.5	45°55.8	·· 34.6	43°54.5	·· 54.3
22	242°57.8	126°48.7	43.3	170°27.6	41.7	60°58.1	34.5	58°56.9	54.2
23	258°00.3	141°47.9	42.8	185°28.1	42.0	76°00.4	34.4	73°59.3	54.2
Mer.pass. 05:51		ν -0.8′	d 0.5′	ν 0.6′	d 0.2′	ν 2.3′	d 0.1′	ν 2.4′	d 0.0′
		m -3.91		m 1.48		m -2.00		m 0.86	

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	273°02.7	156°47.1	N22°42.4	200°28.7	N22°42.2	91°02.7	N00°34.3	89°01.7	N00°54.1
1	288°05.2	171°46.4	41.9	215°29.3	42.4	106°04.9	34.2	104°04.1	54.1
2	303°07.7	186°45.6	41.4	230°29.9	42.7	121°07.2	34.1	119°06.5	54.1
3	318°10.1	201°44.8	·· 40.9	245°30.5	·· 42.9	136°09.5	·· 34.0	134°08.8	·· 54.0
4	333°12.6	216°44.0	40.4	260°31.1	43.1	151°11.8	34.0	149°11.2	54.0
5	348°15.0	231°43.2	39.9	275°31.7	43.4	166°14.1	33.9	164°13.6	53.9
6	3°17.5	246°42.4	N22°39.4	290°32.3	N22°43.6	181°16.4	N00°33.8	179°16.0	N00°53.9
7	18°20.0	261°41.6	38.9	305°32.9	43.8	196°18.6	33.7	194°18.4	53.8
8	33°22.4	276°40.8	38.4	320°33.5	44.1	211°20.9	33.6	209°20.8	53.8
9	48°24.9	291°40.0	·· 37.9	335°34.1	·· 44.3	226°23.2	·· 33.5	224°23.2	·· 53.8
10	63°27.4	306°39.2	37.4	350°34.7	44.5	241°25.5	33.4	239°25.6	53.7
11	78°29.8	321°38.4	36.9	5°35.3	44.8	256°27.8	33.3	254°28.0	53.7
12	93°32.3	336°37.6	N22°36.4	20°35.8	N22°45.0	271°30.0	N00°33.2	269°30.4	N00°53.6
13	108°34.8	351°36.8	35.9	35°36.4	45.2	286°32.3	33.2	284°32.8	53.6
14	123°37.2	6°36.1	35.4	50°37.0	45.5	301°34.6	33.1	299°35.1	53.6
15	138°39.7	21°35.3	·· 34.9	65°37.6	·· 45.7	316°36.9	·· 33.0	314°37.5	·· 53.5
16	153°42.1	36°34.5	34.4	80°38.2	45.9	331°39.2	32.9	329°39.9	53.5
17	168°44.6	51°33.7	33.9	95°38.8	46.1	346°41.5	32.8	344°42.3	53.4
18	183°47.1	66°32.9	N22°33.4	110°39.4	N22°46.4	1°43.7	N00°32.7	359°44.7	N00°53.4
19	198°49.5	81°32.1	32.9	125°40.0	46.6	16°46.0	32.6	14°47.1	53.3
20	213°52.0	96°31.3	32.4	140°40.6	46.8	31°48.3	32.5	29°49.5	53.3
21	228°54.5	111°30.5	·· 31.9	155°41.2	·· 47.1	46°50.6	·· 32.4	44°51.9	·· 53.3
22	243°56.9	126°29.8	31.4	170°41.8	47.3	61°52.8	32.3	59°54.3	53.2
23	258°59.4	141°29.0	30.9	185°42.4	47.5	76°55.1	32.3	74°56.6	53.2
Mer.pass. 05:47		ν -0.8′	d 0.5′	ν 0.6′	d 0.2′	ν 2.3′	d 0.1′	ν 2.4′	d 0.0′
		m -3.91		m 1.48		m -1.99		m 0.87	

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	274°01.9	156°28.2	N22°30.4	200°42.9	N22°47.7	91°57.4	N00°32.2	89°59.0	N00°53.1
1	289°04.3	171°27.4	29.9	215°43.5	48.0	106°59.7	32.1	105°01.4	53.1
2	304°06.8	186°26.6	29.3	230°44.1	48.2	122°02.0	32.0	120°03.8	53.0
3	319°09.3	201°25.8	·· 28.8	245°44.7	·· 48.4	137°04.2	·· 31.9	135°06.2	·· 53.0
4	334°11.7	216°25.0	28.3	260°45.3	48.6	152°06.5	31.8	150°08.6	53.0
5	349°14.2	231°24.3	27.8	275°45.9	48.9	167°08.8	31.7	165°11.0	52.9
6	4°16.6	246°23.5	N22°27.3	290°46.5	N22°49.1	182°11.1	N00°31.6	180°13.4	N00°52.9
7	19°19.1	261°22.7	26.8	305°47.1	49.3	197°13.4	31.5	195°15.7	52.8
8	34°21.6	276°21.9	26.2	320°47.7	49.5	212°15.6	31.4	210°18.1	52.8
9	49°24.0	291°21.1	·· 25.7	335°48.3	·· 49.8	227°17.9	·· 31.3	225°20.5	·· 52.7
10	64°26.5	306°20.4	25.2	350°48.9	50.0	242°20.2	31.2	240°22.9	52.7
11	79°29.0	321°19.6	24.7	5°49.5	50.2	257°22.5	31.2	255°25.3	52.6
12	94°31.4	336°18.8	N22°24.1	20°50.1	N22°50.4	272°24.7	N00°31.1	270°27.7	N00°52.6
13	109°33.9	351°18.0	23.6	35°50.6	50.6	287°27.0	31.0	285°30.1	52.6
14	124°36.4	6°17.2	23.1	50°51.2	50.9	302°29.3	30.9	300°32.5	52.5
15	139°38.8	21°16.5	·· 22.6	65°51.8	·· 51.1	317°31.6	·· 30.8	315°34.8	·· 52.5
16	154°41.3	36°15.7	22.0	80°52.4	51.3	332°33.8	30.7	330°37.2	52.4
17	169°43.7	51°14.9	21.5	95°53.0	51.5	347°36.1	30.6	345°39.6	52.4
18	184°46.2	66°14.1	N22°21.0	110°53.6	N22°51.7	2°38.4	N00°30.5	0°42.0	N00°52.3
19	199°48.7	81°13.3	20.4	125°54.2	52.0	17°40.7	30.4	15°44.4	52.3
20	214°51.1	96°12.6	19.9	140°54.8	52.2	32°42.9	30.3	30°46.8	52.3
21	229°53.6	111°11.8	·· 19.4	155°55.4	·· 52.4	47°45.2	·· 30.2	45°49.2	·· 52.2
22	244°56.1	126°11.0	18.8	170°56.0	52.6	62°47.5	30.1	60°51.5	52.2
23	259°58.5	141°10.2	18.3	185°56.6	52.8	77°49.7	30.0	75°53.9	52.1
Mer.pass. 05:43		ν -0.8′	d 0.5′	ν 0.6′	d 0.2′	ν 2.3′	d 0.1′	ν 2.4′	d 0.0′
		m -3.91		m 1.49		m -1.98		m 0.87	

Stars

	SHA	Dec
Alpheratz	358°08.8	28°59.0
Ankaa	353°39.8	-42°24.3
Schedar	350°08.5	56°25.8
Diphda	349°20.4	-18°05.3
Achernar	335°45.1	-57°19.7
Hamal	328°28.5	23°22.3
Polaris	326°53.7	89°10.4
Acamar	315°37.1	-40°22.7
Menkar	314°40.8	4°00.9
Mirfak	309°15.7	49°47.5
Aldebaran	291°17.7	16°28.2
Rigel	281°35.8	-8°13.4
Capella	281°11.0	45°58.7
Bellatrix	278°58.5	6°19.9
Elnath	278°43.8	28°35.4
Alnilam	276°11.5	-1°12.9
Betelgeuse	271°28.0	7°24.2
Canopus	264°07.5	-52°41.2
Sirius	258°55.5	-16°41.5
Adhara	255°32.1	-28°56.9
Procyon	245°25.5	5°16.4
Pollux	243°57.9	28°04.3
Avior	234°28.5	-59°27.1
Suhail	223°10.7	-43°21.6
Miaplacidus	221°45.5	-69°38.7
Alphard	218°20.3	-8°34.7
Regulus	208°09.6	12°03.6
Dubhe	194°21.7	61°51.4
Denebola	182°58.5	14°40.7
Gienah	176°17.4	-17°26.3
Acrux	173°36.6	-63°00.0
Gacrux	172°28.1	-57°00.7
Alioth	166°41.9	56°04.0
Spica	158°56.9	-11°03.8
Alkaid	153°17.9	49°24.7
Hadar	149°22.3	-60°17.2
Menkent	148°36.2	-36°16.8
Arcturus	146°17.8	19°16.9
Rigil Kent.	140°24.7	-60°45.5
Kochab	137°18.2	74°14.3
Zuben'ubi	137°32.2	-15°57.9
Alphecca	126°31.4	26°46.8
Antares	112°55.9	-26°23.5
Atria	108°19.1	-68°59.7
Sabik	102°40.2	-15°42.1
Shaula	96°54.6	-37°05.4
Rasalhague	96°28.7	12°34.5
Eltanin	90°56.9	51°29.6
Kaus Aust.	84°15.7	-34°23.6
Vega	80°55.0	38°46.0
Nunki	76°28.1	-26°19.1
Altair	62°31.7	8°49.1
Peacock	53°57.0	-56°47.6
Deneb	49°47.7	45°12.7
Enif	34°10.8	9°47.3
Al Na'ir	28°14.0	-47°02.9
Fomalhaut	15°50.7	-29°43.1
Scheat	14°16.9	27°58.7
Markab	14°02.5	15°06.2

Jun 24 Wed	SHA	Mer.pass
Venus	245°02.8	13:32
Mars	288°10.9	10:39
Jupiter	178°04.2	17:57
Saturn	176°00.6	18:05

Jun 25 Thu	SHA	Mer.pass
Venus	243°44.4	13:34
Mars	287°26.0	10:38
Jupiter	177°59.9	17:53
Saturn	175°58.9	18:01

Jun 26 Fri	SHA	Mer.pass
Venus	242°26.3	13:35
Mars	286°41.1	10:37
Jupiter	177°55.5	17:49
Saturn	175°57.2	17:57

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = -0.6172 sec ΔT = TT-UT1 = +51.8012 sec

1981 June 24 to Jun. 26 UT

h	Sun		Moon				
Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°27.0	N23°25.1	282°15.2	11.3′	S08°26.0	11.2′	57.8′
1	194°26.9	25.1	296°45.5	11.3′	08°14.8	11.3′	57.8′
2	209°26.7	25.0	311°15.8	11.3′	08°03.5	11.4′	57.8′
3	224°26.6	·· 25.0	325°46.1	11.3′	07°52.1	11.4′	57.9′
4	239°26.5	24.9	340°16.4	11.3′	07°40.7	11.4′	57.9′
5	254°26.3	24.9	354°46.8	11.3′	07°29.3	11.5′	57.9′
6	269°26.2	N23°24.8	9°17.1	11.3′	S07°17.8	11.6′	57.9′
7	284°26.1	24.8	23°47.4	11.3′	07°06.2	11.6′	58.0′
8	299°25.9	24.7	38°17.7	11.3′	06°54.6	11.6′	58.0′
9	314°25.8	·· 24.7	52°48.0	11.3′	06°43.0	11.7′	58.0′
10	329°25.7	24.6	67°18.3	11.3′	06°31.3	11.8′	58.1′
11	344°25.5	24.6	81°48.6	11.3′	06°19.5	11.7′	58.1′
12	359°25.4	N23°24.5	96°18.9	11.3′	S06°07.8	11.8′	58.1′
13	14°25.3	24.5	110°49.2	11.3′	05°56.0	11.9′	58.1′
14	29°25.1	24.4	125°19.5	11.3′	05°44.1	11.9′	58.2′
15	44°25.0	·· 24.4	139°49.8	11.3′	05°32.2	11.9′	58.2′
16	59°24.9	24.3	154°20.0	11.3′	05°20.3	12.0′	58.2′
17	74°24.7	24.3	168°50.3	11.3′	05°08.3	12.0′	58.2′
18	89°24.6	N23°24.2	183°20.6	11.2′	S04°56.3	12.1′	58.3′
19	104°24.5	24.2	197°50.8	11.2′	04°44.2	12.1′	58.3′
20	119°24.3	24.1	212°21.0	11.2′	04°32.1	12.1′	58.3′
21	134°24.2	·· 24.0	226°51.3	11.2′	04°20.0	12.2′	58.3′
22	149°24.1	24.0	241°21.5	11.2′	04°07.8	12.1′	58.4′
23	164°23.9	23.9	255°51.7	11.2′	03°55.7	12.3′	58.4′
	SD = 15.7′	d = 0.0′	SD = 15.8′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°23.8	N23°23.9	270°21.9	11.2′	S03°43.4	12.2′	58.4′
1	194°23.7	23.8	284°52.0	11.2′	03°31.2	12.3′	58.5′
2	209°23.5	23.7	299°22.2	11.1′	03°18.9	12.3′	58.5′
3	224°23.4	·· 23.7	313°52.3	11.1′	03°06.6	12.4′	58.5′
4	239°23.3	23.6	328°22.5	11.1′	02°54.2	12.3′	58.5′
5	254°23.1	23.5	342°52.6	11.1′	02°41.9	12.4′	58.6′
6	269°23.0	N23°23.5	357°22.7	11.1′	S02°29.5	12.4′	58.6′
7	284°22.9	23.4	11°52.7	11.1′	02°17.1	12.5′	58.6′
8	299°22.7	23.4	26°22.8	11.0′	02°04.6	12.4′	58.6′
9	314°22.6	·· 23.3	40°52.8	11.0′	01°52.2	12.5′	58.7′
10	329°22.5	23.2	55°22.8	11.0′	01°39.7	12.5′	58.7′
11	344°22.3	23.2	69°52.8	11.0′	01°27.2	12.5′	58.7′
12	359°22.2	N23°23.1	84°22.8	10.9′	S01°14.7	12.6′	58.7′
13	14°22.1	23.0	98°52.7	10.9′	01°02.1	12.5′	58.8′
14	29°21.9	22.9	113°22.6	10.9′	00°49.6	12.6′	58.8′
15	44°21.8	·· 22.9	127°52.5	10.9′	00°37.0	12.6′	58.8′
16	59°21.7	22.8	142°22.4	10.8′	00°24.4	12.6′	58.8′
17	74°21.5	22.7	156°52.2	10.8′	S00°11.8	12.6′	58.9′
18	89°21.4	N23°22.7	171°22.0	10.8′	N00°00.8	12.6′	58.9′
19	104°21.3	22.6	185°51.8	10.7′	00°13.4	12.6′	58.9′
20	119°21.1	22.5	200°21.5	10.7′	00°26.0	12.7′	59.0′
21	134°21.0	·· 22.4	214°51.2	10.7′	00°38.7	12.6′	59.0′
22	149°20.9	22.4	229°20.9	10.7′	00°51.3	12.7′	59.0′
23	164°20.7	22.3	243°50.6	10.6′	01°04.0	12.7′	59.0′
	SD = 15.7′	d = 0.1′	SD = 15.9′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°20.6	N23°22.2	258°20.2	10.6′	N01°16.7	12.6′	59.1′
1	194°20.5	22.1	272°49.8	10.5′	01°29.3	12.7′	59.1′
2	209°20.3	22.0	287°19.3	10.5′	01°42.0	12.7′	59.1′
3	224°20.2	·· 22.0	301°48.8	10.5′	01°54.7	12.6′	59.1′
4	239°20.1	21.9	316°18.3	10.4′	02°07.3	12.7′	59.2′
5	254°20.0	21.8	330°47.7	10.4′	02°20.0	12.7′	59.2′
6	269°19.8	N23°21.7	345°17.1	10.4′	N02°32.7	12.6′	59.2′
7	284°19.7	21.6	359°46.5	10.3′	02°45.3	12.7′	59.2′
8	299°19.6	21.6	14°15.8	10.3′	02°58.0	12.6′	59.3′
9	314°19.4	·· 21.5	28°45.1	10.2′	03°10.6	12.7′	59.3′
10	329°19.3	21.4	43°14.3	10.2′	03°23.3	12.6′	59.3′
11	344°19.2	21.3	57°43.5	10.1′	03°35.9	12.7′	59.3′
12	359°19.0	N23°21.2	72°12.7	10.1′	N03°48.6	12.6′	59.3′
13	14°18.9	21.1	86°41.8	10.1′	04°01.2	12.6′	59.4′
14	29°18.8	21.0	101°10.8	10.0′	04°13.8	12.6′	59.4′
15	44°18.6	·· 21.0	115°39.8	10.0′	04°26.4	12.6′	59.4′
16	59°18.5	20.9	130°08.8	9.9′	04°39.0	12.5′	59.4′
17	74°18.4	20.8	144°37.7	9.9′	04°51.5	12.6′	59.5′
18	89°18.2	N23°20.7	159°06.6	9.8′	N05°04.1	12.5′	59.5′
19	104°18.1	20.6	173°35.4	9.8′	05°16.6	12.5′	59.5′
20	119°18.0	20.5	188°04.2	9.7′	05°29.1	12.5′	59.5′
21	134°17.8	·· 20.4	202°32.9	9.7′	05°41.6	12.5′	59.6′
22	149°17.7	20.3	217°01.6	9.6′	05°54.1	12.4′	59.6′
23	164°17.6	20.2	231°30.2	9.6′	06°06.5	12.4′	59.6′
	SD = 15.7′	d = 0.1′	SD = 16.1′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	▭	▭	▭	▭	▭	▭
66°	▭	▭	▭	▭	▭	▭
64°	////	////	01:33	22:32	////	////
62°	////	////	02:11	21:54	////	////
60°	////	00:52	02:37	21:28	23:12	////
N 58°	////	01:42	02:58	21:07	22:23	////
56°	////	02:12	03:14	20:51	21:53	////
54°	00:47	02:34	03:28	20:36	21:31	23:17
52°	01:34	02:52	03:41	20:24	21:13	22:31
50°	02:02	03:07	03:52	20:13	20:58	22:03
45°	02:47	03:37	04:14	19:51	20:28	21:18
N 40°	03:18	03:59	04:32	19:33	20:06	20:47
35°	03:41	04:18	04:47	19:18	19:47	20:24
30°	03:59	04:33	05:00	19:05	19:32	20:06
20°	04:29	04:58	05:22	18:43	19:07	19:36
N 10°	04:51	05:18	05:41	18:24	18:47	19:14
0°	05:10	05:36	05:59	18:06	18:29	18:55
S 10°	05:27	05:53	06:16	17:49	18:12	18:38
20°	05:43	06:11	06:35	17:30	17:54	18:22
30°	06:00	06:30	06:56	17:09	17:35	18:05
35°	06:09	06:40	07:08	16:57	17:25	17:57
40°	06:18	06:52	07:23	16:43	17:13	17:47
45°	06:28	07:06	07:39	16:26	17:00	17:37
S 50°	06:40	07:22	08:00	16:05	16:44	17:25
52°	06:45	07:29	08:10	15:55	16:36	17:20
54°	06:51	07:37	08:21	15:44	16:28	17:14
56°	06:57	07:46	08:34	15:31	16:19	17:08
58°	07:04	07:57	08:48	15:17	16:09	17:01
S 60°	07:11	08:08	09:06	14:59	15:57	16:54

Lat.	**Moonrise** Wed	Thu	Fri	**Moonset** Wed	Thu	Fri
N 72°	01:01	00:46	00:32	10:07	12:06	14:06
N 70°	00:49	00:41	00:34	10:17	12:08	14:00
68°	00:39	00:37	00:36	10:25	12:09	13:56
66°	00:30	00:34	00:37	10:32	12:11	13:51
64°	00:23	00:31	00:38	10:38	12:12	13:48
62°	00:17	00:28	00:39	10:42	12:13	13:45
60°	00:12	00:26	00:39	10:47	12:13	13:42
N 58°	00:07	00:24	00:40	10:50	12:14	13:40
56°	00:03	00:22	00:41	10:54	12:15	13:38
54°	·· ··	00:20	00:41	10:57	12:15	13:36
52°	·· ··	00:19	00:42	10:59	12:16	13:35
50°	·· ··	00:18	00:42	11:02	12:16	13:33
45°	·· ··	00:15	00:43	11:07	12:18	13:30
N 40°	·· ··	00:12	00:44	11:11	12:18	13:27
35°	·· ··	00:10	00:45	11:15	12:19	13:25
30°	·· ··	00:08	00:46	11:18	12:20	13:23
20°	·· ··	00:05	00:47	11:24	12:21	13:19
N 10°	·· ··	00:02	00:48	11:29	12:22	13:16
0°	23:59	·· ··	00:49	11:33	12:23	13:13
S 10°	23:56	·· ··	00:50	11:38	12:23	13:10
20°	23:53	·· ··	00:51	11:43	12:24	13:07
30°	23:50	·· ··	00:52	11:48	12:25	13:03
35°	23:48	·· ··	00:53	11:51	12:26	13:01
40°	23:46	·· ··	00:54	11:55	12:26	12:59
45°	23:44	·· ··	00:55	11:59	12:27	12:56
S 50°	23:41	·· ··	00:57	12:03	12:28	12:53
52°	23:39	·· ··	00:57	12:06	12:28	12:51
54°	23:38	·· ··	00:58	12:08	12:29	12:50
56°	23:36	·· ··	00:58	12:11	12:29	12:48
58°	23:34	·· ··	00:59	12:13	12:30	12:46
S 60°	23:32	·· ··	01:00	12:17	12:30	12:44

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 22-24 63-41%
24	02:12	02:18	12:02	05:22	17:46	
25	02:25	02:31	12:03	06:11	18:36	
26	02:38	02:44	12:03	07:01	19:27	

June 27, 28, 29 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	275°01.0	156°09.5	N22°17.7	200°57.2	N22°53.0	92°52.0	N00°29.9	90°56.3	N00°52.1
1	290°03.5	171°08.7	17.2	215°57.8	53.3	107°54.3	29.9	105°58.7	52.0
2	305°05.9	186°07.9	16.7	230°58.3	53.5	122°56.6	29.8	121°01.1	52.0
3	320°08.4	201°07.1	·· 16.1	245°58.9	·· 53.7	137°58.8	·· 29.7	136°03.5	·· 51.9
4	335°10.9	216°06.4	15.6	260°59.5	53.9	153°01.1	29.6	151°05.8	51.9
5	350°13.3	231°05.6	15.0	276°00.1	54.1	168°03.4	29.5	166°08.2	51.8
6	5°15.8	246°04.8	N22°14.5	291°00.7	N22°54.3	183°05.7	N00°29.4	181°10.6	N00°51.8
7	20°18.2	261°04.1	13.9	306°01.3	54.6	198°07.9	29.3	196°13.0	51.8
8	35°20.7	276°03.3	13.4	321°01.9	54.8	213°10.2	29.2	211°15.4	51.7
9	50°23.2	291°02.5	·· 12.8	336°02.5	·· 55.0	228°12.5	·· 29.1	226°17.8	·· 51.7
10	65°25.6	306°01.7	12.3	351°03.1	55.2	243°14.7	29.0	241°20.2	51.6
11	80°28.1	321°01.0	11.7	6°03.7	55.4	258°17.0	28.9	256°22.5	51.6
12	95°30.6	336°00.2	N22°11.2	21°04.3	N22°55.6	273°19.3	N00°28.8	271°24.9	N00°51.5
13	110°33.0	350°59.4	10.6	36°04.9	55.8	288°21.5	28.7	286°27.3	51.5
14	125°35.5	5°58.7	10.1	51°05.4	56.0	303°23.8	28.6	301°29.7	51.4
15	140°38.0	20°57.9	·· 09.5	66°06.0	·· 56.3	318°26.1	·· 28.5	316°32.1	·· 51.4
16	155°40.4	35°57.1	09.0	81°06.6	56.5	333°28.4	28.4	331°34.4	51.4
17	170°42.9	50°56.4	08.4	96°07.2	56.7	348°30.6	28.3	346°36.8	51.3
18	185°45.4	65°55.6	N22°07.9	111°07.8	N22°56.9	3°32.9	N00°28.3	1°39.2	N00°51.3
19	200°47.8	80°54.8	07.3	126°08.4	57.1	18°35.2	28.2	16°41.6	51.2
20	215°50.3	95°54.1	06.7	141°09.0	57.3	33°37.4	28.1	31°44.0	51.2
21	230°52.7	110°53.3	·· 06.2	156°09.6	·· 57.5	48°39.7	·· 28.0	46°46.4	·· 51.1
22	245°55.2	125°52.5	05.6	171°10.2	57.7	63°42.0	27.9	61°48.7	51.1
23	260°57.7	140°51.8	05.1	186°10.8	57.9	78°44.2	27.8	76°51.1	51.0
Mer.pass. 05:39		ν -0.8′	d 0.5′	ν 0.6′	d 0.2′	ν 2.3′	d 0.1′	ν 2.4′	d 0.0′
		m -3.91		m 1.49		m -1.98		m 0.87	

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	276°00.1	155°51.0	N22°04.5	201°11.4	N22°58.1	93°46.5	N00°27.7	91°53.5	N00°51.0
1	291°02.6	170°50.3	03.9	216°12.0	58.4	108°48.8	27.6	106°55.9	50.9
2	306°05.1	185°49.5	03.4	231°12.6	58.6	123°51.0	27.5	121°58.3	50.9
3	321°07.5	200°48.7	·· 02.8	246°13.1	·· 58.8	138°53.3	·· 27.4	137°00.6	·· 50.8
4	336°10.0	215°48.0	02.2	261°13.7	59.0	153°55.6	27.3	152°03.0	50.8
5	351°12.5	230°47.2	01.6	276°14.3	59.2	168°57.8	27.2	167°05.4	50.8
6	6°14.9	245°46.4	N22°01.1	291°14.9	N22°59.4	184°00.1	N00°27.1	182°07.8	N00°50.7
7	21°17.4	260°45.7	22°00.5	306°15.5	59.6	199°02.4	27.0	197°10.2	50.7
8	36°19.8	275°44.9	21°59.9	321°16.1	22°59.8	214°04.6	26.9	212°12.5	50.6
9	51°22.3	290°44.2	·· 59.4	336°16.7	23°00.0	229°06.9	·· 26.8	227°14.9	·· 50.6
10	66°24.8	305°43.4	58.8	351°17.3	00.2	244°09.2	26.7	242°17.3	50.5
11	81°27.2	320°42.7	58.2	6°17.9	00.4	259°11.4	26.6	257°19.7	50.5
12	96°29.7	335°41.9	N21°57.6	21°18.5	N23°00.6	274°13.7	N00°26.5	272°22.1	N00°50.4
13	111°32.2	350°41.1	57.0	36°19.1	00.8	289°15.9	26.4	287°24.4	50.4
14	126°34.6	5°40.4	56.5	51°19.7	01.0	304°18.2	26.3	302°26.8	50.3
15	141°37.1	20°39.6	·· 55.9	66°20.3	·· 01.2	319°20.5	·· 26.2	317°29.2	·· 50.3
16	156°39.6	35°38.9	55.3	81°20.8	01.4	334°22.7	26.1	332°31.6	50.2
17	171°42.0	50°38.1	54.7	96°21.4	01.6	349°25.0	26.0	347°34.0	50.2
18	186°44.5	65°37.4	N21°54.1	111°22.0	N23°01.8	4°27.3	N00°25.9	2°36.3	N00°50.1
19	201°47.0	80°36.6	53.5	126°22.6	02.0	19°29.5	25.8	17°38.7	50.1
20	216°49.4	95°35.8	53.0	141°23.2	02.2	34°31.8	25.7	32°41.1	50.0
21	231°51.9	110°35.1	·· 52.4	156°23.8	·· 02.4	49°34.0	·· 25.6	47°43.5	·· 50.0
22	246°54.3	125°34.3	51.8	171°24.4	02.6	64°36.3	25.5	62°45.8	50.0
23	261°56.8	140°33.6	51.2	186°25.0	02.8	79°38.6	25.4	77°48.2	49.9
Mer.pass. 05:35		ν -0.8′	d 0.6′	ν 0.6′	d 0.2′	ν 2.3′	d 0.1′	ν 2.4′	d 0.0′
		m -3.91		m 1.49		m -1.97		m 0.88	

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	276°59.3	155°32.8	N21°50.6	201°25.6	N23°03.0	94°40.8	N00°25.3	92°50.6	N00°49.9
1	292°01.7	170°32.1	50.0	216°26.2	03.2	109°43.1	25.3	107°53.0	49.8
2	307°04.2	185°31.3	49.4	231°26.8	03.4	124°45.4	25.2	122°55.4	49.8
3	322°06.7	200°30.6	·· 48.8	246°27.4	·· 03.6	139°47.6	·· 25.1	137°57.7	·· 49.7
4	337°09.1	215°29.8	48.2	261°28.0	03.8	154°49.9	25.0	153°00.1	49.7
5	352°11.6	230°29.1	47.6	276°28.5	04.0	169°52.1	24.9	168°02.5	49.6
6	7°14.1	245°28.3	N21°47.0	291°29.1	N23°04.2	184°54.4	N00°24.8	183°04.9	N00°49.6
7	22°16.5	260°27.6	46.4	306°29.7	04.4	199°56.7	24.7	198°07.2	49.5
8	37°19.0	275°26.8	45.8	321°30.3	04.6	214°58.9	24.6	213°09.6	49.5
9	52°21.5	290°26.1	·· 45.2	336°30.9	·· 04.8	230°01.2	·· 24.5	228°12.0	·· 49.4
10	67°23.9	305°25.3	44.6	351°31.5	05.0	245°03.4	24.4	243°14.4	49.4
11	82°26.4	320°24.6	44.0	6°32.1	05.2	260°05.7	24.3	258°16.7	49.3
12	97°28.8	335°23.8	N21°43.4	21°32.7	N23°05.4	275°08.0	N00°24.2	273°19.1	N00°49.3
13	112°31.3	350°23.1	42.8	36°33.3	05.6	290°10.2	24.1	288°21.5	49.2
14	127°33.8	5°22.4	42.2	51°33.9	05.8	305°12.5	24.0	303°23.9	49.2
15	142°36.2	20°21.6	·· 41.6	66°34.5	·· 06.0	320°14.7	·· 23.9	318°26.2	·· 49.1
16	157°38.7	35°20.9	41.0	81°35.1	06.2	335°17.0	23.8	333°28.6	49.1
17	172°41.2	50°20.1	40.4	96°35.7	06.4	350°19.2	23.7	348°31.0	49.0
18	187°43.6	65°19.4	N21°39.8	111°36.2	N23°06.5	5°21.5	N00°23.6	3°33.4	N00°49.0
19	202°46.1	80°18.6	39.2	126°36.8	06.7	20°23.8	23.5	18°35.7	48.9
20	217°48.6	95°17.9	38.6	141°37.4	06.9	35°26.0	23.4	33°38.1	48.9
21	232°51.0	110°17.2	·· 37.9	156°38.0	·· 07.1	50°28.3	·· 23.3	48°40.5	·· 48.8
22	247°53.5	125°16.4	37.3	171°38.6	07.3	65°30.5	23.2	63°42.9	48.8
23	262°56.0	140°15.7	36.7	186°39.2	07.5	80°32.8	23.1	78°45.2	48.7
Mer.pass. 05:31		ν -0.8′	d 0.6′	ν 0.6′	d 0.2′	ν 2.3′	d 0.1′	ν 2.4′	d 0.0′
		m -3.91		m 1.50		m -1.97		m 0.88	

Stars

	SHA	Dec
Alpheratz	358°08.7	28°59.0
Ankaa	353°39.7	-42°24.3
Schedar	350°08.4	56°25.8
Diphda	349°20.4	-18°05.3
Achernar	335°45.1	-57°19.7
Hamal	328°28.5	23°22.3
Polaris	326°52.7	89°10.4
Acamar	315°37.1	-40°22.7
Menkar	314°40.8	4°00.9
Mirfak	309°15.7	49°47.5
Aldebaran	291°17.7	16°28.2
Rigel	281°35.8	-8°13.4
Capella	281°11.0	45°58.7
Bellatrix	278°58.5	6°19.9
Elnath	278°43.8	28°35.4
Alnilam	276°11.4	-1°12.9
Betelgeuse	271°28.0	7°24.2
Canopus	264°07.5	-52°41.2
Sirius	258°55.5	-16°41.5
Adhara	255°32.1	-28°56.8
Procyon	245°25.5	5°16.4
Pollux	243°57.9	28°04.3
Avior	234°28.5	-59°27.1
Suhail	223°10.7	-43°21.6
Miaplacidus	221°45.6	-69°38.6
Alphard	218°20.3	-8°34.7
Regulus	208°09.6	12°03.6
Dubhe	194°21.7	61°51.4
Denebola	182°58.6	14°40.7
Gienah	176°17.4	-17°26.3
Acrux	173°36.7	-63°00.0
Gacrux	172°28.1	-57°00.7
Alioth	166°42.0	56°04.0
Spica	158°56.9	-11°03.8
Alkaid	153°17.9	49°24.7
Hadar	149°22.3	-60°17.2
Menkent	148°36.2	-36°16.8
Arcturus	146°17.8	19°16.9
Rigil Kent.	140°24.7	-60°45.5
Kochab	137°18.3	74°14.3
Zuben'ubi	137°32.2	-15°57.9
Alphecca	126°31.4	26°46.8
Antares	112°55.9	-26°23.5
Atria	108°19.1	-68°59.7
Sabik	102°40.2	-15°42.1
Shaula	96°54.6	-37°05.4
Rasalhague	96°28.7	12°34.5
Eltanin	90°56.9	51°29.6
Kaus Aust.	84°15.7	-34°23.6
Vega	80°55.0	38°46.0
Nunki	76°28.1	-26°19.1
Altair	62°31.7	8°49.2
Peacock	53°57.0	-56°47.6
Deneb	49°47.7	45°12.7
Enif	34°10.8	9°47.3
Al Na'ir	28°14.0	-47°02.9
Fomalhaut	15°50.7	-29°43.1
Scheat	14°16.9	27°58.7
Markab	14°02.5	15°06.2

Jun 27 Sat	SHA	Mer.pass
Venus	241°08.5	13:36
Mars	285°56.2	10:36
Jupiter	177°51.0	17:46
Saturn	175°55.3	17:53

Jun 28 Sun	SHA	Mer.pass
Venus	239°50.9	13:37
Mars	285°11.2	10:35
Jupiter	177°46.4	17:42
Saturn	175°53.4	17:50

Jun 29 Mon	SHA	Mer.pass
Venus	238°33.6	13:38
Mars	284°26.3	10:34
Jupiter	177°41.6	17:39
Saturn	175°51.3	17:46

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°17.5	N23°20.1	245°58.8	9.5′	N06°18.9	12.4′	59.6′
1	194°17.3	20.0	260°27.3	9.5′	06°31.3	12.4′	59.6′
2	209°17.2	19.9	274°55.7	9.4′	06°43.7	12.3′	59.7′
3	224°17.1	·· 19.9	289°24.1	9.3′	06°56.0	12.3′	59.7′
4	239°16.9	19.8	303°52.5	9.3′	07°08.3	12.3′	59.7′
5	254°16.8	19.7	318°20.8	9.2′	07°20.6	12.2′	59.7′
6	269°16.7	N23°19.6	332°49.0	9.2′	N07°32.8	12.2′	59.7′
7	284°16.5	19.5	347°17.2	9.1′	07°45.0	12.2′	59.8′
8	299°16.4	19.4	1°45.3	9.1′	07°57.2	12.1′	59.8′
9	314°16.3	·· 19.3	16°13.3	9.0′	08°09.3	12.1′	59.8′
10	329°16.2	19.2	30°41.3	8.9′	08°21.4	12.0′	59.8′
11	344°16.0	19.1	45°09.3	8.9′	08°33.4	12.0′	59.8′
12	359°15.9	N23°19.0	59°37.1	8.8′	N08°45.4	12.0′	59.9′
13	14°15.8	18.8	74°04.9	8.8′	08°57.4	11.9′	59.9′
14	29°15.6	18.7	88°32.7	8.7′	09°09.3	11.9′	59.9′
15	44°15.5	·· 18.6	103°00.4	8.6′	09°21.2	11.8′	59.9′
16	59°15.4	18.5	117°28.0	8.6′	09°33.0	11.7′	59.9′
17	74°15.2	18.4	131°55.6	8.5′	09°44.7	11.8′	60.0′
18	89°15.1	N23°18.3	146°23.1	8.4′	N09°56.5	11.6′	60.0′
19	104°15.0	18.2	160°50.5	8.4′	10°08.1	11.6′	60.0′
20	119°14.9	18.1	175°17.9	8.3′	10°19.7	11.6′	60.0′
21	134°14.7	·· 18.0	189°45.2	8.2′	10°31.3	11.5′	60.0′
22	149°14.6	17.9	204°12.4	8.2′	10°42.8	11.4′	60.0′
23	164°14.5	17.8	218°39.6	8.1′	10°54.2	11.4′	60.1′
	SD = 15.7′	d = 0.1′	SD = 16.3′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°14.3	N23°17.7	233°06.7	8.0′	N11°05.6	11.3′	60.1′
1	194°14.2	17.5	247°33.7	8.0′	11°16.9	11.2′	60.1′
2	209°14.1	17.4	262°00.7	7.9′	11°28.1	11.2′	60.1′
3	224°14.0	·· 17.3	276°27.6	7.8′	11°39.3	11.1′	60.1′
4	239°13.8	17.2	290°54.4	7.8′	11°50.4	11.1′	60.1′
5	254°13.7	17.1	305°21.2	7.7′	12°01.5	11.0′	60.2′
6	269°13.6	N23°17.0	319°47.9	7.6′	N12°12.5	10.9′	60.2′
7	284°13.4	16.9	334°14.5	7.6′	12°23.4	10.8′	60.2′
8	299°13.3	16.7	348°41.1	7.5′	12°34.2	10.8′	60.2′
9	314°13.2	·· 16.6	3°07.6	7.4′	12°45.0	10.7′	60.2′
10	329°13.1	16.5	17°34.0	7.4′	12°55.7	10.6′	60.2′
11	344°12.9	16.4	32°00.3	7.3′	13°06.3	10.5′	60.2′
12	359°12.8	N23°16.3	46°26.6	7.2′	N13°16.8	10.5′	60.2′
13	14°12.7	16.1	60°52.8	7.1′	13°27.3	10.3′	60.3′
14	29°12.5	16.0	75°19.0	7.1′	13°37.6	10.3′	60.3′
15	44°12.4	·· 15.9	89°45.0	7.0′	13°47.9	10.2′	60.3′
16	59°12.3	15.8	104°11.0	6.9′	13°58.1	10.1′	60.3′
17	74°12.2	15.7	118°37.0	6.9′	14°08.2	10.1′	60.3′
18	89°12.0	N23°15.5	133°02.9	6.8′	N14°18.3	9.9′	60.3′
19	104°11.9	15.4	147°28.7	6.7′	14°28.2	9.9′	60.3′
20	119°11.8	15.3	161°54.4	6.7′	14°38.1	9.7′	60.3′
21	134°11.6	·· 15.2	176°20.0	6.6′	14°47.8	9.7′	60.3′
22	149°11.5	15.0	190°45.6	6.5′	14°57.5	9.5′	60.4′
23	164°11.4	14.9	205°11.2	6.5′	15°07.0	9.5′	60.4′
	SD = 15.7′	d = 0.1′	SD = 16.4′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°11.3	N23°14.8	219°36.6	6.4′	N15°16.5	9.4′	60.4′
1	194°11.1	14.6	234°02.0	6.3′	15°25.9	9.3′	60.4′
2	209°11.0	14.5	248°27.3	6.3′	15°35.2	9.1′	60.4′
3	224°10.9	·· 14.4	262°52.6	6.2′	15°44.3	9.1′	60.4′
4	239°10.8	14.3	277°17.8	6.1′	15°53.4	9.0′	60.4′
5	254°10.6	14.1	291°42.9	6.1′	16°02.4	8.8′	60.4′
6	269°10.5	N23°14.0	306°08.0	6.0′	N16°11.2	8.8′	60.4′
7	284°10.4	13.9	320°33.0	5.9′	16°20.0	8.6′	60.4′
8	299°10.2	13.7	334°57.9	5.9′	16°28.6	8.5′	60.4′
9	314°10.1	·· 13.6	349°22.8	5.8′	16°37.1	8.5′	60.4′
10	329°10.0	13.5	3°47.6	5.7′	16°45.6	8.3′	60.4′
11	344°09.9	13.3	18°12.3	5.7′	16°53.9	8.2′	60.4′
12	359°09.7	N23°13.2	32°37.0	5.6′	N17°02.1	8.1′	60.4′
13	14°09.6	13.0	47°01.6	5.6′	17°10.2	7.9′	60.4′
14	29°09.5	12.9	61°26.2	5.5′	17°18.1	7.9′	60.4′
15	44°09.4	·· 12.8	75°50.7	5.4′	17°26.0	7.7′	60.4′
16	59°09.2	12.6	90°15.1	5.4′	17°33.7	7.6′	60.4′
17	74°09.1	12.5	104°39.5	5.3′	17°41.3	7.5′	60.4′
18	89°09.0	N23°12.3	119°03.8	5.3′	N17°48.8	7.4′	60.4′
19	104°08.9	12.2	133°28.1	5.2′	17°56.2	7.2′	60.4′
20	119°08.7	12.1	147°52.3	5.2′	18°03.4	7.1′	60.4′
21	134°08.6	·· 11.9	162°16.5	5.1′	18°10.5	7.0′	60.4′
22	149°08.5	11.8	176°40.6	5.1′	18°17.5	6.9′	60.4′
23	164°08.4	11.6	191°04.6	5.0′	18°24.4	6.7′	60.4′
	SD = 15.7′	d = 0.1′	SD = 16.5′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	▭	▭	▭	▭	▭	▭
66°	▭	▭	▭	▭	▭	▭
64°	////	////	01:36	22:29	////	////
62°	////	////	02:13	21:53	////	////
60°	////	00:56	02:39	21:27	23:08	////
N 58°	////	01:45	02:59	21:07	22:21	////
56°	////	02:14	03:16	20:50	21:52	////
54°	00:52	02:36	03:30	20:36	21:30	23:13
52°	01:36	02:54	03:42	20:24	21:12	22:29
50°	02:03	03:09	03:53	20:13	20:57	22:02
45°	02:49	03:38	04:15	19:51	20:28	21:17
N 40°	03:19	04:01	04:33	19:33	20:06	20:47
35°	03:42	04:19	04:48	19:18	19:48	20:24
30°	04:00	04:34	05:01	19:05	19:32	20:06
20°	04:29	04:59	05:23	18:43	19:08	19:37
N 10°	04:52	05:19	05:42	18:24	18:47	19:14
0°	05:11	05:37	05:59	18:07	18:29	18:56
S 10°	05:28	05:54	06:17	17:49	18:12	18:39
20°	05:44	06:11	06:35	17:31	17:55	18:23
30°	06:00	06:30	06:56	17:10	17:36	18:06
35°	06:09	06:40	07:09	16:58	17:26	17:58
40°	06:18	06:52	07:23	16:44	17:14	17:48
45°	06:28	07:06	07:39	16:27	17:01	17:38
S 50°	06:40	07:22	08:00	16:06	16:45	17:26
52°	06:45	07:29	08:10	15:57	16:37	17:21
54°	06:51	07:37	08:21	15:46	16:29	17:15
56°	06:57	07:46	08:33	15:33	16:20	17:09
58°	07:04	07:56	08:48	15:19	16:10	17:03
S 60°	07:11	08:08	09:05	15:01	15:59	16:55

Lat.	**Moonrise** Sat	Sun	Mon	**Moonset** Sat	Sun	Mon
N 72°	00:18	00:02 23:37	▭	16:14	18:34	▭
N 70°	00:27	00:19	00:10 23:55	15:58	18:03	20:20
68°	00:34	00:33	00:34	15:46	17:41	19:39
66°	00:40	00:45	00:53	15:36	17:23	19:11
64°	00:45	00:55	01:08	15:27	17:09	18:50
62°	00:50	01:03	01:21	15:20	16:57	18:33
60°	00:54	01:10	01:32	15:14	16:47	18:18
N 58°	00:57	01:17	01:41	15:08	16:38	18:06
56°	01:00	01:23	01:50	15:04	16:30	17:56
54°	01:03	01:28	01:57	14:59	16:23	17:47
52°	01:06	01:32	02:04	14:55	16:17	17:39
50°	01:08	01:37	02:10	14:52	16:12	17:31
45°	01:13	01:46	02:23	14:44	16:00	17:15
N 40°	01:17	01:53	02:34	14:38	15:50	17:03
35°	01:21	02:00	02:43	14:32	15:42	16:52
30°	01:24	02:06	02:52	14:28	15:34	16:42
20°	01:30	02:16	03:06	14:19	15:22	16:26
N 10°	01:35	02:25	03:18	14:12	15:11	16:12
0°	01:40	02:34	03:30	14:05	15:00	15:58
S 10°	01:45	02:42	03:42	13:59	14:50	15:45
20°	01:50	02:52	03:55	13:51	14:39	15:31
30°	01:56	03:02	04:10	13:43	14:27	15:15
35°	02:00	03:09	04:19	13:39	14:19	15:05
40°	02:04	03:16	04:28	13:33	14:11	14:54
45°	02:09	03:24	04:40	13:27	14:02	14:42
S 50°	02:14	03:34	04:54	13:20	13:50	14:27
52°	02:17	03:39	05:01	13:16	13:45	14:20
54°	02:20	03:44	05:08	13:13	13:39	14:12
56°	02:23	03:49	05:16	13:09	13:33	14:03
58°	02:27	03:56	05:26	13:04	13:25	13:53
S 60°	02:31	04:03	05:36	12:59	13:17	13:42

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 25-27 30-11%
27	02:50	02:56	12:03	07:53	20:20	
28	03:03	03:09	12:03	08:47	21:15	
29	03:15	03:21	12:03	09:44	22:14	

June 30, 01, 02 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	277°58.4	155°14.9	N21°36.1	201°39.8	N23°07.7	95°35.0	N00°23.0	93°47.6	N00°48.7
1	293°00.9	170°14.2	35.5	216°40.4	07.9	110°37.3	22.9	108°50.0	48.6
2	308°03.3	185°13.5	34.9	231°41.0	08.1	125°39.5	22.8	123°52.4	48.6
3	323°05.8	200°12.7	·· 34.2	246°41.6	·· 08.3	140°41.8	·· 22.7	138°54.7	·· 48.5
4	338°08.3	215°12.0	33.6	261°42.2	08.5	155°44.1	22.6	153°57.1	48.5
5	353°10.7	230°11.2	33.0	276°42.8	08.6	170°46.3	22.5	168°59.5	48.4
6	8°13.2	245°10.5	N21°32.4	291°43.4	N23°08.8	185°48.6	N00°22.4	184°01.9	N00°48.4
7	23°15.7	260°09.8	31.8	306°43.9	09.0	200°50.8	22.3	199°04.2	48.3
8	38°18.1	275°09.0	31.1	321°44.5	09.2	215°53.1	22.2	214°06.6	48.3
9	53°20.6	290°08.3	·· 30.5	336°45.1	·· 09.4	230°55.3	·· 22.1	229°09.0	·· 48.2
10	68°23.1	305°07.6	29.9	351°45.7	09.6	245°57.6	21.9	244°11.4	48.2
11	83°25.5	320°06.8	29.3	6°46.3	09.8	260°59.8	21.8	259°13.7	48.1
12	98°28.0	335°06.1	N21°28.6	21°46.9	N23°09.9	276°02.1	N00°21.7	274°16.1	N00°48.1
13	113°30.5	350°05.4	28.0	36°47.5	10.1	291°04.3	21.6	289°18.5	48.0
14	128°32.9	5°04.6	27.4	51°48.1	10.3	306°06.6	21.5	304°20.8	48.0
15	143°35.4	20°03.9	·· 26.7	66°48.7	·· 10.5	321°08.8	·· 21.4	319°23.2	·· 47.9
16	158°37.8	35°03.2	26.1	81°49.3	10.7	336°11.1	21.3	334°25.6	47.9
17	173°40.3	50°02.4	25.5	96°49.9	10.9	351°13.3	21.2	349°28.0	47.8
18	188°42.8	65°01.7	N21°24.8	111°50.5	N23°11.1	6°15.6	N00°21.1	4°30.3	N00°47.8
19	203°45.2	80°01.0	24.2	126°51.1	11.2	21°17.8	21.0	19°32.7	47.7
20	218°47.7	95°00.2	23.6	141°51.6	11.4	36°20.1	20.9	34°35.1	47.7
21	233°50.2	109°59.5	·· 22.9	156°52.2	·· 11.6	51°22.3	·· 20.8	49°37.4	·· 47.6
22	248°52.6	124°58.8	22.3	171°52.8	11.8	66°24.6	20.7	64°39.8	47.6
23	263°55.1	139°58.0	21.6	186°53.4	12.0	81°26.8	20.6	79°42.2	47.5
Mer.pass. 05:27		ν -0.7′	d 0.6′	ν 0.6′	d 0.2′	ν 2.3′	d 0.1′	ν 2.4′	d 0.0′
		m -3.91		m 1.50		m -1.96		m 0.88	

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	278°57.6	154°57.3	N21°21.0	201°54.0	N23°12.1	96°29.1	N00°20.5	94°44.5	N00°47.5
1	294°00.0	169°56.6	20.3	216°54.6	12.3	111°31.3	20.4	109°46.9	47.4
2	309°02.5	184°55.9	19.7	231°55.2	12.5	126°33.6	20.3	124°49.3	47.4
3	324°05.0	199°55.1	·· 19.1	246°55.8	·· 12.7	141°35.8	·· 20.2	139°51.7	·· 47.3
4	339°07.4	214°54.4	18.4	261°56.4	12.9	156°38.1	20.1	154°54.0	47.3
5	354°09.9	229°53.7	17.8	276°57.0	13.0	171°40.3	20.0	169°56.4	47.2
6	9°12.3	244°53.0	N21°17.1	291°57.6	N23°13.2	186°42.6	N00°19.9	184°58.8	N00°47.2
7	24°14.8	259°52.2	16.5	306°58.2	13.4	201°44.8	19.8	200°01.1	47.1
8	39°17.3	274°51.5	15.8	321°58.8	13.6	216°47.1	19.7	215°03.5	47.1
9	54°19.7	289°50.8	·· 15.2	336°59.4	·· 13.8	231°49.3	·· 19.6	230°05.9	·· 47.0
10	69°22.2	304°50.1	14.5	351°59.9	13.9	246°51.6	19.5	245°08.2	47.0
11	84°24.7	319°49.3	13.9	7°00.5	14.1	261°53.8	19.4	260°10.6	46.9
12	99°27.1	334°48.6	N21°13.2	22°01.1	N23°14.3	276°56.1	N00°19.3	275°13.0	N00°46.9
13	114°29.6	349°47.9	12.6	37°01.7	14.5	291°58.3	19.2	290°15.3	46.8
14	129°32.1	4°47.2	11.9	52°02.3	14.6	307°00.6	19.1	305°17.7	46.8
15	144°34.5	19°46.5	·· 11.2	67°02.9	·· 14.8	322°02.8	·· 19.0	320°20.1	·· 46.7
16	159°37.0	34°45.7	10.6	82°03.5	15.0	337°05.1	18.9	335°22.5	46.7
17	174°39.4	49°45.0	09.9	97°04.1	15.2	352°07.3	18.8	350°24.8	46.6
18	189°41.9	64°44.3	N21°09.3	112°04.7	N23°15.3	7°09.6	N00°18.6	5°27.2	N00°46.6
19	204°44.4	79°43.6	08.6	127°05.3	15.5	22°11.8	18.5	20°29.6	46.5
20	219°46.8	94°42.9	07.9	142°05.9	15.7	37°14.0	18.4	35°31.9	46.5
21	234°49.3	109°42.1	·· 07.3	157°06.5	·· 15.9	52°16.3	·· 18.3	50°34.3	·· 46.4
22	249°51.8	124°41.4	06.6	172°07.1	16.0	67°18.5	18.2	65°36.7	46.4
23	264°54.2	139°40.7	05.9	187°07.7	16.2	82°20.8	18.1	80°39.0	46.3
Mer.pass. 05:23		ν -0.7′	d 0.6′	ν 0.6′	d 0.2′	ν 2.2′	d 0.1′	ν 2.4′	d 0.1′
		m -3.91		m 1.51		m -1.95		m 0.88	

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	279°56.7	154°40.0	N21°05.3	202°08.3	N23°16.4	97°23.0	N00°18.0	95°41.4	N00°46.3
1	294°59.2	169°39.3	04.6	217°08.8	16.6	112°25.3	17.9	110°43.8	46.2
2	310°01.6	184°38.6	03.9	232°09.4	16.7	127°27.5	17.8	125°46.1	46.2
3	325°04.1	199°37.8	·· 03.3	247°10.0	·· 16.9	142°29.8	·· 17.7	140°48.5	·· 46.1
4	340°06.6	214°37.1	02.6	262°10.6	17.1	157°32.0	17.6	155°50.9	46.0
5	355°09.0	229°36.4	01.9	277°11.2	17.2	172°34.2	17.5	170°53.2	46.0
6	10°11.5	244°35.7	N21°01.3	292°11.8	N23°17.4	187°36.5	N00°17.4	185°55.6	N00°45.9
7	25°13.9	259°35.0	21°00.6	307°12.4	17.6	202°38.7	17.3	200°58.0	45.9
8	40°16.4	274°34.3	20°59.9	322°13.0	17.7	217°41.0	17.2	216°00.3	45.8
9	55°18.9	289°33.6	·· 59.2	337°13.6	·· 17.9	232°43.2	·· 17.1	231°02.7	·· 45.8
10	70°21.3	304°32.9	58.6	352°14.2	18.1	247°45.5	17.0	246°05.0	45.7
11	85°23.8	319°32.1	57.9	7°14.8	18.3	262°47.7	16.9	261°07.4	45.7
12	100°26.3	334°31.4	N20°57.2	22°15.4	N23°18.4	277°49.9	N00°16.7	276°09.8	N00°45.6
13	115°28.7	349°30.7	56.5	37°16.0	18.6	292°52.2	16.6	291°12.1	45.6
14	130°31.2	4°30.0	55.8	52°16.6	18.8	307°54.4	16.5	306°14.5	45.5
15	145°33.7	19°29.3	·· 55.2	67°17.2	·· 18.9	322°56.7	·· 16.4	321°16.9	·· 45.5
16	160°36.1	34°28.6	54.5	82°17.7	19.1	337°58.9	16.3	336°19.2	45.4
17	175°38.6	49°27.9	53.8	97°18.3	19.3	353°01.1	16.2	351°21.6	45.4
18	190°41.1	64°27.2	N20°53.1	112°18.9	N23°19.4	8°03.4	N00°16.1	6°24.0	N00°45.3
19	205°43.5	79°26.5	52.4	127°19.5	19.6	23°05.6	16.0	21°26.3	45.3
20	220°46.0	94°25.8	51.7	142°20.1	19.8	38°07.9	15.9	36°28.7	45.2
21	235°48.4	109°25.1	·· 51.1	157°20.7	·· 19.9	53°10.1	·· 15.8	51°31.1	·· 45.1
22	250°50.9	124°24.4	50.4	172°21.3	20.1	68°12.3	15.7	66°33.4	45.1
23	265°53.4	139°23.7	49.7	187°21.9	20.2	83°14.6	15.6	81°35.8	45.0
Mer.pass. 05:19		ν -0.7′	d 0.7′	ν 0.6′	d 0.2′	ν 2.2′	d 0.1′	ν 2.4′	d 0.1′
		m -3.91		m 1.51		m -1.95		m 0.89	

Stars

	SHA	Dec
Alpheratz	358°08.7	28°59.1
Ankaa	353°39.7	-42°24.3
Schedar	350°08.4	56°25.8
Diphda	349°20.3	-18°05.3
Achernar	335°45.1	-57°19.7
Hamal	328°28.4	23°22.3
Polaris	326°51.4	89°10.4
Acamar	315°37.1	-40°22.6
Menkar	314°40.8	4°00.9
Mirfak	309°15.7	49°47.5
Aldebaran	291°17.7	16°28.2
Rigel	281°35.8	-8°13.4
Capella	281°10.9	45°58.7
Bellatrix	278°58.5	6°19.9
Elnath	278°43.8	28°35.4
Alnilam	276°11.4	-1°12.8
Betelgeuse	271°28.0	7°24.2
Canopus	264°07.5	-52°41.2
Sirius	258°55.5	-16°41.4
Adhara	255°32.1	-28°56.8
Procyon	245°25.5	5°16.4
Pollux	243°57.9	28°04.3
Avior	234°28.6	-59°27.1
Suhail	223°10.7	-43°21.6
Miaplacidus	221°45.6	-69°38.6
Alphard	218°20.3	-8°34.7
Regulus	208°09.6	12°03.6
Dubhe	194°21.8	61°51.4
Denebola	182°58.6	14°40.7
Gienah	176°17.4	-17°26.3
Acrux	173°36.7	-63°00.0
Gacrux	172°28.1	-57°00.7
Alioth	166°42.0	56°04.0
Spica	158°56.9	-11°03.8
Alkaid	153°17.9	49°24.7
Hadar	149°22.3	-60°17.2
Menkent	148°36.2	-36°16.8
Arcturus	146°17.8	19°16.9
Rigil Kent.	140°24.7	-60°45.5
Kochab	137°18.3	74°14.3
Zuben'ubi	137°32.2	-15°57.9
Alphecca	126°31.4	26°46.8
Antares	112°55.9	-26°23.5
Atria	108°19.1	-68°59.7
Sabik	102°40.2	-15°42.1
Shaula	96°54.6	-37°05.4
Rasalhague	96°28.7	12°34.5
Eltanin	90°56.9	51°29.6
Kaus Aust.	84°15.7	-34°23.6
Vega	80°55.0	38°46.0
Nunki	76°28.1	-26°19.1
Altair	62°31.7	8°49.2
Peacock	53°57.0	-56°47.6
Deneb	49°47.7	45°12.7
Enif	34°10.8	9°47.3
Al Na'ir	28°14.0	-47°02.9
Fomalhaut	15°50.7	-29°43.1
Scheat	14°16.9	27°58.7
Markab	14°02.5	15°06.2

Jun 30 Tue	SHA	Mer.pass
Venus	237°16.5	13:40
Mars	283°41.4	10:33
Jupiter	177°36.6	17:35
Saturn	175°49.2	17:42

Jul 01 Wed	SHA	Mer.pass
Venus	235°59.8	13:41
Mars	282°56.5	10:32
Jupiter	177°31.5	17:31
Saturn	175°47.0	17:38

Jul 02 Thu	SHA	Mer.pass
Venus	234°43.3	13:42
Mars	282°11.6	10:31
Jupiter	177°26.3	17:28
Saturn	175°44.7	17:34

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°08.2	N23°11.5	205°28.7	5.0′	N18°31.1	6.6′	60.4′
1	194°08.1	11.3	219°52.6	4.9′	18°37.7	6.5′	60.4′
2	209°08.0	11.2	234°16.5	4.9′	18°44.2	6.3′	60.4′
3	224°07.9	·· 11.0	248°40.4	4.8′	18°50.5	6.2′	60.4′
4	239°07.7	10.9	263°04.2	4.8′	18°56.7	6.1′	60.4′
5	254°07.6	10.7	277°28.0	4.7′	19°02.8	5.9′	60.4′
6	269°07.5	N23°10.6	291°51.7	4.7′	N19°08.7	5.8′	60.4′
7	284°07.4	10.4	306°15.4	4.7′	19°14.5	5.7′	60.4′
8	299°07.2	10.3	320°39.1	4.6′	19°20.2	5.5′	60.4′
9	314°07.1	·· 10.1	335°02.7	4.6′	19°25.7	5.4′	60.4′
10	329°07.0	10.0	349°26.3	4.5′	19°31.1	5.3′	60.4′
11	344°06.9	09.8	3°49.8	4.5′	19°36.4	5.1′	60.4′
12	359°06.7	N23°09.7	18°13.3	4.5′	N19°41.5	4.9′	60.4′
13	14°06.6	09.5	32°36.8	4.4′	19°46.4	4.9′	60.4′
14	29°06.5	09.4	47°00.2	4.4′	19°51.3	4.7′	60.4′
15	44°06.4	·· 09.2	61°23.6	4.4′	19°56.0	4.5′	60.4′
16	59°06.2	09.1	75°47.0	4.4′	20°00.5	4.4′	60.3′
17	74°06.1	08.9	90°10.4	4.3′	20°04.9	4.3′	60.3′
18	89°06.0	N23°08.7	104°33.7	4.3′	N20°09.2	4.1′	60.3′
19	104°05.9	08.6	118°57.0	4.3′	20°13.3	3.9′	60.3′
20	119°05.7	08.4	133°20.3	4.3′	20°17.2	3.8′	60.3′
21	134°05.6	·· 08.3	147°43.6	4.2′	20°21.0	3.7′	60.3′
22	149°05.5	08.1	162°06.8	4.2′	20°24.7	3.5′	60.3′
23	164°05.4	07.9	176°30.0	4.2′	20°28.2	3.4′	60.3′
	SD = 15.7′	d = 0.1′	SD = 16.5′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°05.3	N23°07.8	190°53.3	4.2′	N20°31.6	3.2′	60.3′
1	194°05.1	07.6	205°16.5	4.2′	20°34.8	3.1′	60.2′
2	209°05.0	07.5	219°39.7	4.2′	20°37.9	2.9′	60.2′
3	224°04.9	·· 07.3	234°02.8	4.2′	20°40.8	2.8′	60.2′
4	239°04.8	07.1	248°26.0	4.2′	20°43.6	2.6′	60.2′
5	254°04.6	07.0	262°49.2	4.2′	20°46.2	2.5′	60.2′
6	269°04.5	N23°06.8	277°12.4	4.2′	N20°48.7	2.3′	60.2′
7	284°04.4	06.6	291°35.5	4.2′	20°51.0	2.2′	60.2′
8	299°04.3	06.5	305°58.7	4.2′	20°53.2	2.0′	60.1′
9	314°04.2	·· 06.3	320°21.9	4.2′	20°55.2	1.9′	60.1′
10	329°04.0	06.1	334°45.1	4.2′	20°57.1	1.7′	60.1′
11	344°03.9	06.0	349°08.2	4.2′	20°58.8	1.6′	60.1′
12	359°03.8	N23°05.8	3°31.4	4.2′	N21°00.4	1.4′	60.1′
13	14°03.7	05.6	17°54.6	4.2′	21°01.8	1.3′	60.1′
14	29°03.5	05.4	32°17.8	4.2′	21°03.1	1.1′	60.0′
15	44°03.4	·· 05.3	46°41.1	4.2′	21°04.2	1.0′	60.0′
16	59°03.3	05.1	61°04.3	4.3′	21°05.2	0.8′	60.0′
17	74°03.2	04.9	75°27.6	4.3′	21°06.0	0.7′	60.0′
18	89°03.1	N23°04.7	89°50.8	4.3′	N21°06.7	0.5′	60.0′
19	104°02.9	04.6	104°14.1	4.3′	21°07.2	0.4′	59.9′
20	119°02.8	04.4	118°37.5	4.3′	21°07.6	0.2′	59.9′
21	134°02.7	·· 04.2	133°00.8	4.4′	21°07.8	0.1′	59.9′
22	149°02.6	04.0	147°24.2	4.4′	21°07.9	0.1′	59.9′
23	164°02.5	03.9	161°47.6	4.4′	21°07.8	0.2′	59.9′
	SD = 15.7′	d = 0.2′	SD = 16.4′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°02.3	N23°03.7	176°11.0	4.5′	N21°07.6	0.4′	59.8′
1	194°02.2	03.5	190°34.5	4.5′	21°07.2	0.5′	59.8′
2	209°02.1	03.3	204°58.0	4.5′	21°06.7	0.7′	59.8′
3	224°02.0	·· 03.1	219°21.5	4.6′	21°06.0	0.8′	59.8′
4	239°01.9	03.0	233°45.1	4.6′	21°05.2	1.0′	59.7′
5	254°01.7	02.8	248°08.7	4.6′	21°04.2	1.1′	59.7′
6	269°01.6	N23°02.6	262°32.3	4.7′	N21°03.1	1.2′	59.7′
7	284°01.5	02.4	276°56.0	4.7′	21°01.9	1.4′	59.7′
8	299°01.4	02.2	291°19.7	4.8′	21°00.5	1.6′	59.6′
9	314°01.3	·· 02.0	305°43.5	4.8′	20°58.9	1.7′	59.6′
10	329°01.1	01.9	320°07.4	4.9′	20°57.2	1.8′	59.6′
11	344°01.0	01.7	334°31.2	4.9′	20°55.4	2.0′	59.6′
12	359°00.9	N23°01.5	348°55.2	5.0′	N20°53.4	2.1′	59.5′
13	14°00.8	01.3	3°19.2	5.0′	20°51.3	2.3′	59.5′
14	29°00.7	01.1	17°43.2	5.1′	20°49.0	2.4′	59.5′
15	44°00.5	·· 00.9	32°07.3	5.2′	20°46.6	2.5′	59.5′
16	59°00.4	00.7	46°31.4	5.2′	20°44.1	2.7′	59.4′
17	74°00.3	00.5	60°55.7	5.3′	20°41.4	2.8′	59.4′
18	89°00.2	N23°00.3	75°19.9	5.3′	N20°38.6	2.9′	59.4′
19	104°00.1	00.1	89°44.3	5.4′	20°35.7	3.1′	59.3′
20	119°00.0	23°00.0	104°08.6	5.5′	20°32.6	3.2′	59.3′
21	133°59.8	22°59.8	118°33.1	5.5′	20°29.4	3.4′	59.3′
22	148°59.7	59.6	132°57.6	5.6′	20°26.0	3.5′	59.3′
23	163°59.6	59.4	147°22.2	5.7′	20°22.5	3.6′	59.2′
	SD = 15.7′	d = 0.2′	SD = 16.3′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	▭	▭	▭	▭	▭	▭
66°	////	////	00:18	23:41	////	////
64°	////	////	01:41	22:25	////	////
62°	////	////	02:16	21:50	////	////
60°	////	01:03	02:42	21:25	23:03	////
N 58°	////	01:48	03:02	21:05	22:18	////
56°	////	02:17	03:18	20:49	21:50	////
54°	00:58	02:38	03:32	20:35	21:29	23:08
52°	01:40	02:56	03:44	20:23	21:11	22:27
50°	02:06	03:11	03:55	20:12	20:57	22:01
45°	02:50	03:40	04:17	19:50	20:27	21:17
N 40°	03:21	04:02	04:35	19:33	20:05	20:47
35°	03:43	04:20	04:49	19:18	19:47	20:24
30°	04:02	04:35	05:02	19:05	19:32	20:06
20°	04:30	05:00	05:24	18:43	19:08	19:37
N 10°	04:53	05:20	05:43	18:25	18:48	19:15
0°	05:11	05:38	06:00	18:07	18:30	18:56
S 10°	05:28	05:55	06:17	17:50	18:13	18:39
20°	05:44	06:12	06:36	17:32	17:56	18:23
30°	06:00	06:30	06:56	17:11	17:37	18:07
35°	06:09	06:41	07:09	16:59	17:27	17:59
40°	06:18	06:52	07:23	16:45	17:15	17:49
45°	06:28	07:05	07:39	16:28	17:02	17:39
S 50°	06:40	07:21	07:59	16:08	16:46	17:28
52°	06:45	07:29	08:09	15:58	16:39	17:23
54°	06:51	07:37	08:20	15:48	16:31	17:17
56°	06:57	07:45	08:32	15:35	16:22	17:11
58°	07:03	07:55	08:47	15:21	16:12	17:05
S 60°	07:10	08:07	09:04	15:04	16:01	16:57

Lat.	**Moonrise** Tue	Wed	Thu	**Moonset** Tue	Wed	Thu
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	00:38	00:50	01:33	21:33	22:59	23:34
66°	01:06	01:33	02:24	20:51	22:08	22:54
64°	01:28	02:02	02:56	20:23	21:37	22:26
62°	01:46	02:24	03:19	20:01	21:13	22:04
60°	02:01	02:42	03:38	19:43	20:54	21:47
N 58°	02:13	02:57	03:54	19:29	20:38	21:32
56°	02:24	03:10	04:07	19:16	20:25	21:20
54°	02:34	03:21	04:19	19:05	20:13	21:09
52°	02:42	03:31	04:29	18:55	20:03	20:59
50°	02:50	03:40	04:38	18:47	19:54	20:50
45°	03:07	03:58	04:58	18:28	19:34	20:32
N 40°	03:20	04:14	05:13	18:13	19:19	20:16
35°	03:32	04:27	05:27	18:00	19:05	20:04
30°	03:42	04:38	05:38	17:49	18:54	19:52
20°	04:00	04:58	05:58	17:30	18:34	19:33
N 10°	04:15	05:15	06:16	17:14	18:16	19:16
0°	04:30	05:31	06:32	16:59	18:00	19:00
S 10°	04:44	05:47	06:48	16:43	17:44	18:45
20°	05:00	06:04	07:05	16:27	17:26	18:28
30°	05:18	06:24	07:25	16:08	17:06	18:08
35°	05:28	06:35	07:37	15:57	16:54	17:57
40°	05:40	06:49	07:50	15:44	16:41	17:43
45°	05:55	07:04	08:06	15:29	16:25	17:28
S 50°	06:12	07:24	08:26	15:11	16:05	17:09
52°	06:20	07:33	08:35	15:03	15:56	16:59
54°	06:30	07:43	08:45	14:53	15:46	16:49
56°	06:40	07:55	08:57	14:42	15:34	16:38
58°	06:52	08:09	09:11	14:30	15:20	16:24
S 60°	07:06	08:25	09:26	14:16	15:04	16:09

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 28-1 5-0%
30	03:27	03:33	12:04	10:44	23:15	
01	03:39	03:45	12:04	11:45	–:–	
02	03:51	03:56	12:04	12:46	00:16	

July 03, 04, 05 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	280°55.8	154°23.0	N20°49.0	202°22.5	N23°20.4	98°16.8	N00°15.5	96°38.1	N00°45.0
1	295°58.3	169°22.3	48.3	217°23.1	20.6	113°19.1	15.4	111°40.5	44.9
2	311°00.8	184°21.6	47.6	232°23.7	20.7	128°21.3	15.2	126°42.9	44.9
3	326°03.2	199°20.9	·· 46.9	247°24.3	·· 20.9	143°23.5	·· 15.1	141°45.2	·· 44.8
4	341°05.7	214°20.2	46.2	262°24.9	21.1	158°25.8	15.0	156°47.6	44.8
5	356°08.2	229°19.5	45.5	277°25.5	21.2	173°28.0	14.9	171°50.0	44.7
6	11°10.6	244°18.8	N20°44.8	292°26.1	N23°21.4	188°30.3	N00°14.8	186°52.3	N00°44.7
7	26°13.1	259°18.1	44.1	307°26.7	21.5	203°32.5	14.7	201°54.7	44.6
8	41°15.6	274°17.4	43.4	322°27.2	21.7	218°34.7	14.6	216°57.0	44.6
9	56°18.0	289°16.7	·· 42.7	337°27.8	·· 21.9	233°37.0	·· 14.5	231°59.4	·· 44.5
10	71°20.5	304°16.0	42.0	352°28.4	22.0	248°39.2	14.4	247°01.8	44.4
11	86°22.9	319°15.3	41.3	7°29.0	22.2	263°41.4	14.3	262°04.1	44.4
12	101°25.4	334°14.6	N20°40.6	22°29.6	N23°22.3	278°43.7	N00°14.2	277°06.5	N00°44.3
13	116°27.9	349°13.9	39.9	37°30.2	22.5	293°45.9	14.1	292°08.9	44.3
14	131°30.3	4°13.2	39.2	52°30.8	22.7	308°48.1	13.9	307°11.2	44.2
15	146°32.8	19°12.5	·· 38.5	67°31.4	·· 22.8	323°50.4	·· 13.8	322°13.6	·· 44.2
16	161°35.3	34°11.8	37.8	82°32.0	23.0	338°52.6	13.7	337°15.9	44.1
17	176°37.7	49°11.1	37.1	97°32.6	23.1	353°54.8	13.6	352°18.3	44.1
18	191°40.2	64°10.4	N20°36.4	112°33.2	N23°23.3	8°57.1	N00°13.5	7°20.7	N00°44.0
19	206°42.7	79°09.7	35.7	127°33.8	23.4	23°59.3	13.4	22°23.0	44.0
20	221°45.1	94°09.0	35.0	142°34.4	23.6	39°01.6	13.3	37°25.4	43.9
21	236°47.6	109°08.3	·· 34.3	157°35.0	·· 23.8	54°03.8	·· 13.2	52°27.7	·· 43.8
22	251°50.1	124°07.6	33.5	172°35.6	23.9	69°06.0	13.1	67°30.1	43.8
23	266°52.5	139°06.9	32.8	187°36.2	24.1	84°08.3	13.0	82°32.5	43.7
Mer.pass. 05:15		ν -0.7′	d 0.7′	m -3.91	ν 0.6′	d 0.2′	m 1.51	ν 2.2′	d 0.1′ m -1.94	ν 2.4′	d 0.1′ m 0.89

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	281°55.0	154°06.2	N20°32.1	202°36.8	N23°24.2	99°10.5	N00°12.8	97°34.8	N00°43.7
1	296°57.4	169°05.6	31.4	217°37.4	24.4	114°12.7	12.7	112°37.2	43.6
2	311°59.9	184°04.9	30.7	232°37.9	24.5	129°15.0	12.6	127°39.5	43.6
3	327°02.4	199°04.2	·· 30.0	247°38.5	·· 24.7	144°17.2	·· 12.5	142°41.9	·· 43.5
4	342°04.8	214°03.5	29.2	262°39.1	24.8	159°19.4	12.4	157°44.3	43.5
5	357°07.3	229°02.8	28.5	277°39.7	25.0	174°21.6	12.3	172°46.6	43.4
6	12°09.8	244°02.1	N20°27.8	292°40.3	N23°25.1	189°23.9	N00°12.2	187°49.0	N00°43.3
7	27°12.2	259°01.4	27.1	307°40.9	25.3	204°26.1	12.1	202°51.3	43.3
8	42°14.7	274°00.7	26.4	322°41.5	25.4	219°28.3	12.0	217°53.7	43.2
9	57°17.2	289°00.1	·· 25.6	337°42.1	·· 25.6	234°30.6	·· 11.9	232°56.0	·· 43.2
10	72°19.6	303°59.4	24.9	352°42.7	25.7	249°32.8	11.7	247°58.4	43.1
11	87°22.1	318°58.7	24.2	7°43.3	25.9	264°35.0	11.6	263°00.8	43.1
12	102°24.6	333°58.0	N20°23.5	22°43.9	N23°26.0	279°37.3	N00°11.5	278°03.1	N00°43.0
13	117°27.0	348°57.3	22.7	37°44.5	26.2	294°39.5	11.4	293°05.5	43.0
14	132°29.5	3°56.6	22.0	52°45.1	26.3	309°41.7	11.3	308°07.8	42.9
15	147°31.9	18°56.0	·· 21.3	67°45.7	·· 26.5	324°44.0	·· 11.2	323°10.2	·· 42.8
16	162°34.4	33°55.3	20.6	82°46.3	26.6	339°46.2	11.1	338°12.6	42.8
17	177°36.9	48°54.6	19.8	97°46.9	26.8	354°48.4	11.0	353°14.9	42.7
18	192°39.3	63°53.9	N20°19.1	112°47.5	N23°26.9	9°50.6	N00°10.9	8°17.3	N00°42.7
19	207°41.8	78°53.2	18.4	127°48.1	27.1	24°52.9	10.7	23°19.6	42.6
20	222°44.3	93°52.6	17.6	142°48.7	27.2	39°55.1	10.6	38°22.0	42.6
21	237°46.7	108°51.9	·· 16.9	157°49.3	·· 27.4	54°57.3	·· 10.5	53°24.3	·· 42.5
22	252°49.2	123°51.2	16.2	172°49.8	27.5	69°59.6	10.4	68°26.7	42.4
23	267°51.7	138°50.5	15.4	187°50.4	27.7	85°01.8	10.3	83°29.0	42.4
Mer.pass. 05:11		ν -0.7′	d 0.7′	m -3.91	ν 0.6′	d 0.2′	m 1.52	ν 2.2′	d 0.1′ m -1.94	ν 2.4′	d 0.1′ m 0.89

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	282°54.1	153°49.8	N20°14.7	202°51.0	N23°27.8	100°04.0	N00°10.2	98°31.4	N00°42.3
1	297°56.6	168°49.2	13.9	217°51.6	28.0	115°06.2	10.1	113°33.8	42.3
2	312°59.0	183°48.5	13.2	232°52.2	28.1	130°08.5	10.0	128°36.1	42.2
3	328°01.5	198°47.8	·· 12.5	247°52.8	·· 28.2	145°10.7	·· 09.8	143°38.5	·· 42.2
4	343°04.0	213°47.1	11.7	262°53.4	28.4	160°12.9	09.7	158°40.8	42.1
5	358°06.4	228°46.5	11.0	277°54.0	28.5	175°15.2	09.6	173°43.2	42.1
6	13°08.9	243°45.8	N20°10.2	292°54.6	N23°28.7	190°17.4	N00°09.5	188°45.5	N00°42.0
7	28°11.4	258°45.1	09.5	307°55.2	28.8	205°19.6	09.4	203°47.9	41.9
8	43°13.8	273°44.4	08.7	322°55.8	29.0	220°21.8	09.3	218°50.2	41.9
9	58°16.3	288°43.8	·· 08.0	337°56.4	·· 29.1	235°24.1	·· 09.2	233°52.6	·· 41.8
10	73°18.8	303°43.1	07.2	352°57.0	29.2	250°26.3	09.1	248°55.0	41.8
11	88°21.2	318°42.4	06.5	7°57.6	29.4	265°28.5	08.9	263°57.3	41.7
12	103°23.7	333°41.8	N20°05.7	22°58.2	N23°29.5	280°30.7	N00°08.8	278°59.7	N00°41.7
13	118°26.2	348°41.1	05.0	37°58.8	29.7	295°33.0	08.7	294°02.0	41.6
14	133°28.6	3°40.4	04.2	52°59.4	29.8	310°35.2	08.6	309°04.4	41.5
15	148°31.1	18°39.7	·· 03.5	68°00.0	·· 29.9	325°37.4	·· 08.5	324°06.7	·· 41.5
16	163°33.5	33°39.1	02.7	83°00.6	30.1	340°39.6	08.4	339°09.1	41.4
17	178°36.0	48°38.4	02.0	98°01.2	30.2	355°41.9	08.3	354°11.4	41.4
18	193°38.5	63°37.7	N20°01.2	113°01.8	N23°30.4	10°44.1	N00°08.1	9°13.8	N00°41.3
19	208°40.9	78°37.1	20°00.5	128°02.4	30.5	25°46.3	08.0	24°16.1	41.2
20	223°43.4	93°36.4	19°59.7	143°03.0	30.6	40°48.5	07.9	39°18.5	41.2
21	238°45.9	108°35.7	·· 59.0	158°03.5	·· 30.8	55°50.8	·· 07.8	54°20.9	·· 41.1
22	253°48.3	123°35.1	58.2	173°04.1	30.9	70°53.0	07.7	69°23.2	41.1
23	268°50.8	138°34.4	57.4	188°04.7	31.1	85°55.2	07.6	84°25.6	41.0
Mer.pass. 05:08		ν -0.7′	d 0.7′	m -3.91	ν 0.6′	d 0.1′	m 1.52	ν 2.2′	d 0.1′ m -1.93	ν 2.4′	d 0.1′ m 0.90

Stars

	SHA	Dec
Alpheratz	358°08.7	28°59.1
Ankaa	353°39.7	-42°24.2
Schedar	350°08.3	56°25.8
Diphda	349°20.3	-18°05.3
Achernar	335°45.0	-57°19.7
Hamal	328°28.4	23°22.3
Polaris	326°50.3	89°10.4
Acamar	315°37.1	-40°22.6
Menkar	314°40.7	4°01.0
Mirfak	309°15.6	49°47.5
Aldebaran	291°17.7	16°28.2
Rigel	281°35.8	-8°13.4
Capella	281°10.9	45°58.7
Bellatrix	278°58.5	6°19.9
Elnath	278°43.8	28°35.4
Alnilam	276°11.4	-1°12.8
Betelgeuse	271°28.0	7°24.2
Canopus	264°07.5	-52°41.1
Sirius	258°55.5	-16°41.4
Adhara	255°32.1	-28°56.8
Procyon	245°25.5	5°16.4
Pollux	243°57.9	28°04.3
Avior	234°28.6	-59°27.1
Suhail	223°10.7	-43°21.6
Miaplacidus	221°45.6	-69°38.6
Alphard	218°20.3	-8°34.7
Regulus	208°09.6	12°03.6
Dubhe	194°21.8	61°51.4
Denebola	182°58.6	14°40.7
Gienah	176°17.4	-17°26.3
Acrux	173°36.7	-63°00.0
Gacrux	172°28.1	-57°00.7
Alioth	166°42.0	56°04.0
Spica	158°56.9	-11°03.8
Alkaid	153°17.9	49°24.7
Hadar	149°22.3	-60°17.2
Menkent	148°36.2	-36°16.8
Arcturus	146°17.8	19°17.0
Rigil Kent.	140°24.7	-60°45.6
Kochab	137°18.4	74°14.3
Zuben'ubi	137°32.2	-15°57.9
Alphecca	126°31.4	26°46.8
Antares	112°55.9	-26°23.5
Atria	108°19.1	-68°59.8
Sabik	102°40.2	-15°42.1
Shaula	96°54.6	-37°05.4
Rasalhague	96°28.7	12°34.5
Eltanin	90°56.9	51°29.6
Kaus Aust.	84°15.7	-34°23.6
Vega	80°55.0	38°46.1
Nunki	76°28.1	-26°19.1
Altair	62°31.6	8°49.2
Peacock	53°57.0	-56°47.6
Deneb	49°47.7	45°12.7
Enif	34°10.8	9°47.3
Al Na'ir	28°13.9	-47°02.9
Fomalhaut	15°50.6	-29°43.1
Scheat	14°16.9	27°58.8
Markab	14°02.5	15°06.2

Jul 03 Fri	SHA	Mer.pass
Venus	233°27.1	13:43
Mars	281°26.7	10:30
Jupiter	177°21.0	17:24
Saturn	175°42.3	17:31

Jul 04 Sat	SHA	Mer.pass
Venus	232°11.3	13:44
Mars	280°41.8	10:29
Jupiter	177°15.5	17:21
Saturn	175°39.8	17:27

Jul 05 Sun	SHA	Mer.pass
Venus	230°55.7	13:45
Mars	279°56.9	10:28
Jupiter	177°09.9	17:17
Saturn	175°37.3	17:23

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h

	Sun		Moon				
Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°59.5	N22°59.2	161°46.9	5.7′	N20°18.9	3.8′	59.2′
1	193°59.4	59.0	176°11.6	5.8′	20°15.1	3.8′	59.2′
2	208°59.3	58.8	190°36.4	5.9′	20°11.3	4.0′	59.1′
3	223°59.1	·· 58.6	205°01.3	5.9′	20°07.3	4.2′	59.1′
4	238°59.0	58.4	219°26.2	6.0′	20°03.1	4.2′	59.1′
5	253°58.9	58.2	233°51.3	6.1′	19°58.9	4.4′	59.0′
6	268°58.8	N22°58.0	248°16.4	6.2′	N19°54.5	4.6′	59.0′
7	283°58.7	57.8	262°41.5	6.3′	19°49.9	4.6′	59.0′
8	298°58.6	57.6	277°06.8	6.3′	19°45.3	4.8′	58.9′
9	313°58.4	·· 57.4	291°32.1	6.4′	19°40.5	4.8′	58.9′
10	328°58.3	57.2	305°57.5	6.5′	19°35.7	5.0′	58.9′
11	343°58.2	57.0	320°23.0	6.6′	19°30.7	5.2′	58.8′
12	358°58.1	N22°56.8	334°48.6	6.7′	N19°25.5	5.2′	58.8′
13	13°58.0	56.6	349°14.2	6.7′	19°20.3	5.4′	58.8′
14	28°57.9	56.4	3°40.0	6.8′	19°14.9	5.4′	58.8′
15	43°57.7	·· 56.2	18°05.8	6.9′	19°09.5	5.6′	58.7′
16	58°57.6	55.9	32°31.7	7.0′	19°03.9	5.7′	58.7′
17	73°57.5	55.7	46°57.7	7.1′	18°58.2	5.8′	58.7′
18	88°57.4	N22°55.5	61°23.8	7.2′	N18°52.4	5.9′	58.6′
19	103°57.3	55.3	75°49.9	7.2′	18°46.5	6.1′	58.6′
20	118°57.2	55.1	90°16.2	7.3′	18°40.4	6.1′	58.5′
21	133°57.1	·· 54.9	104°42.5	7.4′	18°34.3	6.2′	58.5′
22	148°56.9	54.7	119°08.9	7.5′	18°28.1	6.4′	58.5′
23	163°56.8	54.5	133°35.4	7.6′	18°21.7	6.5′	58.4′
	SD = 15.7′	d = 0.2′	SD = 16.1′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°56.7	N22°54.3	148°02.0	7.7′	N18°15.2	6.5′	58.4′
1	193°56.6	54.1	162°28.7	7.8′	18°08.7	6.7′	58.4′
2	208°56.5	53.8	176°55.5	7.9′	18°02.0	6.7′	58.3′
3	223°56.4	·· 53.6	191°22.4	8.0′	17°55.3	6.9′	58.3′
4	238°56.3	53.4	205°49.3	8.1′	17°48.4	6.9′	58.3′
5	253°56.1	53.2	220°16.4	8.1′	17°41.5	7.1′	58.2′
6	268°56.0	N22°53.0	234°43.5	8.2′	N17°34.4	7.1′	58.2′
7	283°55.9	52.8	249°10.8	8.3′	17°27.3	7.3′	58.2′
8	298°55.8	52.5	263°38.1	8.4′	17°20.0	7.3′	58.1′
9	313°55.7	·· 52.3	278°05.5	8.5′	17°12.7	7.4′	58.1′
10	328°55.6	52.1	292°33.0	8.6′	17°05.3	7.5′	58.1′
11	343°55.5	51.9	307°00.6	8.7′	16°57.8	7.6′	58.0′
12	358°55.4	N22°51.7	321°28.3	8.8′	N16°50.2	7.7′	58.0′
13	13°55.2	51.4	335°56.1	8.9′	16°42.5	7.8′	58.0′
14	28°55.1	51.2	350°24.0	9.0′	16°34.7	7.9′	57.9′
15	43°55.0	·· 51.0	4°51.9	9.1′	16°26.8	7.9′	57.9′
16	58°54.9	50.8	19°20.0	9.2′	16°18.9	8.0′	57.8′
17	73°54.8	50.6	33°48.2	9.2′	16°10.9	8.1′	57.8′
18	88°54.7	N22°50.3	48°16.4	9.3′	N16°02.8	8.2′	57.8′
19	103°54.6	50.1	62°44.7	9.4′	15°54.6	8.3′	57.7′
20	118°54.5	49.9	77°13.2	9.5′	15°46.3	8.3′	57.7′
21	133°54.4	·· 49.6	91°41.7	9.6′	15°38.0	8.4′	57.7′
22	148°54.2	49.4	106°10.3	9.7′	15°29.6	8.5′	57.6′
23	163°54.1	49.2	120°39.0	9.8′	15°21.1	8.6′	57.6′
	SD = 15.7′	d = 0.2′	SD = 15.9′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°54.0	N22°49.0	135°07.8	9.9′	N15°12.5	8.6′	57.6′
1	193°53.9	48.7	149°36.7	10.0′	15°03.9	8.7′	57.5′
2	208°53.8	48.5	164°05.6	10.1′	14°55.2	8.8′	57.5′
3	223°53.7	·· 48.3	178°34.7	10.2′	14°46.4	8.8′	57.4′
4	238°53.6	48.0	193°03.9	10.2′	14°37.6	8.9′	57.4′
5	253°53.5	47.8	207°33.1	10.3′	14°28.7	9.0′	57.4′
6	268°53.4	N22°47.6	222°02.4	10.4′	N14°19.7	9.0′	57.3′
7	283°53.3	47.3	236°31.8	10.5′	14°10.7	9.1′	57.3′
8	298°53.1	47.1	251°01.4	10.6′	14°01.6	9.2′	57.3′
9	313°53.0	·· 46.9	265°30.9	10.7′	13°52.4	9.2′	57.2′
10	328°52.9	46.6	280°00.6	10.8′	13°43.2	9.3′	57.2′
11	343°52.8	46.4	294°30.4	10.9′	13°33.9	9.3′	57.2′
12	358°52.7	N22°46.2	309°00.2	10.9′	N13°24.6	9.4′	57.1′
13	13°52.6	45.9	323°30.2	11.0′	13°15.2	9.5′	57.1′
14	28°52.5	45.7	338°00.2	11.1′	13°05.7	9.5′	57.1′
15	43°52.4	·· 45.4	352°30.3	11.2′	12°56.2	9.6′	57.0′
16	58°52.3	45.2	7°00.5	11.3′	12°46.6	9.6′	57.0′
17	73°52.2	45.0	21°30.8	11.4′	12°37.0	9.6′	56.9′
18	88°52.1	N22°44.7	36°01.1	11.4′	N12°27.4	9.8′	56.9′
19	103°52.0	44.5	50°31.6	11.5′	12°17.6	9.7′	56.9′
20	118°51.8	44.2	65°02.1	11.6′	12°07.9	9.8′	56.8′
21	133°51.7	·· 44.0	79°32.7	11.7′	11°58.1	9.9′	56.8′
22	148°51.6	43.8	94°03.4	11.8′	11°48.2	9.9′	56.8′
23	163°51.5	43.5	108°34.1	11.8′	11°38.3	9.9′	56.7′
	SD = 15.7′	d = 0.2′	SD = 15.7′				

Lat.	**Twilight** Naut.	**Twilight** Civil	**Sunrise**	**Sunset**	**Twilight** Civil	**Twilight** Naut.
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	▭	▭	▭	▭	▭	▭
66°	////	////	00:40	23:23	////	////
64°	////	////	01:47	22:20	////	////
62°	////	////	02:21	21:47	////	////
60°	////	01:10	02:45	21:22	22:56	////
N 58°	////	01:53	03:05	21:03	22:15	////
56°	////	02:20	03:21	20:47	21:47	////
54°	01:05	02:41	03:34	20:34	21:27	23:02
52°	01:44	02:58	03:46	20:22	21:10	22:24
50°	02:09	03:13	03:57	20:11	20:55	21:58
45°	02:53	03:42	04:19	19:50	20:27	21:15
N 40°	03:22	04:04	04:36	19:32	20:05	20:46
35°	03:45	04:21	04:51	19:18	19:47	20:23
30°	04:03	04:36	05:04	19:05	19:32	20:05
20°	04:31	05:01	05:25	18:44	19:08	19:37
N 10°	04:54	05:21	05:44	18:25	18:48	19:15
0°	05:12	05:38	06:01	18:08	18:30	18:57
S 10°	05:29	05:55	06:18	17:51	18:14	18:40
20°	05:44	06:12	06:36	17:33	17:57	18:24
30°	06:00	06:30	06:56	17:12	17:39	18:08
35°	06:09	06:40	07:08	17:00	17:28	18:00
40°	06:18	06:52	07:22	16:47	17:17	17:51
45°	06:28	07:05	07:39	16:30	17:04	17:41
S 50°	06:39	07:20	07:59	16:10	16:48	17:30
52°	06:44	07:28	08:08	16:01	16:41	17:25
54°	06:50	07:36	08:19	15:50	16:33	17:19
56°	06:56	07:44	08:31	15:38	16:25	17:13
58°	07:02	07:54	08:45	15:24	16:15	17:07
S 60°	07:09	08:05	09:02	15:07	16:04	17:00

Lat.	**Moonrise** Fri	Sat	Sun	**Moonset** Fri	Sat	Sun
N 72°	▭	02:49	05:46	▭	01:49	00:43
N 70°	▭	04:14	06:17	▭	00:23	00:10
68°	03:04	04:52	06:39	23:44	23:47	23:47
66°	03:44	05:19	06:57	23:16	23:28	23:35
64°	04:11	05:40	07:11	22:55	23:13	23:25
62°	04:32	05:56	07:23	22:38	23:00	23:16
60°	04:50	06:10	07:33	22:24	22:50	23:08
N 58°	05:04	06:22	07:42	22:12	22:40	23:02
56°	05:16	06:32	07:49	22:01	22:32	22:56
54°	05:27	06:41	07:56	21:52	22:25	22:51
52°	05:37	06:49	08:02	21:43	22:18	22:46
50°	05:45	06:56	08:08	21:36	22:12	22:41
45°	06:03	07:11	08:20	21:19	21:59	22:32
N 40°	06:18	07:24	08:29	21:06	21:48	22:24
35°	06:30	07:35	08:38	20:55	21:39	22:17
30°	06:41	07:44	08:45	20:45	21:31	22:11
20°	07:00	08:00	08:58	20:27	21:17	22:01
N 10°	07:16	08:14	09:09	20:12	21:04	21:51
0°	07:31	08:27	09:19	19:58	20:52	21:43
S 10°	07:46	08:40	09:29	19:44	20:41	21:34
20°	08:02	08:54	09:40	19:29	20:28	21:24
30°	08:21	09:10	09:53	19:11	20:13	21:14
35°	08:32	09:19	10:00	19:01	20:05	21:07
40°	08:44	09:30	10:08	18:49	19:55	21:00
45°	08:59	09:42	10:18	18:35	19:44	20:52
S 50°	09:16	09:57	10:29	18:18	19:30	20:42
52°	09:25	10:04	10:34	18:10	19:24	20:37
54°	09:34	10:11	10:40	18:01	19:16	20:32
56°	09:44	10:20	10:47	17:51	19:08	20:26
58°	09:56	10:29	10:54	17:39	18:59	20:19
S 60°	10:10	10:41	11:02	17:26	18:49	20:12

Day	**Sun** Eqn.of Time 00^h mm:ss	Eqn.of Time 12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 2-4 2-13%
03	04:02	04:08	12:04	13:45	01:16	
04	04:13	04:19	12:04	14:40	02:13	
05	04:24	04:29	12:04	15:31	03:06	

July 06, 07, 08 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	283°53.3	153°33.8	N19°56.7	203°05.3	N23°31.2	100°57.4	N00°07.5	99°27.9	N00°41.0
1	298°55.7	168°33.1	55.9	218°05.9	31.3	115°59.6	07.3	114°30.3	40.9
2	313°58.2	183°32.4	55.2	233°06.5	31.5	131°01.9	07.2	129°32.6	40.8
3	329°00.7	198°31.8	·· 54.4	248°07.1	·· 31.6	146°04.1	·· 07.1	144°35.0	·· 40.8
4	344°03.1	213°31.1	53.6	263°07.7	31.7	161°06.3	07.0	159°37.3	40.7
5	359°05.6	228°30.4	52.9	278°08.3	31.9	176°08.5	06.9	174°39.7	40.7
6	14°08.0	243°29.8	N19°52.1	293°08.9	N23°32.0	191°10.8	N00°06.8	189°42.0	N00°40.6
7	29°10.5	258°29.1	51.3	308°09.5	32.1	206°13.0	06.7	204°44.4	40.6
8	44°13.0	273°28.5	50.6	323°10.1	32.3	221°15.2	06.5	219°46.7	40.5
9	59°15.4	288°27.8	·· 49.8	338°10.7	·· 32.4	236°17.4	·· 06.4	234°49.1	·· 40.4
10	74°17.9	303°27.1	49.0	353°11.3	32.5	251°19.6	06.3	249°51.4	40.4
11	89°20.4	318°26.5	48.2	8°11.9	32.7	266°21.9	06.2	264°53.8	40.3
12	104°22.8	333°25.8	N19°47.5	23°12.5	N23°32.8	281°24.1	N00°06.1	279°56.1	N00°40.3
13	119°25.3	348°25.2	46.7	38°13.1	32.9	296°26.3	06.0	294°58.5	40.2
14	134°27.8	3°24.5	45.9	53°13.7	33.1	311°28.5	05.9	310°00.8	40.1
15	149°30.2	18°23.9	·· 45.2	68°14.3	·· 33.2	326°30.7	·· 05.7	325°03.2	·· 40.1
16	164°32.7	33°23.2	44.4	83°14.9	33.3	341°33.0	05.6	340°05.5	40.0
17	179°35.1	48°22.5	43.6	98°15.5	33.4	356°35.2	05.5	355°07.9	40.0
18	194°37.6	63°21.9	N19°42.8	113°16.1	N23°33.6	11°37.4	N00°05.4	10°10.2	N00°39.9
19	209°40.1	78°21.2	42.0	128°16.7	33.7	26°39.6	05.3	25°12.6	39.8
20	224°42.5	93°20.6	41.3	143°17.3	33.8	41°41.8	05.2	40°14.9	39.8
21	239°45.0	108°19.9	·· 40.5	158°17.9	·· 34.0	56°44.1	·· 05.0	55°17.3	·· 39.7
22	254°47.5	123°19.3	39.7	173°18.5	34.1	71°46.3	04.9	70°19.6	39.7
23	269°49.9	138°18.6	38.9	188°19.1	34.2	86°48.5	04.8	85°22.0	39.6
Mer.pass. 05:04		ν -0.7′	d 0.8′	ν 0.6′	d 0.1′	ν 2.2′	d 0.1′	ν 2.4′	d 0.1′
		m -3.91		m 1.52		m -1.93		m 0.90	

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	284°52.4	153°18.0	N19°38.1	203°19.7	N23°34.3	101°50.7	N00°04.7	100°24.3	N00°39.5
1	299°54.9	168°17.3	37.4	218°20.3	34.5	116°52.9	04.6	115°26.7	39.5
2	314°57.3	183°16.7	36.6	233°20.9	34.6	131°55.1	04.5	130°29.0	39.4
3	329°59.8	198°16.0	·· 35.8	248°21.5	·· 34.7	146°57.4	·· 04.3	145°31.4	·· 39.4
4	345°02.3	213°15.4	35.0	263°22.1	34.9	161°59.6	04.2	160°33.7	39.3
5	0°04.7	228°14.7	34.2	278°22.7	35.0	177°01.8	04.1	175°36.1	39.3
6	15°07.2	243°14.1	N19°33.4	293°23.2	N23°35.1	192°04.0	N00°04.0	190°38.4	N00°39.2
7	30°09.6	258°13.4	32.6	308°23.8	35.2	207°06.2	03.9	205°40.8	39.1
8	45°12.1	273°12.8	31.8	323°24.4	35.4	222°08.4	03.8	220°43.1	39.1
9	60°14.6	288°12.2	·· 31.0	338°25.0	·· 35.5	237°10.6	·· 03.6	235°45.5	·· 39.0
10	75°17.0	303°11.5	30.3	353°25.6	35.6	252°12.9	03.5	250°47.8	39.0
11	90°19.5	318°10.9	29.5	8°26.2	35.7	267°15.1	03.4	265°50.2	38.9
12	105°22.0	333°10.2	N19°28.7	23°26.8	N23°35.9	282°17.3	N00°03.3	280°52.5	N00°38.8
13	120°24.4	348°09.6	27.9	38°27.4	36.0	297°19.5	03.2	295°54.9	38.8
14	135°26.9	3°08.9	27.1	53°28.0	36.1	312°21.7	03.0	310°57.2	38.7
15	150°29.4	18°08.3	·· 26.3	68°28.6	·· 36.2	327°23.9	·· 02.9	325°59.6	·· 38.7
16	165°31.8	33°07.7	25.5	83°29.2	36.3	342°26.2	02.8	341°01.9	38.6
17	180°34.3	48°07.0	24.7	98°29.8	36.5	357°28.4	02.7	356°04.2	38.5
18	195°36.7	63°06.4	N19°23.9	113°30.4	N23°36.6	12°30.6	N00°02.6	11°06.6	N00°38.5
19	210°39.2	78°05.7	23.1	128°31.0	36.7	27°32.8	02.5	26°08.9	38.4
20	225°41.7	93°05.1	22.3	143°31.6	36.8	42°35.0	02.3	41°11.3	38.3
21	240°44.1	108°04.5	·· 21.5	158°32.2	·· 36.9	57°37.2	·· 02.2	56°13.6	·· 38.3
22	255°46.6	123°03.8	20.7	173°32.8	37.1	72°39.4	02.1	71°16.0	38.2
23	270°49.1	138°03.2	19.9	188°33.4	37.2	87°41.6	02.0	86°18.3	38.2
Mer.pass. 05:00		ν -0.7′	d 0.8′	ν 0.6′	d 0.1′	ν 2.2′	d 0.1′	ν 2.3′	d 0.1′
		m -3.91		m 1.53		m -1.92		m 0.90	

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	285°51.5	153°02.5	N19°19.1	203°34.0	N23°37.3	102°43.9	N00°01.9	101°20.7	N00°38.1
1	300°54.0	168°01.9	18.3	218°34.6	37.4	117°46.1	01.7	116°23.0	38.0
2	315°56.5	183°01.3	17.4	233°35.2	37.5	132°48.3	01.6	131°25.4	38.0
3	330°58.9	198°00.6	·· 16.6	248°35.8	·· 37.7	147°50.5	·· 01.5	146°27.7	·· 37.9
4	346°01.4	213°00.0	15.8	263°36.4	37.8	162°52.7	01.4	161°30.0	37.9
5	1°03.9	227°59.4	15.0	278°37.0	37.9	177°54.9	01.3	176°32.4	37.8
6	16°06.3	242°58.7	N19°14.2	293°37.6	N23°38.0	192°57.1	N00°01.2	191°34.7	N00°37.7
7	31°08.8	257°58.1	13.4	308°38.2	38.1	207°59.3	01.0	206°37.1	37.7
8	46°11.2	272°57.5	12.6	323°38.8	38.2	223°01.5	00.9	221°39.4	37.6
9	61°13.7	287°56.8	·· 11.8	338°39.4	·· 38.3	238°03.8	·· 00.8	236°41.8	·· 37.6
10	76°16.2	302°56.2	11.0	353°40.0	38.5	253°06.0	00.7	251°44.1	37.5
11	91°18.6	317°55.6	10.1	8°40.6	38.6	268°08.2	00.6	266°46.5	37.4
12	106°21.1	332°54.9	N19°09.3	23°41.2	N23°38.7	283°10.4	N00°00.4	281°48.8	N00°37.4
13	121°23.6	347°54.3	08.5	38°41.8	38.8	298°12.6	00.3	296°51.2	37.3
14	136°26.0	2°53.7	07.7	53°42.4	38.9	313°14.8	00.2	311°53.5	37.2
15	151°28.5	17°53.1	·· 06.9	68°43.0	·· 39.0	328°17.0	N00°00.1	326°55.8	·· 37.2
16	166°31.0	32°52.4	06.1	83°43.6	39.1	343°19.2	S00°00.0	341°58.2	37.1
17	181°33.4	47°51.8	05.2	98°44.2	39.3	358°21.4	00.2	357°00.5	37.1
18	196°35.9	62°51.2	N19°04.4	113°44.8	N23°39.4	13°23.6	S00°00.3	12°02.9	N00°37.0
19	211°38.4	77°50.5	03.6	128°45.4	39.5	28°25.8	00.4	27°05.2	36.9
20	226°40.8	92°49.9	02.8	143°46.0	39.6	43°28.1	00.5	42°07.6	36.9
21	241°43.3	107°49.3	·· 01.9	158°46.6	·· 39.7	58°30.3	·· 00.6	57°09.9	·· 36.8
22	256°45.7	122°48.7	01.1	173°47.2	39.8	73°32.5	00.8	72°12.2	36.8
23	271°48.2	137°48.0	00.3	188°47.8	39.9	88°34.7	00.9	87°14.6	36.7
Mer.pass. 04:56		ν -0.6′	d 0.8′	ν 0.6′	d 0.1′	ν 2.2′	d 0.1′	ν 2.3′	d 0.1′
		m -3.91		m 1.53		m -1.92		m 0.90	

Stars

	SHA	Dec
Alpheratz	358°08.6	28°59.1
Ankaa	353°39.6	-42°24.2
Schedar	350°08.3	56°25.8
Diphda	349°20.3	-18°05.2
Achernar	335°45.0	-57°19.6
Hamal	328°28.4	23°22.3
Polaris	326°49.3	89°10.4
Acamar	315°37.0	-40°22.6
Menkar	314°40.7	4°01.0
Mirfak	309°15.6	49°47.5
Aldebaran	291°17.6	16°28.3
Rigel	281°35.8	-8°13.4
Capella	281°10.9	45°58.7
Bellatrix	278°58.5	6°20.0
Elnath	278°43.8	28°35.4
Alnilam	276°11.4	-1°12.8
Betelgeuse	271°28.0	7°24.2
Canopus	264°07.5	-52°41.1
Sirius	258°55.5	-16°41.4
Adhara	255°32.0	-28°56.8
Procyon	245°25.5	5°16.4
Pollux	243°57.9	28°04.3
Avior	234°28.6	-59°27.1
Suhail	223°10.7	-43°21.5
Miaplacidus	221°45.6	-69°38.6
Alphard	218°20.3	-8°34.7
Regulus	208°09.6	12°03.6
Dubhe	194°21.8	61°51.4
Denebola	182°58.6	14°40.7
Gienah	176°17.4	-17°26.3
Acrux	173°36.7	-63°00.0
Gacrux	172°28.2	-57°00.7
Alioth	166°42.0	56°04.0
Spica	158°56.9	-11°03.8
Alkaid	153°17.9	49°24.7
Hadar	149°22.4	-60°17.2
Menkent	148°36.2	-36°16.8
Arcturus	146°17.8	19°17.0
Rigil Kent.	140°24.7	-60°45.6
Kochab	137°18.4	74°14.3
Zuben'ubi	137°32.2	-15°57.9
Alphecca	126°31.4	26°46.8
Antares	112°55.9	-26°23.5
Atria	108°19.1	-68°59.8
Sabik	102°40.2	-15°42.1
Shaula	96°54.6	-37°05.4
Rasalhague	96°28.7	12°34.5
Eltanin	90°56.9	51°29.6
Kaus Aust.	84°15.7	-34°23.6
Vega	80°55.0	38°46.1
Nunki	76°28.1	-26°19.2
Altair	62°31.6	8°49.2
Peacock	53°56.9	-56°47.6
Deneb	49°47.6	45°12.8
Enif	34°10.8	9°47.4
Al Na'ir	28°13.9	-47°02.9
Fomalhaut	15°50.6	-29°43.1
Scheat	14°16.8	27°58.8
Markab	14°02.4	15°06.2

Jul 06 Mon	SHA	Mer.pass
Venus	229°40.5	13:46
Mars	279°12.1	10:27
Jupiter	177°04.2	17:14
Saturn	175°34.7	17:19

Jul 07 Tue	SHA	Mer.pass
Venus	228°25.6	13:47
Mars	278°27.3	10:26
Jupiter	176°58.3	17:10
Saturn	175°31.9	17:16

Jul 08 Wed	SHA	Mer.pass
Venus	227°11.0	13:48
Mars	277°42.5	10:25
Jupiter	176°52.3	17:07
Saturn	175°29.1	17:12

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°51.4	N22°43.3	123°05.0	11.9′	N11°28.4	10.0′	56.7′
1	193°51.3	43.0	137°35.9	12.0′	11°18.4	10.1′	56.7′
2	208°51.2	42.8	152°06.9	12.1′	11°08.3	10.1′	56.6′
3	223°51.1	·· 42.5	166°38.0	12.1′	10°58.2	10.1′	56.6′
4	238°51.0	42.3	181°09.1	12.2′	10°48.1	10.1′	56.6′
5	253°50.9	42.0	195°40.3	12.3′	10°38.0	10.2′	56.5′
6	268°50.8	N22°41.8	210°11.6	12.4′	N10°27.8	10.3′	56.5′
7	283°50.7	41.5	224°43.0	12.4′	10°17.5	10.2′	56.5′
8	298°50.6	41.3	239°14.4	12.5′	10°07.3	10.3′	56.4′
9	313°50.5	·· 41.0	253°46.0	12.6′	09°57.0	10.4′	56.4′
10	328°50.4	40.8	268°17.5	12.7′	09°46.6	10.3′	56.4′
11	343°50.3	40.5	282°49.2	12.7′	09°36.3	10.4′	56.3′
12	358°50.2	N22°40.3	297°20.9	12.8′	N09°25.9	10.5′	56.3′
13	13°50.0	40.0	311°52.7	12.9′	09°15.4	10.4′	56.3′
14	28°49.9	39.8	326°24.6	12.9′	09°05.0	10.5′	56.2′
15	43°49.8	·· 39.5	340°56.5	13.0′	08°54.5	10.6′	56.2′
16	58°49.7	39.2	355°28.5	13.1′	08°43.9	10.5′	56.2′
17	73°49.6	39.0	10°00.6	13.1′	08°33.4	10.6′	56.1′
18	88°49.5	N22°38.7	24°32.7	13.2′	N08°22.8	10.6′	56.1′
19	103°49.4	38.5	39°04.9	13.3′	08°12.2	10.6′	56.1′
20	118°49.3	38.2	53°37.2	13.3′	08°01.6	10.7′	56.0′
21	133°49.2	·· 37.9	68°09.5	13.4′	07°50.9	10.6′	56.0′
22	148°49.1	37.7	82°41.9	13.4′	07°40.3	10.7′	56.0′
23	163°49.0	37.4	97°14.3	13.5′	07°29.6	10.8′	55.9′
	SD = 15.7′	d = 0.2′	SD = 15.5′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°48.9	N22°37.2	111°46.8	13.6′	N07°18.8	10.7′	55.9′
1	193°48.8	36.9	126°19.4	13.6′	07°08.1	10.8′	55.9′
2	208°48.7	36.6	140°52.0	13.7′	06°57.3	10.7′	55.8′
3	223°48.6	·· 36.4	155°24.7	13.7′	06°46.6	10.8′	55.8′
4	238°48.5	36.1	169°57.4	13.8′	06°35.8	10.8′	55.8′
5	253°48.4	35.8	184°30.2	13.8′	06°25.0	10.9′	55.8′
6	268°48.3	N22°35.6	199°03.0	13.9′	N06°14.1	10.8′	55.7′
7	283°48.2	35.3	213°35.9	13.9′	06°03.3	10.9′	55.7′
8	298°48.1	35.0	228°08.8	14.0′	05°52.4	10.8′	55.7′
9	313°48.0	·· 34.8	242°41.8	14.0′	05°41.6	10.9′	55.6′
10	328°47.9	34.5	257°14.9	14.1′	05°30.7	10.9′	55.6′
11	343°47.8	34.2	271°48.0	14.1′	05°19.8	10.9′	55.6′
12	358°47.7	N22°34.0	286°21.1	14.2′	N05°08.9	11.0′	55.6′
13	13°47.6	33.7	300°54.3	14.2′	04°57.9	10.9′	55.5′
14	28°47.5	33.4	315°27.6	14.3′	04°47.0	10.9′	55.5′
15	43°47.4	·· 33.2	330°00.9	14.3′	04°36.1	11.0′	55.5′
16	58°47.3	32.9	344°34.2	14.4′	04°25.1	10.9′	55.4′
17	73°47.2	32.6	359°07.6	14.4′	04°14.2	11.0′	55.4′
18	88°47.1	N22°32.3	13°41.0	14.5′	N04°03.2	11.0′	55.4′
19	103°47.0	32.1	28°14.4	14.5′	03°52.2	10.9′	55.4′
20	118°46.9	31.8	42°48.0	14.5′	03°41.3	11.0′	55.3′
21	133°46.8	·· 31.5	57°21.5	14.6′	03°30.3	11.0′	55.3′
22	148°46.7	31.2	71°55.1	14.6′	03°19.3	11.0′	55.3′
23	163°46.6	31.0	86°28.7	14.7′	03°08.3	11.0′	55.3′
	SD = 15.7′	d = 0.3′	SD = 15.2′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°46.5	N22°30.7	101°02.4	14.7′	N02°57.3	10.9′	55.2′
1	193°46.4	30.4	115°36.1	14.7′	02°46.4	11.0′	55.2′
2	208°46.3	30.1	130°09.8	14.8′	02°35.4	11.0′	55.2′
3	223°46.2	·· 29.8	144°43.6	14.8′	02°24.4	11.0′	55.2′
4	238°46.1	29.6	159°17.4	14.8′	02°13.4	11.0′	55.1′
5	253°46.0	29.3	173°51.2	14.9′	02°02.4	11.0′	55.1′
6	268°45.9	N22°29.0	188°25.1	14.9′	N01°51.4	11.0′	55.1′
7	283°45.8	28.7	202°59.0	14.9′	01°40.4	11.0′	55.1′
8	298°45.7	28.4	217°32.9	15.0′	01°29.4	10.9′	55.0′
9	313°45.6	·· 28.1	232°06.9	15.0′	01°18.5	11.0′	55.0′
10	328°45.5	27.9	246°40.8	15.0′	01°07.5	11.0′	55.0′
11	343°45.4	27.6	261°14.9	15.0′	00°56.5	11.0′	55.0′
12	358°45.3	N22°27.3	275°48.9	15.1′	N00°45.5	10.9′	54.9′
13	13°45.2	27.0	290°23.0	15.1′	00°34.6	11.0′	54.9′
14	28°45.1	26.7	304°57.1	15.1′	00°23.6	10.9′	54.9′
15	43°45.0	·· 26.4	319°31.2	15.1′	00°12.7	11.0′	54.9′
16	58°44.9	26.1	334°05.3	15.2′	N00°01.7	10.9′	54.9′
17	73°44.8	25.8	348°39.5	15.2′	S00°09.2	10.9′	54.8′
18	88°44.7	N22°25.6	3°13.7	15.2′	S00°20.1	10.9′	54.8′
19	103°44.7	25.3	17°47.9	15.2′	00°31.0	10.9′	54.8′
20	118°44.6	25.0	32°22.1	15.2′	00°41.9	10.9′	54.8′
21	133°44.5	·· 24.7	46°56.3	15.3′	00°52.8	10.9′	54.8′
22	148°44.4	24.4	61°30.6	15.3′	01°03.7	10.9′	54.7′
23	163°44.3	24.1	76°04.9	15.3′	01°14.6	10.8′	54.7′
	SD = 15.7′	d = 0.3′	SD = 15.1′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	▭	▭	▭	▭	▭	▭
66°	////	////	00:57	23:08	////	////
64°	////	////	01:53	22:14	////	////
62°	////	////	02:26	21:43	////	////
60°	////	01:19	02:49	21:19	22:48	////
N 58°	////	01:58	03:08	21:00	22:10	////
56°	////	02:24	03:24	20:45	21:44	////
54°	01:13	02:45	03:37	20:32	21:24	22:55
52°	01:49	03:02	03:49	20:20	21:07	22:20
50°	02:13	03:16	03:59	20:10	20:53	21:55
45°	02:56	03:44	04:21	19:49	20:25	21:13
N 40°	03:25	04:06	04:38	19:31	20:04	20:45
35°	03:47	04:23	04:52	19:17	19:46	20:23
30°	04:05	04:38	05:05	19:05	19:32	20:05
20°	04:33	05:02	05:26	18:43	19:08	19:37
N 10°	04:54	05:21	05:44	18:25	18:48	19:15
0°	05:13	05:39	06:01	18:08	18:31	18:57
S 10°	05:29	05:55	06:18	17:52	18:14	18:41
20°	05:45	06:12	06:36	17:34	17:58	18:25
30°	06:00	06:30	06:56	17:14	17:40	18:10
35°	06:09	06:40	07:08	17:02	17:30	18:01
40°	06:17	06:51	07:22	16:48	17:19	17:52
45°	06:27	07:04	07:38	16:32	17:06	17:43
S 50°	06:38	07:19	07:57	16:13	16:51	17:32
52°	06:43	07:26	08:07	16:03	16:43	17:27
54°	06:49	07:34	08:17	15:53	16:36	17:21
56°	06:54	07:43	08:29	15:41	16:27	17:16
58°	07:01	07:52	08:43	15:27	16:18	17:09
S 60°	07:08	08:03	08:59	15:11	16:07	17:02

Lat.	**Moonrise** Mon	Tue	Wed	**Moonset** Mon	Tue	Wed
N 72°	07:51	09:42	11:26	00:20	00:04 23:51	23:39
N 70°	08:08	09:50	11:28	00:01 23:54	23:47	23:41
68°	08:21	09:57	11:28	23:46	23:44	23:42
66°	08:32	10:02	11:29	23:39	23:41	23:44
64°	08:41	10:07	11:30	23:33	23:39	23:45
62°	08:48	10:11	11:30	23:28	23:37	23:46
60°	08:55	10:14	11:31	23:23	23:35	23:47
N 58°	09:01	10:17	11:31	23:19	23:34	23:47
56°	09:06	10:20	11:32	23:15	23:32	23:48
54°	09:10	10:22	11:32	23:12	23:31	23:49
52°	09:15	10:24	11:32	23:09	23:30	23:49
50°	09:18	10:26	11:33	23:07	23:29	23:50
45°	09:26	10:31	11:33	23:01	23:27	23:51
N 40°	09:33	10:34	11:34	22:56	23:25	23:52
35°	09:39	10:37	11:34	22:51	23:23	23:53
30°	09:44	10:40	11:35	22:48	23:21	23:54
20°	09:53	10:45	11:35	22:41	23:19	23:55
N 10°	10:00	10:49	11:36	22:35	23:16	23:56
0°	10:08	10:53	11:36	22:30	23:14	23:57
S 10°	10:15	10:57	11:37	22:24	23:12	23:58
20°	10:22	11:01	11:38	22:18	23:09	23:59
30°	10:31	11:06	11:38	22:11	23:07	·· ··
35°	10:36	11:08	11:39	22:07	23:05	·· ··
40°	10:42	11:12	11:39	22:03	23:03	·· ··
45°	10:48	11:15	11:40	21:58	23:01	·· ··
S 50°	10:56	11:19	11:41	21:51	22:58	·· ··
52°	11:00	11:21	11:41	21:48	22:57	·· ··
54°	11:03	11:23	11:41	21:45	22:56	·· ··
56°	11:08	11:26	11:42	21:41	22:54	·· ··
58°	11:13	11:28	11:42	21:37	22:53	·· ··
S 60°	11:18	11:31	11:43	21:33	22:51	·· ··

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 5-7 21-39%
06	04:34	04:39	12:05	16:19	03:55	
07	04:44	04:49	12:05	17:04	04:41	
08	04:54	04:59	12:05	17:47	05:25	

July 09, 10, 11 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	286°50.7	152°47.4	N18°59.5	203°48.4	N23°40.0	103°36.9	S00°01.0	102°16.9	N00°36.6
1	301°53.1	167°46.8	58.6	218°49.0	40.1	118°39.1	01.1	117°19.3	36.6
2	316°55.6	182°46.2	57.8	233°49.6	40.2	133°41.3	01.3	132°21.6	36.5
3	331°58.1	197°45.6	·· 57.0	248°50.2	·· 40.4	148°43.5	·· 01.4	147°24.0	·· 36.4
4	347°00.5	212°44.9	56.1	263°50.8	40.5	163°45.7	01.5	162°26.3	36.4
5	2°03.0	227°44.3	55.3	278°51.4	40.6	178°47.9	01.6	177°28.6	36.3
6	17°05.5	242°43.7	N18°54.5	293°52.0	N23°40.7	193°50.1	S00°01.7	192°31.0	N00°36.3
7	32°07.9	257°43.1	53.6	308°52.6	40.8	208°52.3	01.9	207°33.3	36.2
8	47°10.4	272°42.5	52.8	323°53.2	40.9	223°54.5	02.0	222°35.7	36.1
9	62°12.8	287°41.8	·· 52.0	338°53.8	·· 41.0	238°56.7	·· 02.1	237°38.0	·· 36.1
10	77°15.3	302°41.2	51.1	353°54.4	41.1	253°58.9	02.2	252°40.3	36.0
11	92°17.8	317°40.6	50.3	8°55.0	41.2	269°01.1	02.3	267°42.7	35.9
12	107°20.2	332°40.0	N18°49.5	23°55.6	N23°41.3	284°03.4	S00°02.5	282°45.0	N00°35.9
13	122°22.7	347°39.4	48.6	38°56.2	41.4	299°05.6	02.6	297°47.4	35.8
14	137°25.2	2°38.8	47.8	53°56.8	41.5	314°07.8	02.7	312°49.7	35.7
15	152°27.6	17°38.1	·· 46.9	68°57.4	·· 41.6	329°10.0	·· 02.8	327°52.0	·· 35.7
16	167°30.1	32°37.5	46.1	83°58.0	41.7	344°12.2	03.0	342°54.4	35.6
17	182°32.6	47°36.9	45.3	98°58.6	41.8	359°14.4	03.1	357°56.7	35.6
18	197°35.0	62°36.3	N18°44.4	113°59.2	N23°41.9	14°16.6	S00°03.2	12°59.1	N00°35.5
19	212°37.5	77°35.7	43.6	128°59.8	42.0	29°18.8	03.3	28°01.4	35.4
20	227°40.0	92°35.1	42.7	144°00.4	42.1	44°21.0	03.4	43°03.7	35.4
21	242°42.4	107°34.5	·· 41.9	159°01.0	·· 42.2	59°23.2	·· 03.6	58°06.1	·· 35.3
22	257°44.9	122°33.8	41.0	174°01.6	42.3	74°25.4	03.7	73°08.4	35.2
23	272°47.3	137°33.2	40.2	189°02.2	42.4	89°27.6	03.8	88°10.8	35.2
Mer.pass. 04:52		ν -0.6′	d 0.8′	m -3.91	ν 0.6′	d 0.1′	m 1.53	ν 2.2′	d 0.1′ m -1.91	ν 2.3′	d 0.1′ m 0.91

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	287°49.8	152°32.6	N18°39.3	204°02.8	N23°42.5	104°29.8	S00°03.9	103°13.1	N00°35.1
1	302°52.3	167°32.0	38.5	219°03.4	42.6	119°32.0	04.1	118°15.4	35.1
2	317°54.7	182°31.4	37.6	234°04.0	42.7	134°34.2	04.2	133°17.8	35.0
3	332°57.2	197°30.8	·· 36.8	249°04.6	·· 42.8	149°36.4	·· 04.3	148°20.1	·· 34.9
4	347°59.7	212°30.2	35.9	264°05.2	42.9	164°38.6	04.4	163°22.5	34.9
5	3°02.1	227°29.6	35.1	279°05.8	43.0	179°40.8	04.6	178°24.8	34.8
6	18°04.6	242°29.0	N18°34.2	294°06.4	N23°43.1	194°43.0	S00°04.7	193°27.1	N00°34.7
7	33°07.1	257°28.4	33.4	309°07.0	43.2	209°45.2	04.8	208°29.5	34.7
8	48°09.5	272°27.8	32.5	324°07.6	43.3	224°47.4	04.9	223°31.8	34.6
9	63°12.0	287°27.2	·· 31.7	339°08.2	·· 43.4	239°49.6	·· 05.0	238°34.1	·· 34.5
10	78°14.5	302°26.6	30.8	354°08.8	43.5	254°51.8	05.2	253°36.5	34.5
11	93°16.9	317°26.0	30.0	9°09.4	43.6	269°54.0	05.3	268°38.8	34.4
12	108°19.4	332°25.4	N18°29.1	24°10.0	N23°43.7	284°56.2	S00°05.4	283°41.2	N00°34.3
13	123°21.8	347°24.8	28.2	39°10.6	43.8	299°58.4	05.5	298°43.5	34.3
14	138°24.3	2°24.2	27.4	54°11.2	43.9	315°00.6	05.7	313°45.8	34.2
15	153°26.8	17°23.6	·· 26.5	69°11.8	·· 44.0	330°02.8	·· 05.8	328°48.2	·· 34.2
16	168°29.2	32°23.0	25.7	84°12.4	44.1	345°05.0	05.9	343°50.5	34.1
17	183°31.7	47°22.4	24.8	99°13.0	44.2	0°07.2	06.0	358°52.8	34.0
18	198°34.2	62°21.8	N18°23.9	114°13.6	N23°44.3	15°09.4	S00°06.2	13°55.2	N00°34.0
19	213°36.6	77°21.2	23.1	129°14.2	44.4	30°11.6	06.3	28°57.5	33.9
20	228°39.1	92°20.6	22.2	144°14.8	44.5	45°13.8	06.4	43°59.9	33.8
21	243°41.6	107°20.0	·· 21.3	159°15.4	·· 44.6	60°16.0	·· 06.5	59°02.2	·· 33.8
22	258°44.0	122°19.4	20.5	174°16.0	44.7	75°18.2	06.7	74°04.5	33.7
23	273°46.5	137°18.8	19.6	189°16.6	44.8	90°20.4	06.8	89°06.9	33.6
Mer.pass. 04:48		ν -0.6′	d 0.8′	m -3.92	ν 0.6′	d 0.1′	m 1.54	ν 2.2′	d 0.1′ m -1.90	ν 2.3′	d 0.1′ m 0.91

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	288°48.9	152°18.2	N18°18.7	204°17.2	N23°44.9	105°22.6	S00°06.9	104°09.2	N00°33.6
1	303°51.4	167°17.6	17.9	219°17.8	44.9	120°24.8	07.0	119°11.5	33.5
2	318°53.9	182°17.0	17.0	234°18.4	45.0	135°27.0	07.2	134°13.9	33.4
3	333°56.3	197°16.4	·· 16.1	249°19.0	·· 45.1	150°29.2	·· 07.3	149°16.2	·· 33.4
4	348°58.8	212°15.8	15.2	264°19.6	45.2	165°31.4	07.4	164°18.5	33.3
5	4°01.3	227°15.2	14.4	279°20.2	45.3	180°33.6	07.5	179°20.9	33.2
6	19°03.7	242°14.6	N18°13.5	294°20.9	N23°45.4	195°35.8	S00°07.7	194°23.2	N00°33.2
7	34°06.2	257°14.0	12.6	309°21.5	45.5	210°37.9	07.8	209°25.5	33.1
8	49°08.7	272°13.4	11.8	324°22.1	45.6	225°40.1	07.9	224°27.9	33.1
9	64°11.1	287°12.8	·· 10.9	339°22.7	·· 45.7	240°42.3	·· 08.0	239°30.2	·· 33.0
10	79°13.6	302°12.2	10.0	354°23.3	45.7	255°44.5	08.2	254°32.5	32.9
11	94°16.1	317°11.7	09.1	9°23.9	45.8	270°46.7	08.3	269°34.9	32.9
12	109°18.5	332°11.1	N18°08.2	24°24.5	N23°45.9	285°48.9	S00°08.4	284°37.2	N00°32.8
13	124°21.0	347°10.5	07.4	39°25.1	46.0	300°51.1	08.5	299°39.5	32.7
14	139°23.4	2°09.9	06.5	54°25.7	46.1	315°53.3	08.7	314°41.9	32.7
15	154°25.9	17°09.3	·· 05.6	69°26.3	·· 46.2	330°55.5	·· 08.8	329°44.2	·· 32.6
16	169°28.4	32°08.7	04.7	84°26.9	46.3	345°57.7	08.9	344°46.6	32.5
17	184°30.8	47°08.1	03.8	99°27.5	46.4	0°59.9	09.0	359°48.9	32.5
18	199°33.3	62°07.5	N18°02.9	114°28.1	N23°46.4	16°02.1	S00°09.2	14°51.2	N00°32.4
19	214°35.8	77°07.0	02.1	129°28.7	46.5	31°04.3	09.3	29°53.6	32.3
20	229°38.2	92°06.4	01.2	144°29.3	46.6	46°06.5	09.4	44°55.9	32.3
21	244°40.7	107°05.8	18°00.3	159°29.9	·· 46.7	61°08.7	·· 09.6	59°58.2	·· 32.2
22	259°43.2	122°05.2	17°59.4	174°30.5	46.8	76°10.9	09.7	75°00.5	32.1
23	274°45.6	137°04.6	58.5	189°31.1	46.9	91°13.0	09.8	90°02.9	32.1
Mer.pass. 04:44		ν -0.6′	d 0.9′	m -3.92	ν 0.6′	d 0.1′	m 1.54	ν 2.2′	d 0.1′ m -1.90	ν 2.3′	d 0.1′ m 0.91

Stars

	SHA	Dec
Alpheratz	358°08.6	28°59.1
Ankaa	353°39.6	-42°24.2
Schedar	350°08.3	56°25.8
Diphda	349°20.3	-18°05.2
Achernar	335°44.9	-57°19.6
Hamal	328°28.4	23°22.3
Polaris	326°48.2	89°10.4
Acamar	315°37.0	-40°22.6
Menkar	314°40.7	4°01.0
Mirfak	309°15.6	49°47.5
Aldebaran	291°17.6	16°28.3
Rigel	281°35.8	-8°13.4
Capella	281°10.9	45°58.6
Bellatrix	278°58.4	6°20.0
Elnath	278°43.8	28°35.4
Alnilam	276°11.4	-1°12.8
Betelgeuse	271°28.0	7°24.2
Canopus	264°07.5	-52°41.1
Sirius	258°55.5	-16°41.4
Adhara	255°32.0	-28°56.8
Procyon	245°25.5	5°16.4
Pollux	243°57.9	28°04.3
Avior	234°28.6	-59°27.1
Suhail	223°10.8	-43°21.5
Miaplacidus	221°45.7	-69°38.6
Alphard	218°20.3	-8°34.6
Regulus	208°09.6	12°03.6
Dubhe	194°21.8	61°51.4
Denebola	182°58.6	14°40.7
Gienah	176°17.5	-17°26.3
Acrux	173°36.8	-63°00.0
Gacrux	172°28.2	-57°00.7
Alioth	166°42.0	56°04.0
Spica	158°56.9	-11°03.8
Alkaid	153°18.0	49°24.7
Hadar	149°22.4	-60°17.2
Menkent	148°36.2	-36°16.8
Arcturus	146°17.8	19°17.0
Rigil Kent.	140°24.8	-60°45.6
Kochab	137°18.5	74°14.3
Zuben'ubi	137°32.3	-15°57.9
Alphecca	126°31.4	26°46.9
Antares	112°55.9	-26°23.5
Atria	108°19.2	-68°59.8
Sabik	102°40.2	-15°42.1
Shaula	96°54.6	-37°05.4
Rasalhague	96°28.7	12°34.5
Eltanin	90°56.9	51°29.6
Kaus Aust.	84°15.7	-34°23.6
Vega	80°55.0	38°46.1
Nunki	76°28.1	-26°19.2
Altair	62°31.6	8°49.2
Peacock	53°56.9	-56°47.6
Deneb	49°47.6	45°12.8
Enif	34°10.8	9°47.4
Al Na'ir	28°13.9	-47°02.9
Fomalhaut	15°50.6	-29°43.1
Scheat	14°16.8	27°58.8
Markab	14°02.4	15°06.2

Jul 09 Thu	SHA	Mer.pass
Venus	225°56.7	13:49
Mars	276°57.7	10:24
Jupiter	176°46.2	17:03
Saturn	175°26.3	17:08

Jul 10 Fri	SHA	Mer.pass
Venus	224°42.8	13:50
Mars	276°13.0	10:23
Jupiter	176°40.0	17:00
Saturn	175°23.3	17:04

Jul 11 Sat	SHA	Mer.pass
Venus	223°29.2	13:51
Mars	275°28.3	10:22
Jupiter	176°33.6	16:56
Saturn	175°20.2	17:01

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°44.2	N22°23.8	90°39.2	15.3′	S01°25.4	10.9′	54.7′
1	193°44.1	23.5	105°13.5	15.3′	01°36.3	10.8′	54.7′
2	208°44.0	23.2	119°47.8	15.3′	01°47.1	10.8′	54.7′
3	223°43.9	·· 22.9	134°22.1	15.3′	01°57.9	10.8′	54.6′
4	238°43.8	22.6	148°56.5	15.4′	02°08.7	10.8′	54.6′
5	253°43.7	22.3	163°30.8	15.4′	02°19.5	10.7′	54.6′
6	268°43.6	N22°22.0	178°05.2	15.4′	S02°30.2	10.8′	54.6′
7	283°43.5	21.7	192°39.6	15.4′	02°41.0	10.7′	54.6′
8	298°43.4	21.4	207°14.0	15.4′	02°51.7	10.7′	54.6′
9	313°43.3	·· 21.1	221°48.4	15.4′	03°02.4	10.7′	54.5′
10	328°43.2	20.8	236°22.8	15.4′	03°13.1	10.7′	54.5′
11	343°43.2	20.5	250°57.2	15.4′	03°23.8	10.7′	54.5′
12	358°43.1	N22°20.2	265°31.6	15.4′	S03°34.5	10.6′	54.5′
13	13°43.0	19.9	280°06.0	15.4′	03°45.1	10.6′	54.5′
14	28°42.9	19.6	294°40.4	15.4′	03°55.7	10.6′	54.5′
15	43°42.8	·· 19.3	309°14.9	15.4′	04°06.3	10.6′	54.5′
16	58°42.7	19.0	323°49.3	15.4′	04°16.9	10.6′	54.4′
17	73°42.6	18.7	338°23.7	15.4′	04°27.5	10.5′	54.4′
18	88°42.5	N22°18.4	352°58.2	15.4′	S04°38.0	10.5′	54.4′
19	103°42.4	18.1	7°32.6	15.4′	04°48.5	10.5′	54.4′
20	118°42.3	17.8	22°07.0	15.4′	04°59.0	10.4′	54.4′
21	133°42.2	·· 17.5	36°41.4	15.4′	05°09.4	10.5′	54.4′
22	148°42.1	17.2	51°15.9	15.4′	05°19.9	10.4′	54.4′
23	163°42.1	16.8	65°50.3	15.4′	05°30.3	10.3′	54.3′
	SD = 15.7′	d = 0.3′	SD = 14.9′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°42.0	N22°16.5	80°24.7	15.4′	S05°40.6	10.4′	54.3′
1	193°41.9	16.2	94°59.1	15.4′	05°51.0	10.3′	54.3′
2	208°41.8	15.9	109°33.5	15.4′	06°01.3	10.3′	54.3′
3	223°41.7	·· 15.6	124°07.9	15.4′	06°11.6	10.3′	54.3′
4	238°41.6	15.3	138°42.3	15.4′	06°21.9	10.2′	54.3′
5	253°41.5	15.0	153°16.7	15.4′	06°32.1	10.2′	54.3′
6	268°41.4	N22°14.7	167°51.1	15.4′	S06°42.3	10.2′	54.3′
7	283°41.3	14.3	182°25.4	15.3′	06°52.5	10.2′	54.3′
8	298°41.3	14.0	196°59.8	15.3′	07°02.7	10.1′	54.2′
9	313°41.2	·· 13.7	211°34.1	15.3′	07°12.8	10.1′	54.2′
10	328°41.1	13.4	226°08.4	15.3′	07°22.9	10.0′	54.2′
11	343°41.0	13.1	240°42.7	15.3′	07°32.9	10.1′	54.2′
12	358°40.9	N22°12.8	255°17.0	15.3′	S07°43.0	9.9′	54.2′
13	13°40.8	12.4	269°51.3	15.3′	07°52.9	10.0′	54.2′
14	28°40.7	12.1	284°25.6	15.3′	08°02.9	9.9′	54.2′
15	43°40.6	·· 11.8	298°59.8	15.2′	08°12.8	9.9′	54.2′
16	58°40.6	11.5	313°34.1	15.2′	08°22.7	9.9′	54.2′
17	73°40.5	11.2	328°08.3	15.2′	08°32.6	9.8′	54.2′
18	88°40.4	N22°10.8	342°42.5	15.2′	S08°42.4	9.8′	54.2′
19	103°40.3	10.5	357°16.7	15.2′	08°52.2	9.7′	54.2′
20	118°40.2	10.2	11°50.8	15.1′	09°01.9	9.7′	54.2′
21	133°40.1	·· 09.9	26°25.0	15.1′	09°11.6	9.7′	54.2′
22	148°40.0	09.5	40°59.1	15.1′	09°21.3	9.6′	54.1′
23	163°40.0	09.2	55°33.2	15.1′	09°30.9	9.6′	54.1′
	SD = 15.7′	d = 0.3′	SD = 14.8′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°39.9	N22°08.9	70°07.2	15.0′	S09°40.5	9.5′	54.1′
1	193°39.8	08.6	84°41.3	15.0′	09°50.0	9.5′	54.1′
2	208°39.7	08.2	99°15.3	15.0′	09°59.5	9.5′	54.1′
3	223°39.6	·· 07.9	113°49.3	15.0′	10°09.0	9.4′	54.1′
4	238°39.5	07.6	128°23.3	14.9′	10°18.4	9.4′	54.1′
5	253°39.4	07.2	142°57.2	14.9′	10°27.8	9.3′	54.1′
6	268°39.4	N22°06.9	157°31.2	14.9′	S10°37.1	9.3′	54.1′
7	283°39.3	06.6	172°05.1	14.9′	10°46.4	9.3′	54.1′
8	298°39.2	06.2	186°38.9	14.8′	10°55.7	9.2′	54.1′
9	313°39.1	·· 05.9	201°12.8	14.8′	11°04.9	9.1′	54.1′
10	328°39.0	05.6	215°46.6	14.8′	11°14.0	9.2′	54.1′
11	343°38.9	05.3	230°20.3	14.7′	11°23.2	9.0′	54.1′
12	358°38.9	N22°04.9	244°54.1	14.7′	S11°32.2	9.1′	54.1′
13	13°38.8	04.6	259°27.8	14.7′	11°41.3	8.9′	54.1′
14	28°38.7	04.2	274°01.5	14.7′	11°50.2	9.0′	54.1′
15	43°38.6	·· 03.9	288°35.1	14.6′	11°59.2	8.8′	54.1′
16	58°38.5	03.6	303°08.8	14.6′	12°08.0	8.9′	54.1′
17	73°38.5	03.2	317°42.3	14.6′	12°16.9	8.7′	54.1′
18	88°38.4	N22°02.9	332°15.9	14.5′	S12°25.6	8.8′	54.1′
19	103°38.3	02.6	346°49.4	14.5′	12°34.4	8.6′	54.1′
20	118°38.2	02.2	1°22.9	14.4′	12°43.0	8.7′	54.1′
21	133°38.1	·· 01.9	15°56.3	14.4′	12°51.7	8.5′	54.1′
22	148°38.0	01.5	30°29.7	14.4′	13°00.2	8.6′	54.1′
23	163°38.0	01.2	45°03.1	14.3′	13°08.8	8.4′	54.1′
	SD = 15.7′	d = 0.3′	SD = 14.8′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	▭	▭	▭	▭	▭	▭
66°	////	////	01:12	22:55	////	////
64°	////	////	02:01	22:07	////	////
62°	////	////	02:31	21:38	////	////
60°	////	01:28	02:54	21:15	22:40	////
N 58°	////	02:04	03:12	20:57	22:05	////
56°	////	02:29	03:28	20:42	21:40	////
54°	01:21	02:49	03:41	20:29	21:21	22:47
52°	01:54	03:05	03:52	20:18	21:05	22:15
50°	02:18	03:19	04:02	20:08	20:51	21:52
45°	02:59	03:47	04:23	19:47	20:23	21:11
N 40°	03:27	04:08	04:40	19:30	20:02	20:43
35°	03:49	04:25	04:54	19:16	19:45	20:21
30°	04:06	04:39	05:06	19:04	19:31	20:04
20°	04:34	05:03	05:27	18:43	19:08	19:36
N 10°	04:55	05:22	05:45	18:25	18:48	19:15
0°	05:13	05:39	06:02	18:09	18:31	18:57
S 10°	05:29	05:55	06:18	17:52	18:15	18:41
20°	05:45	06:12	06:36	17:35	17:59	18:26
30°	06:00	06:30	06:56	17:15	17:41	18:11
35°	06:08	06:39	07:07	17:03	17:31	18:03
40°	06:17	06:50	07:21	16:50	17:20	17:54
45°	06:26	07:03	07:36	16:35	17:08	17:45
S 50°	06:37	07:18	07:56	16:15	16:53	17:34
52°	06:42	07:25	08:05	16:06	16:46	17:29
54°	06:47	07:32	08:15	15:56	16:39	17:24
56°	06:52	07:41	08:26	15:44	16:30	17:18
58°	06:59	07:50	08:40	15:31	16:21	17:12
S 60°	07:05	08:01	08:56	15:15	16:10	17:06

Lat.	**Moonrise** Thu	Fri	Sat	**Moonset** Thu	Fri	Sat
N 72°	13:08	14:50	16:37	23:26	23:12	22:54
N 70°	13:02	14:37	16:14	23:34	23:27	23:19
68°	12:58	14:27	15:57	23:40	23:39	23:37
66°	12:54	14:18	15:43	23:46	23:48	23:52
64°	12:51	14:11	15:31	23:50	23:57	·· ··
62°	12:48	14:05	15:22	23:54	·· ··	00:04
60°	12:46	14:00	15:13	23:58	·· ··	00:10
N 58°	12:44	13:55	15:06	·· ··	00:01	00:16
56°	12:42	13:51	15:00	·· ··	00:04	00:21
54°	12:40	13:47	14:54	·· ··	00:06	00:25
52°	12:39	13:44	14:49	·· ··	00:09	00:29
50°	12:37	13:41	14:44	·· ··	00:11	00:33
45°	12:34	13:34	14:34	·· ··	00:15	00:40
N 40°	12:32	13:29	14:26	·· ··	00:19	00:47
35°	12:29	13:24	14:19	·· ··	00:22	00:53
30°	12:28	13:20	14:13	·· ··	00:25	00:58
20°	12:24	13:13	14:02	·· ··	00:30	01:07
N 10°	12:21	13:07	13:53	·· ··	00:35	01:14
0°	12:19	13:01	13:44	·· ··	00:39	01:21
S 10°	12:16	12:55	13:35	·· ··	00:43	01:29
20°	12:13	12:49	13:26	·· ··	00:48	01:37
30°	12:10	12:42	13:15	00:00	00:53	01:45
35°	12:08	12:38	13:09	00:01	00:56	01:51
40°	12:06	12:34	13:03	00:02	00:59	01:56
45°	12:04	12:29	12:55	00:03	01:03	02:03
S 50°	12:01	12:23	12:45	00:04	01:08	02:11
52°	12:00	12:20	12:41	00:04	01:10	02:15
54°	11:59	12:17	12:36	00:05	01:12	02:19
56°	11:57	12:13	12:31	00:05	01:15	02:24
58°	11:56	12:10	12:25	00:06	01:18	02:29
S 60°	11:54	12:05	12:19	00:07	01:21	02:35

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 8-10 49-68%
09	05:03	05:08	12:05	18:29	06:08	
10	05:12	05:16	12:05	19:11	06:50	
11	05:21	05:25	12:05	19:54	07:33	

July 12, 13, 14 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	289°48.1	152°04.0	N17°57.6	204°31.7	N23°46.9	106°15.2	S00°09.9	105°05.2	N00°32.0
1	304°50.6	167°03.5	56.7	219°32.3	47.0	121°17.4	10.1	120°07.5	31.9
2	319°53.0	182°02.9	55.8	234°32.9	47.1	136°19.6	10.2	135°09.9	31.9
3	334°55.5	197°02.3	·· 55.0	249°33.5	·· 47.2	151°21.8	·· 10.3	150°12.2	·· 31.8
4	349°57.9	212°01.7	54.1	264°34.1	47.3	166°24.0	10.4	165°14.5	31.7
5	5°00.4	227°01.1	53.2	279°34.7	47.4	181°26.2	10.6	180°16.9	31.7
6	20°02.9	242°00.6	N17°52.3	294°35.3	N23°47.4	196°28.4	S00°10.7	195°19.2	N00°31.6
7	35°05.3	257°00.0	51.4	309°35.9	47.5	211°30.6	10.8	210°21.5	31.5
8	50°07.8	271°59.4	50.5	324°36.5	47.6	226°32.8	11.0	225°23.9	31.5
9	65°10.3	286°58.8	·· 49.6	339°37.1	·· 47.7	241°35.0	·· 11.1	240°26.2	·· 31.4
10	80°12.7	301°58.2	48.7	354°37.8	47.8	256°37.2	11.2	255°28.5	31.3
11	95°15.2	316°57.7	47.8	9°38.4	47.8	271°39.3	11.3	270°30.9	31.3
12	110°17.7	331°57.1	N17°46.9	24°39.0	N23°47.9	286°41.5	S00°11.5	285°33.2	N00°31.2
13	125°20.1	346°56.5	46.0	39°39.6	48.0	301°43.7	11.6	300°35.5	31.1
14	140°22.6	1°55.9	45.1	54°40.2	48.1	316°45.9	11.7	315°37.9	31.1
15	155°25.0	16°55.4	·· 44.2	69°40.8	·· 48.1	331°48.1	·· 11.9	330°40.2	·· 31.0
16	170°27.5	31°54.8	43.3	84°41.4	48.2	346°50.3	12.0	345°42.5	30.9
17	185°30.0	46°54.2	42.4	99°42.0	48.3	1°52.5	12.1	0°44.8	30.9
18	200°32.4	61°53.7	N17°41.5	114°42.6	N23°48.4	16°54.7	S00°12.2	15°47.2	N00°30.8
19	215°34.9	76°53.1	40.6	129°43.2	48.4	31°56.9	12.4	30°49.5	30.7
20	230°37.4	91°52.5	39.7	144°43.8	48.5	46°59.0	12.5	45°51.8	30.7
21	245°39.8	106°51.9	·· 38.8	159°44.4	·· 48.6	62°01.2	·· 12.6	60°54.2	·· 30.6
22	260°42.3	121°51.4	37.9	174°45.0	48.7	77°03.4	12.8	75°56.5	30.5
23	275°44.8	136°50.8	37.0	189°45.6	48.7	92°05.6	12.9	90°58.8	30.5
Mer.pass. 04:40		ν -0.6′	d 0.9′	ν 0.6′	d 0.1′	ν 2.2′	d 0.1′	ν 2.3′	d 0.1′
		m -3.92		m 1.54		m -1.89		m 0.91	

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	290°47.2	151°50.2	N17°36.0	204°46.2	N23°48.8	107°07.8	S00°13.0	106°01.2	N00°30.4
1	305°49.7	166°49.7	35.1	219°46.8	48.9	122°10.0	13.1	121°03.5	30.3
2	320°52.2	181°49.1	34.2	234°47.4	49.0	137°12.2	13.3	136°05.8	30.3
3	335°54.6	196°48.5	·· 33.3	249°48.0	·· 49.0	152°14.3	·· 13.4	151°08.1	·· 30.2
4	350°57.1	211°48.0	32.4	264°48.6	49.1	167°16.5	13.5	166°10.5	30.1
5	5°59.5	226°47.4	31.5	279°49.2	49.2	182°18.7	13.7	181°12.8	30.0
6	21°02.0	241°46.8	N17°30.6	294°49.9	N23°49.3	197°20.9	S00°13.8	196°15.1	N00°30.0
7	36°04.5	256°46.3	29.7	309°50.5	49.3	212°23.1	13.9	211°17.5	29.9
8	51°06.9	271°45.7	28.7	324°51.1	49.4	227°25.3	14.0	226°19.8	29.8
9	66°09.4	286°45.1	·· 27.8	339°51.7	·· 49.5	242°27.5	·· 14.2	241°22.1	·· 29.8
10	81°11.9	301°44.6	26.9	354°52.3	49.5	257°29.7	14.3	256°24.4	29.7
11	96°14.3	316°44.0	26.0	9°52.9	49.6	272°31.8	14.4	271°26.8	29.6
12	111°16.8	331°43.5	N17°25.1	24°53.5	N23°49.7	287°34.0	S00°14.6	286°29.1	N00°29.6
13	126°19.3	346°42.9	24.2	39°54.1	49.7	302°36.2	14.7	301°31.4	29.5
14	141°21.7	1°42.3	23.2	54°54.7	49.8	317°38.4	14.8	316°33.7	29.4
15	156°24.2	16°41.8	·· 22.3	69°55.3	·· 49.9	332°40.6	·· 15.0	331°36.1	·· 29.4
16	171°26.7	31°41.2	21.4	84°55.9	50.0	347°42.8	15.1	346°38.4	29.3
17	186°29.1	46°40.7	20.5	99°56.5	50.0	2°44.9	15.2	1°40.7	29.2
18	201°31.6	61°40.1	N17°19.6	114°57.1	N23°50.1	17°47.1	S00°15.4	16°43.1	N00°29.2
19	216°34.0	76°39.5	18.6	129°57.7	50.2	32°49.3	15.5	31°45.4	29.1
20	231°36.5	91°39.0	17.7	144°58.3	50.2	47°51.5	15.6	46°47.7	29.0
21	246°39.0	106°38.4	·· 16.8	159°58.9	·· 50.3	62°53.7	·· 15.7	61°50.0	·· 29.0
22	261°41.4	121°37.9	15.9	174°59.6	50.4	77°55.9	15.9	76°52.4	28.9
23	276°43.9	136°37.3	14.9	190°00.2	50.4	92°58.0	16.0	91°54.7	28.8
Mer.pass. 04:36		ν -0.6′	d 0.9′	ν 0.6′	d 0.1′	ν 2.2′	d 0.1′	ν 2.3′	d 0.1′
		m -3.92		m 1.55		m -1.89		m 0.92	

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	291°46.4	151°36.8	N17°14.0	205°00.8	N23°50.5	108°00.2	S00°16.1	106°57.0	N00°28.7
1	306°48.8	166°36.2	13.1	220°01.4	50.5	123°02.4	16.3	121°59.3	28.7
2	321°51.3	181°35.7	12.1	235°02.0	50.6	138°04.6	16.4	137°01.7	28.6
3	336°53.8	196°35.1	·· 11.2	250°02.6	·· 50.7	153°06.8	·· 16.5	152°04.0	·· 28.5
4	351°56.2	211°34.6	10.3	265°03.2	50.7	168°08.9	16.7	167°06.3	28.5
5	6°58.7	226°34.0	09.3	280°03.8	50.8	183°11.1	16.8	182°08.6	28.4
6	22°01.2	241°33.4	N17°08.4	295°04.4	N23°50.9	198°13.3	S00°16.9	197°11.0	N00°28.3
7	37°03.6	256°32.9	07.5	310°05.0	50.9	213°15.5	17.1	212°13.3	28.3
8	52°06.1	271°32.3	06.5	325°05.6	51.0	228°17.7	17.2	227°15.6	28.2
9	67°08.5	286°31.8	·· 05.6	340°06.2	·· 51.1	243°19.9	·· 17.3	242°17.9	·· 28.1
10	82°11.0	301°31.2	04.7	355°06.8	51.1	258°22.0	17.5	257°20.3	28.1
11	97°13.5	316°30.7	03.7	10°07.5	51.2	273°24.2	17.6	272°22.6	28.0
12	112°15.9	331°30.2	N17°02.8	25°08.1	N23°51.2	288°26.4	S00°17.7	287°24.9	N00°27.9
13	127°18.4	346°29.6	01.9	40°08.7	51.3	303°28.6	17.8	302°27.2	27.8
14	142°20.9	1°29.1	00.9	55°09.3	51.4	318°30.8	18.0	317°29.6	27.8
15	157°23.3	16°28.5	17°00.0	70°09.9	·· 51.4	333°32.9	·· 18.1	332°31.9	·· 27.7
16	172°25.8	31°28.0	16°59.0	85°10.5	51.5	348°35.1	18.2	347°34.2	27.6
17	187°28.3	46°27.4	58.1	100°11.1	51.5	3°37.3	18.4	2°36.5	27.6
18	202°30.7	61°26.9	N16°57.2	115°11.7	N23°51.6	18°39.5	S00°18.5	17°38.9	N00°27.5
19	217°33.2	76°26.3	56.2	130°12.3	51.7	33°41.6	18.6	32°41.2	27.4
20	232°35.6	91°25.8	55.3	145°12.9	51.7	48°43.8	18.8	47°43.5	27.4
21	247°38.1	106°25.2	·· 54.3	160°13.5	·· 51.8	63°46.0	·· 18.9	62°45.8	·· 27.3
22	262°40.6	121°24.7	53.4	175°14.1	51.8	78°48.2	19.0	77°48.2	27.2
23	277°43.0	136°24.2	52.4	190°14.8	51.9	93°50.4	19.2	92°50.5	27.1
Mer.pass. 04:32		ν -0.6′	d 0.9′	ν 0.6′	d 0.1′	ν 2.2′	d 0.1′	ν 2.3′	d 0.1′
		m -3.92		m 1.55		m -1.88		m 0.92	

Stars

	SHA	**Dec**
Alpheratz	358°08.6	28°59.1
Ankaa	353°39.6	-42°24.2
Schedar	350°08.2	56°25.8
Diphda	349°20.2	-18°05.2
Achernar	335°44.9	-57°19.6
Hamal	328°28.3	23°22.3
Polaris	326°47.0	89°10.4
Acamar	315°37.0	-40°22.6
Menkar	314°40.7	4°01.0
Mirfak	309°15.5	49°47.5
Aldebaran	291°17.6	16°28.3
Rigel	281°35.8	-8°13.4
Capella	281°10.9	45°58.6
Bellatrix	278°58.4	6°20.0
Elnath	278°43.7	28°35.4
Alnilam	276°11.4	-1°12.8
Betelgeuse	271°28.0	7°24.2
Canopus	264°07.5	-52°41.1
Sirius	258°55.5	-16°41.4
Adhara	255°32.0	-28°56.8
Procyon	245°25.5	5°16.4
Pollux	243°57.8	28°04.3
Avior	234°28.6	-59°27.1
Suhail	223°10.8	-43°21.5
Miaplacidus	221°45.7	-69°38.6
Alphard	218°20.3	-8°34.6
Regulus	208°09.6	12°03.6
Dubhe	194°21.8	61°51.4
Denebola	182°58.6	14°40.7
Gienah	176°17.5	-17°26.3
Acrux	173°36.8	-63°00.0
Gacrux	172°28.2	-57°00.7
Alioth	166°42.1	56°04.0
Spica	158°56.9	-11°03.8
Alkaid	153°18.0	49°24.7
Hadar	149°22.4	-60°17.2
Menkent	148°36.2	-36°16.8
Arcturus	146°17.9	19°17.0
Rigil Kent.	140°24.8	-60°45.6
Kochab	137°18.5	74°14.3
Zuben'ubi	137°32.3	-15°57.9
Alphecca	126°31.4	26°46.9
Antares	112°55.9	-26°23.5
Atria	108°19.2	-68°59.8
Sabik	102°40.2	-15°42.1
Shaula	96°54.6	-37°05.4
Rasalhague	96°28.7	12°34.5
Eltanin	90°56.9	51°29.6
Kaus Aust.	84°15.7	-34°23.6
Vega	80°55.0	38°46.1
Nunki	76°28.1	-26°19.2
Altair	62°31.6	8°49.2
Peacock	53°56.9	-56°47.6
Deneb	49°47.6	45°12.8
Enif	34°10.7	9°47.4
Al Na'ir	28°13.9	-47°02.9
Fomalhaut	15°50.6	-29°43.1
Scheat	14°16.8	27°58.8
Markab	14°02.4	15°06.2

Jul 12 Sun	**SHA**	**Mer.pass**
Venus	222°16.0	13:52
Mars	274°43.6	10:21
Jupiter	176°27.2	16:53
Saturn	175°17.1	16:57

Jul 13 Mon	**SHA**	**Mer.pass**
Venus	221°03.0	13:53
Mars	273°59.0	10:21
Jupiter	176°20.6	16:49
Saturn	175°13.9	16:53

Jul 14 Tue	**SHA**	**Mer.pass**
Venus	219°50.4	13:54
Mars	273°14.4	10:20
Jupiter	176°13.9	16:46
Saturn	175°10.6	16:50

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h

	Sun		Moon				
Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°37.9	N22°00.9	59°36.5	14.3′	S13°17.2	8.4′	54.1′
1	193°37.8	00.5	74°09.8	14.3′	13°25.6	8.4′	54.1′
2	208°37.7	22°00.2	88°43.0	14.2′	13°34.0	8.3′	54.1′
3	223°37.6	21°59.8	103°16.2	14.2′	13°42.3	8.2′	54.1′
4	238°37.6	59.5	117°49.4	14.1′	13°50.5	8.2′	54.1′
5	253°37.5	59.1	132°22.6	14.1′	13°58.7	8.2′	54.1′
6	268°37.4	N21°58.8	146°55.7	14.1′	S14°06.9	8.0′	54.1′
7	283°37.3	58.4	161°28.7	14.0′	14°14.9	8.1′	54.1′
8	298°37.3	58.1	176°01.7	14.0′	14°23.0	7.9′	54.1′
9	313°37.2	·· 57.7	190°34.7	13.9′	14°30.9	7.9′	54.1′
10	328°37.1	57.4	205°07.7	13.9′	14°38.8	7.8′	54.1′
11	343°37.0	57.0	219°40.5	13.9′	14°46.6	7.8′	54.1′
12	358°36.9	N21°56.7	234°13.4	13.8′	S14°54.4	7.7′	54.1′
13	13°36.9	56.3	248°46.2	13.8′	15°02.1	7.7′	54.1′
14	28°36.8	56.0	263°19.0	13.7′	15°09.8	7.6′	54.1′
15	43°36.7	·· 55.6	277°51.7	13.7′	15°17.4	7.5′	54.2′
16	58°36.6	55.3	292°24.4	13.6′	15°24.9	7.5′	54.2′
17	73°36.6	54.9	306°57.0	13.6′	15°32.4	7.4′	54.2′
18	88°36.5	N21°54.6	321°29.6	13.5′	S15°39.8	7.3′	54.2′
19	103°36.4	54.2	336°02.1	13.5′	15°47.1	7.3′	54.2′
20	118°36.3	53.9	350°34.6	13.5′	15°54.4	7.2′	54.2′
21	133°36.2	·· 53.5	5°07.1	13.4′	16°01.6	7.1′	54.2′
22	148°36.2	53.2	19°39.5	13.4′	16°08.7	7.1′	54.2′
23	163°36.1	52.8	34°11.8	13.3′	16°15.8	7.0′	54.2′
	SD = 15.7′	d = 0.3′	SD = 14.8′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°36.0	N21°52.4	48°44.1	13.3′	S16°22.8	6.9′	54.2′
1	193°35.9	52.1	63°16.4	13.2′	16°29.7	6.9′	54.2′
2	208°35.9	51.7	77°48.6	13.2′	16°36.6	6.8′	54.2′
3	223°35.8	·· 51.4	92°20.8	13.1′	16°43.4	6.7′	54.2′
4	238°35.7	51.0	106°52.9	13.1′	16°50.1	6.6′	54.2′
5	253°35.6	50.6	121°25.0	13.0′	16°56.7	6.6′	54.3′
6	268°35.6	N21°50.3	135°57.0	13.0′	S17°03.3	6.5′	54.3′
7	283°35.5	49.9	150°29.0	12.9′	17°09.8	6.4′	54.3′
8	298°35.4	49.6	165°00.9	12.9′	17°16.2	6.4′	54.3′
9	313°35.4	·· 49.2	179°32.8	12.8′	17°22.6	6.3′	54.3′
10	328°35.3	48.8	194°04.6	12.8′	17°28.9	6.2′	54.3′
11	343°35.2	48.5	208°36.4	12.7′	17°35.1	6.1′	54.3′
12	358°35.1	N21°48.1	223°08.2	12.7′	S17°41.2	6.0′	54.3′
13	13°35.1	47.7	237°39.9	12.6′	17°47.2	6.0′	54.3′
14	28°35.0	47.4	252°11.5	12.6′	17°53.2	5.9′	54.3′
15	43°34.9	·· 47.0	266°43.1	12.5′	17°59.1	5.8′	54.3′
16	58°34.8	46.6	281°14.6	12.5′	18°04.9	5.7′	54.4′
17	73°34.8	46.3	295°46.1	12.4′	18°10.6	5.7′	54.4′
18	88°34.7	N21°45.9	310°17.6	12.4′	S18°16.3	5.6′	54.4′
19	103°34.6	45.5	324°49.0	12.3′	18°21.9	5.5′	54.4′
20	118°34.6	45.2	339°20.3	12.3′	18°27.4	5.4′	54.4′
21	133°34.5	·· 44.8	353°51.6	12.2′	18°32.8	5.3′	54.4′
22	148°34.4	44.4	8°22.8	12.2′	18°38.1	5.3′	54.4′
23	163°34.3	44.0	22°54.0	12.2′	18°43.4	5.1′	54.4′
	SD = 15.7′	d = 0.4′	SD = 14.8′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°34.3	N21°43.7	37°25.2	12.1′	S18°48.5	5.1′	54.5′
1	193°34.2	43.3	51°56.3	12.1′	18°53.6	5.0′	54.5′
2	208°34.1	42.9	66°27.4	12.0′	18°58.6	4.9′	54.5′
3	223°34.1	·· 42.5	80°58.4	12.0′	19°03.5	4.8′	54.5′
4	238°34.0	42.2	95°29.3	11.9′	19°08.3	4.8′	54.5′
5	253°33.9	41.8	110°00.2	11.9′	19°13.1	4.6′	54.5′
6	268°33.9	N21°41.4	124°31.1	11.8′	S19°17.7	4.6′	54.5′
7	283°33.8	41.0	139°01.9	11.8′	19°22.3	4.4′	54.5′
8	298°33.7	40.7	153°32.7	11.7′	19°26.7	4.4′	54.6′
9	313°33.7	·· 40.3	168°03.4	11.7′	19°31.1	4.3′	54.6′
10	328°33.6	39.9	182°34.0	11.6′	19°35.4	4.2′	54.6′
11	343°33.5	39.5	197°04.7	11.6′	19°39.6	4.1′	54.6′
12	358°33.5	N21°39.1	211°35.2	11.5′	S19°43.7	4.0′	54.6′
13	13°33.4	38.8	226°05.8	11.5′	19°47.7	4.0′	54.6′
14	28°33.3	38.4	240°36.3	11.4′	19°51.7	3.8′	54.6′
15	43°33.3	·· 38.0	255°06.7	11.4′	19°55.5	3.7′	54.7′
16	58°33.2	37.6	269°37.1	11.3′	19°59.2	3.7′	54.7′
17	73°33.1	37.2	284°07.4	11.3′	20°02.9	3.5′	54.7′
18	88°33.1	N21°36.8	298°37.7	11.3′	S20°06.4	3.5′	54.7′
19	103°33.0	36.5	313°08.0	11.2′	20°09.9	3.4′	54.7′
20	118°32.9	36.1	327°38.2	11.2′	20°13.3	3.2′	54.7′
21	133°32.9	·· 35.7	342°08.4	11.1′	20°16.5	3.2′	54.8′
22	148°32.8	35.3	356°38.5	11.1′	20°19.7	3.1′	54.8′
23	163°32.7	34.9	11°08.6	11.0′	20°22.8	2.9′	54.8′
	SD = 15.7′	d = 0.4′	SD = 14.9′				

Lat.	**Twilight** Naut.	**Twilight** Civil	**Sunrise**	**Sunset**	**Twilight** Civil	**Twilight** Naut.
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	▭	▭	▭	▭	▭	▭
66°	////	////	01:26	22:42	////	////
64°	////	////	02:09	22:00	////	////
62°	////	00:29	02:38	21:32	23:32	////
60°	////	01:38	02:59	21:11	22:31	////
N 58°	////	02:11	03:17	20:53	21:59	////
56°	00:27	02:35	03:32	20:39	21:35	23:35
54°	01:30	02:53	03:44	20:26	21:17	22:39
52°	02:00	03:09	03:55	20:15	21:01	22:09
50°	02:23	03:23	04:05	20:06	20:48	21:47
45°	03:02	03:49	04:26	19:45	20:21	21:08
N 40°	03:30	04:10	04:42	19:29	20:01	20:41
35°	03:51	04:27	04:56	19:15	19:44	20:20
30°	04:08	04:41	05:08	19:03	19:30	20:03
20°	04:35	05:04	05:28	18:43	19:07	19:36
N 10°	04:56	05:23	05:46	18:25	18:48	19:15
0°	05:14	05:40	06:02	18:09	18:32	18:57
S 10°	05:30	05:56	06:18	17:53	18:16	18:42
20°	05:44	06:12	06:35	17:36	18:00	18:27
30°	05:59	06:29	06:55	17:17	17:43	18:12
35°	06:07	06:39	07:06	17:05	17:33	18:04
40°	06:16	06:49	07:19	16:52	17:22	17:56
45°	06:25	07:02	07:35	16:37	17:10	17:47
S 50°	06:35	07:16	07:53	16:18	16:56	17:36
52°	06:40	07:23	08:02	16:09	16:49	17:32
54°	06:45	07:30	08:12	15:59	16:42	17:27
56°	06:50	07:38	08:23	15:48	16:34	17:21
58°	06:56	07:47	08:36	15:35	16:25	17:16
S 60°	07:03	07:57	08:52	15:20	16:14	17:09

Lat.	**Moonrise** Sun	**Moonrise** Mon	**Moonrise** Tue	**Moonset** Sun	**Moonset** Mon	**Moonset** Tue
N 72°	18:38	▬	▬	22:26	▬	▬
N 70°	17:57	19:51	▬	23:08	22:51	▬
68°	17:29	19:04	20:37	23:37	23:38	23:46
66°	17:08	18:34	19:54	23:59	·· ··	00:09
64°	16:52	18:11	19:25	00:05	00:16	00:32
62°	16:38	17:53	19:04	00:15	00:30	00:51
60°	16:27	17:38	18:46	00:24	00:42	01:06
N 58°	16:17	17:26	18:31	00:32	00:53	01:19
56°	16:08	17:15	18:19	00:39	01:02	01:30
54°	16:00	17:05	18:08	00:46	01:10	01:40
52°	15:53	16:57	17:58	00:51	01:17	01:49
50°	15:47	16:49	17:49	00:57	01:24	01:57
45°	15:34	16:33	17:31	01:08	01:38	02:13
N 40°	15:23	16:20	17:16	01:17	01:50	02:27
35°	15:14	16:09	17:03	01:25	02:00	02:39
30°	15:06	15:59	16:52	01:32	02:09	02:49
20°	14:52	15:42	16:34	01:44	02:24	03:07
N 10°	14:39	15:28	16:17	01:55	02:37	03:22
0°	14:28	15:14	16:02	02:05	02:50	03:37
S 10°	14:17	15:00	15:47	02:15	03:02	03:51
20°	14:05	14:46	15:31	02:26	03:16	04:07
30°	13:51	14:30	15:12	02:38	03:31	04:25
35°	13:43	14:20	15:01	02:45	03:40	04:35
40°	13:34	14:09	14:49	02:53	03:50	04:47
45°	13:24	13:56	14:34	03:03	04:02	05:01
S 50°	13:11	13:41	14:17	03:15	04:17	05:18
52°	13:05	13:34	14:08	03:20	04:24	05:26
54°	12:59	13:26	13:59	03:26	04:32	05:35
56°	12:52	13:17	13:49	03:32	04:40	05:46
58°	12:44	13:07	13:37	03:40	04:50	05:57
S 60°	12:35	12:55	13:23	03:48	05:01	06:11

Day	**Sun** Eqn.of Time 00^h mm:ss	**Sun** Eqn.of Time 12^h mm:ss	**Sun** Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	**Moon** Mer.Pass. Lower hh:mm	**Moon** Age 11-13 76-90%
12	05:28	05:32	12:06	20:39	08:16	
13	05:36	05:39	12:06	21:25	09:02	
14	05:43	05:46	12:06	22:14	09:49	

July 15, 16, 17 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	292°45.5	151°23.6	N16°51.5	205°15.4	N23°51.9	108°52.5	S00°19.3	107°52.8	N00°27.1
1	307°48.0	166°23.1	50.6	220°16.0	52.0	123°54.7	19.4	122°55.1	27.0
2	322°50.4	181°22.5	49.6	235°16.6	52.0	138°56.9	19.6	137°57.4	26.9
3	337°52.9	196°22.0	·· 48.7	250°17.2	·· 52.1	153°59.1	·· 19.7	152°59.8	·· 26.9
4	352°55.4	211°21.5	47.7	265°17.8	52.2	169°01.2	19.8	168°02.1	26.8
5	7°57.8	226°20.9	46.8	280°18.4	52.2	184°03.4	20.0	183°04.4	26.7
6	23°00.3	241°20.4	N16°45.8	295°19.0	N23°52.3	199°05.6	S00°20.1	198°06.7	N00°26.7
7	38°02.8	256°19.8	44.9	310°19.6	52.3	214°07.8	20.2	213°09.1	26.6
8	53°05.2	271°19.3	43.9	325°20.2	52.4	229°10.0	20.4	228°11.4	26.5
9	68°07.7	286°18.8	·· 42.9	340°20.8	·· 52.4	244°12.1	·· 20.5	243°13.7	·· 26.4
10	83°10.1	301°18.2	42.0	355°21.5	52.5	259°14.3	20.6	258°16.0	26.4
11	98°12.6	316°17.7	41.0	10°22.1	52.5	274°16.5	20.8	273°18.3	26.3
12	113°15.1	331°17.2	N16°40.1	25°22.7	N23°52.6	289°18.7	S00°20.9	288°20.7	N00°26.2
13	128°17.5	346°16.6	39.1	40°23.3	52.6	304°20.8	21.0	303°23.0	26.2
14	143°20.0	1°16.1	38.2	55°23.9	52.7	319°23.0	21.2	318°25.3	26.1
15	158°22.5	16°15.6	·· 37.2	70°24.5	·· 52.7	334°25.2	·· 21.3	333°27.6	·· 26.0
16	173°24.9	31°15.0	36.3	85°25.1	52.8	349°27.4	21.4	348°29.9	25.9
17	188°27.4	46°14.5	35.3	100°25.7	52.8	4°29.5	21.6	3°32.3	25.9
18	203°29.9	61°14.0	N16°34.3	115°26.3	N23°52.9	19°31.7	S00°21.7	18°34.6	N00°25.8
19	218°32.3	76°13.4	33.4	130°26.9	52.9	34°33.9	21.8	33°36.9	25.7
20	233°34.8	91°12.9	32.4	145°27.5	53.0	49°36.0	22.0	48°39.2	25.7
21	248°37.3	106°12.4	·· 31.4	160°28.2	·· 53.0	64°38.2	·· 22.1	63°41.5	·· 25.6
22	263°39.7	121°11.9	30.5	175°28.8	53.1	79°40.4	22.3	78°43.9	25.5
23	278°42.2	136°11.3	29.5	190°29.4	53.1	94°42.6	22.4	93°46.2	25.4
Mer.pass. 04:28		ν -0.5′	d 0.9′	m -3.92	ν 0.6′	d 0.1′	m 1.55	ν 2.2′	d 0.1′ m -1.88	ν 2.3′	d 0.1′ m 0.92

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	293°44.6	151°10.8	N16°28.6	205°30.0	N23°53.2	109°44.7	S00°22.5	108°48.5	N00°25.4
1	308°47.1	166°10.3	27.6	220°30.6	53.2	124°46.9	22.7	123°50.8	25.3
2	323°49.6	181°09.7	26.6	235°31.2	53.3	139°49.1	22.8	138°53.1	25.2
3	338°52.0	196°09.2	·· 25.7	250°31.8	·· 53.3	154°51.3	·· 22.9	153°55.5	·· 25.2
4	353°54.5	211°08.7	24.7	265°32.4	53.4	169°53.4	23.1	168°57.8	25.1
5	8°57.0	226°08.2	23.7	280°33.0	53.4	184°55.6	23.2	184°00.1	25.0
6	23°59.4	241°07.6	N16°22.8	295°33.7	N23°53.5	199°57.8	S00°23.3	199°02.4	N00°24.9
7	39°01.9	256°07.1	21.8	310°34.3	53.5	214°59.9	23.5	214°04.7	24.9
8	54°04.4	271°06.6	20.8	325°34.9	53.5	230°02.1	23.6	229°07.1	24.8
9	69°06.8	286°06.1	·· 19.8	340°35.5	·· 53.6	245°04.3	·· 23.7	244°09.4	·· 24.7
10	84°09.3	301°05.6	18.9	355°36.1	53.6	260°06.5	23.9	259°11.7	24.7
11	99°11.8	316°05.0	17.9	10°36.7	53.7	275°08.6	24.0	274°14.0	24.6
12	114°14.2	331°04.5	N16°16.9	25°37.3	N23°53.7	290°10.8	S00°24.1	289°16.3	N00°24.5
13	129°16.7	346°04.0	15.9	40°37.9	53.8	305°13.0	24.3	304°18.6	24.4
14	144°19.1	1°03.5	15.0	55°38.5	53.8	320°15.1	24.4	319°21.0	24.4
15	159°21.6	16°03.0	·· 14.0	70°39.2	·· 53.8	335°17.3	·· 24.6	334°23.3	·· 24.3
16	174°24.1	31°02.4	13.0	85°39.8	53.9	350°19.5	24.7	349°25.6	24.2
17	189°26.5	46°01.9	12.0	100°40.4	53.9	5°21.7	24.8	4°27.9	24.1
18	204°29.0	61°01.4	N16°11.1	115°41.0	N23°54.0	20°23.8	S00°25.0	19°30.2	N00°24.1
19	219°31.5	76°00.9	10.1	130°41.6	54.0	35°26.0	25.1	34°32.6	24.0
20	234°33.9	91°00.4	09.1	145°42.2	54.1	50°28.2	25.2	49°34.9	23.9
21	249°36.4	105°59.9	·· 08.1	160°42.8	·· 54.1	65°30.3	·· 25.4	64°37.2	·· 23.9
22	264°38.9	120°59.3	07.1	175°43.4	54.1	80°32.5	25.5	79°39.5	23.8
23	279°41.3	135°58.8	06.2	190°44.1	54.2	95°34.7	25.6	94°41.8	23.7
Mer.pass. 04:24		ν -0.5′	d 1.0′	m -3.92	ν 0.6′	d 0.0′	m 1.55	ν 2.2′	d 0.1′ m -1.87	ν 2.3′	d 0.1′ m 0.92

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	294°43.8	150°58.3	N16°05.2	205°44.7	N23°54.2	110°36.8	S00°25.8	109°44.1	N00°23.6
1	309°46.3	165°57.8	04.2	220°45.3	54.3	125°39.0	25.9	124°46.5	23.6
2	324°48.7	180°57.3	03.2	235°45.9	54.3	140°41.2	26.1	139°48.8	23.5
3	339°51.2	195°56.8	·· 02.2	250°46.5	·· 54.3	155°43.3	·· 26.2	154°51.1	·· 23.4
4	354°53.6	210°56.3	01.2	265°47.1	54.4	170°45.5	26.3	169°53.4	23.3
5	9°56.1	225°55.7	16°00.3	280°47.7	54.4	185°47.7	26.5	184°55.7	23.3
6	24°58.6	240°55.2	N15°59.3	295°48.3	N23°54.4	200°49.8	S00°26.6	199°58.0	N00°23.2
7	40°01.0	255°54.7	58.3	310°49.0	54.5	215°52.0	26.7	215°00.3	23.1
8	55°03.5	270°54.2	57.3	325°49.6	54.5	230°54.2	26.9	230°02.7	23.1
9	70°06.0	285°53.7	·· 56.3	340°50.2	·· 54.5	245°56.3	·· 27.0	245°05.0	·· 23.0
10	85°08.4	300°53.2	55.3	355°50.8	54.6	260°58.5	27.2	260°07.3	22.9
11	100°10.9	315°52.7	54.3	10°51.4	54.6	276°00.7	27.3	275°09.6	22.8
12	115°13.4	330°52.2	N15°53.3	25°52.0	N23°54.6	291°02.8	S00°27.4	290°11.9	N00°22.8
13	130°15.8	345°51.7	52.3	40°52.6	54.7	306°05.0	27.6	305°14.2	22.7
14	145°18.3	0°51.2	51.4	55°53.2	54.7	321°07.2	27.7	320°16.6	22.6
15	160°20.7	15°50.7	·· 50.4	70°53.9	·· 54.8	336°09.3	·· 27.8	335°18.9	·· 22.5
16	175°23.2	30°50.2	49.4	85°54.5	54.8	351°11.5	28.0	350°21.2	22.5
17	190°25.7	45°49.6	48.4	100°55.1	54.8	6°13.7	28.1	5°23.5	22.4
18	205°28.1	60°49.1	N15°47.4	115°55.7	N23°54.8	21°15.8	S00°28.3	20°25.8	N00°22.3
19	220°30.6	75°48.6	46.4	130°56.3	54.9	36°18.0	28.4	35°28.1	22.2
20	235°33.1	90°48.1	45.4	145°56.9	54.9	51°20.2	28.5	50°30.4	22.2
21	250°35.5	105°47.6	·· 44.4	160°57.5	·· 54.9	66°22.3	·· 28.7	65°32.8	·· 22.1
22	265°38.0	120°47.1	43.4	175°58.2	55.0	81°24.5	28.8	80°35.1	22.0
23	280°40.5	135°46.6	42.4	190°58.8	55.0	96°26.7	29.0	95°37.4	21.9
Mer.pass. 04:20		ν -0.5′	d 1.0′	m -3.92	ν 0.6′	d 0.0′	m 1.56	ν 2.2′	d 0.1′ m -1.87	ν 2.3′	d 0.1′ m 0.92

Stars

	SHA	Dec
Alpheratz	358°08.6	28°59.1
Ankaa	353°39.6	-42°24.2
Schedar	350°08.2	56°25.8
Diphda	349°20.2	-18°05.2
Achernar	335°44.9	-57°19.6
Hamal	328°28.3	23°22.3
Polaris	326°45.7	89°10.4
Acamar	315°37.0	-40°22.6
Menkar	314°40.6	4°01.0
Mirfak	309°15.5	49°47.5
Aldebaran	291°17.6	16°28.3
Rigel	281°35.7	-8°13.4
Capella	281°10.8	45°58.6
Bellatrix	278°58.4	6°20.0
Elnath	278°43.7	28°35.4
Alnilam	276°11.4	-1°12.8
Betelgeuse	271°28.0	7°24.2
Canopus	264°07.5	-52°41.1
Sirius	258°55.5	-16°41.4
Adhara	255°32.0	-28°56.8
Procyon	245°25.5	5°16.4
Pollux	243°57.8	28°04.3
Avior	234°28.6	-59°27.0
Suhail	223°10.8	-43°21.5
Miaplacidus	221°45.7	-69°38.6
Alphard	218°20.3	-8°34.6
Regulus	208°09.6	12°03.6
Dubhe	194°21.8	61°51.4
Denebola	182°58.6	14°40.7
Gienah	176°17.5	-17°26.3
Acrux	173°36.8	-63°00.0
Gacrux	172°28.2	-57°00.7
Alioth	166°42.1	56°04.0
Spica	158°56.9	-11°03.8
Alkaid	153°18.0	49°24.7
Hadar	149°22.4	-60°17.2
Menkent	148°36.3	-36°16.8
Arcturus	146°17.9	19°17.0
Rigil Kent.	140°24.8	-60°45.6
Kochab	137°18.6	74°14.3
Zuben'ubi	137°32.3	-15°57.9
Alphecca	126°31.4	26°46.9
Antares	112°55.9	-26°23.5
Atria	108°19.2	-68°59.8
Sabik	102°40.2	-15°42.1
Shaula	96°54.6	-37°05.4
Rasalhague	96°28.7	12°34.5
Eltanin	90°57.0	51°29.7
Kaus Aust.	84°15.7	-34°23.6
Vega	80°55.0	38°46.1
Nunki	76°28.1	-26°19.2
Altair	62°31.6	8°49.2
Peacock	53°56.9	-56°47.6
Deneb	49°47.6	45°12.8
Enif	34°10.7	9°47.4
Al Na'ir	28°13.8	-47°02.9
Fomalhaut	15°50.5	-29°43.1
Scheat	14°16.8	27°58.8
Markab	14°02.4	15°06.3

Jul 15 Wed	SHA	Mer.pass
Venus	218°38.1	13:55
Mars	272°29.9	10:19
Jupiter	176°07.0	16:42
Saturn	175°07.3	16:46

Jul 16 Thu	SHA	Mer.pass
Venus	217°26.2	13:56
Mars	271°45.3	10:18
Jupiter	176°00.1	16:39
Saturn	175°03.9	16:42

Jul 17 Fri	SHA	Mer.pass
Venus	216°14.5	13:57
Mars	271°00.9	10:17
Jupiter	175°53.0	16:35
Saturn	175°00.4	16:38

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°32.7	N21°34.5	25°38.6	11.0′	S20°25.7	2.9′	54.8′
1	193°32.6	34.1	40°08.6	11.0′	20°28.6	2.8′	54.8′
2	208°32.5	33.7	54°38.6	10.9′	20°31.4	2.7′	54.8′
3	223°32.5	·· 33.3	69°08.5	10.9′	20°34.1	2.6′	54.9′
4	238°32.4	33.0	83°38.4	10.8′	20°36.7	2.4′	54.9′
5	253°32.3	32.6	98°08.2	10.8′	20°39.1	2.4′	54.9′
6	268°32.3	N21°32.2	112°38.0	10.8′	S20°41.5	2.3′	54.9′
7	283°32.2	31.8	127°07.8	10.7′	20°43.8	2.2′	54.9′
8	298°32.1	31.4	141°37.5	10.7′	20°46.0	2.0′	54.9′
9	313°32.1	·· 31.0	156°07.2	10.6′	20°48.0	2.0′	55.0′
10	328°32.0	30.6	170°36.9	10.6′	20°50.0	1.9′	55.0′
11	343°32.0	30.2	185°06.5	10.6′	20°51.9	1.7′	55.0′
12	358°31.9	N21°29.8	199°36.0	10.5′	S20°53.6	1.7′	55.0′
13	13°31.8	29.4	214°05.6	10.5′	20°55.3	1.6′	55.0′
14	28°31.8	29.0	228°35.1	10.5′	20°56.9	1.4′	55.0′
15	43°31.7	·· 28.6	243°04.5	10.4′	20°58.3	1.4′	55.1′
16	58°31.6	28.2	257°34.0	10.4′	20°59.7	1.2′	55.1′
17	73°31.6	27.8	272°03.4	10.4′	21°00.9	1.1′	55.1′
18	88°31.5	N21°27.4	286°32.8	10.3′	S21°02.0	1.1′	55.1′
19	103°31.5	27.0	301°02.1	10.3′	21°03.1	0.9′	55.1′
20	118°31.4	26.6	315°31.4	10.3′	21°04.0	0.8′	55.2′
21	133°31.3	·· 26.2	330°00.7	10.2′	21°04.8	0.7′	55.2′
22	148°31.3	25.8	344°29.9	10.2′	21°05.5	0.6′	55.2′
23	163°31.2	25.4	358°59.1	10.2′	21°06.1	0.5′	55.2′
	SD = 15.7′	d = 0.4′	SD = 14.9′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°31.2	N21°25.0	13°28.3	10.2′	S21°06.6	0.4′	55.2′
1	193°31.1	24.6	27°57.5	10.1′	21°07.0	0.3′	55.2′
2	208°31.0	24.2	42°26.6	10.1′	21°07.3	0.2′	55.3′
3	223°31.0	·· 23.8	56°55.7	10.1′	21°07.5	0.0′	55.3′
4	238°30.9	23.4	71°24.8	10.1′	21°07.5	0.0′	55.3′
5	253°30.9	23.0	85°53.9	10.0′	21°07.5	0.2′	55.3′
6	268°30.8	N21°22.6	100°22.9	10.0′	S21°07.3	0.2′	55.3′
7	283°30.8	22.2	114°51.9	10.0′	21°07.1	0.4′	55.4′
8	298°30.7	21.7	129°20.9	10.0′	21°06.7	0.5′	55.4′
9	313°30.6	·· 21.3	143°49.9	9.9′	21°06.2	0.6′	55.4′
10	328°30.6	20.9	158°18.8	9.9′	21°05.6	0.7′	55.4′
11	343°30.5	20.5	172°47.8	9.9′	21°04.9	0.8′	55.4′
12	358°30.5	N21°20.1	187°16.7	9.9′	S21°04.1	0.9′	55.5′
13	13°30.4	19.7	201°45.6	9.9′	21°03.2	1.1′	55.5′
14	28°30.4	19.3	216°14.4	9.9′	21°02.1	1.1′	55.5′
15	43°30.3	·· 18.9	230°43.3	9.8′	21°01.0	1.3′	55.5′
16	58°30.2	18.4	245°12.1	9.8′	20°59.7	1.3′	55.5′
17	73°30.2	18.0	259°41.0	9.8′	20°58.4	1.5′	55.6′
18	88°30.1	N21°17.6	274°09.8	9.8′	S20°56.9	1.6′	55.6′
19	103°30.1	17.2	288°38.6	9.8′	20°55.3	1.7′	55.6′
20	118°30.0	16.8	303°07.4	9.8′	20°53.6	1.8′	55.6′
21	133°30.0	·· 16.4	317°36.1	9.8′	20°51.8	2.0′	55.6′
22	148°29.9	16.0	332°04.9	9.8′	20°49.8	2.0′	55.7′
23	163°29.9	15.5	346°33.6	9.7′	20°47.8	2.1′	55.7′
	SD = 15.7′	d = 0.4′	SD = 15.1′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°29.8	N21°15.1	1°02.4	9.7′	S20°45.7	2.3′	55.7′
1	193°29.7	14.7	15°31.1	9.7′	20°43.4	2.4′	55.7′
2	208°29.7	14.3	29°59.8	9.7′	20°41.0	2.4′	55.7′
3	223°29.6	·· 13.9	44°28.6	9.7′	20°38.6	2.6′	55.8′
4	238°29.6	13.4	58°57.3	9.7′	20°36.0	2.7′	55.8′
5	253°29.5	13.0	73°26.0	9.7′	20°33.3	2.9′	55.8′
6	268°29.5	N21°12.6	87°54.7	9.7′	S20°30.4	2.9′	55.8′
7	283°29.4	12.2	102°23.4	9.7′	20°27.5	3.0′	55.9′
8	298°29.4	11.7	116°52.1	9.7′	20°24.5	3.2′	55.9′
9	313°29.3	·· 11.3	131°20.8	9.7′	20°21.3	3.2′	55.9′
10	328°29.3	10.9	145°49.5	9.7′	20°18.1	3.4′	55.9′
11	343°29.2	10.5	160°18.1	9.7′	20°14.7	3.5′	55.9′
12	358°29.2	N21°10.0	174°46.8	9.7′	S20°11.2	3.6′	56.0′
13	13°29.1	09.6	189°15.5	9.7′	20°07.6	3.7′	56.0′
14	28°29.1	09.2	203°44.2	9.7′	20°03.9	3.8′	56.0′
15	43°29.0	·· 08.8	218°12.9	9.7′	20°00.1	3.9′	56.0′
16	58°29.0	08.3	232°41.6	9.7′	19°56.2	4.0′	56.0′
17	73°28.9	07.9	247°10.3	9.7′	19°52.2	4.1′	56.1′
18	88°28.9	N21°07.5	261°39.0	9.7′	S19°48.1	4.3′	56.1′
19	103°28.8	07.0	276°07.7	9.7′	19°43.8	4.3′	56.1′
20	118°28.8	06.6	290°36.4	9.7′	19°39.5	4.5′	56.1′
21	133°28.7	·· 06.2	305°05.1	9.7′	19°35.0	4.6′	56.1′
22	148°28.7	05.7	319°33.9	9.7′	19°30.4	4.6′	56.2′
23	163°28.6	05.3	334°02.6	9.7′	19°25.8	4.8′	56.2′
	SD = 15.7′	d = 0.4′	SD = 15.2′				

Lat.	**Twilight** Naut.	**Twilight** Civil	**Sunrise**	**Sunset**	**Twilight** Civil	**Twilight** Naut.
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	▭	▭	▭	▭	▭	▭
66°	////	////	01:39	22:29	////	////
64°	////	////	02:18	21:52	////	////
62°	////	00:56	02:44	21:26	23:10	////
60°	////	01:47	03:05	21:05	22:22	////
N 58°	////	02:18	03:22	20:49	21:52	////
56°	00:51	02:40	03:36	20:35	21:30	23:15
54°	01:39	02:58	03:48	20:23	21:12	22:31
52°	02:07	03:13	03:59	20:12	20:58	22:03
50°	02:28	03:26	04:08	20:03	20:45	21:43
45°	03:06	03:52	04:28	19:43	20:19	21:05
N 40°	03:33	04:12	04:44	19:27	19:59	20:39
35°	03:53	04:29	04:58	19:14	19:43	20:18
30°	04:10	04:43	05:09	19:02	19:29	20:01
20°	04:37	05:05	05:29	18:42	19:07	19:35
N 10°	04:57	05:24	05:46	18:25	18:48	19:15
0°	05:14	05:40	06:02	18:10	18:32	18:58
S 10°	05:30	05:56	06:18	17:54	18:16	18:42
20°	05:44	06:11	06:35	17:37	18:01	18:28
30°	05:59	06:28	06:54	17:18	17:44	18:13
35°	06:06	06:37	07:05	17:07	17:35	18:06
40°	06:14	06:48	07:18	16:55	17:24	17:58
45°	06:23	07:00	07:33	16:40	17:13	17:49
S 50°	06:33	07:14	07:51	16:21	16:59	17:39
52°	06:38	07:20	07:59	16:13	16:52	17:35
54°	06:43	07:27	08:09	16:03	16:45	17:30
56°	06:48	07:35	08:20	15:52	16:37	17:25
58°	06:53	07:44	08:32	15:40	16:29	17:19
S 60°	06:59	07:54	08:47	15:25	16:19	17:13

Lat.	**Moonrise** Wed	**Moonrise** Thu	**Moonrise** Fri	**Moonset** Wed	**Moonset** Thu	**Moonset** Fri
N 72°	▬	▬	▬	▬	▬	▬
N 70°	▬	▬	23:51	▬	▬	▬
68°	21:57	22:37	22:50	·· ··	00:11	01:18
66°	21:02	21:48	22:15	00:29	01:06	02:06
64°	20:29	21:17	21:49	00:58	01:38	02:37
62°	20:05	20:54	21:30	01:20	02:03	03:00
60°	19:46	20:35	21:13	01:38	02:22	03:19
N 58°	19:30	20:20	21:00	01:53	02:38	03:34
56°	19:17	20:07	20:48	02:06	02:51	03:47
54°	19:05	19:55	20:37	02:17	03:03	03:59
52°	18:55	19:45	20:28	02:27	03:13	04:09
50°	18:45	19:36	20:20	02:36	03:23	04:18
45°	18:26	19:17	20:02	02:54	03:42	04:37
N 40°	18:10	19:01	19:48	03:10	03:58	04:52
35°	17:57	18:48	19:35	03:23	04:11	05:05
30°	17:45	18:36	19:25	03:34	04:23	05:16
20°	17:25	18:16	19:06	03:53	04:43	05:36
N 10°	17:08	17:59	18:50	04:10	05:00	05:52
0°	16:52	17:43	18:35	04:26	05:17	06:08
S 10°	16:36	17:27	18:20	04:42	05:33	06:24
20°	16:19	17:10	18:04	04:58	05:50	06:40
30°	15:59	16:50	17:45	05:18	06:10	07:00
35°	15:48	16:39	17:35	05:29	06:21	07:11
40°	15:34	16:26	17:22	05:42	06:35	07:24
45°	15:19	16:10	17:08	05:58	06:50	07:39
S 50°	15:00	15:51	16:50	06:16	07:10	07:57
52°	14:51	15:42	16:41	06:25	07:19	08:06
54°	14:41	15:31	16:32	06:35	07:29	08:15
56°	14:29	15:20	16:21	06:47	07:41	08:26
58°	14:16	15:07	16:09	07:00	07:54	08:39
S 60°	14:01	14:51	15:55	07:15	08:10	08:53

Day	**Sun** Eqn.of Time 00^h mm:ss	**Sun** Eqn.of Time 12^h mm:ss	**Sun** Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	**Moon** Mer.Pass. Lower hh:mm	**Moon** Age 14-16 95-100%
15	05:49	05:52	12:06	23:04	10:39	
16	05:55	05:58	12:06	23:56	11:30	
17	06:01	06:03	12:06	–:–	12:22	

July 18, 19, 20 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	295°42.9	150°46.1	N15°41.4	205°59.4	N23°55.0	111°28.8	S00°29.1	110°39.7	N00°21.9
1	310°45.4	165°45.6	40.4	221°00.0	55.1	126°31.0	29.2	125°42.0	21.8
2	325°47.9	180°45.1	39.4	236°00.6	55.1	141°33.1	29.4	140°44.3	21.7
3	340°50.3	195°44.6	·· 38.4	251°01.2	·· 55.1	156°35.3	·· 29.5	155°46.6	·· 21.7
4	355°52.8	210°44.1	37.4	266°01.8	55.2	171°37.5	29.7	170°48.9	21.6
5	10°55.2	225°43.6	36.4	281°02.5	55.2	186°39.6	29.8	185°51.3	21.5
6	25°57.7	240°43.1	N15°35.4	296°03.1	N23°55.2	201°41.8	S00°29.9	200°53.6	N00°21.4
7	41°00.2	255°42.6	34.4	311°03.7	55.2	216°44.0	30.1	215°55.9	21.4
8	56°02.6	270°42.1	33.4	326°04.3	55.3	231°46.1	30.2	230°58.2	21.3
9	71°05.1	285°41.6	·· 32.4	341°04.9	·· 55.3	246°48.3	·· 30.3	246°00.5	·· 21.2
10	86°07.6	300°41.1	31.4	356°05.5	55.3	261°50.4	30.5	261°02.8	21.1
11	101°10.0	315°40.7	30.3	11°06.2	55.3	276°52.6	30.6	276°05.1	21.1
12	116°12.5	330°40.2	N15°29.3	26°06.8	N23°55.4	291°54.8	S00°30.8	291°07.4	N00°21.0
13	131°15.0	345°39.7	28.3	41°07.4	55.4	306°56.9	30.9	306°09.8	20.9
14	146°17.4	0°39.2	27.3	56°08.0	55.4	321°59.1	31.0	321°12.1	20.8
15	161°19.9	15°38.7	·· 26.3	71°08.6	·· 55.4	337°01.2	·· 31.2	336°14.4	·· 20.8
16	176°22.4	30°38.2	25.3	86°09.2	55.5	352°03.4	31.3	351°16.7	20.7
17	191°24.8	45°37.7	24.3	101°09.8	55.5	7°05.6	31.5	6°19.0	20.6
18	206°27.3	60°37.2	N15°23.3	116°10.5	N23°55.5	22°07.7	S00°31.6	21°21.3	N00°20.5
19	221°29.7	75°36.7	22.3	131°11.1	55.5	37°09.9	31.7	36°23.6	20.5
20	236°32.2	90°36.2	21.3	146°11.7	55.6	52°12.0	31.9	51°25.9	20.4
21	251°34.7	105°35.7	·· 20.2	161°12.3	·· 55.6	67°14.2	·· 32.0	66°28.2	·· 20.3
22	266°37.1	120°35.2	19.2	176°12.9	55.6	82°16.4	32.2	81°30.6	20.2
23	281°39.6	135°34.8	18.2	191°13.5	55.6	97°18.5	32.3	96°32.9	20.2
Mer.pass. 04:16		ν -0.5′	d 1.0′	ν 0.6′	d 0.0′	ν 2.2′	d 0.1′	ν 2.3′	d 0.1′
		m -3.92		m 1.56		m -1.86		m 0.92	

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	296°42.1	150°34.3	N15°17.2	206°14.2	N23°55.6	112°20.7	S00°32.4	111°35.2	N00°20.1
1	311°44.5	165°33.8	16.2	221°14.8	55.7	127°22.8	32.6	126°37.5	20.0
2	326°47.0	180°33.3	15.2	236°15.4	55.7	142°25.0	32.7	141°39.8	19.9
3	341°49.5	195°32.8	·· 14.1	251°16.0	·· 55.7	157°27.2	·· 32.9	156°42.1	·· 19.9
4	356°51.9	210°32.3	13.1	266°16.6	55.7	172°29.3	33.0	171°44.4	19.8
5	11°54.4	225°31.8	12.1	281°17.2	55.7	187°31.5	33.2	186°46.7	19.7
6	26°56.9	240°31.4	N15°11.1	296°17.9	N23°55.8	202°33.6	S00°33.3	201°49.0	N00°19.6
7	41°59.3	255°30.9	10.1	311°18.5	55.8	217°35.8	33.4	216°51.3	19.6
8	57°01.8	270°30.4	09.0	326°19.1	55.8	232°38.0	33.6	231°53.7	19.5
9	72°04.2	285°29.9	·· 08.0	341°19.7	·· 55.8	247°40.1	·· 33.7	246°56.0	·· 19.4
10	87°06.7	300°29.4	07.0	356°20.3	55.8	262°42.3	33.9	261°58.3	19.3
11	102°09.2	315°28.9	06.0	11°20.9	55.9	277°44.4	34.0	277°00.6	19.2
12	117°11.6	330°28.5	N15°04.9	26°21.6	N23°55.9	292°46.6	S00°34.1	292°02.9	N00°19.2
13	132°14.1	345°28.0	03.9	41°22.2	55.9	307°48.7	34.3	307°05.2	19.1
14	147°16.6	0°27.5	02.9	56°22.8	55.9	322°50.9	34.4	322°07.5	19.0
15	162°19.0	15°27.0	·· 01.9	71°23.4	·· 55.9	337°53.1	·· 34.6	337°09.8	·· 18.9
16	177°21.5	30°26.5	15°00.8	86°24.0	55.9	352°55.2	34.7	352°12.1	18.9
17	192°24.0	45°26.1	14°59.8	101°24.7	56.0	7°57.4	34.8	7°14.4	18.8
18	207°26.4	60°25.6	N14°58.8	116°25.3	N23°56.0	22°59.5	S00°35.0	22°16.7	N00°18.7
19	222°28.9	75°25.1	57.8	131°25.9	56.0	38°01.7	35.1	37°19.1	18.6
20	237°31.3	90°24.6	56.7	146°26.5	56.0	53°03.8	35.3	52°21.4	18.6
21	252°33.8	105°24.1	·· 55.7	161°27.1	·· 56.0	68°06.0	·· 35.4	67°23.7	·· 18.5
22	267°36.3	120°23.7	54.7	176°27.7	56.0	83°08.1	35.6	82°26.0	18.4
23	282°38.7	135°23.2	53.6	191°28.4	56.0	98°10.3	35.7	97°28.3	18.3
Mer.pass. 04:13		ν -0.5′	d 1.0′	ν 0.6′	d 0.0′	ν 2.2′	d 0.1′	ν 2.3′	d 0.1′
		m -3.92		m 1.56		m -1.86		m 0.93	

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	297°41.2	150°22.7	N14°52.6	206°29.0	N23°56.1	113°12.4	S00°35.8	112°30.6	N00°18.3
1	312°43.7	165°22.2	51.6	221°29.6	56.1	128°14.6	36.0	127°32.9	18.2
2	327°46.1	180°21.8	50.5	236°30.2	56.1	143°16.8	36.1	142°35.2	18.1
3	342°48.6	195°21.3	·· 49.5	251°30.8	·· 56.1	158°18.9	·· 36.3	157°37.5	·· 18.0
4	357°51.1	210°20.8	48.5	266°31.5	56.1	173°21.1	36.4	172°39.8	18.0
5	12°53.5	225°20.4	47.4	281°32.1	56.1	188°23.2	36.6	187°42.1	17.9
6	27°56.0	240°19.9	N14°46.4	296°32.7	N23°56.1	203°25.4	S00°36.7	202°44.4	N00°17.8
7	42°58.5	255°19.4	45.4	311°33.3	56.1	218°27.5	36.8	217°46.7	17.7
8	58°00.9	270°18.9	44.3	326°33.9	56.1	233°29.7	37.0	232°49.0	17.6
9	73°03.4	285°18.5	·· 43.3	341°34.5	·· 56.2	248°31.8	·· 37.1	247°51.3	·· 17.6
10	88°05.8	300°18.0	42.2	356°35.2	56.2	263°34.0	37.3	262°53.7	17.5
11	103°08.3	315°17.5	41.2	11°35.8	56.2	278°36.1	37.4	277°56.0	17.4
12	118°10.8	330°17.1	N14°40.2	26°36.4	N23°56.2	293°38.3	S00°37.6	292°58.3	N00°17.3
13	133°13.2	345°16.6	39.1	41°37.0	56.2	308°40.4	37.7	308°00.6	17.3
14	148°15.7	0°16.1	38.1	56°37.6	56.2	323°42.6	37.8	323°02.9	17.2
15	163°18.2	15°15.7	·· 37.0	71°38.3	·· 56.2	338°44.7	·· 38.0	338°05.2	·· 17.1
16	178°20.6	30°15.2	36.0	86°38.9	56.2	353°46.9	38.1	353°07.5	17.0
17	193°23.1	45°14.7	34.9	101°39.5	56.2	8°49.0	38.3	8°09.8	17.0
18	208°25.6	60°14.3	N14°33.9	116°40.1	N23°56.2	23°51.2	S00°38.4	23°12.1	N00°16.9
19	223°28.0	75°13.8	32.9	131°40.7	56.2	38°53.4	38.6	38°14.4	16.8
20	238°30.5	90°13.3	31.8	146°41.4	56.2	53°55.5	38.7	53°16.7	16.7
21	253°33.0	105°12.9	·· 30.8	161°42.0	·· 56.2	68°57.7	·· 38.9	68°19.0	·· 16.6
22	268°35.4	120°12.4	29.7	176°42.6	56.2	83°59.8	39.0	83°21.3	16.6
23	283°37.9	135°11.9	28.7	191°43.2	56.2	99°02.0	39.1	98°23.6	16.5
Mer.pass. 04:09		ν -0.5′	d 1.0′	ν 0.6′	d 0.0′	ν 2.2′	d 0.1′	ν 2.3′	d 0.1′
		m -3.92		m 1.57		m -1.85		m 0.93	

Stars

	SHA	Dec
Alpheratz	358°08.6	28°59.1
Ankaa	353°39.5	-42°24.2
Schedar	350°08.2	56°25.8
Diphda	349°20.2	-18°05.2
Achernar	335°44.8	-57°19.6
Hamal	328°28.3	23°22.3
Polaris	326°44.6	89°10.4
Acamar	315°36.9	-40°22.6
Menkar	314°40.6	4°01.0
Mirfak	309°15.5	49°47.5
Aldebaran	291°17.6	16°28.3
Rigel	281°35.7	-8°13.3
Capella	281°10.8	45°58.6
Bellatrix	278°58.4	6°20.0
Elnath	278°43.7	28°35.4
Alnilam	276°11.3	-1°12.8
Betelgeuse	271°27.9	7°24.2
Canopus	264°07.5	-52°41.1
Sirius	258°55.5	-16°41.4
Adhara	255°32.0	-28°56.8
Procyon	245°25.5	5°16.4
Pollux	243°57.8	28°04.3
Avior	234°28.6	-59°27.0
Suhail	223°10.8	-43°21.5
Miaplacidus	221°45.7	-69°38.6
Alphard	218°20.3	-8°34.6
Regulus	208°09.6	12°03.6
Dubhe	194°21.8	61°51.4
Denebola	182°58.6	14°40.7
Gienah	176°17.5	-17°26.3
Acrux	173°36.9	-63°00.0
Gacrux	172°28.3	-57°00.7
Alioth	166°42.1	56°04.0
Spica	158°56.9	-11°03.8
Alkaid	153°18.0	49°24.7
Hadar	149°22.4	-60°17.2
Menkent	148°36.3	-36°16.8
Arcturus	146°17.9	19°17.0
Rigil Kent.	140°24.8	-60°45.6
Kochab	137°18.6	74°14.3
Zuben'ubi	137°32.3	-15°57.9
Alphecca	126°31.4	26°46.9
Antares	112°55.9	-26°23.5
Atria	108°19.2	-68°59.8
Sabik	102°40.2	-15°42.1
Shaula	96°54.6	-37°05.5
Rasalhague	96°28.7	12°34.5
Eltanin	90°57.0	51°29.7
Kaus Aust.	84°15.7	-34°23.6
Vega	80°55.0	38°46.1
Nunki	76°28.1	-26°19.2
Altair	62°31.6	8°49.2
Peacock	53°56.9	-56°47.6
Deneb	49°47.6	45°12.8
Enif	34°10.7	9°47.4
Al Na'ir	28°13.8	-47°02.9
Fomalhaut	15°50.5	-29°43.1
Scheat	14°16.7	27°58.8
Markab	14°02.4	15°06.3

Jul 18 Sat	SHA	Mer.pass
Venus	215°03.2	13:57
Mars	270°16.5	10:16
Jupiter	175°45.9	16:32
Saturn	174°56.8	16:35

Jul 19 Sun	SHA	Mer.pass
Venus	213°52.2	13:58
Mars	269°32.1	10:15
Jupiter	175°38.6	16:28
Saturn	174°53.1	16:31

Jul 20 Mon	SHA	Mer.pass
Venus	212°41.5	13:59
Mars	268°47.8	10:14
Jupiter	175°31.2	16:25
Saturn	174°49.4	16:27

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h

Sat	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	178°28.6	N21°04.9	348°31.3	9.7′	S19°21.0	4.9′	56.2′
1	193°28.5	04.4	3°00.1	9.8′	19°16.1	5.0′	56.2′
2	208°28.5	04.0	17°28.8	9.8′	19°11.1	5.1′	56.3′
3	223°28.4	·· 03.6	31°57.6	9.8′	19°06.0	5.2′	56.3′
4	238°28.4	03.1	46°26.4	9.8′	19°00.8	5.3′	56.3′
5	253°28.3	02.7	60°55.2	9.8′	18°55.5	5.4′	56.3′
6	268°28.3	N21°02.3	75°24.0	9.8′	S18°50.1	5.6′	56.3′
7	283°28.2	01.8	89°52.8	9.8′	18°44.5	5.6′	56.4′
8	298°28.2	01.4	104°21.6	9.8′	18°38.9	5.7′	56.4′
9	313°28.1	·· 00.9	118°50.5	9.9′	18°33.2	5.9′	56.4′
10	328°28.1	00.5	133°19.3	9.9′	18°27.3	5.9′	56.4′
11	343°28.0	21°00.1	147°48.2	9.9′	18°21.4	6.0′	56.4′
12	358°28.0	N20°59.6	162°17.1	9.9′	S18°15.4	6.2′	56.5′
13	13°27.9	59.2	176°46.0	9.9′	18°09.2	6.2′	56.5′
14	28°27.9	58.7	191°14.9	9.9′	18°03.0	6.4′	56.5′
15	43°27.9	·· 58.3	205°43.8	9.9′	17°56.6	6.4′	56.5′
16	58°27.8	57.8	220°12.8	10.0′	17°50.2	6.5′	56.6′
17	73°27.8	57.4	234°41.7	10.0′	17°43.7	6.7′	56.6′
18	88°27.7	N20°57.0	249°10.7	10.0′	S17°37.0	6.7′	56.6′
19	103°27.7	56.5	263°39.7	10.0′	17°30.3	6.9′	56.6′
20	118°27.6	56.1	278°08.7	10.0′	17°23.4	6.9′	56.6′
21	133°27.6	·· 55.6	292°37.7	10.1′	17°16.5	7.0′	56.7′
22	148°27.5	55.2	307°06.8	10.1′	17°09.5	7.2′	56.7′
23	163°27.5	54.7	321°35.9	10.1′	17°02.3	7.2′	56.7′
	SD = 15.7′	d = 0.4′		SD = 15.3′			

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	178°27.5	N20°54.3	336°05.0	10.1′	S16°55.1	7.3′	56.7′
1	193°27.4	53.8	350°34.1	10.1′	16°47.8	7.4′	56.7′
2	208°27.4	53.4	5°03.2	10.2′	16°40.4	7.5′	56.8′
3	223°27.3	·· 52.9	19°32.4	10.2′	16°32.9	7.6′	56.8′
4	238°27.3	52.5	34°01.5	10.2′	16°25.3	7.7′	56.8′
5	253°27.2	52.0	48°30.7	10.2′	16°17.6	7.8′	56.8′
6	268°27.2	N20°51.6	63°00.0	10.2′	S16°09.8	7.9′	56.8′
7	283°27.2	51.1	77°29.2	10.3′	16°01.9	8.0′	56.9′
8	298°27.1	50.7	91°58.5	10.3′	15°53.9	8.0′	56.9′
9	313°27.1	·· 50.2	106°27.7	10.3′	15°45.9	8.2′	56.9′
10	328°27.0	49.8	120°57.0	10.3′	15°37.7	8.2′	56.9′
11	343°27.0	49.3	135°26.4	10.3′	15°29.5	8.3′	57.0′
12	358°27.0	N20°48.8	149°55.7	10.4′	S15°21.2	8.5′	57.0′
13	13°26.9	48.4	164°25.1	10.4′	15°12.7	8.4′	57.0′
14	28°26.9	47.9	178°54.5	10.4′	15°04.3	8.6′	57.0′
15	43°26.8	·· 47.5	193°23.9	10.4′	14°55.7	8.7′	57.0′
16	58°26.8	47.0	207°53.3	10.5′	14°47.0	8.7′	57.1′
17	73°26.8	46.6	222°22.8	10.5′	14°38.3	8.9′	57.1′
18	88°26.7	N20°46.1	236°52.3	10.5′	S14°29.4	8.9′	57.1′
19	103°26.7	45.6	251°21.8	10.5′	14°20.5	9.0′	57.1′
20	118°26.6	45.2	265°51.3	10.5′	14°11.5	9.1′	57.1′
21	133°26.6	·· 44.7	280°20.8	10.6′	14°02.4	9.1′	57.2′
22	148°26.6	44.2	294°50.4	10.6′	13°53.3	9.3′	57.2′
23	163°26.5	43.8	309°20.0	10.6′	13°44.0	9.3′	57.2′
	SD = 15.7′	d = 0.4′		SD = 15.5′			

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	178°26.5	N20°43.3	323°49.6	10.6′	S13°34.7	9.4′	57.2′
1	193°26.5	42.9	338°19.2	10.7′	13°25.3	9.5′	57.2′
2	208°26.4	42.4	352°48.9	10.7′	13°15.8	9.5′	57.3′
3	223°26.4	·· 41.9	7°18.6	10.7′	13°06.3	9.6′	57.3′
4	238°26.3	41.5	21°48.3	10.7′	12°56.7	9.7′	57.3′
5	253°26.3	41.0	36°18.0	10.7′	12°47.0	9.8′	57.3′
6	268°26.3	N20°40.5	50°47.7	10.8′	S12°37.2	9.8′	57.3′
7	283°26.2	40.1	65°17.5	10.8′	12°27.4	9.9′	57.4′
8	298°26.2	39.6	79°47.3	10.8′	12°17.5	10.0′	57.4′
9	313°26.2	·· 39.1	94°17.1	10.8′	12°07.5	10.1′	57.4′
10	328°26.1	38.7	108°46.9	10.8′	11°57.4	10.1′	57.4′
11	343°26.1	38.2	123°16.8	10.9′	11°47.3	10.2′	57.4′
12	358°26.1	N20°37.7	137°46.6	10.9′	S11°37.1	10.3′	57.5′
13	13°26.0	37.2	152°16.5	10.9′	11°26.8	10.3′	57.5′
14	28°26.0	36.8	166°46.4	10.9′	11°16.5	10.4′	57.5′
15	43°26.0	·· 36.3	181°16.4	10.9′	11°06.1	10.4′	57.5′
16	58°25.9	35.8	195°46.3	11.0′	10°55.7	10.6′	57.5′
17	73°25.9	35.4	210°16.3	11.0′	10°45.1	10.5′	57.6′
18	88°25.9	N20°34.9	224°46.2	11.0′	S10°34.6	10.7′	57.6′
19	103°25.8	34.4	239°16.2	11.0′	10°23.9	10.7′	57.6′
20	118°25.8	33.9	253°46.3	11.0′	10°13.2	10.7′	57.6′
21	133°25.8	·· 33.5	268°16.3	11.0′	10°02.5	10.9′	57.6′
22	148°25.7	33.0	282°46.3	11.1′	09°51.6	10.9′	57.7′
23	163°25.7	32.5	297°16.4	11.1′	09°40.7	10.9′	57.7′
	SD = 15.7′	d = 0.5′		SD = 15.6′			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°						
N 70°						
68°	////	////	00:44	23:18	////	////
66°	////	////	01:52	22:17	////	////
64°	////	////	02:27	21:43	////	////
62°	////	01:14	02:52	21:19	22:53	////
60°	////	01:57	03:11	21:00	22:12	////
N 58°	////	02:25	03:27	20:44	21:45	////
56°	01:08	02:46	03:41	20:31	21:25	23:00
54°	01:47	03:03	03:52	20:19	21:08	22:22
52°	02:13	03:18	04:03	20:09	20:53	21:57
50°	02:33	03:30	04:12	20:00	20:41	21:38
45°	03:10	03:56	04:31	19:41	20:16	21:02
N 40°	03:36	04:15	04:47	19:25	19:57	20:36
35°	03:56	04:31	05:00	19:12	19:41	20:16
30°	04:12	04:44	05:11	19:01	19:28	20:00
20°	04:38	05:06	05:30	18:42	19:06	19:34
N 10°	04:58	05:25	05:47	18:25	18:48	19:14
0°	05:15	05:41	06:03	18:10	18:32	18:58
S 10°	05:30	05:56	06:18	17:54	18:17	18:43
20°	05:44	06:11	06:34	17:38	18:02	18:29
30°	05:58	06:27	06:53	17:20	17:46	18:15
35°	06:05	06:36	07:04	17:09	17:37	18:08
40°	06:13	06:46	07:16	16:57	17:27	18:00
45°	06:21	06:58	07:30	16:42	17:15	17:51
S 50°	06:31	07:11	07:48	16:25	17:02	17:42
52°	06:35	07:17	07:56	16:17	16:55	17:38
54°	06:40	07:24	08:06	16:07	16:49	17:33
56°	06:45	07:32	08:16	15:57	16:41	17:28
58°	06:50	07:40	08:28	15:45	16:33	17:23
S 60°	06:56	07:50	08:42	15:31	16:23	17:17

Lat.	Moonrise Sat	Moonrise Sun	Moonrise Mon	Moonset Sat	Moonset Sun	Moonset Mon
N 72°	▬	00:17 23:40	23:19	▬	03:15	05:38
N 70°	23:25	23:13	23:04	01:53	04:06	06:03
68°	22:53	22:53	22:52	02:53	04:37	06:22
66°	22:29	22:37	22:42	03:28	05:00	06:37
64°	22:10	22:24	22:34	03:52	05:18	06:49
62°	21:55	22:13	22:27	04:12	05:33	06:59
60°	21:42	22:03	22:20	04:28	05:46	07:08
N 58°	21:31	21:55	22:15	04:41	05:56	07:16
56°	21:21	21:47	22:10	04:53	06:05	07:23
54°	21:12	21:41	22:05	05:03	06:14	07:29
52°	21:04	21:35	22:01	05:12	06:21	07:34
50°	20:57	21:29	21:58	05:20	06:28	07:39
45°	20:42	21:18	21:50	05:37	06:42	07:49
N 40°	20:30	21:08	21:43	05:51	06:53	07:58
35°	20:19	21:00	21:37	06:03	07:03	08:05
30°	20:10	20:52	21:32	06:13	07:12	08:12
20°	19:54	20:39	21:23	06:30	07:26	08:23
N 10°	19:40	20:28	21:15	06:46	07:39	08:33
0°	19:27	20:18	21:08	07:00	07:51	08:42
S 10°	19:14	20:07	21:00	07:14	08:03	08:51
20°	19:00	19:56	20:52	07:29	08:16	09:00
30°	18:43	19:43	20:43	07:47	08:30	09:11
35°	18:34	19:35	20:38	07:57	08:39	09:17
40°	18:23	19:27	20:32	08:08	08:48	09:24
45°	18:10	19:17	20:25	08:21	08:59	09:32
S 50°	17:55	19:05	20:17	08:38	09:12	09:42
52°	17:48	18:59	20:13	08:45	09:18	09:47
54°	17:40	18:53	20:09	08:54	09:25	09:52
56°	17:31	18:46	20:04	09:03	09:33	09:57
58°	17:20	18:38	19:59	09:14	09:41	10:03
S 60°	17:08	18:29	19:53	09:26	09:51	10:10

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 17-19 99-92%
18	06:06	06:08	12:06	00:48	13:13	
19	06:10	06:12	12:06	01:39	14:05	
20	06:14	06:16	12:06	02:30	14:55	

July 21, 22, 23 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	298°40.3	150°11.5	N14°27.6	206°43.9	N23°56.2	114°04.1	S00°39.3	113°25.9	N00°16.4
1	313°42.8	165°11.0	26.6	221°44.5	56.3	129°06.3	39.4	128°28.2	16.3
2	328°45.3	180°10.6	25.5	236°45.1	56.3	144°08.4	39.6	143°30.5	16.3
3	343°47.7	195°10.1	·· 24.5	251°45.7	·· 56.3	159°10.6	·· 39.7	158°32.8	·· 16.2
4	358°50.2	210°09.6	23.4	266°46.3	56.3	174°12.7	39.9	173°35.1	16.1
5	13°52.7	225°09.2	22.4	281°47.0	56.3	189°14.9	40.0	188°37.4	16.0
6	28°55.1	240°08.7	N14°21.3	296°47.6	N23°56.3	204°17.0	S00°40.1	203°39.7	N00°15.9
7	43°57.6	255°08.3	20.3	311°48.2	56.3	219°19.2	40.3	218°42.1	15.9
8	59°00.1	270°07.8	19.2	326°48.8	56.3	234°21.3	40.4	233°44.4	15.8
9	74°02.5	285°07.3	·· 18.2	341°49.4	·· 56.3	249°23.4	·· 40.6	248°46.7	·· 15.7
10	89°05.0	300°06.9	17.1	356°50.1	56.3	264°25.6	40.7	263°49.0	15.6
11	104°07.4	315°06.4	16.1	11°50.7	56.3	279°27.7	40.9	278°51.3	15.6
12	119°09.9	330°06.0	N14°15.0	26°51.3	N23°56.3	294°29.9	S00°41.0	293°53.6	N00°15.5
13	134°12.4	345°05.5	13.9	41°51.9	56.3	309°32.0	41.2	308°55.9	15.4
14	149°14.8	0°05.1	12.9	56°52.6	56.3	324°34.2	41.3	323°58.2	15.3
15	164°17.3	15°04.6	·· 11.8	71°53.2	·· 56.3	339°36.3	·· 41.5	339°00.5	·· 15.2
16	179°19.8	30°04.2	10.8	86°53.8	56.3	354°38.5	41.6	354°02.8	15.2
17	194°22.2	45°03.7	09.7	101°54.4	56.3	9°40.6	41.7	9°05.1	15.1
18	209°24.7	60°03.2	N14°08.6	116°55.0	N23°56.3	24°42.8	S00°41.9	24°07.4	N00°15.0
19	224°27.2	75°02.8	07.6	131°55.7	56.3	39°44.9	42.0	39°09.7	14.9
20	239°29.6	90°02.3	06.5	146°56.3	56.3	54°47.1	42.2	54°12.0	14.8
21	254°32.1	105°01.9	·· 05.5	161°56.9	·· 56.3	69°49.2	·· 42.3	69°14.3	·· 14.8
22	269°34.6	120°01.4	04.4	176°57.5	56.2	84°51.4	42.5	84°16.6	14.7
23	284°37.0	135°01.0	03.3	191°58.2	56.2	99°53.5	42.6	99°18.9	14.6
Mer.pass. 04:05		ν -0.5′	d 1.0′	m -3.92	ν 0.6′	d 0.0′	m 1.57	ν 2.2′	d 0.1′ m -1.85	ν 2.3′	d 0.1′ m 0.93

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	299°39.5	150°00.5	N14°02.3	206°58.8	N23°56.2	114°55.7	S00°42.8	114°21.2	N00°14.5
1	314°41.9	165°00.1	01.2	221°59.4	56.2	129°57.8	42.9	129°23.5	14.4
2	329°44.4	179°59.6	14°00.1	237°00.0	56.2	144°59.9	43.1	144°25.8	14.4
3	344°46.9	194°59.2	13°59.1	252°00.6	·· 56.2	160°02.1	·· 43.2	159°28.1	·· 14.3
4	359°49.3	209°58.7	58.0	267°01.3	56.2	175°04.2	43.3	174°30.4	14.2
5	14°51.8	224°58.3	57.0	282°01.9	56.2	190°06.4	43.5	189°32.7	14.1
6	29°54.3	239°57.8	N13°55.9	297°02.5	N23°56.2	205°08.5	S00°43.6	204°35.0	N00°14.1
7	44°56.7	254°57.4	54.8	312°03.1	56.2	220°10.7	43.8	219°37.3	14.0
8	59°59.2	269°57.0	53.7	327°03.8	56.2	235°12.8	43.9	234°39.6	13.9
9	75°01.7	284°56.5	·· 52.7	342°04.4	·· 56.2	250°15.0	·· 44.1	249°41.9	·· 13.8
10	90°04.1	299°56.1	51.6	357°05.0	56.2	265°17.1	44.2	264°44.2	13.7
11	105°06.6	314°55.6	50.5	12°05.6	56.2	280°19.2	44.4	279°46.5	13.7
12	120°09.0	329°55.2	N13°49.5	27°06.3	N23°56.2	295°21.4	S00°44.5	294°48.8	N00°13.6
13	135°11.5	344°54.7	48.4	42°06.9	56.1	310°23.5	44.7	309°51.1	13.5
14	150°14.0	359°54.3	47.3	57°07.5	56.1	325°25.7	44.8	324°53.4	13.4
15	165°16.4	14°53.9	·· 46.3	72°08.1	·· 56.1	340°27.8	·· 45.0	339°55.7	·· 13.3
16	180°18.9	29°53.4	45.2	87°08.8	56.1	355°30.0	45.1	354°58.0	13.3
17	195°21.4	44°53.0	44.1	102°09.4	56.1	10°32.1	45.3	10°00.3	13.2
18	210°23.8	59°52.5	N13°43.0	117°10.0	N23°56.1	25°34.2	S00°45.4	25°02.6	N00°13.1
19	225°26.3	74°52.1	42.0	132°10.6	56.1	40°36.4	45.6	40°04.9	13.0
20	240°28.8	89°51.6	40.9	147°11.3	56.1	55°38.5	45.7	55°07.2	12.9
21	255°31.2	104°51.2	·· 39.8	162°11.9	·· 56.1	70°40.7	·· 45.8	70°09.5	·· 12.9
22	270°33.7	119°50.8	38.7	177°12.5	56.0	85°42.8	46.0	85°11.8	12.8
23	285°36.2	134°50.3	37.7	192°13.1	56.0	100°45.0	46.1	100°14.1	12.7
Mer.pass. 04:01		ν -0.4′	d 1.1′	m -3.92	ν 0.6′	d 0.0′	m 1.57	ν 2.1′	d 0.1′ m -1.84	ν 2.3′	d 0.1′ m 0.93

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	300°38.6	149°49.9	N13°36.6	207°13.8	N23°56.0	115°47.1	S00°46.3	115°16.4	N00°12.6
1	315°41.1	164°49.5	35.5	222°14.4	56.0	130°49.2	46.4	130°18.7	12.5
2	330°43.5	179°49.0	34.4	237°15.0	56.0	145°51.4	46.6	145°21.0	12.5
3	345°46.0	194°48.6	·· 33.3	252°15.6	·· 56.0	160°53.5	·· 46.7	160°23.3	·· 12.4
4	0°48.5	209°48.1	32.3	267°16.3	56.0	175°55.7	46.9	175°25.6	12.3
5	15°50.9	224°47.7	31.2	282°16.9	56.0	190°57.8	47.0	190°27.9	12.2
6	30°53.4	239°47.3	N13°30.1	297°17.5	N23°55.9	205°59.9	S00°47.2	205°30.2	N00°12.1
7	45°55.9	254°46.8	29.0	312°18.1	55.9	221°02.1	47.3	220°32.5	12.1
8	60°58.3	269°46.4	27.9	327°18.8	55.9	236°04.2	47.5	235°34.8	12.0
9	76°00.8	284°46.0	·· 26.8	342°19.4	·· 55.9	251°06.4	·· 47.6	250°37.1	·· 11.9
10	91°03.3	299°45.5	25.8	357°20.0	55.9	266°08.5	47.8	265°39.4	11.8
11	106°05.7	314°45.1	24.7	12°20.6	55.9	281°10.6	47.9	280°41.7	11.7
12	121°08.2	329°44.7	N13°23.6	27°21.3	N23°55.8	296°12.8	S00°48.1	295°44.0	N00°11.7
13	136°10.7	344°44.3	22.5	42°21.9	55.8	311°14.9	48.2	310°46.3	11.6
14	151°13.1	359°43.8	21.4	57°22.5	55.8	326°17.1	48.4	325°48.6	11.5
15	166°15.6	14°43.4	·· 20.3	72°23.2	·· 55.8	341°19.2	·· 48.5	340°50.8	·· 11.4
16	181°18.0	29°43.0	19.2	87°23.8	55.8	356°21.3	48.7	355°53.1	11.3
17	196°20.5	44°42.5	18.2	102°24.4	55.7	11°23.5	48.8	10°55.4	11.3
18	211°23.0	59°42.1	N13°17.1	117°25.0	N23°55.7	26°25.6	S00°49.0	25°57.7	N00°11.2
19	226°25.4	74°41.7	16.0	132°25.7	55.7	41°27.8	49.1	41°00.0	11.1
20	241°27.9	89°41.2	14.9	147°26.3	55.7	56°29.9	49.3	56°02.3	11.0
21	256°30.4	104°40.8	·· 13.8	162°26.9	·· 55.7	71°32.0	·· 49.4	71°04.6	·· 10.9
22	271°32.8	119°40.4	12.7	177°27.5	55.6	86°34.2	49.6	86°06.9	10.8
23	286°35.3	134°40.0	11.6	192°28.2	55.6	101°36.3	49.7	101°09.2	10.8
Mer.pass. 03:57		ν -0.4′	d 1.1′	m -3.92	ν 0.6′	d 0.0′	m 1.57	ν 2.1′	d 0.1′ m -1.84	ν 2.3′	d 0.1′ m 0.93

Stars

	SHA	Dec
Alpheratz	358°08.5	28°59.1
Ankaa	353°39.5	-42°24.2
Schedar	350°08.1	56°25.9
Diphda	349°20.2	-18°05.2
Achernar	335°44.8	-57°19.6
Hamal	328°28.3	23°22.4
Polaris	326°43.6	89°10.4
Acamar	315°36.9	-40°22.6
Menkar	314°40.6	4°01.0
Mirfak	309°15.4	49°47.5
Aldebaran	291°17.5	16°28.3
Rigel	281°35.7	-8°13.3
Capella	281°10.8	45°58.6
Bellatrix	278°58.4	6°20.0
Elnath	278°43.7	28°35.5
Alnilam	276°11.3	-1°12.8
Betelgeuse	271°27.9	7°24.2
Canopus	264°07.5	-52°41.0
Sirius	258°55.5	-16°41.4
Adhara	255°32.0	-28°56.7
Procyon	245°25.5	5°16.4
Pollux	243°57.8	28°04.3
Avior	234°28.6	-59°27.0
Suhail	223°10.8	-43°21.5
Miaplacidus	221°45.7	-69°38.5
Alphard	218°20.3	-8°34.6
Regulus	208°09.7	12°03.6
Dubhe	194°21.9	61°51.4
Denebola	182°58.6	14°40.7
Gienah	176°17.5	-17°26.3
Acrux	173°36.9	-63°00.0
Gacrux	172°28.3	-57°00.7
Alioth	166°42.1	56°04.0
Spica	158°56.9	-11°03.8
Alkaid	153°18.0	49°24.7
Hadar	149°22.5	-60°17.2
Menkent	148°36.3	-36°16.8
Arcturus	146°17.9	19°17.0
Rigil Kent.	140°24.9	-60°45.6
Kochab	137°18.7	74°14.3
Zuben'ubi	137°32.3	-15°57.8
Alphecca	126°31.4	26°46.9
Antares	112°55.9	-26°23.5
Atria	108°19.2	-68°59.8
Sabik	102°40.2	-15°42.1
Shaula	96°54.6	-37°05.5
Rasalhague	96°28.7	12°34.6
Eltanin	90°57.0	51°29.7
Kaus Aust.	84°15.7	-34°23.6
Vega	80°55.0	38°46.1
Nunki	76°28.1	-26°19.2
Altair	62°31.6	8°49.2
Peacock	53°56.9	-56°47.6
Deneb	49°47.6	45°12.8
Enif	34°10.7	9°47.4
Al Na'ir	28°13.8	-47°02.9
Fomalhaut	15°50.5	-29°43.1
Scheat	14°16.7	27°58.8
Markab	14°02.3	15°06.3

Jul 21 Tue	SHA	Mer.pass
Venus	211°31.1	14:00
Mars	268°03.5	10:13
Jupiter	175°23.8	16:21
Saturn	174°45.6	16:24

Jul 22 Wed	SHA	Mer.pass
Venus	210°21.1	14:00
Mars	267°19.3	10:12
Jupiter	175°16.2	16:18
Saturn	174°41.7	16:20

Jul 23 Thu	SHA	Mer.pass
Venus	209°11.3	14:01
Mars	266°35.1	10:11
Jupiter	175°08.5	16:15
Saturn	174°37.8	16:16

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h

Tue	Sun GHA	Sun Dec	Moon GHA	ν	Moon Dec	d	HP
0	178°25.7	N20°32.0	311°46.5	11.1′	S09°29.8	11.0′	57.7′
1	193°25.6	31.5	326°16.6	11.1′	09°18.8	11.0′	57.7′
2	208°25.6	31.1	340°46.7	11.1′	09°07.8	11.1′	57.7′
3	223°25.6	·· 30.6	355°16.8	11.1′	08°56.7	11.2′	57.8′
4	238°25.5	30.1	9°46.9	11.2′	08°45.5	11.2′	57.8′
5	253°25.5	29.6	24°17.1	11.2′	08°34.3	11.3′	57.8′
6	268°25.5	N20°29.1	38°47.3	11.2′	S08°23.0	11.3′	57.8′
7	283°25.4	28.7	53°17.4	11.2′	08°11.7	11.3′	57.8′
8	298°25.4	28.2	67°47.6	11.2′	08°00.4	11.5′	57.9′
9	313°25.4	·· 27.7	82°17.8	11.2′	07°48.9	11.4′	57.9′
10	328°25.4	27.2	96°48.0	11.2′	07°37.5	11.5′	57.9′
11	343°25.3	26.7	111°18.2	11.2′	07°26.0	11.6′	57.9′
12	358°25.3	N20°26.2	125°48.5	11.2′	S07°14.4	11.6′	57.9′
13	13°25.3	25.8	140°18.7	11.2′	07°02.8	11.6′	58.0′
14	28°25.2	25.3	154°49.0	11.3′	06°51.2	11.7′	58.0′
15	43°25.2	·· 24.8	169°19.2	11.3′	06°39.5	11.7′	58.0′
16	58°25.2	24.3	183°49.5	11.3′	06°27.8	11.8′	58.0′
17	73°25.2	23.8	198°19.7	11.3′	06°16.0	11.8′	58.0′
18	88°25.1	N20°23.3	212°50.0	11.3′	S06°04.2	11.8′	58.0′
19	103°25.1	22.8	227°20.3	11.3′	05°52.4	11.9′	58.1′
20	118°25.1	22.3	241°50.6	11.3′	05°40.5	11.9′	58.1′
21	133°25.0	·· 21.8	256°20.9	11.3′	05°28.6	11.9′	58.1′
22	148°25.0	21.4	270°51.2	11.3′	05°16.7	12.0′	58.1′
23	163°25.0	20.9	285°21.4	11.3′	05°04.7	12.0′	58.1′
	SD = 15.7′	d = 0.5′	SD = 15.7′				

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	178°25.0	N20°20.4	299°51.7	11.3′	S04°52.7	12.1′	58.2′
1	193°24.9	19.9	314°22.0	11.3′	04°40.6	12.1′	58.2′
2	208°24.9	19.4	328°52.3	11.3′	04°28.5	12.1′	58.2′
3	223°24.9	·· 18.9	343°22.6	11.3′	04°16.4	12.1′	58.2′
4	238°24.9	18.4	357°52.9	11.3′	04°04.3	12.2′	58.2′
5	253°24.8	17.9	12°23.2	11.3′	03°52.1	12.2′	58.2′
6	268°24.8	N20°17.4	26°53.5	11.3′	S03°39.9	12.2′	58.3′
7	283°24.8	16.9	41°23.8	11.3′	03°27.7	12.2′	58.3′
8	298°24.8	16.4	55°54.1	11.3′	03°15.5	12.3′	58.3′
9	313°24.7	·· 15.9	70°24.4	11.3′	03°03.2	12.3′	58.3′
10	328°24.7	15.4	84°54.6	11.3′	02°50.9	12.3′	58.3′
11	343°24.7	14.9	99°24.9	11.3′	02°38.6	12.3′	58.4′
12	358°24.7	N20°14.4	113°55.2	11.3′	S02°26.3	12.4′	58.4′
13	13°24.6	13.9	128°25.4	11.2′	02°13.9	12.4′	58.4′
14	28°24.6	13.4	142°55.7	11.2′	02°01.5	12.3′	58.4′
15	43°24.6	·· 12.9	157°25.9	11.2′	01°49.2	12.5′	58.4′
16	58°24.6	12.4	171°56.1	11.2′	01°36.7	12.4′	58.4′
17	73°24.6	11.9	186°26.3	11.2′	01°24.3	12.4′	58.5′
18	88°24.5	N20°11.4	200°56.5	11.2′	S01°11.9	12.5′	58.5′
19	103°24.5	10.9	215°26.7	11.2′	00°59.4	12.4′	58.5′
20	118°24.5	10.4	229°56.9	11.2′	00°47.0	12.5′	58.5′
21	133°24.5	·· 09.9	244°27.1	11.1′	00°34.5	12.5′	58.5′
22	148°24.4	09.4	258°57.2	11.1′	00°22.0	12.4′	58.5′
23	163°24.4	08.9	273°27.3	11.1′	00°09.6	12.5′	58.6′
	SD = 15.7′	d = 0.5′	SD = 15.9′				

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	178°24.4	N20°08.4	287°57.5	11.1′	N00°02.9	12.5′	58.6′
1	193°24.4	07.9	302°27.6	11.1′	00°15.4	12.6′	58.6′
2	208°24.4	07.4	316°57.6	11.1′	00°28.0	12.5′	58.6′
3	223°24.3	·· 06.9	331°27.7	11.0′	00°40.5	12.5′	58.6′
4	238°24.3	06.4	345°57.8	11.0′	00°53.0	12.5′	58.6′
5	253°24.3	05.8	0°27.8	11.0′	01°05.5	12.5′	58.7′
6	268°24.3	N20°05.3	14°57.8	11.0′	N01°18.0	12.5′	58.7′
7	283°24.3	04.8	29°27.8	11.0′	01°30.5	12.5′	58.7′
8	298°24.3	04.3	43°57.7	10.9′	01°43.0	12.5′	58.7′
9	313°24.2	·· 03.8	58°27.7	10.9′	01°55.5	12.6′	58.7′
10	328°24.2	03.3	72°57.6	10.9′	02°08.1	12.5′	58.7′
11	343°24.2	02.8	87°27.4	10.9′	02°20.6	12.5′	58.8′
12	358°24.2	N20°02.3	101°57.3	10.8′	N02°33.1	12.4′	58.8′
13	13°24.2	01.8	116°27.1	10.8′	02°45.5	12.5′	58.8′
14	28°24.1	01.2	130°56.9	10.8′	02°58.0	12.5′	58.8′
15	43°24.1	·· 00.7	145°26.7	10.7′	03°10.5	12.4′	58.8′
16	58°24.1	20°00.2	159°56.5	10.7′	03°22.9	12.5′	58.8′
17	73°24.1	19°59.7	174°26.2	10.7′	03°35.4	12.4′	58.8′
18	88°24.1	N19°59.2	188°55.8	10.7′	N03°47.8	12.4′	58.9′
19	103°24.1	58.7	203°25.5	10.6′	04°00.2	12.4′	58.9′
20	118°24.1	58.1	217°55.1	10.6′	04°12.6	12.4′	58.9′
21	133°24.0	·· 57.6	232°24.7	10.6′	04°25.0	12.4′	58.9′
22	148°24.0	57.1	246°54.3	10.5′	04°37.4	12.4′	58.9′
23	163°24.0	56.6	261°23.8	10.5′	04°49.8	12.3′	58.9′
	SD = 15.7′	d = 0.5′	SD = 16.0′				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	////	////	01:13	22:53	////	////
66°	////	////	02:05	22:05	////	////
64°	////	////	02:36	21:34	////	////
62°	////	01:30	02:59	21:12	22:38	////
60°	////	02:07	03:17	20:54	22:03	////
N 58°	////	02:33	03:33	20:39	21:38	////
56°	01:22	02:53	03:46	20:26	21:18	22:47
54°	01:56	03:09	03:57	20:15	21:02	22:14
52°	02:20	03:23	04:07	20:05	20:49	21:51
50°	02:39	03:35	04:16	19:56	20:37	21:32
45°	03:14	03:59	04:34	19:38	20:13	20:58
N 40°	03:39	04:18	04:49	19:23	19:54	20:33
35°	03:58	04:33	05:02	19:11	19:39	20:14
30°	04:14	04:46	05:13	19:00	19:26	19:58
20°	04:39	05:08	05:32	18:41	19:05	19:33
N 10°	04:59	05:25	05:48	18:25	18:47	19:14
0°	05:15	05:41	06:03	18:10	18:32	18:58
S 10°	05:30	05:55	06:18	17:55	18:17	18:43
20°	05:43	06:10	06:33	17:39	18:03	18:30
30°	05:57	06:26	06:51	17:21	17:47	18:16
35°	06:04	06:35	07:02	17:11	17:38	18:09
40°	06:11	06:44	07:14	16:59	17:29	18:02
45°	06:19	06:55	07:28	16:45	17:18	17:54
S 50°	06:28	07:08	07:45	16:28	17:05	17:45
52°	06:32	07:14	07:53	16:20	16:59	17:41
54°	06:37	07:21	08:02	16:12	16:52	17:37
56°	06:41	07:28	08:12	16:02	16:45	17:32
58°	06:46	07:36	08:23	15:50	16:37	17:27
S 60°	06:52	07:45	08:36	15:37	16:28	17:22

Lat.	Moonrise Tue	Moonrise Wed	Moonrise Thu	Moonset Tue	Moonset Wed	Moonset Thu
N 72°	23:04	22:50	22:36	07:43	09:42	11:40
N 70°	22:57	22:50	22:43	07:56	09:46	11:37
68°	22:51	22:49	22:48	08:06	09:50	11:34
66°	22:46	22:49	22:52	08:15	09:53	11:32
64°	22:42	22:49	22:56	08:22	09:55	11:30
62°	22:38	22:49	22:59	08:28	09:58	11:28
60°	22:35	22:48	23:02	08:33	09:59	11:27
N 58°	22:32	22:48	23:05	08:38	10:01	11:26
56°	22:29	22:48	23:07	08:42	10:03	11:24
54°	22:27	22:48	23:09	08:46	10:04	11:23
52°	22:25	22:48	23:11	08:49	10:05	11:22
50°	22:23	22:48	23:12	08:52	10:06	11:22
45°	22:19	22:47	23:16	08:58	10:09	11:20
N 40°	22:15	22:47	23:19	09:04	10:11	11:18
35°	22:12	22:47	23:22	09:08	10:12	11:17
30°	22:10	22:47	23:25	09:13	10:14	11:16
20°	22:05	22:47	23:29	09:20	10:16	11:13
N 10°	22:01	22:46	23:33	09:26	10:18	11:12
0°	21:57	22:46	23:36	09:31	10:20	11:10
S 10°	21:53	22:46	23:40	09:37	10:22	11:08
20°	21:49	22:46	23:44	09:43	10:25	11:06
30°	21:44	22:46	23:48	09:50	10:27	11:04
35°	21:42	22:46	23:51	09:53	10:28	11:03
40°	21:39	22:46	23:54	09:58	10:30	11:02
45°	21:35	22:46	23:57	10:03	10:32	11:00
S 50°	21:31	22:46	·· ··	10:09	10:34	10:58
52°	21:29	22:46	·· ··	10:12	10:35	10:57
54°	21:27	22:46	·· ··	10:15	10:36	10:56
56°	21:24	22:45	·· ··	10:18	10:37	10:55
58°	21:22	22:45	·· ··	10:21	10:38	10:54
S 60°	21:19	22:45	·· ··	10:26	10:39	10:53

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 20-22 85-66%
21	06:17	06:19	12:06	03:20	15:44	
22	06:20	06:21	12:06	04:09	16:33	
23	06:22	06:23	12:06	04:58	17:23	

July 24, 25, 26 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	301°37.8	149°39.5	N13°10.5	207°28.8	N23°55.6	116°38.4	S00°49.9	116°11.5	N00°10.7
1	316°40.2	164°39.1	09.4	222°29.4	55.6	131°40.6	50.0	131°13.8	10.6
2	331°42.7	179°38.7	08.3	237°30.1	55.6	146°42.7	50.2	146°16.1	10.5
3	346°45.1	194°38.3	·· 07.2	252°30.7	·· 55.5	161°44.9	·· 50.3	161°18.4	·· 10.4
4	1°47.6	209°37.8	06.1	267°31.3	55.5	176°47.0	50.5	176°20.7	10.4
5	16°50.1	224°37.4	05.0	282°31.9	55.5	191°49.1	50.6	191°23.0	10.3
6	31°52.5	239°37.0	N13°04.0	297°32.6	N23°55.5	206°51.3	S00°50.8	206°25.3	N00°10.2
7	46°55.0	254°36.6	02.9	312°33.2	55.4	221°53.4	50.9	221°27.6	10.1
8	61°57.5	269°36.2	01.8	327°33.8	55.4	236°55.5	51.1	236°29.9	10.0
9	76°59.9	284°35.7	13°00.7	342°34.5	·· 55.4	251°57.7	·· 51.2	251°32.2	·· 10.0
10	92°02.4	299°35.3	12°59.6	357°35.1	55.4	266°59.8	51.4	266°34.5	09.9
11	107°04.9	314°34.9	58.5	12°35.7	55.3	282°01.9	51.5	281°36.8	09.8
12	122°07.3	329°34.5	N12°57.4	27°36.3	N23°55.3	297°04.1	S00°51.7	296°39.0	N00°09.7
13	137°09.8	344°34.1	56.3	42°37.0	55.3	312°06.2	51.8	311°41.3	09.6
14	152°12.3	359°33.6	55.2	57°37.6	55.3	327°08.3	52.0	326°43.6	09.5
15	167°14.7	14°33.2	·· 54.1	72°38.2	·· 55.2	342°10.5	·· 52.1	341°45.9	·· 09.5
16	182°17.2	29°32.8	53.0	87°38.9	55.2	357°12.6	52.3	356°48.2	09.4
17	197°19.6	44°32.4	51.9	102°39.5	55.2	12°14.8	52.4	11°50.5	09.3
18	212°22.1	59°32.0	N12°50.8	117°40.1	N23°55.2	27°16.9	S00°52.6	26°52.8	N00°09.2
19	227°24.6	74°31.5	49.7	132°40.8	55.1	42°19.0	52.7	41°55.1	09.1
20	242°27.0	89°31.1	48.6	147°41.4	55.1	57°21.2	52.9	56°57.4	09.0
21	257°29.5	104°30.7	·· 47.4	162°42.0	·· 55.1	72°23.3	·· 53.0	71°59.7	·· 09.0
22	272°32.0	119°30.3	46.3	177°42.6	55.0	87°25.4	53.2	87°02.0	08.9
23	287°34.4	134°29.9	45.2	192°43.3	55.0	102°27.6	53.3	102°04.3	08.8
Mer.pass. 03:53		ν -0.4′	d 1.1′	m -3.92	ν 0.6′	d 0.0′	m 1.58	ν 2.1′	d 0.1′ m -1.84	ν 2.3′	d 0.1′ m 0.93

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	302°36.9	149°29.5	N12°44.1	207°43.9	N23°55.0	117°29.7	S00°53.5	117°06.6	N00°08.7
1	317°39.4	164°29.1	43.0	222°44.5	54.9	132°31.8	53.6	132°08.9	08.6
2	332°41.8	179°28.6	41.9	237°45.2	54.9	147°34.0	53.8	147°11.1	08.6
3	347°44.3	194°28.2	·· 40.8	252°45.8	·· 54.9	162°36.1	·· 53.9	162°13.4	·· 08.5
4	2°46.8	209°27.8	39.7	267°46.4	54.9	177°38.2	54.1	177°15.7	08.4
5	17°49.2	224°27.4	38.6	282°47.1	54.8	192°40.3	54.2	192°18.0	08.3
6	32°51.7	239°27.0	N12°37.5	297°47.7	N23°54.8	207°42.5	S00°54.4	207°20.3	N00°08.2
7	47°54.1	254°26.6	36.4	312°48.3	54.8	222°44.6	54.5	222°22.6	08.1
8	62°56.6	269°26.2	35.3	327°49.0	54.7	237°46.7	54.7	237°24.9	08.1
9	77°59.1	284°25.8	·· 34.2	342°49.6	·· 54.7	252°48.9	·· 54.8	252°27.2	·· 08.0
10	93°01.5	299°25.4	33.0	357°50.2	54.7	267°51.0	55.0	267°29.5	07.9
11	108°04.0	314°25.0	31.9	12°50.8	54.6	282°53.1	55.1	282°31.8	07.8
12	123°06.5	329°24.5	N12°30.8	27°51.5	N23°54.6	297°55.3	S00°55.3	297°34.1	N00°07.7
13	138°08.9	344°24.1	29.7	42°52.1	54.6	312°57.4	55.4	312°36.4	07.6
14	153°11.4	359°23.7	28.6	57°52.7	54.5	327°59.5	55.6	327°38.6	07.6
15	168°13.9	14°23.3	·· 27.5	72°53.4	·· 54.5	343°01.7	·· 55.7	342°40.9	·· 07.5
16	183°16.3	29°22.9	26.4	87°54.0	54.4	358°03.8	55.9	357°43.2	07.4
17	198°18.8	44°22.5	25.2	102°54.6	54.4	13°05.9	56.0	12°45.5	07.3
18	213°21.2	59°22.1	N12°24.1	117°55.3	N23°54.4	28°08.0	S00°56.2	27°47.8	N00°07.2
19	228°23.7	74°21.7	23.0	132°55.9	54.3	43°10.2	56.3	42°50.1	07.1
20	243°26.2	89°21.3	21.9	147°56.5	54.3	58°12.3	56.5	57°52.4	07.1
21	258°28.6	104°20.9	·· 20.8	162°57.2	·· 54.3	73°14.4	·· 56.7	72°54.7	·· 07.0
22	273°31.1	119°20.5	19.7	177°57.8	54.2	88°16.6	56.8	87°57.0	06.9
23	288°33.6	134°20.1	18.5	192°58.4	54.2	103°18.7	57.0	102°59.3	06.8
Mer.pass. 03:49		ν -0.4′	d 1.1′	m -3.92	ν 0.6′	d 0.0′	m 1.58	ν 2.1′	d 0.2′ m -1.83	ν 2.3′	d 0.1′ m 0.94

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	303°36.0	149°19.7	N12°17.4	207°59.1	N23°54.1	118°20.8	S00°57.1	118°01.5	N00°06.7
1	318°38.5	164°19.3	16.3	222°59.7	54.1	133°23.0	57.3	133°03.8	06.6
2	333°41.0	179°18.9	15.2	238°00.3	54.1	148°25.1	57.4	148°06.1	06.6
3	348°43.4	194°18.5	·· 14.1	253°01.0	·· 54.0	163°27.2	·· 57.6	163°08.4	·· 06.5
4	3°45.9	209°18.1	12.9	268°01.6	54.0	178°29.3	57.7	178°10.7	06.4
5	18°48.4	224°17.7	11.8	283°02.2	53.9	193°31.5	57.9	193°13.0	06.3
6	33°50.8	239°17.3	N12°10.7	298°02.9	N23°53.9	208°33.6	S00°58.0	208°15.3	N00°06.2
7	48°53.3	254°16.9	09.6	313°03.5	53.9	223°35.7	58.2	223°17.6	06.1
8	63°55.7	269°16.5	08.4	328°04.1	53.8	238°37.8	58.3	238°19.9	06.1
9	78°58.2	284°16.1	·· 07.3	343°04.8	·· 53.8	253°40.0	·· 58.5	253°22.1	·· 06.0
10	94°00.7	299°15.7	06.2	358°05.4	53.7	268°42.1	58.6	268°24.4	05.9
11	109°03.1	314°15.3	05.1	13°06.0	53.7	283°44.2	58.8	283°26.7	05.8
12	124°05.6	329°14.9	N12°03.9	28°06.7	N23°53.7	298°46.4	S00°58.9	298°29.0	N00°05.7
13	139°08.1	344°14.5	02.8	43°07.3	53.6	313°48.5	59.1	313°31.3	05.6
14	154°10.5	359°14.1	01.7	58°07.9	53.6	328°50.6	59.3	328°33.6	05.6
15	169°13.0	14°13.7	12°00.6	73°08.6	·· 53.5	343°52.7	·· 59.4	343°35.9	·· 05.5
16	184°15.5	29°13.3	11°59.4	88°09.2	53.5	358°54.9	59.6	358°38.2	05.4
17	199°17.9	44°12.9	58.3	103°09.8	53.4	13°57.0	59.7	13°40.5	05.3
18	214°20.4	59°12.5	N11°57.2	118°10.5	N23°53.4	28°59.1	S00°59.9	28°42.7	N00°05.2
19	229°22.9	74°12.1	56.1	133°11.1	53.3	44°01.2	01°00.0	43°45.0	05.1
20	244°25.3	89°11.7	54.9	148°11.8	53.3	59°03.4	00.2	58°47.3	05.0
21	259°27.8	104°11.3	·· 53.8	163°12.4	·· 53.3	74°05.5	·· 00.3	73°49.6	·· 05.0
22	274°30.2	119°10.9	52.7	178°13.0	53.2	89°07.6	00.5	88°51.9	04.9
23	289°32.7	134°10.6	51.5	193°13.7	53.2	104°09.7	00.6	103°54.2	04.8
Mer.pass. 03:45		ν -0.4′	d 1.1′	m -3.92	ν 0.6′	d 0.0′	m 1.58	ν 2.1′	d 0.2′ m -1.83	ν 2.3′	d 0.1′ m 0.94

Stars

	SHA	Dec
Alpheratz	358°08.5	28°59.1
Ankaa	353°39.5	-42°24.2
Schedar	350°08.1	56°25.9
Diphda	349°20.1	-18°05.2
Achernar	335°44.8	-57°19.6
Hamal	328°28.2	23°22.4
Polaris	326°42.5	89°10.4
Acamar	315°36.9	-40°22.5
Menkar	314°40.6	4°01.0
Mirfak	309°15.4	49°47.5
Aldebaran	291°17.5	16°28.3
Rigel	281°35.7	-8°13.3
Capella	281°10.8	45°58.6
Bellatrix	278°58.4	6°20.0
Elnath	278°43.7	28°35.4
Alnilam	276°11.3	-1°12.8
Betelgeuse	271°27.9	7°24.2
Canopus	264°07.4	-52°41.0
Sirius	258°55.5	-16°41.4
Adhara	255°32.0	-28°56.7
Procyon	245°25.5	5°16.4
Pollux	243°57.8	28°04.3
Avior	234°28.6	-59°27.0
Suhail	223°10.8	-43°21.5
Miaplacidus	221°45.7	-69°38.5
Alphard	218°20.3	-8°34.6
Regulus	208°09.7	12°03.6
Dubhe	194°21.9	61°51.4
Denebola	182°58.6	14°40.7
Gienah	176°17.5	-17°26.3
Acrux	173°36.9	-63°00.0
Gacrux	172°28.3	-57°00.7
Alioth	166°42.2	56°04.0
Spica	158°57.0	-11°03.8
Alkaid	153°18.1	49°24.7
Hadar	149°22.5	-60°17.2
Menkent	148°36.3	-36°16.8
Arcturus	146°17.9	19°17.0
Rigil Kent.	140°24.9	-60°45.6
Kochab	137°18.8	74°14.3
Zuben'ubi	137°32.3	-15°57.8
Alphecca	126°31.5	26°46.9
Antares	112°55.9	-26°23.5
Atria	108°19.2	-68°59.8
Sabik	102°40.2	-15°42.1
Shaula	96°54.6	-37°05.5
Rasalhague	96°28.7	12°34.6
Eltanin	90°57.0	51°29.7
Kaus Aust.	84°15.7	-34°23.6
Vega	80°55.0	38°46.2
Nunki	76°28.1	-26°19.2
Altair	62°31.6	8°49.2
Peacock	53°56.9	-56°47.6
Deneb	49°47.6	45°12.9
Enif	34°10.7	9°47.4
Al Na'ir	28°13.8	-47°02.9
Fomalhaut	15°50.5	-29°43.1
Scheat	14°16.7	27°58.8
Markab	14°02.3	15°06.3

Jul 24 Fri	SHA	Mer.pass
Venus	208°01.8	14:02
Mars	265°51.0	10:10
Jupiter	175°00.7	16:11
Saturn	174°33.8	16:13

Jul 25 Sat	SHA	Mer.pass
Venus	206°52.6	14:02
Mars	265°07.0	10:09
Jupiter	174°52.8	16:08
Saturn	174°29.7	16:09

Jul 26 Sun	SHA	Mer.pass
Venus	205°43.6	14:03
Mars	264°23.0	10:08
Jupiter	174°44.8	16:04
Saturn	174°25.5	16:05

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°24.0	N19°56.1	275°53.2	10.4′	N05°02.1	12.3′	59.0′
1	193°24.0	55.5	290°22.7	10.4′	05°14.4	12.3′	59.0′
2	208°24.0	55.0	304°52.1	10.4′	05°26.7	12.2′	59.0′
3	223°23.9	·· 54.5	319°21.5	10.3′	05°38.9	12.3′	59.0′
4	238°23.9	54.0	333°50.8	10.3′	05°51.2	12.2′	59.0′
5	253°23.9	53.5	348°20.1	10.2′	06°03.4	12.1′	59.0′
6	268°23.9	N19°52.9	2°49.3	10.2′	N06°15.5	12.2′	59.0′
7	283°23.9	52.4	17°18.5	10.2′	06°27.7	12.1′	59.0′
8	298°23.9	51.9	31°47.7	10.1′	06°39.8	12.1′	59.1′
9	313°23.9	·· 51.4	46°16.8	10.1′	06°51.9	12.1′	59.1′
10	328°23.9	50.8	60°45.9	10.0′	07°04.0	12.0′	59.1′
11	343°23.8	50.3	75°14.9	10.0′	07°16.0	12.0′	59.1′
12	358°23.8	N19°49.8	89°43.9	9.9′	N07°28.0	11.9′	59.1′
13	13°23.8	49.3	104°12.9	9.9′	07°39.9	11.9′	59.1′
14	28°23.8	48.7	118°41.8	9.8′	07°51.8	11.9′	59.1′
15	43°23.8	·· 48.2	133°10.6	9.8′	08°03.7	11.8′	59.2′
16	58°23.8	47.7	147°39.4	9.8′	08°15.5	11.8′	59.2′
17	73°23.8	47.1	162°08.2	9.7′	08°27.3	11.8′	59.2′
18	88°23.8	N19°46.6	176°36.9	9.7′	N08°39.1	11.7′	59.2′
19	103°23.8	46.1	191°05.5	9.6′	08°50.8	11.6′	59.2′
20	118°23.7	45.5	205°34.1	9.6′	09°02.4	11.6′	59.2′
21	133°23.7	·· 45.0	220°02.7	9.5′	09°14.0	11.6′	59.2′
22	148°23.7	44.5	234°31.2	9.5′	09°25.6	11.5′	59.2′
23	163°23.7	43.9	248°59.6	9.4′	09°37.1	11.5′	59.3′
	SD = 15.7′	d = 0.5′	SD = 16.1′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°23.7	N19°43.4	263°28.0	9.3′	N09°48.6	11.4′	59.3′
1	193°23.7	42.9	277°56.4	9.3′	10°00.0	11.3′	59.3′
2	208°23.7	42.3	292°24.7	9.2′	10°11.3	11.3′	59.3′
3	223°23.7	·· 41.8	306°52.9	9.2′	10°22.6	11.3′	59.3′
4	238°23.7	41.3	321°21.1	9.1′	10°33.9	11.2′	59.3′
5	253°23.7	40.7	335°49.2	9.1′	10°45.1	11.1′	59.3′
6	268°23.7	N19°40.2	350°17.3	9.0′	N10°56.2	11.1′	59.3′
7	283°23.7	39.7	4°45.3	9.0′	11°07.3	11.0′	59.3′
8	298°23.7	39.1	19°13.3	8.9′	11°18.3	10.9′	59.4′
9	313°23.6	·· 38.6	33°41.2	8.8′	11°29.2	10.9′	59.4′
10	328°23.6	38.0	48°09.0	8.8′	11°40.1	10.8′	59.4′
11	343°23.6	37.5	62°36.8	8.7′	11°50.9	10.8′	59.4′
12	358°23.6	N19°37.0	77°04.5	8.7′	N12°01.7	10.6′	59.4′
13	13°23.6	36.4	91°32.2	8.6′	12°12.3	10.7′	59.4′
14	28°23.6	35.9	105°59.8	8.5′	12°23.0	10.5′	59.4′
15	43°23.6	·· 35.3	120°27.3	8.5′	12°33.5	10.5′	59.4′
16	58°23.6	34.8	134°54.8	8.4′	12°44.0	10.4′	59.4′
17	73°23.6	34.2	149°22.2	8.4′	12°54.4	10.3′	59.4′
18	88°23.6	N19°33.7	163°49.6	8.3′	N13°04.7	10.2′	59.5′
19	103°23.6	33.2	178°16.9	8.2′	13°14.9	10.2′	59.5′
20	118°23.6	32.6	192°44.2	8.2′	13°25.1	10.1′	59.5′
21	133°23.6	·· 32.1	207°11.3	8.1′	13°35.2	10.0′	59.5′
22	148°23.6	31.5	221°38.5	8.1′	13°45.2	9.9′	59.5′
23	163°23.6	31.0	236°05.5	8.0′	13°55.1	9.9′	59.5′
	SD = 15.7′	d = 0.5′	SD = 16.2′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°23.6	N19°30.4	250°32.5	7.9′	N14°05.0	9.8′	59.5′
1	193°23.6	29.9	264°59.5	7.9′	14°14.8	9.6′	59.5′
2	208°23.6	29.3	279°26.3	7.8′	14°24.4	9.6′	59.5′
3	223°23.6	·· 28.8	293°53.2	7.8′	14°34.0	9.5′	59.5′
4	238°23.6	28.2	308°19.9	7.7′	14°43.5	9.5′	59.5′
5	253°23.6	27.7	322°46.6	7.6′	14°53.0	9.3′	59.5′
6	268°23.6	N19°27.1	337°13.2	7.6′	N15°02.3	9.2′	59.5′
7	283°23.6	26.6	351°39.8	7.5′	15°11.5	9.2′	59.5′
8	298°23.6	26.0	6°06.3	7.4′	15°20.7	9.0′	59.6′
9	313°23.6	·· 25.5	20°32.8	7.4′	15°29.7	9.0′	59.6′
10	328°23.6	24.9	34°59.1	7.3′	15°38.7	8.9′	59.6′
11	343°23.6	24.4	49°25.5	7.3′	15°47.6	8.7′	59.6′
12	358°23.6	N19°23.8	63°51.7	7.2′	N15°56.3	8.7′	59.6′
13	13°23.6	23.3	78°17.9	7.1′	16°05.0	8.5′	59.6′
14	28°23.6	22.7	92°44.1	7.1′	16°13.5	8.5′	59.6′
15	43°23.6	·· 22.1	107°10.1	7.0′	16°22.0	8.4′	59.6′
16	58°23.6	21.6	121°36.2	7.0′	16°30.4	8.2′	59.6′
17	73°23.6	21.0	136°02.1	6.9′	16°38.6	8.2′	59.6′
18	88°23.6	N19°20.5	150°28.0	6.8′	N16°46.8	8.0′	59.6′
19	103°23.6	19.9	164°53.9	6.8′	16°54.8	8.0′	59.6′
20	118°23.6	19.4	179°19.7	6.7′	17°02.8	7.8′	59.6′
21	133°23.6	·· 18.8	193°45.4	6.7′	17°10.6	7.7′	59.6′
22	148°23.6	18.2	208°11.0	6.6′	17°18.3	7.6′	59.6′
23	163°23.6	17.7	222°36.7	6.6′	17°25.9	7.5′	59.6′
	SD = 15.7′	d = 0.5′	SD = 16.2′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°						
N 70°						
68°	////	////	01:34	22:33	////	////
66°	////	////	02:17	21:53	////	////
64°	////	00:42	02:45	21:25	23:20	////
62°	////	01:44	03:07	21:04	22:25	////
60°	////	02:17	03:24	20:47	21:53	////
N 58°	00:38	02:40	03:38	20:33	21:30	23:24
56°	01:35	02:59	03:51	20:21	21:12	22:34
54°	02:05	03:15	04:01	20:10	20:57	22:05
52°	02:27	03:28	04:11	20:01	20:44	21:44
50°	02:45	03:39	04:19	19:53	20:33	21:26
45°	03:18	04:02	04:37	19:35	20:10	20:54
N 40°	03:42	04:21	04:52	19:21	19:52	20:30
35°	04:01	04:36	05:04	19:08	19:37	20:11
30°	04:16	04:48	05:15	18:58	19:24	19:56
20°	04:41	05:09	05:33	18:40	19:04	19:32
N 10°	05:00	05:26	05:48	18:24	18:47	19:13
0°	05:15	05:41	06:03	18:10	18:32	18:57
S 10°	05:29	05:55	06:17	17:56	18:18	18:44
20°	05:42	06:09	06:33	17:40	18:04	18:31
30°	05:55	06:24	06:50	17:23	17:49	18:18
35°	06:02	06:33	07:00	17:13	17:40	18:11
40°	06:09	06:42	07:11	17:02	17:31	18:04
45°	06:17	06:53	07:25	16:48	17:21	17:56
S 50°	06:25	07:05	07:41	16:32	17:08	17:48
52°	06:29	07:11	07:49	16:25	17:03	17:44
54°	06:33	07:17	07:57	16:16	16:56	17:40
56°	06:37	07:24	08:07	16:06	16:50	17:36
58°	06:42	07:31	08:18	15:56	16:42	17:31
S 60°	06:47	07:40	08:30	15:43	16:34	17:26

Lat.	**Moonrise** Fri	Sat	Sun	**Moonset** Fri	Sat	Sun
N 72°	22:21	22:01	21:22	13:42	15:53	18:28
N 70°	22:35	22:27	22:15	13:30	15:29	17:37
68°	22:47	22:46	22:48	13:21	15:11	17:05
66°	22:56	23:02	23:13	13:13	14:56	16:41
64°	23:04	23:15	23:32	13:06	14:44	16:23
62°	23:11	23:26	23:47	13:01	14:34	16:08
60°	23:17	23:36	·· ··	12:56	14:26	15:55
N 58°	23:23	23:44	·· ··	12:51	14:18	15:45
56°	23:27	23:52	·· ··	12:47	14:11	15:35
54°	23:32	23:58	·· ··	12:44	14:06	15:27
52°	23:36	·· ··	00:04	12:41	14:00	15:20
50°	23:39	·· ··	00:09	12:38	13:55	15:13
45°	23:47	·· ··	00:21	12:32	13:45	14:59
N 40°	23:53	·· ··	00:31	12:27	13:37	14:47
35°	23:59	·· ··	00:39	12:22	13:29	14:37
30°	·· ··	00:04	00:47	12:19	13:23	14:28
20°	·· ··	00:13	00:59	12:12	13:12	14:13
N 10°	·· ··	00:20	01:11	12:06	13:02	14:00
0°	·· ··	00:28	01:21	12:00	12:53	13:48
S 10°	·· ··	00:35	01:32	11:55	12:44	13:36
20°	·· ··	00:43	01:44	11:49	12:34	13:23
30°	·· ··	00:52	01:57	11:43	12:23	13:08
35°	·· ··	00:57	02:05	11:39	12:17	12:59
40°	·· ··	01:03	02:14	11:34	12:10	12:50
45°	·· ··	01:10	02:24	11:29	12:02	12:38
S 50°	00:02	01:19	02:36	11:24	11:52	12:24
52°	00:03	01:23	02:42	11:21	11:47	12:18
54°	00:06	01:27	02:49	11:18	11:42	12:11
56°	00:08	01:32	02:56	11:15	11:36	12:03
58°	00:11	01:37	03:04	11:11	11:30	11:54
S 60°	00:14	01:43	03:14	11:07	11:23	11:44

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 23-25 55-32%
24	06:24	06:25	12:06	05:48	18:14	
25	06:25	06:25	12:06	06:40	19:07	
26	06:26	06:26	12:06	07:35	20:03	

July 27, 28, 29 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	304°35.2	149°10.2	N11°50.4	208°14.3	N23°53.1	119°11.9	S01°00.8	118°56.5	N00°04.7
1	319°37.6	164°09.8	49.3	223°14.9	53.1	134°14.0	01.0	133°58.7	04.6
2	334°40.1	179°09.4	48.1	238°15.6	53.0	149°16.1	01.1	149°01.0	04.5
3	349°42.6	194°09.0	·· 47.0	253°16.2	·· 53.0	164°18.2	·· 01.3	164°03.3	·· 04.5
4	4°45.0	209°08.6	45.9	268°16.8	52.9	179°20.4	01.4	179°05.6	04.4
5	19°47.5	224°08.2	44.7	283°17.5	52.9	194°22.5	01.6	194°07.9	04.3
6	34°50.0	239°07.8	N11°43.6	298°18.1	N23°52.8	209°24.6	S01°01.7	209°10.2	N00°04.2
7	49°52.4	254°07.4	42.5	313°18.8	52.8	224°26.7	01.9	224°12.5	04.1
8	64°54.9	269°07.0	41.3	328°19.4	52.7	239°28.9	02.0	239°14.8	04.0
9	79°57.4	284°06.7	·· 40.2	343°20.0	·· 52.7	254°31.0	·· 02.2	254°17.0	·· 03.9
10	94°59.8	299°06.3	39.0	358°20.7	52.6	269°33.1	02.3	269°19.3	03.9
11	110°02.3	314°05.9	37.9	13°21.3	52.6	284°35.2	02.5	284°21.6	03.8
12	125°04.7	329°05.5	N11°36.8	28°21.9	N23°52.5	299°37.3	S01°02.7	299°23.9	N00°03.7
13	140°07.2	344°05.1	35.6	43°22.6	52.5	314°39.5	02.8	314°26.2	03.6
14	155°09.7	359°04.7	34.5	58°23.2	52.4	329°41.6	03.0	329°28.5	03.5
15	170°12.1	14°04.3	·· 33.4	73°23.9	·· 52.4	344°43.7	·· 03.1	344°30.7	·· 03.4
16	185°14.6	29°04.0	32.2	88°24.5	52.3	359°45.8	03.3	359°33.0	03.3
17	200°17.1	44°03.6	31.1	103°25.1	52.3	14°48.0	03.4	14°35.3	03.3
18	215°19.5	59°03.2	N11°29.9	118°25.8	N23°52.2	29°50.1	S01°03.6	29°37.6	N00°03.2
19	230°22.0	74°02.8	28.8	133°26.4	52.2	44°52.2	03.7	44°39.9	03.1
20	245°24.5	89°02.4	27.6	148°27.0	52.1	59°54.3	03.9	59°42.2	03.0
21	260°26.9	104°02.0	·· 26.5	163°27.7	·· 52.1	74°56.4	·· 04.1	74°44.5	·· 02.9
22	275°29.4	119°01.7	25.4	178°28.3	52.0	89°58.6	04.2	89°46.7	02.8
23	290°31.8	134°01.3	24.2	193°29.0	51.9	105°00.7	04.4	104°49.0	02.7
Mer.pass. 03:41		ν -0.4′	d 1.1′	m -3.93	ν 0.6′	d 0.0′	m 1.58	ν 2.1′	d 0.2′ m -1.82	ν 2.3′	d 0.1′ m 0.94

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	305°34.3	149°00.9	N11°23.1	208°29.6	N23°51.9	120°02.8	S01°04.5	119°51.3	N00°02.7
1	320°36.8	164°00.5	21.9	223°30.2	51.8	135°04.9	04.7	134°53.6	02.6
2	335°39.2	179°00.1	20.8	238°30.9	51.8	150°07.0	04.8	149°55.9	02.5
3	350°41.7	193°59.8	·· 19.6	253°31.5	·· 51.7	165°09.2	·· 05.0	164°58.2	·· 02.4
4	5°44.2	208°59.4	18.5	268°32.2	51.7	180°11.3	05.1	180°00.4	02.3
5	20°46.6	223°59.0	17.3	283°32.8	51.6	195°13.4	05.3	195°02.7	02.2
6	35°49.1	238°58.6	N11°16.2	298°33.4	N23°51.5	210°15.5	S01°05.5	210°05.0	N00°02.1
7	50°51.6	253°58.3	15.0	313°34.1	51.5	225°17.6	05.6	225°07.3	02.1
8	65°54.0	268°57.9	13.9	328°34.7	51.4	240°19.8	05.8	240°09.6	02.0
9	80°56.5	283°57.5	·· 12.8	343°35.4	·· 51.4	255°21.9	·· 05.9	255°11.9	·· 01.9
10	95°59.0	298°57.1	11.6	358°36.0	51.3	270°24.0	06.1	270°14.1	01.8
11	111°01.4	313°56.7	10.5	13°36.6	51.3	285°26.1	06.2	285°16.4	01.7
12	126°03.9	328°56.4	N11°09.3	28°37.3	N23°51.2	300°28.2	S01°06.4	300°18.7	N00°01.6
13	141°06.3	343°56.0	08.2	43°37.9	51.1	315°30.4	06.6	315°21.0	01.5
14	156°08.8	358°55.6	07.0	58°38.6	51.1	330°32.5	06.7	330°23.3	01.5
15	171°11.3	13°55.3	·· 05.8	73°39.2	·· 51.0	345°34.6	·· 06.9	345°25.6	·· 01.4
16	186°13.7	28°54.9	04.7	88°39.8	51.0	0°36.7	07.0	0°27.8	01.3
17	201°16.2	43°54.5	03.5	103°40.5	50.9	15°38.8	07.2	15°30.1	01.2
18	216°18.7	58°54.1	N11°02.4	118°41.1	N23°50.8	30°40.9	S01°07.3	30°32.4	N00°01.1
19	231°21.1	73°53.8	01.2	133°41.8	50.8	45°43.1	07.5	45°34.7	01.0
20	246°23.6	88°53.4	11°00.1	148°42.4	50.7	60°45.2	07.7	60°37.0	00.9
21	261°26.1	103°53.0	10°58.9	163°43.0	·· 50.6	75°47.3	·· 07.8	75°39.2	·· 00.9
22	276°28.5	118°52.6	57.8	178°43.7	50.6	90°49.4	08.0	90°41.5	00.8
23	291°31.0	133°52.3	56.6	193°44.3	50.5	105°51.5	08.1	105°43.8	00.7
Mer.pass. 03:37		ν -0.4′	d 1.1′	m -3.93	ν 0.6′	d 0.1′	m 1.58	ν 2.1′	d 0.2′ m -1.82	ν 2.3′	d 0.1′ m 0.94

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	306°33.5	148°51.9	N10°55.5	208°45.0	N23°50.5	120°53.6	S01°08.3	120°46.1	N00°00.6
1	321°35.9	163°51.5	54.3	223°45.6	50.4	135°55.8	08.4	135°48.4	00.5
2	336°38.4	178°51.2	53.1	238°46.2	50.3	150°57.9	08.6	150°50.7	00.4
3	351°40.8	193°50.8	·· 52.0	253°46.9	·· 50.3	166°00.0	·· 08.8	165°52.9	·· 00.3
4	6°43.3	208°50.4	50.8	268°47.5	50.2	181°02.1	08.9	180°55.2	00.2
5	21°45.8	223°50.1	49.7	283°48.2	50.1	196°04.2	09.1	195°57.5	00.2
6	36°48.2	238°49.7	N10°48.5	298°48.8	N23°50.1	211°06.3	S01°09.2	210°59.8	N00°00.1
7	51°50.7	253°49.3	47.4	313°49.5	50.0	226°08.5	09.4	226°02.1	S00°00.0
8	66°53.2	268°49.0	46.2	328°50.1	49.9	241°10.6	09.6	241°04.3	00.1
9	81°55.6	283°48.6	·· 45.0	343°50.7	·· 49.9	256°12.7	·· 09.7	256°06.6	·· 00.2
10	96°58.1	298°48.2	43.9	358°51.4	49.8	271°14.8	09.9	271°08.9	00.3
11	112°00.6	313°47.9	42.7	13°52.0	49.7	286°16.9	10.0	286°11.2	00.4
12	127°03.0	328°47.5	N10°41.6	28°52.7	N23°49.7	301°19.0	S01°10.2	301°13.5	S00°00.5
13	142°05.5	343°47.1	40.4	43°53.3	49.6	316°21.1	10.3	316°15.7	00.5
14	157°08.0	358°46.8	39.2	58°54.0	49.5	331°23.3	10.5	331°18.0	00.6
15	172°10.4	13°46.4	·· 38.1	73°54.6	·· 49.5	346°25.4	·· 10.7	346°20.3	·· 00.7
16	187°12.9	28°46.0	36.9	88°55.3	49.4	1°27.5	10.8	1°22.6	00.8
17	202°15.3	43°45.7	35.7	103°55.9	49.3	16°29.6	11.0	16°24.9	00.9
18	217°17.8	58°45.3	N10°34.6	118°56.5	N23°49.3	31°31.7	S01°11.1	31°27.1	S00°01.0
19	232°20.3	73°45.0	33.4	133°57.2	49.2	46°33.8	11.3	46°29.4	01.1
20	247°22.7	88°44.6	32.2	148°57.8	49.1	61°35.9	11.5	61°31.7	01.2
21	262°25.2	103°44.2	·· 31.1	163°58.5	·· 49.0	76°38.1	·· 11.6	76°34.0	·· 01.2
22	277°27.7	118°43.9	29.9	178°59.1	49.0	91°40.2	11.8	91°36.2	01.3
23	292°30.1	133°43.5	28.7	193°59.8	48.9	106°42.3	11.9	106°38.5	01.4
Mer.pass. 03:33		ν -0.4′	d 1.2′	m -3.93	ν 0.6′	d 0.1′	m 1.59	ν 2.1′	d 0.2′ m -1.81	ν 2.3′	d 0.1′ m 0.94

Stars

	SHA	Dec
Alpheratz	358°08.5	28°59.2
Ankaa	353°39.4	-42°24.2
Schedar	350°08.1	56°25.9
Diphda	349°20.1	-18°05.2
Achernar	335°44.7	-57°19.6
Hamal	328°28.2	23°22.4
Polaris	326°41.1	89°10.4
Acamar	315°36.9	-40°22.5
Menkar	314°40.6	4°01.0
Mirfak	309°15.4	49°47.5
Aldebaran	291°17.5	16°28.3
Rigel	281°35.7	-8°13.3
Capella	281°10.7	45°58.6
Bellatrix	278°58.3	6°20.0
Elnath	278°43.6	28°35.4
Alnilam	276°11.3	-1°12.8
Betelgeuse	271°27.9	7°24.2
Canopus	264°07.4	-52°41.0
Sirius	258°55.4	-16°41.3
Adhara	255°32.0	-28°56.7
Procyon	245°25.5	5°16.4
Pollux	243°57.8	28°04.3
Avior	234°28.6	-59°27.0
Suhail	223°10.8	-43°21.5
Miaplacidus	221°45.8	-69°38.5
Alphard	218°20.3	-8°34.6
Regulus	208°09.7	12°03.6
Dubhe	194°21.9	61°51.3
Denebola	182°58.6	14°40.7
Gienah	176°17.5	-17°26.3
Acrux	173°36.9	-63°00.0
Gacrux	172°28.3	-57°00.7
Alioth	166°42.2	56°04.0
Spica	158°57.0	-11°03.8
Alkaid	153°18.1	49°24.7
Hadar	149°22.5	-60°17.2
Menkent	148°36.3	-36°16.8
Arcturus	146°17.9	19°17.0
Rigil Kent.	140°24.9	-60°45.6
Kochab	137°18.8	74°14.3
Zuben'ubi	137°32.3	-15°57.8
Alphecca	126°31.5	26°46.9
Antares	112°55.9	-26°23.5
Atria	108°19.3	-68°59.8
Sabik	102°40.2	-15°42.1
Shaula	96°54.6	-37°05.5
Rasalhague	96°28.8	12°34.6
Eltanin	90°57.0	51°29.7
Kaus Aust.	84°15.7	-34°23.6
Vega	80°55.0	38°46.2
Nunki	76°28.1	-26°19.2
Altair	62°31.6	8°49.2
Peacock	53°56.8	-56°47.6
Deneb	49°47.6	45°12.9
Enif	34°10.7	9°47.4
Al Na'ir	28°13.8	-47°02.9
Fomalhaut	15°50.5	-29°43.1
Scheat	14°16.7	27°58.9
Markab	14°02.3	15°06.3

Jul 27 Mon	SHA	Mer.pass
Venus	204°35.0	14:04
Mars	263°39.1	10:07
Jupiter	174°36.7	16:01
Saturn	174°21.3	16:02

Jul 28 Tue	SHA	Mer.pass
Venus	203°26.6	14:04
Mars	262°55.3	10:06
Jupiter	174°28.5	15:58
Saturn	174°17.0	15:58

Jul 29 Wed	SHA	Mer.pass
Venus	202°18.5	14:05
Mars	262°11.5	10:05
Jupiter	174°20.2	15:54
Saturn	174°12.6	15:55

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°23.6	N19°17.1	237°02.2	6.5′	N17°33.4	7.4′	59.6′
1	193°23.6	16.6	251°27.7	6.4′	17°40.8	7.3′	59.6′
2	208°23.6	16.0	265°53.2	6.4′	17°48.1	7.1′	59.6′
3	223°23.6	·· 15.4	280°18.5	6.3′	17°55.2	7.1′	59.6′
4	238°23.6	14.9	294°43.9	6.3′	18°02.3	6.9′	59.6′
5	253°23.6	14.3	309°09.2	6.2′	18°09.2	6.8′	59.6′
6	268°23.6	N19°13.7	323°34.4	6.2′	N18°16.0	6.7′	59.6′
7	283°23.6	13.2	337°59.6	6.1′	18°22.7	6.5′	59.6′
8	298°23.6	12.6	352°24.7	6.1′	18°29.2	6.5′	59.6′
9	313°23.6	·· 12.0	6°49.8	6.0′	18°35.7	6.3′	59.6′
10	328°23.6	11.5	21°14.8	6.0′	18°42.0	6.2′	59.6′
11	343°23.6	10.9	35°39.8	5.9′	18°48.2	6.1′	59.6′
12	358°23.6	N19°10.3	50°04.7	5.9′	N18°54.3	5.9′	59.6′
13	13°23.6	09.8	64°29.6	5.8′	19°00.2	5.8′	59.6′
14	28°23.7	09.2	78°54.4	5.8′	19°06.0	5.7′	59.6′
15	43°23.7	·· 08.6	93°19.2	5.7′	19°11.7	5.6′	59.6′
16	58°23.7	08.1	107°44.0	5.7′	19°17.3	5.4′	59.6′
17	73°23.7	07.5	122°08.7	5.7′	19°22.7	5.3′	59.6′
18	88°23.7	N19°06.9	136°33.3	5.6′	N19°28.0	5.2′	59.6′
19	103°23.7	06.3	150°57.9	5.6′	19°33.2	5.0′	59.6′
20	118°23.7	05.8	165°22.5	5.5′	19°38.2	4.9′	59.6′
21	133°23.7	·· 05.2	179°47.1	5.5′	19°43.1	4.8′	59.6′
22	148°23.7	04.6	194°11.6	5.5′	19°47.9	4.6′	59.6′
23	163°23.7	04.1	208°36.1	5.4′	19°52.5	4.6′	59.6′
	SD = 15.7′	d = 0.6′	SD = 16.3′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°23.7	N19°03.5	223°00.5	5.4′	N19°57.1	4.3′	59.6′
1	193°23.7	02.9	237°24.9	5.4′	20°01.4	4.3′	59.6′
2	208°23.8	02.3	251°49.3	5.3′	20°05.7	4.1′	59.6′
3	223°23.8	·· 01.8	266°13.6	5.3′	20°09.8	3.9′	59.6′
4	238°23.8	01.2	280°37.9	5.3′	20°13.7	3.8′	59.6′
5	253°23.8	00.6	295°02.2	5.3′	20°17.5	3.7′	59.6′
6	268°23.8	N19°00.0	309°26.5	5.2′	N20°21.2	3.6′	59.6′
7	283°23.8	18°59.4	323°50.7	5.2′	20°24.8	3.4′	59.6′
8	298°23.8	58.9	338°14.9	5.2′	20°28.2	3.2′	59.6′
9	313°23.8	·· 58.3	352°39.1	5.2′	20°31.4	3.2′	59.6′
10	328°23.8	57.7	7°03.3	5.1′	20°34.6	3.0′	59.5′
11	343°23.9	57.1	21°27.4	5.1′	20°37.6	2.8′	59.5′
12	358°23.9	N18°56.5	35°51.6	5.1′	N20°40.4	2.7′	59.5′
13	13°23.9	56.0	50°15.7	5.1′	20°43.1	2.6′	59.5′
14	28°23.9	55.4	64°39.8	5.1′	20°45.7	2.4′	59.5′
15	43°23.9	·· 54.8	79°03.9	5.1′	20°48.1	2.3′	59.5′
16	58°23.9	54.2	93°27.9	5.1′	20°50.4	2.1′	59.5′
17	73°23.9	53.6	107°52.0	5.1′	20°52.5	2.0′	59.5′
18	88°23.9	N18°53.1	122°16.1	5.1′	N20°54.5	1.8′	59.5′
19	103°24.0	52.5	136°40.1	5.0′	20°56.3	1.7′	59.5′
20	118°24.0	51.9	151°04.2	5.0′	20°58.0	1.6′	59.5′
21	133°24.0	·· 51.3	165°28.2	5.0′	20°59.6	1.4′	59.5′
22	148°24.0	50.7	179°52.3	5.0′	21°01.0	1.3′	59.4′
23	163°24.0	50.1	194°16.3	5.0′	21°02.3	1.1′	59.4′
	SD = 15.7′	d = 0.6′	SD = 16.3′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°24.0	N18°49.5	208°40.3	5.0′	N21°03.4	1.0′	59.4′
1	193°24.1	49.0	223°04.4	5.0′	21°04.4	0.8′	59.4′
2	208°24.1	48.4	237°28.4	5.1′	21°05.2	0.7′	59.4′
3	223°24.1	·· 47.8	251°52.5	5.1′	21°05.9	0.5′	59.4′
4	238°24.1	47.2	266°16.5	5.1′	21°06.4	0.4′	59.4′
5	253°24.1	46.6	280°40.6	5.1′	21°06.8	0.3′	59.4′
6	268°24.1	N18°46.0	295°04.7	5.1′	N21°07.1	0.1′	59.3′
7	283°24.2	45.4	309°28.8	5.1′	21°07.2	0.0′	59.3′
8	298°24.2	44.8	323°52.9	5.1′	21°07.2	0.2′	59.3′
9	313°24.2	·· 44.2	338°17.0	5.1′	21°07.0	0.3′	59.3′
10	328°24.2	43.6	352°41.2	5.2′	21°06.7	0.5′	59.3′
11	343°24.2	43.0	7°05.3	5.2′	21°06.2	0.6′	59.3′
12	358°24.2	N18°42.4	21°29.5	5.2′	N21°05.6	0.7′	59.3′
13	13°24.3	41.9	35°53.7	5.2′	21°04.9	0.9′	59.3′
14	28°24.3	41.3	50°18.0	5.3′	21°04.0	1.0′	59.2′
15	43°24.3	·· 40.7	64°42.2	5.3′	21°03.0	1.2′	59.2′
16	58°24.3	40.1	79°06.5	5.3′	21°01.8	1.3′	59.2′
17	73°24.3	39.5	93°30.8	5.3′	21°00.5	1.5′	59.2′
18	88°24.4	N18°38.9	107°55.2	5.4′	N20°59.0	1.6′	59.2′
19	103°24.4	38.3	122°19.6	5.4′	20°57.4	1.7′	59.2′
20	118°24.4	37.7	136°44.0	5.4′	20°55.7	1.9′	59.1′
21	133°24.4	·· 37.1	151°08.4	5.5′	20°53.8	2.0′	59.1′
22	148°24.4	36.5	165°32.9	5.5′	20°51.8	2.1′	59.1′
23	163°24.5	35.9	179°57.4	5.6′	20°49.7	2.3′	59.1′
	SD = 15.7′	d = 0.6′	SD = 16.2′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	▭	▭	▭	▭	▭	▭
N 70°	////	////	00:32	23:23	////	////
68°	////	////	01:52	22:16	////	////
66°	////	////	02:29	21:41	////	////
64°	////	01:11	02:55	21:16	22:55	////
62°	////	01:58	03:15	20:56	22:12	////
60°	////	02:27	03:31	20:40	21:44	////
N 58°	01:05	02:48	03:44	20:27	21:22	23:02
56°	01:47	03:06	03:56	20:15	21:05	22:22
54°	02:14	03:20	04:06	20:05	20:51	21:56
52°	02:34	03:33	04:15	19:57	20:39	21:37
50°	02:51	03:44	04:23	19:49	20:28	21:20
45°	03:22	04:06	04:40	19:32	20:06	20:49
N 40°	03:46	04:24	04:54	19:18	19:48	20:26
35°	04:04	04:38	05:06	19:06	19:34	20:08
30°	04:19	04:50	05:16	18:56	19:22	19:54
20°	04:42	05:10	05:34	18:39	19:02	19:30
N 10°	05:00	05:27	05:49	18:24	18:46	19:12
0°	05:16	05:41	06:03	18:10	18:32	18:57
S 10°	05:29	05:55	06:17	17:56	18:18	18:44
20°	05:41	06:08	06:31	17:42	18:05	18:32
30°	05:54	06:23	06:48	17:25	17:50	18:19
35°	06:00	06:31	06:58	17:15	17:42	18:13
40°	06:07	06:40	07:09	17:04	17:34	18:06
45°	06:14	06:50	07:22	16:52	17:24	17:59
S 50°	06:22	07:02	07:37	16:36	17:12	17:51
52°	06:26	07:07	07:45	16:29	17:06	17:48
54°	06:29	07:13	07:53	16:21	17:01	17:44
56°	06:33	07:19	08:02	16:12	16:54	17:40
58°	06:38	07:26	08:12	16:01	16:47	17:36
S 60°	06:42	07:34	08:24	15:49	16:39	17:31

Lat.	**Moonrise** Mon	Tue	Wed	**Moonset** Mon	Tue	Wed
N 72°	▭	▭	▭	▭	▭	▭
N 70°	21:49	▭	▭	20:05	▭	▭
68°	22:55	23:20	·· ··	18:59	20:39	21:35
66°	23:32	·· ··	00:09	18:23	19:50	20:48
64°	23:58	·· ··	00:41	17:57	19:19	20:18
62°	·· ··	00:18	01:04	17:37	18:55	19:55
60°	00:00	00:35	01:23	17:21	18:37	19:36
N 58°	00:12	00:49	01:38	17:07	18:21	19:21
56°	00:22	01:01	01:52	16:56	18:08	19:08
54°	00:31	01:12	02:03	16:45	17:56	18:57
52°	00:38	01:21	02:14	16:36	17:46	18:46
50°	00:46	01:29	02:23	16:28	17:37	18:37
45°	01:01	01:47	02:42	16:11	17:18	18:18
N 40°	01:13	02:02	02:58	15:56	17:02	18:03
35°	01:24	02:15	03:11	15:44	16:49	17:49
30°	01:34	02:26	03:23	15:34	16:38	17:38
20°	01:50	02:45	03:43	15:16	16:18	17:18
N 10°	02:04	03:01	04:00	15:00	16:01	17:01
0°	02:18	03:16	04:16	14:45	15:45	16:45
S 10°	02:31	03:32	04:32	14:31	15:29	16:28
20°	02:46	03:49	04:50	14:15	15:12	16:11
30°	03:03	04:08	05:10	13:57	14:52	15:51
35°	03:12	04:19	05:22	13:47	14:40	15:39
40°	03:24	04:32	05:35	13:35	14:27	15:26
45°	03:37	04:47	05:51	13:21	14:12	15:10
S 50°	03:53	05:06	06:11	13:04	13:52	14:50
52°	04:01	05:15	06:20	12:56	13:43	14:41
54°	04:09	05:25	06:31	12:47	13:33	14:31
56°	04:19	05:36	06:43	12:37	13:22	14:19
58°	04:30	05:49	06:56	12:26	13:09	14:05
S 60°	04:42	06:04	07:12	12:13	12:53	13:49

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 26-28 22-6%
27	06:26	06:25	12:06	08:32	21:01	
28	06:25	06:25	12:06	09:31	22:01	
29	06:24	06:23	12:06	10:30	23:00	

July 30, 31, 01 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	307°32.6	148°43.2	N10°27.6	209°00.4	N23°48.8	121°44.4	S01°12.1	121°40.8	S00°01.5
1	322°35.1	163°42.8	26.4	224°01.1	48.8	136°46.5	12.3	136°43.1	01.6
2	337°37.5	178°42.4	25.2	239°01.7	48.7	151°48.6	12.4	151°45.4	01.7
3	352°40.0	193°42.1	·· 24.1	254°02.3	·· 48.6	166°50.7	·· 12.6	166°47.6	·· 01.8
4	7°42.5	208°41.7	22.9	269°03.0	48.5	181°52.8	12.7	181°49.9	01.9
5	22°44.9	223°41.4	21.7	284°03.6	48.5	196°55.0	12.9	196°52.2	01.9
6	37°47.4	238°41.0	N10°20.6	299°04.3	N23°48.4	211°57.1	S01°13.1	211°54.5	S00°02.0
7	52°49.8	253°40.7	19.4	314°04.9	48.3	226°59.2	13.2	226°56.7	02.1
8	67°52.3	268°40.3	18.2	329°05.6	48.2	242°01.3	13.4	241°59.0	02.2
9	82°54.8	283°39.9	·· 17.0	344°06.2	·· 48.2	257°03.4	·· 13.5	257°01.3	·· 02.3
10	97°57.2	298°39.6	15.9	359°06.9	48.1	272°05.5	13.7	272°03.6	02.4
11	112°59.7	313°39.2	14.7	14°07.5	48.0	287°07.6	13.9	287°05.9	02.5
12	128°02.2	328°38.9	N10°13.5	29°08.2	N23°47.9	302°09.7	S01°14.0	302°08.1	S00°02.6
13	143°04.6	343°38.5	12.4	44°08.8	47.9	317°11.8	14.2	317°10.4	02.7
14	158°07.1	358°38.2	11.2	59°09.5	47.8	332°14.0	14.3	332°12.7	02.7
15	173°09.6	13°37.8	·· 10.0	74°10.1	·· 47.7	347°16.1	·· 14.5	347°15.0	·· 02.8
16	188°12.0	28°37.5	08.8	89°10.7	47.6	2°18.2	14.7	2°17.2	02.9
17	203°14.5	43°37.1	07.7	104°11.4	47.6	17°20.3	14.8	17°19.5	03.0
18	218°17.0	58°36.8	N10°06.5	119°12.0	N23°47.5	32°22.4	S01°15.0	32°21.8	S00°03.1
19	233°19.4	73°36.4	05.3	134°12.7	47.4	47°24.5	15.1	47°24.1	03.2
20	248°21.9	88°36.1	04.1	149°13.3	47.3	62°26.6	15.3	62°26.3	03.3
21	263°24.3	103°35.7	·· 03.0	164°14.0	·· 47.2	77°28.7	·· 15.5	77°28.6	·· 03.4
22	278°26.8	118°35.4	01.8	179°14.6	47.2	92°30.8	15.6	92°30.9	03.5
23	293°29.3	133°35.0	00.6	194°15.3	47.1	107°32.9	15.8	107°33.2	03.5
Mer.pass.	03:29	ν -0.4′	d 1.2′	m -3.93	ν 0.6′	d 0.1′	m 1.59	ν 2.1′	d 0.2′ m -1.81	ν 2.3′	d 0.1′ m 0.94

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	308°31.7	148°34.7	N09°59.4	209°15.9	N23°47.0	122°35.0	S01°15.9	122°35.5	S00°03.6
1	323°34.2	163°34.3	58.2	224°16.6	46.9	137°37.2	16.1	137°37.7	03.7
2	338°36.7	178°34.0	57.1	239°17.2	46.8	152°39.3	16.3	152°40.0	03.8
3	353°39.1	193°33.6	·· 55.9	254°17.9	·· 46.8	167°41.4	·· 16.4	167°42.3	·· 03.9
4	8°41.6	208°33.3	54.7	269°18.5	46.7	182°43.5	16.6	182°44.6	04.0
5	23°44.1	223°32.9	53.5	284°19.2	46.6	197°45.6	16.7	197°46.8	04.1
6	38°46.5	238°32.6	N09°52.3	299°19.8	N23°46.5	212°47.7	S01°16.9	212°49.1	S00°04.2
7	53°49.0	253°32.2	51.2	314°20.5	46.4	227°49.8	17.1	227°51.4	04.3
8	68°51.4	268°31.9	50.0	329°21.1	46.3	242°51.9	17.2	242°53.7	04.3
9	83°53.9	283°31.5	·· 48.8	344°21.8	·· 46.3	257°54.0	·· 17.4	257°55.9	·· 04.4
10	98°56.4	298°31.2	47.6	359°22.4	46.2	272°56.1	17.5	272°58.2	04.5
11	113°58.8	313°30.8	46.4	14°23.1	46.1	287°58.2	17.7	288°00.5	04.6
12	129°01.3	328°30.5	N09°45.3	29°23.7	N23°46.0	303°00.3	S01°17.9	303°02.8	S00°04.7
13	144°03.8	343°30.2	44.1	44°24.4	45.9	318°02.4	18.0	318°05.0	04.8
14	159°06.2	358°29.8	42.9	59°25.0	45.8	333°04.5	18.2	333°07.3	04.9
15	174°08.7	13°29.5	·· 41.7	74°25.7	·· 45.8	348°06.7	·· 18.4	348°09.6	·· 05.0
16	189°11.2	28°29.1	40.5	89°26.3	45.7	3°08.8	18.5	3°11.8	05.1
17	204°13.6	43°28.8	39.3	104°27.0	45.6	18°10.9	18.7	18°14.1	05.1
18	219°16.1	58°28.4	N09°38.1	119°27.6	N23°45.5	33°13.0	S01°18.8	33°16.4	S00°05.2
19	234°18.6	73°28.1	37.0	134°28.3	45.4	48°15.1	19.0	48°18.7	05.3
20	249°21.0	88°27.8	35.8	149°28.9	45.3	63°17.2	19.2	63°20.9	05.4
21	264°23.5	103°27.4	·· 34.6	164°29.6	·· 45.2	78°19.3	·· 19.3	78°23.2	·· 05.5
22	279°25.9	118°27.1	33.4	179°30.2	45.2	93°21.4	19.5	93°25.5	05.6
23	294°28.4	133°26.7	32.2	194°30.9	45.1	108°23.5	19.7	108°27.8	05.7
Mer.pass.	03:25	ν -0.3′	d 1.2′	m -3.93	ν 0.6′	d 0.1′	m 1.59	ν 2.1′	d 0.2′ m -1.81	ν 2.3′	d 0.1′ m 0.94

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	309°30.9	148°26.4	N09°31.0	209°31.5	N23°45.0	123°25.6	S01°19.8	123°30.0	S00°05.8
1	324°33.3	163°26.1	29.8	224°32.2	44.9	138°27.7	20.0	138°32.3	05.9
2	339°35.8	178°25.7	28.6	239°32.8	44.8	153°29.8	20.1	153°34.6	06.0
3	354°38.3	193°25.4	·· 27.5	254°33.5	·· 44.7	168°31.9	·· 20.3	168°36.9	·· 06.0
4	9°40.7	208°25.0	26.3	269°34.1	44.6	183°34.0	20.5	183°39.1	06.1
5	24°43.2	223°24.7	25.1	284°34.8	44.5	198°36.1	20.6	198°41.4	06.2
6	39°45.7	238°24.4	N09°23.9	299°35.4	N23°44.4	213°38.2	S01°20.8	213°43.7	S00°06.3
7	54°48.1	253°24.0	22.7	314°36.1	44.4	228°40.3	21.0	228°45.9	06.4
8	69°50.6	268°23.7	21.5	329°36.7	44.3	243°42.4	21.1	243°48.2	06.5
9	84°53.1	283°23.4	·· 20.3	344°37.4	·· 44.2	258°44.5	·· 21.3	258°50.5	·· 06.6
10	99°55.5	298°23.0	19.1	359°38.1	44.1	273°46.6	21.4	273°52.8	06.7
11	114°58.0	313°22.7	17.9	14°38.7	44.0	288°48.7	21.6	288°55.0	06.8
12	130°00.4	328°22.3	N09°16.7	29°39.4	N23°43.9	303°50.8	S01°21.8	303°57.3	S00°06.9
13	145°02.9	343°22.0	15.5	44°40.0	43.8	318°53.0	21.9	318°59.6	07.0
14	160°05.4	358°21.7	14.3	59°40.7	43.7	333°55.1	22.1	334°01.8	07.0
15	175°07.8	13°21.3	·· 13.1	74°41.3	·· 43.6	348°57.2	·· 22.3	349°04.1	·· 07.1
16	190°10.3	28°21.0	12.0	89°42.0	43.5	3°59.3	22.4	4°06.4	07.2
17	205°12.8	43°20.7	10.8	104°42.6	43.4	19°01.4	22.6	19°08.7	07.3
18	220°15.2	58°20.3	N09°09.6	119°43.3	N23°43.3	34°03.5	S01°22.7	34°10.9	S00°07.4
19	235°17.7	73°20.0	08.4	134°43.9	43.2	49°05.6	22.9	49°13.2	07.5
20	250°20.2	88°19.7	07.2	149°44.6	43.1	64°07.7	23.1	64°15.5	07.6
21	265°22.6	103°19.3	·· 06.0	164°45.2	·· 43.1	79°09.8	·· 23.2	79°17.7	·· 07.7
22	280°25.1	118°19.0	04.8	179°45.9	43.0	94°11.9	23.4	94°20.0	07.8
23	295°27.5	133°18.7	03.6	194°46.6	42.9	109°14.0	23.6	109°22.3	07.9
Mer.pass.	03:21	ν -0.3′	d 1.2′	m -3.93	ν 0.7′	d 0.1′	m 1.59	ν 2.1′	d 0.2′ m -1.80	ν 2.3′	d 0.1′ m 0.94

Stars

	SHA	Dec
Alpheratz	358°08.5	28°59.2
Ankaa	353°39.4	-42°24.2
Schedar	350°08.0	56°25.9
Diphda	349°20.1	-18°05.2
Achernar	335°44.7	-57°19.6
Hamal	328°28.2	23°22.4
Polaris	326°39.9	89°10.4
Acamar	315°36.8	-40°22.5
Menkar	314°40.5	4°01.0
Mirfak	309°15.3	49°47.5
Aldebaran	291°17.5	16°28.3
Rigel	281°35.6	-8°13.3
Capella	281°10.7	45°58.6
Bellatrix	278°58.3	6°20.0
Elnath	278°43.6	28°35.5
Alnilam	276°11.3	-1°12.8
Betelgeuse	271°27.9	7°24.2
Canopus	264°07.4	-52°41.0
Sirius	258°55.4	-16°41.3
Adhara	255°32.0	-28°56.7
Procyon	245°25.5	5°16.4
Pollux	243°57.8	28°04.3
Avior	234°28.6	-59°27.0
Suhail	223°10.8	-43°21.4
Miaplacidus	221°45.8	-69°38.5
Alphard	218°20.3	-8°34.6
Regulus	208°09.6	12°03.6
Dubhe	194°21.9	61°51.3
Denebola	182°58.6	14°40.7
Gienah	176°17.5	-17°26.3
Acrux	173°37.0	-62°59.9
Gacrux	172°28.3	-57°00.7
Alioth	166°42.2	56°04.0
Spica	158°57.0	-11°03.8
Alkaid	153°18.1	49°24.7
Hadar	149°22.5	-60°17.2
Menkent	148°36.3	-36°16.8
Arcturus	146°17.9	19°17.0
Rigil Kent.	140°24.9	-60°45.6
Kochab	137°18.9	74°14.3
Zuben'ubi	137°32.3	-15°57.8
Alphecca	126°31.5	26°46.9
Antares	112°55.9	-26°23.5
Atria	108°19.3	-68°59.9
Sabik	102°40.2	-15°42.1
Shaula	96°54.6	-37°05.5
Rasalhague	96°28.8	12°34.6
Eltanin	90°57.0	51°29.7
Kaus Aust.	84°15.7	-34°23.6
Vega	80°55.0	38°46.2
Nunki	76°28.1	-26°19.2
Altair	62°31.6	8°49.3
Peacock	53°56.8	-56°47.7
Deneb	49°47.6	45°12.9
Enif	34°10.7	9°47.4
Al Na'ir	28°13.7	-47°02.9
Fomalhaut	15°50.4	-29°43.1
Scheat	14°16.7	27°58.9
Markab	14°02.3	15°06.3

Jul 30 Thu	SHA	Mer.pass
Venus	201°10.6	14:05
Mars	261°27.8	10:04
Jupiter	174°11.8	15:51
Saturn	174°08.2	15:51

Jul 31 Fri	SHA	Mer.pass
Venus	200°02.9	14:06
Mars	260°44.2	10:03
Jupiter	174°03.3	15:47
Saturn	174°03.7	15:47

Aug 01 Sat	SHA	Mer.pass
Venus	198°55.5	14:07
Mars	260°00.7	10:01
Jupiter	173°54.7	15:44
Saturn	173°59.2	15:44

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h

	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°24.5	N18°35.3	194°22.0	5.6′	N20°47.4	2.5′	59.1′
1	193°24.5	34.7	208°46.6	5.6′	20°44.9	2.5′	59.1′
2	208°24.5	34.1	223°11.3	5.7′	20°42.4	2.7′	59.0′
3	223°24.6	·· 33.5	237°35.9	5.7′	20°39.7	2.9′	59.0′
4	238°24.6	32.9	252°00.7	5.8′	20°36.8	2.9′	59.0′
5	253°24.6	32.3	266°25.5	5.8′	20°33.9	3.1′	59.0′
6	268°24.6	N18°31.7	280°50.3	5.9′	N20°30.8	3.3′	59.0′
7	283°24.6	31.1	295°15.2	5.9′	20°27.5	3.3′	58.9′
8	298°24.7	30.5	309°40.1	6.0′	20°24.2	3.5′	58.9′
9	313°24.7	·· 29.9	324°05.1	6.0′	20°20.7	3.7′	58.9′
10	328°24.7	29.3	338°30.2	6.1′	20°17.0	3.7′	58.9′
11	343°24.7	28.6	352°55.3	6.2′	20°13.3	3.9′	58.9′
12	358°24.8	N18°28.0	7°20.4	6.2′	N20°09.4	4.0′	58.8′
13	13°24.8	27.4	21°45.6	6.3′	20°05.4	4.2′	58.8′
14	28°24.8	26.8	36°10.9	6.3′	20°01.2	4.2′	58.8′
15	43°24.8	·· 26.2	50°36.2	6.4′	19°57.0	4.4′	58.8′
16	58°24.9	25.6	65°01.6	6.5′	19°52.6	4.6′	58.7′
17	73°24.9	25.0	79°27.1	6.5′	19°48.0	4.6′	58.7′
18	88°24.9	N18°24.4	93°52.6	6.6′	N19°43.4	4.8′	58.7′
19	103°24.9	23.8	108°18.2	6.6′	19°38.6	4.9′	58.7′
20	118°25.0	23.2	122°43.8	6.7′	19°33.7	5.0′	58.7′
21	133°25.0	·· 22.6	137°09.5	6.8′	19°28.7	5.1′	58.6′
22	148°25.0	21.9	151°35.3	6.8′	19°23.6	5.2′	58.6′
23	163°25.1	21.3	166°01.1	6.9′	19°18.4	5.4′	58.6′
	SD = 15.7′	d = 0.6′	SD = 16.1′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°25.1	N18°20.7	180°27.1	7.0′	N19°13.0	5.5′	58.6′
1	193°25.1	20.1	194°53.0	7.1′	19°07.5	5.6′	58.5′
2	208°25.1	19.5	209°19.1	7.1′	19°01.9	5.7′	58.5′
3	223°25.2	·· 18.9	223°45.2	7.2′	18°56.2	5.8′	58.5′
4	238°25.2	18.3	238°11.4	7.3′	18°50.4	5.9′	58.5′
5	253°25.2	17.7	252°37.7	7.3′	18°44.5	6.1′	58.4′
6	268°25.3	N18°17.0	267°04.1	7.4′	N18°38.4	6.1′	58.4′
7	283°25.3	16.4	281°30.5	7.5′	18°32.3	6.3′	58.4′
8	298°25.3	15.8	295°57.0	7.6′	18°26.0	6.4′	58.4′
9	313°25.3	·· 15.2	310°23.5	7.6′	18°19.6	6.4′	58.3′
10	328°25.4	14.6	324°50.2	7.7′	18°13.2	6.6′	58.3′
11	343°25.4	14.0	339°16.9	7.8′	18°06.6	6.7′	58.3′
12	358°25.4	N18°13.3	353°43.7	7.9′	N17°59.9	6.8′	58.3′
13	13°25.5	12.7	8°10.6	8.0′	17°53.1	6.9′	58.2′
14	28°25.5	12.1	22°37.6	8.0′	17°46.2	6.9′	58.2′
15	43°25.5	·· 11.5	37°04.6	8.1′	17°39.3	7.1′	58.2′
16	58°25.6	10.9	51°31.7	8.2′	17°32.2	7.2′	58.2′
17	73°25.6	10.2	65°58.9	8.3′	17°25.0	7.3′	58.1′
18	88°25.6	N18°09.6	80°26.2	8.4′	N17°17.7	7.4′	58.1′
19	103°25.7	09.0	94°53.6	8.4′	17°10.3	7.4′	58.1′
20	118°25.7	08.4	109°21.0	8.5′	17°02.9	7.6′	58.0′
21	133°25.7	·· 07.7	123°48.5	8.6′	16°55.3	7.6′	58.0′
22	148°25.8	07.1	138°16.1	8.7′	16°47.7	7.8′	58.0′
23	163°25.8	06.5	152°43.8	8.8′	16°39.9	7.8′	58.0′
	SD = 15.7′	d = 0.6′	SD = 16.0′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°25.8	N18°05.9	167°11.6	8.8′	N16°32.1	7.9′	57.9′
1	193°25.9	05.2	181°39.4	8.9′	16°24.2	8.0′	57.9′
2	208°25.9	04.6	196°07.4	9.0′	16°16.2	8.1′	57.9′
3	223°25.9	·· 04.0	210°35.4	9.1′	16°08.1	8.2′	57.8′
4	238°26.0	03.4	225°03.5	9.2′	15°59.9	8.2′	57.8′
5	253°26.0	02.7	239°31.6	9.3′	15°51.7	8.4′	57.8′
6	268°26.0	N18°02.1	253°59.9	9.3′	N15°43.3	8.4′	57.8′
7	283°26.1	01.5	268°28.2	9.4′	15°34.9	8.5′	57.7′
8	298°26.1	00.8	282°56.7	9.5′	15°26.4	8.5′	57.7′
9	313°26.2	18°00.2	297°25.2	9.6′	15°17.9	8.7′	57.7′
10	328°26.2	17°59.6	311°53.8	9.7′	15°09.2	8.7′	57.6′
11	343°26.2	59.0	326°22.4	9.8′	15°00.5	8.8′	57.6′
12	358°26.3	N17°58.3	340°51.2	9.8′	N14°51.7	8.9′	57.6′
13	13°26.3	57.7	355°20.0	9.9′	14°42.8	8.9′	57.6′
14	28°26.3	57.1	9°48.9	10.0′	14°33.9	9.0′	57.5′
15	43°26.4	·· 56.4	24°17.9	10.1′	14°24.9	9.1′	57.5′
16	58°26.4	55.8	38°47.0	10.2′	14°15.8	9.1′	57.5′
17	73°26.5	55.2	53°16.2	10.2′	14°06.7	9.3′	57.4′
18	88°26.5	N17°54.5	67°45.4	10.3′	N13°57.4	9.2′	57.4′
19	103°26.5	53.9	82°14.7	10.4′	13°48.2	9.4′	57.4′
20	118°26.6	53.3	96°44.2	10.5′	13°38.8	9.4′	57.3′
21	133°26.6	·· 52.6	111°13.6	10.6′	13°29.4	9.4′	57.3′
22	148°26.7	52.0	125°43.2	10.6′	13°20.0	9.6′	57.3′
23	163°26.7	51.3	140°12.8	10.7′	13°10.4	9.5′	57.2′
	SD = 15.8′	d = 0.6′	SD = 15.8′				

Lat.	**Twilight** Naut.	**Twilight** Civil	**Sunrise**	**Sunset**	**Twilight** Civil	**Twilight** Naut.
N 72°	▭	▭	▭	▭	▭	▭
N 70°	////	////	01:15	22:49	////	////
68°	////	////	02:09	21:59	////	////
66°	////	////	02:41	21:29	////	////
64°	////	01:32	03:04	21:06	22:35	////
62°	////	02:10	03:23	20:48	21:59	////
60°	////	02:36	03:38	20:33	21:34	////
N 58°	01:24	02:56	03:51	20:21	21:14	22:44
56°	01:58	03:13	04:02	20:10	20:58	22:11
54°	02:23	03:26	04:11	20:00	20:45	21:48
52°	02:41	03:38	04:20	19:52	20:33	21:29
50°	02:57	03:49	04:28	19:44	20:23	21:14
45°	03:27	04:10	04:44	19:28	20:02	20:44
N 40°	03:49	04:27	04:57	19:15	19:45	20:23
35°	04:07	04:40	05:08	19:04	19:32	20:05
30°	04:21	04:52	05:18	18:54	19:20	19:51
20°	04:44	05:11	05:35	18:37	19:01	19:29
N 10°	05:01	05:27	05:49	18:23	18:45	19:11
0°	05:16	05:41	06:03	18:10	18:32	18:57
S 10°	05:29	05:54	06:16	17:57	18:19	18:44
20°	05:40	06:07	06:30	17:43	18:06	18:32
30°	05:52	06:21	06:46	17:27	17:52	18:21
35°	05:58	06:29	06:55	17:18	17:44	18:15
40°	06:04	06:37	07:06	17:07	17:36	18:09
45°	06:11	06:47	07:18	16:55	17:27	18:02
S 50°	06:18	06:58	07:33	16:40	17:15	17:55
52°	06:22	07:03	07:40	16:33	17:10	17:51
54°	06:25	07:08	07:48	16:25	17:05	17:48
56°	06:29	07:14	07:56	16:17	16:59	17:44
58°	06:33	07:21	08:06	16:07	16:52	17:41
S 60°	06:37	07:29	08:17	15:56	16:45	17:36

Lat.	**Moonrise** Thu	Fri	Sat	**Moonset** Thu	Fri	Sat
N 72°	▭	▭	02:49	▭	23:13	22:41
N 70°	▭	01:19	03:32	22:47	22:28	22:18
68°	00:29	02:12	04:01	21:53	21:58	21:59
66°	01:15	02:45	04:23	21:20	21:36	21:44
64°	01:46	03:09	04:40	20:55	21:18	21:32
62°	02:08	03:27	04:54	20:36	21:03	21:21
60°	02:27	03:43	05:06	20:20	20:50	21:12
N 58°	02:42	03:56	05:16	20:06	20:40	21:04
56°	02:55	04:07	05:25	19:55	20:30	20:57
54°	03:06	04:17	05:32	19:45	20:22	20:51
52°	03:16	04:26	05:39	19:35	20:14	20:45
50°	03:25	04:34	05:46	19:27	20:08	20:40
45°	03:44	04:51	05:59	19:10	19:53	20:29
N 40°	03:59	05:04	06:11	18:56	19:41	20:20
35°	04:12	05:16	06:20	18:43	19:31	20:12
30°	04:24	05:26	06:28	18:33	19:22	20:05
20°	04:43	05:44	06:43	18:14	19:06	19:53
N 10°	05:00	05:59	06:55	17:58	18:52	19:42
0°	05:16	06:13	07:07	17:43	18:39	19:32
S 10°	05:31	06:27	07:19	17:28	18:26	19:21
20°	05:48	06:42	07:31	17:12	18:12	19:10
30°	06:08	06:59	07:45	16:53	17:56	18:58
35°	06:19	07:09	07:53	16:42	17:47	18:50
40°	06:32	07:21	08:03	16:30	17:36	18:42
45°	06:47	07:34	08:13	16:15	17:23	18:32
S 50°	07:06	07:51	08:27	15:57	17:08	18:20
52°	07:15	07:58	08:33	15:48	17:00	18:15
54°	07:25	08:07	08:39	15:38	16:52	18:08
56°	07:36	08:16	08:47	15:27	16:43	18:02
58°	07:49	08:27	08:55	15:15	16:33	17:54
S 60°	08:04	08:40	09:05	15:00	16:21	17:45

Day	**Sun** Eqn.of Time 00^h mm:ss	Eqn.of Time 12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Mer.Pass. Lower hh:mm	Age 29-1 2-1%
30	06:22	06:21	12:06	11:29	23:58	
31	06:20	06:18	12:06	12:26	–:–	
01	06:17	06:15	12:06	13:19	00:53	

August 02, 03, 04 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	310°30.0	148°18.4	N09°02.4	209°47.2	N23°42.8	124°16.1	S01°23.7	124°24.6	S00°08.0
1	325°32.5	163°18.0	01.2	224°47.9	42.7	139°18.2	23.9	139°26.8	08.0
2	340°34.9	178°17.7	09°00.0	239°48.5	42.6	154°20.3	24.1	154°29.1	08.1
3	355°37.4	193°17.4	08°58.8	254°49.2	·· 42.5	169°22.4	·· 24.2	169°31.4	·· 08.2
4	10°39.9	208°17.0	57.6	269°49.8	42.4	184°24.5	24.4	184°33.6	08.3
5	25°42.3	223°16.7	56.4	284°50.5	42.3	199°26.6	24.5	199°35.9	08.4
6	40°44.8	238°16.4	N08°55.2	299°51.1	N23°42.2	214°28.7	S01°24.7	214°38.2	S00°08.5
7	55°47.3	253°16.1	54.0	314°51.8	42.1	229°30.8	24.9	229°40.4	08.6
8	70°49.7	268°15.7	52.8	329°52.5	42.0	244°32.9	25.0	244°42.7	08.7
9	85°52.2	283°15.4	·· 51.6	344°53.1	·· 41.9	259°35.0	·· 25.2	259°45.0	·· 08.8
10	100°54.7	298°15.1	50.4	359°53.8	41.8	274°37.1	25.4	274°47.3	08.9
11	115°57.1	313°14.7	49.2	14°54.4	41.7	289°39.2	25.5	289°49.5	09.0
12	130°59.6	328°14.4	N08°48.0	29°55.1	N23°41.6	304°41.3	S01°25.7	304°51.8	S00°09.0
13	146°02.0	343°14.1	46.8	44°55.7	41.5	319°43.4	25.9	319°54.1	09.1
14	161°04.5	358°13.8	45.6	59°56.4	41.4	334°45.5	26.0	334°56.3	09.2
15	176°07.0	13°13.4	·· 44.4	74°57.1	·· 41.3	349°47.6	·· 26.2	349°58.6	·· 09.3
16	191°09.4	28°13.1	43.2	89°57.7	41.2	4°49.7	26.4	5°00.9	09.4
17	206°11.9	43°12.8	42.0	104°58.4	41.1	19°51.8	26.5	20°03.1	09.5
18	221°14.4	58°12.5	N08°40.8	119°59.0	N23°41.0	34°53.9	S01°26.7	35°05.4	S00°09.6
19	236°16.8	73°12.2	39.5	134°59.7	40.9	49°56.0	26.9	50°07.7	09.7
20	251°19.3	88°11.8	38.3	150°00.3	40.8	64°58.1	27.0	65°09.9	09.8
21	266°21.8	103°11.5	·· 37.1	165°01.0	·· 40.7	80°00.2	·· 27.2	80°12.2	·· 09.9
22	281°24.2	118°11.2	35.9	180°01.7	40.6	95°02.3	27.3	95°14.5	10.0
23	296°26.7	133°10.9	34.7	195°02.3	40.5	110°04.3	27.5	110°16.7	10.1
Mer.pass. 03:17		ν -0.3′	d 1.2′	ν 0.7′	d 0.1′	ν 2.1′	d 0.2′	ν 2.3′	d 0.1′
		m -3.93		m 1.59		m -1.80		m 0.94	

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	311°29.2	148°10.5	N08°33.5	210°03.0	N23°40.4	125°06.4	S01°27.7	125°19.0	S00°10.1
1	326°31.6	163°10.2	32.3	225°03.6	40.2	140°08.5	27.8	140°21.3	10.2
2	341°34.1	178°09.9	31.1	240°04.3	40.1	155°10.6	28.0	155°23.5	10.3
3	356°36.5	193°09.6	·· 29.9	255°05.0	·· 40.0	170°12.7	·· 28.2	170°25.8	·· 10.4
4	11°39.0	208°09.3	28.7	270°05.6	39.9	185°14.8	28.3	185°28.1	10.5
5	26°41.5	223°08.9	27.5	285°06.3	39.8	200°16.9	28.5	200°30.4	10.6
6	41°43.9	238°08.6	N08°26.3	300°06.9	N23°39.7	215°19.0	S01°28.7	215°32.6	S00°10.7
7	56°46.4	253°08.3	25.1	315°07.6	39.6	230°21.1	28.8	230°34.9	10.8
8	71°48.9	268°08.0	23.8	330°08.2	39.5	245°23.2	29.0	245°37.2	10.9
9	86°51.3	283°07.7	·· 22.6	345°08.9	·· 39.4	260°25.3	·· 29.2	260°39.4	·· 11.0
10	101°53.8	298°07.4	21.4	0°09.6	39.3	275°27.4	29.3	275°41.7	11.1
11	116°56.3	313°07.0	20.2	15°10.2	39.2	290°29.5	29.5	290°44.0	11.2
12	131°58.7	328°06.7	N08°19.0	30°10.9	N23°39.1	305°31.6	S01°29.7	305°46.2	S00°11.3
13	147°01.2	343°06.4	17.8	45°11.5	39.0	320°33.7	29.8	320°48.5	11.3
14	162°03.6	358°06.1	16.6	60°12.2	38.9	335°35.8	30.0	335°50.8	11.4
15	177°06.1	13°05.8	·· 15.4	75°12.9	·· 38.7	350°37.9	·· 30.2	350°53.0	·· 11.5
16	192°08.6	28°05.5	14.1	90°13.5	38.6	5°40.0	30.3	5°55.3	11.6
17	207°11.0	43°05.1	12.9	105°14.2	38.5	20°42.1	30.5	20°57.5	11.7
18	222°13.5	58°04.8	N08°11.7	120°14.9	N23°38.4	35°44.2	S01°30.7	35°59.8	S00°11.8
19	237°16.0	73°04.5	10.5	135°15.5	38.3	50°46.3	30.8	51°02.1	11.9
20	252°18.4	88°04.2	09.3	150°16.2	38.2	65°48.4	31.0	66°04.3	12.0
21	267°20.9	103°03.9	·· 08.1	165°16.8	·· 38.1	80°50.5	·· 31.2	81°06.6	·· 12.1
22	282°23.4	118°03.6	06.9	180°17.5	38.0	95°52.5	31.3	96°08.9	12.2
23	297°25.8	133°03.3	05.6	195°18.2	37.9	110°54.6	31.5	111°11.1	12.3
Mer.pass. 03:14		ν -0.3′	d 1.2′	ν 0.7′	d 0.1′	ν 2.1′	d 0.2′	ν 2.3′	d 0.1′
		m -3.93		m 1.60		m -1.79		m 0.94	

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	312°28.3	148°02.9	N08°04.4	210°18.8	N23°37.7	125°56.7	S01°31.7	126°13.4	S00°12.4
1	327°30.8	163°02.6	03.2	225°19.5	37.6	140°58.8	31.8	141°15.7	12.5
2	342°33.2	178°02.3	02.0	240°20.1	37.5	156°00.9	32.0	156°17.9	12.6
3	357°35.7	193°02.0	08°00.8	255°20.8	·· 37.4	171°03.0	·· 32.2	171°20.2	·· 12.6
4	12°38.1	208°01.7	07°59.6	270°21.5	37.3	186°05.1	32.3	186°22.5	12.7
5	27°40.6	223°01.4	58.3	285°22.1	37.2	201°07.2	32.5	201°24.7	12.8
6	42°43.1	238°01.1	N07°57.1	300°22.8	N23°37.1	216°09.3	S01°32.7	216°27.0	S00°12.9
7	57°45.5	253°00.8	55.9	315°23.5	37.0	231°11.4	32.8	231°29.3	13.0
8	72°48.0	268°00.5	54.7	330°24.1	36.8	246°13.5	33.0	246°31.5	13.1
9	87°50.5	283°00.1	·· 53.5	345°24.8	·· 36.7	261°15.6	·· 33.2	261°33.8	·· 13.2
10	102°52.9	297°59.8	52.2	0°25.5	36.6	276°17.7	33.3	276°36.1	13.3
11	117°55.4	312°59.5	51.0	15°26.1	36.5	291°19.8	33.5	291°38.3	13.4
12	132°57.9	327°59.2	N07°49.8	30°26.8	N23°36.4	306°21.8	S01°33.7	306°40.6	S00°13.5
13	148°00.3	342°58.9	48.6	45°27.4	36.3	321°23.9	33.8	321°42.8	13.6
14	163°02.8	357°58.6	47.4	60°28.1	36.1	336°26.0	34.0	336°45.1	13.7
15	178°05.2	12°58.3	·· 46.1	75°28.8	·· 36.0	351°28.1	·· 34.2	351°47.4	·· 13.8
16	193°07.7	27°58.0	44.9	90°29.4	35.9	6°30.2	34.3	6°49.6	13.9
17	208°10.2	42°57.7	43.7	105°30.1	35.8	21°32.3	34.5	21°51.9	14.0
18	223°12.6	57°57.4	N07°42.5	120°30.8	N23°35.7	36°34.4	S01°34.7	36°54.2	S00°14.0
19	238°15.1	72°57.1	41.3	135°31.4	35.6	51°36.5	34.8	51°56.4	14.1
20	253°17.6	87°56.8	40.0	150°32.1	35.4	66°38.6	35.0	66°58.7	14.2
21	268°20.0	102°56.5	·· 38.8	165°32.8	·· 35.3	81°40.7	·· 35.2	82°01.0	·· 14.3
22	283°22.5	117°56.2	37.6	180°33.4	35.2	96°42.8	35.3	97°03.2	14.4
23	298°25.0	132°55.9	36.4	195°34.1	35.1	111°44.8	35.5	112°05.5	14.5
Mer.pass. 03:10		ν -0.3′	d 1.2′	ν 0.7′	d 0.1′	ν 2.1′	d 0.2′	ν 2.3′	d 0.1′
		m -3.93		m 1.60		m -1.79		m 0.94	

Stars

	SHA	**Dec**
Alpheratz	358°08.4	28°59.2
Ankaa	353°39.4	-42°24.2
Schedar	350°08.0	56°25.9
Diphda	349°20.1	-18°05.2
Achernar	335°44.7	-57°19.6
Hamal	328°28.2	23°22.4
Polaris	326°38.9	89°10.4
Acamar	315°36.8	-40°22.5
Menkar	314°40.5	4°01.0
Mirfak	309°15.3	49°47.5
Aldebaran	291°17.5	16°28.3
Rigel	281°35.6	-8°13.3
Capella	281°10.7	45°58.6
Bellatrix	278°58.3	6°20.0
Elnath	278°43.6	28°35.5
Alnilam	276°11.3	-1°12.8
Betelgeuse	271°27.9	7°24.3
Canopus	264°07.4	-52°41.0
Sirius	258°55.4	-16°41.3
Adhara	255°32.0	-28°56.7
Procyon	245°25.4	5°16.4
Pollux	243°57.8	28°04.3
Avior	234°28.6	-59°26.9
Suhail	223°10.8	-43°21.4
Miaplacidus	221°45.8	-69°38.5
Alphard	218°20.3	-8°34.6
Regulus	208°09.6	12°03.6
Dubhe	194°21.9	61°51.3
Denebola	182°58.6	14°40.7
Gienah	176°17.5	-17°26.3
Acrux	173°37.0	-62°59.9
Gacrux	172°28.4	-57°00.7
Alioth	166°42.2	56°04.0
Spica	158°57.0	-11°03.8
Alkaid	153°18.1	49°24.7
Hadar	149°22.6	-60°17.2
Menkent	148°36.3	-36°16.8
Arcturus	146°17.9	19°17.0
Rigil Kent.	140°25.0	-60°45.6
Kochab	137°18.9	74°14.3
Zuben'ubi	137°32.3	-15°57.8
Alphecca	126°31.5	26°46.9
Antares	112°55.9	-26°23.5
Atria	108°19.3	-68°59.9
Sabik	102°40.2	-15°42.1
Shaula	96°54.6	-37°05.5
Rasalhague	96°28.8	12°34.6
Eltanin	90°57.0	51°29.7
Kaus Aust.	84°15.7	-34°23.6
Vega	80°55.0	38°46.2
Nunki	76°28.1	-26°19.2
Altair	62°31.6	8°49.3
Peacock	53°56.8	-56°47.7
Deneb	49°47.6	45°12.9
Enif	34°10.6	9°47.4
Al Na'ir	28°13.7	-47°02.9
Fomalhaut	15°50.4	-29°43.1
Scheat	14°16.7	27°58.9
Markab	14°02.3	15°06.3

Aug 02 Sun	**SHA**	**Mer.pass**
Venus	197°48.3	14:07
Mars	259°17.2	10:00
Jupiter	173°46.1	15:41
Saturn	173°54.5	15:40

Aug 03 Mon	**SHA**	**Mer.pass**
Venus	196°41.4	14:08
Mars	258°33.8	09:59
Jupiter	173°37.3	15:37
Saturn	173°49.9	15:36

Aug 04 Tue	**SHA**	**Mer.pass**
Venus	195°34.7	14:08
Mars	257°50.5	09:58
Jupiter	173°28.4	15:34
Saturn	173°45.1	15:33

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°26.7	N17°50.7	154°42.6	10.8′	N13°00.9	9.7′	57.2′
1	193°26.8	50.1	169°12.4	10.9′	12°51.2	9.7′	57.2′
2	208°26.8	49.4	183°42.2	11.0′	12°41.5	9.7′	57.2′
3	223°26.9	·· 48.8	198°12.2	11.0′	12°31.8	9.8′	57.1′
4	238°26.9	48.2	212°42.2	11.1′	12°22.0	9.9′	57.1′
5	253°26.9	47.5	227°12.4	11.2′	12°12.1	9.9′	57.1′
6	268°27.0	N17°46.9	241°42.5	11.3′	N12°02.2	9.9′	57.0′
7	283°27.0	46.2	256°12.8	11.3′	11°52.3	10.1′	57.0′
8	298°27.1	45.6	270°43.1	11.4′	11°42.2	10.0′	57.0′
9	313°27.1	·· 45.0	285°13.6	11.5′	11°32.2	10.1′	56.9′
10	328°27.2	44.3	299°44.1	11.6′	11°22.1	10.2′	56.9′
11	343°27.2	43.7	314°14.6	11.6′	11°11.9	10.2′	56.9′
12	358°27.2	N17°43.0	328°45.3	11.7′	N11°01.7	10.2′	56.9′
13	13°27.3	42.4	343°16.0	11.8′	10°51.5	10.3′	56.8′
14	28°27.3	41.7	357°46.8	11.9′	10°41.2	10.3′	56.8′
15	43°27.4	·· 41.1	12°17.6	11.9′	10°30.9	10.4′	56.8′
16	58°27.4	40.4	26°48.5	12.0′	10°20.5	10.4′	56.7′
17	73°27.5	39.8	41°19.5	12.1′	10°10.1	10.4′	56.7′
18	88°27.5	N17°39.2	55°50.6	12.1′	N09°59.7	10.5′	56.7′
19	103°27.6	38.5	70°21.7	12.2′	09°49.2	10.5′	56.6′
20	118°27.6	37.9	84°52.9	12.3′	09°38.7	10.5′	56.6′
21	133°27.7	·· 37.2	99°24.2	12.3′	09°28.2	10.6′	56.6′
22	148°27.7	36.6	113°55.6	12.4′	09°17.6	10.6′	56.5′
23	163°27.7	35.9	128°27.0	12.5′	09°07.0	10.7′	56.5′
	SD = 15.8′	d = 0.6′	SD = 15.6′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°27.8	N17°35.3	142°58.4	12.5′	N08°56.3	10.7′	56.5′
1	193°27.8	34.6	157°30.0	12.6′	08°45.6	10.7′	56.5′
2	208°27.9	34.0	172°01.6	12.7′	08°34.9	10.7′	56.4′
3	223°27.9	·· 33.3	186°33.3	12.7′	08°24.2	10.8′	56.4′
4	238°28.0	32.7	201°05.0	12.8′	08°13.4	10.8′	56.4′
5	253°28.0	32.0	215°36.8	12.9′	08°02.6	10.8′	56.3′
6	268°28.1	N17°31.4	230°08.6	12.9′	N07°51.8	10.8′	56.3′
7	283°28.1	30.7	244°40.6	13.0′	07°41.0	10.9′	56.3′
8	298°28.2	30.0	259°12.5	13.0′	07°30.1	10.9′	56.3′
9	313°28.2	·· 29.4	273°44.6	13.1′	07°19.2	10.9′	56.2′
10	328°28.3	28.7	288°16.7	13.2′	07°08.3	10.9′	56.2′
11	343°28.3	28.1	302°48.8	13.2′	06°57.4	11.0′	56.2′
12	358°28.4	N17°27.4	317°21.0	13.3′	N06°46.4	10.9′	56.1′
13	13°28.4	26.8	331°53.3	13.3′	06°35.5	11.0′	56.1′
14	28°28.5	26.1	346°25.6	13.4′	06°24.5	11.0′	56.1′
15	43°28.5	·· 25.5	0°58.0	13.4′	06°13.5	11.0′	56.0′
16	58°28.6	24.8	15°30.4	13.5′	06°02.5	11.1′	56.0′
17	73°28.6	24.1	30°02.9	13.5′	05°51.4	11.0′	56.0′
18	88°28.7	N17°23.5	44°35.5	13.6′	N05°40.4	11.1′	56.0′
19	103°28.7	22.8	59°08.0	13.6′	05°29.3	11.1′	55.9′
20	118°28.8	22.2	73°40.7	13.7′	05°18.2	11.0′	55.9′
21	133°28.8	·· 21.5	88°13.4	13.7′	05°07.2	11.1′	55.9′
22	148°28.9	20.9	102°46.1	13.8′	04°56.1	11.1′	55.8′
23	163°28.9	20.2	117°18.9	13.8′	04°45.0	11.2′	55.8′
	SD = 15.8′	d = 0.6′	SD = 15.4′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°29.0	N17°19.5	131°51.7	13.9′	N04°33.8	11.1′	55.8′
1	193°29.1	18.9	146°24.6	13.9′	04°22.7	11.1′	55.8′
2	208°29.1	18.2	160°57.6	14.0′	04°11.6	11.2′	55.7′
3	223°29.2	·· 17.5	175°30.5	14.0′	04°00.4	11.1′	55.7′
4	238°29.2	16.9	190°03.6	14.1′	03°49.3	11.2′	55.7′
5	253°29.3	16.2	204°36.6	14.1′	03°38.1	11.1′	55.7′
6	268°29.3	N17°15.6	219°09.7	14.1′	N03°27.0	11.2′	55.6′
7	283°29.4	14.9	233°42.9	14.2′	03°15.8	11.1′	55.6′
8	298°29.4	14.2	248°16.1	14.2′	03°04.7	11.2′	55.6′
9	313°29.5	·· 13.6	262°49.3	14.3′	02°53.5	11.2′	55.6′
10	328°29.6	12.9	277°22.6	14.3′	02°42.3	11.1′	55.5′
11	343°29.6	12.2	291°55.9	14.3′	02°31.2	11.2′	55.5′
12	358°29.7	N17°11.6	306°29.2	14.4′	N02°20.0	11.2′	55.5′
13	13°29.7	10.9	321°02.6	14.4′	02°08.8	11.1′	55.5′
14	28°29.8	10.2	335°36.0	14.5′	01°57.7	11.2′	55.4′
15	43°29.8	·· 09.6	350°09.5	14.5′	01°46.5	11.1′	55.4′
16	58°29.9	08.9	4°42.9	14.5′	01°35.4	11.2′	55.4′
17	73°30.0	08.2	19°16.5	14.6′	01°24.2	11.1′	55.4′
18	88°30.0	N17°07.5	33°50.0	14.6′	N01°13.1	11.2′	55.3′
19	103°30.1	06.9	48°23.6	14.6′	01°01.9	11.1′	55.3′
20	118°30.1	06.2	62°57.2	14.6′	00°50.8	11.2′	55.3′
21	133°30.2	·· 05.5	77°30.9	14.7′	00°39.6	11.1′	55.3′
22	148°30.2	04.9	92°04.5	14.7′	00°28.5	11.1′	55.2′
23	163°30.3	04.2	106°38.2	14.7′	00°17.4	11.1′	55.2′
	SD = 15.8′	d = 0.7′	SD = 15.2′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	▭	▭	▭	▭	▭	▭
N 70°	////	////	01:42	22:24	////	////
68°	////	////	02:24	21:44	////	////
66°	////	00:51	02:52	21:17	23:10	////
64°	////	01:50	03:14	20:56	22:18	////
62°	////	02:22	03:31	20:39	21:47	////
60°	00:46	02:46	03:45	20:26	21:24	23:16
N 58°	01:39	03:04	03:57	20:14	21:06	22:28
56°	02:09	03:19	04:07	20:04	20:51	22:00
54°	02:31	03:32	04:16	19:55	20:38	21:39
52°	02:49	03:44	04:24	19:47	20:27	21:22
50°	03:03	03:53	04:32	19:40	20:18	21:07
45°	03:32	04:14	04:47	19:24	19:58	20:40
N 40°	03:53	04:30	05:00	19:12	19:42	20:19
35°	04:09	04:43	05:11	19:01	19:29	20:02
30°	04:23	04:54	05:20	18:52	19:18	19:48
20°	04:45	05:13	05:36	18:36	18:59	19:27
N 10°	05:02	05:28	05:50	18:22	18:44	19:10
0°	05:16	05:41	06:03	18:10	18:31	18:56
S 10°	05:28	05:53	06:15	17:57	18:19	18:44
20°	05:39	06:06	06:29	17:44	18:07	18:33
30°	05:50	06:19	06:44	17:28	17:54	18:22
35°	05:56	06:26	06:53	17:20	17:46	18:17
40°	06:02	06:34	07:03	17:10	17:39	18:11
45°	06:08	06:43	07:15	16:58	17:30	18:05
S 50°	06:15	06:54	07:29	16:44	17:19	17:58
52°	06:18	06:58	07:35	16:38	17:14	17:55
54°	06:21	07:04	07:42	16:30	17:09	17:52
56°	06:24	07:09	07:51	16:22	17:04	17:49
58°	06:28	07:15	08:00	16:13	16:57	17:45
S 60°	06:32	07:23	08:10	16:03	16:50	17:42

Lat.	**Moonrise** Sun	Mon	Tue	**Moonset** Sun	Mon	Tue
N 72°	05:07	07:05	08:54	22:23	22:09	21:56
N 70°	05:29	07:17	08:58	22:10	22:03	21:56
68°	05:46	07:26	09:01	21:58	21:57	21:55
66°	06:00	07:34	09:04	21:49	21:53	21:55
64°	06:11	07:40	09:06	21:41	21:49	21:55
62°	06:21	07:46	09:08	21:35	21:45	21:54
60°	06:29	07:51	09:10	21:29	21:42	21:54
N 58°	06:36	07:55	09:12	21:24	21:40	21:54
56°	06:43	07:59	09:13	21:19	21:37	21:54
54°	06:48	08:02	09:14	21:15	21:35	21:54
52°	06:53	08:05	09:15	21:11	21:33	21:53
50°	06:58	08:08	09:16	21:08	21:31	21:53
45°	07:08	08:14	09:19	21:00	21:28	21:53
N 40°	07:16	08:19	09:20	20:54	21:24	21:53
35°	07:23	08:24	09:22	20:48	21:21	21:52
30°	07:29	08:27	09:23	20:44	21:19	21:52
20°	07:40	08:34	09:26	20:35	21:14	21:52
N 10°	07:49	08:40	09:28	20:28	21:11	21:51
0°	07:58	08:45	09:30	20:21	21:07	21:51
S 10°	08:06	08:50	09:32	20:14	21:03	21:51
20°	08:15	08:56	09:34	20:06	20:59	21:50
30°	08:26	09:03	09:37	19:57	20:55	21:50
35°	08:32	09:06	09:38	19:52	20:52	21:49
40°	08:39	09:11	09:40	19:46	20:49	21:49
45°	08:47	09:16	09:42	19:40	20:45	21:49
S 50°	08:56	09:21	09:44	19:32	20:41	21:48
52°	09:01	09:24	09:45	19:28	20:39	21:48
54°	09:05	09:27	09:46	19:24	20:37	21:48
56°	09:11	09:30	09:47	19:19	20:35	21:48
58°	09:17	09:34	09:49	19:14	20:32	21:47
S 60°	09:23	09:38	09:50	19:08	20:29	21:47

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 2-4 4-16%
02	06:13	06:11	12:06	14:09	01:45	
03	06:09	06:06	12:06	14:56	02:33	
04	06:04	06:01	12:06	15:41	03:19	

August 05, 06, 07 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	313°27.4	147°55.6	N07°35.1	210°34.8	N23°35.0	126°46.9	S01°35.7	127°07.7	S00°14.6
1	328°29.9	162°55.3	33.9	225°35.4	34.8	141°49.0	35.8	142°10.0	14.7
2	343°32.4	177°54.9	32.7	240°36.1	34.7	156°51.1	36.0	157°12.3	14.8
3	358°34.8	192°54.6	·· 31.5	255°36.8	·· 34.6	171°53.2	·· 36.2	172°14.5	·· 14.9
4	13°37.3	207°54.3	30.2	270°37.4	34.5	186°55.3	36.4	187°16.8	15.0
5	28°39.7	222°54.0	29.0	285°38.1	34.4	201°57.4	36.5	202°19.1	15.1
6	43°42.2	237°53.7	N07°27.8	300°38.8	N23°34.2	216°59.5	S01°36.7	217°21.3	S00°15.2
7	58°44.7	252°53.4	26.6	315°39.4	34.1	232°01.6	36.9	232°23.6	15.3
8	73°47.1	267°53.1	25.3	330°40.1	34.0	247°03.6	37.0	247°25.8	15.4
9	88°49.6	282°52.8	·· 24.1	345°40.8	·· 33.9	262°05.7	·· 37.2	262°28.1	·· 15.5
10	103°52.1	297°52.5	22.9	0°41.4	33.7	277°07.8	37.4	277°30.4	15.6
11	118°54.5	312°52.2	21.7	15°42.1	33.6	292°09.9	37.5	292°32.6	15.6
12	133°57.0	327°51.9	N07°20.4	30°42.8	N23°33.5	307°12.0	S01°37.7	307°34.9	S00°15.7
13	148°59.5	342°51.6	19.2	45°43.4	33.4	322°14.1	37.9	322°37.1	15.8
14	164°01.9	357°51.3	18.0	60°44.1	33.2	337°16.2	38.0	337°39.4	15.9
15	179°04.4	12°51.0	·· 16.7	75°44.8	·· 33.1	352°18.3	·· 38.2	352°41.7	·· 16.0
16	194°06.9	27°50.7	15.5	90°45.4	33.0	7°20.4	38.4	7°43.9	16.1
17	209°09.3	42°50.4	14.3	105°46.1	32.9	22°22.4	38.5	22°46.2	16.2
18	224°11.8	57°50.1	N07°13.0	120°46.8	N23°32.7	37°24.5	S01°38.7	37°48.5	S00°16.3
19	239°14.2	72°49.8	11.8	135°47.4	32.6	52°26.6	38.9	52°50.7	16.4
20	254°16.7	87°49.5	10.6	150°48.1	32.5	67°28.7	39.1	67°53.0	16.5
21	269°19.2	102°49.3	·· 09.4	165°48.8	·· 32.4	82°30.8	·· 39.2	82°55.2	·· 16.6
22	284°21.6	117°49.0	08.1	180°49.5	32.2	97°32.9	39.4	97°57.5	16.7
23	299°24.1	132°48.7	06.9	195°50.1	32.1	112°35.0	39.6	112°59.8	16.8
Mer.pass. 03:06		ν -0.3′	d 1.2′	m -3.93	ν 0.7′	d 0.1′	m 1.60	ν 2.1′	d 0.2′ m -1.79	ν 2.3′	d 0.1′ m 0.94

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	314°26.6	147°48.4	N07°05.7	210°50.8	N23°32.0	127°37.0	S01°39.7	128°02.0	S00°16.9
1	329°29.0	162°48.1	04.4	225°51.5	31.8	142°39.1	39.9	143°04.3	17.0
2	344°31.5	177°47.8	03.2	240°52.1	31.7	157°41.2	40.1	158°06.5	17.1
3	359°34.0	192°47.5	·· 02.0	255°52.8	·· 31.6	172°43.3	·· 40.2	173°08.8	·· 17.2
4	14°36.4	207°47.2	07°00.7	270°53.5	31.5	187°45.4	40.4	188°11.1	17.3
5	29°38.9	222°46.9	06°59.5	285°54.1	31.3	202°47.5	40.6	203°13.3	17.4
6	44°41.3	237°46.6	N06°58.3	300°54.8	N23°31.2	217°49.6	S01°40.7	218°15.6	S00°17.4
7	59°43.8	252°46.3	57.0	315°55.5	31.1	232°51.6	40.9	233°17.8	17.5
8	74°46.3	267°46.0	55.8	330°56.2	30.9	247°53.7	41.1	248°20.1	17.6
9	89°48.7	282°45.7	·· 54.6	345°56.8	·· 30.8	262°55.8	·· 41.3	263°22.4	·· 17.7
10	104°51.2	297°45.4	53.3	0°57.5	30.7	277°57.9	41.4	278°24.6	17.8
11	119°53.7	312°45.1	52.1	15°58.2	30.5	293°00.0	41.6	293°26.9	17.9
12	134°56.1	327°44.8	N06°50.9	30°58.8	N23°30.4	308°02.1	S01°41.8	308°29.1	S00°18.0
13	149°58.6	342°44.5	49.6	45°59.5	30.3	323°04.2	41.9	323°31.4	18.1
14	165°01.1	357°44.3	48.4	61°00.2	30.1	338°06.2	42.1	338°33.7	18.2
15	180°03.5	12°44.0	·· 47.1	76°00.9	·· 30.0	353°08.3	·· 42.3	353°35.9	·· 18.3
16	195°06.0	27°43.7	45.9	91°01.5	29.9	8°10.4	42.4	8°38.2	18.4
17	210°08.5	42°43.4	44.7	106°02.2	29.7	23°12.5	42.6	23°40.4	18.5
18	225°10.9	57°43.1	N06°43.4	121°02.9	N23°29.6	38°14.6	S01°42.8	38°42.7	S00°18.6
19	240°13.4	72°42.8	42.2	136°03.5	29.5	53°16.7	43.0	53°44.9	18.7
20	255°15.8	87°42.5	41.0	151°04.2	29.3	68°18.7	43.1	68°47.2	18.8
21	270°18.3	102°42.2	·· 39.7	166°04.9	·· 29.2	83°20.8	·· 43.3	83°49.5	·· 18.9
22	285°20.8	117°41.9	38.5	181°05.6	29.1	98°22.9	43.5	98°51.7	19.0
23	300°23.2	132°41.7	37.2	196°06.2	28.9	113°25.0	43.6	113°54.0	19.1
Mer.pass. 03:02		ν -0.3′	d 1.2′	m -3.94	ν 0.7′	d 0.1′	m 1.60	ν 2.1′	d 0.2′ m -1.78	ν 2.3′	d 0.1′ m 0.95

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	315°25.7	147°41.4	N06°36.0	211°06.9	N23°28.8	128°27.1	S01°43.8	128°56.2	S00°19.2
1	330°28.2	162°41.1	34.8	226°07.6	28.7	143°29.2	44.0	143°58.5	19.3
2	345°30.6	177°40.8	33.5	241°08.3	28.5	158°31.2	44.2	159°00.7	19.4
3	0°33.1	192°40.5	·· 32.3	256°08.9	·· 28.4	173°33.3	·· 44.3	174°03.0	·· 19.5
4	15°35.6	207°40.2	31.0	271°09.6	28.3	188°35.4	44.5	189°05.3	19.5
5	30°38.0	222°39.9	29.8	286°10.3	28.1	203°37.5	44.7	204°07.5	19.6
6	45°40.5	237°39.6	N06°28.6	301°11.0	N23°28.0	218°39.6	S01°44.8	219°09.8	S00°19.7
7	60°42.9	252°39.4	27.3	316°11.6	27.8	233°41.7	45.0	234°12.0	19.8
8	75°45.4	267°39.1	26.1	331°12.3	27.7	248°43.7	45.2	249°14.3	19.9
9	90°47.9	282°38.8	·· 24.8	346°13.0	·· 27.6	263°45.8	·· 45.4	264°16.5	·· 20.0
10	105°50.3	297°38.5	23.6	1°13.7	27.4	278°47.9	45.5	279°18.8	20.1
11	120°52.8	312°38.2	22.3	16°14.3	27.3	293°50.0	45.7	294°21.1	20.2
12	135°55.3	327°37.9	N06°21.1	31°15.0	N23°27.1	308°52.1	S01°45.9	309°23.3	S00°20.3
13	150°57.7	342°37.6	19.9	46°15.7	27.0	323°54.1	46.0	324°25.6	20.4
14	166°00.2	357°37.4	18.6	61°16.4	26.9	338°56.2	46.2	339°27.8	20.5
15	181°02.7	12°37.1	·· 17.4	76°17.0	·· 26.7	353°58.3	·· 46.4	354°30.1	·· 20.6
16	196°05.1	27°36.8	16.1	91°17.7	26.6	9°00.4	46.6	9°32.3	20.7
17	211°07.6	42°36.5	14.9	106°18.4	26.4	24°02.5	46.7	24°34.6	20.8
18	226°10.1	57°36.2	N06°13.6	121°19.1	N23°26.3	39°04.5	S01°46.9	39°36.9	S00°20.9
19	241°12.5	72°35.9	12.4	136°19.7	26.2	54°06.6	47.1	54°39.1	21.0
20	256°15.0	87°35.7	11.2	151°20.4	26.0	69°08.7	47.2	69°41.4	21.1
21	271°17.4	102°35.4	·· 09.9	166°21.1	·· 25.9	84°10.8	·· 47.4	84°43.6	·· 21.2
22	286°19.9	117°35.1	08.7	181°21.8	25.7	99°12.9	47.6	99°45.9	21.3
23	301°22.4	132°34.8	07.4	196°22.5	25.6	114°14.9	47.8	114°48.1	21.4
Mer.pass. 02:58		ν -0.3′	d 1.2′	m -3.94	ν 0.7′	d 0.1′	m 1.60	ν 2.1′	d 0.2′ m -1.78	ν 2.3′	d 0.1′ m 0.95

Stars

	SHA	Dec
Alpheratz	358°08.4	28°59.2
Ankaa	353°39.4	-42°24.2
Schedar	350°08.0	56°25.9
Diphda	349°20.1	-18°05.2
Achernar	335°44.6	-57°19.6
Hamal	328°28.1	23°22.4
Polaris	326°37.8	89°10.4
Acamar	315°36.8	-40°22.5
Menkar	314°40.5	4°01.0
Mirfak	309°15.3	49°47.5
Aldebaran	291°17.4	16°28.3
Rigel	281°35.6	-8°13.3
Capella	281°10.7	45°58.6
Bellatrix	278°58.3	6°20.0
Elnath	278°43.6	28°35.5
Alnilam	276°11.2	-1°12.8
Betelgeuse	271°27.8	7°24.3
Canopus	264°07.4	-52°41.0
Sirius	258°55.4	-16°41.3
Adhara	255°31.9	-28°56.7
Procyon	245°25.4	5°16.4
Pollux	243°57.8	28°04.3
Avior	234°28.6	-59°26.9
Suhail	223°10.8	-43°21.4
Miaplacidus	221°45.8	-69°38.5
Alphard	218°20.3	-8°34.6
Regulus	208°09.7	12°03.6
Dubhe	194°21.9	61°51.3
Denebola	182°58.6	14°40.7
Gienah	176°17.5	-17°26.3
Acrux	173°37.0	-62°59.9
Gacrux	172°28.4	-57°00.7
Alioth	166°42.2	56°04.0
Spica	158°57.0	-11°03.8
Alkaid	153°18.1	49°24.7
Hadar	149°22.6	-60°17.2
Menkent	148°36.3	-36°16.8
Arcturus	146°17.9	19°17.0
Rigil Kent.	140°25.0	-60°45.6
Kochab	137°19.0	74°14.3
Zuben'ubi	137°32.3	-15°57.8
Alphecca	126°31.5	26°46.9
Antares	112°55.9	-26°23.5
Atria	108°19.3	-68°59.9
Sabik	102°40.2	-15°42.1
Shaula	96°54.6	-37°05.5
Rasalhague	96°28.8	12°34.6
Eltanin	90°57.0	51°29.7
Kaus Aust.	84°15.7	-34°23.6
Vega	80°55.0	38°46.2
Nunki	76°28.1	-26°19.2
Altair	62°31.6	8°49.3
Peacock	53°56.8	-56°47.7
Deneb	49°47.6	45°12.9
Enif	34°10.6	9°47.5
Al Na'ir	28°13.7	-47°02.9
Fomalhaut	15°50.4	-29°43.1
Scheat	14°16.7	27°58.9
Markab	14°02.3	15°06.3

Aug 05 Wed	SHA	Mer.pass
Venus	194°28.1	14:09
Mars	257°07.3	09:57
Jupiter	173°19.5	15:31
Saturn	173°40.3	15:29

Aug 06 Thu	SHA	Mer.pass
Venus	193°21.8	14:09
Mars	256°24.2	09:56
Jupiter	173°10.5	15:27
Saturn	173°35.5	15:26

Aug 07 Fri	SHA	Mer.pass
Venus	192°15.7	14:10
Mars	255°41.2	09:55
Jupiter	173°01.4	15:24
Saturn	173°30.5	15:22

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°30.4	N17°03.5	121°12.0	14.8′	N00°06.3	11.1′	55.2′
1	193°30.4	02.8	135°45.7	14.8′	S00°04.8	11.1′	55.2′
2	208°30.5	02.2	150°19.5	14.8′	00°15.9	11.1′	55.1′
3	223°30.5	·· 01.5	164°53.3	14.8′	00°27.0	11.0′	55.1′
4	238°30.6	00.8	179°27.1	14.9′	00°38.0	11.1′	55.1′
5	253°30.7	17°00.1	194°01.0	14.9′	00°49.1	11.0′	55.1′
6	268°30.7	N16°59.5	208°34.9	14.9′	S01°00.1	11.0′	55.0′
7	283°30.8	58.8	223°08.7	14.9′	01°11.1	11.0′	55.0′
8	298°30.9	58.1	237°42.7	14.9′	01°22.1	11.0′	55.0′
9	313°30.9	·· 57.4	252°16.6	15.0′	01°33.1	11.0′	55.0′
10	328°31.0	56.8	266°50.6	15.0′	01°44.1	11.0′	55.0′
11	343°31.0	56.1	281°24.5	15.0′	01°55.1	10.9′	54.9′
12	358°31.1	N16°55.4	295°58.5	15.0′	S02°06.0	10.9′	54.9′
13	13°31.2	54.7	310°32.5	15.0′	02°16.9	11.0′	54.9′
14	28°31.2	54.0	325°06.5	15.0′	02°27.9	10.9′	54.9′
15	43°31.3	·· 53.4	339°40.6	15.0′	02°38.8	10.8′	54.9′
16	58°31.4	52.7	354°14.6	15.1′	02°49.6	10.9′	54.8′
17	73°31.4	52.0	8°48.7	15.1′	03°00.5	10.8′	54.8′
18	88°31.5	N16°51.3	23°22.8	15.1′	S03°11.3	10.8′	54.8′
19	103°31.6	50.6	37°56.9	15.1′	03°22.1	10.8′	54.8′
20	118°31.6	50.0	52°31.0	15.1′	03°32.9	10.8′	54.8′
21	133°31.7	·· 49.3	67°05.1	15.1′	03°43.7	10.7′	54.8′
22	148°31.8	48.6	81°39.2	15.1′	03°54.4	10.7′	54.7′
23	163°31.8	47.9	96°13.3	15.1′	04°05.1	10.7′	54.7′
	SD = 15.8′	d = 0.7′	SD = 15.1′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°31.9	N16°47.2	110°47.4	15.1′	S04°15.8	10.7′	54.7′
1	193°32.0	46.5	125°21.6	15.1′	04°26.5	10.7′	54.7′
2	208°32.0	45.9	139°55.7	15.1′	04°37.2	10.6′	54.7′
3	223°32.1	·· 45.2	154°29.9	15.2′	04°47.8	10.6′	54.6′
4	238°32.2	44.5	169°04.0	15.2′	04°58.4	10.5′	54.6′
5	253°32.2	43.8	183°38.2	15.2′	05°08.9	10.6′	54.6′
6	268°32.3	N16°43.1	198°12.3	15.2′	S05°19.5	10.5′	54.6′
7	283°32.4	42.4	212°46.5	15.2′	05°30.0	10.5′	54.6′
8	298°32.4	41.7	227°20.6	15.2′	05°40.5	10.4′	54.6′
9	313°32.5	·· 41.1	241°54.8	15.2′	05°50.9	10.5′	54.6′
10	328°32.6	40.4	256°28.9	15.2′	06°01.4	10.4′	54.5′
11	343°32.6	39.7	271°03.1	15.2′	06°11.8	10.3′	54.5′
12	358°32.7	N16°39.0	285°37.2	15.1′	S06°22.1	10.4′	54.5′
13	13°32.8	38.3	300°11.4	15.1′	06°32.5	10.3′	54.5′
14	28°32.8	37.6	314°45.5	15.1′	06°42.8	10.2′	54.5′
15	43°32.9	·· 36.9	329°19.7	15.1′	06°53.0	10.3′	54.5′
16	58°33.0	36.2	343°53.8	15.1′	07°03.3	10.2′	54.5′
17	73°33.1	35.5	358°27.9	15.1′	07°13.5	10.1′	54.4′
18	88°33.1	N16°34.8	13°02.1	15.1′	S07°23.6	10.2′	54.4′
19	103°33.2	34.1	27°36.2	15.1′	07°33.8	10.1′	54.4′
20	118°33.3	33.4	42°10.3	15.1′	07°43.9	10.0′	54.4′
21	133°33.3	·· 32.8	56°44.4	15.1′	07°53.9	10.0′	54.4′
22	148°33.4	32.1	71°18.5	15.1′	08°03.9	10.0′	54.4′
23	163°33.5	31.4	85°52.5	15.1′	08°13.9	10.0′	54.4′
	SD = 15.8′	d = 0.7′	SD = 14.9′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°33.6	N16°30.7	100°26.6	15.0′	S08°23.9	9.9′	54.4′
1	193°33.6	30.0	115°00.6	15.0′	08°33.8	9.9′	54.4′
2	208°33.7	29.3	129°34.7	15.0′	08°43.7	9.8′	54.3′
3	223°33.8	·· 28.6	144°08.7	15.0′	08°53.5	9.8′	54.3′
4	238°33.9	27.9	158°42.7	15.0′	09°03.3	9.8′	54.3′
5	253°33.9	27.2	173°16.7	15.0′	09°13.1	9.7′	54.3′
6	268°34.0	N16°26.5	187°50.7	15.0′	S09°22.8	9.6′	54.3′
7	283°34.1	25.8	202°24.6	14.9′	09°32.4	9.7′	54.3′
8	298°34.1	25.1	216°58.6	14.9′	09°42.1	9.6′	54.3′
9	313°34.2	·· 24.4	231°32.5	14.9′	09°51.7	9.5′	54.3′
10	328°34.3	23.7	246°06.4	14.9′	10°01.2	9.5′	54.3′
11	343°34.4	23.0	260°40.3	14.9′	10°10.7	9.5′	54.3′
12	358°34.5	N16°22.3	275°14.2	14.8′	S10°20.2	9.4′	54.3′
13	13°34.5	21.6	289°48.0	14.8′	10°29.6	9.4′	54.2′
14	28°34.6	20.9	304°21.8	14.8′	10°39.0	9.3′	54.2′
15	43°34.7	·· 20.2	318°55.6	14.8′	10°48.3	9.3′	54.2′
16	58°34.8	19.5	333°29.4	14.8′	10°57.6	9.2′	54.2′
17	73°34.8	18.8	348°03.2	14.7′	11°06.8	9.2′	54.2′
18	88°34.9	N16°18.1	2°36.9	14.7′	S11°16.0	9.1′	54.2′
19	103°35.0	17.4	17°10.6	14.7′	11°25.1	9.1′	54.2′
20	118°35.1	16.7	31°44.3	14.7′	11°34.2	9.0′	54.2′
21	133°35.1	·· 16.0	46°17.9	14.6′	11°43.2	9.0′	54.2′
22	148°35.2	15.3	60°51.6	14.6′	11°52.2	9.0′	54.2′
23	163°35.3	14.6	75°25.2	14.6′	12°01.2	8.8′	54.2′
	SD = 15.8′	d = 0.7′	SD = 14.8′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	////	////	00:55	23:02	////	////
N 70°	////	////	02:03	22:03	////	////
68°	////	////	02:39	21:29	////	////
66°	////	01:22	03:04	21:05	22:42	////
64°	////	02:06	03:23	20:46	22:02	////
62°	////	02:34	03:39	20:31	21:35	////
60°	01:14	02:55	03:52	20:18	21:14	22:51
N 58°	01:53	03:12	04:03	20:07	20:58	22:14
56°	02:20	03:26	04:13	19:57	20:44	21:49
54°	02:39	03:38	04:22	19:49	20:32	21:30
52°	02:56	03:49	04:29	19:41	20:21	21:14
50°	03:09	03:58	04:36	19:35	20:12	21:01
45°	03:36	04:18	04:51	19:20	19:53	20:34
N 40°	03:56	04:33	05:03	19:08	19:38	20:14
35°	04:12	04:45	05:13	18:58	19:26	19:59
30°	04:25	04:56	05:22	18:49	19:15	19:46
20°	04:46	05:14	05:37	18:34	18:58	19:25
N 10°	05:02	05:28	05:50	18:21	18:43	19:09
0°	05:16	05:41	06:02	18:09	18:31	18:56
S 10°	05:27	05:53	06:14	17:57	18:19	18:44
20°	05:38	06:04	06:27	17:45	18:08	18:34
30°	05:48	06:17	06:42	17:30	17:55	18:24
35°	05:53	06:24	06:50	17:22	17:48	18:19
40°	05:59	06:31	07:00	17:13	17:41	18:13
45°	06:04	06:39	07:11	17:02	17:33	18:08
S 50°	06:10	06:49	07:24	16:48	17:23	18:02
52°	06:13	06:54	07:30	16:42	17:19	17:59
54°	06:16	06:58	07:37	16:35	17:14	17:56
56°	06:19	07:04	07:45	16:28	17:09	17:54
58°	06:22	07:10	07:53	16:19	17:03	17:50
S 60°	06:26	07:16	08:03	16:09	16:56	17:47

Lat.	**Moonrise** Wed	Thu	Fri	**Moonset** Wed	Thu	Fri
N 72°	10:38	12:21	14:06	21:44	21:30	21:14
N 70°	10:35	12:11	13:47	21:49	21:42	21:34
68°	10:33	12:03	13:33	21:53	21:52	21:50
66°	10:31	11:56	13:21	21:57	22:00	22:03
64°	10:29	11:51	13:12	22:00	22:06	22:14
62°	10:28	11:46	13:03	22:03	22:12	22:23
60°	10:27	11:42	12:56	22:05	22:17	22:31
N 58°	10:26	11:38	12:50	22:08	22:22	22:38
56°	10:25	11:35	12:45	22:10	22:26	22:44
54°	10:24	11:32	12:40	22:11	22:30	22:49
52°	10:23	11:30	12:35	22:13	22:33	22:54
50°	10:23	11:27	12:31	22:14	22:36	22:59
45°	10:21	11:22	12:23	22:17	22:42	23:09
N 40°	10:20	11:18	12:15	22:20	22:48	23:17
35°	10:19	11:14	12:09	22:22	22:53	23:24
30°	10:18	11:11	12:04	22:24	22:57	23:30
20°	10:16	11:05	11:54	22:28	23:04	23:41
N 10°	10:15	11:01	11:46	22:31	23:11	23:51
0°	10:13	10:56	11:39	22:34	23:17	·· ··
S 10°	10:12	10:52	11:31	22:37	23:23	·· ··
20°	10:11	10:47	11:23	22:40	23:29	·· ··
30°	10:09	10:41	11:14	22:44	23:37	·· ··
35°	10:08	10:38	11:09	22:46	23:41	·· ··
40°	10:07	10:35	11:03	22:48	23:46	·· ··
45°	10:06	10:31	10:56	22:51	23:51	·· ··
S 50°	10:05	10:26	10:48	22:54	23:58	·· ··
52°	10:04	10:24	10:45	22:55	·· ··	00:01
54°	10:04	10:22	10:40	22:57	·· ··	00:05
56°	10:03	10:19	10:36	22:59	·· ··	00:09
58°	10:02	10:16	10:31	23:01	·· ··	00:13
S 60°	10:01	10:13	10:25	23:03	·· ··	00:18

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 5-7 24-42%
05	05:59	05:56	12:06	16:24	04:02	
06	05:52	05:49	12:06	17:06	04:45	
07	05:46	05:42	12:06	17:49	05:28	

August 08, 09, 10 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	316°24.8	147°34.5	N06°06.2	211°23.1	N23°25.4	129°17.0	S01°47.9	129°50.4	S00°21.5
1	331°27.3	162°34.3	04.9	226°23.8	25.3	144°19.1	48.1	144°52.6	21.6
2	346°29.8	177°34.0	03.7	241°24.5	25.2	159°21.2	48.3	159°54.9	21.7
3	1°32.2	192°33.7	·· 02.4	256°25.2	·· 25.0	174°23.3	·· 48.4	174°57.2	·· 21.8
4	16°34.7	207°33.4	06°01.2	271°25.8	24.9	189°25.3	48.6	189°59.4	21.9
5	31°37.2	222°33.1	05°59.9	286°26.5	24.7	204°27.4	48.8	205°01.7	22.0
6	46°39.6	237°32.9	N05°58.7	301°27.2	N23°24.6	219°29.5	S01°49.0	220°03.9	S00°22.1
7	61°42.1	252°32.6	57.4	316°27.9	24.4	234°31.6	49.1	235°06.2	22.2
8	76°44.6	267°32.3	56.2	331°28.6	24.3	249°33.7	49.3	250°08.4	22.3
9	91°47.0	282°32.0	·· 54.9	346°29.2	·· 24.1	264°35.7	·· 49.5	265°10.7	·· 22.3
10	106°49.5	297°31.8	53.7	1°29.9	24.0	279°37.8	49.7	280°12.9	22.4
11	121°51.9	312°31.5	52.4	16°30.6	23.8	294°39.9	49.8	295°15.2	22.5
12	136°54.4	327°31.2	N05°51.2	31°31.3	N23°23.7	309°42.0	S01°50.0	310°17.4	S00°22.6
13	151°56.9	342°30.9	49.9	46°32.0	23.5	324°44.0	50.2	325°19.7	22.7
14	166°59.3	357°30.6	48.7	61°32.6	23.4	339°46.1	50.3	340°22.0	22.8
15	182°01.8	12°30.4	·· 47.4	76°33.3	·· 23.3	354°48.2	·· 50.5	355°24.2	·· 22.9
16	197°04.3	27°30.1	46.2	91°34.0	23.1	9°50.3	50.7	10°26.5	23.0
17	212°06.7	42°29.8	44.9	106°34.7	23.0	24°52.4	50.9	25°28.7	23.1
18	227°09.2	57°29.5	N05°43.7	121°35.4	N23°22.8	39°54.4	S01°51.0	40°31.0	S00°23.2
19	242°11.7	72°29.3	42.4	136°36.0	22.7	54°56.5	51.2	55°33.2	23.3
20	257°14.1	87°29.0	41.2	151°36.7	22.5	69°58.6	51.4	70°35.5	23.4
21	272°16.6	102°28.7	·· 39.9	166°37.4	·· 22.4	85°00.7	·· 51.6	85°37.7	·· 23.5
22	287°19.0	117°28.4	38.7	181°38.1	22.2	100°02.7	51.7	100°40.0	23.6
23	302°21.5	132°28.2	37.4	196°38.8	22.1	115°04.8	51.9	115°42.2	23.7
Mer.pass. 02:54		ν -0.3′	d 1.2′	m -3.94	ν 0.7′	d 0.1′	m 1.60	ν 2.1′	d 0.2′ m -1.78	ν 2.3′	d 0.1′ m 0.95

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	317°24.0	147°27.9	N05°36.2	211°39.4	N23°21.9	130°06.9	S01°52.1	130°44.5	S00°23.8
1	332°26.4	162°27.6	34.9	226°40.1	21.7	145°09.0	52.2	145°46.7	23.9
2	347°28.9	177°27.4	33.7	241°40.8	21.6	160°11.0	52.4	160°49.0	24.0
3	2°31.4	192°27.1	·· 32.4	256°41.5	·· 21.4	175°13.1	·· 52.6	175°51.3	·· 24.1
4	17°33.8	207°26.8	31.2	271°42.2	21.3	190°15.2	52.8	190°53.5	24.2
5	32°36.3	222°26.5	29.9	286°42.8	21.1	205°17.3	52.9	205°55.8	24.3
6	47°38.8	237°26.3	N05°28.7	301°43.5	N23°21.0	220°19.3	S01°53.1	220°58.0	S00°24.4
7	62°41.2	252°26.0	27.4	316°44.2	20.8	235°21.4	53.3	236°00.3	24.5
8	77°43.7	267°25.7	26.2	331°44.9	20.7	250°23.5	53.5	251°02.5	24.6
9	92°46.2	282°25.4	·· 24.9	346°45.6	·· 20.5	265°25.6	·· 53.6	266°04.8	·· 24.7
10	107°48.6	297°25.2	23.6	1°46.3	20.4	280°27.6	53.8	281°07.0	24.8
11	122°51.1	312°24.9	22.4	16°46.9	20.2	295°29.7	54.0	296°09.3	24.9
12	137°53.5	327°24.6	N05°21.1	31°47.6	N23°20.1	310°31.8	S01°54.2	311°11.5	S00°25.0
13	152°56.0	342°24.4	19.9	46°48.3	19.9	325°33.9	54.3	326°13.8	25.1
14	167°58.5	357°24.1	18.6	61°49.0	19.7	340°35.9	54.5	341°16.0	25.2
15	183°00.9	12°23.8	·· 17.4	76°49.7	·· 19.6	355°38.0	·· 54.7	356°18.3	·· 25.3
16	198°03.4	27°23.6	16.1	91°50.4	19.4	10°40.1	54.9	11°20.5	25.4
17	213°05.9	42°23.3	14.9	106°51.1	19.3	25°42.2	55.0	26°22.8	25.5
18	228°08.3	57°23.0	N05°13.6	121°51.7	N23°19.1	40°44.2	S01°55.2	41°25.0	S00°25.6
19	243°10.8	72°22.8	12.3	136°52.4	19.0	55°46.3	55.4	56°27.3	25.7
20	258°13.3	87°22.5	11.1	151°53.1	18.8	70°48.4	55.6	71°29.5	25.8
21	273°15.7	102°22.2	·· 09.8	166°53.8	·· 18.7	85°50.5	·· 55.7	86°31.8	·· 25.9
22	288°18.2	117°22.0	08.6	181°54.5	18.5	100°52.5	55.9	101°34.0	26.0
23	303°20.7	132°21.7	07.3	196°55.2	18.3	115°54.6	56.1	116°36.3	26.1
Mer.pass. 02:50		ν -0.3′	d 1.3′	m -3.94	ν 0.7′	d 0.2′	m 1.61	ν 2.1′	d 0.2′ m -1.77	ν 2.3′	d 0.1′ m 0.95

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	318°23.1	147°21.4	N05°06.1	211°55.8	N23°18.2	130°56.7	S01°56.3	131°38.5	S00°26.2
1	333°25.6	162°21.2	04.8	226°56.5	18.0	145°58.7	56.4	146°40.8	26.3
2	348°28.0	177°20.9	03.5	241°57.2	17.9	161°00.8	56.6	161°43.0	26.4
3	3°30.5	192°20.6	·· 02.3	256°57.9	·· 17.7	176°02.9	·· 56.8	176°45.3	·· 26.5
4	18°33.0	207°20.4	05°01.0	271°58.6	17.5	191°05.0	57.0	191°47.5	26.6
5	33°35.4	222°20.1	04°59.8	286°59.3	17.4	206°07.0	57.1	206°49.8	26.7
6	48°37.9	237°19.8	N04°58.5	302°00.0	N23°17.2	221°09.1	S01°57.3	221°52.0	S00°26.8
7	63°40.4	252°19.6	57.2	317°00.6	17.1	236°11.2	57.5	236°54.3	26.9
8	78°42.8	267°19.3	56.0	332°01.3	16.9	251°13.2	57.7	251°56.5	26.9
9	93°45.3	282°19.0	·· 54.7	347°02.0	·· 16.7	266°15.3	·· 57.8	266°58.8	·· 27.0
10	108°47.8	297°18.8	53.5	2°02.7	16.6	281°17.4	58.0	282°01.0	27.1
11	123°50.2	312°18.5	52.2	17°03.4	16.4	296°19.5	58.2	297°03.3	27.2
12	138°52.7	327°18.2	N04°50.9	32°04.1	N23°16.2	311°21.5	S01°58.4	312°05.5	S00°27.3
13	153°55.2	342°18.0	49.7	47°04.8	16.1	326°23.6	58.5	327°07.8	27.4
14	168°57.6	357°17.7	48.4	62°05.5	15.9	341°25.7	58.7	342°10.0	27.5
15	184°00.1	12°17.4	·· 47.1	77°06.1	·· 15.8	356°27.7	·· 58.9	357°12.3	·· 27.6
16	199°02.5	27°17.2	45.9	92°06.8	15.6	11°29.8	59.1	12°14.5	27.7
17	214°05.0	42°16.9	44.6	107°07.5	15.4	26°31.9	59.2	27°16.8	27.8
18	229°07.5	57°16.7	N04°43.4	122°08.2	N23°15.3	41°34.0	S01°59.4	42°19.0	S00°27.9
19	244°09.9	72°16.4	42.1	137°08.9	15.1	56°36.0	59.6	57°21.3	28.0
20	259°12.4	87°16.1	40.8	152°09.6	14.9	71°38.1	59.8	72°23.5	28.1
21	274°14.9	102°15.9	·· 39.6	167°10.3	·· 14.8	86°40.2	01°59.9	87°25.8	·· 28.2
22	289°17.3	117°15.6	38.3	182°11.0	14.6	101°42.2	02°00.1	102°28.0	28.3
23	304°19.8	132°15.4	37.0	197°11.7	14.4	116°44.3	00.3	117°30.3	28.4
Mer.pass. 02:46		ν -0.3′	d 1.3′	m -3.94	ν 0.7′	d 0.2′	m 1.61	ν 2.1′	d 0.2′ m -1.77	ν 2.3′	d 0.1′ m 0.95

Stars

	SHA	Dec
Alpheratz	358°08.4	28°59.2
Ankaa	353°39.3	-42°24.2
Schedar	350°08.0	56°25.9
Diphda	349°20.0	-18°05.2
Achernar	335°44.6	-57°19.6
Hamal	328°28.1	23°22.4
Polaris	326°36.6	89°10.4
Acamar	315°36.7	-40°22.5
Menkar	314°40.5	4°01.1
Mirfak	309°15.3	49°47.5
Aldebaran	291°17.4	16°28.3
Rigel	281°35.6	-8°13.3
Capella	281°10.6	45°58.6
Bellatrix	278°58.3	6°20.0
Elnath	278°43.6	28°35.5
Alnilam	276°11.2	-1°12.7
Betelgeuse	271°27.8	7°24.3
Canopus	264°07.3	-52°41.0
Sirius	258°55.4	-16°41.3
Adhara	255°31.9	-28°56.7
Procyon	245°25.4	5°16.4
Pollux	243°57.7	28°04.3
Avior	234°28.6	-59°26.9
Suhail	223°10.8	-43°21.4
Miaplacidus	221°45.8	-69°38.4
Alphard	218°20.3	-8°34.6
Regulus	208°09.7	12°03.6
Dubhe	194°21.9	61°51.3
Denebola	182°58.6	14°40.7
Gienah	176°17.5	-17°26.3
Acrux	173°37.0	-62°59.9
Gacrux	172°28.4	-57°00.7
Alioth	166°42.2	56°04.0
Spica	158°57.0	-11°03.8
Alkaid	153°18.1	49°24.7
Hadar	149°22.6	-60°17.2
Menkent	148°36.4	-36°16.8
Arcturus	146°18.0	19°17.0
Rigil Kent.	140°25.0	-60°45.6
Kochab	137°19.0	74°14.3
Zuben'ubi	137°32.3	-15°57.8
Alphecca	126°31.5	26°46.9
Antares	112°55.9	-26°23.5
Atria	108°19.4	-68°59.9
Sabik	102°40.2	-15°42.1
Shaula	96°54.6	-37°05.5
Rasalhague	96°28.8	12°34.6
Eltanin	90°57.1	51°29.8
Kaus Aust.	84°15.7	-34°23.6
Vega	80°55.1	38°46.2
Nunki	76°28.1	-26°19.2
Altair	62°31.6	8°49.3
Peacock	53°56.8	-56°47.7
Deneb	49°47.6	45°12.9
Enif	34°10.6	9°47.5
Al Na'ir	28°13.7	-47°02.9
Fomalhaut	15°50.4	-29°43.1
Scheat	14°16.6	27°58.9
Markab	14°02.2	15°06.3

Aug 08 Sat	SHA	Mer.pass
Venus	191°09.7	14:10
Mars	254°58.3	09:54
Jupiter	172°52.2	15:21
Saturn	173°25.6	15:18

Aug 09 Sun	SHA	Mer.pass
Venus	190°03.9	14:10
Mars	254°15.5	09:53
Jupiter	172°42.9	15:17
Saturn	173°20.5	15:15

Aug 10 Mon	SHA	Mer.pass
Venus	188°58.3	14:11
Mars	253°32.7	09:52
Jupiter	172°33.6	15:14
Saturn	173°15.4	15:11

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h

	Sun		Moon				
Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°35.4	N16°13.8	89°58.7	14.5′	S12°10.0	8.9′	54.2′
1	193°35.5	13.1	104°32.3	14.5′	12°18.9	8.8′	54.2′
2	208°35.5	12.4	119°05.8	14.5′	12°27.7	8.7′	54.2′
3	223°35.6	·· 11.7	133°39.3	14.5′	12°36.4	8.7′	54.2′
4	238°35.7	11.0	148°12.7	14.4′	12°45.1	8.6′	54.2′
5	253°35.8	10.3	162°46.1	14.4′	12°53.7	8.6′	54.2′
6	268°35.9	N16°09.6	177°19.5	14.4′	S13°02.3	8.5′	54.2′
7	283°35.9	08.9	191°52.9	14.3′	13°10.8	8.5′	54.2′
8	298°36.0	08.2	206°26.2	14.3′	13°19.3	8.4′	54.2′
9	313°36.1	·· 07.5	220°59.5	14.3′	13°27.7	8.3′	54.2′
10	328°36.2	06.8	235°32.8	14.2′	13°36.0	8.3′	54.2′
11	343°36.3	06.0	250°06.0	14.2′	13°44.3	8.2′	54.2′
12	358°36.4	N16°05.3	264°39.2	14.2′	S13°52.5	8.2′	54.2′
13	13°36.4	04.6	279°12.3	14.1′	14°00.7	8.1′	54.2′
14	28°36.5	03.9	293°45.5	14.1′	14°08.8	8.1′	54.2′
15	43°36.6	·· 03.2	308°18.5	14.0′	14°16.9	8.0′	54.2′
16	58°36.7	02.5	322°51.6	14.0′	14°24.9	7.9′	54.2′
17	73°36.8	01.8	337°24.6	14.0′	14°32.8	7.9′	54.2′
18	88°36.9	N16°01.1	351°57.6	13.9′	S14°40.7	7.8′	54.2′
19	103°36.9	16°00.3	6°30.5	13.9′	14°48.5	7.8′	54.2′
20	118°37.0	15°59.6	21°03.4	13.9′	14°56.3	7.7′	54.2′
21	133°37.1	·· 58.9	35°36.2	13.8′	15°04.0	7.6′	54.2′
22	148°37.2	58.2	50°09.0	13.8′	15°11.6	7.6′	54.2′
23	163°37.3	57.5	64°41.8	13.7′	15°19.2	7.5′	54.2′
	SD = 15.8′	d = 0.7′	SD = 14.8′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°37.4	N15°56.8	79°14.6	13.7′	S15°26.7	7.4′	54.2′
1	193°37.4	56.0	93°47.2	13.7′	15°34.1	7.4′	54.2′
2	208°37.5	55.3	108°19.9	13.6′	15°41.5	7.3′	54.2′
3	223°37.6	·· 54.6	122°52.5	13.6′	15°48.8	7.3′	54.2′
4	238°37.7	53.9	137°25.1	13.5′	15°56.1	7.1′	54.2′
5	253°37.8	53.2	151°57.6	13.5′	16°03.2	7.1′	54.2′
6	268°37.9	N15°52.4	166°30.1	13.4′	S16°10.3	7.1′	54.2′
7	283°38.0	51.7	181°02.5	13.4′	16°17.4	6.9′	54.2′
8	298°38.1	51.0	195°34.9	13.4′	16°24.3	6.9′	54.2′
9	313°38.1	·· 50.3	210°07.3	13.3′	16°31.2	6.9′	54.2′
10	328°38.2	49.6	224°39.6	13.3′	16°38.1	6.7′	54.2′
11	343°38.3	48.8	239°11.8	13.2′	16°44.8	6.7′	54.3′
12	358°38.4	N15°48.1	253°44.1	13.2′	S16°51.5	6.6′	54.3′
13	13°38.5	47.4	268°16.2	13.1′	16°58.1	6.6′	54.3′
14	28°38.6	46.7	282°48.4	13.1′	17°04.7	6.5′	54.3′
15	43°38.7	·· 46.0	297°20.4	13.0′	17°11.2	6.3′	54.3′
16	58°38.8	45.2	311°52.5	13.0′	17°17.5	6.4′	54.3′
17	73°38.8	44.5	326°24.5	12.9′	17°23.9	6.2′	54.3′
18	88°38.9	N15°43.8	340°56.4	12.9′	S17°30.1	6.2′	54.3′
19	103°39.0	43.1	355°28.3	12.9′	17°36.3	6.1′	54.3′
20	118°39.1	42.3	10°00.2	12.8′	17°42.4	6.0′	54.3′
21	133°39.2	·· 41.6	24°32.0	12.8′	17°48.4	5.9′	54.3′
22	148°39.3	40.9	39°03.7	12.7′	17°54.3	5.9′	54.3′
23	163°39.4	40.1	53°35.4	12.7′	18°00.2	5.8′	54.4′
	SD = 15.8′	d = 0.7′	SD = 14.8′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°39.5	N15°39.4	68°07.1	12.6′	S18°06.0	5.7′	54.4′
1	193°39.6	38.7	82°38.7	12.6′	18°11.7	5.6′	54.4′
2	208°39.7	38.0	97°10.3	12.5′	18°17.3	5.6′	54.4′
3	223°39.8	·· 37.2	111°41.8	12.5′	18°22.9	5.4′	54.4′
4	238°39.9	36.5	126°13.3	12.4′	18°28.3	5.4′	54.4′
5	253°39.9	35.8	140°44.7	12.4′	18°33.7	5.3′	54.4′
6	268°40.0	N15°35.0	155°16.1	12.3′	S18°39.0	5.2′	54.4′
7	283°40.1	34.3	169°47.4	12.3′	18°44.2	5.2′	54.4′
8	298°40.2	33.6	184°18.7	12.2′	18°49.4	5.0′	54.5′
9	313°40.3	·· 32.9	198°49.9	12.2′	18°54.4	5.0′	54.5′
10	328°40.4	32.1	213°21.1	12.1′	18°59.4	4.9′	54.5′
11	343°40.5	31.4	227°52.2	12.1′	19°04.3	4.8′	54.5′
12	358°40.6	N15°30.7	242°23.3	12.0′	S19°09.1	4.7′	54.5′
13	13°40.7	29.9	256°54.3	12.0′	19°13.8	4.6′	54.5′
14	28°40.8	29.2	271°25.3	11.9′	19°18.4	4.5′	54.5′
15	43°40.9	·· 28.5	285°56.3	11.9′	19°22.9	4.5′	54.6′
16	58°41.0	27.7	300°27.2	11.8′	19°27.4	4.3′	54.6′
17	73°41.1	27.0	314°58.0	11.8′	19°31.7	4.3′	54.6′
18	88°41.2	N15°26.3	329°28.8	11.8′	S19°36.0	4.2′	54.6′
19	103°41.3	25.5	343°59.6	11.7′	19°40.2	4.1′	54.6′
20	118°41.4	24.8	358°30.3	11.7′	19°44.3	4.0′	54.6′
21	133°41.5	·· 24.0	13°00.9	11.6′	19°48.3	3.9′	54.6′
22	148°41.6	23.3	27°31.6	11.6′	19°52.2	3.8′	54.7′
23	163°41.7	22.6	42°02.1	11.5′	19°56.0	3.7′	54.7′
	SD = 15.8′	d = 0.7′	SD = 14.8′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	////	////	01:34	22:29	////	////
N 70°	////	////	02:22	21:44	////	////
68°	////	00:23	02:53	21:15	23:24	////
66°	////	01:45	03:15	20:53	22:21	////
64°	////	02:20	03:33	20:36	21:47	////
62°	00:21	02:45	03:47	20:22	21:23	23:29
60°	01:34	03:04	03:59	20:10	21:04	22:32
N 58°	02:06	03:20	04:10	20:00	20:49	22:01
56°	02:29	03:33	04:19	19:51	20:36	21:39
54°	02:48	03:45	04:27	19:43	20:25	21:21
52°	03:03	03:54	04:34	19:36	20:15	21:06
50°	03:15	04:03	04:40	19:29	20:06	20:54
45°	03:41	04:21	04:54	19:16	19:48	20:29
N 40°	04:00	04:36	05:06	19:05	19:34	20:10
35°	04:15	04:48	05:15	18:55	19:22	19:55
30°	04:28	04:58	05:24	18:47	19:12	19:43
20°	04:48	05:15	05:38	18:33	18:56	19:23
N 10°	05:03	05:29	05:50	18:20	18:42	19:08
0°	05:16	05:41	06:02	18:09	18:30	18:55
S 10°	05:26	05:52	06:13	17:58	18:19	18:44
20°	05:36	06:03	06:26	17:46	18:08	18:35
30°	05:46	06:14	06:39	17:32	17:57	18:25
35°	05:51	06:21	06:47	17:24	17:51	18:21
40°	05:56	06:28	06:56	17:15	17:44	18:16
45°	06:01	06:35	07:06	17:05	17:36	18:11
S 50°	06:06	06:45	07:19	16:53	17:27	18:05
52°	06:08	06:49	07:25	16:47	17:23	18:03
54°	06:11	06:53	07:31	16:40	17:19	18:01
56°	06:14	06:58	07:38	16:33	17:14	17:58
58°	06:16	07:03	07:46	16:25	17:08	17:55
S 60°	06:19	07:09	07:55	16:16	17:02	17:53

Lat.	**Moonrise** Sat	Sun	Mon	**Moonset** Sat	Sun	Mon
N 72°	16:00	18:30	▬	20:52	19:56	▬
N 70°	15:28	17:15	19:31	21:25	21:12	20:34
68°	15:05	16:38	18:12	21:49	21:50	21:54
66°	14:47	16:12	17:35	22:08	22:16	22:32
64°	14:32	15:52	17:08	22:23	22:37	22:58
62°	14:20	15:36	16:48	22:36	22:54	23:19
60°	14:10	15:22	16:31	22:47	23:08	23:36
N 58°	14:01	15:11	16:18	22:56	23:20	23:50
56°	13:53	15:01	16:06	23:05	23:30	·· ··
54°	13:46	14:52	15:55	23:12	23:39	·· ··
52°	13:40	14:44	15:46	23:19	23:48	·· ··
50°	13:34	14:37	15:38	23:25	23:55	·· ··
45°	13:22	14:22	15:20	23:38	·· ··	00:11
N 40°	13:12	14:09	15:06	23:49	·· ··	00:24
35°	13:04	13:59	14:54	23:58	·· ··	00:35
30°	12:57	13:50	14:43	·· ··	00:06	00:45
20°	12:44	13:34	14:25	·· ··	00:20	01:02
N 10°	12:33	13:20	14:09	·· ··	00:32	01:16
0°	12:22	13:08	13:55	00:00	00:44	01:30
S 10°	12:12	12:55	13:40	00:09	00:56	01:44
20°	12:01	12:41	13:24	00:18	01:08	01:58
30°	11:49	12:26	13:07	00:29	01:22	02:15
35°	11:42	12:17	12:56	00:36	01:31	02:25
40°	11:33	12:07	12:44	00:43	01:40	02:37
45°	11:24	11:55	12:31	00:51	01:51	02:50
S 50°	11:13	11:41	12:14	01:02	02:04	03:06
52°	11:07	11:34	12:06	01:06	02:11	03:14
54°	11:02	11:27	11:57	01:12	02:18	03:22
56°	10:55	11:18	11:47	01:17	02:26	03:32
58°	10:48	11:09	11:36	01:24	02:34	03:43
S 60°	10:40	10:58	11:23	01:31	02:44	03:55

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 8-10 52-70%
08	05:38	05:35	12:06	18:33	06:11	
09	05:31	05:26	12:05	19:19	06:56	
10	05:22	05:18	12:05	20:06	07:42	

August 11, 12, 13 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	319°22.3	147°15.1	N04°35.8	212°12.3	N23°14.3	131°46.4	S02°00.5	132°32.5	S00°28.5
1	334°24.7	162°14.8	34.5	227°13.0	14.1	146°48.4	00.6	147°34.8	28.6
2	349°27.2	177°14.6	33.3	242°13.7	13.9	161°50.5	00.8	162°37.0	28.7
3	4°29.6	192°14.3	·· 32.0	257°14.4	·· 13.8	176°52.6	·· 01.0	177°39.3	·· 28.8
4	19°32.1	207°14.1	30.7	272°15.1	13.6	191°54.7	01.2	192°41.5	28.9
5	34°34.6	222°13.8	29.5	287°15.8	13.4	206°56.7	01.3	207°43.8	29.0
6	49°37.0	237°13.5	N04°28.2	302°16.5	N23°13.3	221°58.8	S02°01.5	222°46.0	S00°29.1
7	64°39.5	252°13.3	26.9	317°17.2	13.1	237°00.9	01.7	237°48.3	29.2
8	79°42.0	267°13.0	25.7	332°17.9	12.9	252°02.9	01.9	252°50.5	29.3
9	94°44.4	282°12.8	·· 24.4	347°18.6	·· 12.8	267°05.0	·· 02.0	267°52.8	·· 29.4
10	109°46.9	297°12.5	23.1	2°19.3	12.6	282°07.1	02.2	282°55.0	29.5
11	124°49.4	312°12.2	21.9	17°19.9	12.4	297°09.1	02.4	297°57.3	29.6
12	139°51.8	327°12.0	N04°20.6	32°20.6	N23°12.2	312°11.2	S02°02.6	312°59.5	S00°29.7
13	154°54.3	342°11.7	19.3	47°21.3	12.1	327°13.3	02.8	328°01.7	29.8
14	169°56.8	357°11.5	18.1	62°22.0	11.9	342°15.3	02.9	343°04.0	29.9
15	184°59.2	12°11.2	·· 16.8	77°22.7	·· 11.7	357°17.4	·· 03.1	358°06.2	·· 30.0
16	200°01.7	27°11.0	15.5	92°23.4	11.6	12°19.5	03.3	13°08.5	30.1
17	215°04.1	42°10.7	14.3	107°24.1	11.4	27°21.5	03.5	28°10.7	30.2
18	230°06.6	57°10.4	N04°13.0	122°24.8	N23°11.2	42°23.6	S02°03.6	43°13.0	S00°30.3
19	245°09.1	72°10.2	11.7	137°25.5	11.0	57°25.7	03.8	58°15.2	30.4
20	260°11.5	87°09.9	10.5	152°26.2	10.9	72°27.7	04.0	73°17.5	30.5
21	275°14.0	102°09.7	·· 09.2	167°26.9	·· 10.7	87°29.8	·· 04.2	88°19.7	·· 30.6
22	290°16.5	117°09.4	07.9	182°27.6	10.5	102°31.9	04.3	103°22.0	30.7
23	305°18.9	132°09.2	06.7	197°28.3	10.4	117°33.9	04.5	118°24.2	30.8
Mer.pass. 02:42		ν -0.3′	d 1.3′	m -3.94	ν 0.7′	d 0.2′	m 1.61	ν 2.1′	d 0.2′ m -1.77	ν 2.2′	d 0.1′ m 0.95

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	320°21.4	147°08.9	N04°05.4	212°29.0	N23°10.2	132°36.0	S02°04.7	133°26.5	S00°30.9
1	335°23.9	162°08.7	04.1	227°29.6	10.0	147°38.1	04.9	148°28.7	31.0
2	350°26.3	177°08.4	02.9	242°30.3	09.8	162°40.1	05.1	163°31.0	31.1
3	5°28.8	192°08.2	·· 01.6	257°31.0	·· 09.7	177°42.2	·· 05.2	178°33.2	·· 31.2
4	20°31.3	207°07.9	04°00.3	272°31.7	09.5	192°44.3	05.4	193°35.4	31.3
5	35°33.7	222°07.6	03°59.1	287°32.4	09.3	207°46.3	05.6	208°37.7	31.4
6	50°36.2	237°07.4	N03°57.8	302°33.1	N23°09.1	222°48.4	S02°05.8	223°39.9	S00°31.5
7	65°38.6	252°07.1	56.5	317°33.8	09.0	237°50.5	05.9	238°42.2	31.6
8	80°41.1	267°06.9	55.2	332°34.5	08.8	252°52.5	06.1	253°44.4	31.7
9	95°43.6	282°06.6	·· 54.0	347°35.2	·· 08.6	267°54.6	·· 06.3	268°46.7	·· 31.8
10	110°46.0	297°06.4	52.7	2°35.9	08.4	282°56.7	06.5	283°48.9	31.9
11	125°48.5	312°06.1	51.4	17°36.6	08.2	297°58.7	06.6	298°51.2	32.0
12	140°51.0	327°05.9	N03°50.2	32°37.3	N23°08.1	313°00.8	S02°06.8	313°53.4	S00°32.1
13	155°53.4	342°05.6	48.9	47°38.0	07.9	328°02.9	07.0	328°55.7	32.2
14	170°55.9	357°05.4	47.6	62°38.7	07.7	343°04.9	07.2	343°57.9	32.3
15	185°58.4	12°05.1	·· 46.3	77°39.4	·· 07.5	358°07.0	·· 07.4	359°00.1	·· 32.4
16	201°00.8	27°04.9	45.1	92°40.1	07.4	13°09.0	07.5	14°02.4	32.5
17	216°03.3	42°04.6	43.8	107°40.8	07.2	28°11.1	07.7	29°04.6	32.6
18	231°05.8	57°04.4	N03°42.5	122°41.5	N23°07.0	43°13.2	S02°07.9	44°06.9	S00°32.7
19	246°08.2	72°04.1	41.3	137°42.2	06.8	58°15.2	08.1	59°09.1	32.8
20	261°10.7	87°03.9	40.0	152°42.9	06.6	73°17.3	08.3	74°11.4	32.9
21	276°13.1	102°03.6	·· 38.7	167°43.6	·· 06.5	88°19.4	·· 08.4	89°13.6	·· 33.0
22	291°15.6	117°03.4	37.4	182°44.3	06.3	103°21.4	08.6	104°15.9	33.1
23	306°18.1	132°03.1	36.2	197°45.0	06.1	118°23.5	08.8	119°18.1	33.2
Mer.pass. 02:38		ν -0.3′	d 1.3′	m -3.94	ν 0.7′	d 0.2′	m 1.61	ν 2.1′	d 0.2′ m -1.76	ν 2.2′	d 0.1′ m 0.95

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	321°20.5	147°02.9	N03°34.9	212°45.7	N23°05.9	133°25.6	S02°09.0	134°20.3	S00°33.3
1	336°23.0	162°02.6	33.6	227°46.4	05.7	148°27.6	09.1	149°22.6	33.4
2	351°25.5	177°02.4	32.4	242°47.1	05.6	163°29.7	09.3	164°24.8	33.5
3	6°27.9	192°02.1	·· 31.1	257°47.8	·· 05.4	178°31.7	·· 09.5	179°27.1	·· 33.6
4	21°30.4	207°01.9	29.8	272°48.4	05.2	193°33.8	09.7	194°29.3	33.7
5	36°32.9	222°01.6	28.5	287°49.1	05.0	208°35.9	09.9	209°31.6	33.8
6	51°35.3	237°01.4	N03°27.3	302°49.8	N23°04.8	223°37.9	S02°10.0	224°33.8	S00°34.0
7	66°37.8	252°01.1	26.0	317°50.5	04.6	238°40.0	10.2	239°36.0	34.1
8	81°40.2	267°00.9	24.7	332°51.2	04.5	253°42.1	10.4	254°38.3	34.2
9	96°42.7	282°00.6	·· 23.4	347°51.9	·· 04.3	268°44.1	·· 10.6	269°40.5	·· 34.3
10	111°45.2	297°00.4	22.2	2°52.6	04.1	283°46.2	10.7	284°42.8	34.4
11	126°47.6	312°00.1	20.9	17°53.3	03.9	298°48.2	10.9	299°45.0	34.5
12	141°50.1	326°59.9	N03°19.6	32°54.0	N23°03.7	313°50.3	S02°11.1	314°47.3	S00°34.6
13	156°52.6	341°59.7	18.3	47°54.7	03.5	328°52.4	11.3	329°49.5	34.7
14	171°55.0	356°59.4	17.1	62°55.4	03.3	343°54.4	11.5	344°51.8	34.8
15	186°57.5	11°59.2	·· 15.8	77°56.1	·· 03.2	358°56.5	·· 11.6	359°54.0	·· 34.9
16	202°00.0	26°58.9	14.5	92°56.8	03.0	13°58.5	11.8	14°56.2	35.0
17	217°02.4	41°58.7	13.2	107°57.5	02.8	29°00.6	12.0	29°58.5	35.1
18	232°04.9	56°58.4	N03°12.0	122°58.2	N23°02.6	44°02.7	S02°12.2	45°00.7	S00°35.2
19	247°07.4	71°58.2	10.7	137°59.0	02.4	59°04.7	12.4	60°03.0	35.3
20	262°09.8	86°57.9	09.4	152°59.7	02.2	74°06.8	12.5	75°05.2	35.4
21	277°12.3	101°57.7	·· 08.1	168°00.4	·· 02.0	89°08.8	·· 12.7	90°07.4	·· 35.5
22	292°14.7	116°57.4	06.9	183°01.1	01.8	104°10.9	12.9	105°09.7	35.6
23	307°17.2	131°57.2	05.6	198°01.8	01.7	119°13.0	13.1	120°11.9	35.7
Mer.pass. 02:34		ν -0.2′	d 1.3′	m -3.95	ν 0.7′	d 0.2′	m 1.61	ν 2.1′	d 0.2′ m -1.76	ν 2.2′	d 0.1′ m 0.95

Stars

	SHA	Dec
Alpheratz	358°08.4	28°59.2
Ankaa	353°39.3	-42°24.2
Schedar	350°07.9	56°25.9
Diphda	349°20.0	-18°05.2
Achernar	335°44.6	-57°19.6
Hamal	328°28.1	23°22.4
Polaris	326°35.4	89°10.4
Acamar	315°36.7	-40°22.5
Menkar	314°40.4	4°01.1
Mirfak	309°15.2	49°47.5
Aldebaran	291°17.4	16°28.3
Rigel	281°35.6	-8°13.3
Capella	281°10.6	45°58.6
Bellatrix	278°58.2	6°20.0
Elnath	278°43.5	28°35.5
Alnilam	276°11.2	-1°12.7
Betelgeuse	271°27.8	7°24.3
Canopus	264°07.3	-52°40.9
Sirius	258°55.4	-16°41.3
Adhara	255°31.9	-28°56.7
Procyon	245°25.4	5°16.4
Pollux	243°57.7	28°04.3
Avior	234°28.6	-59°26.9
Suhail	223°10.8	-43°21.4
Miaplacidus	221°45.8	-69°38.4
Alphard	218°20.3	-8°34.6
Regulus	208°09.6	12°03.6
Dubhe	194°21.9	61°51.3
Denebola	182°58.7	14°40.7
Gienah	176°17.5	-17°26.3
Acrux	173°37.1	-62°59.9
Gacrux	172°28.4	-57°00.7
Alioth	166°42.3	56°04.0
Spica	158°57.0	-11°03.8
Alkaid	153°18.2	49°24.7
Hadar	149°22.6	-60°17.2
Menkent	148°36.4	-36°16.8
Arcturus	146°18.0	19°17.0
Rigil Kent.	140°25.0	-60°45.6
Kochab	137°19.1	74°14.3
Zuben'ubi	137°32.4	-15°57.8
Alphecca	126°31.5	26°46.9
Antares	112°55.9	-26°23.5
Atria	108°19.4	-68°59.9
Sabik	102°40.2	-15°42.1
Shaula	96°54.7	-37°05.5
Rasalhague	96°28.8	12°34.6
Eltanin	90°57.1	51°29.8
Kaus Aust.	84°15.7	-34°23.6
Vega	80°55.1	38°46.2
Nunki	76°28.1	-26°19.2
Altair	62°31.6	8°49.3
Peacock	53°56.8	-56°47.7
Deneb	49°47.6	45°12.9
Enif	34°10.6	9°47.5
Al Na'ir	28°13.7	-47°02.9
Fomalhaut	15°50.4	-29°43.1
Scheat	14°16.6	27°58.9
Markab	14°02.2	15°06.4

Aug 11 Tue	SHA	Mer.pass
Venus	187°52.8	14:11
Mars	252°50.1	09:51
Jupiter	172°24.1	15:11
Saturn	173°10.3	15:08

Aug 12 Wed	SHA	Mer.pass
Venus	186°47.5	14:12
Mars	252°07.6	09:50
Jupiter	172°14.6	15:08
Saturn	173°05.1	15:04

Aug 13 Thu	SHA	Mer.pass
Venus	185°42.3	14:12
Mars	251°25.1	09:48
Jupiter	172°05.0	15:04
Saturn	172°59.8	15:00

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h

	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°41.8	N15°21.8	56°32.6	11.5′	S19°59.7	3.7′	54.7′
1	193°41.9	21.1	71°03.1	11.4′	20°03.4	3.5′	54.7′
2	208°42.0	20.4	85°33.5	11.4′	20°06.9	3.4′	54.7′
3	223°42.1	·· 19.6	100°03.9	11.3′	20°10.3	3.4′	54.7′
4	238°42.1	18.9	114°34.2	11.3′	20°13.7	3.2′	54.8′
5	253°42.2	18.1	129°04.5	11.2′	20°16.9	3.2′	54.8′
6	268°42.3	N15°17.4	143°34.8	11.2′	S20°20.1	3.1′	54.8′
7	283°42.4	16.7	158°05.0	11.2′	20°23.2	2.9′	54.8′
8	298°42.5	15.9	172°35.1	11.1′	20°26.1	2.9′	54.8′
9	313°42.6	·· 15.2	187°05.2	11.1′	20°29.0	2.7′	54.8′
10	328°42.7	14.4	201°35.3	11.0′	20°31.7	2.7′	54.9′
11	343°42.8	13.7	216°05.3	11.0′	20°34.4	2.6′	54.9′
12	358°42.9	N15°12.9	230°35.3	10.9′	S20°37.0	2.5′	54.9′
13	13°43.0	12.2	245°05.2	10.9′	20°39.5	2.3′	54.9′
14	28°43.2	11.5	259°35.1	10.8′	20°41.8	2.3′	54.9′
15	43°43.3	·· 10.7	274°04.9	10.8′	20°44.1	2.2′	55.0′
16	58°43.4	10.0	288°34.8	10.8′	20°46.3	2.0′	55.0′
17	73°43.5	09.2	303°04.5	10.7′	20°48.3	2.0′	55.0′
18	88°43.6	N15°08.5	317°34.2	10.7′	S20°50.3	1.9′	55.0′
19	103°43.7	07.7	332°03.9	10.6′	20°52.2	1.7′	55.0′
20	118°43.8	07.0	346°33.6	10.6′	20°53.9	1.7′	55.1′
21	133°43.9	·· 06.2	1°03.2	10.6′	20°55.6	1.5′	55.1′
22	148°44.0	05.5	15°32.7	10.5′	20°57.1	1.5′	55.1′
23	163°44.1	04.7	30°02.3	10.5′	20°58.6	1.3′	55.1′
	SD = 15.8′	d = 0.7′	SD = 14.9′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°44.2	N15°04.0	44°31.7	10.4′	S20°59.9	1.3′	55.1′
1	193°44.3	03.2	59°01.2	10.4′	21°01.2	1.1′	55.2′
2	208°44.4	02.5	73°30.6	10.4′	21°02.3	1.0′	55.2′
3	223°44.5	·· 01.8	88°00.0	10.3′	21°03.3	1.0′	55.2′
4	238°44.6	01.0	102°29.3	10.3′	21°04.3	0.8′	55.2′
5	253°44.7	15°00.3	116°58.6	10.3′	21°05.1	0.7′	55.3′
6	268°44.8	N14°59.5	131°27.9	10.2′	S21°05.8	0.6′	55.3′
7	283°44.9	58.7	145°57.1	10.2′	21°06.4	0.5′	55.3′
8	298°45.0	58.0	160°26.3	10.2′	21°06.9	0.4′	55.3′
9	313°45.1	·· 57.2	174°55.5	10.1′	21°07.3	0.2′	55.3′
10	328°45.2	56.5	189°24.6	10.1′	21°07.5	0.2′	55.4′
11	343°45.3	55.7	203°53.7	10.1′	21°07.7	0.1′	55.4′
12	358°45.4	N14°55.0	218°22.8	10.0′	S21°07.8	0.1′	55.4′
13	13°45.5	54.2	232°51.9	10.0′	21°07.7	0.1′	55.4′
14	28°45.7	53.5	247°20.9	10.0′	21°07.6	0.3′	55.5′
15	43°45.8	·· 52.7	261°49.9	10.0′	21°07.3	0.4′	55.5′
16	58°45.9	52.0	276°18.8	9.9′	21°06.9	0.5′	55.5′
17	73°46.0	51.2	290°47.7	9.9′	21°06.4	0.6′	55.5′
18	88°46.1	N14°50.5	305°16.6	9.9′	S21°05.8	0.7′	55.6′
19	103°46.2	49.7	319°45.5	9.8′	21°05.1	0.8′	55.6′
20	118°46.3	49.0	334°14.4	9.8′	21°04.3	0.9′	55.6′
21	133°46.4	·· 48.2	348°43.2	9.8′	21°03.4	1.1′	55.6′
22	148°46.5	47.4	3°12.0	9.8′	21°02.3	1.1′	55.6′
23	163°46.6	46.7	17°40.8	9.8′	21°01.2	1.3′	55.7′
	SD = 15.8′	d = 0.7′	SD = 15.0′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°46.7	N14°45.9	32°09.5	9.7′	S20°59.9	1.4′	55.7′
1	193°46.8	45.2	46°38.2	9.7′	20°58.5	1.5′	55.7′
2	208°47.0	44.4	61°07.0	9.7′	20°57.0	1.6′	55.7′
3	223°47.1	·· 43.6	75°35.6	9.7′	20°55.4	1.7′	55.8′
4	238°47.2	42.9	90°04.3	9.6′	20°53.7	1.8′	55.8′
5	253°47.3	42.1	104°33.0	9.6′	20°51.9	1.9′	55.8′
6	268°47.4	N14°41.4	119°01.6	9.6′	S20°50.0	2.1′	55.8′
7	283°47.5	40.6	133°30.2	9.6′	20°47.9	2.2′	55.9′
8	298°47.6	39.8	147°58.8	9.6′	20°45.7	2.3′	55.9′
9	313°47.7	·· 39.1	162°27.4	9.6′	20°43.4	2.3′	55.9′
10	328°47.8	38.3	176°56.0	9.6′	20°41.1	2.6′	55.9′
11	343°48.0	37.6	191°24.5	9.5′	20°38.5	2.6′	56.0′
12	358°48.1	N14°36.8	205°53.0	9.5′	S20°35.9	2.7′	56.0′
13	13°48.2	36.0	220°21.6	9.5′	20°33.2	2.8′	56.0′
14	28°48.3	35.3	234°50.1	9.5′	20°30.4	3.0′	56.0′
15	43°48.4	·· 34.5	249°18.6	9.5′	20°27.4	3.1′	56.1′
16	58°48.5	33.7	263°47.1	9.5′	20°24.3	3.2′	56.1′
17	73°48.6	33.0	278°15.5	9.5′	20°21.1	3.3′	56.1′
18	88°48.8	N14°32.2	292°44.0	9.5′	S20°17.8	3.4′	56.2′
19	103°48.9	31.4	307°12.5	9.5′	20°14.4	3.5′	56.2′
20	118°49.0	30.7	321°40.9	9.4′	20°10.9	3.6′	56.2′
21	133°49.1	·· 29.9	336°09.4	9.4′	20°07.3	3.8′	56.2′
22	148°49.2	29.1	350°37.8	9.4′	20°03.5	3.8′	56.3′
23	163°49.3	28.4	5°06.2	9.4′	19°59.7	4.0′	56.3′
	SD = 15.8′	d = 0.8′	SD = 15.2′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	////	////	02:01	22:03	////	////
N 70°	////	////	02:39	21:26	////	////
68°	////	01:15	03:06	21:01	22:46	////
66°	////	02:03	03:26	20:41	22:02	////
64°	////	02:33	03:42	20:26	21:33	////
62°	01:06	02:56	03:55	20:13	21:11	22:55
60°	01:50	03:13	04:06	20:02	20:54	22:15
N 58°	02:18	03:28	04:16	19:52	20:40	21:49
56°	02:39	03:40	04:25	19:44	20:28	21:29
54°	02:56	03:51	04:32	19:37	20:18	21:12
52°	03:09	04:00	04:39	19:30	20:09	20:59
50°	03:21	04:08	04:45	19:24	20:01	20:47
45°	03:45	04:25	04:58	19:11	19:44	20:23
N 40°	04:03	04:39	05:08	19:01	19:30	20:06
35°	04:18	04:50	05:17	18:52	19:19	19:51
30°	04:30	05:00	05:25	18:44	19:09	19:39
20°	04:49	05:16	05:39	18:31	18:54	19:21
N 10°	05:03	05:29	05:51	18:19	18:41	19:06
0°	05:15	05:40	06:02	18:08	18:30	18:55
S 10°	05:26	05:51	06:12	17:58	18:19	18:44
20°	05:35	06:01	06:24	17:46	18:09	18:35
30°	05:43	06:12	06:37	17:34	17:58	18:27
35°	05:48	06:18	06:44	17:26	17:53	18:23
40°	05:52	06:24	06:52	17:18	17:46	18:18
45°	05:57	06:31	07:02	17:08	17:39	18:14
S 50°	06:01	06:40	07:14	16:57	17:31	18:09
52°	06:03	06:43	07:19	16:51	17:27	18:07
54°	06:06	06:47	07:25	16:46	17:23	18:05
56°	06:08	06:52	07:32	16:39	17:19	18:03
58°	06:10	06:57	07:39	16:32	17:14	18:01
S 60°	06:13	07:02	07:48	16:23	17:09	17:58

Lat.	**Moonrise** Tue	Wed	Thu	**Moonset** Tue	Wed	Thu
N 72°	▬	▬	▬	▬	▬	▬
N 70°	▬	▬	▬	▬	▬	▬
68°	19:40	20:38	20:59	22:09	22:57	·· ··
66°	18:49	19:45	20:18	23:00	23:50	·· ··
64°	18:17	19:12	19:50	23:32	·· ··	00:23
62°	17:54	18:48	19:29	23:56	·· ··	00:47
60°	17:35	18:29	19:11	·· ··	00:14	01:06
N 58°	17:19	18:13	18:57	·· ··	00:30	01:22
56°	17:06	17:59	18:44	00:02	00:44	01:35
54°	16:54	17:48	18:33	00:13	00:55	01:47
52°	16:44	17:37	18:24	00:23	01:05	01:57
50°	16:35	17:28	18:15	00:31	01:15	02:06
45°	16:16	17:09	17:57	00:49	01:34	02:26
N 40°	16:01	16:53	17:41	01:04	01:50	02:41
35°	15:47	16:39	17:29	01:17	02:03	02:55
30°	15:36	16:28	17:18	01:27	02:15	03:06
20°	15:16	16:08	16:58	01:46	02:34	03:26
N 10°	14:59	15:51	16:42	02:03	02:52	03:43
0°	14:44	15:34	16:26	02:18	03:08	03:59
S 10°	14:28	15:18	16:11	02:33	03:24	04:15
20°	14:11	15:01	15:54	02:50	03:41	04:32
30°	13:51	14:41	15:35	03:09	04:01	04:52
35°	13:40	14:29	15:24	03:20	04:13	05:03
40°	13:27	14:16	15:11	03:32	04:26	05:16
45°	13:12	14:00	14:56	03:47	04:41	05:32
S 50°	12:53	13:41	14:37	04:05	05:01	05:51
52°	12:45	13:32	14:28	04:14	05:10	06:00
54°	12:35	13:22	14:18	04:24	05:20	06:10
56°	12:24	13:10	14:07	04:35	05:32	06:21
58°	12:11	12:57	13:54	04:47	05:45	06:34
S 60°	11:56	12:41	13:40	05:02	06:01	06:49

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 11-13 79-92%
11	05:13	05:08	12:05	20:56	08:31	
12	05:03	04:58	12:05	21:47	09:21	
13	04:53	04:48	12:05	22:39	10:13	

August 14, 15, 16 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	322°19.7	146°57.0	N03°04.3	213°02.5	N23°01.5	134°15.0	S02°13.3	135°14.2	S00°35.8
1	337°22.1	161°56.7	03.0	228°03.2	01.3	149°17.1	13.4	150°16.4	35.9
2	352°24.6	176°56.5	01.7	243°03.9	01.1	164°19.1	13.6	165°18.7	36.0
3	7°27.1	191°56.2	03°00.5	258°04.6	·· 00.9	179°21.2	·· 13.8	180°20.9	·· 36.1
4	22°29.5	206°56.0	02°59.2	273°05.3	00.7	194°23.3	14.0	195°23.1	36.2
5	37°32.0	221°55.7	57.9	288°06.0	00.5	209°25.3	14.2	210°25.4	36.3
6	52°34.5	236°55.5	N02°56.6	303°06.7	N23°00.3	224°27.4	S02°14.3	225°27.6	S00°36.4
7	67°36.9	251°55.3	55.4	318°07.4	00.1	239°29.4	14.5	240°29.9	36.5
8	82°39.4	266°55.0	54.1	333°08.1	23°00.0	254°31.5	14.7	255°32.1	36.6
9	97°41.9	281°54.8	·· 52.8	348°08.8	22°59.8	269°33.6	·· 14.9	270°34.3	·· 36.7
10	112°44.3	296°54.5	51.5	3°09.5	59.6	284°35.6	15.1	285°36.6	36.8
11	127°46.8	311°54.3	50.2	18°10.2	59.4	299°37.7	15.2	300°38.8	36.9
12	142°49.2	326°54.0	N02°49.0	33°10.9	N22°59.2	314°39.7	S02°15.4	315°41.1	S00°37.0
13	157°51.7	341°53.8	47.7	48°11.6	59.0	329°41.8	15.6	330°43.3	37.1
14	172°54.2	356°53.6	46.4	63°12.3	58.8	344°43.9	15.8	345°45.5	37.2
15	187°56.6	11°53.3	·· 45.1	78°13.0	·· 58.6	359°45.9	·· 16.0	0°47.8	·· 37.3
16	202°59.1	26°53.1	43.9	93°13.7	58.4	14°48.0	16.1	15°50.0	37.4
17	218°01.6	41°52.8	42.6	108°14.4	58.2	29°50.0	16.3	30°52.3	37.5
18	233°04.0	56°52.6	N02°41.3	123°15.1	N22°58.0	44°52.1	S02°16.5	45°54.5	S00°37.6
19	248°06.5	71°52.4	40.0	138°15.8	57.8	59°54.1	16.7	60°56.8	37.7
20	263°09.0	86°52.1	38.7	153°16.5	57.6	74°56.2	16.9	75°59.0	37.8
21	278°11.4	101°51.9	·· 37.5	168°17.2	·· 57.4	89°58.3	·· 17.0	91°01.2	·· 37.9
22	293°13.9	116°51.6	36.2	183°18.0	57.2	105°00.3	17.2	106°03.5	38.0
23	308°16.4	131°51.4	34.9	198°18.7	57.1	120°02.4	17.4	121°05.7	38.1
Mer.pass. 02:30		ν -0.2′	d 1.3′	ν 0.7′	d 0.2′	ν 2.1′	d 0.2′	ν 2.2′	d 0.1′
		m -3.95		m 1.61		m -1.76		m 0.95	

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	323°18.8	146°51.2	N02°33.6	213°19.4	N22°56.9	135°04.4	S02°17.6	136°08.0	S00°38.2
1	338°21.3	161°50.9	32.3	228°20.1	56.7	150°06.5	17.8	151°10.2	38.3
2	353°23.7	176°50.7	31.1	243°20.8	56.5	165°08.5	17.9	166°12.4	38.4
3	8°26.2	191°50.4	·· 29.8	258°21.5	·· 56.3	180°10.6	·· 18.1	181°14.7	·· 38.5
4	23°28.7	206°50.2	28.5	273°22.2	56.1	195°12.7	18.3	196°16.9	38.6
5	38°31.1	221°50.0	27.2	288°22.9	55.9	210°14.7	18.5	211°19.1	38.7
6	53°33.6	236°49.7	N02°25.9	303°23.6	N22°55.7	225°16.8	S02°18.7	226°21.4	S00°38.8
7	68°36.1	251°49.5	24.7	318°24.3	55.5	240°18.8	18.8	241°23.6	38.9
8	83°38.5	266°49.2	23.4	333°25.0	55.3	255°20.9	19.0	256°25.9	39.1
9	98°41.0	281°49.0	·· 22.1	348°25.7	·· 55.1	270°22.9	·· 19.2	271°28.1	·· 39.2
10	113°43.5	296°48.8	20.8	3°26.4	54.9	285°25.0	19.4	286°30.3	39.3
11	128°45.9	311°48.5	19.5	18°27.1	54.7	300°27.0	19.6	301°32.6	39.4
12	143°48.4	326°48.3	N02°18.2	33°27.9	N22°54.5	315°29.1	S02°19.7	316°34.8	S00°39.5
13	158°50.8	341°48.1	17.0	48°28.6	54.3	330°31.2	19.9	331°37.1	39.6
14	173°53.3	356°47.8	15.7	63°29.3	54.1	345°33.2	20.1	346°39.3	39.7
15	188°55.8	11°47.6	·· 14.4	78°30.0	·· 53.9	0°35.3	·· 20.3	1°41.5	·· 39.8
16	203°58.2	26°47.3	13.1	93°30.7	53.7	15°37.3	20.5	16°43.8	39.9
17	219°00.7	41°47.1	11.8	108°31.4	53.5	30°39.4	20.7	31°46.0	40.0
18	234°03.2	56°46.9	N02°10.6	123°32.1	N22°53.3	45°41.4	S02°20.8	46°48.3	S00°40.1
19	249°05.6	71°46.6	09.3	138°32.8	53.1	60°43.5	21.0	61°50.5	40.2
20	264°08.1	86°46.4	08.0	153°33.5	52.9	75°45.5	21.2	76°52.7	40.3
21	279°10.6	101°46.2	·· 06.7	168°34.2	·· 52.7	90°47.6	·· 21.4	91°55.0	·· 40.4
22	294°13.0	116°45.9	05.4	183°35.0	52.5	105°49.7	21.6	106°57.2	40.5
23	309°15.5	131°45.7	04.1	198°35.7	52.3	120°51.7	21.7	121°59.4	40.6
Mer.pass. 02:26		ν -0.2′	d 1.3′	ν 0.7′	d 0.2′	ν 2.1′	d 0.2′	ν 2.2′	d 0.1′
		m -3.95		m 1.61		m -1.75		m 0.95	

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	324°18.0	146°45.5	N02°02.9	213°36.4	N22°52.1	135°53.8	S02°21.9	137°01.7	S00°40.7
1	339°20.4	161°45.2	01.6	228°37.1	51.9	150°55.8	22.1	152°03.9	40.8
2	354°22.9	176°45.0	02°00.3	243°37.8	51.7	165°57.9	22.3	167°06.2	40.9
3	9°25.3	191°44.8	01°59.0	258°38.5	·· 51.5	180°59.9	·· 22.5	182°08.4	·· 41.0
4	24°27.8	206°44.5	57.7	273°39.2	51.3	196°02.0	22.7	197°10.6	41.1
5	39°30.3	221°44.3	56.4	288°39.9	51.0	211°04.0	22.8	212°12.9	41.2
6	54°32.7	236°44.1	N01°55.2	303°40.6	N22°50.8	226°06.1	S02°23.0	227°15.1	S00°41.3
7	69°35.2	251°43.8	53.9	318°41.4	50.6	241°08.1	23.2	242°17.3	41.4
8	84°37.7	266°43.6	52.6	333°42.1	50.4	256°10.2	23.4	257°19.6	41.5
9	99°40.1	281°43.4	·· 51.3	348°42.8	·· 50.2	271°12.2	·· 23.6	272°21.8	·· 41.6
10	114°42.6	296°43.1	50.0	3°43.5	50.0	286°14.3	23.7	287°24.0	41.7
11	129°45.1	311°42.9	48.7	18°44.2	49.8	301°16.3	23.9	302°26.3	41.8
12	144°47.5	326°42.7	N01°47.4	33°44.9	N22°49.6	316°18.4	S02°24.1	317°28.5	S00°41.9
13	159°50.0	341°42.4	46.2	48°45.6	49.4	331°20.4	24.3	332°30.8	42.0
14	174°52.4	356°42.2	44.9	63°46.3	49.2	346°22.5	24.5	347°33.0	42.1
15	189°54.9	11°42.0	·· 43.6	78°47.1	·· 49.0	1°24.6	·· 24.7	2°35.2	·· 42.3
16	204°57.4	26°41.7	42.3	93°47.8	48.8	16°26.6	24.8	17°37.5	42.4
17	219°59.8	41°41.5	41.0	108°48.5	48.6	31°28.7	25.0	32°39.7	42.5
18	235°02.3	56°41.3	N01°39.7	123°49.2	N22°48.4	46°30.7	S02°25.2	47°41.9	S00°42.6
19	250°04.8	71°41.0	38.5	138°49.9	48.2	61°32.8	25.4	62°44.2	42.7
20	265°07.2	86°40.8	37.2	153°50.6	47.9	76°34.8	25.6	77°46.4	42.8
21	280°09.7	101°40.6	·· 35.9	168°51.3	·· 47.7	91°36.9	·· 25.7	92°48.6	·· 42.9
22	295°12.2	116°40.3	34.6	183°52.1	47.5	106°38.9	25.9	107°50.9	43.0
23	310°14.6	131°40.1	33.3	198°52.8	47.3	121°41.0	26.1	122°53.1	43.1
Mer.pass. 02:22		ν -0.2′	d 1.3′	ν 0.7′	d 0.2′	ν 2.1′	d 0.2′	ν 2.2′	d 0.1′
		m -3.95		m 1.61		m -1.75		m 0.95	

Stars

	SHA	Dec
Alpheratz	358°08.4	28°59.2
Ankaa	353°39.3	-42°24.2
Schedar	350°07.9	56°26.0
Diphda	349°20.0	-18°05.2
Achernar	335°44.5	-57°19.6
Hamal	328°28.1	23°22.4
Polaris	326°34.3	89°10.4
Acamar	315°36.7	-40°22.5
Menkar	314°40.4	4°01.1
Mirfak	309°15.2	49°47.5
Aldebaran	291°17.4	16°28.3
Rigel	281°35.5	-8°13.3
Capella	281°10.6	45°58.6
Bellatrix	278°58.2	6°20.0
Elnath	278°43.5	28°35.5
Alnilam	276°11.2	-1°12.7
Betelgeuse	271°27.8	7°24.3
Canopus	264°07.3	-52°40.9
Sirius	258°55.3	-16°41.3
Adhara	255°31.9	-28°56.6
Procyon	245°25.4	5°16.4
Pollux	243°57.7	28°04.3
Avior	234°28.6	-59°26.9
Suhail	223°10.8	-43°21.4
Miaplacidus	221°45.8	-69°38.4
Alphard	218°20.3	-8°34.6
Regulus	208°09.6	12°03.6
Dubhe	194°21.9	61°51.3
Denebola	182°58.7	14°40.7
Gienah	176°17.5	-17°26.3
Acrux	173°37.1	-62°59.9
Gacrux	172°28.4	-57°00.7
Alioth	166°42.3	56°03.9
Spica	158°57.0	-11°03.8
Alkaid	153°18.2	49°24.7
Hadar	149°22.7	-60°17.2
Menkent	148°36.4	-36°16.8
Arcturus	146°18.0	19°17.0
Rigil Kent.	140°25.1	-60°45.6
Kochab	137°19.2	74°14.3
Zuben'ubi	137°32.4	-15°57.8
Alphecca	126°31.5	26°46.9
Antares	112°56.0	-26°23.5
Atria	108°19.4	-68°59.9
Sabik	102°40.2	-15°42.1
Shaula	96°54.7	-37°05.5
Rasalhague	96°28.8	12°34.6
Eltanin	90°57.1	51°29.8
Kaus Aust.	84°15.7	-34°23.6
Vega	80°55.1	38°46.2
Nunki	76°28.1	-26°19.2
Altair	62°31.6	8°49.3
Peacock	53°56.8	-56°47.7
Deneb	49°47.6	45°13.0
Enif	34°10.6	9°47.5
Al Na'ir	28°13.7	-47°03.0
Fomalhaut	15°50.4	-29°43.1
Scheat	14°16.6	27°58.9
Markab	14°02.2	15°06.4

Aug 14 Fri	SHA	Mer.pass
Venus	184°37.3	14:12
Mars	250°42.8	09:47
Jupiter	171°55.4	15:01
Saturn	172°54.5	14:57

Aug 15 Sat	SHA	Mer.pass
Venus	183°32.3	14:13
Mars	250°00.6	09:46
Jupiter	171°45.6	14:58
Saturn	172°49.1	14:53

Aug 16 Sun	SHA	Mer.pass
Venus	182°27.5	14:13
Mars	249°18.4	09:45
Jupiter	171°35.8	14:54
Saturn	172°43.7	14:50

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.3111 sec ΔT = TT-UT1 = +51.8729 sec

1981 August 14 to Aug. 16 UT

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Fri	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	178°49.4	N14°27.6	19°34.7	9.4′	S19°55.7	4.1′	56.3′
1	193°49.6	26.8	34°03.1	9.4′	19°51.6	4.2′	56.3′
2	208°49.7	26.1	48°31.5	9.4′	19°47.4	4.3′	56.4′
3	223°49.8	·· 25.3	62°59.9	9.4′	19°43.1	4.4′	56.4′
4	238°49.9	24.5	77°28.3	9.4′	19°38.7	4.5′	56.4′
5	253°50.0	23.8	91°56.8	9.4′	19°34.2	4.7′	56.4′
6	268°50.1	N14°23.0	106°25.2	9.4′	S19°29.5	4.7′	56.5′
7	283°50.3	22.2	120°53.6	9.4′	19°24.8	4.9′	56.5′
8	298°50.4	21.5	135°22.0	9.4′	19°19.9	5.0′	56.5′
9	313°50.5	·· 20.7	149°50.4	9.4′	19°14.9	5.1′	56.5′
10	328°50.6	19.9	164°18.8	9.4′	19°09.8	5.2′	56.6′
11	343°50.7	19.1	178°47.2	9.4′	19°04.6	5.3′	56.6′
12	358°50.8	N14°18.4	193°15.7	9.4′	S18°59.3	5.4′	56.6′
13	13°51.0	17.6	207°44.1	9.4′	18°53.9	5.5′	56.6′
14	28°51.1	16.8	222°12.5	9.4′	18°48.4	5.6′	56.7′
15	43°51.2	·· 16.1	236°41.0	9.4′	18°42.8	5.8′	56.7′
16	58°51.3	15.3	251°09.4	9.4′	18°37.0	5.8′	56.7′
17	73°51.4	14.5	265°37.8	9.5′	18°31.2	6.0′	56.8′
18	88°51.6	N14°13.7	280°06.3	9.5′	S18°25.2	6.0′	56.8′
19	103°51.7	13.0	294°34.8	9.5′	18°19.2	6.2′	56.8′
20	118°51.8	12.2	309°03.2	9.5′	18°13.0	6.2′	56.8′
21	133°51.9	·· 11.4	323°31.7	9.5′	18°06.8	6.4′	56.9′
22	148°52.0	10.6	338°00.2	9.5′	18°00.4	6.5′	56.9′
23	163°52.2	09.9	352°28.7	9.5′	17°53.9	6.6′	56.9′
	SD = 15.8′	d = 0.8′		SD = 15.4′			

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	178°52.3	N14°09.1	6°57.2	9.5′	S17°47.3	6.7′	56.9′
1	193°52.4	08.3	21°25.7	9.5′	17°40.6	6.8′	57.0′
2	208°52.5	07.5	35°54.2	9.5′	17°33.8	6.9′	57.0′
3	223°52.6	·· 06.7	50°22.8	9.6′	17°26.9	7.0′	57.0′
4	238°52.8	06.0	64°51.3	9.6′	17°19.9	7.1′	57.0′
5	253°52.9	05.2	79°19.9	9.6′	17°12.8	7.2′	57.1′
6	268°53.0	N14°04.4	93°48.5	9.6′	S17°05.6	7.3′	57.1′
7	283°53.1	03.6	108°17.0	9.6′	16°58.3	7.4′	57.1′
8	298°53.3	02.8	122°45.7	9.6′	16°50.9	7.5′	57.1′
9	313°53.4	·· 02.1	137°14.3	9.6′	16°43.4	7.6′	57.2′
10	328°53.5	01.3	151°42.9	9.6′	16°35.8	7.6′	57.2′
11	343°53.6	14°00.5	166°11.5	9.7′	16°28.2	7.8′	57.2′
12	358°53.7	N13°59.7	180°40.2	9.7′	S16°20.4	7.9′	57.2′
13	13°53.9	58.9	195°08.9	9.7′	16°12.5	8.0′	57.3′
14	28°54.0	58.2	209°37.6	9.7′	16°04.5	8.1′	57.3′
15	43°54.1	·· 57.4	224°06.3	9.7′	15°56.4	8.2′	57.3′
16	58°54.2	56.6	238°35.0	9.7′	15°48.2	8.2′	57.3′
17	73°54.4	55.8	253°03.8	9.8′	15°40.0	8.4′	57.4′
18	88°54.5	N13°55.0	267°32.5	9.8′	S15°31.6	8.5′	57.4′
19	103°54.6	54.2	282°01.3	9.8′	15°23.1	8.5′	57.4′
20	118°54.7	53.5	296°30.1	9.8′	15°14.6	8.7′	57.4′
21	133°54.9	·· 52.7	310°58.9	9.8′	15°05.9	8.7′	57.5′
22	148°55.0	51.9	325°27.7	9.8′	14°57.2	8.8′	57.5′
23	163°55.1	51.1	339°56.6	9.9′	14°48.4	8.9′	57.5′
	SD = 15.8′	d = 0.8′		SD = 15.5′			

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	178°55.3	N13°50.3	354°25.4	9.9′	S14°39.5	9.0′	57.5′
1	193°55.4	49.5	8°54.3	9.9′	14°30.5	9.1′	57.6′
2	208°55.5	48.7	23°23.2	9.9′	14°21.4	9.2′	57.6′
3	223°55.6	·· 48.0	37°52.1	9.9′	14°12.2	9.2′	57.6′
4	238°55.8	47.2	52°21.1	10.0′	14°03.0	9.4′	57.6′
5	253°55.9	46.4	66°50.0	10.0′	13°53.6	9.4′	57.7′
6	268°56.0	N13°45.6	81°19.0	10.0′	S13°44.2	9.5′	57.7′
7	283°56.1	44.8	95°48.0	10.0′	13°34.7	9.6′	57.7′
8	298°56.3	44.0	110°17.0	10.0′	13°25.1	9.6′	57.7′
9	313°56.4	·· 43.2	124°46.0	10.1′	13°15.5	9.8′	57.7′
10	328°56.5	42.4	139°15.1	10.1′	13°05.7	9.8′	57.8′
11	343°56.7	41.6	153°44.2	10.1′	12°55.9	9.9′	57.8′
12	358°56.8	N13°40.9	168°13.2	10.1′	S12°46.0	10.0′	57.8′
13	13°56.9	40.1	182°42.4	10.1′	12°36.0	10.1′	57.8′
14	28°57.0	39.3	197°11.5	10.1′	12°25.9	10.1′	57.9′
15	43°57.2	·· 38.5	211°40.6	10.2′	12°15.8	10.2′	57.9′
16	58°57.3	37.7	226°09.8	10.2′	12°05.6	10.3′	57.9′
17	73°57.4	36.9	240°39.0	10.2′	11°55.3	10.3′	57.9′
18	88°57.6	N13°36.1	255°08.2	10.2′	S11°45.0	10.5′	57.9′
19	103°57.7	35.3	269°37.4	10.2′	11°34.5	10.5′	58.0′
20	118°57.8	34.5	284°06.6	10.3′	11°24.0	10.5′	58.0′
21	133°58.0	·· 33.7	298°35.9	10.3′	11°13.5	10.7′	58.0′
22	148°58.1	32.9	313°05.1	10.3′	11°02.8	10.7′	58.0′
23	163°58.2	32.1	327°34.4	10.3′	10°52.1	10.8′	58.1′
	SD = 15.8′	d = 0.8′		SD = 15.7′			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	////	////	02:23	21:40	////	////
N 70°	////	////	02:55	21:09	23:35	////
68°	////	01:42	03:19	20:47	22:20	////
66°	////	02:20	03:37	20:30	21:44	////
64°	////	02:46	03:51	20:15	21:19	23:38
62°	01:31	03:06	04:03	20:04	21:00	22:32
60°	02:05	03:22	04:14	19:53	20:44	22:00
N 58°	02:29	03:35	04:23	19:45	20:31	21:37
56°	02:48	03:47	04:30	19:37	20:20	21:18
54°	03:03	03:57	04:37	19:30	20:11	21:03
52°	03:16	04:05	04:44	19:24	20:02	20:51
50°	03:27	04:13	04:49	19:19	19:54	20:40
45°	03:50	04:29	05:01	19:07	19:39	20:18
N 40°	04:07	04:42	05:11	18:57	19:26	20:01
35°	04:21	04:53	05:20	18:49	19:15	19:47
30°	04:32	05:02	05:27	18:41	19:06	19:36
20°	04:50	05:17	05:40	18:29	18:52	19:19
N 10°	05:04	05:29	05:51	18:18	18:40	19:05
0°	05:15	05:40	06:01	18:08	18:29	18:54
S 10°	05:25	05:50	06:11	17:58	18:19	18:44
20°	05:33	05:59	06:22	17:47	18:10	18:36
30°	05:41	06:09	06:34	17:35	18:00	18:28
35°	05:45	06:15	06:41	17:29	17:55	18:25
40°	05:49	06:20	06:48	17:21	17:49	18:21
45°	05:52	06:27	06:57	17:12	17:42	18:17
S 50°	05:57	06:35	07:08	17:01	17:35	18:13
52°	05:58	06:38	07:13	16:56	17:32	18:11
54°	06:00	06:42	07:19	16:51	17:28	18:10
56°	06:02	06:46	07:25	16:45	17:24	18:08
58°	06:04	06:50	07:32	16:38	17:20	18:06
S 60°	06:06	06:55	07:40	16:30	17:15	18:04

Lat.	Moonrise Fri	Moonrise Sat	Moonrise Sun	Moonset Fri	Moonset Sat	Moonset Sun
N 72°	23:21	22:02	21:38	23:54	·· ··	03:01
N 70°	21:45	21:30	21:20	▬	01:29	03:33
68°	21:04	21:06	21:05	00:25	02:08	03:55
66°	20:37	20:47	20:53	01:05	02:36	04:13
64°	20:15	20:32	20:43	01:33	02:56	04:27
62°	19:58	20:19	20:34	01:54	03:13	04:39
60°	19:44	20:08	20:27	02:11	03:27	04:49
N 58°	19:31	19:59	20:20	02:25	03:39	04:58
56°	19:21	19:50	20:14	02:38	03:49	05:06
54°	19:11	19:43	20:09	02:48	03:58	05:13
52°	19:03	19:36	20:04	02:58	04:06	05:19
50°	18:55	19:30	20:00	03:06	04:13	05:24
45°	18:39	19:17	19:51	03:24	04:28	05:36
N 40°	18:26	19:06	19:43	03:39	04:41	05:46
35°	18:15	18:57	19:36	03:51	04:52	05:54
30°	18:05	18:49	19:30	04:02	05:01	06:02
20°	17:48	18:35	19:20	04:20	05:17	06:14
N 10°	17:33	18:22	19:11	04:36	05:31	06:25
0°	17:19	18:11	19:02	04:51	05:44	06:35
S 10°	17:05	17:59	18:54	05:06	05:57	06:46
20°	16:50	17:47	18:44	05:22	06:10	06:56
30°	16:32	17:32	18:34	05:40	06:26	07:08
35°	16:22	17:24	18:28	05:51	06:35	07:15
40°	16:11	17:15	18:21	06:03	06:45	07:23
45°	15:57	17:04	18:13	06:17	06:57	07:33
S 50°	15:41	16:50	18:03	06:34	07:12	07:44
52°	15:33	16:44	17:59	06:42	07:18	07:49
54°	15:24	16:37	17:54	06:51	07:26	07:54
56°	15:14	16:29	17:48	07:01	07:34	08:01
58°	15:03	16:20	17:42	07:13	07:43	08:08
S 60°	14:50	16:10	17:35	07:26	07:54	08:16

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 14-16 / 97-100%
14	04:42	04:37	12:05	23:31	11:05	◯
15	04:31	04:25	12:04	–:–	11:57	
16	04:19	04:13	12:04	00:23	12:49	

August 17, 18, 19 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	325°17.1	146°39.9	N01°32.0	213°53.5	N22°47.1	136°43.0	S02°26.3	137°55.4	S00°43.2
1	340°19.6	161°39.6	30.7	228°54.2	46.9	151°45.1	26.5	152°57.6	43.3
2	355°22.0	176°39.4	29.5	243°54.9	46.7	166°47.1	26.7	167°59.8	43.4
3	10°24.5	191°39.2	·· 28.2	258°55.6	·· 46.5	181°49.2	·· 26.8	183°02.1	·· 43.5
4	25°26.9	206°38.9	26.9	273°56.4	46.3	196°51.2	27.0	198°04.3	43.6
5	40°29.4	221°38.7	25.6	288°57.1	46.0	211°53.3	27.2	213°06.5	43.7
6	55°31.9	236°38.5	N01°24.3	303°57.8	N22°45.8	226°55.3	S02°27.4	228°08.8	S00°43.8
7	70°34.3	251°38.3	23.0	318°58.5	45.6	241°57.4	27.6	243°11.0	43.9
8	85°36.8	266°38.0	21.7	333°59.2	45.4	256°59.4	27.8	258°13.2	44.0
9	100°39.3	281°37.8	·· 20.5	348°59.9	·· 45.2	272°01.5	·· 27.9	273°15.5	·· 44.1
10	115°41.7	296°37.6	19.2	4°00.7	45.0	287°03.5	28.1	288°17.7	44.2
11	130°44.2	311°37.3	17.9	19°01.4	44.8	302°05.6	28.3	303°19.9	44.3
12	145°46.7	326°37.1	N01°16.6	34°02.1	N22°44.6	317°07.6	S02°28.5	318°22.2	S00°44.4
13	160°49.1	341°36.9	15.3	49°02.8	44.3	332°09.7	28.7	333°24.4	44.5
14	175°51.6	356°36.6	14.0	64°03.5	44.1	347°11.7	28.9	348°26.6	44.6
15	190°54.1	11°36.4	·· 12.7	79°04.2	·· 43.9	2°13.8	·· 29.0	3°28.9	·· 44.8
16	205°56.5	26°36.2	11.4	94°05.0	43.7	17°15.8	29.2	18°31.1	44.9
17	220°59.0	41°36.0	10.2	109°05.7	43.5	32°17.9	29.4	33°33.3	45.0
18	236°01.4	56°35.7	N01°08.9	124°06.4	N22°43.3	47°19.9	S02°29.6	48°35.6	S00°45.1
19	251°03.9	71°35.5	07.6	139°07.1	43.1	62°22.0	29.8	63°37.8	45.2
20	266°06.4	86°35.3	06.3	154°07.8	42.8	77°24.0	30.0	78°40.0	45.3
21	281°08.8	101°35.0	·· 05.0	169°08.6	·· 42.6	92°26.1	·· 30.1	93°42.3	·· 45.4
22	296°11.3	116°34.8	03.7	184°09.3	42.4	107°28.1	30.3	108°44.5	45.5
23	311°13.8	131°34.6	02.4	199°10.0	42.2	122°30.2	30.5	123°46.7	45.6
Mer.pass. 02:18		ν -0.2′	d 1.3′	m -3.95	ν 0.7′	d 0.2′	m 1.61	ν 2.1′	d 0.2′ m -1.75	ν 2.2′	d 0.1′ m 0.95

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	326°16.2	146°34.4	N01°01.1	214°10.7	N22°42.0	137°32.2	S02°30.7	138°49.0	S00°45.7
1	341°18.7	161°34.1	00°59.9	229°11.4	41.8	152°34.2	30.9	153°51.2	45.8
2	356°21.2	176°33.9	58.6	244°12.2	41.5	167°36.3	31.1	168°53.4	45.9
3	11°23.6	191°33.7	·· 57.3	259°12.9	·· 41.3	182°38.3	·· 31.2	183°55.7	·· 46.0
4	26°26.1	206°33.5	56.0	274°13.6	41.1	197°40.4	31.4	198°57.9	46.1
5	41°28.5	221°33.2	54.7	289°14.3	40.9	212°42.4	31.6	214°00.1	46.2
6	56°31.0	236°33.0	N00°53.4	304°15.0	N22°40.7	227°44.5	S02°31.8	229°02.4	S00°46.3
7	71°33.5	251°32.8	52.1	319°15.8	40.4	242°46.5	32.0	244°04.6	46.4
8	86°35.9	266°32.5	50.8	334°16.5	40.2	257°48.6	32.2	259°06.8	46.5
9	101°38.4	281°32.3	·· 49.6	349°17.2	·· 40.0	272°50.6	·· 32.3	274°09.1	·· 46.6
10	116°40.9	296°32.1	48.3	4°17.9	39.8	287°52.7	32.5	289°11.3	46.7
11	131°43.3	311°31.9	47.0	19°18.6	39.6	302°54.7	32.7	304°13.5	46.8
12	146°45.8	326°31.6	N00°45.7	34°19.4	N22°39.3	317°56.8	S02°32.9	319°15.8	S00°47.0
13	161°48.3	341°31.4	44.4	49°20.1	39.1	332°58.8	33.1	334°18.0	47.1
14	176°50.7	356°31.2	43.1	64°20.8	38.9	348°00.9	33.3	349°20.2	47.2
15	191°53.2	11°31.0	·· 41.8	79°21.5	·· 38.7	3°02.9	·· 33.5	4°22.5	·· 47.3
16	206°55.7	26°30.7	40.5	94°22.3	38.5	18°05.0	33.6	19°24.7	47.4
17	221°58.1	41°30.5	39.2	109°23.0	38.2	33°07.0	33.8	34°26.9	47.5
18	237°00.6	56°30.3	N00°38.0	124°23.7	N22°38.0	48°09.0	S02°34.0	49°29.2	S00°47.6
19	252°03.0	71°30.1	36.7	139°24.4	37.8	63°11.1	34.2	64°31.4	47.7
20	267°05.5	86°29.8	35.4	154°25.1	37.6	78°13.1	34.4	79°33.6	47.8
21	282°08.0	101°29.6	·· 34.1	169°25.9	·· 37.3	93°15.2	·· 34.6	94°35.9	·· 47.9
22	297°10.4	116°29.4	32.8	184°26.6	37.1	108°17.2	34.7	109°38.1	48.0
23	312°12.9	131°29.2	31.5	199°27.3	36.9	123°19.3	34.9	124°40.3	48.1
Mer.pass. 02:15		ν -0.2′	d 1.3′	m -3.95	ν 0.7′	d 0.2′	m 1.61	ν 2.0′	d 0.2′ m -1.75	ν 2.2′	d 0.1′ m 0.95

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	327°15.4	146°28.9	N00°30.2	214°28.0	N22°36.7	138°21.3	S02°35.1	139°42.6	S00°48.2
1	342°17.8	161°28.7	28.9	229°28.8	36.4	153°23.4	35.3	154°44.8	48.3
2	357°20.3	176°28.5	27.6	244°29.5	36.2	168°25.4	35.5	169°47.0	48.4
3	12°22.8	191°28.3	·· 26.4	259°30.2	·· 36.0	183°27.5	·· 35.7	184°49.3	·· 48.5
4	27°25.2	206°28.0	25.1	274°30.9	35.8	198°29.5	35.9	199°51.5	48.6
5	42°27.7	221°27.8	23.8	289°31.7	35.5	213°31.5	36.0	214°53.7	48.7
6	57°30.1	236°27.6	N00°22.5	304°32.4	N22°35.3	228°33.6	S02°36.2	229°55.9	S00°48.8
7	72°32.6	251°27.4	21.2	319°33.1	35.1	243°35.6	36.4	244°58.2	49.0
8	87°35.1	266°27.1	19.9	334°33.8	34.9	258°37.7	36.6	260°00.4	49.1
9	102°37.5	281°26.9	·· 18.6	349°34.6	·· 34.6	273°39.7	·· 36.8	275°02.6	·· 49.2
10	117°40.0	296°26.7	17.3	4°35.3	34.4	288°41.8	37.0	290°04.9	49.3
11	132°42.5	311°26.5	16.0	19°36.0	34.2	303°43.8	37.2	305°07.1	49.4
12	147°44.9	326°26.2	N00°14.7	34°36.7	N22°34.0	318°45.8	S02°37.3	320°09.3	S00°49.5
13	162°47.4	341°26.0	13.5	49°37.5	33.7	333°47.9	37.5	335°11.6	49.6
14	177°49.9	356°25.8	12.2	64°38.2	33.5	348°49.9	37.7	350°13.8	49.7
15	192°52.3	11°25.6	·· 10.9	79°38.9	·· 33.3	3°52.0	·· 37.9	5°16.0	·· 49.8
16	207°54.8	26°25.3	09.6	94°39.6	33.0	18°54.0	38.1	20°18.3	49.9
17	222°57.3	41°25.1	08.3	109°40.4	32.8	33°56.1	38.3	35°20.5	50.0
18	237°59.7	56°24.9	N00°07.0	124°41.1	N22°32.6	48°58.1	S02°38.4	50°22.7	S00°50.1
19	253°02.2	71°24.7	05.7	139°41.8	32.4	64°00.2	38.6	65°24.9	50.2
20	268°04.6	86°24.5	04.4	154°42.6	32.1	79°02.2	38.8	80°27.2	50.3
21	283°07.1	101°24.2	·· 03.1	169°43.3	·· 31.9	94°04.2	·· 39.0	95°29.4	·· 50.4
22	298°09.6	116°24.0	01.8	184°44.0	31.7	109°06.3	39.2	110°31.6	50.5
23	313°12.0	131°23.8	00.6	199°44.7	31.4	124°08.3	39.4	125°33.9	50.6
Mer.pass. 02:11		ν -0.2′	d 1.3′	m -3.96	ν 0.7′	d 0.2′	m 1.61	ν 2.0′	d 0.2′ m -1.74	ν 2.2′	d 0.1′ m 0.94

Stars

	SHA	Dec
Alpheratz	358°08.4	28°59.2
Ankaa	353°39.3	-42°24.2
Schedar	350°07.9	56°26.0
Diphda	349°20.0	-18°05.2
Achernar	335°44.5	-57°19.6
Hamal	328°28.1	23°22.4
Polaris	326°33.4	89°10.4
Acamar	315°36.7	-40°22.5
Menkar	314°40.4	4°01.1
Mirfak	309°15.2	49°47.5
Aldebaran	291°17.3	16°28.3
Rigel	281°35.5	-8°13.3
Capella	281°10.5	45°58.6
Bellatrix	278°58.2	6°20.0
Elnath	278°43.5	28°35.5
Alnilam	276°11.2	-1°12.7
Betelgeuse	271°27.8	7°24.3
Canopus	264°07.3	-52°40.9
Sirius	258°55.3	-16°41.3
Adhara	255°31.9	-28°56.6
Procyon	245°25.4	5°16.5
Pollux	243°57.7	28°04.3
Avior	234°28.5	-59°26.9
Suhail	223°10.7	-43°21.4
Miaplacidus	221°45.8	-69°38.4
Alphard	218°20.2	-8°34.6
Regulus	208°09.6	12°03.6
Dubhe	194°21.9	61°51.3
Denebola	182°58.7	14°40.7
Gienah	176°17.6	-17°26.3
Acrux	173°37.1	-62°59.9
Gacrux	172°28.5	-57°00.7
Alioth	166°42.3	56°03.9
Spica	158°57.0	-11°03.8
Alkaid	153°18.2	49°24.7
Hadar	149°22.7	-60°17.2
Menkent	148°36.4	-36°16.8
Arcturus	146°18.0	19°17.0
Rigil Kent.	140°25.1	-60°45.6
Kochab	137°19.2	74°14.3
Zuben'ubi	137°32.4	-15°57.8
Alphecca	126°31.6	26°46.9
Antares	112°56.0	-26°23.5
Atria	108°19.5	-68°59.9
Sabik	102°40.2	-15°42.1
Shaula	96°54.7	-37°05.5
Rasalhague	96°28.8	12°34.6
Eltanin	90°57.1	51°29.8
Kaus Aust.	84°15.7	-34°23.6
Vega	80°55.1	38°46.2
Nunki	76°28.1	-26°19.2
Altair	62°31.6	8°49.3
Peacock	53°56.8	-56°47.7
Deneb	49°47.6	45°13.0
Enif	34°10.6	9°47.5
Al Na'ir	28°13.6	-47°03.0
Fomalhaut	15°50.3	-29°43.1
Scheat	14°16.6	27°58.9
Markab	14°02.2	15°06.4

Aug 17 Mon	SHA	Mer.pass
Venus	181°22.8	14:14
Mars	248°36.4	09:44
Jupiter	171°25.9	14:51
Saturn	172°38.3	14:46

Aug 18 Tue	SHA	Mer.pass
Venus	180°18.1	14:14
Mars	247°54.5	09:43
Jupiter	171°16.0	14:48
Saturn	172°32.8	14:43

Aug 19 Wed	SHA	Mer.pass
Venus	179°13.6	14:14
Mars	247°12.7	09:42
Jupiter	171°06.0	14:45
Saturn	172°27.2	14:39

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h — Sun — Moon

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	178°58.4	N13°31.3	342°03.7	10.3′	S10°41.3	10.8′	58.1′
1	193°58.5	30.5	356°33.1	10.3′	10°30.5	10.9′	58.1′
2	208°58.6	29.7	11°02.4	10.4′	10°19.6	11.0′	58.1′
3	223°58.8	·· 28.9	25°31.8	10.4′	10°08.6	11.0′	58.1′
4	238°58.9	28.1	40°01.1	10.4′	09°57.6	11.1′	58.2′
5	253°59.0	27.4	54°30.5	10.4′	09°46.5	11.1′	58.2′
6	268°59.2	N13°26.6	68°59.9	10.4′	S09°35.4	11.2′	58.2′
7	283°59.3	25.8	83°29.4	10.4′	09°24.2	11.3′	58.2′
8	298°59.4	25.0	97°58.8	10.5′	09°12.9	11.3′	58.2′
9	313°59.6	·· 24.2	112°28.3	10.5′	09°01.6	11.4′	58.3′
10	328°59.7	23.4	126°57.7	10.5′	08°50.2	11.4′	58.3′
11	343°59.8	22.6	141°27.2	10.5′	08°38.8	11.5′	58.3′
12	359°00.0	N13°21.8	155°56.7	10.5′	S08°27.3	11.6′	58.3′
13	14°00.1	21.0	170°26.2	10.5′	08°15.7	11.6′	58.3′
14	29°00.2	20.2	184°55.7	10.5′	08°04.1	11.6′	58.3′
15	44°00.4	·· 19.4	199°25.3	10.5′	07°52.5	11.7′	58.4′
16	59°00.5	18.6	213°54.8	10.6′	07°40.8	11.7′	58.4′
17	74°00.6	17.8	228°24.4	10.6′	07°29.1	11.8′	58.4′
18	89°00.8	N13°17.0	242°54.0	10.6′	S07°17.3	11.9′	58.4′
19	104°00.9	16.2	257°23.5	10.6′	07°05.4	11.9′	58.4′
20	119°01.0	15.4	271°53.1	10.6′	06°53.5	11.9′	58.5′
21	134°01.2	·· 14.5	286°22.7	10.6′	06°41.6	11.9′	58.5′
22	149°01.3	13.7	300°52.3	10.6′	06°29.7	12.1′	58.5′
23	164°01.5	12.9	315°22.0	10.6′	06°17.6	12.0′	58.5′
	SD = 15.8′	d = 0.8′	SD = 15.8′				

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	179°01.6	N13°12.1	329°51.6	10.6′	S06°05.6	12.1′	58.5′
1	194°01.7	11.3	344°21.2	10.6′	05°53.5	12.1′	58.5′
2	209°01.9	10.5	358°50.9	10.7′	05°41.4	12.2′	58.6′
3	224°02.0	·· 09.7	13°20.5	10.7′	05°29.2	12.2′	58.6′
4	239°02.1	08.9	27°50.2	10.7′	05°17.0	12.2′	58.6′
5	254°02.3	08.1	42°19.9	10.7′	05°04.8	12.3′	58.6′
6	269°02.4	N13°07.3	56°49.5	10.7′	S04°52.5	12.3′	58.6′
7	284°02.6	06.5	71°19.2	10.7′	04°40.2	12.3′	58.6′
8	299°02.7	05.7	85°48.9	10.7′	04°27.9	12.4′	58.6′
9	314°02.8	·· 04.9	100°18.6	10.7′	04°15.5	12.4′	58.7′
10	329°03.0	04.1	114°48.3	10.7′	04°03.1	12.4′	58.7′
11	344°03.1	03.3	129°18.0	10.7′	03°50.7	12.4′	58.7′
12	359°03.3	N13°02.5	143°47.7	10.7′	S03°38.3	12.5′	58.7′
13	14°03.4	01.7	158°17.4	10.7′	03°25.8	12.5′	58.7′
14	29°03.5	00.8	172°47.1	10.7′	03°13.3	12.5′	58.7′
15	44°03.7	13°00.0	187°16.8	10.7′	03°00.8	12.5′	58.7′
16	59°03.8	12°59.2	201°46.5	10.7′	02°48.3	12.6′	58.8′
17	74°04.0	58.4	216°16.2	10.7′	02°35.7	12.6′	58.8′
18	89°04.1	N12°57.6	230°45.9	10.7′	S02°23.1	12.6′	58.8′
19	104°04.2	56.8	245°15.6	10.7′	02°10.5	12.6′	58.8′
20	119°04.4	56.0	259°45.3	10.7′	01°57.9	12.6′	58.8′
21	134°04.5	·· 55.2	274°14.9	10.7′	01°45.3	12.6′	58.8′
22	149°04.7	54.4	288°44.6	10.7′	01°32.7	12.7′	58.8′
23	164°04.8	53.5	303°14.3	10.7′	01°20.0	12.6′	58.8′
	SD = 15.8′	d = 0.8′	SD = 16.0′				

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	179°04.9	N12°52.7	317°44.0	10.7′	S01°07.4	12.7′	58.9′
1	194°05.1	51.9	332°13.7	10.7′	00°54.7	12.7′	58.9′
2	209°05.2	51.1	346°43.3	10.7′	00°42.0	12.7′	58.9′
3	224°05.4	·· 50.3	1°13.0	10.6′	00°29.3	12.7′	58.9′
4	239°05.5	49.5	15°42.6	10.6′	00°16.6	12.7′	58.9′
5	254°05.7	48.7	30°12.3	10.6′	S00°03.9	12.7′	58.9′
6	269°05.8	N12°47.8	44°41.9	10.6′	N00°08.8	12.7′	58.9′
7	284°05.9	47.0	59°11.5	10.6′	00°21.5	12.7′	58.9′
8	299°06.1	46.2	73°41.1	10.6′	00°34.2	12.7′	58.9′
9	314°06.2	·· 45.4	88°10.7	10.6′	00°46.9	12.8′	59.0′
10	329°06.4	44.6	102°40.3	10.6′	00°59.7	12.7′	59.0′
11	344°06.5	43.8	117°09.9	10.6′	01°12.4	12.7′	59.0′
12	359°06.7	N12°43.0	131°39.4	10.5′	N01°25.1	12.7′	59.0′
13	14°06.8	42.1	146°09.0	10.5′	01°37.8	12.7′	59.0′
14	29°07.0	41.3	160°38.5	10.5′	01°50.5	12.7′	59.0′
15	44°07.1	·· 40.5	175°08.0	10.5′	02°03.2	12.6′	59.0′
16	59°07.2	39.7	189°37.5	10.5′	02°15.8	12.7′	59.0′
17	74°07.4	38.9	204°07.0	10.5′	02°28.5	12.7′	59.0′
18	89°07.5	N12°38.0	218°36.4	10.4′	N02°41.2	12.6′	59.0′
19	104°07.7	37.2	233°05.9	10.4′	02°53.8	12.7′	59.1′
20	119°07.8	36.4	247°35.3	10.4′	03°06.5	12.6′	59.1′
21	134°08.0	·· 35.6	262°04.7	10.4′	03°19.1	12.6′	59.1′
22	149°08.1	34.8	276°34.1	10.4′	03°31.7	12.6′	59.1′
23	164°08.3	33.9	291°03.5	10.3′	03°44.3	12.5′	59.1′
	SD = 15.8′	d = 0.8′	SD = 16.1′				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	////	////	02:43	21:19	////	////
N 70°	////	01:11	03:11	20:53	22:46	////
68°	////	02:04	03:31	20:33	21:58	////
66°	////	02:35	03:47	20:18	21:28	////
64°	01:02	02:58	04:00	20:05	21:06	22:55
62°	01:50	03:16	04:11	19:54	20:49	22:13
60°	02:19	03:31	04:21	19:45	20:35	21:45
N 58°	02:40	03:43	04:29	19:37	20:23	21:25
56°	02:57	03:54	04:36	19:30	20:12	21:08
54°	03:11	04:03	04:43	19:24	20:03	20:55
52°	03:23	04:11	04:48	19:18	19:55	20:43
50°	03:33	04:18	04:54	19:13	19:48	20:33
45°	03:54	04:33	05:05	19:02	19:33	20:12
N 40°	04:11	04:45	05:14	18:53	19:21	19:56
35°	04:23	04:55	05:22	18:45	19:12	19:43
30°	04:34	05:04	05:29	18:38	19:03	19:33
20°	04:51	05:18	05:41	18:27	18:49	19:16
N 10°	05:04	05:29	05:51	18:16	18:38	19:03
0°	05:15	05:39	06:00	18:07	18:28	18:53
S 10°	05:23	05:48	06:10	17:58	18:19	18:44
20°	05:31	05:57	06:20	17:48	18:11	18:37
30°	05:38	06:06	06:31	17:37	18:02	18:30
35°	05:42	06:11	06:37	17:31	17:57	18:27
40°	05:45	06:17	06:44	17:24	17:52	18:23
45°	05:48	06:22	06:53	17:15	17:46	18:20
S 50°	05:51	06:29	07:03	17:05	17:39	18:17
52°	05:53	06:32	07:07	17:01	17:36	18:16
54°	05:54	06:36	07:12	16:56	17:33	18:14
56°	05:56	06:39	07:18	16:50	17:29	18:13
58°	05:57	06:43	07:24	16:44	17:25	18:12
S 60°	05:59	06:47	07:32	16:37	17:21	18:10

Lat.	Moonrise Mon	Moonrise Tue	Moonrise Wed	Moonset Mon	Moonset Tue	Moonset Wed
N 72°	21:21	21:06	20:53	05:13	07:16	09:16
N 70°	21:11	21:04	20:57	05:29	07:23	09:15
68°	21:04	21:02	21:00	05:42	07:28	09:14
66°	20:57	21:00	21:03	05:53	07:33	09:14
64°	20:51	20:59	21:06	06:02	07:37	09:13
62°	20:47	20:57	21:08	06:09	07:41	09:13
60°	20:42	20:56	21:10	06:16	07:44	09:12
N 58°	20:39	20:55	21:12	06:21	07:46	09:12
56°	20:35	20:54	21:13	06:26	07:48	09:12
54°	20:32	20:54	21:15	06:31	07:51	09:11
52°	20:29	20:53	21:16	06:35	07:52	09:11
50°	20:27	20:52	21:17	06:39	07:54	09:11
45°	20:21	20:51	21:20	06:46	07:58	09:10
N 40°	20:17	20:49	21:22	06:53	08:01	09:10
35°	20:13	20:48	21:24	06:59	08:04	09:09
30°	20:09	20:47	21:25	07:04	08:06	09:09
20°	20:03	20:46	21:28	07:12	08:10	09:08
N 10°	19:58	20:44	21:31	07:19	08:13	09:08
0°	19:53	20:43	21:33	07:26	08:17	09:07
S 10°	19:48	20:42	21:36	07:33	08:20	09:06
20°	19:42	20:40	21:39	07:40	08:23	09:06
30°	19:36	20:39	21:42	07:49	08:27	09:05
35°	19:33	20:38	21:44	07:53	08:29	09:04
40°	19:29	20:37	21:46	07:59	08:32	09:04
45°	19:24	20:36	21:48	08:05	08:35	09:03
S 50°	19:18	20:34	21:51	08:12	08:38	09:03
52°	19:16	20:34	21:52	08:15	08:39	09:02
54°	19:13	20:33	21:54	08:19	08:41	09:02
56°	19:09	20:32	21:56	08:23	08:43	09:02
58°	19:06	20:31	21:57	08:28	08:45	09:01
S 60°	19:02	20:30	21:59	08:33	08:47	09:01

Day	Sun Eqn.of Time 00h	Sun Eqn.of Time 12h	Sun Mer. Pass	Moon Mer.Pass. Upper	Moon Mer.Pass. Lower	Moon Age
	mm:ss	mm:ss	hh:mm	hh:mm	hh:mm	17-19 98-87%
17	04:07	04:00	12:04	01:14	13:40	
18	03:54	03:47	12:04	02:05	14:30	
19	03:40	03:33	12:04	02:55	15:20	

August 20, 21, 22 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	328°14.5	146°23.6	S00°00.7	214°45.5	N22°31.2	139°10.4	S02°39.6	140°36.1	S00°50.8
1	343°17.0	161°23.3	02.0	229°46.2	31.0	154°12.4	39.7	155°38.3	50.9
2	358°19.4	176°23.1	03.3	244°46.9	30.7	169°14.4	39.9	170°40.6	51.0
3	13°21.9	191°22.9	·· 04.6	259°47.7	·· 30.5	184°16.5	·· 40.1	185°42.8	·· 51.1
4	28°24.4	206°22.7	05.9	274°48.4	30.3	199°18.5	40.3	200°45.0	51.2
5	43°26.8	221°22.5	07.2	289°49.1	30.0	214°20.6	40.5	215°47.2	51.3
6	58°29.3	236°22.2	S00°08.5	304°49.8	N22°29.8	229°22.6	S02°40.7	230°49.5	S00°51.4
7	73°31.8	251°22.0	09.8	319°50.6	29.6	244°24.7	40.9	245°51.7	51.5
8	88°34.2	266°21.8	11.1	334°51.3	29.3	259°26.7	41.1	260°53.9	51.6
9	103°36.7	281°21.6	·· 12.3	349°52.0	·· 29.1	274°28.7	·· 41.2	275°56.2	·· 51.7
10	118°39.1	296°21.3	13.6	4°52.8	28.9	289°30.8	41.4	290°58.4	51.8
11	133°41.6	311°21.1	14.9	19°53.5	28.6	304°32.8	41.6	306°00.6	51.9
12	148°44.1	326°20.9	S00°16.2	34°54.2	N22°28.4	319°34.9	S02°41.8	321°02.8	S00°52.0
13	163°46.5	341°20.7	17.5	49°55.0	28.2	334°36.9	42.0	336°05.1	52.1
14	178°49.0	356°20.5	18.8	64°55.7	27.9	349°38.9	42.2	351°07.3	52.2
15	193°51.5	11°20.2	·· 20.1	79°56.4	·· 27.7	4°41.0	·· 42.4	6°09.5	·· 52.4
16	208°53.9	26°20.0	21.4	94°57.2	27.5	19°43.0	42.5	21°11.8	52.5
17	223°56.4	41°19.8	22.7	109°57.9	27.2	34°45.1	42.7	36°14.0	52.6
18	238°58.9	56°19.6	S00°24.0	124°58.6	N22°27.0	49°47.1	S02°42.9	51°16.2	S00°52.7
19	254°01.3	71°19.4	25.3	139°59.3	26.8	64°49.1	43.1	66°18.4	52.8
20	269°03.8	86°19.1	26.5	155°00.1	26.5	79°51.2	43.3	81°20.7	52.9
21	284°06.2	101°18.9	·· 27.8	170°00.8	·· 26.3	94°53.2	·· 43.5	96°22.9	·· 53.0
22	299°08.7	116°18.7	29.1	185°01.5	26.0	109°55.3	43.7	111°25.1	53.1
23	314°11.2	131°18.5	30.4	200°02.3	25.8	124°57.3	43.8	126°27.3	53.2
Mer.pass.	02:07	ν -0.2′	d 1.3′	m -3.96	ν 0.7′	d 0.2′	m 1.62	ν 2.0′	d 0.2′ m -1.74	ν 2.2′	d 0.1′ m 0.94

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	329°13.6	146°18.2	S00°31.7	215°03.0	N22°25.6	139°59.3	S02°44.0	141°29.6	S00°53.3
1	344°16.1	161°18.0	33.0	230°03.7	25.3	155°01.4	44.2	156°31.8	53.4
2	359°18.6	176°17.8	34.3	245°04.5	25.1	170°03.4	44.4	171°34.0	53.5
3	14°21.0	191°17.6	·· 35.6	260°05.2	·· 24.9	185°05.5	·· 44.6	186°36.3	·· 53.6
4	29°23.5	206°17.4	36.9	275°05.9	24.6	200°07.5	44.8	201°38.5	53.7
5	44°26.0	221°17.1	38.2	290°06.7	24.4	215°09.5	45.0	216°40.7	53.8
6	59°28.4	236°16.9	S00°39.5	305°07.4	N22°24.1	230°11.6	S02°45.2	231°42.9	S00°54.0
7	74°30.9	251°16.7	40.8	320°08.1	23.9	245°13.6	45.3	246°45.2	54.1
8	89°33.4	266°16.5	42.0	335°08.9	23.7	260°15.7	45.5	261°47.4	54.2
9	104°35.8	281°16.3	·· 43.3	350°09.6	·· 23.4	275°17.7	·· 45.7	276°49.6	·· 54.3
10	119°38.3	296°16.0	44.6	5°10.4	23.2	290°19.7	45.9	291°51.8	54.4
11	134°40.7	311°15.8	45.9	20°11.1	22.9	305°21.8	46.1	306°54.1	54.5
12	149°43.2	326°15.6	S00°47.2	35°11.8	N22°22.7	320°23.8	S02°46.3	321°56.3	S00°54.6
13	164°45.7	341°15.4	48.5	50°12.6	22.5	335°25.8	46.5	336°58.5	54.7
14	179°48.1	356°15.2	49.8	65°13.3	22.2	350°27.9	46.7	352°00.8	54.8
15	194°50.6	11°15.0	·· 51.1	80°14.0	·· 22.0	5°29.9	·· 46.8	7°03.0	·· 54.9
16	209°53.1	26°14.7	52.4	95°14.8	21.7	20°32.0	47.0	22°05.2	55.0
17	224°55.5	41°14.5	53.7	110°15.5	21.5	35°34.0	47.2	37°07.4	55.1
18	239°58.0	56°14.3	S00°55.0	125°16.2	N22°21.2	50°36.0	S02°47.4	52°09.7	S00°55.2
19	255°00.5	71°14.1	56.2	140°17.0	21.0	65°38.1	47.6	67°11.9	55.3
20	270°02.9	86°13.9	57.5	155°17.7	20.8	80°40.1	47.8	82°14.1	55.5
21	285°05.4	101°13.6	00°58.8	170°18.5	·· 20.5	95°42.1	·· 48.0	97°16.3	·· 55.6
22	300°07.8	116°13.4	01°00.1	185°19.2	20.3	110°44.2	48.2	112°18.6	55.7
23	315°10.3	131°13.2	01.4	200°19.9	20.0	125°46.2	48.3	127°20.8	55.8
Mer.pass.	02:03	ν -0.2′	d 1.3′	m -3.96	ν 0.7′	d 0.2′	m 1.62	ν 2.0′	d 0.2′ m -1.74	ν 2.2′	d 0.1′ m 0.94

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	330°12.8	146°13.0	S01°02.7	215°20.7	N22°19.8	140°48.3	S02°48.5	142°23.0	S00°55.9
1	345°15.2	161°12.8	04.0	230°21.4	19.5	155°50.3	48.7	157°25.2	56.0
2	0°17.7	176°12.5	05.3	245°22.1	19.3	170°52.3	48.9	172°27.5	56.1
3	15°20.2	191°12.3	·· 06.6	260°22.9	·· 19.0	185°54.4	·· 49.1	187°29.7	·· 56.2
4	30°22.6	206°12.1	07.9	275°23.6	18.8	200°56.4	49.3	202°31.9	56.3
5	45°25.1	221°11.9	09.2	290°24.4	18.5	215°58.4	49.5	217°34.1	56.4
6	60°27.6	236°11.7	S01°10.5	305°25.1	N22°18.3	231°00.5	S02°49.7	232°36.4	S00°56.5
7	75°30.0	251°11.5	11.7	320°25.8	18.1	246°02.5	49.8	247°38.6	56.6
8	90°32.5	266°11.2	13.0	335°26.6	17.8	261°04.5	50.0	262°40.8	56.7
9	105°35.0	281°11.0	·· 14.3	350°27.3	·· 17.6	276°06.6	·· 50.2	277°43.0	·· 56.9
10	120°37.4	296°10.8	15.6	5°28.1	17.3	291°08.6	50.4	292°45.3	57.0
11	135°39.9	311°10.6	16.9	20°28.8	17.1	306°10.7	50.6	307°47.5	57.1
12	150°42.3	326°10.4	S01°18.2	35°29.5	N22°16.8	321°12.7	S02°50.8	322°49.7	S00°57.2
13	165°44.8	341°10.1	19.5	50°30.3	16.6	336°14.7	51.0	337°51.9	57.3
14	180°47.3	356°09.9	20.8	65°31.0	16.3	351°16.8	51.2	352°54.2	57.4
15	195°49.7	11°09.7	·· 22.1	80°31.8	·· 16.1	6°18.8	·· 51.4	7°56.4	·· 57.5
16	210°52.2	26°09.5	23.4	95°32.5	15.8	21°20.8	51.5	22°58.6	57.6
17	225°54.7	41°09.3	24.7	110°33.2	15.6	36°22.9	51.7	38°00.8	57.7
18	240°57.1	56°09.1	S01°25.9	125°34.0	N22°15.3	51°24.9	S02°51.9	53°03.1	S00°57.8
19	255°59.6	71°08.8	27.2	140°34.7	15.1	66°26.9	52.1	68°05.3	57.9
20	271°02.1	86°08.6	28.5	155°35.5	14.8	81°29.0	52.3	83°07.5	58.0
21	286°04.5	101°08.4	·· 29.8	170°36.2	·· 14.6	96°31.0	·· 52.5	98°09.7	·· 58.1
22	301°07.0	116°08.2	31.1	185°36.9	14.3	111°33.0	52.7	113°12.0	58.3
23	316°09.5	131°08.0	32.4	200°37.7	14.1	126°35.1	52.9	128°14.2	58.4
Mer.pass.	01:59	ν -0.2′	d 1.3′	m -3.96	ν 0.7′	d 0.2′	m 1.62	ν 2.0′	d 0.2′ m -1.73	ν 2.2′	d 0.1′ m 0.94

Stars

	SHA	Dec
Alpheratz	358°08.3	28°59.3
Ankaa	353°39.3	-42°24.2
Schedar	350°07.9	56°26.0
Diphda	349°20.0	-18°05.2
Achernar	335°44.5	-57°19.6
Hamal	328°28.0	23°22.4
Polaris	326°32.3	89°10.5
Acamar	315°36.6	-40°22.5
Menkar	314°40.4	4°01.1
Mirfak	309°15.1	49°47.5
Aldebaran	291°17.3	16°28.3
Rigel	281°35.5	-8°13.3
Capella	281°10.5	45°58.6
Bellatrix	278°58.2	6°20.0
Elnath	278°43.5	28°35.5
Alnilam	276°11.1	-1°12.7
Betelgeuse	271°27.7	7°24.3
Canopus	264°07.3	-52°40.9
Sirius	258°55.3	-16°41.3
Adhara	255°31.9	-28°56.6
Procyon	245°25.4	5°16.5
Pollux	243°57.7	28°04.3
Avior	234°28.5	-59°26.9
Suhail	223°10.7	-43°21.3
Miaplacidus	221°45.8	-69°38.4
Alphard	218°20.2	-8°34.6
Regulus	208°09.6	12°03.6
Dubhe	194°21.9	61°51.2
Denebola	182°58.7	14°40.7
Gienah	176°17.6	-17°26.3
Acrux	173°37.1	-62°59.9
Gacrux	172°28.5	-57°00.6
Alioth	166°42.3	56°03.9
Spica	158°57.0	-11°03.8
Alkaid	153°18.2	49°24.7
Hadar	149°22.7	-60°17.2
Menkent	148°36.4	-36°16.8
Arcturus	146°18.0	19°17.0
Rigil Kent.	140°25.1	-60°45.6
Kochab	137°19.3	74°14.3
Zuben'ubi	137°32.4	-15°57.8
Alphecca	126°31.6	26°46.9
Antares	112°56.0	-26°23.5
Atria	108°19.5	-68°59.9
Sabik	102°40.3	-15°42.1
Shaula	96°54.7	-37°05.5
Rasalhague	96°28.8	12°34.6
Eltanin	90°57.1	51°29.8
Kaus Aust.	84°15.7	-34°23.7
Vega	80°55.1	38°46.2
Nunki	76°28.1	-26°19.2
Altair	62°31.6	8°49.3
Peacock	53°56.8	-56°47.7
Deneb	49°47.6	45°13.0
Enif	34°10.6	9°47.5
Al Na'ir	28°13.6	-47°03.0
Fomalhaut	15°50.3	-29°43.1
Scheat	14°16.6	27°59.0
Markab	14°02.2	15°06.4

Aug 20 Thu	SHA	Mer.pass
Venus	178°09.1	14:15
Mars	246°31.0	09:40
Jupiter	170°55.9	14:41
Saturn	172°21.6	14:35

Aug 21 Fri	SHA	Mer.pass
Venus	177°04.6	14:15
Mars	245°49.4	09:39
Jupiter	170°45.7	14:38
Saturn	172°15.9	14:32

Aug 22 Sat	SHA	Mer.pass
Venus	176°00.2	14:15
Mars	245°07.9	09:38
Jupiter	170°35.5	14:35
Saturn	172°10.2	14:28

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°08.4	N12°33.1	305°32.8	10.3′	N03°56.8	12.6′	59.1′
1	194°08.6	32.3	320°02.1	10.3′	04°09.4	12.5′	59.1′
2	209°08.7	31.5	334°31.4	10.3′	04°21.9	12.5′	59.1′
3	224°08.9	·· 30.7	349°00.7	10.2′	04°34.4	12.5′	59.1′
4	239°09.0	29.8	3°29.9	10.2′	04°46.9	12.5′	59.1′
5	254°09.2	29.0	17°59.1	10.2′	04°59.4	12.4′	59.1′
6	269°09.3	N12°28.2	32°28.3	10.2′	N05°11.8	12.4′	59.1′
7	284°09.5	27.4	46°57.5	10.1′	05°24.2	12.4′	59.1′
8	299°09.6	26.5	61°26.6	10.1′	05°36.6	12.3′	59.1′
9	314°09.7	·· 25.7	75°55.8	10.1′	05°48.9	12.4′	59.1′
10	329°09.9	24.9	90°24.8	10.1′	06°01.3	12.2′	59.2′
11	344°10.0	24.1	104°53.9	10.0′	06°13.5	12.3′	59.2′
12	359°10.2	N12°23.2	119°22.9	10.0′	N06°25.8	12.2′	59.2′
13	14°10.3	22.4	133°51.9	10.0′	06°38.0	12.2′	59.2′
14	29°10.5	21.6	148°20.9	9.9′	06°50.2	12.1′	59.2′
15	44°10.6	·· 20.8	162°49.8	9.9′	07°02.3	12.1′	59.2′
16	59°10.8	19.9	177°18.7	9.9′	07°14.4	12.1′	59.2′
17	74°10.9	19.1	191°47.6	9.8′	07°26.5	12.0′	59.2′
18	89°11.1	N12°18.3	206°16.4	9.8′	N07°38.5	12.0′	59.2′
19	104°11.2	17.5	220°45.2	9.8′	07°50.5	12.0′	59.2′
20	119°11.4	16.6	235°13.9	9.7′	08°02.5	11.9′	59.2′
21	134°11.6	·· 15.8	249°42.7	9.7′	08°14.4	11.8′	59.2′
22	149°11.7	15.0	264°11.4	9.7′	08°26.2	11.8′	59.2′
23	164°11.9	14.1	278°40.0	9.6′	08°38.0	11.8′	59.2′
	SD = 15.8′	d = 0.8′	SD = 16.1′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°12.0	N12°13.3	293°08.6	9.6′	N08°49.8	11.7′	59.2′
1	194°12.2	12.5	307°37.2	9.5′	09°01.5	11.6′	59.2′
2	209°12.3	11.7	322°05.7	9.5′	09°13.1	11.6′	59.2′
3	224°12.5	·· 10.8	336°34.2	9.5′	09°24.7	11.6′	59.2′
4	239°12.6	10.0	351°02.7	9.4′	09°36.3	11.4′	59.2′
5	254°12.8	09.2	5°31.1	9.4′	09°47.7	11.5′	59.2′
6	269°12.9	N12°08.3	19°59.5	9.3′	N09°59.2	11.4′	59.2′
7	284°13.1	07.5	34°27.8	9.3′	10°10.6	11.3′	59.2′
8	299°13.2	06.7	48°56.1	9.3′	10°21.9	11.2′	59.2′
9	314°13.4	·· 05.8	63°24.4	9.2′	10°33.1	11.2′	59.2′
10	329°13.5	05.0	77°52.6	9.2′	10°44.3	11.2′	59.2′
11	344°13.7	04.2	92°20.8	9.1′	10°55.5	11.0′	59.2′
12	359°13.8	N12°03.3	106°48.9	9.1′	N11°06.5	11.0′	59.2′
13	14°14.0	02.5	121°17.0	9.0′	11°17.5	11.0′	59.2′
14	29°14.2	01.7	135°45.0	9.0′	11°28.5	10.9′	59.2′
15	44°14.3	·· 00.8	150°13.0	8.9′	11°39.4	10.8′	59.2′
16	59°14.5	12°00.0	164°40.9	8.9′	11°50.2	10.7′	59.2′
17	74°14.6	11°59.2	179°08.9	8.9′	12°00.9	10.7′	59.2′
18	89°14.8	N11°58.3	193°36.7	8.8′	N12°11.6	10.6′	59.2′
19	104°14.9	57.5	208°04.5	8.8′	12°22.2	10.5′	59.2′
20	119°15.1	56.7	222°32.3	8.7′	12°32.7	10.4′	59.2′
21	134°15.2	·· 55.8	237°00.0	8.7′	12°43.1	10.4′	59.2′
22	149°15.4	55.0	251°27.7	8.6′	12°53.5	10.3′	59.2′
23	164°15.6	54.1	265°55.3	8.6′	13°03.8	10.2′	59.2′
	SD = 15.8′	d = 0.8′	SD = 16.1′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°15.7	N11°53.3	280°22.9	8.5′	N13°14.0	10.1′	59.2′
1	194°15.9	52.5	294°50.4	8.5′	13°24.1	10.1′	59.2′
2	209°16.0	51.6	309°17.9	8.4′	13°34.2	10.0′	59.2′
3	224°16.2	·· 50.8	323°45.4	8.4′	13°44.2	9.8′	59.2′
4	239°16.3	50.0	338°12.7	8.3′	13°54.0	9.9′	59.2′
5	254°16.5	49.1	352°40.1	8.3′	14°03.9	9.7′	59.2′
6	269°16.6	N11°48.3	7°07.4	8.2′	N14°13.6	9.6′	59.2′
7	284°16.8	47.4	21°34.6	8.2′	14°23.2	9.6′	59.2′
8	299°17.0	46.6	36°01.8	8.1′	14°32.8	9.4′	59.2′
9	314°17.1	·· 45.8	50°29.0	8.1′	14°42.2	9.4′	59.2′
10	329°17.3	44.9	64°56.1	8.1′	14°51.6	9.3′	59.2′
11	344°17.4	44.1	79°23.1	8.0′	15°00.9	9.1′	59.2′
12	359°17.6	N11°43.2	93°50.1	8.0′	N15°10.0	9.1′	59.2′
13	14°17.8	42.4	108°17.1	7.9′	15°19.1	9.0′	59.2′
14	29°17.9	41.6	122°44.0	7.9′	15°28.1	8.9′	59.2′
15	44°18.1	·· 40.7	137°10.8	7.8′	15°37.0	8.8′	59.2′
16	59°18.2	39.9	151°37.7	7.8′	15°45.8	8.7′	59.2′
17	74°18.4	39.0	166°04.4	7.7′	15°54.5	8.7′	59.2′
18	89°18.6	N11°38.2	180°31.1	7.7′	N16°03.2	8.5′	59.2′
19	104°18.7	37.3	194°57.8	7.6′	16°11.7	8.4′	59.2′
20	119°18.9	36.5	209°24.4	7.6′	16°20.1	8.3′	59.2′
21	134°19.0	·· 35.6	223°51.0	7.5′	16°28.4	8.2′	59.2′
22	149°19.2	34.8	238°17.5	7.5′	16°36.6	8.1′	59.2′
23	164°19.4	34.0	252°44.0	7.4′	16°44.7	8.0′	59.2′
	SD = 15.8′	d = 0.8′	SD = 16.2′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	////	////	03:01	21:00	23:37	////
N 70°	////	01:43	03:25	20:37	22:15	////
68°	////	02:23	03:43	20:20	21:38	////
66°	////	02:50	03:58	20:06	21:13	23:41
64°	01:30	03:10	04:10	19:55	20:53	22:29
62°	02:06	03:26	04:20	19:45	20:38	21:56
60°	02:31	03:39	04:28	19:36	20:25	21:32
N 58°	02:50	03:51	04:36	19:29	20:14	21:14
56°	03:05	04:00	04:42	19:23	20:04	20:59
54°	03:18	04:09	04:48	19:17	19:56	20:46
52°	03:29	04:16	04:53	19:12	19:49	20:35
50°	03:39	04:23	04:58	19:07	19:42	20:26
45°	03:59	04:37	05:08	18:57	19:28	20:06
N 40°	04:14	04:48	05:17	18:48	19:17	19:51
35°	04:26	04:58	05:24	18:41	19:08	19:39
30°	04:36	05:06	05:31	18:35	19:00	19:29
20°	04:52	05:19	05:42	18:24	18:47	19:14
N 10°	05:04	05:29	05:51	18:15	18:37	19:02
0°	05:14	05:39	06:00	18:06	18:28	18:52
S 10°	05:22	05:47	06:08	17:58	18:19	18:44
20°	05:29	05:55	06:17	17:49	18:11	18:37
30°	05:35	06:03	06:28	17:39	18:03	18:31
35°	05:38	06:08	06:34	17:33	17:59	18:29
40°	05:41	06:13	06:40	17:26	17:54	18:26
45°	05:44	06:18	06:48	17:19	17:49	18:23
S 50°	05:46	06:24	06:57	17:10	17:43	18:21
52°	05:47	06:26	07:01	17:06	17:41	18:20
54°	05:48	06:29	07:06	17:01	17:38	18:19
56°	05:49	06:32	07:11	16:56	17:35	18:18
58°	05:50	06:36	07:17	16:50	17:31	18:17
S 60°	05:51	06:40	07:23	16:44	17:28	18:16

Lat.	**Moonrise** Thu	Fri	Sat	**Moonset** Thu	Fri	Sat
N 72°	20:38	20:19	19:50	11:18	13:26	15:50
N 70°	20:49	20:41	20:31	11:09	13:06	15:10
68°	20:59	20:58	20:59	11:02	12:51	14:43
66°	21:07	21:12	21:20	10:55	12:38	14:22
64°	21:14	21:24	21:38	10:50	12:28	14:06
62°	21:19	21:33	21:52	10:46	12:19	13:53
60°	21:25	21:42	22:04	10:42	12:12	13:41
N 58°	21:29	21:49	22:14	10:38	12:05	13:31
56°	21:33	21:56	22:24	10:35	11:59	13:23
54°	21:37	22:02	22:32	10:32	11:54	13:15
52°	21:40	22:07	22:39	10:30	11:49	13:08
50°	21:43	22:12	22:46	10:28	11:45	13:02
45°	21:50	22:23	23:00	10:23	11:36	12:49
N 40°	21:55	22:31	23:12	10:19	11:28	12:38
35°	22:00	22:39	23:22	10:15	11:22	12:29
30°	22:04	22:46	23:31	10:12	11:16	12:21
20°	22:12	22:58	23:46	10:07	11:06	12:07
N 10°	22:18	23:08	·· ··	10:02	10:58	11:55
0°	22:25	23:18	·· ··	09:58	10:50	11:43
S 10°	22:31	23:27	·· ··	09:53	10:42	11:32
20°	22:38	23:38	·· ··	09:49	10:33	11:20
30°	22:46	23:50	·· ··	09:43	10:23	11:06
35°	22:50	23:57	·· ··	09:40	10:18	10:58
40°	22:55	·· ··	00:05	09:37	10:11	10:49
45°	23:01	·· ··	00:14	09:33	10:04	10:39
S 50°	23:08	·· ··	00:26	09:28	09:55	10:26
52°	23:12	·· ··	00:31	09:26	09:51	10:20
54°	23:15	·· ··	00:37	09:23	09:47	10:14
56°	23:20	·· ··	00:44	09:21	09:42	10:07
58°	23:24	·· ··	00:51	09:18	09:36	09:58
S 60°	23:29	·· ··	00:59	09:15	09:30	09:49

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 20-22 78-57%
20	03:26	03:19	12:03	03:46	16:11	
21	03:12	03:05	12:03	04:37	17:04	
22	02:57	02:50	12:03	05:30	17:58	

August 23, 24, 25 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	331°11.9	146°07.7	S01°33.7	215°38.4	N22°13.8	141°37.1	S02°53.0	143°16.4	S00°58.5
1	346°14.4	161°07.5	35.0	230°39.2	13.6	156°39.1	53.2	158°18.6	58.6
2	1°16.8	176°07.3	36.3	245°39.9	13.3	171°41.2	53.4	173°20.9	58.7
3	16°19.3	191°07.1	·· 37.6	260°40.7	·· 13.1	186°43.2	·· 53.6	188°23.1	·· 58.8
4	31°21.8	206°06.9	38.9	275°41.4	12.8	201°45.2	53.8	203°25.3	58.9
5	46°24.2	221°06.7	40.1	290°42.1	12.6	216°47.3	54.0	218°27.5	59.0
6	61°26.7	236°06.4	S01°41.4	305°42.9	N22°12.3	231°49.3	S02°54.2	233°29.7	S00°59.1
7	76°29.2	251°06.2	42.7	320°43.6	12.1	246°51.3	54.4	248°32.0	59.2
8	91°31.6	266°06.0	44.0	335°44.4	11.8	261°53.4	54.6	263°34.2	59.3
9	106°34.1	281°05.8	·· 45.3	350°45.1	·· 11.5	276°55.4	·· 54.7	278°36.4	·· 59.4
10	121°36.6	296°05.6	46.6	5°45.9	11.3	291°57.4	54.9	293°38.6	59.6
11	136°39.0	311°05.4	47.9	20°46.6	11.0	306°59.5	55.1	308°40.9	59.7
12	151°41.5	326°05.1	S01°49.2	35°47.3	N22°10.8	322°01.5	S02°55.3	323°43.1	S00°59.8
13	166°44.0	341°04.9	50.5	50°48.1	10.5	337°03.5	55.5	338°45.3	00°59.9
14	181°46.4	356°04.7	51.8	65°48.8	10.3	352°05.6	55.7	353°47.5	01°00.0
15	196°48.9	11°04.5	·· 53.1	80°49.6	·· 10.0	7°07.6	·· 55.9	8°49.8	·· 00.1
16	211°51.3	26°04.3	54.3	95°50.3	09.8	22°09.6	56.1	23°52.0	00.2
17	226°53.8	41°04.1	55.6	110°51.1	09.5	37°11.7	56.3	38°54.2	00.3
18	241°56.3	56°03.8	S01°56.9	125°51.8	N22°09.2	52°13.7	S02°56.5	53°56.4	S01°00.4
19	256°58.7	71°03.6	58.2	140°52.6	09.0	67°15.7	56.6	68°58.6	00.5
20	272°01.2	86°03.4	01°59.5	155°53.3	08.7	82°17.8	56.8	84°00.9	00.6
21	287°03.7	101°03.2	02°00.8	170°54.1	·· 08.5	97°19.8	·· 57.0	99°03.1	·· 00.8
22	302°06.1	116°03.0	02.1	185°54.8	08.2	112°21.8	57.2	114°05.3	00.9
23	317°08.6	131°02.8	03.4	200°55.6	08.0	127°23.9	57.4	129°07.5	01.0
Mer.pass. 01:55		ν -0.2′	d 1.3′	m -3.96	ν 0.7′	d 0.3′	m 1.62	ν 2.0′	d 0.2′ m -1.73	ν 2.2′	d 0.1′ m 0.94

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	332°11.1	146°02.5	S02°04.7	215°56.3	N22°07.7	142°25.9	S02°57.6	144°09.8	S01°01.1
1	347°13.5	161°02.3	06.0	230°57.0	07.4	157°27.9	57.8	159°12.0	01.2
2	2°16.0	176°02.1	07.3	245°57.8	07.2	172°29.9	58.0	174°14.2	01.3
3	17°18.4	191°01.9	·· 08.5	260°58.5	·· 06.9	187°32.0	·· 58.2	189°16.4	·· 01.4
4	32°20.9	206°01.7	09.8	275°59.3	06.7	202°34.0	58.3	204°18.6	01.5
5	47°23.4	221°01.5	11.1	291°00.0	06.4	217°36.0	58.5	219°20.9	01.6
6	62°25.8	236°01.2	S02°12.4	306°00.8	N22°06.2	232°38.1	S02°58.7	234°23.1	S01°01.7
7	77°28.3	251°01.0	13.7	321°01.5	05.9	247°40.1	58.9	249°25.3	01.8
8	92°30.8	266°00.8	15.0	336°02.3	05.6	262°42.1	59.1	264°27.5	01.9
9	107°33.2	281°00.6	·· 16.3	351°03.0	·· 05.4	277°44.2	·· 59.3	279°29.8	·· 02.1
10	122°35.7	296°00.4	17.6	6°03.8	05.1	292°46.2	59.5	294°32.0	02.2
11	137°38.2	311°00.2	18.9	21°04.5	04.9	307°48.2	59.7	309°34.2	02.3
12	152°40.6	325°59.9	S02°20.2	36°05.3	N22°04.6	322°50.3	S02°59.9	324°36.4	S01°02.4
13	167°43.1	340°59.7	21.4	51°06.0	04.3	337°52.3	03°00.1	339°38.6	02.5
14	182°45.6	355°59.5	22.7	66°06.8	04.1	352°54.3	00.2	354°40.9	02.6
15	197°48.0	10°59.3	·· 24.0	81°07.5	·· 03.8	7°56.3	·· 00.4	9°43.1	·· 02.7
16	212°50.5	25°59.1	25.3	96°08.3	03.5	22°58.4	00.6	24°45.3	02.8
17	227°52.9	40°58.9	26.6	111°09.0	03.3	38°00.4	00.8	39°47.5	02.9
18	242°55.4	55°58.6	S02°27.9	126°09.8	N22°03.0	53°02.4	S03°01.0	54°49.7	S01°03.0
19	257°57.9	70°58.4	29.2	141°10.5	02.8	68°04.5	01.2	69°52.0	03.2
20	273°00.3	85°58.2	30.5	156°11.3	02.5	83°06.5	01.4	84°54.2	03.3
21	288°02.8	100°58.0	·· 31.8	171°12.0	·· 02.2	98°08.5	·· 01.6	99°56.4	·· 03.4
22	303°05.3	115°57.8	33.1	186°12.8	02.0	113°10.5	01.8	114°58.6	03.5
23	318°07.7	130°57.6	34.3	201°13.5	01.7	128°12.6	02.0	130°00.8	03.6
Mer.pass. 01:51		ν -0.2′	d 1.3′	m -3.97	ν 0.7′	d 0.3′	m 1.62	ν 2.0′	d 0.2′ m -1.73	ν 2.2′	d 0.1′ m 0.94

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	333°10.2	145°57.3	S02°35.6	216°14.3	N22°01.4	143°14.6	S03°02.2	145°03.1	S01°03.7
1	348°12.7	160°57.1	36.9	231°15.0	01.2	158°16.6	02.3	160°05.3	03.8
2	3°15.1	175°56.9	38.2	246°15.8	00.9	173°18.7	02.5	175°07.5	03.9
3	18°17.6	190°56.7	·· 39.5	261°16.5	·· 00.6	188°20.7	·· 02.7	190°09.7	·· 04.0
4	33°20.1	205°56.5	40.8	276°17.3	00.4	203°22.7	02.9	205°11.9	04.1
5	48°22.5	220°56.3	42.1	291°18.0	22°00.1	218°24.7	03.1	220°14.2	04.2
6	63°25.0	235°56.0	S02°43.4	306°18.8	N21°59.8	233°26.8	S03°03.3	235°16.4	S01°04.4
7	78°27.4	250°55.8	44.7	321°19.6	59.6	248°28.8	03.5	250°18.6	04.5
8	93°29.9	265°55.6	45.9	336°20.3	59.3	263°30.8	03.7	265°20.8	04.6
9	108°32.4	280°55.4	·· 47.2	351°21.1	·· 59.0	278°32.9	·· 03.9	280°23.0	·· 04.7
10	123°34.8	295°55.2	48.5	6°21.8	58.8	293°34.9	04.1	295°25.3	04.8
11	138°37.3	310°55.0	49.8	21°22.6	58.5	308°36.9	04.3	310°27.5	04.9
12	153°39.8	325°54.7	S02°51.1	36°23.3	N21°58.2	323°38.9	S03°04.4	325°29.7	S01°05.0
13	168°42.2	340°54.5	52.4	51°24.1	58.0	338°41.0	04.6	340°31.9	05.1
14	183°44.7	355°54.3	53.7	66°24.8	57.7	353°43.0	04.8	355°34.1	05.2
15	198°47.2	10°54.1	·· 55.0	81°25.6	·· 57.4	8°45.0	·· 05.0	10°36.4	·· 05.3
16	213°49.6	25°53.9	56.3	96°26.3	57.2	23°47.0	05.2	25°38.6	05.5
17	228°52.1	40°53.7	57.5	111°27.1	56.9	38°49.1	05.4	40°40.8	05.6
18	243°54.6	55°53.4	S02°58.8	126°27.9	N21°56.6	53°51.1	S03°05.6	55°43.0	S01°05.7
19	258°57.0	70°53.2	03°00.1	141°28.6	56.4	68°53.1	05.8	70°45.2	05.8
20	273°59.5	85°53.0	01.4	156°29.4	56.1	83°55.2	06.0	85°47.4	05.9
21	289°01.9	100°52.8	·· 02.7	171°30.1	·· 55.8	98°57.2	·· 06.2	100°49.7	·· 06.0
22	304°04.4	115°52.6	04.0	186°30.9	55.5	113°59.2	06.4	115°51.9	06.1
23	319°06.9	130°52.4	05.3	201°31.6	55.3	129°01.2	06.5	130°54.1	06.2
Mer.pass. 01:47		ν -0.2′	d 1.3′	m -3.97	ν 0.8′	d 0.3′	m 1.62	ν 2.0′	d 0.2′ m -1.73	ν 2.2′	d 0.1′ m 0.94

Stars

	SHA	Dec
Alpheratz	358°08.3	28°59.3
Ankaa	353°39.2	-42°24.2
Schedar	350°07.8	56°26.0
Diphda	349°20.0	-18°05.2
Achernar	335°44.4	-57°19.6
Hamal	328°28.0	23°22.5
Polaris	326°31.1	89°10.5
Acamar	315°36.6	-40°22.5
Menkar	314°40.4	4°01.1
Mirfak	309°15.1	49°47.5
Aldebaran	291°17.3	16°28.3
Rigel	281°35.5	-8°13.2
Capella	281°10.5	45°58.6
Bellatrix	278°58.2	6°20.0
Elnath	278°43.4	28°35.5
Alnilam	276°11.1	-1°12.7
Betelgeuse	271°27.7	7°24.3
Canopus	264°07.2	-52°40.9
Sirius	258°55.3	-16°41.3
Adhara	255°31.9	-28°56.6
Procyon	245°25.4	5°16.5
Pollux	243°57.7	28°04.3
Avior	234°28.5	-59°26.8
Suhail	223°10.7	-43°21.3
Miaplacidus	221°45.8	-69°38.4
Alphard	218°20.2	-8°34.6
Regulus	208°09.6	12°03.6
Dubhe	194°21.9	61°51.2
Denebola	182°58.7	14°40.7
Gienah	176°17.6	-17°26.2
Acrux	173°37.1	-62°59.9
Gacrux	172°28.5	-57°00.6
Alioth	166°42.3	56°03.9
Spica	158°57.0	-11°03.8
Alkaid	153°18.2	49°24.7
Hadar	149°22.7	-60°17.2
Menkent	148°36.4	-36°16.8
Arcturus	146°18.0	19°17.0
Rigil Kent.	140°25.2	-60°45.6
Kochab	137°19.3	74°14.3
Zuben'ubi	137°32.4	-15°57.8
Alphecca	126°31.6	26°46.9
Antares	112°56.0	-26°23.5
Atria	108°19.5	-68°59.9
Sabik	102°40.3	-15°42.1
Shaula	96°54.7	-37°05.5
Rasalhague	96°28.8	12°34.6
Eltanin	90°57.2	51°29.8
Kaus Aust.	84°15.7	-34°23.7
Vega	80°55.1	38°46.3
Nunki	76°28.1	-26°19.2
Altair	62°31.6	8°49.3
Peacock	53°56.8	-56°47.7
Deneb	49°47.6	45°13.0
Enif	34°10.6	9°47.5
Al Na'ir	28°13.6	-47°03.0
Fomalhaut	15°50.3	-29°43.1
Scheat	14°16.6	27°59.0
Markab	14°02.2	15°06.4

Aug 23 Sun	SHA	Mer.pass
Venus	174°55.8	14:16
Mars	244°26.5	09:37
Jupiter	170°25.2	14:32
Saturn	172°04.5	14:25

Aug 24 Mon	SHA	Mer.pass
Venus	173°51.5	14:16
Mars	243°45.2	09:36
Jupiter	170°14.8	14:28
Saturn	171°58.7	14:21

Aug 25 Tue	SHA	Mer.pass
Venus	172°47.1	14:16
Mars	243°04.1	09:35
Jupiter	170°04.4	14:25
Saturn	171°52.9	14:18

Horizontal parallax	
Venus:	0.1
Mars:	0.1

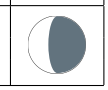
h	Sun		Moon				
Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°19.5	N11°33.1	267°10.4	7.4′	N16°52.7	7.9′	59.2′
1	194°19.7	32.3	281°36.8	7.3′	17°00.6	7.7′	59.2′
2	209°19.8	31.4	296°03.2	7.3′	17°08.3	7.7′	59.2′
3	224°20.0	·· 30.6	310°29.4	7.2′	17°16.0	7.6′	59.2′
4	239°20.2	29.7	324°55.7	7.2′	17°23.6	7.4′	59.2′
5	254°20.3	28.9	339°21.9	7.2′	17°31.0	7.4′	59.2′
6	269°20.5	N11°28.0	353°48.1	7.1′	N17°38.4	7.2′	59.2′
7	284°20.6	27.2	8°14.2	7.1′	17°45.6	7.1′	59.2′
8	299°20.8	26.3	22°40.2	7.0′	17°52.7	7.0′	59.2′
9	314°21.0	·· 25.5	37°06.3	7.0′	17°59.7	6.9′	59.2′
10	329°21.1	24.6	51°32.3	6.9′	18°06.6	6.8′	59.1′
11	344°21.3	23.8	65°58.2	6.9′	18°13.4	6.7′	59.1′
12	359°21.5	N11°22.9	80°24.1	6.9′	N18°20.1	6.5′	59.1′
13	14°21.6	22.1	94°50.0	6.8′	18°26.6	6.4′	59.1′
14	29°21.8	21.2	109°15.8	6.8′	18°33.0	6.3′	59.1′
15	44°22.0	·· 20.4	123°41.6	6.7′	18°39.3	6.2′	59.1′
16	59°22.1	19.5	138°07.3	6.7′	18°45.5	6.1′	59.1′
17	74°22.3	18.7	152°33.0	6.7′	18°51.6	5.9′	59.1′
18	89°22.4	N11°17.8	166°58.7	6.6′	N18°57.5	5.8′	59.1′
19	104°22.6	17.0	181°24.3	6.6′	19°03.3	5.7′	59.1′
20	119°22.8	16.1	195°49.9	6.6′	19°09.0	5.6′	59.1′
21	134°22.9	·· 15.3	210°15.5	6.5′	19°14.6	5.5′	59.1′
22	149°23.1	14.4	224°41.0	6.5′	19°20.1	5.3′	59.1′
23	164°23.3	13.6	239°06.5	6.5′	19°25.4	5.2′	59.1′
	SD = 15.8′	d = 0.8′	SD = 16.1′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°23.4	N11°12.7	253°32.0	6.4′	N19°30.6	5.1′	59.1′
1	194°23.6	11.9	267°57.4	6.4′	19°35.7	4.9′	59.1′
2	209°23.8	11.0	282°22.8	6.4′	19°40.6	4.8′	59.0′
3	224°23.9	·· 10.2	296°48.2	6.3′	19°45.4	4.7′	59.0′
4	239°24.1	09.3	311°13.5	6.3′	19°50.1	4.6′	59.0′
5	254°24.3	08.5	325°38.8	6.3′	19°54.7	4.4′	59.0′
6	269°24.4	N11°07.6	340°04.1	6.3′	N19°59.1	4.3′	59.0′
7	284°24.6	06.8	354°29.3	6.2′	20°03.4	4.1′	59.0′
8	299°24.8	05.9	8°54.6	6.2′	20°07.5	4.1′	59.0′
9	314°24.9	·· 05.0	23°19.8	6.2′	20°11.6	3.9′	59.0′
10	329°25.1	04.2	37°45.0	6.2′	20°15.5	3.8′	59.0′
11	344°25.3	03.3	52°10.1	6.1′	20°19.3	3.6′	59.0′
12	359°25.4	N11°02.5	66°35.3	6.1′	N20°22.9	3.5′	59.0′
13	14°25.6	01.6	81°00.4	6.1′	20°26.4	3.4′	59.0′
14	29°25.8	11°00.8	95°25.5	6.1′	20°29.8	3.2′	58.9′
15	44°25.9	10°59.9	109°50.6	6.1′	20°33.0	3.1′	58.9′
16	59°26.1	59.0	124°15.7	6.1′	20°36.1	3.0′	58.9′
17	74°26.3	58.2	138°40.7	6.0′	20°39.1	2.8′	58.9′
18	89°26.4	N10°57.3	153°05.8	6.0′	N20°41.9	2.7′	58.9′
19	104°26.6	56.5	167°30.8	6.0′	20°44.6	2.6′	58.9′
20	119°26.8	55.6	181°55.8	6.0′	20°47.2	2.4′	58.9′
21	134°26.9	·· 54.8	196°20.8	6.0′	20°49.6	2.3′	58.9′
22	149°27.1	53.9	210°45.8	6.0′	20°51.9	2.1′	58.9′
23	164°27.3	53.0	225°10.8	6.0′	20°54.0	2.1′	58.9′
	SD = 15.8′	d = 0.9′	SD = 16.1′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°27.4	N10°52.2	239°35.8	6.0′	N20°56.1	1.8′	58.8′
1	194°27.6	51.3	254°00.8	6.0′	20°57.9	1.8′	58.8′
2	209°27.8	50.5	268°25.7	6.0′	20°59.7	1.6′	58.8′
3	224°28.0	·· 49.6	282°50.7	6.0′	21°01.3	1.4′	58.8′
4	239°28.1	48.7	297°15.7	6.0′	21°02.7	1.4′	58.8′
5	254°28.3	47.9	311°40.6	6.0′	21°04.1	1.2′	58.8′
6	269°28.5	N10°47.0	326°05.6	6.0′	N21°05.3	1.0′	58.8′
7	284°28.6	46.1	340°30.6	6.0′	21°06.3	0.9′	58.8′
8	299°28.8	45.3	354°55.6	6.0′	21°07.2	0.8′	58.8′
9	314°29.0	·· 44.4	9°20.6	6.0′	21°08.0	0.6′	58.7′
10	329°29.2	43.6	23°45.5	6.0′	21°08.6	0.5′	58.7′
11	344°29.3	42.7	38°10.5	6.0′	21°09.1	0.4′	58.7′
12	359°29.5	N10°41.8	52°35.5	6.0′	N21°09.5	0.2′	58.7′
13	14°29.7	41.0	67°00.6	6.0′	21°09.7	0.1′	58.7′
14	29°29.8	40.1	81°25.6	6.0′	21°09.8	0.0′	58.7′
15	44°30.0	·· 39.2	95°50.6	6.1′	21°09.8	0.2′	58.7′
16	59°30.2	38.4	110°15.7	6.1′	21°09.6	0.3′	58.7′
17	74°30.4	37.5	124°40.8	6.1′	21°09.3	0.5′	58.6′
18	89°30.5	N10°36.6	139°05.9	6.1′	N21°08.8	0.6′	58.6′
19	104°30.7	35.8	153°31.0	6.1′	21°08.2	0.7′	58.6′
20	119°30.9	34.9	167°56.1	6.1′	21°07.5	0.9′	58.6′
21	134°31.0	·· 34.0	182°21.2	6.2′	21°06.6	1.0′	58.6′
22	149°31.2	33.2	196°46.4	6.2′	21°05.6	1.1′	58.6′
23	164°31.4	32.3	211°11.6	6.2′	21°04.5	1.3′	58.6′
	SD = 15.8′	d = 0.9′	SD = 16.0′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	////	01:12	03:19	20:42	22:40	////
N 70°	////	02:08	03:39	20:22	21:51	////
68°	////	02:40	03:55	20:07	21:20	////
66°	01:03	03:03	04:08	19:54	20:58	22:51
64°	01:52	03:21	04:19	19:44	20:41	22:08
62°	02:21	03:36	04:28	19:35	20:27	21:40
60°	02:42	03:48	04:35	19:28	20:15	21:19
N 58°	03:00	03:58	04:42	19:21	20:05	21:02
56°	03:14	04:07	04:48	19:15	19:56	20:49
54°	03:26	04:15	04:53	19:10	19:48	20:37
52°	03:36	04:22	04:58	19:05	19:42	20:27
50°	03:45	04:28	05:03	19:01	19:35	20:18
45°	04:03	04:41	05:12	18:52	19:23	20:00
N 40°	04:17	04:52	05:20	18:44	19:12	19:46
35°	04:29	05:00	05:27	18:38	19:04	19:35
30°	04:38	05:08	05:32	18:32	18:56	19:26
20°	04:53	05:20	05:42	18:22	18:45	19:11
N 10°	05:05	05:30	05:51	18:13	18:35	19:00
0°	05:13	05:38	05:59	18:06	18:27	18:51
S 10°	05:21	05:46	06:07	17:58	18:19	18:44
20°	05:27	05:53	06:15	17:50	18:12	18:38
30°	05:32	06:00	06:25	17:40	18:05	18:33
35°	05:35	06:04	06:30	17:35	18:01	18:30
40°	05:37	06:08	06:36	17:29	17:57	18:28
45°	05:39	06:13	06:43	17:22	17:52	18:27
S 50°	05:41	06:18	06:51	17:14	17:47	18:25
52°	05:41	06:20	06:55	17:10	17:45	18:24
54°	05:42	06:23	06:59	17:06	17:43	18:24
56°	05:42	06:26	07:04	17:02	17:40	18:23
58°	05:43	06:28	07:09	16:57	17:37	18:23
S 60°	05:43	06:32	07:15	16:51	17:34	18:23

Lat.	**Moonrise** Sun	Mon	Tue	**Moonset** Sun	Mon	Tue
N 72°	▭	▭	▭	▭	▭	▭
N 70°	20:12	▭	▭	17:26	▭	▭
68°	21:03	21:18	22:08	16:36	18:21	19:34
66°	21:35	22:04	22:58	16:04	17:36	18:43
64°	21:59	22:35	23:30	15:41	17:06	18:12
62°	22:18	22:57	23:54	15:22	16:43	17:48
60°	22:34	23:16	·· ··	15:07	16:25	17:29
N 58°	22:47	23:31	·· ··	14:54	16:10	17:13
56°	22:59	23:44	·· ··	14:43	15:57	17:00
54°	23:09	23:56	·· ··	14:33	15:46	16:48
52°	23:18	·· ··	00:06	14:25	15:36	16:38
50°	23:26	·· ··	00:15	14:17	15:27	16:29
45°	23:43	·· ··	00:34	14:00	15:08	16:09
N 40°	23:57	·· ··	00:49	13:47	14:53	15:54
35°	·· ··	00:10	01:03	13:35	14:40	15:40
30°	·· ··	00:20	01:14	13:25	14:29	15:29
20°	·· ··	00:38	01:34	13:08	14:09	15:09
N 10°	00:00	00:54	01:51	12:53	13:52	14:51
0°	00:12	01:09	02:07	12:39	13:37	14:35
S 10°	00:25	01:24	02:23	12:25	13:21	14:19
20°	00:39	01:40	02:41	12:10	13:04	14:01
30°	00:55	01:59	03:01	11:53	12:45	13:41
35°	01:04	02:10	03:12	11:43	12:34	13:29
40°	01:15	02:22	03:26	11:32	12:21	13:16
45°	01:27	02:37	03:42	11:19	12:06	13:00
S 50°	01:42	02:55	04:01	11:03	11:47	12:40
52°	01:49	03:04	04:11	10:55	11:38	12:31
54°	01:57	03:13	04:21	10:47	11:28	12:20
56°	02:06	03:24	04:33	10:37	11:17	12:09
58°	02:16	03:36	04:46	10:27	11:05	11:55
S 60°	02:28	03:51	05:02	10:15	10:50	11:39

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 23-25 45-24%
23	02:42	02:34	12:03	06:26	18:54	
24	02:26	02:18	12:02	07:23	19:52	
25	02:10	02:02	12:02	08:21	20:50	

August 26, 27, 28 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	334°09.3	145°52.1	S03°06.6	216°32.4	N21°55.0	144°03.3	S03°06.7	145°56.3	S01°06.3
1	349°11.8	160°51.9	07.8	231°33.1	54.7	159°05.3	06.9	160°58.5	06.4
2	4°14.3	175°51.7	09.1	246°33.9	54.5	174°07.3	07.1	176°00.8	06.6
3	19°16.7	190°51.5	·· 10.4	261°34.7	·· 54.2	189°09.3	·· 07.3	191°03.0	·· 06.7
4	34°19.2	205°51.3	11.7	276°35.4	53.9	204°11.4	07.5	206°05.2	06.8
5	49°21.7	220°51.1	13.0	291°36.2	53.6	219°13.4	07.7	221°07.4	06.9
6	64°24.1	235°50.8	S03°14.3	306°36.9	N21°53.4	234°15.4	S03°07.9	236°09.6	S01°07.0
7	79°26.6	250°50.6	15.6	321°37.7	53.1	249°17.4	08.1	251°11.8	07.1
8	94°29.0	265°50.4	16.9	336°38.5	52.8	264°19.5	08.3	266°14.1	07.2
9	109°31.5	280°50.2	·· 18.1	351°39.2	·· 52.6	279°21.5	·· 08.5	281°16.3	·· 07.3
10	124°34.0	295°50.0	19.4	6°40.0	52.3	294°23.5	08.7	296°18.5	07.4
11	139°36.4	310°49.8	20.7	21°40.7	52.0	309°25.5	08.8	311°20.7	07.5
12	154°38.9	325°49.5	S03°22.0	36°41.5	N21°51.7	324°27.6	S03°09.0	326°22.9	S01°07.7
13	169°41.4	340°49.3	23.3	51°42.2	51.5	339°29.6	09.2	341°25.2	07.8
14	184°43.8	355°49.1	24.6	66°43.0	51.2	354°31.6	09.4	356°27.4	07.9
15	199°46.3	10°48.9	·· 25.9	81°43.8	·· 50.9	9°33.6	·· 09.6	11°29.6	·· 08.0
16	214°48.8	25°48.7	27.1	96°44.5	50.6	24°35.7	09.8	26°31.8	08.1
17	229°51.2	40°48.5	28.4	111°45.3	50.4	39°37.7	10.0	41°34.0	08.2
18	244°53.7	55°48.2	S03°29.7	126°46.0	N21°50.1	54°39.7	S03°10.2	56°36.2	S01°08.3
19	259°56.2	70°48.0	31.0	141°46.8	49.8	69°41.7	10.4	71°38.5	08.4
20	274°58.6	85°47.8	32.3	156°47.6	49.5	84°43.8	10.6	86°40.7	08.5
21	290°01.1	100°47.6	·· 33.6	171°48.3	·· 49.3	99°45.8	·· 10.8	101°42.9	·· 08.6
22	305°03.5	115°47.4	34.9	186°49.1	49.0	114°47.8	11.0	116°45.1	08.8
23	320°06.0	130°47.2	36.1	201°49.8	48.7	129°49.8	11.1	131°47.3	08.9
Mer.pass. 01:43		ν -0.2′	d 1.3′	m -3.97	ν 0.8′	d 0.3′	m 1.62	ν 2.0′	d 0.2′ m -1.72	ν 2.2′	d 0.1′ m 0.94

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	335°08.5	145°46.9	S03°37.4	216°50.6	N21°48.4	144°51.8	S03°11.3	146°49.5	S01°09.0
1	350°10.9	160°46.7	38.7	231°51.4	48.2	159°53.9	11.5	161°51.8	09.1
2	5°13.4	175°46.5	40.0	246°52.1	47.9	174°55.9	11.7	176°54.0	09.2
3	20°15.9	190°46.3	·· 41.3	261°52.9	·· 47.6	189°57.9	·· 11.9	191°56.2	·· 09.3
4	35°18.3	205°46.1	42.6	276°53.7	47.3	204°59.9	12.1	206°58.4	09.4
5	50°20.8	220°45.9	43.9	291°54.4	47.0	220°02.0	12.3	222°00.6	09.5
6	65°23.3	235°45.6	S03°45.1	306°55.2	N21°46.8	235°04.0	S03°12.5	237°02.8	S01°09.6
7	80°25.7	250°45.4	46.4	321°55.9	46.5	250°06.0	12.7	252°05.1	09.8
8	95°28.2	265°45.2	47.7	336°56.7	46.2	265°08.0	12.9	267°07.3	09.9
9	110°30.7	280°45.0	·· 49.0	351°57.5	·· 45.9	280°10.1	·· 13.1	282°09.5	·· 10.0
10	125°33.1	295°44.8	50.3	6°58.2	45.6	295°12.1	13.3	297°11.7	10.1
11	140°35.6	310°44.6	51.6	21°59.0	45.4	310°14.1	13.5	312°13.9	10.2
12	155°38.0	325°44.3	S03°52.9	36°59.8	N21°45.1	325°16.1	S03°13.7	327°16.1	S01°10.3
13	170°40.5	340°44.1	54.1	52°00.5	44.8	340°18.1	13.8	342°18.4	10.4
14	185°43.0	355°43.9	55.4	67°01.3	44.5	355°20.2	14.0	357°20.6	10.5
15	200°45.4	10°43.7	·· 56.7	82°02.1	·· 44.2	10°22.2	·· 14.2	12°22.8	·· 10.6
16	215°47.9	25°43.5	58.0	97°02.8	44.0	25°24.2	14.4	27°25.0	10.8
17	230°50.4	40°43.3	03°59.3	112°03.6	43.7	40°26.2	14.6	42°27.2	10.9
18	245°52.8	55°43.0	S04°00.6	127°04.4	N21°43.4	55°28.3	S03°14.8	57°29.4	S01°11.0
19	260°55.3	70°42.8	01.8	142°05.1	43.1	70°30.3	15.0	72°31.6	11.1
20	275°57.8	85°42.6	03.1	157°05.9	42.8	85°32.3	15.2	87°33.9	11.2
21	291°00.2	100°42.4	·· 04.4	172°06.7	·· 42.5	100°34.3	·· 15.4	102°36.1	·· 11.3
22	306°02.7	115°42.2	05.7	187°07.4	42.3	115°36.3	15.6	117°38.3	11.4
23	321°05.2	130°42.0	07.0	202°08.2	42.0	130°38.4	15.8	132°40.5	11.5
Mer.pass. 01:39		ν -0.2′	d 1.3′	m -3.97	ν 0.8′	d 0.3′	m 1.62	ν 2.0′	d 0.2′ m -1.72	ν 2.2′	d 0.1′ m 0.94

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	336°07.6	145°41.7	S04°08.3	217°09.0	N21°41.7	145°40.4	S03°16.0	147°42.7	S01°11.6
1	351°10.1	160°41.5	09.5	232°09.7	41.4	160°42.4	16.2	162°44.9	11.8
2	6°12.5	175°41.3	10.8	247°10.5	41.1	175°44.4	16.4	177°47.2	11.9
3	21°15.0	190°41.1	·· 12.1	262°11.3	·· 40.8	190°46.4	·· 16.5	192°49.4	·· 12.0
4	36°17.5	205°40.9	13.4	277°12.0	40.6	205°48.5	16.7	207°51.6	12.1
5	51°19.9	220°40.6	14.7	292°12.8	40.3	220°50.5	16.9	222°53.8	12.2
6	66°22.4	235°40.4	S04°16.0	307°13.6	N21°40.0	235°52.5	S03°17.1	237°56.0	S01°12.3
7	81°24.9	250°40.2	17.2	322°14.3	39.7	250°54.5	17.3	252°58.2	12.4
8	96°27.3	265°40.0	18.5	337°15.1	39.4	265°56.5	17.5	268°00.4	12.5
9	111°29.8	280°39.8	·· 19.8	352°15.9	·· 39.1	280°58.6	·· 17.7	283°02.7	·· 12.6
10	126°32.3	295°39.6	21.1	7°16.6	38.8	296°00.6	17.9	298°04.9	12.8
11	141°34.7	310°39.3	22.4	22°17.4	38.6	311°02.6	18.1	313°07.1	12.9
12	156°37.2	325°39.1	S04°23.6	37°18.2	N21°38.3	326°04.6	S03°18.3	328°09.3	S01°13.0
13	171°39.6	340°38.9	24.9	52°18.9	38.0	341°06.6	18.5	343°11.5	13.1
14	186°42.1	355°38.7	26.2	67°19.7	37.7	356°08.7	18.7	358°13.7	13.2
15	201°44.6	10°38.5	·· 27.5	82°20.5	·· 37.4	11°10.7	·· 18.9	13°15.9	·· 13.3
16	216°47.0	25°38.2	28.8	97°21.2	37.1	26°12.7	19.1	28°18.2	13.4
17	231°49.5	40°38.0	30.1	112°22.0	36.8	41°14.7	19.3	43°20.4	13.5
18	246°52.0	55°37.8	S04°31.3	127°22.8	N21°36.6	56°16.7	S03°19.4	58°22.6	S01°13.6
19	261°54.4	70°37.6	32.6	142°23.6	36.3	71°18.8	19.6	73°24.8	13.8
20	276°56.9	85°37.4	33.9	157°24.3	36.0	86°20.8	19.8	88°27.0	13.9
21	291°59.4	100°37.2	·· 35.2	172°25.1	·· 35.7	101°22.8	·· 20.0	103°29.2	·· 14.0
22	307°01.8	115°36.9	36.5	187°25.9	35.4	116°24.8	20.2	118°31.4	14.1
23	322°04.3	130°36.7	37.7	202°26.6	35.1	131°26.8	20.4	133°33.6	14.2
Mer.pass. 01:35		ν -0.2′	d 1.3′	m -3.98	ν 0.8′	d 0.3′	m 1.62	ν 2.0′	d 0.2′ m -1.72	ν 2.2′	d 0.1′ m 0.94

Stars

	SHA	Dec
Alpheratz	358°08.3	28°59.3
Ankaa	353°39.2	-42°24.2
Schedar	350°07.8	56°26.0
Diphda	349°19.9	-18°05.2
Achernar	335°44.4	-57°19.6
Hamal	328°28.0	23°22.5
Polaris	326°30.0	89°10.5
Acamar	315°36.6	-40°22.5
Menkar	314°40.3	4°01.1
Mirfak	309°15.1	49°47.5
Aldebaran	291°17.3	16°28.3
Rigel	281°35.5	-8°13.2
Capella	281°10.4	45°58.6
Bellatrix	278°58.1	6°20.0
Elnath	278°43.4	28°35.5
Alnilam	276°11.1	-1°12.7
Betelgeuse	271°27.7	7°24.3
Canopus	264°07.2	-52°40.9
Sirius	258°55.3	-16°41.3
Adhara	255°31.8	-28°56.6
Procyon	245°25.3	5°16.5
Pollux	243°57.6	28°04.3
Avior	234°28.5	-59°26.8
Suhail	223°10.7	-43°21.3
Miaplacidus	221°45.7	-69°38.4
Alphard	218°20.2	-8°34.6
Regulus	208°09.6	12°03.6
Dubhe	194°21.9	61°51.2
Denebola	182°58.7	14°40.7
Gienah	176°17.6	-17°26.2
Acrux	173°37.1	-62°59.9
Gacrux	172°28.5	-57°00.6
Alioth	166°42.3	56°03.9
Spica	158°57.0	-11°03.8
Alkaid	153°18.2	49°24.7
Hadar	149°22.8	-60°17.2
Menkent	148°36.4	-36°16.8
Arcturus	146°18.0	19°17.0
Rigil Kent.	140°25.2	-60°45.5
Kochab	137°19.4	74°14.3
Zuben'ubi	137°32.4	-15°57.8
Alphecca	126°31.6	26°46.9
Antares	112°56.0	-26°23.5
Atria	108°19.6	-68°59.9
Sabik	102°40.3	-15°42.1
Shaula	96°54.7	-37°05.5
Rasalhague	96°28.8	12°34.6
Eltanin	90°57.2	51°29.8
Kaus Aust.	84°15.8	-34°23.7
Vega	80°55.1	38°46.3
Nunki	76°28.1	-26°19.2
Altair	62°31.6	8°49.3
Peacock	53°56.8	-56°47.8
Deneb	49°47.6	45°13.0
Enif	34°10.6	9°47.5
Al Na'ir	28°13.6	-47°03.0
Fomalhaut	15°50.3	-29°43.1
Scheat	14°16.6	27°59.0
Markab	14°02.2	15°06.4

Aug 26 Wed	SHA	Mer.pass
Venus	171°42.8	14:17
Mars	242°23.1	09:33
Jupiter	169°53.9	14:22
Saturn	171°47.0	14:14

Aug 27 Thu	SHA	Mer.pass
Venus	170°38.5	14:17
Mars	241°42.1	09:32
Jupiter	169°43.4	14:19
Saturn	171°41.1	14:11

Aug 28 Fri	SHA	Mer.pass
Venus	169°34.1	14:17
Mars	241°01.3	09:31
Jupiter	169°32.8	14:15
Saturn	171°35.1	14:07

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°31.6	N10°31.4	225°36.8	6.2′	N21°03.2	1.4′	58.6′
1	194°31.7	30.6	240°02.1	6.3′	21°01.8	1.6′	58.5′
2	209°31.9	29.7	254°27.3	6.3′	21°00.2	1.6′	58.5′
3	224°32.1	·· 28.8	268°52.6	6.3′	20°58.6	1.9′	58.5′
4	239°32.3	28.0	283°18.0	6.4′	20°56.7	1.9′	58.5′
5	254°32.4	27.1	297°43.3	6.4′	20°54.8	2.1′	58.5′
6	269°32.6	N10°26.2	312°08.7	6.4′	N20°52.7	2.2′	58.5′
7	284°32.8	25.4	326°34.2	6.5′	20°50.5	2.3′	58.5′
8	299°33.0	24.5	340°59.6	6.5′	20°48.2	2.5′	58.4′
9	314°33.1	·· 23.6	355°25.1	6.5′	20°45.7	2.6′	58.4′
10	329°33.3	22.8	9°50.7	6.6′	20°43.1	2.7′	58.4′
11	344°33.5	21.9	24°16.3	6.6′	20°40.4	2.9′	58.4′
12	359°33.7	N10°21.0	38°41.9	6.7′	N20°37.5	3.0′	58.4′
13	14°33.8	20.1	53°07.5	6.7′	20°34.5	3.1′	58.4′
14	29°34.0	19.3	67°33.2	6.7′	20°31.4	3.3′	58.3′
15	44°34.2	·· 18.4	81°59.0	6.8′	20°28.1	3.3′	58.3′
16	59°34.4	17.5	96°24.8	6.8′	20°24.8	3.5′	58.3′
17	74°34.5	16.7	110°50.6	6.9′	20°21.3	3.7′	58.3′
18	89°34.7	N10°15.8	125°16.5	6.9′	N20°17.6	3.7′	58.3′
19	104°34.9	14.9	139°42.4	7.0′	20°13.9	3.9′	58.3′
20	119°35.1	14.0	154°08.4	7.0′	20°10.0	4.0′	58.2′
21	134°35.2	·· 13.2	168°34.4	7.1′	20°06.0	4.1′	58.2′
22	149°35.4	12.3	183°00.5	7.1′	20°01.9	4.3′	58.2′
23	164°35.6	11.4	197°26.6	7.2′	19°57.6	4.3′	58.2′
	SD = 15.8′	d = 0.9′	SD = 16.0′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°35.8	N10°10.5	211°52.8	7.2′	N19°53.3	4.5′	58.2′
1	194°36.0	09.7	226°19.0	7.3′	19°48.8	4.6′	58.2′
2	209°36.1	08.8	240°45.3	7.3′	19°44.2	4.7′	58.1′
3	224°36.3	·· 07.9	255°11.6	7.4′	19°39.5	4.9′	58.1′
4	239°36.5	07.0	269°38.0	7.5′	19°34.6	4.9′	58.1′
5	254°36.7	06.2	284°04.5	7.5′	19°29.7	5.1′	58.1′
6	269°36.8	N10°05.3	298°31.0	7.6′	N19°24.6	5.2′	58.1′
7	284°37.0	04.4	312°57.6	7.6′	19°19.4	5.3′	58.0′
8	299°37.2	03.5	327°24.2	7.7′	19°14.1	5.4′	58.0′
9	314°37.4	·· 02.7	341°50.9	7.7′	19°08.7	5.5′	58.0′
10	329°37.6	01.8	356°17.6	7.8′	19°03.2	5.7′	58.0′
11	344°37.7	00.9	10°44.4	7.9′	18°57.5	5.7′	58.0′
12	359°37.9	N10°00.0	25°11.3	7.9′	N18°51.8	5.9′	58.0′
13	14°38.1	09°59.2	39°38.2	8.0′	18°45.9	6.0′	57.9′
14	29°38.3	58.3	54°05.2	8.1′	18°39.9	6.0′	57.9′
15	44°38.5	·· 57.4	68°32.3	8.1′	18°33.9	6.2′	57.9′
16	59°38.6	56.5	82°59.4	8.2′	18°27.7	6.3′	57.9′
17	74°38.8	55.6	97°26.6	8.3′	18°21.4	6.4′	57.9′
18	89°39.0	N09°54.8	111°53.9	8.3′	N18°15.0	6.5′	57.8′
19	104°39.2	53.9	126°21.2	8.4′	18°08.5	6.6′	57.8′
20	119°39.4	53.0	140°48.6	8.5′	18°01.9	6.7′	57.8′
21	134°39.5	·· 52.1	155°16.0	8.5′	17°55.2	6.8′	57.8′
22	149°39.7	51.2	169°43.5	8.6′	17°48.4	6.9′	57.8′
23	164°39.9	50.4	184°11.1	8.7′	17°41.5	6.9′	57.7′
	SD = 15.8′	d = 0.9′	SD = 15.9′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°40.1	N09°49.5	198°38.8	8.7′	N17°34.6	7.1′	57.7′
1	194°40.3	48.6	213°06.5	8.8′	17°27.5	7.2′	57.7′
2	209°40.4	47.7	227°34.3	8.9′	17°20.3	7.3′	57.7′
3	224°40.6	·· 46.8	242°02.2	8.9′	17°13.0	7.4′	57.7′
4	239°40.8	46.0	256°30.1	9.0′	17°05.6	7.4′	57.6′
5	254°41.0	45.1	270°58.1	9.1′	16°58.2	7.6′	57.6′
6	269°41.2	N09°44.2	285°26.2	9.1′	N16°50.6	7.6′	57.6′
7	284°41.4	43.3	299°54.3	9.2′	16°43.0	7.8′	57.6′
8	299°41.5	42.4	314°22.5	9.3′	16°35.2	7.8′	57.5′
9	314°41.7	·· 41.5	328°50.8	9.4′	16°27.4	7.9′	57.5′
10	329°41.9	40.7	343°19.2	9.4′	16°19.5	8.0′	57.5′
11	344°42.1	39.8	357°47.6	9.5′	16°11.5	8.1′	57.5′
12	359°42.3	N09°38.9	12°16.1	9.6′	N16°03.4	8.2′	57.5′
13	14°42.4	38.0	26°44.6	9.6′	15°55.2	8.2′	57.4′
14	29°42.6	37.1	41°13.3	9.7′	15°47.0	8.3′	57.4′
15	44°42.8	·· 36.2	55°42.0	9.8′	15°38.7	8.4′	57.4′
16	59°43.0	35.4	70°10.8	9.8′	15°30.3	8.5′	57.4′
17	74°43.2	34.5	84°39.6	9.9′	15°21.8	8.6′	57.3′
18	89°43.4	N09°33.6	99°08.5	10.0′	N15°13.2	8.6′	57.3′
19	104°43.6	32.7	113°37.5	10.1′	15°04.6	8.7′	57.3′
20	119°43.7	31.8	128°06.6	10.1′	14°55.9	8.8′	57.3′
21	134°43.9	·· 30.9	142°35.7	10.2′	14°47.1	8.9′	57.3′
22	149°44.1	30.0	157°04.9	10.3′	14°38.2	8.9′	57.2′
23	164°44.3	29.2	171°34.2	10.3′	14°29.3	9.0′	57.2′
	SD = 15.8′	d = 0.9′	SD = 15.7′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	////	01:48	03:35	20:24	22:07	////
N 70°	////	02:28	03:53	20:07	21:29	////
68°	////	02:55	04:07	19:54	21:03	23:33
66°	01:33	03:16	04:18	19:43	20:44	22:23
64°	02:09	03:32	04:27	19:33	20:29	21:49
62°	02:34	03:45	04:36	19:26	20:16	21:25
60°	02:53	03:56	04:42	19:19	20:05	21:07
N 58°	03:09	04:05	04:49	19:13	19:56	20:52
56°	03:22	04:13	04:54	19:08	19:48	20:39
54°	03:33	04:21	04:59	19:03	19:41	20:28
52°	03:42	04:27	05:03	18:59	19:35	20:19
50°	03:51	04:33	05:07	18:55	19:29	20:11
45°	04:08	04:45	05:16	18:46	19:17	19:54
N 40°	04:21	04:55	05:23	18:40	19:08	19:41
35°	04:32	05:03	05:29	18:34	19:00	19:31
30°	04:40	05:09	05:34	18:28	18:53	19:22
20°	04:54	05:21	05:43	18:20	18:42	19:08
N 10°	05:05	05:30	05:51	18:12	18:33	18:58
0°	05:13	05:37	05:58	18:05	18:26	18:50
S 10°	05:19	05:44	06:05	17:58	18:19	18:44
20°	05:25	05:51	06:13	17:50	18:13	18:38
30°	05:29	05:57	06:21	17:42	18:06	18:34
35°	05:31	06:00	06:26	17:37	18:03	18:33
40°	05:33	06:04	06:31	17:32	18:00	18:31
45°	05:34	06:08	06:38	17:26	17:56	18:30
S 50°	05:35	06:12	06:45	17:19	17:51	18:29
52°	05:35	06:14	06:49	17:15	17:50	18:29
54°	05:35	06:16	06:52	17:12	17:48	18:29
56°	05:35	06:18	06:56	17:07	17:45	18:29
58°	05:35	06:21	07:01	17:03	17:43	18:29
S 60°	05:35	06:24	07:06	16:58	17:41	18:29

Lat.	**Moonrise** Wed	Thu	Fri	**Moonset** Wed	Thu	Fri
N 72°	▭	23:42	·· ··	▭	21:56	21:04
N 70°	22:15	·· ··	00:51	21:27	20:46	20:34
68°	23:40	·· ··	01:27	20:01	20:09	20:11
66°	·· ··	00:19	01:53	19:23	19:43	19:53
64°	·· ··	00:45	02:13	18:55	19:22	19:39
62°	·· ··	01:06	02:29	18:34	19:05	19:26
60°	00:12	01:23	02:42	18:17	18:51	19:16
N 58°	00:28	01:37	02:54	18:03	18:39	19:07
56°	00:41	01:49	03:04	17:50	18:29	18:59
54°	00:53	02:00	03:13	17:39	18:20	18:51
52°	01:03	02:09	03:20	17:30	18:12	18:45
50°	01:12	02:18	03:27	17:21	18:04	18:39
45°	01:32	02:35	03:42	17:03	17:48	18:26
N 40°	01:47	02:50	03:55	16:48	17:35	18:16
35°	02:01	03:02	04:05	16:35	17:24	18:07
30°	02:12	03:13	04:14	16:24	17:14	17:59
20°	02:32	03:31	04:30	16:05	16:57	17:45
N 10°	02:49	03:47	04:44	15:48	16:42	17:33
0°	03:05	04:02	04:57	15:33	16:29	17:22
S 10°	03:21	04:17	05:09	15:17	16:15	17:10
20°	03:39	04:33	05:23	15:00	15:59	16:58
30°	03:59	04:51	05:39	14:41	15:42	16:44
35°	04:10	05:02	05:48	14:29	15:32	16:35
40°	04:23	05:14	05:58	14:16	15:20	16:26
45°	04:39	05:28	06:10	14:01	15:07	16:15
S 50°	04:58	05:46	06:24	13:42	14:50	16:01
52°	05:08	05:54	06:31	13:33	14:42	15:55
54°	05:18	06:03	06:39	13:23	14:33	15:48
56°	05:29	06:13	06:47	13:11	14:23	15:40
58°	05:43	06:25	06:56	12:58	14:12	15:31
S 60°	05:58	06:39	07:07	12:43	13:59	15:21

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 26-28 15-3%
26	01:54	01:45	12:02	09:19	21:47	
27	01:37	01:28	12:01	10:15	22:43	
28	01:20	01:11	12:01	11:09	23:35	

August 29, 30, 31 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	337°06.8	145°36.5	S04°39.0	217°27.4	N21°34.8	146°28.9	S03°20.6	148°35.9	S01°14.3
1	352°09.2	160°36.3	40.3	232°28.2	34.5	161°30.9	20.8	163°38.1	14.4
2	7°11.7	175°36.1	41.6	247°29.0	34.2	176°32.9	21.0	178°40.3	14.5
3	22°14.1	190°35.8	·· 42.9	262°29.7	·· 33.9	191°34.9	·· 21.2	193°42.5	·· 14.7
4	37°16.6	205°35.6	44.1	277°30.5	33.7	206°36.9	21.4	208°44.7	14.8
5	52°19.1	220°35.4	45.4	292°31.3	33.4	221°38.9	21.6	223°46.9	14.9
6	67°21.5	235°35.2	S04°46.7	307°32.0	N21°33.1	236°41.0	S03°21.8	238°49.1	S01°15.0
7	82°24.0	250°35.0	48.0	322°32.8	32.8	251°43.0	22.0	253°51.4	15.1
8	97°26.5	265°34.7	49.3	337°33.6	32.5	266°45.0	22.2	268°53.6	15.2
9	112°28.9	280°34.5	·· 50.5	352°34.4	·· 32.2	281°47.0	·· 22.4	283°55.8	·· 15.3
10	127°31.4	295°34.3	51.8	7°35.1	31.9	296°49.0	22.5	298°58.0	15.4
11	142°33.9	310°34.1	53.1	22°35.9	31.6	311°51.1	22.7	314°00.2	15.5
12	157°36.3	325°33.9	S04°54.4	37°36.7	N21°31.3	326°53.1	S03°22.9	329°02.4	S01°15.7
13	172°38.8	340°33.6	55.6	52°37.5	31.0	341°55.1	23.1	344°04.6	15.8
14	187°41.2	355°33.4	56.9	67°38.2	30.7	356°57.1	23.3	359°06.8	15.9
15	202°43.7	10°33.2	·· 58.2	82°39.0	·· 30.4	11°59.1	·· 23.5	14°09.1	·· 16.0
16	217°46.2	25°33.0	04°59.5	97°39.8	30.2	27°01.1	23.7	29°11.3	16.1
17	232°48.6	40°32.8	05°00.8	112°40.6	29.9	42°03.2	23.9	44°13.5	16.2
18	247°51.1	55°32.5	S05°02.0	127°41.3	N21°29.6	57°05.2	S03°24.1	59°15.7	S01°16.3
19	262°53.6	70°32.3	03.3	142°42.1	29.3	72°07.2	24.3	74°17.9	16.4
20	277°56.0	85°32.1	04.6	157°42.9	29.0	87°09.2	24.5	89°20.1	16.6
21	292°58.5	100°31.9	·· 05.9	172°43.7	·· 28.7	102°11.2	·· 24.7	104°22.3	·· 16.7
22	308°01.0	115°31.7	07.1	187°44.4	28.4	117°13.2	24.9	119°24.5	16.8
23	323°03.4	130°31.4	08.4	202°45.2	28.1	132°15.3	25.1	134°26.7	16.9
Mer.pass. 01:31		ν -0.2′	d 1.3′	m -3.98	ν 0.8′	d 0.3′	m 1.62	ν 2.0′	d 0.2′ m -1.72	ν 2.2′	d 0.1′ m 0.94

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	338°05.9	145°31.2	S05°09.7	217°46.0	N21°27.8	147°17.3	S03°25.3	149°29.0	S01°17.0
1	353°08.4	160°31.0	11.0	232°46.8	27.5	162°19.3	25.5	164°31.2	17.1
2	8°10.8	175°30.8	12.3	247°47.5	27.2	177°21.3	25.7	179°33.4	17.2
3	23°13.3	190°30.6	·· 13.5	262°48.3	·· 26.9	192°23.3	·· 25.9	194°35.6	·· 17.3
4	38°15.7	205°30.3	14.8	277°49.1	26.6	207°25.3	26.0	209°37.8	17.5
5	53°18.2	220°30.1	16.1	292°49.9	26.3	222°27.4	26.2	224°40.0	17.6
6	68°20.7	235°29.9	S05°17.4	307°50.7	N21°26.0	237°29.4	S03°26.4	239°42.2	S01°17.7
7	83°23.1	250°29.7	18.6	322°51.4	25.7	252°31.4	26.6	254°44.4	17.8
8	98°25.6	265°29.5	19.9	337°52.2	25.4	267°33.4	26.8	269°46.7	17.9
9	113°28.1	280°29.2	·· 21.2	352°53.0	·· 25.1	282°35.4	·· 27.0	284°48.9	·· 18.0
10	128°30.5	295°29.0	22.5	7°53.8	24.8	297°37.4	27.2	299°51.1	18.1
11	143°33.0	310°28.8	23.7	22°54.5	24.5	312°39.4	27.4	314°53.3	18.2
12	158°35.5	325°28.6	S05°25.0	37°55.3	N21°24.2	327°41.5	S03°27.6	329°55.5	S01°18.4
13	173°37.9	340°28.4	26.3	52°56.1	23.9	342°43.5	27.8	344°57.7	18.5
14	188°40.4	355°28.1	27.6	67°56.9	23.6	357°45.5	28.0	359°59.9	18.6
15	203°42.9	10°27.9	·· 28.8	82°57.7	·· 23.3	12°47.5	·· 28.2	15°02.1	·· 18.7
16	218°45.3	25°27.7	30.1	97°58.4	23.0	27°49.5	28.4	30°04.3	18.8
17	233°47.8	40°27.5	31.4	112°59.2	22.7	42°51.5	28.6	45°06.6	18.9
18	248°50.2	55°27.2	S05°32.7	128°00.0	N21°22.4	57°53.5	S03°28.8	60°08.8	S01°19.0
19	263°52.7	70°27.0	33.9	143°00.8	22.1	72°55.6	29.0	75°11.0	19.1
20	278°55.2	85°26.8	35.2	158°01.6	21.8	87°57.6	29.2	90°13.2	19.3
21	293°57.6	100°26.6	·· 36.5	173°02.3	·· 21.5	102°59.6	·· 29.4	105°15.4	·· 19.4
22	309°00.1	115°26.4	37.7	188°03.1	21.2	118°01.6	29.6	120°17.6	19.5
23	324°02.6	130°26.1	39.0	203°03.9	20.9	133°03.6	29.8	135°19.8	19.6
Mer.pass. 01:27		ν -0.2′	d 1.3′	m -3.98	ν 0.8′	d 0.3′	m 1.62	ν 2.0′	d 0.2′ m -1.71	ν 2.2′	d 0.1′ m 0.94

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	339°05.0	145°25.9	S05°40.3	218°04.7	N21°20.6	148°05.6	S03°30.0	150°22.0	S01°19.7
1	354°07.5	160°25.7	41.6	233°05.5	20.3	163°07.6	30.1	165°24.2	19.8
2	9°10.0	175°25.5	42.8	248°06.3	20.0	178°09.7	30.3	180°26.4	19.9
3	24°12.4	190°25.2	·· 44.1	263°07.0	·· 19.7	193°11.7	·· 30.5	195°28.7	·· 20.0
4	39°14.9	205°25.0	45.4	278°07.8	19.4	208°13.7	30.7	210°30.9	20.2
5	54°17.3	220°24.8	46.7	293°08.6	19.1	223°15.7	30.9	225°33.1	20.3
6	69°19.8	235°24.6	S05°47.9	308°09.4	N21°18.8	238°17.7	S03°31.1	240°35.3	S01°20.4
7	84°22.3	250°24.4	49.2	323°10.2	18.5	253°19.7	31.3	255°37.5	20.5
8	99°24.7	265°24.1	50.5	338°11.0	18.2	268°21.7	31.5	270°39.7	20.6
9	114°27.2	280°23.9	·· 51.7	353°11.7	·· 17.9	283°23.8	·· 31.7	285°41.9	·· 20.7
10	129°29.7	295°23.7	53.0	8°12.5	17.6	298°25.8	31.9	300°44.1	20.8
11	144°32.1	310°23.5	54.3	23°13.3	17.3	313°27.8	32.1	315°46.3	20.9
12	159°34.6	325°23.2	S05°55.5	38°14.1	N21°17.0	328°29.8	S03°32.3	330°48.5	S01°21.1
13	174°37.1	340°23.0	56.8	53°14.9	16.7	343°31.8	32.5	345°50.8	21.2
14	189°39.5	355°22.8	58.1	68°15.7	16.4	358°33.8	32.7	0°53.0	21.3
15	204°42.0	10°22.6	05°59.4	83°16.4	·· 16.1	13°35.8	·· 32.9	15°55.2	·· 21.4
16	219°44.5	25°22.3	06°00.6	98°17.2	15.8	28°37.8	33.1	30°57.4	21.5
17	234°46.9	40°22.1	01.9	113°18.0	15.5	43°39.9	33.3	45°59.6	21.6
18	249°49.4	55°21.9	S06°03.2	128°18.8	N21°15.1	58°41.9	S03°33.5	61°01.8	S01°21.7
19	264°51.8	70°21.7	04.4	143°19.6	14.8	73°43.9	33.7	76°04.0	21.8
20	279°54.3	85°21.5	05.7	158°20.4	14.5	88°45.9	33.9	91°06.2	22.0
21	294°56.8	100°21.2	·· 07.0	173°21.2	·· 14.2	103°47.9	·· 34.1	106°08.4	·· 22.1
22	309°59.2	115°21.0	08.2	188°21.9	13.9	118°49.9	34.3	121°10.6	22.2
23	325°01.7	130°20.8	09.5	203°22.7	13.6	133°51.9	34.5	136°12.8	22.3
Mer.pass. 01:23		ν -0.2′	d 1.3′	m -3.98	ν 0.8′	d 0.3′	m 1.62	ν 2.0′	d 0.2′ m -1.71	ν 2.2′	d 0.1′ m 0.93

Stars

	SHA	Dec
Alpheratz	358°08.3	28°59.3
Ankaa	353°39.2	-42°24.2
Schedar	350°07.8	56°26.0
Diphda	349°19.9	-18°05.2
Achernar	335°44.4	-57°19.6
Hamal	328°28.0	23°22.5
Polaris	326°29.1	89°10.5
Acamar	315°36.6	-40°22.5
Menkar	314°40.3	4°01.1
Mirfak	309°15.0	49°47.6
Aldebaran	291°17.2	16°28.3
Rigel	281°35.4	-8°13.2
Capella	281°10.4	45°58.6
Bellatrix	278°58.1	6°20.1
Elnath	278°43.4	28°35.5
Alnilam	276°11.1	-1°12.7
Betelgeuse	271°27.7	7°24.3
Canopus	264°07.2	-52°40.9
Sirius	258°55.3	-16°41.3
Adhara	255°31.8	-28°56.6
Procyon	245°25.3	5°16.5
Pollux	243°57.6	28°04.3
Avior	234°28.5	-59°26.8
Suhail	223°10.7	-43°21.3
Miaplacidus	221°45.7	-69°38.3
Alphard	218°20.2	-8°34.5
Regulus	208°09.6	12°03.6
Dubhe	194°21.9	61°51.2
Denebola	182°58.7	14°40.7
Gienah	176°17.6	-17°26.2
Acrux	173°37.2	-62°59.8
Gacrux	172°28.5	-57°00.6
Alioth	166°42.3	56°03.9
Spica	158°57.1	-11°03.8
Alkaid	153°18.3	49°24.7
Hadar	149°22.8	-60°17.2
Menkent	148°36.4	-36°16.8
Arcturus	146°18.0	19°17.0
Rigil Kent.	140°25.2	-60°45.5
Kochab	137°19.4	74°14.3
Zuben'ubi	137°32.4	-15°57.8
Alphecca	126°31.6	26°46.9
Antares	112°56.0	-26°23.5
Atria	108°19.6	-68°59.9
Sabik	102°40.3	-15°42.1
Shaula	96°54.7	-37°05.5
Rasalhague	96°28.9	12°34.6
Eltanin	90°57.2	51°29.8
Kaus Aust.	84°15.8	-34°23.7
Vega	80°55.1	38°46.3
Nunki	76°28.1	-26°19.2
Altair	62°31.6	8°49.3
Peacock	53°56.8	-56°47.8
Deneb	49°47.6	45°13.0
Enif	34°10.6	9°47.5
Al Na'ir	28°13.6	-47°03.0
Fomalhaut	15°50.3	-29°43.1
Scheat	14°16.6	27°59.0
Markab	14°02.2	15°06.4

Aug 29 Sat	SHA	Mer.pass
Venus	168°29.7	14:18
Mars	240°20.7	09:30
Jupiter	169°22.1	14:12
Saturn	171°29.1	14:04

Aug 30 Sun	SHA	Mer.pass
Venus	167°25.3	14:18
Mars	239°40.1	09:28
Jupiter	169°11.4	14:09
Saturn	171°23.1	14:00

Aug 31 Mon	SHA	Mer.pass
Venus	166°20.9	14:18
Mars	238°59.7	09:27
Jupiter	169°00.6	14:06
Saturn	171°17.0	13:56

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h — Sun — Moon

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	179°44.5	N09°28.3	186°03.5	10.4′	N14°20.3	9.1′	57.2′
1	194°44.7	27.4	200°33.0	10.5′	14°11.2	9.1′	57.2′
2	209°44.8	26.5	215°02.4	10.6′	14°02.1	9.3′	57.1′
3	224°45.0	·· 25.6	229°32.0	10.6′	13°52.8	9.2′	57.1′
4	239°45.2	24.7	244°01.6	10.7′	13°43.6	9.4′	57.1′
5	254°45.4	23.8	258°31.3	10.8′	13°34.2	9.4′	57.1′
6	269°45.6	N09°22.9	273°01.1	10.8′	N13°24.8	9.4′	57.0′
7	284°45.8	22.0	287°30.9	10.9′	13°15.4	9.6′	57.0′
8	299°46.0	21.2	302°00.8	11.0′	13°05.8	9.6′	57.0′
9	314°46.1	·· 20.3	316°30.8	11.0′	12°56.2	9.6′	57.0′
10	329°46.3	19.4	331°00.9	11.1′	12°46.6	9.7′	57.0′
11	344°46.5	18.5	345°31.0	11.2′	12°36.9	9.8′	56.9′
12	359°46.7	N09°17.6	0°01.1	11.2′	N12°27.1	9.8′	56.9′
13	14°46.9	16.7	14°31.4	11.3′	12°17.3	9.9′	56.9′
14	29°47.1	15.8	29°01.7	11.4′	12°07.4	9.9′	56.9′
15	44°47.3	·· 14.9	43°32.1	11.4′	11°57.5	10.0′	56.8′
16	59°47.5	14.0	58°02.5	11.5′	11°47.5	10.0′	56.8′
17	74°47.6	13.1	72°33.0	11.6′	11°37.5	10.1′	56.8′
18	89°47.8	N09°12.3	87°03.6	11.6′	N11°27.4	10.1′	56.8′
19	104°48.0	11.4	101°34.3	11.7′	11°17.3	10.2′	56.7′
20	119°48.2	10.5	116°05.0	11.8′	11°07.1	10.2′	56.7′
21	134°48.4	·· 09.6	130°35.8	11.8′	10°56.9	10.3′	56.7′
22	149°48.6	08.7	145°06.6	11.9′	10°46.6	10.3′	56.7′
23	164°48.8	07.8	159°37.5	12.0′	10°36.3	10.4′	56.6′
	SD = 15.8′	d = 0.9′		SD = 15.6′			

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	179°49.0	N09°06.9	174°08.5	12.0′	N10°25.9	10.4′	56.6′
1	194°49.1	06.0	188°39.5	12.1′	10°15.5	10.4′	56.6′
2	209°49.3	05.1	203°10.6	12.2′	10°05.1	10.5′	56.6′
3	224°49.5	·· 04.2	217°41.7	12.2′	09°54.6	10.5′	56.5′
4	239°49.7	03.3	232°12.9	12.3′	09°44.1	10.6′	56.5′
5	254°49.9	02.4	246°44.2	12.3′	09°33.5	10.6′	56.5′
6	269°50.1	N09°01.5	261°15.5	12.4′	N09°22.9	10.6′	56.5′
7	284°50.3	09°00.6	275°46.9	12.4′	09°12.3	10.7′	56.4′
8	299°50.5	08°59.7	290°18.4	12.5′	09°01.6	10.7′	56.4′
9	314°50.7	·· 58.8	304°49.9	12.6′	08°50.9	10.7′	56.4′
10	329°50.9	57.9	319°21.5	12.6′	08°40.2	10.8′	56.4′
11	344°51.0	57.1	333°53.1	12.7′	08°29.4	10.8′	56.3′
12	359°51.2	N08°56.2	348°24.8	12.7′	N08°18.6	10.8′	56.3′
13	14°51.4	55.3	2°56.5	12.8′	08°07.8	10.9′	56.3′
14	29°51.6	54.4	17°28.3	12.8′	07°56.9	10.9′	56.3′
15	44°51.8	·· 53.5	32°00.1	12.9′	07°46.0	10.9′	56.2′
16	59°52.0	52.6	46°32.0	13.0′	07°35.1	10.9′	56.2′
17	74°52.2	51.7	61°04.0	13.0′	07°24.2	11.0′	56.2′
18	89°52.4	N08°50.8	75°36.0	13.1′	N07°13.2	11.0′	56.2′
19	104°52.6	49.9	90°08.0	13.1′	07°02.2	11.0′	56.1′
20	119°52.8	49.0	104°40.2	13.2′	06°51.2	11.0′	56.1′
21	134°52.9	·· 48.1	119°12.3	13.2′	06°40.2	11.1′	56.1′
22	149°53.1	47.2	133°44.5	13.3′	06°29.1	11.0′	56.1′
23	164°53.3	46.3	148°16.8	13.3′	06°18.1	11.1′	56.1′
	SD = 15.8′	d = 0.9′		SD = 15.4′			

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	179°53.5	N08°45.4	162°49.1	13.4′	N06°07.0	11.1′	56.0′
1	194°53.7	44.5	177°21.5	13.4′	05°55.9	11.2′	56.0′
2	209°53.9	43.6	191°53.9	13.5′	05°44.7	11.1′	56.0′
3	224°54.1	·· 42.7	206°26.3	13.5′	05°33.6	11.2′	56.0′
4	239°54.3	41.8	220°58.8	13.5′	05°22.4	11.1′	55.9′
5	254°54.5	40.9	235°31.4	13.6′	05°11.3	11.2′	55.9′
6	269°54.7	N08°40.0	250°03.9	13.6′	N05°00.1	11.2′	55.9′
7	284°54.9	39.1	264°36.6	13.7′	04°48.9	11.2′	55.9′
8	299°55.1	38.2	279°09.3	13.7′	04°37.7	11.3′	55.8′
9	314°55.3	·· 37.3	293°42.0	13.8′	04°26.4	11.2′	55.8′
10	329°55.5	36.4	308°14.7	13.8′	04°15.2	11.2′	55.8′
11	344°55.6	35.5	322°47.5	13.8′	04°04.0	11.3′	55.8′
12	359°55.8	N08°34.6	337°20.4	13.9′	N03°52.7	11.2′	55.7′
13	14°56.0	33.7	351°53.3	13.9′	03°41.5	11.3′	55.7′
14	29°56.2	32.8	6°26.2	14.0′	03°30.2	11.3′	55.7′
15	44°56.4	·· 31.9	20°59.2	14.0′	03°18.9	11.3′	55.7′
16	59°56.6	31.0	35°32.2	14.0′	03°07.6	11.2′	55.6′
17	74°56.8	30.1	50°05.2	14.1′	02°56.4	11.3′	55.6′
18	89°57.0	N08°29.2	64°38.3	14.1′	N02°45.1	11.3′	55.6′
19	104°57.2	28.2	79°11.4	14.1′	02°33.8	11.3′	55.6′
20	119°57.4	27.3	93°44.5	14.2′	02°22.5	11.3′	55.6′
21	134°57.6	·· 26.4	108°17.7	14.2′	02°11.2	11.2′	55.5′
22	149°57.8	25.5	122°50.9	14.2′	02°00.0	11.3′	55.5′
23	164°58.0	24.6	137°24.1	14.3′	01°48.7	11.3′	55.5′
	SD = 15.8′	d = 0.9′		SD = 15.3′			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	////	02:15	03:50	20:07	21:40	////
N 70°	////	02:47	04:06	19:52	21:09	////
68°	01:07	03:10	04:18	19:41	20:47	22:43
66°	01:56	03:28	04:28	19:31	20:30	22:00
64°	02:25	03:42	04:36	19:23	20:16	21:32
62°	02:47	03:54	04:43	19:16	20:05	21:11
60°	03:04	04:04	04:50	19:10	19:55	20:55
N 58°	03:18	04:13	04:55	19:05	19:47	20:41
56°	03:29	04:20	05:00	19:00	19:40	20:30
54°	03:40	04:27	05:04	18:56	19:33	20:20
52°	03:48	04:32	05:08	18:52	19:27	20:11
50°	03:56	04:38	05:12	18:49	19:22	20:04
45°	04:12	04:49	05:19	18:41	19:11	19:48
N 40°	04:24	04:58	05:26	18:35	19:03	19:36
35°	04:34	05:05	05:31	18:30	18:56	19:26
30°	04:42	05:11	05:36	18:25	18:49	19:18
20°	04:55	05:21	05:44	18:17	18:39	19:06
N 10°	05:05	05:30	05:51	18:10	18:31	18:56
0°	05:12	05:36	05:57	18:04	18:25	18:49
S 10°	05:18	05:42	06:04	17:58	18:19	18:43
20°	05:22	05:48	06:10	17:51	18:13	18:39
30°	05:26	05:54	06:18	17:44	18:08	18:36
35°	05:27	05:57	06:22	17:40	18:05	18:35
40°	05:28	06:00	06:27	17:35	18:02	18:34
45°	05:29	06:03	06:32	17:29	17:59	18:33
S 50°	05:29	06:06	06:39	17:23	17:56	18:33
52°	05:29	06:08	06:42	17:20	17:54	18:33
54°	05:29	06:10	06:45	17:17	17:53	18:34
56°	05:28	06:11	06:49	17:13	17:51	18:34
58°	05:28	06:13	06:53	17:09	17:49	18:35
S 60°	05:27	06:15	06:57	17:05	17:47	18:35

Lat.	Moonrise Sat	Moonrise Sun	Moonrise Mon	Moonset Sat	Moonset Sun	Moonset Mon
N 72°	02:23	04:28	06:20	20:42	20:26	20:13
N 70°	02:52	04:43	06:27	20:25	20:17	20:10
68°	03:14	04:56	06:33	20:11	20:09	20:07
66°	03:30	05:06	06:38	19:59	20:03	20:05
64°	03:44	05:14	06:42	19:49	19:57	20:04
62°	03:55	05:21	06:45	19:41	19:53	20:02
60°	04:05	05:28	06:48	19:34	19:48	20:01
N 58°	04:14	05:33	06:51	19:28	19:45	19:59
56°	04:21	05:38	06:53	19:22	19:41	19:58
54°	04:28	05:42	06:55	19:17	19:38	19:57
52°	04:34	05:46	06:57	19:12	19:36	19:56
50°	04:39	05:50	06:59	19:08	19:33	19:56
45°	04:50	05:57	07:03	18:59	19:28	19:54
N 40°	05:00	06:04	07:06	18:51	19:23	19:52
35°	05:08	06:09	07:09	18:45	19:19	19:51
30°	05:15	06:14	07:11	18:39	19:16	19:50
20°	05:27	06:23	07:16	18:29	19:10	19:48
N 10°	05:38	06:30	07:19	18:20	19:04	19:46
0°	05:48	06:37	07:23	18:12	18:59	19:44
S 10°	05:58	06:43	07:26	18:03	18:54	19:42
20°	06:09	06:51	07:30	17:54	18:48	19:40
30°	06:21	06:59	07:34	17:44	18:42	19:38
35°	06:28	07:04	07:36	17:38	18:38	19:37
40°	06:36	07:09	07:39	17:31	18:34	19:36
45°	06:45	07:15	07:42	17:23	18:29	19:34
S 50°	06:56	07:23	07:46	17:13	18:23	19:32
52°	07:01	07:26	07:48	17:08	18:20	19:31
54°	07:07	07:30	07:50	17:03	18:17	19:30
56°	07:13	07:34	07:52	16:58	18:14	19:29
58°	07:20	07:38	07:54	16:51	18:10	19:27
S 60°	07:28	07:43	07:56	16:44	18:06	19:26

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 0-2 0-2%
29	01:02	00:53	12:01	12:00	–:–	
30	00:44	00:35	12:01	12:48	00:24	
31	00:26	00:17	12:00	13:33	01:11	

September 01, 02, 03 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	340°04.2	145°20.6	S06°10.8	218°23.5	N21°13.3	148°53.9	S03°34.6	151°15.0	S01°22.4
1	355°06.6	160°20.3	12.0	233°24.3	13.0	163°55.9	34.8	166°17.3	22.5
2	10°09.1	175°20.1	13.3	248°25.1	12.7	178°58.0	35.0	181°19.5	22.6
3	25°11.6	190°19.9	·· 14.6	263°25.9	·· 12.4	194°00.0	·· 35.2	196°21.7	·· 22.8
4	40°14.0	205°19.7	15.9	278°26.7	12.1	209°02.0	35.4	211°23.9	22.9
5	55°16.5	220°19.4	17.1	293°27.5	11.8	224°04.0	35.6	226°26.1	23.0
6	70°18.9	235°19.2	S06°18.4	308°28.2	N21°11.5	239°06.0	S03°35.8	241°28.3	S01°23.1
7	85°21.4	250°19.0	19.7	323°29.0	11.1	254°08.0	36.0	256°30.5	23.2
8	100°23.9	265°18.8	20.9	338°29.8	10.8	269°10.0	36.2	271°32.7	23.3
9	115°26.3	280°18.5	·· 22.2	353°30.6	·· 10.5	284°12.0	·· 36.4	286°34.9	·· 23.4
10	130°28.8	295°18.3	23.5	8°31.4	10.2	299°14.0	36.6	301°37.1	23.5
11	145°31.3	310°18.1	24.7	23°32.2	09.9	314°16.1	36.8	316°39.3	23.7
12	160°33.7	325°17.9	S06°26.0	38°33.0	N21°09.6	329°18.1	S03°37.0	331°41.5	S01°23.8
13	175°36.2	340°17.6	27.2	53°33.8	09.3	344°20.1	37.2	346°43.8	23.9
14	190°38.7	355°17.4	28.5	68°34.6	09.0	359°22.1	37.4	1°46.0	24.0
15	205°41.1	10°17.2	·· 29.8	83°35.3	·· 08.7	14°24.1	·· 37.6	16°48.2	·· 24.1
16	220°43.6	25°17.0	31.0	98°36.1	08.4	29°26.1	37.8	31°50.4	24.2
17	235°46.1	40°16.7	32.3	113°36.9	08.0	44°28.1	38.0	46°52.6	24.3
18	250°48.5	55°16.5	S06°33.6	128°37.7	N21°07.7	59°30.1	S03°38.2	61°54.8	S01°24.5
19	265°51.0	70°16.3	34.8	143°38.5	07.4	74°32.1	38.4	76°57.0	24.6
20	280°53.4	85°16.0	36.1	158°39.3	07.1	89°34.2	38.6	91°59.2	24.7
21	295°55.9	100°15.8	·· 37.4	173°40.1	·· 06.8	104°36.2	·· 38.8	107°01.4	·· 24.8
22	310°58.4	115°15.6	38.6	188°40.9	06.5	119°38.2	39.0	122°03.6	24.9
23	326°00.8	130°15.4	39.9	203°41.7	06.2	134°40.2	39.2	137°05.8	25.0
Mer.pass. 01:20		ν -0.2′	d 1.3′	ν 0.8′	d 0.3′	ν 2.0′	d 0.2′	ν 2.2′	d 0.1′
		m -3.99		m 1.62		m -1.71		m 0.93	

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	341°03.3	145°15.1	S06°41.2	218°42.5	N21°05.9	149°42.2	S03°39.4	152°08.0	S01°25.1
1	356°05.8	160°14.9	42.4	233°43.3	05.5	164°44.2	39.6	167°10.2	25.2
2	11°08.2	175°14.7	43.7	248°44.1	05.2	179°46.2	39.8	182°12.5	25.4
3	26°10.7	190°14.5	·· 44.9	263°44.8	·· 04.9	194°48.2	·· 40.0	197°14.7	·· 25.5
4	41°13.2	205°14.2	46.2	278°45.6	04.6	209°50.2	40.1	212°16.9	25.6
5	56°15.6	220°14.0	47.5	293°46.4	04.3	224°52.2	40.3	227°19.1	25.7
6	71°18.1	235°13.8	S06°48.7	308°47.2	N21°04.0	239°54.2	S03°40.5	242°21.3	S01°25.8
7	86°20.5	250°13.5	50.0	323°48.0	03.6	254°56.3	40.7	257°23.5	25.9
8	101°23.0	265°13.3	51.3	338°48.8	03.3	269°58.3	40.9	272°25.7	26.0
9	116°25.5	280°13.1	·· 52.5	353°49.6	·· 03.0	285°00.3	·· 41.1	287°27.9	·· 26.2
10	131°27.9	295°12.9	53.8	8°50.4	02.7	300°02.3	41.3	302°30.1	26.3
11	146°30.4	310°12.6	55.0	23°51.2	02.4	315°04.3	41.5	317°32.3	26.4
12	161°32.9	325°12.4	S06°56.3	38°52.0	N21°02.1	330°06.3	S03°41.7	332°34.5	S01°26.5
13	176°35.3	340°12.2	57.6	53°52.8	01.8	345°08.3	41.9	347°36.7	26.6
14	191°37.8	355°11.9	06°58.8	68°53.6	01.4	0°10.3	42.1	2°38.9	26.7
15	206°40.3	10°11.7	07°00.1	83°54.4	·· 01.1	15°12.3	·· 42.3	17°41.1	·· 26.8
16	221°42.7	25°11.5	01.3	98°55.2	00.8	30°14.3	42.5	32°43.3	27.0
17	236°45.2	40°11.3	02.6	113°56.0	00.5	45°16.3	42.7	47°45.6	27.1
18	251°47.7	55°11.0	S07°03.9	128°56.8	N21°00.2	60°18.3	S03°42.9	62°47.8	S01°27.2
19	266°50.1	70°10.8	05.1	143°57.6	20°59.8	75°20.4	43.1	77°50.0	27.3
20	281°52.6	85°10.6	06.4	158°58.4	59.5	90°22.4	43.3	92°52.2	27.4
21	296°55.0	100°10.3	·· 07.6	173°59.2	·· 59.2	105°24.4	·· 43.5	107°54.4	·· 27.5
22	311°57.5	115°10.1	08.9	188°59.9	58.9	120°26.4	43.7	122°56.6	27.6
23	327°00.0	130°09.9	10.2	204°00.7	58.6	135°28.4	43.9	137°58.8	27.8
Mer.pass. 01:16		ν -0.2′	d 1.3′	ν 0.8′	d 0.3′	ν 2.0′	d 0.2′	ν 2.2′	d 0.1′
		m -3.99		m 1.62		m -1.71		m 0.93	

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	342°02.4	145°09.7	S07°11.4	219°01.5	N20°58.3	150°30.4	S03°44.1	153°01.0	S01°27.9
1	357°04.9	160°09.4	12.7	234°02.3	57.9	165°32.4	44.3	168°03.2	28.0
2	12°07.4	175°09.2	13.9	249°03.1	57.6	180°34.4	44.5	183°05.4	28.1
3	27°09.8	190°09.0	·· 15.2	264°03.9	·· 57.3	195°36.4	·· 44.7	198°07.6	·· 28.2
4	42°12.3	205°08.7	16.4	279°04.7	57.0	210°38.4	44.9	213°09.8	28.3
5	57°14.8	220°08.5	17.7	294°05.5	56.7	225°40.4	45.1	228°12.0	28.4
6	72°17.2	235°08.3	S07°19.0	309°06.3	N20°56.3	240°42.4	S03°45.3	243°14.2	S01°28.6
7	87°19.7	250°08.0	20.2	324°07.1	56.0	255°44.4	45.5	258°16.4	28.7
8	102°22.2	265°07.8	21.5	339°07.9	55.7	270°46.4	45.7	273°18.6	28.8
9	117°24.6	280°07.6	·· 22.7	354°08.7	·· 55.4	285°48.4	·· 45.9	288°20.8	·· 28.9
10	132°27.1	295°07.3	24.0	9°09.5	55.1	300°50.5	46.1	303°23.0	29.0
11	147°29.5	310°07.1	25.2	24°10.3	54.7	315°52.5	46.3	318°25.3	29.1
12	162°32.0	325°06.9	S07°26.5	39°11.1	N20°54.4	330°54.5	S03°46.5	333°27.5	S01°29.2
13	177°34.5	340°06.7	27.7	54°11.9	54.1	345°56.5	46.7	348°29.7	29.4
14	192°36.9	355°06.4	29.0	69°12.7	53.8	0°58.5	46.9	3°31.9	29.5
15	207°39.4	10°06.2	·· 30.3	84°13.5	·· 53.4	16°00.5	·· 47.1	18°34.1	·· 29.6
16	222°41.9	25°06.0	31.5	99°14.3	53.1	31°02.5	47.3	33°36.3	29.7
17	237°44.3	40°05.7	32.8	114°15.1	52.8	46°04.5	47.5	48°38.5	29.8
18	252°46.8	55°05.5	S07°34.0	129°15.9	N20°52.5	61°06.5	S03°47.7	63°40.7	S01°29.9
19	267°49.3	70°05.3	35.3	144°16.7	52.1	76°08.5	47.8	78°42.9	30.0
20	282°51.7	85°05.0	36.5	159°17.5	51.8	91°10.5	48.0	93°45.1	30.2
21	297°54.2	100°04.8	·· 37.8	174°18.3	·· 51.5	106°12.5	·· 48.2	108°47.3	·· 30.3
22	312°56.6	115°04.6	39.0	189°19.1	51.2	121°14.5	48.4	123°49.5	30.4
23	327°59.1	130°04.3	40.3	204°19.9	50.8	136°16.5	48.6	138°51.7	30.5
Mer.pass. 01:12		ν -0.2′	d 1.3′	ν 0.8′	d 0.3′	ν 2.0′	d 0.2′	ν 2.2′	d 0.1′
		m -3.99		m 1.62		m -1.71		m 0.93	

Stars

	SHA	Dec
Alpheratz	358°08.3	28°59.3
Ankaa	353°39.2	-42°24.2
Schedar	350°07.8	56°26.0
Diphda	349°19.9	-18°05.2
Achernar	335°44.3	-57°19.6
Hamal	328°28.0	23°22.5
Polaris	326°28.3	89°10.5
Acamar	315°36.5	-40°22.5
Menkar	314°40.3	4°01.1
Mirfak	309°15.0	49°47.6
Aldebaran	291°17.2	16°28.3
Rigel	281°35.4	-8°13.2
Capella	281°10.4	45°58.6
Bellatrix	278°58.1	6°20.1
Elnath	278°43.4	28°35.5
Alnilam	276°11.1	-1°12.7
Betelgeuse	271°27.7	7°24.3
Canopus	264°07.2	-52°40.9
Sirius	258°55.2	-16°41.3
Adhara	255°31.8	-28°56.6
Procyon	245°25.3	5°16.5
Pollux	243°57.6	28°04.3
Avior	234°28.5	-59°26.8
Suhail	223°10.7	-43°21.3
Miaplacidus	221°45.7	-69°38.3
Alphard	218°20.2	-8°34.5
Regulus	208°09.6	12°03.6
Dubhe	194°21.9	61°51.2
Denebola	182°58.7	14°40.7
Gienah	176°17.6	-17°26.2
Acrux	173°37.2	-62°59.8
Gacrux	172°28.5	-57°00.6
Alioth	166°42.4	56°03.9
Spica	158°57.1	-11°03.8
Alkaid	153°18.3	49°24.6
Hadar	149°22.8	-60°17.1
Menkent	148°36.5	-36°16.7
Arcturus	146°18.0	19°17.0
Rigil Kent.	140°25.2	-60°45.5
Kochab	137°19.5	74°14.3
Zuben'ubi	137°32.4	-15°57.8
Alphecca	126°31.6	26°46.9
Antares	112°56.0	-26°23.5
Atria	108°19.7	-68°59.9
Sabik	102°40.3	-15°42.1
Shaula	96°54.7	-37°05.5
Rasalhague	96°28.9	12°34.6
Eltanin	90°57.2	51°29.8
Kaus Aust.	84°15.8	-34°23.7
Vega	80°55.2	38°46.3
Nunki	76°28.1	-26°19.2
Altair	62°31.6	8°49.3
Peacock	53°56.8	-56°47.8
Deneb	49°47.6	45°13.0
Enif	34°10.6	9°47.5
Al Na'ir	28°13.6	-47°03.0
Fomalhaut	15°50.3	-29°43.1
Scheat	14°16.6	27°59.0
Markab	14°02.2	15°06.4

Sep 01 Tue	SHA	Mer.pass
Venus	165°16.4	14:19
Mars	238°19.4	09:26
Jupiter	168°49.8	14:03
Saturn	171°10.9	13:53

Sep 02 Wed	SHA	Mer.pass
Venus	164°11.8	14:19
Mars	237°39.2	09:25
Jupiter	168°38.9	13:59
Saturn	171°04.7	13:49

Sep 03 Thu	SHA	Mer.pass
Venus	163°07.2	14:20
Mars	236°59.1	09:23
Jupiter	168°27.9	13:56
Saturn	170°58.6	13:46

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°58.2	N08°23.7	151°57.4	14.3′	N01°37.4	11.3′	55.5′
1	194°58.4	22.8	166°30.7	14.3′	01°26.1	11.3′	55.4′
2	209°58.6	21.9	181°04.1	14.4′	01°14.8	11.2′	55.4′
3	224°58.8	·· 21.0	195°37.4	14.4′	01°03.6	11.3′	55.4′
4	239°59.0	20.1	210°10.8	14.4′	00°52.3	11.3′	55.4′
5	254°59.2	19.2	224°44.2	14.5′	00°41.0	11.2′	55.4′
6	269°59.3	N08°18.3	239°17.7	14.5′	N00°29.8	11.3′	55.3′
7	284°59.5	17.4	253°51.2	14.5′	00°18.5	11.2′	55.3′
8	299°59.7	16.5	268°24.7	14.5′	N00°07.3	11.2′	55.3′
9	314°59.9	·· 15.6	282°58.2	14.6′	S00°03.9	11.3′	55.3′
10	330°00.1	14.7	297°31.8	14.6′	00°15.2	11.2′	55.2′
11	345°00.3	13.8	312°05.3	14.6′	00°26.4	11.2′	55.2′
12	0°00.5	N08°12.8	326°38.9	14.6′	S00°37.6	11.1′	55.2′
13	15°00.7	11.9	341°12.6	14.6′	00°48.7	11.2′	55.2′
14	30°00.9	11.0	355°46.2	14.7′	00°59.9	11.2′	55.2′
15	45°01.1	·· 10.1	10°19.9	14.7′	01°11.1	11.1′	55.1′
16	60°01.3	09.2	24°53.5	14.7′	01°22.2	11.2′	55.1′
17	75°01.5	08.3	39°27.2	14.7′	01°33.4	11.1′	55.1′
18	90°01.7	N08°07.4	54°01.0	14.7′	S01°44.5	11.1′	55.1′
19	105°01.9	06.5	68°34.7	14.8′	01°55.6	11.1′	55.1′
20	120°02.1	05.6	83°08.5	14.8′	02°06.7	11.0′	55.0′
21	135°02.3	·· 04.7	97°42.2	14.8′	02°17.7	11.1′	55.0′
22	150°02.5	03.8	112°16.0	14.8′	02°28.8	11.0′	55.0′
23	165°02.7	02.8	126°49.8	14.8′	02°39.8	11.0′	55.0′
	SD = 15.8′	d = 0.9′	SD = 15.1′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°02.9	N08°01.9	141°23.6	14.8′	S02°50.8	11.0′	55.0′
1	195°03.1	01.0	155°57.5	14.8′	03°01.8	11.0′	54.9′
2	210°03.3	08°00.1	170°31.3	14.9′	03°12.8	10.9′	54.9′
3	225°03.5	07°59.2	185°05.2	14.9′	03°23.7	10.9′	54.9′
4	240°03.7	58.3	199°39.0	14.9′	03°34.6	10.9′	54.9′
5	255°03.9	57.4	214°12.9	14.9′	03°45.5	10.9′	54.9′
6	270°04.1	N07°56.5	228°46.8	14.9′	S03°56.4	10.9′	54.8′
7	285°04.3	55.6	243°20.7	14.9′	04°07.3	10.8′	54.8′
8	300°04.5	54.6	257°54.6	14.9′	04°18.1	10.8′	54.8′
9	315°04.7	·· 53.7	272°28.5	14.9′	04°28.9	10.8′	54.8′
10	330°04.9	52.8	287°02.4	14.9′	04°39.7	10.7′	54.8′
11	345°05.1	51.9	301°36.3	14.9′	04°50.4	10.8′	54.8′
12	0°05.3	N07°51.0	316°10.3	14.9′	S05°01.2	10.7′	54.7′
13	15°05.5	50.1	330°44.2	14.9′	05°11.9	10.6′	54.7′
14	30°05.7	49.2	345°18.1	14.9′	05°22.5	10.7′	54.7′
15	45°05.9	·· 48.3	359°52.1	14.9′	05°33.2	10.6′	54.7′
16	60°06.1	47.3	14°26.0	14.9′	05°43.8	10.6′	54.7′
17	75°06.3	46.4	28°59.9	14.9′	05°54.4	10.5′	54.7′
18	90°06.5	N07°45.5	43°33.9	14.9′	S06°04.9	10.5′	54.6′
19	105°06.7	44.6	58°07.8	14.9′	06°15.4	10.5′	54.6′
20	120°06.9	43.7	72°41.8	14.9′	06°25.9	10.5′	54.6′
21	135°07.1	·· 42.8	87°15.7	14.9′	06°36.4	10.4′	54.6′
22	150°07.3	41.8	101°49.7	14.9′	06°46.8	10.4′	54.6′
23	165°07.5	40.9	116°23.6	14.9′	06°57.2	10.3′	54.6′
	SD = 15.8′	d = 0.9′	SD = 15.0′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°07.7	N07°40.0	130°57.5	14.9′	S07°07.5	10.3′	54.6′
1	195°07.9	39.1	145°31.5	14.9′	07°17.8	10.3′	54.5′
2	210°08.1	38.2	160°05.4	14.9′	07°28.1	10.2′	54.5′
3	225°08.3	·· 37.3	174°39.3	14.9′	07°38.3	10.2′	54.5′
4	240°08.5	36.4	189°13.2	14.9′	07°48.5	10.2′	54.5′
5	255°08.7	35.4	203°47.1	14.9′	07°58.7	10.1′	54.5′
6	270°08.9	N07°34.5	218°21.0	14.9′	S08°08.8	10.1′	54.5′
7	285°09.1	33.6	232°54.9	14.9′	08°18.9	10.1′	54.5′
8	300°09.3	32.7	247°28.8	14.9′	08°29.0	10.0′	54.4′
9	315°09.5	·· 31.8	262°02.7	14.9′	08°39.0	9.9′	54.4′
10	330°09.7	30.8	276°36.6	14.9′	08°48.9	10.0′	54.4′
11	345°09.9	29.9	291°10.4	14.8′	08°58.9	9.9′	54.4′
12	0°10.1	N07°29.0	305°44.3	14.8′	S09°08.8	9.8′	54.4′
13	15°10.3	28.1	320°18.1	14.8′	09°18.6	9.8′	54.4′
14	30°10.5	27.2	334°51.9	14.8′	09°28.4	9.8′	54.4′
15	45°10.7	·· 26.3	349°25.7	14.8′	09°38.2	9.7′	54.4′
16	60°10.9	25.3	3°59.5	14.8′	09°47.9	9.6′	54.4′
17	75°11.1	24.4	18°33.3	14.8′	09°57.5	9.7′	54.3′
18	90°11.3	N07°23.5	33°07.0	14.7′	S10°07.2	9.5′	54.3′
19	105°11.6	22.6	47°40.8	14.7′	10°16.7	9.6′	54.3′
20	120°11.8	21.7	62°14.5	14.7′	10°26.3	9.5′	54.3′
21	135°12.0	·· 20.7	76°48.2	14.7′	10°35.8	9.4′	54.3′
22	150°12.2	19.8	91°21.9	14.7′	10°45.2	9.4′	54.3′
23	165°12.4	18.9	105°55.6	14.7′	10°54.6	9.3′	54.3′
	SD = 15.8′	d = 0.9′	SD = 14.9′				

Lat.	**Twilight** Naut.	**Twilight** Civil	**Sunrise**	**Sunset**	**Twilight** Civil	**Twilight** Naut.
N 72°	////	02:37	04:05	19:50	21:17	////
N 70°	////	03:04	04:19	19:38	20:51	23:18
68°	01:39	03:24	04:29	19:28	20:32	22:13
66°	02:15	03:40	04:38	19:19	20:17	21:40
64°	02:40	03:52	04:45	19:12	20:05	21:16
62°	02:59	04:03	04:51	19:06	19:54	20:58
60°	03:14	04:12	04:57	19:01	19:46	20:43
N 58°	03:26	04:20	05:02	18:56	19:38	20:31
56°	03:37	04:26	05:06	18:52	19:31	20:20
54°	03:46	04:32	05:10	18:49	19:26	20:11
52°	03:54	04:38	05:13	18:45	19:20	20:03
50°	04:01	04:42	05:16	18:42	19:16	19:56
45°	04:16	04:53	05:23	18:36	19:06	19:42
N 40°	04:28	05:01	05:28	18:30	18:58	19:31
35°	04:37	05:07	05:33	18:26	18:51	19:22
30°	04:44	05:13	05:37	18:21	18:46	19:14
20°	04:56	05:22	05:45	18:15	18:37	19:03
N 10°	05:05	05:29	05:51	18:08	18:30	18:54
0°	05:11	05:36	05:56	18:03	18:24	18:48
S 10°	05:16	05:41	06:02	17:57	18:19	18:43
20°	05:20	05:46	06:08	17:52	18:14	18:40
30°	05:23	05:50	06:14	17:45	18:09	18:37
35°	05:23	05:53	06:18	17:42	18:07	18:37
40°	05:24	05:55	06:22	17:38	18:05	18:36
45°	05:24	05:58	06:27	17:33	18:03	18:37
S 50°	05:23	06:00	06:33	17:27	18:00	18:37
52°	05:22	06:01	06:35	17:25	17:59	18:38
54°	05:22	06:03	06:38	17:22	17:58	18:39
56°	05:21	06:04	06:41	17:19	17:56	18:40
58°	05:20	06:05	06:45	17:16	17:55	18:41
S 60°	05:19	06:07	06:49	17:12	17:54	18:42

Lat.	**Moonrise** Tue	Wed	Thu	**Moonset** Tue	Wed	Thu
N 72°	08:07	09:51	11:36	20:00	19:47	19:32
N 70°	08:07	09:44	11:21	20:03	19:56	19:48
68°	08:07	09:38	11:09	20:05	20:03	20:01
66°	08:07	09:34	10:59	20:07	20:10	20:12
64°	08:07	09:30	10:51	20:09	20:15	20:21
62°	08:07	09:26	10:45	20:11	20:20	20:29
60°	08:07	09:23	10:39	20:12	20:24	20:36
N 58°	08:07	09:21	10:33	20:13	20:27	20:42
56°	08:07	09:18	10:29	20:14	20:30	20:48
54°	08:07	09:16	10:25	20:15	20:33	20:52
52°	08:07	09:14	10:21	20:16	20:36	20:57
50°	08:07	09:13	10:18	20:17	20:38	21:01
45°	08:07	09:09	10:10	20:19	20:44	21:09
N 40°	08:07	09:06	10:04	20:20	20:48	21:16
35°	08:07	09:03	09:59	20:21	20:52	21:23
30°	08:07	09:01	09:54	20:23	20:55	21:28
20°	08:07	08:57	09:46	20:25	21:01	21:38
N 10°	08:07	08:53	09:40	20:26	21:06	21:46
0°	08:07	08:50	09:33	20:28	21:11	21:54
S 10°	08:07	08:47	09:27	20:29	21:16	22:02
20°	08:07	08:44	09:20	20:31	21:21	22:10
30°	08:07	08:40	09:12	20:33	21:27	22:20
35°	08:07	08:38	09:08	20:34	21:30	22:26
40°	08:07	08:35	09:03	20:35	21:34	22:32
45°	08:08	08:32	08:57	20:37	21:39	22:39
S 50°	08:08	08:29	08:50	20:39	21:44	22:48
52°	08:08	08:27	08:47	20:39	21:46	22:52
54°	08:08	08:26	08:44	20:40	21:49	22:57
56°	08:08	08:24	08:40	20:41	21:52	23:02
58°	08:08	08:22	08:36	20:42	21:56	23:08
S 60°	08:08	08:19	08:31	20:43	21:59	23:14

Day	**Sun** Eqn.of Time 00^h mm:ss	Eqn.of Time 12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Mer.Pass. Lower hh:mm	Age 3-5 6-19%
01	00:07	00:02	12:00	14:17	01:56	
02	00:12	00:21	12:00	15:01	02:39	
03	00:31	00:41	11:59	15:44	03:22	

September 04, 05, 06 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	343°01.6	145°04.1	S07°41.5	219°20.7	N20°50.5	151°18.5	S03°48.8	153°53.9	S01°30.6
1	358°04.0	160°03.9	42.8	234°21.5	50.2	166°20.5	49.0	168°56.1	30.7
2	13°06.5	175°03.6	44.0	249°22.4	49.9	181°22.5	49.2	183°58.3	30.8
3	28°09.0	190°03.4	·· 45.3	264°23.2	·· 49.5	196°24.5	·· 49.4	199°00.5	·· 31.0
4	43°11.4	205°03.2	46.5	279°24.0	49.2	211°26.6	49.6	214°02.7	31.1
5	58°13.9	220°02.9	47.8	294°24.8	48.9	226°28.6	49.8	229°04.9	31.2
6	73°16.4	235°02.7	S07°49.0	309°25.6	N20°48.6	241°30.6	S03°50.0	244°07.1	S01°31.3
7	88°18.8	250°02.5	50.3	324°26.4	48.2	256°32.6	50.2	259°09.3	31.4
8	103°21.3	265°02.2	51.5	339°27.2	47.9	271°34.6	50.4	274°11.5	31.5
9	118°23.8	280°02.0	·· 52.8	354°28.0	·· 47.6	286°36.6	·· 50.6	289°13.8	·· 31.6
10	133°26.2	295°01.8	54.0	9°28.8	47.3	301°38.6	50.8	304°16.0	31.8
11	148°28.7	310°01.5	55.3	24°29.6	46.9	316°40.6	51.0	319°18.2	31.9
12	163°31.1	325°01.3	S07°56.5	39°30.4	N20°46.6	331°42.6	S03°51.2	334°20.4	S01°32.0
13	178°33.6	340°01.0	57.8	54°31.2	46.3	346°44.6	51.4	349°22.6	32.1
14	193°36.1	355°00.8	07°59.0	69°32.0	46.0	1°46.6	51.6	4°24.8	32.2
15	208°38.5	10°00.6	08°00.3	84°32.8	·· 45.6	16°48.6	·· 51.8	19°27.0	·· 32.3
16	223°41.0	25°00.3	01.5	99°33.6	45.3	31°50.6	52.0	34°29.2	32.4
17	238°43.5	40°00.1	02.8	114°34.4	45.0	46°52.6	52.2	49°31.4	32.6
18	253°45.9	54°59.9	S08°04.0	129°35.2	N20°44.6	61°54.6	S03°52.4	64°33.6	S01°32.7
19	268°48.4	69°59.6	05.3	144°36.0	44.3	76°56.6	52.6	79°35.8	32.8
20	283°50.9	84°59.4	06.5	159°36.8	44.0	91°58.6	52.8	94°38.0	32.9
21	298°53.3	99°59.2	·· 07.8	174°37.7	·· 43.6	107°00.6	·· 53.0	109°40.2	·· 33.0
22	313°55.8	114°58.9	09.0	189°38.5	43.3	122°02.6	53.2	124°42.4	33.1
23	328°58.2	129°58.7	10.3	204°39.3	43.0	137°04.6	53.4	139°44.6	33.3
Mer.pass. 01:08		ν -0.2′	d 1.3′	m -4.00	ν 0.8′	d 0.3′	m 1.61	ν 2.0′	d 0.2′ m -1.70	ν 2.2′	d 0.1′ m 0.93

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	344°00.7	144°58.5	S08°11.5	219°40.1	N20°42.7	152°06.6	S03°53.6	154°46.8	S01°33.4
1	359°03.2	159°58.2	12.7	234°40.9	42.3	167°08.6	53.8	169°49.0	33.5
2	14°05.6	174°58.0	14.0	249°41.7	42.0	182°10.6	54.0	184°51.2	33.6
3	29°08.1	189°57.7	·· 15.2	264°42.5	·· 41.7	197°12.6	·· 54.2	199°53.4	·· 33.7
4	44°10.6	204°57.5	16.5	279°43.3	41.3	212°14.6	54.4	214°55.6	33.8
5	59°13.0	219°57.3	17.7	294°44.1	41.0	227°16.6	54.6	229°57.8	33.9
6	74°15.5	234°57.0	S08°19.0	309°44.9	N20°40.7	242°18.6	S03°54.8	245°00.0	S01°34.1
7	89°18.0	249°56.8	20.2	324°45.7	40.3	257°20.6	55.0	260°02.2	34.2
8	104°20.4	264°56.6	21.5	339°46.5	40.0	272°22.7	55.2	275°04.4	34.3
9	119°22.9	279°56.3	·· 22.7	354°47.4	·· 39.7	287°24.7	·· 55.4	290°06.6	·· 34.4
10	134°25.4	294°56.1	23.9	9°48.2	39.3	302°26.7	55.6	305°08.8	34.5
11	149°27.8	309°55.8	25.2	24°49.0	39.0	317°28.7	55.8	320°11.0	34.6
12	164°30.3	324°55.6	S08°26.4	39°49.8	N20°38.7	332°30.7	S03°56.0	335°13.2	S01°34.7
13	179°32.7	339°55.4	27.7	54°50.6	38.3	347°32.7	56.2	350°15.4	34.9
14	194°35.2	354°55.1	28.9	69°51.4	38.0	2°34.7	56.4	5°17.6	35.0
15	209°37.7	9°54.9	·· 30.2	84°52.2	·· 37.7	17°36.7	·· 56.6	20°19.8	·· 35.1
16	224°40.1	24°54.6	31.4	99°53.0	37.3	32°38.7	56.8	35°22.0	35.2
17	239°42.6	39°54.4	32.6	114°53.8	37.0	47°40.7	57.0	50°24.2	35.3
18	254°45.1	54°54.2	S08°33.9	129°54.7	N20°36.7	62°42.7	S03°57.2	65°26.4	S01°35.4
19	269°47.5	69°53.9	35.1	144°55.5	36.3	77°44.7	57.4	80°28.7	35.6
20	284°50.0	84°53.7	36.4	159°56.3	36.0	92°46.7	57.6	95°30.9	35.7
21	299°52.5	99°53.4	·· 37.6	174°57.1	·· 35.7	107°48.7	·· 57.8	110°33.1	·· 35.8
22	314°54.9	114°53.2	38.8	189°57.9	35.3	122°50.7	58.0	125°35.3	35.9
23	329°57.4	129°53.0	40.1	204°58.7	35.0	137°52.7	58.2	140°37.5	36.0
Mer.pass. 01:04		ν -0.2′	d 1.2′	m -4.00	ν 0.8′	d 0.3′	m 1.61	ν 2.0′	d 0.2′ m -1.70	ν 2.2′	d 0.1′ m 0.93

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	344°59.9	144°52.7	S08°41.3	219°59.5	N20°34.7	152°54.7	S03°58.4	155°39.7	S01°36.1
1	0°02.3	159°52.5	42.6	235°00.3	34.3	167°56.7	58.6	170°41.9	36.2
2	15°04.8	174°52.2	43.8	250°01.2	34.0	182°58.7	58.8	185°44.1	36.4
3	30°07.2	189°52.0	·· 45.0	265°02.0	·· 33.6	198°00.7	·· 59.0	200°46.3	·· 36.5
4	45°09.7	204°51.8	46.3	280°02.8	33.3	213°02.7	59.2	215°48.5	36.6
5	60°12.2	219°51.5	47.5	295°03.6	33.0	228°04.7	59.4	230°50.7	36.7
6	75°14.6	234°51.3	S08°48.7	310°04.4	N20°32.6	243°06.7	S03°59.6	245°52.9	S01°36.8
7	90°17.1	249°51.0	50.0	325°05.2	32.3	258°08.7	03°59.8	260°55.1	36.9
8	105°19.6	264°50.8	51.2	340°06.0	32.0	273°10.7	04°00.0	275°57.3	37.1
9	120°22.0	279°50.5	·· 52.5	355°06.9	·· 31.6	288°12.7	·· 00.2	290°59.5	·· 37.2
10	135°24.5	294°50.3	53.7	10°07.7	31.3	303°14.7	00.4	306°01.7	37.3
11	150°27.0	309°50.1	54.9	25°08.5	30.9	318°16.7	00.6	321°03.9	37.4
12	165°29.4	324°49.8	S08°56.2	40°09.3	N20°30.6	333°18.7	S04°00.8	336°06.1	S01°37.5
13	180°31.9	339°49.6	57.4	55°10.1	30.3	348°20.7	01.0	351°08.3	37.6
14	195°34.3	354°49.3	58.6	70°10.9	29.9	3°22.7	01.2	6°10.5	37.7
15	210°36.8	9°49.1	08°59.9	85°11.8	·· 29.6	18°24.7	·· 01.4	21°12.7	·· 37.9
16	225°39.3	24°48.8	09°01.1	100°12.6	29.3	33°26.7	01.6	36°14.9	38.0
17	240°41.7	39°48.6	02.3	115°13.4	28.9	48°28.7	01.8	51°17.1	38.1
18	255°44.2	54°48.4	S09°03.6	130°14.2	N20°28.6	63°30.7	S04°02.0	66°19.3	S01°38.2
19	270°46.7	69°48.1	04.8	145°15.0	28.2	78°32.7	02.2	81°21.5	38.3
20	285°49.1	84°47.9	06.0	160°15.8	27.9	93°34.7	02.4	96°23.7	38.4
21	300°51.6	99°47.6	·· 07.3	175°16.7	·· 27.6	108°36.7	·· 02.6	111°25.9	·· 38.6
22	315°54.1	114°47.4	08.5	190°17.5	27.2	123°38.7	02.8	126°28.1	38.7
23	330°56.5	129°47.1	09.7	205°18.3	26.9	138°40.7	03.0	141°30.3	38.8
Mer.pass. 01:00		ν -0.2′	d 1.2′	m -4.00	ν 0.8′	d 0.3′	m 1.61	ν 2.0′	d 0.2′ m -1.70	ν 2.2′	d 0.1′ m 0.93

Stars

	SHA	Dec
Alpheratz	358°08.3	28°59.3
Ankaa	353°39.2	-42°24.3
Schedar	350°07.8	56°26.1
Diphda	349°19.9	-18°05.2
Achernar	335°44.3	-57°19.6
Hamal	328°27.9	23°22.5
Polaris	326°27.3	89°10.5
Acamar	315°36.5	-40°22.5
Menkar	314°40.3	4°01.1
Mirfak	309°15.0	49°47.6
Aldebaran	291°17.2	16°28.3
Rigel	281°35.4	-8°13.2
Capella	281°10.4	45°58.6
Bellatrix	278°58.1	6°20.1
Elnath	278°43.3	28°35.5
Alnilam	276°11.0	-1°12.7
Betelgeuse	271°27.6	7°24.3
Canopus	264°07.1	-52°40.9
Sirius	258°55.2	-16°41.2
Adhara	255°31.8	-28°56.6
Procyon	245°25.3	5°16.5
Pollux	243°57.6	28°04.3
Avior	234°28.4	-59°26.8
Suhail	223°10.7	-43°21.3
Miaplacidus	221°45.7	-69°38.3
Alphard	218°20.2	-8°34.5
Regulus	208°09.6	12°03.6
Dubhe	194°21.9	61°51.2
Denebola	182°58.7	14°40.7
Gienah	176°17.6	-17°26.2
Acrux	173°37.2	-62°59.8
Gacrux	172°28.5	-57°00.6
Alioth	166°42.4	56°03.9
Spica	158°57.1	-11°03.8
Alkaid	153°18.3	49°24.6
Hadar	149°22.8	-60°17.1
Menkent	148°36.5	-36°16.7
Arcturus	146°18.1	19°17.0
Rigil Kent.	140°25.3	-60°45.5
Kochab	137°19.5	74°14.2
Zuben'ubi	137°32.5	-15°57.8
Alphecca	126°31.6	26°46.9
Antares	112°56.1	-26°23.5
Atria	108°19.7	-68°59.9
Sabik	102°40.3	-15°42.1
Shaula	96°54.8	-37°05.5
Rasalhague	96°28.9	12°34.6
Eltanin	90°57.3	51°29.8
Kaus Aust.	84°15.8	-34°23.7
Vega	80°55.2	38°46.3
Nunki	76°28.1	-26°19.2
Altair	62°31.6	8°49.3
Peacock	53°56.9	-56°47.8
Deneb	49°47.6	45°13.1
Enif	34°10.6	9°47.5
Al Na'ir	28°13.6	-47°03.0
Fomalhaut	15°50.3	-29°43.1
Scheat	14°16.6	27°59.0
Markab	14°02.2	15°06.4

Sep 04 Fri	SHA	Mer.pass
Venus	162°02.5	14:20
Mars	236°19.2	09:22
Jupiter	168°17.0	13:53
Saturn	170°52.3	13:42

Sep 05 Sat	SHA	Mer.pass
Venus	160°57.7	14:20
Mars	235°39.4	09:21
Jupiter	168°05.9	13:50
Saturn	170°46.1	13:39

Sep 06 Sun	SHA	Mer.pass
Venus	159°52.9	14:21
Mars	234°59.7	09:20
Jupiter	167°54.8	13:47
Saturn	170°39.8	13:35

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°12.6	N07°18.0	120°29.3	14.6′	S11°03.9	9.3′	54.3′
1	195°12.8	17.1	135°02.9	14.6′	11°13.2	9.3′	54.3′
2	210°13.0	16.1	149°36.5	14.6′	11°22.5	9.2′	54.3′
3	225°13.2	·· 15.2	164°10.1	14.6′	11°31.7	9.1′	54.3′
4	240°13.4	14.3	178°43.7	14.6′	11°40.8	9.1′	54.2′
5	255°13.6	13.4	193°17.3	14.5′	11°49.9	9.0′	54.2′
6	270°13.8	N07°12.4	207°50.8	14.5′	S11°58.9	9.0′	54.2′
7	285°14.0	11.5	222°24.3	14.5′	12°07.9	9.0′	54.2′
8	300°14.2	10.6	236°57.8	14.5′	12°16.9	8.8′	54.2′
9	315°14.4	·· 09.7	251°31.3	14.4′	12°25.7	8.9′	54.2′
10	330°14.6	08.8	266°04.7	14.4′	12°34.6	8.7′	54.2′
11	345°14.8	07.8	280°38.1	14.4′	12°43.3	8.7′	54.2′
12	0°15.0	N07°06.9	295°11.5	14.4′	S12°52.0	8.7′	54.2′
13	15°15.2	06.0	309°44.9	14.3′	13°00.7	8.6′	54.2′
14	30°15.4	05.1	324°18.2	14.3′	13°09.3	8.6′	54.2′
15	45°15.7	·· 04.1	338°51.5	14.3′	13°17.9	8.5′	54.2′
16	60°15.9	03.2	353°24.8	14.3′	13°26.4	8.4′	54.2′
17	75°16.1	02.3	7°58.1	14.2′	13°34.8	8.4′	54.2′
18	90°16.3	N07°01.4	22°31.3	14.2′	S13°43.2	8.3′	54.2′
19	105°16.5	07°00.4	37°04.5	14.2′	13°51.5	8.2′	54.2′
20	120°16.7	06°59.5	51°37.7	14.1′	13°59.7	8.2′	54.2′
21	135°16.9	·· 58.6	66°10.8	14.1′	14°07.9	8.2′	54.2′
22	150°17.1	57.7	80°43.9	14.1′	14°16.1	8.1′	54.2′
23	165°17.3	56.7	95°17.0	14.0′	14°24.2	8.0′	54.2′
	SD = 15.9′	d = 0.9′	SD = 14.8′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°17.5	N06°55.8	109°50.0	14.0′	S14°32.2	7.9′	54.1′
1	195°17.7	54.9	124°23.0	14.0′	14°40.1	7.9′	54.1′
2	210°17.9	54.0	138°56.0	13.9′	14°48.0	7.8′	54.1′
3	225°18.1	·· 53.0	153°29.0	13.9′	14°55.8	7.8′	54.1′
4	240°18.3	52.1	168°01.9	13.9′	15°03.6	7.7′	54.1′
5	255°18.5	51.2	182°34.7	13.8′	15°11.3	7.6′	54.1′
6	270°18.8	N06°50.3	197°07.6	13.8′	S15°18.9	7.6′	54.1′
7	285°19.0	49.3	211°40.4	13.8′	15°26.5	7.5′	54.1′
8	300°19.2	48.4	226°13.2	13.7′	15°34.0	7.4′	54.1′
9	315°19.4	·· 47.5	240°45.9	13.7′	15°41.4	7.4′	54.1′
10	330°19.6	46.5	255°18.6	13.7′	15°48.8	7.3′	54.1′
11	345°19.8	45.6	269°51.3	13.6′	15°56.1	7.2′	54.1′
12	0°20.0	N06°44.7	284°23.9	13.6′	S16°03.3	7.2′	54.1′
13	15°20.2	43.8	298°56.5	13.6′	16°10.5	7.1′	54.1′
14	30°20.4	42.8	313°29.1	13.5′	16°17.6	7.0′	54.2′
15	45°20.6	·· 41.9	328°01.6	13.5′	16°24.6	7.0′	54.2′
16	60°20.8	41.0	342°34.1	13.4′	16°31.6	6.9′	54.2′
17	75°21.0	40.0	357°06.5	13.4′	16°38.5	6.8′	54.2′
18	90°21.3	N06°39.1	11°38.9	13.4′	S16°45.3	6.7′	54.2′
19	105°21.5	38.2	26°11.3	13.3′	16°52.0	6.7′	54.2′
20	120°21.7	37.3	40°43.6	13.3′	16°58.7	6.6′	54.2′
21	135°21.9	·· 36.3	55°15.9	13.3′	17°05.3	6.5′	54.2′
22	150°22.1	35.4	69°48.2	13.2′	17°11.8	6.5′	54.2′
23	165°22.3	34.5	84°20.4	13.2′	17°18.3	6.3′	54.2′
	SD = 15.9′	d = 0.9′	SD = 14.8′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°22.5	N06°33.5	98°52.6	13.1′	S17°24.6	6.3′	54.2′
1	195°22.7	32.6	113°24.7	13.1′	17°30.9	6.3′	54.2′
2	210°22.9	31.7	127°56.8	13.0′	17°37.2	6.1′	54.2′
3	225°23.1	·· 30.8	142°28.8	13.0′	17°43.3	6.1′	54.2′
4	240°23.4	29.8	157°00.8	13.0′	17°49.4	6.0′	54.2′
5	255°23.6	28.9	171°32.8	12.9′	17°55.4	5.9′	54.2′
6	270°23.8	N06°28.0	186°04.7	12.9′	S18°01.3	5.8′	54.2′
7	285°24.0	27.0	200°36.6	12.8′	18°07.1	5.8′	54.2′
8	300°24.2	26.1	215°08.5	12.8′	18°12.9	5.7′	54.2′
9	315°24.4	·· 25.2	229°40.3	12.8′	18°18.6	5.6′	54.2′
10	330°24.6	24.2	244°12.0	12.7′	18°24.2	5.5′	54.3′
11	345°24.8	23.3	258°43.7	12.7′	18°29.7	5.4′	54.3′
12	0°25.0	N06°22.4	273°15.4	12.6′	S18°35.1	5.4′	54.3′
13	15°25.2	21.4	287°47.1	12.6′	18°40.5	5.2′	54.3′
14	30°25.5	20.5	302°18.6	12.5′	18°45.7	5.2′	54.3′
15	45°25.7	·· 19.6	316°50.2	12.5′	18°50.9	5.1′	54.3′
16	60°25.9	18.6	331°21.7	12.5′	18°56.0	5.1′	54.3′
17	75°26.1	17.7	345°53.2	12.4′	19°01.1	4.9′	54.3′
18	90°26.3	N06°16.8	0°24.6	12.4′	S19°06.0	4.8′	54.3′
19	105°26.5	15.8	14°55.9	12.3′	19°10.8	4.8′	54.3′
20	120°26.7	14.9	29°27.3	12.3′	19°15.6	4.7′	54.4′
21	135°26.9	·· 14.0	43°58.6	12.2′	19°20.3	4.6′	54.4′
22	150°27.1	13.0	58°29.8	12.2′	19°24.9	4.5′	54.4′
23	165°27.4	12.1	73°01.0	12.2′	19°29.4	4.4′	54.4′
	SD = 15.9′	d = 0.9′	SD = 14.8′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	////	02:57	04:20	19:34	20:55	////
N 70°	01:15	03:20	04:31	19:23	20:34	22:32
68°	02:02	03:37	04:40	19:15	20:17	21:49
66°	02:31	03:51	04:47	19:08	20:04	21:22
64°	02:53	04:02	04:54	19:02	19:53	21:01
62°	03:10	04:12	04:59	18:56	19:44	20:45
60°	03:23	04:20	05:04	18:52	19:36	20:32
N 58°	03:35	04:27	05:08	18:48	19:29	20:20
56°	03:44	04:33	05:12	18:44	19:23	20:11
54°	03:53	04:38	05:15	18:41	19:18	20:03
52°	04:00	04:43	05:18	18:38	19:13	19:56
50°	04:07	04:47	05:21	18:36	19:09	19:49
45°	04:20	04:56	05:26	18:30	19:00	19:36
N 40°	04:31	05:04	05:31	18:25	18:53	19:26
35°	04:39	05:10	05:35	18:21	18:47	19:17
30°	04:46	05:15	05:39	18:18	18:42	19:11
20°	04:57	05:23	05:45	18:12	18:34	19:00
N 10°	05:05	05:29	05:51	18:07	18:28	18:52
0°	05:10	05:35	05:55	18:02	18:23	18:47
S 10°	05:15	05:39	06:00	17:57	18:18	18:43
20°	05:17	05:43	06:05	17:52	18:15	18:40
30°	05:19	05:47	06:11	17:47	18:11	18:39
35°	05:19	05:49	06:14	17:44	18:09	18:39
40°	05:19	05:50	06:17	17:40	18:08	18:39
45°	05:18	05:52	06:22	17:37	18:06	18:40
S 50°	05:17	05:54	06:26	17:32	18:04	18:42
52°	05:16	05:55	06:29	17:30	18:04	18:43
54°	05:15	05:56	06:31	17:27	18:03	18:44
56°	05:13	05:56	06:34	17:25	18:02	18:45
58°	05:12	05:57	06:37	17:22	18:01	18:47
S 60°	05:10	05:58	06:40	17:19	18:01	18:49

Lat.	**Moonrise** Fri	Sat	Sun	**Moonset** Fri	Sat	Sun
N 72°	13:26	15:34	▬	19:12	18:37	▬
N 70°	13:00	14:45	16:44	19:39	19:27	19:05
68°	12:41	14:14	15:48	20:00	19:59	20:01
66°	12:25	13:51	15:15	20:16	20:23	20:34
64°	12:13	13:33	14:51	20:30	20:41	20:59
62°	12:02	13:18	14:32	20:41	20:57	21:18
60°	11:53	13:06	14:17	20:51	21:10	21:34
N 58°	11:45	12:55	14:03	20:59	21:21	21:48
56°	11:38	12:46	13:52	21:07	21:30	21:59
54°	11:32	12:38	13:42	21:14	21:39	22:09
52°	11:26	12:31	13:33	21:20	21:47	22:18
50°	11:21	12:24	13:26	21:25	21:53	22:27
45°	11:11	12:10	13:09	21:37	22:08	22:44
N 40°	11:02	11:59	12:55	21:47	22:21	22:58
35°	10:54	11:49	12:44	21:55	22:31	23:10
30°	10:47	11:40	12:33	22:03	22:40	23:21
20°	10:36	11:26	12:16	22:16	22:56	23:39
N 10°	10:26	11:13	12:01	22:27	23:10	23:55
0°	10:17	11:01	11:47	22:38	23:23	·· ··
S 10°	10:07	10:49	11:33	22:49	23:36	·· ··
20°	09:57	10:36	11:18	23:00	23:50	·· ··
30°	09:46	10:22	11:01	23:13	·· ··	00:06
35°	09:40	10:14	10:51	23:21	·· ··	00:15
40°	09:32	10:04	10:40	23:29	·· ··	00:26
45°	09:24	09:53	10:27	23:39	·· ··	00:39
S 50°	09:14	09:40	10:11	23:52	·· ··	00:54
52°	09:09	09:34	10:03	23:57	·· ··	01:01
54°	09:04	09:27	09:55	·· ··	00:04	01:09
56°	08:58	09:20	09:45	·· ··	00:11	01:18
58°	08:52	09:11	09:35	·· ··	00:19	01:28
S 60°	08:45	09:01	09:23	·· ··	00:28	01:40

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 6-8 27-45%
04	00:50	01:00	11:59	16:27	04:05	
05	01:10	01:20	11:59	17:12	04:49	
06	01:30	01:40	11:58	17:58	05:35	

September 07, 08, 09 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	345°59.0	144°46.9	S09°11.0	220°19.1	N20°26.5	153°42.7	S04°03.2	156°32.5	S01°38.9
1	1°01.5	159°46.6	12.2	235°19.9	26.2	168°44.7	03.4	171°34.7	39.0
2	16°03.9	174°46.4	13.4	250°20.7	25.8	183°46.7	03.6	186°36.9	39.1
3	31°06.4	189°46.2	·· 14.7	265°21.6	·· 25.5	198°48.7	·· 03.8	201°39.1	·· 39.2
4	46°08.8	204°45.9	15.9	280°22.4	25.2	213°50.7	04.0	216°41.3	39.4
5	61°11.3	219°45.7	17.1	295°23.2	24.8	228°52.7	04.2	231°43.5	39.5
6	76°13.8	234°45.4	S09°18.3	310°24.0	N20°24.5	243°54.7	S04°04.4	246°45.7	S01°39.6
7	91°16.2	249°45.2	19.6	325°24.8	24.1	258°56.7	04.6	261°47.9	39.7
8	106°18.7	264°44.9	20.8	340°25.7	23.8	273°58.7	04.8	276°50.1	39.8
9	121°21.2	279°44.7	·· 22.0	355°26.5	·· 23.4	289°00.7	·· 05.0	291°52.3	·· 39.9
10	136°23.6	294°44.4	23.3	10°27.3	23.1	304°02.7	05.2	306°54.5	40.1
11	151°26.1	309°44.2	24.5	25°28.1	22.8	319°04.7	05.4	321°56.7	40.2
12	166°28.6	324°43.9	S09°25.7	40°28.9	N20°22.4	334°06.7	S04°05.6	336°58.9	S01°40.3
13	181°31.0	339°43.7	26.9	55°29.8	22.1	349°08.7	05.8	352°01.1	40.4
14	196°33.5	354°43.4	28.2	70°30.6	21.7	4°10.7	06.0	7°03.3	40.5
15	211°36.0	9°43.2	·· 29.4	85°31.4	·· 21.4	19°12.7	·· 06.2	22°05.5	·· 40.6
16	226°38.4	24°42.9	30.6	100°32.2	21.0	34°14.7	06.4	37°07.7	40.8
17	241°40.9	39°42.7	31.9	115°33.1	20.7	49°16.7	06.6	52°09.9	40.9
18	256°43.3	54°42.4	S09°33.1	130°33.9	N20°20.3	64°18.6	S04°06.8	67°12.1	S01°41.0
19	271°45.8	69°42.2	34.3	145°34.7	20.0	79°20.6	07.0	82°14.3	41.1
20	286°48.3	84°42.0	35.5	160°35.5	19.7	94°22.6	07.2	97°16.5	41.2
21	301°50.7	99°41.7	·· 36.8	175°36.3	·· 19.3	109°24.6	·· 07.4	112°18.7	·· 41.3
22	316°53.2	114°41.5	38.0	190°37.2	19.0	124°26.6	07.6	127°20.9	41.5
23	331°55.7	129°41.2	39.2	205°38.0	18.6	139°28.6	07.8	142°23.1	41.6
Mer.pass. 00:56		ν -0.2′	d 1.2′	m -4.01	ν 0.8′	d 0.3′	m 1.61	ν 2.0′	d 0.2′ m -1.70	ν 2.2′	d 0.1′ m 0.92

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	346°58.1	144°41.0	S09°40.4	220°38.8	N20°18.3	154°30.6	S04°08.0	157°25.3	S01°41.7
1	2°00.6	159°40.7	41.7	235°39.6	17.9	169°32.6	08.2	172°27.5	41.8
2	17°03.1	174°40.5	42.9	250°40.5	17.6	184°34.6	08.4	187°29.7	41.9
3	32°05.5	189°40.2	·· 44.1	265°41.3	·· 17.2	199°36.6	·· 08.6	202°31.9	·· 42.0
4	47°08.0	204°40.0	45.3	280°42.1	16.9	214°38.6	08.8	217°34.1	42.1
5	62°10.5	219°39.7	46.5	295°42.9	16.5	229°40.6	09.0	232°36.3	42.3
6	77°12.9	234°39.5	S09°47.8	310°43.8	N20°16.2	244°42.6	S04°09.2	247°38.5	S01°42.4
7	92°15.4	249°39.2	49.0	325°44.6	15.8	259°44.6	09.4	262°40.7	42.5
8	107°17.8	264°39.0	50.2	340°45.4	15.5	274°46.6	09.6	277°42.9	42.6
9	122°20.3	279°38.7	·· 51.4	355°46.2	·· 15.1	289°48.6	·· 09.8	292°45.1	·· 42.7
10	137°22.8	294°38.4	52.6	10°47.1	14.8	304°50.6	10.0	307°47.3	42.8
11	152°25.2	309°38.2	53.9	25°47.9	14.4	319°52.6	10.2	322°49.5	43.0
12	167°27.7	324°37.9	S09°55.1	40°48.7	N20°14.1	334°54.6	S04°10.4	337°51.7	S01°43.1
13	182°30.2	339°37.7	56.3	55°49.5	13.7	349°56.6	10.6	352°53.9	43.2
14	197°32.6	354°37.4	57.5	70°50.4	13.4	4°58.6	10.8	7°56.1	43.3
15	212°35.1	9°37.2	09°58.7	85°51.2	·· 13.0	20°00.6	·· 11.0	22°58.3	·· 43.4
16	227°37.6	24°36.9	10°00.0	100°52.0	12.7	35°02.6	11.2	38°00.5	43.5
17	242°40.0	39°36.7	01.2	115°52.9	12.3	50°04.6	11.4	53°02.7	43.7
18	257°42.5	54°36.4	S10°02.4	130°53.7	N20°12.0	65°06.6	S04°11.6	68°04.9	S01°43.8
19	272°44.9	69°36.2	03.6	145°54.5	11.6	80°08.6	11.8	83°07.1	43.9
20	287°47.4	84°35.9	04.8	160°55.3	11.3	95°10.6	12.0	98°09.3	44.0
21	302°49.9	99°35.7	·· 06.1	175°56.2	·· 10.9	110°12.6	·· 12.2	113°11.5	·· 44.1
22	317°52.3	114°35.4	07.3	190°57.0	10.6	125°14.6	12.4	128°13.7	44.2
23	332°54.8	129°35.2	08.5	205°57.8	10.2	140°16.5	12.6	143°15.8	44.4
Mer.pass. 00:52		ν -0.2′	d 1.2′	m -4.01	ν 0.8′	d 0.3′	m 1.61	ν 2.0′	d 0.2′ m -1.70	ν 2.2′	d 0.1′ m 0.92

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	347°57.3	144°34.9	S10°09.7	220°58.7	N20°09.9	155°18.5	S04°12.8	158°18.0	S01°44.5
1	2°59.7	159°34.7	10.9	235°59.5	09.5	170°20.5	13.0	173°20.2	44.6
2	18°02.2	174°34.4	12.1	251°00.3	09.2	185°22.5	13.2	188°22.4	44.7
3	33°04.7	189°34.1	·· 13.3	266°01.1	·· 08.8	200°24.5	·· 13.4	203°24.6	·· 44.8
4	48°07.1	204°33.9	14.6	281°02.0	08.5	215°26.5	13.6	218°26.8	44.9
5	63°09.6	219°33.6	15.8	296°02.8	08.1	230°28.5	13.8	233°29.0	45.1
6	78°12.1	234°33.4	S10°17.0	311°03.6	N20°07.8	245°30.5	S04°14.0	248°31.2	S01°45.2
7	93°14.5	249°33.1	18.2	326°04.5	07.4	260°32.5	14.2	263°33.4	45.3
8	108°17.0	264°32.9	19.4	341°05.3	07.1	275°34.5	14.4	278°35.6	45.4
9	123°19.4	279°32.6	·· 20.6	356°06.1	·· 06.7	290°36.5	·· 14.6	293°37.8	·· 45.5
10	138°21.9	294°32.4	21.8	11°07.0	06.4	305°38.5	14.8	308°40.0	45.6
11	153°24.4	309°32.1	23.0	26°07.8	06.0	320°40.5	15.0	323°42.2	45.8
12	168°26.8	324°31.8	S10°24.3	41°08.6	N20°05.6	335°42.5	S04°15.2	338°44.4	S01°45.9
13	183°29.3	339°31.6	25.5	56°09.5	05.3	350°44.5	15.4	353°46.6	46.0
14	198°31.8	354°31.3	26.7	71°10.3	04.9	5°46.5	15.6	8°48.8	46.1
15	213°34.2	9°31.1	·· 27.9	86°11.1	·· 04.6	20°48.5	·· 15.8	23°51.0	·· 46.2
16	228°36.7	24°30.8	29.1	101°11.9	04.2	35°50.5	16.0	38°53.2	46.3
17	243°39.2	39°30.5	30.3	116°12.8	03.9	50°52.4	16.2	53°55.4	46.5
18	258°41.6	54°30.3	S10°31.5	131°13.6	N20°03.5	65°54.4	S04°16.4	68°57.6	S01°46.6
19	273°44.1	69°30.0	32.7	146°14.4	03.2	80°56.4	16.6	83°59.8	46.7
20	288°46.6	84°29.8	33.9	161°15.3	02.8	95°58.4	16.8	99°02.0	46.8
21	303°49.0	99°29.5	·· 35.1	176°16.1	·· 02.4	111°00.4	·· 17.0	114°04.2	·· 46.9
22	318°51.5	114°29.3	36.4	191°16.9	02.1	126°02.4	17.2	129°06.4	47.0
23	333°53.9	129°29.0	37.6	206°17.8	01.7	141°04.4	17.4	144°08.6	47.2
Mer.pass. 00:48		ν -0.3′	d 1.2′	m -4.01	ν 0.8′	d 0.4′	m 1.61	ν 2.0′	d 0.2′ m -1.70	ν 2.2′	d 0.1′ m 0.92

Stars

	SHA	Dec
Alpheratz	358°08.3	28°59.3
Ankaa	353°39.2	-42°24.3
Schedar	350°07.7	56°26.1
Diphda	349°19.9	-18°05.2
Achernar	335°44.3	-57°19.6
Hamal	328°27.9	23°22.5
Polaris	326°26.2	89°10.5
Acamar	315°36.5	-40°22.5
Menkar	314°40.3	4°01.1
Mirfak	309°14.9	49°47.6
Aldebaran	291°17.2	16°28.3
Rigel	281°35.4	-8°13.2
Capella	281°10.3	45°58.6
Bellatrix	278°58.0	6°20.1
Elnath	278°43.3	28°35.5
Alnilam	276°11.0	-1°12.7
Betelgeuse	271°27.6	7°24.3
Canopus	264°07.1	-52°40.9
Sirius	258°55.2	-16°41.2
Adhara	255°31.8	-28°56.6
Procyon	245°25.3	5°16.5
Pollux	243°57.6	28°04.3
Avior	234°28.4	-59°26.8
Suhail	223°10.7	-43°21.3
Miaplacidus	221°45.7	-69°38.3
Alphard	218°20.2	-8°34.5
Regulus	208°09.6	12°03.6
Dubhe	194°21.9	61°51.1
Denebola	182°58.7	14°40.7
Gienah	176°17.6	-17°26.2
Acrux	173°37.2	-62°59.8
Gacrux	172°28.5	-57°00.6
Alioth	166°42.4	56°03.9
Spica	158°57.1	-11°03.8
Alkaid	153°18.3	49°24.6
Hadar	149°22.9	-60°17.1
Menkent	148°36.5	-36°16.7
Arcturus	146°18.1	19°17.0
Rigil Kent.	140°25.3	-60°45.5
Kochab	137°19.6	74°14.2
Zuben'ubi	137°32.5	-15°57.8
Alphecca	126°31.7	26°46.9
Antares	112°56.1	-26°23.5
Atria	108°19.7	-68°59.9
Sabik	102°40.3	-15°42.1
Shaula	96°54.8	-37°05.5
Rasalhague	96°28.9	12°34.6
Eltanin	90°57.3	51°29.8
Kaus Aust.	84°15.8	-34°23.7
Vega	80°55.2	38°46.3
Nunki	76°28.2	-26°19.2
Altair	62°31.6	8°49.3
Peacock	53°56.9	-56°47.8
Deneb	49°47.6	45°13.1
Enif	34°10.6	9°47.5
Al Na'ir	28°13.6	-47°03.0
Fomalhaut	15°50.3	-29°43.1
Scheat	14°16.6	27°59.0
Markab	14°02.2	15°06.4

Sep 07 Mon	SHA	Mer.pass
Venus	158°47.9	14:21
Mars	234°20.1	09:18
Jupiter	167°43.7	13:43
Saturn	170°33.5	13:32

Sep 08 Tue	SHA	Mer.pass
Venus	157°42.8	14:22
Mars	233°40.7	09:17
Jupiter	167°32.5	13:40
Saturn	170°27.2	13:28

Sep 09 Wed	SHA	Mer.pass
Venus	156°37.6	14:22
Mars	233°01.4	09:16
Jupiter	167°21.3	13:37
Saturn	170°20.8	13:25

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°27.6	N06°11.2	87°32.2	12.1′	S19°33.8	4.4′	54.4′
1	195°27.8	10.2	102°03.3	12.1′	19°38.2	4.2′	54.4′
2	210°28.0	09.3	116°34.4	12.0′	19°42.4	4.2′	54.4′
3	225°28.2	·· 08.4	131°05.4	12.0′	19°46.6	4.0′	54.4′
4	240°28.4	07.4	145°36.4	11.9′	19°50.6	4.0′	54.5′
5	255°28.6	06.5	160°07.3	11.9′	19°54.6	3.9′	54.5′
6	270°28.8	N06°05.6	174°38.2	11.9′	S19°58.5	3.8′	54.5′
7	285°29.1	04.6	189°09.1	11.8′	20°02.3	3.7′	54.5′
8	300°29.3	03.7	203°39.9	11.8′	20°06.0	3.6′	54.5′
9	315°29.5	·· 02.7	218°10.7	11.7′	20°09.6	3.5′	54.5′
10	330°29.7	01.8	232°41.4	11.7′	20°13.1	3.4′	54.5′
11	345°29.9	06°00.9	247°12.1	11.6′	20°16.5	3.4′	54.6′
12	0°30.1	N05°59.9	261°42.7	11.6′	S20°19.9	3.2′	54.6′
13	15°30.3	59.0	276°13.3	11.6′	20°23.1	3.1′	54.6′
14	30°30.5	58.1	290°43.9	11.5′	20°26.2	3.1′	54.6′
15	45°30.8	·· 57.1	305°14.4	11.5′	20°29.3	2.9′	54.6′
16	60°31.0	56.2	319°44.9	11.4′	20°32.2	2.9′	54.6′
17	75°31.2	55.3	334°15.3	11.4′	20°35.1	2.7′	54.7′
18	90°31.4	N05°54.3	348°45.7	11.4′	S20°37.8	2.7′	54.7′
19	105°31.6	53.4	3°16.1	11.3′	20°40.5	2.6′	54.7′
20	120°31.8	52.4	17°46.4	11.3′	20°43.1	2.4′	54.7′
21	135°32.0	·· 51.5	32°16.7	11.2′	20°45.5	2.4′	54.7′
22	150°32.3	50.6	46°46.9	11.2′	20°47.9	2.3′	54.7′
23	165°32.5	49.6	61°17.1	11.2′	20°50.2	2.1′	54.8′
	SD = 15.9′	d = 0.9′	SD = 14.8′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°32.7	N05°48.7	75°47.3	11.1′	S20°52.3	2.1′	54.8′
1	195°32.9	47.7	90°17.4	11.1′	20°54.4	2.0′	54.8′
2	210°33.1	46.8	104°47.5	11.0′	20°56.4	1.9′	54.8′
3	225°33.3	·· 45.9	119°17.5	11.0′	20°58.3	1.7′	54.8′
4	240°33.5	44.9	133°47.5	11.0′	21°00.0	1.7′	54.9′
5	255°33.8	44.0	148°17.5	10.9′	21°01.7	1.6′	54.9′
6	270°34.0	N05°43.0	162°47.4	10.9′	S21°03.3	1.4′	54.9′
7	285°34.2	42.1	177°17.3	10.8′	21°04.7	1.4′	54.9′
8	300°34.4	41.2	191°47.1	10.8′	21°06.1	1.2′	54.9′
9	315°34.6	·· 40.2	206°16.9	10.8′	21°07.3	1.2′	55.0′
10	330°34.8	39.3	220°46.7	10.7′	21°08.5	1.0′	55.0′
11	345°35.0	38.3	235°16.4	10.7′	21°09.5	1.0′	55.0′
12	0°35.3	N05°37.4	249°46.2	10.7′	S21°10.5	0.8′	55.0′
13	15°35.5	36.5	264°15.8	10.6′	21°11.3	0.8′	55.1′
14	30°35.7	35.5	278°45.5	10.6′	21°12.1	0.6′	55.1′
15	45°35.9	·· 34.6	293°15.1	10.6′	21°12.7	0.5′	55.1′
16	60°36.1	33.6	307°44.6	10.5′	21°13.2	0.4′	55.1′
17	75°36.3	32.7	322°14.2	10.5′	21°13.6	0.4′	55.1′
18	90°36.6	N05°31.8	336°43.7	10.5′	S21°14.0	0.2′	55.2′
19	105°36.8	30.8	351°13.1	10.4′	21°14.2	0.1′	55.2′
20	120°37.0	29.9	5°42.6	10.4′	21°14.3	0.1′	55.2′
21	135°37.2	·· 28.9	20°12.0	10.4′	21°14.2	0.1′	55.2′
22	150°37.4	28.0	34°41.3	10.3′	21°14.1	0.2′	55.3′
23	165°37.6	27.1	49°10.7	10.3′	21°13.9	0.3′	55.3′
	SD = 15.9′	d = 0.9′	SD = 14.9′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°37.8	N05°26.1	63°40.0	10.3′	S21°13.6	0.5′	55.3′
1	195°38.1	25.2	78°09.3	10.3′	21°13.1	0.5′	55.3′
2	210°38.3	24.2	92°38.5	10.2′	21°12.6	0.7′	55.4′
3	225°38.5	·· 23.3	107°07.8	10.2′	21°11.9	0.7′	55.4′
4	240°38.7	22.3	121°37.0	10.2′	21°11.2	0.9′	55.4′
5	255°38.9	21.4	136°06.1	10.1′	21°10.3	1.0′	55.4′
6	270°39.1	N05°20.5	150°35.3	10.1′	S21°09.3	1.1′	55.5′
7	285°39.4	19.5	165°04.4	10.1′	21°08.2	1.2′	55.5′
8	300°39.6	18.6	179°33.5	10.1′	21°07.0	1.3′	55.5′
9	315°39.8	·· 17.6	194°02.6	10.0′	21°05.7	1.5′	55.6′
10	330°40.0	16.7	208°31.6	10.0′	21°04.2	1.5′	55.6′
11	345°40.2	15.7	223°00.6	10.0′	21°02.7	1.6′	55.6′
12	0°40.4	N05°14.8	237°29.6	10.0′	S21°01.1	1.8′	55.6′
13	15°40.7	13.8	251°58.6	9.9′	20°59.3	1.9′	55.7′
14	30°40.9	12.9	266°27.5	9.9′	20°57.4	2.0′	55.7′
15	45°41.1	·· 12.0	280°56.5	9.9′	20°55.4	2.1′	55.7′
16	60°41.3	11.0	295°25.4	9.9′	20°53.3	2.2′	55.7′
17	75°41.5	10.1	309°54.2	9.9′	20°51.1	2.3′	55.8′
18	90°41.7	N05°09.1	324°23.1	9.8′	S20°48.8	2.4′	55.8′
19	105°42.0	08.2	338°52.0	9.8′	20°46.4	2.6′	55.8′
20	120°42.2	07.2	353°20.8	9.8′	20°43.8	2.6′	55.9′
21	135°42.4	·· 06.3	7°49.6	9.8′	20°41.2	2.8′	55.9′
22	150°42.6	05.3	22°18.4	9.8′	20°38.4	2.9′	55.9′
23	165°42.8	04.4	36°47.2	9.8′	20°35.5	3.0′	55.9′
	SD = 15.9′	d = 0.9′	SD = 15.1′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	00:32	03:16	04:34	19:18	20:35	23:01
N 70°	01:47	03:35	04:43	19:09	20:17	22:01
68°	02:22	03:50	04:51	19:02	20:02	21:28
66°	02:47	04:02	04:57	18:56	19:51	21:05
64°	03:05	04:12	05:02	18:51	19:41	20:47
62°	03:20	04:20	05:07	18:47	19:33	20:32
60°	03:32	04:27	05:11	18:43	19:26	20:21
N 58°	03:43	04:34	05:14	18:40	19:20	20:10
56°	03:52	04:39	05:17	18:37	19:15	20:02
54°	03:59	04:44	05:20	18:34	19:10	19:54
52°	04:06	04:48	05:23	18:31	19:06	19:48
50°	04:12	04:52	05:25	18:29	19:02	19:42
45°	04:24	05:00	05:30	18:25	18:54	19:30
N 40°	04:34	05:07	05:34	18:21	18:48	19:20
35°	04:42	05:12	05:38	18:17	18:43	19:13
30°	04:48	05:16	05:41	18:14	18:38	19:07
20°	04:58	05:24	05:46	18:09	18:31	18:57
N 10°	05:05	05:29	05:50	18:05	18:26	18:51
0°	05:10	05:34	05:54	18:01	18:22	18:46
S 10°	05:13	05:37	05:58	17:57	18:18	18:43
20°	05:15	05:40	06:03	17:53	18:15	18:41
30°	05:15	05:43	06:07	17:49	18:13	18:40
35°	05:15	05:44	06:10	17:46	18:11	18:41
40°	05:14	05:46	06:13	17:43	18:10	18:42
45°	05:13	05:47	06:16	17:40	18:09	18:43
S 50°	05:10	05:48	06:20	17:36	18:09	18:46
52°	05:09	05:48	06:22	17:35	18:08	18:47
54°	05:08	05:48	06:24	17:33	18:08	18:49
56°	05:06	05:49	06:26	17:31	18:08	18:51
58°	05:04	05:49	06:28	17:28	18:07	18:53
S 60°	05:01	05:49	06:31	17:26	18:07	18:56

Lat.	**Moonrise** Mon	Tue	Wed	**Moonset** Mon	Tue	Wed
N 72°	▬	▬	▬	▬	▬	▬
N 70°	▬	▬	▬	▬	▬	▬
68°	17:21	18:35	19:08	20:08	20:37	21:52
66°	16:34	17:38	18:20	20:55	21:35	22:39
64°	16:03	17:04	17:49	21:26	22:09	23:10
62°	15:41	16:39	17:26	21:49	22:33	23:33
60°	15:22	16:20	17:07	22:07	22:53	23:51
N 58°	15:07	16:04	16:51	22:23	23:09	·· ··
56°	14:54	15:50	16:38	22:36	23:22	·· ··
54°	14:43	15:38	16:27	22:47	23:34	·· ··
52°	14:33	15:28	16:17	22:57	23:45	·· ··
50°	14:24	15:19	16:08	23:06	23:54	·· ··
45°	14:05	14:59	15:48	23:26	·· ··	00:14
N 40°	13:50	14:43	15:33	23:41	·· ··	00:30
35°	13:37	14:30	15:20	23:54	·· ··	00:43
30°	13:26	14:18	15:08	·· ··	00:06	00:55
20°	13:07	13:58	14:48	·· ··	00:25	01:15
N 10°	12:50	13:40	14:31	·· ··	00:42	01:32
0°	12:35	13:24	14:15	00:10	00:58	01:49
S 10°	12:19	13:08	13:59	00:25	01:14	02:05
20°	12:03	12:51	13:42	00:41	01:31	02:22
30°	11:44	12:31	13:22	00:59	01:51	02:42
35°	11:33	12:19	13:11	01:09	02:03	02:54
40°	11:20	12:06	12:58	01:22	02:16	03:07
45°	11:05	11:50	12:42	01:36	02:31	03:23
S 50°	10:47	11:31	12:23	01:54	02:50	03:42
52°	10:38	11:22	12:14	02:02	03:00	03:51
54°	10:29	11:11	12:03	02:12	03:10	04:02
56°	10:18	11:00	11:52	02:22	03:21	04:13
58°	10:06	10:46	11:39	02:34	03:34	04:27
S 60°	09:52	10:31	11:23	02:48	03:50	04:42

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 9-11 54-73%
07	01:50	02:00	11:58	18:46	06:22	
08	02:11	02:21	11:58	19:36	07:11	
09	02:31	02:42	11:57	20:28	08:02	

September 10, 11, 12 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	348°56.4	144°28.7	S10°38.8	221°18.6	N20°01.4	156°06.4	S04°17.6	159°10.8	S01°47.3
1	3°58.9	159°28.5	40.0	236°19.5	01.0	171°08.4	17.8	174°13.0	47.4
2	19°01.3	174°28.2	41.2	251°20.3	00.7	186°10.4	18.0	189°15.2	47.5
3	34°03.8	189°28.0	·· 42.4	266°21.1	20°00.3	201°12.4	·· 18.2	204°17.4	·· 47.6
4	49°06.3	204°27.7	43.6	281°22.0	19°59.9	216°14.4	18.4	219°19.6	47.7
5	64°08.7	219°27.4	44.8	296°22.8	59.6	231°16.4	18.6	234°21.8	47.9
6	79°11.2	234°27.2	S10°46.0	311°23.6	N19°59.2	246°18.4	S04°18.8	249°24.0	S01°48.0
7	94°13.7	249°26.9	47.2	326°24.5	58.9	261°20.4	19.0	264°26.2	48.1
8	109°16.1	264°26.7	48.4	341°25.3	58.5	276°22.3	19.2	279°28.4	48.2
9	124°18.6	279°26.4	·· 49.6	356°26.1	·· 58.2	291°24.3	·· 19.4	294°30.6	·· 48.3
10	139°21.0	294°26.1	50.8	11°27.0	57.8	306°26.3	19.6	309°32.8	48.4
11	154°23.5	309°25.9	52.0	26°27.8	57.4	321°28.3	19.8	324°34.9	48.6
12	169°26.0	324°25.6	S10°53.2	41°28.6	N19°57.1	336°30.3	S04°20.0	339°37.1	S01°48.7
13	184°28.4	339°25.3	54.4	56°29.5	56.7	351°32.3	20.2	354°39.3	48.8
14	199°30.9	354°25.1	55.6	71°30.3	56.4	6°34.3	20.4	9°41.5	48.9
15	214°33.4	9°24.8	·· 56.8	86°31.2	·· 56.0	21°36.3	·· 20.6	24°43.7	·· 49.0
16	229°35.8	24°24.6	58.0	101°32.0	55.6	36°38.3	20.8	39°45.9	49.1
17	244°38.3	39°24.3	10°59.2	116°32.8	55.3	51°40.3	21.0	54°48.1	49.3
18	259°40.8	54°24.0	S11°00.4	131°33.7	N19°54.9	66°42.3	S04°21.2	69°50.3	S01°49.4
19	274°43.2	69°23.8	01.6	146°34.5	54.6	81°44.3	21.4	84°52.5	49.5
20	289°45.7	84°23.5	02.8	161°35.3	54.2	96°46.3	21.6	99°54.7	49.6
21	304°48.2	99°23.2	·· 04.0	176°36.2	·· 53.8	111°48.3	·· 21.8	114°56.9	·· 49.7
22	319°50.6	114°23.0	05.2	191°37.0	53.5	126°50.2	22.0	129°59.1	49.8
23	334°53.1	129°22.7	06.4	206°37.9	53.1	141°52.2	22.2	145°01.3	50.0
Mer.pass. 00:44		ν -0.3′	d 1.2′	m -4.02	ν 0.8′	d 0.4′	m 1.61	ν 2.0′	d 0.2′ m -1.69	ν 2.2′	d 0.1′ m 0.92

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	349°55.5	144°22.4	S11°07.6	221°38.7	N19°52.7	156°54.2	S04°22.4	160°03.5	S01°50.1
1	4°58.0	159°22.2	08.8	236°39.5	52.4	171°56.2	22.6	175°05.7	50.2
2	20°00.5	174°21.9	10.0	251°40.4	52.0	186°58.2	22.8	190°07.9	50.3
3	35°02.9	189°21.6	·· 11.2	266°41.2	·· 51.7	202°00.2	·· 23.1	205°10.1	·· 50.4
4	50°05.4	204°21.4	12.4	281°42.1	51.3	217°02.2	23.3	220°12.3	50.5
5	65°07.9	219°21.1	13.6	296°42.9	50.9	232°04.2	23.5	235°14.5	50.7
6	80°10.3	234°20.8	S11°14.8	311°43.7	N19°50.6	247°06.2	S04°23.7	250°16.7	S01°50.8
7	95°12.8	249°20.6	16.0	326°44.6	50.2	262°08.2	23.9	265°18.9	50.9
8	110°15.3	264°20.3	17.2	341°45.4	49.8	277°10.2	24.1	280°21.1	51.0
9	125°17.7	279°20.0	·· 18.4	356°46.3	·· 49.5	292°12.1	·· 24.3	295°23.3	·· 51.1
10	140°20.2	294°19.8	19.6	11°47.1	49.1	307°14.1	24.5	310°25.5	51.2
11	155°22.7	309°19.5	20.8	26°48.0	48.7	322°16.1	24.7	325°27.6	51.4
12	170°25.1	324°19.2	S11°22.0	41°48.8	N19°48.4	337°18.1	S04°24.9	340°29.8	S01°51.5
13	185°27.6	339°19.0	23.2	56°49.6	48.0	352°20.1	25.1	355°32.0	51.6
14	200°30.0	354°18.7	24.3	71°50.5	47.7	7°22.1	25.3	10°34.2	51.7
15	215°32.5	9°18.4	·· 25.5	86°51.3	·· 47.3	22°24.1	·· 25.5	25°36.4	·· 51.8
16	230°35.0	24°18.2	26.7	101°52.2	46.9	37°26.1	25.7	40°38.6	51.9
17	245°37.4	39°17.9	27.9	116°53.0	46.6	52°28.1	25.9	55°40.8	52.1
18	260°39.9	54°17.6	S11°29.1	131°53.9	N19°46.2	67°30.1	S04°26.1	70°43.0	S01°52.2
19	275°42.4	69°17.4	30.3	146°54.7	45.8	82°32.1	26.3	85°45.2	52.3
20	290°44.8	84°17.1	31.5	161°55.5	45.5	97°34.0	26.5	100°47.4	52.4
21	305°47.3	99°16.8	·· 32.7	176°56.4	·· 45.1	112°36.0	·· 26.7	115°49.6	·· 52.5
22	320°49.8	114°16.6	33.9	191°57.2	44.7	127°38.0	26.9	130°51.8	52.7
23	335°52.2	129°16.3	35.1	206°58.1	44.4	142°40.0	27.1	145°54.0	52.8
Mer.pass. 00:40		ν -0.3′	d 1.2′	m -4.02	ν 0.8′	d 0.4′	m 1.61	ν 2.0′	d 0.2′ m -1.69	ν 2.2′	d 0.1′ m 0.92

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	350°54.7	144°16.0	S11°36.2	221°58.9	N19°44.0	157°42.0	S04°27.3	160°56.2	S01°52.9
1	5°57.1	159°15.7	37.4	236°59.8	43.6	172°44.0	27.5	175°58.4	53.0
2	20°59.6	174°15.5	38.6	252°00.6	43.3	187°46.0	27.7	191°00.6	53.1
3	36°02.1	189°15.2	·· 39.8	267°01.5	·· 42.9	202°48.0	·· 27.9	206°02.8	·· 53.2
4	51°04.5	204°14.9	41.0	282°02.3	42.5	217°50.0	28.1	221°05.0	53.4
5	66°07.0	219°14.7	42.2	297°03.2	42.2	232°52.0	28.3	236°07.2	53.5
6	81°09.5	234°14.4	S11°43.4	312°04.0	N19°41.8	247°53.9	S04°28.5	251°09.4	S01°53.6
7	96°11.9	249°14.1	44.5	327°04.8	41.4	262°55.9	28.7	266°11.5	53.7
8	111°14.4	264°13.8	45.7	342°05.7	41.1	277°57.9	28.9	281°13.7	53.8
9	126°16.9	279°13.6	·· 46.9	357°06.5	·· 40.7	292°59.9	·· 29.1	296°15.9	·· 53.9
10	141°19.3	294°13.3	48.1	12°07.4	40.3	308°01.9	29.3	311°18.1	54.1
11	156°21.8	309°13.0	49.3	27°08.2	39.9	323°03.9	29.5	326°20.3	54.2
12	171°24.3	324°12.7	S11°50.5	42°09.1	N19°39.6	338°05.9	S04°29.7	341°22.5	S01°54.3
13	186°26.7	339°12.5	51.6	57°09.9	39.2	353°07.9	29.9	356°24.7	54.4
14	201°29.2	354°12.2	52.8	72°10.8	38.8	8°09.9	30.1	11°26.9	54.5
15	216°31.6	9°11.9	·· 54.0	87°11.6	·· 38.5	23°11.8	·· 30.3	26°29.1	·· 54.6
16	231°34.1	24°11.6	55.2	102°12.5	38.1	38°13.8	30.5	41°31.3	54.8
17	246°36.6	39°11.4	56.4	117°13.3	37.7	53°15.8	30.7	56°33.5	54.9
18	261°39.0	54°11.1	S11°57.6	132°14.2	N19°37.4	68°17.8	S04°30.9	71°35.7	S01°55.0
19	276°41.5	69°10.8	58.7	147°15.0	37.0	83°19.8	31.1	86°37.9	55.1
20	291°44.0	84°10.5	11°59.9	162°15.9	36.6	98°21.8	31.3	101°40.1	55.2
21	306°46.4	99°10.3	12°01.1	177°16.7	·· 36.2	113°23.8	·· 31.5	116°42.3	·· 55.4
22	321°48.9	114°10.0	02.3	192°17.6	35.9	128°25.8	31.7	131°44.5	55.5
23	336°51.4	129°09.7	03.5	207°18.4	35.5	143°27.8	31.9	146°46.7	55.6
Mer.pass. 00:36		ν -0.3′	d 1.2′	m -4.02	ν 0.8′	d 0.4′	m 1.61	ν 2.0′	d 0.2′ m -1.69	ν 2.2′	d 0.1′ m 0.91

Stars

	SHA	Dec
Alpheratz	358°08.3	28°59.3
Ankaa	353°39.2	-42°24.3
Schedar	350°07.7	56°26.1
Diphda	349°19.9	-18°05.2
Achernar	335°44.3	-57°19.7
Hamal	328°27.9	23°22.5
Polaris	326°25.3	89°10.5
Acamar	315°36.5	-40°22.5
Menkar	314°40.2	4°01.1
Mirfak	309°14.9	49°47.6
Aldebaran	291°17.2	16°28.4
Rigel	281°35.4	-8°13.2
Capella	281°10.3	45°58.6
Bellatrix	278°58.0	6°20.1
Elnath	278°43.3	28°35.5
Alnilam	276°11.0	-1°12.7
Betelgeuse	271°27.6	7°24.3
Canopus	264°07.1	-52°40.9
Sirius	258°55.2	-16°41.2
Adhara	255°31.7	-28°56.6
Procyon	245°25.3	5°16.5
Pollux	243°57.5	28°04.3
Avior	234°28.4	-59°26.8
Suhail	223°10.7	-43°21.3
Miaplacidus	221°45.6	-69°38.3
Alphard	218°20.2	-8°34.5
Regulus	208°09.6	12°03.6
Dubhe	194°21.9	61°51.1
Denebola	182°58.7	14°40.7
Gienah	176°17.6	-17°26.2
Acrux	173°37.2	-62°59.8
Gacrux	172°28.5	-57°00.6
Alioth	166°42.4	56°03.8
Spica	158°57.1	-11°03.8
Alkaid	153°18.3	49°24.6
Hadar	149°22.9	-60°17.1
Menkent	148°36.5	-36°16.7
Arcturus	146°18.1	19°17.0
Rigil Kent.	140°25.3	-60°45.5
Kochab	137°19.6	74°14.2
Zuben'ubi	137°32.5	-15°57.8
Alphecca	126°31.7	26°46.9
Antares	112°56.1	-26°23.5
Atria	108°19.8	-68°59.9
Sabik	102°40.3	-15°42.1
Shaula	96°54.8	-37°05.5
Rasalhague	96°28.9	12°34.6
Eltanin	90°57.3	51°29.8
Kaus Aust.	84°15.8	-34°23.7
Vega	80°55.2	38°46.3
Nunki	76°28.2	-26°19.2
Altair	62°31.7	8°49.3
Peacock	53°56.9	-56°47.8
Deneb	49°47.6	45°13.1
Enif	34°10.6	9°47.5
Al Na'ir	28°13.6	-47°03.0
Fomalhaut	15°50.3	-29°43.1
Scheat	14°16.5	27°59.0
Markab	14°02.2	15°06.4

Sep 10 Thu	SHA	Mer.pass
Venus	155°32.3	14:22
Mars	232°22.2	09:14
Jupiter	167°10.0	13:34
Saturn	170°14.4	13:21

Sep 11 Fri	SHA	Mer.pass
Venus	154°26.9	14:23
Mars	231°43.2	09:13
Jupiter	166°58.7	13:31
Saturn	170°08.0	13:18

Sep 12 Sat	SHA	Mer.pass
Venus	153°21.3	14:23
Mars	231°04.2	09:12
Jupiter	166°47.3	13:27
Saturn	170°01.5	13:14

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°43.1	N05°03.4	51°15.9	9.7′	S20°32.5	3.1′	56.0′
1	195°43.3	02.5	65°44.7	9.7′	20°29.4	3.2′	56.0′
2	210°43.5	01.6	80°13.4	9.7′	20°26.2	3.3′	56.0′
3	225°43.7	05°00.6	94°42.1	9.7′	20°22.9	3.5′	56.1′
4	240°43.9	04°59.7	109°10.8	9.7′	20°19.4	3.5′	56.1′
5	255°44.1	58.7	123°39.5	9.7′	20°15.9	3.7′	56.1′
6	270°44.4	N04°57.8	138°08.1	9.7′	S20°12.2	3.8′	56.2′
7	285°44.6	56.8	152°36.8	9.6′	20°08.4	3.9′	56.2′
8	300°44.8	55.9	167°05.4	9.6′	20°04.5	4.0′	56.2′
9	315°45.0	·· 54.9	181°34.1	9.6′	20°00.5	4.1′	56.3′
10	330°45.2	54.0	196°02.7	9.6′	19°56.4	4.2′	56.3′
11	345°45.5	53.0	210°31.3	9.6′	19°52.2	4.3′	56.3′
12	0°45.7	N04°52.1	224°59.9	9.6′	S19°47.9	4.5′	56.3′
13	15°45.9	51.1	239°28.5	9.6′	19°43.4	4.5′	56.4′
14	30°46.1	50.2	253°57.1	9.6′	19°38.9	4.7′	56.4′
15	45°46.3	·· 49.2	268°25.7	9.6′	19°34.2	4.8′	56.4′
16	60°46.5	48.3	282°54.2	9.6′	19°29.4	4.9′	56.5′
17	75°46.8	47.3	297°22.8	9.6′	19°24.5	5.0′	56.5′
18	90°47.0	N04°46.4	311°51.4	9.6′	S19°19.5	5.1′	56.5′
19	105°47.2	45.4	326°19.9	9.5′	19°14.4	5.3′	56.6′
20	120°47.4	44.5	340°48.5	9.5′	19°09.1	5.3′	56.6′
21	135°47.6	·· 43.5	355°17.0	9.5′	19°03.8	5.5′	56.6′
22	150°47.9	42.6	9°45.5	9.5′	18°58.3	5.5′	56.7′
23	165°48.1	41.6	24°14.1	9.5′	18°52.8	5.7′	56.7′
	SD = 15.9′	d = 0.9′	SD = 15.3′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°48.3	N04°40.7	38°42.6	9.5′	S18°47.1	5.8′	56.7′
1	195°48.5	39.7	53°11.1	9.5′	18°41.3	5.8′	56.8′
2	210°48.7	38.8	67°39.7	9.5′	18°35.5	6.0′	56.8′
3	225°49.0	·· 37.8	82°08.2	9.5′	18°29.5	6.1′	56.8′
4	240°49.2	36.9	96°36.7	9.5′	18°23.4	6.3′	56.9′
5	255°49.4	35.9	111°05.2	9.5′	18°17.1	6.3′	56.9′
6	270°49.6	N04°35.0	125°33.7	9.5′	S18°10.8	6.4′	56.9′
7	285°49.8	34.0	140°02.3	9.5′	18°04.4	6.5′	57.0′
8	300°50.1	33.1	154°30.8	9.5′	17°57.9	6.7′	57.0′
9	315°50.3	·· 32.1	168°59.3	9.5′	17°51.2	6.7′	57.0′
10	330°50.5	31.2	183°27.8	9.5′	17°44.5	6.9′	57.1′
11	345°50.7	30.2	197°56.4	9.5′	17°37.6	6.9′	57.1′
12	0°50.9	N04°29.3	212°24.9	9.5′	S17°30.7	7.1′	57.1′
13	15°51.1	28.3	226°53.4	9.5′	17°23.6	7.2′	57.1′
14	30°51.4	27.4	241°22.0	9.5′	17°16.4	7.2′	57.2′
15	45°51.6	·· 26.4	255°50.5	9.5′	17°09.2	7.4′	57.2′
16	60°51.8	25.5	270°19.0	9.5′	17°01.8	7.5′	57.2′
17	75°52.0	24.5	284°47.6	9.5′	16°54.3	7.6′	57.3′
18	90°52.2	N04°23.6	299°16.1	9.6′	S16°46.7	7.7′	57.3′
19	105°52.5	22.6	313°44.7	9.6′	16°39.0	7.8′	57.3′
20	120°52.7	21.7	328°13.2	9.6′	16°31.2	7.8′	57.4′
21	135°52.9	·· 20.7	342°41.8	9.6′	16°23.4	8.0′	57.4′
22	150°53.1	19.8	357°10.4	9.6′	16°15.4	8.1′	57.4′
23	165°53.4	18.8	11°38.9	9.6′	16°07.3	8.2′	57.5′
	SD = 15.9′	d = 0.9′	SD = 15.5′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°53.6	N04°17.9	26°07.5	9.6′	S15°59.1	8.3′	57.5′
1	195°53.8	16.9	40°36.1	9.6′	15°50.8	8.4′	57.5′
2	210°54.0	16.0	55°04.7	9.6′	15°42.4	8.4′	57.6′
3	225°54.2	·· 15.0	69°33.3	9.6′	15°34.0	8.6′	57.6′
4	240°54.5	14.1	84°01.9	9.6′	15°25.4	8.7′	57.6′
5	255°54.7	13.1	98°30.5	9.6′	15°16.7	8.7′	57.7′
6	270°54.9	N04°12.1	112°59.2	9.6′	S15°08.0	8.9′	57.7′
7	285°55.1	11.2	127°27.8	9.6′	14°59.1	9.0′	57.7′
8	300°55.3	10.2	141°56.4	9.6′	14°50.1	9.0′	57.8′
9	315°55.6	·· 09.3	156°25.1	9.7′	14°41.1	9.1′	57.8′
10	330°55.8	08.3	170°53.7	9.7′	14°32.0	9.3′	57.8′
11	345°56.0	07.4	185°22.4	9.7′	14°22.7	9.3′	57.9′
12	0°56.2	N04°06.4	199°51.0	9.7′	S14°13.4	9.4′	57.9′
13	15°56.4	05.5	214°19.7	9.7′	14°04.0	9.5′	57.9′
14	30°56.7	04.5	228°48.4	9.7′	13°54.5	9.6′	58.0′
15	45°56.9	·· 03.6	243°17.1	9.7′	13°44.9	9.7′	58.0′
16	60°57.1	02.6	257°45.8	9.7′	13°35.2	9.7′	58.0′
17	75°57.3	01.6	272°14.5	9.7′	13°25.5	9.9′	58.0′
18	90°57.5	N04°00.7	286°43.2	9.7′	S13°15.6	9.9′	58.1′
19	105°57.8	03°59.7	301°12.0	9.7′	13°05.7	10.0′	58.1′
20	120°58.0	58.8	315°40.7	9.7′	12°55.7	10.1′	58.1′
21	135°58.2	·· 57.8	330°09.5	9.8′	12°45.6	10.2′	58.2′
22	150°58.4	56.9	344°38.2	9.8′	12°35.4	10.3′	58.2′
23	165°58.7	55.9	359°07.0	9.8′	12°25.1	10.3′	58.2′
	SD = 15.9′	d = 1.0′	SD = 15.7′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	01:26	03:33	04:48	19:02	20:16	22:17
N 70°	02:11	03:49	04:56	18:55	20:01	21:36
68°	02:40	04:02	05:02	18:49	19:48	21:09
66°	03:01	04:13	05:07	18:44	19:38	20:49
64°	03:17	04:21	05:11	18:40	19:30	20:33
62°	03:30	04:29	05:15	18:37	19:23	20:20
60°	03:41	04:35	05:18	18:34	19:17	20:10
N 58°	03:51	04:40	05:21	18:31	19:11	20:01
56°	03:59	04:45	05:23	18:29	19:07	19:53
54°	04:06	04:49	05:26	18:26	19:02	19:46
52°	04:12	04:53	05:28	18:24	18:59	19:40
50°	04:17	04:57	05:30	18:23	18:55	19:35
45°	04:28	05:04	05:34	18:19	18:48	19:24
N 40°	04:37	05:10	05:37	18:16	18:43	19:15
35°	04:44	05:14	05:40	18:13	18:38	19:08
30°	04:50	05:18	05:42	18:11	18:35	19:03
20°	04:59	05:24	05:46	18:06	18:29	18:54
N 10°	05:04	05:29	05:50	18:03	18:24	18:49
0°	05:09	05:33	05:53	18:00	18:21	18:45
S 10°	05:11	05:36	05:57	17:57	18:18	18:42
20°	05:12	05:38	06:00	17:54	18:16	18:41
30°	05:12	05:40	06:03	17:50	18:14	18:42
35°	05:11	05:40	06:05	17:48	18:14	18:43
40°	05:09	05:41	06:08	17:46	18:13	18:44
45°	05:07	05:41	06:10	17:44	18:13	18:47
S 50°	05:04	05:41	06:13	17:41	18:13	18:50
52°	05:02	05:41	06:15	17:39	18:13	18:52
54°	05:00	05:41	06:16	17:38	18:13	18:54
56°	04:58	05:41	06:18	17:36	18:13	18:57
58°	04:55	05:41	06:20	17:35	18:14	18:59
S 60°	04:52	05:40	06:22	17:33	18:14	19:03

Lat.	**Moonrise** Thu	Fri	Sat	**Moonset** Thu	Fri	Sat
N 72°	▬	20:34	20:00	▬	▬	00:05
N 70°	20:12	19:48	19:36	22:36	·· ··	00:49
68°	19:16	19:18	19:18	23:31	·· ··	01:18
66°	18:43	18:56	19:03	·· ··	00:04	01:40
64°	18:18	18:38	18:51	·· ··	00:28	01:57
62°	17:59	18:23	18:40	·· ··	00:47	02:11
60°	17:43	18:10	18:31	·· ··	01:03	02:23
N 58°	17:30	17:59	18:23	00:07	01:16	02:33
56°	17:18	17:50	18:16	00:20	01:27	02:42
54°	17:08	17:42	18:10	00:31	01:37	02:50
52°	16:59	17:34	18:04	00:41	01:46	02:57
50°	16:50	17:27	17:59	00:50	01:54	03:04
45°	16:33	17:13	17:48	01:09	02:10	03:17
N 40°	16:19	17:01	17:39	01:24	02:24	03:28
35°	16:07	16:50	17:31	01:37	02:36	03:38
30°	15:56	16:41	17:24	01:48	02:46	03:46
20°	15:38	16:26	17:12	02:08	03:03	04:00
N 10°	15:22	16:12	17:01	02:24	03:18	04:13
0°	15:07	15:59	16:51	02:40	03:32	04:24
S 10°	14:52	15:46	16:41	02:56	03:46	04:36
20°	14:36	15:33	16:31	03:12	04:01	04:48
30°	14:18	15:17	16:18	03:31	04:18	05:02
35°	14:07	15:08	16:11	03:42	04:28	05:10
40°	13:55	14:57	16:03	03:55	04:39	05:19
45°	13:40	14:45	15:54	04:10	04:52	05:29
S 50°	13:23	14:30	15:42	04:28	05:08	05:42
52°	13:14	14:23	15:37	04:37	05:15	05:48
54°	13:05	14:15	15:31	04:46	05:23	05:54
56°	12:54	14:06	15:24	04:57	05:33	06:02
58°	12:42	13:56	15:17	05:09	05:43	06:10
S 60°	12:28	13:45	15:08	05:24	05:55	06:19

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 12-14 81-94%
10	02:52	03:03	11:57	21:20	08:54	
11	03:13	03:24	11:57	22:12	09:46	
12	03:34	03:45	11:56	23:04	10:38	

September 13, 14, 15 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	351°53.8	144°09.4	S12°04.6	222°19.3	N19°35.1	158°29.7	S04°32.2	161°48.8	S01°55.7
1	6°56.3	159°09.2	05.8	237°20.1	34.8	173°31.7	32.4	176°51.0	55.8
2	21°58.8	174°08.9	07.0	252°21.0	34.4	188°33.7	32.6	191°53.2	55.9
3	37°01.2	189°08.6	·· 08.2	267°21.8	·· 34.0	203°35.7	·· 32.8	206°55.4	·· 56.1
4	52°03.7	204°08.3	09.3	282°22.7	33.6	218°37.7	33.0	221°57.6	56.2
5	67°06.1	219°08.1	10.5	297°23.5	33.3	233°39.7	33.2	236°59.8	56.3
6	82°08.6	234°07.8	S12°11.7	312°24.4	N19°32.9	248°41.7	S04°33.4	252°02.0	S01°56.4
7	97°11.1	249°07.5	12.9	327°25.2	32.5	263°43.7	33.6	267°04.2	56.5
8	112°13.5	264°07.2	14.0	342°26.1	32.1	278°45.6	33.8	282°06.4	56.6
9	127°16.0	279°06.9	·· 15.2	357°26.9	·· 31.8	293°47.6	·· 34.0	297°08.6	·· 56.8
10	142°18.5	294°06.7	16.4	12°27.8	31.4	308°49.6	34.2	312°10.8	56.9
11	157°20.9	309°06.4	17.6	27°28.6	31.0	323°51.6	34.4	327°13.0	57.0
12	172°23.4	324°06.1	S12°18.7	42°29.5	N19°30.6	338°53.6	S04°34.6	342°15.2	S01°57.1
13	187°25.9	339°05.8	19.9	57°30.3	30.3	353°55.6	34.8	357°17.4	57.2
14	202°28.3	354°05.5	21.1	72°31.2	29.9	8°57.6	35.0	12°19.6	57.3
15	217°30.8	9°05.3	·· 22.2	87°32.0	·· 29.5	23°59.6	·· 35.2	27°21.7	·· 57.5
16	232°33.2	24°05.0	23.4	102°32.9	29.1	39°01.5	35.4	42°23.9	57.6
17	247°35.7	39°04.7	24.6	117°33.8	28.8	54°03.5	35.6	57°26.1	57.7
18	262°38.2	54°04.4	S12°25.8	132°34.6	N19°28.4	69°05.5	S04°35.8	72°28.3	S01°57.8
19	277°40.6	69°04.1	26.9	147°35.5	28.0	84°07.5	36.0	87°30.5	57.9
20	292°43.1	84°03.9	28.1	162°36.3	27.6	99°09.5	36.2	102°32.7	58.1
21	307°45.6	99°03.6	·· 29.3	177°37.2	·· 27.3	114°11.5	·· 36.4	117°34.9	·· 58.2
22	322°48.0	114°03.3	30.4	192°38.0	26.9	129°13.5	36.6	132°37.1	58.3
23	337°50.5	129°03.0	31.6	207°38.9	26.5	144°15.5	36.8	147°39.3	58.4
Mer.pass. 00:32		ν -0.3′	d 1.2′	m -4.03	ν 0.9′	d 0.4′	m 1.61	ν 2.0′	d 0.2′ m -1.69	ν 2.2′	d 0.1′ m 0.91

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	352°53.0	144°02.7	S12°32.8	222°39.7	N19°26.1	159°17.4	S04°37.0	162°41.5	S01°58.5
1	7°55.4	159°02.4	33.9	237°40.6	25.8	174°19.4	37.2	177°43.7	58.6
2	22°57.9	174°02.2	35.1	252°41.4	25.4	189°21.4	37.4	192°45.9	58.8
3	38°00.4	189°01.9	·· 36.3	267°42.3	·· 25.0	204°23.4	·· 37.6	207°48.1	·· 58.9
4	53°02.8	204°01.6	37.4	282°43.2	24.6	219°25.4	37.8	222°50.3	59.0
5	68°05.3	219°01.3	38.6	297°44.0	24.3	234°27.4	38.0	237°52.4	59.1
6	83°07.7	234°01.0	S12°39.8	312°44.9	N19°23.9	249°29.4	S04°38.2	252°54.6	S01°59.2
7	98°10.2	249°00.7	40.9	327°45.7	23.5	264°31.3	38.4	267°56.8	59.4
8	113°12.7	264°00.4	42.1	342°46.6	23.1	279°33.3	38.6	282°59.0	59.5
9	128°15.1	279°00.2	·· 43.2	357°47.4	·· 22.7	294°35.3	·· 38.8	298°01.2	·· 59.6
10	143°17.6	293°59.9	44.4	12°48.3	22.4	309°37.3	39.0	313°03.4	59.7
11	158°20.1	308°59.6	45.6	27°49.2	22.0	324°39.3	39.3	328°05.6	59.8
12	173°22.5	323°59.3	S12°46.7	42°50.0	N19°21.6	339°41.3	S04°39.5	343°07.8	S01°59.9
13	188°25.0	338°59.0	47.9	57°50.9	21.2	354°43.3	39.7	358°10.0	02°00.1
14	203°27.5	353°58.7	49.1	72°51.7	20.8	9°45.2	39.9	13°12.2	00.2
15	218°29.9	8°58.4	·· 50.2	87°52.6	·· 20.5	24°47.2	·· 40.1	28°14.4	·· 00.3
16	233°32.4	23°58.2	51.4	102°53.5	20.1	39°49.2	40.3	43°16.6	00.4
17	248°34.8	38°57.9	52.5	117°54.3	19.7	54°51.2	40.5	58°18.8	00.5
18	263°37.3	53°57.6	S12°53.7	132°55.2	N19°19.3	69°53.2	S04°40.7	73°20.9	S02°00.6
19	278°39.8	68°57.3	54.9	147°56.0	18.9	84°55.2	40.9	88°23.1	00.8
20	293°42.2	83°57.0	56.0	162°56.9	18.6	99°57.2	41.1	103°25.3	00.9
21	308°44.7	98°56.7	·· 57.2	177°57.8	·· 18.2	114°59.1	·· 41.3	118°27.5	·· 01.0
22	323°47.2	113°56.4	58.3	192°58.6	17.8	130°01.1	41.5	133°29.7	01.1
23	338°49.6	128°56.1	59.5	207°59.5	17.4	145°03.1	41.7	148°31.9	01.2
Mer.pass. 00:28		ν -0.3′	d 1.2′	m -4.03	ν 0.9′	d 0.4′	m 1.60	ν 2.0′	d 0.2′ m -1.69	ν 2.2′	d 0.1′ m 0.91

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	353°52.1	143°55.8	S13°00.6	223°00.3	N19°17.0	160°05.1	S04°41.9	163°34.1	S02°01.4
1	8°54.6	158°55.6	01.8	238°01.2	16.7	175°07.1	42.1	178°36.3	01.5
2	23°57.0	173°55.3	02.9	253°02.1	16.3	190°09.1	42.3	193°38.5	01.6
3	38°59.5	188°55.0	·· 04.1	268°02.9	·· 15.9	205°11.1	·· 42.5	208°40.7	·· 01.7
4	54°02.0	203°54.7	05.3	283°03.8	15.5	220°13.0	42.7	223°42.9	01.8
5	69°04.4	218°54.4	06.4	298°04.6	15.1	235°15.0	42.9	238°45.1	01.9
6	84°06.9	233°54.1	S13°07.6	313°05.5	N19°14.7	250°17.0	S04°43.1	253°47.2	S02°02.1
7	99°09.3	248°53.8	08.7	328°06.4	14.4	265°19.0	43.3	268°49.4	02.2
8	114°11.8	263°53.5	09.9	343°07.2	14.0	280°21.0	43.5	283°51.6	02.3
9	129°14.3	278°53.2	·· 11.0	358°08.1	·· 13.6	295°23.0	·· 43.7	298°53.8	·· 02.4
10	144°16.7	293°52.9	12.2	13°09.0	13.2	310°24.9	43.9	313°56.0	02.5
11	159°19.2	308°52.6	13.3	28°09.8	12.8	325°26.9	44.1	328°58.2	02.7
12	174°21.7	323°52.4	S13°14.5	43°10.7	N19°12.4	340°28.9	S04°44.3	344°00.4	S02°02.8
13	189°24.1	338°52.1	15.6	58°11.5	12.1	355°30.9	44.5	359°02.6	02.9
14	204°26.6	353°51.8	16.8	73°12.4	11.7	10°32.9	44.7	14°04.8	03.0
15	219°29.1	8°51.5	·· 17.9	88°13.3	·· 11.3	25°34.9	·· 44.9	29°07.0	·· 03.1
16	234°31.5	23°51.2	19.1	103°14.1	10.9	40°36.8	45.2	44°09.2	03.2
17	249°34.0	38°50.9	20.2	118°15.0	10.5	55°38.8	45.4	59°11.3	03.4
18	264°36.4	53°50.6	S13°21.4	133°15.9	N19°10.1	70°40.8	S04°45.6	74°13.5	S02°03.5
19	279°38.9	68°50.3	22.5	148°16.7	09.8	85°42.8	45.8	89°15.7	03.6
20	294°41.4	83°50.0	23.7	163°17.6	09.4	100°44.8	46.0	104°17.9	03.7
21	309°43.8	98°49.7	·· 24.8	178°18.5	·· 09.0	115°46.8	·· 46.2	119°20.1	·· 03.8
22	324°46.3	113°49.4	25.9	193°19.3	08.6	130°48.8	46.4	134°22.3	04.0
23	339°48.8	128°49.1	27.1	208°20.2	08.2	145°50.7	46.6	149°24.5	04.1
Mer.pass. 00:24		ν -0.3′	d 1.2′	m -4.04	ν 0.9′	d 0.4′	m 1.60	ν 2.0′	d 0.2′ m -1.69	ν 2.2′	d 0.1′ m 0.91

Stars

	SHA	Dec
Alpheratz	358°08.3	28°59.4
Ankaa	353°39.1	-42°24.3
Schedar	350°07.7	56°26.1
Diphda	349°19.9	-18°05.2
Achernar	335°44.2	-57°19.7
Hamal	328°27.9	23°22.5
Polaris	326°24.6	89°10.6
Acamar	315°36.4	-40°22.5
Menkar	314°40.2	4°01.1
Mirfak	309°14.9	49°47.6
Aldebaran	291°17.1	16°28.4
Rigel	281°35.3	-8°13.2
Capella	281°10.3	45°58.6
Bellatrix	278°58.0	6°20.1
Elnath	278°43.3	28°35.5
Alnilam	276°11.0	-1°12.7
Betelgeuse	271°27.6	7°24.3
Canopus	264°07.0	-52°40.8
Sirius	258°55.2	-16°41.2
Adhara	255°31.7	-28°56.6
Procyon	245°25.2	5°16.5
Pollux	243°57.5	28°04.3
Avior	234°28.4	-59°26.8
Suhail	223°10.6	-43°21.2
Miaplacidus	221°45.6	-69°38.3
Alphard	218°20.2	-8°34.5
Regulus	208°09.6	12°03.6
Dubhe	194°21.9	61°51.1
Denebola	182°58.7	14°40.7
Gienah	176°17.6	-17°26.2
Acrux	173°37.2	-62°59.8
Gacrux	172°28.6	-57°00.5
Alioth	166°42.4	56°03.8
Spica	158°57.1	-11°03.8
Alkaid	153°18.3	49°24.6
Hadar	149°22.9	-60°17.1
Menkent	148°36.5	-36°16.7
Arcturus	146°18.1	19°16.9
Rigil Kent.	140°25.3	-60°45.5
Kochab	137°19.7	74°14.2
Zuben'ubi	137°32.5	-15°57.8
Alphecca	126°31.7	26°46.9
Antares	112°56.1	-26°23.5
Atria	108°19.8	-68°59.9
Sabik	102°40.4	-15°42.1
Shaula	96°54.8	-37°05.5
Rasalhague	96°28.9	12°34.6
Eltanin	90°57.3	51°29.8
Kaus Aust.	84°15.8	-34°23.7
Vega	80°55.2	38°46.3
Nunki	76°28.2	-26°19.2
Altair	62°31.7	8°49.3
Peacock	53°56.9	-56°47.8
Deneb	49°47.7	45°13.1
Enif	34°10.6	9°47.5
Al Na'ir	28°13.6	-47°03.0
Fomalhaut	15°50.3	-29°43.2
Scheat	14°16.5	27°59.1
Markab	14°02.2	15°06.5

Sep 13 Sun	SHA	Mer.pass
Venus	152°15.6	14:24
Mars	230°25.4	09:10
Jupiter	166°35.9	13:24
Saturn	169°55.0	13:11

Sep 14 Mon	SHA	Mer.pass
Venus	151°09.8	14:24
Mars	229°46.8	09:09
Jupiter	166°24.5	13:21
Saturn	169°48.5	13:07

Sep 15 Tue	SHA	Mer.pass
Venus	150°03.8	14:25
Mars	229°08.2	09:07
Jupiter	166°13.0	13:18
Saturn	169°42.0	13:04

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h — Sun — Moon

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	180°58.9	N03°55.0	13°35.8	9.8′	S12°14.8	10.5′	58.3′
1	195°59.1	54.0	28°04.5	9.8′	12°04.3	10.5′	58.3′
2	210°59.3	53.1	42°33.3	9.8′	11°53.8	10.6′	58.3′
3	225°59.5	·· 52.1	57°02.1	9.8′	11°43.2	10.6′	58.3′
4	240°59.8	51.1	71°30.9	9.8′	11°32.6	10.8′	58.4′
5	256°00.0	50.2	85°59.7	9.8′	11°21.8	10.8′	58.4′
6	271°00.2	N03°49.2	100°28.6	9.8′	S11°11.0	10.9′	58.4′
7	286°00.4	48.3	114°57.4	9.8′	11°00.1	10.9′	58.5′
8	301°00.6	47.3	129°26.2	9.8′	10°49.2	11.0′	58.5′
9	316°00.9	·· 46.4	143°55.1	9.9′	10°38.2	11.1′	58.5′
10	331°01.1	45.4	158°23.9	9.9′	10°27.1	11.2′	58.6′
11	346°01.3	44.4	172°52.8	9.9′	10°15.9	11.3′	58.6′
12	1°01.5	N03°43.5	187°21.7	9.9′	S10°04.6	11.3′	58.6′
13	16°01.8	42.5	201°50.5	9.9′	09°53.3	11.3′	58.6′
14	31°02.0	41.6	216°19.4	9.9′	09°42.0	11.5′	58.7′
15	46°02.2	·· 40.6	230°48.3	9.9′	09°30.5	11.5′	58.7′
16	61°02.4	39.7	245°17.2	9.9′	09°19.0	11.6′	58.7′
17	76°02.6	38.7	259°46.1	9.9′	09°07.4	11.6′	58.7′
18	91°02.9	N03°37.7	274°15.0	9.9′	S08°55.8	11.7′	58.8′
19	106°03.1	36.8	288°43.9	9.9′	08°44.1	11.7′	58.8′
20	121°03.3	35.8	303°12.8	9.9′	08°32.4	11.8′	58.8′
21	136°03.5	·· 34.9	317°41.8	9.9′	08°20.6	11.9′	58.8′
22	151°03.8	33.9	332°10.7	9.9′	08°08.7	11.9′	58.9′
23	166°04.0	33.0	346°39.6	9.9′	07°56.8	12.0′	58.9′
	SD = 15.9′	d = 1.0′		SD = 15.9′			

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	181°04.2	N03°32.0	1°08.6	9.9′	S07°44.8	12.0′	58.9′
1	196°04.4	31.0	15°37.5	9.9′	07°32.8	12.1′	58.9′
2	211°04.6	30.1	30°06.4	9.9′	07°20.7	12.2′	59.0′
3	226°04.9	·· 29.1	44°35.4	9.9′	07°08.5	12.2′	59.0′
4	241°05.1	28.2	59°04.3	9.9′	06°56.3	12.2′	59.0′
5	256°05.3	27.2	73°33.3	10.0′	06°44.1	12.3′	59.0′
6	271°05.5	N03°26.2	88°02.2	10.0′	S06°31.8	12.3′	59.1′
7	286°05.8	25.3	102°31.2	10.0′	06°19.5	12.4′	59.1′
8	301°06.0	24.3	117°00.1	10.0′	06°07.1	12.4′	59.1′
9	316°06.2	·· 23.4	131°29.1	10.0′	05°54.7	12.5′	59.1′
10	331°06.4	22.4	145°58.0	10.0′	05°42.2	12.5′	59.2′
11	346°06.6	21.4	160°27.0	10.0′	05°29.7	12.5′	59.2′
12	1°06.9	N03°20.5	174°55.9	10.0′	S05°17.2	12.6′	59.2′
13	16°07.1	19.5	189°24.9	10.0′	05°04.6	12.7′	59.2′
14	31°07.3	18.6	203°53.8	9.9′	04°51.9	12.6′	59.2′
15	46°07.5	·· 17.6	218°22.8	9.9′	04°39.3	12.7′	59.3′
16	61°07.8	16.6	232°51.7	9.9′	04°26.6	12.8′	59.3′
17	76°08.0	15.7	247°20.7	9.9′	04°13.8	12.7′	59.3′
18	91°08.2	N03°14.7	261°49.6	9.9′	S04°01.1	12.8′	59.3′
19	106°08.4	13.8	276°18.6	9.9′	03°48.3	12.8′	59.3′
20	121°08.7	12.8	290°47.5	9.9′	03°35.5	12.9′	59.4′
21	136°08.9	·· 11.8	305°16.4	9.9′	03°22.6	12.9′	59.4′
22	151°09.1	10.9	319°45.3	9.9′	03°09.7	12.9′	59.4′
23	166°09.3	09.9	334°14.3	9.9′	02°56.8	12.9′	59.4′
	SD = 15.9′	d = 1.0′		SD = 16.1′			

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	181°09.5	N03°09.0	348°43.2	9.9′	S02°43.9	13.0′	59.4′
1	196°09.8	08.0	3°12.1	9.9′	02°30.9	13.0′	59.5′
2	211°10.0	07.0	17°41.0	9.9′	02°17.9	13.0′	59.5′
3	226°10.2	·· 06.1	32°09.9	9.9′	02°04.9	13.0′	59.5′
4	241°10.4	05.1	46°38.7	9.9′	01°51.9	13.0′	59.5′
5	256°10.7	04.2	61°07.6	9.9′	01°38.9	13.1′	59.5′
6	271°10.9	N03°03.2	75°36.5	9.9′	S01°25.8	13.0′	59.5′
7	286°11.1	02.2	90°05.3	9.8′	01°12.8	13.1′	59.6′
8	301°11.3	01.3	104°34.2	9.8′	00°59.7	13.1′	59.6′
9	316°11.5	03°00.3	119°03.0	9.8′	00°46.6	13.1′	59.6′
10	331°11.8	02°59.3	133°31.8	9.8′	00°33.5	13.1′	59.6′
11	346°12.0	58.4	148°00.6	9.8′	00°20.4	13.1′	59.6′
12	1°12.2	N02°57.4	162°29.4	9.8′	S00°07.3	13.2′	59.6′
13	16°12.4	56.5	176°58.2	9.8′	N00°05.9	13.1′	59.6′
14	31°12.7	55.5	191°27.0	9.8′	00°19.0	13.1′	59.7′
15	46°12.9	·· 54.5	205°55.7	9.7′	00°32.1	13.2′	59.7′
16	61°13.1	53.6	220°24.4	9.7′	00°45.3	13.1′	59.7′
17	76°13.3	52.6	234°53.2	9.7′	00°58.4	13.1′	59.7′
18	91°13.6	N02°51.6	249°21.9	9.7′	N01°11.5	13.2′	59.7′
19	106°13.8	50.7	263°50.5	9.7′	01°24.7	13.1′	59.7′
20	121°14.0	49.7	278°19.2	9.7′	01°37.8	13.1′	59.7′
21	136°14.2	·· 48.8	292°47.9	9.6′	01°50.9	13.2′	59.7′
22	151°14.4	47.8	307°16.5	9.6′	02°04.1	13.1′	59.7′
23	166°14.7	46.8	321°45.1	9.6′	02°17.2	13.1′	59.8′
	SD = 15.9′	d = 1.0′		SD = 16.2′			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	01:57	03:49	05:02	18:46	19:58	21:46
N 70°	02:32	04:03	05:08	18:41	19:45	21:14
68°	02:56	04:14	05:12	18:37	19:34	20:51
66°	03:14	04:23	05:16	18:33	19:26	20:34
64°	03:28	04:31	05:20	18:30	19:18	20:20
62°	03:40	04:37	05:22	18:27	19:12	20:09
60°	03:50	04:42	05:25	18:25	19:07	19:59
N 58°	03:58	04:47	05:27	18:23	19:02	19:51
56°	04:06	04:51	05:29	18:21	18:58	19:44
54°	04:12	04:55	05:31	18:19	18:55	19:38
52°	04:17	04:58	05:33	18:17	18:52	19:32
50°	04:22	05:01	05:34	18:16	18:49	19:27
45°	04:32	05:08	05:37	18:13	18:43	19:18
N 40°	04:40	05:12	05:40	18:11	18:38	19:10
35°	04:47	05:16	05:42	18:09	18:34	19:04
30°	04:52	05:20	05:44	18:07	18:31	18:59
20°	04:59	05:25	05:47	18:04	18:26	18:51
N 10°	05:04	05:29	05:50	18:01	18:22	18:47
0°	05:08	05:32	05:52	17:59	18:19	18:44
S 10°	05:09	05:34	05:55	17:57	18:18	18:42
20°	05:10	05:35	05:57	17:54	18:16	18:42
30°	05:08	05:36	06:00	17:52	18:16	18:43
35°	05:07	05:36	06:01	17:50	18:16	18:45
40°	05:05	05:36	06:03	17:49	18:16	18:47
45°	05:01	05:35	06:05	17:47	18:16	18:51
S 50°	04:57	05:35	06:07	17:45	18:17	18:55
52°	04:55	05:34	06:08	17:44	18:18	18:57
54°	04:53	05:34	06:09	17:43	18:18	19:00
56°	04:50	05:33	06:10	17:42	18:19	19:03
58°	04:47	05:32	06:11	17:41	18:20	19:06
S 60°	04:43	05:32	06:13	17:40	18:21	19:10

Lat.	Moonrise Sun	Moonrise Mon	Moonrise Tue	Moonset Sun	Moonset Mon	Moonset Tue
N 72°	19:40	19:24	19:09	02:28	04:37	06:41
N 70°	19:27	19:19	19:11	02:50	04:47	06:43
68°	19:16	19:14	19:12	03:07	04:56	06:45
66°	19:07	19:11	19:14	03:21	05:03	06:46
64°	19:00	19:08	19:15	03:32	05:09	06:47
62°	18:54	19:05	19:15	03:41	05:14	06:48
60°	18:48	19:02	19:16	03:49	05:18	06:49
N 58°	18:43	19:00	19:17	03:56	05:22	06:50
56°	18:39	18:58	19:18	04:03	05:26	06:51
54°	18:35	18:57	19:18	04:08	05:29	06:51
52°	18:31	18:55	19:19	04:13	05:32	06:52
50°	18:28	18:54	19:19	04:18	05:34	06:53
45°	18:20	18:51	19:20	04:27	05:40	06:54
N 40°	18:14	18:48	19:21	04:35	05:44	06:55
35°	18:09	18:46	19:22	04:42	05:48	06:55
30°	18:05	18:44	19:23	04:48	05:52	06:56
20°	17:57	18:40	19:24	04:59	05:58	06:57
N 10°	17:50	18:37	19:25	05:08	06:03	06:58
0°	17:43	18:35	19:26	05:16	06:08	06:59
S 10°	17:36	18:32	19:27	05:24	06:12	07:00
20°	17:29	18:29	19:29	05:33	06:17	07:01
30°	17:21	18:25	19:30	05:43	06:23	07:02
35°	17:17	18:23	19:31	05:49	06:26	07:02
40°	17:11	18:21	19:32	05:55	06:30	07:03
45°	17:05	18:18	19:33	06:03	06:34	07:04
S 50°	16:58	18:15	19:34	06:12	06:39	07:05
52°	16:54	18:14	19:35	06:16	06:41	07:05
54°	16:50	18:12	19:35	06:21	06:44	07:05
56°	16:46	18:10	19:36	06:26	06:46	07:06
58°	16:41	18:09	19:37	06:31	06:50	07:06
S 60°	16:36	18:06	19:38	06:37	06:53	07:07

Day	Sun Eqn.of Time 00h	Sun Eqn.of Time 12h	Sun Mer. Pass	Moon Mer.Pass. Upper	Moon Mer.Pass. Lower	Age
	mm:ss	mm:ss	hh:mm	hh:mm	hh:mm	15-17 98-99%
13	03:56	04:06	11:56	23:55	11:30	
14	04:17	04:27	11:56	–:–	12:21	
15	04:38	04:49	11:55	00:47	13:13	

September 16, 17, 18 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	354°51.2	143°48.8	S13°28.2	223°21.1	N19°07.8	160°52.7	S04°46.8	164°26.7	S02°04.2
1	9°53.7	158°48.5	29.4	238°21.9	07.4	175°54.7	47.0	179°28.9	04.3
2	24°56.2	173°48.2	30.5	253°22.8	07.1	190°56.7	47.2	194°31.1	04.4
3	39°58.6	188°47.9	·· 31.7	268°23.7	·· 06.7	205°58.7	·· 47.4	209°33.3	·· 04.5
4	55°01.1	203°47.6	32.8	283°24.5	06.3	221°00.7	47.6	224°35.4	04.7
5	70°03.6	218°47.3	34.0	298°25.4	05.9	236°02.6	47.8	239°37.6	04.8
6	85°06.0	233°47.0	S13°35.1	313°26.3	N19°05.5	251°04.6	S04°48.0	254°39.8	S02°04.9
7	100°08.5	248°46.7	36.2	328°27.1	05.1	266°06.6	48.2	269°42.0	05.0
8	115°10.9	263°46.4	37.4	343°28.0	04.7	281°08.6	48.4	284°44.2	05.1
9	130°13.4	278°46.1	·· 38.5	358°28.9	·· 04.3	296°10.6	·· 48.6	299°46.4	·· 05.3
10	145°15.9	293°45.8	39.7	13°29.7	04.0	311°12.5	48.8	314°48.6	05.4
11	160°18.3	308°45.5	40.8	28°30.6	03.6	326°14.5	49.0	329°50.8	05.5
12	175°20.8	323°45.2	S13°41.9	43°31.5	N19°03.2	341°16.5	S04°49.2	344°53.0	S02°05.6
13	190°23.3	338°44.9	43.1	58°32.3	02.8	356°18.5	49.4	359°55.2	05.7
14	205°25.7	353°44.6	44.2	73°33.2	02.4	11°20.5	49.6	14°57.4	05.8
15	220°28.2	8°44.3	·· 45.3	88°34.1	·· 02.0	26°22.5	·· 49.8	29°59.5	·· 06.0
16	235°30.7	23°44.0	46.5	103°34.9	01.6	41°24.4	50.0	45°01.7	06.1
17	250°33.1	38°43.7	47.6	118°35.8	01.2	56°26.4	50.2	60°03.9	06.2
18	265°35.6	53°43.4	S13°48.8	133°36.7	N19°00.8	71°28.4	S04°50.4	75°06.1	S02°06.3
19	280°38.1	68°43.1	49.9	148°37.6	00.5	86°30.4	50.7	90°08.3	06.4
20	295°40.5	83°42.8	51.0	163°38.4	19°00.1	101°32.4	50.9	105°10.5	06.6
21	310°43.0	98°42.5	·· 52.2	178°39.3	18°59.7	116°34.4	·· 51.1	120°12.7	·· 06.7
22	325°45.4	113°42.2	53.3	193°40.2	59.3	131°36.3	51.3	135°14.9	06.8
23	340°47.9	128°41.9	54.4	208°41.0	58.9	146°38.3	51.5	150°17.1	06.9
Mer.pass. 00:21		ν -0.3′	d 1.1′	m -4.04	ν 0.9′	d 0.4′	m 1.60	ν 2.0′	d 0.2′ m -1.69	ν 2.2′	d 0.1′ m 0.91

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	355°50.4	143°41.6	S13°55.6	223°41.9	N18°58.5	161°40.3	S04°51.7	165°19.3	S02°07.0
1	10°52.8	158°41.3	56.7	238°42.8	58.1	176°42.3	51.9	180°21.4	07.1
2	25°55.3	173°41.0	57.8	253°43.7	57.7	191°44.3	52.1	195°23.6	07.3
3	40°57.8	188°40.7	13°58.9	268°44.5	·· 57.3	206°46.2	·· 52.3	210°25.8	·· 07.4
4	56°00.2	203°40.4	14°00.1	283°45.4	56.9	221°48.2	52.5	225°28.0	07.5
5	71°02.7	218°40.1	01.2	298°46.3	56.6	236°50.2	52.7	240°30.2	07.6
6	86°05.2	233°39.8	S14°02.3	313°47.1	N18°56.2	251°52.2	S04°52.9	255°32.4	S02°07.7
7	101°07.6	248°39.5	03.5	328°48.0	55.8	266°54.2	53.1	270°34.6	07.9
8	116°10.1	263°39.2	04.6	343°48.9	55.4	281°56.2	53.3	285°36.8	08.0
9	131°12.5	278°38.9	·· 05.7	358°49.8	·· 55.0	296°58.1	·· 53.5	300°39.0	·· 08.1
10	146°15.0	293°38.6	06.8	13°50.6	54.6	312°00.1	53.7	315°41.1	08.2
11	161°17.5	308°38.3	08.0	28°51.5	54.2	327°02.1	53.9	330°43.3	08.3
12	176°19.9	323°37.9	S14°09.1	43°52.4	N18°53.8	342°04.1	S04°54.1	345°45.5	S02°08.4
13	191°22.4	338°37.6	10.2	58°53.3	53.4	357°06.1	54.3	0°47.7	08.6
14	206°24.9	353°37.3	11.4	73°54.1	53.0	12°08.0	54.5	15°49.9	08.7
15	221°27.3	8°37.0	·· 12.5	88°55.0	·· 52.6	27°10.0	·· 54.7	30°52.1	·· 08.8
16	236°29.8	23°36.7	13.6	103°55.9	52.2	42°12.0	54.9	45°54.3	08.9
17	251°32.3	38°36.4	14.7	118°56.8	51.8	57°14.0	55.1	60°56.5	09.0
18	266°34.7	53°36.1	S14°15.8	133°57.6	N18°51.4	72°16.0	S04°55.3	75°58.7	S02°09.2
19	281°37.2	68°35.8	17.0	148°58.5	51.1	87°17.9	55.6	91°00.9	09.3
20	296°39.7	83°35.5	18.1	163°59.4	50.7	102°19.9	55.8	106°03.0	09.4
21	311°42.1	98°35.2	·· 19.2	179°00.3	·· 50.3	117°21.9	·· 56.0	121°05.2	·· 09.5
22	326°44.6	113°34.9	20.3	194°01.1	49.9	132°23.9	56.2	136°07.4	09.6
23	341°47.0	128°34.5	21.5	209°02.0	49.5	147°25.9	56.4	151°09.6	09.7
Mer.pass. 00:17		ν -0.3′	d 1.1′	m -4.05	ν 0.9′	d 0.4′	m 1.60	ν 2.0′	d 0.2′ m -1.68	ν 2.2′	d 0.1′ m 0.90

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	356°49.5	143°34.2	S14°22.6	224°02.9	N18°49.1	162°27.8	S04°56.6	166°11.8	S02°09.9
1	11°52.0	158°33.9	23.7	239°03.8	48.7	177°29.8	56.8	181°14.0	10.0
2	26°54.4	173°33.6	24.8	254°04.6	48.3	192°31.8	57.0	196°16.2	10.1
3	41°56.9	188°33.3	·· 25.9	269°05.5	·· 47.9	207°33.8	·· 57.2	211°18.4	·· 10.2
4	56°59.4	203°33.0	27.0	284°06.4	47.5	222°35.8	57.4	226°20.6	10.3
5	72°01.8	218°32.7	28.2	299°07.3	47.1	237°37.7	57.6	241°22.7	10.5
6	87°04.3	233°32.4	S14°29.3	314°08.1	N18°46.7	252°39.7	S04°57.8	256°24.9	S02°10.6
7	102°06.8	248°32.0	30.4	329°09.0	46.3	267°41.7	58.0	271°27.1	10.7
8	117°09.2	263°31.7	31.5	344°09.9	45.9	282°43.7	58.2	286°29.3	10.8
9	132°11.7	278°31.4	·· 32.6	359°10.8	·· 45.5	297°45.7	·· 58.4	301°31.5	·· 10.9
10	147°14.1	293°31.1	33.7	14°11.7	45.1	312°47.6	58.6	316°33.7	11.1
11	162°16.6	308°30.8	34.9	29°12.5	44.7	327°49.6	58.8	331°35.9	11.2
12	177°19.1	323°30.5	S14°36.0	44°13.4	N18°44.3	342°51.6	S04°59.0	346°38.1	S02°11.3
13	192°21.5	338°30.2	37.1	59°14.3	43.9	357°53.6	59.2	1°40.3	11.4
14	207°24.0	353°29.8	38.2	74°15.2	43.5	12°55.6	59.4	16°42.4	11.5
15	222°26.5	8°29.5	·· 39.3	89°16.1	·· 43.1	27°57.5	·· 59.6	31°44.6	·· 11.6
16	237°28.9	23°29.2	40.4	104°16.9	42.7	42°59.5	04°59.8	46°46.8	11.8
17	252°31.4	38°28.9	41.5	119°17.8	42.3	58°01.5	05°00.0	61°49.0	11.9
18	267°33.9	53°28.6	S14°42.6	134°18.7	N18°41.9	73°03.5	S05°00.3	76°51.2	S02°12.0
19	282°36.3	68°28.3	43.7	149°19.6	41.5	88°05.5	00.5	91°53.4	12.1
20	297°38.8	83°27.9	44.9	164°20.5	41.1	103°07.4	00.7	106°55.6	12.2
21	312°41.3	98°27.6	·· 46.0	179°21.3	·· 40.7	118°09.4	·· 00.9	121°57.8	·· 12.4
22	327°43.7	113°27.3	47.1	194°22.2	40.3	133°11.4	01.1	136°59.9	12.5
23	342°46.2	128°27.0	48.2	209°23.1	39.9	148°13.4	01.3	152°02.1	12.6
Mer.pass. 00:13		ν -0.3′	d 1.1′	m -4.05	ν 0.9′	d 0.4′	m 1.60	ν 2.0′	d 0.2′ m -1.68	ν 2.2′	d 0.1′ m 0.90

Stars

	SHA	Dec
Alpheratz	358°08.3	28°59.4
Ankaa	353°39.1	-42°24.3
Schedar	350°07.7	56°26.1
Diphda	349°19.9	-18°05.2
Achernar	335°44.2	-57°19.7
Hamal	328°27.9	23°22.5
Polaris	326°23.9	89°10.6
Acamar	315°36.4	-40°22.5
Menkar	314°40.2	4°01.1
Mirfak	309°14.9	49°47.6
Aldebaran	291°17.1	16°28.4
Rigel	281°35.3	-8°13.2
Capella	281°10.2	45°58.6
Bellatrix	278°58.0	6°20.1
Elnath	278°43.2	28°35.5
Alnilam	276°11.0	-1°12.7
Betelgeuse	271°27.6	7°24.3
Canopus	264°07.0	-52°40.8
Sirius	258°55.1	-16°41.2
Adhara	255°31.7	-28°56.6
Procyon	245°25.2	5°16.5
Pollux	243°57.5	28°04.3
Avior	234°28.3	-59°26.7
Suhail	223°10.6	-43°21.2
Miaplacidus	221°45.6	-69°38.3
Alphard	218°20.2	-8°34.5
Regulus	208°09.6	12°03.6
Dubhe	194°21.9	61°51.1
Denebola	182°58.7	14°40.7
Gienah	176°17.6	-17°26.2
Acrux	173°37.2	-62°59.8
Gacrux	172°28.6	-57°00.5
Alioth	166°42.4	56°03.8
Spica	158°57.1	-11°03.7
Alkaid	153°18.3	49°24.6
Hadar	149°22.9	-60°17.1
Menkent	148°36.5	-36°16.7
Arcturus	146°18.1	19°16.9
Rigil Kent.	140°25.4	-60°45.5
Kochab	137°19.7	74°14.2
Zuben'ubi	137°32.5	-15°57.8
Alphecca	126°31.7	26°46.9
Antares	112°56.1	-26°23.5
Atria	108°19.9	-68°59.9
Sabik	102°40.4	-15°42.1
Shaula	96°54.8	-37°05.5
Rasalhague	96°28.9	12°34.6
Eltanin	90°57.4	51°29.8
Kaus Aust.	84°15.9	-34°23.7
Vega	80°55.3	38°46.3
Nunki	76°28.2	-26°19.2
Altair	62°31.7	8°49.3
Peacock	53°56.9	-56°47.8
Deneb	49°47.7	45°13.1
Enif	34°10.6	9°47.5
Al Na'ir	28°13.6	-47°03.1
Fomalhaut	15°50.3	-29°43.2
Scheat	14°16.6	27°59.1
Markab	14°02.2	15°06.5

Sep 16 Wed	SHA	Mer.pass
Venus	148°57.6	14:25
Mars	228°29.8	09:06
Jupiter	166°01.5	13:15
Saturn	169°35.4	13:00

Sep 17 Thu	SHA	Mer.pass
Venus	147°51.2	14:26
Mars	227°51.5	09:05
Jupiter	165°49.9	13:12
Saturn	169°28.9	12:57

Sep 18 Fri	SHA	Mer.pass
Venus	146°44.7	14:26
Mars	227°13.4	09:03
Jupiter	165°38.3	13:08
Saturn	169°22.3	12:53

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	181°14.9	N02°45.9	336°13.7	9.6′	N02°30.3	13.1′	59.8′
1	196°15.1	44.9	350°42.3	9.6′	02°43.4	13.1′	59.8′
2	211°15.3	43.9	5°10.8	9.5′	02°56.5	13.0′	59.8′
3	226°15.6	·· 43.0	19°39.4	9.5′	03°09.5	13.1′	59.8′
4	241°15.8	42.0	34°07.9	9.5′	03°22.6	13.0′	59.8′
5	256°16.0	41.0	48°36.4	9.5′	03°35.6	13.0′	59.8′
6	271°16.2	N02°40.1	63°04.8	9.4′	N03°48.6	13.0′	59.8′
7	286°16.5	39.1	77°33.3	9.4′	04°01.6	13.0′	59.8′
8	301°16.7	38.2	92°01.7	9.4′	04°14.6	13.0′	59.8′
9	316°16.9	·· 37.2	106°30.1	9.4′	04°27.6	12.9′	59.8′
10	331°17.1	36.2	120°58.5	9.3′	04°40.5	12.9′	59.8′
11	346°17.3	35.3	135°26.8	9.3′	04°53.4	12.9′	59.8′
12	1°17.6	N02°34.3	149°55.1	9.3′	N05°06.3	12.8′	59.9′
13	16°17.8	33.3	164°23.4	9.3′	05°19.1	12.8′	59.9′
14	31°18.0	32.4	178°51.7	9.2′	05°31.9	12.8′	59.9′
15	46°18.2	·· 31.4	193°19.9	9.2′	05°44.7	12.8′	59.9′
16	61°18.5	30.4	207°48.1	9.2′	05°57.5	12.7′	59.9′
17	76°18.7	29.5	222°16.3	9.1′	06°10.2	12.7′	59.9′
18	91°18.9	N02°28.5	236°44.4	9.1′	N06°22.9	12.6′	59.9′
19	106°19.1	27.5	251°12.6	9.1′	06°35.5	12.6′	59.9′
20	121°19.4	26.6	265°40.7	9.1′	06°48.1	12.6′	59.9′
21	136°19.6	·· 25.6	280°08.7	9.0′	07°00.7	12.5′	59.9′
22	151°19.8	24.6	294°36.7	9.0′	07°13.2	12.5′	59.9′
23	166°20.0	23.7	309°04.7	9.0′	07°25.7	12.5′	59.9′
	SD = 15.9′	d = 1.0′	SD = 16.3′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	181°20.3	N02°22.7	323°32.7	8.9′	N07°38.2	12.4′	59.9′
1	196°20.5	21.8	338°00.6	8.9′	07°50.6	12.3′	59.9′
2	211°20.7	20.8	352°28.5	8.9′	08°02.9	12.3′	59.9′
3	226°20.9	·· 19.8	6°56.4	8.8′	08°15.2	12.3′	59.9′
4	241°21.1	18.9	21°24.2	8.8′	08°27.5	12.2′	59.9′
5	256°21.4	17.9	35°52.0	8.8′	08°39.7	12.1′	59.9′
6	271°21.6	N02°16.9	50°19.8	8.7′	N08°51.8	12.1′	59.9′
7	286°21.8	16.0	64°47.5	8.7′	09°03.9	12.0′	59.9′
8	301°22.0	15.0	79°15.2	8.7′	09°15.9	12.0′	59.9′
9	316°22.3	·· 14.0	93°42.9	8.6′	09°27.9	11.9′	59.9′
10	331°22.5	13.1	108°10.5	8.6′	09°39.8	11.9′	59.9′
11	346°22.7	12.1	122°38.1	8.5′	09°51.7	11.8′	59.9′
12	1°22.9	N02°11.1	137°05.6	8.5′	N10°03.5	11.7′	59.9′
13	16°23.2	10.2	151°33.2	8.5′	10°15.2	11.7′	59.9′
14	31°23.4	09.2	166°00.6	8.4′	10°26.9	11.6′	59.9′
15	46°23.6	·· 08.2	180°28.1	8.4′	10°38.5	11.6′	59.9′
16	61°23.8	07.3	194°55.5	8.4′	10°50.1	11.4′	59.9′
17	76°24.0	06.3	209°22.8	8.3′	11°01.5	11.4′	59.9′
18	91°24.3	N02°05.3	223°50.2	8.3′	N11°12.9	11.4′	59.9′
19	106°24.5	04.4	238°17.4	8.2′	11°24.3	11.2′	59.9′
20	121°24.7	03.4	252°44.7	8.2′	11°35.5	11.2′	59.9′
21	136°24.9	·· 02.4	267°11.9	8.2′	11°46.7	11.1′	59.9′
22	151°25.2	01.5	281°39.1	8.1′	11°57.8	11.1′	59.8′
23	166°25.4	00.5	296°06.2	8.1′	12°08.9	10.9′	59.8′
	SD = 15.9′	d = 1.0′	SD = 16.3′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	181°25.6	N01°59.5	310°33.3	8.1′	N12°19.8	10.9′	59.8′
1	196°25.8	58.6	325°00.3	8.0′	12°30.7	10.8′	59.8′
2	211°26.0	57.6	339°27.3	8.0′	12°41.5	10.7′	59.8′
3	226°26.3	·· 56.6	353°54.3	7.9′	12°52.2	10.7′	59.8′
4	241°26.5	55.7	8°21.3	7.9′	13°02.9	10.5′	59.8′
5	256°26.7	54.7	22°48.1	7.9′	13°13.4	10.5′	59.8′
6	271°26.9	N01°53.7	37°15.0	7.8′	N13°23.9	10.4′	59.8′
7	286°27.2	52.7	51°41.8	7.8′	13°34.3	10.3′	59.8′
8	301°27.4	51.8	66°08.6	7.7′	13°44.6	10.2′	59.8′
9	316°27.6	·· 50.8	80°35.3	7.7′	13°54.8	10.1′	59.8′
10	331°27.8	49.8	95°02.0	7.7′	14°04.9	10.0′	59.8′
11	346°28.1	48.9	109°28.7	7.6′	14°14.9	9.9′	59.8′
12	1°28.3	N01°47.9	123°55.3	7.6′	N14°24.8	9.9′	59.7′
13	16°28.5	46.9	138°21.9	7.5′	14°34.7	9.7′	59.7′
14	31°28.7	46.0	152°48.4	7.5′	14°44.4	9.6′	59.7′
15	46°28.9	·· 45.0	167°14.9	7.5′	14°54.0	9.6′	59.7′
16	61°29.2	44.0	181°41.3	7.4′	15°03.6	9.4′	59.7′
17	76°29.4	43.1	196°07.8	7.4′	15°13.0	9.4′	59.7′
18	91°29.6	N01°42.1	210°34.1	7.3′	N15°22.4	9.2′	59.7′
19	106°29.8	41.1	225°00.5	7.3′	15°31.6	9.2′	59.7′
20	121°30.1	40.2	239°26.8	7.3′	15°40.8	9.0′	59.7′
21	136°30.3	·· 39.2	253°53.0	7.2′	15°49.8	9.0′	59.7′
22	151°30.5	38.2	268°19.3	7.2′	15°58.8	8.8′	59.6′
23	166°30.7	37.3	282°45.5	7.1′	16°07.6	8.7′	59.6′
	SD = 15.9′	d = 1.0′	SD = 16.3′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	02:22	04:04	05:15	18:31	19:41	21:20
N 70°	02:50	04:16	05:19	18:27	19:30	20:54
68°	03:11	04:26	05:23	18:24	19:21	20:35
66°	03:26	04:33	05:26	18:21	19:13	20:19
64°	03:39	04:40	05:28	18:19	19:07	20:07
62°	03:49	04:45	05:30	18:17	19:02	19:57
60°	03:58	04:50	05:32	18:16	18:57	19:49
N 58°	04:06	04:54	05:34	18:14	18:54	19:41
56°	04:12	04:57	05:35	18:13	18:50	19:35
54°	04:18	05:01	05:36	18:12	18:47	19:30
52°	04:23	05:03	05:37	18:10	18:44	19:25
50°	04:27	05:06	05:38	18:10	18:42	19:20
45°	04:36	05:11	05:41	18:07	18:37	19:12
N 40°	04:43	05:15	05:43	18:06	18:33	19:05
35°	04:49	05:19	05:44	18:04	18:30	18:59
30°	04:53	05:21	05:45	18:03	18:27	18:55
20°	05:00	05:26	05:48	18:01	18:23	18:49
N 10°	05:04	05:29	05:50	17:59	18:20	18:45
0°	05:07	05:31	05:51	17:58	18:18	18:42
S 10°	05:07	05:32	05:53	17:56	18:17	18:42
20°	05:07	05:32	05:54	17:55	18:17	18:42
30°	05:04	05:32	05:56	17:53	18:17	18:45
35°	05:02	05:32	05:57	17:53	18:18	18:47
40°	05:00	05:31	05:58	17:52	18:19	18:50
45°	04:56	05:30	05:59	17:51	18:20	18:54
S 50°	04:51	05:28	06:00	17:50	18:22	19:00
52°	04:48	05:27	06:01	17:49	18:23	19:02
54°	04:45	05:26	06:01	17:49	18:24	19:05
56°	04:42	05:25	06:02	17:48	18:25	19:09
58°	04:38	05:24	06:03	17:47	18:26	19:13
S 60°	04:34	05:22	06:04	17:47	18:28	19:17

Lat.	**Moonrise** Wed	Thu	Fri	**Moonset** Wed	Thu	Fri
N 72°	18:54	18:36	18:10	08:46	10:56	13:17
N 70°	19:03	18:54	18:44	08:40	10:40	12:45
68°	19:10	19:09	19:09	08:35	10:27	12:22
66°	19:17	19:21	19:28	08:31	10:17	12:04
64°	19:22	19:31	19:43	08:27	10:08	11:49
62°	19:27	19:40	19:56	08:24	10:01	11:37
60°	19:31	19:47	20:07	08:21	09:54	11:27
N 58°	19:34	19:54	20:17	08:19	09:49	11:18
56°	19:37	19:59	20:26	08:17	09:44	11:10
54°	19:40	20:05	20:33	08:15	09:39	11:03
52°	19:43	20:09	20:40	08:13	09:35	10:57
50°	19:45	20:14	20:46	08:12	09:32	10:51
45°	19:51	20:23	21:00	08:08	09:24	10:39
N 40°	19:55	20:31	21:11	08:06	09:17	10:29
35°	19:59	20:38	21:20	08:03	09:12	10:20
30°	20:02	20:44	21:28	08:01	09:07	10:13
20°	20:08	20:54	21:43	07:57	08:58	10:00
N 10°	20:14	21:04	21:56	07:54	08:51	09:49
0°	20:19	21:12	22:08	07:51	08:44	09:38
S 10°	20:24	21:21	22:20	07:48	08:37	09:28
20°	20:29	21:31	22:33	07:45	08:30	09:17
30°	20:35	21:41	22:48	07:41	08:21	09:04
35°	20:39	21:48	22:56	07:39	08:16	08:57
40°	20:43	21:55	23:06	07:36	08:11	08:48
45°	20:48	22:03	23:18	07:33	08:05	08:39
S 50°	20:54	22:14	23:32	07:30	07:57	08:27
52°	20:57	22:18	23:39	07:29	07:54	08:22
54°	20:59	22:24	23:46	07:27	07:50	08:16
56°	21:03	22:30	23:55	07:25	07:46	08:09
58°	21:06	22:36	·· ··	07:23	07:41	08:02
S 60°	21:11	22:44	·· ··	07:21	07:36	07:54

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 18-20 95-81%
16	05:00	05:10	11:55	01:39	14:05	
17	05:21	05:32	11:54	02:31	14:58	
18	05:42	05:53	11:54	03:25	15:53	

September 19, 20, 21 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	357°48.6	143°26.7	S14°49.3	224°24.0	N18°39.5	163°15.4	S05°01.5	167°04.3	S02°12.7
1	12°51.1	158°26.4	50.4	239°24.9	39.1	178°17.3	01.7	182°06.5	12.8
2	27°53.6	173°26.0	51.5	254°25.7	38.7	193°19.3	01.9	197°08.7	13.0
3	42°56.0	188°25.7	·· 52.6	269°26.6	·· 38.3	208°21.3	·· 02.1	212°10.9	·· 13.1
4	57°58.5	203°25.4	53.7	284°27.5	37.9	223°23.3	02.3	227°13.1	13.2
5	73°01.0	218°25.1	54.8	299°28.4	37.5	238°25.2	02.5	242°15.3	13.3
6	88°03.4	233°24.8	S14°55.9	314°29.3	N18°37.1	253°27.2	S05°02.7	257°17.5	S02°13.4
7	103°05.9	248°24.4	57.0	329°30.2	36.7	268°29.2	02.9	272°19.6	13.5
8	118°08.4	263°24.1	58.1	344°31.0	36.3	283°31.2	03.1	287°21.8	13.7
9	133°10.8	278°23.8	14°59.2	359°31.9	·· 35.9	298°33.2	·· 03.3	302°24.0	·· 13.8
10	148°13.3	293°23.5	15°00.3	14°32.8	35.5	313°35.1	03.5	317°26.2	13.9
11	163°15.8	308°23.1	01.4	29°33.7	35.1	328°37.1	03.7	332°28.4	14.0
12	178°18.2	323°22.8	S15°02.5	44°34.6	N18°34.7	343°39.1	S05°03.9	347°30.6	S02°14.1
13	193°20.7	338°22.5	03.6	59°35.5	34.3	358°41.1	04.1	2°32.8	14.3
14	208°23.1	353°22.2	04.7	74°36.3	33.9	13°43.1	04.3	17°35.0	14.4
15	223°25.6	8°21.9	·· 05.8	89°37.2	·· 33.5	28°45.0	·· 04.6	32°37.1	·· 14.5
16	238°28.1	23°21.5	06.9	104°38.1	33.1	43°47.0	04.8	47°39.3	14.6
17	253°30.5	38°21.2	08.0	119°39.0	32.7	58°49.0	05.0	62°41.5	14.7
18	268°33.0	53°20.9	S15°09.1	134°39.9	N18°32.3	73°51.0	S05°05.2	77°43.7	S02°14.9
19	283°35.5	68°20.6	10.2	149°40.8	31.9	88°52.9	05.4	92°45.9	15.0
20	298°37.9	83°20.2	11.3	164°41.7	31.5	103°54.9	05.6	107°48.1	15.1
21	313°40.4	98°19.9	·· 12.4	179°42.5	·· 31.1	118°56.9	·· 05.8	122°50.3	·· 15.2
22	328°42.9	113°19.6	13.5	194°43.4	30.7	133°58.9	06.0	137°52.5	15.3
23	343°45.3	128°19.3	14.6	209°44.3	30.3	149°00.9	06.2	152°54.6	15.4
Mer.pass. 00:09		ν -0.3′	d 1.1′	m -4.06	ν 0.9′	d 0.4′	m 1.60	ν 2.0′	d 0.2′ m -1.68	ν 2.2′	d 0.1′ m 0.90

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	358°47.8	143°18.9	S15°15.7	224°45.2	N18°29.9	164°02.8	S05°06.4	167°56.8	S02°15.6
1	13°50.3	158°18.6	16.8	239°46.1	29.5	179°04.8	06.6	182°59.0	15.7
2	28°52.7	173°18.3	17.9	254°47.0	29.1	194°06.8	06.8	198°01.2	15.8
3	43°55.2	188°17.9	·· 19.0	269°47.9	·· 28.7	209°08.8	·· 07.0	213°03.4	·· 15.9
4	58°57.6	203°17.6	20.1	284°48.8	28.3	224°10.7	07.2	228°05.6	16.0
5	74°00.1	218°17.3	21.1	299°49.6	27.9	239°12.7	07.4	243°07.8	16.2
6	89°02.6	233°17.0	S15°22.2	314°50.5	N18°27.5	254°14.7	S05°07.6	258°10.0	S02°16.3
7	104°05.0	248°16.6	23.3	329°51.4	27.1	269°16.7	07.8	273°12.1	16.4
8	119°07.5	263°16.3	24.4	344°52.3	26.7	284°18.6	08.0	288°14.3	16.5
9	134°10.0	278°16.0	·· 25.5	359°53.2	·· 26.3	299°20.6	·· 08.2	303°16.5	·· 16.6
10	149°12.4	293°15.6	26.6	14°54.1	25.9	314°22.6	08.4	318°18.7	16.8
11	164°14.9	308°15.3	27.7	29°55.0	25.4	329°24.6	08.6	333°20.9	16.9
12	179°17.4	323°15.0	S15°28.8	44°55.9	N18°25.0	344°26.6	S05°08.9	348°23.1	S02°17.0
13	194°19.8	338°14.7	29.9	59°56.8	24.6	359°28.5	09.1	3°25.3	17.1
14	209°22.3	353°14.3	30.9	74°57.6	24.2	14°30.5	09.3	18°27.5	17.2
15	224°24.7	8°14.0	·· 32.0	89°58.5	·· 23.8	29°32.5	·· 09.5	33°29.6	·· 17.4
16	239°27.2	23°13.7	33.1	104°59.4	23.4	44°34.5	09.7	48°31.8	17.5
17	254°29.7	38°13.3	34.2	120°00.3	23.0	59°36.4	09.9	63°34.0	17.6
18	269°32.1	53°13.0	S15°35.3	135°01.2	N18°22.6	74°38.4	S05°10.1	78°36.2	S02°17.7
19	284°34.6	68°12.7	36.4	150°02.1	22.2	89°40.4	10.3	93°38.4	17.8
20	299°37.1	83°12.3	37.4	165°03.0	21.8	104°42.4	10.5	108°40.6	17.9
21	314°39.5	98°12.0	·· 38.5	180°03.9	·· 21.4	119°44.3	·· 10.7	123°42.8	·· 18.1
22	329°42.0	113°11.7	39.6	195°04.8	21.0	134°46.3	10.9	138°44.9	18.2
23	344°44.5	128°11.3	40.7	210°05.7	20.6	149°48.3	11.1	153°47.1	18.3
Mer.pass. 00:05		ν -0.3′	d 1.1′	m -4.06	ν 0.9′	d 0.4′	m 1.59	ν 2.0′	d 0.2′ m -1.68	ν 2.2′	d 0.1′ m 0.90

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	359°46.9	143°11.0	S15°41.8	225°06.6	N18°20.2	164°50.3	S05°11.3	168°49.3	S02°18.4
1	14°49.4	158°10.7	42.8	240°07.5	19.7	179°52.2	11.5	183°51.5	18.5
2	29°51.9	173°10.3	43.9	255°08.3	19.3	194°54.2	11.7	198°53.7	18.7
3	44°54.3	188°10.0	·· 45.0	270°09.2	·· 18.9	209°56.2	·· 11.9	213°55.9	·· 18.8
4	59°56.8	203°09.7	46.1	285°10.1	18.5	224°58.2	12.1	228°58.1	18.9
5	74°59.2	218°09.3	47.1	300°11.0	18.1	240°00.2	12.3	244°00.3	19.0
6	90°01.7	233°09.0	S15°48.2	315°11.9	N18°17.7	255°02.1	S05°12.5	259°02.4	S02°19.1
7	105°04.2	248°08.6	49.3	330°12.8	17.3	270°04.1	12.8	274°04.6	19.3
8	120°06.6	263°08.3	50.4	345°13.7	16.9	285°06.1	13.0	289°06.8	19.4
9	135°09.1	278°08.0	·· 51.4	0°14.6	·· 16.5	300°08.1	·· 13.2	304°09.0	·· 19.5
10	150°11.6	293°07.6	52.5	15°15.5	16.1	315°10.0	13.4	319°11.2	19.6
11	165°14.0	308°07.3	53.6	30°16.4	15.7	330°12.0	13.6	334°13.4	19.7
12	180°16.5	323°07.0	S15°54.7	45°17.3	N18°15.2	345°14.0	S05°13.8	349°15.6	S02°19.8
13	195°19.0	338°06.6	55.7	60°18.2	14.8	0°16.0	14.0	4°17.7	20.0
14	210°21.4	353°06.3	56.8	75°19.1	14.4	15°17.9	14.2	19°19.9	20.1
15	225°23.9	8°05.9	·· 57.9	90°20.0	·· 14.0	30°19.9	·· 14.4	34°22.1	·· 20.2
16	240°26.4	23°05.6	15°59.0	105°20.9	13.6	45°21.9	14.6	49°24.3	20.3
17	255°28.8	38°05.3	16°00.0	120°21.8	13.2	60°23.9	14.8	64°26.5	20.4
18	270°31.3	53°04.9	S16°01.1	135°22.7	N18°12.8	75°25.8	S05°15.0	79°28.7	S02°20.6
19	285°33.7	68°04.6	02.2	150°23.6	12.4	90°27.8	15.2	94°30.9	20.7
20	300°36.2	83°04.2	03.2	165°24.5	12.0	105°29.8	15.4	109°33.0	20.8
21	315°38.7	98°03.9	·· 04.3	180°25.3	·· 11.6	120°31.8	·· 15.6	124°35.2	·· 20.9
22	330°41.1	113°03.5	05.4	195°26.2	11.1	135°33.7	15.8	139°37.4	21.0
23	345°43.6	128°03.2	06.4	210°27.1	10.7	150°35.7	16.0	154°39.6	21.2
Mer.pass. 23:57		ν -0.3′	d 1.1′	m -4.07	ν 0.9′	d 0.4′	m 1.59	ν 2.0′	d 0.2′ m -1.68	ν 2.2′	d 0.1′ m 0.89

Stars

	SHA	Dec
Alpheratz	358°08.2	28°59.4
Ankaa	353°39.1	-42°24.3
Schedar	350°07.7	56°26.1
Diphda	349°19.8	-18°05.2
Achernar	335°44.2	-57°19.7
Hamal	328°27.9	23°22.5
Polaris	326°22.9	89°10.6
Acamar	315°36.4	-40°22.5
Menkar	314°40.2	4°01.1
Mirfak	309°14.8	49°47.6
Aldebaran	291°17.1	16°28.4
Rigel	281°35.3	-8°13.2
Capella	281°10.2	45°58.6
Bellatrix	278°58.0	6°20.1
Elnath	278°43.2	28°35.5
Alnilam	276°10.9	-1°12.7
Betelgeuse	271°27.5	7°24.3
Canopus	264°07.0	-52°40.8
Sirius	258°55.1	-16°41.2
Adhara	255°31.7	-28°56.6
Procyon	245°25.2	5°16.5
Pollux	243°57.5	28°04.3
Avior	234°28.3	-59°26.7
Suhail	223°10.6	-43°21.2
Miaplacidus	221°45.6	-69°38.2
Alphard	218°20.1	-8°34.5
Regulus	208°09.6	12°03.6
Dubhe	194°21.9	61°51.1
Denebola	182°58.7	14°40.7
Gienah	176°17.6	-17°26.2
Acrux	173°37.2	-62°59.7
Gacrux	172°28.6	-57°00.5
Alioth	166°42.4	56°03.8
Spica	158°57.1	-11°03.7
Alkaid	153°18.3	49°24.6
Hadar	149°22.9	-60°17.1
Menkent	148°36.5	-36°16.7
Arcturus	146°18.1	19°16.9
Rigil Kent.	140°25.4	-60°45.5
Kochab	137°19.8	74°14.2
Zuben'ubi	137°32.5	-15°57.8
Alphecca	126°31.7	26°46.9
Antares	112°56.1	-26°23.5
Atria	108°19.9	-68°59.9
Sabik	102°40.4	-15°42.1
Shaula	96°54.8	-37°05.5
Rasalhague	96°29.0	12°34.6
Eltanin	90°57.4	51°29.8
Kaus Aust.	84°15.9	-34°23.7
Vega	80°55.3	38°46.3
Nunki	76°28.2	-26°19.2
Altair	62°31.7	8°49.3
Peacock	53°56.9	-56°47.8
Deneb	49°47.7	45°13.1
Enif	34°10.6	9°47.6
Al Na'ir	28°13.6	-47°03.1
Fomalhaut	15°50.3	-29°43.2
Scheat	14°16.6	27°59.1
Markab	14°02.2	15°06.5

Sep 19 Sat	SHA	Mer.pass
Venus	145°38.0	14:27
Mars	226°35.3	09:02
Jupiter	165°26.7	13:05
Saturn	169°15.7	12:50

Sep 20 Sun	SHA	Mer.pass
Venus	144°31.1	14:27
Mars	225°57.4	09:00
Jupiter	165°15.0	13:02
Saturn	169°09.0	12:46

Sep 21 Mon	SHA	Mer.pass
Venus	143°24.1	14:28
Mars	225°19.6	08:59
Jupiter	165°03.3	12:59
Saturn	169°02.4	12:43

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h

Sat	Sun GHA	Sun Dec	Moon GHA	ν	Moon Dec	d	HP
0	181°30.9	N01°36.3	297°11.6	7.1′	N16°16.3	8.7′	59.6′
1	196°31.2	35.3	311°37.7	7.1′	16°25.0	8.5′	59.6′
2	211°31.4	34.3	326°03.8	7.0′	16°33.5	8.4′	59.6′
3	226°31.6	·· 33.4	340°29.8	7.0′	16°41.9	8.3′	59.6′
4	241°31.8	32.4	354°55.8	7.0′	16°50.2	8.2′	59.6′
5	256°32.1	31.4	9°21.8	6.9′	16°58.4	8.0′	59.6′
6	271°32.3	N01°30.5	23°47.7	6.9′	N17°06.4	8.0′	59.5′
7	286°32.5	29.5	38°13.6	6.9′	17°14.4	7.8′	59.5′
8	301°32.7	28.5	52°39.5	6.8′	17°22.2	7.8′	59.5′
9	316°32.9	·· 27.6	67°05.3	6.8′	17°30.0	7.6′	59.5′
10	331°33.2	26.6	81°31.1	6.8′	17°37.6	7.5′	59.5′
11	346°33.4	25.6	95°56.9	6.7′	17°45.1	7.4′	59.5′
12	1°33.6	N01°24.7	110°22.6	6.7′	N17°52.5	7.2′	59.5′
13	16°33.8	23.7	124°48.3	6.7′	17°59.7	7.2′	59.4′
14	31°34.1	22.7	139°14.0	6.6′	18°06.9	7.0′	59.4′
15	46°34.3	·· 21.7	153°39.6	6.6′	18°13.9	6.9′	59.4′
16	61°34.5	20.8	168°05.3	6.6′	18°20.8	6.8′	59.4′
17	76°34.7	19.8	182°30.8	6.6′	18°27.6	6.6′	59.4′
18	91°34.9	N01°18.8	196°56.4	6.5′	N18°34.2	6.6′	59.4′
19	106°35.2	17.9	211°21.9	6.5′	18°40.8	6.4′	59.4′
20	121°35.4	16.9	225°47.4	6.5′	18°47.2	6.3′	59.3′
21	136°35.6	·· 15.9	240°12.9	6.5′	18°53.5	6.1′	59.3′
22	151°35.8	14.9	254°38.4	6.4′	18°59.6	6.1′	59.3′
23	166°36.1	14.0	269°03.8	6.4′	19°05.7	5.9′	59.3′
	SD = 15.9′	d = 1.0′	SD = 16.3′				

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	181°36.3	N01°13.0	283°29.2	6.4′	N19°11.6	5.7′	59.3′
1	196°36.5	12.0	297°54.6	6.4′	19°17.3	5.7′	59.3′
2	211°36.7	11.1	312°19.9	6.3′	19°23.0	5.5′	59.2′
3	226°36.9	·· 10.1	326°45.3	6.3′	19°28.5	5.4′	59.2′
4	241°37.2	09.1	341°10.6	6.3′	19°33.9	5.3′	59.2′
5	256°37.4	08.2	355°35.9	6.3′	19°39.2	5.1′	59.2′
6	271°37.6	N01°07.2	10°01.1	6.3′	N19°44.3	5.0′	59.2′
7	286°37.8	06.2	24°26.4	6.2′	19°49.3	4.9′	59.2′
8	301°38.1	05.2	38°51.6	6.2′	19°54.2	4.7′	59.1′
9	316°38.3	·· 04.3	53°16.9	6.2′	19°58.9	4.6′	59.1′
10	331°38.5	03.3	67°42.1	6.2′	20°03.5	4.5′	59.1′
11	346°38.7	02.3	82°07.3	6.2′	20°08.0	4.3′	59.1′
12	1°38.9	N01°01.4	96°32.5	6.2′	N20°12.3	4.3′	59.1′
13	16°39.2	01°00.4	110°57.7	6.2′	20°16.6	4.0′	59.1′
14	31°39.4	00°59.4	125°22.8	6.2′	20°20.6	4.0′	59.0′
15	46°39.6	·· 58.4	139°48.0	6.1′	20°24.6	3.8′	59.0′
16	61°39.8	57.5	154°13.1	6.1′	20°28.4	3.6′	59.0′
17	76°40.0	56.5	168°38.3	6.1′	20°32.0	3.6′	59.0′
18	91°40.3	N00°55.5	183°03.4	6.1′	N20°35.6	3.4′	59.0′
19	106°40.5	54.6	197°28.5	6.1′	20°39.0	3.2′	59.0′
20	121°40.7	53.6	211°53.7	6.1′	20°42.2	3.2′	58.9′
21	136°40.9	·· 52.6	226°18.8	6.1′	20°45.4	3.0′	58.9′
22	151°41.1	51.6	240°43.9	6.1′	20°48.4	2.8′	58.9′
23	166°41.4	50.7	255°09.0	6.1′	20°51.2	2.7′	58.9′
	SD = 15.9′	d = 1.0′	SD = 16.2′				

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	181°41.6	N00°49.7	269°34.1	6.1′	N20°53.9	2.6′	58.9′
1	196°41.8	48.7	283°59.3	6.1′	20°56.5	2.5′	58.8′
2	211°42.0	47.8	298°24.4	6.1′	20°59.0	2.3′	58.8′
3	226°42.3	·· 46.8	312°49.5	6.1′	21°01.3	2.1′	58.8′
4	241°42.5	45.8	327°14.6	6.1′	21°03.4	2.1′	58.8′
5	256°42.7	44.8	341°39.8	6.1′	21°05.5	1.9′	58.8′
6	271°42.9	N00°43.9	356°04.9	6.2′	N21°07.4	1.7′	58.7′
7	286°43.1	42.9	10°30.1	6.2′	21°09.1	1.6′	58.7′
8	301°43.4	41.9	24°55.2	6.2′	21°10.7	1.5′	58.7′
9	316°43.6	·· 41.0	39°20.4	6.2′	21°12.2	1.4′	58.7′
10	331°43.8	40.0	53°45.6	6.2′	21°13.6	1.2′	58.7′
11	346°44.0	39.0	68°10.8	6.2′	21°14.8	1.0′	58.7′
12	1°44.2	N00°38.0	82°36.0	6.2′	N21°15.8	1.0′	58.6′
13	16°44.5	37.1	97°01.2	6.2′	21°16.8	0.8′	58.6′
14	31°44.7	36.1	111°26.5	6.3′	21°17.6	0.6′	58.6′
15	46°44.9	·· 35.1	125°51.8	6.3′	21°18.2	0.6′	58.6′
16	61°45.1	34.1	140°17.0	6.3′	21°18.8	0.3′	58.6′
17	76°45.3	33.2	154°42.3	6.3′	21°19.1	0.3′	58.5′
18	91°45.6	N00°32.2	169°07.7	6.3′	N21°19.4	0.1′	58.5′
19	106°45.8	31.2	183°33.0	6.4′	21°19.5	0.0′	58.5′
20	121°46.0	30.3	197°58.4	6.4′	21°19.5	0.2′	58.5′
21	136°46.2	·· 29.3	212°23.8	6.4′	21°19.3	0.3′	58.5′
22	151°46.4	28.3	226°49.2	6.4′	21°19.0	0.4′	58.4′
23	166°46.7	27.3	241°14.7	6.5′	21°18.6	0.5′	58.4′
	SD = 15.9′	d = 1.0′	SD = 16.1′				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	02:44	04:19	05:29	18:15	19:24	20:57
N 70°	03:07	04:29	05:31	18:13	19:15	20:36
68°	03:25	04:37	05:33	18:11	19:08	20:19
66°	03:38	04:43	05:35	18:10	19:01	20:06
64°	03:49	04:49	05:37	18:08	18:56	19:55
62°	03:59	04:53	05:38	18:07	18:52	19:46
60°	04:06	04:57	05:39	18:06	18:48	19:38
N 58°	04:13	05:01	05:40	18:06	18:45	19:32
56°	04:19	05:04	05:41	18:05	18:42	19:26
54°	04:24	05:06	05:42	18:04	18:39	19:21
52°	04:28	05:09	05:42	18:03	18:37	19:17
50°	04:32	05:11	05:43	18:03	18:35	19:13
45°	04:40	05:15	05:44	18:02	18:31	19:06
N 40°	04:47	05:18	05:45	18:01	18:28	18:59
35°	04:51	05:21	05:46	18:00	18:25	18:55
30°	04:55	05:23	05:47	17:59	18:23	18:51
20°	05:01	05:26	05:48	17:58	18:20	18:46
N 10°	05:04	05:28	05:49	17:57	18:18	18:43
0°	05:06	05:30	05:50	17:57	18:17	18:41
S 10°	05:06	05:30	05:51	17:56	18:17	18:41
20°	05:04	05:30	05:52	17:56	18:18	18:43
30°	05:01	05:28	05:52	17:55	18:19	18:47
35°	04:58	05:27	05:53	17:55	18:20	18:49
40°	04:54	05:26	05:53	17:55	18:22	18:53
45°	04:50	05:24	05:53	17:54	18:24	18:58
S 50°	04:44	05:22	05:54	17:54	18:26	19:04
52°	04:41	05:20	05:54	17:54	18:28	19:07
54°	04:37	05:19	05:54	17:54	18:29	19:11
56°	04:33	05:17	05:54	17:54	18:31	19:15
58°	04:29	05:15	05:54	17:54	18:33	19:19
S 60°	04:24	05:13	05:55	17:54	18:35	19:25

Lat.	Moonrise Sat	Moonrise Sun	Moonrise Mon	Moonset Sat	Moonset Sun	Moonset Mon
N 72°						
N 70°	18:27			15:00		
68°	19:10	19:19	19:54	14:18	16:10	17:37
66°	19:40	20:03	20:48	13:49	15:26	16:42
64°	20:02	20:32	21:21	13:28	14:57	16:09
62°	20:20	20:55	21:45	13:10	14:35	15:45
60°	20:35	21:13	22:04	12:56	14:18	15:26
N 58°	20:47	21:28	22:20	12:44	14:03	15:10
56°	20:58	21:41	22:34	12:33	13:50	14:56
54°	21:08	21:52	22:46	12:24	13:39	14:45
52°	21:17	22:02	22:56	12:16	13:29	14:34
50°	21:25	22:11	23:05	12:08	13:20	14:25
45°	21:41	22:30	23:25	11:52	13:02	14:05
N 40°	21:55	22:45	23:41	11:39	12:47	13:49
35°	22:07	22:58	23:54	11:28	12:34	13:36
30°	22:17	23:10	·· ··	11:19	12:23	13:24
20°	22:35	23:29	·· ··	11:02	12:04	13:04
N 10°	22:50	23:46	·· ··	10:48	11:48	12:47
0°	23:05	·· ··	00:02	10:35	11:32	12:30
S 10°	23:19	·· ··	00:19	10:21	11:17	12:14
20°	23:35	·· ··	00:36	10:07	11:00	11:56
30°	23:53	·· ··	00:56	09:51	10:41	11:36
35°	·· ··	00:03	01:07	09:41	10:30	11:24
40°	·· ··	00:16	01:21	09:30	10:18	11:11
45°	·· ··	00:30	01:37	09:18	10:03	10:55
S 50°	·· ··	00:47	01:56	09:02	09:44	10:35
52°	·· ··	00:56	02:05	08:55	09:36	10:25
54°	·· ··	01:05	02:16	08:47	09:26	10:15
56°	·· ··	01:16	02:28	08:38	09:15	10:03
58°	00:04	01:28	02:41	08:28	09:03	09:49
S 60°	00:15	01:41	02:57	08:17	08:49	09:33

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Age 21-23 71-48%
19	06:04	06:14	11:54	04:21	16:50	
20	06:25	06:36	11:53	05:18	17:47	
21	06:46	06:57	11:53	06:16	18:45	

September 22, 23, 24 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	0°46.1	143°02.9	S16°07.5	225°28.0	N18°10.3	165°37.7	S05°16.2	169°41.8	S02°21.3
1	15°48.5	158°02.5	08.6	240°28.9	09.9	180°39.7	16.4	184°44.0	21.4
2	30°51.0	173°02.2	09.6	255°29.8	09.5	195°41.6	16.7	199°46.2	21.5
3	45°53.5	188°01.8	·· 10.7	270°30.7	·· 09.1	210°43.6	·· 16.9	214°48.4	·· 21.6
4	60°55.9	203°01.5	11.7	285°31.6	08.7	225°45.6	17.1	229°50.5	21.8
5	75°58.4	218°01.1	12.8	300°32.5	08.3	240°47.6	17.3	244°52.7	21.9
6	91°00.9	233°00.8	S16°13.9	315°33.4	N18°07.8	255°49.5	S05°17.5	259°54.9	S02°22.0
7	106°03.3	248°00.5	14.9	330°34.3	07.4	270°51.5	17.7	274°57.1	22.1
8	121°05.8	263°00.1	16.0	345°35.2	07.0	285°53.5	17.9	289°59.3	22.2
9	136°08.2	277°59.8	·· 17.0	0°36.1	·· 06.6	300°55.4	·· 18.1	305°01.5	·· 22.4
10	151°10.7	292°59.4	18.1	15°37.0	06.2	315°57.4	18.3	320°03.7	22.5
11	166°13.2	307°59.1	19.2	30°37.9	05.8	330°59.4	18.5	335°05.8	22.6
12	181°15.6	322°58.7	S16°20.2	45°38.8	N18°05.4	346°01.4	S05°18.7	350°08.0	S02°22.7
13	196°18.1	337°58.4	21.3	60°39.7	04.9	1°03.3	18.9	5°10.2	22.8
14	211°20.6	352°58.0	22.3	75°40.6	04.5	16°05.3	19.1	20°12.4	22.9
15	226°23.0	7°57.7	·· 23.4	90°41.5	·· 04.1	31°07.3	·· 19.3	35°14.6	·· 23.1
16	241°25.5	22°57.3	24.4	105°42.4	03.7	46°09.3	19.5	50°16.8	23.2
17	256°28.0	37°57.0	25.5	120°43.3	03.3	61°11.2	19.7	65°18.9	23.3
18	271°30.4	52°56.6	S16°26.6	135°44.2	N18°02.9	76°13.2	S05°19.9	80°21.1	S02°23.4
19	286°32.9	67°56.3	27.6	150°45.1	02.5	91°15.2	20.1	95°23.3	23.5
20	301°35.3	82°55.9	28.7	165°46.0	02.0	106°17.2	20.4	110°25.5	23.7
21	316°37.8	97°55.6	·· 29.7	180°46.9	·· 01.6	121°19.1	·· 20.6	125°27.7	·· 23.8
22	331°40.3	112°55.2	30.8	195°47.8	01.2	136°21.1	20.8	140°29.9	23.9
23	346°42.7	127°54.9	31.8	210°48.7	00.8	151°23.1	21.0	155°32.1	24.0
Mer.pass. 23:53		ν -0.3′	d 1.1′	m -4.07	ν 0.9′	d 0.4′	m 1.59	ν 2.0′	d 0.2′ m -1.68	ν 2.2′	d 0.1′ m 0.89

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	1°45.2	142°54.5	S16°32.9	225°49.6	N18°00.4	166°25.1	S05°21.2	170°34.2	S02°24.1
1	16°47.7	157°54.2	33.9	240°50.5	18°00.0	181°27.0	21.4	185°36.4	24.3
2	31°50.1	172°53.8	35.0	255°51.5	17°59.5	196°29.0	21.6	200°38.6	24.4
3	46°52.6	187°53.5	·· 36.0	270°52.4	·· 59.1	211°31.0	·· 21.8	215°40.8	·· 24.5
4	61°55.1	202°53.1	37.1	285°53.3	58.7	226°32.9	22.0	230°43.0	24.6
5	76°57.5	217°52.8	38.1	300°54.2	58.3	241°34.9	22.2	245°45.2	24.7
6	92°00.0	232°52.4	S16°39.2	315°55.1	N17°57.9	256°36.9	S05°22.4	260°47.4	S02°24.9
7	107°02.5	247°52.1	40.2	330°56.0	57.5	271°38.9	22.6	275°49.5	25.0
8	122°04.9	262°51.7	41.3	345°56.9	57.0	286°40.8	22.8	290°51.7	25.1
9	137°07.4	277°51.4	·· 42.3	0°57.8	·· 56.6	301°42.8	·· 23.0	305°53.9	·· 25.2
10	152°09.8	292°51.0	43.3	15°58.7	56.2	316°44.8	23.2	320°56.1	25.3
11	167°12.3	307°50.6	44.4	30°59.6	55.8	331°46.8	23.4	335°58.3	25.4
12	182°14.8	322°50.3	S16°45.4	46°00.5	N17°55.4	346°48.7	S05°23.6	351°00.5	S02°25.6
13	197°17.2	337°49.9	46.5	61°01.4	55.0	1°50.7	23.8	6°02.7	25.7
14	212°19.7	352°49.6	47.5	76°02.3	54.5	16°52.7	24.1	21°04.8	25.8
15	227°22.2	7°49.2	·· 48.5	91°03.2	·· 54.1	31°54.7	·· 24.3	36°07.0	·· 25.9
16	242°24.6	22°48.9	49.6	106°04.1	53.7	46°56.6	24.5	51°09.2	26.0
17	257°27.1	37°48.5	50.6	121°05.0	53.3	61°58.6	24.7	66°11.4	26.2
18	272°29.6	52°48.1	S16°51.7	136°05.9	N17°52.9	77°00.6	S05°24.9	81°13.6	S02°26.3
19	287°32.0	67°47.8	52.7	151°06.8	52.4	92°02.5	25.1	96°15.8	26.4
20	302°34.5	82°47.4	53.7	166°07.7	52.0	107°04.5	25.3	111°17.9	26.5
21	317°37.0	97°47.1	·· 54.8	181°08.7	·· 51.6	122°06.5	·· 25.5	126°20.1	·· 26.6
22	332°39.4	112°46.7	55.8	196°09.6	51.2	137°08.5	25.7	141°22.3	26.8
23	347°41.9	127°46.4	56.9	211°10.5	50.8	152°10.4	25.9	156°24.5	26.9
Mer.pass. 23:49		ν -0.4′	d 1.0′	m -4.08	ν 0.9′	d 0.4′	m 1.59	ν 2.0′	d 0.2′ m -1.68	ν 2.2′	d 0.1′ m 0.89

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	2°44.3	142°46.0	S16°57.9	226°11.4	N17°50.3	167°12.4	S05°26.1	171°26.7	S02°27.0
1	17°46.8	157°45.6	16°58.9	241°12.3	49.9	182°14.4	26.3	186°28.9	27.1
2	32°49.3	172°45.3	17°00.0	256°13.2	49.5	197°16.3	26.5	201°31.1	27.2
3	47°51.7	187°44.9	·· 01.0	271°14.1	·· 49.1	212°18.3	·· 26.7	216°33.2	·· 27.4
4	62°54.2	202°44.6	02.0	286°15.0	48.7	227°20.3	26.9	231°35.4	27.5
5	77°56.7	217°44.2	03.1	301°15.9	48.2	242°22.3	27.1	246°37.6	27.6
6	92°59.1	232°43.8	S17°04.1	316°16.8	N17°47.8	257°24.2	S05°27.3	261°39.8	S02°27.7
7	108°01.6	247°43.5	05.1	331°17.7	47.4	272°26.2	27.6	276°42.0	27.8
8	123°04.1	262°43.1	06.1	346°18.7	47.0	287°28.2	27.8	291°44.2	28.0
9	138°06.5	277°42.7	·· 07.2	1°19.6	·· 46.6	302°30.1	·· 28.0	306°46.3	·· 28.1
10	153°09.0	292°42.4	08.2	16°20.5	46.1	317°32.1	28.2	321°48.5	28.2
11	168°11.4	307°42.0	09.2	31°21.4	45.7	332°34.1	28.4	336°50.7	28.3
12	183°13.9	322°41.7	S17°10.3	46°22.3	N17°45.3	347°36.1	S05°28.6	351°52.9	S02°28.4
13	198°16.4	337°41.3	11.3	61°23.2	44.9	2°38.0	28.8	6°55.1	28.6
14	213°18.8	352°40.9	12.3	76°24.1	44.4	17°40.0	29.0	21°57.3	28.7
15	228°21.3	7°40.6	·· 13.3	91°25.0	·· 44.0	32°42.0	·· 29.2	36°59.5	·· 28.8
16	243°23.8	22°40.2	14.4	106°25.9	43.6	47°43.9	29.4	52°01.6	28.9
17	258°26.2	37°39.8	15.4	121°26.9	43.2	62°45.9	29.6	67°03.8	29.0
18	273°28.7	52°39.5	S17°16.4	136°27.8	N17°42.8	77°47.9	S05°29.8	82°06.0	S02°29.1
19	288°31.2	67°39.1	17.4	151°28.7	42.3	92°49.9	30.0	97°08.2	29.3
20	303°33.6	82°38.7	18.5	166°29.6	41.9	107°51.8	30.2	112°10.4	29.4
21	318°36.1	97°38.4	·· 19.5	181°30.5	·· 41.5	122°53.8	·· 30.4	127°12.6	·· 29.5
22	333°38.6	112°38.0	20.5	196°31.4	41.1	137°55.8	30.6	142°14.7	29.6
23	348°41.0	127°37.6	21.5	211°32.3	40.6	152°57.7	30.8	157°16.9	29.7
Mer.pass. 23:45		ν -0.4′	d 1.0′	m -4.08	ν 0.9′	d 0.4′	m 1.58	ν 2.0′	d 0.2′ m -1.68	ν 2.2′	d 0.1′ m 0.88

Stars

	SHA	Dec
Alpheratz	358°08.2	28°59.4
Ankaa	353°39.1	-42°24.3
Schedar	350°07.7	56°26.2
Diphda	349°19.8	-18°05.2
Achernar	335°44.2	-57°19.7
Hamal	328°27.8	23°22.5
Polaris	326°22.1	89°10.6
Acamar	315°36.4	-40°22.5
Menkar	314°40.2	4°01.1
Mirfak	309°14.8	49°47.6
Aldebaran	291°17.1	16°28.4
Rigel	281°35.3	-8°13.2
Capella	281°10.2	45°58.6
Bellatrix	278°57.9	6°20.1
Elnath	278°43.2	28°35.5
Alnilam	276°10.9	-1°12.7
Betelgeuse	271°27.5	7°24.3
Canopus	264°06.9	-52°40.8
Sirius	258°55.1	-16°41.2
Adhara	255°31.6	-28°56.6
Procyon	245°25.2	5°16.5
Pollux	243°57.5	28°04.3
Avior	234°28.3	-59°26.7
Suhail	223°10.6	-43°21.2
Miaplacidus	221°45.5	-69°38.2
Alphard	218°20.1	-8°34.5
Regulus	208°09.5	12°03.6
Dubhe	194°21.9	61°51.1
Denebola	182°58.6	14°40.7
Gienah	176°17.6	-17°26.2
Acrux	173°37.2	-62°59.7
Gacrux	172°28.6	-57°00.5
Alioth	166°42.4	56°03.8
Spica	158°57.1	-11°03.7
Alkaid	153°18.4	49°24.6
Hadar	149°22.9	-60°17.1
Menkent	148°36.5	-36°16.7
Arcturus	146°18.1	19°16.9
Rigil Kent.	140°25.4	-60°45.5
Kochab	137°19.8	74°14.2
Zuben'ubi	137°32.5	-15°57.8
Alphecca	126°31.7	26°46.9
Antares	112°56.1	-26°23.5
Atria	108°19.9	-68°59.9
Sabik	102°40.4	-15°42.1
Shaula	96°54.9	-37°05.5
Rasalhague	96°29.0	12°34.6
Eltanin	90°57.4	51°29.8
Kaus Aust.	84°15.9	-34°23.7
Vega	80°55.3	38°46.3
Nunki	76°28.2	-26°19.2
Altair	62°31.7	8°49.3
Peacock	53°56.9	-56°47.8
Deneb	49°47.7	45°13.1
Enif	34°10.6	9°47.6
Al Na'ir	28°13.6	-47°03.1
Fomalhaut	15°50.3	-29°43.2
Scheat	14°16.5	27°59.1
Markab	14°02.2	15°06.5

Sep 22 Tue	SHA	Mer.pass
Venus	142°16.8	14:28
Mars	224°42.0	08:58
Jupiter	164°51.6	12:56
Saturn	168°55.7	12:39

Sep 23 Wed	SHA	Mer.pass
Venus	141°09.3	14:29
Mars	224°04.4	08:56
Jupiter	164°39.9	12:53
Saturn	168°49.0	12:36

Sep 24 Thu	SHA	Mer.pass
Venus	140°01.7	14:29
Mars	223°27.0	08:55
Jupiter	164°28.1	12:49
Saturn	168°42.3	12:32

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h — Sun — Moon

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	181°46.9	N00°26.4	255°40.1	6.5′	N21°18.1	0.7′	58.4′
1	196°47.1	25.4	270°05.6	6.5′	21°17.4	0.9′	58.4′
2	211°47.3	24.4	284°31.2	6.6′	21°16.5	0.9′	58.4′
3	226°47.5	·· 23.4	298°56.7	6.6′	21°15.6	1.1′	58.3′
4	241°47.8	22.5	313°22.3	6.6′	21°14.5	1.3′	58.3′
5	256°48.0	21.5	327°48.0	6.7′	21°13.2	1.3′	58.3′
6	271°48.2	N00°20.5	342°13.6	6.7′	N21°11.9	1.5′	58.3′
7	286°48.4	19.6	356°39.3	6.7′	21°10.4	1.6′	58.3′
8	301°48.6	18.6	11°05.1	6.8′	21°08.8	1.8′	58.2′
9	316°48.9	·· 17.6	25°30.9	6.8′	21°07.0	1.9′	58.2′
10	331°49.1	16.6	39°56.7	6.9′	21°05.1	2.0′	58.2′
11	346°49.3	15.7	54°22.5	6.9′	21°03.1	2.1′	58.2′
12	1°49.5	N00°14.7	68°48.4	6.9′	N21°01.0	2.3′	58.1′
13	16°49.7	13.7	83°14.4	7.0′	20°58.7	2.4′	58.1′
14	31°49.9	12.7	97°40.4	7.0′	20°56.3	2.5′	58.1′
15	46°50.2	·· 11.8	112°06.4	7.1′	20°53.8	2.7′	58.1′
16	61°50.4	10.8	126°32.5	7.1′	20°51.1	2.8′	58.1′
17	76°50.6	09.8	140°58.6	7.2′	20°48.3	2.9′	58.0′
18	91°50.8	N00°08.8	155°24.7	7.2′	N20°45.4	3.0′	58.0′
19	106°51.0	07.9	169°51.0	7.3′	20°42.4	3.2′	58.0′
20	121°51.3	06.9	184°17.2	7.3′	20°39.2	3.3′	58.0′
21	136°51.5	·· 05.9	198°43.5	7.4′	20°35.9	3.4′	58.0′
22	151°51.7	05.0	213°09.9	7.4′	20°32.5	3.5′	57.9′
23	166°51.9	04.0	227°36.3	7.5′	20°29.0	3.6′	57.9′
	SD = 15.9′	d = 1.0′	SD = 15.9′				

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	181°52.1	N00°03.0	242°02.8	7.5′	N20°25.4	3.8′	57.9′
1	196°52.4	02.0	256°29.3	7.6′	20°21.6	3.9′	57.9′
2	211°52.6	01.1	270°55.8	7.6′	20°17.7	4.0′	57.9′
3	226°52.8	N00°00.1	285°22.5	7.7′	20°13.7	4.1′	57.8′
4	241°53.0	S00°00.9	299°49.1	7.7′	20°09.6	4.3′	57.8′
5	256°53.2	01.9	314°15.9	7.8′	20°05.3	4.4′	57.8′
6	271°53.4	S00°02.8	328°42.7	7.8′	N20°00.9	4.4′	57.8′
7	286°53.7	03.8	343°09.5	7.9′	19°56.5	4.6′	57.8′
8	301°53.9	04.8	357°36.4	8.0′	19°51.9	4.7′	57.7′
9	316°54.1	·· 05.8	12°03.4	8.0′	19°47.2	4.9′	57.7′
10	331°54.3	06.7	26°30.4	8.1′	19°42.3	4.9′	57.7′
11	346°54.5	07.7	40°57.4	8.1′	19°37.4	5.0′	57.7′
12	1°54.8	S00°08.7	55°24.6	8.2′	N19°32.4	5.2′	57.7′
13	16°55.0	09.7	69°51.8	8.3′	19°27.2	5.3′	57.6′
14	31°55.2	10.6	84°19.0	8.3′	19°21.9	5.3′	57.6′
15	46°55.4	·· 11.6	98°46.4	8.4′	19°16.6	5.5′	57.6′
16	61°55.6	12.6	113°13.7	8.4′	19°11.1	5.6′	57.6′
17	76°55.8	13.5	127°41.2	8.5′	19°05.5	5.7′	57.5′
18	91°56.1	S00°14.5	142°08.7	8.6′	N18°59.8	5.8′	57.5′
19	106°56.3	15.5	156°36.3	8.6′	18°54.0	5.9′	57.5′
20	121°56.5	16.5	171°03.9	8.7′	18°48.1	6.1′	57.5′
21	136°56.7	·· 17.4	185°31.6	8.8′	18°42.0	6.1′	57.5′
22	151°56.9	18.4	199°59.3	8.8′	18°35.9	6.2′	57.4′
23	166°57.1	19.4	214°27.2	8.9′	18°29.7	6.3′	57.4′
	SD = 15.9′	d = 1.0′	SD = 15.8′				

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	181°57.4	S00°20.4	228°55.1	9.0′	N18°23.4	6.4′	57.4′
1	196°57.6	21.3	243°23.0	9.0′	18°17.0	6.6′	57.4′
2	211°57.8	22.3	257°51.0	9.1′	18°10.4	6.6′	57.4′
3	226°58.0	·· 23.3	272°19.1	9.2′	18°03.8	6.7′	57.3′
4	241°58.2	24.3	286°47.3	9.2′	17°57.1	6.8′	57.3′
5	256°58.4	25.2	301°15.5	9.3′	17°50.3	6.9′	57.3′
6	271°58.7	S00°26.2	315°43.8	9.4′	N17°43.4	7.0′	57.3′
7	286°58.9	27.2	330°12.1	9.4′	17°36.4	7.1′	57.3′
8	301°59.1	28.2	344°40.5	9.5′	17°29.3	7.2′	57.2′
9	316°59.3	·· 29.1	359°09.0	9.6′	17°22.1	7.3′	57.2′
10	331°59.5	30.1	13°37.6	9.6′	17°14.8	7.3′	57.2′
11	346°59.7	31.1	28°06.2	9.7′	17°07.5	7.5′	57.2′
12	2°00.0	S00°32.1	42°34.9	9.8′	N17°00.0	7.5′	57.1′
13	17°00.2	33.0	57°03.6	9.8′	16°52.5	7.7′	57.1′
14	32°00.4	34.0	71°32.5	9.9′	16°44.8	7.7′	57.1′
15	47°00.6	·· 35.0	86°01.3	10.0′	16°37.1	7.8′	57.1′
16	62°00.8	36.0	100°30.3	10.0′	16°29.3	7.9′	57.1′
17	77°01.0	36.9	114°59.3	10.1′	16°21.4	7.9′	57.0′
18	92°01.3	S00°37.9	129°28.4	10.2′	N16°13.5	8.1′	57.0′
19	107°01.5	38.9	143°57.6	10.2′	16°05.4	8.1′	57.0′
20	122°01.7	39.9	158°26.8	10.3′	15°57.3	8.2′	57.0′
21	137°01.9	·· 40.8	172°56.1	10.4′	15°49.1	8.3′	57.0′
22	152°02.1	41.8	187°25.4	10.4′	15°40.8	8.4′	56.9′
23	167°02.3	42.8	201°54.9	10.5′	15°32.4	8.4′	56.9′
	SD = 15.9′	d = 1.0′	SD = 15.7′				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	03:03	04:34	05:42	18:00	19:08	20:37
N 70°	03:23	04:42	05:43	17:59	19:00	20:18
68°	03:38	04:48	05:44	17:59	18:54	20:04
66°	03:50	04:53	05:45	17:58	18:49	19:52
64°	03:59	04:58	05:45	17:58	18:45	19:43
62°	04:07	05:01	05:46	17:58	18:42	19:35
60°	04:14	05:04	05:46	17:57	18:39	19:28
N 58°	04:20	05:07	05:46	17:57	18:36	19:23
56°	04:25	05:10	05:47	17:57	18:34	19:18
54°	04:30	05:12	05:47	17:57	18:32	19:14
52°	04:34	05:14	05:47	17:56	18:30	19:10
50°	04:37	05:15	05:47	17:56	18:28	19:06
45°	04:44	05:19	05:48	17:56	18:25	19:00
N 40°	04:50	05:21	05:48	17:56	18:23	18:54
35°	04:54	05:23	05:49	17:56	18:21	18:50
30°	04:57	05:25	05:49	17:56	18:19	18:47
20°	05:01	05:27	05:49	17:55	18:17	18:43
N 10°	05:04	05:28	05:49	17:55	18:16	18:41
0°	05:04	05:28	05:49	17:56	18:16	18:40
S 10°	05:04	05:28	05:49	17:56	18:17	18:41
20°	05:01	05:27	05:49	17:56	18:18	18:44
30°	04:57	05:25	05:48	17:57	18:21	18:48
35°	04:54	05:23	05:48	17:57	18:22	18:52
40°	04:49	05:21	05:48	17:57	18:24	18:56
45°	04:44	05:18	05:48	17:58	18:27	19:02
S 50°	04:37	05:15	05:47	17:59	18:31	19:09
52°	04:33	05:13	05:47	17:59	18:33	19:13
54°	04:29	05:11	05:47	17:59	18:35	19:17
56°	04:25	05:09	05:46	18:00	18:37	19:21
58°	04:20	05:07	05:46	18:00	18:39	19:26
S 60°	04:14	05:04	05:45	18:01	18:42	19:33

Lat.	Moonrise Tue	Moonrise Wed	Moonrise Thu	Moonset Tue	Moonset Wed	Moonset Thu
N 72°	▭	▭	23:44	▭	▭	19:30
N 70°	▭	22:15	·· ··	▭	19:10	18:52
68°	21:16	23:01	·· ··	18:13	18:22	18:24
66°	22:01	23:31	·· ··	17:28	17:52	18:04
64°	22:30	23:54	·· ··	16:59	17:29	17:47
62°	22:52	·· ··	00:12	16:36	17:10	17:33
60°	23:10	·· ··	00:26	16:18	16:55	17:21
N 58°	23:25	·· ··	00:39	16:03	16:42	17:11
56°	23:38	·· ··	00:50	15:50	16:31	17:02
54°	23:49	·· ··	00:59	15:38	16:21	16:54
52°	23:59	·· ··	01:08	15:28	16:12	16:47
50°	·· ··	00:08	01:15	15:19	16:04	16:41
45°	·· ··	00:26	01:31	15:00	15:47	16:27
N 40°	·· ··	00:42	01:45	14:45	15:33	16:15
35°	·· ··	00:54	01:56	14:32	15:22	16:05
30°	00:06	01:05	02:06	14:20	15:11	15:57
20°	00:26	01:25	02:23	14:01	14:53	15:42
N 10°	00:44	01:41	02:37	13:44	14:38	15:28
0°	01:00	01:57	02:51	13:27	14:23	15:16
S 10°	01:17	02:12	03:05	13:11	14:08	15:03
20°	01:34	02:29	03:19	12:54	13:52	14:50
30°	01:54	02:48	03:36	12:34	13:34	14:35
35°	02:06	02:59	03:46	12:22	13:24	14:26
40°	02:20	03:12	03:57	12:09	13:11	14:15
45°	02:36	03:27	04:10	11:53	12:57	14:03
S 50°	02:56	03:45	04:25	11:34	12:39	13:48
52°	03:05	03:54	04:33	11:24	12:31	13:41
54°	03:16	04:03	04:41	11:14	12:21	13:34
56°	03:27	04:14	04:50	11:02	12:11	13:25
58°	03:41	04:27	05:00	10:48	11:59	13:15
S 60°	03:57	04:41	05:12	10:32	11:44	13:04

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 24-26 37-18%
22	07:08	07:18	11:53	07:14	19:42	
23	07:29	07:39	11:52	08:10	20:37	
24	07:49	08:00	11:52	09:04	21:29	

September 25, 26, 27 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	3°43.5	142°37.3	S17°22.5	226°33.2	N17°40.2	167°59.7	S05°31.0	172°19.1	S02°29.9
1	18°45.9	157°36.9	23.6	241°34.2	39.8	183°01.7	31.3	187°21.3	30.0
2	33°48.4	172°36.5	24.6	256°35.1	39.4	198°03.7	31.5	202°23.5	30.1
3	48°50.9	187°36.2	·· 25.6	271°36.0	·· 38.9	213°05.6	·· 31.7	217°25.7	·· 30.2
4	63°53.3	202°35.8	26.6	286°36.9	38.5	228°07.6	31.9	232°27.8	30.3
5	78°55.8	217°35.4	27.6	301°37.8	38.1	243°09.6	32.1	247°30.0	30.5
6	93°58.3	232°35.0	S17°28.6	316°38.7	N17°37.7	258°11.5	S05°32.3	262°32.2	S02°30.6
7	109°00.7	247°34.7	29.7	331°39.6	37.2	273°13.5	32.5	277°34.4	30.7
8	124°03.2	262°34.3	30.7	346°40.6	36.8	288°15.5	32.7	292°36.6	30.8
9	139°05.7	277°33.9	·· 31.7	1°41.5	·· 36.4	303°17.5	·· 32.9	307°38.8	·· 30.9
10	154°08.1	292°33.6	32.7	16°42.4	36.0	318°19.4	33.1	322°41.0	31.1
11	169°10.6	307°33.2	33.7	31°43.3	35.5	333°21.4	33.3	337°43.1	31.2
12	184°13.1	322°32.8	S17°34.7	46°44.2	N17°35.1	348°23.4	S05°33.5	352°45.3	S02°31.3
13	199°15.5	337°32.4	35.7	61°45.1	34.7	3°25.3	33.7	7°47.5	31.4
14	214°18.0	352°32.1	36.7	76°46.1	34.3	18°27.3	33.9	22°49.7	31.5
15	229°20.4	7°31.7	·· 37.7	91°47.0	·· 33.8	33°29.3	·· 34.1	37°51.9	·· 31.7
16	244°22.9	22°31.3	38.8	106°47.9	33.4	48°31.2	34.3	52°54.1	31.8
17	259°25.4	37°30.9	39.8	121°48.8	33.0	63°33.2	34.5	67°56.2	31.9
18	274°27.8	52°30.6	S17°40.8	136°49.7	N17°32.6	78°35.2	S05°34.8	82°58.4	S02°32.0
19	289°30.3	67°30.2	41.8	151°50.6	32.1	93°37.2	35.0	98°00.6	32.1
20	304°32.8	82°29.8	42.8	166°51.6	31.7	108°39.1	35.2	113°02.8	32.2
21	319°35.2	97°29.4	·· 43.8	181°52.5	·· 31.3	123°41.1	·· 35.4	128°05.0	·· 32.4
22	334°37.7	112°29.1	44.8	196°53.4	30.9	138°43.1	35.6	143°07.2	32.5
23	349°40.2	127°28.7	45.8	211°54.3	30.4	153°45.0	35.8	158°09.3	32.6
Mer.pass. 23:41		ν -0.4′	d 1.0′	m -4.09	ν 0.9′	d 0.4′	m 1.58	ν 2.0′	d 0.2′ m -1.68	ν 2.2′	d 0.1′ m 0.88

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	4°42.6	142°28.3	S17°46.8	226°55.2	N17°30.0	168°47.0	S05°36.0	173°11.5	S02°32.7
1	19°45.1	157°27.9	47.8	241°56.2	29.6	183°49.0	36.2	188°13.7	32.8
2	34°47.5	172°27.6	48.8	256°57.1	29.1	198°50.9	36.4	203°15.9	33.0
3	49°50.0	187°27.2	·· 49.8	271°58.0	·· 28.7	213°52.9	·· 36.6	218°18.1	·· 33.1
4	64°52.5	202°26.8	50.8	286°58.9	28.3	228°54.9	36.8	233°20.3	33.2
5	79°54.9	217°26.4	51.8	301°59.8	27.9	243°56.9	37.0	248°22.4	33.3
6	94°57.4	232°26.0	S17°52.8	317°00.8	N17°27.4	258°58.8	S05°37.2	263°24.6	S02°33.4
7	109°59.9	247°25.7	53.8	332°01.7	27.0	274°00.8	37.4	278°26.8	33.6
8	125°02.3	262°25.3	54.8	347°02.6	26.6	289°02.8	37.6	293°29.0	33.7
9	140°04.8	277°24.9	·· 55.8	2°03.5	·· 26.1	304°04.7	·· 37.8	308°31.2	·· 33.8
10	155°07.3	292°24.5	56.8	17°04.4	25.7	319°06.7	38.1	323°33.4	33.9
11	170°09.7	307°24.1	57.8	32°05.4	25.3	334°08.7	38.3	338°35.5	34.0
12	185°12.2	322°23.8	S17°58.8	47°06.3	N17°24.9	349°10.6	S05°38.5	353°37.7	S02°34.2
13	200°14.7	337°23.4	17°59.8	62°07.2	24.4	4°12.6	38.7	8°39.9	34.3
14	215°17.1	352°23.0	18°00.8	77°08.1	24.0	19°14.6	38.9	23°42.1	34.4
15	230°19.6	7°22.6	·· 01.8	92°09.0	·· 23.6	34°16.5	·· 39.1	38°44.3	·· 34.5
16	245°22.0	22°22.2	02.7	107°10.0	23.1	49°18.5	39.3	53°46.5	34.6
17	260°24.5	37°21.9	03.7	122°10.9	22.7	64°20.5	39.5	68°48.6	34.8
18	275°27.0	52°21.5	S18°04.7	137°11.8	N17°22.3	79°22.5	S05°39.7	83°50.8	S02°34.9
19	290°29.4	67°21.1	05.7	152°12.7	21.9	94°24.4	39.9	98°53.0	35.0
20	305°31.9	82°20.7	06.7	167°13.7	21.4	109°26.4	40.1	113°55.2	35.1
21	320°34.4	97°20.3	·· 07.7	182°14.6	·· 21.0	124°28.4	·· 40.3	128°57.4	·· 35.2
22	335°36.8	112°19.9	08.7	197°15.5	20.6	139°30.3	40.5	143°59.6	35.4
23	350°39.3	127°19.5	09.7	212°16.4	20.1	154°32.3	40.7	159°01.7	35.5
Mer.pass. 23:37		ν -0.4′	d 1.0′	m -4.09	ν 0.9′	d 0.4′	m 1.58	ν 2.0′	d 0.2′ m -1.67	ν 2.2′	d 0.1′ m 0.87

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	5°41.8	142°19.2	S18°10.7	227°17.4	N17°19.7	169°34.3	S05°40.9	174°03.9	S02°35.6
1	20°44.2	157°18.8	11.6	242°18.3	19.3	184°36.2	41.1	189°06.1	35.7
2	35°46.7	172°18.4	12.6	257°19.2	18.8	199°38.2	41.3	204°08.3	35.8
3	50°49.1	187°18.0	·· 13.6	272°20.1	·· 18.4	214°40.2	·· 41.6	219°10.5	·· 35.9
4	65°51.6	202°17.6	14.6	287°21.1	18.0	229°42.1	41.8	234°12.7	36.1
5	80°54.1	217°17.2	15.6	302°22.0	17.5	244°44.1	42.0	249°14.8	36.2
6	95°56.5	232°16.8	S18°16.6	317°22.9	N17°17.1	259°46.1	S05°42.2	264°17.0	S02°36.3
7	110°59.0	247°16.5	17.5	332°23.8	16.7	274°48.0	42.4	279°19.2	36.4
8	126°01.5	262°16.1	18.5	347°24.8	16.2	289°50.0	42.6	294°21.4	36.5
9	141°03.9	277°15.7	·· 19.5	2°25.7	·· 15.8	304°52.0	·· 42.8	309°23.6	·· 36.7
10	156°06.4	292°15.3	20.5	17°26.6	15.4	319°54.0	43.0	324°25.8	36.8
11	171°08.9	307°14.9	21.5	32°27.5	14.9	334°55.9	43.2	339°27.9	36.9
12	186°11.3	322°14.5	S18°22.4	47°28.5	N17°14.5	349°57.9	S05°43.4	354°30.1	S02°37.0
13	201°13.8	337°14.1	23.4	62°29.4	14.1	4°59.9	43.6	9°32.3	37.1
14	216°16.3	352°13.7	24.4	77°30.3	13.6	20°01.8	43.8	24°34.5	37.3
15	231°18.7	7°13.3	·· 25.4	92°31.2	·· 13.2	35°03.8	·· 44.0	39°36.7	·· 37.4
16	246°21.2	22°12.9	26.3	107°32.2	12.8	50°05.8	44.2	54°38.8	37.5
17	261°23.6	37°12.6	27.3	122°33.1	12.3	65°07.7	44.4	69°41.0	37.6
18	276°26.1	52°12.2	S18°28.3	137°34.0	N17°11.9	80°09.7	S05°44.6	84°43.2	S02°37.7
19	291°28.6	67°11.8	29.3	152°35.0	11.5	95°11.7	44.9	99°45.4	37.9
20	306°31.0	82°11.4	30.2	167°35.9	11.0	110°13.6	45.1	114°47.6	38.0
21	321°33.5	97°11.0	·· 31.2	182°36.8	·· 10.6	125°15.6	·· 45.3	129°49.8	·· 38.1
22	336°36.0	112°10.6	32.2	197°37.7	10.2	140°17.6	45.5	144°51.9	38.2
23	351°38.4	127°10.2	33.1	212°38.7	09.7	155°19.5	45.7	159°54.1	38.3
Mer.pass. 23:33		ν -0.4′	d 1.0′	m -4.10	ν 0.9′	d 0.4′	m 1.58	ν 2.0′	d 0.2′ m -1.67	ν 2.2′	d 0.1′ m 0.87

Stars

	SHA	Dec
Alpheratz	358°08.2	28°59.4
Ankaa	353°39.1	-42°24.3
Schedar	350°07.7	56°26.2
Diphda	349°19.8	-18°05.2
Achernar	335°44.2	-57°19.7
Hamal	328°27.8	23°22.5
Polaris	326°21.5	89°10.6
Acamar	315°36.4	-40°22.5
Menkar	314°40.2	4°01.1
Mirfak	309°14.8	49°47.6
Aldebaran	291°17.1	16°28.4
Rigel	281°35.2	-8°13.2
Capella	281°10.1	45°58.6
Bellatrix	278°57.9	6°20.1
Elnath	278°43.2	28°35.5
Alnilam	276°10.9	-1°12.7
Betelgeuse	271°27.5	7°24.3
Canopus	264°06.9	-52°40.8
Sirius	258°55.1	-16°41.2
Adhara	255°31.6	-28°56.6
Procyon	245°25.2	5°16.5
Pollux	243°57.4	28°04.3
Avior	234°28.3	-59°26.7
Suhail	223°10.6	-43°21.2
Miaplacidus	221°45.5	-69°38.2
Alphard	218°20.1	-8°34.5
Regulus	208°09.5	12°03.6
Dubhe	194°21.9	61°51.0
Denebola	182°58.6	14°40.7
Gienah	176°17.6	-17°26.2
Acrux	173°37.2	-62°59.7
Gacrux	172°28.6	-57°00.5
Alioth	166°42.4	56°03.8
Spica	158°57.1	-11°03.7
Alkaid	153°18.4	49°24.5
Hadar	149°22.9	-60°17.1
Menkent	148°36.5	-36°16.7
Arcturus	146°18.1	19°16.9
Rigil Kent.	140°25.4	-60°45.5
Kochab	137°19.9	74°14.2
Zuben'ubi	137°32.5	-15°57.8
Alphecca	126°31.7	26°46.9
Antares	112°56.1	-26°23.5
Atria	108°20.0	-68°59.9
Sabik	102°40.4	-15°42.1
Shaula	96°54.9	-37°05.5
Rasalhague	96°29.0	12°34.6
Eltanin	90°57.4	51°29.8
Kaus Aust.	84°15.9	-34°23.7
Vega	80°55.3	38°46.3
Nunki	76°28.2	-26°19.2
Altair	62°31.7	8°49.3
Peacock	53°57.0	-56°47.8
Deneb	49°47.7	45°13.1
Enif	34°10.6	9°47.6
Al Na'ir	28°13.6	-47°03.1
Fomalhaut	15°50.3	-29°43.2
Scheat	14°16.5	27°59.1
Markab	14°02.2	15°06.5

Sep 25 Fri	SHA	Mer.pass
Venus	138°53.8	14:30
Mars	222°49.8	08:53
Jupiter	164°16.2	12:46
Saturn	168°35.6	12:29

Sep 26 Sat	SHA	Mer.pass
Venus	137°45.7	14:30
Mars	222°12.6	08:52
Jupiter	164°04.4	12:43
Saturn	168°28.9	12:25

Sep 27 Sun	SHA	Mer.pass
Venus	136°37.4	14:31
Mars	221°35.6	08:50
Jupiter	163°52.5	12:40
Saturn	168°22.2	12:22

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.2380 sec ΔT = TT-UT1 = +51.9460 sec

1981 September 25 to Sep. 27 UT

h	Sun		Moon				
Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	182°02.5	S00°43.8	216°24.3	10.6′	N15°24.0	8.5′	56.9′
1	197°02.8	44.7	230°53.9	10.6′	15°15.5	8.6′	56.9′
2	212°03.0	45.7	245°23.5	10.7′	15°06.9	8.7′	56.9′
3	227°03.2	·· 46.7	259°53.2	10.8′	14°58.2	8.7′	56.8′
4	242°03.4	47.6	274°23.0	10.8′	14°49.5	8.8′	56.8′
5	257°03.6	48.6	288°52.8	10.9′	14°40.7	8.9′	56.8′
6	272°03.8	S00°49.6	303°22.7	11.0′	N14°31.8	9.0′	56.8′
7	287°04.1	50.6	317°52.6	11.0′	14°22.8	9.0′	56.8′
8	302°04.3	51.5	332°22.7	11.1′	14°13.8	9.1′	56.7′
9	317°04.5	·· 52.5	346°52.7	11.1′	14°04.7	9.1′	56.7′
10	332°04.7	53.5	1°22.9	11.2′	13°55.6	9.2′	56.7′
11	347°04.9	54.5	15°53.1	11.3′	13°46.4	9.3′	56.7′
12	2°05.1	S00°55.4	30°23.4	11.3′	N13°37.1	9.4′	56.6′
13	17°05.3	56.4	44°53.7	11.4′	13°27.7	9.4′	56.6′
14	32°05.6	57.4	59°24.1	11.5′	13°18.3	9.4′	56.6′
15	47°05.8	·· 58.4	73°54.6	11.5′	13°08.9	9.6′	56.6′
16	62°06.0	00°59.3	88°25.1	11.6′	12°59.3	9.5′	56.6′
17	77°06.2	01°00.3	102°55.7	11.7′	12°49.8	9.7′	56.5′
18	92°06.4	S01°01.3	117°26.4	11.7′	N12°40.1	9.7′	56.5′
19	107°06.6	02.3	131°57.1	11.8′	12°30.4	9.7′	56.5′
20	122°06.8	03.2	146°27.8	11.8′	12°20.7	9.8′	56.5′
21	137°07.1	·· 04.2	160°58.7	11.9′	12°10.9	9.9′	56.5′
22	152°07.3	05.2	175°29.6	12.0′	12°01.0	9.9′	56.4′
23	167°07.5	06.2	190°00.5	12.0′	11°51.1	10.0′	56.4′
	SD = 15.9′	d = 1.0′	SD = 15.5′				

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	182°07.7	S01°07.1	204°31.5	12.1′	N11°41.1	10.0′	56.4′
1	197°07.9	08.1	219°02.6	12.1′	11°31.1	10.1′	56.4′
2	212°08.1	09.1	233°33.8	12.2′	11°21.0	10.1′	56.4′
3	227°08.3	·· 10.1	248°04.9	12.2′	11°10.9	10.2′	56.3′
4	242°08.5	11.0	262°36.2	12.3′	11°00.7	10.2′	56.3′
5	257°08.8	12.0	277°07.5	12.4′	10°50.5	10.2′	56.3′
6	272°09.0	S01°13.0	291°38.9	12.4′	N10°40.3	10.3′	56.3′
7	287°09.2	14.0	306°10.3	12.5′	10°30.0	10.4′	56.3′
8	302°09.4	14.9	320°41.8	12.5′	10°19.6	10.4′	56.2′
9	317°09.6	·· 15.9	335°13.3	12.6′	10°09.2	10.4′	56.2′
10	332°09.8	16.9	349°44.9	12.6′	09°58.8	10.5′	56.2′
11	347°10.0	17.9	4°16.5	12.7′	09°48.3	10.5′	56.2′
12	2°10.2	S01°18.8	18°48.2	12.7′	N09°37.8	10.5′	56.1′
13	17°10.5	19.8	33°19.9	12.8′	09°27.3	10.6′	56.1′
14	32°10.7	20.8	47°51.7	12.8′	09°16.7	10.6′	56.1′
15	47°10.9	·· 21.8	62°23.6	12.9′	09°06.1	10.7′	56.1′
16	62°11.1	22.7	76°55.5	13.0′	08°55.4	10.7′	56.1′
17	77°11.3	23.7	91°27.4	13.0′	08°44.7	10.7′	56.0′
18	92°11.5	S01°24.7	105°59.4	13.1′	N08°34.0	10.7′	56.0′
19	107°11.7	25.6	120°31.5	13.1′	08°23.3	10.8′	56.0′
20	122°11.9	26.6	135°03.6	13.1′	08°12.5	10.9′	56.0′
21	137°12.2	·· 27.6	149°35.7	13.2′	08°01.6	10.8′	56.0′
22	152°12.4	28.6	164°07.9	13.2′	07°50.8	10.9′	55.9′
23	167°12.6	29.5	178°40.2	13.3′	07°39.9	10.9′	55.9′
	SD = 15.9′	d = 1.0′	SD = 15.4′				

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	182°12.8	S01°30.5	193°12.5	13.3′	N07°29.0	10.9′	55.9′
1	197°13.0	31.5	207°44.8	13.4′	07°18.1	11.0′	55.9′
2	212°13.2	32.5	222°17.2	13.4′	07°07.1	11.0′	55.9′
3	227°13.4	·· 33.4	236°49.6	13.5′	06°56.1	11.0′	55.8′
4	242°13.6	34.4	251°22.1	13.5′	06°45.1	11.0′	55.8′
5	257°13.8	35.4	265°54.6	13.6′	06°34.1	11.1′	55.8′
6	272°14.1	S01°36.4	280°27.1	13.6′	N06°23.0	11.0′	55.8′
7	287°14.3	37.3	294°59.7	13.6′	06°12.0	11.1′	55.8′
8	302°14.5	38.3	309°32.4	13.7′	06°00.9	11.2′	55.7′
9	317°14.7	·· 39.3	324°05.1	13.7′	05°49.7	11.1′	55.7′
10	332°14.9	40.3	338°37.8	13.8′	05°38.6	11.2′	55.7′
11	347°15.1	41.2	353°10.5	13.8′	05°27.4	11.1′	55.7′
12	2°15.3	S01°42.2	7°43.3	13.8′	N05°16.3	11.2′	55.7′
13	17°15.5	43.2	22°16.2	13.9′	05°05.1	11.2′	55.6′
14	32°15.7	44.2	36°49.0	13.9′	04°53.9	11.2′	55.6′
15	47°16.0	·· 45.1	51°22.0	13.9′	04°42.7	11.3′	55.6′
16	62°16.2	46.1	65°54.9	14.0′	04°31.4	11.2′	55.6′
17	77°16.4	47.1	80°27.9	14.0′	04°20.2	11.3′	55.6′
18	92°16.6	S01°48.1	95°00.9	14.1′	N04°08.9	11.2′	55.5′
19	107°16.8	49.0	109°34.0	14.1′	03°57.7	11.3′	55.5′
20	122°17.0	50.0	124°07.0	14.1′	03°46.4	11.3′	55.5′
21	137°17.2	·· 51.0	138°40.2	14.2′	03°35.1	11.3′	55.5′
22	152°17.4	51.9	153°13.3	14.2′	03°23.8	11.3′	55.5′
23	167°17.6	52.9	167°46.5	14.2′	03°12.5	11.3′	55.4′
	SD = 16.0′	d = 1.0′	SD = 15.2′				

Lat.	Twilight		Sunrise	Sunset	Twilight	
	Naut.	Civil			Civil	Naut.
N 72°	03:21	04:48	05:56	17:45	18:52	20:17
N 70°	03:38	04:54	05:55	17:45	18:46	20:02
68°	03:50	04:59	05:55	17:46	18:41	19:49
66°	04:01	05:03	05:54	17:47	18:38	19:39
64°	04:09	05:06	05:54	17:47	18:34	19:31
62°	04:16	05:09	05:53	17:48	18:32	19:24
60°	04:22	05:12	05:53	17:48	18:29	19:19
N 58°	04:27	05:14	05:53	17:48	18:27	19:14
56°	04:32	05:16	05:53	17:49	18:26	19:09
54°	04:36	05:17	05:52	17:49	18:24	19:06
52°	04:39	05:19	05:52	17:49	18:23	19:02
50°	04:42	05:20	05:52	17:50	18:22	19:00
45°	04:48	05:22	05:52	17:50	18:20	18:54
N 40°	04:53	05:24	05:51	17:51	18:18	18:49
35°	04:56	05:25	05:51	17:51	18:17	18:46
30°	04:59	05:26	05:50	17:52	18:16	18:43
20°	05:02	05:28	05:50	17:53	18:15	18:40
N 10°	05:04	05:28	05:49	17:54	18:15	18:39
0°	05:03	05:27	05:48	17:55	18:15	18:39
S 10°	05:02	05:26	05:47	17:56	18:17	18:41
20°	04:58	05:24	05:46	17:57	18:19	18:44
30°	04:53	05:21	05:45	17:58	18:22	18:50
35°	04:49	05:19	05:44	17:59	18:25	18:54
40°	04:44	05:16	05:43	18:00	18:27	18:59
45°	04:38	05:13	05:42	18:02	18:31	19:06
S 50°	04:30	05:08	05:40	18:03	18:36	19:14
52°	04:26	05:06	05:40	18:04	18:38	19:18
54°	04:22	05:04	05:39	18:05	18:40	19:23
56°	04:16	05:01	05:38	18:06	18:43	19:28
58°	04:11	04:58	05:37	18:07	18:46	19:34
S 60°	04:04	04:55	05:36	18:08	18:50	19:41

Lat.	Moonrise			Moonset		
	Fri	Sat	Sun	Fri	Sat	Sun
N 72°	·· ··	01:55	03:50	19:02	18:44	18:30
N 70°	00:22	02:15	04:00	18:41	18:32	18:25
68°	00:48	02:30	04:08	18:24	18:22	18:20
66°	01:07	02:42	04:15	18:10	18:14	18:16
64°	01:23	02:53	04:21	17:59	18:07	18:13
62°	01:36	03:02	04:25	17:49	18:01	18:10
60°	01:47	03:09	04:30	17:41	17:56	18:08
N 58°	01:57	03:16	04:33	17:33	17:51	18:06
56°	02:05	03:21	04:37	17:27	17:47	18:04
54°	02:13	03:27	04:40	17:21	17:43	18:02
52°	02:19	03:31	04:42	17:16	17:39	18:01
50°	02:25	03:36	04:45	17:11	17:36	17:59
45°	02:38	03:45	04:50	17:00	17:29	17:56
N 40°	02:49	03:52	04:55	16:52	17:24	17:53
35°	02:58	03:59	04:58	16:44	17:19	17:51
30°	03:06	04:05	05:02	16:37	17:14	17:49
20°	03:19	04:14	05:07	16:26	17:07	17:45
N 10°	03:31	04:23	05:13	16:16	17:00	17:42
0°	03:42	04:31	05:17	16:06	16:54	17:39
S 10°	03:53	04:39	05:22	15:56	16:47	17:36
20°	04:05	04:48	05:27	15:46	16:40	17:32
30°	04:19	04:57	05:33	15:34	16:32	17:29
35°	04:27	05:03	05:36	15:27	16:28	17:26
40°	04:35	05:09	05:40	15:19	16:22	17:24
45°	04:46	05:17	05:44	15:10	16:16	17:21
S 50°	04:58	05:25	05:49	14:59	16:09	17:18
52°	05:04	05:30	05:52	14:54	16:05	17:16
54°	05:10	05:34	05:54	14:48	16:02	17:14
56°	05:17	05:39	05:57	14:41	15:57	17:12
58°	05:25	05:44	06:00	14:34	15:53	17:10
S 60°	05:34	05:50	06:04	14:26	15:48	17:07

Day	Sun			Moon		
	Eqn.of Time		Mer.	Mer.Pass.		Age
	00^h	12^h	Pass	Upper	Lower	27-29
	mm:ss	mm:ss	hh:mm	hh:mm	hh:mm	10-2%
25	08:10	08:21	11:52	09:54	22:19	
26	08:31	08:41	11:51	10:42	23:05	
27	08:51	09:01	11:51	11:28	23:50	

September 28, 29, 30 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	6°40.9	142°09.8	S18°34.1	227°39.6	N17°09.3	170°21.5	S05°45.9	174°56.3	S02°38.5
1	21°43.4	157°09.4	35.1	242°40.5	08.9	185°23.5	46.1	189°58.5	38.6
2	36°45.8	172°09.0	36.1	257°41.5	08.4	200°25.4	46.3	205°00.7	38.7
3	51°48.3	187°08.6	·· 37.0	272°42.4	·· 08.0	215°27.4	·· 46.5	220°02.9	·· 38.8
4	66°50.7	202°08.2	38.0	287°43.3	07.6	230°29.4	46.7	235°05.0	38.9
5	81°53.2	217°07.8	39.0	302°44.3	07.1	245°31.3	46.9	250°07.2	39.0
6	96°55.7	232°07.4	S18°39.9	317°45.2	N17°06.7	260°33.3	S05°47.1	265°09.4	S02°39.2
7	111°58.1	247°07.0	40.9	332°46.1	06.3	275°35.3	47.3	280°11.6	39.3
8	127°00.6	262°06.6	41.8	347°47.1	05.8	290°37.2	47.5	295°13.8	39.4
9	142°03.1	277°06.2	·· 42.8	2°48.0	·· 05.4	305°39.2	·· 47.7	310°16.0	·· 39.5
10	157°05.5	292°05.8	43.8	17°48.9	05.0	320°41.2	47.9	325°18.1	39.6
11	172°08.0	307°05.4	44.7	32°49.9	04.5	335°43.1	48.2	340°20.3	39.8
12	187°10.5	322°05.0	S18°45.7	47°50.8	N17°04.1	350°45.1	S05°48.4	355°22.5	S02°39.9
13	202°12.9	337°04.6	46.7	62°51.7	03.6	5°47.1	48.6	10°24.7	40.0
14	217°15.4	352°04.2	47.6	77°52.6	03.2	20°49.0	48.8	25°26.9	40.1
15	232°17.9	7°03.8	·· 48.6	92°53.6	·· 02.8	35°51.0	·· 49.0	40°29.0	·· 40.2
16	247°20.3	22°03.4	49.5	107°54.5	02.3	50°53.0	49.2	55°31.2	40.4
17	262°22.8	37°03.0	50.5	122°55.4	01.9	65°54.9	49.4	70°33.4	40.5
18	277°25.2	52°02.6	S18°51.4	137°56.4	N17°01.5	80°56.9	S05°49.6	85°35.6	S02°40.6
19	292°27.7	67°02.2	52.4	152°57.3	01.0	95°58.9	49.8	100°37.8	40.7
20	307°30.2	82°01.8	53.3	167°58.3	00.6	111°00.8	50.0	115°40.0	40.8
21	322°32.6	97°01.4	·· 54.3	182°59.2	17°00.1	126°02.8	·· 50.2	130°42.1	·· 41.0
22	337°35.1	112°01.0	55.3	198°00.1	16°59.7	141°04.8	50.4	145°44.3	41.1
23	352°37.6	127°00.6	56.2	213°01.1	59.3	156°06.7	50.6	160°46.5	41.2
Mer.pass. 23:29		ν -0.4′	d 1.0′	m -4.10	ν 0.9′	d 0.4′	m 1.57	ν 2.0′	d 0.2′ m -1.67	ν 2.2′	d 0.1′ m 0.87

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	7°40.0	142°00.2	S18°57.2	228°02.0	N16°58.8	171°08.7	S05°50.8	175°48.7	S02°41.3
1	22°42.5	156°59.8	58.1	243°02.9	58.4	186°10.7	51.0	190°50.9	41.4
2	37°45.0	171°59.4	18°59.1	258°03.9	58.0	201°12.6	51.2	205°53.0	41.6
3	52°47.4	186°59.0	19°00.0	273°04.8	·· 57.5	216°14.6	·· 51.4	220°55.2	·· 41.7
4	67°49.9	201°58.6	01.0	288°05.7	57.1	231°16.6	51.7	235°57.4	41.8
5	82°52.3	216°58.2	01.9	303°06.7	56.6	246°18.5	51.9	250°59.6	41.9
6	97°54.8	231°57.8	S19°02.9	318°07.6	N16°56.2	261°20.5	S05°52.1	266°01.8	S02°42.0
7	112°57.3	246°57.4	03.8	333°08.5	55.8	276°22.5	52.3	281°04.0	42.2
8	127°59.7	261°57.0	04.7	348°09.5	55.3	291°24.4	52.5	296°06.1	42.3
9	143°02.2	276°56.6	·· 05.7	3°10.4	·· 54.9	306°26.4	·· 52.7	311°08.3	·· 42.4
10	158°04.7	291°56.2	06.6	18°11.4	54.4	321°28.4	52.9	326°10.5	42.5
11	173°07.1	306°55.8	07.6	33°12.3	54.0	336°30.3	53.1	341°12.7	42.6
12	188°09.6	321°55.4	S19°08.5	48°13.2	N16°53.6	351°32.3	S05°53.3	356°14.9	S02°42.7
13	203°12.1	336°55.0	09.5	63°14.2	53.1	6°34.3	53.5	11°17.1	42.9
14	218°14.5	351°54.6	10.4	78°15.1	52.7	21°36.2	53.7	26°19.2	43.0
15	233°17.0	6°54.1	·· 11.3	93°16.0	·· 52.2	36°38.2	·· 53.9	41°21.4	·· 43.1
16	248°19.5	21°53.7	12.3	108°17.0	51.8	51°40.2	54.1	56°23.6	43.2
17	263°21.9	36°53.3	13.2	123°17.9	51.4	66°42.1	54.3	71°25.8	43.3
18	278°24.4	51°52.9	S19°14.2	138°18.9	N16°50.9	81°44.1	S05°54.5	86°28.0	S02°43.5
19	293°26.8	66°52.5	15.1	153°19.8	50.5	96°46.1	54.7	101°30.1	43.6
20	308°29.3	81°52.1	16.0	168°20.7	50.0	111°48.0	55.0	116°32.3	43.7
21	323°31.8	96°51.7	·· 17.0	183°21.7	·· 49.6	126°50.0	·· 55.2	131°34.5	·· 43.8
22	338°34.2	111°51.3	17.9	198°22.6	49.2	141°52.0	55.4	146°36.7	43.9
23	353°36.7	126°50.9	18.8	213°23.6	48.7	156°53.9	55.6	161°38.9	44.1
Mer.pass. 23:25		ν -0.4′	d 1.0′	m -4.11	ν 0.9′	d 0.4′	m 1.57	ν 2.0′	d 0.2′ m -1.67	ν 2.2′	d 0.1′ m 0.86

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	8°39.2	141°50.5	S19°19.8	228°24.5	N16°48.3	171°55.9	S05°55.8	176°41.1	S02°44.2
1	23°41.6	156°50.0	20.7	243°25.4	47.8	186°57.9	56.0	191°43.2	44.3
2	38°44.1	171°49.6	21.6	258°26.4	47.4	201°59.8	56.2	206°45.4	44.4
3	53°46.6	186°49.2	·· 22.6	273°27.3	·· 47.0	217°01.8	·· 56.4	221°47.6	·· 44.5
4	68°49.0	201°48.8	23.5	288°28.3	46.5	232°03.8	56.6	236°49.8	44.7
5	83°51.5	216°48.4	24.4	303°29.2	46.1	247°05.7	56.8	251°52.0	44.8
6	98°54.0	231°48.0	S19°25.4	318°30.2	N16°45.6	262°07.7	S05°57.0	266°54.1	S02°44.9
7	113°56.4	246°47.6	26.3	333°31.1	45.2	277°09.7	57.2	281°56.3	45.0
8	128°58.9	261°47.2	27.2	348°32.0	44.7	292°11.6	57.4	296°58.5	45.1
9	144°01.3	276°46.7	·· 28.1	3°33.0	·· 44.3	307°13.6	·· 57.6	312°00.7	·· 45.3
10	159°03.8	291°46.3	29.1	18°33.9	43.9	322°15.6	57.8	327°02.9	45.4
11	174°06.3	306°45.9	30.0	33°34.9	43.4	337°17.5	58.0	342°05.1	45.5
12	189°08.7	321°45.5	S19°30.9	48°35.8	N16°43.0	352°19.5	S05°58.3	357°07.2	S02°45.6
13	204°11.2	336°45.1	31.8	63°36.8	42.5	7°21.4	58.5	12°09.4	45.7
14	219°13.7	351°44.7	32.8	78°37.7	42.1	22°23.4	58.7	27°11.6	45.8
15	234°16.1	6°44.2	·· 33.7	93°38.6	·· 41.6	37°25.4	·· 58.9	42°13.8	·· 46.0
16	249°18.6	21°43.8	34.6	108°39.6	41.2	52°27.3	59.1	57°16.0	46.1
17	264°21.1	36°43.4	35.5	123°40.5	40.8	67°29.3	59.3	72°18.1	46.2
18	279°23.5	51°43.0	S19°36.4	138°41.5	N16°40.3	82°31.3	S05°59.5	87°20.3	S02°46.3
19	294°26.0	66°42.6	37.4	153°42.4	39.9	97°33.2	59.7	102°22.5	46.4
20	309°28.4	81°42.2	38.3	168°43.4	39.4	112°35.2	05°59.9	117°24.7	46.6
21	324°30.9	96°41.7	·· 39.2	183°44.3	·· 39.0	127°37.2	06°00.1	132°26.9	·· 46.7
22	339°33.4	111°41.3	40.1	198°45.3	38.5	142°39.1	00.3	147°29.0	46.8
23	354°35.8	126°40.9	41.0	213°46.2	38.1	157°41.1	00.5	162°31.2	46.9
Mer.pass. 23:22		ν -0.4′	d 0.9′	m -4.11	ν 0.9′	d 0.4′	m 1.57	ν 2.0′	d 0.2′ m -1.67	ν 2.2′	d 0.1′ m 0.86

Stars

	SHA	Dec
Alpheratz	358°08.2	28°59.4
Ankaa	353°39.1	-42°24.3
Schedar	350°07.7	56°26.2
Diphda	349°19.8	-18°05.2
Achernar	335°44.2	-57°19.7
Hamal	328°27.8	23°22.6
Polaris	326°20.9	89°10.6
Acamar	315°36.4	-40°22.5
Menkar	314°40.1	4°01.1
Mirfak	309°14.7	49°47.6
Aldebaran	291°17.0	16°28.4
Rigel	281°35.2	-8°13.2
Capella	281°10.1	45°58.6
Bellatrix	278°57.9	6°20.1
Elnath	278°43.1	28°35.5
Alnilam	276°10.9	-1°12.7
Betelgeuse	271°27.5	7°24.3
Canopus	264°06.9	-52°40.8
Sirius	258°55.1	-16°41.2
Adhara	255°31.6	-28°56.6
Procyon	245°25.1	5°16.5
Pollux	243°57.4	28°04.2
Avior	234°28.2	-59°26.7
Suhail	223°10.6	-43°21.2
Miaplacidus	221°45.5	-69°38.2
Alphard	218°20.1	-8°34.5
Regulus	208°09.5	12°03.6
Dubhe	194°21.8	61°51.0
Denebola	182°58.6	14°40.7
Gienah	176°17.6	-17°26.2
Acrux	173°37.2	-62°59.7
Gacrux	172°28.6	-57°00.5
Alioth	166°42.4	56°03.7
Spica	158°57.1	-11°03.7
Alkaid	153°18.4	49°24.5
Hadar	149°23.0	-60°17.1
Menkent	148°36.5	-36°16.7
Arcturus	146°18.1	19°16.9
Rigil Kent.	140°25.4	-60°45.4
Kochab	137°19.9	74°14.1
Zuben'ubi	137°32.5	-15°57.8
Alphecca	126°31.7	26°46.9
Antares	112°56.2	-26°23.5
Atria	108°20.0	-68°59.9
Sabik	102°40.4	-15°42.1
Shaula	96°54.9	-37°05.5
Rasalhague	96°29.0	12°34.6
Eltanin	90°57.5	51°29.8
Kaus Aust.	84°15.9	-34°23.7
Vega	80°55.3	38°46.3
Nunki	76°28.2	-26°19.2
Altair	62°31.7	8°49.3
Peacock	53°57.0	-56°47.9
Deneb	49°47.7	45°13.1
Enif	34°10.6	9°47.6
Al Na'ir	28°13.7	-47°03.1
Fomalhaut	15°50.3	-29°43.2
Scheat	14°16.6	27°59.1
Markab	14°02.2	15°06.5

Sep 28 Mon	SHA	Mer.pass
Venus	135°28.9	14:32
Mars	220°58.7	08:49
Jupiter	163°40.6	12:37
Saturn	168°15.4	12:18

Sep 29 Tue	SHA	Mer.pass
Venus	134°20.2	14:32
Mars	220°22.0	08:47
Jupiter	163°28.7	12:34
Saturn	168°08.7	12:15

Sep 30 Wed	SHA	Mer.pass
Venus	133°11.3	14:33
Mars	219°45.3	08:46
Jupiter	163°16.7	12:31
Saturn	168°01.9	12:11

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°17.8	S01°53.9	182°19.7	14.2′	N03°01.2	11.3′	55.4′
1	197°18.0	54.9	196°53.0	14.3′	02°49.9	11.3′	55.4′
2	212°18.3	55.8	211°26.2	14.3′	02°38.6	11.3′	55.4′
3	227°18.5	·· 56.8	225°59.5	14.3′	02°27.3	11.4′	55.4′
4	242°18.7	57.8	240°32.9	14.4′	02°15.9	11.3′	55.4′
5	257°18.9	58.8	255°06.2	14.4′	02°04.6	11.3′	55.3′
6	272°19.1	S01°59.7	269°39.6	14.4′	N01°53.3	11.4′	55.3′
7	287°19.3	02°00.7	284°13.0	14.4′	01°41.9	11.3′	55.3′
8	302°19.5	01.7	298°46.5	14.5′	01°30.6	11.3′	55.3′
9	317°19.7	·· 02.7	313°19.9	14.5′	01°19.3	11.3′	55.3′
10	332°19.9	03.6	327°53.4	14.5′	01°08.0	11.4′	55.2′
11	347°20.1	04.6	342°26.9	14.5′	00°56.6	11.3′	55.2′
12	2°20.3	S02°05.6	357°00.4	14.6′	N00°45.3	11.3′	55.2′
13	17°20.5	06.5	11°34.0	14.6′	00°34.0	11.3′	55.2′
14	32°20.8	07.5	26°07.6	14.6′	00°22.7	11.3′	55.2′
15	47°21.0	·· 08.5	40°41.2	14.6′	00°11.4	11.3′	55.2′
16	62°21.2	09.5	55°14.8	14.6′	N00°00.1	11.3′	55.1′
17	77°21.4	10.4	69°48.4	14.7′	S00°11.2	11.3′	55.1′
18	92°21.6	S02°11.4	84°22.1	14.7′	S00°22.5	11.3′	55.1′
19	107°21.8	12.4	98°55.7	14.7′	00°33.8	11.3′	55.1′
20	122°22.0	13.4	113°29.4	14.7′	00°45.1	11.2′	55.1′
21	137°22.2	·· 14.3	128°03.1	14.7′	00°56.3	11.3′	55.0′
22	152°22.4	15.3	142°36.9	14.7′	01°07.6	11.2′	55.0′
23	167°22.6	16.3	157°10.6	14.8′	01°18.8	11.2′	55.0′
	SD = 16.0′	d = 1.0′	SD = 15.1′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°22.8	S02°17.3	171°44.3	14.8′	S01°30.0	11.2′	55.0′
1	197°23.0	18.2	186°18.1	14.8′	01°41.2	11.2′	55.0′
2	212°23.2	19.2	200°51.9	14.8′	01°52.4	11.2′	55.0′
3	227°23.4	·· 20.2	215°25.7	14.8′	02°03.6	11.2′	54.9′
4	242°23.7	21.1	229°59.5	14.8′	02°14.8	11.1′	54.9′
5	257°23.9	22.1	244°33.3	14.8′	02°25.9	11.1′	54.9′
6	272°24.1	S02°23.1	259°07.1	14.8′	S02°37.0	11.2′	54.9′
7	287°24.3	24.1	273°41.0	14.8′	02°48.2	11.1′	54.9′
8	302°24.5	25.0	288°14.8	14.9′	02°59.3	11.0′	54.9′
9	317°24.7	·· 26.0	302°48.7	14.9′	03°10.3	11.1′	54.8′
10	332°24.9	27.0	317°22.5	14.9′	03°21.4	11.0′	54.8′
11	347°25.1	28.0	331°56.4	14.9′	03°32.4	11.0′	54.8′
12	2°25.3	S02°28.9	346°30.3	14.9′	S03°43.4	11.0′	54.8′
13	17°25.5	29.9	1°04.2	14.9′	03°54.4	11.0′	54.8′
14	32°25.7	30.9	15°38.1	14.9′	04°05.4	11.0′	54.8′
15	47°25.9	·· 31.8	30°11.9	14.9′	04°16.4	10.9′	54.7′
16	62°26.1	32.8	44°45.8	14.9′	04°27.3	10.9′	54.7′
17	77°26.3	33.8	59°19.7	14.9′	04°38.2	10.9′	54.7′
18	92°26.5	S02°34.8	73°53.7	14.9′	S04°49.1	10.8′	54.7′
19	107°26.7	35.7	88°27.6	14.9′	04°59.9	10.8′	54.7′
20	122°26.9	36.7	103°01.5	14.9′	05°10.7	10.8′	54.7′
21	137°27.1	·· 37.7	117°35.4	14.9′	05°21.5	10.8′	54.7′
22	152°27.4	38.7	132°09.3	14.9′	05°32.3	10.7′	54.6′
23	167°27.6	39.6	146°43.2	14.9′	05°43.0	10.7′	54.6′
	SD = 16.0′	d = 1.0′	SD = 15.0′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°27.8	S02°40.6	161°17.1	14.9′	S05°53.7	10.7′	54.6′
1	197°28.0	41.6	175°51.0	14.9′	06°04.4	10.6′	54.6′
2	212°28.2	42.5	190°24.9	14.9′	06°15.0	10.7′	54.6′
3	227°28.4	·· 43.5	204°58.8	14.9′	06°25.7	10.5′	54.6′
4	242°28.6	44.5	219°32.7	14.9′	06°36.2	10.6′	54.6′
5	257°28.8	45.5	234°06.6	14.9′	06°46.8	10.5′	54.5′
6	272°29.0	S02°46.4	248°40.5	14.9′	S06°57.3	10.5′	54.5′
7	287°29.2	47.4	263°14.4	14.9′	07°07.8	10.4′	54.5′
8	302°29.4	48.4	277°48.3	14.9′	07°18.2	10.5′	54.5′
9	317°29.6	·· 49.3	292°22.2	14.9′	07°28.7	10.3′	54.5′
10	332°29.8	50.3	306°56.0	14.9′	07°39.0	10.4′	54.5′
11	347°30.0	51.3	321°29.9	14.9′	07°49.4	10.3′	54.5′
12	2°30.2	S02°52.3	336°03.7	14.8′	S07°59.7	10.2′	54.4′
13	17°30.4	53.2	350°37.6	14.8′	08°09.9	10.3′	54.4′
14	32°30.6	54.2	5°11.4	14.8′	08°20.2	10.1′	54.4′
15	47°30.8	·· 55.2	19°45.2	14.8′	08°30.3	10.2′	54.4′
16	62°31.0	56.1	34°19.1	14.8′	08°40.5	10.1′	54.4′
17	77°31.2	57.1	48°52.9	14.8′	08°50.6	10.1′	54.4′
18	92°31.4	S02°58.1	63°26.7	14.8′	S09°00.7	10.0′	54.4′
19	107°31.6	02°59.1	78°00.4	14.8′	09°10.7	10.0′	54.4′
20	122°31.8	03°00.0	92°34.2	14.8′	09°20.7	9.9′	54.3′
21	137°32.0	·· 01.0	107°08.0	14.7′	09°30.6	9.9′	54.3′
22	152°32.2	02.0	121°41.7	14.7′	09°40.5	9.8′	54.3′
23	167°32.4	02.9	136°15.4	14.7′	09°50.3	9.8′	54.3′
	SD = 16.0′	d = 1.0′	SD = 14.9′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	03:38	05:02	06:09	17:29	18:36	19:59
N 70°	03:52	05:06	06:07	17:32	18:32	19:46
68°	04:03	05:10	06:05	17:34	18:29	19:35
66°	04:11	05:13	06:04	17:35	18:26	19:27
64°	04:19	05:15	06:02	17:37	18:24	19:20
62°	04:25	05:17	06:01	17:38	18:22	19:14
60°	04:30	05:19	06:00	17:39	18:20	19:09
N 58°	04:34	05:20	05:59	17:40	18:19	19:05
56°	04:38	05:22	05:59	17:41	18:18	19:01
54°	04:41	05:23	05:58	17:42	18:17	18:58
52°	04:44	05:24	05:57	17:42	18:16	18:55
50°	04:47	05:24	05:57	17:43	18:15	18:53
45°	04:52	05:26	05:55	17:45	18:14	18:48
N 40°	04:56	05:27	05:54	17:46	18:13	18:44
35°	04:58	05:28	05:53	17:47	18:12	18:42
30°	05:00	05:28	05:52	17:48	18:12	18:40
20°	05:03	05:28	05:50	17:50	18:12	18:38
N 10°	05:03	05:28	05:49	17:52	18:13	18:37
0°	05:02	05:26	05:47	17:54	18:14	18:38
S 10°	05:00	05:24	05:45	17:55	18:16	18:41
20°	04:56	05:21	05:43	17:58	18:20	18:45
30°	04:49	05:17	05:41	18:00	18:24	18:52
35°	04:45	05:14	05:40	18:02	18:27	18:57
40°	04:39	05:11	05:38	18:03	18:30	19:02
45°	04:32	05:07	05:36	18:05	18:35	19:10
S 50°	04:23	05:01	05:34	18:08	18:40	19:19
52°	04:18	04:59	05:33	18:09	18:43	19:24
54°	04:13	04:56	05:32	18:10	18:46	19:29
56°	04:08	04:53	05:30	18:12	18:49	19:35
58°	04:01	04:49	05:29	18:13	18:53	19:41
S 60°	03:54	04:45	05:27	18:15	18:57	19:49

Lat.	**Moonrise** Mon	Tue	Wed	**Moonset** Mon	Tue	Wed
N 72°	05:38	07:23	09:08	18:16	18:03	17:48
N 70°	05:41	07:19	08:56	18:17	18:10	18:02
68°	05:43	07:15	08:47	18:18	18:15	18:13
66°	05:44	07:12	08:39	18:18	18:20	18:22
64°	05:46	07:10	08:32	18:19	18:24	18:30
62°	05:47	07:08	08:27	18:19	18:27	18:36
60°	05:49	07:06	08:22	18:19	18:30	18:42
N 58°	05:50	07:04	08:18	18:20	18:33	18:47
56°	05:50	07:03	08:14	18:20	18:35	18:52
54°	05:51	07:01	08:11	18:20	18:38	18:56
52°	05:52	07:00	08:08	18:20	18:40	19:00
50°	05:53	06:59	08:05	18:20	18:41	19:03
45°	05:54	06:57	07:59	18:21	18:45	19:10
N 40°	05:55	06:55	07:54	18:21	18:49	19:17
35°	05:56	06:53	07:49	18:21	18:51	19:22
30°	05:57	06:52	07:46	18:22	18:54	19:27
20°	05:59	06:49	07:39	18:22	18:58	19:35
N 10°	06:00	06:47	07:34	18:22	19:02	19:42
0°	06:02	06:45	07:28	18:23	19:06	19:49
S 10°	06:03	06:43	07:23	18:23	19:10	19:56
20°	06:05	06:41	07:17	18:23	19:13	20:03
30°	06:06	06:39	07:11	18:24	19:18	20:12
35°	06:07	06:37	07:08	18:24	19:21	20:16
40°	06:08	06:36	07:04	18:24	19:23	20:22
45°	06:10	06:34	06:59	18:24	19:27	20:28
S 50°	06:11	06:32	06:53	18:25	19:31	20:36
52°	06:12	06:31	06:51	18:25	19:33	20:39
54°	06:13	06:30	06:48	18:25	19:35	20:43
56°	06:13	06:29	06:45	18:25	19:37	20:48
58°	06:14	06:28	06:41	18:25	19:40	20:53
S 60°	06:15	06:26	06:38	18:26	19:42	20:58

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 0-2 0-3%
28	09:11	09:21	11:51	12:12	–:–	
29	09:31	09:41	11:50	12:56	00:34	
30	09:51	10:01	11:50	13:39	01:17	

October 01, 02, 03 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	9°38.3	141°40.5	S19°41.9	228°47.1	N16°37.6	172°43.1	S06°00.7	177°33.4	S02°47.0
1	24°40.8	156°40.1	42.9	243°48.1	37.2	187°45.0	00.9	192°35.6	47.2
2	39°43.2	171°39.6	43.8	258°49.0	36.8	202°47.0	01.1	207°37.8	47.3
3	54°45.7	186°39.2	·· 44.7	273°50.0	·· 36.3	217°49.0	·· 01.3	222°40.0	·· 47.4
4	69°48.2	201°38.8	45.6	288°50.9	35.9	232°50.9	01.6	237°42.1	47.5
5	84°50.6	216°38.4	46.5	303°51.9	35.4	247°52.9	01.8	252°44.3	47.6
6	99°53.1	231°38.0	S19°47.4	318°52.8	N16°35.0	262°54.8	S06°02.0	267°46.5	S02°47.8
7	114°55.6	246°37.5	48.3	333°53.8	34.5	277°56.8	02.2	282°48.7	47.9
8	129°58.0	261°37.1	49.2	348°54.7	34.1	292°58.8	02.4	297°50.9	48.0
9	145°00.5	276°36.7	·· 50.1	3°55.7	·· 33.6	308°00.7	·· 02.6	312°53.0	·· 48.1
10	160°02.9	291°36.3	51.0	18°56.6	33.2	323°02.7	02.8	327°55.2	48.2
11	175°05.4	306°35.8	51.9	33°57.6	32.7	338°04.7	03.0	342°57.4	48.3
12	190°07.9	321°35.4	S19°52.9	48°58.5	N16°32.3	353°06.6	S06°03.2	357°59.6	S02°48.5
13	205°10.3	336°35.0	53.8	63°59.5	31.9	8°08.6	03.4	13°01.8	48.6
14	220°12.8	351°34.6	54.7	79°00.4	31.4	23°10.6	03.6	28°04.0	48.7
15	235°15.3	6°34.1	·· 55.6	94°01.4	·· 31.0	38°12.5	·· 03.8	43°06.1	·· 48.8
16	250°17.7	21°33.7	56.5	109°02.3	30.5	53°14.5	04.0	58°08.3	48.9
17	265°20.2	36°33.3	57.4	124°03.3	30.1	68°16.5	04.2	73°10.5	49.1
18	280°22.7	51°32.9	S19°58.3	139°04.2	N16°29.6	83°18.4	S06°04.4	88°12.7	S02°49.2
19	295°25.1	66°32.4	19°59.2	154°05.2	29.2	98°20.4	04.6	103°14.9	49.3
20	310°27.6	81°32.0	20°00.1	169°06.1	28.7	113°22.3	04.9	118°17.0	49.4
21	325°30.0	96°31.6	·· 01.0	184°07.1	·· 28.3	128°24.3	·· 05.1	133°19.2	·· 49.5
22	340°32.5	111°31.2	01.9	199°08.0	27.8	143°26.3	05.3	148°21.4	49.7
23	355°35.0	126°30.7	02.8	214°09.0	27.4	158°28.2	05.5	163°23.6	49.8
Mer.pass. 23:18		ν -0.4′	d 0.9′	m -4.12	ν 0.9′	d 0.4′	m 1.56	ν 2.0′	d 0.2′ m -1.67	ν 2.2′	d 0.1′ m 0.85

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	10°37.4	141°30.3	S20°03.7	229°09.9	N16°26.9	173°30.2	S06°05.7	178°25.8	S02°49.9
1	25°39.9	156°29.9	04.5	244°10.9	26.5	188°32.2	05.9	193°27.9	50.0
2	40°42.4	171°29.4	05.4	259°11.8	26.0	203°34.1	06.1	208°30.1	50.1
3	55°44.8	186°29.0	·· 06.3	274°12.8	·· 25.6	218°36.1	·· 06.3	223°32.3	·· 50.3
4	70°47.3	201°28.6	07.2	289°13.7	25.1	233°38.1	06.5	238°34.5	50.4
5	85°49.8	216°28.2	08.1	304°14.7	24.7	248°40.0	06.7	253°36.7	50.5
6	100°52.2	231°27.7	S20°09.0	319°15.6	N16°24.2	263°42.0	S06°06.9	268°38.9	S02°50.6
7	115°54.7	246°27.3	09.9	334°16.6	23.8	278°43.9	07.1	283°41.0	50.7
8	130°57.2	261°26.9	10.8	349°17.5	23.3	293°45.9	07.3	298°43.2	50.8
9	145°59.6	276°26.4	·· 11.7	4°18.5	·· 22.9	308°47.9	·· 07.5	313°45.4	·· 51.0
10	161°02.1	291°26.0	12.6	19°19.4	22.4	323°49.8	07.7	328°47.6	51.1
11	176°04.5	306°25.6	13.5	34°20.4	22.0	338°51.8	07.9	343°49.8	51.2
12	191°07.0	321°25.1	S20°14.3	49°21.4	N16°21.5	353°53.8	S06°08.2	358°51.9	S02°51.3
13	206°09.5	336°24.7	15.2	64°22.3	21.1	8°55.7	08.4	13°54.1	51.4
14	221°11.9	351°24.3	16.1	79°23.3	20.6	23°57.7	08.6	28°56.3	51.6
15	236°14.4	6°23.8	·· 17.0	94°24.2	·· 20.2	38°59.7	·· 08.8	43°58.5	·· 51.7
16	251°16.9	21°23.4	17.9	109°25.2	19.7	54°01.6	09.0	59°00.7	51.8
17	266°19.3	36°23.0	18.8	124°26.1	19.3	69°03.6	09.2	74°02.8	51.9
18	281°21.8	51°22.5	S20°19.6	139°27.1	N16°18.8	84°05.5	S06°09.4	89°05.0	S02°52.0
19	296°24.3	66°22.1	20.5	154°28.0	18.4	99°07.5	09.6	104°07.2	52.2
20	311°26.7	81°21.7	21.4	169°29.0	17.9	114°09.5	09.8	119°09.4	52.3
21	326°29.2	96°21.2	·· 22.3	184°29.9	·· 17.5	129°11.4	·· 10.0	134°11.6	·· 52.4
22	341°31.7	111°20.8	23.2	199°30.9	17.0	144°13.4	10.2	149°13.7	52.5
23	356°34.1	126°20.4	24.0	214°31.9	16.6	159°15.4	10.4	164°15.9	52.6
Mer.pass. 23:14		ν -0.4′	d 0.9′	m -4.13	ν 1.0′	d 0.4′	m 1.56	ν 2.0′	d 0.2′ m -1.67	ν 2.2′	d 0.1′ m 0.84

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	11°36.6	141°19.9	S20°24.9	229°32.8	N16°16.1	174°17.3	S06°10.6	179°18.1	S02°52.8
1	26°39.0	156°19.5	25.8	244°33.8	15.7	189°19.3	10.8	194°20.3	52.9
2	41°41.5	171°19.0	26.7	259°34.7	15.2	204°21.3	11.0	209°22.5	53.0
3	56°44.0	186°18.6	·· 27.5	274°35.7	·· 14.8	219°23.2	·· 11.2	224°24.7	·· 53.1
4	71°46.4	201°18.2	28.4	289°36.6	14.3	234°25.2	11.5	239°26.8	53.2
5	86°48.9	216°17.7	29.3	304°37.6	13.9	249°27.1	11.7	254°29.0	53.3
6	101°51.4	231°17.3	S20°30.2	319°38.6	N16°13.4	264°29.1	S06°11.9	269°31.2	S02°53.5
7	116°53.8	246°16.9	31.0	334°39.5	13.0	279°31.1	12.1	284°33.4	53.6
8	131°56.3	261°16.4	31.9	349°40.5	12.5	294°33.0	12.3	299°35.6	53.7
9	146°58.8	276°16.0	·· 32.8	4°41.4	·· 12.1	309°35.0	·· 12.5	314°37.7	·· 53.8
10	162°01.2	291°15.5	33.6	19°42.4	11.6	324°37.0	12.7	329°39.9	53.9
11	177°03.7	306°15.1	34.5	34°43.4	11.2	339°38.9	12.9	344°42.1	54.1
12	192°06.1	321°14.7	S20°35.4	49°44.3	N16°10.7	354°40.9	S06°13.1	359°44.3	S02°54.2
13	207°08.6	336°14.2	36.2	64°45.3	10.3	9°42.8	13.3	14°46.5	54.3
14	222°11.1	351°13.8	37.1	79°46.2	09.8	24°44.8	13.5	29°48.6	54.4
15	237°13.5	6°13.3	·· 38.0	94°47.2	·· 09.4	39°46.8	·· 13.7	44°50.8	·· 54.5
16	252°16.0	21°12.9	38.8	109°48.2	08.9	54°48.7	13.9	59°53.0	54.7
17	267°18.5	36°12.4	39.7	124°49.1	08.5	69°50.7	14.1	74°55.2	54.8
18	282°20.9	51°12.0	S20°40.5	139°50.1	N16°08.0	84°52.7	S06°14.3	89°57.4	S02°54.9
19	297°23.4	66°11.6	41.4	154°51.0	07.6	99°54.6	14.5	104°59.5	55.0
20	312°25.9	81°11.1	42.3	169°52.0	07.1	114°56.6	14.7	120°01.7	55.1
21	327°28.3	96°10.7	·· 43.1	184°53.0	·· 06.6	129°58.5	·· 15.0	135°03.9	·· 55.3
22	342°30.8	111°10.2	44.0	199°53.9	06.2	145°00.5	15.2	150°06.1	55.4
23	357°33.3	126°09.8	44.8	214°54.9	05.7	160°02.5	15.4	165°08.3	55.5
Mer.pass. 23:10		ν -0.4′	d 0.9′	m -4.13	ν 1.0′	d 0.5′	m 1.56	ν 2.0′	d 0.2′ m -1.67	ν 2.2′	d 0.1′ m 0.84

Stars

	SHA	Dec
Alpheratz	358°08.2	28°59.4
Ankaa	353°39.1	-42°24.3
Schedar	350°07.7	56°26.2
Diphda	349°19.8	-18°05.2
Achernar	335°44.2	-57°19.7
Hamal	328°27.8	23°22.6
Polaris	326°20.3	89°10.6
Acamar	315°36.3	-40°22.5
Menkar	314°40.1	4°01.1
Mirfak	309°14.7	49°47.7
Aldebaran	291°17.0	16°28.4
Rigel	281°35.2	-8°13.2
Capella	281°10.1	45°58.6
Bellatrix	278°57.9	6°20.1
Elnath	278°43.1	28°35.5
Alnilam	276°10.9	-1°12.7
Betelgeuse	271°27.4	7°24.3
Canopus	264°06.9	-52°40.8
Sirius	258°55.0	-16°41.2
Adhara	255°31.6	-28°56.6
Procyon	245°25.1	5°16.5
Pollux	243°57.4	28°04.2
Avior	234°28.2	-59°26.7
Suhail	223°10.5	-43°21.2
Miaplacidus	221°45.4	-69°38.2
Alphard	218°20.1	-8°34.5
Regulus	208°09.5	12°03.6
Dubhe	194°21.8	61°51.0
Denebola	182°58.6	14°40.7
Gienah	176°17.6	-17°26.2
Acrux	173°37.2	-62°59.7
Gacrux	172°28.6	-57°00.5
Alioth	166°42.4	56°03.7
Spica	158°57.1	-11°03.7
Alkaid	153°18.4	49°24.5
Hadar	149°23.0	-60°17.0
Menkent	148°36.6	-36°16.7
Arcturus	146°18.1	19°16.9
Rigil Kent.	140°25.4	-60°45.4
Kochab	137°19.9	74°14.1
Zuben'ubi	137°32.5	-15°57.8
Alphecca	126°31.8	26°46.9
Antares	112°56.2	-26°23.4
Atria	108°20.1	-68°59.9
Sabik	102°40.4	-15°42.1
Shaula	96°54.9	-37°05.5
Rasalhague	96°29.0	12°34.6
Eltanin	90°57.5	51°29.8
Kaus Aust.	84°15.9	-34°23.7
Vega	80°55.4	38°46.3
Nunki	76°28.3	-26°19.2
Altair	62°31.7	8°49.3
Peacock	53°57.0	-56°47.9
Deneb	49°47.8	45°13.1
Enif	34°10.7	9°47.6
Al Na'ir	28°13.7	-47°03.1
Fomalhaut	15°50.3	-29°43.2
Scheat	14°16.6	27°59.1
Markab	14°02.2	15°06.5

Oct 01 Thu	SHA	Mer.pass
Venus	132°02.2	14:34
Mars	219°08.8	08:44
Jupiter	163°04.8	12:27
Saturn	167°55.1	12:08

Oct 02 Fri	SHA	Mer.pass
Venus	130°52.9	14:34
Mars	218°32.5	08:43
Jupiter	162°52.8	12:24
Saturn	167°48.3	12:05

Oct 03 Sat	SHA	Mer.pass
Venus	129°43.3	14:35
Mars	217°56.2	08:41
Jupiter	162°40.7	12:21
Saturn	167°41.5	12:01

Horizontal parallax	
Venus:	0.2
Mars:	0.1

h

	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°32.6	S03°03.9	150°49.1	14.7′	S10°00.1	9.8′	54.3′
1	197°32.8	04.9	165°22.8	14.7′	10°09.9	9.7′	54.3′
2	212°33.0	05.8	179°56.5	14.7′	10°19.6	9.7′	54.3′
3	227°33.2	·· 06.8	194°30.2	14.7′	10°29.3	9.6′	54.3′
4	242°33.4	07.8	209°03.8	14.6′	10°38.9	9.6′	54.3′
5	257°33.6	08.8	223°37.5	14.6′	10°48.5	9.5′	54.3′
6	272°33.8	S03°09.7	238°11.1	14.6′	S10°58.0	9.5′	54.2′
7	287°34.0	10.7	252°44.7	14.6′	11°07.5	9.4′	54.2′
8	302°34.2	11.7	267°18.3	14.6′	11°16.9	9.4′	54.2′
9	317°34.4	·· 12.6	281°51.8	14.5′	11°26.3	9.3′	54.2′
10	332°34.6	13.6	296°25.4	14.5′	11°35.6	9.3′	54.2′
11	347°34.8	14.6	310°58.9	14.5′	11°44.9	9.2′	54.2′
12	2°35.0	S03°15.6	325°32.4	14.5′	S11°54.1	9.1′	54.2′
13	17°35.2	16.5	340°05.9	14.5′	12°03.2	9.2′	54.2′
14	32°35.4	17.5	354°39.3	14.4′	12°12.4	9.0′	54.2′
15	47°35.6	·· 18.5	9°12.8	14.4′	12°21.4	9.0′	54.2′
16	62°35.8	19.4	23°46.2	14.4′	12°30.4	9.0′	54.2′
17	77°36.0	20.4	38°19.6	14.4′	12°39.4	8.9′	54.1′
18	92°36.2	S03°21.4	52°52.9	14.3′	S12°48.3	8.8′	54.1′
19	107°36.4	22.3	67°26.3	14.3′	12°57.1	8.8′	54.1′
20	122°36.6	23.3	81°59.6	14.3′	13°05.9	8.7′	54.1′
21	137°36.8	·· 24.3	96°32.9	14.3′	13°14.6	8.7′	54.1′
22	152°37.0	25.2	111°06.1	14.2′	13°23.3	8.6′	54.1′
23	167°37.2	26.2	125°39.4	14.2′	13°31.9	8.5′	54.1′
	SD = 16.0′	d = 1.0′	SD = 14.8′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°37.4	S03°27.2	140°12.6	14.2′	S13°40.4	8.5′	54.1′
1	197°37.6	28.2	154°45.8	14.2′	13°48.9	8.5′	54.1′
2	212°37.8	29.1	169°19.0	14.1′	13°57.4	8.3′	54.1′
3	227°38.0	·· 30.1	183°52.1	14.1′	14°05.7	8.3′	54.1′
4	242°38.2	31.1	198°25.2	14.1′	14°14.0	8.3′	54.1′
5	257°38.4	32.0	212°58.3	14.1′	14°22.3	8.2′	54.1′
6	272°38.6	S03°33.0	227°31.4	14.0′	S14°30.5	8.1′	54.1′
7	287°38.8	34.0	242°04.4	14.0′	14°38.6	8.1′	54.1′
8	302°39.0	34.9	256°37.4	14.0′	14°46.7	7.9′	54.1′
9	317°39.2	·· 35.9	271°10.4	13.9′	14°54.6	8.0′	54.1′
10	332°39.4	36.9	285°43.3	13.9′	15°02.6	7.8′	54.1′
11	347°39.6	37.8	300°16.2	13.9′	15°10.4	7.8′	54.0′
12	2°39.8	S03°38.8	314°49.1	13.9′	S15°18.2	7.8′	54.0′
13	17°40.0	39.8	329°21.9	13.8′	15°26.0	7.6′	54.0′
14	32°40.2	40.8	343°54.8	13.8′	15°33.6	7.6′	54.0′
15	47°40.4	·· 41.7	358°27.5	13.8′	15°41.2	7.6′	54.0′
16	62°40.6	42.7	13°00.3	13.7′	15°48.8	7.4′	54.0′
17	77°40.8	43.7	27°33.0	13.7′	15°56.2	7.4′	54.0′
18	92°41.0	S03°44.6	42°05.7	13.7′	S16°03.6	7.3′	54.0′
19	107°41.2	45.6	56°38.4	13.6′	16°10.9	7.3′	54.0′
20	122°41.4	46.6	71°11.0	13.6′	16°18.2	7.2′	54.0′
21	137°41.6	·· 47.5	85°43.6	13.6′	16°25.4	7.1′	54.0′
22	152°41.8	48.5	100°16.2	13.5′	16°32.5	7.0′	54.0′
23	167°42.0	49.5	114°48.7	13.5′	16°39.5	7.0′	54.0′
	SD = 16.0′	d = 1.0′	SD = 14.8′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°42.2	S03°50.4	129°21.2	13.5′	S16°46.5	6.9′	54.0′
1	197°42.4	51.4	143°53.7	13.4′	16°53.4	6.8′	54.0′
2	212°42.5	52.4	158°26.1	13.4′	17°00.2	6.8′	54.0′
3	227°42.7	·· 53.3	172°58.5	13.4′	17°07.0	6.6′	54.0′
4	242°42.9	54.3	187°30.9	13.3′	17°13.6	6.6′	54.0′
5	257°43.1	55.3	202°03.2	13.3′	17°20.2	6.6′	54.0′
6	272°43.3	S03°56.2	216°35.5	13.3′	S17°26.8	6.4′	54.0′
7	287°43.5	57.2	231°07.7	13.2′	17°33.2	6.4′	54.0′
8	302°43.7	58.2	245°40.0	13.2′	17°39.6	6.3′	54.0′
9	317°43.9	03°59.1	260°12.2	13.2′	17°45.9	6.2′	54.0′
10	332°44.1	04°00.1	274°44.3	13.1′	17°52.1	6.1′	54.0′
11	347°44.3	01.1	289°16.4	13.1′	17°58.2	6.1′	54.0′
12	2°44.5	S04°02.0	303°48.5	13.0′	S18°04.3	6.0′	54.0′
13	17°44.7	03.0	318°20.6	13.0′	18°10.3	5.9′	54.0′
14	32°44.9	04.0	332°52.6	13.0′	18°16.2	5.8′	54.0′
15	47°45.1	·· 04.9	347°24.6	12.9′	18°22.0	5.8′	54.0′
16	62°45.3	05.9	1°56.5	12.9′	18°27.8	5.6′	54.1′
17	77°45.5	06.9	16°28.4	12.9′	18°33.4	5.6′	54.1′
18	92°45.7	S04°07.8	31°00.3	12.8′	S18°39.0	5.5′	54.1′
19	107°45.8	08.8	45°32.1	12.8′	18°44.5	5.4′	54.1′
20	122°46.0	09.8	60°03.9	12.8′	18°49.9	5.3′	54.1′
21	137°46.2	·· 10.7	74°35.7	12.7′	18°55.2	5.3′	54.1′
22	152°46.4	11.7	89°07.4	12.7′	19°00.5	5.2′	54.1′
23	167°46.6	12.7	103°39.1	12.7′	19°05.7	5.0′	54.1′
	SD = 16.0′	d = 1.0′	SD = 14.7′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	03:53	05:15	06:23	17:14	18:21	19:42
N 70°	04:05	05:18	06:19	17:18	18:18	19:31
68°	04:14	05:20	06:16	17:21	18:16	19:22
66°	04:22	05:22	06:13	17:24	18:15	19:15
64°	04:28	05:24	06:11	17:26	18:13	19:09
62°	04:33	05:25	06:09	17:28	18:12	19:04
60°	04:37	05:26	06:07	17:30	18:11	19:00
N 58°	04:41	05:27	06:06	17:32	18:11	18:56
56°	04:44	05:28	06:05	17:33	18:10	18:53
54°	04:47	05:28	06:03	17:34	18:09	18:50
52°	04:49	05:29	06:02	17:36	18:09	18:48
50°	04:51	05:29	06:01	17:37	18:09	18:46
45°	04:56	05:30	05:59	17:39	18:08	18:42
N 40°	04:59	05:30	05:57	17:41	18:08	18:39
35°	05:01	05:30	05:55	17:43	18:08	18:37
30°	05:02	05:30	05:54	17:44	18:08	18:36
20°	05:03	05:29	05:51	17:47	18:09	18:35
N 10°	05:03	05:28	05:49	17:50	18:11	18:35
0°	05:01	05:25	05:46	17:53	18:13	18:37
S 10°	04:58	05:23	05:44	17:55	18:16	18:41
20°	04:53	05:19	05:41	17:58	18:20	18:46
30°	04:45	05:13	05:37	18:02	18:26	18:54
35°	04:40	05:10	05:35	18:04	18:29	18:59
40°	04:34	05:06	05:33	18:06	18:33	19:06
45°	04:26	05:01	05:31	18:09	18:39	19:14
S 50°	04:16	04:55	05:27	18:12	18:45	19:24
52°	04:11	04:52	05:26	18:14	18:48	19:29
54°	04:05	04:48	05:24	18:16	18:52	19:35
56°	03:59	04:45	05:22	18:18	18:55	19:41
58°	03:52	04:41	05:20	18:20	19:00	19:49
S 60°	03:43	04:36	05:18	18:22	19:05	19:58

Lat.	**Moonrise** Thu	Fri	Sat	**Moonset** Thu	Fri	Sat
N 72°	10:57	12:57	▬	17:30	17:01	▬
N 70°	10:35	12:19	14:12	17:53	17:41	17:22
68°	10:19	11:52	13:27	18:10	18:08	18:08
66°	10:05	11:32	12:58	18:25	18:29	18:38
64°	09:54	11:16	12:36	18:37	18:46	19:00
62°	09:45	11:03	12:18	18:47	19:00	19:19
60°	09:37	10:51	12:03	18:56	19:12	19:34
N 58°	09:30	10:42	11:51	19:03	19:22	19:46
56°	09:24	10:33	11:40	19:10	19:31	19:57
54°	09:19	10:26	11:31	19:16	19:39	20:07
52°	09:14	10:19	11:23	19:21	19:46	20:16
50°	09:09	10:13	11:15	19:26	19:53	20:24
45°	09:00	10:00	10:59	19:37	20:07	20:40
N 40°	08:52	09:49	10:46	19:46	20:18	20:54
35°	08:45	09:40	10:35	19:54	20:28	21:06
30°	08:39	09:32	10:25	20:01	20:37	21:16
20°	08:29	09:19	10:09	20:13	20:52	21:34
N 10°	08:20	09:07	09:54	20:23	21:05	21:49
0°	08:11	08:56	09:41	20:33	21:17	22:03
S 10°	08:03	08:44	09:27	20:42	21:30	22:18
20°	07:54	08:33	09:13	20:53	21:43	22:33
30°	07:44	08:19	08:57	21:05	21:58	22:51
35°	07:39	08:12	08:47	21:12	22:07	23:01
40°	07:32	08:03	08:37	21:20	22:17	23:13
45°	07:25	07:53	08:24	21:29	22:29	23:27
S 50°	07:16	07:40	08:09	21:40	22:43	23:44
52°	07:12	07:35	08:02	21:45	22:50	23:52
54°	07:07	07:29	07:54	21:51	22:57	·· ··
56°	07:02	07:22	07:45	21:57	23:06	·· ··
58°	06:56	07:14	07:35	22:05	23:15	·· ··
S 60°	06:50	07:05	07:24	22:13	23:26	·· ··

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 3-5 8-21%
01	10:11	10:20	11:50	14:22	02:00	
02	10:30	10:39	11:49	15:06	02:44	
03	10:49	10:58	11:49	15:52	03:29	

October 04, 05, 06 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	12°35.7	141°09.3	S20°45.7	229°55.9	N16°05.3	175°04.4	S06°15.6	180°10.5	S02°55.6
1	27°38.2	156°08.9	46.5	244°56.8	04.8	190°06.4	15.8	195°12.6	55.7
2	42°40.6	171°08.5	47.4	259°57.8	04.4	205°08.4	16.0	210°14.8	55.8
3	57°43.1	186°08.0	·· 48.3	274°58.7	·· 03.9	220°10.3	·· 16.2	225°17.0	·· 56.0
4	72°45.6	201°07.6	49.1	289°59.7	03.5	235°12.3	16.4	240°19.2	56.1
5	87°48.0	216°07.1	50.0	305°00.7	03.0	250°14.2	16.6	255°21.4	56.2
6	102°50.5	231°06.7	S20°50.8	320°01.6	N16°02.6	265°16.2	S06°16.8	270°23.5	S02°56.3
7	117°53.0	246°06.2	51.7	335°02.6	02.1	280°18.2	17.0	285°25.7	56.4
8	132°55.4	261°05.8	52.5	350°03.6	01.6	295°20.1	17.2	300°27.9	56.6
9	147°57.9	276°05.3	·· 53.4	5°04.5	·· 01.2	310°22.1	·· 17.4	315°30.1	·· 56.7
10	163°00.4	291°04.9	54.2	20°05.5	00.7	325°24.1	17.6	330°32.3	56.8
11	178°02.8	306°04.4	55.1	35°06.5	16°00.3	340°26.0	17.8	345°34.4	56.9
12	193°05.3	321°04.0	S20°55.9	50°07.4	N15°59.8	355°28.0	S06°18.0	0°36.6	S02°57.0
13	208°07.8	336°03.5	56.7	65°08.4	59.4	10°29.9	18.3	15°38.8	57.2
14	223°10.2	351°03.1	57.6	80°09.3	58.9	25°31.9	18.5	30°41.0	57.3
15	238°12.7	6°02.6	·· 58.4	95°10.3	·· 58.5	40°33.9	·· 18.7	45°43.2	·· 57.4
16	253°15.1	21°02.2	20°59.3	110°11.3	58.0	55°35.8	18.9	60°45.3	57.5
17	268°17.6	36°01.7	21°00.1	125°12.2	57.5	70°37.8	19.1	75°47.5	57.6
18	283°20.1	51°01.3	S21°01.0	140°13.2	N15°57.1	85°39.7	S06°19.3	90°49.7	S02°57.7
19	298°22.5	66°00.8	01.8	155°14.2	56.6	100°41.7	19.5	105°51.9	57.9
20	313°25.0	81°00.4	02.6	170°15.1	56.2	115°43.7	19.7	120°54.1	58.0
21	328°27.5	95°59.9	·· 03.5	185°16.1	·· 55.7	130°45.6	·· 19.9	135°56.2	·· 58.1
22	343°29.9	110°59.5	04.3	200°17.1	55.3	145°47.6	20.1	150°58.4	58.2
23	358°32.4	125°59.0	05.2	215°18.0	54.8	160°49.6	20.3	166°00.6	58.3
Mer.pass. 23:06		ν -0.4′	d 0.9′	ν 1.0′	d 0.5′	ν 2.0′	d 0.2′	ν 2.2′	d 0.1′
		m -4.14		m 1.55		m -1.67		m 0.83	

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	13°34.9	140°58.6	S21°06.0	230°19.0	N15°54.4	175°51.5	S06°20.5	181°02.8	S02°58.5
1	28°37.3	155°58.1	06.8	245°20.0	53.9	190°53.5	20.7	196°05.0	58.6
2	43°39.8	170°57.7	07.7	260°20.9	53.4	205°55.4	20.9	211°07.2	58.7
3	58°42.2	185°57.2	·· 08.5	275°21.9	·· 53.0	220°57.4	·· 21.1	226°09.3	·· 58.8
4	73°44.7	200°56.8	09.3	290°22.9	52.5	235°59.4	21.3	241°11.5	58.9
5	88°47.2	215°56.3	10.2	305°23.9	52.1	251°01.3	21.5	256°13.7	59.1
6	103°49.6	230°55.9	S21°11.0	320°24.8	N15°51.6	266°03.3	S06°21.8	271°15.9	S02°59.2
7	118°52.1	245°55.4	11.8	335°25.8	51.2	281°05.2	22.0	286°18.1	59.3
8	133°54.6	260°54.9	12.6	350°26.8	50.7	296°07.2	22.2	301°20.2	59.4
9	148°57.0	275°54.5	·· 13.5	5°27.7	·· 50.2	311°09.2	·· 22.4	316°22.4	·· 59.5
10	163°59.5	290°54.0	14.3	20°28.7	49.8	326°11.1	22.6	331°24.6	59.6
11	179°02.0	305°53.6	15.1	35°29.7	49.3	341°13.1	22.8	346°26.8	59.8
12	194°04.4	320°53.1	S21°16.0	50°30.6	N15°48.9	356°15.1	S06°23.0	1°29.0	S02°59.9
13	209°06.9	335°52.7	16.8	65°31.6	48.4	11°17.0	23.2	16°31.1	03°00.0
14	224°09.4	350°52.2	17.6	80°32.6	47.9	26°19.0	23.4	31°33.3	00.1
15	239°11.8	5°51.7	·· 18.4	95°33.6	·· 47.5	41°20.9	·· 23.6	46°35.5	·· 00.2
16	254°14.3	20°51.3	19.3	110°34.5	47.0	56°22.9	23.8	61°37.7	00.4
17	269°16.7	35°50.8	20.1	125°35.5	46.6	71°24.9	24.0	76°39.9	00.5
18	284°19.2	50°50.4	S21°20.9	140°36.5	N15°46.1	86°26.8	S06°24.2	91°42.0	S03°00.6
19	299°21.7	65°49.9	21.7	155°37.4	45.7	101°28.8	24.4	106°44.2	00.7
20	314°24.1	80°49.5	22.5	170°38.4	45.2	116°30.7	24.6	121°46.4	00.8
21	329°26.6	95°49.0	·· 23.3	185°39.4	·· 44.7	131°32.7	·· 24.8	136°48.6	·· 00.9
22	344°29.1	110°48.5	24.2	200°40.4	44.3	146°34.7	25.0	151°50.8	01.1
23	359°31.5	125°48.1	25.0	215°41.3	43.8	161°36.6	25.3	166°52.9	01.2
Mer.pass. 23:02		ν -0.5′	d 0.8′	ν 1.0′	d 0.5′	ν 2.0′	d 0.2′	ν 2.2′	d 0.1′
		m -4.15		m 1.55		m -1.67		m 0.83	

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	14°34.0	140°47.6	S21°25.8	230°42.3	N15°43.4	176°38.6	S06°25.5	181°55.1	S03°01.3
1	29°36.5	155°47.2	26.6	245°43.3	42.9	191°40.6	25.7	196°57.3	01.4
2	44°38.9	170°46.7	27.4	260°44.3	42.4	206°42.5	25.9	211°59.5	01.5
3	59°41.4	185°46.2	·· 28.2	275°45.2	·· 42.0	221°44.5	·· 26.1	227°01.7	·· 01.7
4	74°43.9	200°45.8	29.0	290°46.2	41.5	236°46.4	26.3	242°03.8	01.8
5	89°46.3	215°45.3	29.9	305°47.2	41.1	251°48.4	26.5	257°06.0	01.9
6	104°48.8	230°44.9	S21°30.7	320°48.1	N15°40.6	266°50.4	S06°26.7	272°08.2	S03°02.0
7	119°51.2	245°44.4	31.5	335°49.1	40.1	281°52.3	26.9	287°10.4	02.1
8	134°53.7	260°43.9	32.3	350°50.1	39.7	296°54.3	27.1	302°12.6	02.3
9	149°56.2	275°43.5	·· 33.1	5°51.1	·· 39.2	311°56.2	·· 27.3	317°14.8	·· 02.4
10	164°58.6	290°43.0	33.9	20°52.0	38.8	326°58.2	27.5	332°16.9	02.5
11	180°01.1	305°42.5	34.7	35°53.0	38.3	342°00.2	27.7	347°19.1	02.6
12	195°03.6	320°42.1	S21°35.5	50°54.0	N15°37.8	357°02.1	S06°27.9	2°21.3	S03°02.7
13	210°06.0	335°41.6	36.3	65°55.0	37.4	12°04.1	28.1	17°23.5	02.8
14	225°08.5	350°41.1	37.1	80°56.0	36.9	27°06.0	28.3	32°25.7	03.0
15	240°11.0	5°40.7	·· 37.9	95°56.9	·· 36.4	42°08.0	·· 28.5	47°27.8	·· 03.1
16	255°13.4	20°40.2	38.7	110°57.9	36.0	57°10.0	28.8	62°30.0	03.2
17	270°15.9	35°39.8	39.5	125°58.9	35.5	72°11.9	29.0	77°32.2	03.3
18	285°18.4	50°39.3	S21°40.3	140°59.9	N15°35.1	87°13.9	S06°29.2	92°34.4	S03°03.4
19	300°20.8	65°38.8	41.1	156°00.8	34.6	102°15.8	29.4	107°36.6	03.6
20	315°23.3	80°38.4	41.9	171°01.8	34.1	117°17.8	29.6	122°38.7	03.7
21	330°25.7	95°37.9	·· 42.7	186°02.8	·· 33.7	132°19.8	·· 29.8	137°40.9	·· 03.8
22	345°28.2	110°37.4	43.5	201°03.8	33.2	147°21.7	30.0	152°43.1	03.9
23	0°30.7	125°37.0	44.3	216°04.7	32.8	162°23.7	30.2	167°45.3	04.0
Mer.pass. 22:58		ν -0.5′	d 0.8′	ν 1.0′	d 0.5′	ν 2.0′	d 0.2′	ν 2.2′	d 0.1′
		m -4.15		m 1.55		m -1.67		m 0.82	

Stars

	SHA	Dec
Alpheratz	358°08.2	28°59.4
Ankaa	353°39.1	-42°24.3
Schedar	350°07.6	56°26.2
Diphda	349°19.8	-18°05.2
Achernar	335°44.1	-57°19.7
Hamal	328°27.8	23°22.6
Polaris	326°19.6	89°10.7
Acamar	315°36.3	-40°22.6
Menkar	314°40.1	4°01.1
Mirfak	309°14.7	49°47.7
Aldebaran	291°17.0	16°28.4
Rigel	281°35.2	-8°13.2
Capella	281°10.1	45°58.7
Bellatrix	278°57.9	6°20.1
Elnath	278°43.1	28°35.5
Alnilam	276°10.8	-1°12.7
Betelgeuse	271°27.4	7°24.3
Canopus	264°06.8	-52°40.8
Sirius	258°55.0	-16°41.2
Adhara	255°31.6	-28°56.6
Procyon	245°25.1	5°16.5
Pollux	243°57.4	28°04.2
Avior	234°28.2	-59°26.7
Suhail	223°10.5	-43°21.2
Miaplacidus	221°45.4	-69°38.2
Alphard	218°20.1	-8°34.5
Regulus	208°09.5	12°03.6
Dubhe	194°21.8	61°51.0
Denebola	182°58.6	14°40.7
Gienah	176°17.6	-17°26.2
Acrux	173°37.2	-62°59.7
Gacrux	172°28.5	-57°00.5
Alioth	166°42.4	56°03.7
Spica	158°57.1	-11°03.7
Alkaid	153°18.4	49°24.5
Hadar	149°23.0	-60°17.0
Menkent	148°36.6	-36°16.7
Arcturus	146°18.1	19°16.9
Rigil Kent.	140°25.4	-60°45.4
Kochab	137°20.0	74°14.1
Zuben'ubi	137°32.5	-15°57.8
Alphecca	126°31.8	26°46.9
Antares	112°56.2	-26°23.4
Atria	108°20.1	-68°59.9
Sabik	102°40.5	-15°42.1
Shaula	96°54.9	-37°05.5
Rasalhague	96°29.0	12°34.6
Eltanin	90°57.5	51°29.8
Kaus Aust.	84°16.0	-34°23.7
Vega	80°55.4	38°46.3
Nunki	76°28.3	-26°19.2
Altair	62°31.8	8°49.3
Peacock	53°57.0	-56°47.9
Deneb	49°47.8	45°13.2
Enif	34°10.7	9°47.6
Al Na'ir	28°13.7	-47°03.1
Fomalhaut	15°50.3	-29°43.2
Scheat	14°16.6	27°59.1
Markab	14°02.2	15°06.5

Oct 04 Sun	**SHA**	**Mer.pass**
Venus	128°33.6	14:36
Mars	217°20.1	08:40
Jupiter	162°28.7	12:18
Saturn	167°34.7	11:58

Oct 05 Mon	**SHA**	**Mer.pass**
Venus	127°23.7	14:37
Mars	216°44.2	08:38
Jupiter	162°16.7	12:15
Saturn	167°27.9	11:54

Oct 06 Tue	**SHA**	**Mer.pass**
Venus	126°13.6	14:37
Mars	216°08.3	08:37
Jupiter	162°04.6	12:12
Saturn	167°21.1	11:51

Horizontal parallax	
Venus:	0.2
Mars:	0.1

h	Sun		Moon				
Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°46.8	S04°13.6	118°10.7	12.6′	S19°10.7	5.0′	54.1′
1	197°47.0	14.6	132°42.3	12.6′	19°15.7	5.0′	54.1′
2	212°47.2	15.6	147°13.9	12.5′	19°20.7	4.8′	54.1′
3	227°47.4	·· 16.5	161°45.5	12.5′	19°25.5	4.7′	54.1′
4	242°47.6	17.5	176°17.0	12.5′	19°30.2	4.7′	54.1′
5	257°47.8	18.5	190°48.4	12.4′	19°34.9	4.5′	54.1′
6	272°48.0	S04°19.4	205°19.9	12.4′	S19°39.4	4.5′	54.1′
7	287°48.1	20.4	219°51.3	12.4′	19°43.9	4.4′	54.1′
8	302°48.3	21.3	234°22.6	12.3′	19°48.3	4.3′	54.1′
9	317°48.5	·· 22.3	248°54.0	12.3′	19°52.6	4.2′	54.2′
10	332°48.7	23.3	263°25.3	12.3′	19°56.8	4.1′	54.2′
11	347°48.9	24.2	277°56.5	12.2′	20°00.9	4.1′	54.2′
12	2°49.1	S04°25.2	292°27.7	12.2′	S20°05.0	3.9′	54.2′
13	17°49.3	26.2	306°58.9	12.1′	20°08.9	3.9′	54.2′
14	32°49.5	27.1	321°30.1	12.1′	20°12.8	3.7′	54.2′
15	47°49.7	·· 28.1	336°01.2	12.1′	20°16.5	3.7′	54.2′
16	62°49.9	29.1	350°32.3	12.0′	20°20.2	3.6′	54.2′
17	77°50.1	30.0	5°03.3	12.0′	20°23.8	3.5′	54.2′
18	92°50.2	S04°31.0	19°34.3	12.0′	S20°27.3	3.4′	54.2′
19	107°50.4	32.0	34°05.3	11.9′	20°30.7	3.3′	54.3′
20	122°50.6	32.9	48°36.2	11.9′	20°34.0	3.2′	54.3′
21	137°50.8	·· 33.9	63°07.1	11.9′	20°37.2	3.1′	54.3′
22	152°51.0	34.8	77°38.0	11.8′	20°40.3	3.0′	54.3′
23	167°51.2	35.8	92°08.8	11.8′	20°43.3	2.9′	54.3′
	SD = 16.0′	d = 1.0′	SD = 14.8′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°51.4	S04°36.8	106°39.6	11.8′	S20°46.2	2.8′	54.3′
1	197°51.6	37.7	121°10.4	11.7′	20°49.0	2.8′	54.3′
2	212°51.8	38.7	135°41.1	11.7′	20°51.8	2.6′	54.3′
3	227°51.9	·· 39.7	150°11.8	11.7′	20°54.4	2.5′	54.4′
4	242°52.1	40.6	164°42.5	11.6′	20°56.9	2.5′	54.4′
5	257°52.3	41.6	179°13.1	11.6′	20°59.4	2.3′	54.4′
6	272°52.5	S04°42.5	193°43.7	11.6′	S21°01.7	2.3′	54.4′
7	287°52.7	43.5	208°14.3	11.5′	21°04.0	2.1′	54.4′
8	302°52.9	44.5	222°44.8	11.5′	21°06.1	2.0′	54.4′
9	317°53.1	·· 45.4	237°15.3	11.5′	21°08.1	2.0′	54.4′
10	332°53.3	46.4	251°45.8	11.4′	21°10.1	1.8′	54.5′
11	347°53.4	47.4	266°16.2	11.4′	21°11.9	1.8′	54.5′
12	2°53.6	S04°48.3	280°46.6	11.4′	S21°13.7	1.6′	54.5′
13	17°53.8	49.3	295°17.0	11.3′	21°15.3	1.6′	54.5′
14	32°54.0	50.2	309°47.4	11.3′	21°16.9	1.4′	54.5′
15	47°54.2	·· 51.2	324°17.7	11.3′	21°18.3	1.4′	54.5′
16	62°54.4	52.2	338°48.0	11.3′	21°19.7	1.2′	54.6′
17	77°54.6	53.1	353°18.2	11.2′	21°20.9	1.2′	54.6′
18	92°54.7	S04°54.1	7°48.4	11.2′	S21°22.1	1.0′	54.6′
19	107°54.9	55.1	22°18.6	11.2′	21°23.1	1.0′	54.6′
20	122°55.1	56.0	36°48.8	11.1′	21°24.1	0.8′	54.6′
21	137°55.3	·· 57.0	51°18.9	11.1′	21°24.9	0.7′	54.7′
22	152°55.5	57.9	65°49.1	11.1′	21°25.6	0.7′	54.7′
23	167°55.7	58.9	80°19.1	11.1′	21°26.3	0.5′	54.7′
	SD = 16.0′	d = 1.0′	SD = 14.8′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°55.9	S04°59.9	94°49.2	11.0′	S21°26.8	0.4′	54.7′
1	197°56.0	05°00.8	109°19.2	11.0′	21°27.2	0.4′	54.7′
2	212°56.2	01.8	123°49.2	11.0′	21°27.6	0.2′	54.8′
3	227°56.4	·· 02.7	138°19.2	11.0′	21°27.8	0.1′	54.8′
4	242°56.6	03.7	152°49.2	10.9′	21°27.9	0.0′	54.8′
5	257°56.8	04.7	167°19.1	10.9′	21°27.9	0.1′	54.8′
6	272°57.0	S05°05.6	181°49.0	10.9′	S21°27.8	0.2′	54.8′
7	287°57.1	06.6	196°18.9	10.9′	21°27.6	0.3′	54.9′
8	302°57.3	07.5	210°48.7	10.8′	21°27.3	0.4′	54.9′
9	317°57.5	·· 08.5	225°18.6	10.8′	21°26.9	0.5′	54.9′
10	332°57.7	09.5	239°48.4	10.8′	21°26.4	0.7′	54.9′
11	347°57.9	10.4	254°18.1	10.8′	21°25.7	0.7′	55.0′
12	2°58.1	S05°11.4	268°47.9	10.7′	S21°25.0	0.8′	55.0′
13	17°58.2	12.3	283°17.6	10.7′	21°24.2	1.0′	55.0′
14	32°58.4	13.3	297°47.3	10.7′	21°23.2	1.0′	55.0′
15	47°58.6	·· 14.3	312°17.0	10.7′	21°22.2	1.2′	55.0′
16	62°58.8	15.2	326°46.7	10.7′	21°21.0	1.3′	55.1′
17	77°59.0	16.2	341°16.4	10.6′	21°19.7	1.3′	55.1′
18	92°59.2	S05°17.1	355°46.0	10.6′	S21°18.4	1.5′	55.1′
19	107°59.3	18.1	10°15.6	10.6′	21°16.9	1.6′	55.1′
20	122°59.5	19.0	24°45.2	10.6′	21°15.3	1.7′	55.2′
21	137°59.7	·· 20.0	39°14.8	10.6′	21°13.6	1.8′	55.2′
22	152°59.9	21.0	53°44.3	10.5′	21°11.8	1.9′	55.2′
23	168°00.1	21.9	68°13.9	10.5′	21°09.9	2.0′	55.3′
	SD = 16.0′	d = 1.0′	SD = 14.9′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	04:08	05:29	06:36	16:58	18:06	19:25
N 70°	04:18	05:30	06:31	17:04	18:05	19:16
68°	04:26	05:31	06:27	17:09	18:04	19:09
66°	04:32	05:32	06:23	17:12	18:03	19:03
64°	04:37	05:32	06:20	17:16	18:03	18:58
62°	04:41	05:33	06:17	17:18	18:03	18:54
60°	04:45	05:33	06:15	17:21	18:02	18:51
N 58°	04:48	05:33	06:12	17:23	18:02	18:48
56°	04:50	05:33	06:11	17:25	18:02	18:45
54°	04:53	05:34	06:09	17:27	18:02	18:43
52°	04:54	05:34	06:07	17:29	18:02	18:41
50°	04:56	05:34	06:06	17:30	18:02	18:40
45°	04:59	05:33	06:03	17:33	18:03	18:37
N 40°	05:02	05:33	06:00	17:36	18:03	18:35
35°	05:03	05:32	05:58	17:39	18:04	18:33
30°	05:04	05:32	05:56	17:41	18:05	18:32
20°	05:04	05:30	05:52	17:45	18:07	18:32
N 10°	05:03	05:27	05:48	17:48	18:09	18:34
0°	05:00	05:24	05:45	17:52	18:12	18:37
S 10°	04:56	05:21	05:42	17:55	18:16	18:41
20°	04:50	05:16	05:38	17:59	18:21	18:47
30°	04:42	05:10	05:34	18:04	18:28	18:56
35°	04:36	05:06	05:31	18:06	18:32	19:02
40°	04:29	05:01	05:28	18:09	18:37	19:09
45°	04:20	04:55	05:25	18:13	18:43	19:18
S 50°	04:09	04:48	05:21	18:17	18:50	19:30
52°	04:03	04:45	05:19	18:19	18:53	19:35
54°	03:57	04:41	05:17	18:21	18:57	19:41
56°	03:50	04:37	05:15	18:24	19:02	19:49
58°	03:42	04:32	05:12	18:26	19:07	19:57
S 60°	03:33	04:26	05:09	18:29	19:12	20:06

Lat.	**Moonrise** Sun	Mon	Tue	**Moonset** Sun	Mon	Tue
N 72°	▬	▬	▬	▬	▬	▬
N 70°	▬	▬	▬	▬	▬	▬
68°	15:03	16:31	17:20	18:09	18:22	19:17
66°	14:20	15:31	16:21	18:53	19:23	20:16
64°	13:51	14:57	15:47	19:22	19:57	20:50
62°	13:29	14:32	15:22	19:45	20:22	21:15
60°	13:11	14:12	15:03	20:03	20:42	21:34
N 58°	12:57	13:56	14:47	20:17	20:58	21:50
56°	12:44	13:42	14:33	20:30	21:12	22:04
54°	12:33	13:30	14:21	20:42	21:24	22:16
52°	12:23	13:20	14:10	20:51	21:35	22:26
50°	12:15	13:10	14:01	21:00	21:44	22:35
45°	11:56	12:51	13:41	21:19	22:04	22:55
N 40°	11:41	12:35	13:25	21:34	22:20	23:11
35°	11:29	12:21	13:11	21:47	22:33	23:24
30°	11:18	12:10	13:00	21:59	22:45	23:36
20°	10:59	11:49	12:39	22:18	23:06	23:56
N 10°	10:43	11:32	12:22	22:35	23:23	·· ··
0°	10:28	11:16	12:05	22:51	23:40	·· ··
S 10°	10:12	11:00	11:49	23:07	23:56	·· ··
20°	09:56	10:42	11:31	23:23	·· ··	00:14
30°	09:38	10:22	11:11	23:43	·· ··	00:34
35°	09:27	10:11	11:00	23:54	·· ··	00:46
40°	09:15	09:58	10:46	·· ··	00:07	00:59
45°	09:00	09:42	10:30	·· ··	00:23	01:15
S 50°	08:43	09:23	10:10	·· ··	00:42	01:35
52°	08:34	09:13	10:01	·· ··	00:51	01:44
54°	08:25	09:03	09:50	00:01	01:01	01:55
56°	08:15	08:52	09:39	00:11	01:12	02:07
58°	08:03	08:38	09:25	00:23	01:25	02:20
S 60°	07:49	08:23	09:09	00:36	01:41	02:36

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 6-8 29-47%
04	11:07	11:16	11:49	16:39	04:15	
05	11:26	11:35	11:48	17:28	05:03	
06	11:43	11:52	11:48	18:18	05:52	

October 07, 08, 09 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	15°33.1	140°36.5	S21°45.1	231°05.7	N15°32.3	177°25.6	S06°30.4	182°47.5	S03°04.1
1	30°35.6	155°36.0	45.9	246°06.7	31.8	192°27.6	30.6	197°49.6	04.3
2	45°38.1	170°35.6	46.7	261°07.7	31.4	207°29.6	30.8	212°51.8	04.4
3	60°40.5	185°35.1	·· 47.5	276°08.7	·· 30.9	222°31.5	·· 31.0	227°54.0	·· 04.5
4	75°43.0	200°34.6	48.3	291°09.6	30.4	237°33.5	31.2	242°56.2	04.6
5	90°45.5	215°34.1	49.1	306°10.6	30.0	252°35.4	31.4	257°58.4	04.7
6	105°47.9	230°33.7	S21°49.8	321°11.6	N15°29.5	267°37.4	S06°31.6	273°00.5	S03°04.9
7	120°50.4	245°33.2	50.6	336°12.6	29.0	282°39.4	31.8	288°02.7	05.0
8	135°52.8	260°32.7	51.4	351°13.6	28.6	297°41.3	32.0	303°04.9	05.1
9	150°55.3	275°32.3	·· 52.2	6°14.5	·· 28.1	312°43.3	·· 32.3	318°07.1	·· 05.2
10	165°57.8	290°31.8	53.0	21°15.5	27.7	327°45.2	32.5	333°09.3	05.3
11	181°00.2	305°31.3	53.8	36°16.5	27.2	342°47.2	32.7	348°11.4	05.5
12	196°02.7	320°30.9	S21°54.6	51°17.5	N15°26.7	357°49.2	S06°32.9	3°13.6	S03°05.6
13	211°05.2	335°30.4	55.3	66°18.5	26.3	12°51.1	33.1	18°15.8	05.7
14	226°07.6	350°29.9	56.1	81°19.4	25.8	27°53.1	33.3	33°18.0	05.8
15	241°10.1	5°29.4	·· 56.9	96°20.4	·· 25.3	42°55.0	·· 33.5	48°20.2	·· 05.9
16	256°12.6	20°29.0	57.7	111°21.4	24.9	57°57.0	33.7	63°22.4	06.0
17	271°15.0	35°28.5	58.5	126°22.4	24.4	72°59.0	33.9	78°24.5	06.2
18	286°17.5	50°28.0	S21°59.2	141°23.4	N15°23.9	88°00.9	S06°34.1	93°26.7	S03°06.3
19	301°20.0	65°27.6	22°00.0	156°24.4	23.5	103°02.9	34.3	108°28.9	06.4
20	316°22.4	80°27.1	00.8	171°25.3	23.0	118°04.8	34.5	123°31.1	06.5
21	331°24.9	95°26.6	·· 01.6	186°26.3	·· 22.6	133°06.8	·· 34.7	138°33.3	·· 06.6
22	346°27.3	110°26.1	02.3	201°27.3	22.1	148°08.8	34.9	153°35.4	06.8
23	1°29.8	125°25.7	03.1	216°28.3	21.6	163°10.7	35.1	168°37.6	06.9
Mer.pass. 22:54		ν -0.5′ d 0.8′	m -4.16	ν 1.0′ d 0.5′	m 1.54	ν 2.0′ d 0.2′	m -1.67	ν 2.2′ d 0.1′	m 0.82

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	16°32.3	140°25.2	S22°03.9	231°29.3	N15°21.2	178°12.7	S06°35.3	183°39.8	S03°07.0
1	31°34.7	155°24.7	04.7	246°30.3	20.7	193°14.6	35.5	198°42.0	07.1
2	46°37.2	170°24.2	05.4	261°31.2	20.2	208°16.6	35.7	213°44.2	07.2
3	61°39.7	185°23.8	·· 06.2	276°32.2	·· 19.8	223°18.6	·· 36.0	228°46.3	·· 07.3
4	76°42.1	200°23.3	07.0	291°33.2	19.3	238°20.5	36.2	243°48.5	07.5
5	91°44.6	215°22.8	07.7	306°34.2	18.8	253°22.5	36.4	258°50.7	07.6
6	106°47.1	230°22.3	S22°08.5	321°35.2	N15°18.4	268°24.4	S06°36.6	273°52.9	S03°07.7
7	121°49.5	245°21.9	09.3	336°36.2	17.9	283°26.4	36.8	288°55.1	07.8
8	136°52.0	260°21.4	10.0	351°37.1	17.4	298°28.4	37.0	303°57.2	07.9
9	151°54.5	275°20.9	·· 10.8	6°38.1	·· 17.0	313°30.3	·· 37.2	318°59.4	·· 08.1
10	166°56.9	290°20.4	11.6	21°39.1	16.5	328°32.3	37.4	334°01.6	08.2
11	181°59.4	305°19.9	12.3	36°40.1	16.0	343°34.2	37.6	349°03.8	08.3
12	197°01.8	320°19.5	S22°13.1	51°41.1	N15°15.6	358°36.2	S06°37.8	4°06.0	S03°08.4
13	212°04.3	335°19.0	13.8	66°42.1	15.1	13°38.2	38.0	19°08.1	08.5
14	227°06.8	350°18.5	14.6	81°43.1	14.6	28°40.1	38.2	34°10.3	08.6
15	242°09.2	5°18.0	·· 15.4	96°44.1	·· 14.2	43°42.1	·· 38.4	49°12.5	·· 08.8
16	257°11.7	20°17.6	16.1	111°45.0	13.7	58°44.0	38.6	64°14.7	08.9
17	272°14.2	35°17.1	16.9	126°46.0	13.2	73°46.0	38.8	79°16.9	09.0
18	287°16.6	50°16.6	S22°17.6	141°47.0	N15°12.8	88°48.0	S06°39.0	94°19.0	S03°09.1
19	302°19.1	65°16.1	18.4	156°48.0	12.3	103°49.9	39.2	109°21.2	09.2
20	317°21.6	80°15.6	19.1	171°49.0	11.8	118°51.9	39.4	124°23.4	09.4
21	332°24.0	95°15.2	·· 19.9	186°50.0	·· 11.4	133°53.8	·· 39.6	139°25.6	·· 09.5
22	347°26.5	110°14.7	20.6	201°51.0	10.9	148°55.8	39.9	154°27.8	09.6
23	2°28.9	125°14.2	21.4	216°52.0	10.4	163°57.8	40.1	169°29.9	09.7
Mer.pass. 22:50		ν -0.5′ d 0.8′	m -4.17	ν 1.0′ d 0.5′	m 1.54	ν 2.0′ d 0.2′	m -1.67	ν 2.2′ d 0.1′	m 0.83

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	17°31.4	140°13.7	S22°22.1	231°52.9	N15°10.0	178°59.7	S06°40.3	184°32.1	S03°09.8
1	32°33.9	155°13.2	22.9	246°53.9	09.5	194°01.7	40.5	199°34.3	09.9
2	47°36.3	170°12.8	23.6	261°54.9	09.0	209°03.6	40.7	214°36.5	10.1
3	62°38.8	185°12.3	·· 24.4	276°55.9	·· 08.6	224°05.6	·· 40.9	229°38.7	·· 10.2
4	77°41.3	200°11.8	25.1	291°56.9	08.1	239°07.6	41.1	244°40.8	10.3
5	92°43.7	215°11.3	25.9	306°57.9	07.6	254°09.5	41.3	259°43.0	10.4
6	107°46.2	230°10.8	S22°26.6	321°58.9	N15°07.2	269°11.5	S06°41.5	274°45.2	S03°10.5
7	122°48.7	245°10.3	27.4	336°59.9	06.7	284°13.4	41.7	289°47.4	10.6
8	137°51.1	260°09.9	28.1	352°00.9	06.2	299°15.4	41.9	304°49.6	10.8
9	152°53.6	275°09.4	·· 28.9	7°01.9	·· 05.8	314°17.3	·· 42.1	319°51.8	·· 10.9
10	167°56.1	290°08.9	29.6	22°02.8	05.3	329°19.3	42.3	334°53.9	11.0
11	182°58.5	305°08.4	30.3	37°03.8	04.8	344°21.3	42.5	349°56.1	11.1
12	198°01.0	320°07.9	S22°31.1	52°04.8	N15°04.3	359°23.2	S06°42.7	4°58.3	S03°11.2
13	213°03.4	335°07.4	31.8	67°05.8	03.9	14°25.2	42.9	20°00.5	11.4
14	228°05.9	350°06.9	32.6	82°06.8	03.4	29°27.1	43.1	35°02.7	11.5
15	243°08.4	5°06.5	·· 33.3	97°07.8	·· 02.9	44°29.1	·· 43.3	50°04.8	·· 11.6
16	258°10.8	20°06.0	34.0	112°08.8	02.5	59°31.1	43.5	65°07.0	11.7
17	273°13.3	35°05.5	34.8	127°09.8	02.0	74°33.0	43.8	80°09.2	11.8
18	288°15.8	50°05.0	S22°35.5	142°10.8	N15°01.5	89°35.0	S06°44.0	95°11.4	S03°11.9
19	303°18.2	65°04.5	36.2	157°11.8	01.1	104°36.9	44.2	110°13.6	12.1
20	318°20.7	80°04.0	37.0	172°12.8	00.6	119°38.9	44.4	125°15.7	12.2
21	333°23.2	95°03.5	·· 37.7	187°13.8	15°00.1	134°40.9	·· 44.6	140°17.9	·· 12.3
22	348°25.6	110°03.1	38.4	202°14.8	14°59.7	149°42.8	44.8	155°20.1	12.4
23	3°28.1	125°02.6	39.1	217°15.8	59.2	164°44.8	45.0	170°22.3	12.5
Mer.pass. 22:46		ν -0.5′ d 0.7′	m -4.17	ν 1.0′ d 0.5′	m 1.53	ν 2.0′ d 0.2′	m -1.67	ν 2.2′ d 0.1′	m 0.83

Stars

	SHA	Dec
Alpheratz	358°08.2	28°59.4
Ankaa	353°39.1	-42°24.4
Schedar	350°07.6	56°26.2
Diphda	349°19.8	-18°05.2
Achernar	335°44.1	-57°19.8
Hamal	328°27.8	23°22.6
Polaris	326°19.0	89°10.7
Acamar	315°36.3	-40°22.6
Menkar	314°40.1	4°01.1
Mirfak	309°14.7	49°47.7
Aldebaran	291°17.0	16°28.4
Rigel	281°35.2	-8°13.2
Capella	281°10.0	45°58.7
Bellatrix	278°57.8	6°20.1
Elnath	278°43.1	28°35.5
Alnilam	276°10.8	-1°12.7
Betelgeuse	271°27.4	7°24.3
Canopus	264°06.8	-52°40.8
Sirius	258°55.0	-16°41.2
Adhara	255°31.5	-28°56.6
Procyon	245°25.1	5°16.4
Pollux	243°57.3	28°04.2
Avior	234°28.1	-59°26.7
Suhail	223°10.5	-43°21.2
Miaplacidus	221°45.3	-69°38.2
Alphard	218°20.0	-8°34.5
Regulus	208°09.5	12°03.6
Dubhe	194°21.8	61°51.0
Denebola	182°58.6	14°40.6
Gienah	176°17.6	-17°26.2
Acrux	173°37.2	-62°59.7
Gacrux	172°28.5	-57°00.4
Alioth	166°42.4	56°03.7
Spica	158°57.1	-11°03.7
Alkaid	153°18.4	49°24.5
Hadar	149°23.0	-60°17.0
Menkent	148°36.6	-36°16.7
Arcturus	146°18.1	19°16.9
Rigil Kent.	140°25.5	-60°45.4
Kochab	137°20.0	74°14.1
Zuben'ubi	137°32.5	-15°57.8
Alphecca	126°31.8	26°46.8
Antares	112°56.2	-26°23.4
Atria	108°20.1	-68°59.9
Sabik	102°40.5	-15°42.1
Shaula	96°54.9	-37°05.5
Rasalhague	96°29.0	12°34.6
Eltanin	90°57.5	51°29.8
Kaus Aust.	84°16.0	-34°23.7
Vega	80°55.4	38°46.3
Nunki	76°28.3	-26°19.2
Altair	62°31.8	8°49.3
Peacock	53°57.0	-56°47.9
Deneb	49°47.8	45°13.2
Enif	34°10.7	9°47.6
Al Na'ir	28°13.7	-47°03.1
Fomalhaut	15°50.3	-29°43.2
Scheat	14°16.6	27°59.1
Markab	14°02.2	15°06.5

Oct 07 Wed	SHA	Mer.pass
Venus	125°03.4	14:38
Mars	215°32.6	08:35
Jupiter	161°52.5	12:09
Saturn	167°14.3	11:47

Oct 08 Thu	SHA	Mer.pass
Venus	123°52.9	14:39
Mars	214°57.0	08:33
Jupiter	161°40.4	12:06
Saturn	167°07.5	11:44

Oct 09 Fri	SHA	Mer.pass
Venus	122°42.3	14:40
Mars	214°21.5	08:32
Jupiter	161°28.3	12:02
Saturn	167°00.7	11:40

Horizontal parallax	
Venus:	0.2
Mars:	0.1

h — Sun — Moon

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	183°00.2	S05°22.9	82°43.4	10.5′	S21°07.9	2.2′	55.3′
1	198°00.4	23.8	97°12.9	10.5′	21°05.7	2.2′	55.3′
2	213°00.6	24.8	111°42.4	10.5′	21°03.5	2.4′	55.3′
3	228°00.8	·· 25.8	126°11.8	10.5′	21°01.1	2.4′	55.4′
4	243°01.0	26.7	140°41.3	10.4′	20°58.7	2.6′	55.4′
5	258°01.2	27.7	155°10.7	10.4′	20°56.1	2.6′	55.4′
6	273°01.3	S05°28.6	169°40.2	10.4′	S20°53.5	2.8′	55.4′
7	288°01.5	29.6	184°09.6	10.4′	20°50.7	2.9′	55.5′
8	303°01.7	30.5	198°39.0	10.4′	20°47.8	3.0′	55.5′
9	318°01.9	·· 31.5	213°08.3	10.4′	20°44.8	3.1′	55.5′
10	333°02.0	32.5	227°37.7	10.4′	20°41.7	3.2′	55.6′
11	348°02.2	33.4	242°07.1	10.3′	20°38.5	3.4′	55.6′
12	3°02.4	S05°34.4	256°36.4	10.3′	S20°35.1	3.4′	55.6′
13	18°02.6	35.3	271°05.7	10.3′	20°31.7	3.5′	55.6′
14	33°02.8	36.3	285°35.0	10.3′	20°28.2	3.7′	55.7′
15	48°02.9	·· 37.2	300°04.3	10.3′	20°24.5	3.8′	55.7′
16	63°03.1	38.2	314°33.6	10.3′	20°20.7	3.8′	55.7′
17	78°03.3	39.1	329°02.9	10.3′	20°16.9	4.0′	55.8′
18	93°03.5	S05°40.1	343°32.2	10.3′	S20°12.9	4.1′	55.8′
19	108°03.7	41.1	358°01.4	10.3′	20°08.8	4.2′	55.8′
20	123°03.8	42.0	12°30.7	10.2′	20°04.6	4.3′	55.9′
21	138°04.0	·· 43.0	26°59.9	10.2′	20°00.3	4.4′	55.9′
22	153°04.2	43.9	41°29.2	10.2′	19°55.9	4.5′	55.9′
23	168°04.4	44.9	55°58.4	10.2′	19°51.4	4.7′	56.0′
	SD = 16.0′	d = 1.0′		SD = 15.1′			

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	183°04.5	S05°45.8	70°27.6	10.2′	S19°46.7	4.7′	56.0′
1	198°04.7	46.8	84°56.8	10.2′	19°42.0	4.8′	56.0′
2	213°04.9	47.7	99°26.0	10.2′	19°37.2	5.0′	56.1′
3	228°05.1	·· 48.7	113°55.2	10.2′	19°32.2	5.1′	56.1′
4	243°05.2	49.7	128°24.4	10.2′	19°27.1	5.1′	56.1′
5	258°05.4	50.6	142°53.6	10.2′	19°22.0	5.3′	56.2′
6	273°05.6	S05°51.6	157°22.8	10.2′	S19°16.7	5.4′	56.2′
7	288°05.8	52.5	171°52.0	10.2′	19°11.3	5.5′	56.2′
8	303°06.0	53.5	186°21.1	10.2′	19°05.8	5.6′	56.3′
9	318°06.1	·· 54.4	200°50.3	10.2′	19°00.2	5.7′	56.3′
10	333°06.3	55.4	215°19.4	10.2′	18°54.5	5.8′	56.3′
11	348°06.5	56.3	229°48.6	10.1′	18°48.7	5.9′	56.4′
12	3°06.7	S05°57.3	244°17.7	10.1′	S18°42.8	6.0′	56.4′
13	18°06.8	58.2	258°46.9	10.1′	18°36.8	6.2′	56.4′
14	33°07.0	05°59.2	273°16.0	10.1′	18°30.6	6.2′	56.5′
15	48°07.2	06°00.1	287°45.2	10.1′	18°24.4	6.4′	56.5′
16	63°07.3	01.1	302°14.3	10.1′	18°18.0	6.4′	56.5′
17	78°07.5	02.0	316°43.4	10.1′	18°11.6	6.6′	56.6′
18	93°07.7	S06°03.0	331°12.5	10.1′	S18°05.0	6.6′	56.6′
19	108°07.9	04.0	345°41.7	10.1′	17°58.4	6.8′	56.6′
20	123°08.0	04.9	0°10.8	10.1′	17°51.6	6.8′	56.7′
21	138°08.2	·· 05.9	14°39.9	10.1′	17°44.8	7.0′	56.7′
22	153°08.4	06.8	29°09.0	10.1′	17°37.8	7.1′	56.8′
23	168°08.6	07.8	43°38.1	10.1′	17°30.7	7.1′	56.8′
	SD = 16.0′	d = 1.0′		SD = 15.3′			

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	183°08.7	S06°08.7	58°07.3	10.1′	S17°23.6	7.3′	56.8′
1	198°08.9	09.7	72°36.4	10.1′	17°16.3	7.4′	56.9′
2	213°09.1	10.6	87°05.5	10.1′	17°08.9	7.5′	56.9′
3	228°09.3	·· 11.6	101°34.6	10.1′	17°01.4	7.5′	56.9′
4	243°09.4	12.5	116°03.7	10.1′	16°53.9	7.7′	57.0′
5	258°09.6	13.5	130°32.8	10.1′	16°46.2	7.8′	57.0′
6	273°09.8	S06°14.4	145°01.9	10.1′	S16°38.4	7.9′	57.0′
7	288°09.9	15.4	159°31.0	10.1′	16°30.5	8.0′	57.1′
8	303°10.1	16.3	174°00.1	10.1′	16°22.5	8.0′	57.1′
9	318°10.3	·· 17.3	188°29.3	10.1′	16°14.5	8.2′	57.2′
10	333°10.5	18.2	202°58.4	10.1′	16°06.3	8.3′	57.2′
11	348°10.6	19.2	217°27.5	10.1′	15°58.0	8.4′	57.2′
12	3°10.8	S06°20.1	231°56.6	10.1′	S15°49.6	8.4′	57.3′
13	18°11.0	21.1	246°25.7	10.1′	15°41.2	8.6′	57.3′
14	33°11.1	22.0	260°54.8	10.1′	15°32.6	8.7′	57.3′
15	48°11.3	·· 23.0	275°23.9	10.1′	15°23.9	8.7′	57.4′
16	63°11.5	23.9	289°53.0	10.1′	15°15.2	8.9′	57.4′
17	78°11.6	24.9	304°22.1	10.1′	15°06.3	8.9′	57.5′
18	93°11.8	S06°25.8	318°51.2	10.1′	S14°57.4	9.1′	57.5′
19	108°12.0	26.8	333°20.3	10.1′	14°48.3	9.1′	57.5′
20	123°12.1	27.7	347°49.4	10.1′	14°39.2	9.2′	57.6′
21	138°12.3	·· 28.7	2°18.5	10.1′	14°30.0	9.3′	57.6′
22	153°12.5	29.6	16°47.6	10.1′	14°20.7	9.4′	57.7′
23	168°12.7	30.6	31°16.7	10.1′	14°11.3	9.5′	57.7′
	SD = 16.0′	d = 1.0′		SD = 15.5′			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	04:23	05:42	06:50	16:43	17:51	19:09
N 70°	04:31	05:42	06:43	16:50	17:51	19:02
68°	04:37	05:42	06:37	16:56	17:52	18:56
66°	04:42	05:41	06:33	17:01	17:52	18:51
64°	04:46	05:41	06:29	17:05	17:53	18:48
62°	04:49	05:41	06:25	17:09	17:53	18:44
60°	04:52	05:40	06:22	17:12	17:54	18:42
N 58°	04:54	05:40	06:19	17:15	17:54	18:39
56°	04:56	05:39	06:17	17:17	17:55	18:37
54°	04:58	05:39	06:14	17:20	17:55	18:36
52°	05:00	05:39	06:12	17:22	17:56	18:34
50°	05:01	05:38	06:11	17:24	17:56	18:33
45°	05:03	05:37	06:06	17:28	17:57	18:31
N 40°	05:05	05:36	06:03	17:31	17:59	18:30
35°	05:05	05:35	06:00	17:35	18:00	18:29
30°	05:06	05:33	05:57	17:37	18:01	18:29
20°	05:05	05:31	05:53	17:42	18:04	18:30
N 10°	05:03	05:27	05:48	17:47	18:08	18:32
0°	04:59	05:24	05:44	17:51	18:12	18:36
S 10°	04:54	05:19	05:40	17:55	18:16	18:41
20°	04:47	05:13	05:36	18:00	18:22	18:48
30°	04:38	05:06	05:30	18:05	18:30	18:58
35°	04:31	05:02	05:27	18:09	18:34	19:04
40°	04:24	04:56	05:24	18:12	18:40	19:12
45°	04:14	04:50	05:19	18:17	18:47	19:22
S 50°	04:02	04:41	05:14	18:22	18:55	19:35
52°	03:56	04:37	05:12	18:24	18:59	19:41
54°	03:49	04:33	05:09	18:27	19:03	19:48
56°	03:41	04:28	05:07	18:30	19:08	19:56
58°	03:32	04:23	05:04	18:33	19:14	20:05
S 60°	03:22	04:17	05:00	18:37	19:20	20:16

Lat.	Moonrise Wed	Moonrise Thu	Moonrise Fri	Moonset Wed	Moonset Thu	Moonset Fri
N 72°	▬	19:53	18:28	▬	20:18	23:30
N 70°	▬	18:13	17:56	▬	21:57	·· ··
68°	17:32	17:33	17:32	20:51	22:36	·· ··
66°	16:50	17:05	17:14	21:32	23:03	·· ··
64°	16:22	16:44	16:58	22:00	23:24	·· ··
62°	16:00	16:27	16:46	22:22	23:41	·· ··
60°	15:42	16:12	16:35	22:39	23:55	·· ··
N 58°	15:28	16:00	16:25	22:53	·· ··	00:06
56°	15:15	15:49	16:17	23:06	·· ··	00:17
54°	15:04	15:40	16:10	23:17	·· ··	00:26
52°	14:54	15:31	16:03	23:26	·· ··	00:34
50°	14:45	15:24	15:57	23:35	·· ··	00:41
45°	14:27	15:08	15:44	23:53	·· ··	00:56
N 40°	14:12	14:54	15:33	·· ··	00:08	01:09
35°	13:59	14:43	15:24	·· ··	00:20	01:19
30°	13:48	14:33	15:16	·· ··	00:31	01:29
20°	13:28	14:16	15:02	·· ··	00:49	01:45
N 10°	13:12	14:01	14:50	00:13	01:05	01:59
0°	12:56	13:47	14:38	00:30	01:20	02:12
S 10°	12:40	13:33	14:27	00:46	01:35	02:24
20°	12:23	13:18	14:14	01:03	01:51	02:38
30°	12:04	13:01	14:00	01:23	02:10	02:54
35°	11:53	12:51	13:52	01:34	02:20	03:03
40°	11:40	12:39	13:42	01:48	02:32	03:13
45°	11:25	12:25	13:31	02:03	02:46	03:25
S 50°	11:06	12:09	13:18	02:22	03:04	03:39
52°	10:57	12:01	13:12	02:31	03:12	03:46
54°	10:47	11:52	13:05	02:42	03:21	03:54
56°	10:36	11:42	12:57	02:53	03:31	04:02
58°	10:23	11:31	12:48	03:06	03:43	04:11
S 60°	10:08	11:18	12:38	03:22	03:56	04:22

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 9-11 57-76%
07	12:01	12:10	11:48	19:08	06:43	
08	12:18	12:27	11:48	19:59	07:34	
09	12:35	12:43	11:47	20:50	08:25	

October 10, 11, 12 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	18°30.6	140°02.1	S22°39.9	232°16.7	N14°58.7	179°46.7	S06°45.2	185°24.5	S03°12.7
1	33°33.0	155°01.6	40.6	247°17.7	58.2	194°48.7	45.4	200°26.6	12.8
2	48°35.5	170°01.1	41.3	262°18.7	57.8	209°50.7	45.6	215°28.8	12.9
3	63°37.9	185°00.6	·· 42.0	277°19.7	·· 57.3	224°52.6	·· 45.8	230°31.0	·· 13.0
4	78°40.4	200°00.1	42.8	292°20.7	56.8	239°54.6	46.0	245°33.2	13.1
5	93°42.9	214°59.6	43.5	307°21.7	56.4	254°56.5	46.2	260°35.4	13.2
6	108°45.3	229°59.2	S22°44.2	322°22.7	N14°55.9	269°58.5	S06°46.4	275°37.5	S03°13.4
7	123°47.8	244°58.7	44.9	337°23.7	55.4	285°00.4	46.6	290°39.7	13.5
8	138°50.3	259°58.2	45.7	352°24.7	55.0	300°02.4	46.8	305°41.9	13.6
9	153°52.7	274°57.7	·· 46.4	7°25.7	·· 54.5	315°04.4	·· 47.0	320°44.1	·· 13.7
10	168°55.2	289°57.2	47.1	22°26.7	54.0	330°06.3	47.2	335°46.3	13.8
11	183°57.7	304°56.7	47.8	37°27.7	53.5	345°08.3	47.4	350°48.4	13.9
12	199°00.1	319°56.2	S22°48.5	52°28.7	N14°53.1	0°10.2	S06°47.7	5°50.6	S03°14.1
13	214°02.6	334°55.7	49.2	67°29.7	52.6	15°12.2	47.9	20°52.8	14.2
14	229°05.0	349°55.2	50.0	82°30.7	52.1	30°14.2	48.1	35°55.0	14.3
15	244°07.5	4°54.7	·· 50.7	97°31.7	·· 51.7	45°16.1	·· 48.3	50°57.2	·· 14.4
16	259°10.0	19°54.3	51.4	112°32.7	51.2	60°18.1	48.5	65°59.4	14.5
17	274°12.4	34°53.8	52.1	127°33.7	50.7	75°20.0	48.7	81°01.5	14.7
18	289°14.9	49°53.3	S22°52.8	142°34.7	N14°50.2	90°22.0	S06°48.9	96°03.7	S03°14.8
19	304°17.4	64°52.8	53.5	157°35.7	49.8	105°23.9	49.1	111°05.9	14.9
20	319°19.8	79°52.3	54.2	172°36.7	49.3	120°25.9	49.3	126°08.1	15.0
21	334°22.3	94°51.8	·· 54.9	187°37.7	·· 48.8	135°27.9	·· 49.5	141°10.3	·· 15.1
22	349°24.8	109°51.3	55.6	202°38.7	48.3	150°29.8	49.7	156°12.4	15.2
23	4°27.2	124°50.8	56.3	217°39.7	47.9	165°31.8	49.9	171°14.6	15.4
Mer.pass. 22:42		ν -0.5′	d 0.7′	m -4.18	ν 1.0′	d 0.5′	m 1.53	ν 2.0′	d 0.2′ m -1.67	ν 2.2′	d 0.1′ m 0.83

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	19°29.7	139°50.3	S22°57.1	232°40.7	N14°47.4	180°33.7	S06°50.1	186°16.8	S03°15.5
1	34°32.2	154°49.8	57.8	247°41.7	46.9	195°35.7	50.3	201°19.0	15.6
2	49°34.6	169°49.3	58.5	262°42.7	46.5	210°37.7	50.5	216°21.2	15.7
3	64°37.1	184°48.8	·· 59.2	277°43.7	·· 46.0	225°39.6	·· 50.7	231°23.3	·· 15.8
4	79°39.5	199°48.3	22°59.9	292°44.7	45.5	240°41.6	50.9	246°25.5	15.9
5	94°42.0	214°47.8	23°00.6	307°45.7	45.0	255°43.5	51.1	261°27.7	16.1
6	109°44.5	229°47.3	S23°01.3	322°46.7	N14°44.6	270°45.5	S06°51.3	276°29.9	S03°16.2
7	124°46.9	244°46.8	02.0	337°47.7	44.1	285°47.4	51.5	291°32.1	16.3
8	139°49.4	259°46.4	02.7	352°48.7	43.6	300°49.4	51.7	306°34.2	16.4
9	154°51.9	274°45.9	·· 03.4	7°49.7	·· 43.1	315°51.4	·· 52.0	321°36.4	·· 16.5
10	169°54.3	289°45.4	04.1	22°50.7	42.7	330°53.3	52.2	336°38.6	16.6
11	184°56.8	304°44.9	04.7	37°51.7	42.2	345°55.3	52.4	351°40.8	16.8
12	199°59.3	319°44.4	S23°05.4	52°52.7	N14°41.7	0°57.2	S06°52.6	6°43.0	S03°16.9
13	215°01.7	334°43.9	06.1	67°53.7	41.3	15°59.2	52.8	21°45.1	17.0
14	230°04.2	349°43.4	06.8	82°54.7	40.8	31°01.2	53.0	36°47.3	17.1
15	245°06.6	4°42.9	·· 07.5	97°55.7	·· 40.3	46°03.1	·· 53.2	51°49.5	·· 17.2
16	260°09.1	19°42.4	08.2	112°56.7	39.8	61°05.1	53.4	66°51.7	17.4
17	275°11.6	34°41.9	08.9	127°57.7	39.4	76°07.0	53.6	81°53.9	17.5
18	290°14.0	49°41.4	S23°09.6	142°58.7	N14°38.9	91°09.0	S06°53.8	96°56.1	S03°17.6
19	305°16.5	64°40.9	10.3	157°59.7	38.4	106°10.9	54.0	111°58.2	17.7
20	320°19.0	79°40.4	11.0	173°00.7	37.9	121°12.9	54.2	127°00.4	17.8
21	335°21.4	94°39.9	·· 11.6	188°01.7	·· 37.5	136°14.9	·· 54.4	142°02.6	·· 17.9
22	350°23.9	109°39.4	12.3	203°02.7	37.0	151°16.8	54.6	157°04.8	18.1
23	5°26.4	124°38.9	13.0	218°03.7	36.5	166°18.8	54.8	172°07.0	18.2
Mer.pass. 22:38		ν -0.5′	d 0.7′	m -4.19	ν 1.0′	d 0.5′	m 1.53	ν 2.0′	d 0.2′ m -1.67	ν 2.2′	d 0.1′ m 0.84

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	20°28.8	139°38.4	S23°13.7	233°04.7	N14°36.0	181°20.7	S06°55.0	187°09.1	S03°18.3
1	35°31.3	154°37.9	14.4	248°05.7	35.6	196°22.7	55.2	202°11.3	18.4
2	50°33.8	169°37.4	15.0	263°06.7	35.1	211°24.7	55.4	217°13.5	18.5
3	65°36.2	184°36.9	·· 15.7	278°07.7	·· 34.6	226°26.6	·· 55.6	232°15.7	·· 18.6
4	80°38.7	199°36.4	16.4	293°08.8	34.1	241°28.6	55.8	247°17.9	18.8
5	95°41.1	214°35.9	17.1	308°09.8	33.7	256°30.5	56.0	262°20.0	18.9
6	110°43.6	229°35.4	S23°17.8	323°10.8	N14°33.2	271°32.5	S06°56.2	277°22.2	S03°19.0
7	125°46.1	244°34.9	18.4	338°11.8	32.7	286°34.4	56.5	292°24.4	19.1
8	140°48.5	259°34.4	19.1	353°12.8	32.2	301°36.4	56.7	307°26.6	19.2
9	155°51.0	274°33.9	·· 19.8	8°13.8	·· 31.8	316°38.4	·· 56.9	322°28.8	·· 19.3
10	170°53.5	289°33.4	20.4	23°14.8	31.3	331°40.3	57.1	337°30.9	19.5
11	185°55.9	304°32.9	21.1	38°15.8	30.8	346°42.3	57.3	352°33.1	19.6
12	200°58.4	319°32.4	S23°21.8	53°16.8	N14°30.3	1°44.2	S06°57.5	7°35.3	S03°19.7
13	216°00.9	334°31.9	22.5	68°17.8	29.9	16°46.2	57.7	22°37.5	19.8
14	231°03.3	349°31.4	23.1	83°18.8	29.4	31°48.1	57.9	37°39.7	19.9
15	246°05.8	4°30.9	·· 23.8	98°19.8	·· 28.9	46°50.1	·· 58.1	52°41.8	·· 20.0
16	261°08.2	19°30.4	24.5	113°20.8	28.4	61°52.1	58.3	67°44.0	20.2
17	276°10.7	34°29.9	25.1	128°21.8	28.0	76°54.0	58.5	82°46.2	20.3
18	291°13.2	49°29.4	S23°25.8	143°22.9	N14°27.5	91°56.0	S06°58.7	97°48.4	S03°20.4
19	306°15.6	64°28.9	26.5	158°23.9	27.0	106°57.9	58.9	112°50.6	20.5
20	321°18.1	79°28.4	27.1	173°24.9	26.5	121°59.9	59.1	127°52.8	20.6
21	336°20.6	94°27.9	·· 27.8	188°25.9	·· 26.0	137°01.8	·· 59.3	142°54.9	·· 20.7
22	351°23.0	109°27.4	28.4	203°26.9	25.6	152°03.8	59.5	157°57.1	20.9
23	6°25.5	124°26.8	29.1	218°27.9	25.1	167°05.8	59.7	172°59.3	21.0
Mer.pass. 22:34		ν -0.5′	d 0.7′	m -4.20	ν 1.0′	d 0.5′	m 1.52	ν 2.0′	d 0.2′ m -1.67	ν 2.2′	d 0.1′ m 0.84

Stars

	SHA	Dec
Alpheratz	358°08.2	28°59.4
Ankaa	353°39.1	-42°24.4
Schedar	350°07.6	56°26.3
Diphda	349°19.8	-18°05.2
Achernar	335°44.1	-57°19.8
Hamal	328°27.8	23°22.6
Polaris	326°18.7	89°10.7
Acamar	315°36.3	-40°22.6
Menkar	314°40.1	4°01.1
Mirfak	309°14.7	49°47.7
Aldebaran	291°17.0	16°28.4
Rigel	281°35.1	-8°13.2
Capella	281°10.0	45°58.7
Bellatrix	278°57.8	6°20.1
Elnath	278°43.0	28°35.5
Alnilam	276°10.8	-1°12.7
Betelgeuse	271°27.4	7°24.3
Canopus	264°06.8	-52°40.8
Sirius	258°55.0	-16°41.2
Adhara	255°31.5	-28°56.6
Procyon	245°25.0	5°16.4
Pollux	243°57.3	28°04.2
Avior	234°28.1	-59°26.7
Suhail	223°10.5	-43°21.2
Miaplacidus	221°45.3	-69°38.2
Alphard	218°20.0	-8°34.5
Regulus	208°09.4	12°03.5
Dubhe	194°21.8	61°51.0
Denebola	182°58.6	14°40.6
Gienah	176°17.5	-17°26.2
Acrux	173°37.2	-62°59.7
Gacrux	172°28.5	-57°00.4
Alioth	166°42.4	56°03.7
Spica	158°57.1	-11°03.7
Alkaid	153°18.4	49°24.5
Hadar	149°23.0	-60°17.0
Menkent	148°36.6	-36°16.7
Arcturus	146°18.1	19°16.9
Rigil Kent.	140°25.5	-60°45.4
Kochab	137°20.0	74°14.1
Zuben'ubi	137°32.5	-15°57.8
Alphecca	126°31.8	26°46.8
Antares	112°56.2	-26°23.4
Atria	108°20.2	-68°59.9
Sabik	102°40.5	-15°42.1
Shaula	96°55.0	-37°05.5
Rasalhague	96°29.0	12°34.6
Eltanin	90°57.6	51°29.8
Kaus Aust.	84°16.0	-34°23.7
Vega	80°55.4	38°46.3
Nunki	76°28.3	-26°19.2
Altair	62°31.8	8°49.3
Peacock	53°57.1	-56°47.9
Deneb	49°47.8	45°13.2
Enif	34°10.7	9°47.6
Al Na'ir	28°13.7	-47°03.1
Fomalhaut	15°50.3	-29°43.2
Scheat	14°16.6	27°59.1
Markab	14°02.2	15°06.5

Oct 10 Sat	SHA	Mer.pass
Venus	121°31.5	14:40
Mars	213°46.2	08:30
Jupiter	161°16.2	11:59
Saturn	166°53.9	11:37

Oct 11 Sun	SHA	Mer.pass
Venus	120°20.6	14:41
Mars	213°11.0	08:29
Jupiter	161°04.1	11:56
Saturn	166°47.1	11:33

Oct 12 Mon	SHA	Mer.pass
Venus	119°09.6	14:42
Mars	212°35.9	08:27
Jupiter	160°51.9	11:53
Saturn	166°40.3	11:30

Horizontal parallax	
Venus:	0.2
Mars:	0.1

DUT1 = UT1-UTC = +0.2053 sec ΔT = TT-UT1 = +51.9787 sec

1981 October 10 to Oct. 12 UT

h

Sat	Sun GHA	Sun Dec	Moon GHA	ν	Moon Dec	d	HP
0	183°12.8	S06°31.5	45°45.8	10.1′	S14°01.8	9.6′	57.7′
1	198°13.0	32.5	60°15.0	10.1′	13°52.2	9.7′	57.8′
2	213°13.2	33.4	74°44.1	10.1′	13°42.5	9.8′	57.8′
3	228°13.3	·· 34.3	89°13.2	10.1′	13°32.7	9.8′	57.8′
4	243°13.5	35.3	103°42.3	10.1′	13°22.9	10.0′	57.9′
5	258°13.7	36.2	118°11.4	10.1′	13°12.9	10.0′	57.9′
6	273°13.8	S06°37.2	132°40.5	10.1′	S13°02.9	10.1′	58.0′
7	288°14.0	38.1	147°09.6	10.1′	12°52.8	10.2′	58.0′
8	303°14.2	39.1	161°38.7	10.1′	12°42.6	10.3′	58.0′
9	318°14.3	·· 40.0	176°07.8	10.1′	12°32.3	10.4′	58.1′
10	333°14.5	41.0	190°36.9	10.1′	12°21.9	10.4′	58.1′
11	348°14.7	41.9	205°05.9	10.1′	12°11.5	10.5′	58.2′
12	3°14.8	S06°42.9	219°35.0	10.1′	S12°01.0	10.6′	58.2′
13	18°15.0	43.8	234°04.1	10.1′	11°50.4	10.7′	58.2′
14	33°15.2	44.8	248°33.2	10.1′	11°39.7	10.8′	58.3′
15	48°15.3	·· 45.7	263°02.3	10.1′	11°28.9	10.8′	58.3′
16	63°15.5	46.7	277°31.4	10.1′	11°18.1	11.0′	58.3′
17	78°15.6	47.6	292°00.4	10.1′	11°07.1	11.0′	58.4′
18	93°15.8	S06°48.5	306°29.5	10.1′	S10°56.1	11.1′	58.4′
19	108°16.0	49.5	320°58.6	10.1′	10°45.0	11.1′	58.5′
20	123°16.1	50.4	335°27.7	10.1′	10°33.9	11.2′	58.5′
21	138°16.3	·· 51.4	349°56.7	10.1′	10°22.7	11.3′	58.5′
22	153°16.5	52.3	4°25.8	10.1′	10°11.4	11.4′	58.6′
23	168°16.6	53.3	18°54.8	10.0′	10°00.0	11.4′	58.6′
	SD = 16.0′	d = 0.9′	SD = 15.7′				

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	183°16.8	S06°54.2	33°23.9	10.0′	S09°48.6	11.6′	58.6′
1	198°17.0	55.2	47°52.9	10.0′	09°37.0	11.5′	58.7′
2	213°17.1	56.1	62°21.9	10.0′	09°25.5	11.7′	58.7′
3	228°17.3	·· 57.0	76°51.0	10.0′	09°13.8	11.7′	58.7′
4	243°17.4	58.0	91°20.0	10.0′	09°02.1	11.8′	58.8′
5	258°17.6	58.9	105°49.0	10.0′	08°50.3	11.8′	58.8′
6	273°17.8	S06°59.9	120°18.0	10.0′	S08°38.5	12.0′	58.9′
7	288°17.9	07°00.8	134°47.0	10.0′	08°26.5	11.9′	58.9′
8	303°18.1	01.8	149°16.0	10.0′	08°14.6	12.1′	58.9′
9	318°18.3	·· 02.7	163°45.0	10.0′	08°02.5	12.1′	59.0′
10	333°18.4	03.6	178°14.0	10.0′	07°50.4	12.1′	59.0′
11	348°18.6	04.6	192°42.9	10.0′	07°38.3	12.2′	59.0′
12	3°18.7	S07°05.5	207°11.9	9.9′	S07°26.1	12.3′	59.1′
13	18°18.9	06.5	221°40.8	9.9′	07°13.8	12.3′	59.1′
14	33°19.1	07.4	236°09.8	9.9′	07°01.5	12.4′	59.1′
15	48°19.2	·· 08.4	250°38.7	9.9′	06°49.1	12.5′	59.2′
16	63°19.4	09.3	265°07.6	9.9′	06°36.6	12.5′	59.2′
17	78°19.5	10.2	279°36.5	9.9′	06°24.1	12.5′	59.2′
18	93°19.7	S07°11.2	294°05.4	9.9′	S06°11.6	12.6′	59.3′
19	108°19.9	12.1	308°34.3	9.9′	05°59.0	12.6′	59.3′
20	123°20.0	13.1	323°03.1	9.8′	05°46.4	12.7′	59.3′
21	138°20.2	·· 14.0	337°32.0	9.8′	05°33.7	12.8′	59.4′
22	153°20.3	14.9	352°00.8	9.8′	05°20.9	12.8′	59.4′
23	168°20.5	15.9	6°29.6	9.8′	05°08.1	12.8′	59.4′
	SD = 16.0′	d = 0.9′	SD = 16.0′				

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	183°20.7	S07°16.8	20°58.4	9.8′	S04°55.3	12.8′	59.5′
1	198°20.8	17.8	35°27.2	9.8′	04°42.5	13.0′	59.5′
2	213°21.0	18.7	49°56.0	9.8′	04°29.5	12.9′	59.5′
3	228°21.1	·· 19.6	64°24.7	9.7′	04°16.6	13.0′	59.6′
4	243°21.3	20.6	78°53.5	9.7′	04°03.6	13.0′	59.6′
5	258°21.4	21.5	93°22.2	9.7′	03°50.6	13.1′	59.6′
6	273°21.6	S07°22.5	107°50.9	9.7′	S03°37.5	13.1′	59.7′
7	288°21.8	23.4	122°19.6	9.7′	03°24.4	13.1′	59.7′
8	303°21.9	24.3	136°48.2	9.6′	03°11.3	13.2′	59.7′
9	318°22.1	·· 25.3	151°16.9	9.6′	02°58.1	13.2′	59.7′
10	333°22.2	26.2	165°45.5	9.6′	02°44.9	13.2′	59.8′
11	348°22.4	27.2	180°14.1	9.6′	02°31.7	13.3′	59.8′
12	3°22.5	S07°28.1	194°42.7	9.6′	S02°18.4	13.3′	59.8′
13	18°22.7	29.0	209°11.2	9.5′	02°05.1	13.3′	59.9′
14	33°22.8	30.0	223°39.7	9.5′	01°51.8	13.3′	59.9′
15	48°23.0	·· 30.9	238°08.2	9.5′	01°38.5	13.4′	59.9′
16	63°23.2	31.8	252°36.7	9.5′	01°25.1	13.3′	59.9′
17	78°23.3	32.8	267°05.2	9.4′	01°11.8	13.4′	60.0′
18	93°23.5	S07°33.7	281°33.6	9.4′	S00°58.4	13.5′	60.0′
19	108°23.6	34.7	296°02.0	9.4′	00°44.9	13.4′	60.0′
20	123°23.8	35.6	310°30.4	9.4′	00°31.5	13.4′	60.0′
21	138°23.9	·· 36.5	324°58.8	9.3′	00°18.1	13.5′	60.1′
22	153°24.1	37.5	339°27.1	9.3′	S00°04.6	13.5′	60.1′
23	168°24.2	38.4	353°55.4	9.3′	N00°08.9	13.4′	60.1′
	SD = 16.0′	d = 0.9′	SD = 16.2′				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	04:37	05:55	07:04	16:27	17:36	18:54
N 70°	04:43	05:54	06:55	16:36	17:38	18:48
68°	04:47	05:52	06:48	16:44	17:40	18:44
66°	04:51	05:51	06:42	16:50	17:41	18:40
64°	04:54	05:49	06:37	16:55	17:43	18:37
62°	04:57	05:48	06:33	16:59	17:44	18:35
60°	04:59	05:47	06:29	17:03	17:45	18:33
N 58°	05:01	05:46	06:26	17:07	17:46	18:31
56°	05:02	05:45	06:23	17:10	17:47	18:30
54°	05:04	05:44	06:20	17:13	17:48	18:29
52°	05:05	05:44	06:17	17:15	17:49	18:28
50°	05:05	05:43	06:15	17:17	17:50	18:27
45°	05:07	05:41	06:10	17:23	17:52	18:26
N 40°	05:08	05:39	06:06	17:27	17:54	18:25
35°	05:08	05:37	06:02	17:31	17:56	18:25
30°	05:07	05:35	05:59	17:34	17:58	18:26
20°	05:06	05:31	05:53	17:40	18:02	18:27
N 10°	05:03	05:27	05:48	17:45	18:06	18:31
0°	04:58	05:23	05:43	17:50	18:11	18:35
S 10°	04:53	05:17	05:38	17:55	18:16	18:41
20°	04:45	05:11	05:33	18:01	18:23	18:49
30°	04:34	05:02	05:27	18:07	18:32	19:00
35°	04:27	04:57	05:23	18:11	18:37	19:07
40°	04:18	04:51	05:19	18:15	18:43	19:16
45°	04:08	04:44	05:14	18:20	18:51	19:27
S 50°	03:54	04:35	05:08	18:27	19:00	19:41
52°	03:48	04:30	05:05	18:29	19:04	19:47
54°	03:40	04:26	05:02	18:33	19:09	19:55
56°	03:32	04:20	04:59	18:36	19:15	20:04
58°	03:22	04:14	04:55	18:40	19:21	20:14
S 60°	03:11	04:07	04:51	18:44	19:28	20:25

Lat.	Moonrise Sat	Moonrise Sun	Moonrise Mon	Moonset Sat	Moonset Sun	Moonset Mon
N 72°	18:02	17:44	17:28	·· ··	01:44	03:51
N 70°	17:44	17:35	17:27	00:01	02:00	03:57
68°	17:30	17:28	17:25	00:24	02:13	04:02
66°	17:18	17:22	17:24	00:41	02:23	04:07
64°	17:09	17:16	17:23	00:56	02:32	04:10
62°	17:00	17:12	17:22	01:07	02:39	04:13
60°	16:53	17:08	17:21	01:18	02:45	04:16
N 58°	16:46	17:04	17:21	01:26	02:51	04:18
56°	16:41	17:01	17:20	01:34	02:56	04:20
54°	16:35	16:58	17:20	01:41	03:00	04:22
52°	16:31	16:56	17:19	01:47	03:04	04:24
50°	16:26	16:53	17:19	01:52	03:07	04:25
45°	16:17	16:48	17:18	02:04	03:15	04:29
N 40°	16:10	16:44	17:17	02:14	03:21	04:31
35°	16:03	16:40	17:16	02:22	03:27	04:34
30°	15:57	16:37	17:16	02:29	03:32	04:36
20°	15:47	16:31	17:15	02:42	03:40	04:39
N 10°	15:38	16:26	17:14	02:53	03:47	04:43
0°	15:29	16:21	17:13	03:03	03:54	04:45
S 10°	15:21	16:16	17:12	03:13	04:01	04:48
20°	15:12	16:11	17:11	03:23	04:08	04:51
30°	15:02	16:05	17:10	03:35	04:15	04:55
35°	14:56	16:02	17:10	03:42	04:20	04:56
40°	14:49	15:58	17:09	03:50	04:25	04:59
45°	14:41	15:53	17:08	03:59	04:31	05:01
S 50°	14:31	15:48	17:07	04:10	04:38	05:04
52°	14:27	15:46	17:07	04:15	04:41	05:05
54°	14:22	15:43	17:07	04:21	04:45	05:07
56°	14:16	15:40	17:06	04:27	04:49	05:08
58°	14:10	15:37	17:06	04:34	04:53	05:10
S 60°	14:03	15:33	17:05	04:42	04:58	05:12

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 12-14 / 84-97%
10	12:51	12:59	11:47	21:42	09:16	
11	13:07	13:15	11:47	22:33	10:07	
12	13:23	13:30	11:46	23:25	10:59	

October 13, 14, 15 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	21°28.0	139°26.3	S23°29.8	233°28.9	N14°24.6	182°07.7	S06°59.9	188°01.5	S03°21.1
1	36°30.4	154°25.8	30.4	248°29.9	24.1	197°09.7	07°00.1	203°03.7	21.2
2	51°32.9	169°25.3	31.1	263°30.9	23.7	212°11.6	00.3	218°05.8	21.3
3	66°35.4	184°24.8	·· 31.7	278°31.9	·· 23.2	227°13.6	·· 00.5	233°08.0	·· 21.4
4	81°37.8	199°24.3	32.4	293°33.0	22.7	242°15.6	00.7	248°10.2	21.6
5	96°40.3	214°23.8	33.0	308°34.0	22.2	257°17.5	00.9	263°12.4	21.7
6	111°42.7	229°23.3	S23°33.7	323°35.0	N14°21.8	272°19.5	S07°01.2	278°14.6	S03°21.8
7	126°45.2	244°22.8	34.3	338°36.0	21.3	287°21.4	01.4	293°16.7	21.9
8	141°47.7	259°22.3	35.0	353°37.0	20.8	302°23.4	01.6	308°18.9	22.0
9	156°50.1	274°21.8	·· 35.6	8°38.0	·· 20.3	317°25.3	·· 01.8	323°21.1	·· 22.1
10	171°52.6	289°21.3	36.3	23°39.0	19.8	332°27.3	02.0	338°23.3	22.3
11	186°55.1	304°20.8	36.9	38°40.0	19.4	347°29.3	02.2	353°25.5	22.4
12	201°57.5	319°20.3	S23°37.6	53°41.0	N14°18.9	2°31.2	S07°02.4	8°27.7	S03°22.5
13	217°00.0	334°19.8	38.2	68°42.1	18.4	17°33.2	02.6	23°29.8	22.6
14	232°02.5	349°19.3	38.9	83°43.1	17.9	32°35.1	02.8	38°32.0	22.7
15	247°04.9	4°18.8	·· 39.5	98°44.1	·· 17.5	47°37.1	·· 03.0	53°34.2	·· 22.8
16	262°07.4	19°18.2	40.2	113°45.1	17.0	62°39.0	03.2	68°36.4	23.0
17	277°09.9	34°17.7	40.8	128°46.1	16.5	77°41.0	03.4	83°38.6	23.1
18	292°12.3	49°17.2	S23°41.4	143°47.1	N14°16.0	92°43.0	S07°03.6	98°40.7	S03°23.2
19	307°14.8	64°16.7	42.1	158°48.1	15.5	107°44.9	03.8	113°42.9	23.3
20	322°17.2	79°16.2	42.7	173°49.2	15.1	122°46.9	04.0	128°45.1	23.4
21	337°19.7	94°15.7	·· 43.3	188°50.2	·· 14.6	137°48.8	·· 04.2	143°47.3	·· 23.5
22	352°22.2	109°15.2	44.0	203°51.2	14.1	152°50.8	04.4	158°49.5	23.7
23	7°24.6	124°14.7	44.6	218°52.2	13.6	167°52.7	04.6	173°51.6	23.8
Mer.pass. 22:30		ν -0.5′	d 0.7′	m -4.20	ν 1.0′	d 0.5′	m 1.52	ν 2.0′	d 0.2′ m -1.67	ν 2.2′	d 0.1′ m 0.85

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	22°27.1	139°14.2	S23°45.3	233°53.2	N14°13.1	182°54.7	S07°04.8	188°53.8	S03°23.9
1	37°29.6	154°13.7	45.9	248°54.2	12.7	197°56.7	05.0	203°56.0	24.0
2	52°32.0	169°13.2	46.5	263°55.2	12.2	212°58.6	05.2	218°58.2	24.1
3	67°34.5	184°12.6	·· 47.2	278°56.3	·· 11.7	228°00.6	·· 05.4	234°00.4	·· 24.2
4	82°37.0	199°12.1	47.8	293°57.3	11.2	243°02.5	05.6	249°02.6	24.4
5	97°39.4	214°11.6	48.4	308°58.3	10.7	258°04.5	05.8	264°04.7	24.5
6	112°41.9	229°11.1	S23°49.0	323°59.3	N14°10.3	273°06.4	S07°06.0	279°06.9	S03°24.6
7	127°44.3	244°10.6	49.7	339°00.3	09.8	288°08.4	06.2	294°09.1	24.7
8	142°46.8	259°10.1	50.3	354°01.3	09.3	303°10.4	06.5	309°11.3	24.8
9	157°49.3	274°09.6	·· 50.9	9°02.4	·· 08.8	318°12.3	·· 06.7	324°13.5	·· 24.9
10	172°51.7	289°09.1	51.5	24°03.4	08.3	333°14.3	06.9	339°15.6	25.1
11	187°54.2	304°08.6	52.2	39°04.4	07.9	348°16.2	07.1	354°17.8	25.2
12	202°56.7	319°08.0	S23°52.8	54°05.4	N14°07.4	3°18.2	S07°07.3	9°20.0	S03°25.3
13	217°59.1	334°07.5	53.4	69°06.4	06.9	18°20.1	07.5	24°22.2	25.4
14	233°01.6	349°07.0	54.0	84°07.4	06.4	33°22.1	07.7	39°24.4	25.5
15	248°04.1	4°06.5	·· 54.6	99°08.5	·· 05.9	48°24.1	·· 07.9	54°26.5	·· 25.6
16	263°06.5	19°06.0	55.3	114°09.5	05.5	63°26.0	08.1	69°28.7	25.8
17	278°09.0	34°05.5	55.9	129°10.5	05.0	78°28.0	08.3	84°30.9	25.9
18	293°11.5	49°05.0	S23°56.5	144°11.5	N14°04.5	93°29.9	S07°08.5	99°33.1	S03°26.0
19	308°13.9	64°04.5	57.1	159°12.5	04.0	108°31.9	08.7	114°35.3	26.1
20	323°16.4	79°04.0	57.7	174°13.6	03.5	123°33.9	08.9	129°37.5	26.2
21	338°18.8	94°03.4	·· 58.3	189°14.6	·· 03.1	138°35.8	·· 09.1	144°39.6	·· 26.3
22	353°21.3	109°02.9	59.0	204°15.6	02.6	153°37.8	09.3	159°41.8	26.5
23	8°23.8	124°02.4	59.6	219°16.6	02.1	168°39.7	09.5	174°44.0	26.6
Mer.pass. 22:27		ν -0.5′	d 0.6′	m -4.21	ν 1.0′	d 0.5′	m 1.51	ν 2.0′	d 0.2′ m -1.67	ν 2.2′	d 0.1′ m 0.85

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	23°26.2	139°01.9	S24°00.2	234°17.6	N14°01.6	183°41.7	S07°09.7	189°46.2	S03°26.7
1	38°28.7	154°01.4	00.8	249°18.7	01.1	198°43.6	09.9	204°48.4	26.8
2	53°31.2	169°00.9	01.4	264°19.7	00.7	213°45.6	10.1	219°50.5	26.9
3	68°33.6	184°00.4	·· 02.0	279°20.7	14°00.2	228°47.6	·· 10.3	234°52.7	·· 27.0
4	83°36.1	198°59.8	02.6	294°21.7	13°59.7	243°49.5	10.5	249°54.9	27.2
5	98°38.6	213°59.3	03.2	309°22.7	59.2	258°51.5	10.7	264°57.1	27.3
6	113°41.0	228°58.8	S24°03.8	324°23.8	N13°58.7	273°53.4	S07°10.9	279°59.3	S03°27.4
7	128°43.5	243°58.3	04.4	339°24.8	58.2	288°55.4	11.1	295°01.5	27.5
8	143°45.9	258°57.8	05.0	354°25.8	57.8	303°57.3	11.3	310°03.6	27.6
9	158°48.4	273°57.3	·· 05.6	9°26.8	·· 57.3	318°59.3	·· 11.5	325°05.8	·· 27.7
10	173°50.9	288°56.8	06.2	24°27.9	56.8	334°01.3	11.8	340°08.0	27.9
11	188°53.3	303°56.2	06.8	39°28.9	56.3	349°03.2	12.0	355°10.2	28.0
12	203°55.8	318°55.7	S24°07.4	54°29.9	N13°55.8	4°05.2	S07°12.2	10°12.4	S03°28.1
13	218°58.3	333°55.2	08.0	69°30.9	55.4	19°07.1	12.4	25°14.5	28.2
14	234°00.7	348°54.7	08.6	84°31.9	54.9	34°09.1	12.6	40°16.7	28.3
15	249°03.2	3°54.2	·· 09.2	99°33.0	·· 54.4	49°11.0	·· 12.8	55°18.9	·· 28.4
16	264°05.7	18°53.7	09.8	114°34.0	53.9	64°13.0	13.0	70°21.1	28.5
17	279°08.1	33°53.1	10.4	129°35.0	53.4	79°14.9	13.2	85°23.3	28.7
18	294°10.6	48°52.6	S24°11.0	144°36.0	N13°52.9	94°16.9	S07°13.4	100°25.4	S03°28.8
19	309°13.1	63°52.1	11.6	159°37.1	52.5	109°18.9	13.6	115°27.6	28.9
20	324°15.5	78°51.6	12.2	174°38.1	52.0	124°20.8	13.8	130°29.8	29.0
21	339°18.0	93°51.1	·· 12.8	189°39.1	·· 51.5	139°22.8	·· 14.0	145°32.0	·· 29.1
22	354°20.4	108°50.6	13.3	204°40.1	51.0	154°24.7	14.2	160°34.2	29.2
23	9°22.9	123°50.0	13.9	219°41.2	50.5	169°26.7	14.4	175°36.4	29.4
Mer.pass. 22:23		ν -0.5′	d 0.6′	m -4.22	ν 1.0′	d 0.5′	m 1.51	ν 2.0′	d 0.2′ m -1.67	ν 2.2′	d 0.1′ m 0.85

Stars

	SHA	Dec
Alpheratz	358°08.2	28°59.4
Ankaa	353°39.1	-42°24.4
Schedar	350°07.6	56°26.3
Diphda	349°19.8	-18°05.2
Achernar	335°44.1	-57°19.8
Hamal	328°27.8	23°22.6
Polaris	326°18.3	89°10.7
Acamar	315°36.3	-40°22.6
Menkar	314°40.1	4°01.1
Mirfak	309°14.6	49°47.7
Aldebaran	291°16.9	16°28.4
Rigel	281°35.1	-8°13.2
Capella	281°10.0	45°58.7
Bellatrix	278°57.8	6°20.1
Elnath	278°43.0	28°35.5
Alnilam	276°10.8	-1°12.7
Betelgeuse	271°27.4	7°24.3
Canopus	264°06.7	-52°40.8
Sirius	258°55.0	-16°41.2
Adhara	255°31.5	-28°56.6
Procyon	245°25.0	5°16.4
Pollux	243°57.3	28°04.2
Avior	234°28.1	-59°26.7
Suhail	223°10.4	-43°21.2
Miaplacidus	221°45.3	-69°38.2
Alphard	218°20.0	-8°34.5
Regulus	208°09.4	12°03.5
Dubhe	194°21.7	61°51.0
Denebola	182°58.6	14°40.6
Gienah	176°17.5	-17°26.2
Acrux	173°37.2	-62°59.6
Gacrux	172°28.5	-57°00.4
Alioth	166°42.4	56°03.7
Spica	158°57.1	-11°03.7
Alkaid	153°18.4	49°24.5
Hadar	149°23.0	-60°17.0
Menkent	148°36.6	-36°16.7
Arcturus	146°18.1	19°16.9
Rigil Kent.	140°25.5	-60°45.4
Kochab	137°20.1	74°14.1
Zuben'ubi	137°32.5	-15°57.8
Alphecca	126°31.8	26°46.8
Antares	112°56.2	-26°23.4
Atria	108°20.2	-68°59.8
Sabik	102°40.5	-15°42.1
Shaula	96°55.0	-37°05.5
Rasalhague	96°29.1	12°34.6
Eltanin	90°57.6	51°29.8
Kaus Aust.	84°16.0	-34°23.7
Vega	80°55.4	38°46.3
Nunki	76°28.3	-26°19.2
Altair	62°31.8	8°49.3
Peacock	53°57.1	-56°47.9
Deneb	49°47.8	45°13.2
Enif	34°10.7	9°47.6
Al Na'ir	28°13.7	-47°03.1
Fomalhaut	15°50.3	-29°43.2
Scheat	14°16.6	27°59.1
Markab	14°02.2	15°06.5

Oct 13 Tue	SHA	Mer.pass
Venus	117°58.4	14:43
Mars	212°00.9	08:26
Jupiter	160°39.8	11:50
Saturn	166°33.5	11:26

Oct 14 Wed	SHA	Mer.pass
Venus	116°47.1	14:44
Mars	211°26.1	08:24
Jupiter	160°27.6	11:47
Saturn	166°26.7	11:23

Oct 15 Thu	SHA	Mer.pass
Venus	115°35.7	14:44
Mars	210°51.4	08:22
Jupiter	160°15.4	11:44
Saturn	166°19.9	11:19

Horizontal parallax	
Venus:	0.2
Mars:	0.1

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°24.4	S07°39.3	8°23.7	9.2′	N00°22.3	13.5′	60.1′
1	198°24.5	40.3	22°51.9	9.2′	00°35.8	13.5′	60.2′
2	213°24.7	41.2	37°20.1	9.2′	00°49.3	13.5′	60.2′
3	228°24.8	·· 42.1	51°48.3	9.2′	01°02.8	13.5′	60.2′
4	243°25.0	43.1	66°16.5	9.1′	01°16.3	13.6′	60.2′
5	258°25.2	44.0	80°44.6	9.1′	01°29.9	13.5′	60.3′
6	273°25.3	S07°44.9	95°12.7	9.1′	N01°43.4	13.5′	60.3′
7	288°25.5	45.9	109°40.7	9.0′	01°56.9	13.5′	60.3′
8	303°25.6	46.8	124°08.8	9.0′	02°10.4	13.5′	60.3′
9	318°25.8	·· 47.7	138°36.7	9.0′	02°23.9	13.5′	60.3′
10	333°25.9	48.7	153°04.7	8.9′	02°37.4	13.5′	60.4′
11	348°26.1	49.6	167°32.6	8.9′	02°50.9	13.5′	60.4′
12	3°26.2	S07°50.5	182°00.5	8.9′	N03°04.4	13.5′	60.4′
13	18°26.4	51.5	196°28.4	8.8′	03°17.9	13.4′	60.4′
14	33°26.5	52.4	210°56.2	8.8′	03°31.3	13.5′	60.4′
15	48°26.7	·· 53.3	225°24.0	8.7′	03°44.8	13.4′	60.5′
16	63°26.8	54.3	239°51.7	8.7′	03°58.2	13.4′	60.5′
17	78°27.0	55.2	254°19.4	8.7′	04°11.6	13.4′	60.5′
18	93°27.1	S07°56.1	268°47.1	8.6′	N04°25.0	13.4′	60.5′
19	108°27.3	57.1	283°14.7	8.6′	04°38.4	13.4′	60.5′
20	123°27.4	58.0	297°42.3	8.5′	04°51.8	13.3′	60.5′
21	138°27.6	·· 58.9	312°09.8	8.5′	05°05.1	13.3′	60.5′
22	153°27.7	07°59.9	326°37.3	8.5′	05°18.4	13.3′	60.6′
23	168°27.8	08°00.8	341°04.8	8.4′	05°31.7	13.3′	60.6′
	SD = 16.0′	d = 0.9′	SD = 16.4′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°28.0	S08°01.7	355°32.2	8.4′	N05°45.0	13.2′	60.6′
1	198°28.1	02.7	9°59.6	8.3′	05°58.2	13.2′	60.6′
2	213°28.3	03.6	24°27.0	8.3′	06°11.4	13.1′	60.6′
3	228°28.4	·· 04.5	38°54.3	8.3′	06°24.5	13.2′	60.6′
4	243°28.6	05.5	53°21.5	8.2′	06°37.7	13.1′	60.6′
5	258°28.7	06.4	67°48.8	8.2′	06°50.8	13.0′	60.6′
6	273°28.9	S08°07.3	82°15.9	8.1′	N07°03.8	13.0′	60.7′
7	288°29.0	08.3	96°43.1	8.1′	07°16.8	13.0′	60.7′
8	303°29.2	09.2	111°10.2	8.0′	07°29.8	12.9′	60.7′
9	318°29.3	·· 10.1	125°37.2	8.0′	07°42.7	12.9′	60.7′
10	333°29.5	11.0	140°04.2	8.0′	07°55.6	12.9′	60.7′
11	348°29.6	12.0	154°31.1	7.9′	08°08.5	12.7′	60.7′
12	3°29.7	S08°12.9	168°58.1	7.9′	N08°21.2	12.8′	60.7′
13	18°29.9	13.8	183°24.9	7.8′	08°34.0	12.7′	60.7′
14	33°30.0	14.8	197°51.7	7.8′	08°46.7	12.6′	60.7′
15	48°30.2	·· 15.7	212°18.5	7.7′	08°59.3	12.6′	60.7′
16	63°30.3	16.6	226°45.2	7.7′	09°11.9	12.5′	60.7′
17	78°30.5	17.5	241°11.9	7.6′	09°24.4	12.5′	60.7′
18	93°30.6	S08°18.5	255°38.5	7.6′	N09°36.9	12.4′	60.7′
19	108°30.8	19.4	270°05.1	7.5′	09°49.3	12.3′	60.7′
20	123°30.9	20.3	284°31.7	7.5′	10°01.6	12.3′	60.7′
21	138°31.0	·· 21.3	298°58.1	7.4′	10°13.9	12.2′	60.7′
22	153°31.2	22.2	313°24.6	7.4′	10°26.1	12.2′	60.7′
23	168°31.3	23.1	327°51.0	7.3′	10°38.3	12.0′	60.8′
	SD = 16.0′	d = 0.9′	SD = 16.5′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°31.5	S08°24.0	342°17.3	7.3′	N10°50.3	12.0′	60.8′
1	198°31.6	25.0	356°43.6	7.3′	11°02.3	12.0′	60.8′
2	213°31.7	25.9	11°09.9	7.2′	11°14.3	11.8′	60.8′
3	228°31.9	·· 26.8	25°36.1	7.2′	11°26.1	11.8′	60.8′
4	243°32.0	27.7	40°02.2	7.1′	11°37.9	11.7′	60.8′
5	258°32.2	28.7	54°28.3	7.1′	11°49.6	11.7′	60.8′
6	273°32.3	S08°29.6	68°54.4	7.0′	N12°01.3	11.5′	60.7′
7	288°32.5	30.5	83°20.4	7.0′	12°12.8	11.5′	60.7′
8	303°32.6	31.4	97°46.4	6.9′	12°24.3	11.4′	60.7′
9	318°32.7	·· 32.4	112°12.3	6.9′	12°35.7	11.3′	60.7′
10	333°32.9	33.3	126°38.2	6.8′	12°47.0	11.2′	60.7′
11	348°33.0	34.2	141°04.0	6.8′	12°58.2	11.2′	60.7′
12	3°33.1	S08°35.1	155°29.8	6.7′	N13°09.4	11.0′	60.7′
13	18°33.3	36.1	169°55.5	6.7′	13°20.4	11.0′	60.7′
14	33°33.4	37.0	184°21.2	6.6′	13°31.4	10.8′	60.7′
15	48°33.6	·· 37.9	198°46.8	6.6′	13°42.2	10.8′	60.7′
16	63°33.7	38.8	213°12.4	6.5′	13°53.0	10.7′	60.7′
17	78°33.8	39.8	227°37.9	6.5′	14°03.7	10.5′	60.7′
18	93°34.0	S08°40.7	242°03.4	6.4′	N14°14.2	10.5′	60.7′
19	108°34.1	41.6	256°28.8	6.4′	14°24.7	10.4′	60.7′
20	123°34.3	42.5	270°54.2	6.4′	14°35.1	10.3′	60.7′
21	138°34.4	·· 43.4	285°19.6	6.3′	14°45.4	10.2′	60.7′
22	153°34.5	44.4	299°44.9	6.3′	14°55.6	10.0′	60.7′
23	168°34.7	45.3	314°10.2	6.2′	15°05.6	10.0′	60.6′
	SD = 16.0′	d = 0.9′	SD = 16.6′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	04:50	06:09	07:19	16:12	17:21	18:39
N 70°	04:55	06:05	07:08	16:22	17:25	18:35
68°	04:58	06:02	06:59	16:31	17:28	18:32
66°	05:01	06:00	06:52	16:38	17:30	18:29
64°	05:03	05:58	06:46	16:44	17:33	18:27
62°	05:05	05:56	06:41	16:50	17:35	18:26
60°	05:06	05:54	06:36	16:54	17:36	18:24
N 58°	05:07	05:53	06:32	16:59	17:38	18:23
56°	05:08	05:51	06:29	17:02	17:40	18:23
54°	05:09	05:50	06:26	17:05	17:41	18:22
52°	05:10	05:49	06:23	17:08	17:42	18:21
50°	05:10	05:47	06:20	17:11	17:44	18:21
45°	05:11	05:45	06:14	17:17	17:47	18:21
N 40°	05:11	05:42	06:09	17:22	17:49	18:21
35°	05:10	05:39	06:05	17:27	17:52	18:21
30°	05:09	05:37	06:01	17:31	17:55	18:22
20°	05:07	05:32	05:54	17:37	18:00	18:25
N 10°	05:03	05:27	05:48	17:43	18:05	18:29
0°	04:58	05:22	05:43	17:49	18:10	18:34
S 10°	04:51	05:16	05:37	17:55	18:17	18:41
20°	04:42	05:08	05:31	18:02	18:24	18:50
30°	04:30	04:59	05:23	18:09	18:34	19:02
35°	04:23	04:53	05:19	18:14	18:39	19:10
40°	04:13	04:46	05:14	18:19	18:46	19:20
45°	04:02	04:38	05:09	18:24	18:55	19:31
S 50°	03:47	04:28	05:02	18:31	19:05	19:46
52°	03:40	04:23	04:59	18:35	19:10	19:54
54°	03:32	04:18	04:55	18:38	19:16	20:02
56°	03:23	04:12	04:51	18:42	19:22	20:11
58°	03:12	04:05	04:47	18:47	19:29	20:22
S 60°	02:59	03:57	04:42	18:52	19:37	20:36

Lat.	**Moonrise** Tue	Wed	Thu	**Moonset** Tue	Wed	Thu
N 72°	17:13	16:55	16:32	05:58	08:09	10:30
N 70°	17:18	17:09	16:58	05:56	07:58	10:06
68°	17:23	17:20	17:19	05:54	07:49	09:47
66°	17:26	17:30	17:35	05:53	07:41	09:32
64°	17:30	17:38	17:48	05:51	07:35	09:20
62°	17:33	17:45	17:59	05:50	07:29	09:10
60°	17:35	17:51	18:09	05:49	07:24	09:01
N 58°	17:37	17:56	18:18	05:48	07:20	08:53
56°	17:39	18:01	18:25	05:47	07:17	08:46
54°	17:41	18:05	18:32	05:47	07:13	08:40
52°	17:43	18:09	18:38	05:46	07:10	08:35
50°	17:44	18:12	18:43	05:46	07:08	08:30
45°	17:48	18:20	18:55	05:44	07:02	08:20
N 40°	17:51	18:26	19:05	05:43	06:57	08:11
35°	17:53	18:32	19:14	05:42	06:52	08:04
30°	17:55	18:37	19:21	05:42	06:49	07:57
20°	17:59	18:45	19:35	05:40	06:42	07:46
N 10°	18:03	18:53	19:46	05:39	06:37	07:36
0°	18:06	19:00	19:57	05:38	06:31	07:27
S 10°	18:09	19:08	20:08	05:37	06:26	07:18
20°	18:13	19:16	20:20	05:35	06:21	07:08
30°	18:17	19:25	20:33	05:34	06:14	06:57
35°	18:19	19:30	20:41	05:33	06:10	06:51
40°	18:22	19:36	20:50	05:32	06:06	06:43
45°	18:25	19:43	21:01	05:31	06:02	06:35
S 50°	18:29	19:51	21:14	05:29	05:56	06:25
52°	18:30	19:55	21:20	05:29	05:53	06:20
54°	18:32	19:59	21:26	05:28	05:50	06:15
56°	18:34	20:04	21:34	05:27	05:47	06:10
58°	18:37	20:10	21:42	05:27	05:44	06:03
S 60°	18:39	20:16	21:52	05:26	05:40	05:56

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 15-17 99-97%
13	13:38	13:45	11:46	–:–	11:52	
14	13:52	13:59	11:46	00:19	12:46	
15	14:06	14:13	11:46	01:14	13:42	

October 16, 17, 18 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	24°25.4	138°49.5	S24°14.5	234°42.2	N13°50.0	184°28.6	S07°14.6	190°38.5	S03°29.5
1	39°27.8	153°49.0	15.1	249°43.2	49.6	199°30.6	14.8	205°40.7	29.6
2	54°30.3	168°48.5	15.7	264°44.2	49.1	214°32.6	15.0	220°42.9	29.7
3	69°32.8	183°48.0	·· 16.3	279°45.3	·· 48.6	229°34.5	·· 15.2	235°45.1	·· 29.8
4	84°35.2	198°47.4	16.8	294°46.3	48.1	244°36.5	15.4	250°47.3	29.9
5	99°37.7	213°46.9	17.4	309°47.3	47.6	259°38.4	15.6	265°49.4	30.1
6	114°40.2	228°46.4	S24°18.0	324°48.3	N13°47.1	274°40.4	S07°15.8	280°51.6	S03°30.2
7	129°42.6	243°45.9	18.6	339°49.4	46.7	289°42.3	16.0	295°53.8	30.3
8	144°45.1	258°45.4	19.2	354°50.4	46.2	304°44.3	16.2	310°56.0	30.4
9	159°47.6	273°44.9	·· 19.7	9°51.4	·· 45.7	319°46.3	·· 16.4	325°58.2	·· 30.5
10	174°50.0	288°44.3	20.3	24°52.5	45.2	334°48.2	16.6	341°00.4	30.6
11	189°52.5	303°43.8	20.9	39°53.5	44.7	349°50.2	16.8	356°02.5	30.8
12	204°54.9	318°43.3	S24°21.5	54°54.5	N13°44.2	4°52.1	S07°17.0	11°04.7	S03°30.9
13	219°57.4	333°42.8	22.0	69°55.5	43.8	19°54.1	17.2	26°06.9	31.0
14	234°59.9	348°42.3	22.6	84°56.6	43.3	34°56.0	17.4	41°09.1	31.1
15	250°02.3	3°41.7	·· 23.2	99°57.6	·· 42.8	49°58.0	·· 17.7	56°11.3	·· 31.2
16	265°04.8	18°41.2	23.7	114°58.6	42.3	65°00.0	17.9	71°13.4	31.3
17	280°07.3	33°40.7	24.3	129°59.6	41.8	80°01.9	18.1	86°15.6	31.4
18	295°09.7	48°40.2	S24°24.9	145°00.7	N13°41.3	95°03.9	S07°18.3	101°17.8	S03°31.6
19	310°12.2	63°39.7	25.4	160°01.7	40.9	110°05.8	18.5	116°20.0	31.7
20	325°14.7	78°39.1	26.0	175°02.7	40.4	125°07.8	18.7	131°22.2	31.8
21	340°17.1	93°38.6	·· 26.6	190°03.8	·· 39.9	140°09.7	·· 18.9	146°24.4	·· 31.9
22	355°19.6	108°38.1	27.1	205°04.8	39.4	155°11.7	19.1	161°26.5	32.0
23	10°22.1	123°37.6	27.7	220°05.8	38.9	170°13.7	19.3	176°28.7	32.1
Mer.pass. 22:19		ν -0.5′	d 0.6′	m -4.23	ν 1.0′	d 0.5′	m 1.50	ν 2.0′	d 0.2′ m -1.67	ν 2.2′	d 0.1′ m 0.85

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	25°24.5	138°37.1	S24°28.3	235°06.9	N13°38.4	185°15.6	S07°19.5	191°30.9	S03°32.3
1	40°27.0	153°36.5	28.8	250°07.9	37.9	200°17.6	19.7	206°33.1	32.4
2	55°29.4	168°36.0	29.4	265°08.9	37.5	215°19.5	19.9	221°35.3	32.5
3	70°31.9	183°35.5	·· 29.9	280°09.9	·· 37.0	230°21.5	·· 20.1	236°37.5	·· 32.6
4	85°34.4	198°35.0	30.5	295°11.0	36.5	245°23.4	20.3	251°39.6	32.7
5	100°36.8	213°34.4	31.0	310°12.0	36.0	260°25.4	20.5	266°41.8	32.8
6	115°39.3	228°33.9	S24°31.6	325°13.0	N13°35.5	275°27.3	S07°20.7	281°44.0	S03°32.9
7	130°41.8	243°33.4	32.2	340°14.1	35.0	290°29.3	20.9	296°46.2	33.1
8	145°44.2	258°32.9	32.7	355°15.1	34.5	305°31.3	21.1	311°48.4	33.2
9	160°46.7	273°32.4	·· 33.3	10°16.1	·· 34.1	320°33.2	·· 21.3	326°50.5	·· 33.3
10	175°49.2	288°31.8	33.8	25°17.2	33.6	335°35.2	21.5	341°52.7	33.4
11	190°51.6	303°31.3	34.4	40°18.2	33.1	350°37.1	21.7	356°54.9	33.5
12	205°54.1	318°30.8	S24°34.9	55°19.2	N13°32.6	5°39.1	S07°21.9	11°57.1	S03°33.6
13	220°56.5	333°30.3	35.5	70°20.3	32.1	20°41.0	22.1	26°59.3	33.8
14	235°59.0	348°29.7	36.0	85°21.3	31.6	35°43.0	22.3	42°01.5	33.9
15	251°01.5	3°29.2	·· 36.5	100°22.3	·· 31.1	50°45.0	·· 22.5	57°03.6	·· 34.0
16	266°03.9	18°28.7	37.1	115°23.4	30.7	65°46.9	22.7	72°05.8	34.1
17	281°06.4	33°28.2	37.6	130°24.4	30.2	80°48.9	22.9	87°08.0	34.2
18	296°08.9	48°27.7	S24°38.2	145°25.4	N13°29.7	95°50.8	S07°23.1	102°10.2	S03°34.3
19	311°11.3	63°27.1	38.7	160°26.5	29.2	110°52.8	23.3	117°12.4	34.4
20	326°13.8	78°26.6	39.3	175°27.5	28.7	125°54.7	23.5	132°14.6	34.6
21	341°16.3	93°26.1	·· 39.8	190°28.5	·· 28.2	140°56.7	·· 23.7	147°16.7	·· 34.7
22	356°18.7	108°25.6	40.3	205°29.6	27.7	155°58.7	23.9	162°18.9	34.8
23	11°21.2	123°25.0	40.9	220°30.6	27.3	171°00.6	24.1	177°21.1	34.9
Mer.pass. 22:15		ν -0.5′	d 0.6′	m -4.24	ν 1.0′	d 0.5′	m 1.50	ν 2.0′	d 0.2′ m -1.67	ν 2.2′	d 0.1′ m 0.86

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	26°23.7	138°24.5	S24°41.4	235°31.6	N13°26.8	186°02.6	S07°24.3	192°23.3	S03°35.0
1	41°26.1	153°24.0	41.9	250°32.7	26.3	201°04.5	24.5	207°25.5	35.1
2	56°28.6	168°23.5	42.5	265°33.7	25.8	216°06.5	24.8	222°27.6	35.3
3	71°31.0	183°22.9	·· 43.0	280°34.8	·· 25.3	231°08.4	·· 25.0	237°29.8	·· 35.4
4	86°33.5	198°22.4	43.5	295°35.8	24.8	246°10.4	25.2	252°32.0	35.5
5	101°36.0	213°21.9	44.1	310°36.8	24.3	261°12.3	25.4	267°34.2	35.6
6	116°38.4	228°21.4	S24°44.6	325°37.9	N13°23.8	276°14.3	S07°25.6	282°36.4	S03°35.7
7	131°40.9	243°20.8	45.1	340°38.9	23.4	291°16.3	25.8	297°38.6	35.8
8	146°43.4	258°20.3	45.7	355°39.9	22.9	306°18.2	26.0	312°40.7	35.9
9	161°45.8	273°19.8	·· 46.2	10°41.0	·· 22.4	321°20.2	·· 26.2	327°42.9	·· 36.1
10	176°48.3	288°19.3	46.7	25°42.0	21.9	336°22.1	26.4	342°45.1	36.2
11	191°50.8	303°18.7	47.2	40°43.1	21.4	351°24.1	26.6	357°47.3	36.3
12	206°53.2	318°18.2	S24°47.8	55°44.1	N13°20.9	6°26.0	S07°26.8	12°49.5	S03°36.4
13	221°55.7	333°17.7	48.3	70°45.1	20.4	21°28.0	27.0	27°51.7	36.5
14	236°58.2	348°17.2	48.8	85°46.2	19.9	36°30.0	27.2	42°53.8	36.6
15	252°00.6	3°16.6	·· 49.3	100°47.2	·· 19.5	51°31.9	·· 27.4	57°56.0	·· 36.8
16	267°03.1	18°16.1	49.8	115°48.2	19.0	66°33.9	27.6	72°58.2	36.9
17	282°05.5	33°15.6	50.4	130°49.3	18.5	81°35.8	27.8	88°00.4	37.0
18	297°08.0	48°15.1	S24°50.9	145°50.3	N13°18.0	96°37.8	S07°28.0	103°02.6	S03°37.1
19	312°10.5	63°14.5	51.4	160°51.4	17.5	111°39.7	28.2	118°04.8	37.2
20	327°12.9	78°14.0	51.9	175°52.4	17.0	126°41.7	28.4	133°06.9	37.3
21	342°15.4	93°13.5	·· 52.4	190°53.4	·· 16.5	141°43.6	·· 28.6	148°09.1	·· 37.4
22	357°17.9	108°13.0	52.9	205°54.5	16.0	156°45.6	28.8	163°11.3	37.6
23	12°20.3	123°12.4	53.4	220°55.5	15.5	171°47.6	29.0	178°13.5	37.7
Mer.pass. 22:11		ν -0.5′	d 0.5′	m -4.24	ν 1.0′	d 0.5′	m 1.49	ν 2.0′	d 0.2′ m -1.67	ν 2.2′	d 0.1′ m 0.86

Stars

	SHA	Dec
Alpheratz	358°08.2	28°59.5
Ankaa	353°39.1	-42°24.4
Schedar	350°07.6	56°26.3
Diphda	349°19.8	-18°05.2
Achernar	335°44.1	-57°19.8
Hamal	328°27.8	23°22.6
Polaris	326°17.8	89°10.7
Acamar	315°36.3	-40°22.6
Menkar	314°40.1	4°01.1
Mirfak	309°14.6	49°47.7
Aldebaran	291°16.9	16°28.4
Rigel	281°35.1	-8°13.2
Capella	281°09.9	45°58.7
Bellatrix	278°57.8	6°20.1
Elnath	278°43.0	28°35.5
Alnilam	276°10.7	-1°12.7
Betelgeuse	271°27.3	7°24.3
Canopus	264°06.7	-52°40.9
Sirius	258°54.9	-16°41.3
Adhara	255°31.5	-28°56.6
Procyon	245°25.0	5°16.4
Pollux	243°57.3	28°04.2
Avior	234°28.0	-59°26.7
Suhail	223°10.4	-43°21.2
Miaplacidus	221°45.2	-69°38.2
Alphard	218°20.0	-8°34.5
Regulus	208°09.4	12°03.5
Dubhe	194°21.7	61°50.9
Denebola	182°58.6	14°40.6
Gienah	176°17.5	-17°26.2
Acrux	173°37.2	-62°59.6
Gacrux	172°28.5	-57°00.4
Alioth	166°42.4	56°03.6
Spica	158°57.1	-11°03.7
Alkaid	153°18.4	49°24.4
Hadar	149°23.0	-60°17.0
Menkent	148°36.6	-36°16.6
Arcturus	146°18.1	19°16.9
Rigil Kent.	140°25.5	-60°45.4
Kochab	137°20.1	74°14.0
Zuben'ubi	137°32.5	-15°57.8
Alphecca	126°31.8	26°46.8
Antares	112°56.2	-26°23.4
Atria	108°20.2	-68°59.8
Sabik	102°40.5	-15°42.1
Shaula	96°55.0	-37°05.5
Rasalhague	96°29.1	12°34.6
Eltanin	90°57.6	51°29.8
Kaus Aust.	84°16.0	-34°23.7
Vega	80°55.5	38°46.3
Nunki	76°28.3	-26°19.2
Altair	62°31.8	8°49.3
Peacock	53°57.1	-56°47.9
Deneb	49°47.9	45°13.2
Enif	34°10.7	9°47.6
Al Na'ir	28°13.7	-47°03.2
Fomalhaut	15°50.3	-29°43.2
Scheat	14°16.6	27°59.1
Markab	14°02.2	15°06.5

Oct 16 Fri	SHA	Mer.pass
Venus	114°24.1	14:45
Mars	210°16.8	08:21
Jupiter	160°03.3	11:41
Saturn	166°13.2	11:16

Oct 17 Sat	SHA	Mer.pass
Venus	113°12.5	14:46
Mars	209°42.3	08:19
Jupiter	159°51.1	11:37
Saturn	166°06.4	11:12

Oct 18 Sun	SHA	Mer.pass
Venus	112°00.9	14:47
Mars	209°08.0	08:17
Jupiter	159°38.9	11:34
Saturn	165°59.6	11:09

Horizontal parallax	
Venus:	0.2
Mars:	0.1

h

	Sun		Moon				
Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°34.8	S08°46.2	328°35.4	6.2′	N15°15.6	9.9′	60.6′
1	198°34.9	47.1	343°00.6	6.1′	15°25.5	9.7′	60.6′
2	213°35.1	48.0	357°25.7	6.1′	15°35.2	9.7′	60.6′
3	228°35.2	·· 49.0	11°50.8	6.1′	15°44.9	9.5′	60.6′
4	243°35.3	49.9	26°15.9	6.0′	15°54.4	9.4′	60.6′
5	258°35.5	50.8	40°40.9	6.0′	16°03.8	9.3′	60.6′
6	273°35.6	S08°51.7	55°05.9	5.9′	N16°13.1	9.2′	60.6′
7	288°35.7	52.7	69°30.8	5.9′	16°22.3	9.1′	60.6′
8	303°35.9	53.6	83°55.7	5.9′	16°31.4	9.0′	60.5′
9	318°36.0	·· 54.5	98°20.5	5.8′	16°40.4	8.8′	60.5′
10	333°36.1	55.4	112°45.3	5.8′	16°49.2	8.8′	60.5′
11	348°36.3	56.3	127°10.1	5.7′	16°58.0	8.6′	60.5′
12	3°36.4	S08°57.2	141°34.8	5.7′	N17°06.6	8.5′	60.5′
13	18°36.5	58.2	155°59.6	5.7′	17°15.1	8.3′	60.5′
14	33°36.7	08°59.1	170°24.2	5.6′	17°23.4	8.3′	60.5′
15	48°36.8	09°00.0	184°48.9	5.6′	17°31.7	8.1′	60.4′
16	63°36.9	00.9	199°13.5	5.6′	17°39.8	8.0′	60.4′
17	78°37.1	01.8	213°38.0	5.5′	17°47.8	7.9′	60.4′
18	93°37.2	S09°02.8	228°02.6	5.5′	N17°55.7	7.7′	60.4′
19	108°37.3	03.7	242°27.1	5.5′	18°03.4	7.6′	60.4′
20	123°37.5	04.6	256°51.5	5.4′	18°11.0	7.5′	60.4′
21	138°37.6	·· 05.5	271°16.0	5.4′	18°18.5	7.3′	60.3′
22	153°37.7	06.4	285°40.4	5.4′	18°25.8	7.3′	60.3′
23	168°37.9	07.3	300°04.8	5.4′	18°33.1	7.1′	60.3′
	SD = 16.0′	d = 0.9′	SD = 16.5′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°38.0	S09°08.3	314°29.1	5.3′	N18°40.2	6.9′	60.3′
1	198°38.1	09.2	328°53.5	5.3′	18°47.1	6.8′	60.3′
2	213°38.2	10.1	343°17.8	5.3′	18°53.9	6.7′	60.2′
3	228°38.4	·· 11.0	357°42.1	5.3′	19°00.6	6.6′	60.2′
4	243°38.5	11.9	12°06.3	5.2′	19°07.2	6.4′	60.2′
5	258°38.6	12.8	26°30.6	5.2′	19°13.6	6.3′	60.2′
6	273°38.8	S09°13.8	40°54.8	5.2′	N19°19.9	6.1′	60.2′
7	288°38.9	14.7	55°19.0	5.2′	19°26.0	6.0′	60.1′
8	303°39.0	15.6	69°43.2	5.2′	19°32.0	5.9′	60.1′
9	318°39.1	·· 16.5	84°07.4	5.2′	19°37.9	5.7′	60.1′
10	333°39.3	17.4	98°31.6	5.1′	19°43.6	5.6′	60.1′
11	348°39.4	18.3	112°55.7	5.1′	19°49.2	5.4′	60.0′
12	3°39.5	S09°19.2	127°19.8	5.1′	N19°54.6	5.3′	60.0′
13	18°39.6	20.2	141°44.0	5.1′	19°59.9	5.2′	60.0′
14	33°39.8	21.1	156°08.1	5.1′	20°05.1	5.0′	60.0′
15	48°39.9	·· 22.0	170°32.2	5.1′	20°10.1	4.9′	60.0′
16	63°40.0	22.9	184°56.3	5.1′	20°15.0	4.7′	59.9′
17	78°40.1	23.8	199°20.4	5.1′	20°19.7	4.6′	59.9′
18	93°40.3	S09°24.7	213°44.4	5.1′	N20°24.3	4.5′	59.9′
19	108°40.4	25.6	228°08.5	5.1′	20°28.8	4.3′	59.9′
20	123°40.5	26.5	242°32.6	5.1′	20°33.1	4.1′	59.8′
21	138°40.6	·· 27.4	256°56.7	5.1′	20°37.2	4.1′	59.8′
22	153°40.8	28.4	271°20.8	5.1′	20°41.3	3.8′	59.8′
23	168°40.9	29.3	285°44.8	5.1′	20°45.1	3.7′	59.8′
	SD = 16.0′	d = 0.9′	SD = 16.4′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°41.0	S09°30.2	300°08.9	5.1′	N20°48.8	3.6′	59.7′
1	198°41.1	31.1	314°33.0	5.1′	20°52.4	3.5′	59.7′
2	213°41.3	32.0	328°57.1	5.1′	20°55.9	3.2′	59.7′
3	228°41.4	·· 32.9	343°21.2	5.1′	20°59.1	3.2′	59.7′
4	243°41.5	33.8	357°45.3	5.1′	21°02.3	3.0′	59.6′
5	258°41.6	34.7	12°09.4	5.1′	21°05.3	2.8′	59.6′
6	273°41.8	S09°35.6	26°33.6	5.1′	N21°08.1	2.7′	59.6′
7	288°41.9	36.6	40°57.7	5.2′	21°10.8	2.6′	59.5′
8	303°42.0	37.5	55°21.9	5.2′	21°13.4	2.4′	59.5′
9	318°42.1	·· 38.4	69°46.1	5.2′	21°15.8	2.3′	59.5′
10	333°42.2	39.3	84°10.2	5.2′	21°18.1	2.1′	59.5′
11	348°42.4	40.2	98°34.5	5.2′	21°20.2	2.0′	59.4′
12	3°42.5	S09°41.1	112°58.7	5.3′	N21°22.2	1.8′	59.4′
13	18°42.6	42.0	127°22.9	5.3′	21°24.0	1.7′	59.4′
14	33°42.7	42.9	141°47.2	5.3′	21°25.7	1.5′	59.4′
15	48°42.8	·· 43.8	156°11.5	5.3′	21°27.2	1.4′	59.3′
16	63°43.0	44.7	170°35.8	5.4′	21°28.6	1.2′	59.3′
17	78°43.1	45.6	185°00.2	5.4′	21°29.8	1.1′	59.3′
18	93°43.2	S09°46.5	199°24.6	5.4′	N21°30.9	1.0′	59.2′
19	108°43.3	47.4	213°49.0	5.4′	21°31.9	0.8′	59.2′
20	123°43.4	48.3	228°13.4	5.5′	21°32.7	0.7′	59.2′
21	138°43.5	·· 49.3	242°37.9	5.5′	21°33.4	0.5′	59.1′
22	153°43.7	50.2	257°02.4	5.5′	21°33.9	0.4′	59.1′
23	168°43.8	51.1	271°26.9	5.6′	21°34.3	0.2′	59.1′
	SD = 16.0′	d = 0.9′	SD = 16.3′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	05:03	06:22	07:33	15:56	17:07	18:25
N 70°	05:06	06:17	07:21	16:08	17:12	18:22
68°	05:08	06:13	07:11	16:18	17:16	18:20
66°	05:10	06:09	07:02	16:27	17:20	18:19
64°	05:11	06:06	06:55	16:34	17:23	18:18
62°	05:12	06:04	06:49	16:40	17:26	18:17
60°	05:13	06:01	06:44	16:46	17:28	18:16
N 58°	05:14	05:59	06:39	16:50	17:30	18:16
56°	05:14	05:57	06:35	16:55	17:32	18:15
54°	05:14	05:55	06:31	16:59	17:34	18:15
52°	05:15	05:54	06:28	17:02	17:36	18:15
50°	05:15	05:52	06:25	17:05	17:38	18:15
45°	05:14	05:48	06:18	17:12	17:42	18:16
N 40°	05:14	05:45	06:12	17:18	17:45	18:17
35°	05:12	05:42	06:07	17:23	17:48	18:18
30°	05:11	05:39	06:03	17:27	17:51	18:19
20°	05:07	05:33	05:55	17:35	17:57	18:23
N 10°	05:03	05:27	05:49	17:42	18:03	18:28
0°	04:57	05:21	05:42	17:49	18:10	18:34
S 10°	04:49	05:14	05:35	17:55	18:17	18:42
20°	04:40	05:06	05:28	18:03	18:25	18:51
30°	04:27	04:56	05:20	18:11	18:36	19:05
35°	04:18	04:49	05:15	18:16	18:42	19:13
40°	04:08	04:42	05:10	18:22	18:50	19:23
45°	03:56	04:33	05:03	18:28	18:59	19:36
S 50°	03:40	04:22	04:55	18:36	19:10	19:52
52°	03:32	04:16	04:52	18:40	19:16	20:00
54°	03:23	04:10	04:48	18:44	19:22	20:09
56°	03:13	04:04	04:44	18:49	19:29	20:20
58°	03:01	03:56	04:39	18:54	19:36	20:32
S 60°	02:47	03:48	04:33	18:59	19:45	20:46

Lat.	**Moonrise** Fri	Sat	Sun	**Moonset** Fri	Sat	Sun
N 72°	15:41	▭	▭	13:24	▭	▭
N 70°	16:42	▭	▭	12:23	▭	▭
68°	17:18	17:21	17:40	11:48	13:50	15:37
66°	17:44	18:01	18:38	11:24	13:10	14:39
64°	18:04	18:29	19:12	11:04	12:43	14:05
62°	18:20	18:51	19:36	10:49	12:22	13:40
60°	18:34	19:08	19:56	10:36	12:05	13:21
N 58°	18:46	19:23	20:12	10:25	11:50	13:04
56°	18:56	19:35	20:26	10:15	11:38	12:51
54°	19:05	19:46	20:38	10:06	11:27	12:39
52°	19:13	19:56	20:49	09:59	11:18	12:28
50°	19:20	20:05	20:58	09:52	11:09	12:19
45°	19:36	20:24	21:18	09:37	10:51	11:59
N 40°	19:49	20:39	21:34	09:25	10:37	11:43
35°	20:00	20:52	21:48	09:15	10:24	11:30
30°	20:10	21:03	22:00	09:06	10:13	11:18
20°	20:27	21:22	22:20	08:51	09:55	10:58
N 10°	20:42	21:39	22:38	08:37	09:39	10:40
0°	20:55	21:55	22:55	08:25	09:24	10:24
S 10°	21:09	22:11	23:11	08:12	09:09	10:07
20°	21:24	22:28	23:29	07:59	08:53	09:50
30°	21:42	22:48	23:50	07:43	08:34	09:29
35°	21:52	22:59	·· ··	07:35	08:24	09:17
40°	22:03	23:13	·· ··	07:25	08:11	09:04
45°	22:17	23:28	·· ··	07:13	07:57	08:48
S 50°	22:34	23:48	·· ··	06:59	07:39	08:28
52°	22:42	23:57	·· ··	06:52	07:31	08:19
54°	22:51	·· ··	00:07	06:45	07:22	08:08
56°	23:00	·· ··	00:19	06:37	07:11	07:56
58°	23:12	·· ··	00:32	06:28	07:00	07:43
S 60°	23:25	·· ··	00:48	06:17	06:46	07:27

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 18-20 91-74%
16	14:19	14:26	11:46	02:11	14:40	
17	14:32	14:38	11:45	03:10	15:39	
18	14:44	14:50	11:45	04:09	16:39	

October 19, 20, 21 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	27°22.8	138°11.9	S24°53.9	235°56.6	N13°15.1	186°49.5	S07°29.2	193°15.7	S03°37.8
1	42°25.3	153°11.4	54.5	250°57.6	14.6	201°51.5	29.4	208°17.8	37.9
2	57°27.7	168°10.9	55.0	265°58.6	14.1	216°53.4	29.6	223°20.0	38.0
3	72°30.2	183°10.3	·· 55.5	280°59.7	·· 13.6	231°55.4	·· 29.8	238°22.2	·· 38.1
4	87°32.7	198°09.8	56.0	296°00.7	13.1	246°57.3	30.0	253°24.4	38.2
5	102°35.1	213°09.3	56.5	311°01.8	12.6	261°59.3	30.2	268°26.6	38.4
6	117°37.6	228°08.7	S24°57.0	326°02.8	N13°12.1	277°01.3	S07°30.4	283°28.8	S03°38.5
7	132°40.0	243°08.2	57.5	341°03.9	11.6	292°03.2	30.6	298°30.9	38.6
8	147°42.5	258°07.7	58.0	356°04.9	11.1	307°05.2	30.8	313°33.1	38.7
9	162°45.0	273°07.2	·· 58.5	11°05.9	·· 10.7	322°07.1	·· 31.0	328°35.3	·· 38.8
10	177°47.4	288°06.6	59.0	26°07.0	10.2	337°09.1	31.2	343°37.5	38.9
11	192°49.9	303°06.1	24°59.5	41°08.0	09.7	352°11.0	31.4	358°39.7	39.0
12	207°52.4	318°05.6	S25°00.0	56°09.1	N13°09.2	7°13.0	S07°31.6	13°41.9	S03°39.2
13	222°54.8	333°05.1	00.5	71°10.1	08.7	22°15.0	31.8	28°44.0	39.3
14	237°57.3	348°04.5	01.0	86°11.2	08.2	37°16.9	32.0	43°46.2	39.4
15	252°59.8	3°04.0	·· 01.5	101°12.2	·· 07.7	52°18.9	·· 32.2	58°48.4	·· 39.5
16	268°02.2	18°03.5	02.0	116°13.2	07.2	67°20.8	32.4	73°50.6	39.6
17	283°04.7	33°02.9	02.5	131°14.3	06.7	82°22.8	32.6	88°52.8	39.7
18	298°07.1	48°02.4	S25°03.0	146°15.3	N13°06.3	97°24.7	S07°32.8	103°55.0	S03°39.9
19	313°09.6	63°01.9	03.4	161°16.4	05.8	112°26.7	33.0	118°57.1	40.0
20	328°12.1	78°01.4	03.9	176°17.4	05.3	127°28.6	33.2	133°59.3	40.1
21	343°14.5	93°00.8	·· 04.4	191°18.5	·· 04.8	142°30.6	·· 33.4	149°01.5	·· 40.2
22	358°17.0	108°00.3	04.9	206°19.5	04.3	157°32.6	33.7	164°03.7	40.3
23	13°19.5	122°59.8	05.4	221°20.6	03.8	172°34.5	33.9	179°05.9	40.4
Mer.pass. 22:07		ν -0.5′	d 0.5′	m -4.25	ν 1.0′	d 0.5′	m 1.49	ν 2.0′	d 0.2′ m -1.67	ν 2.2′	d 0.1′ m 0.86

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	28°21.9	137°59.2	S25°05.9	236°21.6	N13°03.3	187°36.5	S07°34.1	194°08.1	S03°40.5
1	43°24.4	152°58.7	06.4	251°22.6	02.8	202°38.4	34.3	209°10.2	40.7
2	58°26.9	167°58.2	06.8	266°23.7	02.3	217°40.4	34.5	224°12.4	40.8
3	73°29.3	182°57.7	·· 07.3	281°24.7	·· 01.8	232°42.3	·· 34.7	239°14.6	·· 40.9
4	88°31.8	197°57.1	07.8	296°25.8	01.3	247°44.3	34.9	254°16.8	41.0
5	103°34.3	212°56.6	08.3	311°26.8	00.9	262°46.3	35.1	269°19.0	41.1
6	118°36.7	227°56.1	S25°08.8	326°27.9	N13°00.4	277°48.2	S07°35.3	284°21.2	S03°41.2
7	133°39.2	242°55.5	09.2	341°28.9	12°59.9	292°50.2	35.5	299°23.3	41.3
8	148°41.6	257°55.0	09.7	356°30.0	59.4	307°52.1	35.7	314°25.5	41.5
9	163°44.1	272°54.5	·· 10.2	11°31.0	·· 58.9	322°54.1	·· 35.9	329°27.7	·· 41.6
10	178°46.6	287°54.0	10.7	26°32.1	58.4	337°56.0	36.1	344°29.9	41.7
11	193°49.0	302°53.4	11.1	41°33.1	57.9	352°58.0	36.3	359°32.1	41.8
12	208°51.5	317°52.9	S25°11.6	56°34.2	N12°57.4	7°59.9	S07°36.5	14°34.3	S03°41.9
13	223°54.0	332°52.4	12.1	71°35.2	56.9	23°01.9	36.7	29°36.4	42.0
14	238°56.4	347°51.8	12.6	86°36.3	56.4	38°03.9	36.9	44°38.6	42.1
15	253°58.9	2°51.3	·· 13.0	101°37.3	·· 56.0	53°05.8	·· 37.1	59°40.8	·· 42.3
16	269°01.4	17°50.8	13.5	116°38.4	55.5	68°07.8	37.3	74°43.0	42.4
17	284°03.8	32°50.3	14.0	131°39.4	55.0	83°09.7	37.5	89°45.2	42.5
18	299°06.3	47°49.7	S25°14.4	146°40.5	N12°54.5	98°11.7	S07°37.7	104°47.4	S03°42.6
19	314°08.8	62°49.2	14.9	161°41.5	54.0	113°13.6	37.9	119°49.6	42.7
20	329°11.2	77°48.7	15.4	176°42.6	53.5	128°15.6	38.1	134°51.7	42.8
21	344°13.7	92°48.1	·· 15.8	191°43.6	·· 53.0	143°17.6	·· 38.3	149°53.9	·· 42.9
22	359°16.1	107°47.6	16.3	206°44.7	52.5	158°19.5	38.5	164°56.1	43.1
23	14°18.6	122°47.1	16.7	221°45.7	52.0	173°21.5	38.7	179°58.3	43.2
Mer.pass. 22:03		ν -0.5′	d 0.5′	m -4.26	ν 1.0′	d 0.5′	m 1.48	ν 2.0′	d 0.2′ m -1.67	ν 2.2′	d 0.1′ m 0.86

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	29°21.1	137°46.6	S25°17.2	236°46.8	N12°51.5	188°23.4	S07°38.9	195°00.5	S03°43.3
1	44°23.5	152°46.0	17.7	251°47.8	51.0	203°25.4	39.1	210°02.7	43.4
2	59°26.0	167°45.5	18.1	266°48.9	50.5	218°27.3	39.3	225°04.8	43.5
3	74°28.5	182°45.0	·· 18.6	281°49.9	·· 50.1	233°29.3	·· 39.5	240°07.0	·· 43.6
4	89°30.9	197°44.4	19.0	296°51.0	49.6	248°31.2	39.7	255°09.2	43.7
5	104°33.4	212°43.9	19.5	311°52.0	49.1	263°33.2	39.9	270°11.4	43.9
6	119°35.9	227°43.4	S25°19.9	326°53.1	N12°48.6	278°35.2	S07°40.1	285°13.6	S03°44.0
7	134°38.3	242°42.9	20.4	341°54.1	48.1	293°37.1	40.3	300°15.8	44.1
8	149°40.8	257°42.3	20.8	356°55.2	47.6	308°39.1	40.5	315°17.9	44.2
9	164°43.3	272°41.8	·· 21.3	11°56.2	·· 47.1	323°41.0	·· 40.7	330°20.1	·· 44.3
10	179°45.7	287°41.3	21.7	26°57.3	46.6	338°43.0	40.9	345°22.3	44.4
11	194°48.2	302°40.7	22.2	41°58.3	46.1	353°44.9	41.1	0°24.5	44.5
12	209°50.6	317°40.2	S25°22.6	56°59.4	N12°45.6	8°46.9	S07°41.3	15°26.7	S03°44.6
13	224°53.1	332°39.7	23.1	72°00.4	45.1	23°48.9	41.5	30°28.9	44.8
14	239°55.6	347°39.1	23.5	87°01.5	44.6	38°50.8	41.7	45°31.0	44.9
15	254°58.0	2°38.6	·· 24.0	102°02.5	·· 44.1	53°52.8	·· 41.9	60°33.2	·· 45.0
16	270°00.5	17°38.1	24.4	117°03.6	43.7	68°54.7	42.1	75°35.4	45.1
17	285°03.0	32°37.6	24.8	132°04.7	43.2	83°56.7	42.3	90°37.6	45.2
18	300°05.4	47°37.0	S25°25.3	147°05.7	N12°42.7	98°58.6	S07°42.5	105°39.8	S03°45.3
19	315°07.9	62°36.5	25.7	162°06.8	42.2	114°00.6	42.7	120°42.0	45.4
20	330°10.4	77°36.0	26.2	177°07.8	41.7	129°02.5	42.9	135°44.2	45.6
21	345°12.8	92°35.4	·· 26.6	192°08.9	·· 41.2	144°04.5	·· 43.1	150°46.3	·· 45.7
22	0°15.3	107°34.9	27.0	207°09.9	40.7	159°06.5	43.3	165°48.5	45.8
23	15°17.7	122°34.4	27.5	222°11.0	40.2	174°08.4	43.5	180°50.7	45.9
Mer.pass. 21:59		ν -0.5′	d 0.5′	m -4.27	ν 1.1′	d 0.5′	m 1.48	ν 2.0′	d 0.2′ m -1.67	ν 2.2′	d 0.1′ m 0.86

Stars

	SHA	Dec
Alpheratz	358°08.2	28°59.5
Ankaa	353°39.1	-42°24.4
Schedar	350°07.6	56°26.3
Diphda	349°19.8	-18°05.2
Achernar	335°44.1	-57°19.8
Hamal	328°27.7	23°22.6
Polaris	326°17.4	89°10.8
Acamar	315°36.3	-40°22.6
Menkar	314°40.0	4°01.1
Mirfak	309°14.6	49°47.7
Aldebaran	291°16.9	16°28.4
Rigel	281°35.1	-8°13.2
Capella	281°09.9	45°58.7
Bellatrix	278°57.8	6°20.1
Elnath	278°43.0	28°35.5
Alnilam	276°10.7	-1°12.7
Betelgeuse	271°27.3	7°24.3
Canopus	264°06.7	-52°40.9
Sirius	258°54.9	-16°41.3
Adhara	255°31.4	-28°56.6
Procyon	245°25.0	5°16.4
Pollux	243°57.2	28°04.2
Avior	234°28.0	-59°26.7
Suhail	223°10.4	-43°21.2
Miaplacidus	221°45.2	-69°38.2
Alphard	218°20.0	-8°34.5
Regulus	208°09.4	12°03.5
Dubhe	194°21.7	61°50.9
Denebola	182°58.6	14°40.6
Gienah	176°17.5	-17°26.2
Acrux	173°37.2	-62°59.6
Gacrux	172°28.5	-57°00.4
Alioth	166°42.4	56°03.6
Spica	158°57.1	-11°03.7
Alkaid	153°18.4	49°24.4
Hadar	149°23.0	-60°17.0
Menkent	148°36.5	-36°16.6
Arcturus	146°18.1	19°16.9
Rigil Kent.	140°25.5	-60°45.4
Kochab	137°20.1	74°14.0
Zuben'ubi	137°32.5	-15°57.8
Alphecca	126°31.8	26°46.8
Antares	112°56.2	-26°23.4
Atria	108°20.2	-68°59.8
Sabik	102°40.5	-15°42.1
Shaula	96°55.0	-37°05.5
Rasalhague	96°29.1	12°34.6
Eltanin	90°57.6	51°29.8
Kaus Aust.	84°16.0	-34°23.7
Vega	80°55.5	38°46.3
Nunki	76°28.3	-26°19.2
Altair	62°31.8	8°49.3
Peacock	53°57.1	-56°47.9
Deneb	49°47.9	45°13.2
Enif	34°10.7	9°47.6
Al Na'ir	28°13.7	-47°03.2
Fomalhaut	15°50.3	-29°43.2
Scheat	14°16.6	27°59.2
Markab	14°02.2	15°06.5

Oct 19 Mon	SHA	Mer.pass
Venus	110°49.1	14:48
Mars	208°33.8	08:16
Jupiter	159°26.7	11:31
Saturn	165°52.9	11:05

Oct 20 Tue	SHA	Mer.pass
Venus	109°37.3	14:49
Mars	207°59.7	08:14
Jupiter	159°14.5	11:28
Saturn	165°46.1	11:02

Oct 21 Wed	SHA	Mer.pass
Venus	108°25.5	14:49
Mars	207°25.7	08:12
Jupiter	159°02.3	11:25
Saturn	165°39.4	10:58

Horizontal parallax	
Venus:	0.2
Mars:	0.1

DUT1 = UT1-UTC = +0.1817 sec ΔT = TT-UT1 = +52.0023 sec

1981 October 19 to Oct. 21 UT

h	Sun		Moon				
Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°43.9	S09°52.0	285°51.5	5.6′	N21°34.5	0.1′	59.1′
1	198°44.0	52.9	300°16.1	5.7′	21°34.6	0.1′	59.0′
2	213°44.1	53.8	314°40.8	5.7′	21°34.5	0.2′	59.0′
3	228°44.2	·· 54.7	329°05.5	5.7′	21°34.3	0.3′	59.0′
4	243°44.4	55.6	343°30.2	5.8′	21°34.0	0.5′	58.9′
5	258°44.5	56.5	357°55.0	5.8′	21°33.5	0.6′	58.9′
6	273°44.6	S09°57.4	12°19.8	5.9′	N21°32.9	0.7′	58.9′
7	288°44.7	58.3	26°44.7	5.9′	21°32.2	0.9′	58.9′
8	303°44.8	09°59.2	41°09.6	6.0′	21°31.3	1.0′	58.8′
9	318°44.9	10°00.1	55°34.6	6.0′	21°30.3	1.2′	58.8′
10	333°45.0	01.0	69°59.6	6.1′	21°29.1	1.3′	58.8′
11	348°45.2	01.9	84°24.6	6.1′	21°27.8	1.5′	58.7′
12	3°45.3	S10°02.8	98°49.7	6.2′	N21°26.3	1.6′	58.7′
13	18°45.4	03.7	113°14.9	6.2′	21°24.7	1.7′	58.7′
14	33°45.5	04.6	127°40.1	6.3′	21°23.0	1.8′	58.6′
15	48°45.6	·· 05.5	142°05.4	6.3′	21°21.2	2.0′	58.6′
16	63°45.7	06.4	156°30.7	6.4′	21°19.2	2.1′	58.6′
17	78°45.8	07.3	170°56.1	6.4′	21°17.1	2.3′	58.6′
18	93°45.9	S10°08.2	185°21.5	6.5′	N21°14.8	2.4′	58.5′
19	108°46.1	09.1	199°47.0	6.6′	21°12.4	2.5′	58.5′
20	123°46.2	10.0	214°12.6	6.6′	21°09.9	2.6′	58.5′
21	138°46.3	·· 10.9	228°38.2	6.7′	21°07.3	2.8′	58.4′
22	153°46.4	11.8	243°03.9	6.7′	21°04.5	2.9′	58.4′
23	168°46.5	12.7	257°29.6	6.8′	21°01.6	3.0′	58.4′
	SD = 16.1′	d = 0.9′	SD = 16.1′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°46.6	S10°13.6	271°55.4	6.9′	N20°58.6	3.2′	58.3′
1	198°46.7	14.5	286°21.3	6.9′	20°55.4	3.3′	58.3′
2	213°46.8	15.4	300°47.2	7.0′	20°52.1	3.4′	58.3′
3	228°46.9	·· 16.3	315°13.2	7.1′	20°48.7	3.5′	58.3′
4	243°47.1	17.2	329°39.2	7.1′	20°45.2	3.7′	58.2′
5	258°47.2	18.1	344°05.4	7.2′	20°41.5	3.8′	58.2′
6	273°47.3	S10°19.0	358°31.6	7.3′	N20°37.7	3.9′	58.2′
7	288°47.4	19.9	12°57.8	7.3′	20°33.8	4.0′	58.1′
8	303°47.5	20.8	27°24.1	7.4′	20°29.8	4.1′	58.1′
9	318°47.6	·· 21.7	41°50.5	7.5′	20°25.7	4.3′	58.1′
10	333°47.7	22.6	56°17.0	7.5′	20°21.4	4.4′	58.0′
11	348°47.8	23.5	70°43.5	7.6′	20°17.0	4.5′	58.0′
12	3°47.9	S10°24.4	85°10.2	7.7′	N20°12.5	4.6′	58.0′
13	18°48.0	25.3	99°36.8	7.8′	20°07.9	4.7′	58.0′
14	33°48.1	26.2	114°03.6	7.8′	20°03.2	4.9′	57.9′
15	48°48.2	·· 27.1	128°30.4	7.9′	19°58.3	4.9′	57.9′
16	63°48.3	28.0	142°57.3	8.0′	19°53.4	5.1′	57.9′
17	78°48.4	28.9	157°24.3	8.0′	19°48.3	5.2′	57.8′
18	93°48.5	S10°29.8	171°51.3	8.1′	N19°43.1	5.3′	57.8′
19	108°48.6	30.6	186°18.4	8.2′	19°37.8	5.4′	57.8′
20	123°48.8	31.5	200°45.6	8.3′	19°32.4	5.5′	57.7′
21	138°48.9	·· 32.4	215°12.9	8.3′	19°26.9	5.6′	57.7′
22	153°49.0	33.3	229°40.3	8.4′	19°21.3	5.8′	57.7′
23	168°49.1	34.2	244°07.7	8.5′	19°15.5	5.8′	57.7′
	SD = 16.1′	d = 0.9′	SD = 15.9′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°49.2	S10°35.1	258°35.2	8.6′	N19°09.7	5.9′	57.6′
1	198°49.3	36.0	273°02.7	8.6′	19°03.8	6.1′	57.6′
2	213°49.4	36.9	287°30.4	8.7′	18°57.7	6.1′	57.6′
3	228°49.5	·· 37.8	301°58.1	8.8′	18°51.6	6.2′	57.5′
4	243°49.6	38.7	316°25.9	8.9′	18°45.4	6.4′	57.5′
5	258°49.7	39.6	330°53.8	9.0′	18°39.0	6.4′	57.5′
6	273°49.8	S10°40.5	345°21.7	9.0′	N18°32.6	6.6′	57.5′
7	288°49.9	41.4	359°49.8	9.1′	18°26.0	6.6′	57.4′
8	303°50.0	42.2	14°17.9	9.2′	18°19.4	6.7′	57.4′
9	318°50.1	·· 43.1	28°46.1	9.3′	18°12.7	6.9′	57.4′
10	333°50.2	44.0	43°14.3	9.3′	18°05.8	6.9′	57.3′
11	348°50.3	44.9	57°42.7	9.4′	17°58.9	7.0′	57.3′
12	3°50.4	S10°45.8	72°11.1	9.5′	N17°51.9	7.1′	57.3′
13	18°50.5	46.7	86°39.6	9.6′	17°44.8	7.2′	57.3′
14	33°50.6	47.6	101°08.2	9.6′	17°37.6	7.3′	57.2′
15	48°50.7	·· 48.5	115°36.8	9.7′	17°30.3	7.4′	57.2′
16	63°50.8	49.4	130°05.5	9.8′	17°22.9	7.4′	57.2′
17	78°50.9	50.2	144°34.3	9.9′	17°15.5	7.6′	57.1′
18	93°51.0	S10°51.1	159°03.2	10.0′	N17°07.9	7.6′	57.1′
19	108°51.1	52.0	173°32.2	10.0′	17°00.3	7.7′	57.1′
20	123°51.2	52.9	188°01.2	10.1′	16°52.6	7.8′	57.1′
21	138°51.3	·· 53.8	202°30.3	10.2′	16°44.8	7.9′	57.0′
22	153°51.4	54.7	216°59.5	10.3′	16°36.9	8.0′	57.0′
23	168°51.5	55.6	231°28.8	10.3′	16°28.9	8.0′	57.0′
	SD = 16.1′	d = 0.9′	SD = 15.7′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	05:16	06:35	07:49	15:39	16:53	18:11
N 70°	05:18	06:29	07:34	15:54	16:59	18:10
68°	05:19	06:23	07:22	16:06	17:05	18:09
66°	05:19	06:19	07:13	16:16	17:09	18:09
64°	05:20	06:15	07:04	16:24	17:13	18:08
62°	05:20	06:12	06:57	16:31	17:17	18:08
60°	05:20	06:08	06:51	16:37	17:20	18:08
N 58°	05:20	06:06	06:46	16:43	17:23	18:08
56°	05:20	06:03	06:41	16:47	17:25	18:08
54°	05:20	06:01	06:37	16:52	17:28	18:09
52°	05:19	05:59	06:33	16:56	17:30	18:09
50°	05:19	05:57	06:30	16:59	17:32	18:10
45°	05:18	05:52	06:22	17:07	17:37	18:11
N 40°	05:17	05:48	06:16	17:13	17:41	18:12
35°	05:15	05:44	06:10	17:19	17:45	18:14
30°	05:13	05:41	06:05	17:24	17:48	18:16
20°	05:08	05:34	05:56	17:33	17:55	18:21
N 10°	05:03	05:27	05:49	17:41	18:02	18:27
0°	04:56	05:20	05:41	17:48	18:09	18:34
S 10°	04:48	05:13	05:34	17:56	18:17	18:42
20°	04:37	05:04	05:26	18:04	18:26	18:53
30°	04:23	04:52	05:17	18:13	18:38	19:07
35°	04:14	04:45	05:11	18:19	18:45	19:16
40°	04:03	04:37	05:05	18:25	18:53	19:27
45°	03:50	04:27	04:58	18:32	19:03	19:41
S 50°	03:33	04:15	04:49	18:41	19:16	19:58
52°	03:24	04:09	04:45	18:45	19:22	20:07
54°	03:15	04:03	04:41	18:50	19:28	20:17
56°	03:04	03:56	04:36	18:55	19:36	20:28
58°	02:51	03:47	04:31	19:01	19:44	20:41
S 60°	02:35	03:38	04:24	19:07	19:54	20:57

Lat.	**Moonrise** Mon	Tue	Wed	**Moonset** Mon	Tue	Wed
N 72°	▭	▭	21:03	▭	▭	18:05
N 70°	▭	19:32	21:54	▭	17:45	17:13
68°	18:50	20:37	22:25	16:28	16:39	16:41
66°	19:44	21:12	22:48	15:35	16:03	16:17
64°	20:16	21:38	23:07	15:03	15:37	15:58
62°	20:40	21:57	23:21	14:38	15:17	15:42
60°	20:59	22:13	23:34	14:19	15:01	15:29
N 58°	21:15	22:27	23:44	14:03	14:47	15:18
56°	21:28	22:39	23:54	13:50	14:35	15:08
54°	21:40	22:49	·· ··	13:38	14:24	14:59
52°	21:50	22:58	·· ··	13:27	14:15	14:52
50°	21:59	23:06	·· ··	13:18	14:06	14:45
45°	22:19	23:24	·· ··	12:58	13:48	14:30
N 40°	22:35	23:38	·· ··	12:42	13:33	14:17
35°	22:48	23:50	·· ··	12:29	13:21	14:06
30°	22:59	·· ··	00:00	12:17	13:10	13:57
20°	23:19	·· ··	00:18	11:57	12:51	13:41
N 10°	23:37	·· ··	00:33	11:39	12:35	13:27
0°	23:53	·· ··	00:48	11:23	12:19	13:13
S 10°	·· ··	00:09	01:02	11:06	12:04	13:00
20°	·· ··	00:26	01:18	10:48	11:47	12:45
30°	·· ··	00:46	01:36	10:28	11:28	12:29
35°	00:02	00:57	01:46	10:16	11:17	12:19
40°	00:16	01:11	01:58	10:02	11:04	12:08
45°	00:32	01:26	02:12	09:46	10:49	11:55
S 50°	00:52	01:46	02:28	09:26	10:30	11:39
52°	01:02	01:55	02:36	09:16	10:21	11:32
54°	01:13	02:05	02:45	09:05	10:11	11:23
56°	01:25	02:16	02:55	08:53	10:00	11:14
58°	01:39	02:30	03:06	08:39	09:47	11:03
S 60°	01:56	02:45	03:19	08:22	09:32	10:51

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 21-23 63-41%
19	14:56	15:01	11:45	05:09	17:38	
20	15:06	15:12	11:45	06:06	18:34	
21	15:17	15:22	11:45	07:01	19:27	

October 22, 23, 24 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	30°20.2	137°33.8	S25°27.9	237°12.0	N12°39.7	189°10.4	S07°43.7	195°52.9	S03°46.0
1	45°22.7	152°33.3	28.3	252°13.1	39.2	204°12.3	43.9	210°55.1	46.1
2	60°25.1	167°32.8	28.8	267°14.2	38.7	219°14.3	44.1	225°57.3	46.2
3	75°27.6	182°32.3	·· 29.2	282°15.2	·· 38.2	234°16.2	·· 44.3	240°59.4	·· 46.4
4	90°30.1	197°31.7	29.6	297°16.3	37.7	249°18.2	44.5	256°01.6	46.5
5	105°32.5	212°31.2	30.0	312°17.3	37.2	264°20.2	44.7	271°03.8	46.6
6	120°35.0	227°30.7	S25°30.5	327°18.4	N12°36.7	279°22.1	S07°44.9	286°06.0	S03°46.7
7	135°37.5	242°30.1	30.9	342°19.4	36.3	294°24.1	45.1	301°08.2	46.8
8	150°39.9	257°29.6	31.3	357°20.5	35.8	309°26.0	45.3	316°10.4	46.9
9	165°42.4	272°29.1	·· 31.7	12°21.6	·· 35.3	324°28.0	·· 45.5	331°12.5	·· 47.0
10	180°44.9	287°28.6	32.2	27°22.6	34.8	339°29.9	45.7	346°14.7	47.1
11	195°47.3	302°28.0	32.6	42°23.7	34.3	354°31.9	45.9	1°16.9	47.3
12	210°49.8	317°27.5	S25°33.0	57°24.7	N12°33.8	9°33.8	S07°46.1	16°19.1	S03°47.4
13	225°52.2	332°27.0	33.4	72°25.8	33.3	24°35.8	46.3	31°21.3	47.5
14	240°54.7	347°26.4	33.8	87°26.8	32.8	39°37.8	46.5	46°23.5	47.6
15	255°57.2	2°25.9	·· 34.3	102°27.9	·· 32.3	54°39.7	·· 46.7	61°25.7	·· 47.7
16	270°59.6	17°25.4	34.7	117°29.0	31.8	69°41.7	46.9	76°27.8	47.8
17	286°02.1	32°24.8	35.1	132°30.0	31.3	84°43.6	47.1	91°30.0	47.9
18	301°04.6	47°24.3	S25°35.5	147°31.1	N12°30.8	99°45.6	S07°47.3	106°32.2	S03°48.1
19	316°07.0	62°23.8	35.9	162°32.1	30.3	114°47.5	47.5	121°34.4	48.2
20	331°09.5	77°23.3	36.3	177°33.2	29.8	129°49.5	47.7	136°36.6	48.3
21	346°12.0	92°22.7	·· 36.7	192°34.3	·· 29.3	144°51.5	·· 47.9	151°38.8	·· 48.4
22	1°14.4	107°22.2	37.2	207°35.3	28.8	159°53.4	48.1	166°41.0	48.5
23	16°16.9	122°21.7	37.6	222°36.4	28.4	174°55.4	48.3	181°43.1	48.6
Mer.pass.	21:55	ν -0.5′	d 0.4′	m -4.28	ν 1.1′	d 0.5′	m 1.47	ν 2.0′	d 0.2′ m -1.67	ν 2.2′	d 0.1′ m 0.86

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	31°19.4	137°21.1	S25°38.0	237°37.4	N12°27.9	189°57.3	S07°48.5	196°45.3	S03°48.7
1	46°21.8	152°20.6	38.4	252°38.5	27.4	204°59.3	48.7	211°47.5	48.8
2	61°24.3	167°20.1	38.8	267°39.6	26.9	220°01.2	48.9	226°49.7	49.0
3	76°26.7	182°19.6	·· 39.2	282°40.6	·· 26.4	235°03.2	·· 49.1	241°51.9	·· 49.1
4	91°29.2	197°19.0	39.6	297°41.7	25.9	250°05.2	49.3	256°54.1	49.2
5	106°31.7	212°18.5	40.0	312°42.8	25.4	265°07.1	49.5	271°56.2	49.3
6	121°34.1	227°18.0	S25°40.4	327°43.8	N12°24.9	280°09.1	S07°49.7	286°58.4	S03°49.4
7	136°36.6	242°17.4	40.8	342°44.9	24.4	295°11.0	49.9	302°00.6	49.5
8	151°39.1	257°16.9	41.2	357°45.9	23.9	310°13.0	50.1	317°02.8	49.6
9	166°41.5	272°16.4	·· 41.6	12°47.0	·· 23.4	325°14.9	·· 50.3	332°05.0	·· 49.7
10	181°44.0	287°15.8	42.0	27°48.1	22.9	340°16.9	50.5	347°07.2	49.9
11	196°46.5	302°15.3	42.4	42°49.1	22.4	355°18.8	50.7	2°09.4	50.0
12	211°48.9	317°14.8	S25°42.8	57°50.2	N12°21.9	10°20.8	S07°50.9	17°11.5	S03°50.1
13	226°51.4	332°14.3	43.2	72°51.3	21.4	25°22.8	51.1	32°13.7	50.2
14	241°53.8	347°13.7	43.6	87°52.3	20.9	40°24.7	51.3	47°15.9	50.3
15	256°56.3	2°13.2	·· 43.9	102°53.4	·· 20.4	55°26.7	·· 51.5	62°18.1	·· 50.4
16	271°58.8	17°12.7	44.3	117°54.5	19.9	70°28.6	51.7	77°20.3	50.5
17	287°01.2	32°12.1	44.7	132°55.5	19.4	85°30.6	51.9	92°22.5	50.6
18	302°03.7	47°11.6	S25°45.1	147°56.6	N12°18.9	100°32.5	S07°52.1	107°24.7	S03°50.8
19	317°06.2	62°11.1	45.5	162°57.6	18.5	115°34.5	52.3	122°26.8	50.9
20	332°08.6	77°10.6	45.9	177°58.7	18.0	130°36.5	52.5	137°29.0	51.0
21	347°11.1	92°10.0	·· 46.3	192°59.8	·· 17.5	145°38.4	·· 52.7	152°31.2	·· 51.1
22	2°13.6	107°09.5	46.6	208°00.8	17.0	160°40.4	52.9	167°33.4	51.2
23	17°16.0	122°09.0	47.0	223°01.9	16.5	175°42.3	53.1	182°35.6	51.3
Mer.pass.	21:51	ν -0.5′	d 0.4′	m -4.29	ν 1.1′	d 0.5′	m 1.47	ν 2.0′	d 0.2′ m -1.67	ν 2.2′	d 0.1′ m 0.86

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	32°18.5	137°08.4	S25°47.4	238°03.0	N12°16.0	190°44.3	S07°53.3	197°37.8	S03°51.4
1	47°21.0	152°07.9	47.8	253°04.0	15.5	205°46.2	53.5	212°40.0	51.6
2	62°23.4	167°07.4	48.2	268°05.1	15.0	220°48.2	53.7	227°42.1	51.7
3	77°25.9	182°06.9	·· 48.5	283°06.2	·· 14.5	235°50.2	·· 53.9	242°44.3	·· 51.8
4	92°28.3	197°06.3	48.9	298°07.2	14.0	250°52.1	54.1	257°46.5	51.9
5	107°30.8	212°05.8	49.3	313°08.3	13.5	265°54.1	54.3	272°48.7	52.0
6	122°33.3	227°05.3	S25°49.7	328°09.4	N12°13.0	280°56.0	S07°54.5	287°50.9	S03°52.1
7	137°35.7	242°04.7	50.0	343°10.4	12.5	295°58.0	54.7	302°53.1	52.2
8	152°38.2	257°04.2	50.4	358°11.5	12.0	310°59.9	54.9	317°55.3	52.3
9	167°40.7	272°03.7	·· 50.8	13°12.6	·· 11.5	326°01.9	·· 55.1	332°57.4	·· 52.5
10	182°43.1	287°03.2	51.2	28°13.7	11.0	341°03.8	55.3	347°59.6	52.6
11	197°45.6	302°02.6	51.5	43°14.7	10.5	356°05.8	55.5	3°01.8	52.7
12	212°48.1	317°02.1	S25°51.9	58°15.8	N12°10.0	11°07.8	S07°55.7	18°04.0	S03°52.8
13	227°50.5	332°01.6	52.3	73°16.9	09.5	26°09.7	55.9	33°06.2	52.9
14	242°53.0	347°01.1	52.6	88°17.9	09.0	41°11.7	56.1	48°08.4	53.0
15	257°55.4	2°00.5	·· 53.0	103°19.0	·· 08.5	56°13.6	·· 56.3	63°10.6	·· 53.1
16	272°57.9	17°00.0	53.3	118°20.1	08.0	71°15.6	56.5	78°12.7	53.2
17	288°00.4	31°59.5	53.7	133°21.1	07.5	86°17.5	56.7	93°14.9	53.3
18	303°02.8	46°58.9	S25°54.1	148°22.2	N12°07.0	101°19.5	S07°56.9	108°17.1	S03°53.5
19	318°05.3	61°58.4	54.4	163°23.3	06.5	116°21.5	57.1	123°19.3	53.6
20	333°07.8	76°57.9	54.8	178°24.3	06.1	131°23.4	57.3	138°21.5	53.7
21	348°10.2	91°57.4	·· 55.1	193°25.4	·· 05.6	146°25.4	·· 57.5	153°23.7	·· 53.8
22	3°12.7	106°56.8	55.5	208°26.5	05.1	161°27.3	57.7	168°25.9	53.9
23	18°15.2	121°56.3	55.9	223°27.6	04.6	176°29.3	57.9	183°28.0	54.0
Mer.pass.	21:47	ν -0.5′	d 0.4′	m -4.30	ν 1.1′	d 0.5′	m 1.46	ν 2.0′	d 0.2′ m -1.67	ν 2.2′	d 0.1′ m 0.87

Stars

	SHA	Dec
Alpheratz	358°08.2	28°59.5
Ankaa	353°39.1	-42°24.4
Schedar	350°07.6	56°26.3
Diphda	349°19.8	-18°05.2
Achernar	335°44.1	-57°19.8
Hamal	328°27.7	23°22.6
Polaris	326°17.2	89°10.8
Acamar	315°36.2	-40°22.6
Menkar	314°40.0	4°01.1
Mirfak	309°14.6	49°47.7
Aldebaran	291°16.9	16°28.4
Rigel	281°35.1	-8°13.2
Capella	281°09.9	45°58.7
Bellatrix	278°57.7	6°20.1
Elnath	278°43.0	28°35.5
Alnilam	276°10.7	-1°12.7
Betelgeuse	271°27.3	7°24.3
Canopus	264°06.6	-52°40.9
Sirius	258°54.9	-16°41.3
Adhara	255°31.4	-28°56.6
Procyon	245°25.0	5°16.4
Pollux	243°57.2	28°04.2
Avior	234°27.9	-59°26.7
Suhail	223°10.4	-43°21.2
Miaplacidus	221°45.1	-69°38.2
Alphard	218°19.9	-8°34.5
Regulus	208°09.4	12°03.5
Dubhe	194°21.6	61°50.9
Denebola	182°58.6	14°40.6
Gienah	176°17.5	-17°26.2
Acrux	173°37.1	-62°59.6
Gacrux	172°28.5	-57°00.4
Alioth	166°42.4	56°03.6
Spica	158°57.1	-11°03.7
Alkaid	153°18.4	49°24.4
Hadar	149°23.0	-60°17.0
Menkent	148°36.5	-36°16.6
Arcturus	146°18.1	19°16.8
Rigil Kent.	140°25.5	-60°45.4
Kochab	137°20.1	74°14.0
Zuben'ubi	137°32.5	-15°57.8
Alphecca	126°31.8	26°46.8
Antares	112°56.2	-26°23.4
Atria	108°20.3	-68°59.8
Sabik	102°40.5	-15°42.1
Shaula	96°55.0	-37°05.5
Rasalhague	96°29.1	12°34.6
Eltanin	90°57.7	51°29.8
Kaus Aust.	84°16.0	-34°23.7
Vega	80°55.5	38°46.3
Nunki	76°28.4	-26°19.2
Altair	62°31.8	8°49.3
Peacock	53°57.2	-56°47.9
Deneb	49°47.9	45°13.2
Enif	34°10.7	9°47.6
Al Na'ir	28°13.7	-47°03.2
Fomalhaut	15°50.3	-29°43.2
Scheat	14°16.6	27°59.2
Markab	14°02.2	15°06.5

Oct 22 Thu	SHA	Mer.pass
Venus	107°13.6	14:50
Mars	206°51.8	08:11
Jupiter	158°50.2	11:22
Saturn	165°32.7	10:55

Oct 23 Fri	SHA	Mer.pass
Venus	106°01.8	14:51
Mars	206°18.1	08:09
Jupiter	158°38.0	11:19
Saturn	165°26.0	10:51

Oct 24 Sat	SHA	Mer.pass
Venus	104°50.0	14:52
Mars	205°44.5	08:07
Jupiter	158°25.8	11:16
Saturn	165°19.3	10:48

Horizontal parallax	
Venus:	0.2
Mars:	0.1

h	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°51.6	S10°56.5	245°58.1	10.4′	N16°20.9	8.1′	56.9′
1	198°51.6	57.3	260°27.5	10.5′	16°12.8	8.2′	56.9′
2	213°51.7	58.2	274°57.0	10.6′	16°04.6	8.3′	56.9′
3	228°51.8	10°59.1	289°26.5	10.6′	15°56.3	8.4′	56.9′
4	243°51.9	11°00.0	303°56.2	10.7′	15°47.9	8.4′	56.8′
5	258°52.0	00.9	318°25.9	10.8′	15°39.5	8.5′	56.8′
6	273°52.1	S11°01.8	332°55.7	10.9′	N15°31.0	8.6′	56.8′
7	288°52.2	02.7	347°25.5	10.9′	15°22.4	8.6′	56.8′
8	303°52.3	03.5	1°55.5	11.0′	15°13.8	8.8′	56.7′
9	318°52.4	·· 04.4	16°25.5	11.1′	15°05.0	8.7′	56.7′
10	333°52.5	05.3	30°55.5	11.1′	14°56.3	8.9′	56.7′
11	348°52.6	06.2	45°25.7	11.2′	14°47.4	8.9′	56.7′
12	3°52.7	S11°07.1	59°55.9	11.3′	N14°38.5	9.0′	56.6′
13	18°52.8	07.9	74°26.2	11.4′	14°29.5	9.1′	56.6′
14	33°52.9	08.8	88°56.5	11.4′	14°20.4	9.1′	56.6′
15	48°53.0	·· 09.7	103°27.0	11.5′	14°11.3	9.2′	56.6′
16	63°53.0	10.6	117°57.5	11.6′	14°02.1	9.2′	56.5′
17	78°53.1	11.5	132°28.0	11.6′	13°52.9	9.3′	56.5′
18	93°53.2	S11°12.4	146°58.7	11.7′	N13°43.6	9.4′	56.5′
19	108°53.3	13.2	161°29.4	11.8′	13°34.2	9.4′	56.5′
20	123°53.4	14.1	176°00.2	11.8′	13°24.8	9.5′	56.4′
21	138°53.5	·· 15.0	190°31.0	11.9′	13°15.3	9.5′	56.4′
22	153°53.6	15.9	205°01.9	12.0′	13°05.8	9.6′	56.4′
23	168°53.7	16.8	219°32.9	12.0′	12°56.2	9.7′	56.4′
	SD = 16.1′	d = 0.9′	SD = 15.5′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°53.8	S11°17.6	234°03.9	12.1′	N12°46.5	9.7′	56.3′
1	198°53.9	18.5	248°35.0	12.2′	12°36.8	9.8′	56.3′
2	213°53.9	19.4	263°06.2	12.2′	12°27.0	9.8′	56.3′
3	228°54.0	·· 20.3	277°37.4	12.3′	12°17.2	9.8′	56.3′
4	243°54.1	21.1	292°08.7	12.4′	12°07.4	10.0′	56.2′
5	258°54.2	22.0	306°40.1	12.4′	11°57.4	9.9′	56.2′
6	273°54.3	S11°22.9	321°11.5	12.5′	N11°47.5	10.0′	56.2′
7	288°54.4	23.8	335°43.0	12.5′	11°37.5	10.1′	56.2′
8	303°54.5	24.7	350°14.5	12.6′	11°27.4	10.1′	56.1′
9	318°54.6	·· 25.5	4°46.1	12.7′	11°17.3	10.2′	56.1′
10	333°54.6	26.4	19°17.8	12.7′	11°07.1	10.2′	56.1′
11	348°54.7	27.3	33°49.5	12.8′	10°56.9	10.2′	56.1′
12	3°54.8	S11°28.2	48°21.3	12.8′	N10°46.7	10.3′	56.0′
13	18°54.9	29.0	62°53.1	12.9′	10°36.4	10.3′	56.0′
14	33°55.0	29.9	77°25.0	12.9′	10°26.1	10.4′	56.0′
15	48°55.1	·· 30.8	91°57.0	13.0′	10°15.7	10.4′	56.0′
16	63°55.1	31.7	106°29.0	13.1′	10°05.3	10.5′	56.0′
17	78°55.2	32.5	121°01.0	13.1′	09°54.8	10.4′	55.9′
18	93°55.3	S11°33.4	135°33.1	13.2′	N09°44.4	10.6′	55.9′
19	108°55.4	34.3	150°05.3	13.2′	09°33.8	10.5′	55.9′
20	123°55.5	35.2	164°37.5	13.3′	09°23.3	10.6′	55.9′
21	138°55.6	·· 36.0	179°09.8	13.3′	09°12.7	10.7′	55.8′
22	153°55.6	36.9	193°42.1	13.4′	09°02.0	10.6′	55.8′
23	168°55.7	37.8	208°14.5	13.4′	08°51.4	10.7′	55.8′
	SD = 16.1′	d = 0.9′	SD = 15.4′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°55.8	S11°38.6	222°46.9	13.5′	N08°40.7	10.8′	55.8′
1	198°55.9	39.5	237°19.4	13.5′	08°29.9	10.7′	55.8′
2	213°56.0	40.4	251°51.9	13.6′	08°19.2	10.8′	55.7′
3	228°56.0	·· 41.3	266°24.5	13.6′	08°08.4	10.8′	55.7′
4	243°56.1	42.1	280°57.1	13.7′	07°57.6	10.9′	55.7′
5	258°56.2	43.0	295°29.8	13.7′	07°46.7	10.9′	55.7′
6	273°56.3	S11°43.9	310°02.5	13.8′	N07°35.8	10.9′	55.6′
7	288°56.4	44.7	324°35.2	13.8′	07°24.9	10.9′	55.6′
8	303°56.4	45.6	339°08.0	13.8′	07°14.0	10.9′	55.6′
9	318°56.5	·· 46.5	353°40.9	13.9′	07°03.1	11.0′	55.6′
10	333°56.6	47.4	8°13.8	13.9′	06°52.1	11.0′	55.6′
11	348°56.7	48.2	22°46.7	14.0′	06°41.1	11.1′	55.5′
12	3°56.8	S11°49.1	37°19.7	14.0′	N06°30.0	11.0′	55.5′
13	18°56.8	50.0	51°52.7	14.0′	06°19.0	11.1′	55.5′
14	33°56.9	50.8	66°25.7	14.1′	06°07.9	11.1′	55.5′
15	48°57.0	·· 51.7	80°58.8	14.1′	05°56.8	11.1′	55.5′
16	63°57.1	52.6	95°31.9	14.2′	05°45.7	11.1′	55.4′
17	78°57.1	53.4	110°05.1	14.2′	05°34.6	11.1′	55.4′
18	93°57.2	S11°54.3	124°38.3	14.2′	N05°23.5	11.2′	55.4′
19	108°57.3	55.2	139°11.5	14.3′	05°12.3	11.2′	55.4′
20	123°57.4	56.0	153°44.8	14.3′	05°01.1	11.2′	55.4′
21	138°57.4	·· 56.9	168°18.1	14.3′	04°49.9	11.2′	55.3′
22	153°57.5	57.8	182°51.4	14.4′	04°38.7	11.2′	55.3′
23	168°57.6	58.6	197°24.8	14.4′	04°27.5	11.2′	55.3′
	SD = 16.1′	d = 0.9′	SD = 15.2′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	05:29	06:48	08:04	15:23	16:39	17:57
N 70°	05:29	06:40	07:47	15:40	16:47	17:58
68°	05:29	06:34	07:34	15:53	16:53	17:58
66°	05:28	06:28	07:23	16:05	16:59	17:59
64°	05:28	06:23	07:14	16:14	17:04	17:59
62°	05:28	06:19	07:06	16:22	17:08	18:00
60°	05:27	06:16	06:59	16:29	17:12	18:00
N 58°	05:26	06:12	06:53	16:35	17:15	18:01
56°	05:26	06:09	06:48	16:40	17:19	18:02
54°	05:25	06:06	06:43	16:45	17:21	18:03
52°	05:24	06:04	06:38	16:49	17:24	18:03
50°	05:24	06:01	06:35	16:53	17:27	18:04
45°	05:22	05:56	06:26	17:02	17:32	18:06
N 40°	05:20	05:51	06:19	17:09	17:37	18:09
35°	05:17	05:47	06:13	17:16	17:41	18:11
30°	05:15	05:43	06:07	17:21	17:45	18:13
20°	05:09	05:35	05:58	17:31	17:53	18:19
N 10°	05:03	05:28	05:49	17:39	18:01	18:26
0°	04:55	05:20	05:41	17:48	18:09	18:33
S 10°	04:46	05:11	05:33	17:56	18:18	18:43
20°	04:35	05:01	05:24	18:05	18:28	18:54
30°	04:20	04:49	05:14	18:15	18:40	19:10
35°	04:10	04:42	05:08	18:21	18:48	19:19
40°	03:59	04:33	05:01	18:28	18:57	19:31
45°	03:44	04:22	04:53	18:36	19:08	19:46
S 50°	03:26	04:09	04:44	18:46	19:21	20:05
52°	03:17	04:02	04:39	18:51	19:28	20:14
54°	03:06	03:55	04:34	18:56	19:35	20:24
56°	02:54	03:48	04:29	19:01	19:43	20:37
58°	02:40	03:38	04:23	19:08	19:52	20:51
S 60°	02:23	03:28	04:16	19:15	20:03	21:09

Lat.	**Moonrise** Thu	Fri	Sat	**Moonset** Thu	Fri	Sat
N 72°	23:26	·· ··	01:25	17:25	17:04	16:48
N 70°	23:51	·· ··	01:38	16:59	16:49	16:41
68°	·· ··	00:09	01:48	16:39	16:37	16:35
66°	·· ··	00:24	01:57	16:23	16:27	16:29
64°	·· ··	00:36	02:04	16:10	16:19	16:25
62°	·· ··	00:46	02:10	15:59	16:11	16:21
60°	·· ··	00:55	02:16	15:50	16:05	16:17
N 58°	·· ··	01:03	02:20	15:41	15:59	16:14
56°	·· ··	01:10	02:24	15:34	15:54	16:12
54°	00:02	01:16	02:28	15:27	15:50	16:09
52°	00:09	01:21	02:32	15:21	15:46	16:07
50°	00:16	01:26	02:35	15:16	15:42	16:05
45°	00:30	01:36	02:41	15:04	15:34	16:00
N 40°	00:42	01:45	02:47	14:54	15:27	15:57
35°	00:51	01:52	02:52	14:46	15:21	15:53
30°	01:00	01:59	02:56	14:39	15:16	15:51
20°	01:15	02:10	03:03	14:26	15:07	15:45
N 10°	01:28	02:20	03:09	14:15	14:59	15:41
0°	01:40	02:29	03:15	14:04	14:51	15:37
S 10°	01:52	02:38	03:21	13:53	14:44	15:32
20°	02:05	02:48	03:27	13:42	14:36	15:28
30°	02:20	02:59	03:35	13:28	14:26	15:23
35°	02:28	03:05	03:39	13:21	14:21	15:20
40°	02:38	03:13	03:43	13:12	14:15	15:16
45°	02:49	03:21	03:49	13:02	14:08	15:12
S 50°	03:03	03:31	03:55	12:49	13:59	15:07
52°	03:09	03:36	03:58	12:43	13:55	15:05
54°	03:16	03:41	04:01	12:37	13:50	15:03
56°	03:24	03:46	04:05	12:30	13:45	15:00
58°	03:33	03:53	04:09	12:22	13:40	14:57
S 60°	03:43	04:00	04:13	12:12	13:34	14:53

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 24-26 31-14%
22	15:26	15:31	11:44	07:52	20:17	
23	15:35	15:39	11:44	08:40	21:03	
24	15:43	15:47	11:44	09:26	21:48	

October 25, 26, 27 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	33°17.6	136°55.8	S25°56.2	238°28.6	N12°04.1	191°31.2	S07°58.1	198°30.2	S03°54.1
1	48°20.1	151°55.3	56.6	253°29.7	03.6	206°33.2	58.3	213°32.4	54.2
2	63°22.6	166°54.7	56.9	268°30.8	03.1	221°35.2	58.5	228°34.6	54.4
3	78°25.0	181°54.2	·· 57.3	283°31.8	·· 02.6	236°37.1	·· 58.7	243°36.8	·· 54.5
4	93°27.5	196°53.7	57.6	298°32.9	02.1	251°39.1	58.9	258°39.0	54.6
5	108°29.9	211°53.1	58.0	313°34.0	01.6	266°41.0	59.1	273°41.2	54.7
6	123°32.4	226°52.6	S25°58.3	328°35.1	N12°01.1	281°43.0	S07°59.3	288°43.4	S03°54.8
7	138°34.9	241°52.1	58.7	343°36.1	00.6	296°44.9	59.5	303°45.5	54.9
8	153°37.3	256°51.6	59.0	358°37.2	12°00.1	311°46.9	59.7	318°47.7	55.0
9	168°39.8	271°51.0	·· 59.4	13°38.3	11°59.6	326°48.9	07°59.9	333°49.9	·· 55.1
10	183°42.3	286°50.5	25°59.7	28°39.4	59.1	341°50.8	08°00.1	348°52.1	55.3
11	198°44.7	301°50.0	26°00.0	43°40.4	58.6	356°52.8	00.3	3°54.3	55.4
12	213°47.2	316°49.5	S26°00.4	58°41.5	N11°58.1	11°54.7	S08°00.5	18°56.5	S03°55.5
13	228°49.7	331°48.9	00.7	73°42.6	57.6	26°56.7	00.7	33°58.7	55.6
14	243°52.1	346°48.4	01.1	88°43.7	57.1	41°58.6	00.9	49°00.8	55.7
15	258°54.6	1°47.9	·· 01.4	103°44.7	·· 56.6	57°00.6	·· 01.1	64°03.0	·· 55.8
16	273°57.0	16°47.4	01.7	118°45.8	56.1	72°02.6	01.3	79°05.2	55.9
17	288°59.5	31°46.8	02.1	133°46.9	55.6	87°04.5	01.5	94°07.4	56.0
18	304°02.0	46°46.3	S26°02.4	148°48.0	N11°55.1	102°06.5	S08°01.7	109°09.6	S03°56.1
19	319°04.4	61°45.8	02.7	163°49.0	54.6	117°08.4	01.9	124°11.8	56.3
20	334°06.9	76°45.3	03.1	178°50.1	54.1	132°10.4	02.1	139°14.0	56.4
21	349°09.4	91°44.7	·· 03.4	193°51.2	·· 53.6	147°12.3	·· 02.3	154°16.2	·· 56.5
22	4°11.8	106°44.2	03.7	208°52.3	53.1	162°14.3	02.5	169°18.3	56.6
23	19°14.3	121°43.7	04.1	223°53.3	52.6	177°16.2	02.7	184°20.5	56.7
Mer.pass. 21:43		ν -0.5′	d 0.4′	m -4.31	ν 1.1′	d 0.5′	m 1.45	ν 2.0′	d 0.2′ m -1.67	ν 2.2′	d 0.1′ m 0.87

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	34°16.8	136°43.2	S26°04.4	238°54.4	N11°52.1	192°18.2	S08°02.9	199°22.7	S03°56.8
1	49°19.2	151°42.6	04.7	253°55.5	51.6	207°20.2	03.1	214°24.9	56.9
2	64°21.7	166°42.1	05.0	268°56.6	51.1	222°22.1	03.3	229°27.1	57.0
3	79°24.2	181°41.6	·· 05.4	283°57.6	·· 50.6	237°24.1	·· 03.5	244°29.3	·· 57.2
4	94°26.6	196°41.1	05.7	298°58.7	50.1	252°26.0	03.7	259°31.5	57.3
5	109°29.1	211°40.6	06.0	313°59.8	49.6	267°28.0	03.9	274°33.7	57.4
6	124°31.5	226°40.0	S26°06.3	329°00.9	N11°49.1	282°29.9	S08°04.1	289°35.8	S03°57.5
7	139°34.0	241°39.5	06.6	344°02.0	48.6	297°31.9	04.3	304°38.0	57.6
8	154°36.5	256°39.0	07.0	359°03.0	48.1	312°33.9	04.5	319°40.2	57.7
9	169°38.9	271°38.5	·· 07.3	14°04.1	·· 47.6	327°35.8	·· 04.7	334°42.4	·· 57.8
10	184°41.4	286°37.9	07.6	29°05.2	47.1	342°37.8	04.9	349°44.6	57.9
11	199°43.9	301°37.4	07.9	44°06.3	46.6	357°39.7	05.1	4°46.8	58.0
12	214°46.3	316°36.9	S26°08.2	59°07.4	N11°46.1	12°41.7	S08°05.3	19°49.0	S03°58.2
13	229°48.8	331°36.4	08.5	74°08.4	45.6	27°43.6	05.5	34°51.2	58.3
14	244°51.3	346°35.9	08.9	89°09.5	45.1	42°45.6	05.7	49°53.3	58.4
15	259°53.7	1°35.3	·· 09.2	104°10.6	·· 44.7	57°47.6	·· 05.9	64°55.5	·· 58.5
16	274°56.2	16°34.8	09.5	119°11.7	44.2	72°49.5	06.1	79°57.7	58.6
17	289°58.7	31°34.3	09.8	134°12.8	43.7	87°51.5	06.3	94°59.9	58.7
18	305°01.1	46°33.8	S26°10.1	149°13.8	N11°43.2	102°53.4	S08°06.5	110°02.1	S03°58.8
19	320°03.6	61°33.2	10.4	164°14.9	42.7	117°55.4	06.7	125°04.3	58.9
20	335°06.0	76°32.7	10.7	179°16.0	42.2	132°57.4	06.9	140°06.5	59.0
21	350°08.5	91°32.2	·· 11.0	194°17.1	·· 41.7	147°59.3	·· 07.1	155°08.7	·· 59.2
22	5°11.0	106°31.7	11.3	209°18.2	41.2	163°01.3	07.3	170°10.8	59.3
23	20°13.4	121°31.2	11.6	224°19.2	40.7	178°03.2	07.5	185°13.0	59.4
Mer.pass. 21:39		ν -0.5′	d 0.3′	m -4.32	ν 1.1′	d 0.5′	m 1.45	ν 2.0′	d 0.2′ m -1.67	ν 2.2′	d 0.1′ m 0.87

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	35°15.9	136°30.6	S26°11.9	239°20.3	N11°40.2	193°05.2	S08°07.7	200°15.2	S03°59.5
1	50°18.4	151°30.1	12.2	254°21.4	39.7	208°07.1	07.9	215°17.4	59.6
2	65°20.8	166°29.6	12.5	269°22.5	39.2	223°09.1	08.1	230°19.6	59.7
3	80°23.3	181°29.1	·· 12.8	284°23.6	·· 38.7	238°11.1	·· 08.3	245°21.8	·· 59.8
4	95°25.8	196°28.6	13.1	299°24.7	38.2	253°13.0	08.5	260°24.0	03°59.9
5	110°28.2	211°28.0	13.4	314°25.7	37.7	268°15.0	08.7	275°26.2	04°00.0
6	125°30.7	226°27.5	S26°13.7	329°26.8	N11°37.2	283°16.9	S08°08.9	290°28.3	S04°00.2
7	140°33.1	241°27.0	14.0	344°27.9	36.7	298°18.9	09.1	305°30.5	00.3
8	155°35.6	256°26.5	14.3	359°29.0	36.2	313°20.8	09.3	320°32.7	00.4
9	170°38.1	271°26.0	·· 14.6	14°30.1	·· 35.7	328°22.8	·· 09.5	335°34.9	·· 00.5
10	185°40.5	286°25.4	14.9	29°31.2	35.2	343°24.8	09.7	350°37.1	00.6
11	200°43.0	301°24.9	15.1	44°32.2	34.7	358°26.7	09.9	5°39.3	00.7
12	215°45.5	316°24.4	S26°15.4	59°33.3	N11°34.2	13°28.7	S08°10.0	20°41.5	S04°00.8
13	230°47.9	331°23.9	15.7	74°34.4	33.7	28°30.6	10.2	35°43.7	00.9
14	245°50.4	346°23.4	16.0	89°35.5	33.2	43°32.6	10.4	50°45.8	01.0
15	260°52.9	1°22.9	·· 16.3	104°36.6	·· 32.7	58°34.5	·· 10.6	65°48.0	·· 01.2
16	275°55.3	16°22.3	16.6	119°37.7	32.2	73°36.5	10.8	80°50.2	01.3
17	290°57.8	31°21.8	16.9	134°38.7	31.7	88°38.5	11.0	95°52.4	01.4
18	306°00.3	46°21.3	S26°17.1	149°39.8	N11°31.2	103°40.4	S08°11.2	110°54.6	S04°01.5
19	321°02.7	61°20.8	17.4	164°40.9	30.7	118°42.4	11.4	125°56.8	01.6
20	336°05.2	76°20.3	17.7	179°42.0	30.2	133°44.3	11.6	140°59.0	01.7
21	351°07.6	91°19.8	·· 18.0	194°43.1	·· 29.7	148°46.3	·· 11.8	156°01.2	·· 01.8
22	6°10.1	106°19.2	18.2	209°44.2	29.2	163°48.2	12.0	171°03.4	01.9
23	21°12.6	121°18.7	18.5	224°45.3	28.7	178°50.2	12.2	186°05.5	02.0
Mer.pass. 21:35		ν -0.5′	d 0.3′	m -4.33	ν 1.1′	d 0.5′	m 1.44	ν 2.0′	d 0.2′ m -1.67	ν 2.2′	d 0.1′ m 0.87

Stars

	SHA	**Dec**
Alpheratz	358°08.2	28°59.5
Ankaa	353°39.1	-42°24.4
Schedar	350°07.7	56°26.3
Diphda	349°19.8	-18°05.2
Achernar	335°44.1	-57°19.8
Hamal	328°27.7	23°22.6
Polaris	326°17.1	89°10.8
Acamar	315°36.2	-40°22.6
Menkar	314°40.0	4°01.1
Mirfak	309°14.6	49°47.7
Aldebaran	291°16.9	16°28.4
Rigel	281°35.1	-8°13.2
Capella	281°09.9	45°58.7
Bellatrix	278°57.7	6°20.1
Elnath	278°42.9	28°35.5
Alnilam	276°10.7	-1°12.7
Betelgeuse	271°27.3	7°24.3
Canopus	264°06.6	-52°40.9
Sirius	258°54.9	-16°41.3
Adhara	255°31.4	-28°56.6
Procyon	245°24.9	5°16.4
Pollux	243°57.2	28°04.2
Avior	234°27.9	-59°26.7
Suhail	223°10.3	-43°21.2
Miaplacidus	221°45.1	-69°38.2
Alphard	218°19.9	-8°34.5
Regulus	208°09.4	12°03.5
Dubhe	194°21.6	61°50.9
Denebola	182°58.5	14°40.6
Gienah	176°17.5	-17°26.2
Acrux	173°37.1	-62°59.6
Gacrux	172°28.5	-57°00.4
Alioth	166°42.4	56°03.6
Spica	158°57.1	-11°03.8
Alkaid	153°18.4	49°24.4
Hadar	149°23.0	-60°16.9
Menkent	148°36.5	-36°16.6
Arcturus	146°18.1	19°16.8
Rigil Kent.	140°25.5	-60°45.3
Kochab	137°20.2	74°14.0
Zuben'ubi	137°32.5	-15°57.8
Alphecca	126°31.8	26°46.8
Antares	112°56.2	-26°23.4
Atria	108°20.3	-68°59.8
Sabik	102°40.5	-15°42.1
Shaula	96°55.0	-37°05.5
Rasalhague	96°29.1	12°34.6
Eltanin	90°57.7	51°29.8
Kaus Aust.	84°16.1	-34°23.7
Vega	80°55.5	38°46.3
Nunki	76°28.4	-26°19.2
Altair	62°31.8	8°49.3
Peacock	53°57.2	-56°47.9
Deneb	49°47.9	45°13.2
Enif	34°10.7	9°47.6
Al Na'ir	28°13.8	-47°03.2
Fomalhaut	15°50.3	-29°43.3
Scheat	14°16.6	27°59.2
Markab	14°02.2	15°06.5

Oct 25 Sun	**SHA**	**Mer.pass**
Venus	103°38.2	14:53
Mars	205°11.0	08:06
Jupiter	158°13.6	11:12
Saturn	165°12.6	10:44

Oct 26 Mon	**SHA**	**Mer.pass**
Venus	102°26.4	14:54
Mars	204°37.7	08:04
Jupiter	158°01.4	11:09
Saturn	165°06.0	10:41

Oct 27 Tue	**SHA**	**Mer.pass**
Venus	101°14.7	14:54
Mars	204°04.4	08:02
Jupiter	157°49.3	11:06
Saturn	164°59.3	10:37

Horizontal parallax	
Venus:	0.2
Mars:	0.1

DUT1 = UT1-UTC = +0.1675 sec ΔT = TT-UT1 = +52.0165 sec

1981 October 25 to Oct. 27 UT

h	Sun		Moon				
Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°57.7	S11°59.5	211°58.2	14.4′	N04°16.3	11.3′	55.3′
1	198°57.7	12°00.3	226°31.7	14.5′	04°05.0	11.2′	55.3′
2	213°57.8	01.2	241°05.1	14.5′	03°53.8	11.3′	55.3′
3	228°57.9	·· 02.1	255°38.6	14.5′	03°42.5	11.3′	55.2′
4	243°58.0	02.9	270°12.2	14.6′	03°31.2	11.2′	55.2′
5	258°58.0	03.8	284°45.7	14.6′	03°20.0	11.3′	55.2′
6	273°58.1	S12°04.7	299°19.3	14.6′	N03°08.7	11.3′	55.2′
7	288°58.2	05.5	313°52.9	14.6′	02°57.4	11.3′	55.2′
8	303°58.2	06.4	328°26.6	14.7′	02°46.1	11.3′	55.1′
9	318°58.3	·· 07.3	343°00.2	14.7′	02°34.8	11.4′	55.1′
10	333°58.4	08.1	357°33.9	14.7′	02°23.4	11.3′	55.1′
11	348°58.5	09.0	12°07.6	14.7′	02°12.1	11.3′	55.1′
12	3°58.5	S12°09.8	26°41.4	14.8′	N02°00.8	11.3′	55.1′
13	18°58.6	10.7	41°15.1	14.8′	01°49.5	11.3′	55.1′
14	33°58.7	11.6	55°48.9	14.8′	01°38.2	11.4′	55.0′
15	48°58.7	·· 12.4	70°22.7	14.8′	01°26.8	11.3′	55.0′
16	63°58.8	13.3	84°56.5	14.8′	01°15.5	11.3′	55.0′
17	78°58.9	14.1	99°30.4	14.9′	01°04.2	11.3′	55.0′
18	93°58.9	S12°15.0	114°04.2	14.9′	N00°52.9	11.4′	55.0′
19	108°59.0	15.9	128°38.1	14.9′	00°41.5	11.3′	55.0′
20	123°59.1	16.7	143°12.0	14.9′	00°30.2	11.3′	54.9′
21	138°59.1	·· 17.6	157°45.9	14.9′	00°18.9	11.3′	54.9′
22	153°59.2	18.4	172°19.9	14.9′	N00°07.6	11.3′	54.9′
23	168°59.3	19.3	186°53.8	15.0′	S00°03.7	11.3′	54.9′
	SD = 16.1′	d = 0.9′	SD = 15.1′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°59.3	S12°20.1	201°27.8	15.0′	S00°15.0	11.3′	54.9′
1	198°59.4	21.0	216°01.8	15.0′	00°26.3	11.3′	54.9′
2	213°59.5	21.9	230°35.8	15.0′	00°37.6	11.3′	54.8′
3	228°59.5	·· 22.7	245°09.8	15.0′	00°48.9	11.3′	54.8′
4	243°59.6	23.6	259°43.8	15.0′	01°00.2	11.2′	54.8′
5	258°59.7	24.4	274°17.8	15.0′	01°11.4	11.3′	54.8′
6	273°59.7	S12°25.3	288°51.9	15.0′	S01°22.7	11.2′	54.8′
7	288°59.8	26.1	303°25.9	15.1′	01°33.9	11.3′	54.8′
8	303°59.9	27.0	318°00.0	15.1′	01°45.2	11.2′	54.8′
9	318°59.9	·· 27.8	332°34.0	15.1′	01°56.4	11.2′	54.7′
10	334°00.0	28.7	347°08.1	15.1′	02°07.6	11.2′	54.7′
11	349°00.1	29.5	1°42.2	15.1′	02°18.8	11.1′	54.7′
12	4°00.1	S12°30.4	16°16.3	15.1′	S02°29.9	11.2′	54.7′
13	19°00.2	31.2	30°50.4	15.1′	02°41.1	11.1′	54.7′
14	34°00.2	32.1	45°24.5	15.1′	02°52.2	11.2′	54.7′
15	49°00.3	·· 33.0	59°58.6	15.1′	03°03.4	11.1′	54.7′
16	64°00.4	33.8	74°32.7	15.1′	03°14.5	11.1′	54.6′
17	79°00.4	34.7	89°06.8	15.1′	03°25.6	11.0′	54.6′
18	94°00.5	S12°35.5	103°40.9	15.1′	S03°36.6	11.1′	54.6′
19	109°00.5	36.4	118°15.0	15.1′	03°47.7	11.0′	54.6′
20	124°00.6	37.2	132°49.1	15.1′	03°58.7	11.1′	54.6′
21	139°00.7	·· 38.1	147°23.3	15.1′	04°09.8	10.9′	54.6′
22	154°00.7	38.9	161°57.4	15.1′	04°20.7	11.0′	54.6′
23	169°00.8	39.8	176°31.5	15.1′	04°31.7	11.0′	54.5′
	SD = 16.1′	d = 0.9′	SD = 15.0′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	184°00.8	S12°40.6	191°05.6	15.1′	S04°42.7	10.9′	54.5′
1	199°00.9	41.5	205°39.7	15.1′	04°53.6	10.9′	54.5′
2	214°01.0	42.3	220°13.8	15.1′	05°04.5	10.9′	54.5′
3	229°01.0	·· 43.1	234°47.9	15.1′	05°15.4	10.8′	54.5′
4	244°01.1	44.0	249°22.0	15.1′	05°26.2	10.8′	54.5′
5	259°01.1	44.8	263°56.1	15.1′	05°37.0	10.8′	54.5′
6	274°01.2	S12°45.7	278°30.2	15.1′	S05°47.8	10.8′	54.5′
7	289°01.2	46.5	293°04.3	15.1′	05°58.6	10.7′	54.4′
8	304°01.3	47.4	307°38.4	15.1′	06°09.3	10.7′	54.4′
9	319°01.4	·· 48.2	322°12.5	15.1′	06°20.0	10.7′	54.4′
10	334°01.4	49.1	336°46.6	15.1′	06°30.7	10.7′	54.4′
11	349°01.5	49.9	351°20.6	15.1′	06°41.4	10.6′	54.4′
12	4°01.5	S12°50.8	5°54.7	15.0′	S06°52.0	10.6′	54.4′
13	19°01.6	51.6	20°28.7	15.0′	07°02.6	10.5′	54.4′
14	34°01.6	52.5	35°02.8	15.0′	07°13.1	10.5′	54.4′
15	49°01.7	·· 53.3	49°36.8	15.0′	07°23.6	10.5′	54.3′
16	64°01.7	54.1	64°10.8	15.0′	07°34.1	10.5′	54.3′
17	79°01.8	55.0	78°44.8	15.0′	07°44.6	10.4′	54.3′
18	94°01.8	S12°55.8	93°18.8	15.0′	S07°55.0	10.4′	54.3′
19	109°01.9	56.7	107°52.8	15.0′	08°05.4	10.3′	54.3′
20	124°01.9	57.5	122°26.7	15.0′	08°15.7	10.3′	54.3′
21	139°02.0	·· 58.4	137°00.7	14.9′	08°26.0	10.3′	54.3′
22	154°02.1	12°59.2	151°34.6	14.9′	08°36.3	10.2′	54.3′
23	169°02.1	13°00.0	166°08.5	14.9′	08°46.5	10.2′	54.3′
	SD = 16.1′	d = 0.8′	SD = 14.9′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	05:41	07:02	08:21	15:06	16:25	17:44
N 70°	05:40	06:52	08:01	15:25	16:34	17:46
68°	05:39	06:44	07:46	15:41	16:42	17:48
66°	05:37	06:38	07:33	15:53	16:49	17:49
64°	05:36	06:32	07:23	16:04	16:55	17:50
62°	05:35	06:27	07:14	16:13	17:00	17:52
60°	05:34	06:23	07:07	16:20	17:04	17:53
N 58°	05:33	06:19	07:00	16:27	17:08	17:54
56°	05:32	06:15	06:54	16:33	17:12	17:55
54°	05:30	06:12	06:49	16:39	17:15	17:57
52°	05:29	06:09	06:44	16:43	17:18	17:58
50°	05:28	06:06	06:39	16:48	17:21	17:59
45°	05:25	06:00	06:30	16:57	17:27	18:02
N 40°	05:23	05:54	06:22	17:05	17:33	18:05
35°	05:20	05:49	06:15	17:12	17:38	18:08
30°	05:17	05:45	06:09	17:18	17:43	18:11
20°	05:10	05:36	05:59	17:29	17:51	18:17
N 10°	05:03	05:28	05:49	17:38	18:00	18:25
0°	04:55	05:19	05:41	17:47	18:09	18:33
S 10°	04:45	05:10	05:32	17:56	18:18	18:43
20°	04:33	04:59	05:22	18:06	18:29	18:56
30°	04:17	04:46	05:11	18:18	18:43	19:12
35°	04:06	04:38	05:04	18:24	18:51	19:22
40°	03:54	04:28	04:57	18:32	19:00	19:35
45°	03:39	04:17	04:48	18:41	19:12	19:51
S 50°	03:19	04:03	04:38	18:51	19:27	20:11
52°	03:09	03:56	04:33	18:56	19:34	20:21
54°	02:58	03:48	04:27	19:02	19:41	20:32
56°	02:44	03:40	04:21	19:08	19:50	20:46
58°	02:29	03:30	04:15	19:15	20:00	21:02
S 60°	02:09	03:18	04:07	19:23	20:12	21:22

Lat.	**Moonrise** Sun	Mon	Tue	**Moonset** Sun	Mon	Tue
N 72°	03:14	04:59	06:43	16:34	16:20	16:05
N 70°	03:19	04:57	06:34	16:33	16:25	16:16
68°	03:23	04:55	06:27	16:32	16:29	16:25
66°	03:26	04:54	06:21	16:31	16:32	16:33
64°	03:29	04:53	06:16	16:30	16:34	16:39
62°	03:32	04:52	06:11	16:29	16:37	16:45
60°	03:34	04:51	06:08	16:28	16:39	16:50
N 58°	03:36	04:51	06:04	16:28	16:41	16:54
56°	03:38	04:50	06:01	16:27	16:42	16:58
54°	03:39	04:50	05:59	16:27	16:44	17:01
52°	03:41	04:49	05:56	16:26	16:45	17:04
50°	03:42	04:49	05:54	16:26	16:46	17:07
45°	03:45	04:48	05:49	16:25	16:49	17:13
N 40°	03:47	04:47	05:45	16:24	16:51	17:19
35°	03:49	04:46	05:42	16:24	16:53	17:23
30°	03:51	04:45	05:39	16:23	16:55	17:27
20°	03:54	04:44	05:34	16:22	16:58	17:34
N 10°	03:57	04:44	05:30	16:21	17:01	17:40
0°	04:00	04:43	05:25	16:20	17:03	17:46
S 10°	04:02	04:42	05:21	16:20	17:06	17:52
20°	04:05	04:41	05:17	16:19	17:08	17:58
30°	04:08	04:40	05:12	16:17	17:11	18:05
35°	04:10	04:40	05:09	16:17	17:13	18:09
40°	04:12	04:39	05:06	16:16	17:15	18:14
45°	04:14	04:38	05:02	16:15	17:17	18:19
S 50°	04:17	04:37	04:58	16:14	17:20	18:25
52°	04:18	04:37	04:56	16:14	17:21	18:28
54°	04:20	04:37	04:54	16:13	17:23	18:32
56°	04:21	04:36	04:51	16:13	17:24	18:35
58°	04:23	04:36	04:49	16:12	17:26	18:39
S 60°	04:25	04:35	04:46	16:11	17:28	18:44

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 27-0 8-1%
25	15:51	15:54	11:44	10:10	22:32	
26	15:57	16:00	11:44	10:53	23:14	
27	16:03	16:06	11:44	11:36	23:57	

October 28, 29, 30 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	36°15.0	136°18.2	S26°18.8	239°46.4	N11°28.2	193°52.2	S08°12.4	201°07.7	S04°02.1
1	51°17.5	151°17.7	19.1	254°47.4	27.7	208°54.1	12.6	216°09.9	02.3
2	66°20.0	166°17.2	19.3	269°48.5	27.2	223°56.1	12.8	231°12.1	02.4
3	81°22.4	181°16.7	·· 19.6	284°49.6	·· 26.7	238°58.0	·· 13.0	246°14.3	·· 02.5
4	96°24.9	196°16.1	19.9	299°50.7	26.2	254°00.0	13.2	261°16.5	02.6
5	111°27.4	211°15.6	20.2	314°51.8	25.7	269°01.9	13.4	276°18.7	02.7
6	126°29.8	226°15.1	S26°20.4	329°52.9	N11°25.2	284°03.9	S08°13.6	291°20.9	S04°02.8
7	141°32.3	241°14.6	20.7	344°54.0	24.7	299°05.9	13.8	306°23.1	02.9
8	156°34.7	256°14.1	21.0	359°55.1	24.2	314°07.8	14.0	321°25.2	03.0
9	171°37.2	271°13.6	·· 21.2	14°56.1	·· 23.7	329°09.8	·· 14.2	336°27.4	·· 03.1
10	186°39.7	286°13.1	21.5	29°57.2	23.2	344°11.7	14.4	351°29.6	03.2
11	201°42.1	301°12.5	21.7	44°58.3	22.7	359°13.7	14.6	6°31.8	03.4
12	216°44.6	316°12.0	S26°22.0	59°59.4	N11°22.2	14°15.7	S08°14.8	21°34.0	S04°03.5
13	231°47.1	331°11.5	22.3	75°00.5	21.7	29°17.6	15.0	36°36.2	03.6
14	246°49.5	346°11.0	22.5	90°01.6	21.2	44°19.6	15.2	51°38.4	03.7
15	261°52.0	1°10.5	·· 22.8	105°02.7	·· 20.7	59°21.5	·· 15.4	66°40.6	·· 03.8
16	276°54.5	16°10.0	23.0	120°03.8	20.2	74°23.5	15.6	81°42.8	03.9
17	291°56.9	31°09.5	23.3	135°04.9	19.7	89°25.4	15.8	96°44.9	04.0
18	306°59.4	46°08.9	S26°23.5	150°06.0	N11°19.2	104°27.4	S08°16.0	111°47.1	S04°04.1
19	322°01.9	61°08.4	23.8	165°07.1	18.7	119°29.4	16.2	126°49.3	04.2
20	337°04.3	76°07.9	24.0	180°08.1	18.2	134°31.3	16.4	141°51.5	04.4
21	352°06.8	91°07.4	·· 24.3	195°09.2	·· 17.7	149°33.3	·· 16.6	156°53.7	·· 04.5
22	7°09.2	106°06.9	24.5	210°10.3	17.2	164°35.2	16.8	171°55.9	04.6
23	22°11.7	121°06.4	24.8	225°11.4	16.7	179°37.2	17.0	186°58.1	04.7
Mer.pass. 21:31		ν -0.5′	d 0.3′	m -4.34	ν 1.1′	d 0.5′	m 1.44	ν 2.0′	d 0.2′ m -1.68	ν 2.2′	d 0.1′ m 0.87

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	37°14.2	136°05.9	S26°25.0	240°12.5	N11°16.2	194°39.2	S08°17.2	202°00.3	S04°04.8
1	52°16.6	151°05.4	25.3	255°13.6	15.7	209°41.1	17.4	217°02.5	04.9
2	67°19.1	166°04.9	25.5	270°14.7	15.2	224°43.1	17.6	232°04.7	05.0
3	82°21.6	181°04.3	·· 25.8	285°15.8	·· 14.7	239°45.0	·· 17.7	247°06.8	·· 05.1
4	97°24.0	196°03.8	26.0	300°16.9	14.2	254°47.0	17.9	262°09.0	05.2
5	112°26.5	211°03.3	26.3	315°18.0	13.7	269°48.9	18.1	277°11.2	05.3
6	127°29.0	226°02.8	S26°26.5	330°19.1	N11°13.2	284°50.9	S08°18.3	292°13.4	S04°05.4
7	142°31.4	241°02.3	26.7	345°20.2	12.7	299°52.9	18.5	307°15.6	05.6
8	157°33.9	256°01.8	27.0	0°21.3	12.2	314°54.8	18.7	322°17.8	05.7
9	172°36.4	271°01.3	·· 27.2	15°22.4	·· 11.7	329°56.8	·· 18.9	337°20.0	·· 05.8
10	187°38.8	286°00.8	27.5	30°23.4	11.2	344°58.7	19.1	352°22.2	05.9
11	202°41.3	301°00.3	27.7	45°24.5	10.7	0°00.7	19.3	7°24.4	06.0
12	217°43.7	315°59.8	S26°27.9	60°25.6	N11°10.2	15°02.6	S08°19.5	22°26.6	S04°06.1
13	232°46.2	330°59.3	28.2	75°26.7	09.7	30°04.6	19.7	37°28.7	06.2
14	247°48.7	345°58.8	28.4	90°27.8	09.2	45°06.6	19.9	52°30.9	06.3
15	262°51.1	0°58.2	·· 28.6	105°28.9	·· 08.7	60°08.5	·· 20.1	67°33.1	·· 06.4
16	277°53.6	15°57.7	28.8	120°30.0	08.2	75°10.5	20.3	82°35.3	06.5
17	292°56.1	30°57.2	29.1	135°31.1	07.7	90°12.4	20.5	97°37.5	06.7
18	307°58.5	45°56.7	S26°29.3	150°32.2	N11°07.2	105°14.4	S08°20.7	112°39.7	S04°06.8
19	323°01.0	60°56.2	29.5	165°33.3	06.7	120°16.4	20.9	127°41.9	06.9
20	338°03.5	75°55.7	29.7	180°34.4	06.2	135°18.3	21.1	142°44.1	07.0
21	353°05.9	90°55.2	·· 30.0	195°35.5	·· 05.7	150°20.3	·· 21.3	157°46.3	·· 07.1
22	8°08.4	105°54.7	30.2	210°36.6	05.2	165°22.2	21.5	172°48.5	07.2
23	23°10.8	120°54.2	30.4	225°37.7	04.7	180°24.2	21.7	187°50.6	07.3
Mer.pass. 21:28		ν -0.5′	d 0.2′	m -4.35	ν 1.1′	d 0.5′	m 1.43	ν 2.0′	d 0.2′ m -1.68	ν 2.2′	d 0.1′ m 0.87

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	38°13.3	135°53.7	S26°30.6	240°38.8	N11°04.2	195°26.2	S08°21.9	202°52.8	S04°07.4
1	53°15.8	150°53.2	30.9	255°39.9	03.6	210°28.1	22.1	217°55.0	07.5
2	68°18.2	165°52.7	31.1	270°41.0	03.1	225°30.1	22.3	232°57.2	07.6
3	83°20.7	180°52.2	·· 31.3	285°42.1	·· 02.6	240°32.0	·· 22.5	247°59.4	·· 07.7
4	98°23.2	195°51.7	31.5	300°43.2	02.1	255°34.0	22.7	263°01.6	07.9
5	113°25.6	210°51.2	31.7	315°44.3	01.6	270°35.9	22.9	278°03.8	08.0
6	128°28.1	225°50.7	S26°31.9	330°45.4	N11°01.1	285°37.9	S08°23.1	293°06.0	S04°08.1
7	143°30.6	240°50.2	32.1	345°46.5	00.6	300°39.9	23.3	308°08.2	08.2
8	158°33.0	255°49.7	32.4	0°47.6	11°00.1	315°41.8	23.4	323°10.4	08.3
9	173°35.5	270°49.2	·· 32.6	15°48.7	10°59.6	330°43.8	·· 23.6	338°12.6	·· 08.4
10	188°38.0	285°48.7	32.8	30°49.8	59.1	345°45.7	23.8	353°14.7	08.5
11	203°40.4	300°48.2	33.0	45°50.9	58.6	0°47.7	24.0	8°16.9	08.6
12	218°42.9	315°47.7	S26°33.2	60°52.0	N10°58.1	15°49.7	S08°24.2	23°19.1	S04°08.7
13	233°45.3	330°47.2	33.4	75°53.1	57.6	30°51.6	24.4	38°21.3	08.8
14	248°47.8	345°46.7	33.6	90°54.2	57.1	45°53.6	24.6	53°23.5	08.9
15	263°50.3	0°46.2	·· 33.8	105°55.3	·· 56.6	60°55.5	·· 24.8	68°25.7	·· 09.1
16	278°52.7	15°45.7	34.0	120°56.4	56.1	75°57.5	25.0	83°27.9	09.2
17	293°55.2	30°45.2	34.2	135°57.5	55.6	90°59.5	25.2	98°30.1	09.3
18	308°57.7	45°44.7	S26°34.4	150°58.6	N10°55.1	106°01.4	S08°25.4	113°32.3	S04°09.4
19	324°00.1	60°44.2	34.6	165°59.7	54.6	121°03.4	25.6	128°34.5	09.5
20	339°02.6	75°43.7	34.8	181°00.8	54.1	136°05.3	25.8	143°36.7	09.6
21	354°05.1	90°43.2	·· 35.0	196°01.9	·· 53.6	151°07.3	·· 26.0	158°38.8	·· 09.7
22	9°07.5	105°42.7	35.2	211°03.0	53.1	166°09.2	26.2	173°41.0	09.8
23	24°10.0	120°42.2	35.4	226°04.1	52.6	181°11.2	26.4	188°43.2	09.9
Mer.pass. 21:24		ν -0.5′	d 0.2′	m -4.36	ν 1.1′	d 0.5′	m 1.42	ν 2.0′	d 0.2′ m -1.68	ν 2.2′	d 0.1′ m 0.87

Stars

	SHA	Dec
Alpheratz	358°08.2	28°59.5
Ankaa	353°39.1	-42°24.4
Schedar	350°07.7	56°26.3
Diphda	349°19.8	-18°05.2
Achernar	335°44.1	-57°19.9
Hamal	328°27.7	23°22.6
Polaris	326°16.9	89°10.8
Acamar	315°36.2	-40°22.6
Menkar	314°40.0	4°01.1
Mirfak	309°14.5	49°47.7
Aldebaran	291°16.8	16°28.4
Rigel	281°35.0	-8°13.3
Capella	281°09.8	45°58.7
Bellatrix	278°57.7	6°20.1
Elnath	278°42.9	28°35.5
Alnilam	276°10.7	-1°12.7
Betelgeuse	271°27.3	7°24.3
Canopus	264°06.6	-52°40.9
Sirius	258°54.8	-16°41.3
Adhara	255°31.4	-28°56.6
Procyon	245°24.9	5°16.4
Pollux	243°57.2	28°04.2
Avior	234°27.9	-59°26.7
Suhail	223°10.3	-43°21.2
Miaplacidus	221°45.0	-69°38.2
Alphard	218°19.9	-8°34.6
Regulus	208°09.3	12°03.5
Dubhe	194°21.6	61°50.9
Denebola	182°58.5	14°40.6
Gienah	176°17.5	-17°26.2
Acrux	173°37.1	-62°59.6
Gacrux	172°28.4	-57°00.4
Alioth	166°42.3	56°03.6
Spica	158°57.1	-11°03.8
Alkaid	153°18.4	49°24.4
Hadar	149°23.0	-60°16.9
Menkent	148°36.5	-36°16.6
Arcturus	146°18.1	19°16.8
Rigil Kent.	140°25.5	-60°45.3
Kochab	137°20.2	74°14.0
Zuben'ubi	137°32.5	-15°57.8
Alphecca	126°31.8	26°46.8
Antares	112°56.3	-26°23.4
Atria	108°20.3	-68°59.8
Sabik	102°40.5	-15°42.1
Shaula	96°55.0	-37°05.5
Rasalhague	96°29.1	12°34.6
Eltanin	90°57.7	51°29.8
Kaus Aust.	84°16.1	-34°23.7
Vega	80°55.5	38°46.3
Nunki	76°28.4	-26°19.2
Altair	62°31.9	8°49.3
Peacock	53°57.2	-56°47.9
Deneb	49°47.9	45°13.2
Enif	34°10.7	9°47.6
Al Na'ir	28°13.8	-47°03.2
Fomalhaut	15°50.4	-29°43.3
Scheat	14°16.6	27°59.2
Markab	14°02.2	15°06.5

Oct 28 Wed	SHA	Mer.pass
Venus	100°03.2	14:55
Mars	203°31.3	08:00
Jupiter	157°37.1	11:03
Saturn	164°52.7	10:34

Oct 29 Thu	SHA	Mer.pass
Venus	98°51.7	14:56
Mars	202°58.3	07:59
Jupiter	157°25.0	11:00
Saturn	164°46.1	10:30

Oct 30 Fri	SHA	Mer.pass
Venus	97°40.4	14:57
Mars	202°25.5	07:57
Jupiter	157°12.8	10:57
Saturn	164°39.5	10:27

Horizontal parallax	
Venus:	0.2
Mars:	0.1

h	Sun		Moon				
Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	184°02.2	S13°00.9	180°42.4	14.9′	S08°56.7	10.2′	54.2′
1	199°02.2	01.7	195°16.3	14.9′	09°06.9	10.1′	54.2′
2	214°02.3	02.6	209°50.2	14.9′	09°17.0	10.0′	54.2′
3	229°02.3	·· 03.4	224°24.1	14.8′	09°27.0	10.1′	54.2′
4	244°02.4	04.2	238°57.9	14.8′	09°37.1	10.0′	54.2′
5	259°02.4	05.1	253°31.7	14.8′	09°47.1	9.9′	54.2′
6	274°02.5	S13°05.9	268°05.5	14.8′	S09°57.0	9.9′	54.2′
7	289°02.5	06.7	282°39.3	14.8′	10°06.9	9.8′	54.2′
8	304°02.6	07.6	297°13.1	14.7′	10°16.7	9.9′	54.2′
9	319°02.6	·· 08.4	311°46.8	14.7′	10°26.6	9.7′	54.2′
10	334°02.6	09.3	326°20.6	14.7′	10°36.3	9.7′	54.2′
11	349°02.7	10.1	340°54.3	14.7′	10°46.0	9.7′	54.1′
12	4°02.7	S13°10.9	355°28.0	14.7′	S10°55.7	9.6′	54.1′
13	19°02.8	11.8	10°01.6	14.6′	11°05.3	9.6′	54.1′
14	34°02.8	12.6	24°35.3	14.6′	11°14.9	9.5′	54.1′
15	49°02.9	·· 13.4	39°08.9	14.6′	11°24.4	9.5′	54.1′
16	64°02.9	14.3	53°42.5	14.6′	11°33.9	9.4′	54.1′
17	79°03.0	15.1	68°16.1	14.6′	11°43.3	9.4′	54.1′
18	94°03.0	S13°15.9	82°49.6	14.5′	S11°52.7	9.3′	54.1′
19	109°03.1	16.8	97°23.2	14.5′	12°02.0	9.3′	54.1′
20	124°03.1	17.6	111°56.7	14.5′	12°11.3	9.2′	54.1′
21	139°03.1	·· 18.4	126°30.1	14.5′	12°20.5	9.2′	54.1′
22	154°03.2	19.3	141°03.6	14.4′	12°29.7	9.1′	54.1′
23	169°03.2	20.1	155°37.0	14.4′	12°38.8	9.0′	54.1′
	SD = 16.1′	d = 0.8′	SD = 14.8′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	184°03.3	S13°20.9	170°10.4	14.4′	S12°47.8	9.0′	54.0′
1	199°03.3	21.8	184°43.8	14.4′	12°56.8	9.0′	54.0′
2	214°03.4	22.6	199°17.2	14.3′	13°05.8	8.9′	54.0′
3	229°03.4	·· 23.4	213°50.5	14.3′	13°14.7	8.8′	54.0′
4	244°03.4	24.3	228°23.8	14.3′	13°23.5	8.8′	54.0′
5	259°03.5	25.1	242°57.1	14.2′	13°32.3	8.7′	54.0′
6	274°03.5	S13°25.9	257°30.3	14.2′	S13°41.0	8.6′	54.0′
7	289°03.6	26.8	272°03.5	14.2′	13°49.6	8.6′	54.0′
8	304°03.6	27.6	286°36.7	14.2′	13°58.2	8.6′	54.0′
9	319°03.7	·· 28.4	301°09.9	14.1′	14°06.8	8.4′	54.0′
10	334°03.7	29.2	315°43.0	14.1′	14°15.2	8.5′	54.0′
11	349°03.7	30.1	330°16.1	14.1′	14°23.7	8.3′	54.0′
12	4°03.8	S13°30.9	344°49.2	14.0′	S14°32.0	8.3′	54.0′
13	19°03.8	31.7	359°22.2	14.0′	14°40.3	8.2′	54.0′
14	34°03.8	32.5	13°55.2	14.0′	14°48.5	8.2′	54.0′
15	49°03.9	·· 33.4	28°28.2	13.9′	14°56.7	8.1′	54.0′
16	64°03.9	34.2	43°01.1	13.9′	15°04.8	8.0′	54.0′
17	79°04.0	35.0	57°34.0	13.9′	15°12.8	8.0′	53.9′
18	94°04.0	S13°35.9	72°06.9	13.9′	S15°20.8	7.9′	53.9′
19	109°04.0	36.7	86°39.8	13.8′	15°28.7	7.8′	53.9′
20	124°04.1	37.5	101°12.6	13.8′	15°36.5	7.8′	53.9′
21	139°04.1	·· 38.3	115°45.4	13.8′	15°44.3	7.7′	53.9′
22	154°04.1	39.2	130°18.2	13.7′	15°52.0	7.6′	53.9′
23	169°04.2	40.0	144°50.9	13.7′	15°59.6	7.6′	53.9′
	SD = 16.1′	d = 0.8′	SD = 14.7′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	184°04.2	S13°40.8	159°23.6	13.7′	S16°07.2	7.4′	53.9′
1	199°04.2	41.6	173°56.3	13.6′	16°14.6	7.5′	53.9′
2	214°04.3	42.4	188°28.9	13.6′	16°22.1	7.3′	53.9′
3	229°04.3	·· 43.3	203°01.5	13.6′	16°29.4	7.3′	53.9′
4	244°04.3	44.1	217°34.1	13.5′	16°36.7	7.2′	53.9′
5	259°04.4	44.9	232°06.6	13.5′	16°43.9	7.1′	53.9′
6	274°04.4	S13°45.7	246°39.1	13.5′	S16°51.0	7.1′	53.9′
7	289°04.4	46.5	261°11.6	13.4′	16°58.1	7.0′	53.9′
8	304°04.5	47.4	275°44.0	13.4′	17°05.1	6.9′	53.9′
9	319°04.5	·· 48.2	290°16.4	13.4′	17°12.0	6.8′	53.9′
10	334°04.5	49.0	304°48.8	13.3′	17°18.8	6.8′	53.9′
11	349°04.6	49.8	319°21.1	13.3′	17°25.6	6.7′	53.9′
12	4°04.6	S13°50.6	333°53.4	13.3′	S17°32.3	6.6′	53.9′
13	19°04.6	51.5	348°25.7	13.2′	17°38.9	6.5′	53.9′
14	34°04.7	52.3	2°57.9	13.2′	17°45.4	6.5′	53.9′
15	49°04.7	·· 53.1	17°30.1	13.2′	17°51.9	6.3′	53.9′
16	64°04.7	53.9	32°02.3	13.1′	17°58.2	6.3′	53.9′
17	79°04.8	54.7	46°34.4	13.1′	18°04.5	6.3′	53.9′
18	94°04.8	S13°55.5	61°06.5	13.1′	S18°10.8	6.1′	53.9′
19	109°04.8	56.4	75°38.6	13.0′	18°16.9	6.0′	53.9′
20	124°04.8	57.2	90°10.6	13.0′	18°22.9	6.0′	53.9′
21	139°04.9	·· 58.0	104°42.6	13.0′	18°28.9	5.9′	53.9′
22	154°04.9	58.8	119°14.6	12.9′	18°34.8	5.8′	53.9′
23	169°04.9	59.6	133°46.5	12.9′	18°40.6	5.8′	53.9′
	SD = 16.1′	d = 0.8′	SD = 14.7′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	05:54	07:15	08:38	14:48	16:11	17:32
N 70°	05:51	07:04	08:15	15:11	16:22	17:35
68°	05:48	06:55	07:58	15:28	16:31	17:37
66°	05:46	06:47	07:44	15:42	16:39	17:40
64°	05:44	06:40	07:32	15:54	16:46	17:42
62°	05:42	06:35	07:23	16:04	16:52	17:44
60°	05:41	06:30	07:14	16:12	16:57	17:46
N 58°	05:39	06:25	07:07	16:20	17:01	17:48
56°	05:37	06:21	07:00	16:26	17:06	17:49
54°	05:36	06:17	06:54	16:32	17:09	17:51
52°	05:34	06:14	06:49	16:38	17:13	17:52
50°	05:33	06:11	06:44	16:42	17:16	17:54
45°	05:29	06:04	06:34	16:53	17:23	17:58
N 40°	05:26	05:58	06:25	17:01	17:29	18:01
35°	05:22	05:52	06:18	17:09	17:35	18:05
30°	05:19	05:47	06:11	17:16	17:40	18:08
20°	05:11	05:37	06:00	17:27	17:50	18:16
N 10°	05:03	05:28	05:50	17:37	17:59	18:24
0°	04:54	05:19	05:40	17:47	18:08	18:33
S 10°	04:44	05:09	05:31	17:57	18:19	18:44
20°	04:31	04:57	05:20	18:08	18:30	18:57
30°	04:13	04:43	05:08	18:20	18:45	19:15
35°	04:02	04:34	05:01	18:27	18:54	19:26
40°	03:49	04:24	04:53	18:35	19:04	19:39
45°	03:33	04:12	04:44	18:45	19:17	19:56
S 50°	03:12	03:57	04:32	18:56	19:32	20:17
52°	03:01	03:49	04:27	19:02	19:40	20:28
54°	02:49	03:41	04:21	19:08	19:48	20:41
56°	02:35	03:32	04:14	19:14	19:58	20:55
58°	02:17	03:21	04:07	19:22	20:09	21:13
S 60°	01:56	03:08	03:59	19:31	20:21	21:36

Lat.	**Moonrise** Wed	Thu	Fri	**Moonset** Wed	Thu	Fri
N 72°	08:30	10:27	13:07	15:48	15:23	14:17
N 70°	08:13	09:55	11:47	16:07	15:55	15:38
68°	07:59	09:32	11:09	16:22	16:19	16:17
66°	07:48	09:15	10:42	16:35	16:38	16:44
64°	07:38	09:00	10:22	16:45	16:53	17:05
62°	07:30	08:48	10:06	16:54	17:06	17:22
60°	07:23	08:38	09:52	17:02	17:17	17:36
N 58°	07:17	08:30	09:40	17:09	17:26	17:48
56°	07:12	08:22	09:30	17:15	17:34	17:58
54°	07:07	08:15	09:21	17:20	17:42	18:08
52°	07:03	08:09	09:13	17:25	17:48	18:16
50°	06:59	08:03	09:06	17:30	17:54	18:23
45°	06:51	07:51	08:51	17:39	18:07	18:39
N 40°	06:44	07:42	08:39	17:47	18:18	18:52
35°	06:38	07:33	08:28	17:54	18:27	19:04
30°	06:32	07:26	08:19	18:00	18:36	19:13
20°	06:23	07:13	08:03	18:11	18:50	19:30
N 10°	06:16	07:02	07:50	18:20	19:02	19:45
0°	06:08	06:52	07:37	18:29	19:13	19:59
S 10°	06:01	06:42	07:24	18:38	19:25	20:13
20°	05:53	06:31	07:10	18:47	19:37	20:28
30°	05:44	06:19	06:55	18:58	19:52	20:45
35°	05:39	06:11	06:46	19:05	20:00	20:55
40°	05:34	06:03	06:36	19:12	20:09	21:06
45°	05:27	05:54	06:24	19:20	20:20	21:19
S 50°	05:19	05:43	06:10	19:30	20:34	21:36
52°	05:16	05:38	06:03	19:35	20:40	21:44
54°	05:12	05:32	05:55	19:40	20:47	21:52
56°	05:07	05:26	05:47	19:46	20:55	22:02
58°	05:03	05:18	05:38	19:52	21:04	22:13
S 60°	04:57	05:10	05:27	19:59	21:14	22:26

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 1-3 0-4%
28	16:09	16:11	11:44	12:19	–:–	
29	16:13	16:15	11:44	13:03	00:41	
30	16:17	16:18	11:44	13:48	01:25	

October 31, 01, 02 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	39°12.5	135°41.7	S26°35.6	241°05.2	N10°52.1	196°13.2	S08°26.6	203°45.4	S04°10.0
1	54°14.9	150°41.2	35.8	256°06.3	51.6	211°15.1	26.8	218°47.6	10.1
2	69°17.4	165°40.7	36.0	271°07.4	51.1	226°17.1	27.0	233°49.8	10.3
3	84°19.8	180°40.2	·· 36.2	286°08.5	·· 50.6	241°19.0	·· 27.2	248°52.0	·· 10.4
4	99°22.3	195°39.7	36.3	301°09.6	50.1	256°21.0	27.4	263°54.2	10.5
5	114°24.8	210°39.2	36.5	316°10.7	49.6	271°23.0	27.6	278°56.4	10.6
6	129°27.2	225°38.7	S26°36.7	331°11.8	N10°49.1	286°24.9	S08°27.8	293°58.6	S04°10.7
7	144°29.7	240°38.2	36.9	346°12.9	48.6	301°26.9	27.9	309°00.8	10.8
8	159°32.2	255°37.7	37.1	1°14.0	48.1	316°28.8	28.1	324°03.0	10.9
9	174°34.6	270°37.2	·· 37.3	16°15.1	·· 47.6	331°30.8	·· 28.3	339°05.1	·· 11.0
10	189°37.1	285°36.7	37.5	31°16.2	47.1	346°32.8	28.5	354°07.3	11.1
11	204°39.6	300°36.2	37.6	46°17.4	46.6	1°34.7	28.7	9°09.5	11.2
12	219°42.0	315°35.7	S26°37.8	61°18.5	N10°46.1	16°36.7	S08°28.9	24°11.7	S04°11.3
13	234°44.5	330°35.3	38.0	76°19.6	45.6	31°38.6	29.1	39°13.9	11.4
14	249°46.9	345°34.8	38.2	91°20.7	45.1	46°40.6	29.3	54°16.1	11.6
15	264°49.4	0°34.3	·· 38.4	106°21.8	·· 44.6	61°42.6	·· 29.5	69°18.3	·· 11.7
16	279°51.9	15°33.8	38.5	121°22.9	44.1	76°44.5	29.7	84°20.5	11.8
17	294°54.3	30°33.3	38.7	136°24.0	43.6	91°46.5	29.9	99°22.7	11.9
18	309°56.8	45°32.8	S26°38.9	151°25.1	N10°43.1	106°48.4	S08°30.1	114°24.9	S04°12.0
19	324°59.3	60°32.3	39.0	166°26.2	42.6	121°50.4	30.3	129°27.1	12.1
20	340°01.7	75°31.8	39.2	181°27.3	42.1	136°52.4	30.5	144°29.3	12.2
21	355°04.2	90°31.3	·· 39.4	196°28.4	·· 41.6	151°54.3	·· 30.7	159°31.5	·· 12.3
22	10°06.7	105°30.8	39.6	211°29.5	41.1	166°56.3	30.9	174°33.6	12.4
23	25°09.1	120°30.3	39.7	226°30.6	40.6	181°58.2	31.1	189°35.8	12.5
Mer.pass. 21:20		ν -0.5′	d 0.2′	m -4.37	ν 1.1′	d 0.5′	m 1.42	ν 2.0′	d 0.2′ m -1.68	ν 2.2′	d 0.1′ m 0.87

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	40°11.6	135°29.9	S26°39.9	241°31.7	N10°40.1	197°00.2	S08°31.3	204°38.0	S04°12.6
1	55°14.1	150°29.4	40.1	256°32.8	39.6	212°02.2	31.5	219°40.2	12.7
2	70°16.5	165°28.9	40.2	271°34.0	39.1	227°04.1	31.7	234°42.4	12.9
3	85°19.0	180°28.4	·· 40.4	286°35.1	·· 38.6	242°06.1	·· 31.9	249°44.6	·· 13.0
4	100°21.4	195°27.9	40.5	301°36.2	38.0	257°08.0	32.0	264°46.8	13.1
5	115°23.9	210°27.4	40.7	316°37.3	37.5	272°10.0	32.2	279°49.0	13.2
6	130°26.4	225°26.9	S26°40.9	331°38.4	N10°37.0	287°12.0	S08°32.4	294°51.2	S04°13.3
7	145°28.8	240°26.4	41.0	346°39.5	36.5	302°13.9	32.6	309°53.4	13.4
8	160°31.3	255°26.0	41.2	1°40.6	36.0	317°15.9	32.8	324°55.6	13.5
9	175°33.8	270°25.5	·· 41.3	16°41.7	·· 35.5	332°17.8	·· 33.0	339°57.8	·· 13.6
10	190°36.2	285°25.0	41.5	31°42.8	35.0	347°19.8	33.2	355°00.0	13.7
11	205°38.7	300°24.5	41.6	46°43.9	34.5	2°21.8	33.4	10°02.1	13.8
12	220°41.2	315°24.0	S26°41.8	61°45.1	N10°34.0	17°23.7	S08°33.6	25°04.3	S04°13.9
13	235°43.6	330°23.5	42.0	76°46.2	33.5	32°25.7	33.8	40°06.5	14.0
14	250°46.1	345°23.0	42.1	91°47.3	33.0	47°27.6	34.0	55°08.7	14.1
15	265°48.6	0°22.6	·· 42.3	106°48.4	·· 32.5	62°29.6	·· 34.2	70°10.9	·· 14.3
16	280°51.0	15°22.1	42.4	121°49.5	32.0	77°31.6	34.4	85°13.1	14.4
17	295°53.5	30°21.6	42.5	136°50.6	31.5	92°33.5	34.6	100°15.3	14.5
18	310°55.9	45°21.1	S26°42.7	151°51.7	N10°31.0	107°35.5	S08°34.8	115°17.5	S04°14.6
19	325°58.4	60°20.6	42.8	166°52.8	30.5	122°37.4	35.0	130°19.7	14.7
20	341°00.9	75°20.2	43.0	181°54.0	30.0	137°39.4	35.2	145°21.9	14.8
21	356°03.3	90°19.7	·· 43.1	196°55.1	·· 29.5	152°41.4	·· 35.4	160°24.1	·· 14.9
22	11°05.8	105°19.2	43.3	211°56.2	29.0	167°43.3	35.5	175°26.3	15.0
23	26°08.3	120°18.7	43.4	226°57.3	28.5	182°45.3	35.7	190°28.5	15.1
Mer.pass. 21:16		ν -0.5′	d 0.2′	m -4.38	ν 1.1′	d 0.5′	m 1.41	ν 2.0′	d 0.2′ m -1.68	ν 2.2′	d 0.1′ m 0.87

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	41°10.7	135°18.2	S26°43.6	241°58.4	N10°28.0	197°47.2	S08°35.9	205°30.7	S04°15.2
1	56°13.2	150°17.8	43.7	256°59.5	27.5	212°49.2	36.1	220°32.9	15.3
2	71°15.7	165°17.3	43.8	272°00.6	27.0	227°51.2	36.3	235°35.0	15.4
3	86°18.1	180°16.8	·· 44.0	287°01.7	·· 26.5	242°53.1	·· 36.5	250°37.2	·· 15.5
4	101°20.6	195°16.3	44.1	302°02.9	26.0	257°55.1	36.7	265°39.4	15.7
5	116°23.1	210°15.8	44.2	317°04.0	25.5	272°57.0	36.9	280°41.6	15.8
6	131°25.5	225°15.4	S26°44.4	332°05.1	N10°25.0	287°59.0	S08°37.1	295°43.8	S04°15.9
7	146°28.0	240°14.9	44.5	347°06.2	24.5	303°01.0	37.3	310°46.0	16.0
8	161°30.4	255°14.4	44.6	2°07.3	24.0	318°02.9	37.5	325°48.2	16.1
9	176°32.9	270°13.9	·· 44.8	17°08.4	·· 23.5	333°04.9	·· 37.7	340°50.4	·· 16.2
10	191°35.4	285°13.5	44.9	32°09.6	23.0	348°06.8	37.9	355°52.6	16.3
11	206°37.8	300°13.0	45.0	47°10.7	22.5	3°08.8	38.1	10°54.8	16.4
12	221°40.3	315°12.5	S26°45.1	62°11.8	N10°22.0	18°10.8	S08°38.3	25°57.0	S04°16.5
13	236°42.8	330°12.0	45.3	77°12.9	21.5	33°12.7	38.5	40°59.2	16.6
14	251°45.2	345°11.6	45.4	92°14.0	21.0	48°14.7	38.7	56°01.4	16.7
15	266°47.7	0°11.1	·· 45.5	107°15.1	·· 20.5	63°16.6	·· 38.8	71°03.6	·· 16.8
16	281°50.2	15°10.6	45.6	122°16.2	19.9	78°18.6	39.0	86°05.8	16.9
17	296°52.6	30°10.2	45.8	137°17.4	19.4	93°20.6	39.2	101°08.0	17.0
18	311°55.1	45°09.7	S26°45.9	152°18.5	N10°18.9	108°22.5	S08°39.4	116°10.2	S04°17.2
19	326°57.5	60°09.2	46.0	167°19.6	18.4	123°24.5	39.6	131°12.3	17.3
20	342°00.0	75°08.7	46.1	182°20.7	17.9	138°26.4	39.8	146°14.5	17.4
21	357°02.5	90°08.3	·· 46.2	197°21.8	·· 17.4	153°28.4	·· 40.0	161°16.7	·· 17.5
22	12°04.9	105°07.8	46.3	212°23.0	16.9	168°30.4	40.2	176°18.9	17.6
23	27°07.4	120°07.3	46.5	227°24.1	16.4	183°32.3	40.4	191°21.1	17.7
Mer.pass. 21:12		ν -0.5′	d 0.1′	m -4.39	ν 1.1′	d 0.5′	m 1.40	ν 2.0′	d 0.2′ m -1.68	ν 2.2′	d 0.1′ m 0.87

Stars

	SHA	Dec
Alpheratz	358°08.3	28°59.5
Ankaa	353°39.1	-42°24.5
Schedar	350°07.7	56°26.4
Diphda	349°19.8	-18°05.2
Achernar	335°44.1	-57°19.9
Hamal	328°27.7	23°22.6
Polaris	326°16.7	89°10.8
Acamar	315°36.2	-40°22.7
Menkar	314°40.0	4°01.1
Mirfak	309°14.5	49°47.8
Aldebaran	291°16.8	16°28.4
Rigel	281°35.0	-8°13.3
Capella	281°09.8	45°58.7
Bellatrix	278°57.7	6°20.1
Elnath	278°42.9	28°35.5
Alnilam	276°10.6	-1°12.7
Betelgeuse	271°27.2	7°24.3
Canopus	264°06.6	-52°40.9
Sirius	258°54.8	-16°41.3
Adhara	255°31.3	-28°56.6
Procyon	245°24.9	5°16.4
Pollux	243°57.1	28°04.2
Avior	234°27.8	-59°26.7
Suhail	223°10.3	-43°21.2
Miaplacidus	221°45.0	-69°38.2
Alphard	218°19.9	-8°34.6
Regulus	208°09.3	12°03.5
Dubhe	194°21.6	61°50.9
Denebola	182°58.5	14°40.6
Gienah	176°17.5	-17°26.2
Acrux	173°37.1	-62°59.6
Gacrux	172°28.4	-57°00.4
Alioth	166°42.3	56°03.6
Spica	158°57.1	-11°03.8
Alkaid	153°18.4	49°24.4
Hadar	149°23.0	-60°16.9
Menkent	148°36.5	-36°16.6
Arcturus	146°18.1	19°16.8
Rigil Kent.	140°25.5	-60°45.3
Kochab	137°20.2	74°14.0
Zuben'ubi	137°32.5	-15°57.8
Alphecca	126°31.8	26°46.8
Antares	112°56.3	-26°23.4
Atria	108°20.3	-68°59.8
Sabik	102°40.5	-15°42.1
Shaula	96°55.0	-37°05.5
Rasalhague	96°29.1	12°34.6
Eltanin	90°57.7	51°29.8
Kaus Aust.	84°16.1	-34°23.7
Vega	80°55.5	38°46.3
Nunki	76°28.4	-26°19.2
Altair	62°31.9	8°49.3
Peacock	53°57.2	-56°47.9
Deneb	49°48.0	45°13.2
Enif	34°10.8	9°47.6
Al Na'ir	28°13.8	-47°03.2
Fomalhaut	15°50.4	-29°43.3
Scheat	14°16.6	27°59.2
Markab	14°02.2	15°06.5

Oct 31 Sat	SHA	Mer.pass
Venus	96°29.2	14:58
Mars	201°52.8	07:55
Jupiter	157°00.7	10:54
Saturn	164°33.0	10:23

Nov 01 Sun	SHA	Mer.pass
Venus	95°18.3	14:58
Mars	201°20.2	07:53
Jupiter	156°48.6	10:51
Saturn	164°26.4	10:20

Nov 02 Mon	SHA	Mer.pass
Venus	94°07.5	14:59
Mars	200°47.7	07:52
Jupiter	156°36.5	10:47
Saturn	164°19.9	10:16

Horizontal parallax	
Venus:	0.2
Mars:	0.1

h	Sun		Moon				
Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	184°05.0	S14°00.4	148°18.4	12.9′	S18°46.4	5.6′	53.9′
1	199°05.0	01.3	162°50.2	12.8′	18°52.0	5.6′	53.9′
2	214°05.0	02.1	177°22.1	12.8′	18°57.6	5.5′	53.9′
3	229°05.0	·· 02.9	191°53.9	12.8′	19°03.1	5.4′	53.9′
4	244°05.1	03.7	206°25.6	12.7′	19°08.5	5.3′	53.9′
5	259°05.1	04.5	220°57.4	12.7′	19°13.8	5.2′	53.9′
6	274°05.1	S14°05.3	235°29.1	12.7′	S19°19.0	5.2′	53.9′
7	289°05.1	06.1	250°00.7	12.6′	19°24.2	5.0′	53.9′
8	304°05.2	06.9	264°32.4	12.6′	19°29.2	5.0′	53.9′
9	319°05.2	·· 07.7	279°04.0	12.6′	19°34.2	4.9′	53.9′
10	334°05.2	08.6	293°35.5	12.5′	19°39.1	4.8′	53.9′
11	349°05.2	09.4	308°07.1	12.5′	19°43.9	4.7′	53.9′
12	4°05.3	S14°10.2	322°38.6	12.5′	S19°48.6	4.6′	53.9′
13	19°05.3	11.0	337°10.0	12.4′	19°53.2	4.5′	53.9′
14	34°05.3	11.8	351°41.5	12.4′	19°57.7	4.5′	53.9′
15	49°05.3	·· 12.6	6°12.9	12.4′	20°02.2	4.3′	54.0′
16	64°05.3	13.4	20°44.2	12.3′	20°06.5	4.3′	54.0′
17	79°05.4	14.2	35°15.6	12.3′	20°10.8	4.2′	54.0′
18	94°05.4	S14°15.0	49°46.9	12.3′	S20°15.0	4.0′	54.0′
19	109°05.4	15.8	64°18.2	12.2′	20°19.0	4.0′	54.0′
20	124°05.4	16.6	78°49.4	12.2′	20°23.0	3.9′	54.0′
21	139°05.4	·· 17.4	93°20.6	12.2′	20°26.9	3.8′	54.0′
22	154°05.5	18.2	107°51.8	12.2′	20°30.7	3.8′	54.0′
23	169°05.5	19.0	122°23.0	12.1′	20°34.5	3.6′	54.0′
	SD = 16.1′	d = 0.8′	SD = 14.7′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	184°05.5	S14°19.9	136°54.1	12.1′	S20°38.1	3.5′	54.0′
1	199°05.5	20.7	151°25.2	12.1′	20°41.6	3.4′	54.0′
2	214°05.5	21.5	165°56.3	12.0′	20°45.0	3.4′	54.0′
3	229°05.6	·· 22.3	180°27.3	12.0′	20°48.4	3.2′	54.0′
4	244°05.6	23.1	194°58.3	12.0′	20°51.6	3.2′	54.0′
5	259°05.6	23.9	209°29.3	12.0′	20°54.8	3.0′	54.0′
6	274°05.6	S14°24.7	224°00.3	11.9′	S20°57.8	3.0′	54.0′
7	289°05.6	25.5	238°31.2	11.9′	21°00.8	2.8′	54.1′
8	304°05.6	26.3	253°02.1	11.9′	21°03.6	2.8′	54.1′
9	319°05.7	·· 27.1	267°33.0	11.8′	21°06.4	2.7′	54.1′
10	334°05.7	27.9	282°03.8	11.8′	21°09.1	2.6′	54.1′
11	349°05.7	28.7	296°34.6	11.8′	21°11.7	2.4′	54.1′
12	4°05.7	S14°29.5	311°05.4	11.8′	S21°14.1	2.4′	54.1′
13	19°05.7	30.3	325°36.2	11.7′	21°16.5	2.3′	54.1′
14	34°05.7	31.1	340°06.9	11.7′	21°18.8	2.2′	54.1′
15	49°05.7	·· 31.9	354°37.7	11.7′	21°21.0	2.1′	54.1′
16	64°05.8	32.7	9°08.3	11.7′	21°23.1	1.9′	54.1′
17	79°05.8	33.5	23°39.0	11.6′	21°25.0	1.9′	54.2′
18	94°05.8	S14°34.3	38°09.7	11.6′	S21°26.9	1.8′	54.2′
19	109°05.8	35.1	52°40.3	11.6′	21°28.7	1.7′	54.2′
20	124°05.8	35.9	67°10.9	11.6′	21°30.4	1.6′	54.2′
21	139°05.8	·· 36.7	81°41.4	11.6′	21°32.0	1.5′	54.2′
22	154°05.8	37.4	96°12.0	11.5′	21°33.5	1.4′	54.2′
23	169°05.8	38.2	110°42.5	11.5′	21°34.9	1.2′	54.2′
	SD = 16.1′	d = 0.8′	SD = 14.7′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	184°05.9	S14°39.0	125°13.0	11.5′	S21°36.1	1.2′	54.2′
1	199°05.9	39.8	139°43.5	11.5′	21°37.3	1.1′	54.2′
2	214°05.9	40.6	154°14.0	11.4′	21°38.4	1.0′	54.3′
3	229°05.9	·· 41.4	168°44.4	11.4′	21°39.4	0.9′	54.3′
4	244°05.9	42.2	183°14.9	11.4′	21°40.3	0.7′	54.3′
5	259°05.9	43.0	197°45.3	11.4′	21°41.0	0.7′	54.3′
6	274°05.9	S14°43.8	212°15.6	11.4′	S21°41.7	0.6′	54.3′
7	289°05.9	44.6	226°46.0	11.3′	21°42.3	0.5′	54.3′
8	304°05.9	45.4	241°16.4	11.3′	21°42.8	0.3′	54.3′
9	319°05.9	·· 46.2	255°46.7	11.3′	21°43.1	0.3′	54.4′
10	334°05.9	47.0	270°17.0	11.3′	21°43.4	0.1′	54.4′
11	349°05.9	47.8	284°47.3	11.3′	21°43.5	0.1′	54.4′
12	4°06.0	S14°48.5	299°17.6	11.3′	S21°43.6	0.0′	54.4′
13	19°06.0	49.3	313°47.8	11.2′	21°43.6	0.2′	54.4′
14	34°06.0	50.1	328°18.1	11.2′	21°43.4	0.2′	54.4′
15	49°06.0	·· 50.9	342°48.3	11.2′	21°43.2	0.4′	54.5′
16	64°06.0	51.7	357°18.5	11.2′	21°42.8	0.5′	54.5′
17	79°06.0	52.5	11°48.7	11.2′	21°42.3	0.5′	54.5′
18	94°06.0	S14°53.3	26°18.9	11.2′	S21°41.8	0.7′	54.5′
19	109°06.0	54.1	40°49.1	11.2′	21°41.1	0.8′	54.5′
20	124°06.0	54.8	55°19.3	11.1′	21°40.3	0.9′	54.5′
21	139°06.0	·· 55.6	69°49.4	11.1′	21°39.4	0.9′	54.6′
22	154°06.0	56.4	84°19.6	11.1′	21°38.5	1.1′	54.6′
23	169°06.0	57.2	98°49.7	11.1′	21°37.4	1.2′	54.6′
	SD = 16.1′	d = 0.8′	SD = 14.8′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	06:06	07:29	08:56	14:30	15:57	17:20
N 70°	06:02	07:16	08:30	14:56	16:10	17:24
68°	05:58	07:05	08:10	15:16	16:21	17:28
66°	05:55	06:56	07:55	15:31	16:30	17:31
64°	05:52	06:49	07:42	15:44	16:37	17:34
62°	05:50	06:42	07:31	15:55	16:44	17:36
60°	05:47	06:37	07:22	16:04	16:50	17:39
N 58°	05:45	06:32	07:14	16:13	16:55	17:41
56°	05:43	06:27	07:07	16:20	16:59	17:43
54°	05:41	06:23	07:00	16:26	17:04	17:45
52°	05:39	06:19	06:55	16:32	17:07	17:47
50°	05:37	06:15	06:49	16:37	17:11	17:49
45°	05:33	06:08	06:38	16:48	17:19	17:54
N 40°	05:29	06:01	06:29	16:58	17:26	17:58
35°	05:25	05:55	06:21	17:06	17:32	18:02
30°	05:21	05:49	06:14	17:13	17:38	18:06
20°	05:13	05:39	06:01	17:26	17:48	18:14
N 10°	05:04	05:29	05:51	17:37	17:58	18:23
0°	04:54	05:19	05:40	17:47	18:08	18:33
S 10°	04:43	05:08	05:30	17:58	18:19	18:45
20°	04:29	04:56	05:19	18:09	18:32	18:59
30°	04:10	04:40	05:06	18:22	18:47	19:17
35°	03:59	04:31	04:58	18:30	18:57	19:29
40°	03:45	04:20	04:49	18:39	19:08	19:43
45°	03:27	04:07	04:39	18:49	19:21	20:01
S 50°	03:05	03:51	04:27	19:02	19:38	20:24
52°	02:53	03:43	04:21	19:07	19:46	20:36
54°	02:40	03:34	04:15	19:14	19:55	20:49
56°	02:25	03:24	04:08	19:21	20:05	21:05
58°	02:05	03:12	04:00	19:29	20:17	21:25
S 60°	01:41	02:59	03:50	19:39	20:31	21:51

Lat.	**Moonrise** Sat	Sun	Mon	**Moonset** Sat	Sun	Mon
N 72°	▬	▬	▬	▬	▬	▬
N 70°	▬	▬	▬	▬	▬	▬
68°	12:47	14:25	15:38	16:15	16:16	16:45
66°	12:07	13:25	14:24	16:55	17:17	17:59
64°	11:40	12:51	13:47	17:22	17:51	18:36
62°	11:19	12:26	13:21	17:44	18:16	19:02
60°	11:02	12:06	13:00	18:01	18:36	19:22
N 58°	10:48	11:50	12:44	18:16	18:52	19:39
56°	10:36	11:36	12:30	18:28	19:06	19:53
54°	10:25	11:24	12:17	18:39	19:18	20:05
52°	10:16	11:14	12:06	18:49	19:28	20:16
50°	10:07	11:05	11:57	18:57	19:38	20:26
45°	09:49	10:45	11:37	19:16	19:58	20:46
N 40°	09:35	10:29	11:20	19:31	20:14	21:02
35°	09:23	10:16	11:06	19:43	20:28	21:16
30°	09:12	10:04	10:54	19:55	20:39	21:28
20°	08:54	09:44	10:34	20:14	21:00	21:49
N 10°	08:38	09:27	10:16	20:30	21:17	22:06
0°	08:23	09:11	09:59	20:46	21:34	22:23
S 10°	08:08	08:54	09:43	21:01	21:50	22:40
20°	07:52	08:37	09:25	21:18	22:08	22:57
30°	07:34	08:17	09:04	21:37	22:28	23:18
35°	07:24	08:06	08:52	21:48	22:40	23:30
40°	07:12	07:53	08:39	22:01	22:54	23:43
45°	06:58	07:37	08:22	22:16	23:10	23:59
S 50°	06:41	07:18	08:02	22:35	23:30	·· ··
52°	06:33	07:09	07:53	22:44	23:39	·· ··
54°	06:24	06:59	07:42	22:54	23:50	·· ··
56°	06:14	06:48	07:30	23:05	·· ··	00:02
58°	06:02	06:34	07:16	23:18	·· ··	00:16
S 60°	05:49	06:19	07:00	23:33	·· ··	00:32

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 4-6 9-22%
31	16:20	16:21	11:44	14:34	02:11	
01	16:22	16:23	11:44	15:22	02:58	
02	16:23	16:24	11:44	16:11	03:47	

November 03, 04, 05 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	42°09.9	135°06.9	S26°46.6	242°25.2	N10°15.9	198°34.3	S08°40.6	206°23.3	S04°17.8
1	57°12.3	150°06.4	46.7	257°26.3	15.4	213°36.3	40.8	221°25.5	17.9
2	72°14.8	165°05.9	46.8	272°27.4	14.9	228°38.2	41.0	236°27.7	18.0
3	87°17.3	180°05.5	·· 46.9	287°28.6	·· 14.4	243°40.2	·· 41.2	251°29.9	·· 18.1
4	102°19.7	195°05.0	47.0	302°29.7	13.9	258°42.1	41.4	266°32.1	18.2
5	117°22.2	210°04.5	47.1	317°30.8	13.4	273°44.1	41.6	281°34.3	18.3
6	132°24.7	225°04.1	S26°47.2	332°31.9	N10°12.9	288°46.1	S08°41.8	296°36.5	S04°18.4
7	147°27.1	240°03.6	47.3	347°33.0	12.4	303°48.0	41.9	311°38.7	18.5
8	162°29.6	255°03.1	47.4	2°34.2	11.9	318°50.0	42.1	326°40.9	18.6
9	177°32.0	270°02.7	·· 47.5	17°35.3	·· 11.4	333°51.9	·· 42.3	341°43.1	·· 18.8
10	192°34.5	285°02.2	47.6	32°36.4	10.9	348°53.9	42.5	356°45.3	18.9
11	207°37.0	300°01.7	47.7	47°37.5	10.4	3°55.9	42.7	11°47.5	19.0
12	222°39.4	315°01.3	S26°47.8	62°38.6	N10°09.9	18°57.8	S08°42.9	26°49.7	S04°19.1
13	237°41.9	330°00.8	47.9	77°39.8	09.4	33°59.8	43.1	41°51.9	19.2
14	252°44.4	345°00.3	48.0	92°40.9	08.9	49°01.8	43.3	56°54.1	19.3
15	267°46.8	359°59.9	·· 48.1	107°42.0	·· 08.4	64°03.7	·· 43.5	71°56.2	·· 19.4
16	282°49.3	14°59.4	48.2	122°43.1	07.9	79°05.7	43.7	86°58.4	19.5
17	297°51.8	29°59.0	48.3	137°44.2	07.4	94°07.6	43.9	102°00.6	19.6
18	312°54.2	44°58.5	S26°48.4	152°45.4	N10°06.9	109°09.6	S08°44.1	117°02.8	S04°19.7
19	327°56.7	59°58.0	48.5	167°46.5	06.4	124°11.6	44.3	132°05.0	19.8
20	342°59.2	74°57.6	48.6	182°47.6	05.9	139°13.5	44.5	147°07.2	19.9
21	358°01.6	89°57.1	·· 48.7	197°48.7	·· 05.4	154°15.5	·· 44.6	162°09.4	·· 20.0
22	13°04.1	104°56.7	48.8	212°49.9	04.9	169°17.4	44.8	177°11.6	20.1
23	28°06.5	119°56.2	48.8	227°51.0	04.3	184°19.4	45.0	192°13.8	20.2
Mer.pass. 21:08		ν -0.5′	d 0.1′	ν 1.1′	d 0.5′	ν 2.0′	d 0.2′	ν 2.2′	d 0.1′
		m -4.40		m 1.40		m -1.68		m 0.87	

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	43°09.0	134°55.7	S26°48.9	242°52.1	N10°03.8	199°21.4	S08°45.2	207°16.0	S04°20.3
1	58°11.5	149°55.3	49.0	257°53.2	03.3	214°23.3	45.4	222°18.2	20.5
2	73°13.9	164°54.8	49.1	272°54.4	02.8	229°25.3	45.6	237°20.4	20.6
3	88°16.4	179°54.4	·· 49.2	287°55.5	·· 02.3	244°27.3	·· 45.8	252°22.6	·· 20.7
4	103°18.9	194°53.9	49.3	302°56.6	01.8	259°29.2	46.0	267°24.8	20.8
5	118°21.3	209°53.5	49.3	317°57.7	01.3	274°31.2	46.2	282°27.0	20.9
6	133°23.8	224°53.0	S26°49.4	332°58.9	N10°00.8	289°33.1	S08°46.4	297°29.2	S04°21.0
7	148°26.3	239°52.6	49.5	348°00.0	10°00.3	304°35.1	46.6	312°31.4	21.1
8	163°28.7	254°52.1	49.6	3°01.1	09°59.8	319°37.1	46.8	327°33.6	21.2
9	178°31.2	269°51.7	·· 49.7	18°02.2	·· 59.3	334°39.0	·· 47.0	342°35.8	·· 21.3
10	193°33.7	284°51.2	49.7	33°03.4	58.8	349°41.0	47.2	357°38.0	21.4
11	208°36.1	299°50.7	49.8	48°04.5	58.3	4°43.0	47.3	12°40.2	21.5
12	223°38.6	314°50.3	S26°49.9	63°05.6	N09°57.8	19°44.9	S08°47.5	27°42.4	S04°21.6
13	238°41.0	329°49.8	50.0	78°06.7	57.3	34°46.9	47.7	42°44.6	21.7
14	253°43.5	344°49.4	50.0	93°07.9	56.8	49°48.8	47.9	57°46.8	21.8
15	268°46.0	359°48.9	·· 50.1	108°09.0	·· 56.3	64°50.8	·· 48.1	72°49.0	·· 21.9
16	283°48.4	14°48.5	50.2	123°10.1	55.8	79°52.8	48.3	87°51.1	22.0
17	298°50.9	29°48.0	50.2	138°11.3	55.3	94°54.7	48.5	102°53.3	22.1
18	313°53.4	44°47.6	S26°50.3	153°12.4	N09°54.8	109°56.7	S08°48.7	117°55.5	S04°22.2
19	328°55.8	59°47.2	50.4	168°13.5	54.3	124°58.7	48.9	132°57.7	22.4
20	343°58.3	74°46.7	50.4	183°14.6	53.8	140°00.6	49.1	147°59.9	22.5
21	359°00.8	89°46.3	·· 50.5	198°15.8	·· 53.3	155°02.6	·· 49.3	163°02.1	·· 22.6
22	14°03.2	104°45.8	50.5	213°16.9	52.8	170°04.5	49.5	178°04.3	22.7
23	29°05.7	119°45.4	50.6	228°18.0	52.3	185°06.5	49.6	193°06.5	22.8
Mer.pass. 21:04		ν -0.5′	d 0.1′	ν 1.1′	d 0.5′	ν 2.0′	d 0.2′	ν 2.2′	d 0.1′
		m -4.41		m 1.39		m -1.68		m 0.87	

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	44°08.1	134°44.9	S26°50.7	243°19.2	N09°51.8	200°08.5	S08°49.8	208°08.7	S04°22.9
1	59°10.6	149°44.5	50.7	258°20.3	51.3	215°10.4	50.0	223°10.9	23.0
2	74°13.1	164°44.0	50.8	273°21.4	50.8	230°12.4	50.2	238°13.1	23.1
3	89°15.5	179°43.6	·· 50.8	288°22.5	·· 50.2	245°14.4	·· 50.4	253°15.3	·· 23.2
4	104°18.0	194°43.1	50.9	303°23.7	49.7	260°16.3	50.6	268°17.5	23.3
5	119°20.5	209°42.7	50.9	318°24.8	49.2	275°18.3	50.8	283°19.7	23.4
6	134°22.9	224°42.3	S26°51.0	333°25.9	N09°48.7	290°20.2	S08°51.0	298°21.9	S04°23.5
7	149°25.4	239°41.8	51.0	348°27.1	48.2	305°22.2	51.2	313°24.1	23.6
8	164°27.9	254°41.4	51.1	3°28.2	47.7	320°24.2	51.4	328°26.3	23.7
9	179°30.3	269°40.9	·· 51.1	18°29.3	·· 47.2	335°26.1	·· 51.6	343°28.5	·· 23.8
10	194°32.8	284°40.5	51.2	33°30.5	46.7	350°28.1	51.8	358°30.7	23.9
11	209°35.3	299°40.1	51.2	48°31.6	46.2	5°30.1	51.9	13°32.9	24.0
12	224°37.7	314°39.6	S26°51.3	63°32.7	N09°45.7	20°32.0	S08°52.1	28°35.1	S04°24.1
13	239°40.2	329°39.2	51.3	78°33.9	45.2	35°34.0	52.3	43°37.3	24.2
14	254°42.6	344°38.8	51.4	93°35.0	44.7	50°35.9	52.5	58°39.5	24.4
15	269°45.1	359°38.3	·· 51.4	108°36.1	·· 44.2	65°37.9	·· 52.7	73°41.7	·· 24.5
16	284°47.6	14°37.9	51.5	123°37.2	43.7	80°39.9	52.9	88°43.9	24.6
17	299°50.0	29°37.4	51.5	138°38.4	43.2	95°41.8	53.1	103°46.1	24.7
18	314°52.5	44°37.0	S26°51.5	153°39.5	N09°42.7	110°43.8	S08°53.3	118°48.3	S04°24.8
19	329°55.0	59°36.6	51.6	168°40.6	42.2	125°45.8	53.5	133°50.5	24.9
20	344°57.4	74°36.1	51.6	183°41.8	41.7	140°47.7	53.7	148°52.7	25.0
21	359°59.9	89°35.7	·· 51.7	198°42.9	·· 41.2	155°49.7	·· 53.9	163°54.9	·· 25.1
22	15°02.4	104°35.3	51.7	213°44.0	40.7	170°51.7	54.1	178°57.1	25.2
23	30°04.8	119°34.8	51.7	228°45.2	40.2	185°53.6	54.2	193°59.3	25.3
Mer.pass. 21:00		ν -0.4′	d 0.1′	ν 1.1′	d 0.5′	ν 2.0′	d 0.2′	ν 2.2′	d 0.1′
		m -4.42		m 1.38		m -1.68		m 0.87	

Stars

	SHA	Dec
Alpheratz	358°08.3	28°59.5
Ankaa	353°39.1	-42°24.5
Schedar	350°07.7	56°26.4
Diphda	349°19.8	-18°05.2
Achernar	335°44.1	-57°19.9
Hamal	328°27.7	23°22.6
Polaris	326°16.6	89°10.9
Acamar	315°36.2	-40°22.7
Menkar	314°40.0	4°01.1
Mirfak	309°14.5	49°47.8
Aldebaran	291°16.8	16°28.4
Rigel	281°35.0	-8°13.3
Capella	281°09.8	45°58.7
Bellatrix	278°57.7	6°20.0
Elnath	278°42.9	28°35.5
Alnilam	276°10.6	-1°12.7
Betelgeuse	271°27.2	7°24.3
Canopus	264°06.5	-52°40.9
Sirius	258°54.8	-16°41.3
Adhara	255°31.3	-28°56.6
Procyon	245°24.9	5°16.4
Pollux	243°57.1	28°04.2
Avior	234°27.8	-59°26.7
Suhail	223°10.2	-43°21.2
Miaplacidus	221°44.9	-69°38.2
Alphard	218°19.9	-8°34.6
Regulus	208°09.3	12°03.5
Dubhe	194°21.5	61°50.8
Denebola	182°58.5	14°40.6
Gienah	176°17.4	-17°26.2
Acrux	173°37.0	-62°59.6
Gacrux	172°28.4	-57°00.4
Alioth	166°42.3	56°03.5
Spica	158°57.0	-11°03.8
Alkaid	153°18.4	49°24.3
Hadar	149°22.9	-60°16.9
Menkent	148°36.5	-36°16.6
Arcturus	146°18.1	19°16.8
Rigil Kent.	140°25.5	-60°45.3
Kochab	137°20.2	74°13.9
Zuben'ubi	137°32.5	-15°57.8
Alphecca	126°31.8	26°46.7
Antares	112°56.3	-26°23.4
Atria	108°20.3	-68°59.8
Sabik	102°40.5	-15°42.1
Shaula	96°55.0	-37°05.5
Rasalhague	96°29.1	12°34.6
Eltanin	90°57.7	51°29.7
Kaus Aust.	84°16.1	-34°23.7
Vega	80°55.6	38°46.3
Nunki	76°28.4	-26°19.2
Altair	62°31.9	8°49.3
Peacock	53°57.3	-56°47.9
Deneb	49°48.0	45°13.2
Enif	34°10.8	9°47.6
Al Na'ir	28°13.8	-47°03.2
Fomalhaut	15°50.4	-29°43.3
Scheat	14°16.6	27°59.2
Markab	14°02.2	15°06.5

Nov 03 Tue	SHA	Mer.pass
Venus	92°57.0	15:00
Mars	200°15.3	07:50
Jupiter	156°24.4	10:44
Saturn	164°13.5	10:13

Nov 04 Wed	SHA	Mer.pass
Venus	91°46.7	15:01
Mars	199°43.1	07:48
Jupiter	156°12.4	10:41
Saturn	164°07.0	10:09

Nov 05 Thu	SHA	Mer.pass
Venus	90°36.8	15:01
Mars	199°11.0	07:46
Jupiter	156°00.3	10:38
Saturn	164°00.6	10:06

Horizontal parallax	
Venus:	0.2
Mars:	0.1

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	184°06.0	S14°58.0	113°19.8	11.1′	S21°36.2	1.3′	54.6′
1	199°06.0	58.8	127°49.9	11.1′	21°34.9	1.4′	54.6′
2	214°06.0	14°59.6	142°20.0	11.1′	21°33.5	1.5′	54.7′
3	229°06.0	15°00.3	156°50.1	11.1′	21°32.0	1.6′	54.7′
4	244°06.0	01.1	171°20.1	11.1′	21°30.4	1.7′	54.7′
5	259°06.0	01.9	185°50.2	11.1′	21°28.7	1.9′	54.7′
6	274°06.0	S15°02.7	200°20.2	11.0′	S21°26.8	1.9′	54.7′
7	289°06.0	03.5	214°50.3	11.0′	21°24.9	2.0′	54.8′
8	304°06.0	04.2	229°20.3	11.0′	21°22.9	2.2′	54.8′
9	319°06.0	·· 05.0	243°50.4	11.0′	21°20.7	2.2′	54.8′
10	334°06.0	05.8	258°20.4	11.0′	21°18.5	2.4′	54.8′
11	349°06.0	06.6	272°50.4	11.0′	21°16.1	2.4′	54.8′
12	4°06.0	S15°07.4	287°20.4	11.0′	S21°13.7	2.6′	54.9′
13	19°06.0	08.1	301°50.4	11.0′	21°11.1	2.6′	54.9′
14	34°06.0	08.9	316°20.4	11.0′	21°08.5	2.8′	54.9′
15	49°06.0	·· 09.7	330°50.4	11.0′	21°05.7	2.9′	54.9′
16	64°06.0	10.5	345°20.4	11.0′	21°02.8	3.0′	55.0′
17	79°06.0	11.3	359°50.3	11.0′	20°59.8	3.0′	55.0′
18	94°06.0	S15°12.0	14°20.3	11.0′	S20°56.8	3.2′	55.0′
19	109°06.0	12.8	28°50.3	11.0′	20°53.6	3.3′	55.0′
20	124°06.0	13.6	43°20.2	11.0′	20°50.3	3.4′	55.0′
21	139°06.0	·· 14.4	57°50.2	11.0′	20°46.9	3.5′	55.1′
22	154°06.0	15.1	72°20.2	11.0′	20°43.4	3.6′	55.1′
23	169°06.0	15.9	86°50.1	11.0′	20°39.8	3.8′	55.1′
	SD = 16.1′	d = 0.8′	SD = 14.9′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	184°06.0	S15°16.7	101°20.1	11.0′	S20°36.0	3.8′	55.1′
1	199°06.0	17.5	115°50.0	11.0′	20°32.2	3.9′	55.2′
2	214°06.0	18.2	130°20.0	10.9′	20°28.3	4.0′	55.2′
3	229°05.9	·· 19.0	144°49.9	10.9′	20°24.3	4.2′	55.2′
4	244°05.9	19.8	159°19.9	10.9′	20°20.1	4.2′	55.2′
5	259°05.9	20.6	173°49.8	10.9′	20°15.9	4.3′	55.3′
6	274°05.9	S15°21.3	188°19.8	10.9′	S20°11.6	4.5′	55.3′
7	289°05.9	22.1	202°49.7	10.9′	20°07.1	4.5′	55.3′
8	304°05.9	22.9	217°19.7	10.9′	20°02.6	4.7′	55.4′
9	319°05.9	·· 23.6	231°49.6	10.9′	19°57.9	4.7′	55.4′
10	334°05.9	24.4	246°19.6	10.9′	19°53.2	4.9′	55.4′
11	349°05.9	25.2	260°49.5	10.9′	19°48.3	4.9′	55.4′
12	4°05.9	S15°25.9	275°19.5	10.9′	S19°43.4	5.1′	55.5′
13	19°05.9	26.7	289°49.4	11.0′	19°38.3	5.2′	55.5′
14	34°05.8	27.5	304°19.4	11.0′	19°33.1	5.2′	55.5′
15	49°05.8	·· 28.3	318°49.3	11.0′	19°27.9	5.4′	55.6′
16	64°05.8	29.0	333°19.3	11.0′	19°22.5	5.5′	55.6′
17	79°05.8	29.8	347°49.2	11.0′	19°17.0	5.5′	55.6′
18	94°05.8	S15°30.6	2°19.2	11.0′	S19°11.5	5.7′	55.6′
19	109°05.8	31.3	16°49.1	11.0′	19°05.8	5.8′	55.7′
20	124°05.8	32.1	31°19.1	11.0′	19°00.0	5.9′	55.7′
21	139°05.8	·· 32.8	45°49.1	11.0′	18°54.1	5.9′	55.7′
22	154°05.7	33.6	60°19.0	11.0′	18°48.2	6.1′	55.8′
23	169°05.7	34.4	74°49.0	11.0′	18°42.1	6.2′	55.8′
	SD = 16.1′	d = 0.8′	SD = 15.0′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	184°05.7	S15°35.1	89°19.0	11.0′	S18°35.9	6.3′	55.8′
1	199°05.7	35.9	103°48.9	11.0′	18°29.6	6.3′	55.9′
2	214°05.7	36.7	118°18.9	11.0′	18°23.3	6.5′	55.9′
3	229°05.7	·· 37.4	132°48.9	11.0′	18°16.8	6.6′	55.9′
4	244°05.7	38.2	147°18.9	11.0′	18°10.2	6.7′	56.0′
5	259°05.6	39.0	161°48.9	11.0′	18°03.5	6.7′	56.0′
6	274°05.6	S15°39.7	176°18.9	11.0′	S17°56.8	6.9′	56.0′
7	289°05.6	40.5	190°48.9	11.0′	17°49.9	7.0′	56.1′
8	304°05.6	41.2	205°18.9	11.0′	17°42.9	7.0′	56.1′
9	319°05.6	·· 42.0	219°48.9	11.0′	17°35.9	7.2′	56.1′
10	334°05.6	42.8	234°18.9	11.0′	17°28.7	7.3′	56.2′
11	349°05.5	43.5	248°48.9	11.0′	17°21.4	7.3′	56.2′
12	4°05.5	S15°44.3	263°18.9	11.0′	S17°14.1	7.5′	56.2′
13	19°05.5	45.0	277°48.9	11.0′	17°06.6	7.5′	56.3′
14	34°05.5	45.8	292°18.9	11.0′	16°59.1	7.7′	56.3′
15	49°05.5	·· 46.5	306°48.9	11.0′	16°51.4	7.7′	56.3′
16	64°05.4	47.3	321°18.9	11.0′	16°43.7	7.8′	56.4′
17	79°05.4	48.1	335°49.0	11.0′	16°35.9	7.9′	56.4′
18	94°05.4	S15°48.8	350°19.0	11.0′	S16°28.0	8.1′	56.4′
19	109°05.4	49.6	4°49.0	11.0′	16°19.9	8.1′	56.5′
20	124°05.4	50.3	19°19.1	11.0′	16°11.8	8.2′	56.5′
21	139°05.3	·· 51.1	33°49.1	11.0′	16°03.6	8.3′	56.5′
22	154°05.3	51.8	48°19.1	11.0′	15°55.3	8.4′	56.6′
23	169°05.3	52.6	62°49.2	11.0′	15°46.9	8.4′	56.6′
	SD = 16.1′	d = 0.8′	SD = 15.2′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	06:18	07:42	09:16	14:10	15:43	17:08
N 70°	06:12	07:28	08:45	14:41	15:58	17:13
68°	06:08	07:16	08:23	15:03	16:10	17:18
66°	06:04	07:06	08:06	15:20	16:20	17:22
64°	06:00	06:57	07:52	15:35	16:29	17:26
62°	05:57	06:50	07:40	15:47	16:36	17:29
60°	05:54	06:44	07:30	15:57	16:43	17:32
N 58°	05:51	06:38	07:21	16:06	16:48	17:35
56°	05:49	06:33	07:13	16:13	16:53	17:38
54°	05:46	06:28	07:06	16:20	16:58	17:40
52°	05:44	06:24	07:00	16:26	17:02	17:43
50°	05:42	06:20	06:54	16:32	17:06	17:45
45°	05:37	06:12	06:42	16:44	17:15	17:50
N 40°	05:32	06:04	06:32	16:54	17:23	17:55
35°	05:27	05:57	06:24	17:03	17:29	17:59
30°	05:23	05:51	06:16	17:11	17:36	18:04
20°	05:14	05:40	06:03	17:24	17:47	18:13
N 10°	05:04	05:29	05:51	17:36	17:58	18:23
0°	04:54	05:19	05:40	17:47	18:09	18:33
S 10°	04:42	05:07	05:29	17:58	18:20	18:46
20°	04:27	04:54	05:17	18:10	18:34	19:01
30°	04:07	04:38	05:03	18:25	18:50	19:20
35°	03:55	04:28	04:55	18:33	19:00	19:33
40°	03:41	04:16	04:46	18:42	19:12	19:48
45°	03:22	04:02	04:35	18:53	19:26	20:06
S 50°	02:58	03:45	04:22	19:07	19:44	20:31
52°	02:46	03:36	04:15	19:13	19:52	20:43
54°	02:31	03:27	04:09	19:20	20:02	20:58
56°	02:14	03:16	04:01	19:28	20:13	21:16
58°	01:53	03:04	03:52	19:37	20:26	21:38
S 60°	01:24	02:49	03:42	19:47	20:41	22:08

Lat.	**Moonrise** Tue	Wed	Thu	**Moonset** Tue	Wed	Thu
N 72°	▬	▬	17:07	▬	▬	20:29
N 70°	▬	16:50	16:20	▬	19:00	21:14
68°	15:51	15:51	15:49	18:15	19:58	21:44
66°	14:59	15:17	15:26	19:07	20:32	22:06
64°	14:27	14:52	15:08	19:39	20:57	22:24
62°	14:03	14:32	14:53	20:03	21:16	22:38
60°	13:44	14:16	14:40	20:21	21:32	22:50
N 58°	13:28	14:02	14:29	20:37	21:45	23:00
56°	13:14	13:51	14:20	20:50	21:56	23:09
54°	13:03	13:40	14:11	21:02	22:06	23:17
52°	12:52	13:31	14:04	21:12	22:15	23:24
50°	12:43	13:23	13:57	21:21	22:23	23:31
45°	12:23	13:05	13:42	21:40	22:40	23:44
N 40°	12:08	12:51	13:30	21:56	22:54	23:55
35°	11:54	12:39	13:20	22:09	23:06	·· ··
30°	11:42	12:28	13:11	22:20	23:16	·· ··
20°	11:22	12:09	12:55	22:40	23:33	·· ··
N 10°	11:05	11:53	12:41	22:57	23:48	·· ··
0°	10:49	11:38	12:28	23:13	·· ··	00:02
S 10°	10:32	11:23	12:15	23:28	·· ··	00:16
20°	10:15	11:07	12:01	23:45	·· ··	00:31
30°	09:55	10:49	11:45	·· ··	00:04	00:48
35°	09:43	10:38	11:36	·· ··	00:16	00:58
40°	09:30	10:26	11:26	·· ··	00:28	01:10
45°	09:14	10:11	11:13	·· ··	00:44	01:23
S 50°	08:54	09:53	10:58	00:19	01:02	01:39
52°	08:45	09:45	10:51	00:29	01:11	01:46
54°	08:34	09:35	10:43	00:39	01:20	01:55
56°	08:22	09:24	10:34	00:51	01:31	02:04
58°	08:09	09:12	10:24	01:05	01:44	02:15
S 60°	07:53	08:58	10:12	01:21	01:59	02:27

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 7-9 31-50%
03	16:24	16:24	11:44	17:01	04:36	
04	16:24	16:23	11:44	17:50	05:26	
05	16:23	16:22	11:44	18:40	06:15	

November 06, 07, 08 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	45°07.3	134°34.4	S26°51.8	243°46.3	N09°39.7	200°55.6	S08°54.4	209°01.5	S04°25.4
1	60°09.8	149°34.0	51.8	258°47.5	39.2	215°57.5	54.6	224°03.7	25.5
2	75°12.2	164°33.6	51.8	273°48.6	38.7	230°59.5	54.8	239°05.9	25.6
3	90°14.7	179°33.1	·· 51.8	288°49.7	·· 38.2	246°01.5	·· 55.0	254°08.1	·· 25.7
4	105°17.1	194°32.7	51.9	303°50.9	37.7	261°03.4	55.2	269°10.3	25.8
5	120°19.6	209°32.3	51.9	318°52.0	37.2	276°05.4	55.4	284°12.5	25.9
6	135°22.1	224°31.8	S26°51.9	333°53.1	N09°36.6	291°07.4	S08°55.6	299°14.7	S04°26.0
7	150°24.5	239°31.4	52.0	348°54.3	36.1	306°09.3	55.8	314°16.9	26.1
8	165°27.0	254°31.0	52.0	3°55.4	35.6	321°11.3	56.0	329°19.1	26.2
9	180°29.5	269°30.6	·· 52.0	18°56.5	·· 35.1	336°13.3	·· 56.2	344°21.3	·· 26.3
10	195°31.9	284°30.1	52.0	33°57.7	34.6	351°15.2	56.3	359°23.5	26.4
11	210°34.4	299°29.7	52.0	48°58.8	34.1	6°17.2	56.5	14°25.7	26.5
12	225°36.9	314°29.3	S26°52.1	63°59.9	N09°33.6	21°19.1	S08°56.7	29°27.9	S04°26.7
13	240°39.3	329°28.9	52.1	79°01.1	33.1	36°21.1	56.9	44°30.1	26.8
14	255°41.8	344°28.4	52.1	94°02.2	32.6	51°23.1	57.1	59°32.3	26.9
15	270°44.2	359°28.0	·· 52.1	109°03.4	·· 32.1	66°25.0	·· 57.3	74°34.5	·· 27.0
16	285°46.7	14°27.6	52.1	124°04.5	31.6	81°27.0	57.5	89°36.6	27.1
17	300°49.2	29°27.2	52.1	139°05.6	31.1	96°29.0	57.7	104°38.8	27.2
18	315°51.6	44°26.8	S26°52.2	154°06.8	N09°30.6	111°30.9	S08°57.9	119°41.0	S04°27.3
19	330°54.1	59°26.3	52.2	169°07.9	30.1	126°32.9	58.1	134°43.2	27.4
20	345°56.6	74°25.9	52.2	184°09.1	29.6	141°34.9	58.3	149°45.4	27.5
21	0°59.0	89°25.5	·· 52.2	199°10.2	·· 29.1	156°36.8	·· 58.4	164°47.6	·· 27.6
22	16°01.5	104°25.1	52.2	214°11.3	28.6	171°38.8	58.6	179°49.8	27.7
23	31°04.0	119°24.7	52.2	229°12.5	28.1	186°40.8	58.8	194°52.0	27.8
Mer.pass. 20:56		ν -0.4′ d 0.0′		ν 1.1′ d 0.5′		ν 2.0′ d 0.2′		ν 2.2′ d 0.1′	
m -4.43		m 1.37		m -1.68		m 0.87			

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	46°06.4	134°24.3	S26°52.2	244°13.6	N09°27.6	201°42.7	S08°59.0	209°54.2	S04°27.9
1	61°08.9	149°23.8	52.2	259°14.8	27.1	216°44.7	59.2	224°56.4	28.0
2	76°11.4	164°23.4	52.2	274°15.9	26.6	231°46.6	59.4	239°58.6	28.1
3	91°13.8	179°23.0	·· 52.2	289°17.0	·· 26.1	246°48.6	·· 59.6	255°00.8	·· 28.2
4	106°16.3	194°22.6	52.2	304°18.2	25.6	261°50.6	08°59.8	270°03.0	28.3
5	121°18.7	209°22.2	52.2	319°19.3	25.1	276°52.5	09°00.0	285°05.2	28.4
6	136°21.2	224°21.8	S26°52.2	334°20.5	N09°24.6	291°54.5	S09°00.2	300°07.4	S04°28.5
7	151°23.7	239°21.4	52.2	349°21.6	24.1	306°56.5	00.3	315°09.6	28.6
8	166°26.1	254°20.9	52.2	4°22.7	23.6	321°58.4	00.5	330°11.8	28.7
9	181°28.6	269°20.5	·· 52.2	19°23.9	·· 23.0	337°00.4	·· 00.7	345°14.0	·· 28.8
10	196°31.1	284°20.1	52.2	34°25.0	22.5	352°02.4	00.9	0°16.2	28.9
11	211°33.5	299°19.7	52.2	49°26.2	22.0	7°04.3	01.1	15°18.4	29.0
12	226°36.0	314°19.3	S26°52.2	64°27.3	N09°21.5	22°06.3	S09°01.3	30°20.6	S04°29.1
13	241°38.5	329°18.9	52.2	79°28.4	21.0	37°08.3	01.5	45°22.8	29.2
14	256°40.9	344°18.5	52.2	94°29.6	20.5	52°10.2	01.7	60°25.0	29.4
15	271°43.4	359°18.1	·· 52.2	109°30.7	·· 20.0	67°12.2	·· 01.9	75°27.2	·· 29.5
16	286°45.9	14°17.7	52.2	124°31.9	19.5	82°14.2	02.1	90°29.4	29.6
17	301°48.3	29°17.3	52.2	139°33.0	19.0	97°16.1	02.2	105°31.6	29.7
18	316°50.8	44°16.9	S26°52.1	154°34.2	N09°18.5	112°18.1	S09°02.4	120°33.8	S04°29.8
19	331°53.2	59°16.5	52.1	169°35.3	18.0	127°20.1	02.6	135°36.0	29.9
20	346°55.7	74°16.1	52.1	184°36.5	17.5	142°22.0	02.8	150°38.2	30.0
21	1°58.2	89°15.7	·· 52.1	199°37.6	·· 17.0	157°24.0	·· 03.0	165°40.4	·· 30.1
22	17°00.6	104°15.3	52.1	214°38.7	16.5	172°25.9	03.2	180°42.6	30.2
23	32°03.1	119°14.9	52.1	229°39.9	16.0	187°27.9	03.4	195°44.9	30.3
Mer.pass. 20:52		ν -0.4′ d 0.0′		ν 1.1′ d 0.5′		ν 2.0′ d 0.2′		ν 2.2′ d 0.1′	
m -4.44		m 1.37		m -1.69		m 0.87			

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	47°05.6	134°14.5	S26°52.0	244°41.0	N09°15.5	202°29.9	S09°03.6	210°47.1	S04°30.4
1	62°08.0	149°14.1	52.0	259°42.2	15.0	217°31.8	03.8	225°49.3	30.5
2	77°10.5	164°13.7	52.0	274°43.3	14.5	232°33.8	03.9	240°51.5	30.6
3	92°13.0	179°13.3	·· 52.0	289°44.5	·· 14.0	247°35.8	·· 04.1	255°53.7	·· 30.7
4	107°15.4	194°12.9	51.9	304°45.6	13.5	262°37.7	04.3	270°55.9	30.8
5	122°17.9	209°12.5	51.9	319°46.8	13.0	277°39.7	04.5	285°58.1	30.9
6	137°20.3	224°12.1	S26°51.9	334°47.9	N09°12.5	292°41.7	S09°04.7	301°00.3	S04°31.0
7	152°22.8	239°11.7	51.9	349°49.0	12.0	307°43.6	04.9	316°02.5	31.1
8	167°25.3	254°11.3	51.8	4°50.2	11.5	322°45.6	05.1	331°04.7	31.2
9	182°27.7	269°10.9	·· 51.8	19°51.3	·· 11.0	337°47.6	·· 05.3	346°06.9	·· 31.3
10	197°30.2	284°10.5	51.8	34°52.5	10.5	352°49.5	05.5	1°09.1	31.4
11	212°32.7	299°10.1	51.7	49°53.6	10.0	7°51.5	05.6	16°11.3	31.5
12	227°35.1	314°09.7	S26°51.7	64°54.8	N09°09.4	22°53.5	S09°05.8	31°13.5	S04°31.6
13	242°37.6	329°09.3	51.7	79°55.9	08.9	37°55.4	06.0	46°15.7	31.7
14	257°40.1	344°08.9	51.6	94°57.1	08.4	52°57.4	06.2	61°17.9	31.8
15	272°42.5	359°08.5	·· 51.6	109°58.2	·· 07.9	67°59.4	·· 06.4	76°20.1	·· 31.9
16	287°45.0	14°08.2	51.6	124°59.4	07.4	83°01.3	06.6	91°22.3	32.0
17	302°47.5	29°07.8	51.5	140°00.5	06.9	98°03.3	06.8	106°24.5	32.1
18	317°49.9	44°07.4	S26°51.5	155°01.7	N09°06.4	113°05.3	S09°07.0	121°26.7	S04°32.2
19	332°52.4	59°07.0	51.5	170°02.8	05.9	128°07.2	07.2	136°28.9	32.3
20	347°54.8	74°06.6	51.4	185°04.0	05.4	143°09.2	07.3	151°31.1	32.4
21	2°57.3	89°06.2	·· 51.4	200°05.1	·· 04.9	158°11.2	·· 07.5	166°33.3	·· 32.5
22	17°59.8	104°05.8	51.3	215°06.3	04.4	173°13.1	07.7	181°35.5	32.6
23	33°02.2	119°05.5	51.3	230°07.4	03.9	188°15.1	07.9	196°37.7	32.7
Mer.pass. 20:48		ν -0.4′ d 0.0′		ν 1.1′ d 0.5′		ν 2.0′ d 0.2′		ν 2.2′ d 0.1′	
m -4.45		m 1.36		m -1.69		m 0.87			

Stars

	SHA	Dec
Alpheratz	358°08.3	28°59.5
Ankaa	353°39.1	-42°24.5
Schedar	350°07.7	56°26.4
Diphda	349°19.8	-18°05.3
Achernar	335°44.1	-57°19.9
Hamal	328°27.7	23°22.6
Polaris	326°16.7	89°10.9
Acamar	315°36.2	-40°22.7
Menkar	314°40.0	4°01.1
Mirfak	309°14.5	49°47.8
Aldebaran	291°16.8	16°28.4
Rigel	281°35.0	-8°13.3
Capella	281°09.8	45°58.7
Bellatrix	278°57.6	6°20.0
Elnath	278°42.9	28°35.5
Alnilam	276°10.6	-1°12.7
Betelgeuse	271°27.2	7°24.3
Canopus	264°06.5	-52°40.9
Sirius	258°54.8	-16°41.3
Adhara	255°31.3	-28°56.6
Procyon	245°24.8	5°16.4
Pollux	243°57.1	28°04.2
Avior	234°27.8	-59°26.7
Suhail	223°10.2	-43°21.2
Miaplacidus	221°44.9	-69°38.2
Alphard	218°19.8	-8°34.6
Regulus	208°09.3	12°03.5
Dubhe	194°21.5	61°50.8
Denebola	182°58.5	14°40.6
Gienah	176°17.4	-17°26.2
Acrux	173°37.0	-62°59.6
Gacrux	172°28.4	-57°00.4
Alioth	166°42.3	56°03.5
Spica	158°57.0	-11°03.8
Alkaid	153°18.3	49°24.3
Hadar	149°22.9	-60°16.9
Menkent	148°36.5	-36°16.6
Arcturus	146°18.1	19°16.8
Rigil Kent.	140°25.5	-60°45.3
Kochab	137°20.2	74°13.9
Zuben'ubi	137°32.5	-15°57.8
Alphecca	126°31.8	26°46.7
Antares	112°56.3	-26°23.4
Atria	108°20.3	-68°59.8
Sabik	102°40.5	-15°42.1
Shaula	96°55.0	-37°05.5
Rasalhague	96°29.1	12°34.6
Eltanin	90°57.8	51°29.7
Kaus Aust.	84°16.1	-34°23.7
Vega	80°55.6	38°46.3
Nunki	76°28.4	-26°19.2
Altair	62°31.9	8°49.3
Peacock	53°57.3	-56°47.9
Deneb	49°48.0	45°13.2
Enif	34°10.8	9°47.6
Al Na'ir	28°13.8	-47°03.2
Fomalhaut	15°50.4	-29°43.3
Scheat	14°16.6	27°59.2
Markab	14°02.2	15°06.5

Nov 06 Fri	SHA	Mer.pass
Venus	89°27.1	15:02
Mars	198°39.0	07:44
Jupiter	155°48.3	10:35
Saturn	163°54.2	10:02

Nov 07 Sat	SHA	Mer.pass
Venus	88°17.8	15:03
Mars	198°07.2	07:43
Jupiter	155°36.3	10:32
Saturn	163°47.8	09:59

Nov 08 Sun	SHA	Mer.pass
Venus	87°08.9	15:03
Mars	197°35.5	07:41
Jupiter	155°24.3	10:29
Saturn	163°41.5	09:55

Horizontal parallax	
Venus:	0.2
Mars:	0.1

h	Sun		Moon				
Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	184°05.3	S15°53.3	77°19.2	11.0′	S15°38.5	8.6′	56.7′
1	199°05.2	54.1	91°49.3	11.0′	15°29.9	8.7′	56.7′
2	214°05.2	54.8	106°19.3	11.0′	15°21.2	8.7′	56.7′
3	229°05.2	·· 55.6	120°49.3	11.0′	15°12.5	8.9′	56.8′
4	244°05.2	56.3	135°19.4	11.0′	15°03.6	8.9′	56.8′
5	259°05.2	57.1	149°49.4	11.1′	14°54.7	9.0′	56.8′
6	274°05.1	S15°57.8	164°19.5	11.1′	S14°45.7	9.1′	56.9′
7	289°05.1	58.6	178°49.5	11.1′	14°36.6	9.2′	56.9′
8	304°05.1	15°59.3	193°19.6	11.1′	14°27.4	9.3′	57.0′
9	319°05.1	16°00.1	207°49.7	11.1′	14°18.1	9.3′	57.0′
10	334°05.0	00.8	222°19.7	11.1′	14°08.8	9.5′	57.0′
11	349°05.0	01.6	236°49.8	11.1′	13°59.3	9.5′	57.1′
12	4°05.0	S16°02.3	251°19.8	11.0′	S13°49.8	9.6′	57.1′
13	19°04.9	03.1	265°49.9	11.0′	13°40.2	9.7′	57.1′
14	34°04.9	03.8	280°19.9	11.0′	13°30.5	9.8′	57.2′
15	49°04.9	·· 04.6	294°49.9	11.0′	13°20.7	9.9′	57.2′
16	64°04.9	05.3	309°20.0	11.0′	13°10.8	10.0′	57.3′
17	79°04.8	06.1	323°50.0	11.0′	13°00.8	10.0′	57.3′
18	94°04.8	S16°06.8	338°20.1	11.0′	S12°50.8	10.1′	57.3′
19	109°04.8	07.5	352°50.1	11.0′	12°40.7	10.2′	57.4′
20	124°04.7	08.3	7°20.1	11.0′	12°30.5	10.3′	57.4′
21	139°04.7	·· 09.0	21°50.2	11.0′	12°20.2	10.3′	57.5′
22	154°04.7	09.8	36°20.2	11.0′	12°09.9	10.4′	57.5′
23	169°04.7	10.5	50°50.2	11.0′	11°59.5	10.6′	57.5′
	SD = 16.1′	d = 0.8′	SD = 15.5′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	184°04.6	S16°11.3	65°20.2	11.0′	S11°48.9	10.5′	57.6′
1	199°04.6	12.0	79°50.2	11.0′	11°38.4	10.7′	57.6′
2	214°04.6	12.7	94°20.2	11.0′	11°27.7	10.7′	57.7′
3	229°04.5	·· 13.5	108°50.2	11.0′	11°17.0	10.9′	57.7′
4	244°04.5	14.2	123°20.2	11.0′	11°06.1	10.8′	57.7′
5	259°04.5	15.0	137°50.2	11.0′	10°55.3	11.0′	57.8′
6	274°04.4	S16°15.7	152°20.2	11.0′	S10°44.3	11.0′	57.8′
7	289°04.4	16.4	166°50.2	11.0′	10°33.3	11.1′	57.9′
8	304°04.4	17.2	181°20.1	10.9′	10°22.2	11.2′	57.9′
9	319°04.3	·· 17.9	195°50.1	10.9′	10°11.0	11.3′	57.9′
10	334°04.3	18.6	210°20.0	10.9′	09°59.7	11.3′	58.0′
11	349°04.3	19.4	224°49.9	10.9′	09°48.4	11.4′	58.0′
12	4°04.2	S16°20.1	239°19.9	10.9′	S09°37.0	11.4′	58.1′
13	19°04.2	20.9	253°49.8	10.9′	09°25.6	11.5′	58.1′
14	34°04.1	21.6	268°19.7	10.9′	09°14.1	11.6′	58.2′
15	49°04.1	·· 22.3	282°49.5	10.9′	09°02.5	11.7′	58.2′
16	64°04.1	23.1	297°19.4	10.9′	08°50.8	11.7′	58.2′
17	79°04.0	23.8	311°49.3	10.8′	08°39.1	11.7′	58.3′
18	94°04.0	S16°24.5	326°19.1	10.8′	S08°27.4	11.9′	58.3′
19	109°04.0	25.3	340°48.9	10.8′	08°15.5	11.9′	58.4′
20	124°03.9	26.0	355°18.8	10.8′	08°03.6	12.0′	58.4′
21	139°03.9	·· 26.7	9°48.5	10.8′	07°51.6	12.0′	58.4′
22	154°03.8	27.5	24°18.3	10.8′	07°39.6	12.1′	58.5′
23	169°03.8	28.2	38°48.1	10.7′	07°27.5	12.1′	58.5′
	SD = 16.1′	d = 0.7′	SD = 15.7′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	184°03.8	S16°28.9	53°17.8	10.7′	S07°15.4	12.2′	58.6′
1	199°03.7	29.6	67°47.6	10.7′	07°03.2	12.2′	58.6′
2	214°03.7	30.4	82°17.3	10.7′	06°51.0	12.4′	58.6′
3	229°03.6	·· 31.1	96°47.0	10.7′	06°38.6	12.3′	58.7′
4	244°03.6	31.8	111°16.6	10.6′	06°26.3	12.4′	58.7′
5	259°03.6	32.6	125°46.3	10.6′	06°13.9	12.5′	58.8′
6	274°03.5	S16°33.3	140°15.9	10.6′	S06°01.4	12.5′	58.8′
7	289°03.5	34.0	154°45.5	10.6′	05°48.9	12.6′	58.8′
8	304°03.4	34.7	169°15.1	10.6′	05°36.3	12.6′	58.9′
9	319°03.4	·· 35.5	183°44.6	10.5′	05°23.7	12.7′	58.9′
10	334°03.3	36.2	198°14.2	10.5′	05°11.0	12.7′	59.0′
11	349°03.3	36.9	212°43.7	10.5′	04°58.3	12.7′	59.0′
12	4°03.3	S16°37.6	227°13.1	10.5′	S04°45.6	12.8′	59.0′
13	19°03.2	38.4	241°42.6	10.4′	04°32.8	12.9′	59.1′
14	34°03.2	39.1	256°12.0	10.4′	04°19.9	12.9′	59.1′
15	49°03.1	·· 39.8	270°41.4	10.4′	04°07.0	12.9′	59.2′
16	64°03.1	40.5	285°10.8	10.3′	03°54.1	13.0′	59.2′
17	79°03.0	41.2	299°40.1	10.3′	03°41.1	13.0′	59.2′
18	94°03.0	S16°42.0	314°09.4	10.3′	S03°28.1	13.0′	59.3′
19	109°02.9	42.7	328°38.7	10.2′	03°15.1	13.1′	59.3′
20	124°02.9	43.4	343°08.0	10.2′	03°02.0	13.1′	59.4′
21	139°02.8	·· 44.1	357°37.2	10.2′	02°48.9	13.2′	59.4′
22	154°02.8	44.9	12°06.4	10.1′	02°35.7	13.2′	59.4′
23	169°02.8	45.6	26°35.5	10.1′	02°22.5	13.2′	59.5′
	SD = 16.1′	d = 0.7′	SD = 16.0′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	06:29	07:56	09:37	13:49	15:30	16:57
N 70°	06:23	07:40	09:01	14:25	15:47	17:03
68°	06:17	07:26	08:36	14:50	16:00	17:09
66°	06:12	07:15	08:17	15:10	16:11	17:14
64°	06:08	07:06	08:01	15:25	16:21	17:19
62°	06:04	06:58	07:48	15:38	16:29	17:23
60°	06:00	06:51	07:37	15:49	16:36	17:26
N 58°	05:57	06:44	07:28	15:59	16:42	17:29
56°	05:54	06:39	07:19	16:07	16:48	17:33
54°	05:51	06:34	07:12	16:15	16:53	17:35
52°	05:49	06:29	07:05	16:21	16:58	17:38
50°	05:46	06:25	06:59	16:27	17:02	17:41
45°	05:40	06:15	06:46	16:40	17:11	17:46
N 40°	05:35	06:07	06:36	16:51	17:20	17:52
35°	05:30	06:00	06:27	17:00	17:27	17:57
30°	05:25	05:53	06:18	17:09	17:34	18:02
20°	05:15	05:41	06:04	17:23	17:46	18:12
N 10°	05:05	05:30	05:52	17:35	17:57	18:22
0°	04:54	05:19	05:40	17:47	18:09	18:34
S 10°	04:41	05:06	05:28	17:59	18:21	18:47
20°	04:25	04:52	05:16	18:12	18:35	19:03
30°	04:05	04:35	05:01	18:27	18:53	19:23
35°	03:52	04:25	04:52	18:36	19:03	19:36
40°	03:37	04:13	04:42	18:46	19:15	19:52
45°	03:17	03:58	04:31	18:57	19:30	20:12
S 50°	02:51	03:39	04:17	19:12	19:49	20:38
52°	02:38	03:30	04:10	19:19	19:58	20:51
54°	02:23	03:20	04:03	19:26	20:09	21:07
56°	02:04	03:09	03:54	19:34	20:21	21:26
58°	01:40	02:55	03:45	19:44	20:34	21:51
S 60°	01:06	02:39	03:34	19:55	20:51	22:28

Lat.	**Moonrise** Fri	Sat	Sun	**Moonset** Fri	Sat	Sun
N 72°	16:29	16:07	15:50	22:50	·· ··	00:57
N 70°	16:05	15:54	15:44	23:13	·· ··	01:08
68°	15:46	15:43	15:40	23:30	·· ··	01:17
66°	15:31	15:34	15:36	23:44	·· ··	01:24
64°	15:19	15:26	15:33	23:55	·· ··	01:31
62°	15:08	15:20	15:30	·· ··	00:05	01:36
60°	14:59	15:14	15:27	·· ··	00:13	01:41
N 58°	14:51	15:09	15:25	·· ··	00:20	01:45
56°	14:44	15:04	15:23	·· ··	00:27	01:48
54°	14:37	15:00	15:21	·· ··	00:32	01:51
52°	14:32	14:57	15:20	·· ··	00:38	01:54
50°	14:27	14:53	15:18	·· ··	00:42	01:57
45°	14:15	14:46	15:15	·· ··	00:52	02:03
N 40°	14:06	14:40	15:12	·· ··	01:00	02:07
35°	13:58	14:34	15:10	00:05	01:07	02:11
30°	13:51	14:30	15:08	00:13	01:13	02:15
20°	13:39	14:21	15:04	00:28	01:24	02:21
N 10°	13:28	14:14	15:01	00:40	01:33	02:26
0°	13:18	14:08	14:58	00:52	01:41	02:31
S 10°	13:08	14:01	14:55	01:04	01:50	02:36
20°	12:57	13:53	14:52	01:16	01:59	02:41
30°	12:44	13:45	14:48	01:30	02:09	02:47
35°	12:37	13:40	14:46	01:38	02:15	02:51
40°	12:29	13:35	14:43	01:47	02:22	02:54
45°	12:19	13:29	14:41	01:58	02:29	02:59
S 50°	12:08	13:21	14:37	02:11	02:38	03:04
52°	12:02	13:17	14:36	02:16	02:43	03:06
54°	11:56	13:14	14:34	02:23	02:47	03:09
56°	11:50	13:09	14:32	02:30	02:52	03:12
58°	11:42	13:04	14:30	02:39	02:58	03:15
S 60°	11:33	12:59	14:28	02:48	03:04	03:18

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 10-12 60-79%
06	16:21	16:20	11:44	19:30	07:05	
07	16:18	16:17	11:44	20:19	07:54	
08	16:15	16:13	11:44	21:10	08:45	

November 09, 10, 11 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	48°04.7	134°05.1	S26°51.2	245°08.6	N09°03.4	203°17.1	S09°08.1	211°39.9	S04°32.8
1	63°07.2	149°04.7	51.2	260°09.7	02.9	218°19.0	08.3	226°42.1	32.9
2	78°09.6	164°04.3	51.1	275°10.9	02.4	233°21.0	08.5	241°44.3	33.1
3	93°12.1	179°03.9	·· 51.1	290°12.0	·· 01.9	248°23.0	·· 08.7	256°46.5	·· 33.2
4	108°14.6	194°03.6	51.0	305°13.2	01.4	263°24.9	08.9	271°48.7	33.3
5	123°17.0	209°03.2	51.0	320°14.3	00.9	278°26.9	09.0	286°50.9	33.4
6	138°19.5	224°02.8	S26°50.9	335°15.5	N09°00.4	293°28.9	S09°09.2	301°53.1	S04°33.5
7	153°21.9	239°02.4	50.9	350°16.6	08°59.9	308°30.8	09.4	316°55.3	33.6
8	168°24.4	254°02.0	50.8	5°17.8	59.4	323°32.8	09.6	331°57.5	33.7
9	183°26.9	269°01.7	·· 50.8	20°18.9	·· 58.9	338°34.8	·· 09.8	346°59.7	·· 33.8
10	198°29.3	284°01.3	50.7	35°20.1	58.4	353°36.7	10.0	2°01.9	33.9
11	213°31.8	299°00.9	50.7	50°21.2	57.9	8°38.7	10.2	17°04.1	34.0
12	228°34.3	314°00.5	S26°50.6	65°22.4	N08°57.4	23°40.7	S09°10.4	32°06.3	S04°34.1
13	243°36.7	329°00.2	50.5	80°23.5	56.9	38°42.6	10.5	47°08.5	34.2
14	258°39.2	343°59.8	50.5	95°24.7	56.4	53°44.6	10.7	62°10.7	34.3
15	273°41.7	358°59.4	·· 50.4	110°25.8	·· 55.9	68°46.6	·· 10.9	77°12.9	·· 34.4
16	288°44.1	13°59.1	50.4	125°27.0	55.4	83°48.5	11.1	92°15.1	34.5
17	303°46.6	28°58.7	50.3	140°28.2	54.8	98°50.5	11.3	107°17.3	34.6
18	318°49.1	43°58.3	S26°50.2	155°29.3	N08°54.3	113°52.5	S09°11.5	122°19.5	S04°34.7
19	333°51.5	58°57.9	50.2	170°30.5	53.8	128°54.4	11.7	137°21.7	34.8
20	348°54.0	73°57.6	50.1	185°31.6	53.3	143°56.4	11.9	152°23.9	34.9
21	3°56.4	88°57.2	·· 50.0	200°32.8	·· 52.8	158°58.4	·· 12.1	167°26.2	·· 35.0
22	18°58.9	103°56.8	50.0	215°33.9	52.3	174°00.3	12.2	182°28.4	35.1
23	34°01.4	118°56.5	49.9	230°35.1	51.8	189°02.3	12.4	197°30.6	35.2
Mer.pass. 20:44		ν -0.4′	d 0.0′	m -4.46	ν 1.2′	d 0.5′	m 1.35	ν 2.0′	d 0.2′ m -1.69	ν 2.2′	d 0.1′ m 0.87

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	49°03.8	133°56.1	S26°49.8	245°36.2	N08°51.3	204°04.3	S09°12.6	212°32.8	S04°35.3
1	64°06.3	148°55.8	49.7	260°37.4	50.8	219°06.2	12.8	227°35.0	35.4
2	79°08.8	163°55.4	49.7	275°38.6	50.3	234°08.2	13.0	242°37.2	35.5
3	94°11.2	178°55.0	·· 49.6	290°39.7	·· 49.8	249°10.2	·· 13.2	257°39.4	·· 35.6
4	109°13.7	193°54.7	49.5	305°40.9	49.3	264°12.1	13.4	272°41.6	35.7
5	124°16.2	208°54.3	49.4	320°42.0	48.8	279°14.1	13.6	287°43.8	35.8
6	139°18.6	223°53.9	S26°49.4	335°43.2	N08°48.3	294°16.1	S09°13.7	302°46.0	S04°35.9
7	154°21.1	238°53.6	49.3	350°44.3	47.8	309°18.0	13.9	317°48.2	36.0
8	169°23.6	253°53.2	49.2	5°45.5	47.3	324°20.0	14.1	332°50.4	36.1
9	184°26.0	268°52.9	·· 49.1	20°46.6	·· 46.8	339°22.0	·· 14.3	347°52.6	·· 36.2
10	199°28.5	283°52.5	49.0	35°47.8	46.3	354°24.0	14.5	2°54.8	36.3
11	214°30.9	298°52.2	49.0	50°49.0	45.8	9°25.9	14.7	17°57.0	36.4
12	229°33.4	313°51.8	S26°48.9	65°50.1	N08°45.3	24°27.9	S09°14.9	32°59.2	S04°36.5
13	244°35.9	328°51.4	48.8	80°51.3	44.8	39°29.9	15.0	48°01.4	36.6
14	259°38.3	343°51.1	48.7	95°52.4	44.3	54°31.8	15.2	63°03.6	36.7
15	274°40.8	358°50.7	·· 48.6	110°53.6	·· 43.8	69°33.8	·· 15.4	78°05.8	·· 36.8
16	289°43.3	13°50.4	48.5	125°54.8	43.3	84°35.8	15.6	93°08.0	36.9
17	304°45.7	28°50.0	48.4	140°55.9	42.8	99°37.7	15.8	108°10.2	37.0
18	319°48.2	43°49.7	S26°48.3	155°57.1	N08°42.3	114°39.7	S09°16.0	123°12.4	S04°37.1
19	334°50.7	58°49.3	48.3	170°58.2	41.8	129°41.7	16.2	138°14.6	37.2
20	349°53.1	73°49.0	48.2	185°59.4	41.3	144°43.6	16.4	153°16.9	37.3
21	4°55.6	88°48.6	·· 48.1	201°00.6	·· 40.8	159°45.6	·· 16.5	168°19.1	·· 37.4
22	19°58.0	103°48.3	48.0	216°01.7	40.3	174°47.6	16.7	183°21.3	37.5
23	35°00.5	118°48.0	47.9	231°02.9	39.8	189°49.5	16.9	198°23.5	37.6
Mer.pass. 20:40		ν -0.4′	d 0.1′	m -4.47	ν 1.2′	d 0.5′	m 1.34	ν 2.0′	d 0.2′ m -1.69	ν 2.2′	d 0.1′ m 0.87

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	50°03.0	133°47.6	S26°47.8	246°04.0	N08°39.2	204°51.5	S09°17.1	213°25.7	S04°37.7
1	65°05.4	148°47.3	47.7	261°05.2	38.7	219°53.5	17.3	228°27.9	37.8
2	80°07.9	163°46.9	47.6	276°06.4	38.2	234°55.4	17.5	243°30.1	37.9
3	95°10.4	178°46.6	·· 47.5	291°07.5	·· 37.7	249°57.4	·· 17.7	258°32.3	·· 38.0
4	110°12.8	193°46.2	47.4	306°08.7	37.2	264°59.4	17.9	273°34.5	38.1
5	125°15.3	208°45.9	47.3	321°09.8	36.7	280°01.4	18.0	288°36.7	38.2
6	140°17.8	223°45.6	S26°47.2	336°11.0	N08°36.2	295°03.3	S09°18.2	303°38.9	S04°38.3
7	155°20.2	238°45.2	47.1	351°12.2	35.7	310°05.3	18.4	318°41.1	38.4
8	170°22.7	253°44.9	47.0	6°13.3	35.2	325°07.3	18.6	333°43.3	38.5
9	185°25.2	268°44.5	·· 46.9	21°14.5	·· 34.7	340°09.2	·· 18.8	348°45.5	·· 38.6
10	200°27.6	283°44.2	46.7	36°15.6	34.2	355°11.2	19.0	3°47.7	38.7
11	215°30.1	298°43.9	46.6	51°16.8	33.7	10°13.2	19.2	18°49.9	38.8
12	230°32.5	313°43.5	S26°46.5	66°18.0	N08°33.2	25°15.1	S09°19.3	33°52.1	S04°38.9
13	245°35.0	328°43.2	46.4	81°19.1	32.7	40°17.1	19.5	48°54.3	39.0
14	260°37.5	343°42.9	46.3	96°20.3	32.2	55°19.1	19.7	63°56.6	39.1
15	275°39.9	358°42.5	·· 46.2	111°21.5	·· 31.7	70°21.0	·· 19.9	78°58.8	·· 39.2
16	290°42.4	13°42.2	46.1	126°22.6	31.2	85°23.0	20.1	94°01.0	39.3
17	305°44.9	28°41.9	46.0	141°23.8	30.7	100°25.0	20.3	109°03.2	39.4
18	320°47.3	43°41.5	S26°45.8	156°25.0	N08°30.2	115°27.0	S09°20.5	124°05.4	S04°39.5
19	335°49.8	58°41.2	45.7	171°26.1	29.7	130°28.9	20.6	139°07.6	39.6
20	350°52.3	73°40.9	45.6	186°27.3	29.2	145°30.9	20.8	154°09.8	39.7
21	5°54.7	88°40.6	·· 45.5	201°28.5	·· 28.7	160°32.9	·· 21.0	169°12.0	·· 39.8
22	20°57.2	103°40.2	45.4	216°29.6	28.2	175°34.8	21.2	184°14.2	39.9
23	35°59.7	118°39.9	45.3	231°30.8	27.7	190°36.8	21.4	199°16.4	40.0
Mer.pass. 20:36		ν -0.3′	d 0.1′	m -4.49	ν 1.2′	d 0.5′	m 1.33	ν 2.0′	d 0.2′ m -1.69	ν 2.2′	d 0.1′ m 0.87

Stars

	SHA	Dec
Alpheratz	358°08.3	28°59.5
Ankaa	353°39.1	-42°24.5
Schedar	350°07.7	56°26.4
Diphda	349°19.8	-18°05.3
Achernar	335°44.1	-57°19.9
Hamal	328°27.7	23°22.6
Polaris	326°16.9	89°10.9
Acamar	315°36.2	-40°22.7
Menkar	314°40.0	4°01.1
Mirfak	309°14.5	49°47.8
Aldebaran	291°16.8	16°28.4
Rigel	281°35.0	-8°13.3
Capella	281°09.7	45°58.7
Bellatrix	278°57.6	6°20.0
Elnath	278°42.8	28°35.5
Alnilam	276°10.6	-1°12.7
Betelgeuse	271°27.2	7°24.3
Canopus	264°06.5	-52°40.9
Sirius	258°54.8	-16°41.3
Adhara	255°31.3	-28°56.6
Procyon	245°24.8	5°16.4
Pollux	243°57.1	28°04.2
Avior	234°27.7	-59°26.7
Suhail	223°10.2	-43°21.2
Miaplacidus	221°44.8	-69°38.2
Alphard	218°19.8	-8°34.6
Regulus	208°09.2	12°03.5
Dubhe	194°21.4	61°50.8
Denebola	182°58.5	14°40.5
Gienah	176°17.4	-17°26.2
Acrux	173°37.0	-62°59.5
Gacrux	172°28.3	-57°00.3
Alioth	166°42.3	56°03.5
Spica	158°57.0	-11°03.8
Alkaid	153°18.3	49°24.3
Hadar	149°22.9	-60°16.9
Menkent	148°36.5	-36°16.6
Arcturus	146°18.1	19°16.8
Rigil Kent.	140°25.4	-60°45.3
Kochab	137°20.2	74°13.9
Zuben'ubi	137°32.5	-15°57.8
Alphecca	126°31.8	26°46.7
Antares	112°56.3	-26°23.4
Atria	108°20.4	-68°59.8
Sabik	102°40.6	-15°42.1
Shaula	96°55.1	-37°05.5
Rasalhague	96°29.1	12°34.5
Eltanin	90°57.8	51°29.7
Kaus Aust.	84°16.1	-34°23.7
Vega	80°55.6	38°46.2
Nunki	76°28.4	-26°19.2
Altair	62°31.9	8°49.3
Peacock	53°57.3	-56°47.9
Deneb	49°48.0	45°13.2
Enif	34°10.8	9°47.6
Al Na'ir	28°13.9	-47°03.2
Fomalhaut	15°50.4	-29°43.3
Scheat	14°16.7	27°59.2
Markab	14°02.2	15°06.5

Nov 09 Mon	SHA	Mer.pass
Venus	86°00.4	15:04
Mars	197°03.9	07:39
Jupiter	155°12.4	10:25
Saturn	163°35.2	09:52

Nov 10 Tue	SHA	Mer.pass
Venus	84°52.3	15:05
Mars	196°32.4	07:37
Jupiter	155°00.4	10:22
Saturn	163°28.9	09:48

Nov 11 Wed	SHA	Mer.pass
Venus	83°44.6	15:05
Mars	196°01.1	07:35
Jupiter	154°48.5	10:19
Saturn	163°22.7	09:45

Horizontal parallax	
Venus:	0.2
Mars:	0.1

h	Sun		Moon				
Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	184°02.7	S16°46.3	41°04.6	10.1′	S02°09.3	13.3′	59.5′
1	199°02.7	47.0	55°33.7	10.0′	01°56.0	13.2′	59.6′
2	214°02.6	47.7	70°02.8	10.0′	01°42.8	13.3′	59.6′
3	229°02.6	·· 48.4	84°31.8	10.0′	01°29.5	13.4′	59.6′
4	244°02.5	49.2	99°00.7	9.9′	01°16.1	13.3′	59.7′
5	259°02.5	49.9	113°29.7	9.9′	01°02.8	13.4′	59.7′
6	274°02.4	S16°50.6	127°58.6	9.9′	S00°49.4	13.4′	59.7′
7	289°02.4	51.3	142°27.4	9.8′	00°36.0	13.4′	59.8′
8	304°02.3	52.0	156°56.2	9.8′	00°22.6	13.5′	59.8′
9	319°02.3	·· 52.7	171°25.0	9.7′	S00°09.1	13.4′	59.8′
10	334°02.2	53.4	185°53.7	9.7′	N00°04.3	13.5′	59.9′
11	349°02.1	54.2	200°22.4	9.6′	00°17.8	13.5′	59.9′
12	4°02.1	S16°54.9	214°51.1	9.6′	N00°31.3	13.5′	60.0′
13	19°02.0	55.6	229°19.7	9.6′	00°44.8	13.5′	60.0′
14	34°02.0	56.3	243°48.2	9.5′	00°58.3	13.6′	60.0′
15	49°01.9	·· 57.0	258°16.7	9.5′	01°11.9	13.5′	60.1′
16	64°01.9	57.7	272°45.2	9.4′	01°25.4	13.5′	60.1′
17	79°01.8	58.4	287°13.6	9.4′	01°38.9	13.6′	60.1′
18	94°01.8	S16°59.1	301°42.0	9.3′	N01°52.5	13.6′	60.2′
19	109°01.7	16°59.8	316°10.3	9.3′	02°06.1	13.5′	60.2′
20	124°01.7	17°00.5	330°38.6	9.2′	02°19.6	13.6′	60.2′
21	139°01.6	·· 01.3	345°06.8	9.2′	02°33.2	13.6′	60.3′
22	154°01.5	02.0	359°35.0	9.1′	02°46.8	13.5′	60.3′
23	169°01.5	02.7	14°03.1	9.1′	03°00.3	13.6′	60.3′
	SD = 16.1′	d = 0.7′	SD = 16.2′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	184°01.4	S17°03.4	28°31.2	9.0′	N03°13.9	13.5′	60.3′
1	199°01.4	04.1	42°59.2	9.0′	03°27.4	13.6′	60.4′
2	214°01.3	04.8	57°27.2	8.9′	03°41.0	13.5′	60.4′
3	229°01.3	·· 05.5	71°55.1	8.9′	03°54.5	13.6′	60.4′
4	244°01.2	06.2	86°22.9	8.8′	04°08.1	13.5′	60.5′
5	259°01.1	06.9	100°50.7	8.7′	04°21.6	13.5′	60.5′
6	274°01.1	S17°07.6	115°18.5	8.7′	N04°35.1	13.5′	60.5′
7	289°01.0	08.3	129°46.2	8.6′	04°48.6	13.5′	60.6′
8	304°01.0	09.0	144°13.8	8.6′	05°02.1	13.4′	60.6′
9	319°00.9	·· 09.7	158°41.4	8.5′	05°15.5	13.5′	60.6′
10	334°00.8	10.4	173°08.9	8.5′	05°29.0	13.4′	60.6′
11	349°00.8	11.1	187°36.4	8.4′	05°42.4	13.4′	60.7′
12	4°00.7	S17°11.8	202°03.8	8.3′	N05°55.8	13.4′	60.7′
13	19°00.7	12.5	216°31.1	8.3′	06°09.2	13.3′	60.7′
14	34°00.6	13.2	230°58.4	8.2′	06°22.5	13.4′	60.7′
15	49°00.5	·· 13.9	245°25.6	8.2′	06°35.9	13.3′	60.8′
16	64°00.5	14.6	259°52.8	8.1′	06°49.2	13.2′	60.8′
17	79°00.4	15.3	274°19.9	8.0′	07°02.4	13.2′	60.8′
18	94°00.3	S17°16.0	288°46.9	8.0′	N07°15.6	13.2′	60.8′
19	109°00.3	16.7	303°13.9	7.9′	07°28.8	13.2′	60.9′
20	124°00.2	17.4	317°40.8	7.8′	07°42.0	13.1′	60.9′
21	139°00.2	·· 18.1	332°07.6	7.8′	07°55.1	13.1′	60.9′
22	154°00.1	18.8	346°34.4	7.7′	08°08.2	13.0′	60.9′
23	169°00.0	19.5	1°01.1	7.6′	08°21.2	13.0′	60.9′
	SD = 16.1′	d = 0.7′	SD = 16.5′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	184°00.0	S17°20.2	15°27.8	7.6′	N08°34.2	13.0′	61.0′
1	198°59.9	20.9	29°54.3	7.5′	08°47.2	12.9′	61.0′
2	213°59.8	21.6	44°20.9	7.5′	09°00.1	12.8′	61.0′
3	228°59.8	·· 22.3	58°47.3	7.4′	09°12.9	12.8′	61.0′
4	243°59.7	22.9	73°13.7	7.3′	09°25.7	12.7′	61.0′
5	258°59.6	23.6	87°40.0	7.3′	09°38.4	12.7′	61.1′
6	273°59.6	S17°24.3	102°06.3	7.2′	N09°51.1	12.7′	61.1′
7	288°59.5	25.0	116°32.5	7.1′	10°03.8	12.5′	61.1′
8	303°59.4	25.7	130°58.6	7.1′	10°16.3	12.6′	61.1′
9	318°59.3	·· 26.4	145°24.6	7.0′	10°28.9	12.4′	61.1′
10	333°59.3	27.1	159°50.6	6.9′	10°41.3	12.4′	61.1′
11	348°59.2	27.8	174°16.5	6.8′	10°53.7	12.3′	61.2′
12	3°59.1	S17°28.5	188°42.4	6.8′	N11°06.0	12.3′	61.2′
13	18°59.1	29.1	203°08.2	6.7′	11°18.3	12.2′	61.2′
14	33°59.0	29.8	217°33.9	6.6′	11°30.5	12.1′	61.2′
15	48°58.9	·· 30.5	231°59.5	6.6′	11°42.6	12.0′	61.2′
16	63°58.9	31.2	246°25.1	6.5′	11°54.6	12.0′	61.2′
17	78°58.8	31.9	260°50.6	6.4′	12°06.6	11.9′	61.2′
18	93°58.7	S17°32.6	275°16.0	6.4′	N12°18.5	11.8′	61.2′
19	108°58.6	33.3	289°41.4	6.3′	12°30.3	11.7′	61.2′
20	123°58.6	33.9	304°06.7	6.2′	12°42.0	11.6′	61.3′
21	138°58.5	·· 34.6	318°31.9	6.2′	12°53.6	11.6′	61.3′
22	153°58.4	35.3	332°57.1	6.1′	13°05.2	11.5′	61.3′
23	168°58.3	36.0	347°22.2	6.0′	13°16.7	11.4′	61.3′
	SD = 16.1′	d = 0.7′	SD = 16.6′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	06:41	08:10	10:02	13:25	15:16	16:46
N 70°	06:33	07:51	09:18	14:09	15:35	16:54
68°	06:26	07:37	08:49	14:37	15:50	17:01
66°	06:20	07:24	08:28	14:59	16:03	17:07
64°	06:15	07:14	08:11	15:16	16:13	17:12
62°	06:11	07:05	07:57	15:30	16:22	17:16
60°	06:07	06:57	07:45	15:42	16:30	17:20
N 58°	06:03	06:51	07:35	15:52	16:36	17:24
56°	05:59	06:45	07:26	16:01	16:43	17:28
54°	05:56	06:39	07:18	16:09	16:48	17:31
52°	05:53	06:34	07:11	16:16	16:53	17:34
50°	05:51	06:29	07:04	16:23	16:58	17:37
45°	05:44	06:19	06:51	16:37	17:08	17:43
N 40°	05:38	06:11	06:39	16:48	17:17	17:49
35°	05:33	06:03	06:29	16:58	17:25	17:55
30°	05:27	05:56	06:21	17:07	17:32	18:00
20°	05:17	05:43	06:06	17:22	17:45	18:11
N 10°	05:06	05:31	05:53	17:35	17:57	18:22
0°	04:54	05:19	05:40	17:47	18:09	18:34
S 10°	04:40	05:06	05:28	18:00	18:22	18:48
20°	04:24	04:51	05:14	18:14	18:37	19:05
30°	04:02	04:33	04:59	18:29	18:55	19:26
35°	03:49	04:22	04:50	18:39	19:06	19:40
40°	03:33	04:09	04:39	18:49	19:19	19:56
45°	03:12	03:54	04:27	19:02	19:35	20:17
S 50°	02:45	03:34	04:12	19:17	19:55	20:45
52°	02:31	03:25	04:05	19:24	20:05	20:59
54°	02:14	03:14	03:57	19:32	20:16	21:16
56°	01:53	03:01	03:48	19:41	20:28	21:37
58°	01:26	02:47	03:38	19:51	20:43	22:06
S 60°	00:43	02:29	03:27	20:03	21:01	22:53

Lat.	**Moonrise** Mon	Tue	Wed	**Moonset** Mon	Tue	Wed
N 72°	15:34	15:17	14:57	03:02	05:10	07:26
N 70°	15:35	15:26	15:16	03:04	05:03	07:09
68°	15:37	15:34	15:31	03:06	04:58	06:56
66°	15:38	15:40	15:43	03:07	04:54	06:45
64°	15:39	15:45	15:54	03:09	04:50	06:36
62°	15:40	15:50	16:03	03:10	04:47	06:28
60°	15:40	15:54	16:10	03:11	04:45	06:22
N 58°	15:41	15:58	16:17	03:12	04:42	06:16
56°	15:41	16:01	16:23	03:13	04:40	06:11
54°	15:42	16:04	16:29	03:13	04:38	06:06
52°	15:42	16:07	16:34	03:14	04:37	06:02
50°	15:43	16:09	16:38	03:15	04:35	05:58
45°	15:44	16:14	16:48	03:16	04:32	05:50
N 40°	15:45	16:19	16:56	03:17	04:29	05:43
35°	15:45	16:23	17:03	03:18	04:26	05:38
30°	15:46	16:26	17:09	03:19	04:24	05:33
20°	15:47	16:32	17:20	03:20	04:21	05:24
N 10°	15:48	16:38	17:30	03:21	04:17	05:16
0°	15:49	16:43	17:39	03:22	04:14	05:09
S 10°	15:50	16:48	17:48	03:23	04:11	05:02
20°	15:51	16:53	17:58	03:24	04:08	04:54
30°	15:53	17:00	18:09	03:25	04:04	04:46
35°	15:53	17:04	18:16	03:26	04:02	04:41
40°	15:54	17:08	18:23	03:27	04:00	04:35
45°	15:55	17:13	18:32	03:28	03:57	04:28
S 50°	15:57	17:19	18:43	03:29	03:54	04:21
52°	15:57	17:21	18:48	03:29	03:52	04:17
54°	15:58	17:24	18:53	03:29	03:50	04:13
56°	15:58	17:28	18:59	03:30	03:49	04:09
58°	15:59	17:32	19:06	03:31	03:46	04:04
S 60°	16:00	17:36	19:14	03:31	03:44	03:59

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 13-15 88-98%
09	16:11	16:08	11:44	22:02	09:36	
10	16:06	16:03	11:44	22:56	10:28	
11	16:00	15:57	11:44	23:53	11:24	

November 12, 13, 14 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	51°02.1	133°39.6	S26°45.1	246°31.9	N08°27.2	205°38.8	S09°21.6	214°18.6	S04°40.1
1	66°04.6	148°39.3	45.0	261°33.1	26.7	220°40.7	21.8	229°20.8	40.2
2	81°07.0	163°38.9	44.9	276°34.3	26.2	235°42.7	21.9	244°23.0	40.3
3	96°09.5	178°38.6	·· 44.8	291°35.4	·· 25.7	250°44.7	·· 22.1	259°25.2	·· 40.4
4	111°12.0	193°38.3	44.6	306°36.6	25.2	265°46.7	22.3	274°27.4	40.5
5	126°14.4	208°38.0	44.5	321°37.8	24.7	280°48.6	22.5	289°29.6	40.6
6	141°16.9	223°37.7	S26°44.4	336°38.9	N08°24.2	295°50.6	S09°22.7	304°31.9	S04°40.7
7	156°19.4	238°37.3	44.2	351°40.1	23.7	310°52.6	22.9	319°34.1	40.8
8	171°21.8	253°37.0	44.1	6°41.3	23.2	325°54.5	23.1	334°36.3	40.9
9	186°24.3	268°36.7	·· 44.0	21°42.4	·· 22.7	340°56.5	·· 23.2	349°38.5	·· 41.0
10	201°26.8	283°36.4	43.8	36°43.6	22.2	355°58.5	23.4	4°40.7	41.1
11	216°29.2	298°36.1	43.7	51°44.8	21.7	11°00.4	23.6	19°42.9	41.2
12	231°31.7	313°35.8	S26°43.6	66°46.0	N08°21.1	26°02.4	S09°23.8	34°45.1	S04°41.3
13	246°34.1	328°35.4	43.4	81°47.1	20.6	41°04.4	24.0	49°47.3	41.4
14	261°36.6	343°35.1	43.3	96°48.3	20.1	56°06.4	24.2	64°49.5	41.5
15	276°39.1	358°34.8	·· 43.2	111°49.5	·· 19.6	71°08.3	·· 24.4	79°51.7	·· 41.6
16	291°41.5	13°34.5	43.0	126°50.6	19.1	86°10.3	24.5	94°53.9	41.7
17	306°44.0	28°34.2	42.9	141°51.8	18.6	101°12.3	24.7	109°56.1	41.8
18	321°46.5	43°33.9	S26°42.7	156°53.0	N08°18.1	116°14.2	S09°24.9	124°58.3	S04°41.9
19	336°48.9	58°33.6	42.6	171°54.1	17.6	131°16.2	25.1	140°00.6	42.0
20	351°51.4	73°33.3	42.5	186°55.3	17.1	146°18.2	25.3	155°02.8	42.1
21	6°53.9	88°33.0	·· 42.3	201°56.5	·· 16.6	161°20.2	·· 25.5	170°05.0	·· 42.2
22	21°56.3	103°32.7	42.2	216°57.6	16.1	176°22.1	25.7	185°07.2	42.3
23	36°58.8	118°32.4	42.0	231°58.8	15.6	191°24.1	25.8	200°09.4	42.4
Mer.pass. 20:32		ν -0.3′	d 0.1′	m -4.50	ν 1.2′	d 0.5′	m 1.33	ν 2.0′	d 0.2′ m -1.69	ν 2.2′	d 0.1′ m 0.86

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	52°01.3	133°32.1	S26°41.9	247°00.0	N08°15.1	206°26.1	S09°26.0	215°11.6	S04°42.5
1	67°03.7	148°31.8	41.7	262°01.2	14.6	221°28.0	26.2	230°13.8	42.6
2	82°06.2	163°31.5	41.6	277°02.3	14.1	236°30.0	26.4	245°16.0	42.7
3	97°08.6	178°31.2	·· 41.4	292°03.5	·· 13.6	251°32.0	·· 26.6	260°18.2	·· 42.8
4	112°11.1	193°30.9	41.3	307°04.7	13.1	266°33.9	26.8	275°20.4	42.9
5	127°13.6	208°30.6	41.1	322°05.8	12.6	281°35.9	26.9	290°22.6	43.0
6	142°16.0	223°30.3	S26°41.0	337°07.0	N08°12.1	296°37.9	S09°27.1	305°24.8	S04°43.1
7	157°18.5	238°30.0	40.8	352°08.2	11.6	311°39.9	27.3	320°27.1	43.2
8	172°21.0	253°29.7	40.7	7°09.4	11.1	326°41.8	27.5	335°29.3	43.3
9	187°23.4	268°29.4	·· 40.5	22°10.5	·· 10.6	341°43.8	·· 27.7	350°31.5	·· 43.4
10	202°25.9	283°29.1	40.4	37°11.7	10.1	356°45.8	27.9	5°33.7	43.5
11	217°28.4	298°28.8	40.2	52°12.9	09.6	11°47.7	28.1	20°35.9	43.6
12	232°30.8	313°28.5	S26°40.0	67°14.1	N08°09.1	26°49.7	S09°28.2	35°38.1	S04°43.7
13	247°33.3	328°28.2	39.9	82°15.2	08.6	41°51.7	28.4	50°40.3	43.8
14	262°35.8	343°27.9	39.7	97°16.4	08.1	56°53.7	28.6	65°42.5	43.9
15	277°38.2	358°27.6	·· 39.5	112°17.6	·· 07.6	71°55.6	·· 28.8	80°44.7	·· 44.0
16	292°40.7	13°27.4	39.4	127°18.8	07.1	86°57.6	29.0	95°46.9	44.1
17	307°43.1	28°27.1	39.2	142°19.9	06.6	101°59.6	29.2	110°49.1	44.2
18	322°45.6	43°26.8	S26°39.1	157°21.1	N08°06.1	117°01.6	S09°29.3	125°51.4	S04°44.3
19	337°48.1	58°26.5	38.9	172°22.3	05.6	132°03.5	29.5	140°53.6	44.4
20	352°50.5	73°26.2	38.7	187°23.5	05.1	147°05.5	29.7	155°55.8	44.5
21	7°53.0	88°25.9	·· 38.6	202°24.6	·· 04.6	162°07.5	·· 29.9	170°58.0	·· 44.6
22	22°55.5	103°25.6	38.4	217°25.8	04.1	177°09.4	30.1	186°00.2	44.7
23	37°57.9	118°25.4	38.2	232°27.0	03.6	192°11.4	30.3	201°02.4	44.8
Mer.pass. 20:29		ν -0.3′	d 0.1′	m -4.51	ν 1.2′	d 0.5′	m 1.32	ν 2.0′	d 0.2′ m -1.70	ν 2.2′	d 0.1′ m 0.86

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	53°00.4	133°25.1	S26°38.0	247°28.2	N08°03.1	207°13.4	S09°30.4	216°04.6	S04°44.9
1	68°02.9	148°24.8	37.9	262°29.3	02.6	222°15.4	30.6	231°06.8	45.0
2	83°05.3	163°24.5	37.7	277°30.5	02.1	237°17.3	30.8	246°09.0	45.1
3	98°07.8	178°24.3	·· 37.5	292°31.7	·· 01.6	252°19.3	·· 31.0	261°11.2	·· 45.2
4	113°10.3	193°24.0	37.3	307°32.9	01.1	267°21.3	31.2	276°13.5	45.3
5	128°12.7	208°23.7	37.2	322°34.0	00.6	282°23.2	31.4	291°15.7	45.4
6	143°15.2	223°23.4	S26°37.0	337°35.2	N08°00.1	297°25.2	S09°31.5	306°17.9	S04°45.5
7	158°17.6	238°23.2	36.8	352°36.4	07°59.6	312°27.2	31.7	321°20.1	45.6
8	173°20.1	253°22.9	36.6	7°37.6	59.1	327°29.2	31.9	336°22.3	45.7
9	188°22.6	268°22.6	·· 36.4	22°38.7	·· 58.6	342°31.1	·· 32.1	351°24.5	·· 45.8
10	203°25.0	283°22.3	36.3	37°39.9	58.1	357°33.1	32.3	6°26.7	45.9
11	218°27.5	298°22.1	36.1	52°41.1	57.6	12°35.1	32.5	21°28.9	46.0
12	233°30.0	313°21.8	S26°35.9	67°42.3	N07°57.1	27°37.1	S09°32.6	36°31.1	S04°46.0
13	248°32.4	328°21.5	35.7	82°43.5	56.5	42°39.0	32.8	51°33.3	46.1
14	263°34.9	343°21.3	35.5	97°44.6	56.0	57°41.0	33.0	66°35.6	46.2
15	278°37.4	358°21.0	·· 35.3	112°45.8	·· 55.5	72°43.0	·· 33.2	81°37.8	·· 46.3
16	293°39.8	13°20.7	35.2	127°47.0	55.0	87°44.9	33.4	96°40.0	46.4
17	308°42.3	28°20.5	35.0	142°48.2	54.5	102°46.9	33.6	111°42.2	46.5
18	323°44.8	43°20.2	S26°34.8	157°49.4	N07°54.0	117°48.9	S09°33.7	126°44.4	S04°46.6
19	338°47.2	58°20.0	34.6	172°50.5	53.5	132°50.9	33.9	141°46.6	46.7
20	353°49.7	73°19.7	34.4	187°51.7	53.0	147°52.8	34.1	156°48.8	46.8
21	8°52.1	88°19.4	·· 34.2	202°52.9	·· 52.5	162°54.8	·· 34.3	171°51.0	·· 46.9
22	23°54.6	103°19.2	34.0	217°54.1	52.0	177°56.8	34.5	186°53.2	47.0
23	38°57.1	118°18.9	33.8	232°55.3	51.5	192°58.8	34.7	201°55.5	47.1
Mer.pass. 20:25		ν -0.3′	d 0.2′	m -4.52	ν 1.2′	d 0.5′	m 1.31	ν 2.0′	d 0.2′ m -1.70	ν 2.2′	d 0.1′ m 0.86

Stars

	SHA	Dec
Alpheratz	358°08.3	28°59.5
Ankaa	353°39.2	-42°24.5
Schedar	350°07.7	56°26.4
Diphda	349°19.8	-18°05.3
Achernar	335°44.1	-57°19.9
Hamal	328°27.7	23°22.6
Polaris	326°16.9	89°10.9
Acamar	315°36.2	-40°22.7
Menkar	314°40.0	4°01.1
Mirfak	309°14.5	49°47.8
Aldebaran	291°16.8	16°28.4
Rigel	281°35.0	-8°13.3
Capella	281°09.7	45°58.7
Bellatrix	278°57.6	6°20.0
Elnath	278°42.8	28°35.5
Alnilam	276°10.6	-1°12.7
Betelgeuse	271°27.2	7°24.3
Canopus	264°06.5	-52°40.9
Sirius	258°54.7	-16°41.3
Adhara	255°31.3	-28°56.6
Procyon	245°24.8	5°16.4
Pollux	243°57.0	28°04.2
Avior	234°27.7	-59°26.7
Suhail	223°10.2	-43°21.2
Miaplacidus	221°44.7	-69°38.2
Alphard	218°19.8	-8°34.6
Regulus	208°09.2	12°03.5
Dubhe	194°21.4	61°50.8
Denebola	182°58.4	14°40.5
Gienah	176°17.4	-17°26.2
Acrux	173°36.9	-62°59.5
Gacrux	172°28.3	-57°00.3
Alioth	166°42.3	56°03.5
Spica	158°57.0	-11°03.8
Alkaid	153°18.3	49°24.3
Hadar	149°22.9	-60°16.9
Menkent	148°36.5	-36°16.6
Arcturus	146°18.1	19°16.8
Rigil Kent.	140°25.4	-60°45.3
Kochab	137°20.2	74°13.9
Zuben'ubi	137°32.5	-15°57.8
Alphecca	126°31.8	26°46.7
Antares	112°56.3	-26°23.4
Atria	108°20.4	-68°59.7
Sabik	102°40.6	-15°42.1
Shaula	96°55.1	-37°05.5
Rasalhague	96°29.2	12°34.5
Eltanin	90°57.8	51°29.7
Kaus Aust.	84°16.1	-34°23.7
Vega	80°55.6	38°46.2
Nunki	76°28.4	-26°19.2
Altair	62°31.9	8°49.3
Peacock	53°57.3	-56°47.9
Deneb	49°48.0	45°13.2
Enif	34°10.8	9°47.6
Al Na'ir	28°13.9	-47°03.2
Fomalhaut	15°50.4	-29°43.3
Scheat	14°16.7	27°59.2
Markab	14°02.3	15°06.5

Nov 12 Thu	SHA	Mer.pass
Venus	82°37.5	15:06
Mars	195°29.8	07:33
Jupiter	154°36.7	10:16
Saturn	163°16.5	09:41

Nov 13 Fri	SHA	Mer.pass
Venus	81°30.8	15:06
Mars	194°58.7	07:31
Jupiter	154°24.8	10:13
Saturn	163°10.3	09:38

Nov 14 Sat	SHA	Mer.pass
Venus	80°24.7	15:07
Mars	194°27.8	07:30
Jupiter	154°13.0	10:10
Saturn	163°04.2	09:34

Horizontal parallax	
Venus:	0.2
Mars:	0.1

h — Sun — Moon

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	183°58.3	S17°36.7	1°47.2	6.0′	N13°28.1	11.3′	61.3′
1	198°58.2	37.4	16°12.2	5.9′	13°39.4	11.2′	61.3′
2	213°58.1	38.0	30°37.1	5.8′	13°50.6	11.1′	61.3′
3	228°58.0	·· 38.7	45°01.9	5.8′	14°01.7	11.0′	61.3′
4	243°58.0	39.4	59°26.7	5.7′	14°12.7	10.9′	61.3′
5	258°57.9	40.1	73°51.4	5.6′	14°23.6	10.8′	61.3′
6	273°57.8	S17°40.7	88°16.0	5.6′	N14°34.4	10.8′	61.3′
7	288°57.7	41.4	102°40.6	5.5′	14°45.2	10.6′	61.3′
8	303°57.7	42.1	117°05.1	5.4′	14°55.8	10.5′	61.3′
9	318°57.6	·· 42.8	131°29.6	5.4′	15°06.3	10.4′	61.3′
10	333°57.5	43.5	145°53.9	5.3′	15°16.7	10.3′	61.3′
11	348°57.4	44.1	160°18.3	5.3′	15°27.0	10.2′	61.3′
12	3°57.3	S17°44.8	174°42.5	5.2′	N15°37.2	10.1′	61.3′
13	18°57.3	45.5	189°06.7	5.1′	15°47.3	10.0′	61.3′
14	33°57.2	46.2	203°30.8	5.1′	15°57.3	9.8′	61.3′
15	48°57.1	·· 46.8	217°54.9	5.0′	16°07.1	9.8′	61.3′
16	63°57.0	47.5	232°18.9	5.0′	16°16.9	9.6′	61.3′
17	78°56.9	48.2	246°42.9	4.9′	16°26.5	9.5′	61.3′
18	93°56.9	S17°48.8	261°06.8	4.8′	N16°36.0	9.4′	61.3′
19	108°56.8	49.5	275°30.6	4.8′	16°45.4	9.3′	61.3′
20	123°56.7	50.2	289°54.4	4.7′	16°54.7	9.1′	61.3′
21	138°56.6	·· 50.9	304°18.1	4.7′	17°03.8	9.1′	61.3′
22	153°56.5	51.5	318°41.8	4.6′	17°12.9	8.8′	61.3′
23	168°56.4	52.2	333°05.4	4.6′	17°21.7	8.8′	61.3′
	SD = 16.2′	d = 0.7′	SD = 16.7′				

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	183°56.4	S17°52.9	347°29.0	4.5′	N17°30.5	8.7′	61.3′
1	198°56.3	53.5	1°52.5	4.5′	17°39.2	8.5′	61.3′
2	213°56.2	54.2	16°15.9	4.4′	17°47.7	8.4′	61.3′
3	228°56.1	·· 54.9	30°39.4	4.4′	17°56.1	8.2′	61.3′
4	243°56.0	55.5	45°02.7	4.3′	18°04.3	8.1′	61.2′
5	258°55.9	56.2	59°26.1	4.3′	18°12.4	8.0′	61.2′
6	273°55.9	S17°56.9	73°49.3	4.2′	N18°20.4	7.8′	61.2′
7	288°55.8	57.5	88°12.6	4.2′	18°28.2	7.7′	61.2′
8	303°55.7	58.2	102°35.7	4.1′	18°35.9	7.6′	61.2′
9	318°55.6	·· 58.9	116°58.9	4.1′	18°43.5	7.4′	61.2′
10	333°55.5	17°59.5	131°22.0	4.1′	18°50.9	7.3′	61.2′
11	348°55.4	18°00.2	145°45.1	4.0′	18°58.2	7.2′	61.2′
12	3°55.3	S18°00.8	160°08.1	4.0′	N19°05.4	7.0′	61.1′
13	18°55.2	01.5	174°31.1	4.0′	19°12.4	6.8′	61.1′
14	33°55.2	02.2	188°54.1	3.9′	19°19.2	6.7′	61.1′
15	48°55.1	·· 02.8	203°17.0	3.9′	19°25.9	6.6′	61.1′
16	63°55.0	03.5	217°39.9	3.9′	19°32.5	6.4′	61.1′
17	78°54.9	04.2	232°02.8	3.8′	19°38.9	6.3′	61.1′
18	93°54.8	S18°04.8	246°25.6	3.8′	N19°45.2	6.1′	61.1′
19	108°54.7	05.5	260°48.4	3.8′	19°51.3	6.0′	61.0′
20	123°54.6	06.1	275°11.2	3.8′	19°57.3	5.8′	61.0′
21	138°54.5	·· 06.8	289°34.0	3.7′	20°03.1	5.7′	61.0′
22	153°54.4	07.4	303°56.7	3.7′	20°08.8	5.5′	61.0′
23	168°54.3	08.1	318°19.4	3.7′	20°14.3	5.3′	61.0′
	SD = 16.2′	d = 0.7′	SD = 16.7′				

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	183°54.2	S18°08.8	332°42.1	3.7′	N20°19.6	5.3′	60.9′
1	198°54.2	09.4	347°04.8	3.7′	20°24.9	5.0′	60.9′
2	213°54.1	10.1	1°27.5	3.7′	20°29.9	4.9′	60.9′
3	228°54.0	·· 10.7	15°50.2	3.7′	20°34.8	4.8′	60.9′
4	243°53.9	11.4	30°12.8	3.6′	20°39.6	4.6′	60.9′
5	258°53.8	12.0	44°35.5	3.6′	20°44.2	4.4′	60.8′
6	273°53.7	S18°12.7	58°58.1	3.6′	N20°48.6	4.3′	60.8′
7	288°53.6	13.3	73°20.7	3.6′	20°52.9	4.1′	60.8′
8	303°53.5	14.0	87°43.4	3.6′	20°57.0	4.0′	60.8′
9	318°53.4	·· 14.6	102°06.0	3.6′	21°01.0	3.8′	60.7′
10	333°53.3	15.3	116°28.6	3.6′	21°04.8	3.6′	60.7′
11	348°53.2	15.9	130°51.2	3.6′	21°08.4	3.5′	60.7′
12	3°53.1	S18°16.6	145°13.9	3.6′	N21°11.9	3.3′	60.7′
13	18°53.0	17.2	159°36.5	3.6′	21°15.2	3.2′	60.6′
14	33°52.9	17.9	173°59.1	3.7′	21°18.4	3.0′	60.6′
15	48°52.8	·· 18.5	188°21.8	3.7′	21°21.4	2.9′	60.6′
16	63°52.7	19.2	202°44.4	3.7′	21°24.3	2.7′	60.6′
17	78°52.6	19.8	217°07.1	3.7′	21°27.0	2.5′	60.5′
18	93°52.5	S18°20.5	231°29.8	3.7′	N21°29.5	2.4′	60.5′
19	108°52.4	21.1	245°52.5	3.7′	21°31.9	2.2′	60.5′
20	123°52.3	21.7	260°15.2	3.7′	21°34.1	2.1′	60.5′
21	138°52.2	·· 22.4	274°38.0	3.8′	21°36.2	1.9′	60.4′
22	153°52.1	23.0	289°00.8	3.8′	21°38.1	1.7′	60.4′
23	168°52.0	23.7	303°23.6	3.8′	21°39.8	1.6′	60.4′
	SD = 16.2′	d = 0.7′	SD = 16.6′				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	06:52	08:24	10:32	12:56	15:03	16:35
N 70°	06:43	08:03	09:36	13:51	15:24	16:45
68°	06:35	07:47	09:03	14:25	15:41	16:53
66°	06:28	07:33	08:39	14:48	15:54	16:59
64°	06:22	07:22	08:21	15:07	16:06	17:05
62°	06:17	07:13	08:05	15:22	16:15	17:10
60°	06:13	07:04	07:53	15:35	16:24	17:15
N 58°	06:09	06:57	07:42	15:46	16:31	17:19
56°	06:05	06:50	07:32	15:56	16:38	17:23
54°	06:01	06:44	07:24	16:04	16:44	17:27
52°	05:58	06:39	07:16	16:12	16:49	17:30
50°	05:55	06:34	07:09	16:19	16:54	17:33
45°	05:48	06:23	06:55	16:33	17:05	17:40
N 40°	05:41	06:14	06:43	16:46	17:14	17:47
35°	05:35	06:06	06:32	16:56	17:23	17:53
30°	05:29	05:58	06:23	17:05	17:30	17:59
20°	05:18	05:45	06:08	17:21	17:44	18:11
N 10°	05:06	05:32	05:54	17:35	17:57	18:22
0°	04:54	05:19	05:41	17:48	18:10	18:35
S 10°	04:39	05:05	05:28	18:01	18:23	18:49
20°	04:22	04:50	05:13	18:15	18:39	19:07
30°	04:00	04:31	04:57	18:32	18:58	19:29
35°	03:46	04:20	04:47	18:42	19:09	19:43
40°	03:29	04:06	04:36	18:53	19:23	20:01
45°	03:07	03:50	04:24	19:06	19:40	20:22
S 50°	02:38	03:29	04:08	19:22	20:01	20:52
52°	02:23	03:19	04:00	19:30	20:11	21:07
54°	02:05	03:08	03:52	19:38	20:23	21:26
56°	01:43	02:54	03:42	19:48	20:36	21:49
58°	01:11	02:39	03:32	19:58	20:52	22:22
S 60°	00:06	02:19	03:19	20:11	21:12	////

Lat.	Moonrise Thu	Moonrise Fri	Moonrise Sat	Moonset Thu	Moonset Fri	Moonset Sat
N 72°	14:23	▭	▭	10:01	▭	▭
N 70°	15:02	14:33	▭	09:25	12:01	▭
68°	15:28	15:27	15:32	08:59	11:07	13:13
66°	15:49	16:01	16:27	08:40	10:35	12:19
64°	16:06	16:25	17:00	08:24	10:11	11:46
62°	16:20	16:45	17:24	08:11	09:52	11:22
60°	16:31	17:01	17:43	08:00	09:36	11:03
N 58°	16:42	17:14	17:59	07:51	09:23	10:47
56°	16:51	17:26	18:13	07:42	09:12	10:34
54°	16:59	17:37	18:25	07:35	09:02	10:22
52°	17:06	17:46	18:36	07:28	08:53	10:12
50°	17:12	17:54	18:45	07:23	08:45	10:02
45°	17:26	18:12	19:05	07:10	08:29	09:43
N 40°	17:38	18:26	19:21	06:59	08:15	09:27
35°	17:48	18:38	19:35	06:50	08:03	09:14
30°	17:57	18:49	19:47	06:43	07:53	09:02
20°	18:12	19:08	20:07	06:29	07:36	08:42
N 10°	18:25	19:24	20:25	06:17	07:21	08:25
0°	18:38	19:39	20:41	06:06	07:07	08:09
S 10°	18:50	19:54	20:58	05:56	06:53	07:53
20°	19:04	20:11	21:16	05:44	06:38	07:35
30°	19:20	20:30	21:37	05:31	06:20	07:15
35°	19:29	20:41	21:49	05:23	06:10	07:04
40°	19:39	20:54	22:03	05:14	05:59	06:51
45°	19:52	21:09	22:19	05:04	05:46	06:35
S 50°	20:07	21:28	22:40	04:52	05:30	06:16
52°	20:14	21:36	22:50	04:46	05:22	06:07
54°	20:22	21:46	23:00	04:40	05:14	05:56
56°	20:31	21:57	23:13	04:33	05:04	05:45
58°	20:41	22:10	23:27	04:26	04:53	05:32
S 60°	20:53	22:25	23:44	04:17	04:41	05:16

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 16-18 100-94%
12	15:53	15:49	11:44	–:–	12:22	
13	15:45	15:41	11:44	00:52	13:23	
14	15:37	15:32	11:44	01:54	14:25	

November 15, 16, 17 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	53°59.5	133°18.7	S26°33.6	247°56.4	N07°51.0	208°00.7	S09°34.8	216°57.7	S04°47.2
1	69°02.0	148°18.4	33.4	262°57.6	50.5	223°02.7	35.0	231°59.9	47.3
2	84°04.5	163°18.2	33.2	277°58.8	50.0	238°04.7	35.2	247°02.1	47.4
3	99°06.9	178°17.9	·· 33.0	293°00.0	·· 49.5	253°06.7	·· 35.4	262°04.3	·· 47.5
4	114°09.4	193°17.7	32.8	308°01.2	49.0	268°08.6	35.6	277°06.5	47.6
5	129°11.9	208°17.4	32.6	323°02.4	48.5	283°10.6	35.8	292°08.7	47.7
6	144°14.3	223°17.2	S26°32.4	338°03.5	N07°48.0	298°12.6	S09°35.9	307°10.9	S04°47.8
7	159°16.8	238°16.9	32.2	353°04.7	47.5	313°14.6	36.1	322°13.1	47.9
8	174°19.3	253°16.7	32.0	8°05.9	47.0	328°16.5	36.3	337°15.4	48.0
9	189°21.7	268°16.4	·· 31.8	23°07.1	·· 46.5	343°18.5	·· 36.5	352°17.6	·· 48.1
10	204°24.2	283°16.2	31.6	38°08.3	46.0	358°20.5	36.7	7°19.8	48.2
11	219°26.6	298°15.9	31.4	53°09.4	45.5	13°22.4	36.9	22°22.0	48.3
12	234°29.1	313°15.7	S26°31.2	68°10.6	N07°45.0	28°24.4	S09°37.0	37°24.2	S04°48.4
13	249°31.6	328°15.4	31.0	83°11.8	44.5	43°26.4	37.2	52°26.4	48.5
14	264°34.0	343°15.2	30.8	98°13.0	44.0	58°28.4	37.4	67°28.6	48.6
15	279°36.5	358°15.0	·· 30.6	113°14.2	·· 43.5	73°30.3	·· 37.6	82°30.8	·· 48.7
16	294°39.0	13°14.7	30.3	128°15.4	43.0	88°32.3	37.8	97°33.1	48.8
17	309°41.4	28°14.5	30.1	143°16.6	42.5	103°34.3	38.0	112°35.3	48.9
18	324°43.9	43°14.2	S26°29.9	158°17.7	N07°42.0	118°36.3	S09°38.1	127°37.5	S04°49.0
19	339°46.4	58°14.0	29.7	173°18.9	41.5	133°38.2	38.3	142°39.7	49.1
20	354°48.8	73°13.8	29.5	188°20.1	41.0	148°40.2	38.5	157°41.9	49.2
21	9°51.3	88°13.5	·· 29.3	203°21.3	·· 40.5	163°42.2	·· 38.7	172°44.1	·· 49.3
22	24°53.7	103°13.3	29.1	218°22.5	40.0	178°44.2	38.9	187°46.3	49.4
23	39°56.2	118°13.1	28.8	233°23.7	39.5	193°46.1	39.0	202°48.5	49.4
Mer.pass. 20:21		ν -0.3′	d 0.2′	m -4.53	ν 1.2′	d 0.5′	m 1.30	ν 2.0′	d 0.2′ m -1.70	ν 2.2′	d 0.1′ m 0.86

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	54°58.7	133°12.8	S26°28.6	248°24.9	N07°39.0	208°48.1	S09°39.2	217°50.8	S04°49.5
1	70°01.1	148°12.6	28.4	263°26.0	38.5	223°50.1	39.4	232°53.0	49.6
2	85°03.6	163°12.4	28.2	278°27.2	38.0	238°52.1	39.6	247°55.2	49.7
3	100°06.1	178°12.2	·· 27.9	293°28.4	·· 37.5	253°54.0	·· 39.8	262°57.4	·· 49.8
4	115°08.5	193°11.9	27.7	308°29.6	37.0	268°56.0	40.0	277°59.6	49.9
5	130°11.0	208°11.7	27.5	323°30.8	36.5	283°58.0	40.1	293°01.8	50.0
6	145°13.5	223°11.5	S26°27.3	338°32.0	N07°36.0	299°00.0	S09°40.3	308°04.0	S04°50.1
7	160°15.9	238°11.3	27.0	353°33.2	35.5	314°01.9	40.5	323°06.3	50.2
8	175°18.4	253°11.0	26.8	8°34.4	35.0	329°03.9	40.7	338°08.5	50.3
9	190°20.9	268°10.8	·· 26.6	23°35.5	·· 34.5	344°05.9	·· 40.9	353°10.7	·· 50.4
10	205°23.3	283°10.6	26.4	38°36.7	34.0	359°07.9	41.0	8°12.9	50.5
11	220°25.8	298°10.4	26.1	53°37.9	33.5	14°09.8	41.2	23°15.1	50.6
12	235°28.2	313°10.2	S26°25.9	68°39.1	N07°33.0	29°11.8	S09°41.4	38°17.3	S04°50.7
13	250°30.7	328°09.9	25.7	83°40.3	32.5	44°13.8	41.6	53°19.5	50.8
14	265°33.2	343°09.7	25.4	98°41.5	32.0	59°15.8	41.8	68°21.8	50.9
15	280°35.6	358°09.5	·· 25.2	113°42.7	·· 31.5	74°17.8	·· 41.9	83°24.0	·· 51.0
16	295°38.1	13°09.3	25.0	128°43.9	31.0	89°19.7	42.1	98°26.2	51.1
17	310°40.6	28°09.1	24.7	143°45.1	30.5	104°21.7	42.3	113°28.4	51.2
18	325°43.0	43°08.9	S26°24.5	158°46.3	N07°30.0	119°23.7	S09°42.5	128°30.6	S04°51.3
19	340°45.5	58°08.7	24.3	173°47.4	29.5	134°25.7	42.7	143°32.8	51.4
20	355°48.0	73°08.4	24.0	188°48.6	29.0	149°27.6	42.9	158°35.0	51.5
21	10°50.4	88°08.2	·· 23.8	203°49.8	·· 28.5	164°29.6	·· 43.0	173°37.3	·· 51.6
22	25°52.9	103°08.0	23.5	218°51.0	28.0	179°31.6	43.2	188°39.5	51.7
23	40°55.4	118°07.8	23.3	233°52.2	27.5	194°33.6	43.4	203°41.7	51.8
Mer.pass. 20:17		ν -0.2′	d 0.2′	m -4.55	ν 1.2′	d 0.5′	m 1.29	ν 2.0′	d 0.2′ m -1.70	ν 2.2′	d 0.1′ m 0.86

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	55°57.8	133°07.6	S26°23.0	248°53.4	N07°27.0	209°35.5	S09°43.6	218°43.9	S04°51.8
1	71°00.3	148°07.4	22.8	263°54.6	26.5	224°37.5	43.8	233°46.1	51.9
2	86°02.7	163°07.2	22.6	278°55.8	26.0	239°39.5	43.9	248°48.3	52.0
3	101°05.2	178°07.0	·· 22.3	293°57.0	·· 25.5	254°41.5	·· 44.1	263°50.5	·· 52.1
4	116°07.7	193°06.8	22.1	308°58.2	25.0	269°43.4	44.3	278°52.8	52.2
5	131°10.1	208°06.6	21.8	323°59.4	24.5	284°45.4	44.5	293°55.0	52.3
6	146°12.6	223°06.4	S26°21.6	339°00.6	N07°24.0	299°47.4	S09°44.7	308°57.2	S04°52.4
7	161°15.1	238°06.2	21.3	354°01.7	23.5	314°49.4	44.8	323°59.4	52.5
8	176°17.5	253°06.0	21.1	9°02.9	23.0	329°51.4	45.0	339°01.6	52.6
9	191°20.0	268°05.8	·· 20.8	24°04.1	·· 22.5	344°53.3	·· 45.2	354°03.8	·· 52.7
10	206°22.5	283°05.6	20.6	39°05.3	22.0	359°55.3	45.4	9°06.0	52.8
11	221°24.9	298°05.4	20.3	54°06.5	21.5	14°57.3	45.6	24°08.3	52.9
12	236°27.4	313°05.3	S26°20.1	69°07.7	N07°21.0	29°59.3	S09°45.7	39°10.5	S04°53.0
13	251°29.9	328°05.1	19.8	84°08.9	20.5	45°01.2	45.9	54°12.7	53.1
14	266°32.3	343°04.9	19.5	99°10.1	20.0	60°03.2	46.1	69°14.9	53.2
15	281°34.8	358°04.7	·· 19.3	114°11.3	·· 19.5	75°05.2	·· 46.3	84°17.1	·· 53.3
16	296°37.2	13°04.5	19.0	129°12.5	19.0	90°07.2	46.5	99°19.3	53.4
17	311°39.7	28°04.3	18.8	144°13.7	18.5	105°09.1	46.6	114°21.6	53.5
18	326°42.2	43°04.1	S26°18.5	159°14.9	N07°18.0	120°11.1	S09°46.8	129°23.8	S04°53.6
19	341°44.6	58°03.9	18.2	174°16.1	17.5	135°13.1	47.0	144°26.0	53.7
20	356°47.1	73°03.8	18.0	189°17.3	17.0	150°15.1	47.2	159°28.2	53.8
21	11°49.6	88°03.6	·· 17.7	204°18.5	·· 16.5	165°17.1	·· 47.4	174°30.4	·· 53.8
22	26°52.0	103°03.4	17.5	219°19.7	16.0	180°19.0	47.5	189°32.6	53.9
23	41°54.5	118°03.2	17.2	234°20.9	15.5	195°21.0	47.7	204°34.9	54.0
Mer.pass. 20:13		ν -0.2′	d 0.2′	m -4.56	ν 1.2′	d 0.5′	m 1.28	ν 2.0′	d 0.2′ m -1.70	ν 2.2′	d 0.1′ m 0.86

Stars

	SHA	Dec
Alpheratz	358°08.3	28°59.5
Ankaa	353°39.2	-42°24.5
Schedar	350°07.7	56°26.4
Diphda	349°19.8	-18°05.3
Achernar	335°44.1	-57°19.9
Hamal	328°27.7	23°22.6
Polaris	326°16.9	89°10.9
Acamar	315°36.2	-40°22.7
Menkar	314°40.0	4°01.1
Mirfak	309°14.5	49°47.8
Aldebaran	291°16.8	16°28.4
Rigel	281°34.9	-8°13.3
Capella	281°09.7	45°58.7
Bellatrix	278°57.6	6°20.0
Elnath	278°42.8	28°35.5
Alnilam	276°10.6	-1°12.8
Betelgeuse	271°27.1	7°24.3
Canopus	264°06.4	-52°41.0
Sirius	258°54.7	-16°41.3
Adhara	255°31.2	-28°56.7
Procyon	245°24.8	5°16.4
Pollux	243°57.0	28°04.2
Avior	234°27.7	-59°26.7
Suhail	223°10.1	-43°21.2
Miaplacidus	221°44.7	-69°38.2
Alphard	218°19.8	-8°34.6
Regulus	208°09.2	12°03.5
Dubhe	194°21.4	61°50.8
Denebola	182°58.4	14°40.5
Gienah	176°17.4	-17°26.2
Acrux	173°36.9	-62°59.5
Gacrux	172°28.3	-57°00.3
Alioth	166°42.2	56°03.5
Spica	158°57.0	-11°03.8
Alkaid	153°18.3	49°24.3
Hadar	149°22.9	-60°16.9
Menkent	148°36.5	-36°16.6
Arcturus	146°18.1	19°16.7
Rigil Kent.	140°25.4	-60°45.3
Kochab	137°20.2	74°13.9
Zuben'ubi	137°32.5	-15°57.8
Alphecca	126°31.8	26°46.7
Antares	112°56.3	-26°23.4
Atria	108°20.4	-68°59.7
Sabik	102°40.5	-15°42.1
Shaula	96°55.1	-37°05.5
Rasalhague	96°29.1	12°34.5
Eltanin	90°57.8	51°29.7
Kaus Aust.	84°16.1	-34°23.7
Vega	80°55.6	38°46.2
Nunki	76°28.4	-26°19.2
Altair	62°31.9	8°49.3
Peacock	53°57.4	-56°47.9
Deneb	49°48.1	45°13.2
Enif	34°10.8	9°47.6
Al Na'ir	28°13.9	-47°03.2
Fomalhaut	15°50.4	-29°43.3
Scheat	14°16.7	27°59.2
Markab	14°02.3	15°06.5

Nov 15 Sun	**SHA**	**Mer.pass**
Venus	79°19.1	15:07
Mars	193°56.9	07:28
Jupiter	154°01.2	10:07
Saturn	162°58.1	09:31

Nov 16 Mon	**SHA**	**Mer.pass**
Venus	78°14.2	15:07
Mars	193°26.2	07:26
Jupiter	153°49.4	10:03
Saturn	162°52.1	09:27

Nov 17 Tue	**SHA**	**Mer.pass**
Venus	77°09.8	15:08
Mars	192°55.6	07:24
Jupiter	153°37.7	10:00
Saturn	162°46.1	09:24

Horizontal parallax	
Venus:	0.2
Mars:	0.1

h	Sun		Moon				
Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°51.9	S18°24.3	317°46.4	3.9′	N21°41.4	1.5′	60.3′
1	198°51.8	25.0	332°09.2	3.9′	21°42.9	1.2′	60.3′
2	213°51.7	25.6	346°32.1	3.9′	21°44.1	1.2′	60.3′
3	228°51.6	·· 26.2	0°55.0	3.9′	21°45.3	0.9′	60.2′
4	243°51.5	26.9	15°18.0	4.0′	21°46.2	0.8′	60.2′
5	258°51.4	27.5	29°41.0	4.0′	21°47.0	0.6′	60.2′
6	273°51.3	S18°28.2	44°04.0	4.1′	N21°47.6	0.5′	60.1′
7	288°51.2	28.8	58°27.0	4.1′	21°48.1	0.4′	60.1′
8	303°51.1	29.4	72°50.1	4.1′	21°48.5	0.1′	60.1′
9	318°51.0	·· 30.1	87°13.3	4.2′	21°48.6	0.1′	60.1′
10	333°50.9	30.7	101°36.5	4.2′	21°48.7	0.2′	60.0′
11	348°50.8	31.3	115°59.7	4.3′	21°48.5	0.3′	60.0′
12	3°50.7	S18°32.0	130°23.0	4.3′	N21°48.2	0.4′	60.0′
13	18°50.6	32.6	144°46.3	4.4′	21°47.8	0.6′	59.9′
14	33°50.5	33.3	159°09.7	4.4′	21°47.2	0.7′	59.9′
15	48°50.3	·· 33.9	173°33.1	4.5′	21°46.5	0.9′	59.9′
16	63°50.2	34.5	187°56.6	4.5′	21°45.6	1.1′	59.8′
17	78°50.1	35.2	202°20.2	4.6′	21°44.5	1.2′	59.8′
18	93°50.0	S18°35.8	216°43.8	4.7′	N21°43.3	1.3′	59.8′
19	108°49.9	36.4	231°07.4	4.7′	21°42.0	1.5′	59.7′
20	123°49.8	37.0	245°31.2	4.8′	21°40.5	1.7′	59.7′
21	138°49.7	·· 37.7	259°55.0	4.9′	21°38.8	1.7′	59.6′
22	153°49.6	38.3	274°18.8	4.9′	21°37.1	2.0′	59.6′
23	168°49.5	38.9	288°42.7	5.0′	21°35.1	2.0′	59.6′
	SD = 16.2′	d = 0.6′	SD = 16.5′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°49.4	S18°39.6	303°06.7	5.1′	N21°33.1	2.3′	59.5′
1	198°49.3	40.2	317°30.8	5.1′	21°30.8	2.3′	59.5′
2	213°49.1	40.8	331°54.9	5.2′	21°28.5	2.5′	59.5′
3	228°49.0	·· 41.4	346°19.1	5.3′	21°26.0	2.7′	59.4′
4	243°48.9	42.1	0°43.3	5.3′	21°23.3	2.8′	59.4′
5	258°48.8	42.7	15°07.7	5.4′	21°20.5	2.9′	59.4′
6	273°48.7	S18°43.3	29°32.1	5.5′	N21°17.6	3.1′	59.3′
7	288°48.6	43.9	43°56.6	5.6′	21°14.5	3.2′	59.3′
8	303°48.5	44.6	58°21.1	5.6′	21°11.3	3.3′	59.2′
9	318°48.4	·· 45.2	72°45.8	5.7′	21°08.0	3.5′	59.2′
10	333°48.2	45.8	87°10.5	5.8′	21°04.5	3.6′	59.2′
11	348°48.1	46.4	101°35.3	5.9′	21°00.9	3.7′	59.1′
12	3°48.0	S18°47.1	116°00.2	6.0′	N20°57.2	3.9′	59.1′
13	18°47.9	47.7	130°25.1	6.0′	20°53.3	4.0′	59.1′
14	33°47.8	48.3	144°50.2	6.1′	20°49.3	4.1′	59.0′
15	48°47.7	·· 48.9	159°15.3	6.2′	20°45.2	4.3′	59.0′
16	63°47.6	49.5	173°40.5	6.3′	20°40.9	4.4′	58.9′
17	78°47.4	50.2	188°05.8	6.4′	20°36.5	4.5′	58.9′
18	93°47.3	S18°50.8	202°31.2	6.5′	N20°32.0	4.6′	58.9′
19	108°47.2	51.4	216°56.7	6.6′	20°27.4	4.8′	58.8′
20	123°47.1	52.0	231°22.2	6.6′	20°22.6	4.9′	58.8′
21	138°47.0	·· 52.6	245°47.9	6.7′	20°17.7	5.0′	58.8′
22	153°46.8	53.3	260°13.6	6.8′	20°12.7	5.1′	58.7′
23	168°46.7	53.9	274°39.4	6.9′	20°07.6	5.3′	58.7′
	SD = 16.2′	d = 0.6′	SD = 16.2′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°46.6	S18°54.5	289°05.3	7.0′	N20°02.3	5.3′	58.6′
1	198°46.5	55.1	303°31.3	7.1′	19°57.0	5.5′	58.6′
2	213°46.4	55.7	317°57.4	7.2′	19°51.5	5.6′	58.6′
3	228°46.2	·· 56.3	332°23.6	7.3′	19°45.9	5.7′	58.5′
4	243°46.1	56.9	346°49.9	7.4′	19°40.2	5.8′	58.5′
5	258°46.0	57.5	1°16.2	7.5′	19°34.4	5.9′	58.5′
6	273°45.9	S18°58.2	15°42.7	7.6′	N19°28.5	6.1′	58.4′
7	288°45.8	58.8	30°09.2	7.6′	19°22.4	6.1′	58.4′
8	303°45.6	18°59.4	44°35.9	7.7′	19°16.3	6.3′	58.3′
9	318°45.5	19°00.0	59°02.6	7.8′	19°10.0	6.3′	58.3′
10	333°45.4	00.6	73°29.4	7.9′	19°03.7	6.5′	58.3′
11	348°45.3	01.2	87°56.4	8.0′	18°57.2	6.6′	58.2′
12	3°45.1	S19°01.8	102°23.4	8.1′	N18°50.6	6.7′	58.2′
13	18°45.0	02.4	116°50.5	8.2′	18°43.9	6.7′	58.2′
14	33°44.9	03.0	131°17.7	8.3′	18°37.2	6.9′	58.1′
15	48°44.8	·· 03.6	145°45.0	8.4′	18°30.3	7.0′	58.1′
16	63°44.7	04.2	160°12.4	8.5′	18°23.3	7.1′	58.0′
17	78°44.5	04.8	174°39.9	8.6′	18°16.2	7.1′	58.0′
18	93°44.4	S19°05.4	189°07.5	8.7′	N18°09.1	7.3′	58.0′
19	108°44.3	06.1	203°35.1	8.8′	18°01.8	7.3′	57.9′
20	123°44.1	06.7	218°02.9	8.9′	17°54.5	7.5′	57.9′
21	138°44.0	·· 07.3	232°30.8	9.0′	17°47.0	7.5′	57.9′
22	153°43.9	07.9	246°58.7	9.1′	17°39.5	7.7′	57.8′
23	168°43.8	08.5	261°26.8	9.1′	17°31.8	7.7′	57.8′
	SD = 16.2′	d = 0.6′	SD = 16.0′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	07:03	08:39	11:27	12:02	14:50	16:26
N 70°	06:52	08:15	09:56	13:33	15:13	16:36
68°	06:43	07:57	09:17	14:12	15:32	16:45
66°	06:36	07:42	08:51	14:38	15:46	16:53
64°	06:30	07:30	08:30	14:59	15:59	16:59
62°	06:24	07:20	08:14	15:15	16:09	17:05
60°	06:19	07:11	08:00	15:29	16:18	17:10
N 58°	06:14	07:03	07:49	15:40	16:26	17:15
56°	06:10	06:56	07:38	15:51	16:33	17:19
54°	06:06	06:50	07:29	16:00	16:39	17:23
52°	06:02	06:44	07:21	16:08	16:45	17:26
50°	05:59	06:39	07:14	16:15	16:51	17:30
45°	05:51	06:27	06:59	16:30	17:02	17:38
N 40°	05:44	06:17	06:46	16:43	17:12	17:45
35°	05:38	06:08	06:35	16:54	17:21	17:52
30°	05:31	06:00	06:26	17:04	17:29	17:58
20°	05:19	05:46	06:09	17:20	17:43	18:10
N 10°	05:07	05:33	05:55	17:35	17:57	18:22
0°	04:54	05:19	05:41	17:48	18:10	18:36
S 10°	04:39	05:05	05:27	18:02	18:25	18:51
20°	04:21	04:49	05:13	18:17	18:41	19:09
30°	03:58	04:29	04:56	18:34	19:01	19:32
35°	03:43	04:17	04:45	18:45	19:13	19:47
40°	03:26	04:03	04:34	18:56	19:27	20:05
45°	03:03	03:46	04:20	19:10	19:44	20:28
S 50°	02:32	03:24	04:04	19:27	20:06	20:59
52°	02:16	03:14	03:56	19:35	20:17	21:15
54°	01:57	03:02	03:47	19:44	20:30	21:35
56°	01:31	02:47	03:37	19:54	20:44	22:02
58°	00:54	02:31	03:26	20:05	21:01	22:42
S 60°	////	02:10	03:12	20:19	21:23	////

Lat.	**Moonrise** Sun	Mon	Tue	**Moonset** Sun	Mon	Tue
N 72°						
N 70°			19:17			15:39
68°	16:15	18:02	19:58	14:40	14:57	14:58
66°	17:21	18:46	20:25	13:34	14:13	14:30
64°	17:56	19:16	20:46	12:58	13:43	14:08
62°	18:22	19:38	21:03	12:33	13:20	13:50
60°	18:42	19:56	21:17	12:13	13:02	13:36
N 58°	18:59	20:11	21:29	11:56	12:47	13:23
56°	19:13	20:23	21:40	11:42	12:34	13:12
54°	19:25	20:34	21:49	11:29	12:23	13:03
52°	19:36	20:44	21:57	11:19	12:13	12:54
50°	19:45	20:53	22:04	11:09	12:04	12:47
45°	20:06	21:11	22:20	10:49	11:45	12:30
N 40°	20:22	21:26	22:32	10:32	11:29	12:17
35°	20:36	21:39	22:43	10:19	11:16	12:05
30°	20:48	21:50	22:53	10:06	11:04	11:55
20°	21:08	22:09	23:09	09:46	10:45	11:38
N 10°	21:26	22:26	23:23	09:28	10:27	11:22
0°	21:43	22:41	23:36	09:11	10:11	11:08
S 10°	21:59	22:57	23:49	08:54	09:55	10:54
20°	22:17	23:13	·· ··	08:36	09:37	10:38
30°	22:38	23:32	·· ··	08:15	09:17	10:20
35°	22:50	23:43	·· ··	08:03	09:06	10:10
40°	23:04	23:56	·· ··	07:49	08:52	09:58
45°	23:20	·· ··	00:10	07:32	08:36	09:44
S 50°	23:40	·· ··	00:29	07:12	08:16	09:26
52°	23:50	·· ··	00:37	07:02	08:07	09:18
54°	·· ··	00:01	00:47	06:51	07:56	09:09
56°	·· ··	00:13	00:57	06:38	07:44	08:58
58°	·· ··	00:27	01:10	06:24	07:30	08:47
S 60°	·· ··	00:43	01:24	06:07	07:14	08:33

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 19-21 86-67%
15	15:28	15:23	11:45	02:56	15:27	
16	15:17	15:12	11:45	03:57	16:26	
17	15:06	15:01	11:45	04:55	17:22	

November 18, 19, 20 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	56°57.0	133°03.0	S26°16.9	249°22.1	N07°15.0	210°23.0	S09°47.9	219°37.1	S04°54.1
1	71°59.4	148°02.9	16.7	264°23.3	14.5	225°25.0	48.1	234°39.3	54.2
2	87°01.9	163°02.7	16.4	279°24.5	14.0	240°26.9	48.3	249°41.5	54.3
3	102°04.3	178°02.5	·· 16.1	294°25.7	·· 13.5	255°28.9	·· 48.4	264°43.7	·· 54.4
4	117°06.8	193°02.4	15.8	309°26.9	13.0	270°30.9	48.6	279°45.9	54.5
5	132°09.3	208°02.2	15.6	324°28.1	12.5	285°32.9	48.8	294°48.2	54.6
6	147°11.7	223°02.0	S26°15.3	339°29.3	N07°12.0	300°34.9	S09°49.0	309°50.4	S04°54.7
7	162°14.2	238°01.8	15.0	354°30.5	11.5	315°36.8	49.2	324°52.6	54.8
8	177°16.7	253°01.7	14.8	9°31.7	11.0	330°38.8	49.3	339°54.8	54.9
9	192°19.1	268°01.5	·· 14.5	24°32.9	·· 10.5	345°40.8	·· 49.5	354°57.0	·· 55.0
10	207°21.6	283°01.3	14.2	39°34.1	10.1	0°42.8	49.7	9°59.2	55.1
11	222°24.1	298°01.2	13.9	54°35.3	09.6	15°44.8	49.9	25°01.5	55.2
12	237°26.5	313°01.0	S26°13.7	69°36.5	N07°09.1	30°46.7	S09°50.1	40°03.7	S04°55.3
13	252°29.0	328°00.8	13.4	84°37.7	08.6	45°48.7	50.2	55°05.9	55.4
14	267°31.5	343°00.7	13.1	99°38.9	08.1	60°50.7	50.4	70°08.1	55.4
15	282°33.9	358°00.5	·· 12.8	114°40.1	·· 07.6	75°52.7	·· 50.6	85°10.3	·· 55.5
16	297°36.4	13°00.4	12.5	129°41.3	07.1	90°54.6	50.8	100°12.5	55.6
17	312°38.8	28°00.2	12.3	144°42.5	06.6	105°56.6	51.0	115°14.8	55.7
18	327°41.3	43°00.1	S26°12.0	159°43.7	N07°06.1	120°58.6	S09°51.1	130°17.0	S04°55.8
19	342°43.8	57°59.9	11.7	174°44.9	05.6	136°00.6	51.3	145°19.2	55.9
20	357°46.2	72°59.7	11.4	189°46.1	05.1	151°02.6	51.5	160°21.4	56.0
21	12°48.7	87°59.6	·· 11.1	204°47.3	·· 04.6	166°04.5	·· 51.7	175°23.6	·· 56.1
22	27°51.2	102°59.4	10.8	219°48.5	04.1	181°06.5	51.9	190°25.9	56.2
23	42°53.6	117°59.3	10.5	234°49.7	03.6	196°08.5	52.0	205°28.1	56.3
Mer.pass. 20:09		ν -0.2′	d 0.3′	m -4.57	ν 1.2′	d 0.5′	m 1.27	ν 2.0′	d 0.2′ m -1.70	ν 2.2′	d 0.1′ m 0.86

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	57°56.1	132°59.1	S26°10.2	249°50.9	N07°03.1	211°10.5	S09°52.2	220°30.3	S04°56.4
1	72°58.6	147°59.0	10.0	264°52.1	02.6	226°12.5	52.4	235°32.5	56.5
2	88°01.0	162°58.9	09.7	279°53.3	02.1	241°14.4	52.6	250°34.7	56.6
3	103°03.5	177°58.7	·· 09.4	294°54.5	·· 01.6	256°16.4	·· 52.7	265°36.9	·· 56.7
4	118°06.0	192°58.6	09.1	309°55.7	01.1	271°18.4	52.9	280°39.2	56.8
5	133°08.4	207°58.4	08.8	324°56.9	00.6	286°20.4	53.1	295°41.4	56.9
6	148°10.9	222°58.3	S26°08.5	339°58.1	N07°00.1	301°22.4	S09°53.3	310°43.6	S04°56.9
7	163°13.3	237°58.1	08.2	354°59.3	06°59.6	316°24.3	53.5	325°45.8	57.0
8	178°15.8	252°58.0	07.9	10°00.5	59.1	331°26.3	53.6	340°48.0	57.1
9	193°18.3	267°57.9	·· 07.6	25°01.7	·· 58.6	346°28.3	·· 53.8	355°50.3	·· 57.2
10	208°20.7	282°57.7	07.3	40°02.9	58.1	1°30.3	54.0	10°52.5	57.3
11	223°23.2	297°57.6	07.0	55°04.1	57.6	16°32.3	54.2	25°54.7	57.4
12	238°25.7	312°57.5	S26°06.7	70°05.3	N06°57.1	31°34.2	S09°54.4	40°56.9	S04°57.5
13	253°28.1	327°57.3	06.4	85°06.5	56.6	46°36.2	54.5	55°59.1	57.6
14	268°30.6	342°57.2	06.1	100°07.7	56.1	61°38.2	54.7	71°01.4	57.7
15	283°33.1	357°57.1	·· 05.8	115°08.9	·· 55.6	76°40.2	·· 54.9	86°03.6	·· 57.8
16	298°35.5	12°56.9	05.5	130°10.1	55.1	91°42.2	55.1	101°05.8	57.9
17	313°38.0	27°56.8	05.2	145°11.3	54.6	106°44.1	55.2	116°08.0	58.0
18	328°40.4	42°56.7	S26°04.9	160°12.6	N06°54.1	121°46.1	S09°55.4	131°10.2	S04°58.1
19	343°42.9	57°56.5	04.6	175°13.8	53.6	136°48.1	55.6	146°12.5	58.2
20	358°45.4	72°56.4	04.3	190°15.0	53.1	151°50.1	55.8	161°14.7	58.3
21	13°47.8	87°56.3	·· 04.0	205°16.2	·· 52.6	166°52.1	·· 56.0	176°16.9	·· 58.3
22	28°50.3	102°56.2	03.7	220°17.4	52.1	181°54.0	56.1	191°19.1	58.4
23	43°52.8	117°56.1	03.4	235°18.6	51.6	196°56.0	56.3	206°21.3	58.5
Mer.pass. 20:05		ν -0.1′	d 0.3′	m -4.58	ν 1.2′	d 0.5′	m 1.26	ν 2.0′	d 0.2′ m -1.71	ν 2.2′	d 0.1′ m 0.86

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	58°55.2	132°55.9	S26°03.0	250°19.8	N06°51.1	211°58.0	S09°56.5	221°23.6	S04°58.6
1	73°57.7	147°55.8	02.7	265°21.0	50.6	227°00.0	56.7	236°25.8	58.7
2	89°00.2	162°55.7	02.4	280°22.2	50.2	242°02.0	56.8	251°28.0	58.8
3	104°02.6	177°55.6	·· 02.1	295°23.4	·· 49.7	257°03.9	·· 57.0	266°30.2	·· 58.9
4	119°05.1	192°55.5	01.8	310°24.6	49.2	272°05.9	57.2	281°32.4	59.0
5	134°07.6	207°55.4	01.5	325°25.8	48.7	287°07.9	57.4	296°34.7	59.1
6	149°10.0	222°55.2	S26°01.2	340°27.0	N06°48.2	302°09.9	S09°57.6	311°36.9	S04°59.2
7	164°12.5	237°55.1	00.8	355°28.3	47.7	317°11.9	57.7	326°39.1	59.3
8	179°14.9	252°55.0	00.5	10°29.5	47.2	332°13.9	57.9	341°41.3	59.4
9	194°17.4	267°54.9	26°00.2	25°30.7	·· 46.7	347°15.8	·· 58.1	356°43.5	·· 59.5
10	209°19.9	282°54.8	25°59.9	40°31.9	46.2	2°17.8	58.3	11°45.8	59.5
11	224°22.3	297°54.7	59.6	55°33.1	45.7	17°19.8	58.4	26°48.0	59.6
12	239°24.8	312°54.6	S25°59.2	70°34.3	N06°45.2	32°21.8	S09°58.6	41°50.2	S04°59.7
13	254°27.3	327°54.5	58.9	85°35.5	44.7	47°23.8	58.8	56°52.4	59.8
14	269°29.7	342°54.4	58.6	100°36.7	44.2	62°25.7	59.0	71°54.6	04°59.9
15	284°32.2	357°54.3	·· 58.3	115°37.9	·· 43.7	77°27.7	·· 59.1	86°56.9	05°00.0
16	299°34.7	12°54.2	57.9	130°39.2	43.2	92°29.7	59.3	101°59.1	00.1
17	314°37.1	27°54.1	57.6	145°40.4	42.7	107°31.7	59.5	117°01.3	00.2
18	329°39.6	42°54.0	S25°57.3	160°41.6	N06°42.2	122°33.7	S09°59.7	132°03.5	S05°00.3
19	344°42.1	57°53.9	57.0	175°42.8	41.7	137°35.7	09°59.9	147°05.8	00.4
20	359°44.5	72°53.8	56.6	190°44.0	41.2	152°37.6	10°00.0	162°08.0	00.5
21	14°47.0	87°53.7	·· 56.3	205°45.2	·· 40.7	167°39.6	·· 00.2	177°10.2	·· 00.6
22	29°49.4	102°53.6	56.0	220°46.4	40.2	182°41.6	00.4	192°12.4	00.7
23	44°51.9	117°53.5	55.6	235°47.6	39.7	197°43.6	00.6	207°14.6	00.7
Mer.pass. 20:01		ν -0.1′	d 0.3′	m -4.59	ν 1.2′	d 0.5′	m 1.26	ν 2.0′	d 0.2′ m -1.71	ν 2.2′	d 0.1′ m 0.86

Stars

	SHA	Dec
Alpheratz	358°08.3	28°59.5
Ankaa	353°39.2	-42°24.5
Schedar	350°07.7	56°26.4
Diphda	349°19.8	-18°05.3
Achernar	335°44.2	-57°20.0
Hamal	328°27.7	23°22.6
Polaris	326°17.2	89°10.9
Acamar	315°36.2	-40°22.7
Menkar	314°40.0	4°01.1
Mirfak	309°14.4	49°47.8
Aldebaran	291°16.7	16°28.4
Rigel	281°34.9	-8°13.3
Capella	281°09.7	45°58.7
Bellatrix	278°57.6	6°20.0
Elnath	278°42.8	28°35.5
Alnilam	276°10.5	-1°12.8
Betelgeuse	271°27.1	7°24.3
Canopus	264°06.4	-52°41.0
Sirius	258°54.7	-16°41.3
Adhara	255°31.2	-28°56.7
Procyon	245°24.8	5°16.4
Pollux	243°57.0	28°04.2
Avior	234°27.6	-59°26.7
Suhail	223°10.1	-43°21.2
Miaplacidus	221°44.6	-69°38.2
Alphard	218°19.7	-8°34.6
Regulus	208°09.2	12°03.4
Dubhe	194°21.3	61°50.8
Denebola	182°58.4	14°40.5
Gienah	176°17.3	-17°26.2
Acrux	173°36.9	-62°59.5
Gacrux	172°28.3	-57°00.3
Alioth	166°42.2	56°03.4
Spica	158°57.0	-11°03.8
Alkaid	153°18.3	49°24.2
Hadar	149°22.8	-60°16.9
Menkent	148°36.4	-36°16.6
Arcturus	146°18.1	19°16.7
Rigil Kent.	140°25.4	-60°45.3
Kochab	137°20.2	74°13.8
Zuben'ubi	137°32.5	-15°57.8
Alphecca	126°31.8	26°46.7
Antares	112°56.2	-26°23.4
Atria	108°20.4	-68°59.7
Sabik	102°40.5	-15°42.1
Shaula	96°55.1	-37°05.4
Rasalhague	96°29.2	12°34.5
Eltanin	90°57.8	51°29.7
Kaus Aust.	84°16.1	-34°23.7
Vega	80°55.6	38°46.2
Nunki	76°28.4	-26°19.2
Altair	62°31.9	8°49.3
Peacock	53°57.4	-56°47.9
Deneb	49°48.1	45°13.2
Enif	34°10.8	9°47.6
Al Na'ir	28°13.9	-47°03.2
Fomalhaut	15°50.4	-29°43.3
Scheat	14°16.7	27°59.2
Markab	14°02.3	15°06.5

Nov 18 Wed	SHA	Mer.pass
Venus	76°06.1	15:08
Mars	192°25.1	07:22
Jupiter	153°26.0	09:57
Saturn	162°40.1	09:20

Nov 19 Thu	SHA	Mer.pass
Venus	75°03.0	15:08
Mars	191°54.8	07:20
Jupiter	153°14.4	09:54
Saturn	162°34.2	09:17

Nov 20 Fri	SHA	Mer.pass
Venus	74°00.7	15:08
Mars	191°24.6	07:18
Jupiter	153°02.8	09:51
Saturn	162°28.3	09:13

Horizontal parallax	
Venus:	0.2
Mars:	0.1

h	Sun		Moon				
Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°43.6	S19°09.1	275°54.9	9.2′	N17°24.1	7.8′	57.7′
1	198°43.5	09.7	290°23.2	9.3′	17°16.3	7.9′	57.7′
2	213°43.4	10.3	304°51.5	9.4′	17°08.4	8.0′	57.7′
3	228°43.2	·· 10.9	319°19.9	9.5′	17°00.4	8.0′	57.6′
4	243°43.1	11.5	333°48.4	9.6′	16°52.4	8.2′	57.6′
5	258°43.0	12.1	348°17.0	9.7′	16°44.2	8.2′	57.6′
6	273°42.9	S19°12.7	2°45.7	9.8′	N16°36.0	8.3′	57.5′
7	288°42.7	13.3	17°14.5	9.9′	16°27.7	8.4′	57.5′
8	303°42.6	13.8	31°43.4	10.0′	16°19.3	8.4′	57.4′
9	318°42.5	·· 14.4	46°12.4	10.1′	16°10.9	8.6′	57.4′
10	333°42.3	15.0	60°41.4	10.2′	16°02.3	8.6′	57.4′
11	348°42.2	15.6	75°10.6	10.2′	15°53.7	8.7′	57.3′
12	3°42.1	S19°16.2	89°39.8	10.3′	N15°45.0	8.7′	57.3′
13	18°41.9	16.8	104°09.2	10.4′	15°36.3	8.8′	57.3′
14	33°41.8	17.4	118°38.6	10.5′	15°27.5	8.9′	57.2′
15	48°41.7	·· 18.0	133°08.1	10.6′	15°18.6	9.0′	57.2′
16	63°41.5	18.6	147°37.7	10.7′	15°09.6	9.0′	57.2′
17	78°41.4	19.2	162°07.4	10.8′	15°00.6	9.1′	57.1′
18	93°41.3	S19°19.8	176°37.1	10.9′	N14°51.5	9.2′	57.1′
19	108°41.1	20.4	191°07.0	10.9′	14°42.3	9.3′	57.1′
20	123°41.0	21.0	205°36.9	11.0′	14°33.0	9.3′	57.0′
21	138°40.9	·· 21.5	220°07.0	11.1′	14°23.7	9.3′	57.0′
22	153°40.7	22.1	234°37.1	11.2′	14°14.4	9.4′	57.0′
23	168°40.6	22.7	249°07.3	11.3′	14°05.0	9.5′	56.9′
	SD = 16.2′	d = 0.6′	SD = 15.7′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°40.4	S19°23.3	263°37.5	11.4′	N13°55.5	9.6′	56.9′
1	198°40.3	23.9	278°07.9	11.4′	13°45.9	9.6′	56.9′
2	213°40.2	24.5	292°38.3	11.5′	13°36.3	9.6′	56.8′
3	228°40.0	·· 25.1	307°08.8	11.6′	13°26.7	9.7′	56.8′
4	243°39.9	25.6	321°39.4	11.7′	13°17.0	9.8′	56.8′
5	258°39.8	26.2	336°10.1	11.8′	13°07.2	9.8′	56.7′
6	273°39.6	S19°26.8	350°40.9	11.8′	N12°57.4	9.9′	56.7′
7	288°39.5	27.4	5°11.7	11.9′	12°47.5	9.9′	56.7′
8	303°39.3	28.0	19°42.6	12.0′	12°37.6	10.0′	56.6′
9	318°39.2	·· 28.6	34°13.6	12.1′	12°27.6	10.0′	56.6′
10	333°39.1	29.1	48°44.7	12.1′	12°17.6	10.1′	56.6′
11	348°38.9	29.7	63°15.8	12.2′	12°07.5	10.1′	56.5′
12	3°38.8	S19°30.3	77°47.0	12.3′	N11°57.4	10.1′	56.5′
13	18°38.6	30.9	92°18.3	12.4′	11°47.3	10.3′	56.5′
14	33°38.5	31.4	106°49.7	12.4′	11°37.0	10.2′	56.4′
15	48°38.3	·· 32.0	121°21.1	12.5′	11°26.8	10.3′	56.4′
16	63°38.2	32.6	135°52.6	12.6′	11°16.5	10.4′	56.4′
17	78°38.1	33.2	150°24.2	12.6′	11°06.1	10.3′	56.3′
18	93°37.9	S19°33.8	164°55.8	12.7′	N10°55.8	10.5′	56.3′
19	108°37.8	34.3	179°27.5	12.8′	10°45.3	10.4′	56.3′
20	123°37.6	34.9	193°59.3	12.8′	10°34.9	10.5′	56.2′
21	138°37.5	·· 35.5	208°31.1	12.9′	10°24.4	10.6′	56.2′
22	153°37.3	36.1	223°03.1	13.0′	10°13.8	10.5′	56.2′
23	168°37.2	36.6	237°35.0	13.0′	10°03.3	10.6′	56.2′
	SD = 16.2′	d = 0.6′	SD = 15.5′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°37.1	S19°37.2	252°07.1	13.1′	N09°52.7	10.7′	56.1′
1	198°36.9	37.8	266°39.2	13.2′	09°42.0	10.7′	56.1′
2	213°36.8	38.3	281°11.3	13.2′	09°31.3	10.7′	56.1′
3	228°36.6	·· 38.9	295°43.6	13.3′	09°20.6	10.7′	56.0′
4	243°36.5	39.5	310°15.9	13.3′	09°09.9	10.8′	56.0′
5	258°36.3	40.0	324°48.2	13.4′	08°59.1	10.8′	56.0′
6	273°36.2	S19°40.6	339°20.6	13.5′	N08°48.3	10.8′	55.9′
7	288°36.0	41.2	353°53.1	13.5′	08°37.5	10.9′	55.9′
8	303°35.9	41.7	8°25.6	13.6′	08°26.6	10.9′	55.9′
9	318°35.7	·· 42.3	22°58.2	13.6′	08°15.7	10.9′	55.9′
10	333°35.6	42.9	37°30.8	13.7′	08°04.8	11.0′	55.8′
11	348°35.4	43.4	52°03.5	13.7′	07°53.8	10.9′	55.8′
12	3°35.3	S19°44.0	66°36.2	13.8′	N07°42.9	11.0′	55.8′
13	18°35.1	44.6	81°09.0	13.8′	07°31.9	11.0′	55.8′
14	33°35.0	45.1	95°41.9	13.9′	07°20.9	11.1′	55.7′
15	48°34.8	·· 45.7	110°14.8	13.9′	07°09.8	11.0′	55.7′
16	63°34.7	46.3	124°47.7	14.0′	06°58.8	11.1′	55.7′
17	78°34.5	46.8	139°20.7	14.0′	06°47.7	11.1′	55.6′
18	93°34.4	S19°47.4	153°53.8	14.1′	N06°36.6	11.1′	55.6′
19	108°34.2	47.9	168°26.9	14.1′	06°25.5	11.2′	55.6′
20	123°34.1	48.5	183°00.0	14.2′	06°14.3	11.1′	55.6′
21	138°33.9	·· 49.1	197°33.2	14.2′	06°03.2	11.2′	55.5′
22	153°33.8	49.6	212°06.4	14.3′	05°52.0	11.2′	55.5′
23	168°33.6	50.2	226°39.7	14.3′	05°40.8	11.2′	55.5′
	SD = 16.2′	d = 0.6′	SD = 15.3′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	07:13	08:53	▬	▬	14:37	16:16
N 70°	07:01	08:27	10:17	13:12	15:03	16:28
68°	06:52	08:07	09:32	13:58	15:23	16:38
66°	06:44	07:51	09:02	14:28	15:39	16:46
64°	06:36	07:38	08:40	14:50	15:52	16:53
62°	06:30	07:27	08:22	15:08	16:03	17:00
60°	06:25	07:17	08:08	15:23	16:13	17:05
N 58°	06:20	07:09	07:55	15:35	16:21	17:10
56°	06:15	07:01	07:44	15:46	16:29	17:15
54°	06:11	06:55	07:35	15:55	16:36	17:19
52°	06:07	06:49	07:27	16:04	16:42	17:23
50°	06:03	06:43	07:19	16:11	16:47	17:27
45°	05:55	06:31	07:03	16:28	17:00	17:36
N 40°	05:47	06:20	06:50	16:41	17:10	17:43
35°	05:40	06:11	06:38	16:52	17:19	17:50
30°	05:34	06:03	06:28	17:02	17:28	17:57
20°	05:21	05:48	06:11	17:20	17:43	18:10
N 10°	05:08	05:34	05:56	17:35	17:57	18:23
0°	04:54	05:20	05:42	17:49	18:11	18:36
S 10°	04:39	05:05	05:27	18:03	18:26	18:52
20°	04:20	04:48	05:12	18:19	18:43	19:11
30°	03:56	04:28	04:54	18:37	19:03	19:35
35°	03:41	04:15	04:44	18:48	19:16	19:50
40°	03:23	04:01	04:32	19:00	19:31	20:09
45°	02:59	03:43	04:17	19:14	19:49	20:33
S 50°	02:26	03:20	04:00	19:32	20:12	21:06
52°	02:09	03:09	03:52	19:40	20:23	21:23
54°	01:48	02:56	03:42	19:50	20:36	21:45
56°	01:20	02:41	03:32	20:00	20:52	22:15
58°	00:32	02:23	03:20	20:13	21:10	23:08
S 60°	////	02:00	03:06	20:27	21:33	////

Lat.	**Moonrise** Wed	Thu	Fri	**Moonset** Wed	Thu	Fri
N 72°	20:53	22:59	·· ··	15:53	15:26	15:08
N 70°	21:24	23:16	·· ··	15:20	15:08	14:58
68°	21:47	23:29	·· ··	14:56	14:53	14:50
66°	22:04	23:39	·· ··	14:38	14:41	14:43
64°	22:19	23:48	·· ··	14:22	14:31	14:38
62°	22:30	23:56	·· ··	14:10	14:23	14:33
60°	22:41	·· ··	00:02	13:59	14:15	14:28
N 58°	22:49	·· ··	00:08	13:49	14:09	14:24
56°	22:57	·· ··	00:13	13:41	14:03	14:21
54°	23:04	·· ··	00:18	13:33	13:58	14:18
52°	23:10	·· ··	00:22	13:27	13:53	14:15
50°	23:15	·· ··	00:26	13:21	13:48	14:12
45°	23:27	·· ··	00:34	13:08	13:39	14:06
N 40°	23:37	·· ··	00:40	12:57	13:31	14:02
35°	23:46	·· ··	00:46	12:48	13:24	13:57
30°	23:53	·· ··	00:51	12:39	13:18	13:54
20°	·· ··	00:06	01:00	12:25	13:08	13:47
N 10°	·· ··	00:17	01:07	12:13	12:59	13:41
0°	·· ··	00:27	01:14	12:01	12:50	13:36
S 10°	·· ··	00:37	01:21	11:49	12:41	13:31
20°	00:03	00:48	01:29	11:36	12:32	13:25
30°	00:19	01:01	01:37	11:22	12:21	13:18
35°	00:29	01:08	01:42	11:13	12:15	13:14
40°	00:39	01:16	01:48	11:03	12:08	13:10
45°	00:52	01:25	01:54	10:52	11:59	13:05
S 50°	01:07	01:37	02:02	10:38	11:49	12:58
52°	01:14	01:42	02:06	10:31	11:44	12:56
54°	01:21	01:48	02:10	10:24	11:39	12:52
56°	01:30	01:54	02:14	10:16	11:33	12:49
58°	01:40	02:02	02:19	10:07	11:27	12:45
S 60°	01:51	02:10	02:24	09:56	11:20	12:41

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 22-24 57-36%
18	14:55	14:48	11:45	05:49	18:14	
19	14:42	14:35	11:45	06:39	19:02	
20	14:28	14:21	11:46	07:25	19:48	

November 21, 22, 23 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	59°54.4	132°53.5	S25°55.3	250°48.9	N06°39.2	212°45.6	S10°00.7	222°16.9	S05°00.8
1	74°56.8	147°53.4	55.0	265°50.1	38.7	227°47.6	00.9	237°19.1	00.9
2	89°59.3	162°53.3	54.6	280°51.3	38.2	242°49.5	01.1	252°21.3	01.0
3	105°01.8	177°53.2	·· 54.3	295°52.5	·· 37.8	257°51.5	·· 01.3	267°23.5	·· 01.1
4	120°04.2	192°53.1	54.0	310°53.7	37.3	272°53.5	01.4	282°25.8	01.2
5	135°06.7	207°53.0	53.6	325°54.9	36.8	287°55.5	01.6	297°28.0	01.3
6	150°09.2	222°53.0	S25°53.3	340°56.1	N06°36.3	302°57.5	S10°01.8	312°30.2	S05°01.4
7	165°11.6	237°52.9	53.0	355°57.4	35.8	317°59.5	02.0	327°32.4	01.5
8	180°14.1	252°52.8	52.6	10°58.6	35.3	333°01.4	02.1	342°34.6	01.6
9	195°16.5	267°52.7	·· 52.3	25°59.8	·· 34.8	348°03.4	·· 02.3	357°36.9	·· 01.7
10	210°19.0	282°52.6	51.9	41°01.0	34.3	3°05.4	02.5	12°39.1	01.7
11	225°21.5	297°52.6	51.6	56°02.2	33.8	18°07.4	02.7	27°41.3	01.8
12	240°23.9	312°52.5	S25°51.3	71°03.4	N06°33.3	33°09.4	S10°02.9	42°43.5	S05°01.9
13	255°26.4	327°52.4	50.9	86°04.7	32.8	48°11.4	03.0	57°45.8	02.0
14	270°28.9	342°52.4	50.6	101°05.9	32.3	63°13.3	03.2	72°48.0	02.1
15	285°31.3	357°52.3	·· 50.2	116°07.1	·· 31.8	78°15.3	·· 03.4	87°50.2	·· 02.2
16	300°33.8	12°52.2	49.9	131°08.3	31.3	93°17.3	03.6	102°52.4	02.3
17	315°36.3	27°52.2	49.5	146°09.5	30.8	108°19.3	03.7	117°54.7	02.4
18	330°38.7	42°52.1	S25°49.2	161°10.7	N06°30.3	123°21.3	S10°03.9	132°56.9	S05°02.5
19	345°41.2	57°52.0	48.8	176°12.0	29.8	138°23.3	04.1	147°59.1	02.6
20	0°43.7	72°52.0	48.5	191°13.2	29.3	153°25.2	04.3	163°01.3	02.7
21	15°46.1	87°51.9	·· 48.1	206°14.4	·· 28.8	168°27.2	·· 04.4	178°03.5	·· 02.8
22	30°48.6	102°51.9	47.8	221°15.6	28.4	183°29.2	04.6	193°05.8	02.8
23	45°51.0	117°51.8	47.4	236°16.8	27.9	198°31.2	04.8	208°08.0	02.9
Mer.pass. 19:57		ν -0.1′	d 0.3′	m -4.61	ν 1.2′	d 0.5′	m 1.25	ν 2.0′	d 0.2′ m -1.71	ν 2.2′	d 0.1′ m 0.86

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	60°53.5	132°51.7	S25°47.1	251°18.1	N06°27.4	213°33.2	S10°05.0	223°10.2	S05°03.0
1	75°56.0	147°51.7	46.7	266°19.3	26.9	228°35.2	05.1	238°12.4	03.1
2	90°58.4	162°51.6	46.4	281°20.5	26.4	243°37.1	05.3	253°14.7	03.2
3	106°00.9	177°51.6	·· 46.0	296°21.7	·· 25.9	258°39.1	·· 05.5	268°16.9	·· 03.3
4	121°03.4	192°51.5	45.7	311°22.9	25.4	273°41.1	05.7	283°19.1	03.4
5	136°05.8	207°51.5	45.3	326°24.2	24.9	288°43.1	05.8	298°21.3	03.5
6	151°08.3	222°51.4	S25°44.9	341°25.4	N06°24.4	303°45.1	S10°06.0	313°23.6	S05°03.6
7	166°10.8	237°51.4	44.6	356°26.6	23.9	318°47.1	06.2	328°25.8	03.7
8	181°13.2	252°51.3	44.2	11°27.8	23.4	333°49.1	06.4	343°28.0	03.7
9	196°15.7	267°51.3	·· 43.9	26°29.0	·· 22.9	348°51.0	·· 06.5	358°30.2	·· 03.8
10	211°18.2	282°51.3	43.5	41°30.3	22.4	3°53.0	06.7	13°32.5	03.9
11	226°20.6	297°51.2	43.1	56°31.5	21.9	18°55.0	06.9	28°34.7	04.0
12	241°23.1	312°51.2	S25°42.8	71°32.7	N06°21.4	33°57.0	S10°07.1	43°36.9	S05°04.1
13	256°25.5	327°51.1	42.4	86°33.9	20.9	48°59.0	07.2	58°39.1	04.2
14	271°28.0	342°51.1	42.0	101°35.1	20.5	64°01.0	07.4	73°41.4	04.3
15	286°30.5	357°51.1	·· 41.7	116°36.4	·· 20.0	79°03.0	·· 07.6	88°43.6	·· 04.4
16	301°32.9	12°51.0	41.3	131°37.6	19.5	94°04.9	07.8	103°45.8	04.5
17	316°35.4	27°51.0	40.9	146°38.8	19.0	109°06.9	07.9	118°48.0	04.6
18	331°37.9	42°51.0	S25°40.6	161°40.0	N06°18.5	124°08.9	S10°08.1	133°50.3	S05°04.6
19	346°40.3	57°50.9	40.2	176°41.3	18.0	139°10.9	08.3	148°52.5	04.7
20	1°42.8	72°50.9	39.8	191°42.5	17.5	154°12.9	08.5	163°54.7	04.8
21	16°45.3	87°50.9	·· 39.5	206°43.7	·· 17.0	169°14.9	·· 08.6	178°56.9	·· 04.9
22	31°47.7	102°50.9	39.1	221°44.9	16.5	184°16.9	08.8	193°59.2	05.0
23	46°50.2	117°50.8	38.7	236°46.2	16.0	199°18.8	09.0	209°01.4	05.1
Mer.pass. 19:53		ν -0.1′	d 0.4′	m -4.62	ν 1.2′	d 0.5′	m 1.24	ν 2.0′	d 0.2′ m -1.71	ν 2.2′	d 0.1′ m 0.86

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	61°52.6	132°50.8	S25°38.3	251°47.4	N06°15.5	214°20.8	S10°09.2	224°03.6	S05°05.2
1	76°55.1	147°50.8	38.0	266°48.6	15.0	229°22.8	09.3	239°05.8	05.3
2	91°57.6	162°50.8	37.6	281°49.8	14.5	244°24.8	09.5	254°08.1	05.4
3	107°00.0	177°50.7	·· 37.2	296°51.1	·· 14.0	259°26.8	·· 09.7	269°10.3	·· 05.5
4	122°02.5	192°50.7	36.8	311°52.3	13.5	274°28.8	09.9	284°12.5	05.5
5	137°05.0	207°50.7	36.5	326°53.5	13.1	289°30.8	10.0	299°14.8	05.6
6	152°07.4	222°50.7	S25°36.1	341°54.7	N06°12.6	304°32.7	S10°10.2	314°17.0	S05°05.7
7	167°09.9	237°50.7	35.7	356°56.0	12.1	319°34.7	10.4	329°19.2	05.8
8	182°12.4	252°50.7	35.3	11°57.2	11.6	334°36.7	10.5	344°21.4	05.9
9	197°14.8	267°50.7	·· 34.9	26°58.4	·· 11.1	349°38.7	·· 10.7	359°23.7	·· 06.0
10	212°17.3	282°50.7	34.5	41°59.6	10.6	4°40.7	10.9	14°25.9	06.1
11	227°19.8	297°50.6	34.2	57°00.9	10.1	19°42.7	11.1	29°28.1	06.2
12	242°22.2	312°50.6	S25°33.8	72°02.1	N06°09.6	34°44.7	S10°11.2	44°30.3	S05°06.3
13	257°24.7	327°50.6	33.4	87°03.3	09.1	49°46.7	11.4	59°32.6	06.3
14	272°27.1	342°50.6	33.0	102°04.6	08.6	64°48.6	11.6	74°34.8	06.4
15	287°29.6	357°50.6	·· 32.6	117°05.8	·· 08.1	79°50.6	·· 11.8	89°37.0	·· 06.5
16	302°32.1	12°50.6	32.2	132°07.0	07.6	94°52.6	11.9	104°39.3	06.6
17	317°34.5	27°50.6	31.8	147°08.2	07.1	109°54.6	12.1	119°41.5	06.7
18	332°37.0	42°50.6	S25°31.5	162°09.5	N06°06.7	124°56.6	S10°12.3	134°43.7	S05°06.8
19	347°39.5	57°50.6	31.1	177°10.7	06.2	139°58.6	12.5	149°45.9	06.9
20	2°41.9	72°50.6	30.7	192°11.9	05.7	155°00.6	12.6	164°48.2	07.0
21	17°44.4	87°50.7	·· 30.3	207°13.2	·· 05.2	170°02.6	·· 12.8	179°50.4	·· 07.1
22	32°46.9	102°50.7	29.9	222°14.4	04.7	185°04.5	13.0	194°52.6	07.1
23	47°49.3	117°50.7	29.5	237°15.6	04.2	200°06.5	13.1	209°54.8	07.2
Mer.pass. 19:49		ν -0.0′	d 0.4′	m -4.63	ν 1.2′	d 0.5′	m 1.23	ν 2.2′	d 0.1′ m 0.85

Stars

	SHA	Dec
Alpheratz	358°08.3	28°59.5
Ankaa	353°39.2	-42°24.5
Schedar	350°07.7	56°26.4
Diphda	349°19.8	-18°05.3
Achernar	335°44.2	-57°20.0
Hamal	328°27.7	23°22.6
Polaris	326°17.6	89°11.0
Acamar	315°36.2	-40°22.7
Menkar	314°40.0	4°01.1
Mirfak	309°14.4	49°47.8
Aldebaran	291°16.7	16°28.4
Rigel	281°34.9	-8°13.3
Capella	281°09.7	45°58.7
Bellatrix	278°57.6	6°20.0
Elnath	278°42.8	28°35.5
Alnilam	276°10.5	-1°12.8
Betelgeuse	271°27.1	7°24.3
Canopus	264°06.4	-52°41.0
Sirius	258°54.7	-16°41.3
Adhara	255°31.2	-28°56.7
Procyon	245°24.7	5°16.4
Pollux	243°57.0	28°04.2
Avior	234°27.6	-59°26.8
Suhail	223°10.1	-43°21.2
Miaplacidus	221°44.6	-69°38.2
Alphard	218°19.7	-8°34.6
Regulus	208°09.1	12°03.4
Dubhe	194°21.3	61°50.8
Denebola	182°58.4	14°40.5
Gienah	176°17.3	-17°26.2
Acrux	173°36.8	-62°59.5
Gacrux	172°28.2	-57°00.3
Alioth	166°42.2	56°03.4
Spica	158°57.0	-11°03.8
Alkaid	153°18.3	49°24.2
Hadar	149°22.8	-60°16.9
Menkent	148°36.4	-36°16.6
Arcturus	146°18.0	19°16.7
Rigil Kent.	140°25.4	-60°45.2
Kochab	137°20.2	74°13.8
Zuben'ubi	137°32.5	-15°57.8
Alphecca	126°31.8	26°46.7
Antares	112°56.2	-26°23.4
Atria	108°20.4	-68°59.7
Sabik	102°40.5	-15°42.1
Shaula	96°55.1	-37°05.4
Rasalhague	96°29.2	12°34.5
Eltanin	90°57.8	51°29.7
Kaus Aust.	84°16.1	-34°23.7
Vega	80°55.6	38°46.2
Nunki	76°28.5	-26°19.2
Altair	62°31.9	8°49.3
Peacock	53°57.4	-56°47.9
Deneb	49°48.1	45°13.2
Enif	34°10.8	9°47.6
Al Na'ir	28°13.9	-47°03.2
Fomalhaut	15°50.4	-29°43.3
Scheat	14°16.7	27°59.2
Markab	14°02.3	15°06.5

Nov 21 Sat	SHA	Mer.pass
Venus	72°59.1	15:09
Mars	190°54.5	07:16
Jupiter	152°51.2	09:48
Saturn	162°22.5	09:10

Nov 22 Sun	SHA	Mer.pass
Venus	71°58.2	15:09
Mars	190°24.5	07:14
Jupiter	152°39.7	09:44
Saturn	162°16.7	09:06

Nov 23 Mon	SHA	Mer.pass
Venus	70°58.2	15:09
Mars	189°54.7	07:12
Jupiter	152°28.2	09:41
Saturn	162°11.0	09:02

Horizontal parallax	
Venus:	0.3
Mars:	0.1

h — Sun — Moon

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	183°33.4	S19°50.7	241°13.0	14.4′	N05°29.6	11.2′	55.5′
1	198°33.3	51.3	255°46.4	14.4′	05°18.4	11.3′	55.4′
2	213°33.1	51.8	270°19.8	14.4′	05°07.1	11.2′	55.4′
3	228°33.0	·· 52.4	284°53.2	14.5′	04°55.9	11.3′	55.4′
4	243°32.8	53.0	299°26.7	14.5′	04°44.6	11.2′	55.4′
5	258°32.7	53.5	314°00.2	14.6′	04°33.4	11.3′	55.3′
6	273°32.5	S19°54.1	328°33.8	14.6′	N04°22.1	11.3′	55.3′
7	288°32.4	54.6	343°07.4	14.6′	04°10.8	11.3′	55.3′
8	303°32.2	55.2	357°41.0	14.7′	03°59.5	11.3′	55.3′
9	318°32.0	·· 55.7	12°14.7	14.7′	03°48.2	11.3′	55.3′
10	333°31.9	56.3	26°48.4	14.7′	03°36.9	11.4′	55.2′
11	348°31.7	56.8	41°22.1	14.8′	03°25.5	11.3′	55.2′
12	3°31.6	S19°57.4	55°55.9	14.8′	N03°14.2	11.3′	55.2′
13	18°31.4	57.9	70°29.7	14.8′	03°02.9	11.4′	55.2′
14	33°31.2	58.5	85°03.5	14.9′	02°51.5	11.3′	55.1′
15	48°31.1	·· 59.0	99°37.3	14.9′	02°40.2	11.4′	55.1′
16	63°30.9	19°59.6	114°11.2	14.9′	02°28.8	11.3′	55.1′
17	78°30.8	20°00.1	128°45.1	14.9′	02°17.5	11.4′	55.1′
18	93°30.6	S20°00.6	143°19.1	15.0′	N02°06.1	11.3′	55.1′
19	108°30.4	01.2	157°53.0	15.0′	01°54.8	11.4′	55.0′
20	123°30.3	01.7	172°27.0	15.0′	01°43.4	11.3′	55.0′
21	138°30.1	·· 02.3	187°01.1	15.0′	01°32.1	11.4′	55.0′
22	153°30.0	02.8	201°35.1	15.1′	01°20.7	11.3′	55.0′
23	168°29.8	03.4	216°09.2	15.1′	01°09.4	11.4′	55.0′
	SD = 16.2′	d = 0.6′		SD = 15.1′			

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	183°29.6	S20°03.9	230°43.2	15.1′	N00°58.0	11.3′	54.9′
1	198°29.5	04.5	245°17.4	15.1′	00°46.7	11.4′	54.9′
2	213°29.3	05.0	259°51.5	15.1′	00°35.3	11.3′	54.9′
3	228°29.1	·· 05.5	274°25.6	15.2′	00°24.0	11.3′	54.9′
4	243°29.0	06.1	288°59.8	15.2′	00°12.7	11.4′	54.9′
5	258°28.8	06.6	303°34.0	15.2′	N00°01.3	11.3′	54.8′
6	273°28.6	S20°07.1	318°08.2	15.2′	S00°10.0	11.3′	54.8′
7	288°28.5	07.7	332°42.4	15.2′	00°21.3	11.3′	54.8′
8	303°28.3	08.2	347°16.6	15.2′	00°32.6	11.3′	54.8′
9	318°28.2	·· 08.8	1°50.9	15.3′	00°43.9	11.3′	54.8′
10	333°28.0	09.3	16°25.1	15.3′	00°55.2	11.3′	54.8′
11	348°27.8	09.8	30°59.4	15.3′	01°06.5	11.2′	54.7′
12	3°27.7	S20°10.4	45°33.7	15.3′	S01°17.7	11.3′	54.7′
13	18°27.5	10.9	60°08.0	15.3′	01°29.0	11.2′	54.7′
14	33°27.3	11.4	74°42.3	15.3′	01°40.2	11.3′	54.7′
15	48°27.1	·· 12.0	89°16.6	15.3′	01°51.5	11.2′	54.7′
16	63°27.0	12.5	103°50.9	15.3′	02°02.7	11.2′	54.6′
17	78°26.8	13.0	118°25.2	15.3′	02°13.9	11.2′	54.6′
18	93°26.6	S20°13.6	132°59.6	15.3′	S02°25.1	11.2′	54.6′
19	108°26.5	14.1	147°33.9	15.4′	02°36.3	11.1′	54.6′
20	123°26.3	14.6	162°08.3	15.4′	02°47.4	11.2′	54.6′
21	138°26.1	·· 15.1	176°42.6	15.4′	02°58.6	11.1′	54.6′
22	153°26.0	15.7	191°17.0	15.4′	03°09.7	11.1′	54.6′
23	168°25.8	16.2	205°51.3	15.4′	03°20.8	11.1′	54.5′
	SD = 16.2′	d = 0.5′		SD = 15.0′			

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	183°25.6	S20°16.7	220°25.7	15.4′	S03°31.9	11.1′	54.5′
1	198°25.4	17.2	235°00.1	15.4′	03°43.0	11.0′	54.5′
2	213°25.3	17.8	249°34.4	15.4′	03°54.0	11.1′	54.5′
3	228°25.1	·· 18.3	264°08.8	15.4′	04°05.1	11.0′	54.5′
4	243°24.9	18.8	278°43.2	15.4′	04°16.1	11.0′	54.5′
5	258°24.8	19.3	293°17.6	15.4′	04°27.1	11.0′	54.4′
6	273°24.6	S20°19.9	307°51.9	15.4′	S04°38.1	10.9′	54.4′
7	288°24.4	20.4	322°26.3	15.4′	04°49.0	10.9′	54.4′
8	303°24.2	20.9	337°00.6	15.4′	04°59.9	10.9′	54.4′
9	318°24.1	·· 21.4	351°35.0	15.4′	05°10.8	10.9′	54.4′
10	333°23.9	21.9	6°09.3	15.3′	05°21.7	10.8′	54.4′
11	348°23.7	22.5	20°43.7	15.3′	05°32.5	10.9′	54.4′
12	3°23.5	S20°23.0	35°18.0	15.3′	S05°43.4	10.8′	54.4′
13	18°23.4	23.5	49°52.4	15.3′	05°54.2	10.7′	54.3′
14	33°23.2	24.0	64°26.7	15.3′	06°04.9	10.8′	54.3′
15	48°23.0	·· 24.5	79°01.0	15.3′	06°15.7	10.7′	54.3′
16	63°22.8	25.1	93°35.3	15.3′	06°26.4	10.7′	54.3′
17	78°22.7	25.6	108°09.6	15.3′	06°37.1	10.6′	54.3′
18	93°22.5	S20°26.1	122°43.9	15.3′	S06°47.7	10.6′	54.3′
19	108°22.3	26.6	137°18.2	15.3′	06°58.3	10.6′	54.3′
20	123°22.1	27.1	151°52.4	15.3′	07°08.9	10.6′	54.3′
21	138°21.9	·· 27.6	166°26.7	15.2′	07°19.5	10.5′	54.2′
22	153°21.8	28.1	181°00.9	15.2′	07°30.0	10.5′	54.2′
23	168°21.6	28.6	195°35.2	15.2′	07°40.5	10.5′	54.2′
	SD = 16.2′	d = 0.5′		SD = 14.9′			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	07:23	09:07	▬	▬	14:24	16:08
N 70°	07:10	08:38	10:44	12:47	14:53	16:21
68°	07:00	08:17	09:47	13:45	15:15	16:32
66°	06:51	08:00	09:13	14:18	15:32	16:41
64°	06:43	07:46	08:49	14:42	15:46	16:48
62°	06:36	07:34	08:30	15:01	15:58	16:55
60°	06:30	07:24	08:15	15:17	16:08	17:01
N 58°	06:25	07:15	08:02	15:30	16:17	17:07
56°	06:20	07:07	07:50	15:41	16:25	17:12
54°	06:15	07:00	07:40	15:51	16:32	17:16
52°	06:11	06:53	07:32	16:00	16:39	17:21
50°	06:07	06:47	07:24	16:08	16:45	17:25
45°	05:58	06:34	07:07	16:25	16:58	17:34
N 40°	05:50	06:23	06:53	16:39	17:09	17:42
35°	05:43	06:14	06:41	16:51	17:18	17:49
30°	05:36	06:05	06:31	17:01	17:27	17:56
20°	05:23	05:50	06:13	17:19	17:43	18:10
N 10°	05:09	05:35	05:57	17:35	17:57	18:23
0°	04:55	05:21	05:43	17:50	18:12	18:37
S 10°	04:39	05:05	05:28	18:05	18:27	18:54
20°	04:20	04:48	05:12	18:21	18:45	19:13
30°	03:55	04:27	04:53	18:40	19:06	19:38
35°	03:39	04:14	04:42	18:51	19:19	19:54
40°	03:20	03:58	04:30	19:03	19:34	20:13
45°	02:55	03:40	04:15	19:18	19:53	20:38
S 50°	02:21	03:16	03:56	19:37	20:17	21:13
52°	02:03	03:04	03:48	19:45	20:29	21:32
54°	01:40	02:51	03:38	19:55	20:43	21:55
56°	01:07	02:35	03:27	20:06	20:59	22:29
58°	////	02:15	03:14	20:19	21:19	////
S 60°	////	01:51	02:59	20:34	21:44	////

Lat.	Moonrise Sat	Moonrise Sun	Moonrise Mon	Moonset Sat	Moonset Sun	Moonset Mon
N 72°	00:51	02:37	04:21	14:53	14:39	14:24
N 70°	00:59	02:38	04:14	14:50	14:41	14:33
68°	01:05	02:38	04:09	14:47	14:44	14:40
66°	01:10	02:38	04:05	14:45	14:45	14:46
64°	01:15	02:39	04:01	14:42	14:47	14:51
62°	01:19	02:39	03:58	14:41	14:48	14:55
60°	01:22	02:39	03:55	14:39	14:49	14:59
N 58°	01:25	02:39	03:53	14:38	14:50	15:03
56°	01:27	02:40	03:51	14:36	14:51	15:06
54°	01:30	02:40	03:49	14:35	14:52	15:09
52°	01:32	02:40	03:47	14:34	14:53	15:11
50°	01:34	02:40	03:45	14:33	14:53	15:13
45°	01:38	02:40	03:42	14:31	14:55	15:19
N 40°	01:41	02:41	03:39	14:29	14:56	15:23
35°	01:44	02:41	03:37	14:28	14:57	15:26
30°	01:47	02:41	03:35	14:26	14:58	15:30
20°	01:51	02:42	03:31	14:24	15:00	15:35
N 10°	01:55	02:42	03:28	14:22	15:01	15:40
0°	01:59	02:42	03:24	14:20	15:03	15:45
S 10°	02:03	02:43	03:21	14:18	15:04	15:50
20°	02:07	02:43	03:18	14:16	15:05	15:54
30°	02:11	02:43	03:15	14:13	15:07	16:00
35°	02:14	02:44	03:13	14:12	15:08	16:03
40°	02:17	02:44	03:10	14:10	15:09	16:07
45°	02:20	02:44	03:08	14:08	15:10	16:12
S 50°	02:24	02:45	03:05	14:06	15:12	16:17
52°	02:26	02:45	03:03	14:05	15:12	16:19
54°	02:28	02:45	03:02	14:03	15:13	16:22
56°	02:30	02:45	03:00	14:02	15:14	16:25
58°	02:33	02:45	02:58	14:01	15:15	16:28
S 60°	02:35	02:46	02:56	13:59	15:16	16:32

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 25-27 27-12%
21	14:14	14:06	11:46	08:10	20:31	
22	13:59	13:51	11:46	08:52	21:14	
23	13:42	13:34	11:46	09:35	21:56	

November 24, 25, 26 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	62°51.8	132°50.7	S25°29.1	252°16.8	N06°03.7	215°08.5	S10°13.3	224°57.1	S05°07.3
1	77°54.2	147°50.7	28.7	267°18.1	03.2	230°10.5	13.5	239°59.3	07.4
2	92°56.7	162°50.7	28.3	282°19.3	02.7	245°12.5	13.7	255°01.5	07.5
3	107°59.2	177°50.7	·· 27.9	297°20.5	·· 02.2	260°14.5	·· 13.8	270°03.8	·· 07.6
4	123°01.6	192°50.7	27.5	312°21.8	01.7	275°16.5	14.0	285°06.0	07.7
5	138°04.1	207°50.8	27.1	327°23.0	01.3	290°18.5	14.2	300°08.2	07.8
6	153°06.6	222°50.8	S25°26.7	342°24.2	N06°00.8	305°20.5	S10°14.4	315°10.4	S05°07.9
7	168°09.0	237°50.8	26.3	357°25.5	06°00.3	320°22.4	14.5	330°12.7	07.9
8	183°11.5	252°50.8	25.9	12°26.7	05°59.8	335°24.4	14.7	345°14.9	08.0
9	198°14.0	267°50.9	·· 25.5	27°27.9	·· 59.3	350°26.4	·· 14.9	0°17.1	·· 08.1
10	213°16.4	282°50.9	25.1	42°29.2	58.8	5°28.4	15.0	15°19.4	08.2
11	228°18.9	297°50.9	24.7	57°30.4	58.3	20°30.4	15.2	30°21.6	08.3
12	243°21.4	312°50.9	S25°24.3	72°31.6	N05°57.8	35°32.4	S10°15.4	45°23.8	S05°08.4
13	258°23.8	327°51.0	23.9	87°32.9	57.3	50°34.4	15.6	60°26.0	08.5
14	273°26.3	342°51.0	23.5	102°34.1	56.8	65°36.4	15.7	75°28.3	08.6
15	288°28.7	357°51.0	·· 23.1	117°35.3	·· 56.3	80°38.4	·· 15.9	90°30.5	·· 08.6
16	303°31.2	12°51.1	22.7	132°36.6	55.9	95°40.3	16.1	105°32.7	08.7
17	318°33.7	27°51.1	22.3	147°37.8	55.4	110°42.3	16.3	120°35.0	08.8
18	333°36.1	42°51.2	S25°21.9	162°39.0	N05°54.9	125°44.3	S10°16.4	135°37.2	S05°08.9
19	348°38.6	57°51.2	21.5	177°40.3	54.4	140°46.3	16.6	150°39.4	09.0
20	3°41.1	72°51.2	21.1	192°41.5	53.9	155°48.3	16.8	165°41.7	09.1
21	18°43.5	87°51.3	·· 20.6	207°42.7	·· 53.4	170°50.3	·· 16.9	180°43.9	·· 09.2
22	33°46.0	102°51.3	20.2	222°44.0	52.9	185°52.3	17.1	195°46.1	09.3
23	48°48.5	117°51.4	19.8	237°45.2	52.4	200°54.3	17.3	210°48.3	09.4
Mer.pass. 19:45		ν 0.0′	d 0.4′	m -4.64	ν 1.2′	d 0.5′	m 1.22	ν 2.0′	d 0.2′ m -1.72	ν 2.2′	d 0.1′ m 0.85

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	63°50.9	132°51.4	S25°19.4	252°46.5	N05°51.9	215°56.3	S10°17.5	225°50.6	S05°09.4
1	78°53.4	147°51.5	19.0	267°47.7	51.4	230°58.3	17.6	240°52.8	09.5
2	93°55.9	162°51.5	18.6	282°48.9	51.0	246°00.2	17.8	255°55.0	09.6
3	108°58.3	177°51.6	·· 18.2	297°50.2	·· 50.5	261°02.2	·· 18.0	270°57.3	·· 09.7
4	124°00.8	192°51.6	17.7	312°51.4	50.0	276°04.2	18.1	285°59.5	09.8
5	139°03.2	207°51.7	17.3	327°52.6	49.5	291°06.2	18.3	301°01.7	09.9
6	154°05.7	222°51.7	S25°16.9	342°53.9	N05°49.0	306°08.2	S10°18.5	316°04.0	S05°10.0
7	169°08.2	237°51.8	16.5	357°55.1	48.5	321°10.2	18.7	331°06.2	10.1
8	184°10.6	252°51.9	16.1	12°56.4	48.0	336°12.2	18.8	346°08.4	10.1
9	199°13.1	267°51.9	·· 15.7	27°57.6	·· 47.5	351°14.2	·· 19.0	1°10.7	·· 10.2
10	214°15.6	282°52.0	15.2	42°58.8	47.0	6°16.2	19.2	16°12.9	10.3
11	229°18.0	297°52.0	14.8	58°00.1	46.5	21°18.2	19.3	31°15.1	10.4
12	244°20.5	312°52.1	S25°14.4	73°01.3	N05°46.1	36°20.1	S10°19.5	46°17.3	S05°10.5
13	259°23.0	327°52.2	14.0	88°02.5	45.6	51°22.1	19.7	61°19.6	10.6
14	274°25.4	342°52.3	13.5	103°03.8	45.1	66°24.1	19.9	76°21.8	10.7
15	289°27.9	357°52.3	·· 13.1	118°05.0	·· 44.6	81°26.1	·· 20.0	91°24.0	·· 10.7
16	304°30.3	12°52.4	12.7	133°06.3	44.1	96°28.1	20.2	106°26.3	10.8
17	319°32.8	27°52.5	12.3	148°07.5	43.6	111°30.1	20.4	121°28.5	10.9
18	334°35.3	42°52.5	S25°11.8	163°08.7	N05°43.1	126°32.1	S10°20.5	136°30.7	S05°11.0
19	349°37.7	57°52.6	11.4	178°10.0	42.6	141°34.1	20.7	151°33.0	11.1
20	4°40.2	72°52.7	11.0	193°11.2	42.1	156°36.1	20.9	166°35.2	11.2
21	19°42.7	87°52.8	·· 10.5	208°12.5	·· 41.7	171°38.1	·· 21.1	181°37.4	·· 11.3
22	34°45.1	102°52.9	10.1	223°13.7	41.2	186°40.1	21.2	196°39.7	11.4
23	49°47.6	117°53.0	09.7	238°15.0	40.7	201°42.1	21.4	211°41.9	11.4
Mer.pass. 19:41		ν 0.0′	d 0.4′	m -4.66	ν 1.2′	d 0.5′	m 1.21	ν 2.0′	d 0.2′ m -1.72	ν 2.2′	d 0.1′ m 0.85

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	64°50.1	132°53.0	S25°09.3	253°16.2	N05°40.2	216°44.0	S10°21.6	226°44.1	S05°11.5
1	79°52.5	147°53.1	08.8	268°17.4	39.7	231°46.0	21.7	241°46.4	11.6
2	94°55.0	162°53.2	08.4	283°18.7	39.2	246°48.0	21.9	256°48.6	11.7
3	109°57.5	177°53.3	·· 08.0	298°19.9	·· 38.7	261°50.0	·· 22.1	271°50.8	·· 11.8
4	124°59.9	192°53.4	07.5	313°21.2	38.2	276°52.0	22.3	286°53.1	11.9
5	140°02.4	207°53.5	07.1	328°22.4	37.8	291°54.0	22.4	301°55.3	12.0
6	155°04.8	222°53.6	S25°06.6	343°23.7	N05°37.3	306°56.0	S10°22.6	316°57.5	S05°12.0
7	170°07.3	237°53.7	06.2	358°24.9	36.8	321°58.0	22.8	331°59.8	12.1
8	185°09.8	252°53.8	05.8	13°26.1	36.3	337°00.0	22.9	347°02.0	12.2
9	200°12.2	267°53.9	·· 05.3	28°27.4	·· 35.8	352°02.0	·· 23.1	2°04.2	·· 12.3
10	215°14.7	282°54.0	04.9	43°28.6	35.3	7°04.0	23.3	17°06.5	12.4
11	230°17.2	297°54.1	04.5	58°29.9	34.8	22°06.0	23.4	32°08.7	12.5
12	245°19.6	312°54.2	S25°04.0	73°31.1	N05°34.3	37°08.0	S10°23.6	47°10.9	S05°12.6
13	260°22.1	327°54.3	03.6	88°32.4	33.9	52°10.0	23.8	62°13.2	12.6
14	275°24.6	342°54.4	03.1	103°33.6	33.4	67°11.9	24.0	77°15.4	12.7
15	290°27.0	357°54.5	·· 02.7	118°34.9	·· 32.9	82°13.9	·· 24.1	92°17.6	·· 12.8
16	305°29.5	12°54.6	02.2	133°36.1	32.4	97°15.9	24.3	107°19.9	12.9
17	320°32.0	27°54.7	01.8	148°37.3	31.9	112°17.9	24.5	122°22.1	13.0
18	335°34.4	42°54.8	S25°01.3	163°38.6	N05°31.4	127°19.9	S10°24.6	137°24.3	S05°13.1
19	350°36.9	57°55.0	00.9	178°39.8	30.9	142°21.9	24.8	152°26.6	13.2
20	5°39.3	72°55.1	00.5	193°41.1	30.4	157°23.9	25.0	167°28.8	13.2
21	20°41.8	87°55.2	25°00.0	208°42.3	·· 30.0	172°25.9	·· 25.1	182°31.0	·· 13.3
22	35°44.3	102°55.3	24°59.6	223°43.6	29.5	187°27.9	25.3	197°33.3	13.4
23	50°46.7	117°55.4	59.1	238°44.8	29.0	202°29.9	25.5	212°35.5	13.5
Mer.pass. 19:37		ν 0.1′	d 0.4′	m -4.67	ν 1.2′	d 0.5′	m 1.20	ν 2.0′	d 0.2′ m -1.72	ν 2.2′	d 0.1′ m 0.85

Stars

	SHA	Dec
Alpheratz	358°08.3	28°59.5
Ankaa	353°39.2	-42°24.5
Schedar	350°07.8	56°26.4
Diphda	349°19.8	-18°05.3
Achernar	335°44.2	-57°20.0
Hamal	328°27.7	23°22.6
Polaris	326°18.0	89°11.0
Acamar	315°36.2	-40°22.8
Menkar	314°40.0	4°01.1
Mirfak	309°14.4	49°47.8
Aldebaran	291°16.7	16°28.4
Rigel	281°34.9	-8°13.3
Capella	281°09.6	45°58.8
Bellatrix	278°57.6	6°20.0
Elnath	278°42.7	28°35.5
Alnilam	276°10.5	-1°12.8
Betelgeuse	271°27.1	7°24.3
Canopus	264°06.4	-52°41.0
Sirius	258°54.7	-16°41.4
Adhara	255°31.2	-28°56.7
Procyon	245°24.7	5°16.4
Pollux	243°56.9	28°04.2
Avior	234°27.6	-59°26.8
Suhail	223°10.1	-43°21.2
Miaplacidus	221°44.5	-69°38.2
Alphard	218°19.7	-8°34.6
Regulus	208°09.1	12°03.4
Dubhe	194°21.2	61°50.8
Denebola	182°58.4	14°40.5
Gienah	176°17.3	-17°26.2
Acrux	173°36.8	-62°59.5
Gacrux	172°28.2	-57°00.3
Alioth	166°42.2	56°03.4
Spica	158°56.9	-11°03.8
Alkaid	153°18.3	49°24.2
Hadar	149°22.8	-60°16.8
Menkent	148°36.4	-36°16.6
Arcturus	146°18.0	19°16.7
Rigil Kent.	140°25.3	-60°45.2
Kochab	137°20.1	74°13.8
Zuben'ubi	137°32.5	-15°57.8
Alphecca	126°31.8	26°46.6
Antares	112°56.2	-26°23.4
Atria	108°20.4	-68°59.7
Sabik	102°40.5	-15°42.1
Shaula	96°55.1	-37°05.4
Rasalhague	96°29.2	12°34.5
Eltanin	90°57.8	51°29.7
Kaus Aust.	84°16.1	-34°23.6
Vega	80°55.6	38°46.2
Nunki	76°28.5	-26°19.2
Altair	62°31.9	8°49.3
Peacock	53°57.4	-56°47.9
Deneb	49°48.1	45°13.2
Enif	34°10.8	9°47.6
Al Na'ir	28°13.9	-47°03.2
Fomalhaut	15°50.5	-29°43.3
Scheat	14°16.7	27°59.2
Markab	14°02.3	15°06.5

Nov 24 Tue	SHA	Mer.pass
Venus	69°58.9	15:09
Mars	189°25.1	07:10
Jupiter	152°16.7	09:38
Saturn	162°05.3	08:59

Nov 25 Wed	SHA	Mer.pass
Venus	69°00.5	15:09
Mars	188°55.5	07:08
Jupiter	152°05.3	09:35
Saturn	161°59.7	08:55

Nov 26 Thu	SHA	Mer.pass
Venus	68°03.0	15:08
Mars	188°26.1	07:06
Jupiter	151°54.0	09:32
Saturn	161°54.1	08:52

Horizontal parallax	
Venus:	0.3
Mars:	0.1

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°21.4	S20°29.2	210°09.4	15.2′	S07°51.0	10.4′	54.2′
1	198°21.2	29.7	224°43.6	15.2′	08°01.4	10.4′	54.2′
2	213°21.0	30.2	239°17.8	15.2′	08°11.8	10.4′	54.2′
3	228°20.9	·· 30.7	253°51.9	15.2′	08°22.2	10.3′	54.2′
4	243°20.7	31.2	268°26.1	15.1′	08°32.5	10.3′	54.2′
5	258°20.5	31.7	283°00.2	15.1′	08°42.8	10.2′	54.2′
6	273°20.3	S20°32.2	297°34.3	15.1′	S08°53.0	10.2′	54.2′
7	288°20.1	32.7	312°08.4	15.1′	09°03.2	10.2′	54.1′
8	303°20.0	33.2	326°42.5	15.1′	09°13.4	10.1′	54.1′
9	318°19.8	·· 33.7	341°16.6	15.0′	09°23.5	10.1′	54.1′
10	333°19.6	34.2	355°50.6	15.0′	09°33.6	10.0′	54.1′
11	348°19.4	34.7	10°24.6	15.0′	09°43.6	10.0′	54.1′
12	3°19.2	S20°35.2	24°58.6	15.0′	S09°53.6	10.0′	54.1′
13	18°19.0	35.7	39°32.6	15.0′	10°03.6	9.9′	54.1′
14	33°18.9	36.2	54°06.5	14.9′	10°13.5	9.9′	54.1′
15	48°18.7	·· 36.7	68°40.5	14.9′	10°23.4	9.8′	54.1′
16	63°18.5	37.2	83°14.4	14.9′	10°33.2	9.8′	54.1′
17	78°18.3	37.7	97°48.3	14.9′	10°43.0	9.8′	54.1′
18	93°18.1	S20°38.2	112°22.1	14.8′	S10°52.8	9.7′	54.0′
19	108°17.9	38.7	126°56.0	14.8′	11°02.5	9.6′	54.0′
20	123°17.7	39.2	141°29.8	14.8′	11°12.1	9.6′	54.0′
21	138°17.6	·· 39.7	156°03.6	14.8′	11°21.7	9.6′	54.0′
22	153°17.4	40.2	170°37.3	14.7′	11°31.3	9.5′	54.0′
23	168°17.2	40.7	185°11.1	14.7′	11°40.8	9.4′	54.0′
	SD = 16.2′	d = 0.5′	SD = 14.8′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°17.0	S20°41.2	199°44.8	14.7′	S11°50.2	9.4′	54.0′
1	198°16.8	41.7	214°18.4	14.7′	11°59.6	9.4′	54.0′
2	213°16.6	42.2	228°52.1	14.6′	12°09.0	9.3′	54.0′
3	228°16.4	·· 42.7	243°25.7	14.6′	12°18.3	9.2′	54.0′
4	243°16.2	43.2	257°59.3	14.6′	12°27.5	9.3′	54.0′
5	258°16.1	43.7	272°32.9	14.5′	12°36.8	9.1′	54.0′
6	273°15.9	S20°44.2	287°06.4	14.5′	S12°45.9	9.1′	54.0′
7	288°15.7	44.7	301°39.9	14.5′	12°55.0	9.0′	54.0′
8	303°15.5	45.2	316°13.4	14.4′	13°04.0	9.0′	54.0′
9	318°15.3	·· 45.6	330°46.8	14.4′	13°13.0	9.0′	54.0′
10	333°15.1	46.1	345°20.3	14.4′	13°22.0	8.8′	53.9′
11	348°14.9	46.6	359°53.6	14.4′	13°30.8	8.8′	53.9′
12	3°14.7	S20°47.1	14°27.0	14.3′	S13°39.6	8.8′	53.9′
13	18°14.5	47.6	29°00.3	14.3′	13°48.4	8.7′	53.9′
14	33°14.3	48.1	43°33.6	14.3′	13°57.1	8.6′	53.9′
15	48°14.1	·· 48.6	58°06.9	14.2′	14°05.7	8.6′	53.9′
16	63°14.0	49.0	72°40.1	14.2′	14°14.3	8.6′	53.9′
17	78°13.8	49.5	87°13.3	14.2′	14°22.9	8.4′	53.9′
18	93°13.6	S20°50.0	101°46.4	14.1′	S14°31.3	8.4′	53.9′
19	108°13.4	50.5	116°19.5	14.1′	14°39.7	8.4′	53.9′
20	123°13.2	51.0	130°52.6	14.1′	14°48.1	8.2′	53.9′
21	138°13.0	·· 51.5	145°25.7	14.0′	14°56.3	8.2′	53.9′
22	153°12.8	51.9	159°58.7	14.0′	15°04.5	8.2′	53.9′
23	168°12.6	52.4	174°31.7	13.9′	15°12.7	8.1′	53.9′
	SD = 16.2′	d = 0.5′	SD = 14.7′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°12.4	S20°52.9	189°04.6	13.9′	S15°20.8	8.0′	53.9′
1	198°12.2	53.4	203°37.5	13.9′	15°28.8	7.9′	53.9′
2	213°12.0	53.8	218°10.4	13.8′	15°36.7	7.9′	53.9′
3	228°11.8	·· 54.3	232°43.3	13.8′	15°44.6	7.9′	53.9′
4	243°11.6	54.8	247°16.1	13.8′	15°52.5	7.7′	53.9′
5	258°11.4	55.3	261°48.8	13.7′	16°00.2	7.7′	53.9′
6	273°11.2	S20°55.8	276°21.6	13.7′	S16°07.9	7.6′	53.9′
7	288°11.0	56.2	290°54.3	13.7′	16°15.5	7.6′	53.9′
8	303°10.8	56.7	305°26.9	13.6′	16°23.1	7.4′	53.9′
9	318°10.6	·· 57.2	319°59.6	13.6′	16°30.5	7.4′	53.9′
10	333°10.4	57.6	334°32.2	13.6′	16°37.9	7.4′	53.9′
11	348°10.2	58.1	349°04.7	13.5′	16°45.3	7.2′	53.9′
12	3°10.0	S20°58.6	3°37.2	13.5′	S16°52.5	7.2′	53.9′
13	18°09.8	59.1	18°09.7	13.4′	16°59.7	7.1′	53.9′
14	33°09.6	20°59.5	32°42.1	13.4′	17°06.8	7.1′	53.9′
15	48°09.4	21°00.0	47°14.5	13.4′	17°13.9	6.9′	53.9′
16	63°09.2	00.5	61°46.9	13.3′	17°20.8	6.9′	53.9′
17	78°09.0	00.9	76°19.2	13.3′	17°27.7	6.9′	53.9′
18	93°08.8	S21°01.4	90°51.5	13.3′	S17°34.6	6.7′	53.9′
19	108°08.6	01.9	105°23.8	13.2′	17°41.3	6.7′	53.9′
20	123°08.4	02.3	119°56.0	13.2′	17°48.0	6.6′	53.9′
21	138°08.2	·· 02.8	134°28.2	13.1′	17°54.6	6.5′	53.9′
22	153°08.0	03.3	149°00.3	13.1′	18°01.1	6.4′	53.9′
23	168°07.8	03.7	163°32.5	13.1′	18°07.5	6.4′	53.9′
	SD = 16.2′	d = 0.5′	SD = 14.7′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	07:33	09:22	▬	▬	14:12	16:00
N 70°	07:19	08:49	11:30	12:03	14:44	16:14
68°	07:07	08:26	10:02	13:31	15:07	16:26
66°	06:58	08:08	09:25	14:09	15:26	16:35
64°	06:49	07:53	08:59	14:35	15:41	16:44
62°	06:42	07:40	08:38	14:55	15:53	16:51
60°	06:36	07:30	08:22	15:12	16:04	16:58
N 58°	06:30	07:20	08:08	15:26	16:13	17:03
56°	06:25	07:12	07:56	15:37	16:22	17:09
54°	06:20	07:04	07:46	15:48	16:29	17:14
52°	06:15	06:58	07:36	15:57	16:36	17:18
50°	06:11	06:51	07:28	16:05	16:42	17:22
45°	06:02	06:38	07:11	16:23	16:56	17:32
N 40°	05:53	06:27	06:56	16:38	17:07	17:40
35°	05:46	06:17	06:44	16:50	17:17	17:48
30°	05:38	06:08	06:33	17:01	17:26	17:56
20°	05:24	05:51	06:15	17:19	17:43	18:10
N 10°	05:10	05:36	05:59	17:35	17:58	18:24
0°	04:56	05:21	05:43	17:51	18:13	18:39
S 10°	04:39	05:05	05:28	18:06	18:29	18:55
20°	04:19	04:47	05:11	18:23	18:47	19:15
30°	03:53	04:26	04:52	18:42	19:09	19:41
35°	03:37	04:12	04:41	18:53	19:22	19:57
40°	03:17	03:57	04:28	19:07	19:38	20:17
45°	02:52	03:37	04:13	19:22	19:58	20:43
S 50°	02:16	03:12	03:54	19:41	20:23	21:20
52°	01:56	03:00	03:44	19:50	20:35	21:40
54°	01:31	02:46	03:34	20:01	20:50	22:05
56°	00:54	02:29	03:23	20:12	21:07	22:45
58°	////	02:08	03:09	20:26	21:28	////
S 60°	////	01:41	02:54	20:42	21:56	////

Lat.	**Moonrise** Tue	Wed	Thu	**Moonset** Tue	Wed	Thu
N 72°	06:06	07:59	10:14	14:07	13:45	13:03
N 70°	05:52	07:33	09:21	14:23	14:12	13:56
68°	05:41	07:14	08:50	14:36	14:33	14:29
66°	05:31	06:58	08:26	14:47	14:49	14:53
64°	05:23	06:46	08:08	14:56	15:03	15:12
62°	05:17	06:35	07:53	15:04	15:14	15:28
60°	05:11	06:26	07:41	15:11	15:24	15:41
N 58°	05:06	06:18	07:30	15:17	15:32	15:52
56°	05:01	06:11	07:20	15:22	15:40	16:02
54°	04:57	06:05	07:12	15:27	15:47	16:11
52°	04:54	06:00	07:05	15:31	15:53	16:18
50°	04:50	05:55	06:58	15:35	15:58	16:25
45°	04:43	05:44	06:44	15:43	16:10	16:40
N 40°	04:37	05:35	06:32	15:50	16:20	16:53
35°	04:32	05:27	06:23	15:57	16:29	17:03
30°	04:28	05:21	06:14	16:02	16:36	17:13
20°	04:20	05:09	05:59	16:11	16:49	17:29
N 10°	04:13	04:59	05:46	16:20	17:00	17:43
0°	04:07	04:50	05:34	16:27	17:11	17:56
S 10°	04:01	04:41	05:22	16:35	17:22	18:09
20°	03:54	04:31	05:09	16:44	17:33	18:23
30°	03:46	04:20	04:55	16:53	17:46	18:40
35°	03:42	04:13	04:47	16:59	17:54	18:49
40°	03:37	04:06	04:37	17:05	18:03	19:00
45°	03:32	03:57	04:26	17:12	18:13	19:13
S 50°	03:25	03:47	04:13	17:21	18:25	19:28
52°	03:22	03:43	04:06	17:25	18:31	19:36
54°	03:19	03:38	03:59	17:30	18:37	19:44
56°	03:15	03:32	03:52	17:35	18:45	19:53
58°	03:11	03:26	03:43	17:41	18:53	20:03
S 60°	03:06	03:18	03:33	17:47	19:02	20:15

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 28-0 6-0%
24	13:26	13:17	11:47	10:17	22:39	
25	13:08	12:59	11:47	11:00	23:23	
26	12:50	12:40	11:47	11:45	–:–	

November 27, 28, 29 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	65°49.2	132°55.6	S24°58.7	253°46.1	N05°28.5	217°31.9	S10°25.7	227°37.7	S05°13.6
1	80°51.7	147°55.7	58.2	268°47.3	28.0	232°33.9	25.8	242°40.0	13.7
2	95°54.1	162°55.8	57.8	283°48.6	27.5	247°35.9	26.0	257°42.2	13.8
3	110°56.6	177°55.9	·· 57.3	298°49.8	·· 27.0	262°37.9	·· 26.2	272°44.4	·· 13.8
4	125°59.1	192°56.1	56.8	313°51.1	26.6	277°39.9	26.3	287°46.7	13.9
5	141°01.5	207°56.2	56.4	328°52.3	26.1	292°41.9	26.5	302°48.9	14.0
6	156°04.0	222°56.3	S24°55.9	343°53.6	N05°25.6	307°43.9	S10°26.7	317°51.1	S05°14.1
7	171°06.5	237°56.5	55.5	358°54.8	25.1	322°45.8	26.8	332°53.4	14.2
8	186°08.9	252°56.6	55.0	13°56.1	24.6	337°47.8	27.0	347°55.6	14.3
9	201°11.4	267°56.8	·· 54.6	28°57.3	·· 24.1	352°49.8	·· 27.2	2°57.9	·· 14.4
10	216°13.8	282°56.9	54.1	43°58.6	23.6	7°51.8	27.3	18°00.1	14.4
11	231°16.3	297°57.0	53.7	58°59.8	23.2	22°53.8	27.5	33°02.3	14.5
12	246°18.8	312°57.2	S24°53.2	74°01.1	N05°22.7	37°55.8	S10°27.7	48°04.6	S05°14.6
13	261°21.2	327°57.3	52.7	89°02.3	22.2	52°57.8	27.8	63°06.8	14.7
14	276°23.7	342°57.5	52.3	104°03.6	21.7	67°59.8	28.0	78°09.0	14.8
15	291°26.2	357°57.6	·· 51.8	119°04.8	·· 21.2	83°01.8	·· 28.2	93°11.3	·· 14.9
16	306°28.6	12°57.8	51.4	134°06.1	20.7	98°03.8	28.4	108°13.5	15.0
17	321°31.1	27°57.9	50.9	149°07.3	20.2	113°05.8	28.5	123°15.7	15.0
18	336°33.6	42°58.1	S24°50.4	164°08.6	N05°19.8	128°07.8	S10°28.7	138°18.0	S05°15.1
19	351°36.0	57°58.2	50.0	179°09.8	19.3	143°09.8	28.9	153°20.2	15.2
20	6°38.5	72°58.4	49.5	194°11.1	18.8	158°11.8	29.0	168°22.4	15.3
21	21°41.0	87°58.6	·· 49.0	209°12.3	·· 18.3	173°13.8	·· 29.2	183°24.7	·· 15.4
22	36°43.4	102°58.7	48.6	224°13.6	17.8	188°15.8	29.4	198°26.9	15.5
23	51°45.9	117°58.9	48.1	239°14.9	17.3	203°17.8	29.5	213°29.2	15.5
Mer.pass. 19:34		ν 0.1′	d 0.5′	m -4.68	ν 1.2′	d 0.5′	m 1.19	ν 2.0′	d 0.2′ m -1.72	ν 2.2′	d 0.1′ m 0.85

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	66°48.3	132°59.0	S24°47.6	254°16.1	N05°16.8	218°19.8	S10°29.7	228°31.4	S05°15.6
1	81°50.8	147°59.2	47.2	269°17.4	16.4	233°21.8	29.9	243°33.6	15.7
2	96°53.3	162°59.4	46.7	284°18.6	15.9	248°23.8	30.0	258°35.9	15.8
3	111°55.7	177°59.6	·· 46.2	299°19.9	·· 15.4	263°25.8	·· 30.2	273°38.1	·· 15.9
4	126°58.2	192°59.7	45.7	314°21.1	14.9	278°27.8	30.4	288°40.3	16.0
5	142°00.7	207°59.9	45.3	329°22.4	14.4	293°29.8	30.5	303°42.6	16.0
6	157°03.1	223°00.1	S24°44.8	344°23.6	N05°13.9	308°31.8	S10°30.7	318°44.8	S05°16.1
7	172°05.6	238°00.2	44.3	359°24.9	13.5	323°33.8	30.9	333°47.1	16.2
8	187°08.1	253°00.4	43.9	14°26.1	13.0	338°35.7	31.0	348°49.3	16.3
9	202°10.5	268°00.6	·· 43.4	29°27.4	·· 12.5	353°37.7	·· 31.2	3°51.5	·· 16.4
10	217°13.0	283°00.8	42.9	44°28.7	12.0	8°39.7	31.4	18°53.8	16.5
11	232°15.4	298°01.0	42.4	59°29.9	11.5	23°41.7	31.5	33°56.0	16.6
12	247°17.9	313°01.2	S24°42.0	74°31.2	N05°11.0	38°43.7	S10°31.7	48°58.2	S05°16.6
13	262°20.4	328°01.3	41.5	89°32.4	10.6	53°45.7	31.9	64°00.5	16.7
14	277°22.8	343°01.5	41.0	104°33.7	10.1	68°47.7	32.1	79°02.7	16.8
15	292°25.3	358°01.7	·· 40.5	119°34.9	·· 09.6	83°49.7	·· 32.2	94°05.0	·· 16.9
16	307°27.8	13°01.9	40.0	134°36.2	09.1	98°51.7	32.4	109°07.2	17.0
17	322°30.2	28°02.1	39.6	149°37.5	08.6	113°53.7	32.6	124°09.4	17.1
18	337°32.7	43°02.3	S24°39.1	164°38.7	N05°08.1	128°55.7	S10°32.7	139°11.7	S05°17.1
19	352°35.2	58°02.5	38.6	179°40.0	07.7	143°57.7	32.9	154°13.9	17.2
20	7°37.6	73°02.7	38.1	194°41.2	07.2	158°59.7	33.1	169°16.2	17.3
21	22°40.1	88°02.9	·· 37.6	209°42.5	·· 06.7	174°01.7	·· 33.2	184°18.4	·· 17.4
22	37°42.6	103°03.1	37.2	224°43.8	06.2	189°03.7	33.4	199°20.6	17.5
23	52°45.0	118°03.3	36.7	239°45.0	05.7	204°05.7	33.6	214°22.9	17.6
Mer.pass. 19:30		ν 0.2′	d 0.5′	m -4.69	ν 1.3′	d 0.5′	m 1.17	ν 2.0′	d 0.2′ m -1.73	ν 2.2′	d 0.1′ m 0.85

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	67°47.5	133°03.5	S24°36.2	254°46.3	N05°05.2	219°07.7	S10°33.7	229°25.1	S05°17.6
1	82°49.9	148°03.7	35.7	269°47.5	04.8	234°09.7	33.9	244°27.3	17.7
2	97°52.4	163°03.9	35.2	284°48.8	04.3	249°11.7	34.1	259°29.6	17.8
3	112°54.9	178°04.1	·· 34.7	299°50.1	·· 03.8	264°13.7	·· 34.2	274°31.8	·· 17.9
4	127°57.3	193°04.4	34.2	314°51.3	03.3	279°15.7	34.4	289°34.1	18.0
5	142°59.8	208°04.6	33.8	329°52.6	02.8	294°17.7	34.6	304°36.3	18.1
6	158°02.3	223°04.8	S24°33.3	344°53.8	N05°02.3	309°19.7	S10°34.7	319°38.5	S05°18.1
7	173°04.7	238°05.0	32.8	359°55.1	01.9	324°21.7	34.9	334°40.8	18.2
8	188°07.2	253°05.2	32.3	14°56.4	01.4	339°23.7	35.1	349°43.0	18.3
9	203°09.7	268°05.4	·· 31.8	29°57.6	·· 00.9	354°25.7	·· 35.2	4°45.3	·· 18.4
10	218°12.1	283°05.7	31.3	44°58.9	05°00.4	9°27.7	35.4	19°47.5	18.5
11	233°14.6	298°05.9	30.8	60°00.2	04°59.9	24°29.7	35.6	34°49.7	18.6
12	248°17.1	313°06.1	S24°30.3	75°01.4	N04°59.4	39°31.7	S10°35.7	49°52.0	S05°18.6
13	263°19.5	328°06.4	29.8	90°02.7	59.0	54°33.7	35.9	64°54.2	18.7
14	278°22.0	343°06.6	29.3	105°03.9	58.5	69°35.7	36.1	79°56.5	18.8
15	293°24.4	358°06.8	·· 28.8	120°05.2	·· 58.0	84°37.7	·· 36.2	94°58.7	·· 18.9
16	308°26.9	13°07.1	28.3	135°06.5	57.5	99°39.7	36.4	110°00.9	19.0
17	323°29.4	28°07.3	27.8	150°07.7	57.0	114°41.7	36.6	125°03.2	19.0
18	338°31.8	43°07.5	S24°27.3	165°09.0	N04°56.6	129°43.7	S10°36.7	140°05.4	S05°19.1
19	353°34.3	58°07.8	26.9	180°10.3	56.1	144°45.7	36.9	155°07.7	19.2
20	8°36.8	73°08.0	26.4	195°11.5	55.6	159°47.7	37.0	170°09.9	19.3
21	23°39.2	88°08.3	·· 25.9	210°12.8	·· 55.1	174°49.7	·· 37.2	185°12.2	·· 19.4
22	38°41.7	103°08.5	25.4	225°14.1	54.6	189°51.7	37.4	200°14.4	19.5
23	53°44.2	118°08.7	24.9	240°15.3	54.2	204°53.7	37.5	215°16.6	19.5
Mer.pass. 19:26		ν 0.2′	d 0.5′	m -4.71	ν 1.3′	d 0.5′	m 1.16	ν 2.0′	d 0.2′ m -1.73	ν 2.2′	d 0.1′ m 0.84

Stars

	SHA	Dec
Alpheratz	358°08.3	28°59.5
Ankaa	353°39.2	-42°24.5
Schedar	350°07.8	56°26.4
Diphda	349°19.9	-18°05.3
Achernar	335°44.2	-57°20.0
Hamal	328°27.7	23°22.6
Polaris	326°18.3	89°11.0
Acamar	315°36.2	-40°22.8
Menkar	314°40.0	4°01.1
Mirfak	309°14.4	49°47.9
Aldebaran	291°16.7	16°28.4
Rigel	281°34.9	-8°13.3
Capella	281°09.6	45°58.8
Bellatrix	278°57.5	6°20.0
Elnath	278°42.7	28°35.5
Alnilam	276°10.5	-1°12.8
Betelgeuse	271°27.1	7°24.2
Canopus	264°06.4	-52°41.0
Sirius	258°54.6	-16°41.4
Adhara	255°31.2	-28°56.7
Procyon	245°24.7	5°16.4
Pollux	243°56.9	28°04.2
Avior	234°27.5	-59°26.8
Suhail	223°10.0	-43°21.3
Miaplacidus	221°44.5	-69°38.2
Alphard	218°19.7	-8°34.6
Regulus	208°09.1	12°03.4
Dubhe	194°21.2	61°50.8
Denebola	182°58.3	14°40.5
Gienah	176°17.3	-17°26.2
Acrux	173°36.8	-62°59.5
Gacrux	172°28.2	-57°00.3
Alioth	166°42.1	56°03.4
Spica	158°56.9	-11°03.8
Alkaid	153°18.2	49°24.2
Hadar	149°22.8	-60°16.8
Menkent	148°36.4	-36°16.6
Arcturus	146°18.0	19°16.7
Rigil Kent.	140°25.3	-60°45.2
Kochab	137°20.1	74°13.8
Zuben'ubi	137°32.5	-15°57.8
Alphecca	126°31.8	26°46.6
Antares	112°56.2	-26°23.4
Atria	108°20.4	-68°59.7
Sabik	102°40.5	-15°42.1
Shaula	96°55.1	-37°05.4
Rasalhague	96°29.2	12°34.5
Eltanin	90°57.8	51°29.6
Kaus Aust.	84°16.1	-34°23.6
Vega	80°55.6	38°46.2
Nunki	76°28.5	-26°19.2
Altair	62°32.0	8°49.3
Peacock	53°57.4	-56°47.9
Deneb	49°48.1	45°13.1
Enif	34°10.9	9°47.6
Al Na'ir	28°14.0	-47°03.2
Fomalhaut	15°50.5	-29°43.3
Scheat	14°16.7	27°59.2
Markab	14°02.3	15°06.5

Nov 27 Fri	SHA	Mer.pass
Venus	67°06.4	15:08
Mars	187°56.9	07:04
Jupiter	151°42.7	09:29
Saturn	161°48.5	08:48

Nov 28 Sat	SHA	Mer.pass
Venus	66°10.7	15:08
Mars	187°27.8	07:02
Jupiter	151°31.4	09:25
Saturn	161°43.1	08:45

Nov 29 Sun	SHA	Mer.pass
Venus	65°16.0	15:08
Mars	186°58.8	07:00
Jupiter	151°20.2	09:22
Saturn	161°37.6	08:41

Horizontal parallax	
Venus:	0.3
Mars:	0.1

h

	Sun		Moon				
Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°07.6	S21°04.2	178°04.5	13.0′	S18°13.9	6.2′	53.9′
1	198°07.4	04.6	192°36.6	13.0′	18°20.1	6.2′	53.9′
2	213°07.2	05.1	207°08.6	13.0′	18°26.3	6.1′	53.9′
3	228°07.0	·· 05.6	221°40.5	12.9′	18°32.4	6.1′	53.9′
4	243°06.8	06.0	236°12.4	12.9′	18°38.5	5.9′	53.9′
5	258°06.6	06.5	250°44.3	12.9′	18°44.4	5.9′	53.9′
6	273°06.4	S21°06.9	265°16.2	12.8′	S18°50.3	5.8′	53.9′
7	288°06.2	07.4	279°48.0	12.8′	18°56.1	5.7′	53.9′
8	303°06.0	07.9	294°19.8	12.7′	19°01.8	5.6′	53.9′
9	318°05.8	·· 08.3	308°51.5	12.7′	19°07.4	5.5′	53.9′
10	333°05.6	08.8	323°23.2	12.7′	19°12.9	5.5′	53.9′
11	348°05.4	09.2	337°54.9	12.6′	19°18.4	5.3′	53.9′
12	3°05.1	S21°09.7	352°26.5	12.6′	S19°23.7	5.3′	53.9′
13	18°04.9	10.1	6°58.1	12.6′	19°29.0	5.2′	53.9′
14	33°04.7	10.6	21°29.7	12.5′	19°34.2	5.1′	53.9′
15	48°04.5	·· 11.0	36°01.2	12.5′	19°39.3	5.0′	53.9′
16	63°04.3	11.5	50°32.7	12.5′	19°44.3	4.9′	53.9′
17	78°04.1	11.9	65°04.2	12.4′	19°49.2	4.9′	53.9′
18	93°03.9	S21°12.4	79°35.6	12.4′	S19°54.1	4.7′	53.9′
19	108°03.7	12.8	94°07.0	12.4′	19°58.8	4.7′	53.9′
20	123°03.5	13.3	108°38.4	12.3′	20°03.5	4.6′	53.9′
21	138°03.3	·· 13.7	123°09.7	12.3′	20°08.1	4.4′	53.9′
22	153°03.1	14.2	137°41.0	12.3′	20°12.5	4.4′	53.9′
23	168°02.9	14.6	152°12.3	12.2′	20°16.9	4.3′	53.9′
	SD = 16.2′	d = 0.5′	SD = 14.7′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°02.6	S21°15.1	166°43.5	12.2′	S20°21.2	4.2′	53.9′
1	198°02.4	15.5	181°14.7	12.2′	20°25.4	4.1′	53.9′
2	213°02.2	16.0	195°45.9	12.1′	20°29.5	4.1′	53.9′
3	228°02.0	·· 16.4	210°17.0	12.1′	20°33.6	3.9′	53.9′
4	243°01.8	16.8	224°48.1	12.1′	20°37.5	3.8′	53.9′
5	258°01.6	17.3	239°19.2	12.0′	20°41.3	3.8′	53.9′
6	273°01.4	S21°17.7	253°50.2	12.0′	S20°45.1	3.6′	53.9′
7	288°01.2	18.2	268°21.2	12.0′	20°48.7	3.6′	53.9′
8	303°00.9	18.6	282°52.2	12.0′	20°52.3	3.4′	53.9′
9	318°00.7	·· 19.0	297°23.2	11.9′	20°55.7	3.4′	54.0′
10	333°00.5	19.5	311°54.1	11.9′	20°59.1	3.2′	54.0′
11	348°00.3	19.9	326°25.0	11.9′	21°02.3	3.2′	54.0′
12	3°00.1	S21°20.4	340°55.9	11.8′	S21°05.5	3.1′	54.0′
13	17°59.9	20.8	355°26.7	11.8′	21°08.6	2.9′	54.0′
14	32°59.7	21.2	9°57.5	11.8′	21°11.5	2.9′	54.0′
15	47°59.4	·· 21.7	24°28.3	11.8′	21°14.4	2.8′	54.0′
16	62°59.2	22.1	38°59.1	11.7′	21°17.2	2.7′	54.0′
17	77°59.0	22.5	53°29.8	11.7′	21°19.9	2.6′	54.0′
18	92°58.8	S21°23.0	68°00.6	11.7′	S21°22.5	2.4′	54.0′
19	107°58.6	23.4	82°31.2	11.7′	21°24.9	2.4′	54.0′
20	122°58.4	23.8	97°01.9	11.6′	21°27.3	2.3′	54.0′
21	137°58.2	·· 24.3	111°32.6	11.6′	21°29.6	2.2′	54.0′
22	152°57.9	24.7	126°03.2	11.6′	21°31.8	2.1′	54.0′
23	167°57.7	25.1	140°33.8	11.6′	21°33.9	2.0′	54.0′
	SD = 16.2′	d = 0.4′	SD = 14.7′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°57.5	S21°25.6	155°04.4	11.6′	S21°35.9	1.8′	54.1′
1	197°57.3	26.0	169°34.9	11.5′	21°37.7	1.8′	54.1′
2	212°57.1	26.4	184°05.4	11.5′	21°39.5	1.7′	54.1′
3	227°56.8	·· 26.8	198°36.0	11.5′	21°41.2	1.6′	54.1′
4	242°56.6	27.3	213°06.4	11.5′	21°42.8	1.5′	54.1′
5	257°56.4	27.7	227°36.9	11.5′	21°44.3	1.3′	54.1′
6	272°56.2	S21°28.1	242°07.4	11.4′	S21°45.6	1.3′	54.1′
7	287°56.0	28.5	256°37.8	11.4′	21°46.9	1.2′	54.1′
8	302°55.7	29.0	271°08.2	11.4′	21°48.1	1.1′	54.1′
9	317°55.5	·· 29.4	285°38.6	11.4′	21°49.2	0.9′	54.1′
10	332°55.3	29.8	300°09.0	11.4′	21°50.1	0.9′	54.1′
11	347°55.1	30.2	314°39.4	11.4′	21°51.0	0.8′	54.2′
12	2°54.9	S21°30.6	329°09.7	11.3′	S21°51.8	0.6′	54.2′
13	17°54.6	31.1	343°40.1	11.3′	21°52.4	0.6′	54.2′
14	32°54.4	31.5	358°10.4	11.3′	21°53.0	0.4′	54.2′
15	47°54.2	·· 31.9	12°40.7	11.3′	21°53.4	0.4′	54.2′
16	62°54.0	32.3	27°11.0	11.3′	21°53.8	0.2′	54.2′
17	77°53.8	32.7	41°41.3	11.3′	21°54.0	0.2′	54.2′
18	92°53.5	S21°33.2	56°11.6	11.3′	S21°54.2	0.0′	54.2′
19	107°53.3	33.6	70°41.8	11.3′	21°54.2	0.1′	54.2′
20	122°53.1	34.0	85°12.1	11.2′	21°54.1	0.1′	54.3′
21	137°52.9	·· 34.4	99°42.3	11.2′	21°54.0	0.3′	54.3′
22	152°52.6	34.8	114°12.6	11.2′	21°53.7	0.4′	54.3′
23	167°52.4	35.2	128°42.8	11.2′	21°53.3	0.5′	54.3′
	SD = 16.2′	d = 0.4′	SD = 14.7′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	07:42	09:36	▬	▬	13:59	15:53
N 70°	07:27	09:00	▬	▬	14:35	16:08
68°	07:15	08:35	10:19	13:17	15:00	16:21
66°	07:04	08:16	09:36	14:00	15:20	16:31
64°	06:55	08:00	09:07	14:28	15:36	16:40
62°	06:48	07:47	08:46	14:50	15:49	16:48
60°	06:41	07:35	08:28	15:07	16:00	16:55
N 58°	06:35	07:25	08:14	15:22	16:10	17:01
56°	06:29	07:17	08:02	15:34	16:19	17:06
54°	06:24	07:09	07:51	15:45	16:27	17:11
52°	06:19	07:02	07:41	15:54	16:34	17:16
50°	06:15	06:55	07:32	16:03	16:40	17:21
45°	06:05	06:41	07:14	16:21	16:54	17:31
N 40°	05:56	06:30	06:59	16:36	17:06	17:40
35°	05:48	06:19	06:47	16:49	17:17	17:48
30°	05:40	06:10	06:36	17:00	17:26	17:55
20°	05:26	05:53	06:17	17:19	17:43	18:10
N 10°	05:12	05:38	06:00	17:36	17:58	18:24
0°	04:56	05:22	05:44	17:52	18:14	18:40
S 10°	04:39	05:06	05:29	18:08	18:30	18:57
20°	04:19	04:47	05:11	18:25	18:49	19:17
30°	03:52	04:25	04:52	18:45	19:11	19:44
35°	03:36	04:11	04:40	18:56	19:25	20:01
40°	03:15	03:55	04:27	19:10	19:42	20:21
45°	02:49	03:35	04:11	19:26	20:02	20:48
S 50°	02:11	03:09	03:51	19:46	20:28	21:26
52°	01:50	02:56	03:42	19:55	20:41	21:47
54°	01:23	02:41	03:31	20:06	20:56	22:16
56°	00:39	02:24	03:19	20:18	21:14	23:03
58°	////	02:02	03:05	20:32	21:36	////
S 60°	////	01:32	02:48	20:49	22:07	////

Lat.	**Moonrise** Fri	Sat	Sun	**Moonset** Fri	Sat	Sun
N 72°	▬	▬	▬	▬	▬	▬
N 70°	11:33	▬	▬	13:21	▬	▬
68°	10:29	12:11	13:55	14:25	14:22	14:20
66°	09:54	11:16	12:24	15:01	15:17	15:51
64°	09:28	10:43	11:46	15:27	15:50	16:29
62°	09:09	10:19	11:19	15:47	16:15	16:55
60°	08:53	10:00	10:58	16:03	16:34	17:16
N 58°	08:39	09:44	10:41	16:17	16:50	17:33
56°	08:28	09:31	10:27	16:29	17:04	17:48
54°	08:17	09:19	10:15	16:40	17:16	18:00
52°	08:08	09:09	10:04	16:49	17:26	18:11
50°	08:00	09:00	09:54	16:57	17:35	18:21
45°	07:43	08:40	09:34	17:15	17:55	18:41
N 40°	07:29	08:25	09:17	17:30	18:11	18:58
35°	07:17	08:11	09:03	17:42	18:25	19:12
30°	07:07	08:00	08:51	17:53	18:36	19:24
20°	06:50	07:40	08:30	18:11	18:57	19:45
N 10°	06:34	07:23	08:12	18:27	19:14	20:03
0°	06:20	07:07	07:56	18:43	19:31	20:19
S 10°	06:06	06:51	07:39	18:58	19:47	20:36
20°	05:51	06:34	07:21	19:14	20:05	20:54
30°	05:33	06:15	07:01	19:33	20:25	21:15
35°	05:23	06:04	06:49	19:44	20:37	21:27
40°	05:12	05:51	06:35	19:56	20:50	21:41
45°	04:58	05:35	06:19	20:11	21:06	21:57
S 50°	04:42	05:17	05:59	20:29	21:26	22:18
52°	04:34	05:08	05:49	20:38	21:35	22:27
54°	04:26	04:58	05:38	20:47	21:46	22:38
56°	04:16	04:47	05:26	20:58	21:58	22:50
58°	04:05	04:34	05:12	21:11	22:12	23:04
S 60°	03:53	04:19	04:56	21:25	22:28	23:21

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 1-3 0-5%
27	12:30	12:21	11:48	12:31	00:08	
28	12:11	12:00	11:48	13:19	00:55	
29	11:50	11:39	11:48	14:08	01:43	

November 30, 01, 02 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	68°46.6	133°09.0	S24°24.4	255°16.6	N04°53.7	219°55.7	S10°37.7	230°18.9	S05°19.6
1	83°49.1	148°09.2	23.9	270°17.9	53.2	234°57.7	37.9	245°21.1	19.7
2	98°51.6	163°09.5	23.3	285°19.1	52.7	249°59.7	38.0	260°23.4	19.8
3	113°54.0	178°09.8	·· 22.8	300°20.4	·· 52.2	265°01.7	·· 38.2	275°25.6	·· 19.9
4	128°56.5	193°10.0	22.3	315°21.7	51.8	280°03.7	38.4	290°27.8	20.0
5	143°58.9	208°10.3	21.8	330°22.9	51.3	295°05.7	38.5	305°30.1	20.0
6	159°01.4	223°10.5	S24°21.3	345°24.2	N04°50.8	310°07.7	S10°38.7	320°32.3	S05°20.1
7	174°03.9	238°10.8	20.8	0°25.5	50.3	325°09.7	38.9	335°34.6	20.2
8	189°06.3	253°11.1	20.3	15°26.7	49.8	340°11.7	39.0	350°36.8	20.3
9	204°08.8	268°11.3	·· 19.8	30°28.0	·· 49.4	355°13.7	·· 39.2	5°39.1	·· 20.4
10	219°11.3	283°11.6	19.3	45°29.3	48.9	10°15.7	39.4	20°41.3	20.4
11	234°13.7	298°11.9	18.8	60°30.5	48.4	25°17.7	39.5	35°43.5	20.5
12	249°16.2	313°12.1	S24°18.3	75°31.8	N04°47.9	40°19.7	S10°39.7	50°45.8	S05°20.6
13	264°18.7	328°12.4	17.8	90°33.1	47.4	55°21.7	39.9	65°48.0	20.7
14	279°21.1	343°12.7	17.3	105°34.3	47.0	70°23.7	40.0	80°50.3	20.8
15	294°23.6	358°13.0	·· 16.8	120°35.6	·· 46.5	85°25.7	·· 40.2	95°52.5	·· 20.8
16	309°26.1	13°13.2	16.2	135°36.9	46.0	100°27.7	40.4	110°54.8	20.9
17	324°28.5	28°13.5	15.7	150°38.2	45.5	115°29.7	40.5	125°57.0	21.0
18	339°31.0	43°13.8	S24°15.2	165°39.4	N04°45.0	130°31.7	S10°40.7	140°59.2	S05°21.1
19	354°33.4	58°14.1	14.7	180°40.7	44.6	145°33.7	40.8	156°01.5	21.2
20	9°35.9	73°14.4	14.2	195°42.0	44.1	160°35.7	41.0	171°03.7	21.3
21	24°38.4	88°14.7	·· 13.7	210°43.2	·· 43.6	175°37.8	·· 41.2	186°06.0	·· 21.3
22	39°40.8	103°15.0	13.2	225°44.5	43.1	190°39.8	41.3	201°08.2	21.4
23	54°43.3	118°15.2	12.7	240°45.8	42.6	205°41.8	41.5	216°10.5	21.5
Mer.pass. 19:22		ν 0.3′	d 0.5′	m -4.72	ν 1.3′	d 0.5′	m 1.15	ν 2.0′	d 0.2′ m -1.73	ν 2.2′	d 0.1′ m 0.84

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	69°45.8	133°15.5	S24°12.1	255°47.1	N04°42.2	220°43.8	S10°41.7	231°12.7	S05°21.6
1	84°48.2	148°15.8	11.6	270°48.3	41.7	235°45.8	41.8	246°14.9	21.7
2	99°50.7	163°16.1	11.1	285°49.6	41.2	250°47.8	42.0	261°17.2	21.7
3	114°53.2	178°16.4	·· 10.6	300°50.9	·· 40.7	265°49.8	·· 42.2	276°19.4	·· 21.8
4	129°55.6	193°16.7	10.1	315°52.2	40.2	280°51.8	42.3	291°21.7	21.9
5	144°58.1	208°17.0	09.5	330°53.4	39.8	295°53.8	42.5	306°23.9	22.0
6	160°00.5	223°17.3	S24°09.0	345°54.7	N04°39.3	310°55.8	S10°42.7	321°26.2	S05°22.1
7	175°03.0	238°17.7	08.5	0°56.0	38.8	325°57.8	42.8	336°28.4	22.1
8	190°05.5	253°18.0	08.0	15°57.2	38.3	340°59.8	43.0	351°30.7	22.2
9	205°07.9	268°18.3	·· 07.5	30°58.5	·· 37.9	356°01.8	·· 43.1	6°32.9	·· 22.3
10	220°10.4	283°18.6	06.9	45°59.8	37.4	11°03.8	43.3	21°35.1	22.4
11	235°12.9	298°18.9	06.4	61°01.1	36.9	26°05.8	43.5	36°37.4	22.5
12	250°15.3	313°19.2	S24°05.9	76°02.3	N04°36.4	41°07.8	S10°43.6	51°39.6	S05°22.5
13	265°17.8	328°19.5	05.4	91°03.6	35.9	56°09.8	43.8	66°41.9	22.6
14	280°20.3	343°19.9	04.8	106°04.9	35.5	71°11.8	44.0	81°44.1	22.7
15	295°22.7	358°20.2	·· 04.3	121°06.2	·· 35.0	86°13.8	·· 44.1	96°46.4	·· 22.8
16	310°25.2	13°20.5	03.8	136°07.5	34.5	101°15.8	44.3	111°48.6	22.9
17	325°27.7	28°20.8	03.3	151°08.7	34.0	116°17.8	44.5	126°50.9	22.9
18	340°30.1	43°21.2	S24°02.7	166°10.0	N04°33.6	131°19.8	S10°44.6	141°53.1	S05°23.0
19	355°32.6	58°21.5	02.2	181°11.3	33.1	146°21.8	44.8	156°55.4	23.1
20	10°35.0	73°21.8	01.7	196°12.6	32.6	161°23.8	44.9	171°57.6	23.2
21	25°37.5	88°22.2	·· 01.1	211°13.8	·· 32.1	176°25.9	·· 45.1	186°59.8	·· 23.3
22	40°40.0	103°22.5	00.6	226°15.1	31.7	191°27.9	45.3	202°02.1	23.3
23	55°42.4	118°22.8	00.1	241°16.4	31.2	206°29.9	45.4	217°04.3	23.4
Mer.pass. 19:18		ν 0.3′	d 0.5′	m -4.73	ν 1.3′	d 0.5′	m 1.14	ν 2.0′	d 0.2′ m -1.73	ν 2.2′	d 0.1′ m 0.84

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	70°44.9	133°23.2	S23°59.6	256°17.7	N04°30.7	221°31.9	S10°45.6	232°06.6	S05°23.5
1	85°47.4	148°23.5	59.0	271°18.9	30.2	236°33.9	45.8	247°08.8	23.6
2	100°49.8	163°23.9	58.5	286°20.2	29.7	251°35.9	45.9	262°11.1	23.7
3	115°52.3	178°24.2	·· 58.0	301°21.5	·· 29.3	266°37.9	·· 46.1	277°13.3	·· 23.7
4	130°54.8	193°24.6	57.4	316°22.8	28.8	281°39.9	46.2	292°15.6	23.8
5	145°57.2	208°24.9	56.9	331°24.1	28.3	296°41.9	46.4	307°17.8	23.9
6	160°59.7	223°25.3	S23°56.4	346°25.3	N04°27.8	311°43.9	S10°46.6	322°20.1	S05°24.0
7	176°02.2	238°25.6	55.8	1°26.6	27.4	326°45.9	46.7	337°22.3	24.1
8	191°04.6	253°26.0	55.3	16°27.9	26.9	341°47.9	46.9	352°24.6	24.1
9	206°07.1	268°26.3	·· 54.8	31°29.2	·· 26.4	356°49.9	·· 47.1	7°26.8	·· 24.2
10	221°09.5	283°26.7	54.2	46°30.5	25.9	11°51.9	47.2	22°29.1	24.3
11	236°12.0	298°27.1	53.7	61°31.8	25.5	26°53.9	47.4	37°31.3	24.4
12	251°14.5	313°27.4	S23°53.1	76°33.0	N04°25.0	41°55.9	S10°47.5	52°33.6	S05°24.5
13	266°16.9	328°27.8	52.6	91°34.3	24.5	56°58.0	47.7	67°35.8	24.5
14	281°19.4	343°28.2	52.1	106°35.6	24.0	72°00.0	47.9	82°38.0	24.6
15	296°21.9	358°28.5	·· 51.5	121°36.9	·· 23.6	87°02.0	·· 48.0	97°40.3	·· 24.7
16	311°24.3	13°28.9	51.0	136°38.2	23.1	102°04.0	48.2	112°42.5	24.8
17	326°26.8	28°29.3	50.4	151°39.4	22.6	117°06.0	48.4	127°44.8	24.9
18	341°29.3	43°29.6	S23°49.9	166°40.7	N04°22.1	132°08.0	S10°48.5	142°47.0	S05°24.9
19	356°31.7	58°30.0	49.4	181°42.0	21.7	147°10.0	48.7	157°49.3	25.0
20	11°34.2	73°30.4	48.8	196°43.3	21.2	162°12.0	48.8	172°51.5	25.1
21	26°36.7	88°30.8	·· 48.3	211°44.6	·· 20.7	177°14.0	·· 49.0	187°53.8	·· 25.2
22	41°39.1	103°31.2	47.7	226°45.9	20.2	192°16.0	49.2	202°56.0	25.2
23	56°41.6	118°31.6	47.2	241°47.1	19.8	207°18.0	49.3	217°58.3	25.3
Mer.pass. 19:14		ν 0.3′	d 0.5′	m -4.74	ν 1.3′	d 0.5′	m 1.13	ν 2.0′	d 0.2′ m -1.74	ν 2.2′	d 0.1′ m 0.84

Stars

	SHA	Dec
Alpheratz	358°08.3	28°59.5
Ankaa	353°39.2	-42°24.5
Schedar	350°07.8	56°26.5
Diphda	349°19.9	-18°05.3
Achernar	335°44.2	-57°20.0
Hamal	328°27.7	23°22.6
Polaris	326°18.7	89°11.0
Acamar	315°36.2	-40°22.8
Menkar	314°40.0	4°01.1
Mirfak	309°14.4	49°47.9
Aldebaran	291°16.7	16°28.4
Rigel	281°34.9	-8°13.3
Capella	281°09.6	45°58.8
Bellatrix	278°57.5	6°20.0
Elnath	278°42.7	28°35.5
Alnilam	276°10.5	-1°12.8
Betelgeuse	271°27.1	7°24.2
Canopus	264°06.3	-52°41.0
Sirius	258°54.6	-16°41.4
Adhara	255°31.1	-28°56.7
Procyon	245°24.7	5°16.3
Pollux	243°56.9	28°04.2
Avior	234°27.5	-59°26.8
Suhail	223°10.0	-43°21.3
Miaplacidus	221°44.4	-69°38.2
Alphard	218°19.6	-8°34.6
Regulus	208°09.1	12°03.4
Dubhe	194°21.2	61°50.7
Denebola	182°58.3	14°40.5
Gienah	176°17.3	-17°26.2
Acrux	173°36.7	-62°59.5
Gacrux	172°28.1	-57°00.3
Alioth	166°42.1	56°03.4
Spica	158°56.9	-11°03.8
Alkaid	153°18.2	49°24.2
Hadar	149°22.7	-60°16.8
Menkent	148°36.4	-36°16.6
Arcturus	146°18.0	19°16.7
Rigil Kent.	140°25.3	-60°45.2
Kochab	137°20.1	74°13.8
Zuben'ubi	137°32.4	-15°57.8
Alphecca	126°31.8	26°46.6
Antares	112°56.2	-26°23.4
Atria	108°20.3	-68°59.7
Sabik	102°40.5	-15°42.1
Shaula	96°55.1	-37°05.4
Rasalhague	96°29.2	12°34.5
Eltanin	90°57.9	51°29.6
Kaus Aust.	84°16.1	-34°23.6
Vega	80°55.7	38°46.2
Nunki	76°28.5	-26°19.2
Altair	62°32.0	8°49.3
Peacock	53°57.4	-56°47.9
Deneb	49°48.1	45°13.1
Enif	34°10.9	9°47.5
Al Na'ir	28°14.0	-47°03.2
Fomalhaut	15°50.5	-29°43.3
Scheat	14°16.7	27°59.2
Markab	14°02.3	15°06.5

Nov 30 Mon	SHA	Mer.pass
Venus	64°22.4	15:07
Mars	186°30.0	06:58
Jupiter	151°09.1	09:19
Saturn	161°32.3	08:37

Dec 01 Tue	SHA	Mer.pass
Venus	63°29.8	15:07
Mars	186°01.3	06:56
Jupiter	150°58.0	09:16
Saturn	161°26.9	08:34

Dec 02 Wed	SHA	Mer.pass
Venus	62°38.3	15:06
Mars	185°32.8	06:54
Jupiter	150°47.0	09:13
Saturn	161°21.7	08:30

Horizontal parallax	
Venus:	0.3
Mars:	0.1

h	Sun		Moon				
Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°52.2	S21°35.6	143°13.0	11.2′	S21°52.8	0.6′	54.3′
1	197°52.0	36.1	157°43.2	11.2′	21°52.2	0.7′	54.3′
2	212°51.7	36.5	172°13.4	11.2′	21°51.5	0.8′	54.3′
3	227°51.5	·· 36.9	186°43.6	11.2′	21°50.7	0.9′	54.3′
4	242°51.3	37.3	201°13.8	11.2′	21°49.8	1.0′	54.4′
5	257°51.1	37.7	215°44.0	11.2′	21°48.8	1.1′	54.4′
6	272°50.8	S21°38.1	230°14.2	11.2′	S21°47.7	1.2′	54.4′
7	287°50.6	38.5	244°44.3	11.2′	21°46.5	1.3′	54.4′
8	302°50.4	38.9	259°14.5	11.2′	21°45.2	1.5′	54.4′
9	317°50.1	·· 39.3	273°44.7	11.2′	21°43.7	1.5′	54.4′
10	332°49.9	39.7	288°14.8	11.2′	21°42.2	1.6′	54.4′
11	347°49.7	40.1	302°45.0	11.2′	21°40.6	1.8′	54.4′
12	2°49.5	S21°40.5	317°15.2	11.2′	S21°38.8	1.8′	54.5′
13	17°49.2	40.9	331°45.3	11.2′	21°37.0	2.0′	54.5′
14	32°49.0	41.3	346°15.5	11.2′	21°35.0	2.0′	54.5′
15	47°48.8	·· 41.7	0°45.6	11.2′	21°33.0	2.2′	54.5′
16	62°48.5	42.1	15°15.8	11.2′	21°30.8	2.2′	54.5′
17	77°48.3	42.5	29°45.9	11.2′	21°28.6	2.4′	54.5′
18	92°48.1	S21°42.9	44°16.1	11.2′	S21°26.2	2.5′	54.6′
19	107°47.9	43.3	58°46.3	11.2′	21°23.7	2.6′	54.6′
20	122°47.6	43.7	73°16.4	11.2′	21°21.1	2.6′	54.6′
21	137°47.4	·· 44.1	87°46.6	11.2′	21°18.5	2.8′	54.6′
22	152°47.2	44.5	102°16.8	11.2′	21°15.7	2.9′	54.6′
23	167°46.9	44.9	116°46.9	11.2′	21°12.8	3.0′	54.6′
	SD = 16.2′	d = 0.4′	SD = 14.8′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°46.7	S21°45.3	131°17.1	11.2′	S21°09.8	3.1′	54.7′
1	197°46.5	45.7	145°47.3	11.2′	21°06.7	3.2′	54.7′
2	212°46.2	46.1	160°17.5	11.2′	21°03.5	3.3′	54.7′
3	227°46.0	·· 46.5	174°47.7	11.2′	21°00.2	3.4′	54.7′
4	242°45.8	46.9	189°17.9	11.2′	20°56.8	3.5′	54.7′
5	257°45.5	47.3	203°48.1	11.2′	20°53.3	3.6′	54.7′
6	272°45.3	S21°47.7	218°18.3	11.2′	S20°49.7	3.7′	54.8′
7	287°45.1	48.1	232°48.5	11.2′	20°46.0	3.8′	54.8′
8	302°44.8	48.4	247°18.7	11.2′	20°42.2	4.0′	54.8′
9	317°44.6	·· 48.8	261°49.0	11.2′	20°38.2	4.0′	54.8′
10	332°44.4	49.2	276°19.2	11.3′	20°34.2	4.1′	54.8′
11	347°44.1	49.6	290°49.5	11.3′	20°30.1	4.2′	54.9′
12	2°43.9	S21°50.0	305°19.7	11.3′	S20°25.9	4.3′	54.9′
13	17°43.7	50.4	319°50.0	11.3′	20°21.6	4.5′	54.9′
14	32°43.4	50.8	334°20.3	11.3′	20°17.1	4.5′	54.9′
15	47°43.2	·· 51.1	348°50.6	11.3′	20°12.6	4.6′	54.9′
16	62°43.0	51.5	3°20.9	11.3′	20°08.0	4.7′	55.0′
17	77°42.7	51.9	17°51.2	11.3′	20°03.3	4.9′	55.0′
18	92°42.5	S21°52.3	32°21.5	11.3′	S19°58.4	4.9′	55.0′
19	107°42.3	52.7	46°51.8	11.3′	19°53.5	5.0′	55.0′
20	122°42.0	53.1	61°22.2	11.4′	19°48.5	5.1′	55.0′
21	137°41.8	·· 53.4	75°52.5	11.4′	19°43.4	5.3′	55.1′
22	152°41.5	53.8	90°22.9	11.4′	19°38.1	5.3′	55.1′
23	167°41.3	54.2	104°53.3	11.4′	19°32.8	5.4′	55.1′
	SD = 16.2′	d = 0.4′	SD = 14.9′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°41.1	S21°54.6	119°23.7	11.4′	S19°27.4	5.5′	55.1′
1	197°40.8	54.9	133°54.1	11.4′	19°21.9	5.6′	55.1′
2	212°40.6	55.3	148°24.5	11.4′	19°16.3	5.7′	55.2′
3	227°40.3	·· 55.7	162°54.9	11.4′	19°10.6	5.8′	55.2′
4	242°40.1	56.1	177°25.4	11.5′	19°04.8	5.9′	55.2′
5	257°39.9	56.4	191°55.8	11.5′	18°58.9	6.0′	55.2′
6	272°39.6	S21°56.8	206°26.3	11.5′	S18°52.9	6.1′	55.3′
7	287°39.4	57.2	220°56.8	11.5′	18°46.8	6.2′	55.3′
8	302°39.1	57.6	235°27.3	11.5′	18°40.6	6.3′	55.3′
9	317°38.9	·· 57.9	249°57.8	11.5′	18°34.3	6.4′	55.3′
10	332°38.7	58.3	264°28.3	11.5′	18°27.9	6.5′	55.4′
11	347°38.4	58.7	278°58.9	11.6′	18°21.4	6.5′	55.4′
12	2°38.2	S21°59.0	293°29.4	11.6′	S18°14.9	6.7′	55.4′
13	17°37.9	59.4	308°00.0	11.6′	18°08.2	6.8′	55.4′
14	32°37.7	21°59.8	322°30.6	11.6′	18°01.4	6.8′	55.5′
15	47°37.5	22°00.1	337°01.2	11.6′	17°54.6	6.9′	55.5′
16	62°37.2	00.5	351°31.8	11.6′	17°47.7	7.1′	55.5′
17	77°37.0	00.9	6°02.4	11.6′	17°40.6	7.1′	55.5′
18	92°36.7	S22°01.2	20°33.0	11.6′	S17°33.5	7.2′	55.6′
19	107°36.5	01.6	35°03.7	11.7′	17°26.3	7.3′	55.6′
20	122°36.2	02.0	49°34.3	11.7′	17°19.0	7.4′	55.6′
21	137°36.0	·· 02.3	64°05.0	11.7′	17°11.6	7.5′	55.6′
22	152°35.8	02.7	78°35.7	11.7′	17°04.1	7.6′	55.7′
23	167°35.5	03.0	93°06.4	11.7′	16°56.5	7.6′	55.7′
	SD = 16.2′	d = 0.4′	SD = 15.0′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	07:51	09:50	▬	▬	13:48	15:47
N 70°	07:35	09:11	▬	▬	14:27	16:03
68°	07:21	08:44	10:36	13:02	14:54	16:16
66°	07:10	08:23	09:47	13:51	15:15	16:27
64°	07:01	08:06	09:16	14:22	15:31	16:36
62°	06:53	07:52	08:53	14:45	15:45	16:45
60°	06:46	07:41	08:35	15:03	15:57	16:52
N 58°	06:39	07:30	08:20	15:18	16:07	16:58
56°	06:33	07:21	08:07	15:31	16:16	17:04
54°	06:28	07:13	07:55	15:42	16:25	17:10
52°	06:23	07:06	07:46	15:52	16:32	17:15
50°	06:18	06:59	07:37	16:01	16:39	17:19
45°	06:08	06:45	07:18	16:20	16:53	17:30
N 40°	05:59	06:32	07:02	16:35	17:05	17:39
35°	05:51	06:22	06:50	16:48	17:16	17:47
30°	05:43	06:12	06:38	17:00	17:26	17:55
20°	05:28	05:55	06:19	17:19	17:43	18:10
N 10°	05:13	05:39	06:02	17:37	17:59	18:25
0°	04:57	05:23	05:45	17:53	18:15	18:41
S 10°	04:40	05:06	05:29	18:09	18:32	18:59
20°	04:19	04:47	05:12	18:27	18:51	19:20
30°	03:52	04:24	04:51	18:47	19:14	19:47
35°	03:35	04:10	04:39	18:59	19:28	20:04
40°	03:13	03:54	04:26	19:13	19:45	20:25
45°	02:46	03:33	04:09	19:29	20:06	20:53
S 50°	02:07	03:06	03:49	19:50	20:33	21:33
52°	01:45	02:53	03:39	20:00	20:46	21:55
54°	01:15	02:38	03:28	20:11	21:02	22:26
56°	00:18	02:19	03:16	20:24	21:21	23:31
58°	////	01:55	03:01	20:38	21:45	////
S 60°	////	01:23	02:44	20:56	22:18	////

Lat.	**Moonrise** Mon	Tue	Wed	**Moonset** Mon	Tue	Wed
N 72°	▬	▬	16:07	▬	▬	17:16
N 70°	▬	▬	14:45	▬	▬	18:37
68°	14:14	14:10	14:07	15:43	17:29	19:15
66°	13:07	13:29	13:39	16:50	18:10	19:41
64°	12:31	13:00	13:18	17:25	18:38	20:02
62°	12:06	12:39	13:01	17:51	19:00	20:18
60°	11:45	12:21	12:47	18:11	19:17	20:32
N 58°	11:29	12:06	12:35	18:27	19:31	20:43
56°	11:15	11:54	12:24	18:41	19:44	20:53
54°	11:03	11:42	12:15	18:53	19:55	21:02
52°	10:52	11:33	12:07	19:04	20:04	21:10
50°	10:42	11:24	11:59	19:13	20:13	21:17
45°	10:22	11:05	11:43	19:33	20:31	21:32
N 40°	10:06	10:50	11:30	19:49	20:45	21:45
35°	09:52	10:37	11:19	20:03	20:58	21:55
30°	09:40	10:26	11:09	20:15	21:09	22:04
20°	09:19	10:07	10:52	20:35	21:27	22:20
N 10°	09:02	09:50	10:37	20:52	21:43	22:34
0°	08:45	09:34	10:23	21:09	21:58	22:47
S 10°	08:28	09:19	10:09	21:25	22:13	22:59
20°	08:10	09:02	09:54	21:42	22:29	23:13
30°	07:50	08:42	09:37	22:02	22:47	23:28
35°	07:38	08:31	09:27	22:14	22:57	23:37
40°	07:24	08:18	09:16	22:27	23:09	23:47
45°	07:08	08:03	09:02	22:43	23:24	23:59
S 50°	06:48	07:44	08:46	23:02	23:41	·· ··
52°	06:38	07:35	08:38	23:12	23:49	·· ··
54°	06:27	07:25	08:29	23:22	23:58	·· ··
56°	06:15	07:13	08:20	23:33	·· ··	00:08
58°	06:01	07:00	08:09	23:47	·· ··	00:20
S 60°	05:44	06:45	07:56	·· ··	00:02	00:33

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 4-6 10-24%
30	11:29	11:18	11:49	14:57	02:32	
01	11:07	10:56	11:49	15:46	03:22	
02	10:44	10:33	11:49	16:35	04:11	

December 03, 04, 05 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	71°44.0	133°31.9	S23°46.6	256°48.4	N04°19.3	222°20.0	S10°49.5	233°00.5	S05°25.4
1	86°46.5	148°32.3	46.1	271°49.7	18.8	237°22.0	49.6	248°02.8	25.5
2	101°49.0	163°32.7	45.5	286°51.0	18.3	252°24.1	49.8	263°05.0	25.6
3	116°51.4	178°33.1	·· 45.0	301°52.3	·· 17.9	267°26.1	·· 50.0	278°07.3	·· 25.6
4	131°53.9	193°33.5	44.4	316°53.6	17.4	282°28.1	50.1	293°09.5	25.7
5	146°56.4	208°33.9	43.9	331°54.9	16.9	297°30.1	50.3	308°11.8	25.8
6	161°58.8	223°34.3	S23°43.3	346°56.1	N04°16.4	312°32.1	S10°50.5	323°14.0	S05°25.9
7	177°01.3	238°34.7	42.8	1°57.4	16.0	327°34.1	50.6	338°16.3	26.0
8	192°03.8	253°35.1	42.3	16°58.7	15.5	342°36.1	50.8	353°18.5	26.0
9	207°06.2	268°35.5	·· 41.7	32°00.0	·· 15.0	357°38.1	·· 50.9	8°20.8	·· 26.1
10	222°08.7	283°35.9	41.1	47°01.3	14.6	12°40.1	51.1	23°23.0	26.2
11	237°11.1	298°36.4	40.6	62°02.6	14.1	27°42.1	51.3	38°25.3	26.3
12	252°13.6	313°36.8	S23°40.0	77°03.9	N04°13.6	42°44.1	S10°51.4	53°27.5	S05°26.3
13	267°16.1	328°37.2	39.5	92°05.2	13.1	57°46.2	51.6	68°29.8	26.4
14	282°18.5	343°37.6	38.9	107°06.4	12.7	72°48.2	51.7	83°32.0	26.5
15	297°21.0	358°38.0	·· 38.4	122°07.7	·· 12.2	87°50.2	·· 51.9	98°34.3	·· 26.6
16	312°23.5	13°38.4	37.8	137°09.0	11.7	102°52.2	52.1	113°36.5	26.7
17	327°25.9	28°38.9	37.3	152°10.3	11.2	117°54.2	52.2	128°38.8	26.7
18	342°28.4	43°39.3	S23°36.7	167°11.6	N04°10.8	132°56.2	S10°52.4	143°41.0	S05°26.8
19	357°30.9	58°39.7	36.2	182°12.9	10.3	147°58.2	52.5	158°43.3	26.9
20	12°33.3	73°40.1	35.6	197°14.2	09.8	163°00.2	52.7	173°45.5	27.0
21	27°35.8	88°40.6	·· 35.1	212°15.5	·· 09.4	178°02.2	·· 52.9	188°47.8	·· 27.0
22	42°38.3	103°41.0	34.5	227°16.8	08.9	193°04.2	53.0	203°50.0	27.1
23	57°40.7	118°41.5	33.9	242°18.1	08.4	208°06.3	53.2	218°52.3	27.2
Mer.pass. 19:10		ν 0.4′	d 0.5′	m -4.76	ν 1.3′	d 0.5′	m 1.12	ν 2.0′	d 0.2′ m -1.74	ν 2.2′	d 0.1′ m 0.84

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	72°43.2	133°41.9	S23°33.4	257°19.3	N04°07.9	223°08.3	S10°53.3	233°54.5	S05°27.3
1	87°45.6	148°42.3	32.8	272°20.6	07.5	238°10.3	53.5	248°56.8	27.4
2	102°48.1	163°42.8	32.3	287°21.9	07.0	253°12.3	53.7	263°59.0	27.4
3	117°50.6	178°43.2	·· 31.7	302°23.2	·· 06.5	268°14.3	·· 53.8	279°01.3	·· 27.5
4	132°53.0	193°43.7	31.1	317°24.5	06.1	283°16.3	54.0	294°03.5	27.6
5	147°55.5	208°44.1	30.6	332°25.8	05.6	298°18.3	54.1	309°05.8	27.7
6	162°58.0	223°44.6	S23°30.0	347°27.1	N04°05.1	313°20.3	S10°54.3	324°08.0	S05°27.7
7	178°00.4	238°45.0	29.5	2°28.4	04.6	328°22.3	54.5	339°10.3	27.8
8	193°02.9	253°45.5	28.9	17°29.7	04.2	343°24.4	54.6	354°12.6	27.9
9	208°05.4	268°45.9	·· 28.3	32°31.0	·· 03.7	358°26.4	·· 54.8	9°14.8	·· 28.0
10	223°07.8	283°46.4	27.8	47°32.3	03.2	13°28.4	54.9	24°17.1	28.0
11	238°10.3	298°46.9	27.2	62°33.6	02.8	28°30.4	55.1	39°19.3	28.1
12	253°12.8	313°47.3	S23°26.6	77°34.9	N04°02.3	43°32.4	S10°55.3	54°21.6	S05°28.2
13	268°15.2	328°47.8	26.1	92°36.1	01.8	58°34.4	55.4	69°23.8	28.3
14	283°17.7	343°48.2	25.5	107°37.4	01.3	73°36.4	55.6	84°26.1	28.4
15	298°20.1	358°48.7	·· 24.9	122°38.7	·· 00.9	88°38.4	·· 55.7	99°28.3	·· 28.4
16	313°22.6	13°49.2	24.4	137°40.0	04°00.4	103°40.5	55.9	114°30.6	28.5
17	328°25.1	28°49.7	23.8	152°41.3	03°59.9	118°42.5	56.1	129°32.8	28.6
18	343°27.5	43°50.1	S23°23.2	167°42.6	N03°59.5	133°44.5	S10°56.2	144°35.1	S05°28.7
19	358°30.0	58°50.6	22.7	182°43.9	59.0	148°46.5	56.4	159°37.3	28.7
20	13°32.5	73°51.1	22.1	197°45.2	58.5	163°48.5	56.5	174°39.6	28.8
21	28°34.9	88°51.6	·· 21.5	212°46.5	·· 58.1	178°50.5	·· 56.7	189°41.8	·· 28.9
22	43°37.4	103°52.1	21.0	227°47.8	57.6	193°52.5	56.9	204°44.1	29.0
23	58°39.9	118°52.6	20.4	242°49.1	57.1	208°54.5	57.0	219°46.3	29.0
Mer.pass. 19:06		ν 0.4′	d 0.6′	m -4.77	ν 1.3′	d 0.5′	m 1.11	ν 2.0′	d 0.2′ m -1.74	ν 2.3′	d 0.1′ m 0.84

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	73°42.3	133°53.0	S23°19.8	257°50.4	N03°56.6	223°56.6	S10°57.2	234°48.6	S05°29.1
1	88°44.8	148°53.5	19.2	272°51.7	56.2	238°58.6	57.3	249°50.9	29.2
2	103°47.2	163°54.0	18.7	287°53.0	55.7	254°00.6	57.5	264°53.1	29.3
3	118°49.7	178°54.5	·· 18.1	302°54.3	·· 55.2	269°02.6	·· 57.6	279°55.4	·· 29.3
4	133°52.2	193°55.0	17.5	317°55.6	54.8	284°04.6	57.8	294°57.6	29.4
5	148°54.6	208°55.5	17.0	332°56.9	54.3	299°06.6	58.0	309°59.9	29.5
6	163°57.1	223°56.0	S23°16.4	347°58.2	N03°53.8	314°08.6	S10°58.1	325°02.1	S05°29.6
7	178°59.6	238°56.5	15.8	2°59.5	53.4	329°10.7	58.3	340°04.4	29.6
8	194°02.0	253°57.0	15.2	18°00.8	52.9	344°12.7	58.4	355°06.6	29.7
9	209°04.5	268°57.6	·· 14.7	33°02.1	·· 52.4	359°14.7	·· 58.6	10°08.9	·· 29.8
10	224°07.0	283°58.1	14.1	48°03.4	52.0	14°16.7	58.8	25°11.1	29.9
11	239°09.4	298°58.6	13.5	63°04.7	51.5	29°18.7	58.9	40°13.4	30.0
12	254°11.9	313°59.1	S23°12.9	78°06.0	N03°51.0	44°20.7	S10°59.1	55°15.7	S05°30.0
13	269°14.4	328°59.6	12.4	93°07.3	50.5	59°22.7	59.2	70°17.9	30.1
14	284°16.8	344°00.1	11.8	108°08.6	50.1	74°24.8	59.4	85°20.2	30.2
15	299°19.3	359°00.7	·· 11.2	123°09.9	·· 49.6	89°26.8	·· 59.5	100°22.4	·· 30.3
16	314°21.7	14°01.2	10.6	138°11.2	49.1	104°28.8	59.7	115°24.7	30.3
17	329°24.2	29°01.7	10.0	153°12.5	48.7	119°30.8	10°59.9	130°26.9	30.4
18	344°26.7	44°02.2	S23°09.5	168°13.8	N03°48.2	134°32.8	S11°00.0	145°29.2	S05°30.5
19	359°29.1	59°02.8	08.9	183°15.1	47.7	149°34.8	00.2	160°31.4	30.6
20	14°31.6	74°03.3	08.3	198°16.4	47.3	164°36.8	00.3	175°33.7	30.6
21	29°34.1	89°03.8	·· 07.7	213°17.7	·· 46.8	179°38.9	·· 00.5	190°36.0	·· 30.7
22	44°36.5	104°04.4	07.1	228°19.0	46.3	194°40.9	00.6	205°38.2	30.8
23	59°39.0	119°04.9	06.5	243°20.3	45.9	209°42.9	00.8	220°40.5	30.9
Mer.pass. 19:02		ν 0.5′	d 0.6′	m -4.78	ν 1.3′	d 0.5′	m 1.10	ν 2.0′	d 0.2′ m -1.75	ν 2.3′	d 0.1′ m 0.83

Stars

	SHA	Dec
Alpheratz	358°08.3	28°59.5
Ankaa	353°39.2	-42°24.6
Schedar	350°07.8	56°26.5
Diphda	349°19.9	-18°05.3
Achernar	335°44.2	-57°20.0
Hamal	328°27.7	23°22.6
Polaris	326°19.3	89°11.0
Acamar	315°36.2	-40°22.8
Menkar	314°40.0	4°01.1
Mirfak	309°14.4	49°47.9
Aldebaran	291°16.7	16°28.4
Rigel	281°34.9	-8°13.3
Capella	281°09.6	45°58.8
Bellatrix	278°57.5	6°20.0
Elnath	278°42.7	28°35.5
Alnilam	276°10.5	-1°12.8
Betelgeuse	271°27.0	7°24.2
Canopus	264°06.3	-52°41.1
Sirius	258°54.6	-16°41.4
Adhara	255°31.1	-28°56.7
Procyon	245°24.7	5°16.3
Pollux	243°56.9	28°04.2
Avior	234°27.5	-59°26.8
Suhail	223°10.0	-43°21.3
Miaplacidus	221°44.4	-69°38.2
Alphard	218°19.6	-8°34.7
Regulus	208°09.0	12°03.4
Dubhe	194°21.1	61°50.7
Denebola	182°58.3	14°40.5
Gienah	176°17.2	-17°26.2
Acrux	173°36.7	-62°59.5
Gacrux	172°28.1	-57°00.3
Alioth	166°42.1	56°03.4
Spica	158°56.9	-11°03.8
Alkaid	153°18.2	49°24.2
Hadar	149°22.7	-60°16.8
Menkent	148°36.4	-36°16.6
Arcturus	146°18.0	19°16.7
Rigil Kent.	140°25.3	-60°45.2
Kochab	137°20.1	74°13.7
Zuben'ubi	137°32.4	-15°57.8
Alphecca	126°31.8	26°46.6
Antares	112°56.2	-26°23.4
Atria	108°20.3	-68°59.7
Sabik	102°40.5	-15°42.1
Shaula	96°55.1	-37°05.4
Rasalhague	96°29.2	12°34.5
Eltanin	90°57.9	51°29.6
Kaus Aust.	84°16.1	-34°23.6
Vega	80°55.7	38°46.1
Nunki	76°28.5	-26°19.2
Altair	62°32.0	8°49.3
Peacock	53°57.5	-56°47.9
Deneb	49°48.2	45°13.1
Enif	34°10.9	9°47.5
Al Na'ir	28°14.0	-47°03.2
Fomalhaut	15°50.5	-29°43.3
Scheat	14°16.7	27°59.2
Markab	14°02.3	15°06.5

Dec 03 Thu	SHA	Mer.pass
Venus	61°47.9	15:05
Mars	185°04.4	06:52
Jupiter	150°36.0	09:09
Saturn	161°16.5	08:27

Dec 04 Fri	SHA	Mer.pass
Venus	60°58.7	15:05
Mars	184°36.2	06:50
Jupiter	150°25.1	09:06
Saturn	161°11.4	08:23

Dec 05 Sat	SHA	Mer.pass
Venus	60°10.7	15:04
Mars	184°08.1	06:48
Jupiter	150°14.2	09:03
Saturn	161°06.3	08:20

Horizontal parallax	
Venus:	0.3
Mars:	0.1

DUT1 = UT1-UTC = +0.0818 sec ΔT = TT-UT1 = +52.1022 sec

1981 December 03 to Dec. 05 UT

h	Sun		Moon				
Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	182°35.3	S22°03.4	107°37.1	11.7′	S16°48.9	7.8′	55.7′
1	197°35.0	03.8	122°07.8	11.7′	16°41.1	7.8′	55.8′
2	212°34.8	04.1	136°38.6	11.8′	16°33.3	7.9′	55.8′
3	227°34.5	·· 04.5	151°09.3	11.8′	16°25.4	8.1′	55.8′
4	242°34.3	04.8	165°40.1	11.8′	16°17.3	8.1′	55.8′
5	257°34.0	05.2	180°10.9	11.8′	16°09.2	8.1′	55.9′
6	272°33.8	S22°05.5	194°41.7	11.8′	S16°01.1	8.3′	55.9′
7	287°33.6	05.9	209°12.5	11.8′	15°52.8	8.4′	55.9′
8	302°33.3	06.2	223°43.3	11.8′	15°44.4	8.4′	56.0′
9	317°33.1	·· 06.6	238°14.1	11.8′	15°36.0	8.5′	56.0′
10	332°32.8	07.0	252°45.0	11.9′	15°27.5	8.6′	56.0′
11	347°32.6	07.3	267°15.8	11.9′	15°18.9	8.7′	56.0′
12	2°32.3	S22°07.7	281°46.7	11.9′	S15°10.2	8.8′	56.1′
13	17°32.1	08.0	296°17.6	11.9′	15°01.4	8.8′	56.1′
14	32°31.8	08.4	310°48.5	11.9′	14°52.6	9.0′	56.1′
15	47°31.6	·· 08.7	325°19.4	11.9′	14°43.6	9.0′	56.2′
16	62°31.3	09.1	339°50.3	11.9′	14°34.6	9.1′	56.2′
17	77°31.1	09.4	354°21.2	11.9′	14°25.5	9.2′	56.2′
18	92°30.8	S22°09.7	8°52.1	11.9′	S14°16.3	9.2′	56.3′
19	107°30.6	10.1	23°23.0	11.9′	14°07.1	9.3′	56.3′
20	122°30.3	10.4	37°54.0	11.9′	13°57.8	9.5′	56.3′
21	137°30.1	·· 10.8	52°24.9	12.0′	13°48.3	9.4′	56.4′
22	152°29.8	11.1	66°55.9	12.0′	13°38.9	9.6′	56.4′
23	167°29.6	11.5	81°26.8	12.0′	13°29.3	9.6′	56.4′
	SD = 16.2′	d = 0.4′	SD = 15.2′				

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	182°29.3	S22°11.8	95°57.8	12.0′	S13°19.7	9.8′	56.5′
1	197°29.1	12.1	110°28.8	12.0′	13°09.9	9.8′	56.5′
2	212°28.8	12.5	124°59.8	12.0′	13°00.1	9.8′	56.5′
3	227°28.6	·· 12.8	139°30.8	12.0′	12°50.3	10.0′	56.6′
4	242°28.3	13.2	154°01.7	12.0′	12°40.3	10.0′	56.6′
5	257°28.1	13.5	168°32.7	12.0′	12°30.3	10.1′	56.6′
6	272°27.8	S22°13.8	183°03.7	12.0′	S12°20.2	10.1′	56.7′
7	287°27.6	14.2	197°34.8	12.0′	12°10.1	10.2′	56.7′
8	302°27.3	14.5	212°05.8	12.0′	11°59.9	10.3′	56.7′
9	317°27.1	·· 14.8	226°36.8	12.0′	11°49.6	10.4′	56.8′
10	332°26.8	15.2	241°07.8	12.0′	11°39.2	10.4′	56.8′
11	347°26.6	15.5	255°38.8	12.0′	11°28.8	10.6′	56.8′
12	2°26.3	S22°15.8	270°09.8	12.0′	S11°18.2	10.5′	56.9′
13	17°26.1	16.2	284°40.8	12.0′	11°07.7	10.7′	56.9′
14	32°25.8	16.5	299°11.8	12.0′	10°57.0	10.7′	56.9′
15	47°25.5	·· 16.8	313°42.9	12.0′	10°46.3	10.8′	57.0′
16	62°25.3	17.2	328°13.9	12.0′	10°35.5	10.8′	57.0′
17	77°25.0	17.5	342°44.9	12.0′	10°24.7	10.9′	57.0′
18	92°24.8	S22°17.8	357°15.9	12.0′	S10°13.8	11.0′	57.1′
19	107°24.5	18.2	11°46.9	12.0′	10°02.8	11.0′	57.1′
20	122°24.3	18.5	26°17.9	12.0′	09°51.8	11.1′	57.1′
21	137°24.0	·· 18.8	40°48.9	12.0′	09°40.7	11.2′	57.2′
22	152°23.8	19.1	55°19.9	12.0′	09°29.5	11.2′	57.2′
23	167°23.5	19.5	69°50.9	12.0′	09°18.3	11.3′	57.2′
	SD = 16.2′	d = 0.3′	SD = 15.4′				

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	182°23.2	S22°19.8	84°21.8	12.0′	S09°07.0	11.3′	57.3′
1	197°23.0	20.1	98°52.8	12.0′	08°55.7	11.4′	57.3′
2	212°22.7	20.4	113°23.8	12.0′	08°44.3	11.5′	57.4′
3	227°22.5	·· 20.8	127°54.7	11.9′	08°32.8	11.5′	57.4′
4	242°22.2	21.1	142°25.7	11.9′	08°21.3	11.5′	57.4′
5	257°22.0	21.4	156°56.6	11.9′	08°09.8	11.7′	57.5′
6	272°21.7	S22°21.7	171°27.5	11.9′	S07°58.1	11.7′	57.5′
7	287°21.4	22.0	185°58.4	11.9′	07°46.4	11.7′	57.5′
8	302°21.2	22.3	200°29.3	11.9′	07°34.7	11.8′	57.6′
9	317°20.9	·· 22.7	215°00.2	11.9′	07°22.9	11.8′	57.6′
10	332°20.7	23.0	229°31.1	11.9′	07°11.1	11.9′	57.7′
11	347°20.4	23.3	244°01.9	11.8′	06°59.2	12.0′	57.7′
12	2°20.2	S22°23.6	258°32.8	11.8′	S06°47.2	12.0′	57.7′
13	17°19.9	23.9	273°03.6	11.8′	06°35.2	12.0′	57.8′
14	32°19.6	24.2	287°34.4	11.8′	06°23.2	12.1′	57.8′
15	47°19.4	·· 24.5	302°05.2	11.8′	06°11.1	12.1′	57.8′
16	62°19.1	24.9	316°36.0	11.8′	05°59.0	12.2′	57.9′
17	77°18.9	25.2	331°06.7	11.7′	05°46.8	12.3′	57.9′
18	92°18.6	S22°25.5	345°37.5	11.7′	S05°34.5	12.2′	58.0′
19	107°18.3	25.8	0°08.2	11.7′	05°22.3	12.4′	58.0′
20	122°18.1	26.1	14°38.9	11.7′	05°09.9	12.3′	58.0′
21	137°17.8	·· 26.4	29°09.5	11.6′	04°57.6	12.4′	58.1′
22	152°17.6	26.7	43°40.2	11.6′	04°45.2	12.5′	58.1′
23	167°17.3	27.0	58°10.8	11.6′	04°32.7	12.5′	58.2′
	SD = 16.2′	d = 0.3′	SD = 15.6′				

Lat.	Twilight		Sunrise	Sunset	Twilight	
	Naut.	Civil			Civil	Naut.
N 72°	07:59	10:04	▬	▬	13:36	15:41
N 70°	07:41	09:20	▬	▬	14:20	15:58
68°	07:28	08:51	10:55	12:45	14:48	16:12
66°	07:16	08:30	09:57	13:43	15:10	16:24
64°	07:06	08:12	09:24	14:16	15:28	16:34
62°	06:58	07:58	09:00	14:40	15:42	16:42
60°	06:50	07:46	08:41	14:59	15:55	16:50
N 58°	06:43	07:35	08:25	15:15	16:05	16:57
56°	06:37	07:26	08:12	15:29	16:15	17:03
54°	06:32	07:17	08:00	15:40	16:23	17:08
52°	06:27	07:10	07:50	15:51	16:31	17:14
50°	06:22	07:03	07:40	16:00	16:37	17:18
45°	06:11	06:48	07:21	16:19	16:52	17:29
N 40°	06:02	06:35	07:05	16:35	17:05	17:39
35°	05:53	06:24	06:52	16:48	17:16	17:47
30°	05:45	06:14	06:41	17:00	17:26	17:56
20°	05:29	05:57	06:21	17:20	17:44	18:11
N 10°	05:14	05:40	06:03	17:37	18:00	18:26
0°	04:58	05:24	05:47	17:54	18:16	18:42
S 10°	04:40	05:07	05:30	18:11	18:33	19:00
20°	04:19	04:48	05:12	18:29	18:53	19:22
30°	03:51	04:24	04:51	18:49	19:17	19:49
35°	03:34	04:10	04:39	19:02	19:31	20:07
40°	03:12	03:53	04:25	19:16	19:48	20:29
45°	02:44	03:32	04:08	19:33	20:09	20:57
S 50°	02:03	03:04	03:47	19:54	20:37	21:38
52°	01:40	02:50	03:37	20:04	20:51	22:02
54°	01:07	02:34	03:26	20:15	21:07	22:36
56°	////	02:15	03:13	20:28	21:27	////
58°	////	01:50	02:58	20:44	21:52	////
S 60°	////	01:15	02:40	21:02	22:29	////

Lat.	Moonrise			Moonset		
	Thu	Fri	Sat	Thu	Fri	Sat
N 72°	14:57	14:31	14:12	20:07	22:14	·· ··
N 70°	14:26	14:13	14:03	20:37	22:30	·· ··
68°	14:03	13:59	13:56	20:59	22:42	·· ··
66°	13:45	13:48	13:49	21:16	22:52	·· ··
64°	13:30	13:38	13:44	21:30	23:01	·· ··
62°	13:17	13:29	13:39	21:41	23:08	·· ··
60°	13:07	13:22	13:35	21:51	23:14	·· ··
N 58°	12:58	13:16	13:32	22:00	23:20	·· ··
56°	12:49	13:10	13:29	22:07	23:25	·· ··
54°	12:42	13:05	13:26	22:14	23:29	·· ··
52°	12:36	13:00	13:23	22:20	23:33	·· ··
50°	12:30	12:56	13:21	22:25	23:36	·· ··
45°	12:17	12:47	13:15	22:37	23:44	·· ··
N 40°	12:06	12:39	13:11	22:47	23:50	·· ··
35°	11:57	12:33	13:07	22:55	23:56	·· ··
30°	11:49	12:27	13:04	23:02	·· ··	00:01
20°	11:35	12:17	12:58	23:14	·· ··	00:09
N 10°	11:23	12:08	12:53	23:25	·· ··	00:16
0°	11:12	12:00	12:48	23:35	·· ··	00:23
S 10°	11:00	11:51	12:43	23:45	·· ··	00:29
20°	10:48	11:43	12:38	23:55	·· ··	00:36
30°	10:34	11:32	12:32	·· ··	00:07	00:44
35°	10:26	11:26	12:29	·· ··	00:14	00:49
40°	10:17	11:20	12:25	·· ··	00:22	00:54
45°	10:06	11:12	12:20	·· ··	00:31	01:00
S 50°	09:52	11:02	12:15	00:13	00:42	01:07
52°	09:46	10:58	12:12	00:20	00:47	01:10
54°	09:39	10:53	12:10	00:28	00:52	01:14
56°	09:32	10:48	12:06	00:36	00:58	01:18
58°	09:23	10:42	12:03	00:45	01:05	01:22
S 60°	09:13	10:35	11:59	00:55	01:13	01:27

Day	Sun			Moon		
	Eqn.of Time		Mer.	Mer.Pass.		Age
	00^h	12^h	Pass	Upper	Lower	7-9
	mm:ss	mm:ss	hh:mm	hh:mm	hh:mm	33-53%
03	10:21	10:09	11:50	17:23	04:59	
04	09:57	09:45	11:50	18:11	05:47	
05	09:33	09:21	11:51	18:59	06:35	

December 06, 07, 08 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	74°41.5	134°05.5	S23°06.0	258°21.6	N03°45.4	224°44.9	S11°01.0	235°42.7	S05°30.9
1	89°43.9	149°06.0	05.4	273°22.9	44.9	239°46.9	01.1	250°45.0	31.0
2	104°46.4	164°06.6	04.8	288°24.2	44.5	254°48.9	01.3	265°47.2	31.1
3	119°48.9	179°07.1	·· 04.2	303°25.5	·· 44.0	269°51.0	·· 01.4	280°49.5	·· 31.2
4	134°51.3	194°07.7	03.6	318°26.8	43.5	284°53.0	01.6	295°51.8	31.2
5	149°53.8	209°08.2	03.0	333°28.1	43.1	299°55.0	01.7	310°54.0	31.3
6	164°56.2	224°08.8	S23°02.5	348°29.4	N03°42.6	314°57.0	S11°01.9	325°56.3	S05°31.4
7	179°58.7	239°09.3	01.9	3°30.8	42.1	329°59.0	02.1	340°58.5	31.5
8	195°01.2	254°09.9	01.3	18°32.1	41.7	345°01.0	02.2	356°00.8	31.5
9	210°03.6	269°10.5	·· 00.7	33°33.4	·· 41.2	0°03.1	·· 02.4	11°03.0	·· 31.6
10	225°06.1	284°11.0	23°00.1	48°34.7	40.7	15°05.1	02.5	26°05.3	31.7
11	240°08.6	299°11.6	22°59.5	63°36.0	40.3	30°07.1	02.7	41°07.6	31.8
12	255°11.0	314°12.2	S22°58.9	78°37.3	N03°39.8	45°09.1	S11°02.8	56°09.8	S05°31.8
13	270°13.5	329°12.7	58.3	93°38.6	39.3	60°11.1	03.0	71°12.1	31.9
14	285°16.0	344°13.3	57.8	108°39.9	38.9	75°13.1	03.2	86°14.3	32.0
15	300°18.4	359°13.9	·· 57.2	123°41.2	·· 38.4	90°15.2	·· 03.3	101°16.6	·· 32.0
16	315°20.9	14°14.5	56.6	138°42.5	37.9	105°17.2	03.5	116°18.8	32.1
17	330°23.3	29°15.0	56.0	153°43.8	37.5	120°19.2	03.6	131°21.1	32.2
18	345°25.8	44°15.6	S22°55.4	168°45.1	N03°37.0	135°21.2	S11°03.8	146°23.4	S05°32.3
19	0°28.3	59°16.2	54.8	183°46.4	36.6	150°23.2	03.9	161°25.6	32.3
20	15°30.7	74°16.8	54.2	198°47.8	36.1	165°25.3	04.1	176°27.9	32.4
21	30°33.2	89°17.4	·· 53.6	213°49.1	·· 35.6	180°27.3	·· 04.2	191°30.1	·· 32.5
22	45°35.7	104°18.0	53.0	228°50.4	35.2	195°29.3	04.4	206°32.4	32.6
23	60°38.1	119°18.6	52.4	243°51.7	34.7	210°31.3	04.6	221°34.7	32.6
Mer.pass. 18:58		ν 0.5′	d 0.6′	m -4.79	ν 1.3′	d 0.5′	m 1.08	ν 2.0′	d 0.2′ m -1.75	ν 2.3′	d 0.1′ m 0.83

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	75°40.6	134°19.2	S22°51.8	258°53.0	N03°34.2	225°33.3	S11°04.7	236°36.9	S05°32.7
1	90°43.1	149°19.8	51.2	273°54.3	33.8	240°35.3	04.9	251°39.2	32.8
2	105°45.5	164°20.4	50.7	288°55.6	33.3	255°37.4	05.0	266°41.4	32.9
3	120°48.0	179°21.0	·· 50.1	303°56.9	·· 32.8	270°39.4	·· 05.2	281°43.7	·· 32.9
4	135°50.5	194°21.6	49.5	318°58.2	32.4	285°41.4	05.3	296°46.0	33.0
5	150°52.9	209°22.2	48.9	333°59.5	31.9	300°43.4	05.5	311°48.2	33.1
6	165°55.4	224°22.8	S22°48.3	349°00.9	N03°31.4	315°45.4	S11°05.7	326°50.5	S05°33.2
7	180°57.8	239°23.4	47.7	4°02.2	31.0	330°47.5	05.8	341°52.7	33.2
8	196°00.3	254°24.0	47.1	19°03.5	30.5	345°49.5	06.0	356°55.0	33.3
9	211°02.8	269°24.7	·· 46.5	34°04.8	·· 30.1	0°51.5	·· 06.1	11°57.3	·· 33.4
10	226°05.2	284°25.3	45.9	49°06.1	29.6	15°53.5	06.3	26°59.5	33.4
11	241°07.7	299°25.9	45.3	64°07.4	29.1	30°55.5	06.4	42°01.8	33.5
12	256°10.2	314°26.5	S22°44.7	79°08.7	N03°28.7	45°57.6	S11°06.6	57°04.0	S05°33.6
13	271°12.6	329°27.2	44.1	94°10.0	28.2	60°59.6	06.7	72°06.3	33.7
14	286°15.1	344°27.8	43.5	109°11.4	27.7	76°01.6	06.9	87°08.6	33.7
15	301°17.6	359°28.4	·· 42.9	124°12.7	·· 27.3	91°03.6	·· 07.0	102°10.8	·· 33.8
16	316°20.0	14°29.1	42.3	139°14.0	26.8	106°05.6	07.2	117°13.1	33.9
17	331°22.5	29°29.7	41.7	154°15.3	26.4	121°07.7	07.4	132°15.3	34.0
18	346°24.9	44°30.3	S22°41.1	169°16.6	N03°25.9	136°09.7	S11°07.5	147°17.6	S05°34.0
19	1°27.4	59°31.0	40.5	184°17.9	25.4	151°11.7	07.7	162°19.9	34.1
20	16°29.9	74°31.6	39.9	199°19.3	25.0	166°13.7	07.8	177°22.1	34.2
21	31°32.3	89°32.3	·· 39.3	214°20.6	·· 24.5	181°15.7	·· 08.0	192°24.4	·· 34.2
22	46°34.8	104°32.9	38.7	229°21.9	24.0	196°17.8	08.1	207°26.6	34.3
23	61°37.3	119°33.6	38.1	244°23.2	23.6	211°19.8	08.3	222°28.9	34.4
Mer.pass. 18:54		ν 0.6′	d 0.6′	m -4.80	ν 1.3′	d 0.5′	m 1.07	ν 2.0′	d 0.2′ m -1.75	ν 2.3′	d 0.1′ m 0.83

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	76°39.7	134°34.2	S22°37.5	259°24.5	N03°23.1	226°21.8	S11°08.4	237°31.2	S05°34.5
1	91°42.2	149°34.9	36.9	274°25.8	22.7	241°23.8	08.6	252°33.4	34.5
2	106°44.7	164°35.6	36.3	289°27.2	22.2	256°25.9	08.7	267°35.7	34.6
3	121°47.1	179°36.2	·· 35.7	304°28.5	·· 21.7	271°27.9	·· 08.9	282°38.0	·· 34.7
4	136°49.6	194°36.9	35.0	319°29.8	21.3	286°29.9	09.1	297°40.2	34.8
5	151°52.1	209°37.5	34.4	334°31.1	20.8	301°31.9	09.2	312°42.5	34.8
6	166°54.5	224°38.2	S22°33.8	349°32.4	N03°20.4	316°33.9	S11°09.4	327°44.7	S05°34.9
7	181°57.0	239°38.9	33.2	4°33.7	19.9	331°36.0	09.5	342°47.0	35.0
8	196°59.4	254°39.6	32.6	19°35.1	19.4	346°38.0	09.7	357°49.3	35.0
9	212°01.9	269°40.2	·· 32.0	34°36.4	·· 19.0	1°40.0	·· 09.8	12°51.5	·· 35.1
10	227°04.4	284°40.9	31.4	49°37.7	18.5	16°42.0	10.0	27°53.8	35.2
11	242°06.8	299°41.6	30.8	64°39.0	18.0	31°44.1	10.1	42°56.1	35.3
12	257°09.3	314°42.3	S22°30.2	79°40.3	N03°17.6	46°46.1	S11°10.3	57°58.3	S05°35.3
13	272°11.8	329°43.0	29.6	94°41.7	17.1	61°48.1	10.4	73°00.6	35.4
14	287°14.2	344°43.7	29.0	109°43.0	16.7	76°50.1	10.6	88°02.9	35.5
15	302°16.7	359°44.3	·· 28.4	124°44.3	·· 16.2	91°52.1	·· 10.7	103°05.1	·· 35.5
16	317°19.2	14°45.0	27.8	139°45.6	15.7	106°54.2	10.9	118°07.4	35.6
17	332°21.6	29°45.7	27.1	154°46.9	15.3	121°56.2	11.1	133°09.6	35.7
18	347°24.1	44°46.4	S22°26.5	169°48.3	N03°14.8	136°58.2	S11°11.2	148°11.9	S05°35.8
19	2°26.6	59°47.1	25.9	184°49.6	14.4	152°00.2	11.4	163°14.2	35.8
20	17°29.0	74°47.8	25.3	199°50.9	13.9	167°02.3	11.5	178°16.4	35.9
21	32°31.5	89°48.5	·· 24.7	214°52.2	·· 13.4	182°04.3	·· 11.7	193°18.7	·· 36.0
22	47°33.9	104°49.3	24.1	229°53.6	13.0	197°06.3	11.8	208°21.0	36.0
23	62°36.4	119°50.0	23.5	244°54.9	12.5	212°08.3	12.0	223°23.2	36.1
Mer.pass. 18:50		ν 0.7′	d 0.6′	m -4.81	ν 1.3′	d 0.5′	m 1.06	ν 2.0′	d 0.2′ m -1.75	ν 2.3′	d 0.1′ m 0.83

Stars

	SHA	Dec
Alpheratz	358°08.4	28°59.5
Ankaa	353°39.2	-42°24.6
Schedar	350°07.8	56°26.5
Diphda	349°19.9	-18°05.3
Achernar	335°44.2	-57°20.0
Hamal	328°27.7	23°22.6
Polaris	326°20.0	89°11.0
Acamar	315°36.2	-40°22.8
Menkar	314°40.0	4°01.1
Mirfak	309°14.4	49°47.9
Aldebaran	291°16.7	16°28.4
Rigel	281°34.9	-8°13.4
Capella	281°09.6	45°58.8
Bellatrix	278°57.5	6°20.0
Elnath	278°42.7	28°35.5
Alnilam	276°10.5	-1°12.8
Betelgeuse	271°27.0	7°24.2
Canopus	264°06.3	-52°41.1
Sirius	258°54.6	-16°41.4
Adhara	255°31.1	-28°56.7
Procyon	245°24.6	5°16.3
Pollux	243°56.8	28°04.2
Avior	234°27.4	-59°26.8
Suhail	223°09.9	-43°21.3
Miaplacidus	221°44.4	-69°38.2
Alphard	218°19.6	-8°34.7
Regulus	208°09.0	12°03.4
Dubhe	194°21.1	61°50.7
Denebola	182°58.3	14°40.4
Gienah	176°17.2	-17°26.3
Acrux	173°36.6	-62°59.5
Gacrux	172°28.1	-57°00.3
Alioth	166°42.0	56°03.4
Spica	158°56.9	-11°03.8
Alkaid	153°18.2	49°24.1
Hadar	149°22.7	-60°16.8
Menkent	148°36.3	-36°16.6
Arcturus	146°18.0	19°16.6
Rigil Kent.	140°25.2	-60°45.2
Kochab	137°20.0	74°13.7
Zuben'ubi	137°32.4	-15°57.8
Alphecca	126°31.8	26°46.6
Antares	112°56.2	-26°23.4
Atria	108°20.3	-68°59.6
Sabik	102°40.5	-15°42.1
Shaula	96°55.0	-37°05.4
Rasalhague	96°29.2	12°34.5
Eltanin	90°57.9	51°29.6
Kaus Aust.	84°16.1	-34°23.6
Vega	80°55.7	38°46.1
Nunki	76°28.5	-26°19.2
Altair	62°32.0	8°49.3
Peacock	53°57.5	-56°47.9
Deneb	49°48.2	45°13.1
Enif	34°10.9	9°47.5
Al Na'ir	28°14.0	-47°03.2
Fomalhaut	15°50.5	-29°43.3
Scheat	14°16.8	27°59.2
Markab	14°02.3	15°06.5

Dec 06 Sun	SHA	Mer.pass
Venus	59°24.0	15:03
Mars	183°40.2	06:46
Jupiter	150°03.4	09:00
Saturn	161°01.3	08:16

Dec 07 Mon	SHA	Mer.pass
Venus	58°38.6	15:02
Mars	183°12.4	06:44
Jupiter	149°52.7	08:57
Saturn	160°56.3	08:12

Dec 08 Tue	SHA	Mer.pass
Venus	57°54.5	15:01
Mars	182°44.8	06:42
Jupiter	149°42.1	08:53
Saturn	160°51.4	08:09

Horizontal parallax	
Venus:	0.3
Mars:	0.1

h	Sun		Moon				
Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°17.0	S22°27.3	72°41.4	11.6′	S04°20.2	12.5′	58.2′
1	197°16.8	27.6	87°11.9	11.5′	04°07.7	12.6′	58.2′
2	212°16.5	27.9	101°42.5	11.5′	03°55.1	12.6′	58.3′
3	227°16.2	·· 28.2	116°13.0	11.5′	03°42.5	12.6′	58.3′
4	242°16.0	28.5	130°43.5	11.5′	03°29.9	12.7′	58.3′
5	257°15.7	28.8	145°13.9	11.4′	03°17.2	12.7′	58.4′
6	272°15.5	S22°29.1	159°44.3	11.4′	S03°04.5	12.8′	58.4′
7	287°15.2	29.4	174°14.7	11.4′	02°51.7	12.8′	58.5′
8	302°14.9	29.7	188°45.1	11.3′	02°38.9	12.8′	58.5′
9	317°14.7	·· 30.0	203°15.4	11.3′	02°26.1	12.8′	58.5′
10	332°14.4	30.3	217°45.7	11.3′	02°13.3	12.9′	58.6′
11	347°14.1	30.6	232°16.0	11.2′	02°00.4	12.9′	58.6′
12	2°13.9	S22°30.9	246°46.2	11.2′	S01°47.5	12.9′	58.7′
13	17°13.6	31.2	261°16.4	11.1′	01°34.6	13.0′	58.7′
14	32°13.3	31.5	275°46.5	11.1′	01°21.6	13.0′	58.7′
15	47°13.1	·· 31.8	290°16.6	11.1′	01°08.6	13.0′	58.8′
16	62°12.8	32.1	304°46.7	11.0′	00°55.6	13.0′	58.8′
17	77°12.6	32.4	319°16.7	11.0′	00°42.6	13.0′	58.9′
18	92°12.3	S22°32.7	333°46.7	10.9′	S00°29.6	13.1′	58.9′
19	107°12.0	33.0	348°16.6	10.9′	00°16.5	13.1′	58.9′
20	122°11.8	33.3	2°46.5	10.9′	S00°03.4	13.1′	59.0′
21	137°11.5	·· 33.6	17°16.4	10.8′	N00°09.7	13.1′	59.0′
22	152°11.2	33.9	31°46.2	10.8′	00°22.8	13.2′	59.0′
23	167°11.0	34.1	46°16.0	10.7′	00°36.0	13.1′	59.1′
	SD = 16.2′	d = 0.3′	SD = 15.9′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°10.7	S22°34.4	60°45.7	10.7′	N00°49.1	13.2′	59.1′
1	197°10.4	34.7	75°15.3	10.6′	01°02.3	13.2′	59.2′
2	212°10.2	35.0	89°45.0	10.6′	01°15.5	13.2′	59.2′
3	227°09.9	·· 35.3	104°14.5	10.5′	01°28.7	13.2′	59.2′
4	242°09.6	35.6	118°44.0	10.5′	01°41.9	13.2′	59.3′
5	257°09.3	35.9	133°13.5	10.4′	01°55.1	13.2′	59.3′
6	272°09.1	S22°36.1	147°42.9	10.4′	N02°08.3	13.2′	59.4′
7	287°08.8	36.4	162°12.3	10.3′	02°21.5	13.3′	59.4′
8	302°08.5	36.7	176°41.6	10.3′	02°34.8	13.2′	59.4′
9	317°08.3	·· 37.0	191°10.8	10.2′	02°48.0	13.2′	59.5′
10	332°08.0	37.3	205°40.0	10.1′	03°01.2	13.3′	59.5′
11	347°07.7	37.5	220°09.2	10.1′	03°14.5	13.2′	59.5′
12	2°07.5	S22°37.8	234°38.3	10.0′	N03°27.7	13.2′	59.6′
13	17°07.2	38.1	249°07.3	10.0′	03°40.9	13.2′	59.6′
14	32°06.9	38.4	263°36.2	9.9′	03°54.1	13.3′	59.6′
15	47°06.7	·· 38.6	278°05.1	9.8′	04°07.4	13.2′	59.7′
16	62°06.4	38.9	292°34.0	9.8′	04°20.6	13.2′	59.7′
17	77°06.1	39.2	307°02.7	9.7′	04°33.8	13.2′	59.8′
18	92°05.8	S22°39.5	321°31.5	9.6′	N04°47.0	13.2′	59.8′
19	107°05.6	39.7	336°00.1	9.6′	05°00.2	13.2′	59.8′
20	122°05.3	40.0	350°28.7	9.5′	05°13.4	13.1′	59.9′
21	137°05.0	·· 40.3	4°57.2	9.5′	05°26.5	13.2′	59.9′
22	152°04.8	40.6	19°25.7	9.4′	05°39.7	13.1′	59.9′
23	167°04.5	40.8	33°54.0	9.3′	05°52.8	13.1′	60.0′
	SD = 16.2′	d = 0.3′	SD = 16.1′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°04.2	S22°41.1	48°22.4	9.2′	N06°05.9	13.1′	60.0′
1	197°03.9	41.4	62°50.6	9.2′	06°19.0	13.1′	60.0′
2	212°03.7	41.6	77°18.8	9.1′	06°32.1	13.0′	60.1′
3	227°03.4	·· 41.9	91°46.9	9.0′	06°45.1	13.0′	60.1′
4	242°03.1	42.2	106°14.9	9.0′	06°58.1	13.0′	60.1′
5	257°02.9	42.4	120°42.9	8.9′	07°11.1	13.0′	60.2′
6	272°02.6	S22°42.7	135°10.8	8.8′	N07°24.1	12.9′	60.2′
7	287°02.3	42.9	149°38.6	8.7′	07°37.0	13.0′	60.2′
8	302°02.0	43.2	164°06.3	8.7′	07°50.0	12.8′	60.3′
9	317°01.8	·· 43.5	178°34.0	8.6′	08°02.8	12.9′	60.3′
10	332°01.5	43.7	193°01.6	8.5′	08°15.7	12.8′	60.3′
11	347°01.2	44.0	207°29.1	8.4′	08°28.5	12.7′	60.4′
12	2°00.9	S22°44.3	221°56.5	8.4′	N08°41.2	12.8′	60.4′
13	17°00.7	44.5	236°23.9	8.3′	08°54.0	12.7′	60.4′
14	32°00.4	44.8	250°51.2	8.2′	09°06.7	12.6′	60.4′
15	47°00.1	·· 45.0	265°18.4	8.1′	09°19.3	12.6′	60.5′
16	61°59.8	45.3	279°45.5	8.0′	09°31.9	12.5′	60.5′
17	76°59.6	45.5	294°12.6	8.0′	09°44.4	12.6′	60.5′
18	91°59.3	S22°45.8	308°39.5	7.9′	N09°57.0	12.4′	60.6′
19	106°59.0	46.0	323°06.4	7.8′	10°09.4	12.4′	60.6′
20	121°58.7	46.3	337°33.2	7.7′	10°21.8	12.4′	60.6′
21	136°58.5	·· 46.6	351°59.9	7.6′	10°34.2	12.3′	60.6′
22	151°58.2	46.8	6°26.6	7.6′	10°46.5	12.2′	60.7′
23	166°57.9	47.1	20°53.1	7.5′	10°58.7	12.2′	60.7′
	SD = 16.2′	d = 0.3′	SD = 16.4′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	08:06	10:17	▬	▬	13:26	15:37
N 70°	07:48	09:29	▬	▬	14:13	15:55
68°	07:33	08:59	11:19	12:24	14:44	16:09
66°	07:21	08:36	10:07	13:36	15:07	16:21
64°	07:11	08:18	09:31	14:11	15:25	16:32
62°	07:02	08:03	09:06	14:37	15:40	16:41
60°	06:54	07:50	08:46	14:57	15:53	16:48
N 58°	06:47	07:39	08:30	15:13	16:04	16:55
56°	06:41	07:29	08:16	15:27	16:13	17:02
54°	06:35	07:21	08:04	15:39	16:22	17:07
52°	06:30	07:13	07:53	15:49	16:30	17:13
50°	06:25	07:06	07:44	15:59	16:37	17:18
45°	06:14	06:51	07:24	16:18	16:52	17:29
N 40°	06:04	06:38	07:08	16:35	17:05	17:39
35°	05:55	06:27	06:55	16:48	17:16	17:48
30°	05:47	06:17	06:43	17:00	17:26	17:56
20°	05:31	05:59	06:22	17:21	17:44	18:12
N 10°	05:16	05:42	06:05	17:38	18:01	18:27
0°	04:59	05:25	05:48	17:55	18:18	18:44
S 10°	04:41	05:08	05:31	18:12	18:35	19:02
20°	04:19	04:48	05:13	18:30	18:55	19:24
30°	03:51	04:24	04:51	18:52	19:19	19:52
35°	03:33	04:10	04:39	19:04	19:34	20:10
40°	03:11	03:52	04:25	19:19	19:51	20:32
45°	02:42	03:31	04:07	19:36	20:13	21:01
S 50°	02:00	03:03	03:46	19:58	20:41	21:44
52°	01:36	02:48	03:36	20:08	20:55	22:09
54°	01:00	02:32	03:24	20:20	21:12	22:45
56°	////	02:11	03:11	20:33	21:33	////
58°	////	01:45	02:55	20:49	21:59	////
S 60°	////	01:07	02:36	21:08	22:39	////

Lat.	**Moonrise** Sun	Mon	Tue	**Moonset** Sun	Mon	Tue
N 72°	13:56	13:39	13:21	00:15	02:16	04:23
N 70°	13:54	13:44	13:34	00:21	02:14	04:12
68°	13:52	13:48	13:45	00:26	02:13	04:04
66°	13:51	13:52	13:54	00:31	02:12	03:57
64°	13:49	13:55	14:01	00:34	02:11	03:51
62°	13:48	13:57	14:08	00:37	02:10	03:46
60°	13:47	14:00	14:14	00:40	02:09	03:41
N 58°	13:47	14:02	14:19	00:43	02:08	03:38
56°	13:46	14:04	14:23	00:45	02:08	03:34
54°	13:45	14:05	14:27	00:47	02:07	03:31
52°	13:45	14:07	14:31	00:49	02:07	03:28
50°	13:44	14:08	14:34	00:50	02:06	03:26
45°	13:43	14:11	14:42	00:54	02:05	03:20
N 40°	13:42	14:14	14:48	00:56	02:05	03:16
35°	13:41	14:16	14:53	00:59	02:04	03:12
30°	13:40	14:18	14:58	01:01	02:03	03:08
20°	13:39	14:21	15:06	01:05	02:02	03:02
N 10°	13:38	14:24	15:13	01:08	02:01	02:57
0°	13:37	14:27	15:20	01:11	02:00	02:52
S 10°	13:36	14:30	15:27	01:14	01:59	02:47
20°	13:35	14:33	15:35	01:17	01:58	02:42
30°	13:33	14:37	15:43	01:21	01:57	02:36
35°	13:33	14:39	15:48	01:23	01:57	02:32
40°	13:32	14:41	15:54	01:25	01:56	02:28
45°	13:31	14:44	16:01	01:27	01:55	02:24
S 50°	13:30	14:48	16:09	01:31	01:54	02:19
52°	13:29	14:49	16:12	01:32	01:53	02:16
54°	13:29	14:51	16:17	01:34	01:53	02:14
56°	13:28	14:53	16:21	01:35	01:52	02:11
58°	13:27	14:55	16:26	01:37	01:52	02:07
S 60°	13:27	14:57	16:32	01:39	01:51	02:04

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 10-12 64-84%
06	09:08	08:55	11:51	19:49	07:24	
07	08:43	08:30	11:52	20:39	08:14	
08	08:17	08:04	11:52	21:33	09:06	

December 09, 10, 11 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	77°38.9	134°50.7	S22°22.9	259°56.2	N03°12.1	227°10.4	S11°12.1	238°25.5	S05°36.2
1	92°41.3	149°51.4	22.2	274°57.5	11.6	242°12.4	12.3	253°27.8	36.3
2	107°43.8	164°52.1	21.6	289°58.8	11.2	257°14.4	12.4	268°30.0	36.3
3	122°46.3	179°52.8	·· 21.0	305°00.2	·· 10.7	272°16.4	·· 12.6	283°32.3	·· 36.4
4	137°48.7	194°53.6	20.4	320°01.5	10.2	287°18.5	12.7	298°34.6	36.5
5	152°51.2	209°54.3	19.8	335°02.8	09.8	302°20.5	12.9	313°36.8	36.5
6	167°53.7	224°55.0	S22°19.2	350°04.1	N03°09.3	317°22.5	S11°13.0	328°39.1	S05°36.6
7	182°56.1	239°55.7	18.6	5°05.5	08.9	332°24.5	13.2	343°41.3	36.7
8	197°58.6	254°56.5	17.9	20°06.8	08.4	347°26.6	13.3	358°43.6	36.8
9	213°01.1	269°57.2	·· 17.3	35°08.1	·· 07.9	2°28.6	·· 13.5	13°45.9	·· 36.8
10	228°03.5	284°58.0	16.7	50°09.5	07.5	17°30.6	13.6	28°48.1	36.9
11	243°06.0	299°58.7	16.1	65°10.8	07.0	32°32.6	13.8	43°50.4	37.0
12	258°08.4	314°59.4	S22°15.5	80°12.1	N03°06.6	47°34.7	S11°14.0	58°52.7	S05°37.0
13	273°10.9	330°00.2	14.9	95°13.4	06.1	62°36.7	14.1	73°54.9	37.1
14	288°13.4	345°00.9	14.2	110°14.8	05.7	77°38.7	14.3	88°57.2	37.2
15	303°15.8	0°01.7	·· 13.6	125°16.1	·· 05.2	92°40.7	·· 14.4	103°59.5	·· 37.2
16	318°18.3	15°02.4	13.0	140°17.4	04.7	107°42.8	14.6	119°01.7	37.3
17	333°20.8	30°03.2	12.4	155°18.7	04.3	122°44.8	14.7	134°04.0	37.4
18	348°23.2	45°04.0	S22°11.8	170°20.1	N03°03.8	137°46.8	S11°14.9	149°06.3	S05°37.5
19	3°25.7	60°04.7	11.1	185°21.4	03.4	152°48.9	15.0	164°08.5	37.5
20	18°28.2	75°05.5	10.5	200°22.7	02.9	167°50.9	15.2	179°10.8	37.6
21	33°30.6	90°06.2	·· 09.9	215°24.1	·· 02.5	182°52.9	·· 15.3	194°13.1	·· 37.7
22	48°33.1	105°07.0	09.3	230°25.4	02.0	197°54.9	15.5	209°15.3	37.7
23	63°35.5	120°07.8	08.7	245°26.7	01.5	212°57.0	15.6	224°17.6	37.8
Mer.pass. 18:46		ν 0.7′	d 0.6′	m -4.82	ν 1.3′	d 0.5′	m 1.05	ν 2.0′	d 0.2′ m -1.76	ν 2.3′	d 0.1′ m 0.83

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	78°38.0	135°08.6	S22°08.0	260°28.0	N03°01.1	227°59.0	S11°15.8	239°19.9	S05°37.9
1	93°40.5	150°09.3	07.4	275°29.4	00.6	243°01.0	15.9	254°22.1	37.9
2	108°42.9	165°10.1	06.8	290°30.7	03°00.2	258°03.0	16.1	269°24.4	38.0
3	123°45.4	180°10.9	·· 06.2	305°32.0	02°59.7	273°05.1	·· 16.2	284°26.7	·· 38.1
4	138°47.9	195°11.7	05.5	320°33.4	59.3	288°07.1	16.4	299°28.9	38.2
5	153°50.3	210°12.5	04.9	335°34.7	58.8	303°09.1	16.5	314°31.2	38.2
6	168°52.8	225°13.3	S22°04.3	350°36.0	N02°58.4	318°11.2	S11°16.7	329°33.5	S05°38.3
7	183°55.3	240°14.0	03.7	5°37.4	57.9	333°13.2	16.8	344°35.8	38.4
8	198°57.7	255°14.8	03.1	20°38.7	57.4	348°15.2	17.0	359°38.0	38.4
9	214°00.2	270°15.6	·· 02.4	35°40.0	·· 57.0	3°17.2	·· 17.1	14°40.3	·· 38.5
10	229°02.7	285°16.4	01.8	50°41.4	56.5	18°19.3	17.3	29°42.6	38.6
11	244°05.1	300°17.2	01.2	65°42.7	56.1	33°21.3	17.4	44°44.8	38.6
12	259°07.6	315°18.0	S22°00.6	80°44.0	N02°55.6	48°23.3	S11°17.6	59°47.1	S05°38.7
13	274°10.0	330°18.9	21°59.9	95°45.4	55.2	63°25.4	17.7	74°49.4	38.8
14	289°12.5	345°19.7	59.3	110°46.7	54.7	78°27.4	17.9	89°51.6	38.9
15	304°15.0	0°20.5	·· 58.7	125°48.0	·· 54.3	93°29.4	·· 18.0	104°53.9	·· 38.9
16	319°17.4	15°21.3	58.0	140°49.4	53.8	108°31.4	18.2	119°56.2	39.0
17	334°19.9	30°22.1	57.4	155°50.7	53.4	123°33.5	18.3	134°58.4	39.1
18	349°22.4	45°22.9	S21°56.8	170°52.0	N02°52.9	138°35.5	S11°18.5	150°00.7	S05°39.1
19	4°24.8	60°23.8	56.2	185°53.4	52.4	153°37.5	18.6	165°03.0	39.2
20	19°27.3	75°24.6	55.5	200°54.7	52.0	168°39.6	18.8	180°05.2	39.3
21	34°29.8	90°25.4	·· 54.9	215°56.0	·· 51.5	183°41.6	·· 18.9	195°07.5	·· 39.3
22	49°32.2	105°26.2	54.3	230°57.4	51.1	198°43.6	19.1	210°09.8	39.4
23	64°34.7	120°27.1	53.7	245°58.7	50.6	213°45.7	19.2	225°12.1	39.5
Mer.pass. 18:42		ν 0.8′	d 0.6′	m -4.83	ν 1.3′	d 0.5′	m 1.03	ν 2.0′	d 0.2′ m -1.76	ν 2.3′	d 0.1′ m 0.82

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	79°37.2	135°27.9	S21°53.0	261°00.0	N02°50.2	228°47.7	S11°19.4	240°14.3	S05°39.5
1	94°39.6	150°28.8	52.4	276°01.4	49.7	243°49.7	19.5	255°16.6	39.6
2	109°42.1	165°29.6	51.8	291°02.7	49.3	258°51.7	19.7	270°18.9	39.7
3	124°44.5	180°30.4	·· 51.1	306°04.1	·· 48.8	273°53.8	·· 19.8	285°21.1	·· 39.7
4	139°47.0	195°31.3	50.5	321°05.4	48.4	288°55.8	20.0	300°23.4	39.8
5	154°49.5	210°32.1	49.9	336°06.7	47.9	303°57.8	20.1	315°25.7	39.9
6	169°51.9	225°33.0	S21°49.2	351°08.1	N02°47.5	318°59.9	S11°20.3	330°28.0	S05°39.9
7	184°54.4	240°33.8	48.6	6°09.4	47.0	334°01.9	20.4	345°30.2	40.0
8	199°56.9	255°34.7	48.0	21°10.7	46.6	349°03.9	20.6	0°32.5	40.1
9	214°59.3	270°35.6	·· 47.4	36°12.1	·· 46.1	4°06.0	·· 20.7	15°34.8	·· 40.2
10	230°01.8	285°36.4	46.7	51°13.4	45.6	19°08.0	20.9	30°37.0	40.2
11	245°04.3	300°37.3	46.1	66°14.8	45.2	34°10.0	21.0	45°39.3	40.3
12	260°06.7	315°38.2	S21°45.5	81°16.1	N02°44.7	49°12.1	S11°21.2	60°41.6	S05°40.4
13	275°09.2	330°39.0	44.8	96°17.4	44.3	64°14.1	21.3	75°43.9	40.4
14	290°11.7	345°39.9	44.2	111°18.8	43.8	79°16.1	21.5	90°46.1	40.5
15	305°14.1	0°40.8	·· 43.6	126°20.1	·· 43.4	94°18.2	·· 21.6	105°48.4	·· 40.6
16	320°16.6	15°41.7	42.9	141°21.5	42.9	109°20.2	21.8	120°50.7	40.6
17	335°19.0	30°42.5	42.3	156°22.8	42.5	124°22.2	21.9	135°52.9	40.7
18	350°21.5	45°43.4	S21°41.7	171°24.2	N02°42.0	139°24.3	S11°22.1	150°55.2	S05°40.8
19	5°24.0	60°44.3	41.0	186°25.5	41.6	154°26.3	22.2	165°57.5	40.8
20	20°26.4	75°45.2	40.4	201°26.8	41.1	169°28.3	22.4	180°59.8	40.9
21	35°28.9	90°46.1	·· 39.7	216°28.2	·· 40.7	184°30.3	·· 22.5	196°02.0	·· 41.0
22	50°31.4	105°47.0	39.1	231°29.5	40.2	199°32.4	22.7	211°04.3	41.0
23	65°33.8	120°47.9	38.5	246°30.9	39.8	214°34.4	22.8	226°06.6	41.1
Mer.pass. 18:38		ν 0.8′	d 0.6′	m -4.84	ν 1.3′	d 0.5′	m 1.02	ν 2.0′	d 0.1′ m -1.76	ν 2.3′	d 0.1′ m 0.82

Stars

	SHA	Dec
Alpheratz	358°08.4	28°59.5
Ankaa	353°39.3	-42°24.6
Schedar	350°07.8	56°26.5
Diphda	349°19.9	-18°05.3
Achernar	335°44.3	-57°20.0
Hamal	328°27.7	23°22.6
Polaris	326°20.5	89°11.1
Acamar	315°36.2	-40°22.8
Menkar	314°40.0	4°01.1
Mirfak	309°14.4	49°47.9
Aldebaran	291°16.7	16°28.4
Rigel	281°34.9	-8°13.4
Capella	281°09.6	45°58.8
Bellatrix	278°57.5	6°20.0
Elnath	278°42.7	28°35.5
Alnilam	276°10.5	-1°12.8
Betelgeuse	271°27.0	7°24.2
Canopus	264°06.3	-52°41.1
Sirius	258°54.6	-16°41.4
Adhara	255°31.1	-28°56.8
Procyon	245°24.6	5°16.3
Pollux	243°56.8	28°04.2
Avior	234°27.4	-59°26.8
Suhail	223°09.9	-43°21.3
Miaplacidus	221°44.3	-69°38.2
Alphard	218°19.6	-8°34.7
Regulus	208°09.0	12°03.4
Dubhe	194°21.0	61°50.7
Denebola	182°58.2	14°40.4
Gienah	176°17.2	-17°26.3
Acrux	173°36.6	-62°59.5
Gacrux	172°28.0	-57°00.3
Alioth	166°42.0	56°03.3
Spica	158°56.8	-11°03.8
Alkaid	153°18.1	49°24.1
Hadar	149°22.6	-60°16.8
Menkent	148°36.3	-36°16.6
Arcturus	146°18.0	19°16.6
Rigil Kent.	140°25.2	-60°45.2
Kochab	137°20.0	74°13.7
Zuben'ubi	137°32.4	-15°57.8
Alphecca	126°31.7	26°46.6
Antares	112°56.2	-26°23.4
Atria	108°20.3	-68°59.6
Sabik	102°40.5	-15°42.1
Shaula	96°55.0	-37°05.4
Rasalhague	96°29.1	12°34.5
Eltanin	90°57.9	51°29.6
Kaus Aust.	84°16.1	-34°23.6
Vega	80°55.7	38°46.1
Nunki	76°28.5	-26°19.2
Altair	62°32.0	8°49.3
Peacock	53°57.5	-56°47.8
Deneb	49°48.2	45°13.1
Enif	34°10.9	9°47.5
Al Na'ir	28°14.0	-47°03.2
Fomalhaut	15°50.5	-29°43.3
Scheat	14°16.8	27°59.2
Markab	14°02.3	15°06.5

Dec 09 Wed	SHA	Mer.pass
Venus	57°11.8	15:00
Mars	182°17.3	06:40
Jupiter	149°31.5	08:50
Saturn	160°46.6	08:05

Dec 10 Thu	SHA	Mer.pass
Venus	56°30.5	14:59
Mars	181°50.0	06:38
Jupiter	149°21.0	08:47
Saturn	160°41.9	08:01

Dec 11 Fri	SHA	Mer.pass
Venus	55°50.8	14:57
Mars	181°22.9	06:35
Jupiter	149°10.5	08:44
Saturn	160°37.2	07:58

Horizontal parallax	
Venus:	0.3
Mars:	0.1

DUT1 = UT1-UTC = +0.0670 sec ΔT = TT-UT1 = +52.1170 sec

1981 December 09 to Dec. 11 UT

h	Sun		Moon				
Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	181°57.6	S22°47.3	35°19.6	7.4′	N11°10.9	12.1′	60.7′
1	196°57.4	47.6	49°46.0	7.3′	11°23.0	12.1′	60.7′
2	211°57.1	47.8	64°12.3	7.2′	11°35.1	11.9′	60.8′
3	226°56.8	·· 48.1	78°38.5	7.1′	11°47.0	12.0′	60.8′
4	241°56.5	48.3	93°04.6	7.1′	11°59.0	11.8′	60.8′
5	256°56.3	48.5	107°30.7	7.0′	12°10.8	11.8′	60.8′
6	271°56.0	S22°48.8	121°56.7	6.9′	N12°22.6	11.7′	60.9′
7	286°55.7	49.0	136°22.6	6.8′	12°34.3	11.7′	60.9′
8	301°55.4	49.3	150°48.4	6.7′	12°46.0	11.6′	60.9′
9	316°55.1	·· 49.5	165°14.1	6.6′	12°57.6	11.4′	60.9′
10	331°54.9	49.8	179°39.7	6.5′	13°09.0	11.5′	61.0′
11	346°54.6	50.0	194°05.2	6.5′	13°20.5	11.3′	61.0′
12	1°54.3	S22°50.2	208°30.7	6.4′	N13°31.8	11.2′	61.0′
13	16°54.0	50.5	222°56.1	6.3′	13°43.0	11.2′	61.0′
14	31°53.7	50.7	237°21.4	6.2′	13°54.2	11.1′	61.0′
15	46°53.5	·· 51.0	251°46.6	6.1′	14°05.3	11.0′	61.1′
16	61°53.2	51.2	266°11.7	6.0′	14°16.3	10.9′	61.1′
17	76°52.9	51.4	280°36.7	5.9′	14°27.2	10.8′	61.1′
18	91°52.6	S22°51.7	295°01.7	5.9′	N14°38.0	10.7′	61.1′
19	106°52.3	51.9	309°26.5	5.8′	14°48.7	10.6′	61.1′
20	121°52.1	52.1	323°51.3	5.7′	14°59.3	10.6′	61.1′
21	136°51.8	·· 52.4	338°16.0	5.6′	15°09.9	10.4′	61.2′
22	151°51.5	52.6	352°40.6	5.5′	15°20.3	10.3′	61.2′
23	166°51.2	52.8	7°05.1	5.4′	15°30.6	10.2′	61.2′
	SD = 16.2′	d = 0.2′	SD = 16.6′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	181°50.9	S22°53.1	21°29.6	5.4′	N15°40.8	10.2′	61.2′
1	196°50.7	53.3	35°53.9	5.3′	15°51.0	10.0′	61.2′
2	211°50.4	53.5	50°18.2	5.2′	16°01.0	9.9′	61.2′
3	226°50.1	·· 53.8	64°42.4	5.1′	16°10.9	9.8′	61.2′
4	241°49.8	54.0	79°06.5	5.0′	16°20.7	9.7′	61.3′
5	256°49.5	54.2	93°30.6	5.0′	16°30.4	9.5′	61.3′
6	271°49.3	S22°54.4	107°54.5	4.9′	N16°39.9	9.5′	61.3′
7	286°49.0	54.7	122°18.4	4.8′	16°49.4	9.3′	61.3′
8	301°48.7	54.9	136°42.2	4.7′	16°58.7	9.3′	61.3′
9	316°48.4	·· 55.1	151°05.9	4.6′	17°08.0	9.1′	61.3′
10	331°48.1	55.3	165°29.6	4.6′	17°17.1	8.9′	61.3′
11	346°47.8	55.6	179°53.2	4.5′	17°26.0	8.9′	61.3′
12	1°47.6	S22°55.8	194°16.7	4.4′	N17°34.9	8.7′	61.3′
13	16°47.3	56.0	208°40.1	4.4′	17°43.6	8.6′	61.3′
14	31°47.0	56.2	223°03.4	4.3′	17°52.2	8.5′	61.3′
15	46°46.7	·· 56.4	237°26.7	4.2′	18°00.7	8.4′	61.4′
16	61°46.4	56.7	251°49.9	4.1′	18°09.1	8.2′	61.4′
17	76°46.1	56.9	266°13.1	4.1′	18°17.3	8.1′	61.4′
18	91°45.9	S22°57.1	280°36.2	4.0′	N18°25.4	7.9′	61.4′
19	106°45.6	57.3	294°59.2	3.9′	18°33.3	7.8′	61.4′
20	121°45.3	57.5	309°22.1	3.9′	18°41.1	7.7′	61.4′
21	136°45.0	·· 57.7	323°45.0	3.8′	18°48.8	7.6′	61.4′
22	151°44.7	58.0	338°07.8	3.8′	18°56.4	7.4′	61.4′
23	166°44.4	58.2	352°30.6	3.7′	19°03.8	7.2′	61.4′
	SD = 16.2′	d = 0.2′	SD = 16.7′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	181°44.2	S22°58.4	6°53.2	3.6′	N19°11.0	7.1′	61.4′
1	196°43.9	58.6	21°15.9	3.6′	19°18.1	7.0′	61.4′
2	211°43.6	58.8	35°38.5	3.5′	19°25.1	6.8′	61.4′
3	226°43.3	·· 59.0	50°01.0	3.5′	19°31.9	6.7′	61.4′
4	241°43.0	59.2	64°23.5	3.4′	19°38.6	6.5′	61.4′
5	256°42.7	59.4	78°45.9	3.4′	19°45.1	6.4′	61.4′
6	271°42.4	S22°59.6	93°08.2	3.3′	N19°51.5	6.3′	61.4′
7	286°42.2	22°59.9	107°30.6	3.3′	19°57.8	6.0′	61.4′
8	301°41.9	23°00.1	121°52.8	3.2′	20°03.8	6.0′	61.4′
9	316°41.6	·· 00.3	136°15.1	3.2′	20°09.8	5.7′	61.4′
10	331°41.3	00.5	150°37.2	3.1′	20°15.5	5.7′	61.4′
11	346°41.0	00.7	164°59.4	3.1′	20°21.2	5.4′	61.3′
12	1°40.7	S23°00.9	179°21.5	3.1′	N20°26.6	5.3′	61.3′
13	16°40.4	01.1	193°43.6	3.0′	20°31.9	5.2′	61.3′
14	31°40.1	01.3	208°05.6	3.0′	20°37.1	5.0′	61.3′
15	46°39.9	·· 01.5	222°27.6	3.0′	20°42.1	4.8′	61.3′
16	61°39.6	01.7	236°49.6	2.9′	20°46.9	4.7′	61.3′
17	76°39.3	01.9	251°11.5	2.9′	20°51.6	4.5′	61.3′
18	91°39.0	S23°02.1	265°33.4	2.9′	N20°56.1	4.4′	61.3′
19	106°38.7	02.3	279°55.3	2.9′	21°00.5	4.2′	61.3′
20	121°38.4	02.5	294°17.1	2.8′	21°04.7	4.0′	61.3′
21	136°38.1	·· 02.7	308°39.0	2.8′	21°08.7	3.9′	61.2′
22	151°37.8	02.9	323°00.8	2.8′	21°12.6	3.7′	61.2′
23	166°37.5	03.1	337°22.6	2.8′	21°16.3	3.5′	61.2′
	SD = 16.2′	d = 0.2′	SD = 16.7′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	08:12	10:29	▬	▬	13:16	15:33
N 70°	07:53	09:37	▬	▬	14:08	15:52
68°	07:38	09:05	▬	▬	14:40	16:07
66°	07:26	08:41	10:15	13:30	15:04	16:20
64°	07:15	08:23	09:38	14:08	15:23	16:30
62°	07:06	08:07	09:11	14:34	15:38	16:39
60°	06:58	07:54	08:51	14:55	15:51	16:47
N 58°	06:51	07:43	08:34	15:11	16:02	16:55
56°	06:44	07:33	08:20	15:26	16:12	17:01
54°	06:38	07:24	08:08	15:38	16:21	17:07
52°	06:33	07:16	07:57	15:49	16:29	17:13
50°	06:28	07:09	07:47	15:58	16:36	17:18
45°	06:16	06:54	07:27	16:18	16:52	17:29
N 40°	06:06	06:40	07:11	16:35	17:05	17:39
35°	05:57	06:29	06:57	16:49	17:17	17:48
30°	05:49	06:19	06:45	17:01	17:27	17:57
20°	05:33	06:00	06:24	17:21	17:45	18:13
N 10°	05:17	05:43	06:06	17:39	18:02	18:29
0°	05:01	05:27	05:49	17:57	18:19	18:45
S 10°	04:42	05:09	05:32	18:14	18:37	19:04
20°	04:20	04:49	05:13	18:32	18:57	19:26
30°	03:52	04:25	04:52	18:54	19:21	19:54
35°	03:33	04:10	04:39	19:07	19:36	20:13
40°	03:11	03:52	04:25	19:21	19:54	20:35
45°	02:41	03:30	04:07	19:39	20:16	21:05
S 50°	01:58	03:01	03:45	20:01	20:45	21:49
52°	01:32	02:47	03:35	20:11	20:59	22:15
54°	00:53	02:30	03:23	20:23	21:17	22:54
56°	////	02:09	03:09	20:37	21:38	////
58°	////	01:41	02:53	20:53	22:06	////
S 60°	////	00:59	02:34	21:13	22:49	////

Lat.	**Moonrise** Wed	Thu	Fri	**Moonset** Wed	Thu	Fri
N 72°	12:57	12:04	▭	06:43	09:40	▭
N 70°	13:22	13:04	▭	06:20	08:41	▭
68°	13:42	13:39	13:38	06:02	08:07	10:18
66°	13:58	14:05	14:21	05:47	07:43	09:37
64°	14:11	14:25	14:49	05:36	07:24	09:08
62°	14:22	14:41	15:12	05:26	07:08	08:47
60°	14:31	14:55	15:29	05:17	06:55	08:29
N 58°	14:39	15:07	15:44	05:10	06:44	08:15
56°	14:47	15:17	15:57	05:04	06:34	08:02
54°	14:53	15:26	16:09	04:58	06:26	07:51
52°	14:59	15:34	16:18	04:53	06:18	07:42
50°	15:05	15:41	16:27	04:48	06:11	07:33
45°	15:16	15:57	16:46	04:38	05:57	07:15
N 40°	15:26	16:10	17:02	04:29	05:45	07:00
35°	15:34	16:21	17:15	04:22	05:35	06:47
30°	15:42	16:31	17:26	04:16	05:26	06:36
20°	15:55	16:48	17:46	04:05	05:10	06:18
N 10°	16:06	17:03	18:03	03:55	04:57	06:01
0°	16:17	17:17	18:19	03:46	04:45	05:46
S 10°	16:27	17:31	18:36	03:38	04:32	05:31
20°	16:39	17:46	18:53	03:28	04:19	05:15
30°	16:52	18:03	19:13	03:17	04:04	04:56
35°	17:00	18:13	19:25	03:11	03:55	04:45
40°	17:09	18:25	19:38	03:04	03:45	04:33
45°	17:19	18:39	19:54	02:56	03:34	04:18
S 50°	17:32	18:55	20:14	02:46	03:20	04:00
52°	17:38	19:03	20:24	02:42	03:13	03:52
54°	17:45	19:12	20:34	02:37	03:06	03:43
56°	17:52	19:22	20:46	02:32	02:58	03:32
58°	18:00	19:34	21:00	02:26	02:49	03:20
S 60°	18:10	19:47	21:17	02:19	02:38	03:07

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 13-15 92-100%
09	07:51	07:37	11:52	22:30	10:01	
10	07:24	07:10	11:53	23:31	11:00	
11	06:57	06:43	11:53	–:–	12:03	

December 12, 13, 14 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	80°36.3	135°48.8	S21°37.8	261°32.2	N02°39.3	229°36.4	S11°23.0	241°08.8	S05°41.2
1	95°38.8	150°49.7	37.2	276°33.6	38.9	244°38.5	23.1	256°11.1	41.2
2	110°41.2	165°50.6	36.6	291°34.9	38.4	259°40.5	23.3	271°13.4	41.3
3	125°43.7	180°51.5	·· 35.9	306°36.2	·· 38.0	274°42.5	·· 23.4	286°15.7	·· 41.4
4	140°46.2	195°52.4	35.3	321°37.6	37.5	289°44.6	23.6	301°17.9	41.4
5	155°48.6	210°53.3	34.7	336°38.9	37.1	304°46.6	23.7	316°20.2	41.5
6	170°51.1	225°54.3	S21°34.0	351°40.3	N02°36.6	319°48.7	S11°23.9	331°22.5	S05°41.6
7	185°53.5	240°55.2	33.4	6°41.6	36.2	334°50.7	24.0	346°24.8	41.6
8	200°56.0	255°56.1	32.7	21°43.0	35.7	349°52.7	24.2	1°27.0	41.7
9	215°58.5	270°57.0	·· 32.1	36°44.3	·· 35.3	4°54.8	·· 24.3	16°29.3	·· 41.8
10	231°00.9	285°58.0	31.5	51°45.7	34.8	19°56.8	24.4	31°31.6	41.8
11	246°03.4	300°58.9	30.8	66°47.0	34.4	34°58.8	24.6	46°33.9	41.9
12	261°05.9	315°59.8	S21°30.2	81°48.4	N02°33.9	50°00.9	S11°24.7	61°36.1	S05°42.0
13	276°08.3	331°00.8	29.6	96°49.7	33.5	65°02.9	24.9	76°38.4	42.0
14	291°10.8	346°01.7	28.9	111°51.0	33.0	80°04.9	25.0	91°40.7	42.1
15	306°13.3	1°02.6	·· 28.3	126°52.4	·· 32.6	95°07.0	·· 25.2	106°43.0	·· 42.2
16	321°15.7	16°03.6	27.6	141°53.7	32.1	110°09.0	25.3	121°45.2	42.2
17	336°18.2	31°04.5	27.0	156°55.1	31.7	125°11.0	25.5	136°47.5	42.3
18	351°20.7	46°05.5	S21°26.4	171°56.4	N02°31.2	140°13.1	S11°25.6	151°49.8	S05°42.4
19	6°23.1	61°06.4	25.7	186°57.8	30.8	155°15.1	25.8	166°52.1	42.4
20	21°25.6	76°07.4	25.1	201°59.1	30.3	170°17.1	25.9	181°54.3	42.5
21	36°28.0	91°08.3	·· 24.4	217°00.5	·· 29.9	185°19.2	·· 26.1	196°56.6	·· 42.6
22	51°30.5	106°09.3	23.8	232°01.8	29.5	200°21.2	26.2	211°58.9	42.6
23	66°33.0	121°10.3	23.2	247°03.2	29.0	215°23.3	26.4	227°01.2	42.7
Mer.pass. 18:35		ν 0.9′	d 0.6′	m -4.85	ν 1.3′	d 0.5′	m 1.01	ν 2.0′	d 0.1′ m -1.77	ν 2.3′	d 0.1′ m 0.82

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	81°35.4	136°11.2	S21°22.5	262°04.5	N02°28.6	230°25.3	S11°26.5	242°03.4	S05°42.8
1	96°37.9	151°12.2	21.9	277°05.9	28.1	245°27.3	26.7	257°05.7	42.8
2	111°40.4	166°13.2	21.2	292°07.2	27.7	260°29.4	26.8	272°08.0	42.9
3	126°42.8	181°14.2	·· 20.6	307°08.6	·· 27.2	275°31.4	·· 26.9	287°10.3	·· 43.0
4	141°45.3	196°15.1	19.9	322°09.9	26.8	290°33.4	27.1	302°12.5	43.0
5	156°47.8	211°16.1	19.3	337°11.3	26.3	305°35.5	27.2	317°14.8	43.1
6	171°50.2	226°17.1	S21°18.7	352°12.6	N02°25.9	320°37.5	S11°27.4	332°17.1	S05°43.2
7	186°52.7	241°18.1	18.0	7°14.0	25.4	335°39.5	27.5	347°19.4	43.2
8	201°55.2	256°19.1	17.4	22°15.4	25.0	350°41.6	27.7	2°21.6	43.3
9	216°57.6	271°20.1	·· 16.7	37°16.7	·· 24.5	5°43.6	·· 27.8	17°23.9	·· 43.4
10	232°00.1	286°21.1	16.1	52°18.1	24.1	20°45.7	28.0	32°26.2	43.4
11	247°02.5	301°22.1	15.4	67°19.4	23.6	35°47.7	28.1	47°28.5	43.5
12	262°05.0	316°23.1	S21°14.8	82°20.8	N02°23.2	50°49.7	S11°28.3	62°30.8	S05°43.6
13	277°07.5	331°24.1	14.2	97°22.1	22.8	65°51.8	28.4	77°33.0	43.6
14	292°09.9	346°25.1	13.5	112°23.5	22.3	80°53.8	28.6	92°35.3	43.7
15	307°12.4	1°26.1	·· 12.9	127°24.8	·· 21.9	95°55.9	·· 28.7	107°37.6	·· 43.8
16	322°14.9	16°27.1	12.2	142°26.2	21.4	110°57.9	28.9	122°39.9	43.8
17	337°17.3	31°28.1	11.6	157°27.5	21.0	125°59.9	29.0	137°42.1	43.9
18	352°19.8	46°29.1	S21°10.9	172°28.9	N02°20.5	141°02.0	S11°29.1	152°44.4	S05°43.9
19	7°22.3	61°30.2	10.3	187°30.2	20.1	156°04.0	29.3	167°46.7	44.0
20	22°24.7	76°31.2	09.6	202°31.6	19.6	171°06.0	29.4	182°49.0	44.1
21	37°27.2	91°32.2	·· 09.0	217°33.0	·· 19.2	186°08.1	·· 29.6	197°51.3	·· 44.1
22	52°29.6	106°33.2	08.4	232°34.3	18.8	201°10.1	29.7	212°53.5	44.2
23	67°32.1	121°34.3	07.7	247°35.7	18.3	216°12.2	29.9	227°55.8	44.3
Mer.pass. 18:31		ν 1.0′	d 0.6′	m -4.86	ν 1.4′	d 0.4′	m 0.99	ν 2.0′	d 0.1′ m -1.77	ν 2.3′	d 0.1′ m 0.82

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	82°34.6	136°35.3	S21°07.1	262°37.0	N02°17.9	231°14.2	S11°30.0	242°58.1	S05°44.3
1	97°37.0	151°36.3	06.4	277°38.4	17.4	246°16.2	30.2	258°00.4	44.4
2	112°39.5	166°37.4	05.8	292°39.7	17.0	261°18.3	30.3	273°02.7	44.5
3	127°42.0	181°38.4	·· 05.1	307°41.1	·· 16.5	276°20.3	·· 30.4	288°04.9	·· 44.5
4	142°44.4	196°39.5	04.5	322°42.5	16.1	291°22.4	30.6	303°07.2	44.6
5	157°46.9	211°40.5	03.8	337°43.8	15.6	306°24.4	30.7	318°09.5	44.7
6	172°49.4	226°41.6	S21°03.2	352°45.2	N02°15.2	321°26.4	S11°30.9	333°11.8	S05°44.7
7	187°51.8	241°42.6	02.5	7°46.5	14.8	336°28.5	31.0	348°14.1	44.8
8	202°54.3	256°43.7	01.9	22°47.9	14.3	351°30.5	31.2	3°16.3	44.9
9	217°56.8	271°44.8	·· 01.2	37°49.3	·· 13.9	6°32.6	·· 31.3	18°18.6	·· 44.9
10	232°59.2	286°45.8	21°00.6	52°50.6	13.4	21°34.6	31.5	33°20.9	45.0
11	248°01.7	301°46.9	20°59.9	67°52.0	13.0	36°36.6	31.6	48°23.2	45.0
12	263°04.1	316°48.0	S20°59.3	82°53.3	N02°12.5	51°38.7	S11°31.8	63°25.5	S05°45.1
13	278°06.6	331°49.0	58.6	97°54.7	12.1	66°40.7	31.9	78°27.7	45.2
14	293°09.1	346°50.1	58.0	112°56.1	11.7	81°42.8	32.0	93°30.0	45.2
15	308°11.5	1°51.2	·· 57.3	127°57.4	·· 11.2	96°44.8	·· 32.2	108°32.3	·· 45.3
16	323°14.0	16°52.3	56.7	142°58.8	10.8	111°46.9	32.3	123°34.6	45.4
17	338°16.5	31°53.3	56.0	158°00.2	10.3	126°48.9	32.5	138°36.9	45.4
18	353°18.9	46°54.4	S20°55.4	173°01.5	N02°09.9	141°50.9	S11°32.6	153°39.1	S05°45.5
19	8°21.4	61°55.5	54.7	188°02.9	09.4	156°53.0	32.8	168°41.4	45.6
20	23°23.9	76°56.6	54.1	203°04.2	09.0	171°55.0	32.9	183°43.7	45.6
21	38°26.3	91°57.7	·· 53.4	218°05.6	·· 08.6	186°57.1	·· 33.1	198°46.0	·· 45.7
22	53°28.8	106°58.8	52.8	233°07.0	08.1	201°59.1	33.2	213°48.3	45.7
23	68°31.3	121°59.9	52.1	248°08.3	07.7	217°01.2	33.3	228°50.5	45.8
Mer.pass. 18:27		ν 1.0′	d 0.6′	m -4.87	ν 1.4′	d 0.4′	m 0.98	ν 2.0′	d 0.1′ m -1.77	ν 2.3′	d 0.1′ m 0.81

Stars

	SHA	Dec
Alpheratz	358°08.4	28°59.5
Ankaa	353°39.3	-42°24.6
Schedar	350°07.8	56°26.5
Diphda	349°19.9	-18°05.3
Achernar	335°44.3	-57°20.1
Hamal	328°27.7	23°22.7
Polaris	326°21.1	89°11.1
Acamar	315°36.2	-40°22.8
Menkar	314°40.0	4°01.1
Mirfak	309°14.4	49°47.9
Aldebaran	291°16.7	16°28.4
Rigel	281°34.8	-8°13.4
Capella	281°09.5	45°58.8
Bellatrix	278°57.5	6°20.0
Elnath	278°42.7	28°35.5
Alnilam	276°10.4	-1°12.8
Betelgeuse	271°27.0	7°24.2
Canopus	264°06.3	-52°41.1
Sirius	258°54.6	-16°41.4
Adhara	255°31.1	-28°56.8
Procyon	245°24.6	5°16.3
Pollux	243°56.8	28°04.2
Avior	234°27.4	-59°26.8
Suhail	223°09.9	-43°21.3
Miaplacidus	221°44.3	-69°38.3
Alphard	218°19.5	-8°34.7
Regulus	208°09.0	12°03.4
Dubhe	194°21.0	61°50.7
Denebola	182°58.2	14°40.4
Gienah	176°17.2	-17°26.3
Acrux	173°36.5	-62°59.5
Gacrux	172°28.0	-57°00.3
Alioth	166°42.0	56°03.3
Spica	158°56.8	-11°03.8
Alkaid	153°18.1	49°24.1
Hadar	149°22.6	-60°16.8
Menkent	148°36.3	-36°16.6
Arcturus	146°17.9	19°16.6
Rigil Kent.	140°25.2	-60°45.2
Kochab	137°20.0	74°13.7
Zuben'ubi	137°32.4	-15°57.8
Alphecca	126°31.7	26°46.6
Antares	112°56.2	-26°23.4
Atria	108°20.3	-68°59.6
Sabik	102°40.5	-15°42.1
Shaula	96°55.0	-37°05.4
Rasalhague	96°29.1	12°34.4
Eltanin	90°57.9	51°29.6
Kaus Aust.	84°16.1	-34°23.6
Vega	80°55.7	38°46.1
Nunki	76°28.5	-26°19.2
Altair	62°32.0	8°49.3
Peacock	53°57.5	-56°47.8
Deneb	49°48.2	45°13.1
Enif	34°10.9	9°47.5
Al Na'ir	28°14.0	-47°03.2
Fomalhaut	15°50.5	-29°43.3
Scheat	14°16.8	27°59.2
Markab	14°02.3	15°06.5

Dec 12 Sat	SHA	Mer.pass
Venus	55°12.5	14:56
Mars	180°55.9	06:33
Jupiter	149°00.2	08:40
Saturn	160°32.6	07:54

Dec 13 Sun	SHA	Mer.pass
Venus	54°35.8	14:54
Mars	180°29.1	06:31
Jupiter	148°49.9	08:37
Saturn	160°28.0	07:51

Dec 14 Mon	SHA	Mer.pass
Venus	54°00.7	14:53
Mars	180°02.5	06:29
Jupiter	148°39.6	08:34
Saturn	160°23.5	07:47

Horizontal parallax	
Venus:	0.3
Mars:	0.1

h

Sat	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	181°37.3	S23°03.2	351°44.4	2.8′	N21°19.8	3.4′	61.2′
1	196°37.0	03.4	6°06.2	2.8′	21°23.2	3.2′	61.2′
2	211°36.7	03.6	20°27.9	2.8′	21°26.4	3.1′	61.2′
3	226°36.4	·· 03.8	34°49.7	2.8′	21°29.5	2.8′	61.2′
4	241°36.1	04.0	49°11.5	2.8′	21°32.3	2.8′	61.1′
5	256°35.8	04.2	63°33.2	2.8′	21°35.1	2.5′	61.1′
6	271°35.5	S23°04.4	77°55.0	2.8′	N21°37.6	2.4′	61.1′
7	286°35.2	04.6	92°16.7	2.8′	21°40.0	2.2′	61.1′
8	301°34.9	04.8	106°38.5	2.8′	21°42.2	2.0′	61.1′
9	316°34.6	·· 05.0	121°00.2	2.8′	21°44.2	1.9′	61.1′
10	331°34.4	05.1	135°22.0	2.8′	21°46.1	1.7′	61.0′
11	346°34.1	05.3	149°43.8	2.8′	21°47.8	1.6′	61.0′
12	1°33.8	S23°05.5	164°05.6	2.8′	N21°49.4	1.4′	61.0′
13	16°33.5	05.7	178°27.4	2.8′	21°50.8	1.2′	61.0′
14	31°33.2	05.9	192°49.2	2.8′	21°52.0	1.0′	61.0′
15	46°32.9	·· 06.1	207°11.1	2.9′	21°53.0	0.9′	60.9′
16	61°32.6	06.2	221°32.9	2.9′	21°53.9	0.7′	60.9′
17	76°32.3	06.4	235°54.8	2.9′	21°54.6	0.6′	60.9′
18	91°32.0	S23°06.6	250°16.8	3.0′	N21°55.2	0.4′	60.9′
19	106°31.7	06.8	264°38.7	3.0′	21°55.6	0.2′	60.8′
20	121°31.4	06.9	279°00.7	3.0′	21°55.8	0.0′	60.8′
21	136°31.2	·· 07.1	293°22.7	3.1′	21°55.8	0.1′	60.8′
22	151°30.9	07.3	307°44.8	3.1′	21°55.7	0.2′	60.8′
23	166°30.6	07.5	322°06.8	3.1′	21°55.5	0.5′	60.7′
	SD = 16.2′	d = 0.2′		SD = 16.7′			

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	181°30.3	S23°07.7	336°29.0	3.2′	N21°55.0	0.6′	60.7′
1	196°30.0	07.8	350°51.1	3.2′	21°54.4	0.7′	60.7′
2	211°29.7	08.0	5°13.4	3.3′	21°53.7	1.0′	60.7′
3	226°29.4	·· 08.2	19°35.6	3.3′	21°52.7	1.1′	60.6′
4	241°29.1	08.3	33°57.9	3.4′	21°51.6	1.2′	60.6′
5	256°28.8	08.5	48°20.3	3.4′	21°50.4	1.4′	60.6′
6	271°28.5	S23°08.7	62°42.7	3.5′	N21°49.0	1.6′	60.5′
7	286°28.2	08.8	77°05.2	3.5′	21°47.4	1.7′	60.5′
8	301°27.9	09.0	91°27.7	3.6′	21°45.7	1.9′	60.5′
9	316°27.6	·· 09.2	105°50.3	3.6′	21°43.8	2.0′	60.5′
10	331°27.3	09.4	120°12.9	3.7′	21°41.8	2.2′	60.4′
11	346°27.0	09.5	134°35.6	3.8′	21°39.6	2.4′	60.4′
12	1°26.7	S23°09.7	148°58.4	3.8′	N21°37.2	2.5′	60.4′
13	16°26.5	09.8	163°21.2	3.9′	21°34.7	2.6′	60.3′
14	31°26.2	10.0	177°44.2	4.0′	21°32.1	2.8′	60.3′
15	46°25.9	·· 10.2	192°07.1	4.0′	21°29.3	3.0′	60.3′
16	61°25.6	10.3	206°30.2	4.1′	21°26.3	3.1′	60.2′
17	76°25.3	10.5	220°53.3	4.2′	21°23.2	3.2′	60.2′
18	91°25.0	S23°10.7	235°16.5	4.3′	N21°20.0	3.4′	60.2′
19	106°24.7	10.8	249°39.8	4.3′	21°16.6	3.6′	60.1′
20	121°24.4	11.0	264°03.1	4.4′	21°13.0	3.7′	60.1′
21	136°24.1	·· 11.1	278°26.5	4.5′	21°09.3	3.8′	60.1′
22	151°23.8	11.3	292°50.0	4.6′	21°05.5	4.0′	60.0′
23	166°23.5	11.4	307°13.6	4.7′	21°01.5	4.1′	60.0′
	SD = 16.2′	d = 0.2′		SD = 16.6′			

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	181°23.2	S23°11.6	321°37.3	4.8′	N20°57.4	4.3′	60.0′
1	196°22.9	11.8	336°01.1	4.8′	20°53.1	4.4′	59.9′
2	211°22.6	11.9	350°24.9	4.9′	20°48.7	4.5′	59.9′
3	226°22.3	·· 12.1	4°48.8	5.0′	20°44.2	4.7′	59.9′
4	241°22.0	12.2	19°12.9	5.1′	20°39.5	4.8′	59.8′
5	256°21.7	12.4	33°37.0	5.2′	20°34.7	5.0′	59.8′
6	271°21.4	S23°12.5	48°01.2	5.3′	N20°29.7	5.1′	59.7′
7	286°21.1	12.7	62°25.5	5.4′	20°24.6	5.2′	59.7′
8	301°20.8	12.8	76°49.9	5.5′	20°19.4	5.3′	59.7′
9	316°20.5	·· 13.0	91°14.3	5.6′	20°14.1	5.5′	59.6′
10	331°20.2	13.1	105°38.9	5.7′	20°08.6	5.6′	59.6′
11	346°19.9	13.3	120°03.6	5.8′	20°03.0	5.7′	59.6′
12	1°19.6	S23°13.4	134°28.3	5.9′	N19°57.3	5.8′	59.5′
13	16°19.3	13.5	148°53.2	6.0′	19°51.5	6.0′	59.5′
14	31°19.0	13.7	163°18.2	6.1′	19°45.5	6.1′	59.4′
15	46°18.7	·· 13.8	177°43.2	6.2′	19°39.4	6.2′	59.4′
16	61°18.4	14.0	192°08.4	6.3′	19°33.2	6.3′	59.4′
17	76°18.1	14.1	206°33.6	6.4′	19°26.9	6.5′	59.3′
18	91°17.8	S23°14.3	220°59.0	6.5′	N19°20.4	6.5′	59.3′
19	106°17.6	14.4	235°24.5	6.6′	19°13.9	6.7′	59.3′
20	121°17.3	14.5	249°50.0	6.7′	19°07.2	6.8′	59.2′
21	136°17.0	·· 14.7	264°15.7	6.8′	19°00.4	6.9′	59.2′
22	151°16.7	14.8	278°41.5	6.9′	18°53.5	7.0′	59.1′
23	166°16.4	14.9	293°07.3	7.0′	18°46.5	7.1′	59.1′
	SD = 16.2′	d = 0.2′		SD = 16.4′			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	08:17	10:40	▬	▬	13:08	15:31
N 70°	07:58	09:44	▬	▬	14:04	15:50
68°	07:42	09:10	▬	▬	14:38	16:06
66°	07:30	08:46	10:23	13:25	15:02	16:19
64°	07:19	08:27	09:43	14:05	15:22	16:29
62°	07:09	08:11	09:16	14:32	15:37	16:39
60°	07:01	07:58	08:55	14:53	15:51	16:47
N 58°	06:54	07:46	08:38	15:11	16:02	16:54
56°	06:47	07:36	08:23	15:25	16:12	17:01
54°	06:41	07:27	08:11	15:37	16:21	17:07
52°	06:36	07:19	08:00	15:48	16:29	17:13
50°	06:30	07:12	07:50	15:58	16:36	17:18
45°	06:19	06:56	07:30	16:19	16:52	17:29
N 40°	06:09	06:43	07:13	16:35	17:06	17:40
35°	05:59	06:31	06:59	16:49	17:17	17:49
30°	05:51	06:21	06:47	17:01	17:28	17:58
20°	05:35	06:02	06:26	17:22	17:46	18:14
N 10°	05:19	05:45	06:08	17:41	18:03	18:30
0°	05:02	05:28	05:50	17:58	18:20	18:47
S 10°	04:43	05:10	05:33	18:15	18:38	19:05
20°	04:21	04:50	05:14	18:34	18:59	19:28
30°	03:52	04:25	04:53	18:56	19:23	19:57
35°	03:34	04:10	04:40	19:09	19:38	20:15
40°	03:11	03:52	04:25	19:24	19:56	20:38
45°	02:41	03:30	04:07	19:41	20:19	21:08
S 50°	01:56	03:01	03:45	20:04	20:48	21:53
52°	01:30	02:46	03:34	20:14	21:03	22:20
54°	00:48	02:28	03:22	20:27	21:21	23:02
56°	////	02:07	03:08	20:41	21:42	////
58°	////	01:38	02:52	20:57	22:11	////
S 60°	////	00:53	02:32	21:17	22:58	////

Lat.	Moonrise Sat	Moonrise Sun	Moonrise Mon	Moonset Sat	Moonset Sun	Moonset Mon
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	16:11	▭	▭	14:18
68°	13:49	15:12	17:15	12:22	13:11	13:14
66°	14:57	16:11	17:50	11:13	12:12	12:38
64°	15:34	16:45	18:15	10:37	11:38	12:13
62°	16:00	17:09	18:35	10:11	11:13	11:52
60°	16:20	17:29	18:51	09:51	10:53	11:36
N 58°	16:37	17:45	19:04	09:34	10:37	11:22
56°	16:51	17:59	19:16	09:20	10:23	11:10
54°	17:04	18:11	19:26	09:08	10:11	10:59
52°	17:14	18:21	19:35	08:57	10:00	10:50
50°	17:24	18:31	19:43	08:48	09:51	10:41
45°	17:44	18:50	20:01	08:27	09:31	10:23
N 40°	18:01	19:06	20:15	08:11	09:14	10:08
35°	18:15	19:20	20:26	07:57	09:01	09:56
30°	18:27	19:32	20:37	07:45	08:49	09:45
20°	18:48	19:52	20:55	07:24	08:28	09:26
N 10°	19:06	20:09	21:10	07:06	08:10	09:10
0°	19:23	20:26	21:25	06:50	07:53	08:54
S 10°	19:40	20:42	21:39	06:33	07:36	08:39
20°	19:58	20:59	21:54	06:15	07:18	08:22
30°	20:19	21:19	22:12	05:54	06:57	08:03
35°	20:32	21:31	22:22	05:42	06:45	07:51
40°	20:46	21:45	22:34	05:28	06:31	07:38
45°	21:03	22:00	22:48	05:12	06:14	07:23
S 50°	21:23	22:20	23:04	04:52	05:54	07:04
52°	21:33	22:29	23:12	04:42	05:44	06:55
54°	21:44	22:40	23:21	04:31	05:33	06:45
56°	21:57	22:51	23:31	04:19	05:20	06:34
58°	22:12	23:05	23:42	04:05	05:06	06:20
S 60°	22:29	23:20	23:54	03:48	04:48	06:05

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Age 16-18 99-90%
12	06:29	06:15	11:54	00:35	13:06	
13	06:01	05:47	11:54	01:38	14:09	
14	05:33	05:19	11:55	02:40	15:09	

December 15, 16, 17 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	83°33.7	137°01.0	S20°51.5	263°09.7	N02°07.2	232°03.2	S11°33.5	243°52.8	S05°45.9
1	98°36.2	152°02.1	50.8	278°11.1	06.8	247°05.2	33.6	258°55.1	45.9
2	113°38.6	167°03.2	50.2	293°12.4	06.4	262°07.3	33.8	273°57.4	46.0
3	128°41.1	182°04.4	·· 49.5	308°13.8	·· 05.9	277°09.3	·· 33.9	288°59.7	·· 46.1
4	143°43.6	197°05.5	48.9	323°15.2	05.5	292°11.4	34.1	304°02.0	46.1
5	158°46.0	212°06.6	48.2	338°16.5	05.0	307°13.4	34.2	319°04.2	46.2
6	173°48.5	227°07.7	S20°47.6	353°17.9	N02°04.6	322°15.5	S11°34.3	334°06.5	S05°46.3
7	188°51.0	242°08.9	46.9	8°19.3	04.2	337°17.5	34.5	349°08.8	46.3
8	203°53.4	257°10.0	46.3	23°20.6	03.7	352°19.5	34.6	4°11.1	46.4
9	218°55.9	272°11.1	·· 45.6	38°22.0	·· 03.3	7°21.6	·· 34.8	19°13.4	·· 46.4
10	233°58.4	287°12.2	45.0	53°23.4	02.8	22°23.6	34.9	34°15.7	46.5
11	249°00.8	302°13.4	44.3	68°24.7	02.4	37°25.7	35.1	49°17.9	46.6
12	264°03.3	317°14.5	S20°43.7	83°26.1	N02°02.0	52°27.7	S11°35.2	64°20.2	S05°46.6
13	279°05.8	332°15.7	43.0	98°27.5	01.5	67°29.8	35.3	79°22.5	46.7
14	294°08.2	347°16.8	42.4	113°28.8	01.1	82°31.8	35.5	94°24.8	46.8
15	309°10.7	2°18.0	·· 41.7	128°30.2	·· 00.6	97°33.9	·· 35.6	109°27.1	·· 46.8
16	324°13.1	17°19.1	41.1	143°31.6	02°00.2	112°35.9	35.8	124°29.4	46.9
17	339°15.6	32°20.3	40.4	158°32.9	01°59.8	127°37.9	35.9	139°31.6	46.9
18	354°18.1	47°21.4	S20°39.8	173°34.3	N01°59.3	142°40.0	S11°36.1	154°33.9	S05°47.0
19	9°20.5	62°22.6	39.1	188°35.7	58.9	157°42.0	36.2	169°36.2	47.1
20	24°23.0	77°23.8	38.5	203°37.1	58.5	172°44.1	36.3	184°38.5	47.1
21	39°25.5	92°24.9	·· 37.8	218°38.4	·· 58.0	187°46.1	·· 36.5	199°40.8	·· 47.2
22	54°27.9	107°26.1	37.2	233°39.8	57.6	202°48.2	36.6	214°43.1	47.2
23	69°30.4	122°27.3	36.5	248°41.2	57.1	217°50.2	36.8	229°45.3	47.3
Mer.pass. 18:23		ν 1.1′	d 0.7′	m -4.88	ν 1.4′	d 0.4′	m 0.97	ν 2.0′	d 0.1′ m -1.78	ν 2.3′	d 0.1′ m 0.81

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	84°32.9	137°28.5	S20°35.9	263°42.5	N01°56.7	232°52.3	S11°36.9	244°47.6	S05°47.4
1	99°35.3	152°29.6	35.2	278°43.9	56.3	247°54.3	37.1	259°49.9	47.4
2	114°37.8	167°30.8	34.5	293°45.3	55.8	262°56.4	37.2	274°52.2	47.5
3	129°40.3	182°32.0	·· 33.9	308°46.7	·· 55.4	277°58.4	·· 37.3	289°54.5	·· 47.6
4	144°42.7	197°33.2	33.2	323°48.0	55.0	293°00.5	37.5	304°56.8	47.6
5	159°45.2	212°34.4	32.6	338°49.4	54.5	308°02.5	37.6	319°59.1	47.7
6	174°47.6	227°35.6	S20°31.9	353°50.8	N01°54.1	323°04.5	S11°37.8	335°01.3	S05°47.7
7	189°50.1	242°36.8	31.3	8°52.1	53.6	338°06.6	37.9	350°03.6	47.8
8	204°52.6	257°38.0	30.6	23°53.5	53.2	353°08.6	38.0	5°05.9	47.9
9	219°55.0	272°39.2	·· 30.0	38°54.9	·· 52.8	8°10.7	·· 38.2	20°08.2	·· 47.9
10	234°57.5	287°40.4	29.3	53°56.3	52.3	23°12.7	38.3	35°10.5	48.0
11	250°00.0	302°41.6	28.7	68°57.6	51.9	38°14.8	38.5	50°12.8	48.1
12	265°02.4	317°42.8	S20°28.0	83°59.0	N01°51.5	53°16.8	S11°38.6	65°15.1	S05°48.1
13	280°04.9	332°44.1	27.4	99°00.4	51.0	68°18.9	38.8	80°17.3	48.2
14	295°07.4	347°45.3	26.7	114°01.8	50.6	83°20.9	38.9	95°19.6	48.2
15	310°09.8	2°46.5	·· 26.0	129°03.2	·· 50.2	98°23.0	·· 39.0	110°21.9	·· 48.3
16	325°12.3	17°47.7	25.4	144°04.5	49.7	113°25.0	39.2	125°24.2	48.4
17	340°14.7	32°49.0	24.7	159°05.9	49.3	128°27.1	39.3	140°26.5	48.4
18	355°17.2	47°50.2	S20°24.1	174°07.3	N01°48.9	143°29.1	S11°39.5	155°28.8	S05°48.5
19	10°19.7	62°51.4	23.4	189°08.7	48.4	158°31.2	39.6	170°31.1	48.5
20	25°22.1	77°52.7	22.8	204°10.0	48.0	173°33.2	39.7	185°33.3	48.6
21	40°24.6	92°53.9	·· 22.1	219°11.4	·· 47.5	188°35.3	·· 39.9	200°35.6	·· 48.7
22	55°27.1	107°55.2	21.5	234°12.8	47.1	203°37.3	40.0	215°37.9	48.7
23	70°29.5	122°56.4	20.8	249°14.2	46.7	218°39.4	40.2	230°40.2	48.8
Mer.pass. 18:19		ν 1.2′	d 0.7′	m -4.89	ν 1.4′	d 0.4′	m 0.95	ν 2.0′	d 0.1′ m -1.78	ν 2.3′	d 0.1′ m 0.81

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	85°32.0	137°57.7	S20°20.1	264°15.6	N01°46.2	233°41.4	S11°40.3	245°42.5	S05°48.8
1	100°34.5	152°58.9	19.5	279°16.9	45.8	248°43.5	40.4	260°44.8	48.9
2	115°36.9	168°00.2	18.8	294°18.3	45.4	263°45.5	40.6	275°47.1	49.0
3	130°39.4	183°01.4	·· 18.2	309°19.7	·· 44.9	278°47.6	·· 40.7	290°49.4	·· 49.0
4	145°41.9	198°02.7	17.5	324°21.1	44.5	293°49.6	40.9	305°51.7	49.1
5	160°44.3	213°04.0	16.9	339°22.5	44.1	308°51.7	41.0	320°53.9	49.1
6	175°46.8	228°05.2	S20°16.2	354°23.8	N01°43.6	323°53.7	S11°41.1	335°56.2	S05°49.2
7	190°49.2	243°06.5	15.6	9°25.2	43.2	338°55.8	41.3	350°58.5	49.3
8	205°51.7	258°07.8	14.9	24°26.6	42.8	353°57.8	41.4	6°00.8	49.3
9	220°54.2	273°09.1	·· 14.3	39°28.0	·· 42.3	8°59.9	·· 41.6	21°03.1	·· 49.4
10	235°56.6	288°10.4	13.6	54°29.4	41.9	24°01.9	41.7	36°05.4	49.4
11	250°59.1	303°11.7	12.9	69°30.7	41.5	39°04.0	41.8	51°07.7	49.5
12	266°01.6	318°12.9	S20°12.3	84°32.1	N01°41.0	54°06.0	S11°42.0	66°10.0	S05°49.6
13	281°04.0	333°14.2	11.6	99°33.5	40.6	69°08.1	42.1	81°12.3	49.6
14	296°06.5	348°15.5	11.0	114°34.9	40.2	84°10.1	42.3	96°14.5	49.7
15	311°09.0	3°16.8	·· 10.3	129°36.3	·· 39.8	99°12.2	·· 42.4	111°16.8	·· 49.7
16	326°11.4	18°18.1	09.7	144°37.7	39.3	114°14.2	42.5	126°19.1	49.8
17	341°13.9	33°19.4	09.0	159°39.1	38.9	129°16.3	42.7	141°21.4	49.9
18	356°16.4	48°20.8	S20°08.3	174°40.4	N01°38.5	144°18.3	S11°42.8	156°23.7	S05°49.9
19	11°18.8	63°22.1	07.7	189°41.8	38.0	159°20.4	43.0	171°26.0	50.0
20	26°21.3	78°23.4	07.0	204°43.2	37.6	174°22.4	43.1	186°28.3	50.0
21	41°23.7	93°24.7	·· 06.4	219°44.6	·· 37.2	189°24.5	·· 43.2	201°30.6	·· 50.1
22	56°26.2	108°26.0	05.7	234°46.0	36.7	204°26.6	43.4	216°32.9	50.2
23	71°28.7	123°27.4	05.1	249°47.4	36.3	219°28.6	43.5	231°35.2	50.2
Mer.pass. 18:15		ν 1.3′	d 0.7′	m -4.89	ν 1.4′	d 0.4′	m 0.94	ν 2.0′	d 0.1′ m -1.79	ν 2.3′	d 0.1′ m 0.81

Stars

	SHA	Dec
Alpheratz	358°08.4	28°59.5
Ankaa	353°39.3	-42°24.6
Schedar	350°07.9	56°26.5
Diphda	349°19.9	-18°05.3
Achernar	335°44.3	-57°20.1
Hamal	328°27.7	23°22.7
Polaris	326°21.8	89°11.1
Acamar	315°36.2	-40°22.8
Menkar	314°40.0	4°01.1
Mirfak	309°14.4	49°47.9
Aldebaran	291°16.7	16°28.4
Rigel	281°34.8	-8°13.4
Capella	281°09.5	45°58.8
Bellatrix	278°57.5	6°20.0
Elnath	278°42.6	28°35.5
Alnilam	276°10.4	-1°12.8
Betelgeuse	271°27.0	7°24.2
Canopus	264°06.3	-52°41.1
Sirius	258°54.6	-16°41.4
Adhara	255°31.1	-28°56.8
Procyon	245°24.6	5°16.3
Pollux	243°56.8	28°04.2
Avior	234°27.3	-59°26.9
Suhail	223°09.9	-43°21.3
Miaplacidus	221°44.2	-69°38.3
Alphard	218°19.5	-8°34.7
Regulus	208°08.9	12°03.4
Dubhe	194°20.9	61°50.7
Denebola	182°58.2	14°40.4
Gienah	176°17.1	-17°26.3
Acrux	173°36.5	-62°59.5
Gacrux	172°27.9	-57°00.3
Alioth	166°41.9	56°03.3
Spica	158°56.8	-11°03.9
Alkaid	153°18.1	49°24.1
Hadar	149°22.6	-60°16.8
Menkent	148°36.3	-36°16.6
Arcturus	146°17.9	19°16.6
Rigil Kent.	140°25.1	-60°45.2
Kochab	137°19.9	74°13.7
Zuben'ubi	137°32.3	-15°57.8
Alphecca	126°31.7	26°46.5
Antares	112°56.2	-26°23.4
Atria	108°20.2	-68°59.6
Sabik	102°40.5	-15°42.1
Shaula	96°55.0	-37°05.4
Rasalhague	96°29.1	12°34.4
Eltanin	90°57.9	51°29.5
Kaus Aust.	84°16.1	-34°23.6
Vega	80°55.7	38°46.1
Nunki	76°28.5	-26°19.2
Altair	62°32.0	8°49.2
Peacock	53°57.5	-56°47.8
Deneb	49°48.2	45°13.1
Enif	34°10.9	9°47.5
Al Na'ir	28°14.0	-47°03.2
Fomalhaut	15°50.5	-29°43.3
Scheat	14°16.8	27°59.2
Markab	14°02.4	15°06.5

Dec 15 Tue	SHA	Mer.pass
Venus	53°27.3	14:51
Mars	179°36.0	06:27
Jupiter	148°29.5	08:31
Saturn	160°19.1	07:43

Dec 16 Wed	SHA	Mer.pass
Venus	52°55.6	14:49
Mars	179°09.7	06:25
Jupiter	148°19.4	08:27
Saturn	160°14.8	07:40

Dec 17 Thu	SHA	Mer.pass
Venus	52°25.7	14:47
Mars	178°43.6	06:22
Jupiter	148°09.4	08:24
Saturn	160°10.5	07:36

Horizontal parallax	
Venus:	0.4
Mars:	0.1

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	181°16.1	S23°15.1	307°33.3	7.1′	N18°39.4	7.2′	59.1′
1	196°15.8	15.2	321°59.4	7.2′	18°32.2	7.4′	59.0′
2	211°15.5	15.4	336°25.6	7.3′	18°24.8	7.4′	59.0′
3	226°15.2	·· 15.5	350°51.9	7.4′	18°17.4	7.5′	58.9′
4	241°14.9	15.6	5°18.2	7.5′	18°09.9	7.7′	58.9′
5	256°14.6	15.7	19°44.7	7.6′	18°02.2	7.7′	58.8′
6	271°14.3	S23°15.9	34°11.3	7.7′	N17°54.5	7.8′	58.8′
7	286°14.0	16.0	48°38.0	7.8′	17°46.7	8.0′	58.8′
8	301°13.7	16.1	63°04.9	7.9′	17°38.7	8.0′	58.7′
9	316°13.4	·· 16.3	77°31.8	8.0′	17°30.7	8.1′	58.7′
10	331°13.1	16.4	91°58.8	8.1′	17°22.6	8.2′	58.6′
11	346°12.8	16.5	106°25.9	8.2′	17°14.4	8.3′	58.6′
12	1°12.5	S23°16.6	120°53.1	8.3′	N17°06.1	8.4′	58.6′
13	16°12.2	16.8	135°20.5	8.4′	16°57.7	8.5′	58.5′
14	31°11.9	16.9	149°47.9	8.5′	16°49.2	8.5′	58.5′
15	46°11.6	·· 17.0	164°15.4	8.6′	16°40.7	8.7′	58.4′
16	61°11.2	17.1	178°43.1	8.7′	16°32.0	8.7′	58.4′
17	76°10.9	17.3	193°10.8	8.9′	16°23.3	8.8′	58.4′
18	91°10.6	S23°17.4	207°38.7	9.0′	N16°14.5	8.9′	58.3′
19	106°10.3	17.5	222°06.6	9.1′	16°05.6	8.9′	58.3′
20	121°10.0	17.6	236°34.7	9.2′	15°56.7	9.1′	58.2′
21	136°09.7	·· 17.8	251°02.8	9.3′	15°47.6	9.1′	58.2′
22	151°09.4	17.9	265°31.1	9.4′	15°38.5	9.2′	58.2′
23	166°09.1	18.0	279°59.5	9.5′	15°29.3	9.3′	58.1′
	SD = 16.2′	d = 0.1′	SD = 16.1′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	181°08.8	S23°18.1	294°27.9	9.6′	N15°20.0	9.3′	58.1′
1	196°08.5	18.2	308°56.5	9.7′	15°10.7	9.4′	58.0′
2	211°08.2	18.3	323°25.2	9.8′	15°01.3	9.5′	58.0′
3	226°07.9	·· 18.4	337°53.9	9.9′	14°51.8	9.5′	57.9′
4	241°07.6	18.6	352°22.8	10.0′	14°42.3	9.6′	57.9′
5	256°07.3	18.7	6°51.7	10.1′	14°32.7	9.7′	57.9′
6	271°07.0	S23°18.8	21°20.8	10.2′	N14°23.0	9.8′	57.8′
7	286°06.7	18.9	35°50.0	10.3′	14°13.2	9.8′	57.8′
8	301°06.4	19.0	50°19.2	10.3′	14°03.4	9.8′	57.7′
9	316°06.1	·· 19.1	64°48.6	10.4′	13°53.6	10.0′	57.7′
10	331°05.8	19.2	79°18.0	10.5′	13°43.6	9.9′	57.7′
11	346°05.5	19.3	93°47.5	10.6′	13°33.7	10.1′	57.6′
12	1°05.2	S23°19.4	108°17.2	10.7′	N13°23.6	10.1′	57.6′
13	16°04.9	19.5	122°46.9	10.8′	13°13.5	10.1′	57.5′
14	31°04.6	19.7	137°16.7	10.9′	13°03.4	10.2′	57.5′
15	46°04.3	·· 19.8	151°46.6	11.0′	12°53.2	10.3′	57.5′
16	61°04.0	19.9	166°16.6	11.1′	12°42.9	10.3′	57.4′
17	76°03.7	20.0	180°46.7	11.2′	12°32.6	10.3′	57.4′
18	91°03.4	S23°20.1	195°16.9	11.3′	N12°22.3	10.4′	57.3′
19	106°03.1	20.2	209°47.2	11.4′	12°11.9	10.5′	57.3′
20	121°02.8	20.3	224°17.5	11.4′	12°01.4	10.5′	57.3′
21	136°02.5	·· 20.4	238°48.0	11.5′	11°50.9	10.5′	57.2′
22	151°02.2	20.5	253°18.5	11.6′	11°40.4	10.6′	57.2′
23	166°01.9	20.6	267°49.1	11.7′	11°29.8	10.6′	57.1′
	SD = 16.2′	d = 0.1′	SD = 15.8′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	181°01.6	S23°20.7	282°19.8	11.8′	N11°19.2	10.7′	57.1′
1	196°01.2	20.8	296°50.6	11.9′	11°08.5	10.7′	57.1′
2	211°00.9	20.9	311°21.5	11.9′	10°57.8	10.7′	57.0′
3	226°00.6	·· 20.9	325°52.4	12.0′	10°47.1	10.8′	57.0′
4	241°00.3	21.0	340°23.4	12.1′	10°36.3	10.9′	57.0′
5	256°00.0	21.1	354°54.5	12.2′	10°25.4	10.8′	56.9′
6	270°59.7	S23°21.2	9°25.7	12.3′	N10°14.6	10.9′	56.9′
7	285°59.4	21.3	23°57.0	12.3′	10°03.7	10.9′	56.8′
8	300°59.1	21.4	38°28.3	12.4′	09°52.8	11.0′	56.8′
9	315°58.8	·· 21.5	52°59.8	12.5′	09°41.8	11.0′	56.8′
10	330°58.5	21.6	67°31.3	12.6′	09°30.8	11.0′	56.7′
11	345°58.2	21.7	82°02.8	12.6′	09°19.8	11.1′	56.7′
12	0°57.9	S23°21.8	96°34.5	12.7′	N09°08.7	11.0′	56.7′
13	15°57.6	21.8	111°06.2	12.8′	08°57.7	11.1′	56.6′
14	30°57.3	21.9	125°38.0	12.9′	08°46.6	11.2′	56.6′
15	45°57.0	·· 22.0	140°09.8	12.9′	08°35.4	11.1′	56.5′
16	60°56.7	22.1	154°41.8	13.0′	08°24.3	11.2′	56.5′
17	75°56.4	22.2	169°13.7	13.1′	08°13.1	11.2′	56.5′
18	90°56.1	S23°22.3	183°45.8	13.1′	N08°01.9	11.3′	56.4′
19	105°55.7	22.4	198°17.9	13.2′	07°50.6	11.2′	56.4′
20	120°55.4	22.4	212°50.1	13.3′	07°39.4	11.3′	56.4′
21	135°55.1	·· 22.5	227°22.4	13.3′	07°28.1	11.3′	56.3′
22	150°54.8	22.6	241°54.7	13.4′	07°16.8	11.3′	56.3′
23	165°54.5	22.7	256°27.1	13.4′	07°05.5	11.3′	56.3′
	SD = 16.2′	d = 0.1′	SD = 15.6′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	08:21	10:49	▬	▬	13:02	15:30
N 70°	08:02	09:49	▬	▬	14:02	15:50
68°	07:46	09:15	▬	▬	14:37	16:05
66°	07:33	08:50	10:29	13:22	15:02	16:18
64°	07:22	08:30	09:48	14:04	15:21	16:29
62°	07:12	08:14	09:20	14:32	15:37	16:39
60°	07:04	08:01	08:58	14:53	15:51	16:47
N 58°	06:56	07:49	08:41	15:10	16:02	16:55
56°	06:50	07:39	08:26	15:25	16:12	17:01
54°	06:44	07:30	08:14	15:38	16:21	17:08
52°	06:38	07:22	08:03	15:49	16:30	17:13
50°	06:33	07:14	07:53	15:59	16:37	17:18
45°	06:21	06:58	07:32	16:19	16:53	17:30
N 40°	06:11	06:45	07:15	16:36	17:06	17:41
35°	06:01	06:33	07:01	16:50	17:18	17:50
30°	05:53	06:23	06:49	17:02	17:29	17:59
20°	05:36	06:04	06:28	17:24	17:48	18:15
N 10°	05:20	05:46	06:09	17:42	18:05	18:31
0°	05:03	05:29	05:52	17:59	18:22	18:48
S 10°	04:44	05:11	05:34	18:17	18:40	19:07
20°	04:22	04:51	05:16	18:36	19:00	19:30
30°	03:53	04:26	04:54	18:58	19:25	19:59
35°	03:34	04:11	04:41	19:11	19:40	20:17
40°	03:11	03:53	04:26	19:26	19:59	20:40
45°	02:41	03:30	04:08	19:44	20:21	21:11
S 50°	01:56	03:01	03:45	20:06	20:51	21:56
52°	01:28	02:46	03:34	20:17	21:06	22:24
54°	00:44	02:28	03:22	20:29	21:24	23:09
56°	////	02:06	03:08	20:43	21:46	////
58°	////	01:37	02:51	21:00	22:15	////
S 60°	////	00:48	02:31	21:21	23:05	////

Lat.	**Moonrise** Tue	Wed	Thu	**Moonset** Tue	Wed	Thu
N 72°	17:59	20:23	22:23	14:29	13:51	13:30
N 70°	18:43	20:45	22:34	13:43	13:27	13:17
68°	19:12	21:01	22:43	13:12	13:09	13:06
66°	19:34	21:15	22:50	12:50	12:55	12:57
64°	19:51	21:26	22:56	12:31	12:43	12:50
62°	20:05	21:35	23:01	12:17	12:32	12:43
60°	20:17	21:43	23:06	12:04	12:23	12:38
N 58°	20:28	21:50	23:10	11:53	12:16	12:33
56°	20:37	21:56	23:13	11:43	12:09	12:28
54°	20:44	22:02	23:16	11:35	12:02	12:24
52°	20:51	22:07	23:19	11:27	11:57	12:21
50°	20:58	22:11	23:22	11:21	11:52	12:17
45°	21:11	22:21	23:27	11:06	11:41	12:10
N 40°	21:23	22:29	23:32	10:54	11:32	12:04
35°	21:32	22:36	23:36	10:43	11:24	11:59
30°	21:41	22:42	23:40	10:34	11:17	11:54
20°	21:55	22:52	23:46	10:18	11:05	11:46
N 10°	22:07	23:01	23:51	10:04	10:54	11:39
0°	22:19	23:10	23:56	09:51	10:44	11:32
S 10°	22:31	23:18	·· ··	09:38	10:34	11:26
20°	22:43	23:27	·· ··	09:24	10:23	11:18
30°	22:57	23:37	·· ··	09:07	10:10	11:10
35°	23:06	23:43	·· ··	08:58	10:03	11:05
40°	23:15	23:50	·· ··	08:47	09:55	10:59
45°	23:26	23:58	·· ··	08:34	09:45	10:53
S 50°	23:39	·· ··	00:07	08:18	09:33	10:45
52°	23:45	·· ··	00:11	08:11	09:27	10:42
54°	23:52	·· ··	00:16	08:03	09:21	10:38
56°	23:59	·· ··	00:21	07:54	09:14	10:33
58°	·· ··	00:08	00:27	07:43	09:07	10:28
S 60°	·· ··	00:17	00:33	07:31	08:58	10:23

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 19-21 82-63%
15	05:04	04:50	11:55	03:38	16:05	
16	04:35	04:21	11:56	04:32	16:57	
17	04:06	03:52	11:56	05:21	17:44	

December 18, 19, 20 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	86°31.1	138°28.7	S20°04.4	264°48.8	N01°35.9	234°30.7	S11°43.7	246°37.4	S05°50.3
1	101°33.6	153°30.0	03.8	279°50.1	35.4	249°32.7	43.8	261°39.7	50.3
2	116°36.1	168°31.4	03.1	294°51.5	35.0	264°34.8	43.9	276°42.0	50.4
3	131°38.5	183°32.7	·· 02.4	309°52.9	·· 34.6	279°36.8	·· 44.1	291°44.3	·· 50.5
4	146°41.0	198°34.0	01.8	324°54.3	34.1	294°38.9	44.2	306°46.6	50.5
5	161°43.5	213°35.4	01.1	339°55.7	33.7	309°40.9	44.3	321°48.9	50.6
6	176°45.9	228°36.7	S20°00.5	354°57.1	N01°33.3	324°43.0	S11°44.5	336°51.2	S05°50.6
7	191°48.4	243°38.1	19°59.8	9°58.5	32.9	339°45.0	44.6	351°53.5	50.7
8	206°50.8	258°39.4	59.2	24°59.9	32.4	354°47.1	44.8	6°55.8	50.7
9	221°53.3	273°40.8	·· 58.5	40°01.2	·· 32.0	9°49.1	·· 44.9	21°58.1	·· 50.8
10	236°55.8	288°42.2	57.8	55°02.6	31.6	24°51.2	45.0	37°00.4	50.9
11	251°58.2	303°43.5	57.2	70°04.0	31.1	39°53.3	45.2	52°02.7	50.9
12	267°00.7	318°44.9	S19°56.5	85°05.4	N01°30.7	54°55.3	S11°45.3	67°05.0	S05°51.0
13	282°03.2	333°46.3	55.9	100°06.8	30.3	69°57.4	45.5	82°07.2	51.0
14	297°05.6	348°47.6	55.2	115°08.2	29.9	84°59.4	45.6	97°09.5	51.1
15	312°08.1	3°49.0	·· 54.6	130°09.6	·· 29.4	100°01.5	·· 45.7	112°11.8	·· 51.2
16	327°10.6	18°50.4	53.9	145°11.0	29.0	115°03.5	45.9	127°14.1	51.2
17	342°13.0	33°51.8	53.2	160°12.4	28.6	130°05.6	46.0	142°16.4	51.3
18	357°15.5	48°53.2	S19°52.6	175°13.8	N01°28.1	145°07.6	S11°46.1	157°18.7	S05°51.3
19	12°18.0	63°54.6	51.9	190°15.2	27.7	160°09.7	46.3	172°21.0	51.4
20	27°20.4	78°56.0	51.3	205°16.6	27.3	175°11.8	46.4	187°23.3	51.4
21	42°22.9	93°57.4	·· 50.6	220°18.0	·· 26.9	190°13.8	·· 46.6	202°25.6	·· 51.5
22	57°25.3	108°58.8	50.0	235°19.3	26.4	205°15.9	46.7	217°27.9	51.6
23	72°27.8	124°00.2	49.3	250°20.7	26.0	220°17.9	46.8	232°30.2	51.6
Mer.pass. 18:11		ν 1.3′	d 0.7′	m -4.90	ν 1.4′	d 0.4′	m 0.93	ν 2.1′	d 0.1′ m -1.79	ν 2.3′	d 0.1′ m 0.80

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	87°30.3	139°01.6	S19°48.7	265°22.1	N01°25.6	235°20.0	S11°47.0	247°32.5	S05°51.7
1	102°32.7	154°03.0	48.0	280°23.5	25.2	250°22.0	47.1	262°34.8	51.7
2	117°35.2	169°04.4	47.3	295°24.9	24.7	265°24.1	47.2	277°37.1	51.8
3	132°37.7	184°05.8	·· 46.7	310°26.3	·· 24.3	280°26.1	·· 47.4	292°39.4	·· 51.9
4	147°40.1	199°07.2	46.0	325°27.7	23.9	295°28.2	47.5	307°41.6	51.9
5	162°42.6	214°08.7	45.4	340°29.1	23.5	310°30.3	47.6	322°43.9	52.0
6	177°45.1	229°10.1	S19°44.7	355°30.5	N01°23.0	325°32.3	S11°47.8	337°46.2	S05°52.0
7	192°47.5	244°11.5	44.1	10°31.9	22.6	340°34.4	47.9	352°48.5	52.1
8	207°50.0	259°13.0	43.4	25°33.3	22.2	355°36.4	48.1	7°50.8	52.1
9	222°52.5	274°14.4	·· 42.7	40°34.7	·· 21.7	10°38.5	·· 48.2	22°53.1	·· 52.2
10	237°54.9	289°15.8	42.1	55°36.1	21.3	25°40.6	48.3	37°55.4	52.3
11	252°57.4	304°17.3	41.4	70°37.5	20.9	40°42.6	48.5	52°57.7	52.3
12	267°59.8	319°18.7	S19°40.8	85°38.9	N01°20.5	55°44.7	S11°48.6	68°00.0	S05°52.4
13	283°02.3	334°20.2	40.1	100°40.3	20.0	70°46.7	48.7	83°02.3	52.4
14	298°04.8	349°21.6	39.5	115°41.7	19.6	85°48.8	48.9	98°04.6	52.5
15	313°07.2	4°23.1	·· 38.8	130°43.1	·· 19.2	100°50.8	·· 49.0	113°06.9	·· 52.5
16	328°09.7	19°24.6	38.2	145°44.5	18.8	115°52.9	49.1	128°09.2	52.6
17	343°12.2	34°26.0	37.5	160°45.9	18.4	130°55.0	49.3	143°11.5	52.7
18	358°14.6	49°27.5	S19°36.8	175°47.3	N01°17.9	145°57.0	S11°49.4	158°13.8	S05°52.7
19	13°17.1	64°29.0	36.2	190°48.7	17.5	160°59.1	49.6	173°16.1	52.8
20	28°19.6	79°30.4	35.5	205°50.1	17.1	176°01.1	49.7	188°18.4	52.8
21	43°22.0	94°31.9	·· 34.9	220°51.5	·· 16.7	191°03.2	·· 49.8	203°20.7	·· 52.9
22	58°24.5	109°33.4	34.2	235°52.9	16.2	206°05.3	50.0	218°23.0	52.9
23	73°26.9	124°34.9	33.6	250°54.3	15.8	221°07.3	50.1	233°25.3	53.0
Mer.pass. 18:07		ν 1.4′	d 0.7′	m -4.90	ν 1.4′	d 0.4′	m 0.91	ν 2.1′	d 0.1′ m -1.79	ν 2.3′	d 0.1′ m 0.80

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	88°29.4	139°36.4	S19°32.9	265°55.7	N01°15.4	236°09.4	S11°50.2	248°27.6	S05°53.0
1	103°31.9	154°37.9	32.3	280°57.1	15.0	251°11.4	50.4	263°29.9	53.1
2	118°34.3	169°39.4	31.6	295°58.5	14.5	266°13.5	50.5	278°32.2	53.2
3	133°36.8	184°40.9	·· 30.9	310°59.9	·· 14.1	281°15.6	·· 50.6	293°34.5	·· 53.2
4	148°39.3	199°42.4	30.3	326°01.3	13.7	296°17.6	50.8	308°36.8	53.3
5	163°41.7	214°43.9	29.6	341°02.7	13.3	311°19.7	50.9	323°39.1	53.3
6	178°44.2	229°45.4	S19°29.0	356°04.1	N01°12.9	326°21.7	S11°51.0	338°41.4	S05°53.4
7	193°46.7	244°46.9	28.3	11°05.5	12.4	341°23.8	51.2	353°43.7	53.4
8	208°49.1	259°48.4	27.7	26°06.9	12.0	356°25.9	51.3	8°46.0	53.5
9	223°51.6	274°49.9	·· 27.0	41°08.3	·· 11.6	11°27.9	·· 51.5	23°48.3	·· 53.6
10	238°54.1	289°51.5	26.4	56°09.8	11.2	26°30.0	51.6	38°50.6	53.6
11	253°56.5	304°53.0	25.7	71°11.2	10.7	41°32.1	51.7	53°52.9	53.7
12	268°59.0	319°54.5	S19°25.0	86°12.6	N01°10.3	56°34.1	S11°51.9	68°55.1	S05°53.7
13	284°01.4	334°56.0	24.4	101°14.0	09.9	71°36.2	52.0	83°57.4	53.8
14	299°03.9	349°57.6	23.7	116°15.4	09.5	86°38.2	52.1	98°59.7	53.8
15	314°06.4	4°59.1	·· 23.1	131°16.8	·· 09.1	101°40.3	·· 52.3	114°02.0	·· 53.9
16	329°08.8	20°00.7	22.4	146°18.2	08.6	116°42.4	52.4	129°04.3	53.9
17	344°11.3	35°02.2	21.8	161°19.6	08.2	131°44.4	52.5	144°06.6	54.0
18	359°13.8	50°03.8	S19°21.1	176°21.0	N01°07.8	146°46.5	S11°52.7	159°08.9	S05°54.1
19	14°16.2	65°05.3	20.5	191°22.4	07.4	161°48.6	52.8	174°11.2	54.1
20	29°18.7	80°06.9	19.8	206°23.8	07.0	176°50.6	52.9	189°13.5	54.2
21	44°21.2	95°08.4	·· 19.2	221°25.2	·· 06.5	191°52.7	·· 53.1	204°15.8	·· 54.2
22	59°23.6	110°10.0	18.5	236°26.6	06.1	206°54.7	53.2	219°18.1	54.3
23	74°26.1	125°11.6	17.9	251°28.1	05.7	221°56.8	53.3	234°20.4	54.3
Mer.pass. 18:03		ν 1.5′	d 0.7′	m -4.91	ν 1.4′	d 0.4′	m 0.90	ν 2.1′	d 0.1′ m -1.80	ν 2.3′	d 0.1′ m 0.80

Stars

	SHA	Dec
Alpheratz	358°08.4	28°59.5
Ankaa	353°39.3	-42°24.6
Schedar	350°07.9	56°26.5
Diphda	349°19.9	-18°05.3
Achernar	335°44.3	-57°20.1
Hamal	328°27.7	23°22.7
Polaris	326°22.8	89°11.1
Acamar	315°36.2	-40°22.9
Menkar	314°40.0	4°01.1
Mirfak	309°14.4	49°47.9
Aldebaran	291°16.7	16°28.4
Rigel	281°34.8	-8°13.4
Capella	281°09.5	45°58.8
Bellatrix	278°57.5	6°20.0
Elnath	278°42.6	28°35.5
Alnilam	276°10.4	-1°12.8
Betelgeuse	271°27.0	7°24.2
Canopus	264°06.3	-52°41.1
Sirius	258°54.5	-16°41.5
Adhara	255°31.0	-28°56.8
Procyon	245°24.6	5°16.3
Pollux	243°56.8	28°04.2
Avior	234°27.3	-59°26.9
Suhail	223°09.8	-43°21.3
Miaplacidus	221°44.2	-69°38.3
Alphard	218°19.5	-8°34.7
Regulus	208°08.9	12°03.4
Dubhe	194°20.9	61°50.7
Denebola	182°58.2	14°40.4
Gienah	176°17.1	-17°26.3
Acrux	173°36.5	-62°59.5
Gacrux	172°27.9	-57°00.3
Alioth	166°41.9	56°03.3
Spica	158°56.8	-11°03.9
Alkaid	153°18.1	49°24.1
Hadar	149°22.5	-60°16.8
Menkent	148°36.2	-36°16.6
Arcturus	146°17.9	19°16.6
Rigil Kent.	140°25.1	-60°45.2
Kochab	137°19.9	74°13.6
Zuben'ubi	137°32.3	-15°57.9
Alphecca	126°31.7	26°46.5
Antares	112°56.1	-26°23.4
Atria	108°20.2	-68°59.6
Sabik	102°40.5	-15°42.1
Shaula	96°55.0	-37°05.4
Rasalhague	96°29.1	12°34.4
Eltanin	90°57.9	51°29.5
Kaus Aust.	84°16.1	-34°23.6
Vega	80°55.7	38°46.1
Nunki	76°28.5	-26°19.2
Altair	62°32.0	8°49.2
Peacock	53°57.5	-56°47.8
Deneb	49°48.2	45°13.1
Enif	34°10.9	9°47.5
Al Na'ir	28°14.0	-47°03.2
Fomalhaut	15°50.5	-29°43.3
Scheat	14°16.8	27°59.2
Markab	14°02.4	15°06.5

Dec 18 Fri	SHA	Mer.pass
Venus	51°57.5	14:45
Mars	178°17.6	06:20
Jupiter	147°59.5	08:21
Saturn	160°06.3	07:32

Dec 19 Sat	SHA	Mer.pass
Venus	51°31.3	14:42
Mars	177°51.9	06:18
Jupiter	147°49.7	08:18
Saturn	160°02.2	07:29

Dec 20 Sun	SHA	Mer.pass
Venus	51°07.0	14:40
Mars	177°26.3	06:16
Jupiter	147°40.0	08:14
Saturn	159°58.2	07:25

Horizontal parallax	
Venus:	0.4
Mars:	0.1

h

Fri	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	180°54.2	S23°22.7	270°59.6	13.5′	N06°54.2	11.4′	56.2′
1	195°53.9	22.8	285°32.1	13.6′	06°42.8	11.4′	56.2′
2	210°53.6	22.9	300°04.6	13.6′	06°31.4	11.3′	56.2′
3	225°53.3	·· 23.0	314°37.3	13.7′	06°20.1	11.4′	56.1′
4	240°53.0	23.1	329°09.9	13.7′	06°08.7	11.4′	56.1′
5	255°52.7	23.1	343°42.7	13.8′	05°57.3	11.5′	56.1′
6	270°52.4	S23°23.2	358°15.5	13.9′	N05°45.8	11.4′	56.0′
7	285°52.1	23.3	12°48.3	13.9′	05°34.4	11.4′	56.0′
8	300°51.8	23.3	27°21.2	14.0′	05°23.0	11.5′	56.0′
9	315°51.4	·· 23.4	41°54.2	14.0′	05°11.5	11.5′	55.9′
10	330°51.1	23.5	56°27.2	14.1′	05°00.0	11.4′	55.9′
11	345°50.8	23.6	71°00.3	14.1′	04°48.6	11.5′	55.9′
12	0°50.5	S23°23.6	85°33.4	14.2′	N04°37.1	11.5′	55.8′
13	15°50.2	23.7	100°06.5	14.2′	04°25.6	11.5′	55.8′
14	30°49.9	23.8	114°39.7	14.3′	04°14.1	11.5′	55.8′
15	45°49.6	·· 23.8	129°13.0	14.3′	04°02.6	11.5′	55.7′
16	60°49.3	23.9	143°46.3	14.3′	03°51.1	11.5′	55.7′
17	75°49.0	23.9	158°19.6	14.4′	03°39.6	11.5′	55.7′
18	90°48.7	S23°24.0	172°53.0	14.4′	N03°28.1	11.6′	55.7′
19	105°48.4	24.1	187°26.5	14.5′	03°16.5	11.5′	55.6′
20	120°48.1	24.1	201°59.9	14.5′	03°05.0	11.5′	55.6′
21	135°47.8	·· 24.2	216°33.4	14.6′	02°53.5	11.5′	55.6′
22	150°47.4	24.3	231°07.0	14.6′	02°42.0	11.5′	55.5′
23	165°47.1	24.3	245°40.6	14.6′	02°30.5	11.6′	55.5′
	SD = 16.2′	d = 0.1′		SD = 15.3′			

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	180°46.8	S23°24.4	260°14.2	14.7′	N02°18.9	11.5′	55.5′
1	195°46.5	24.4	274°47.9	14.7′	02°07.4	11.5′	55.5′
2	210°46.2	24.5	289°21.6	14.7′	01°55.9	11.5′	55.4′
3	225°45.9	·· 24.5	303°55.3	14.8′	01°44.4	11.5′	55.4′
4	240°45.6	24.6	318°29.1	14.8′	01°32.9	11.5′	55.4′
5	255°45.3	24.7	333°02.9	14.8′	01°21.4	11.5′	55.3′
6	270°45.0	S23°24.7	347°36.7	14.9′	N01°09.9	11.5′	55.3′
7	285°44.7	24.8	2°10.5	14.9′	00°58.4	11.5′	55.3′
8	300°44.4	24.8	16°44.4	14.9′	00°46.9	11.5′	55.3′
9	315°44.0	·· 24.9	31°18.4	14.9′	00°35.4	11.5′	55.2′
10	330°43.7	24.9	45°52.3	15.0′	00°23.9	11.4′	55.2′
11	345°43.4	25.0	60°26.3	15.0′	00°12.5	11.5′	55.2′
12	0°43.1	S23°25.0	75°00.3	15.0′	N00°01.0	11.4′	55.2′
13	15°42.8	25.1	89°34.3	15.0′	S00°10.4	11.5′	55.1′
14	30°42.5	25.1	104°08.4	15.1′	00°21.9	11.4′	55.1′
15	45°42.2	·· 25.1	118°42.4	15.1′	00°33.3	11.4′	55.1′
16	60°41.9	25.2	133°16.5	15.1′	00°44.7	11.4′	55.1′
17	75°41.6	25.2	147°50.6	15.1′	00°56.1	11.4′	55.0′
18	90°41.3	S23°25.3	162°24.8	15.2′	S01°07.5	11.3′	55.0′
19	105°41.0	25.3	176°58.9	15.2′	01°18.8	11.4′	55.0′
20	120°40.6	25.4	191°33.1	15.2′	01°30.2	11.3′	55.0′
21	135°40.3	·· 25.4	206°07.3	15.2′	01°41.5	11.4′	54.9′
22	150°40.0	25.4	220°41.5	15.2′	01°52.9	11.3′	54.9′
23	165°39.7	25.5	235°15.7	15.2′	02°04.2	11.3′	54.9′
	SD = 16.2′	d = 0.1′		SD = 15.1′			

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	180°39.4	S23°25.5	249°50.0	15.3′	S02°15.5	11.2′	54.9′
1	195°39.1	25.6	264°24.2	15.3′	02°26.7	11.3′	54.9′
2	210°38.8	25.6	278°58.5	15.3′	02°38.0	11.2′	54.8′
3	225°38.5	·· 25.6	293°32.7	15.3′	02°49.2	11.3′	54.8′
4	240°38.2	25.7	308°07.0	15.3′	03°00.5	11.2′	54.8′
5	255°37.9	25.7	322°41.3	15.3′	03°11.7	11.1′	54.8′
6	270°37.5	S23°25.7	337°15.6	15.3′	S03°22.8	11.2′	54.7′
7	285°37.2	25.8	351°49.9	15.3′	03°34.0	11.1′	54.7′
8	300°36.9	25.8	6°24.3	15.3′	03°45.1	11.2′	54.7′
9	315°36.6	·· 25.8	20°58.6	15.3′	03°56.3	11.0′	54.7′
10	330°36.3	25.9	35°32.9	15.3′	04°07.3	11.1′	54.7′
11	345°36.0	25.9	50°07.3	15.3′	04°18.4	11.1′	54.6′
12	0°35.7	S23°25.9	64°41.6	15.3′	S04°29.5	11.0′	54.6′
13	15°35.4	26.0	79°16.0	15.3′	04°40.5	11.0′	54.6′
14	30°35.1	26.0	93°50.3	15.4′	04°51.5	10.9′	54.6′
15	45°34.7	·· 26.0	108°24.7	15.4′	05°02.4	11.0′	54.6′
16	60°34.4	26.0	122°59.0	15.4′	05°13.4	10.9′	54.6′
17	75°34.1	26.1	137°33.4	15.4′	05°24.3	10.9′	54.5′
18	90°33.8	S23°26.1	152°07.7	15.3′	S05°35.2	10.8′	54.5′
19	105°33.5	26.1	166°42.1	15.3′	05°46.0	10.9′	54.5′
20	120°33.2	26.1	181°16.4	15.3′	05°56.9	10.8′	54.5′
21	135°32.9	·· 26.1	195°50.8	15.3′	06°07.7	10.7′	54.5′
22	150°32.6	26.2	210°25.1	15.3′	06°18.4	10.8′	54.5′
23	165°32.3	26.2	224°59.4	15.3′	06°29.2	10.7′	54.4′
	SD = 16.2′	d = 0.0′		SD = 15.0′			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	08:24	10:56	▬	▬	12:58	15:30
N 70°	08:04	09:53	▬	▬	14:01	15:50
68°	07:48	09:18	▬	▬	14:36	16:06
66°	07:35	08:52	10:33	13:21	15:02	16:19
64°	07:24	08:33	09:51	14:03	15:21	16:30
62°	07:15	08:17	09:22	14:32	15:38	16:40
60°	07:06	08:03	09:01	14:53	15:51	16:48
N 58°	06:59	07:51	08:43	15:11	16:03	16:56
56°	06:52	07:41	08:28	15:26	16:13	17:02
54°	06:46	07:32	08:16	15:38	16:22	17:09
52°	06:40	07:24	08:05	15:50	16:30	17:14
50°	06:35	07:16	07:55	15:59	16:38	17:20
45°	06:23	07:00	07:34	16:20	16:54	17:31
N 40°	06:13	06:47	07:17	16:37	17:08	17:42
35°	06:03	06:35	07:03	16:51	17:19	17:51
30°	05:54	06:24	06:51	17:04	17:30	18:00
20°	05:38	06:05	06:29	17:25	17:49	18:16
N 10°	05:22	05:48	06:11	17:43	18:06	18:33
0°	05:05	05:31	05:53	18:01	18:23	18:50
S 10°	04:46	05:13	05:36	18:18	18:42	19:09
20°	04:23	04:52	05:17	18:37	19:02	19:31
30°	03:54	04:27	04:55	19:00	19:27	20:00
35°	03:35	04:12	04:42	19:13	19:42	20:19
40°	03:12	03:54	04:27	19:28	20:01	20:42
45°	02:41	03:31	04:09	19:46	20:23	21:13
S 50°	01:56	03:01	03:46	20:08	20:53	21:59
52°	01:28	02:46	03:35	20:19	21:08	22:27
54°	00:41	02:28	03:23	20:31	21:26	23:13
56°	////	02:06	03:09	20:46	21:48	////
58°	////	01:36	02:52	21:03	22:18	////
S 60°	////	00:46	02:31	21:23	23:09	////

Lat.	Moonrise Fri	Moonrise Sat	Moonrise Sun	Moonset Fri	Moonset Sat	Moonset Sun
N 72°	·· ··	00:13	01:58	13:13	12:58	12:44
N 70°	·· ··	00:16	01:54	13:07	12:59	12:50
68°	·· ··	00:18	01:51	13:03	12:59	12:55
66°	·· ··	00:20	01:48	12:59	12:59	13:00
64°	·· ··	00:22	01:46	12:55	12:59	13:03
62°	·· ··	00:24	01:44	12:52	13:00	13:07
60°	·· ··	00:25	01:42	12:49	13:00	13:10
N 58°	·· ··	00:26	01:41	12:47	13:00	13:12
56°	·· ··	00:27	01:39	12:45	13:00	13:15
54°	·· ··	00:28	01:38	12:43	13:00	13:17
52°	·· ··	00:29	01:37	12:41	13:00	13:19
50°	·· ··	00:30	01:36	12:40	13:00	13:20
45°	·· ··	00:32	01:34	12:36	13:00	13:24
N 40°	·· ··	00:33	01:32	12:33	13:01	13:27
35°	·· ··	00:34	01:31	12:31	13:01	13:30
30°	·· ··	00:36	01:30	12:29	13:01	13:32
20°	·· ··	00:37	01:27	12:25	13:01	13:37
N 10°	·· ··	00:39	01:25	12:21	13:01	13:40
0°	·· ··	00:41	01:23	12:18	13:01	13:44
S 10°	00:01	00:42	01:22	12:15	13:01	13:47
20°	00:07	00:44	01:20	12:11	13:02	13:51
30°	00:13	00:46	01:18	12:07	13:02	13:55
35°	00:16	00:47	01:16	12:04	13:02	13:58
40°	00:20	00:48	01:15	12:02	13:02	14:01
45°	00:25	00:50	01:13	11:59	13:02	14:04
S 50°	00:30	00:51	01:11	11:55	13:02	14:08
52°	00:33	00:52	01:11	11:53	13:02	14:09
54°	00:36	00:53	01:10	11:51	13:02	14:11
56°	00:39	00:54	01:09	11:49	13:02	14:14
58°	00:42	00:55	01:08	11:47	13:02	14:16
S 60°	00:46	00:56	01:06	11:44	13:02	14:19

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 22-24 53-33%
18	03:37	03:22	11:57	06:07	18:29	
19	03:07	02:52	11:57	06:51	19:12	
20	02:38	02:23	11:58	07:34	19:55	

December 21, 22, 23 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	89°28.5	140°13.2	S19°17.2	266°29.5	N01°05.3	236°58.9	S11°53.5	249°22.7	S05°54.4
1	104°31.0	155°14.7	16.5	281°30.9	04.9	252°00.9	53.6	264°25.0	54.4
2	119°33.5	170°16.3	15.9	296°32.3	04.4	267°03.0	53.7	279°27.3	54.5
3	134°35.9	185°17.9	·· 15.2	311°33.7	·· 04.0	282°05.1	·· 53.9	294°29.6	·· 54.5
4	149°38.4	200°19.5	14.6	326°35.1	03.6	297°07.1	54.0	309°32.0	54.6
5	164°40.9	215°21.1	13.9	341°36.5	03.2	312°09.2	54.1	324°34.3	54.7
6	179°43.3	230°22.7	S19°13.3	356°37.9	N01°02.8	327°11.3	S11°54.3	339°36.6	S05°54.7
7	194°45.8	245°24.3	12.6	11°39.4	02.3	342°13.3	54.4	354°38.9	54.8
8	209°48.3	260°25.9	12.0	26°40.8	01.9	357°15.4	54.5	9°41.2	54.8
9	224°50.7	275°27.5	·· 11.3	41°42.2	·· 01.5	12°17.5	·· 54.7	24°43.5	·· 54.9
10	239°53.2	290°29.1	10.7	56°43.6	01.1	27°19.5	54.8	39°45.8	54.9
11	254°55.7	305°30.7	10.0	71°45.0	00.7	42°21.6	54.9	54°48.1	55.0
12	269°58.1	320°32.3	S19°09.4	86°46.4	N01°00.3	57°23.7	S11°55.1	69°50.4	S05°55.0
13	285°00.6	335°33.9	08.7	101°47.8	00°59.8	72°25.7	55.2	84°52.7	55.1
14	300°03.0	350°35.5	08.1	116°49.3	59.4	87°27.8	55.3	99°55.0	55.1
15	315°05.5	5°37.2	·· 07.4	131°50.7	·· 59.0	102°29.9	·· 55.5	114°57.3	·· 55.2
16	330°08.0	20°38.8	06.8	146°52.1	58.6	117°31.9	55.6	129°59.6	55.3
17	345°10.4	35°40.4	06.1	161°53.5	58.2	132°34.0	55.7	145°01.9	55.3
18	0°12.9	50°42.1	S19°05.5	176°54.9	N00°57.8	147°36.1	S11°55.9	160°04.2	S05°55.4
19	15°15.4	65°43.7	04.8	191°56.3	57.3	162°38.1	56.0	175°06.5	55.4
20	30°17.8	80°45.4	04.2	206°57.8	56.9	177°40.2	56.1	190°08.8	55.5
21	45°20.3	95°47.0	·· 03.5	221°59.2	·· 56.5	192°42.3	·· 56.3	205°11.1	·· 55.5
22	60°22.8	110°48.7	02.9	237°00.6	56.1	207°44.3	56.4	220°13.4	55.6
23	75°25.2	125°50.3	02.2	252°02.0	55.7	222°46.4	56.5	235°15.7	55.6
Mer.pass. 17:59		ν 1.6′	d 0.7′	m -4.91	ν 1.4′	d 0.4′	m 0.88	ν 2.1′	d 0.1′ m -1.80	ν 2.3′	d 0.1′ m 0.79

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	90°27.7	140°52.0	S19°01.6	267°03.4	N00°55.3	237°48.5	S11°56.7	250°18.0	S05°55.7
1	105°30.2	155°53.6	00.9	282°04.9	54.9	252°50.5	56.8	265°20.3	55.7
2	120°32.6	170°55.3	19°00.2	297°06.3	54.4	267°52.6	56.9	280°22.6	55.8
3	135°35.1	185°57.0	18°59.6	312°07.7	·· 54.0	282°54.7	·· 57.1	295°24.9	·· 55.8
4	150°37.5	200°58.6	58.9	327°09.1	53.6	297°56.7	57.2	310°27.2	55.9
5	165°40.0	216°00.3	58.3	342°10.5	53.2	312°58.8	57.3	325°29.5	55.9
6	180°42.5	231°02.0	S18°57.6	357°12.0	N00°52.8	328°00.9	S11°57.4	340°31.8	S05°56.0
7	195°44.9	246°03.7	57.0	12°13.4	52.4	343°02.9	57.6	355°34.1	56.1
8	210°47.4	261°05.4	56.4	27°14.8	52.0	358°05.0	57.7	10°36.4	56.1
9	225°49.9	276°07.1	·· 55.7	42°16.2	·· 51.5	13°07.1	·· 57.8	25°38.7	·· 56.2
10	240°52.3	291°08.8	55.1	57°17.6	51.1	28°09.1	58.0	40°41.0	56.2
11	255°54.8	306°10.5	54.4	72°19.1	50.7	43°11.2	58.1	55°43.4	56.3
12	270°57.3	321°12.2	S18°53.8	87°20.5	N00°50.3	58°13.3	S11°58.2	70°45.7	S05°56.3
13	285°59.7	336°13.9	53.1	102°21.9	49.9	73°15.4	58.4	85°48.0	56.4
14	301°02.2	351°15.6	52.5	117°23.3	49.5	88°17.4	58.5	100°50.3	56.4
15	316°04.7	6°17.3	·· 51.8	132°24.8	·· 49.1	103°19.5	·· 58.6	115°52.6	·· 56.5
16	331°07.1	21°19.0	51.2	147°26.2	48.6	118°21.6	58.8	130°54.9	56.5
17	346°09.6	36°20.7	50.5	162°27.6	48.2	133°23.6	58.9	145°57.2	56.6
18	1°12.0	51°22.5	S18°49.9	177°29.0	N00°47.8	148°25.7	S11°59.0	160°59.5	S05°56.6
19	16°14.5	66°24.2	49.2	192°30.5	47.4	163°27.8	59.2	176°01.8	56.7
20	31°17.0	81°25.9	48.6	207°31.9	47.0	178°29.9	59.3	191°04.1	56.7
21	46°19.4	96°27.7	·· 47.9	222°33.3	·· 46.6	193°31.9	·· 59.4	206°06.4	·· 56.8
22	61°21.9	111°29.4	47.3	237°34.7	46.2	208°34.0	59.5	221°08.7	56.8
23	76°24.4	126°31.1	46.6	252°36.2	45.8	223°36.1	59.7	236°11.0	56.9
Mer.pass. 17:55		ν 1.7′	d 0.7′	m -4.91	ν 1.4′	d 0.4′	m 0.87	ν 2.1′	d 0.1′ m -1.80	ν 2.3′	d 0.1′ m 0.79

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	91°26.8	141°32.9	S18°46.0	267°37.6	N00°45.4	238°38.1	S11°59.8	251°13.3	S05°56.9
1	106°29.3	156°34.6	45.3	282°39.0	44.9	253°40.2	11°59.9	266°15.6	57.0
2	121°31.8	171°36.4	44.7	297°40.5	44.5	268°42.3	12°00.1	281°18.0	57.1
3	136°34.2	186°38.1	·· 44.0	312°41.9	·· 44.1	283°44.4	·· 00.2	296°20.3	·· 57.1
4	151°36.7	201°39.9	43.4	327°43.3	43.7	298°46.4	00.3	311°22.6	57.2
5	166°39.1	216°41.7	42.8	342°44.7	43.3	313°48.5	00.5	326°24.9	57.2
6	181°41.6	231°43.4	S18°42.1	357°46.2	N00°42.9	328°50.6	S12°00.6	341°27.2	S05°57.3
7	196°44.1	246°45.2	41.5	12°47.6	42.5	343°52.6	00.7	356°29.5	57.3
8	211°46.5	261°47.0	40.8	27°49.0	42.1	358°54.7	00.8	11°31.8	57.4
9	226°49.0	276°48.8	·· 40.2	42°50.5	·· 41.7	13°56.8	·· 01.0	26°34.1	·· 57.4
10	241°51.5	291°50.6	39.5	57°51.9	41.2	28°58.9	01.1	41°36.4	57.5
11	256°53.9	306°52.3	38.9	72°53.3	40.8	44°00.9	01.2	56°38.7	57.5
12	271°56.4	321°54.1	S18°38.2	87°54.8	N00°40.4	59°03.0	S12°01.4	71°41.0	S05°57.6
13	286°58.9	336°55.9	37.6	102°56.2	40.0	74°05.1	01.5	86°43.3	57.6
14	302°01.3	351°57.7	37.0	117°57.6	39.6	89°07.2	01.6	101°45.7	57.7
15	317°03.8	6°59.5	·· 36.3	132°59.0	·· 39.2	104°09.2	·· 01.8	116°48.0	·· 57.7
16	332°06.3	22°01.3	35.7	148°00.5	38.8	119°11.3	01.9	131°50.3	57.8
17	347°08.7	37°03.2	35.0	163°01.9	38.4	134°13.4	02.0	146°52.6	57.8
18	2°11.2	52°05.0	S18°34.4	178°03.4	N00°38.0	149°15.5	S12°02.1	161°54.9	S05°57.9
19	17°13.6	67°06.8	33.7	193°04.8	37.6	164°17.5	02.3	176°57.2	57.9
20	32°16.1	82°08.6	33.1	208°06.2	37.2	179°19.6	02.4	191°59.5	58.0
21	47°18.6	97°10.4	·· 32.5	223°07.7	·· 36.8	194°21.7	·· 02.5	207°01.8	·· 58.0
22	62°21.0	112°12.3	31.8	238°09.1	36.3	209°23.8	02.7	222°04.1	58.1
23	77°23.5	127°14.1	31.2	253°10.5	35.9	224°25.8	02.8	237°06.4	58.1
Mer.pass. 17:51		ν 1.8′	d 0.6′	m -4.91	ν 1.4′	d 0.4′	m 0.85	ν 2.1′	d 0.1′ m -1.81	ν 2.3′	d 0.1′ m 0.79

Stars

	SHA	Dec
Alpheratz	358°08.4	28°59.5
Ankaa	353°39.3	-42°24.6
Schedar	350°07.9	56°26.5
Diphda	349°19.9	-18°05.3
Achernar	335°44.3	-57°20.1
Hamal	328°27.7	23°22.7
Polaris	326°23.6	89°11.1
Acamar	315°36.2	-40°22.9
Menkar	314°40.0	4°01.1
Mirfak	309°14.4	49°47.9
Aldebaran	291°16.7	16°28.4
Rigel	281°34.8	-8°13.4
Capella	281°09.5	45°58.8
Bellatrix	278°57.5	6°20.0
Elnath	278°42.6	28°35.5
Alnilam	276°10.4	-1°12.8
Betelgeuse	271°27.0	7°24.2
Canopus	264°06.3	-52°41.2
Sirius	258°54.5	-16°41.5
Adhara	255°31.0	-28°56.8
Procyon	245°24.6	5°16.3
Pollux	243°56.7	28°04.2
Avior	234°27.3	-59°26.9
Suhail	223°09.8	-43°21.4
Miaplacidus	221°44.1	-69°38.3
Alphard	218°19.5	-8°34.7
Regulus	208°08.9	12°03.3
Dubhe	194°20.8	61°50.7
Denebola	182°58.1	14°40.4
Gienah	176°17.1	-17°26.3
Acrux	173°36.4	-62°59.5
Gacrux	172°27.9	-57°00.3
Alioth	166°41.9	56°03.3
Spica	158°56.7	-11°03.9
Alkaid	153°18.0	49°24.1
Hadar	149°22.5	-60°16.8
Menkent	148°36.2	-36°16.6
Arcturus	146°17.9	19°16.6
Rigil Kent.	140°25.1	-60°45.2
Kochab	137°19.9	74°13.6
Zuben'ubi	137°32.3	-15°57.9
Alphecca	126°31.7	26°46.5
Antares	112°56.1	-26°23.4
Atria	108°20.2	-68°59.6
Sabik	102°40.5	-15°42.1
Shaula	96°55.0	-37°05.4
Rasalhague	96°29.1	12°34.4
Eltanin	90°57.9	51°29.5
Kaus Aust.	84°16.1	-34°23.6
Vega	80°55.7	38°46.1
Nunki	76°28.5	-26°19.2
Altair	62°32.0	8°49.2
Peacock	53°57.5	-56°47.8
Deneb	49°48.2	45°13.1
Enif	34°10.9	9°47.5
Al Na'ir	28°14.1	-47°03.2
Fomalhaut	15°50.6	-29°43.3
Scheat	14°16.8	27°59.2
Markab	14°02.4	15°06.5

Dec 21 Mon	SHA	Mer.pass
Venus	50°44.6	14:38
Mars	177°00.9	06:13
Jupiter	147°30.3	08:11
Saturn	159°54.2	07:21

Dec 22 Tue	SHA	Mer.pass
Venus	50°24.3	14:35
Mars	176°35.7	06:11
Jupiter	147°20.8	08:08
Saturn	159°50.3	07:18

Dec 23 Wed	SHA	Mer.pass
Venus	50°06.1	14:32
Mars	176°10.8	06:09
Jupiter	147°11.3	08:04
Saturn	159°46.5	07:14

Horizontal parallax	
Venus:	0.4
Mars:	0.1

h	Sun		Moon				
Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°31.9	S23°26.2	239°33.8	15.3′	S06°39.9	10.7′	54.4′
1	195°31.6	26.2	254°08.1	15.3′	06°50.6	10.6′	54.4′
2	210°31.3	26.2	268°42.4	15.3′	07°01.2	10.6′	54.4′
3	225°31.0	·· 26.3	283°16.7	15.3′	07°11.8	10.6′	54.4′
4	240°30.7	26.3	297°51.0	15.3′	07°22.4	10.5′	54.4′
5	255°30.4	26.3	312°25.3	15.3′	07°32.9	10.6′	54.3′
6	270°30.1	S23°26.3	326°59.6	15.3′	S07°43.5	10.4′	54.3′
7	285°29.8	26.3	341°33.8	15.3′	07°53.9	10.5′	54.3′
8	300°29.5	26.3	356°08.1	15.2′	08°04.4	10.4′	54.3′
9	315°29.1	·· 26.3	10°42.3	15.2′	08°14.8	10.3′	54.3′
10	330°28.8	26.4	25°16.6	15.2′	08°25.1	10.4′	54.3′
11	345°28.5	26.4	39°50.8	15.2′	08°35.5	10.2′	54.3′
12	0°28.2	S23°26.4	54°25.0	15.2′	S08°45.7	10.3′	54.3′
13	15°27.9	26.4	68°59.2	15.2′	08°56.0	10.2′	54.2′
14	30°27.6	26.4	83°33.3	15.2′	09°06.2	10.2′	54.2′
15	45°27.3	·· 26.4	98°07.5	15.1′	09°16.4	10.1′	54.2′
16	60°27.0	26.4	112°41.6	15.1′	09°26.5	10.1′	54.2′
17	75°26.7	26.4	127°15.7	15.1′	09°36.6	10.0′	54.2′
18	90°26.3	S23°26.4	141°49.8	15.1′	S09°46.6	10.1′	54.2′
19	105°26.0	26.4	156°23.9	15.1′	09°56.7	9.9′	54.2′
20	120°25.7	26.4	170°58.0	15.0′	10°06.6	9.9′	54.2′
21	135°25.4	·· 26.4	185°32.0	15.0′	10°16.5	9.9′	54.1′
22	150°25.1	26.4	200°06.0	15.0′	10°26.4	9.8′	54.1′
23	165°24.8	26.4	214°40.0	15.0′	10°36.2	9.8′	54.1′
	SD = 16.3′	d = 0.0′	SD = 14.8′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°24.5	S23°26.4	229°14.0	15.0′	S10°46.0	9.8′	54.1′
1	195°24.2	26.4	243°48.0	14.9′	10°55.8	9.7′	54.1′
2	210°23.9	26.4	258°21.9	14.9′	11°05.5	9.6′	54.1′
3	225°23.5	·· 26.4	272°55.8	14.9′	11°15.1	9.6′	54.1′
4	240°23.2	26.4	287°29.7	14.9′	11°24.7	9.5′	54.1′
5	255°22.9	26.4	302°03.5	14.8′	11°34.2	9.5′	54.1′
6	270°22.6	S23°26.4	316°37.3	14.8′	S11°43.7	9.5′	54.1′
7	285°22.3	26.4	331°11.1	14.8′	11°53.2	9.4′	54.1′
8	300°22.0	26.4	345°44.9	14.7′	12°02.6	9.3′	54.0′
9	315°21.7	·· 26.4	0°18.7	14.7′	12°11.9	9.3′	54.0′
10	330°21.4	26.4	14°52.4	14.7′	12°21.2	9.3′	54.0′
11	345°21.0	26.4	29°26.1	14.7′	12°30.5	9.2′	54.0′
12	0°20.7	S23°26.4	43°59.7	14.6′	S12°39.7	9.1′	54.0′
13	15°20.4	26.3	58°33.4	14.6′	12°48.8	9.1′	54.0′
14	30°20.1	26.3	73°07.0	14.6′	12°57.9	9.1′	54.0′
15	45°19.8	·· 26.3	87°40.5	14.5′	13°07.0	8.9′	54.0′
16	60°19.5	26.3	102°14.1	14.5′	13°15.9	9.0′	54.0′
17	75°19.2	26.3	116°47.6	14.5′	13°24.9	8.8′	54.0′
18	90°18.9	S23°26.3	131°21.0	14.4′	S13°33.7	8.8′	54.0′
19	105°18.5	26.3	145°54.5	14.4′	13°42.5	8.8′	54.0′
20	120°18.2	26.2	160°27.9	14.4′	13°51.3	8.7′	54.0′
21	135°17.9	·· 26.2	175°01.3	14.3′	14°00.0	8.6′	54.0′
22	150°17.6	26.2	189°34.6	14.3′	14°08.6	8.6′	54.0′
23	165°17.3	26.2	204°07.9	14.3′	14°17.2	8.5′	54.0′
	SD = 16.3′	d = 0.0′	SD = 14.8′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°17.0	S23°26.2	218°41.2	14.2′	S14°25.7	8.5′	53.9′
1	195°16.7	26.1	233°14.4	14.2′	14°34.2	8.4′	53.9′
2	210°16.4	26.1	247°47.6	14.2′	14°42.6	8.3′	53.9′
3	225°16.1	·· 26.1	262°20.8	14.1′	14°50.9	8.3′	53.9′
4	240°15.7	26.1	276°53.9	14.1′	14°59.2	8.2′	53.9′
5	255°15.4	26.0	291°27.0	14.1′	15°07.4	8.1′	53.9′
6	270°15.1	S23°26.0	306°00.1	14.0′	S15°15.5	8.1′	53.9′
7	285°14.8	26.0	320°33.1	14.0′	15°23.6	8.0′	53.9′
8	300°14.5	26.0	335°06.1	13.9′	15°31.6	8.0′	53.9′
9	315°14.2	·· 25.9	349°39.0	13.9′	15°39.6	7.9′	53.9′
10	330°13.9	25.9	4°11.9	13.9′	15°47.5	7.8′	53.9′
11	345°13.6	25.9	18°44.8	13.8′	15°55.3	7.8′	53.9′
12	0°13.2	S23°25.9	33°17.6	13.8′	S16°03.1	7.6′	53.9′
13	15°12.9	25.8	47°50.4	13.8′	16°10.7	7.7′	53.9′
14	30°12.6	25.8	62°23.2	13.7′	16°18.4	7.5′	53.9′
15	45°12.3	·· 25.8	76°55.9	13.7′	16°25.9	7.5′	53.9′
16	60°12.0	25.7	91°28.6	13.6′	16°33.4	7.4′	53.9′
17	75°11.7	25.7	106°01.2	13.6′	16°40.8	7.3′	53.9′
18	90°11.4	S23°25.7	120°33.8	13.6′	S16°48.1	7.3′	53.9′
19	105°11.1	25.6	135°06.4	13.5′	16°55.4	7.2′	53.9′
20	120°10.7	25.6	149°38.9	13.5′	17°02.6	7.1′	53.9′
21	135°10.4	·· 25.6	164°11.4	13.4′	17°09.7	7.1′	53.9′
22	150°10.1	25.5	178°43.8	13.4′	17°16.8	6.9′	53.9′
23	165°09.8	25.5	193°16.2	13.4′	17°23.7	6.9′	53.9′
	SD = 16.3′	d = 0.0′	SD = 14.7′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	08:26	10:58	▬	▬	12:59	15:31
N 70°	08:06	09:55	▬	▬	14:02	15:51
68°	07:50	09:20	▬	▬	14:38	16:07
66°	07:37	08:54	10:35	13:22	15:03	16:20
64°	07:26	08:34	09:53	14:05	15:23	16:31
62°	07:16	08:18	09:24	14:33	15:39	16:41
60°	07:08	08:05	09:03	14:55	15:53	16:49
N 58°	07:00	07:53	08:45	15:12	16:04	16:57
56°	06:53	07:43	08:30	15:27	16:15	17:04
54°	06:47	07:34	08:18	15:40	16:24	17:10
52°	06:42	07:25	08:06	15:51	16:32	17:16
50°	06:36	07:18	07:56	16:01	16:39	17:21
45°	06:24	07:02	07:36	16:22	16:55	17:33
N 40°	06:14	06:48	07:19	16:38	17:09	17:43
35°	06:05	06:36	07:05	16:53	17:21	17:53
30°	05:56	06:26	06:52	17:05	17:31	18:01
20°	05:39	06:07	06:31	17:26	17:50	18:18
N 10°	05:23	05:50	06:12	17:45	18:08	18:34
0°	05:06	05:32	05:55	18:02	18:25	18:51
S 10°	04:47	05:14	05:37	18:20	18:43	19:10
20°	04:24	04:54	05:18	18:39	19:04	19:33
30°	03:55	04:29	04:56	19:01	19:29	20:02
35°	03:37	04:13	04:43	19:14	19:44	20:21
40°	03:13	03:55	04:28	19:29	20:02	20:44
45°	02:43	03:32	04:10	19:47	20:25	21:15
S 50°	01:57	03:03	03:47	20:10	20:55	22:00
52°	01:29	02:48	03:36	20:21	21:10	22:28
54°	00:42	02:29	03:24	20:33	21:28	23:15
56°	////	02:07	03:10	20:47	21:50	////
58°	////	01:37	02:53	21:04	22:20	////
S 60°	////	00:46	02:32	21:25	23:11	////

Lat.	**Moonrise** Mon	Tue	Wed	**Moonset** Mon	Tue	Wed
N 72°	03:43	05:32	07:35	12:27	12:07	11:36
N 70°	03:31	05:11	06:56	12:41	12:30	12:16
68°	03:22	04:54	06:29	12:51	12:48	12:44
66°	03:15	04:41	06:09	13:00	13:02	13:05
64°	03:08	04:30	05:53	13:08	13:14	13:22
62°	03:03	04:21	05:39	13:15	13:24	13:36
60°	02:58	04:13	05:28	13:20	13:32	13:48
N 58°	02:54	04:06	05:18	13:25	13:40	13:58
56°	02:50	04:00	05:10	13:30	13:47	14:07
54°	02:47	03:55	05:02	13:34	13:53	14:15
52°	02:44	03:50	04:56	13:38	13:58	14:22
50°	02:41	03:46	04:49	13:41	14:03	14:29
45°	02:35	03:36	04:37	13:48	14:14	14:43
N 40°	02:31	03:28	04:26	13:54	14:23	14:54
35°	02:26	03:22	04:17	14:00	14:31	15:04
30°	02:23	03:16	04:09	14:04	14:37	15:13
20°	02:16	03:05	03:55	14:12	14:49	15:28
N 10°	02:11	02:57	03:43	14:19	14:59	15:41
0°	02:06	02:48	03:32	14:26	15:09	15:54
S 10°	02:01	02:40	03:21	14:33	15:19	16:06
20°	01:55	02:31	03:09	14:40	15:29	16:19
30°	01:49	02:21	02:56	14:48	15:41	16:34
35°	01:46	02:16	02:48	14:53	15:48	16:43
40°	01:42	02:09	02:39	14:58	15:56	16:53
45°	01:37	02:02	02:29	15:05	16:05	17:05
S 50°	01:32	01:53	02:17	15:12	16:16	17:20
52°	01:29	01:49	02:11	15:16	16:22	17:27
54°	01:26	01:44	02:05	15:20	16:27	17:34
56°	01:23	01:39	01:58	15:24	16:34	17:43
58°	01:20	01:34	01:50	15:29	16:41	17:52
S 60°	01:16	01:28	01:41	15:34	16:49	18:03

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 25-27 24-10%
21	02:08	01:53	11:58	08:16	20:37	
22	01:38	01:23	11:59	08:59	21:21	
23	01:08	00:53	11:59	09:43	22:05	

December 24, 25, 26 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	92°26.0	142°15.9	S18°30.5	268°12.0	N00°35.5	239°27.9	S12°02.9	252°08.8	S05°58.2
1	107°28.4	157°17.8	29.9	283°13.4	35.1	254°30.0	03.0	267°11.1	58.2
2	122°30.9	172°19.6	29.2	298°14.8	34.7	269°32.1	03.2	282°13.4	58.3
3	137°33.4	187°21.5	·· 28.6	313°16.3	·· 34.3	284°34.1	·· 03.3	297°15.7	·· 58.3
4	152°35.8	202°23.3	28.0	328°17.7	33.9	299°36.2	03.4	312°18.0	58.4
5	167°38.3	217°25.2	27.3	343°19.1	33.5	314°38.3	03.6	327°20.3	58.4
6	182°40.8	232°27.0	S18°26.7	358°20.6	N00°33.1	329°40.4	S12°03.7	342°22.6	S05°58.5
7	197°43.2	247°28.9	26.0	13°22.0	32.7	344°42.4	03.8	357°24.9	58.5
8	212°45.7	262°30.8	25.4	28°23.5	32.3	359°44.5	03.9	12°27.2	58.6
9	227°48.1	277°32.7	·· 24.8	43°24.9	·· 31.9	14°46.6	·· 04.1	27°29.6	·· 58.6
10	242°50.6	292°34.5	24.1	58°26.3	31.5	29°48.7	04.2	42°31.9	58.7
11	257°53.1	307°36.4	23.5	73°27.8	31.1	44°50.8	04.3	57°34.2	58.7
12	272°55.5	322°38.3	S18°22.8	88°29.2	N00°30.7	59°52.8	S12°04.4	72°36.5	S05°58.8
13	287°58.0	337°40.2	22.2	103°30.7	30.3	74°54.9	04.6	87°38.8	58.8
14	303°00.5	352°42.1	21.6	118°32.1	29.9	89°57.0	04.7	102°41.1	58.9
15	318°02.9	7°44.0	·· 20.9	133°33.5	·· 29.5	104°59.1	·· 04.8	117°43.4	·· 58.9
16	333°05.4	22°45.9	20.3	148°35.0	29.0	120°01.1	05.0	132°45.7	59.0
17	348°07.9	37°47.8	19.7	163°36.4	28.6	135°03.2	05.1	147°48.1	59.0
18	3°10.3	52°49.7	S18°19.0	178°37.9	N00°28.2	150°05.3	S12°05.2	162°50.4	S05°59.1
19	18°12.8	67°51.6	18.4	193°39.3	27.8	165°07.4	05.3	177°52.7	59.1
20	33°15.3	82°53.5	17.7	208°40.8	27.4	180°09.5	05.5	192°55.0	59.2
21	48°17.7	97°55.4	·· 17.1	223°42.2	·· 27.0	195°11.5	·· 05.6	207°57.3	·· 59.2
22	63°20.2	112°57.3	16.5	238°43.6	26.6	210°13.6	05.7	222°59.6	59.3
23	78°22.6	127°59.3	15.8	253°45.1	26.2	225°15.7	05.8	238°01.9	59.3
Mer.pass. 17:47		ν 1.8′	d 0.6′	m -4.91	ν 1.4′	d 0.4′	m 0.84	ν 2.1′	d 0.1′ m -1.81	ν 2.3′	d 0.1′ m 0.78

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	93°25.1	143°01.2	S18°15.2	268°46.5	N00°25.8	240°17.8	S12°06.0	253°04.2	S05°59.4
1	108°27.6	158°03.1	14.6	283°48.0	25.4	255°19.9	06.1	268°06.6	59.4
2	123°30.0	173°05.1	13.9	298°49.4	25.0	270°21.9	06.2	283°08.9	59.5
3	138°32.5	188°07.0	·· 13.3	313°50.9	·· 24.6	285°24.0	·· 06.4	298°11.2	·· 59.5
4	153°35.0	203°09.0	12.7	328°52.3	24.2	300°26.1	06.5	313°13.5	59.6
5	168°37.4	218°10.9	12.0	343°53.8	23.8	315°28.2	06.6	328°15.8	59.6
6	183°39.9	233°12.9	S18°11.4	358°55.2	N00°23.4	330°30.3	S12°06.7	343°18.1	S05°59.7
7	198°42.4	248°14.8	10.8	13°56.7	23.0	345°32.3	06.9	358°20.4	59.7
8	213°44.8	263°16.8	10.1	28°58.1	22.6	0°34.4	07.0	13°22.8	59.8
9	228°47.3	278°18.8	·· 09.5	43°59.6	·· 22.2	15°36.5	·· 07.1	28°25.1	·· 59.8
10	243°49.7	293°20.7	08.9	59°01.0	21.8	30°38.6	07.2	43°27.4	59.9
11	258°52.2	308°22.7	08.2	74°02.5	21.4	45°40.7	07.4	58°29.7	05°59.9
12	273°54.7	323°24.7	S18°07.6	89°03.9	N00°21.0	60°42.7	S12°07.5	73°32.0	S06°00.0
13	288°57.1	338°26.7	07.0	104°05.4	20.6	75°44.8	07.6	88°34.3	00.0
14	303°59.6	353°28.6	06.3	119°06.8	20.2	90°46.9	07.7	103°36.7	00.1
15	319°02.1	8°30.6	·· 05.7	134°08.3	·· 19.8	105°49.0	·· 07.9	118°39.0	·· 00.1
16	334°04.5	23°32.6	05.1	149°09.7	19.4	120°51.1	08.0	133°41.3	00.1
17	349°07.0	38°34.6	04.5	164°11.2	19.0	135°53.2	08.1	148°43.6	00.2
18	4°09.5	53°36.6	S18°03.8	179°12.6	N00°18.6	150°55.2	S12°08.2	163°45.9	S06°00.2
19	19°11.9	68°38.6	03.2	194°14.1	18.2	165°57.3	08.4	178°48.2	00.3
20	34°14.4	83°40.6	02.6	209°15.5	17.8	180°59.4	08.5	193°50.6	00.3
21	49°16.9	98°42.7	·· 01.9	224°17.0	·· 17.4	196°01.5	·· 08.6	208°52.9	·· 00.4
22	64°19.3	113°44.7	01.3	239°18.4	17.0	211°03.6	08.7	223°55.2	00.4
23	79°21.8	128°46.7	00.7	254°19.9	16.6	226°05.7	08.9	238°57.5	00.5
Mer.pass. 17:43		ν 1.9′	d 0.6′	m -4.90	ν 1.4′	d 0.4′	m 0.82	ν 2.1′	d 0.1′ m -1.82	ν 2.3′	d 0.0′ m 0.78

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	94°24.2	143°48.7	S18°00.0	269°21.3	N00°16.2	241°07.7	S12°09.0	253°59.8	S06°00.5
1	109°26.7	158°50.8	17°59.4	284°22.8	15.8	256°09.8	09.1	269°02.1	00.6
2	124°29.2	173°52.8	58.8	299°24.2	15.4	271°11.9	09.2	284°04.5	00.6
3	139°31.6	188°54.8	·· 58.2	314°25.7	·· 15.0	286°14.0	·· 09.4	299°06.8	·· 00.7
4	154°34.1	203°56.9	57.5	329°27.2	14.6	301°16.1	09.5	314°09.1	00.7
5	169°36.6	218°58.9	56.9	344°28.6	14.2	316°18.2	09.6	329°11.4	00.8
6	184°39.0	234°01.0	S17°56.3	359°30.1	N00°13.8	331°20.3	S12°09.7	344°13.7	S06°00.8
7	199°41.5	249°03.0	55.7	14°31.5	13.4	346°22.3	09.9	359°16.1	00.9
8	214°44.0	264°05.1	55.0	29°33.0	13.0	1°24.4	10.0	14°18.4	00.9
9	229°46.4	279°07.1	·· 54.4	44°34.4	·· 12.6	16°26.5	·· 10.1	29°20.7	·· 01.0
10	244°48.9	294°09.2	53.8	59°35.9	12.2	31°28.6	10.2	44°23.0	01.0
11	259°51.4	309°11.3	53.2	74°37.3	11.8	46°30.7	10.4	59°25.3	01.1
12	274°53.8	324°13.4	S17°52.5	89°38.8	N00°11.4	61°32.8	S12°10.5	74°27.6	S06°01.1
13	289°56.3	339°15.4	51.9	104°40.3	11.0	76°34.9	10.6	89°30.0	01.1
14	304°58.7	354°17.5	51.3	119°41.7	10.7	91°36.9	10.7	104°32.3	01.2
15	320°01.2	9°19.6	·· 50.7	134°43.2	·· 10.3	106°39.0	·· 10.9	119°34.6	·· 01.2
16	335°03.7	24°21.7	50.0	149°44.6	09.9	121°41.1	11.0	134°36.9	01.3
17	350°06.1	39°23.8	49.4	164°46.1	09.5	136°43.2	11.1	149°39.2	01.3
18	5°08.6	54°25.9	S17°48.8	179°47.6	N00°09.1	151°45.3	S12°11.2	164°41.6	S06°01.4
19	20°11.1	69°28.0	48.2	194°49.0	08.7	166°47.4	11.4	179°43.9	01.4
20	35°13.5	84°30.1	47.6	209°50.5	08.3	181°49.5	11.5	194°46.2	01.5
21	50°16.0	99°32.2	·· 46.9	224°52.0	·· 07.9	196°51.5	·· 11.6	209°48.5	·· 01.5
22	65°18.5	114°34.3	46.3	239°53.4	07.5	211°53.6	11.7	224°50.8	01.6
23	80°20.9	129°36.4	45.7	254°54.9	07.1	226°55.7	11.9	239°53.2	01.6
Mer.pass. 17:39		ν 2.0′	d 0.6′	m -4.90	ν 1.5′	d 0.4′	m 0.81	ν 2.1′	d 0.1′ m -1.82	ν 2.3′	d 0.0′ m 0.78

Stars

	SHA	Dec
Alpheratz	358°08.4	28°59.5
Ankaa	353°39.3	-42°24.6
Schedar	350°07.9	56°26.5
Diphda	349°19.9	-18°05.4
Achernar	335°44.4	-57°20.1
Hamal	328°27.7	23°22.7
Polaris	326°24.4	89°11.1
Acamar	315°36.3	-40°22.9
Menkar	314°40.0	4°01.1
Mirfak	309°14.4	49°47.9
Aldebaran	291°16.7	16°28.4
Rigel	281°34.8	-8°13.4
Capella	281°09.5	45°58.8
Bellatrix	278°57.5	6°20.0
Elnath	278°42.6	28°35.5
Alnilam	276°10.4	-1°12.8
Betelgeuse	271°27.0	7°24.2
Canopus	264°06.2	-52°41.2
Sirius	258°54.5	-16°41.5
Adhara	255°31.0	-28°56.8
Procyon	245°24.5	5°16.3
Pollux	243°56.7	28°04.2
Avior	234°27.3	-59°26.9
Suhail	223°09.8	-43°21.4
Miaplacidus	221°44.1	-69°38.3
Alphard	218°19.5	-8°34.7
Regulus	208°08.9	12°03.3
Dubhe	194°20.8	61°50.7
Denebola	182°58.1	14°40.4
Gienah	176°17.1	-17°26.3
Acrux	173°36.4	-62°59.5
Gacrux	172°27.8	-57°00.3
Alioth	166°41.8	56°03.3
Spica	158°56.7	-11°03.9
Alkaid	153°18.0	49°24.1
Hadar	149°22.4	-60°16.8
Menkent	148°36.2	-36°16.6
Arcturus	146°17.8	19°16.6
Rigil Kent.	140°25.0	-60°45.2
Kochab	137°19.8	74°13.6
Zuben'ubi	137°32.3	-15°57.9
Alphecca	126°31.7	26°46.5
Antares	112°56.1	-26°23.4
Atria	108°20.2	-68°59.6
Sabik	102°40.5	-15°42.1
Shaula	96°55.0	-37°05.4
Rasalhague	96°29.1	12°34.4
Eltanin	90°57.9	51°29.5
Kaus Aust.	84°16.1	-34°23.6
Vega	80°55.7	38°46.0
Nunki	76°28.4	-26°19.2
Altair	62°32.0	8°49.2
Peacock	53°57.5	-56°47.8
Deneb	49°48.2	45°13.1
Enif	34°10.9	9°47.5
Al Na'ir	28°14.1	-47°03.2
Fomalhaut	15°50.6	-29°43.3
Scheat	14°16.8	27°59.2
Markab	14°02.4	15°06.5

Dec 24 Thu	SHA	Mer.pass
Venus	49°50.0	14:29
Mars	175°46.0	06:07
Jupiter	147°01.9	08:01
Saturn	159°42.8	07:10

Dec 25 Fri	SHA	Mer.pass
Venus	49°36.1	14:26
Mars	175°21.4	06:04
Jupiter	146°52.7	07:58
Saturn	159°39.1	07:07

Dec 26 Sat	SHA	Mer.pass
Venus	49°24.5	14:23
Mars	174°57.1	06:02
Jupiter	146°43.5	07:54
Saturn	159°35.6	07:03

Horizontal parallax	
Venus:	0.4
Mars:	0.1

h	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°09.5	S23°25.4	207°48.6	13.3′	S17°30.6	6.9′	53.9′
1	195°09.2	25.4	222°20.9	13.3′	17°37.5	6.7′	53.9′
2	210°08.9	25.4	236°53.1	13.2′	17°44.2	6.7′	53.9′
3	225°08.6	·· 25.3	251°25.4	13.2′	17°50.9	6.6′	53.9′
4	240°08.3	25.3	265°57.6	13.2′	17°57.5	6.5′	53.9′
5	255°07.9	25.2	280°29.7	13.1′	18°04.0	6.4′	53.9′
6	270°07.6	S23°25.2	295°01.8	13.1′	S18°10.4	6.4′	53.9′
7	285°07.3	25.1	309°33.9	13.0′	18°16.8	6.3′	53.9′
8	300°07.0	25.1	324°06.0	13.0′	18°23.1	6.2′	53.9′
9	315°06.7	·· 25.0	338°37.9	13.0′	18°29.3	6.1′	53.9′
10	330°06.4	25.0	353°09.9	12.9′	18°35.4	6.0′	53.9′
11	345°06.1	24.9	7°41.8	12.9′	18°41.4	6.0′	53.9′
12	0°05.8	S23°24.9	22°13.7	12.8′	S18°47.4	5.9′	53.9′
13	15°05.4	24.8	36°45.5	12.8′	18°53.3	5.8′	53.9′
14	30°05.1	24.8	51°17.3	12.7′	18°59.1	5.7′	53.9′
15	45°04.8	·· 24.7	65°49.0	12.7′	19°04.8	5.6′	53.9′
16	60°04.5	24.7	80°20.7	12.7′	19°10.4	5.6′	53.9′
17	75°04.2	24.6	94°52.4	12.6′	19°16.0	5.4′	53.9′
18	90°03.9	S23°24.6	109°24.0	12.6′	S19°21.4	5.4′	53.9′
19	105°03.6	24.5	123°55.6	12.6′	19°26.8	5.3′	53.9′
20	120°03.3	24.5	138°27.2	12.5′	19°32.1	5.2′	53.9′
21	135°03.0	·· 24.4	152°58.7	12.5′	19°37.3	5.1′	53.9′
22	150°02.6	24.4	167°30.2	12.4′	19°42.4	5.0′	53.9′
23	165°02.3	24.3	182°01.6	12.4′	19°47.4	5.0′	53.9′
	SD = 16.3′	d = 0.0′	SD = 14.7′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°02.0	S23°24.2	196°33.0	12.4′	S19°52.4	4.8′	53.9′
1	195°01.7	24.2	211°04.4	12.3′	19°57.2	4.8′	54.0′
2	210°01.4	24.1	225°35.7	12.3′	20°02.0	4.7′	54.0′
3	225°01.1	·· 24.1	240°07.0	12.2′	20°06.7	4.5′	54.0′
4	240°00.8	24.0	254°38.2	12.2′	20°11.2	4.5′	54.0′
5	255°00.5	23.9	269°09.4	12.2′	20°15.7	4.4′	54.0′
6	270°00.1	S23°23.9	283°40.6	12.1′	S20°20.1	4.3′	54.0′
7	284°59.8	23.8	298°11.7	12.1′	20°24.4	4.2′	54.0′
8	299°59.5	23.7	312°42.8	12.1′	20°28.6	4.2′	54.0′
9	314°59.2	·· 23.7	327°13.9	12.0′	20°32.8	4.0′	54.0′
10	329°58.9	23.6	341°44.9	12.0′	20°36.8	3.9′	54.0′
11	344°58.6	23.5	356°15.9	12.0′	20°40.7	3.9′	54.0′
12	359°58.3	S23°23.5	10°46.8	11.9′	S20°44.6	3.7′	54.0′
13	14°58.0	23.4	25°17.7	11.9′	20°48.3	3.7′	54.0′
14	29°57.7	23.3	39°48.6	11.9′	20°52.0	3.5′	54.0′
15	44°57.3	·· 23.2	54°19.5	11.8′	20°55.5	3.5′	54.0′
16	59°57.0	23.2	68°50.3	11.8′	20°59.0	3.3′	54.0′
17	74°56.7	23.1	83°21.1	11.8′	21°02.3	3.3′	54.0′
18	89°56.4	S23°23.0	97°51.8	11.7′	S21°05.6	3.2′	54.0′
19	104°56.1	23.0	112°22.6	11.7′	21°08.8	3.0′	54.1′
20	119°55.8	22.9	126°53.3	11.7′	21°11.8	3.0′	54.1′
21	134°55.5	·· 22.8	141°23.9	11.6′	21°14.8	2.9′	54.1′
22	149°55.2	22.7	155°54.5	11.6′	21°17.7	2.8′	54.1′
23	164°54.9	22.6	170°25.1	11.6′	21°20.5	2.6′	54.1′
	SD = 16.3′	d = 0.1′	SD = 14.7′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°54.6	S23°22.6	184°55.7	11.5′	S21°23.1	2.6′	54.1′
1	194°54.2	22.5	199°26.3	11.5′	21°25.7	2.5′	54.1′
2	209°53.9	22.4	213°56.8	11.5′	21°28.2	2.4′	54.1′
3	224°53.6	·· 22.3	228°27.3	11.5′	21°30.6	2.3′	54.1′
4	239°53.3	22.2	242°57.7	11.4′	21°32.9	2.1′	54.1′
5	254°53.0	22.2	257°28.2	11.4′	21°35.0	2.1′	54.1′
6	269°52.7	S23°22.1	271°58.6	11.4′	S21°37.1	2.0′	54.1′
7	284°52.4	22.0	286°28.9	11.4′	21°39.1	1.8′	54.1′
8	299°52.1	21.9	300°59.3	11.3′	21°40.9	1.8′	54.2′
9	314°51.8	·· 21.8	315°29.6	11.3′	21°42.7	1.7′	54.2′
10	329°51.4	21.7	329°59.9	11.3′	21°44.4	1.5′	54.2′
11	344°51.1	21.6	344°30.2	11.3′	21°45.9	1.5′	54.2′
12	359°50.8	S23°21.6	359°00.5	11.2′	S21°47.4	1.4′	54.2′
13	14°50.5	21.5	13°30.7	11.2′	21°48.8	1.2′	54.2′
14	29°50.2	21.4	28°01.0	11.2′	21°50.0	1.2′	54.2′
15	44°49.9	·· 21.3	42°31.2	11.2′	21°51.2	1.0′	54.2′
16	59°49.6	21.2	57°01.4	11.2′	21°52.2	0.9′	54.2′
17	74°49.3	21.1	71°31.5	11.1′	21°53.1	0.9′	54.2′
18	89°49.0	S23°21.0	86°01.7	11.1′	S21°54.0	0.7′	54.3′
19	104°48.7	20.9	100°31.8	11.1′	21°54.7	0.6′	54.3′
20	119°48.3	20.8	115°01.9	11.1′	21°55.3	0.6′	54.3′
21	134°48.0	·· 20.7	129°32.0	11.1′	21°55.9	0.4′	54.3′
22	149°47.7	20.6	144°02.1	11.1′	21°56.3	0.3′	54.3′
23	164°47.4	20.5	158°32.2	11.1′	21°56.6	0.2′	54.3′
	SD = 16.3′	d = 0.1′	SD = 14.8′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	08:27	10:57	▬	▬	13:03	15:33
N 70°	08:07	09:55	▬	▬	14:05	15:53
68°	07:51	09:20	▬	▬	14:40	16:09
66°	07:38	08:55	10:36	13:25	15:05	16:22
64°	07:27	08:35	09:53	14:07	15:25	16:33
62°	07:17	08:19	09:25	14:35	15:41	16:43
60°	07:09	08:06	09:04	14:57	15:55	16:51
N 58°	07:01	07:54	08:46	15:14	16:06	16:59
56°	06:55	07:44	08:31	15:29	16:16	17:06
54°	06:49	07:35	08:19	15:42	16:26	17:12
52°	06:43	07:27	08:08	15:53	16:34	17:17
50°	06:38	07:19	07:58	16:03	16:41	17:23
45°	06:26	07:03	07:37	16:23	16:57	17:34
N 40°	06:15	06:50	07:20	16:40	17:11	17:45
35°	06:06	06:38	07:06	16:54	17:23	17:54
30°	05:57	06:27	06:54	17:07	17:33	18:03
20°	05:41	06:08	06:32	17:28	17:52	18:19
N 10°	05:25	05:51	06:14	17:46	18:09	18:36
0°	05:08	05:34	05:56	18:04	18:26	18:53
S 10°	04:49	05:16	05:39	18:21	18:44	19:12
20°	04:26	04:55	05:20	18:40	19:05	19:34
30°	03:57	04:30	04:58	19:02	19:30	20:03
35°	03:38	04:15	04:45	19:15	19:45	20:22
40°	03:15	03:57	04:30	19:30	20:03	20:45
45°	02:44	03:34	04:12	19:48	20:26	21:16
S 50°	01:59	03:05	03:49	20:11	20:56	22:01
52°	01:31	02:49	03:38	20:22	21:11	22:29
54°	00:45	02:31	03:26	20:34	21:29	23:15
56°	////	02:09	03:12	20:48	21:51	////
58°	////	01:39	02:55	21:05	22:20	////
S 60°	////	00:49	02:34	21:25	23:10	////

Lat.	**Moonrise** Thu	Fri	Sat	**Moonset** Thu	Fri	Sat
N 72°	▬	▬	▬	▬	▬	▬
N 70°	08:55	▬	▬	11:52	▬	▬
68°	08:07	09:49	11:37	12:40	12:35	12:29
66°	07:37	09:02	10:17	13:11	13:23	13:49
64°	07:14	08:32	09:40	13:34	13:54	14:26
62°	06:56	08:09	09:14	13:52	14:17	14:53
60°	06:41	07:51	08:53	14:08	14:35	15:13
N 58°	06:29	07:36	08:36	14:21	14:51	15:30
56°	06:18	07:23	08:22	14:32	15:04	15:44
54°	06:08	07:12	08:10	14:42	15:15	15:57
52°	06:00	07:02	07:59	14:51	15:25	16:08
50°	05:52	06:53	07:49	14:59	15:35	16:17
45°	05:36	06:34	07:29	15:16	15:54	16:38
N 40°	05:23	06:19	07:13	15:29	16:09	16:54
35°	05:12	06:06	06:59	15:41	16:23	17:08
30°	05:02	05:55	06:47	15:52	16:34	17:20
20°	04:45	05:36	06:27	16:09	16:54	17:41
N 10°	04:31	05:19	06:09	16:25	17:11	17:59
0°	04:17	05:04	05:52	16:39	17:27	18:16
S 10°	04:04	04:48	05:36	16:54	17:43	18:33
20°	03:49	04:32	05:18	17:10	18:00	18:51
30°	03:33	04:13	04:58	17:28	18:20	19:12
35°	03:23	04:02	04:46	17:38	18:32	19:24
40°	03:12	03:50	04:32	17:50	18:45	19:38
45°	03:00	03:35	04:16	18:04	19:01	19:54
S 50°	02:44	03:17	03:56	18:22	19:20	20:14
52°	02:37	03:09	03:47	18:30	19:30	20:24
54°	02:29	02:59	03:37	18:39	19:40	20:35
56°	02:20	02:49	03:25	18:49	19:52	20:47
58°	02:10	02:36	03:11	19:01	20:05	21:01
S 60°	01:59	02:22	02:55	19:15	20:21	21:18

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 28-0 5-0%
24	00:38	00:23	12:00	10:28	22:52	
25	00:08	00:07	12:00	11:15	23:40	
26	00:22	00:37	12:01	12:04	–:–	

December 27, 28, 29 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	95°23.4	144°38.6	S17°45.1	269°56.3	N00°06.7	241°57.8	S12°12.0	254°55.5	S06°01.7
1	110°25.9	159°40.7	44.5	284°57.8	06.3	256°59.9	12.1	269°57.8	01.7
2	125°28.3	174°42.8	43.8	299°59.3	05.9	272°02.0	12.2	285°00.1	01.7
3	140°30.8	189°45.0	·· 43.2	315°00.7	·· 05.5	287°04.1	·· 12.3	300°02.4	·· 01.8
4	155°33.2	204°47.1	42.6	330°02.2	05.1	302°06.2	12.5	315°04.8	01.8
5	170°35.7	219°49.2	42.0	345°03.7	04.7	317°08.3	12.6	330°07.1	01.9
6	185°38.2	234°51.4	S17°41.4	0°05.1	N00°04.3	332°10.3	S12°12.7	345°09.4	S06°01.9
7	200°40.6	249°53.5	40.7	15°06.6	04.0	347°12.4	12.8	0°11.7	02.0
8	215°43.1	264°55.7	40.1	30°08.1	03.6	2°14.5	13.0	15°14.1	02.0
9	230°45.6	279°57.9	·· 39.5	45°09.5	·· 03.2	17°16.6	·· 13.1	30°16.4	·· 02.1
10	245°48.0	295°00.0	38.9	60°11.0	02.8	32°18.7	13.2	45°18.7	02.1
11	260°50.5	310°02.2	38.3	75°12.5	02.4	47°20.8	13.3	60°21.0	02.2
12	275°53.0	325°04.4	S17°37.7	90°13.9	N00°02.0	62°22.9	S12°13.5	75°23.3	S06°02.2
13	290°55.4	340°06.5	37.1	105°15.4	01.6	77°25.0	13.6	90°25.7	02.2
14	305°57.9	355°08.7	36.4	120°16.9	01.2	92°27.1	13.7	105°28.0	02.3
15	321°00.4	10°10.9	·· 35.8	135°18.3	·· 00.8	107°29.2	·· 13.8	120°30.3	·· 02.3
16	336°02.8	25°13.1	35.2	150°19.8	00.4	122°31.2	13.9	135°32.6	02.4
17	351°05.3	40°15.3	34.6	165°21.3	N00°00.0	137°33.3	14.1	150°35.0	02.4
18	6°07.7	55°17.5	S17°34.0	180°22.7	S00°00.4	152°35.4	S12°14.2	165°37.3	S06°02.5
19	21°10.2	70°19.7	33.4	195°24.2	00.7	167°37.5	14.3	180°39.6	02.5
20	36°12.7	85°21.9	32.8	210°25.7	01.1	182°39.6	14.4	195°41.9	02.6
21	51°15.1	100°24.1	·· 32.2	225°27.2	·· 01.5	197°41.7	·· 14.5	210°44.3	·· 02.6
22	66°17.6	115°26.3	31.5	240°28.6	01.9	212°43.8	14.7	225°46.6	02.7
23	81°20.1	130°28.5	30.9	255°30.1	02.3	227°45.9	14.8	240°48.9	02.7
Mer.pass. 17:36		ν 2.1′ d 0.6′	m -4.89	ν 1.5′ d 0.4′	m 0.79	ν 2.1′ d 0.1′	m -1.83	ν 2.3′ d 0.0′	m 0.77

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	96°22.5	145°30.8	S17°30.3	270°31.6	S00°02.7	242°48.0	S12°14.9	255°51.2	S06°02.7
1	111°25.0	160°33.0	29.7	285°33.0	03.1	257°50.1	15.0	270°53.6	02.8
2	126°27.5	175°35.2	29.1	300°34.5	03.5	272°52.2	15.2	285°55.9	02.8
3	141°29.9	190°37.5	·· 28.5	315°36.0	·· 03.9	287°54.3	·· 15.3	300°58.2	·· 02.9
4	156°32.4	205°39.7	27.9	330°37.5	04.2	302°56.3	15.4	316°00.5	02.9
5	171°34.8	220°42.0	27.3	345°38.9	04.6	317°58.4	15.5	331°02.9	03.0
6	186°37.3	235°44.2	S17°26.7	0°40.4	S00°05.0	333°00.5	S12°15.6	346°05.2	S06°03.0
7	201°39.8	250°46.5	26.1	15°41.9	05.4	348°02.6	15.8	1°07.5	03.1
8	216°42.2	265°48.7	25.5	30°43.4	05.8	3°04.7	15.9	16°09.8	03.1
9	231°44.7	280°51.0	·· 24.8	45°44.8	·· 06.2	18°06.8	·· 16.0	31°12.2	·· 03.1
10	246°47.2	295°53.2	24.2	60°46.3	06.6	33°08.9	16.1	46°14.5	03.2
11	261°49.6	310°55.5	23.6	75°47.8	07.0	48°11.0	16.2	61°16.8	03.2
12	276°52.1	325°57.8	S17°23.0	90°49.3	S00°07.3	63°13.1	S12°16.4	76°19.1	S06°03.3
13	291°54.6	341°00.1	22.4	105°50.8	07.7	78°15.2	16.5	91°21.5	03.3
14	306°57.0	356°02.3	21.8	120°52.2	08.1	93°17.3	16.6	106°23.8	03.4
15	321°59.5	11°04.6	·· 21.2	135°53.7	·· 08.5	108°19.4	·· 16.7	121°26.1	·· 03.4
16	337°02.0	26°06.9	20.6	150°55.2	08.9	123°21.5	16.8	136°28.4	03.4
17	352°04.4	41°09.2	20.0	165°56.7	09.3	138°23.6	17.0	151°30.8	03.5
18	7°06.9	56°11.5	S17°19.4	180°58.1	S00°09.7	153°25.7	S12°17.1	166°33.1	S06°03.5
19	22°09.3	71°13.8	18.8	195°59.6	10.1	168°27.8	17.2	181°35.4	03.6
20	37°11.8	86°16.1	18.2	211°01.1	10.4	183°29.9	17.3	196°37.8	03.6
21	52°14.3	101°18.4	·· 17.6	226°02.6	·· 10.8	198°32.0	·· 17.4	211°40.1	·· 03.7
22	67°16.7	116°20.7	17.0	241°04.1	11.2	213°34.1	17.6	226°42.4	03.7
23	82°19.2	131°23.1	16.4	256°05.5	11.6	228°36.2	17.7	241°44.7	03.7
Mer.pass. 17:32		ν 2.2′ d 0.6′	m -4.88	ν 1.5′ d 0.4′	m 0.77	ν 2.1′ d 0.1′	m -1.83	ν 2.3′ d 0.0′	m 0.77

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	97°21.7	146°25.4	S17°15.8	271°07.0	S00°12.0	243°38.2	S12°17.8	256°47.1	S06°03.8
1	112°24.1	161°27.7	15.2	286°08.5	12.4	258°40.3	17.9	271°49.4	03.8
2	127°26.6	176°30.1	14.6	301°10.0	12.7	273°42.4	18.0	286°51.7	03.9
3	142°29.1	191°32.4	·· 14.0	316°11.5	·· 13.1	288°44.5	·· 18.2	301°54.0	·· 03.9
4	157°31.5	206°34.7	13.4	331°13.0	13.5	303°46.6	18.3	316°56.4	04.0
5	172°34.0	221°37.1	12.8	346°14.4	13.9	318°48.7	18.4	331°58.7	04.0
6	187°36.5	236°39.4	S17°12.2	1°15.9	S00°14.3	333°50.8	S12°18.5	347°01.0	S06°04.0
7	202°38.9	251°41.8	11.6	16°17.4	14.7	348°52.9	18.6	2°03.4	04.1
8	217°41.4	266°44.1	11.0	31°18.9	15.0	3°55.0	18.8	17°05.7	04.1
9	232°43.8	281°46.5	·· 10.4	46°20.4	·· 15.4	18°57.1	·· 18.9	32°08.0	·· 04.2
10	247°46.3	296°48.9	09.8	61°21.9	15.8	33°59.2	19.0	47°10.4	04.2
11	262°48.8	311°51.3	09.2	76°23.4	16.2	49°01.3	19.1	62°12.7	04.3
12	277°51.2	326°53.6	S17°08.6	91°24.8	S00°16.6	64°03.4	S12°19.2	77°15.0	S06°04.3
13	292°53.7	341°56.0	08.1	106°26.3	17.0	79°05.5	19.4	92°17.3	04.3
14	307°56.2	356°58.4	07.5	121°27.8	17.3	94°07.6	19.5	107°19.7	04.4
15	322°58.6	12°00.8	·· 06.9	136°29.3	·· 17.7	109°09.7	·· 19.6	122°22.0	·· 04.4
16	338°01.1	27°03.2	06.3	151°30.8	18.1	124°11.8	19.7	137°24.3	04.5
17	353°03.6	42°05.6	05.7	166°32.3	18.5	139°13.9	19.8	152°26.7	04.5
18	8°06.0	57°08.0	S17°05.1	181°33.8	S00°18.9	154°16.0	S12°19.9	167°29.0	S06°04.6
19	23°08.5	72°10.4	04.5	196°35.3	19.2	169°18.1	20.1	182°31.3	04.6
20	38°11.0	87°12.8	03.9	211°36.8	19.6	184°20.2	20.2	197°33.7	04.6
21	53°13.4	102°15.2	·· 03.3	226°38.2	·· 20.0	199°22.3	·· 20.3	212°36.0	·· 04.7
22	68°15.9	117°17.6	02.7	241°39.7	20.4	214°24.4	20.4	227°38.3	04.7
23	83°18.3	132°20.1	02.1	256°41.2	20.8	229°26.5	20.5	242°40.6	04.8
Mer.pass. 17:28		ν 2.3′ d 0.6′	m -4.87	ν 1.5′ d 0.4′	m 0.76	ν 2.1′ d 0.1′	m -1.83	ν 2.3′ d 0.0′	m 0.77

Stars

	SHA	Dec
Alpheratz	358°08.4	28°59.5
Ankaa	353°39.3	-42°24.6
Schedar	350°08.0	56°26.5
Diphda	349°19.9	-18°05.4
Achernar	335°44.4	-57°20.1
Hamal	328°27.7	23°22.7
Polaris	326°25.2	89°11.1
Acamar	315°36.3	-40°22.9
Menkar	314°40.0	4°01.1
Mirfak	309°14.4	49°47.9
Aldebaran	291°16.7	16°28.4
Rigel	281°34.8	-8°13.4
Capella	281°09.5	45°58.8
Bellatrix	278°57.4	6°20.0
Elnath	278°42.6	28°35.5
Alnilam	276°10.4	-1°12.8
Betelgeuse	271°27.0	7°24.2
Canopus	264°06.2	-52°41.2
Sirius	258°54.5	-16°41.5
Adhara	255°31.0	-28°56.8
Procyon	245°24.5	5°16.3
Pollux	243°56.7	28°04.2
Avior	234°27.3	-59°26.9
Suhail	223°09.8	-43°21.4
Miaplacidus	221°44.1	-69°38.3
Alphard	218°19.4	-8°34.7
Regulus	208°08.9	12°03.3
Dubhe	194°20.8	61°50.7
Denebola	182°58.1	14°40.4
Gienah	176°17.0	-17°26.3
Acrux	173°36.3	-62°59.6
Gacrux	172°27.8	-57°00.4
Alioth	166°41.8	56°03.3
Spica	158°56.7	-11°03.9
Alkaid	153°18.0	49°24.0
Hadar	149°22.4	-60°16.8
Menkent	148°36.1	-36°16.6
Arcturus	146°17.8	19°16.6
Rigil Kent.	140°25.0	-60°45.2
Kochab	137°19.8	74°13.6
Zuben'ubi	137°32.3	-15°57.9
Alphecca	126°31.6	26°46.5
Antares	112°56.1	-26°23.4
Atria	108°20.1	-68°59.6
Sabik	102°40.4	-15°42.1
Shaula	96°55.0	-37°05.4
Rasalhague	96°29.1	12°34.4
Eltanin	90°57.9	51°29.5
Kaus Aust.	84°16.1	-34°23.6
Vega	80°55.7	38°46.0
Nunki	76°28.4	-26°19.2
Altair	62°32.0	8°49.2
Peacock	53°57.5	-56°47.8
Deneb	49°48.3	45°13.0
Enif	34°10.9	9°47.5
Al Na'ir	28°14.1	-47°03.2
Fomalhaut	15°50.6	-29°43.3
Scheat	14°16.8	27°59.1
Markab	14°02.4	15°06.5

Dec 27 Sun	SHA	Mer.pass
Venus	49°15.2	14:19
Mars	174°33.0	06:00
Jupiter	146°34.4	07:51
Saturn	159°32.1	06:59

Dec 28 Mon	SHA	Mer.pass
Venus	49°08.2	14:16
Mars	174°09.0	05:57
Jupiter	146°25.4	07:48
Saturn	159°28.7	06:56

Dec 29 Tue	SHA	Mer.pass
Venus	49°03.7	14:12
Mars	173°45.4	05:55
Jupiter	146°16.6	07:44
Saturn	159°25.4	06:52

Horizontal parallax	
Venus:	0.4
Mars:	0.1

h — Sun — Moon

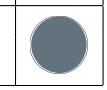
Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	179°47.1	S23°20.4	173°02.2	11.0′	S21°56.8	0.1′	54.3′
1	194°46.8	20.3	187°32.2	11.0′	21°56.9	0.0′	54.3′
2	209°46.5	20.2	202°02.3	11.0′	21°56.9	0.1′	54.3′
3	224°46.2	·· 20.1	216°32.3	11.0′	21°56.8	0.3′	54.3′
4	239°45.9	20.0	231°02.3	11.0′	21°56.5	0.3′	54.4′
5	254°45.6	19.9	245°32.3	11.0′	21°56.2	0.4′	54.4′
6	269°45.3	S23°19.8	260°02.3	11.0′	S21°55.8	0.6′	54.4′
7	284°44.9	19.7	274°32.2	11.0′	21°55.2	0.6′	54.4′
8	299°44.6	19.6	289°02.2	11.0′	21°54.6	0.8′	54.4′
9	314°44.3	·· 19.5	303°32.2	11.0′	21°53.8	0.8′	54.4′
10	329°44.0	19.4	318°02.1	10.9′	21°53.0	1.0′	54.4′
11	344°43.7	19.3	332°32.1	10.9′	21°52.0	1.0′	54.4′
12	359°43.4	S23°19.2	347°02.0	10.9′	S21°51.0	1.2′	54.5′
13	14°43.1	19.1	1°31.9	10.9′	21°49.8	1.3′	54.5′
14	29°42.8	19.0	16°01.9	10.9′	21°48.5	1.4′	54.5′
15	44°42.5	·· 18.9	30°31.8	10.9′	21°47.1	1.5′	54.5′
16	59°42.2	18.7	45°01.7	10.9′	21°45.6	1.6′	54.5′
17	74°41.9	18.6	59°31.6	10.9′	21°44.0	1.7′	54.5′
18	89°41.6	S23°18.5	74°01.6	10.9′	S21°42.3	1.8′	54.5′
19	104°41.2	18.4	88°31.5	10.9′	21°40.5	2.0′	54.5′
20	119°40.9	18.3	103°01.4	10.9′	21°38.5	2.0′	54.6′
21	134°40.6	·· 18.2	117°31.3	10.9′	21°36.5	2.1′	54.6′
22	149°40.3	18.1	132°01.2	10.9′	21°34.4	2.3′	54.6′
23	164°40.0	17.9	146°31.2	10.9′	21°32.1	2.3′	54.6′
	SD = 16.3′	d = 0.1′		SD = 14.8′			

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	179°39.7	S23°17.8	161°01.1	10.9′	S21°29.8	2.5′	54.6′
1	194°39.4	17.7	175°31.0	10.9′	21°27.3	2.5′	54.6′
2	209°39.1	17.6	190°00.9	10.9′	21°24.8	2.7′	54.6′
3	224°38.8	·· 17.5	204°30.9	10.9′	21°22.1	2.8′	54.6′
4	239°38.5	17.3	219°00.8	10.9′	21°19.3	2.8′	54.7′
5	254°38.2	17.2	233°30.8	11.0′	21°16.5	3.0′	54.7′
6	269°37.9	S23°17.1	248°00.7	11.0′	S21°13.5	3.1′	54.7′
7	284°37.6	17.0	262°30.7	11.0′	21°10.4	3.2′	54.7′
8	299°37.2	16.8	277°00.7	11.0′	21°07.2	3.3′	54.7′
9	314°36.9	·· 16.7	291°30.6	11.0′	21°03.9	3.4′	54.7′
10	329°36.6	16.6	306°00.6	11.0′	21°00.5	3.5′	54.7′
11	344°36.3	16.5	320°30.6	11.0′	20°57.0	3.6′	54.8′
12	359°36.0	S23°16.3	335°00.6	11.0′	S20°53.4	3.7′	54.8′
13	14°35.7	16.2	349°30.6	11.0′	20°49.7	3.9′	54.8′
14	29°35.4	16.1	4°00.7	11.0′	20°45.8	3.9′	54.8′
15	44°35.1	·· 15.9	18°30.7	11.1′	20°41.9	4.0′	54.8′
16	59°34.8	15.8	33°00.8	11.1′	20°37.9	4.1′	54.8′
17	74°34.5	15.7	47°30.8	11.1′	20°33.8	4.2′	54.9′
18	89°34.2	S23°15.6	62°00.9	11.1′	S20°29.6	4.4′	54.9′
19	104°33.9	15.4	76°31.0	11.1′	20°25.2	4.4′	54.9′
20	119°33.6	15.3	91°01.1	11.1′	20°20.8	4.5′	54.9′
21	134°33.3	·· 15.2	105°31.2	11.1′	20°16.3	4.7′	54.9′
22	149°33.0	15.0	120°01.4	11.2′	20°11.6	4.7′	54.9′
23	164°32.7	14.9	134°31.5	11.2′	20°06.9	4.8′	55.0′
	SD = 16.3′	d = 0.1′		SD = 14.9′			

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	179°32.3	S23°14.7	149°01.7	11.2′	S20°02.1	5.0′	55.0′
1	194°32.0	14.6	163°31.9	11.2′	19°57.1	5.0′	55.0′
2	209°31.7	14.5	178°02.1	11.2′	19°52.1	5.1′	55.0′
3	224°31.4	·· 14.3	192°32.3	11.2′	19°47.0	5.3′	55.0′
4	239°31.1	14.2	207°02.5	11.3′	19°41.7	5.3′	55.0′
5	254°30.8	14.0	221°32.8	11.3′	19°36.4	5.4′	55.1′
6	269°30.5	S23°13.9	236°03.0	11.3′	S19°31.0	5.6′	55.1′
7	284°30.2	13.8	250°33.3	11.3′	19°25.4	5.6′	55.1′
8	299°29.9	13.6	265°03.6	11.3′	19°19.8	5.7′	55.1′
9	314°29.6	·· 13.5	279°34.0	11.3′	19°14.1	5.8′	55.1′
10	329°29.3	13.3	294°04.3	11.4′	19°08.3	6.0′	55.1′
11	344°29.0	13.2	308°34.7	11.4′	19°02.3	6.0′	55.2′
12	359°28.7	S23°13.0	323°05.1	11.4′	S18°56.3	6.1′	55.2′
13	14°28.4	12.9	337°35.5	11.4′	18°50.2	6.2′	55.2′
14	29°28.1	12.7	352°05.9	11.4′	18°44.0	6.3′	55.2′
15	44°27.8	·· 12.6	6°36.3	11.5′	18°37.7	6.4′	55.2′
16	59°27.5	12.4	21°06.8	11.5′	18°31.3	6.4′	55.2′
17	74°27.2	12.3	35°37.3	11.5′	18°24.9	6.6′	55.3′
18	89°26.9	S23°12.1	50°07.8	11.5′	S18°18.3	6.7′	55.3′
19	104°26.6	12.0	64°38.4	11.6′	18°11.6	6.7′	55.3′
20	119°26.3	11.8	79°08.9	11.6′	18°04.9	6.9′	55.3′
21	134°26.0	·· 11.7	93°39.5	11.6′	17°58.0	6.9′	55.3′
22	149°25.6	11.5	108°10.1	11.6′	17°51.1	7.1′	55.4′
23	164°25.3	11.4	122°40.7	11.6′	17°44.0	7.1′	55.4′
	SD = 16.3′	d = 0.1′		SD = 15.0′			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	08:27	10:53	▬	▬	13:10	15:37
N 70°	08:07	09:54	▬	▬	14:09	15:56
68°	07:51	09:20	▬	▬	14:44	16:12
66°	07:38	08:55	10:34	13:30	15:08	16:25
64°	07:27	08:36	09:53	14:11	15:28	16:36
62°	07:18	08:20	09:25	14:38	15:44	16:45
60°	07:10	08:06	09:04	15:00	15:57	16:54
N 58°	07:02	07:55	08:46	15:17	16:09	17:01
56°	06:55	07:45	08:32	15:32	16:19	17:08
54°	06:49	07:36	08:19	15:44	16:28	17:14
52°	06:44	07:27	08:08	15:55	16:36	17:20
50°	06:38	07:20	07:58	16:05	16:43	17:25
45°	06:27	07:04	07:38	16:25	16:59	17:36
N 40°	06:17	06:51	07:21	16:42	17:13	17:47
35°	06:07	06:39	07:07	16:56	17:24	17:56
30°	05:59	06:28	06:55	17:09	17:35	18:05
20°	05:42	06:10	06:34	17:30	17:54	18:21
N 10°	05:26	05:52	06:15	17:48	18:11	18:37
0°	05:09	05:35	05:58	18:05	18:28	18:54
S 10°	04:50	05:17	05:40	18:23	18:46	19:13
20°	04:28	04:57	05:22	18:42	19:06	19:35
30°	03:59	04:32	05:00	19:04	19:31	20:04
35°	03:40	04:17	04:47	19:16	19:46	20:23
40°	03:17	03:59	04:32	19:31	20:04	20:46
45°	02:47	03:36	04:14	19:49	20:27	21:16
S 50°	02:02	03:07	03:51	20:12	20:56	22:01
52°	01:34	02:52	03:41	20:22	21:11	22:28
54°	00:50	02:34	03:28	20:35	21:29	23:12
56°	////	02:12	03:14	20:49	21:51	////
58°	////	01:43	02:58	21:05	22:20	////
S 60°	////	00:54	02:37	21:25	23:07	////

Lat.	Moonrise Sun	Moonrise Mon	Moonrise Tue	Moonset Sun	Moonset Mon	Moonset Tue
N 72°	▬	▬	▬	▬	▬	▬
N 70°	▬	▬	13:11	▬	▬	16:05
68°	12:34	12:27	12:22	13:15	15:06	16:53
66°	11:10	11:38	11:51	14:39	15:55	17:24
64°	10:32	11:06	11:28	15:17	16:26	17:47
62°	10:06	10:43	11:09	15:43	16:49	18:05
60°	09:45	10:24	10:53	16:04	17:07	18:20
N 58°	09:28	10:09	10:40	16:21	17:22	18:32
56°	09:13	09:56	10:29	16:35	17:35	18:43
54°	09:01	09:44	10:19	16:48	17:47	18:53
52°	08:50	09:34	10:10	16:58	17:57	19:01
50°	08:40	09:25	10:02	17:08	18:06	19:09
45°	08:20	09:05	09:45	17:28	18:24	19:25
N 40°	08:03	08:50	09:31	17:45	18:40	19:38
35°	07:49	08:36	09:19	17:59	18:53	19:50
30°	07:37	08:25	09:09	18:11	19:04	19:59
20°	07:17	08:05	08:51	18:31	19:23	20:16
N 10°	06:58	07:48	08:36	18:49	19:40	20:31
0°	06:42	07:31	08:21	19:06	19:55	20:44
S 10°	06:25	07:15	08:06	19:22	20:11	20:58
20°	06:07	06:58	07:51	19:40	20:27	21:12
30°	05:46	06:38	07:33	20:00	20:46	21:29
35°	05:34	06:26	07:22	20:12	20:57	21:38
40°	05:20	06:13	07:10	20:26	21:10	21:49
45°	05:04	05:57	06:56	20:42	21:25	22:02
S 50°	04:43	05:38	06:38	21:02	21:43	22:17
52°	04:34	05:28	06:30	21:11	21:51	22:24
54°	04:23	05:18	06:21	21:22	22:01	22:32
56°	04:10	05:06	06:10	21:34	22:11	22:41
58°	03:56	04:52	05:58	21:48	22:24	22:51
S 60°	03:39	04:36	05:45	22:04	22:38	23:03

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Age 1-3 0-6%
27	00:52	01:06	12:01	12:54	00:29	
28	01:21	01:36	12:02	13:43	01:19	
29	01:51	02:05	12:02	14:33	02:08	

December 30, 31, 01 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	98°20.8	147°22.5	S17°01.6	271°42.7	S00°21.1	244°28.6	S12°20.7	257°43.0	S06°04.8
1	113°23.3	162°24.9	01.0	286°44.2	21.5	259°30.7	20.8	272°45.3	04.8
2	128°25.7	177°27.3	17°00.4	301°45.7	21.9	274°32.8	20.9	287°47.6	04.9
3	143°28.2	192°29.8	16°59.8	316°47.2	·· 22.3	289°34.9	·· 21.0	302°50.0	·· 04.9
4	158°30.7	207°32.2	59.2	331°48.7	22.7	304°37.0	21.1	317°52.3	05.0
5	173°33.1	222°34.7	58.6	346°50.2	23.0	319°39.1	21.2	332°54.6	05.0
6	188°35.6	237°37.1	S16°58.0	1°51.7	S00°23.4	334°41.2	S12°21.4	347°57.0	S06°05.1
7	203°38.1	252°39.6	57.5	16°53.2	23.8	349°43.3	21.5	2°59.3	05.1
8	218°40.5	267°42.1	56.9	31°54.7	24.2	4°45.4	21.6	18°01.6	05.1
9	233°43.0	282°44.5	·· 56.3	46°56.2	·· 24.6	19°47.5	·· 21.7	33°04.0	·· 05.2
10	248°45.5	297°47.0	55.7	61°57.7	24.9	34°49.6	21.8	48°06.3	05.2
11	263°47.9	312°49.5	55.1	76°59.2	25.3	49°51.8	21.9	63°08.6	05.3
12	278°50.4	327°52.0	S16°54.5	92°00.7	S00°25.7	64°53.9	S12°22.1	78°11.0	S06°05.3
13	293°52.8	342°54.4	54.0	107°02.2	26.1	79°56.0	22.2	93°13.3	05.3
14	308°55.3	357°56.9	53.4	122°03.7	26.4	94°58.1	22.3	108°15.6	05.4
15	323°57.8	12°59.4	·· 52.8	137°05.1	·· 26.8	110°00.2	·· 22.4	123°18.0	·· 05.4
16	339°00.2	28°01.9	52.2	152°06.6	27.2	125°02.3	22.5	138°20.3	05.5
17	354°02.7	43°04.4	51.6	167°08.1	27.6	140°04.4	22.6	153°22.6	05.5
18	9°05.2	58°06.9	S16°51.1	182°09.6	S00°27.9	155°06.5	S12°22.8	168°25.0	S06°05.5
19	24°07.6	73°09.4	50.5	197°11.1	28.3	170°08.6	22.9	183°27.3	05.6
20	39°10.1	88°12.0	49.9	212°12.6	28.7	185°10.7	23.0	198°29.6	05.6
21	54°12.6	103°14.5	·· 49.3	227°14.1	·· 29.1	200°12.8	·· 23.1	213°32.0	·· 05.7
22	69°15.0	118°17.0	48.8	242°15.6	29.5	215°14.9	23.2	228°34.3	05.7
23	84°17.5	133°19.5	48.2	257°17.1	29.8	230°17.0	23.3	243°36.6	05.7
Mer.pass. 17:24		ν 2.4′ d 0.6′	m -4.86	ν 1.5′ d 0.4′	m 0.74	ν 2.1′ d 0.1′	m -1.84	ν 2.3′ d 0.0′	m 0.76

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	99°19.9	148°22.1	S16°47.6	272°18.6	S00°30.2	245°19.1	S12°23.5	258°39.0	S06°05.8
1	114°22.4	163°24.6	47.0	287°20.2	30.6	260°21.2	23.6	273°41.3	05.8
2	129°24.9	178°27.1	46.5	302°21.7	31.0	275°23.3	23.7	288°43.7	05.9
3	144°27.3	193°29.7	·· 45.9	317°23.2	·· 31.3	290°25.4	·· 23.8	303°46.0	·· 05.9
4	159°29.8	208°32.2	45.3	332°24.7	31.7	305°27.5	23.9	318°48.3	05.9
5	174°32.3	223°34.8	44.7	347°26.2	32.1	320°29.6	24.0	333°50.7	06.0
6	189°34.7	238°37.4	S16°44.2	2°27.7	S00°32.4	335°31.8	S12°24.1	348°53.0	S06°06.0
7	204°37.2	253°39.9	43.6	17°29.2	32.8	350°33.9	24.3	3°55.3	06.1
8	219°39.7	268°42.5	43.0	32°30.7	33.2	5°36.0	24.4	18°57.7	06.1
9	234°42.1	283°45.1	·· 42.5	47°32.2	·· 33.6	20°38.1	·· 24.5	34°00.0	·· 06.1
10	249°44.6	298°47.6	41.9	62°33.7	33.9	35°40.2	24.6	49°02.3	06.2
11	264°47.1	313°50.2	41.3	77°35.2	34.3	50°42.3	24.7	64°04.7	06.2
12	279°49.5	328°52.8	S16°40.7	92°36.7	S00°34.7	65°44.4	S12°24.8	79°07.0	S06°06.3
13	294°52.0	343°55.4	40.2	107°38.2	35.1	80°46.5	25.0	94°09.4	06.3
14	309°54.4	358°58.0	39.6	122°39.7	35.4	95°48.6	25.1	109°11.7	06.3
15	324°56.9	14°00.6	·· 39.0	137°41.2	·· 35.8	110°50.7	·· 25.2	124°14.0	·· 06.4
16	339°59.4	29°03.2	38.5	152°42.7	36.2	125°52.8	25.3	139°16.4	06.4
17	355°01.8	44°05.8	37.9	167°44.2	36.5	140°54.9	25.4	154°18.7	06.5
18	10°04.3	59°08.4	S16°37.4	182°45.8	S00°36.9	155°57.0	S12°25.5	169°21.0	S06°06.5
19	25°06.8	74°11.0	36.8	197°47.3	37.3	170°59.2	25.6	184°23.4	06.5
20	40°09.2	89°13.7	36.2	212°48.8	37.7	186°01.3	25.8	199°25.7	06.6
21	55°11.7	104°16.3	·· 35.7	227°50.3	·· 38.0	201°03.4	·· 25.9	214°28.1	·· 06.6
22	70°14.2	119°18.9	35.1	242°51.8	38.4	216°05.5	26.0	229°30.4	06.6
23	85°16.6	134°21.6	34.5	257°53.3	38.8	231°07.6	26.1	244°32.7	06.7
Mer.pass. 17:20		ν 2.5′ d 0.6′	m -4.84	ν 1.5′ d 0.4′	m 0.72	ν 2.1′ d 0.1′	m -1.84	ν 2.3′ d 0.0′	m 0.76

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	100°19.1	149°24.2	S16°34.0	272°54.8	S00°39.1	246°09.7	S12°26.2	259°35.1	S06°06.7
1	115°21.6	164°26.8	33.4	287°56.3	39.5	261°11.8	26.3	274°37.4	06.8
2	130°24.0	179°29.5	32.9	302°57.8	39.9	276°13.9	26.4	289°39.8	06.8
3	145°26.5	194°32.1	·· 32.3	317°59.4	·· 40.2	291°16.0	·· 26.5	304°42.1	·· 06.8
4	160°28.9	209°34.8	31.7	333°00.9	40.6	306°18.1	26.7	319°44.4	06.9
5	175°31.4	224°37.5	31.2	348°02.4	41.0	321°20.3	26.8	334°46.8	06.9
6	190°33.9	239°40.1	S16°30.6	3°03.9	S00°41.4	336°22.4	S12°26.9	349°49.1	S06°06.9
7	205°36.3	254°42.8	30.1	18°05.4	41.7	351°24.5	27.0	4°51.4	07.0
8	220°38.8	269°45.5	29.5	33°06.9	42.1	6°26.6	27.1	19°53.8	07.0
9	235°41.3	284°48.1	·· 29.0	48°08.4	·· 42.5	21°28.7	·· 27.2	34°56.1	·· 07.1
10	250°43.7	299°50.8	28.4	63°10.0	42.8	36°30.8	27.3	49°58.5	07.1
11	265°46.2	314°53.5	27.8	78°11.5	43.2	51°32.9	27.5	65°00.8	07.1
12	280°48.7	329°56.2	S16°27.3	93°13.0	S00°43.6	66°35.0	S12°27.6	80°03.2	S06°07.2
13	295°51.1	344°58.9	26.7	108°14.5	43.9	81°37.2	27.7	95°05.5	07.2
14	310°53.6	0°01.6	26.2	123°16.0	44.3	96°39.3	27.8	110°07.8	07.3
15	325°56.0	15°04.3	·· 25.6	138°17.5	·· 44.7	111°41.4	·· 27.9	125°10.2	·· 07.3
16	340°58.5	30°07.0	25.1	153°19.1	45.0	126°43.5	28.0	140°12.5	07.3
17	356°01.0	45°09.7	24.5	168°20.6	45.4	141°45.6	28.1	155°14.9	07.4
18	11°03.4	60°12.5	S16°24.0	183°22.1	S00°45.8	156°47.7	S12°28.2	170°17.2	S06°07.4
19	26°05.9	75°15.2	23.4	198°23.6	46.1	171°49.8	28.4	185°19.5	07.4
20	41°08.4	90°17.9	22.9	213°25.1	46.5	186°52.0	28.5	200°21.9	07.5
21	56°10.8	105°20.7	·· 22.3	228°26.7	·· 46.9	201°54.1	·· 28.6	215°24.2	·· 07.5
22	71°13.3	120°23.4	21.8	243°28.2	47.2	216°56.2	28.7	230°26.6	07.5
23	86°15.8	135°26.1	21.2	258°29.7	47.6	231°58.3	28.8	245°28.9	07.6
Mer.pass. 17:16		ν 2.6′ d 0.6′	m -4.82	ν 1.5′ d 0.4′	m 0.71	ν 2.1′ d 0.1′	m -1.85	ν 2.3′ d 0.0′	m 0.76

Stars

	SHA	Dec
Alpheratz	358°08.4	28°59.5
Ankaa	353°39.4	-42°24.6
Schedar	350°08.0	56°26.5
Diphda	349°19.9	-18°05.4
Achernar	335°44.4	-57°20.1
Hamal	328°27.8	23°22.7
Polaris	326°26.3	89°11.2
Acamar	315°36.3	-40°22.9
Menkar	314°40.0	4°01.1
Mirfak	309°14.5	49°48.0
Aldebaran	291°16.7	16°28.4
Rigel	281°34.8	-8°13.4
Capella	281°09.5	45°58.8
Bellatrix	278°57.4	6°20.0
Elnath	278°42.6	28°35.5
Alnilam	276°10.4	-1°12.9
Betelgeuse	271°27.0	7°24.2
Canopus	264°06.2	-52°41.2
Sirius	258°54.5	-16°41.5
Adhara	255°31.0	-28°56.9
Procyon	245°24.5	5°16.3
Pollux	243°56.7	28°04.2
Avior	234°27.2	-59°26.9
Suhail	223°09.8	-43°21.4
Miaplacidus	221°44.0	-69°38.3
Alphard	218°19.4	-8°34.7
Regulus	208°08.8	12°03.3
Dubhe	194°20.7	61°50.7
Denebola	182°58.0	14°40.4
Gienah	176°17.0	-17°26.3
Acrux	173°36.3	-62°59.6
Gacrux	172°27.7	-57°00.4
Alioth	166°41.7	56°03.3
Spica	158°56.7	-11°03.9
Alkaid	153°17.9	49°24.0
Hadar	149°22.4	-60°16.8
Menkent	148°36.1	-36°16.6
Arcturus	146°17.8	19°16.5
Rigil Kent.	140°24.9	-60°45.2
Kochab	137°19.7	74°13.6
Zuben'ubi	137°32.2	-15°57.9
Alphecca	126°31.6	26°46.5
Antares	112°56.1	-26°23.4
Atria	108°20.1	-68°59.6
Sabik	102°40.4	-15°42.1
Shaula	96°54.9	-37°05.4
Rasalhague	96°29.1	12°34.4
Eltanin	90°57.8	51°29.4
Kaus Aust.	84°16.1	-34°23.6
Vega	80°55.7	38°46.0
Nunki	76°28.4	-26°19.2
Altair	62°32.0	8°49.2
Peacock	53°57.5	-56°47.8
Deneb	49°48.3	45°13.0
Enif	34°10.9	9°47.5
Al Na'ir	28°14.1	-47°03.2
Fomalhaut	15°50.6	-29°43.3
Scheat	14°16.8	27°59.1
Markab	14°02.4	15°06.5

Dec 30 Wed	SHA	Mer.pass
Venus	49°01.7	14:08
Mars	173°21.9	05:53
Jupiter	146°07.8	07:41
Saturn	159°22.2	06:48

Dec 31 Thu	SHA	Mer.pass
Venus	49°02.1	14:04
Mars	172°58.7	05:50
Jupiter	145°59.2	07:38
Saturn	159°19.0	06:44

Jan 01 Fri	SHA	Mer.pass
Venus	49°05.1	14:00
Mars	172°35.7	05:48
Jupiter	145°50.6	07:34
Saturn	159°16.0	06:41

Horizontal parallax	
Venus:	0.5
Mars:	0.1

h	Sun		Moon				
Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°25.0	S23°11.2	137°11.3	11.7′	S17°36.9	7.2′	55.4′
1	194°24.7	11.0	151°42.0	11.7′	17°29.7	7.3′	55.4′
2	209°24.4	10.9	166°12.7	11.7′	17°22.4	7.4′	55.4′
3	224°24.1	·· 10.7	180°43.4	11.7′	17°15.0	7.4′	55.5′
4	239°23.8	10.6	195°14.1	11.8′	17°07.6	7.6′	55.5′
5	254°23.5	10.4	209°44.9	11.8′	17°00.0	7.7′	55.5′
6	269°23.2	S23°10.2	224°15.7	11.8′	S16°52.3	7.7′	55.5′
7	284°22.9	10.1	238°46.5	11.8′	16°44.6	7.8′	55.5′
8	299°22.6	09.9	253°17.3	11.8′	16°36.8	7.9′	55.6′
9	314°22.3	·· 09.8	267°48.1	11.9′	16°28.9	8.0′	55.6′
10	329°22.0	09.6	282°19.0	11.9′	16°20.9	8.1′	55.6′
11	344°21.7	09.4	296°49.9	11.9′	16°12.8	8.1′	55.6′
12	359°21.4	S23°09.3	311°20.8	11.9′	S16°04.7	8.3′	55.6′
13	14°21.1	09.1	325°51.7	12.0′	15°56.4	8.3′	55.7′
14	29°20.8	08.9	340°22.7	12.0′	15°48.1	8.4′	55.7′
15	44°20.5	·· 08.8	354°53.7	12.0′	15°39.7	8.5′	55.7′
16	59°20.2	08.6	9°24.7	12.0′	15°31.2	8.5′	55.7′
17	74°19.9	08.4	23°55.7	12.0′	15°22.7	8.7′	55.8′
18	89°19.6	S23°08.2	38°26.7	12.1′	S15°14.0	8.7′	55.8′
19	104°19.3	08.1	52°57.8	12.1′	15°05.3	8.8′	55.8′
20	119°19.0	07.9	67°28.9	12.1′	14°56.5	8.9′	55.8′
21	134°18.7	·· 07.7	82°00.0	12.1′	14°47.6	8.9′	55.8′
22	149°18.4	07.5	96°31.1	12.1′	14°38.7	9.1′	55.9′
23	164°18.1	07.4	111°02.2	12.2′	14°29.6	9.1′	55.9′
	SD = 16.3′	d = 0.2′	SD = 15.1′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°17.8	S23°07.2	125°33.4	12.2′	S14°20.5	9.1′	55.9′
1	194°17.5	07.0	140°04.6	12.2′	14°11.4	9.3′	55.9′
2	209°17.2	06.8	154°35.8	12.2′	14°02.1	9.3′	56.0′
3	224°16.9	·· 06.7	169°07.0	12.2′	13°52.8	9.4′	56.0′
4	239°16.6	06.5	183°38.3	12.3′	13°43.4	9.5′	56.0′
5	254°16.3	06.3	198°09.5	12.3′	13°33.9	9.5′	56.0′
6	269°16.0	S23°06.1	212°40.8	12.3′	S13°24.4	9.7′	56.1′
7	284°15.7	05.9	227°12.1	12.3′	13°14.7	9.7′	56.1′
8	299°15.4	05.8	241°43.4	12.3′	13°05.0	9.7′	56.1′
9	314°15.1	·· 05.6	256°14.7	12.3′	12°55.3	9.8′	56.1′
10	329°14.8	05.4	270°46.1	12.4′	12°45.5	9.9′	56.2′
11	344°14.5	05.2	285°17.4	12.4′	12°35.6	10.0′	56.2′
12	359°14.2	S23°05.0	299°48.8	12.4′	S12°25.6	10.0′	56.2′
13	14°13.9	04.8	314°20.2	12.4′	12°15.6	10.1′	56.2′
14	29°13.6	04.6	328°51.6	12.4′	12°05.5	10.2′	56.2′
15	44°13.3	·· 04.5	343°23.0	12.4′	11°55.3	10.2′	56.3′
16	59°13.0	04.3	357°54.4	12.4′	11°45.1	10.3′	56.3′
17	74°12.7	04.1	12°25.9	12.5′	11°34.8	10.3′	56.3′
18	89°12.4	S23°03.9	26°57.3	12.5′	S11°24.5	10.5′	56.3′
19	104°12.1	03.7	41°28.8	12.5′	11°14.0	10.4′	56.4′
20	119°11.8	03.5	56°00.3	12.5′	11°03.6	10.6′	56.4′
21	134°11.5	·· 03.3	70°31.8	12.5′	10°53.0	10.6′	56.4′
22	149°11.2	03.1	85°03.3	12.5′	10°42.4	10.6′	56.5′
23	164°10.9	02.9	99°34.8	12.5′	10°31.8	10.8′	56.5′
	SD = 16.3′	d = 0.2′	SD = 15.2′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°10.6	S23°02.7	114°06.3	12.5′	S10°21.0	10.7′	56.5′
1	194°10.3	02.5	128°37.8	12.5′	10°10.3	10.9′	56.5′
2	209°10.0	02.3	143°09.4	12.5′	09°59.4	10.9′	56.6′
3	224°09.7	·· 02.1	157°40.9	12.6′	09°48.5	10.9′	56.6′
4	239°09.4	01.9	172°12.5	12.6′	09°37.6	11.0′	56.6′
5	254°09.1	01.7	186°44.0	12.6′	09°26.6	11.1′	56.6′
6	269°08.8	S23°01.5	201°15.6	12.6′	S09°15.5	11.1′	56.7′
7	284°08.5	01.3	215°47.2	12.6′	09°04.4	11.1′	56.7′
8	299°08.3	01.1	230°18.7	12.6′	08°53.3	11.3′	56.7′
9	314°08.0	·· 00.9	244°50.3	12.6′	08°42.0	11.2′	56.7′
10	329°07.7	00.7	259°21.9	12.6′	08°30.8	11.3′	56.8′
11	344°07.4	00.5	273°53.5	12.6′	08°19.5	11.4′	56.8′
12	359°07.1	S23°00.3	288°25.1	12.6′	S08°08.1	11.4′	56.8′
13	14°06.8	23°00.1	302°56.7	12.6′	07°56.7	11.5′	56.9′
14	29°06.5	22°59.9	317°28.2	12.6′	07°45.2	11.5′	56.9′
15	44°06.2	·· 59.7	331°59.8	12.6′	07°33.7	11.6′	56.9′
16	59°05.9	59.5	346°31.4	12.6′	07°22.1	11.6′	56.9′
17	74°05.6	59.3	1°03.0	12.6′	07°10.5	11.6′	57.0′
18	89°05.3	S22°59.1	15°34.6	12.6′	S06°58.9	11.7′	57.0′
19	104°05.0	58.9	30°06.1	12.6′	06°47.2	11.8′	57.0′
20	119°04.7	58.7	44°37.7	12.6′	06°35.4	11.8′	57.1′
21	134°04.4	·· 58.4	59°09.3	12.6′	06°23.6	11.8′	57.1′
22	149°04.1	58.2	73°40.8	12.6′	06°11.8	11.9′	57.1′
23	164°03.8	58.0	88°12.4	12.5′	05°59.9	11.9′	57.1′
	SD = 16.3′	d = 0.2′	SD = 15.4′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	08:25	10:46	▬	▬	13:20	15:41
N 70°	08:06	09:51	▬	▬	14:15	16:01
68°	07:51	09:18	▬	▬	14:48	16:16
66°	07:38	08:54	10:30	13:36	15:13	16:29
64°	07:27	08:35	09:51	14:16	15:32	16:39
62°	07:18	08:19	09:24	14:43	15:47	16:49
60°	07:10	08:06	09:03	15:03	16:00	16:57
N 58°	07:02	07:55	08:46	15:20	16:12	17:04
56°	06:56	07:45	08:32	15:35	16:22	17:11
54°	06:50	07:36	08:19	15:47	16:31	17:17
52°	06:44	07:28	08:08	15:58	16:39	17:22
50°	06:39	07:20	07:59	16:08	16:46	17:27
45°	06:28	07:05	07:38	16:28	17:02	17:39
N 40°	06:17	06:51	07:22	16:44	17:15	17:49
35°	06:08	06:40	07:08	16:58	17:26	17:58
30°	06:00	06:29	06:56	17:11	17:37	18:07
20°	05:43	06:11	06:35	17:31	17:55	18:23
N 10°	05:27	05:54	06:17	17:50	18:12	18:39
0°	05:11	05:37	05:59	18:07	18:29	18:55
S 10°	04:52	05:19	05:42	18:24	18:47	19:14
20°	04:30	04:59	05:23	18:43	19:07	19:36
30°	04:01	04:34	05:02	19:04	19:32	20:05
35°	03:43	04:19	04:49	19:17	19:47	20:23
40°	03:20	04:01	04:34	19:32	20:05	20:46
45°	02:50	03:39	04:16	19:50	20:27	21:16
S 50°	02:05	03:10	03:54	20:12	20:56	22:00
52°	01:39	02:55	03:43	20:22	21:11	22:26
54°	00:57	02:38	03:31	20:34	21:28	23:07
56°	////	02:16	03:17	20:48	21:49	////
58°	////	01:48	03:01	21:04	22:17	////
S 60°	////	01:02	02:41	21:24	23:02	////

Lat.	**Moonrise** Wed	Thu	Fri	**Moonset** Wed	Thu	Fri
N 72°	13:25	12:53	12:32	17:33	19:45	21:44
N 70°	12:46	12:31	12:20	18:11	20:05	21:54
68°	12:18	12:14	12:11	18:38	20:20	22:02
66°	11:57	12:01	12:03	18:58	20:33	22:08
64°	11:41	11:49	11:56	19:13	20:43	22:13
62°	11:27	11:40	11:50	19:27	20:52	22:18
60°	11:15	11:31	11:45	19:38	20:59	22:22
N 58°	11:05	11:24	11:40	19:47	21:06	22:26
56°	10:56	11:17	11:36	19:56	21:11	22:29
54°	10:48	11:11	11:32	20:03	21:16	22:32
52°	10:40	11:06	11:29	20:10	21:21	22:34
50°	10:34	11:01	11:26	20:16	21:25	22:36
45°	10:20	10:51	11:19	20:29	21:34	22:41
N 40°	10:09	10:42	11:14	20:39	21:42	22:46
35°	09:59	10:35	11:09	20:48	21:48	22:49
30°	09:50	10:28	11:04	20:56	21:54	22:52
20°	09:35	10:17	10:57	21:10	22:04	22:58
N 10°	09:22	10:07	10:51	21:22	22:12	23:02
0°	09:10	09:57	10:44	21:33	22:20	23:07
S 10°	08:57	09:48	10:38	21:44	22:28	23:11
20°	08:44	09:38	10:32	21:55	22:36	23:16
30°	08:29	09:26	10:24	22:08	22:45	23:21
35°	08:20	09:19	10:20	22:16	22:51	23:24
40°	08:10	09:12	10:15	22:25	22:57	23:27
45°	07:58	09:03	10:09	22:35	23:04	23:31
S 50°	07:44	08:52	10:02	22:47	23:12	23:36
52°	07:37	08:47	09:59	22:52	23:16	23:38
54°	07:29	08:41	09:56	22:58	23:20	23:40
56°	07:21	08:35	09:52	23:05	23:25	23:43
58°	07:11	08:28	09:47	23:13	23:30	23:45
S 60°	07:00	08:20	09:42	23:21	23:36	23:48

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 4-6 12-28%
30	02:20	02:34	12:03	15:21	02:57	
31	02:49	03:03	12:03	16:09	03:45	
01	03:17	03:32	12:04	16:56	04:32	

Increments and Corrections

m 0	Sun Plan.	Aries	Moon	v and d corr		
0	0°00.0	0°00.0	0°00.0	0.0 - 0.0	6.0 - 0.1	12.0 - 0.1
1	0°00.3	0°00.3	0°00.2	0.1 - 0.0	6.1 - 0.1	12.1 - 0.1
2	0°00.5	0°00.5	0°00.5	0.2 - 0.0	6.2 - 0.1	12.2 - 0.1
3	0°00.8	0°00.8	0°00.7	0.3 - 0.0	6.3 - 0.1	12.3 - 0.1
4	0°01.0	0°01.0	0°01.0	0.4 - 0.0	6.4 - 0.1	12.4 - 0.1
5	0°01.3	0°01.3	0°01.2	0.5 - 0.0	6.5 - 0.1	12.5 - 0.1
6	0°01.5	0°01.5	0°01.4	0.6 - 0.0	6.6 - 0.1	12.6 - 0.1
7	0°01.8	0°01.8	0°01.7	0.7 - 0.0	6.7 - 0.1	12.7 - 0.1
8	0°02.0	0°02.0	0°01.9	0.8 - 0.0	6.8 - 0.1	12.8 - 0.1
9	0°02.3	0°02.3	0°02.1	0.9 - 0.0	6.9 - 0.1	12.9 - 0.1
10	0°02.5	0°02.5	0°02.4	1.0 - 0.0	7.0 - 0.1	13.0 - 0.1
11	0°02.8	0°02.8	0°02.6	1.1 - 0.0	7.1 - 0.1	13.1 - 0.1
12	0°03.0	0°03.0	0°02.9	1.2 - 0.0	7.2 - 0.1	13.2 - 0.1
13	0°03.3	0°03.3	0°03.1	1.3 - 0.0	7.3 - 0.1	13.3 - 0.1
14	0°03.5	0°03.5	0°03.3	1.4 - 0.0	7.4 - 0.1	13.4 - 0.1
15	0°03.8	0°03.8	0°03.6	1.5 - 0.0	7.5 - 0.1	13.5 - 0.1
16	0°04.0	0°04.0	0°03.8	1.6 - 0.0	7.6 - 0.1	13.6 - 0.1
17	0°04.3	0°04.3	0°04.1	1.7 - 0.0	7.7 - 0.1	13.7 - 0.1
18	0°04.5	0°04.5	0°04.3	1.8 - 0.0	7.8 - 0.1	13.8 - 0.1
19	0°04.8	0°04.8	0°04.5	1.9 - 0.0	7.9 - 0.1	13.9 - 0.1
20	0°05.0	0°05.0	0°04.8	2.0 - 0.0	8.0 - 0.1	14.0 - 0.1
21	0°05.3	0°05.3	0°05.0	2.1 - 0.0	8.1 - 0.1	14.1 - 0.1
22	0°05.5	0°05.5	0°05.2	2.2 - 0.0	8.2 - 0.1	14.2 - 0.1
23	0°05.8	0°05.8	0°05.5	2.3 - 0.0	8.3 - 0.1	14.3 - 0.1
24	0°06.0	0°06.0	0°05.7	2.4 - 0.0	8.4 - 0.1	14.4 - 0.1
25	0°06.3	0°06.3	0°06.0	2.5 - 0.0	8.5 - 0.1	14.5 - 0.1
26	0°06.5	0°06.5	0°06.2	2.6 - 0.0	8.6 - 0.1	14.6 - 0.1
27	0°06.8	0°06.8	0°06.4	2.7 - 0.0	8.7 - 0.1	14.7 - 0.1
28	0°07.0	0°07.0	0°06.7	2.8 - 0.0	8.8 - 0.1	14.8 - 0.1
29	0°07.3	0°07.3	0°06.9	2.9 - 0.0	8.9 - 0.1	14.9 - 0.1
30	0°07.5	0°07.5	0°07.2	3.0 - 0.0	9.0 - 0.1	15.0 - 0.1
31	0°07.8	0°07.8	0°07.4	3.1 - 0.0	9.1 - 0.1	15.1 - 0.1
32	0°08.0	0°08.0	0°07.6	3.2 - 0.0	9.2 - 0.1	15.2 - 0.1
33	0°08.3	0°08.3	0°07.9	3.3 - 0.0	9.3 - 0.1	15.3 - 0.1
34	0°08.5	0°08.5	0°08.1	3.4 - 0.0	9.4 - 0.1	15.4 - 0.1
35	0°08.8	0°08.8	0°08.4	3.5 - 0.0	9.5 - 0.1	15.5 - 0.1
36	0°09.0	0°09.0	0°08.6	3.6 - 0.0	9.6 - 0.1	15.6 - 0.1
37	0°09.3	0°09.3	0°08.8	3.7 - 0.0	9.7 - 0.1	15.7 - 0.1
38	0°09.5	0°09.5	0°09.1	3.8 - 0.0	9.8 - 0.1	15.8 - 0.1
39	0°09.8	0°09.8	0°09.3	3.9 - 0.0	9.9 - 0.1	15.9 - 0.1
40	0°10.0	0°10.0	0°09.5	4.0 - 0.0	10.0 - 0.1	16.0 - 0.1
41	0°10.3	0°10.3	0°09.8	4.1 - 0.0	10.1 - 0.1	16.1 - 0.1
42	0°10.5	0°10.5	0°10.0	4.2 - 0.0	10.2 - 0.1	16.2 - 0.1
43	0°10.8	0°10.8	0°10.3	4.3 - 0.0	10.3 - 0.1	16.3 - 0.1
44	0°11.0	0°11.0	0°10.5	4.4 - 0.0	10.4 - 0.1	16.4 - 0.1
45	0°11.3	0°11.3	0°10.7	4.5 - 0.0	10.5 - 0.1	16.5 - 0.1
46	0°11.5	0°11.5	0°11.0	4.6 - 0.0	10.6 - 0.1	16.6 - 0.1
47	0°11.8	0°11.8	0°11.2	4.7 - 0.0	10.7 - 0.1	16.7 - 0.1
48	0°12.0	0°12.0	0°11.5	4.8 - 0.0	10.8 - 0.1	16.8 - 0.1
49	0°12.3	0°12.3	0°11.7	4.9 - 0.0	10.9 - 0.1	16.9 - 0.1
50	0°12.5	0°12.5	0°11.9	5.0 - 0.0	11.0 - 0.1	17.0 - 0.1
51	0°12.8	0°12.8	0°12.2	5.1 - 0.0	11.1 - 0.1	17.1 - 0.1
52	0°13.0	0°13.0	0°12.4	5.2 - 0.0	11.2 - 0.1	17.2 - 0.1
53	0°13.3	0°13.3	0°12.6	5.3 - 0.0	11.3 - 0.1	17.3 - 0.1
54	0°13.5	0°13.5	0°12.9	5.4 - 0.0	11.4 - 0.1	17.4 - 0.1
55	0°13.8	0°13.8	0°13.1	5.5 - 0.0	11.5 - 0.1	17.5 - 0.1
56	0°14.0	0°14.0	0°13.4	5.6 - 0.0	11.6 - 0.1	17.6 - 0.1
57	0°14.2	0°14.3	0°13.6	5.7 - 0.0	11.7 - 0.1	17.7 - 0.1
58	0°14.5	0°14.5	0°13.8	5.8 - 0.0	11.8 - 0.1	17.8 - 0.1
59	0°14.7	0°14.8	0°14.1	5.9 - 0.0	11.9 - 0.1	17.9 - 0.1

m 1	Sun Plan.	Aries	Moon	v and d corr		
0	0°15.0	0°15.0	0°14.3	0.0 - 0.0	6.0 - 0.2	12.0 - 0.3
1	0°15.3	0°15.3	0°14.6	0.1 - 0.0	6.1 - 0.2	12.1 - 0.3
2	0°15.5	0°15.5	0°14.8	0.2 - 0.0	6.2 - 0.2	12.2 - 0.3
3	0°15.8	0°15.8	0°15.0	0.3 - 0.0	6.3 - 0.2	12.3 - 0.3
4	0°16.0	0°16.0	0°15.3	0.4 - 0.0	6.4 - 0.2	12.4 - 0.3
5	0°16.3	0°16.3	0°15.5	0.5 - 0.0	6.5 - 0.2	12.5 - 0.3
6	0°16.5	0°16.5	0°15.7	0.6 - 0.0	6.6 - 0.2	12.6 - 0.3
7	0°16.8	0°16.8	0°16.0	0.7 - 0.0	6.7 - 0.2	12.7 - 0.3
8	0°17.0	0°17.0	0°16.2	0.8 - 0.0	6.8 - 0.2	12.8 - 0.3
9	0°17.3	0°17.3	0°16.5	0.9 - 0.0	6.9 - 0.2	12.9 - 0.3
10	0°17.5	0°17.5	0°16.7	1.0 - 0.0	7.0 - 0.2	13.0 - 0.3
11	0°17.8	0°17.8	0°16.9	1.1 - 0.0	7.1 - 0.2	13.1 - 0.3
12	0°18.0	0°18.0	0°17.2	1.2 - 0.0	7.2 - 0.2	13.2 - 0.3
13	0°18.3	0°18.3	0°17.4	1.3 - 0.0	7.3 - 0.2	13.3 - 0.3
14	0°18.5	0°18.6	0°17.7	1.4 - 0.0	7.4 - 0.2	13.4 - 0.3
15	0°18.8	0°18.8	0°17.9	1.5 - 0.0	7.5 - 0.2	13.5 - 0.3
16	0°19.0	0°19.1	0°18.1	1.6 - 0.0	7.6 - 0.2	13.6 - 0.3
17	0°19.3	0°19.3	0°18.4	1.7 - 0.0	7.7 - 0.2	13.7 - 0.3
18	0°19.5	0°19.6	0°18.6	1.8 - 0.0	7.8 - 0.2	13.8 - 0.3
19	0°19.8	0°19.8	0°18.9	1.9 - 0.0	7.9 - 0.2	13.9 - 0.3
20	0°20.0	0°20.1	0°19.1	2.0 - 0.1	8.0 - 0.2	14.0 - 0.4
21	0°20.3	0°20.3	0°19.3	2.1 - 0.1	8.1 - 0.2	14.1 - 0.4
22	0°20.5	0°20.6	0°19.6	2.2 - 0.1	8.2 - 0.2	14.2 - 0.4
23	0°20.8	0°20.8	0°19.8	2.3 - 0.1	8.3 - 0.2	14.3 - 0.4
24	0°21.0	0°21.1	0°20.0	2.4 - 0.1	8.4 - 0.2	14.4 - 0.4
25	0°21.3	0°21.3	0°20.3	2.5 - 0.1	8.5 - 0.2	14.5 - 0.4
26	0°21.5	0°21.6	0°20.5	2.6 - 0.1	8.6 - 0.2	14.6 - 0.4
27	0°21.8	0°21.8	0°20.8	2.7 - 0.1	8.7 - 0.2	14.7 - 0.4
28	0°22.0	0°22.1	0°21.0	2.8 - 0.1	8.8 - 0.2	14.8 - 0.4
29	0°22.3	0°22.3	0°21.2	2.9 - 0.1	8.9 - 0.2	14.9 - 0.4
30	0°22.5	0°22.6	0°21.5	3.0 - 0.1	9.0 - 0.2	15.0 - 0.4
31	0°22.8	0°22.8	0°21.7	3.1 - 0.1	9.1 - 0.2	15.1 - 0.4
32	0°23.0	0°23.1	0°22.0	3.2 - 0.1	9.2 - 0.2	15.2 - 0.4
33	0°23.3	0°23.3	0°22.2	3.3 - 0.1	9.3 - 0.2	15.3 - 0.4
34	0°23.5	0°23.6	0°22.4	3.4 - 0.1	9.4 - 0.2	15.4 - 0.4
35	0°23.8	0°23.8	0°22.7	3.5 - 0.1	9.5 - 0.2	15.5 - 0.4
36	0°24.0	0°24.1	0°22.9	3.6 - 0.1	9.6 - 0.2	15.6 - 0.4
37	0°24.3	0°24.3	0°23.1	3.7 - 0.1	9.7 - 0.2	15.7 - 0.4
38	0°24.5	0°24.6	0°23.4	3.8 - 0.1	9.8 - 0.2	15.8 - 0.4
39	0°24.8	0°24.8	0°23.6	3.9 - 0.1	9.9 - 0.2	15.9 - 0.4
40	0°25.0	0°25.1	0°23.9	4.0 - 0.1	10.0 - 0.3	16.0 - 0.4
41	0°25.3	0°25.3	0°24.1	4.1 - 0.1	10.1 - 0.3	16.1 - 0.4
42	0°25.5	0°25.6	0°24.3	4.2 - 0.1	10.2 - 0.3	16.2 - 0.4
43	0°25.8	0°25.8	0°24.6	4.3 - 0.1	10.3 - 0.3	16.3 - 0.4
44	0°26.0	0°26.1	0°24.8	4.4 - 0.1	10.4 - 0.3	16.4 - 0.4
45	0°26.3	0°26.3	0°25.1	4.5 - 0.1	10.5 - 0.3	16.5 - 0.4
46	0°26.5	0°26.6	0°25.3	4.6 - 0.1	10.6 - 0.3	16.6 - 0.4
47	0°26.8	0°26.8	0°25.5	4.7 - 0.1	10.7 - 0.3	16.7 - 0.4
48	0°27.0	0°27.1	0°25.8	4.8 - 0.1	10.8 - 0.3	16.8 - 0.4
49	0°27.3	0°27.3	0°26.0	4.9 - 0.1	10.9 - 0.3	16.9 - 0.4
50	0°27.5	0°27.6	0°26.2	5.0 - 0.1	11.0 - 0.3	17.0 - 0.4
51	0°27.8	0°27.8	0°26.5	5.1 - 0.1	11.1 - 0.3	17.1 - 0.4
52	0°28.0	0°28.1	0°26.7	5.2 - 0.1	11.2 - 0.3	17.2 - 0.4
53	0°28.3	0°28.3	0°27.0	5.3 - 0.1	11.3 - 0.3	17.3 - 0.4
54	0°28.5	0°28.6	0°27.2	5.4 - 0.1	11.4 - 0.3	17.4 - 0.4
55	0°28.7	0°28.8	0°27.4	5.5 - 0.1	11.5 - 0.3	17.5 - 0.4
56	0°29.0	0°29.1	0°27.7	5.6 - 0.1	11.6 - 0.3	17.6 - 0.4
57	0°29.3	0°29.3	0°27.9	5.7 - 0.1	11.7 - 0.3	17.7 - 0.4
58	0°29.5	0°29.6	0°28.2	5.8 - 0.1	11.8 - 0.3	17.8 - 0.4
59	0°29.7	0°29.8	0°28.4	5.9 - 0.1	11.9 - 0.3	17.9 - 0.4

m 2	Sun Plan.	Aries	Moon	v and d corr		
0	0°30.0	0°30.1	0°28.6	0.0 - 0.0	6.0 - 0.3	12.0 - 0.5
1	0°30.3	0°30.3	0°28.9	0.1 - 0.0	6.1 - 0.3	12.1 - 0.5
2	0°30.5	0°30.6	0°29.1	0.2 - 0.0	6.2 - 0.3	12.2 - 0.5
3	0°30.7	0°30.8	0°29.3	0.3 - 0.0	6.3 - 0.3	12.3 - 0.5
4	0°31.0	0°31.1	0°29.6	0.4 - 0.0	6.4 - 0.3	12.4 - 0.5
5	0°31.3	0°31.3	0°29.8	0.5 - 0.0	6.5 - 0.3	12.5 - 0.5
6	0°31.5	0°31.6	0°30.1	0.6 - 0.0	6.6 - 0.3	12.6 - 0.5
7	0°31.8	0°31.8	0°30.3	0.7 - 0.0	6.7 - 0.3	12.7 - 0.5
8	0°32.0	0°32.1	0°30.5	0.8 - 0.0	6.8 - 0.3	12.8 - 0.5
9	0°32.3	0°32.3	0°30.8	0.9 - 0.0	6.9 - 0.3	12.9 - 0.5
10	0°32.5	0°32.6	0°31.0	1.0 - 0.0	7.0 - 0.3	13.0 - 0.5
11	0°32.8	0°32.8	0°31.3	1.1 - 0.0	7.1 - 0.3	13.1 - 0.5
12	0°33.0	0°33.1	0°31.5	1.2 - 0.1	7.2 - 0.3	13.2 - 0.5
13	0°33.3	0°33.3	0°31.7	1.3 - 0.1	7.3 - 0.3	13.3 - 0.6
14	0°33.5	0°33.6	0°32.0	1.4 - 0.1	7.4 - 0.3	13.4 - 0.6
15	0°33.8	0°33.8	0°32.2	1.5 - 0.1	7.5 - 0.3	13.5 - 0.6
16	0°34.0	0°34.1	0°32.5	1.6 - 0.1	7.6 - 0.3	13.6 - 0.6
17	0°34.3	0°34.3	0°32.7	1.7 - 0.1	7.7 - 0.3	13.7 - 0.6
18	0°34.5	0°34.6	0°32.9	1.8 - 0.1	7.8 - 0.3	13.8 - 0.6
19	0°34.8	0°34.8	0°33.2	1.9 - 0.1	7.9 - 0.3	13.9 - 0.6
20	0°35.0	0°35.1	0°33.4	2.0 - 0.1	8.0 - 0.3	14.0 - 0.6
21	0°35.3	0°35.3	0°33.6	2.1 - 0.1	8.1 - 0.3	14.1 - 0.6
22	0°35.5	0°35.6	0°33.9	2.2 - 0.1	8.2 - 0.3	14.2 - 0.6
23	0°35.8	0°35.8	0°34.1	2.3 - 0.1	8.3 - 0.3	14.3 - 0.6
24	0°36.0	0°36.1	0°34.4	2.4 - 0.1	8.4 - 0.3	14.4 - 0.6
25	0°36.3	0°36.3	0°34.6	2.5 - 0.1	8.5 - 0.4	14.5 - 0.6
26	0°36.5	0°36.6	0°34.8	2.6 - 0.1	8.6 - 0.4	14.6 - 0.6
27	0°36.8	0°36.9	0°35.1	2.7 - 0.1	8.7 - 0.4	14.7 - 0.6
28	0°37.0	0°37.1	0°35.3	2.8 - 0.1	8.8 - 0.4	14.8 - 0.6
29	0°37.3	0°37.4	0°35.6	2.9 - 0.1	8.9 - 0.4	14.9 - 0.6
30	0°37.5	0°37.6	0°35.8	3.0 - 0.1	9.0 - 0.4	15.0 - 0.6
31	0°37.8	0°37.9	0°36.0	3.1 - 0.1	9.1 - 0.4	15.1 - 0.6
32	0°38.0	0°38.1	0°36.3	3.2 - 0.1	9.2 - 0.4	15.2 - 0.6
33	0°38.3	0°38.4	0°36.5	3.3 - 0.1	9.3 - 0.4	15.3 - 0.6
34	0°38.5	0°38.6	0°36.7	3.4 - 0.1	9.4 - 0.4	15.4 - 0.6
35	0°38.8	0°38.9	0°37.0	3.5 - 0.1	9.5 - 0.4	15.5 - 0.6
36	0°39.0	0°39.1	0°37.2	3.6 - 0.1	9.6 - 0.4	15.6 - 0.6
37	0°39.3	0°39.4	0°37.5	3.7 - 0.2	9.7 - 0.4	15.7 - 0.7
38	0°39.5	0°39.6	0°37.7	3.8 - 0.2	9.8 - 0.4	15.8 - 0.7
39	0°39.8	0°39.9	0°37.9	3.9 - 0.2	9.9 - 0.4	15.9 - 0.7
40	0°40.0	0°40.1	0°38.2	4.0 - 0.2	10.0 - 0.4	16.0 - 0.7
41	0°40.3	0°40.4	0°38.4	4.1 - 0.2	10.1 - 0.4	16.1 - 0.7
42	0°40.5	0°40.6	0°38.7	4.2 - 0.2	10.2 - 0.4	16.2 - 0.7
43	0°40.8	0°40.9	0°38.9	4.3 - 0.2	10.3 - 0.4	16.3 - 0.7
44	0°41.0	0°41.1	0°39.1	4.4 - 0.2	10.4 - 0.4	16.4 - 0.7
45	0°41.3	0°41.4	0°39.4	4.5 - 0.2	10.5 - 0.4	16.5 - 0.7
46	0°41.5	0°41.6	0°39.6	4.6 - 0.2	10.6 - 0.4	16.6 - 0.7
47	0°41.8	0°41.9	0°39.8	4.7 - 0.2	10.7 - 0.4	16.7 - 0.7
48	0°42.0	0°42.1	0°40.1	4.8 - 0.2	10.8 - 0.5	16.8 - 0.7
49	0°42.3	0°42.4	0°40.3	4.9 - 0.2	10.9 - 0.5	16.9 - 0.7
50	0°42.5	0°42.6	0°40.6	5.0 - 0.2	11.0 - 0.5	17.0 - 0.7
51	0°42.8	0°42.9	0°40.8	5.1 - 0.2	11.1 - 0.5	17.1 - 0.7
52	0°43.0	0°43.1	0°41.0	5.2 - 0.2	11.2 - 0.5	17.2 - 0.7
53	0°43.3	0°43.4	0°41.3	5.3 - 0.2	11.3 - 0.5	17.3 - 0.7
54	0°43.5	0°43.6	0°41.5	5.4 - 0.2	11.4 - 0.5	17.4 - 0.7
55	0°43.8	0°43.9	0°41.8	5.5 - 0.2	11.5 - 0.5	17.5 - 0.7
56	0°44.0	0°44.1	0°42.0	5.6 - 0.2	11.6 - 0.5	17.6 - 0.7
57	0°44.3	0°44.4	0°42.2	5.7 - 0.2	11.7 - 0.5	17.7 - 0.7
58	0°44.5	0°44.6	0°42.5	5.8 - 0.2	11.8 - 0.5	17.8 - 0.7
59	0°44.8	0°44.9	0°42.7	5.9 - 0.2	11.9 - 0.5	17.9 - 0.7

Increments and Corrections

m 3	Sun Plan.	Aries	Moon	v and d corr		
0	0°45.0	0°45.1	0°43.0	0.0 - 0.0	6.0 - 0.3	12.0 - 0.7
1	0°45.3	0°45.4	0°43.2	0.1 - 0.0	6.1 - 0.4	12.1 - 0.7
2	0°45.5	0°45.6	0°43.4	0.2 - 0.0	6.2 - 0.4	12.2 - 0.7
3	0°45.8	0°45.9	0°43.7	0.3 - 0.0	6.3 - 0.4	12.3 - 0.7
4	0°46.0	0°46.1	0°43.9	0.4 - 0.0	6.4 - 0.4	12.4 - 0.7
5	0°46.3	0°46.4	0°44.1	0.5 - 0.0	6.5 - 0.4	12.5 - 0.7
6	0°46.5	0°46.6	0°44.4	0.6 - 0.0	6.6 - 0.4	12.6 - 0.7
7	0°46.8	0°46.9	0°44.6	0.7 - 0.0	6.7 - 0.4	12.7 - 0.7
8	0°47.0	0°47.1	0°44.9	0.8 - 0.0	6.8 - 0.4	12.8 - 0.7
9	0°47.3	0°47.4	0°45.1	0.9 - 0.1	6.9 - 0.4	12.9 - 0.8
10	0°47.5	0°47.6	0°45.3	1.0 - 0.1	7.0 - 0.4	13.0 - 0.8
11	0°47.8	0°47.9	0°45.6	1.1 - 0.1	7.1 - 0.4	13.1 - 0.8
12	0°48.0	0°48.1	0°45.8	1.2 - 0.1	7.2 - 0.4	13.2 - 0.8
13	0°48.3	0°48.4	0°46.1	1.3 - 0.1	7.3 - 0.4	13.3 - 0.8
14	0°48.5	0°48.6	0°46.3	1.4 - 0.1	7.4 - 0.4	13.4 - 0.8
15	0°48.8	0°48.9	0°46.5	1.5 - 0.1	7.5 - 0.4	13.5 - 0.8
16	0°49.0	0°49.1	0°46.8	1.6 - 0.1	7.6 - 0.4	13.6 - 0.8
17	0°49.3	0°49.4	0°47.0	1.7 - 0.1	7.7 - 0.4	13.7 - 0.8
18	0°49.5	0°49.6	0°47.2	1.8 - 0.1	7.8 - 0.5	13.8 - 0.8
19	0°49.8	0°49.9	0°47.5	1.9 - 0.1	7.9 - 0.5	13.9 - 0.8
20	0°50.0	0°50.1	0°47.7	2.0 - 0.1	8.0 - 0.5	14.0 - 0.8
21	0°50.3	0°50.4	0°48.0	2.1 - 0.1	8.1 - 0.5	14.1 - 0.8
22	0°50.5	0°50.6	0°48.2	2.2 - 0.1	8.2 - 0.5	14.2 - 0.8
23	0°50.8	0°50.9	0°48.4	2.3 - 0.1	8.3 - 0.5	14.3 - 0.8
24	0°51.0	0°51.1	0°48.7	2.4 - 0.1	8.4 - 0.5	14.4 - 0.8
25	0°51.3	0°51.4	0°48.9	2.5 - 0.1	8.5 - 0.5	14.5 - 0.8
26	0°51.5	0°51.6	0°49.2	2.6 - 0.2	8.6 - 0.5	14.6 - 0.9
27	0°51.8	0°51.9	0°49.4	2.7 - 0.2	8.7 - 0.5	14.7 - 0.9
28	0°52.0	0°52.1	0°49.6	2.8 - 0.2	8.8 - 0.5	14.8 - 0.9
29	0°52.3	0°52.4	0°49.9	2.9 - 0.2	8.9 - 0.5	14.9 - 0.9
30	0°52.5	0°52.6	0°50.1	3.0 - 0.2	9.0 - 0.5	15.0 - 0.9
31	0°52.8	0°52.9	0°50.3	3.1 - 0.2	9.1 - 0.5	15.1 - 0.9
32	0°53.0	0°53.1	0°50.6	3.2 - 0.2	9.2 - 0.5	15.2 - 0.9
33	0°53.3	0°53.4	0°50.8	3.3 - 0.2	9.3 - 0.5	15.3 - 0.9
34	0°53.5	0°53.6	0°51.1	3.4 - 0.2	9.4 - 0.5	15.4 - 0.9
35	0°53.8	0°53.9	0°51.3	3.5 - 0.2	9.5 - 0.6	15.5 - 0.9
36	0°54.0	0°54.1	0°51.5	3.6 - 0.2	9.6 - 0.6	15.6 - 0.9
37	0°54.3	0°54.4	0°51.8	3.7 - 0.2	9.7 - 0.6	15.7 - 0.9
38	0°54.5	0°54.6	0°52.0	3.8 - 0.2	9.8 - 0.6	15.8 - 0.9
39	0°54.8	0°54.9	0°52.3	3.9 - 0.2	9.9 - 0.6	15.9 - 0.9
40	0°55.0	0°55.2	0°52.5	4.0 - 0.2	10.0 - 0.6	16.0 - 0.9
41	0°55.3	0°55.4	0°52.7	4.1 - 0.2	10.1 - 0.6	16.1 - 0.9
42	0°55.5	0°55.7	0°53.0	4.2 - 0.2	10.2 - 0.6	16.2 - 0.9
43	0°55.8	0°55.9	0°53.2	4.3 - 0.3	10.3 - 0.6	16.3 - 1.0
44	0°56.0	0°56.2	0°53.4	4.4 - 0.3	10.4 - 0.6	16.4 - 1.0
45	0°56.3	0°56.4	0°53.7	4.5 - 0.3	10.5 - 0.6	16.5 - 1.0
46	0°56.5	0°56.7	0°53.9	4.6 - 0.3	10.6 - 0.6	16.6 - 1.0
47	0°56.8	0°56.9	0°54.2	4.7 - 0.3	10.7 - 0.6	16.7 - 1.0
48	0°57.0	0°57.2	0°54.4	4.8 - 0.3	10.8 - 0.6	16.8 - 1.0
49	0°57.3	0°57.4	0°54.6	4.9 - 0.3	10.9 - 0.6	16.9 - 1.0
50	0°57.5	0°57.7	0°54.9	5.0 - 0.3	11.0 - 0.6	17.0 - 1.0
51	0°57.7	0°57.9	0°55.1	5.1 - 0.3	11.1 - 0.6	17.1 - 1.0
52	0°58.0	0°58.2	0°55.4	5.2 - 0.3	11.2 - 0.7	17.2 - 1.0
53	0°58.3	0°58.4	0°55.6	5.3 - 0.3	11.3 - 0.7	17.3 - 1.0
54	0°58.5	0°58.7	0°55.8	5.4 - 0.3	11.4 - 0.7	17.4 - 1.0
55	0°58.8	0°58.9	0°56.1	5.5 - 0.3	11.5 - 0.7	17.5 - 1.0
56	0°59.0	0°59.2	0°56.3	5.6 - 0.3	11.6 - 0.7	17.6 - 1.0
57	0°59.3	0°59.4	0°56.6	5.7 - 0.3	11.7 - 0.7	17.7 - 1.0
58	0°59.5	0°59.7	0°56.8	5.8 - 0.3	11.8 - 0.7	17.8 - 1.0
59	0°59.8	0°59.9	0°57.0	5.9 - 0.3	11.9 - 0.7	17.9 - 1.0

m 4	Sun Plan.	Aries	Moon	v and d corr		
0	1°00.0	1°00.2	0°57.3	0.0 - 0.0	6.0 - 0.4	12.0 - 0.9
1	1°00.2	1°00.4	0°57.5	0.1 - 0.0	6.1 - 0.5	12.1 - 0.9
2	1°00.5	1°00.7	0°57.7	0.2 - 0.0	6.2 - 0.5	12.2 - 0.9
3	1°00.7	1°00.9	0°58.0	0.3 - 0.0	6.3 - 0.5	12.3 - 0.9
4	1°01.0	1°01.2	0°58.2	0.4 - 0.0	6.4 - 0.5	12.4 - 0.9
5	1°01.2	1°01.4	0°58.5	0.5 - 0.0	6.5 - 0.5	12.5 - 0.9
6	1°01.5	1°01.7	0°58.7	0.6 - 0.0	6.6 - 0.5	12.6 - 0.9
7	1°01.7	1°01.9	0°58.9	0.7 - 0.1	6.7 - 0.5	12.7 - 1.0
8	1°02.0	1°02.2	0°59.2	0.8 - 0.1	6.8 - 0.5	12.8 - 1.0
9	1°02.3	1°02.4	0°59.4	0.9 - 0.1	6.9 - 0.5	12.9 - 1.0
10	1°02.5	1°02.7	0°59.7	1.0 - 0.1	7.0 - 0.5	13.0 - 1.0
11	1°02.8	1°02.9	0°59.9	1.1 - 0.1	7.1 - 0.5	13.1 - 1.0
12	1°03.0	1°03.2	1°00.1	1.2 - 0.1	7.2 - 0.5	13.2 - 1.0
13	1°03.3	1°03.4	1°00.4	1.3 - 0.1	7.3 - 0.5	13.3 - 1.0
14	1°03.5	1°03.7	1°00.6	1.4 - 0.1	7.4 - 0.6	13.4 - 1.0
15	1°03.8	1°03.9	1°00.8	1.5 - 0.1	7.5 - 0.6	13.5 - 1.0
16	1°04.0	1°04.2	1°01.1	1.6 - 0.1	7.6 - 0.6	13.6 - 1.0
17	1°04.2	1°04.4	1°01.3	1.7 - 0.1	7.7 - 0.6	13.7 - 1.0
18	1°04.5	1°04.7	1°01.6	1.8 - 0.1	7.8 - 0.6	13.8 - 1.0
19	1°04.7	1°04.9	1°01.8	1.9 - 0.1	7.9 - 0.6	13.9 - 1.0
20	1°05.0	1°05.2	1°02.0	2.0 - 0.1	8.0 - 0.6	14.0 - 1.1
21	1°05.2	1°05.4	1°02.3	2.1 - 0.2	8.1 - 0.6	14.1 - 1.1
22	1°05.5	1°05.7	1°02.5	2.2 - 0.2	8.2 - 0.6	14.2 - 1.1
23	1°05.8	1°05.9	1°02.8	2.3 - 0.2	8.3 - 0.6	14.3 - 1.1
24	1°06.0	1°06.2	1°03.0	2.4 - 0.2	8.4 - 0.6	14.4 - 1.1
25	1°06.3	1°06.4	1°03.2	2.5 - 0.2	8.5 - 0.6	14.5 - 1.1
26	1°06.5	1°06.7	1°03.5	2.6 - 0.2	8.6 - 0.6	14.6 - 1.1
27	1°06.8	1°06.9	1°03.7	2.7 - 0.2	8.7 - 0.7	14.7 - 1.1
28	1°07.0	1°07.2	1°03.9	2.8 - 0.2	8.8 - 0.7	14.8 - 1.1
29	1°07.3	1°07.4	1°04.2	2.9 - 0.2	8.9 - 0.7	14.9 - 1.1
30	1°07.5	1°07.7	1°04.4	3.0 - 0.2	9.0 - 0.7	15.0 - 1.1
31	1°07.7	1°07.9	1°04.7	3.1 - 0.2	9.1 - 0.7	15.1 - 1.1
32	1°08.0	1°08.2	1°04.9	3.2 - 0.2	9.2 - 0.7	15.2 - 1.1
33	1°08.2	1°08.4	1°05.1	3.3 - 0.2	9.3 - 0.7	15.3 - 1.1
34	1°08.5	1°08.7	1°05.4	3.4 - 0.3	9.4 - 0.7	15.4 - 1.2
35	1°08.7	1°08.9	1°05.6	3.5 - 0.3	9.5 - 0.7	15.5 - 1.2
36	1°09.0	1°09.2	1°05.9	3.6 - 0.3	9.6 - 0.7	15.6 - 1.2
37	1°09.3	1°09.4	1°06.1	3.7 - 0.3	9.7 - 0.7	15.7 - 1.2
38	1°09.5	1°09.7	1°06.3	3.8 - 0.3	9.8 - 0.7	15.8 - 1.2
39	1°09.8	1°09.9	1°06.6	3.9 - 0.3	9.9 - 0.7	15.9 - 1.2
40	1°10.0	1°10.2	1°06.8	4.0 - 0.3	10.0 - 0.8	16.0 - 1.2
41	1°10.3	1°10.4	1°07.0	4.1 - 0.3	10.1 - 0.8	16.1 - 1.2
42	1°10.5	1°10.7	1°07.3	4.2 - 0.3	10.2 - 0.8	16.2 - 1.2
43	1°10.8	1°10.9	1°07.5	4.3 - 0.3	10.3 - 0.8	16.3 - 1.2
44	1°11.0	1°11.2	1°07.8	4.4 - 0.3	10.4 - 0.8	16.4 - 1.2
45	1°11.3	1°11.4	1°08.0	4.5 - 0.3	10.5 - 0.8	16.5 - 1.2
46	1°11.5	1°11.7	1°08.2	4.6 - 0.3	10.6 - 0.8	16.6 - 1.2
47	1°11.7	1°11.9	1°08.5	4.7 - 0.4	10.7 - 0.8	16.7 - 1.3
48	1°12.0	1°12.2	1°08.7	4.8 - 0.4	10.8 - 0.8	16.8 - 1.3
49	1°12.2	1°12.4	1°09.0	4.9 - 0.4	10.9 - 0.8	16.9 - 1.3
50	1°12.5	1°12.7	1°09.2	5.0 - 0.4	11.0 - 0.8	17.0 - 1.3
51	1°12.7	1°12.9	1°09.4	5.1 - 0.4	11.1 - 0.8	17.1 - 1.3
52	1°13.0	1°13.2	1°09.7	5.2 - 0.4	11.2 - 0.8	17.2 - 1.3
53	1°13.2	1°13.5	1°09.9	5.3 - 0.4	11.3 - 0.8	17.3 - 1.3
54	1°13.5	1°13.7	1°10.2	5.4 - 0.4	11.4 - 0.9	17.4 - 1.3
55	1°13.8	1°14.0	1°10.4	5.5 - 0.4	11.5 - 0.9	17.5 - 1.3
56	1°14.0	1°14.2	1°10.6	5.6 - 0.4	11.6 - 0.9	17.6 - 1.3
57	1°14.3	1°14.5	1°10.9	5.7 - 0.4	11.7 - 0.9	17.7 - 1.3
58	1°14.5	1°14.7	1°11.1	5.8 - 0.4	11.8 - 0.9	17.8 - 1.3
59	1°14.8	1°15.0	1°11.3	5.9 - 0.4	11.9 - 0.9	17.9 - 1.3

m 5	Sun Plan.	Aries	Moon	v and d corr		
0	1°15.0	1°15.2	1°11.6	0.0 - 0.0	6.0 - 0.5	12.0 - 1.1
1	1°15.3	1°15.5	1°11.8	0.1 - 0.0	6.1 - 0.6	12.1 - 1.1
2	1°15.5	1°15.7	1°12.1	0.2 - 0.0	6.2 - 0.6	12.2 - 1.1
3	1°15.7	1°16.0	1°12.3	0.3 - 0.0	6.3 - 0.6	12.3 - 1.1
4	1°16.0	1°16.2	1°12.5	0.4 - 0.0	6.4 - 0.6	12.4 - 1.1
5	1°16.2	1°16.5	1°12.8	0.5 - 0.0	6.5 - 0.6	12.5 - 1.1
6	1°16.5	1°16.7	1°13.0	0.6 - 0.1	6.6 - 0.6	12.6 - 1.2
7	1°16.7	1°17.0	1°13.3	0.7 - 0.1	6.7 - 0.6	12.7 - 1.2
8	1°17.0	1°17.2	1°13.5	0.8 - 0.1	6.8 - 0.6	12.8 - 1.2
9	1°17.3	1°17.5	1°13.7	0.9 - 0.1	6.9 - 0.6	12.9 - 1.2
10	1°17.5	1°17.7	1°14.0	1.0 - 0.1	7.0 - 0.6	13.0 - 1.2
11	1°17.8	1°18.0	1°14.2	1.1 - 0.1	7.1 - 0.7	13.1 - 1.2
12	1°18.0	1°18.2	1°14.4	1.2 - 0.1	7.2 - 0.7	13.2 - 1.2
13	1°18.3	1°18.5	1°14.7	1.3 - 0.1	7.3 - 0.7	13.3 - 1.2
14	1°18.5	1°18.7	1°14.9	1.4 - 0.1	7.4 - 0.7	13.4 - 1.2
15	1°18.8	1°19.0	1°15.2	1.5 - 0.1	7.5 - 0.7	13.5 - 1.2
16	1°19.0	1°19.2	1°15.4	1.6 - 0.1	7.6 - 0.7	13.6 - 1.2
17	1°19.3	1°19.5	1°15.6	1.7 - 0.2	7.7 - 0.7	13.7 - 1.3
18	1°19.5	1°19.7	1°15.9	1.8 - 0.2	7.8 - 0.7	13.8 - 1.3
19	1°19.7	1°20.0	1°16.1	1.9 - 0.2	7.9 - 0.7	13.9 - 1.3
20	1°20.0	1°20.2	1°16.4	2.0 - 0.2	8.0 - 0.7	14.0 - 1.3
21	1°20.2	1°20.5	1°16.6	2.1 - 0.2	8.1 - 0.7	14.1 - 1.3
22	1°20.5	1°20.7	1°16.8	2.2 - 0.2	8.2 - 0.8	14.2 - 1.3
23	1°20.8	1°21.0	1°17.1	2.3 - 0.2	8.3 - 0.8	14.3 - 1.3
24	1°21.0	1°21.2	1°17.3	2.4 - 0.2	8.4 - 0.8	14.4 - 1.3
25	1°21.3	1°21.5	1°17.5	2.5 - 0.2	8.5 - 0.8	14.5 - 1.3
26	1°21.5	1°21.7	1°17.8	2.6 - 0.2	8.6 - 0.8	14.6 - 1.3
27	1°21.8	1°22.0	1°18.0	2.7 - 0.2	8.7 - 0.8	14.7 - 1.3
28	1°22.0	1°22.2	1°18.3	2.8 - 0.3	8.8 - 0.8	14.8 - 1.4
29	1°22.3	1°22.5	1°18.5	2.9 - 0.3	8.9 - 0.8	14.9 - 1.4
30	1°22.5	1°22.7	1°18.7	3.0 - 0.3	9.0 - 0.8	15.0 - 1.4
31	1°22.8	1°23.0	1°19.0	3.1 - 0.3	9.1 - 0.8	15.1 - 1.4
32	1°23.0	1°23.2	1°19.2	3.2 - 0.3	9.2 - 0.8	15.2 - 1.4
33	1°23.2	1°23.5	1°19.5	3.3 - 0.3	9.3 - 0.9	15.3 - 1.4
34	1°23.5	1°23.7	1°19.7	3.4 - 0.3	9.4 - 0.9	15.4 - 1.4
35	1°23.7	1°24.0	1°19.9	3.5 - 0.3	9.5 - 0.9	15.5 - 1.4
36	1°24.0	1°24.2	1°20.2	3.6 - 0.3	9.6 - 0.9	15.6 - 1.4
37	1°24.3	1°24.5	1°20.4	3.7 - 0.3	9.7 - 0.9	15.7 - 1.4
38	1°24.5	1°24.7	1°20.7	3.8 - 0.3	9.8 - 0.9	15.8 - 1.4
39	1°24.8	1°25.0	1°20.9	3.9 - 0.4	9.9 - 0.9	15.9 - 1.5
40	1°25.0	1°25.2	1°21.1	4.0 - 0.4	10.0 - 0.9	16.0 - 1.5
41	1°25.3	1°25.5	1°21.4	4.1 - 0.4	10.1 - 0.9	16.1 - 1.5
42	1°25.5	1°25.7	1°21.6	4.2 - 0.4	10.2 - 0.9	16.2 - 1.5
43	1°25.8	1°26.0	1°21.8	4.3 - 0.4	10.3 - 0.9	16.3 - 1.5
44	1°26.0	1°26.2	1°22.1	4.4 - 0.4	10.4 - 1.0	16.4 - 1.5
45	1°26.3	1°26.5	1°22.3	4.5 - 0.4	10.5 - 1.0	16.5 - 1.5
46	1°26.5	1°26.7	1°22.6	4.6 - 0.4	10.6 - 1.0	16.6 - 1.5
47	1°26.8	1°27.0	1°22.8	4.7 - 0.4	10.7 - 1.0	16.7 - 1.5
48	1°27.0	1°27.2	1°23.0	4.8 - 0.4	10.8 - 1.0	16.8 - 1.5
49	1°27.2	1°27.5	1°23.3	4.9 - 0.4	10.9 - 1.0	16.9 - 1.5
50	1°27.5	1°27.7	1°23.5	5.0 - 0.5	11.0 - 1.0	17.0 - 1.6
51	1°27.7	1°28.0	1°23.8	5.1 - 0.5	11.1 - 1.0	17.1 - 1.6
52	1°28.0	1°28.2	1°24.0	5.2 - 0.5	11.2 - 1.0	17.2 - 1.6
53	1°28.2	1°28.5	1°24.2	5.3 - 0.5	11.3 - 1.0	17.3 - 1.6
54	1°28.5	1°28.7	1°24.5	5.4 - 0.5	11.4 - 1.0	17.4 - 1.6
55	1°28.8	1°29.0	1°24.7	5.5 - 0.5	11.5 - 1.1	17.5 - 1.6
56	1°29.0	1°29.2	1°24.9	5.6 - 0.5	11.6 - 1.1	17.6 - 1.6
57	1°29.3	1°29.5	1°25.2	5.7 - 0.5	11.7 - 1.1	17.7 - 1.6
58	1°29.5	1°29.7	1°25.4	5.8 - 0.5	11.8 - 1.1	17.8 - 1.6
59	1°29.8	1°30.0	1°25.7	5.9 - 0.5	11.9 - 1.1	17.9 - 1.6

Increments and Corrections

m 6	Sun Plan.	Aries	Moon	v and d corr		
0	1°30.0	1°30.2	1°25.9	0.0 - 0.0	6.0 - 0.7	12.0 - 1.3
1	1°30.3	1°30.5	1°26.1	0.1 - 0.0	6.1 - 0.7	12.1 - 1.3
2	1°30.5	1°30.7	1°26.4	0.2 - 0.0	6.2 - 0.7	12.2 - 1.3
3	1°30.7	1°31.0	1°26.6	0.3 - 0.0	6.3 - 0.7	12.3 - 1.3
4	1°31.0	1°31.2	1°26.9	0.4 - 0.0	6.4 - 0.7	12.4 - 1.3
5	1°31.2	1°31.5	1°27.1	0.5 - 0.1	6.5 - 0.7	12.5 - 1.4
6	1°31.5	1°31.8	1°27.3	0.6 - 0.1	6.6 - 0.7	12.6 - 1.4
7	1°31.7	1°32.0	1°27.6	0.7 - 0.1	6.7 - 0.7	12.7 - 1.4
8	1°32.0	1°32.3	1°27.8	0.8 - 0.1	6.8 - 0.7	12.8 - 1.4
9	1°32.3	1°32.5	1°28.0	0.9 - 0.1	6.9 - 0.7	12.9 - 1.4
10	1°32.5	1°32.8	1°28.3	1.0 - 0.1	7.0 - 0.8	13.0 - 1.4
11	1°32.8	1°33.0	1°28.5	1.1 - 0.1	7.1 - 0.8	13.1 - 1.4
12	1°33.0	1°33.3	1°28.8	1.2 - 0.1	7.2 - 0.8	13.2 - 1.4
13	1°33.3	1°33.5	1°29.0	1.3 - 0.1	7.3 - 0.8	13.3 - 1.4
14	1°33.5	1°33.8	1°29.2	1.4 - 0.2	7.4 - 0.8	13.4 - 1.5
15	1°33.8	1°34.0	1°29.5	1.5 - 0.2	7.5 - 0.8	13.5 - 1.5
16	1°34.0	1°34.3	1°29.7	1.6 - 0.2	7.6 - 0.8	13.6 - 1.5
17	1°34.3	1°34.5	1°30.0	1.7 - 0.2	7.7 - 0.8	13.7 - 1.5
18	1°34.5	1°34.8	1°30.2	1.8 - 0.2	7.8 - 0.8	13.8 - 1.5
19	1°34.8	1°35.0	1°30.4	1.9 - 0.2	7.9 - 0.9	13.9 - 1.5
20	1°35.0	1°35.3	1°30.7	2.0 - 0.2	8.0 - 0.9	14.0 - 1.5
21	1°35.2	1°35.5	1°30.9	2.1 - 0.2	8.1 - 0.9	14.1 - 1.5
22	1°35.5	1°35.8	1°31.1	2.2 - 0.2	8.2 - 0.9	14.2 - 1.5
23	1°35.8	1°36.0	1°31.4	2.3 - 0.2	8.3 - 0.9	14.3 - 1.5
24	1°36.0	1°36.3	1°31.6	2.4 - 0.3	8.4 - 0.9	14.4 - 1.6
25	1°36.3	1°36.5	1°31.9	2.5 - 0.3	8.5 - 0.9	14.5 - 1.6
26	1°36.5	1°36.8	1°32.1	2.6 - 0.3	8.6 - 0.9	14.6 - 1.6
27	1°36.8	1°37.0	1°32.3	2.7 - 0.3	8.7 - 0.9	14.7 - 1.6
28	1°37.0	1°37.3	1°32.6	2.8 - 0.3	8.8 - 1.0	14.8 - 1.6
29	1°37.3	1°37.5	1°32.8	2.9 - 0.3	8.9 - 1.0	14.9 - 1.6
30	1°37.5	1°37.8	1°33.1	3.0 - 0.3	9.0 - 1.0	15.0 - 1.6
31	1°37.8	1°38.0	1°33.3	3.1 - 0.3	9.1 - 1.0	15.1 - 1.6
32	1°38.0	1°38.3	1°33.5	3.2 - 0.3	9.2 - 1.0	15.2 - 1.6
33	1°38.3	1°38.5	1°33.8	3.3 - 0.4	9.3 - 1.0	15.3 - 1.7
34	1°38.5	1°38.8	1°34.0	3.4 - 0.4	9.4 - 1.0	15.4 - 1.7
35	1°38.7	1°39.0	1°34.3	3.5 - 0.4	9.5 - 1.0	15.5 - 1.7
36	1°39.0	1°39.3	1°34.5	3.6 - 0.4	9.6 - 1.0	15.6 - 1.7
37	1°39.3	1°39.5	1°34.7	3.7 - 0.4	9.7 - 1.1	15.7 - 1.7
38	1°39.5	1°39.8	1°35.0	3.8 - 0.4	9.8 - 1.1	15.8 - 1.7
39	1°39.8	1°40.0	1°35.2	3.9 - 0.4	9.9 - 1.1	15.9 - 1.7
40	1°40.0	1°40.3	1°35.4	4.0 - 0.4	10.0 - 1.1	16.0 - 1.7
41	1°40.3	1°40.5	1°35.7	4.1 - 0.4	10.1 - 1.1	16.1 - 1.7
42	1°40.5	1°40.8	1°35.9	4.2 - 0.5	10.2 - 1.1	16.2 - 1.8
43	1°40.8	1°41.0	1°36.2	4.3 - 0.5	10.3 - 1.1	16.3 - 1.8
44	1°41.0	1°41.3	1°36.4	4.4 - 0.5	10.4 - 1.1	16.4 - 1.8
45	1°41.3	1°41.5	1°36.6	4.5 - 0.5	10.5 - 1.1	16.5 - 1.8
46	1°41.5	1°41.8	1°36.9	4.6 - 0.5	10.6 - 1.1	16.6 - 1.8
47	1°41.8	1°42.0	1°37.1	4.7 - 0.5	10.7 - 1.2	16.7 - 1.8
48	1°42.0	1°42.3	1°37.4	4.8 - 0.5	10.8 - 1.2	16.8 - 1.8
49	1°42.3	1°42.5	1°37.6	4.9 - 0.5	10.9 - 1.2	16.9 - 1.8
50	1°42.5	1°42.8	1°37.8	5.0 - 0.5	11.0 - 1.2	17.0 - 1.8
51	1°42.7	1°43.0	1°38.1	5.1 - 0.6	11.1 - 1.2	17.1 - 1.9
52	1°43.0	1°43.3	1°38.3	5.2 - 0.6	11.2 - 1.2	17.2 - 1.9
53	1°43.2	1°43.5	1°38.5	5.3 - 0.6	11.3 - 1.2	17.3 - 1.9
54	1°43.5	1°43.8	1°38.8	5.4 - 0.6	11.4 - 1.2	17.4 - 1.9
55	1°43.8	1°44.0	1°39.0	5.5 - 0.6	11.5 - 1.2	17.5 - 1.9
56	1°44.0	1°44.3	1°39.3	5.6 - 0.6	11.6 - 1.3	17.6 - 1.9
57	1°44.3	1°44.5	1°39.5	5.7 - 0.6	11.7 - 1.3	17.7 - 1.9
58	1°44.5	1°44.8	1°39.7	5.8 - 0.6	11.8 - 1.3	17.8 - 1.9
59	1°44.8	1°45.0	1°40.0	5.9 - 0.6	11.9 - 1.3	17.9 - 1.9

m 7	Sun Plan.	Aries	Moon	v and d corr		
0	1°45.0	1°45.3	1°40.2	0.0 - 0.0	6.0 - 0.8	12.0 - 1.5
1	1°45.3	1°45.5	1°40.5	0.1 - 0.0	6.1 - 0.8	12.1 - 1.5
2	1°45.5	1°45.8	1°40.7	0.2 - 0.0	6.2 - 0.8	12.2 - 1.5
3	1°45.8	1°46.0	1°40.9	0.3 - 0.0	6.3 - 0.8	12.3 - 1.5
4	1°46.0	1°46.3	1°41.2	0.4 - 0.1	6.4 - 0.8	12.4 - 1.6
5	1°46.2	1°46.5	1°41.4	0.5 - 0.1	6.5 - 0.8	12.5 - 1.6
6	1°46.5	1°46.8	1°41.6	0.6 - 0.1	6.6 - 0.8	12.6 - 1.6
7	1°46.7	1°47.0	1°41.9	0.7 - 0.1	6.7 - 0.8	12.7 - 1.6
8	1°47.0	1°47.3	1°42.1	0.8 - 0.1	6.8 - 0.8	12.8 - 1.6
9	1°47.3	1°47.5	1°42.4	0.9 - 0.1	6.9 - 0.9	12.9 - 1.6
10	1°47.5	1°47.8	1°42.6	1.0 - 0.1	7.0 - 0.9	13.0 - 1.6
11	1°47.8	1°48.0	1°42.8	1.1 - 0.1	7.1 - 0.9	13.1 - 1.6
12	1°48.0	1°48.3	1°43.1	1.2 - 0.2	7.2 - 0.9	13.2 - 1.6
13	1°48.3	1°48.5	1°43.3	1.3 - 0.2	7.3 - 0.9	13.3 - 1.7
14	1°48.5	1°48.8	1°43.6	1.4 - 0.2	7.4 - 0.9	13.4 - 1.7
15	1°48.8	1°49.0	1°43.8	1.5 - 0.2	7.5 - 0.9	13.5 - 1.7
16	1°49.0	1°49.3	1°44.0	1.6 - 0.2	7.6 - 0.9	13.6 - 1.7
17	1°49.3	1°49.5	1°44.3	1.7 - 0.2	7.7 - 1.0	13.7 - 1.7
18	1°49.5	1°49.8	1°44.5	1.8 - 0.2	7.8 - 1.0	13.8 - 1.7
19	1°49.8	1°50.0	1°44.8	1.9 - 0.2	7.9 - 1.0	13.9 - 1.7
20	1°50.0	1°50.3	1°45.0	2.0 - 0.3	8.0 - 1.0	14.0 - 1.8
21	1°50.2	1°50.6	1°45.2	2.1 - 0.3	8.1 - 1.0	14.1 - 1.8
22	1°50.5	1°50.8	1°45.5	2.2 - 0.3	8.2 - 1.0	14.2 - 1.8
23	1°50.8	1°51.1	1°45.7	2.3 - 0.3	8.3 - 1.0	14.3 - 1.8
24	1°51.0	1°51.3	1°45.9	2.4 - 0.3	8.4 - 1.1	14.4 - 1.8
25	1°51.3	1°51.6	1°46.2	2.5 - 0.3	8.5 - 1.1	14.5 - 1.8
26	1°51.5	1°51.8	1°46.4	2.6 - 0.3	8.6 - 1.1	14.6 - 1.8
27	1°51.8	1°52.1	1°46.7	2.7 - 0.3	8.7 - 1.1	14.7 - 1.8
28	1°52.0	1°52.3	1°46.9	2.8 - 0.4	8.8 - 1.1	14.8 - 1.9
29	1°52.3	1°52.6	1°47.1	2.9 - 0.4	8.9 - 1.1	14.9 - 1.9
30	1°52.5	1°52.8	1°47.4	3.0 - 0.4	9.0 - 1.1	15.0 - 1.9
31	1°52.7	1°53.1	1°47.6	3.1 - 0.4	9.1 - 1.1	15.1 - 1.9
32	1°53.0	1°53.3	1°47.9	3.2 - 0.4	9.2 - 1.1	15.2 - 1.9
33	1°53.3	1°53.6	1°48.1	3.3 - 0.4	9.3 - 1.2	15.3 - 1.9
34	1°53.5	1°53.8	1°48.3	3.4 - 0.4	9.4 - 1.2	15.4 - 1.9
35	1°53.7	1°54.1	1°48.6	3.5 - 0.4	9.5 - 1.2	15.5 - 1.9
36	1°54.0	1°54.3	1°48.8	3.6 - 0.5	9.6 - 1.2	15.6 - 1.9
37	1°54.2	1°54.6	1°49.0	3.7 - 0.5	9.7 - 1.2	15.7 - 2.0
38	1°54.5	1°54.8	1°49.3	3.8 - 0.5	9.8 - 1.2	15.8 - 2.0
39	1°54.8	1°55.1	1°49.5	3.9 - 0.5	9.9 - 1.2	15.9 - 2.0
40	1°55.0	1°55.3	1°49.8	4.0 - 0.5	10.0 - 1.3	16.0 - 2.0
41	1°55.3	1°55.6	1°50.0	4.1 - 0.5	10.1 - 1.3	16.1 - 2.0
42	1°55.5	1°55.8	1°50.2	4.2 - 0.5	10.2 - 1.3	16.2 - 2.0
43	1°55.8	1°56.1	1°50.5	4.3 - 0.5	10.3 - 1.3	16.3 - 2.0
44	1°56.0	1°56.3	1°50.7	4.4 - 0.6	10.4 - 1.3	16.4 - 2.0
45	1°56.3	1°56.6	1°51.0	4.5 - 0.6	10.5 - 1.3	16.5 - 2.1
46	1°56.5	1°56.8	1°51.2	4.6 - 0.6	10.6 - 1.3	16.6 - 2.1
47	1°56.7	1°57.1	1°51.4	4.7 - 0.6	10.7 - 1.3	16.7 - 2.1
48	1°57.0	1°57.3	1°51.7	4.8 - 0.6	10.8 - 1.4	16.8 - 2.1
49	1°57.3	1°57.6	1°51.9	4.9 - 0.6	10.9 - 1.4	16.9 - 2.1
50	1°57.5	1°57.8	1°52.1	5.0 - 0.6	11.0 - 1.4	17.0 - 2.1
51	1°57.7	1°58.1	1°52.4	5.1 - 0.6	11.1 - 1.4	17.1 - 2.1
52	1°58.0	1°58.3	1°52.6	5.2 - 0.7	11.2 - 1.4	17.2 - 2.1
53	1°58.2	1°58.6	1°52.9	5.3 - 0.7	11.3 - 1.4	17.3 - 2.2
54	1°58.5	1°58.8	1°53.1	5.4 - 0.7	11.4 - 1.4	17.4 - 2.2
55	1°58.8	1°59.1	1°53.3	5.5 - 0.7	11.5 - 1.4	17.5 - 2.2
56	1°59.0	1°59.3	1°53.6	5.6 - 0.7	11.6 - 1.5	17.6 - 2.2
57	1°59.3	1°59.6	1°53.8	5.7 - 0.7	11.7 - 1.5	17.7 - 2.2
58	1°59.5	1°59.8	1°54.1	5.8 - 0.7	11.8 - 1.5	17.8 - 2.2
59	1°59.8	2°00.1	1°54.3	5.9 - 0.7	11.9 - 1.5	17.9 - 2.2

m 8	Sun Plan.	Aries	Moon	v and d corr		
0	2°00.0	2°00.3	1°54.5	0.0 - 0.0	6.0 - 0.8	12.0 - 1.7
1	2°00.3	2°00.6	1°54.8	0.1 - 0.0	6.1 - 0.9	12.1 - 1.7
2	2°00.5	2°00.8	1°55.0	0.2 - 0.0	6.2 - 0.9	12.2 - 1.7
3	2°00.8	2°01.1	1°55.2	0.3 - 0.0	6.3 - 0.9	12.3 - 1.7
4	2°01.0	2°01.3	1°55.5	0.4 - 0.1	6.4 - 0.9	12.4 - 1.8
5	2°01.3	2°01.6	1°55.7	0.5 - 0.1	6.5 - 0.9	12.5 - 1.8
6	2°01.5	2°01.8	1°56.0	0.6 - 0.1	6.6 - 0.9	12.6 - 1.8
7	2°01.8	2°02.1	1°56.2	0.7 - 0.1	6.7 - 0.9	12.7 - 1.8
8	2°02.0	2°02.3	1°56.4	0.8 - 0.1	6.8 - 1.0	12.8 - 1.8
9	2°02.3	2°02.6	1°56.7	0.9 - 0.1	6.9 - 1.0	12.9 - 1.8
10	2°02.5	2°02.8	1°56.9	1.0 - 0.1	7.0 - 1.0	13.0 - 1.8
11	2°02.8	2°03.1	1°57.2	1.1 - 0.2	7.1 - 1.0	13.1 - 1.9
12	2°03.0	2°03.3	1°57.4	1.2 - 0.2	7.2 - 1.0	13.2 - 1.9
13	2°03.3	2°03.6	1°57.6	1.3 - 0.2	7.3 - 1.0	13.3 - 1.9
14	2°03.5	2°03.8	1°57.9	1.4 - 0.2	7.4 - 1.0	13.4 - 1.9
15	2°03.8	2°04.1	1°58.1	1.5 - 0.2	7.5 - 1.1	13.5 - 1.9
16	2°04.0	2°04.3	1°58.4	1.6 - 0.2	7.6 - 1.1	13.6 - 1.9
17	2°04.2	2°04.6	1°58.6	1.7 - 0.2	7.7 - 1.1	13.7 - 1.9
18	2°04.5	2°04.8	1°58.8	1.8 - 0.3	7.8 - 1.1	13.8 - 2.0
19	2°04.7	2°05.1	1°59.1	1.9 - 0.3	7.9 - 1.1	13.9 - 2.0
20	2°05.0	2°05.3	1°59.3	2.0 - 0.3	8.0 - 1.1	14.0 - 2.0
21	2°05.2	2°05.6	1°59.5	2.1 - 0.3	8.1 - 1.1	14.1 - 2.0
22	2°05.5	2°05.8	1°59.8	2.2 - 0.3	8.2 - 1.2	14.2 - 2.0
23	2°05.7	2°06.1	2°00.0	2.3 - 0.3	8.3 - 1.2	14.3 - 2.0
24	2°06.0	2°06.3	2°00.3	2.4 - 0.3	8.4 - 1.2	14.4 - 2.0
25	2°06.2	2°06.6	2°00.5	2.5 - 0.4	8.5 - 1.2	14.5 - 2.1
26	2°06.5	2°06.8	2°00.7	2.6 - 0.4	8.6 - 1.2	14.6 - 2.1
27	2°06.7	2°07.1	2°01.0	2.7 - 0.4	8.7 - 1.2	14.7 - 2.1
28	2°07.0	2°07.3	2°01.2	2.8 - 0.4	8.8 - 1.2	14.8 - 2.1
29	2°07.2	2°07.6	2°01.5	2.9 - 0.4	8.9 - 1.3	14.9 - 2.1
30	2°07.5	2°07.8	2°01.7	3.0 - 0.4	9.0 - 1.3	15.0 - 2.1
31	2°07.8	2°08.1	2°01.9	3.1 - 0.4	9.1 - 1.3	15.1 - 2.1
32	2°08.0	2°08.3	2°02.2	3.2 - 0.5	9.2 - 1.3	15.2 - 2.2
33	2°08.3	2°08.6	2°02.4	3.3 - 0.5	9.3 - 1.3	15.3 - 2.2
34	2°08.5	2°08.9	2°02.6	3.4 - 0.5	9.4 - 1.3	15.4 - 2.2
35	2°08.8	2°09.1	2°02.9	3.5 - 0.5	9.5 - 1.3	15.5 - 2.2
36	2°09.0	2°09.4	2°03.1	3.6 - 0.5	9.6 - 1.4	15.6 - 2.2
37	2°09.3	2°09.6	2°03.4	3.7 - 0.5	9.7 - 1.4	15.7 - 2.2
38	2°09.5	2°09.9	2°03.6	3.8 - 0.5	9.8 - 1.4	15.8 - 2.2
39	2°09.8	2°10.1	2°03.8	3.9 - 0.6	9.9 - 1.4	15.9 - 2.3
40	2°10.0	2°10.4	2°04.1	4.0 - 0.6	10.0 - 1.4	16.0 - 2.3
41	2°10.3	2°10.6	2°04.3	4.1 - 0.6	10.1 - 1.4	16.1 - 2.3
42	2°10.5	2°10.9	2°04.6	4.2 - 0.6	10.2 - 1.4	16.2 - 2.3
43	2°10.8	2°11.1	2°04.8	4.3 - 0.6	10.3 - 1.5	16.3 - 2.3
44	2°11.0	2°11.4	2°05.0	4.4 - 0.6	10.4 - 1.5	16.4 - 2.3
45	2°11.3	2°11.6	2°05.3	4.5 - 0.6	10.5 - 1.5	16.5 - 2.3
46	2°11.5	2°11.9	2°05.5	4.6 - 0.7	10.6 - 1.5	16.6 - 2.4
47	2°11.7	2°12.1	2°05.7	4.7 - 0.7	10.7 - 1.5	16.7 - 2.4
48	2°12.0	2°12.4	2°06.0	4.8 - 0.7	10.8 - 1.5	16.8 - 2.4
49	2°12.2	2°12.6	2°06.2	4.9 - 0.7	10.9 - 1.5	16.9 - 2.4
50	2°12.5	2°12.9	2°06.5	5.0 - 0.7	11.0 - 1.6	17.0 - 2.4
51	2°12.7	2°13.1	2°06.7	5.1 - 0.7	11.1 - 1.6	17.1 - 2.4
52	2°13.0	2°13.4	2°06.9	5.2 - 0.7	11.2 - 1.6	17.2 - 2.4
53	2°13.2	2°13.6	2°07.2	5.3 - 0.8	11.3 - 1.6	17.3 - 2.5
54	2°13.5	2°13.9	2°07.4	5.4 - 0.8	11.4 - 1.6	17.4 - 2.5
55	2°13.7	2°14.1	2°07.7	5.5 - 0.8	11.5 - 1.6	17.5 - 2.5
56	2°14.0	2°14.4	2°07.9	5.6 - 0.8	11.6 - 1.6	17.6 - 2.5
57	2°14.2	2°14.6	2°08.1	5.7 - 0.8	11.7 - 1.7	17.7 - 2.5
58	2°14.5	2°14.9	2°08.4	5.8 - 0.8	11.8 - 1.7	17.8 - 2.5
59	2°14.7	2°15.1	2°08.6	5.9 - 0.8	11.9 - 1.7	17.9 - 2.5

Increments and Corrections

m 9	Sun Plan.	Aries	Moon	v and d corr		
0	2°15.0	2°15.4	2°08.8	0.0 - 0.0	6.0 - 0.9	12.0 - 1.9
1	2°15.3	2°15.6	2°09.1	0.1 - 0.0	6.1 - 1.0	12.1 - 1.9
2	2°15.5	2°15.9	2°09.3	0.2 - 0.0	6.2 - 1.0	12.2 - 1.9
3	2°15.8	2°16.1	2°09.6	0.3 - 0.0	6.3 - 1.0	12.3 - 1.9
4	2°16.0	2°16.4	2°09.8	0.4 - 0.1	6.4 - 1.0	12.4 - 2.0
5	2°16.3	2°16.6	2°10.0	0.5 - 0.1	6.5 - 1.0	12.5 - 2.0
6	2°16.5	2°16.9	2°10.3	0.6 - 0.1	6.6 - 1.0	12.6 - 2.0
7	2°16.8	2°17.1	2°10.5	0.7 - 0.1	6.7 - 1.1	12.7 - 2.0
8	2°17.0	2°17.4	2°10.8	0.8 - 0.1	6.8 - 1.1	12.8 - 2.0
9	2°17.3	2°17.6	2°11.0	0.9 - 0.1	6.9 - 1.1	12.9 - 2.0
10	2°17.5	2°17.9	2°11.2	1.0 - 0.2	7.0 - 1.1	13.0 - 2.1
11	2°17.8	2°18.1	2°11.5	1.1 - 0.2	7.1 - 1.1	13.1 - 2.1
12	2°18.0	2°18.4	2°11.7	1.2 - 0.2	7.2 - 1.1	13.2 - 2.1
13	2°18.3	2°18.6	2°12.0	1.3 - 0.2	7.3 - 1.2	13.3 - 2.1
14	2°18.5	2°18.9	2°12.2	1.4 - 0.2	7.4 - 1.2	13.4 - 2.1
15	2°18.8	2°19.1	2°12.4	1.5 - 0.2	7.5 - 1.2	13.5 - 2.1
16	2°19.0	2°19.4	2°12.7	1.6 - 0.3	7.6 - 1.2	13.6 - 2.2
17	2°19.3	2°19.6	2°12.9	1.7 - 0.3	7.7 - 1.2	13.7 - 2.2
18	2°19.5	2°19.9	2°13.1	1.8 - 0.3	7.8 - 1.2	13.8 - 2.2
19	2°19.7	2°20.1	2°13.4	1.9 - 0.3	7.9 - 1.3	13.9 - 2.2
20	2°20.0	2°20.4	2°13.6	2.0 - 0.3	8.0 - 1.3	14.0 - 2.2
21	2°20.2	2°20.6	2°13.9	2.1 - 0.3	8.1 - 1.3	14.1 - 2.2
22	2°20.5	2°20.9	2°14.1	2.2 - 0.3	8.2 - 1.3	14.2 - 2.2
23	2°20.7	2°21.1	2°14.3	2.3 - 0.4	8.3 - 1.3	14.3 - 2.3
24	2°21.0	2°21.4	2°14.6	2.4 - 0.4	8.4 - 1.3	14.4 - 2.3
25	2°21.2	2°21.6	2°14.8	2.5 - 0.4	8.5 - 1.3	14.5 - 2.3
26	2°21.5	2°21.9	2°15.1	2.6 - 0.4	8.6 - 1.4	14.6 - 2.3
27	2°21.7	2°22.1	2°15.3	2.7 - 0.4	8.7 - 1.4	14.7 - 2.3
28	2°22.0	2°22.4	2°15.5	2.8 - 0.4	8.8 - 1.4	14.8 - 2.3
29	2°22.2	2°22.6	2°15.8	2.9 - 0.5	8.9 - 1.4	14.9 - 2.4
30	2°22.5	2°22.9	2°16.0	3.0 - 0.5	9.0 - 1.4	15.0 - 2.4
31	2°22.8	2°23.1	2°16.2	3.1 - 0.5	9.1 - 1.4	15.1 - 2.4
32	2°23.0	2°23.4	2°16.5	3.2 - 0.5	9.2 - 1.5	15.2 - 2.4
33	2°23.3	2°23.6	2°16.7	3.3 - 0.5	9.3 - 1.5	15.3 - 2.4
34	2°23.5	2°23.9	2°17.0	3.4 - 0.5	9.4 - 1.5	15.4 - 2.4
35	2°23.8	2°24.1	2°17.2	3.5 - 0.6	9.5 - 1.5	15.5 - 2.5
36	2°24.0	2°24.4	2°17.4	3.6 - 0.6	9.6 - 1.5	15.6 - 2.5
37	2°24.3	2°24.6	2°17.7	3.7 - 0.6	9.7 - 1.5	15.7 - 2.5
38	2°24.5	2°24.9	2°17.9	3.8 - 0.6	9.8 - 1.6	15.8 - 2.5
39	2°24.8	2°25.1	2°18.2	3.9 - 0.6	9.9 - 1.6	15.9 - 2.5
40	2°25.0	2°25.4	2°18.4	4.0 - 0.6	10.0 - 1.6	16.0 - 2.5
41	2°25.3	2°25.6	2°18.6	4.1 - 0.6	10.1 - 1.6	16.1 - 2.5
42	2°25.5	2°25.9	2°18.9	4.2 - 0.7	10.2 - 1.6	16.2 - 2.6
43	2°25.8	2°26.1	2°19.1	4.3 - 0.7	10.3 - 1.6	16.3 - 2.6
44	2°26.0	2°26.4	2°19.3	4.4 - 0.7	10.4 - 1.6	16.4 - 2.6
45	2°26.3	2°26.6	2°19.6	4.5 - 0.7	10.5 - 1.7	16.5 - 2.6
46	2°26.5	2°26.9	2°19.8	4.6 - 0.7	10.6 - 1.7	16.6 - 2.6
47	2°26.8	2°27.2	2°20.1	4.7 - 0.7	10.7 - 1.7	16.7 - 2.6
48	2°27.0	2°27.4	2°20.3	4.8 - 0.8	10.8 - 1.7	16.8 - 2.7
49	2°27.2	2°27.7	2°20.5	4.9 - 0.8	10.9 - 1.7	16.9 - 2.7
50	2°27.5	2°27.9	2°20.8	5.0 - 0.8	11.0 - 1.7	17.0 - 2.7
51	2°27.7	2°28.2	2°21.0	5.1 - 0.8	11.1 - 1.8	17.1 - 2.7
52	2°28.0	2°28.4	2°21.3	5.2 - 0.8	11.2 - 1.8	17.2 - 2.7
53	2°28.2	2°28.7	2°21.5	5.3 - 0.8	11.3 - 1.8	17.3 - 2.7
54	2°28.5	2°28.9	2°21.7	5.4 - 0.9	11.4 - 1.8	17.4 - 2.8
55	2°28.7	2°29.2	2°22.0	5.5 - 0.9	11.5 - 1.8	17.5 - 2.8
56	2°29.0	2°29.4	2°22.2	5.6 - 0.9	11.6 - 1.8	17.6 - 2.8
57	2°29.2	2°29.7	2°22.5	5.7 - 0.9	11.7 - 1.9	17.7 - 2.8
58	2°29.5	2°29.9	2°22.7	5.8 - 0.9	11.8 - 1.9	17.8 - 2.8
59	2°29.7	2°30.2	2°22.9	5.9 - 0.9	11.9 - 1.9	17.9 - 2.8

m 10	Sun Plan.	Aries	Moon	v and d corr		
0	2°30.0	2°30.4	2°23.2	0.0 - 0.0	6.0 - 1.0	12.0 - 2.1
1	2°30.3	2°30.7	2°23.4	0.1 - 0.0	6.1 - 1.1	12.1 - 2.1
2	2°30.5	2°30.9	2°23.6	0.2 - 0.0	6.2 - 1.1	12.2 - 2.1
3	2°30.8	2°31.2	2°23.9	0.3 - 0.1	6.3 - 1.1	12.3 - 2.2
4	2°31.0	2°31.4	2°24.1	0.4 - 0.1	6.4 - 1.1	12.4 - 2.2
5	2°31.3	2°31.7	2°24.4	0.5 - 0.1	6.5 - 1.1	12.5 - 2.2
6	2°31.5	2°31.9	2°24.6	0.6 - 0.1	6.6 - 1.2	12.6 - 2.2
7	2°31.8	2°32.2	2°24.8	0.7 - 0.1	6.7 - 1.2	12.7 - 2.2
8	2°32.0	2°32.4	2°25.1	0.8 - 0.1	6.8 - 1.2	12.8 - 2.2
9	2°32.3	2°32.7	2°25.3	0.9 - 0.2	6.9 - 1.2	12.9 - 2.3
10	2°32.5	2°32.9	2°25.6	1.0 - 0.2	7.0 - 1.2	13.0 - 2.3
11	2°32.8	2°33.2	2°25.8	1.1 - 0.2	7.1 - 1.2	13.1 - 2.3
12	2°33.0	2°33.4	2°26.0	1.2 - 0.2	7.2 - 1.3	13.2 - 2.3
13	2°33.3	2°33.7	2°26.3	1.3 - 0.2	7.3 - 1.3	13.3 - 2.3
14	2°33.5	2°33.9	2°26.5	1.4 - 0.2	7.4 - 1.3	13.4 - 2.3
15	2°33.8	2°34.2	2°26.7	1.5 - 0.3	7.5 - 1.3	13.5 - 2.4
16	2°34.0	2°34.4	2°27.0	1.6 - 0.3	7.6 - 1.3	13.6 - 2.4
17	2°34.3	2°34.7	2°27.2	1.7 - 0.3	7.7 - 1.3	13.7 - 2.4
18	2°34.5	2°34.9	2°27.5	1.8 - 0.3	7.8 - 1.4	13.8 - 2.4
19	2°34.8	2°35.2	2°27.7	1.9 - 0.3	7.9 - 1.4	13.9 - 2.4
20	2°35.0	2°35.4	2°27.9	2.0 - 0.3	8.0 - 1.4	14.0 - 2.4
21	2°35.2	2°35.7	2°28.2	2.1 - 0.4	8.1 - 1.4	14.1 - 2.5
22	2°35.5	2°35.9	2°28.4	2.2 - 0.4	8.2 - 1.4	14.2 - 2.5
23	2°35.7	2°36.2	2°28.7	2.3 - 0.4	8.3 - 1.5	14.3 - 2.5
24	2°36.0	2°36.4	2°28.9	2.4 - 0.4	8.4 - 1.5	14.4 - 2.5
25	2°36.2	2°36.7	2°29.1	2.5 - 0.4	8.5 - 1.5	14.5 - 2.5
26	2°36.5	2°36.9	2°29.4	2.6 - 0.5	8.6 - 1.5	14.6 - 2.6
27	2°36.7	2°37.2	2°29.6	2.7 - 0.5	8.7 - 1.5	14.7 - 2.6
28	2°37.0	2°37.4	2°29.8	2.8 - 0.5	8.8 - 1.5	14.8 - 2.6
29	2°37.2	2°37.7	2°30.1	2.9 - 0.5	8.9 - 1.6	14.9 - 2.6
30	2°37.5	2°37.9	2°30.3	3.0 - 0.5	9.0 - 1.6	15.0 - 2.6
31	2°37.8	2°38.2	2°30.6	3.1 - 0.5	9.1 - 1.6	15.1 - 2.6
32	2°38.0	2°38.4	2°30.8	3.2 - 0.6	9.2 - 1.6	15.2 - 2.7
33	2°38.3	2°38.7	2°31.0	3.3 - 0.6	9.3 - 1.6	15.3 - 2.7
34	2°38.5	2°38.9	2°31.3	3.4 - 0.6	9.4 - 1.6	15.4 - 2.7
35	2°38.8	2°39.2	2°31.5	3.5 - 0.6	9.5 - 1.7	15.5 - 2.7
36	2°39.0	2°39.4	2°31.8	3.6 - 0.6	9.6 - 1.7	15.6 - 2.7
37	2°39.3	2°39.7	2°32.0	3.7 - 0.6	9.7 - 1.7	15.7 - 2.7
38	2°39.5	2°39.9	2°32.2	3.8 - 0.7	9.8 - 1.7	15.8 - 2.8
39	2°39.8	2°40.2	2°32.5	3.9 - 0.7	9.9 - 1.7	15.9 - 2.8
40	2°40.0	2°40.4	2°32.7	4.0 - 0.7	10.0 - 1.8	16.0 - 2.8
41	2°40.3	2°40.7	2°32.9	4.1 - 0.7	10.1 - 1.8	16.1 - 2.8
42	2°40.5	2°40.9	2°33.2	4.2 - 0.7	10.2 - 1.8	16.2 - 2.8
43	2°40.8	2°41.2	2°33.4	4.3 - 0.8	10.3 - 1.8	16.3 - 2.9
44	2°41.0	2°41.4	2°33.7	4.4 - 0.8	10.4 - 1.8	16.4 - 2.9
45	2°41.3	2°41.7	2°33.9	4.5 - 0.8	10.5 - 1.8	16.5 - 2.9
46	2°41.5	2°41.9	2°34.1	4.6 - 0.8	10.6 - 1.9	16.6 - 2.9
47	2°41.8	2°42.2	2°34.4	4.7 - 0.8	10.7 - 1.9	16.7 - 2.9
48	2°42.0	2°42.4	2°34.6	4.8 - 0.8	10.8 - 1.9	16.8 - 2.9
49	2°42.3	2°42.7	2°34.9	4.9 - 0.9	10.9 - 1.9	16.9 - 3.0
50	2°42.5	2°42.9	2°35.1	5.0 - 0.9	11.0 - 1.9	17.0 - 3.0
51	2°42.7	2°43.2	2°35.3	5.1 - 0.9	11.1 - 1.9	17.1 - 3.0
52	2°43.0	2°43.4	2°35.6	5.2 - 0.9	11.2 - 2.0	17.2 - 3.0
53	2°43.2	2°43.7	2°35.8	5.3 - 0.9	11.3 - 2.0	17.3 - 3.0
54	2°43.5	2°43.9	2°36.1	5.4 - 0.9	11.4 - 2.0	17.4 - 3.0
55	2°43.7	2°44.2	2°36.3	5.5 - 1.0	11.5 - 2.0	17.5 - 3.1
56	2°44.0	2°44.4	2°36.5	5.6 - 1.0	11.6 - 2.0	17.6 - 3.1
57	2°44.2	2°44.7	2°36.8	5.7 - 1.0	11.7 - 2.0	17.7 - 3.1
58	2°44.5	2°44.9	2°37.0	5.8 - 1.0	11.8 - 2.1	17.8 - 3.1
59	2°44.7	2°45.2	2°37.2	5.9 - 1.0	11.9 - 2.1	17.9 - 3.1

m 11	Sun Plan.	Aries	Moon	v and d corr		
0	2°45.0	2°45.5	2°37.5	0.0 - 0.0	6.0 - 1.2	12.0 - 2.3
1	2°45.3	2°45.7	2°37.7	0.1 - 0.0	6.1 - 1.2	12.1 - 2.3
2	2°45.5	2°46.0	2°38.0	0.2 - 0.0	6.2 - 1.2	12.2 - 2.3
3	2°45.8	2°46.2	2°38.2	0.3 - 0.1	6.3 - 1.2	12.3 - 2.4
4	2°46.0	2°46.5	2°38.4	0.4 - 0.1	6.4 - 1.2	12.4 - 2.4
5	2°46.3	2°46.7	2°38.7	0.5 - 0.1	6.5 - 1.2	12.5 - 2.4
6	2°46.5	2°47.0	2°38.9	0.6 - 0.1	6.6 - 1.3	12.6 - 2.4
7	2°46.8	2°47.2	2°39.2	0.7 - 0.1	6.7 - 1.3	12.7 - 2.4
8	2°47.0	2°47.5	2°39.4	0.8 - 0.2	6.8 - 1.3	12.8 - 2.5
9	2°47.3	2°47.7	2°39.6	0.9 - 0.2	6.9 - 1.3	12.9 - 2.5
10	2°47.5	2°48.0	2°39.9	1.0 - 0.2	7.0 - 1.3	13.0 - 2.5
11	2°47.8	2°48.2	2°40.1	1.1 - 0.2	7.1 - 1.4	13.1 - 2.5
12	2°48.0	2°48.5	2°40.3	1.2 - 0.2	7.2 - 1.4	13.2 - 2.5
13	2°48.3	2°48.7	2°40.6	1.3 - 0.2	7.3 - 1.4	13.3 - 2.5
14	2°48.5	2°49.0	2°40.8	1.4 - 0.3	7.4 - 1.4	13.4 - 2.6
15	2°48.8	2°49.2	2°41.1	1.5 - 0.3	7.5 - 1.4	13.5 - 2.6
16	2°49.0	2°49.5	2°41.3	1.6 - 0.3	7.6 - 1.5	13.6 - 2.6
17	2°49.3	2°49.7	2°41.5	1.7 - 0.3	7.7 - 1.5	13.7 - 2.6
18	2°49.5	2°50.0	2°41.8	1.8 - 0.3	7.8 - 1.5	13.8 - 2.6
19	2°49.8	2°50.2	2°42.0	1.9 - 0.4	7.9 - 1.5	13.9 - 2.7
20	2°50.0	2°50.5	2°42.3	2.0 - 0.4	8.0 - 1.5	14.0 - 2.7
21	2°50.2	2°50.7	2°42.5	2.1 - 0.4	8.1 - 1.6	14.1 - 2.7
22	2°50.5	2°51.0	2°42.7	2.2 - 0.4	8.2 - 1.6	14.2 - 2.7
23	2°50.7	2°51.2	2°43.0	2.3 - 0.4	8.3 - 1.6	14.3 - 2.7
24	2°51.0	2°51.5	2°43.2	2.4 - 0.5	8.4 - 1.6	14.4 - 2.8
25	2°51.2	2°51.7	2°43.4	2.5 - 0.5	8.5 - 1.6	14.5 - 2.8
26	2°51.5	2°52.0	2°43.7	2.6 - 0.5	8.6 - 1.6	14.6 - 2.8
27	2°51.7	2°52.2	2°43.9	2.7 - 0.5	8.7 - 1.7	14.7 - 2.8
28	2°52.0	2°52.5	2°44.2	2.8 - 0.5	8.8 - 1.7	14.8 - 2.8
29	2°52.2	2°52.7	2°44.4	2.9 - 0.6	8.9 - 1.7	14.9 - 2.9
30	2°52.5	2°53.0	2°44.6	3.0 - 0.6	9.0 - 1.7	15.0 - 2.9
31	2°52.8	2°53.2	2°44.9	3.1 - 0.6	9.1 - 1.7	15.1 - 2.9
32	2°53.0	2°53.5	2°45.1	3.2 - 0.6	9.2 - 1.8	15.2 - 2.9
33	2°53.3	2°53.7	2°45.4	3.3 - 0.6	9.3 - 1.8	15.3 - 2.9
34	2°53.5	2°54.0	2°45.6	3.4 - 0.7	9.4 - 1.8	15.4 - 3.0
35	2°53.8	2°54.2	2°45.8	3.5 - 0.7	9.5 - 1.8	15.5 - 3.0
36	2°54.0	2°54.5	2°46.1	3.6 - 0.7	9.6 - 1.8	15.6 - 3.0
37	2°54.3	2°54.7	2°46.3	3.7 - 0.7	9.7 - 1.9	15.7 - 3.0
38	2°54.5	2°55.0	2°46.6	3.8 - 0.7	9.8 - 1.9	15.8 - 3.0
39	2°54.8	2°55.2	2°46.8	3.9 - 0.7	9.9 - 1.9	15.9 - 3.0
40	2°55.0	2°55.5	2°47.0	4.0 - 0.8	10.0 - 1.9	16.0 - 3.1
41	2°55.3	2°55.7	2°47.3	4.1 - 0.8	10.1 - 1.9	16.1 - 3.1
42	2°55.5	2°56.0	2°47.5	4.2 - 0.8	10.2 - 2.0	16.2 - 3.1
43	2°55.8	2°56.2	2°47.7	4.3 - 0.8	10.3 - 2.0	16.3 - 3.1
44	2°56.0	2°56.5	2°48.0	4.4 - 0.8	10.4 - 2.0	16.4 - 3.1
45	2°56.3	2°56.7	2°48.2	4.5 - 0.9	10.5 - 2.0	16.5 - 3.2
46	2°56.5	2°57.0	2°48.5	4.6 - 0.9	10.6 - 2.0	16.6 - 3.2
47	2°56.8	2°57.2	2°48.7	4.7 - 0.9	10.7 - 2.1	16.7 - 3.2
48	2°57.0	2°57.5	2°48.9	4.8 - 0.9	10.8 - 2.1	16.8 - 3.2
49	2°57.3	2°57.7	2°49.2	4.9 - 0.9	10.9 - 2.1	16.9 - 3.2
50	2°57.5	2°58.0	2°49.4	5.0 - 1.0	11.0 - 2.1	17.0 - 3.3
51	2°57.7	2°58.2	2°49.7	5.1 - 1.0	11.1 - 2.1	17.1 - 3.3
52	2°58.0	2°58.5	2°49.9	5.2 - 1.0	11.2 - 2.1	17.2 - 3.3
53	2°58.2	2°58.7	2°50.1	5.3 - 1.0	11.3 - 2.2	17.3 - 3.3
54	2°58.5	2°59.0	2°50.4	5.4 - 1.0	11.4 - 2.2	17.4 - 3.3
55	2°58.7	2°59.2	2°50.6	5.5 - 1.1	11.5 - 2.2	17.5 - 3.4
56	2°59.0	2°59.5	2°50.8	5.6 - 1.1	11.6 - 2.2	17.6 - 3.4
57	2°59.2	2°59.7	2°51.1	5.7 - 1.1	11.7 - 2.2	17.7 - 3.4
58	2°59.5	3°00.0	2°51.3	5.8 - 1.1	11.8 - 2.3	17.8 - 3.4
59	2°59.7	3°00.2	2°51.6	5.9 - 1.1	11.9 - 2.3	17.9 - 3.4

Increments and Corrections

m 12	Sun Plan.	Aries	Moon	v and d corr		
0	3°00.0	3°00.5	2°51.8	0.0 - 0.0	6.0 - 1.3	12.0 - 2.5
1	3°00.3	3°00.7	2°52.0	0.1 - 0.0	6.1 - 1.3	12.1 - 2.5
2	3°00.5	3°01.0	2°52.3	0.2 - 0.0	6.2 - 1.3	12.2 - 2.5
3	3°00.8	3°01.2	2°52.5	0.3 - 0.1	6.3 - 1.3	12.3 - 2.6
4	3°01.0	3°01.5	2°52.8	0.4 - 0.1	6.4 - 1.3	12.4 - 2.6
5	3°01.3	3°01.7	2°53.0	0.5 - 0.1	6.5 - 1.4	12.5 - 2.6
6	3°01.5	3°02.0	2°53.2	0.6 - 0.1	6.6 - 1.4	12.6 - 2.6
7	3°01.8	3°02.2	2°53.5	0.7 - 0.1	6.7 - 1.4	12.7 - 2.6
8	3°02.0	3°02.5	2°53.7	0.8 - 0.2	6.8 - 1.4	12.8 - 2.7
9	3°02.3	3°02.7	2°53.9	0.9 - 0.2	6.9 - 1.4	12.9 - 2.7
10	3°02.5	3°03.0	2°54.2	1.0 - 0.2	7.0 - 1.5	13.0 - 2.7
11	3°02.8	3°03.2	2°54.4	1.1 - 0.2	7.1 - 1.5	13.1 - 2.7
12	3°03.0	3°03.5	2°54.7	1.2 - 0.3	7.2 - 1.5	13.2 - 2.8
13	3°03.3	3°03.8	2°54.9	1.3 - 0.3	7.3 - 1.5	13.3 - 2.8
14	3°03.5	3°04.0	2°55.1	1.4 - 0.3	7.4 - 1.5	13.4 - 2.8
15	3°03.8	3°04.3	2°55.4	1.5 - 0.3	7.5 - 1.6	13.5 - 2.8
16	3°04.0	3°04.5	2°55.6	1.6 - 0.3	7.6 - 1.6	13.6 - 2.8
17	3°04.2	3°04.8	2°55.9	1.7 - 0.4	7.7 - 1.6	13.7 - 2.9
18	3°04.5	3°05.0	2°56.1	1.8 - 0.4	7.8 - 1.6	13.8 - 2.9
19	3°04.7	3°05.3	2°56.3	1.9 - 0.4	7.9 - 1.6	13.9 - 2.9
20	3°05.0	3°05.5	2°56.6	2.0 - 0.4	8.0 - 1.7	14.0 - 2.9
21	3°05.2	3°05.8	2°56.8	2.1 - 0.4	8.1 - 1.7	14.1 - 2.9
22	3°05.5	3°06.0	2°57.0	2.2 - 0.5	8.2 - 1.7	14.2 - 3.0
23	3°05.7	3°06.3	2°57.3	2.3 - 0.5	8.3 - 1.7	14.3 - 3.0
24	3°06.0	3°06.5	2°57.5	2.4 - 0.5	8.4 - 1.8	14.4 - 3.0
25	3°06.2	3°06.8	2°57.8	2.5 - 0.5	8.5 - 1.8	14.5 - 3.0
26	3°06.5	3°07.0	2°58.0	2.6 - 0.5	8.6 - 1.8	14.6 - 3.0
27	3°06.7	3°07.3	2°58.2	2.7 - 0.6	8.7 - 1.8	14.7 - 3.1
28	3°07.0	3°07.5	2°58.5	2.8 - 0.6	8.8 - 1.8	14.8 - 3.1
29	3°07.2	3°07.8	2°58.7	2.9 - 0.6	8.9 - 1.9	14.9 - 3.1
30	3°07.5	3°08.0	2°59.0	3.0 - 0.6	9.0 - 1.9	15.0 - 3.1
31	3°07.8	3°08.3	2°59.2	3.1 - 0.6	9.1 - 1.9	15.1 - 3.1
32	3°08.0	3°08.5	2°59.4	3.2 - 0.7	9.2 - 1.9	15.2 - 3.2
33	3°08.3	3°08.8	2°59.7	3.3 - 0.7	9.3 - 1.9	15.3 - 3.2
34	3°08.5	3°09.0	2°59.9	3.4 - 0.7	9.4 - 2.0	15.4 - 3.2
35	3°08.8	3°09.3	3°00.2	3.5 - 0.7	9.5 - 2.0	15.5 - 3.2
36	3°09.0	3°09.5	3°00.4	3.6 - 0.8	9.6 - 2.0	15.6 - 3.3
37	3°09.3	3°09.8	3°00.6	3.7 - 0.8	9.7 - 2.0	15.7 - 3.3
38	3°09.5	3°10.0	3°00.9	3.8 - 0.8	9.8 - 2.0	15.8 - 3.3
39	3°09.8	3°10.3	3°01.1	3.9 - 0.8	9.9 - 2.1	15.9 - 3.3
40	3°10.0	3°10.5	3°01.3	4.0 - 0.8	10.0 - 2.1	16.0 - 3.3
41	3°10.3	3°10.8	3°01.6	4.1 - 0.9	10.1 - 2.1	16.1 - 3.4
42	3°10.5	3°11.0	3°01.8	4.2 - 0.9	10.2 - 2.1	16.2 - 3.4
43	3°10.8	3°11.3	3°02.1	4.3 - 0.9	10.3 - 2.1	16.3 - 3.4
44	3°11.0	3°11.5	3°02.3	4.4 - 0.9	10.4 - 2.2	16.4 - 3.4
45	3°11.3	3°11.8	3°02.5	4.5 - 0.9	10.5 - 2.2	16.5 - 3.4
46	3°11.5	3°12.0	3°02.8	4.6 - 1.0	10.6 - 2.2	16.6 - 3.5
47	3°11.7	3°12.3	3°03.0	4.7 - 1.0	10.7 - 2.2	16.7 - 3.5
48	3°12.0	3°12.5	3°03.3	4.8 - 1.0	10.8 - 2.3	16.8 - 3.5
49	3°12.2	3°12.8	3°03.5	4.9 - 1.0	10.9 - 2.3	16.9 - 3.5
50	3°12.5	3°13.0	3°03.7	5.0 - 1.0	11.0 - 2.3	17.0 - 3.5
51	3°12.7	3°13.3	3°04.0	5.1 - 1.1	11.1 - 2.3	17.1 - 3.6
52	3°13.0	3°13.5	3°04.2	5.2 - 1.1	11.2 - 2.3	17.2 - 3.6
53	3°13.2	3°13.8	3°04.4	5.3 - 1.1	11.3 - 2.4	17.3 - 3.6
54	3°13.5	3°14.0	3°04.7	5.4 - 1.1	11.4 - 2.4	17.4 - 3.6
55	3°13.7	3°14.3	3°04.9	5.5 - 1.1	11.5 - 2.4	17.5 - 3.6
56	3°14.0	3°14.5	3°05.2	5.6 - 1.2	11.6 - 2.4	17.6 - 3.7
57	3°14.2	3°14.8	3°05.4	5.7 - 1.2	11.7 - 2.4	17.7 - 3.7
58	3°14.5	3°15.0	3°05.6	5.8 - 1.2	11.8 - 2.5	17.8 - 3.7
59	3°14.7	3°15.3	3°05.9	5.9 - 1.2	11.9 - 2.5	17.9 - 3.7

m 13	Sun Plan.	Aries	Moon	v and d corr		
0	3°15.0	3°15.5	3°06.1	0.0 - 0.0	6.0 - 1.4	12.0 - 2.7
1	3°15.3	3°15.8	3°06.4	0.1 - 0.0	6.1 - 1.4	12.1 - 2.7
2	3°15.5	3°16.0	3°06.6	0.2 - 0.0	6.2 - 1.4	12.2 - 2.7
3	3°15.8	3°16.3	3°06.8	0.3 - 0.1	6.3 - 1.4	12.3 - 2.8
4	3°16.0	3°16.5	3°07.1	0.4 - 0.1	6.4 - 1.4	12.4 - 2.8
5	3°16.3	3°16.8	3°07.3	0.5 - 0.1	6.5 - 1.5	12.5 - 2.8
6	3°16.5	3°17.0	3°07.5	0.6 - 0.1	6.6 - 1.5	12.6 - 2.8
7	3°16.8	3°17.3	3°07.8	0.7 - 0.2	6.7 - 1.5	12.7 - 2.9
8	3°17.0	3°17.5	3°08.0	0.8 - 0.2	6.8 - 1.5	12.8 - 2.9
9	3°17.3	3°17.8	3°08.3	0.9 - 0.2	6.9 - 1.6	12.9 - 2.9
10	3°17.5	3°18.0	3°08.5	1.0 - 0.2	7.0 - 1.6	13.0 - 2.9
11	3°17.8	3°18.3	3°08.7	1.1 - 0.2	7.1 - 1.6	13.1 - 2.9
12	3°18.0	3°18.5	3°09.0	1.2 - 0.3	7.2 - 1.6	13.2 - 3.0
13	3°18.3	3°18.8	3°09.2	1.3 - 0.3	7.3 - 1.6	13.3 - 3.0
14	3°18.5	3°19.0	3°09.5	1.4 - 0.3	7.4 - 1.7	13.4 - 3.0
15	3°18.8	3°19.3	3°09.7	1.5 - 0.3	7.5 - 1.7	13.5 - 3.0
16	3°19.0	3°19.5	3°09.9	1.6 - 0.4	7.6 - 1.7	13.6 - 3.1
17	3°19.3	3°19.8	3°10.2	1.7 - 0.4	7.7 - 1.7	13.7 - 3.1
18	3°19.5	3°20.0	3°10.4	1.8 - 0.4	7.8 - 1.8	13.8 - 3.1
19	3°19.7	3°20.3	3°10.7	1.9 - 0.4	7.9 - 1.8	13.9 - 3.1
20	3°20.0	3°20.5	3°10.9	2.0 - 0.5	8.0 - 1.8	14.0 - 3.1
21	3°20.2	3°20.8	3°11.1	2.1 - 0.5	8.1 - 1.8	14.1 - 3.2
22	3°20.5	3°21.0	3°11.4	2.2 - 0.5	8.2 - 1.8	14.2 - 3.2
23	3°20.7	3°21.3	3°11.6	2.3 - 0.5	8.3 - 1.9	14.3 - 3.2
24	3°21.0	3°21.5	3°11.8	2.4 - 0.5	8.4 - 1.9	14.4 - 3.2
25	3°21.2	3°21.8	3°12.1	2.5 - 0.6	8.5 - 1.9	14.5 - 3.3
26	3°21.5	3°22.1	3°12.3	2.6 - 0.6	8.6 - 1.9	14.6 - 3.3
27	3°21.7	3°22.3	3°12.6	2.7 - 0.6	8.7 - 2.0	14.7 - 3.3
28	3°22.0	3°22.6	3°12.8	2.8 - 0.6	8.8 - 2.0	14.8 - 3.3
29	3°22.2	3°22.8	3°13.0	2.9 - 0.7	8.9 - 2.0	14.9 - 3.4
30	3°22.5	3°23.1	3°13.3	3.0 - 0.7	9.0 - 2.0	15.0 - 3.4
31	3°22.8	3°23.3	3°13.5	3.1 - 0.7	9.1 - 2.0	15.1 - 3.4
32	3°23.0	3°23.6	3°13.8	3.2 - 0.7	9.2 - 2.1	15.2 - 3.4
33	3°23.3	3°23.8	3°14.0	3.3 - 0.7	9.3 - 2.1	15.3 - 3.4
34	3°23.5	3°24.1	3°14.2	3.4 - 0.8	9.4 - 2.1	15.4 - 3.5
35	3°23.8	3°24.3	3°14.5	3.5 - 0.8	9.5 - 2.1	15.5 - 3.5
36	3°24.0	3°24.6	3°14.7	3.6 - 0.8	9.6 - 2.2	15.6 - 3.5
37	3°24.3	3°24.8	3°14.9	3.7 - 0.8	9.7 - 2.2	15.7 - 3.5
38	3°24.5	3°25.1	3°15.2	3.8 - 0.9	9.8 - 2.2	15.8 - 3.6
39	3°24.8	3°25.3	3°15.4	3.9 - 0.9	9.9 - 2.2	15.9 - 3.6
40	3°25.0	3°25.6	3°15.7	4.0 - 0.9	10.0 - 2.3	16.0 - 3.6
41	3°25.3	3°25.8	3°15.9	4.1 - 0.9	10.1 - 2.3	16.1 - 3.6
42	3°25.5	3°26.1	3°16.1	4.2 - 0.9	10.2 - 2.3	16.2 - 3.6
43	3°25.8	3°26.3	3°16.4	4.3 - 1.0	10.3 - 2.3	16.3 - 3.7
44	3°26.0	3°26.6	3°16.6	4.4 - 1.0	10.4 - 2.3	16.4 - 3.7
45	3°26.3	3°26.8	3°16.9	4.5 - 1.0	10.5 - 2.4	16.5 - 3.7
46	3°26.5	3°27.1	3°17.1	4.6 - 1.0	10.6 - 2.4	16.6 - 3.7
47	3°26.8	3°27.3	3°17.3	4.7 - 1.1	10.7 - 2.4	16.7 - 3.8
48	3°27.0	3°27.6	3°17.6	4.8 - 1.1	10.8 - 2.4	16.8 - 3.8
49	3°27.2	3°27.8	3°17.8	4.9 - 1.1	10.9 - 2.5	16.9 - 3.8
50	3°27.5	3°28.1	3°18.0	5.0 - 1.1	11.0 - 2.5	17.0 - 3.8
51	3°27.7	3°28.3	3°18.3	5.1 - 1.1	11.1 - 2.5	17.1 - 3.8
52	3°28.0	3°28.6	3°18.5	5.2 - 1.2	11.2 - 2.5	17.2 - 3.9
53	3°28.2	3°28.8	3°18.8	5.3 - 1.2	11.3 - 2.5	17.3 - 3.9
54	3°28.5	3°29.1	3°19.0	5.4 - 1.2	11.4 - 2.6	17.4 - 3.9
55	3°28.7	3°29.3	3°19.2	5.5 - 1.2	11.5 - 2.6	17.5 - 3.9
56	3°29.0	3°29.6	3°19.5	5.6 - 1.3	11.6 - 2.6	17.6 - 4.0
57	3°29.2	3°29.8	3°19.7	5.7 - 1.3	11.7 - 2.6	17.7 - 4.0
58	3°29.5	3°30.1	3°20.0	5.8 - 1.3	11.8 - 2.7	17.8 - 4.0
59	3°29.7	3°30.3	3°20.2	5.9 - 1.3	11.9 - 2.7	17.9 - 4.0

m 14	Sun Plan.	Aries	Moon	v and d corr		
0	3°30.0	3°30.6	3°20.4	0.0 - 0.0	6.0 - 1.4	12.0 - 2.9
1	3°30.3	3°30.8	3°20.7	0.1 - 0.0	6.1 - 1.5	12.1 - 2.9
2	3°30.5	3°31.1	3°20.9	0.2 - 0.0	6.2 - 1.5	12.2 - 2.9
3	3°30.8	3°31.3	3°21.1	0.3 - 0.1	6.3 - 1.5	12.3 - 3.0
4	3°31.0	3°31.6	3°21.4	0.4 - 0.1	6.4 - 1.5	12.4 - 3.0
5	3°31.3	3°31.8	3°21.6	0.5 - 0.1	6.5 - 1.6	12.5 - 3.0
6	3°31.5	3°32.1	3°21.9	0.6 - 0.1	6.6 - 1.6	12.6 - 3.0
7	3°31.8	3°32.3	3°22.1	0.7 - 0.2	6.7 - 1.6	12.7 - 3.1
8	3°32.0	3°32.6	3°22.3	0.8 - 0.2	6.8 - 1.6	12.8 - 3.1
9	3°32.3	3°32.8	3°22.6	0.9 - 0.2	6.9 - 1.7	12.9 - 3.1
10	3°32.5	3°33.1	3°22.8	1.0 - 0.2	7.0 - 1.7	13.0 - 3.1
11	3°32.8	3°33.3	3°23.1	1.1 - 0.3	7.1 - 1.7	13.1 - 3.2
12	3°33.0	3°33.6	3°23.3	1.2 - 0.3	7.2 - 1.7	13.2 - 3.2
13	3°33.3	3°33.8	3°23.5	1.3 - 0.3	7.3 - 1.8	13.3 - 3.2
14	3°33.5	3°34.1	3°23.8	1.4 - 0.3	7.4 - 1.8	13.4 - 3.2
15	3°33.8	3°34.3	3°24.0	1.5 - 0.4	7.5 - 1.8	13.5 - 3.3
16	3°34.0	3°34.6	3°24.3	1.6 - 0.4	7.6 - 1.8	13.6 - 3.3
17	3°34.3	3°34.8	3°24.5	1.7 - 0.4	7.7 - 1.9	13.7 - 3.3
18	3°34.5	3°35.1	3°24.7	1.8 - 0.4	7.8 - 1.9	13.8 - 3.3
19	3°34.8	3°35.3	3°25.0	1.9 - 0.5	7.9 - 1.9	13.9 - 3.4
20	3°35.0	3°35.6	3°25.2	2.0 - 0.5	8.0 - 1.9	14.0 - 3.4
21	3°35.2	3°35.8	3°25.4	2.1 - 0.5	8.1 - 2.0	14.1 - 3.4
22	3°35.5	3°36.1	3°25.7	2.2 - 0.5	8.2 - 2.0	14.2 - 3.4
23	3°35.7	3°36.3	3°25.9	2.3 - 0.6	8.3 - 2.0	14.3 - 3.5
24	3°36.0	3°36.6	3°26.2	2.4 - 0.6	8.4 - 2.0	14.4 - 3.5
25	3°36.2	3°36.8	3°26.4	2.5 - 0.6	8.5 - 2.1	14.5 - 3.5
26	3°36.5	3°37.1	3°26.6	2.6 - 0.6	8.6 - 2.1	14.6 - 3.5
27	3°36.7	3°37.3	3°26.9	2.7 - 0.7	8.7 - 2.1	14.7 - 3.6
28	3°37.0	3°37.6	3°27.1	2.8 - 0.7	8.8 - 2.1	14.8 - 3.6
29	3°37.2	3°37.8	3°27.4	2.9 - 0.7	8.9 - 2.2	14.9 - 3.6
30	3°37.5	3°38.1	3°27.6	3.0 - 0.7	9.0 - 2.2	15.0 - 3.6
31	3°37.8	3°38.3	3°27.8	3.1 - 0.7	9.1 - 2.2	15.1 - 3.6
32	3°38.0	3°38.6	3°28.1	3.2 - 0.8	9.2 - 2.2	15.2 - 3.7
33	3°38.3	3°38.8	3°28.3	3.3 - 0.8	9.3 - 2.2	15.3 - 3.7
34	3°38.5	3°39.1	3°28.5	3.4 - 0.8	9.4 - 2.3	15.4 - 3.7
35	3°38.8	3°39.3	3°28.8	3.5 - 0.8	9.5 - 2.3	15.5 - 3.7
36	3°39.0	3°39.6	3°29.0	3.6 - 0.9	9.6 - 2.3	15.6 - 3.8
37	3°39.3	3°39.8	3°29.3	3.7 - 0.9	9.7 - 2.3	15.7 - 3.8
38	3°39.5	3°40.1	3°29.5	3.8 - 0.9	9.8 - 2.4	15.8 - 3.8
39	3°39.8	3°40.4	3°29.7	3.9 - 0.9	9.9 - 2.4	15.9 - 3.8
40	3°40.0	3°40.6	3°30.0	4.0 - 1.0	10.0 - 2.4	16.0 - 3.9
41	3°40.3	3°40.9	3°30.2	4.1 - 1.0	10.1 - 2.4	16.1 - 3.9
42	3°40.5	3°41.1	3°30.5	4.2 - 1.0	10.2 - 2.5	16.2 - 3.9
43	3°40.8	3°41.4	3°30.7	4.3 - 1.0	10.3 - 2.5	16.3 - 3.9
44	3°41.0	3°41.6	3°30.9	4.4 - 1.1	10.4 - 2.5	16.4 - 4.0
45	3°41.3	3°41.9	3°31.2	4.5 - 1.1	10.5 - 2.5	16.5 - 4.0
46	3°41.5	3°42.1	3°31.4	4.6 - 1.1	10.6 - 2.6	16.6 - 4.0
47	3°41.8	3°42.4	3°31.6	4.7 - 1.1	10.7 - 2.6	16.7 - 4.0
48	3°42.0	3°42.6	3°31.9	4.8 - 1.2	10.8 - 2.6	16.8 - 4.1
49	3°42.3	3°42.9	3°32.1	4.9 - 1.2	10.9 - 2.6	16.9 - 4.1
50	3°42.5	3°43.1	3°32.4	5.0 - 1.2	11.0 - 2.7	17.0 - 4.1
51	3°42.7	3°43.4	3°32.6	5.1 - 1.2	11.1 - 2.7	17.1 - 4.1
52	3°43.0	3°43.6	3°32.8	5.2 - 1.3	11.2 - 2.7	17.2 - 4.2
53	3°43.2	3°43.9	3°33.1	5.3 - 1.3	11.3 - 2.7	17.3 - 4.2
54	3°43.5	3°44.1	3°33.3	5.4 - 1.3	11.4 - 2.8	17.4 - 4.2
55	3°43.7	3°44.4	3°33.6	5.5 - 1.3	11.5 - 2.8	17.5 - 4.2
56	3°44.0	3°44.6	3°33.8	5.6 - 1.4	11.6 - 2.8	17.6 - 4.3
57	3°44.2	3°44.9	3°34.0	5.7 - 1.4	11.7 - 2.8	17.7 - 4.3
58	3°44.5	3°45.1	3°34.3	5.8 - 1.4	11.8 - 2.9	17.8 - 4.3
59	3°44.7	3°45.4	3°34.5	5.9 - 1.4	11.9 - 2.9	17.9 - 4.3

Increments and Corrections

m 15	Sun Plan.	Aries	Moon	v and d corr		
0	3°45.0	3°45.6	3°34.8	0.0 - 0.0	6.0 - 1.6	12.0 - 3.1
1	3°45.2	3°45.9	3°35.0	0.1 - 0.0	6.1 - 1.6	12.1 - 3.1
2	3°45.5	3°46.1	3°35.2	0.2 - 0.1	6.2 - 1.6	12.2 - 3.2
3	3°45.8	3°46.4	3°35.5	0.3 - 0.1	6.3 - 1.6	12.3 - 3.2
4	3°46.0	3°46.6	3°35.7	0.4 - 0.1	6.4 - 1.7	12.4 - 3.2
5	3°46.2	3°46.9	3°35.9	0.5 - 0.1	6.5 - 1.7	12.5 - 3.2
6	3°46.5	3°47.1	3°36.2	0.6 - 0.2	6.6 - 1.7	12.6 - 3.3
7	3°46.8	3°47.4	3°36.4	0.7 - 0.2	6.7 - 1.7	12.7 - 3.3
8	3°47.0	3°47.6	3°36.7	0.8 - 0.2	6.8 - 1.8	12.8 - 3.3
9	3°47.3	3°47.9	3°36.9	0.9 - 0.2	6.9 - 1.8	12.9 - 3.3
10	3°47.5	3°48.1	3°37.1	1.0 - 0.3	7.0 - 1.8	13.0 - 3.4
11	3°47.7	3°48.4	3°37.4	1.1 - 0.3	7.1 - 1.8	13.1 - 3.4
12	3°48.0	3°48.6	3°37.6	1.2 - 0.3	7.2 - 1.9	13.2 - 3.4
13	3°48.3	3°48.9	3°37.9	1.3 - 0.3	7.3 - 1.9	13.3 - 3.4
14	3°48.5	3°49.1	3°38.1	1.4 - 0.4	7.4 - 1.9	13.4 - 3.5
15	3°48.8	3°49.4	3°38.3	1.5 - 0.4	7.5 - 1.9	13.5 - 3.5
16	3°49.0	3°49.6	3°38.6	1.6 - 0.4	7.6 - 2.0	13.6 - 3.5
17	3°49.3	3°49.9	3°38.8	1.7 - 0.4	7.7 - 2.0	13.7 - 3.5
18	3°49.5	3°50.1	3°39.0	1.8 - 0.5	7.8 - 2.0	13.8 - 3.6
19	3°49.8	3°50.4	3°39.3	1.9 - 0.5	7.9 - 2.0	13.9 - 3.6
20	3°50.0	3°50.6	3°39.5	2.0 - 0.5	8.0 - 2.1	14.0 - 3.6
21	3°50.2	3°50.9	3°39.8	2.1 - 0.5	8.1 - 2.1	14.1 - 3.6
22	3°50.5	3°51.1	3°40.0	2.2 - 0.6	8.2 - 2.1	14.2 - 3.7
23	3°50.7	3°51.4	3°40.2	2.3 - 0.6	8.3 - 2.1	14.3 - 3.7
24	3°51.0	3°51.6	3°40.5	2.4 - 0.6	8.4 - 2.2	14.4 - 3.7
25	3°51.2	3°51.9	3°40.7	2.5 - 0.6	8.5 - 2.2	14.5 - 3.7
26	3°51.5	3°52.1	3°41.0	2.6 - 0.7	8.6 - 2.2	14.6 - 3.8
27	3°51.8	3°52.4	3°41.2	2.7 - 0.7	8.7 - 2.2	14.7 - 3.8
28	3°52.0	3°52.6	3°41.4	2.8 - 0.7	8.8 - 2.3	14.8 - 3.8
29	3°52.2	3°52.9	3°41.7	2.9 - 0.7	8.9 - 2.3	14.9 - 3.8
30	3°52.5	3°53.1	3°41.9	3.0 - 0.8	9.0 - 2.3	15.0 - 3.9
31	3°52.8	3°53.4	3°42.1	3.1 - 0.8	9.1 - 2.4	15.1 - 3.9
32	3°53.0	3°53.6	3°42.4	3.2 - 0.8	9.2 - 2.4	15.2 - 3.9
33	3°53.2	3°53.9	3°42.6	3.3 - 0.9	9.3 - 2.4	15.3 - 4.0
34	3°53.5	3°54.1	3°42.9	3.4 - 0.9	9.4 - 2.4	15.4 - 4.0
35	3°53.8	3°54.4	3°43.1	3.5 - 0.9	9.5 - 2.5	15.5 - 4.0
36	3°54.0	3°54.6	3°43.3	3.6 - 0.9	9.6 - 2.5	15.6 - 4.0
37	3°54.3	3°54.9	3°43.6	3.7 - 1.0	9.7 - 2.5	15.7 - 4.1
38	3°54.5	3°55.1	3°43.8	3.8 - 1.0	9.8 - 2.5	15.8 - 4.1
39	3°54.8	3°55.4	3°44.1	3.9 - 1.0	9.9 - 2.6	15.9 - 4.1
40	3°55.0	3°55.6	3°44.3	4.0 - 1.0	10.0 - 2.6	16.0 - 4.1
41	3°55.3	3°55.9	3°44.5	4.1 - 1.1	10.1 - 2.6	16.1 - 4.2
42	3°55.5	3°56.1	3°44.8	4.2 - 1.1	10.2 - 2.6	16.2 - 4.2
43	3°55.7	3°56.4	3°45.0	4.3 - 1.1	10.3 - 2.7	16.3 - 4.2
44	3°56.0	3°56.6	3°45.2	4.4 - 1.1	10.4 - 2.7	16.4 - 4.2
45	3°56.3	3°56.9	3°45.5	4.5 - 1.2	10.5 - 2.7	16.5 - 4.3
46	3°56.5	3°57.1	3°45.7	4.6 - 1.2	10.6 - 2.7	16.6 - 4.3
47	3°56.8	3°57.4	3°46.0	4.7 - 1.2	10.7 - 2.8	16.7 - 4.3
48	3°57.0	3°57.6	3°46.2	4.8 - 1.2	10.8 - 2.8	16.8 - 4.3
49	3°57.3	3°57.9	3°46.4	4.9 - 1.3	10.9 - 2.8	16.9 - 4.4
50	3°57.5	3°58.1	3°46.7	5.0 - 1.3	11.0 - 2.8	17.0 - 4.4
51	3°57.7	3°58.4	3°46.9	5.1 - 1.3	11.1 - 2.9	17.1 - 4.4
52	3°58.0	3°58.7	3°47.2	5.2 - 1.3	11.2 - 2.9	17.2 - 4.4
53	3°58.2	3°58.9	3°47.4	5.3 - 1.4	11.3 - 2.9	17.3 - 4.5
54	3°58.5	3°59.2	3°47.6	5.4 - 1.4	11.4 - 2.9	17.4 - 4.5
55	3°58.7	3°59.4	3°47.9	5.5 - 1.4	11.5 - 3.0	17.5 - 4.5
56	3°59.0	3°59.7	3°48.1	5.6 - 1.4	11.6 - 3.0	17.6 - 4.5
57	3°59.2	3°59.9	3°48.4	5.7 - 1.5	11.7 - 3.0	17.7 - 4.6
58	3°59.5	4°00.2	3°48.6	5.8 - 1.5	11.8 - 3.0	17.8 - 4.6
59	3°59.8	4°00.4	3°48.8	5.9 - 1.5	11.9 - 3.1	17.9 - 4.6

m 16	Sun Plan.	Aries	Moon	v and d corr		
0	4°00.0	4°00.7	3°49.1	0.0 - 0.0	6.0 - 1.7	12.0 - 3.3
1	4°00.2	4°00.9	3°49.3	0.1 - 0.0	6.1 - 1.7	12.1 - 3.3
2	4°00.5	4°01.2	3°49.5	0.2 - 0.1	6.2 - 1.7	12.2 - 3.4
3	4°00.8	4°01.4	3°49.8	0.3 - 0.1	6.3 - 1.7	12.3 - 3.4
4	4°01.0	4°01.7	3°50.0	0.4 - 0.1	6.4 - 1.8	12.4 - 3.4
5	4°01.2	4°01.9	3°50.3	0.5 - 0.1	6.5 - 1.8	12.5 - 3.4
6	4°01.5	4°02.2	3°50.5	0.6 - 0.2	6.6 - 1.8	12.6 - 3.5
7	4°01.8	4°02.4	3°50.7	0.7 - 0.2	6.7 - 1.8	12.7 - 3.5
8	4°02.0	4°02.7	3°51.0	0.8 - 0.2	6.8 - 1.9	12.8 - 3.5
9	4°02.2	4°02.9	3°51.2	0.9 - 0.2	6.9 - 1.9	12.9 - 3.5
10	4°02.5	4°03.2	3°51.5	1.0 - 0.3	7.0 - 1.9	13.0 - 3.6
11	4°02.8	4°03.4	3°51.7	1.1 - 0.3	7.1 - 2.0	13.1 - 3.6
12	4°03.0	4°03.7	3°51.9	1.2 - 0.3	7.2 - 2.0	13.2 - 3.6
13	4°03.2	4°03.9	3°52.2	1.3 - 0.4	7.3 - 2.0	13.3 - 3.7
14	4°03.5	4°04.2	3°52.4	1.4 - 0.4	7.4 - 2.0	13.4 - 3.7
15	4°03.8	4°04.4	3°52.6	1.5 - 0.4	7.5 - 2.1	13.5 - 3.7
16	4°04.0	4°04.7	3°52.9	1.6 - 0.4	7.6 - 2.1	13.6 - 3.7
17	4°04.3	4°04.9	3°53.1	1.7 - 0.5	7.7 - 2.1	13.7 - 3.8
18	4°04.5	4°05.2	3°53.4	1.8 - 0.5	7.8 - 2.1	13.8 - 3.8
19	4°04.7	4°05.4	3°53.6	1.9 - 0.5	7.9 - 2.2	13.9 - 3.8
20	4°05.0	4°05.7	3°53.8	2.0 - 0.6	8.0 - 2.2	14.0 - 3.9
21	4°05.3	4°05.9	3°54.1	2.1 - 0.6	8.1 - 2.2	14.1 - 3.9
22	4°05.5	4°06.2	3°54.3	2.2 - 0.6	8.2 - 2.3	14.2 - 3.9
23	4°05.7	4°06.4	3°54.6	2.3 - 0.6	8.3 - 2.3	14.3 - 3.9
24	4°06.0	4°06.7	3°54.8	2.4 - 0.7	8.4 - 2.3	14.4 - 4.0
25	4°06.3	4°06.9	3°55.0	2.5 - 0.7	8.5 - 2.3	14.5 - 4.0
26	4°06.5	4°07.2	3°55.3	2.6 - 0.7	8.6 - 2.4	14.6 - 4.0
27	4°06.7	4°07.4	3°55.5	2.7 - 0.7	8.7 - 2.4	14.7 - 4.0
28	4°07.0	4°07.7	3°55.7	2.8 - 0.8	8.8 - 2.4	14.8 - 4.1
29	4°07.3	4°07.9	3°56.0	2.9 - 0.8	8.9 - 2.4	14.9 - 4.1
30	4°07.5	4°08.2	3°56.2	3.0 - 0.8	9.0 - 2.5	15.0 - 4.1
31	4°07.7	4°08.4	3°56.5	3.1 - 0.9	9.1 - 2.5	15.1 - 4.2
32	4°08.0	4°08.7	3°56.7	3.2 - 0.9	9.2 - 2.5	15.2 - 4.2
33	4°08.3	4°08.9	3°56.9	3.3 - 0.9	9.3 - 2.6	15.3 - 4.2
34	4°08.5	4°09.2	3°57.2	3.4 - 0.9	9.4 - 2.6	15.4 - 4.2
35	4°08.7	4°09.4	3°57.4	3.5 - 1.0	9.5 - 2.6	15.5 - 4.3
36	4°09.0	4°09.7	3°57.7	3.6 - 1.0	9.6 - 2.6	15.6 - 4.3
37	4°09.3	4°09.9	3°57.9	3.7 - 1.0	9.7 - 2.7	15.7 - 4.3
38	4°09.5	4°10.2	3°58.1	3.8 - 1.0	9.8 - 2.7	15.8 - 4.3
39	4°09.7	4°10.4	3°58.4	3.9 - 1.1	9.9 - 2.7	15.9 - 4.4
40	4°10.0	4°10.7	3°58.6	4.0 - 1.1	10.0 - 2.8	16.0 - 4.4
41	4°10.3	4°10.9	3°58.8	4.1 - 1.1	10.1 - 2.8	16.1 - 4.4
42	4°10.5	4°11.2	3°59.1	4.2 - 1.2	10.2 - 2.8	16.2 - 4.5
43	4°10.7	4°11.4	3°59.3	4.3 - 1.2	10.3 - 2.8	16.3 - 4.5
44	4°11.0	4°11.7	3°59.6	4.4 - 1.2	10.4 - 2.9	16.4 - 4.5
45	4°11.3	4°11.9	3°59.8	4.5 - 1.2	10.5 - 2.9	16.5 - 4.5
46	4°11.5	4°12.2	4°00.0	4.6 - 1.3	10.6 - 2.9	16.6 - 4.6
47	4°11.8	4°12.4	4°00.3	4.7 - 1.3	10.7 - 2.9	16.7 - 4.6
48	4°12.0	4°12.7	4°00.5	4.8 - 1.3	10.8 - 3.0	16.8 - 4.6
49	4°12.2	4°12.9	4°00.8	4.9 - 1.3	10.9 - 3.0	16.9 - 4.6
50	4°12.5	4°13.2	4°01.0	5.0 - 1.4	11.0 - 3.0	17.0 - 4.7
51	4°12.8	4°13.4	4°01.2	5.1 - 1.4	11.1 - 3.1	17.1 - 4.7
52	4°13.0	4°13.7	4°01.5	5.2 - 1.4	11.2 - 3.1	17.2 - 4.7
53	4°13.2	4°13.9	4°01.7	5.3 - 1.5	11.3 - 3.1	17.3 - 4.8
54	4°13.5	4°14.2	4°02.0	5.4 - 1.5	11.4 - 3.1	17.4 - 4.8
55	4°13.8	4°14.4	4°02.2	5.5 - 1.5	11.5 - 3.2	17.5 - 4.8
56	4°14.0	4°14.7	4°02.4	5.6 - 1.5	11.6 - 3.2	17.6 - 4.8
57	4°14.2	4°14.9	4°02.7	5.7 - 1.6	11.7 - 3.2	17.7 - 4.9
58	4°14.5	4°15.2	4°02.9	5.8 - 1.6	11.8 - 3.2	17.8 - 4.9
59	4°14.8	4°15.4	4°03.1	5.9 - 1.6	11.9 - 3.3	17.9 - 4.9

m 17	Sun Plan.	Aries	Moon	v and d corr		
0	4°15.0	4°15.7	4°03.4	0.0 - 0.0	6.0 - 1.8	12.0 - 3.5
1	4°15.2	4°15.9	4°03.6	0.1 - 0.0	6.1 - 1.8	12.1 - 3.5
2	4°15.5	4°16.2	4°03.9	0.2 - 0.1	6.2 - 1.8	12.2 - 3.6
3	4°15.8	4°16.4	4°04.1	0.3 - 0.1	6.3 - 1.8	12.3 - 3.6
4	4°16.0	4°16.7	4°04.3	0.4 - 0.1	6.4 - 1.9	12.4 - 3.6
5	4°16.2	4°17.0	4°04.6	0.5 - 0.1	6.5 - 1.9	12.5 - 3.6
6	4°16.5	4°17.2	4°04.8	0.6 - 0.2	6.6 - 1.9	12.6 - 3.7
7	4°16.8	4°17.5	4°05.1	0.7 - 0.2	6.7 - 2.0	12.7 - 3.7
8	4°17.0	4°17.7	4°05.3	0.8 - 0.2	6.8 - 2.0	12.8 - 3.7
9	4°17.2	4°18.0	4°05.5	0.9 - 0.3	6.9 - 2.0	12.9 - 3.8
10	4°17.5	4°18.2	4°05.8	1.0 - 0.3	7.0 - 2.0	13.0 - 3.8
11	4°17.8	4°18.5	4°06.0	1.1 - 0.3	7.1 - 2.1	13.1 - 3.8
12	4°18.0	4°18.7	4°06.2	1.2 - 0.4	7.2 - 2.1	13.2 - 3.9
13	4°18.2	4°19.0	4°06.5	1.3 - 0.4	7.3 - 2.1	13.3 - 3.9
14	4°18.5	4°19.2	4°06.7	1.4 - 0.4	7.4 - 2.2	13.4 - 3.9
15	4°18.8	4°19.5	4°07.0	1.5 - 0.4	7.5 - 2.2	13.5 - 3.9
16	4°19.0	4°19.7	4°07.2	1.6 - 0.5	7.6 - 2.2	13.6 - 4.0
17	4°19.3	4°20.0	4°07.4	1.7 - 0.5	7.7 - 2.2	13.7 - 4.0
18	4°19.5	4°20.2	4°07.7	1.8 - 0.5	7.8 - 2.3	13.8 - 4.0
19	4°19.7	4°20.5	4°07.9	1.9 - 0.6	7.9 - 2.3	13.9 - 4.1
20	4°20.0	4°20.7	4°08.2	2.0 - 0.6	8.0 - 2.3	14.0 - 4.1
21	4°20.3	4°21.0	4°08.4	2.1 - 0.6	8.1 - 2.4	14.1 - 4.1
22	4°20.5	4°21.2	4°08.6	2.2 - 0.6	8.2 - 2.4	14.2 - 4.1
23	4°20.7	4°21.5	4°08.9	2.3 - 0.7	8.3 - 2.4	14.3 - 4.2
24	4°21.0	4°21.7	4°09.1	2.4 - 0.7	8.4 - 2.5	14.4 - 4.2
25	4°21.3	4°22.0	4°09.3	2.5 - 0.7	8.5 - 2.5	14.5 - 4.2
26	4°21.5	4°22.2	4°09.6	2.6 - 0.8	8.6 - 2.5	14.6 - 4.3
27	4°21.7	4°22.5	4°09.8	2.7 - 0.8	8.7 - 2.5	14.7 - 4.3
28	4°22.0	4°22.7	4°10.1	2.8 - 0.8	8.8 - 2.6	14.8 - 4.3
29	4°22.3	4°23.0	4°10.3	2.9 - 0.8	8.9 - 2.6	14.9 - 4.3
30	4°22.5	4°23.2	4°10.5	3.0 - 0.9	9.0 - 2.6	15.0 - 4.4
31	4°22.7	4°23.5	4°10.8	3.1 - 0.9	9.1 - 2.7	15.1 - 4.4
32	4°23.0	4°23.7	4°11.0	3.2 - 0.9	9.2 - 2.7	15.2 - 4.4
33	4°23.3	4°24.0	4°11.3	3.3 - 1.0	9.3 - 2.7	15.3 - 4.5
34	4°23.5	4°24.2	4°11.5	3.4 - 1.0	9.4 - 2.7	15.4 - 4.5
35	4°23.7	4°24.5	4°11.7	3.5 - 1.0	9.5 - 2.8	15.5 - 4.5
36	4°24.0	4°24.7	4°12.0	3.6 - 1.1	9.6 - 2.8	15.6 - 4.5
37	4°24.3	4°25.0	4°12.2	3.7 - 1.1	9.7 - 2.8	15.7 - 4.6
38	4°24.5	4°25.2	4°12.5	3.8 - 1.1	9.8 - 2.9	15.8 - 4.6
39	4°24.7	4°25.5	4°12.7	3.9 - 1.1	9.9 - 2.9	15.9 - 4.6
40	4°25.0	4°25.7	4°12.9	4.0 - 1.2	10.0 - 2.9	16.0 - 4.7
41	4°25.3	4°26.0	4°13.2	4.1 - 1.2	10.1 - 2.9	16.1 - 4.7
42	4°25.5	4°26.2	4°13.4	4.2 - 1.2	10.2 - 3.0	16.2 - 4.7
43	4°25.7	4°26.5	4°13.6	4.3 - 1.3	10.3 - 3.0	16.3 - 4.8
44	4°26.0	4°26.7	4°13.9	4.4 - 1.3	10.4 - 3.0	16.4 - 4.8
45	4°26.3	4°27.0	4°14.1	4.5 - 1.3	10.5 - 3.1	16.5 - 4.8
46	4°26.5	4°27.2	4°14.4	4.6 - 1.3	10.6 - 3.1	16.6 - 4.8
47	4°26.8	4°27.5	4°14.6	4.7 - 1.4	10.7 - 3.1	16.7 - 4.9
48	4°27.0	4°27.7	4°14.8	4.8 - 1.4	10.8 - 3.2	16.8 - 4.9
49	4°27.2	4°28.0	4°15.1	4.9 - 1.4	10.9 - 3.2	16.9 - 4.9
50	4°27.5	4°28.2	4°15.3	5.0 - 1.5	11.0 - 3.2	17.0 - 5.0
51	4°27.8	4°28.5	4°15.6	5.1 - 1.5	11.1 - 3.2	17.1 - 5.0
52	4°28.0	4°28.7	4°15.8	5.2 - 1.5	11.2 - 3.3	17.2 - 5.0
53	4°28.2	4°29.0	4°16.0	5.3 - 1.5	11.3 - 3.3	17.3 - 5.0
54	4°28.5	4°29.2	4°16.3	5.4 - 1.6	11.4 - 3.3	17.4 - 5.1
55	4°28.8	4°29.5	4°16.5	5.5 - 1.6	11.5 - 3.4	17.5 - 5.1
56	4°29.0	4°29.7	4°16.7	5.6 - 1.6	11.6 - 3.4	17.6 - 5.1
57	4°29.2	4°30.0	4°17.0	5.7 - 1.7	11.7 - 3.4	17.7 - 5.2
58	4°29.5	4°30.2	4°17.2	5.8 - 1.7	11.8 - 3.4	17.8 - 5.2
59	4°29.8	4°30.5	4°17.5	5.9 - 1.7	11.9 - 3.5	17.9 - 5.2

Increments and Corrections

m	Sun	Aries	Moon	v and d corr		
18	Plan.					
0	4°30.0	4°30.7	4°17.7	0.0 - 0.0	6.0 - 1.9	12.0 - 3.7
1	4°30.2	4°31.0	4°17.9	0.1 - 0.0	6.1 - 1.9	12.1 - 3.7
2	4°30.5	4°31.2	4°18.2	0.2 - 0.1	6.2 - 1.9	12.2 - 3.8
3	4°30.8	4°31.5	4°18.4	0.3 - 0.1	6.3 - 1.9	12.3 - 3.8
4	4°31.0	4°31.7	4°18.7	0.4 - 0.1	6.4 - 2.0	12.4 - 3.8
5	4°31.2	4°32.0	4°18.9	0.5 - 0.2	6.5 - 2.0	12.5 - 3.9
6	4°31.5	4°32.2	4°19.1	0.6 - 0.2	6.6 - 2.0	12.6 - 3.9
7	4°31.8	4°32.5	4°19.4	0.7 - 0.2	6.7 - 2.1	12.7 - 3.9
8	4°32.0	4°32.7	4°19.6	0.8 - 0.2	6.8 - 2.1	12.8 - 3.9
9	4°32.2	4°33.0	4°19.8	0.9 - 0.3	6.9 - 2.1	12.9 - 4.0
10	4°32.5	4°33.2	4°20.1	1.0 - 0.3	7.0 - 2.2	13.0 - 4.0
11	4°32.8	4°33.5	4°20.3	1.1 - 0.3	7.1 - 2.2	13.1 - 4.0
12	4°33.0	4°33.7	4°20.6	1.2 - 0.4	7.2 - 2.2	13.2 - 4.1
13	4°33.2	4°34.0	4°20.8	1.3 - 0.4	7.3 - 2.3	13.3 - 4.1
14	4°33.5	4°34.2	4°21.0	1.4 - 0.4	7.4 - 2.3	13.4 - 4.1
15	4°33.8	4°34.5	4°21.3	1.5 - 0.5	7.5 - 2.3	13.5 - 4.2
16	4°34.0	4°34.7	4°21.5	1.6 - 0.5	7.6 - 2.3	13.6 - 4.2
17	4°34.3	4°35.0	4°21.8	1.7 - 0.5	7.7 - 2.4	13.7 - 4.2
18	4°34.5	4°35.3	4°22.0	1.8 - 0.6	7.8 - 2.4	13.8 - 4.3
19	4°34.8	4°35.5	4°22.2	1.9 - 0.6	7.9 - 2.4	13.9 - 4.3
20	4°35.0	4°35.8	4°22.5	2.0 - 0.6	8.0 - 2.5	14.0 - 4.3
21	4°35.3	4°36.0	4°22.7	2.1 - 0.6	8.1 - 2.5	14.1 - 4.3
22	4°35.5	4°36.3	4°22.9	2.2 - 0.7	8.2 - 2.5	14.2 - 4.4
23	4°35.7	4°36.5	4°23.2	2.3 - 0.7	8.3 - 2.6	14.3 - 4.4
24	4°36.0	4°36.8	4°23.4	2.4 - 0.7	8.4 - 2.6	14.4 - 4.4
25	4°36.3	4°37.0	4°23.7	2.5 - 0.8	8.5 - 2.6	14.5 - 4.5
26	4°36.5	4°37.3	4°23.9	2.6 - 0.8	8.6 - 2.7	14.6 - 4.5
27	4°36.7	4°37.5	4°24.1	2.7 - 0.8	8.7 - 2.7	14.7 - 4.5
28	4°37.0	4°37.8	4°24.4	2.8 - 0.9	8.8 - 2.7	14.8 - 4.6
29	4°37.3	4°38.0	4°24.6	2.9 - 0.9	8.9 - 2.7	14.9 - 4.6
30	4°37.5	4°38.3	4°24.9	3.0 - 0.9	9.0 - 2.8	15.0 - 4.6
31	4°37.7	4°38.5	4°25.1	3.1 - 1.0	9.1 - 2.8	15.1 - 4.7
32	4°38.0	4°38.8	4°25.3	3.2 - 1.0	9.2 - 2.8	15.2 - 4.7
33	4°38.3	4°39.0	4°25.6	3.3 - 1.0	9.3 - 2.9	15.3 - 4.7
34	4°38.5	4°39.3	4°25.8	3.4 - 1.0	9.4 - 2.9	15.4 - 4.7
35	4°38.7	4°39.5	4°26.1	3.5 - 1.1	9.5 - 2.9	15.5 - 4.8
36	4°39.0	4°39.8	4°26.3	3.6 - 1.1	9.6 - 3.0	15.6 - 4.8
37	4°39.3	4°40.0	4°26.5	3.7 - 1.1	9.7 - 3.0	15.7 - 4.8
38	4°39.5	4°40.3	4°26.8	3.8 - 1.2	9.8 - 3.0	15.8 - 4.9
39	4°39.7	4°40.5	4°27.0	3.9 - 1.2	9.9 - 3.1	15.9 - 4.9
40	4°40.0	4°40.8	4°27.2	4.0 - 1.2	10.0 - 3.1	16.0 - 4.9
41	4°40.3	4°41.0	4°27.5	4.1 - 1.3	10.1 - 3.1	16.1 - 5.0
42	4°40.5	4°41.3	4°27.7	4.2 - 1.3	10.2 - 3.1	16.2 - 5.0
43	4°40.7	4°41.5	4°28.0	4.3 - 1.3	10.3 - 3.2	16.3 - 5.0
44	4°41.0	4°41.8	4°28.2	4.4 - 1.4	10.4 - 3.2	16.4 - 5.1
45	4°41.3	4°42.0	4°28.4	4.5 - 1.4	10.5 - 3.2	16.5 - 5.1
46	4°41.5	4°42.3	4°28.7	4.6 - 1.4	10.6 - 3.3	16.6 - 5.1
47	4°41.8	4°42.5	4°28.9	4.7 - 1.4	10.7 - 3.3	16.7 - 5.1
48	4°42.0	4°42.8	4°29.2	4.8 - 1.5	10.8 - 3.3	16.8 - 5.2
49	4°42.3	4°43.0	4°29.4	4.9 - 1.5	10.9 - 3.4	16.9 - 5.2
50	4°42.5	4°43.3	4°29.6	5.0 - 1.5	11.0 - 3.4	17.0 - 5.2
51	4°42.8	4°43.5	4°29.9	5.1 - 1.6	11.1 - 3.4	17.1 - 5.3
52	4°43.0	4°43.8	4°30.1	5.2 - 1.6	11.2 - 3.5	17.2 - 5.3
53	4°43.2	4°44.0	4°30.3	5.3 - 1.6	11.3 - 3.5	17.3 - 5.3
54	4°43.5	4°44.3	4°30.6	5.4 - 1.7	11.4 - 3.5	17.4 - 5.4
55	4°43.8	4°44.5	4°30.8	5.5 - 1.7	11.5 - 3.5	17.5 - 5.4
56	4°44.0	4°44.8	4°31.1	5.6 - 1.7	11.6 - 3.6	17.6 - 5.4
57	4°44.2	4°45.0	4°31.3	5.7 - 1.8	11.7 - 3.6	17.7 - 5.5
58	4°44.5	4°45.3	4°31.5	5.8 - 1.8	11.8 - 3.6	17.8 - 5.5
59	4°44.8	4°45.5	4°31.8	5.9 - 1.8	11.9 - 3.7	17.9 - 5.5

m	Sun	Aries	Moon	v and d corr		
19	Plan.					
0	4°45.0	4°45.8	4°32.0	0.0 - 0.0	6.0 - 2.0	12.0 - 3.9
1	4°45.2	4°46.0	4°32.3	0.1 - 0.0	6.1 - 2.0	12.1 - 3.9
2	4°45.5	4°46.3	4°32.5	0.2 - 0.1	6.2 - 2.0	12.2 - 4.0
3	4°45.8	4°46.5	4°32.7	0.3 - 0.1	6.3 - 2.0	12.3 - 4.0
4	4°46.0	4°46.8	4°33.0	0.4 - 0.1	6.4 - 2.1	12.4 - 4.0
5	4°46.2	4°47.0	4°33.2	0.5 - 0.2	6.5 - 2.1	12.5 - 4.1
6	4°46.5	4°47.3	4°33.4	0.6 - 0.2	6.6 - 2.1	12.6 - 4.1
7	4°46.8	4°47.5	4°33.7	0.7 - 0.2	6.7 - 2.2	12.7 - 4.1
8	4°47.0	4°47.8	4°33.9	0.8 - 0.3	6.8 - 2.2	12.8 - 4.2
9	4°47.2	4°48.0	4°34.2	0.9 - 0.3	6.9 - 2.2	12.9 - 4.2
10	4°47.5	4°48.3	4°34.4	1.0 - 0.3	7.0 - 2.3	13.0 - 4.2
11	4°47.8	4°48.5	4°34.6	1.1 - 0.4	7.1 - 2.3	13.1 - 4.3
12	4°48.0	4°48.8	4°34.9	1.2 - 0.4	7.2 - 2.3	13.2 - 4.3
13	4°48.2	4°49.0	4°35.1	1.3 - 0.4	7.3 - 2.4	13.3 - 4.3
14	4°48.5	4°49.3	4°35.4	1.4 - 0.5	7.4 - 2.4	13.4 - 4.4
15	4°48.8	4°49.5	4°35.6	1.5 - 0.5	7.5 - 2.4	13.5 - 4.4
16	4°49.0	4°49.8	4°35.8	1.6 - 0.5	7.6 - 2.5	13.6 - 4.4
17	4°49.3	4°50.0	4°36.1	1.7 - 0.6	7.7 - 2.5	13.7 - 4.5
18	4°49.5	4°50.3	4°36.3	1.8 - 0.6	7.8 - 2.5	13.8 - 4.5
19	4°49.8	4°50.5	4°36.6	1.9 - 0.6	7.9 - 2.6	13.9 - 4.5
20	4°50.0	4°50.8	4°36.8	2.0 - 0.7	8.0 - 2.6	14.0 - 4.5
21	4°50.3	4°51.0	4°37.0	2.1 - 0.7	8.1 - 2.6	14.1 - 4.6
22	4°50.5	4°51.3	4°37.3	2.2 - 0.7	8.2 - 2.7	14.2 - 4.6
23	4°50.7	4°51.5	4°37.5	2.3 - 0.7	8.3 - 2.7	14.3 - 4.6
24	4°51.0	4°51.8	4°37.7	2.4 - 0.8	8.4 - 2.7	14.4 - 4.7
25	4°51.3	4°52.0	4°38.0	2.5 - 0.8	8.5 - 2.8	14.5 - 4.7
26	4°51.5	4°52.3	4°38.2	2.6 - 0.8	8.6 - 2.8	14.6 - 4.7
27	4°51.7	4°52.5	4°38.5	2.7 - 0.9	8.7 - 2.8	14.7 - 4.8
28	4°52.0	4°52.8	4°38.7	2.8 - 0.9	8.8 - 2.9	14.8 - 4.8
29	4°52.3	4°53.0	4°38.9	2.9 - 0.9	8.9 - 2.9	14.9 - 4.8
30	4°52.5	4°53.3	4°39.2	3.0 - 1.0	9.0 - 2.9	15.0 - 4.9
31	4°52.7	4°53.6	4°39.4	3.1 - 1.0	9.1 - 3.0	15.1 - 4.9
32	4°53.0	4°53.8	4°39.7	3.2 - 1.0	9.2 - 3.0	15.2 - 4.9
33	4°53.3	4°54.1	4°39.9	3.3 - 1.1	9.3 - 3.0	15.3 - 5.0
34	4°53.5	4°54.3	4°40.1	3.4 - 1.1	9.4 - 3.1	15.4 - 5.0
35	4°53.7	4°54.6	4°40.4	3.5 - 1.1	9.5 - 3.1	15.5 - 5.0
36	4°54.0	4°54.8	4°40.6	3.6 - 1.2	9.6 - 3.1	15.6 - 5.1
37	4°54.3	4°55.1	4°40.8	3.7 - 1.2	9.7 - 3.2	15.7 - 5.1
38	4°54.5	4°55.3	4°41.1	3.8 - 1.2	9.8 - 3.2	15.8 - 5.1
39	4°54.7	4°55.6	4°41.3	3.9 - 1.3	9.9 - 3.2	15.9 - 5.2
40	4°55.0	4°55.8	4°41.6	4.0 - 1.3	10.0 - 3.3	16.0 - 5.2
41	4°55.3	4°56.1	4°41.8	4.1 - 1.3	10.1 - 3.3	16.1 - 5.2
42	4°55.5	4°56.3	4°42.0	4.2 - 1.4	10.2 - 3.3	16.2 - 5.3
43	4°55.7	4°56.6	4°42.3	4.3 - 1.4	10.3 - 3.3	16.3 - 5.3
44	4°56.0	4°56.8	4°42.5	4.4 - 1.4	10.4 - 3.4	16.4 - 5.3
45	4°56.3	4°57.1	4°42.8	4.5 - 1.5	10.5 - 3.4	16.5 - 5.4
46	4°56.5	4°57.3	4°43.0	4.6 - 1.5	10.6 - 3.4	16.6 - 5.4
47	4°56.8	4°57.6	4°43.2	4.7 - 1.5	10.7 - 3.5	16.7 - 5.4
48	4°57.0	4°57.8	4°43.5	4.8 - 1.6	10.8 - 3.5	16.8 - 5.5
49	4°57.3	4°58.1	4°43.7	4.9 - 1.6	10.9 - 3.5	16.9 - 5.5
50	4°57.5	4°58.3	4°43.9	5.0 - 1.6	11.0 - 3.6	17.0 - 5.5
51	4°57.8	4°58.6	4°44.2	5.1 - 1.7	11.1 - 3.6	17.1 - 5.6
52	4°58.0	4°58.8	4°44.4	5.2 - 1.7	11.2 - 3.6	17.2 - 5.6
53	4°58.2	4°59.1	4°44.7	5.3 - 1.7	11.3 - 3.7	17.3 - 5.6
54	4°58.5	4°59.3	4°44.9	5.4 - 1.8	11.4 - 3.7	17.4 - 5.7
55	4°58.8	4°59.6	4°45.1	5.5 - 1.8	11.5 - 3.7	17.5 - 5.7
56	4°59.0	4°59.8	4°45.4	5.6 - 1.8	11.6 - 3.8	17.6 - 5.7
57	4°59.2	5°00.1	4°45.6	5.7 - 1.9	11.7 - 3.8	17.7 - 5.8
58	4°59.5	5°00.3	4°45.9	5.8 - 1.9	11.8 - 3.8	17.8 - 5.8
59	4°59.8	5°00.6	4°46.1	5.9 - 1.9	11.9 - 3.9	17.9 - 5.8

m	Sun	Aries	Moon	v and d corr		
20	Plan.					
0	5°00.0	5°00.8	4°46.3	0.0 - 0.0	6.0 - 2.0	12.0 - 4.1
1	5°00.2	5°01.1	4°46.6	0.1 - 0.0	6.1 - 2.1	12.1 - 4.1
2	5°00.5	5°01.3	4°46.8	0.2 - 0.1	6.2 - 2.1	12.2 - 4.2
3	5°00.8	5°01.6	4°47.0	0.3 - 0.1	6.3 - 2.2	12.3 - 4.2
4	5°01.0	5°01.8	4°47.3	0.4 - 0.1	6.4 - 2.2	12.4 - 4.2
5	5°01.2	5°02.1	4°47.5	0.5 - 0.2	6.5 - 2.2	12.5 - 4.3
6	5°01.5	5°02.3	4°47.8	0.6 - 0.2	6.6 - 2.3	12.6 - 4.3
7	5°01.8	5°02.6	4°48.0	0.7 - 0.2	6.7 - 2.3	12.7 - 4.3
8	5°02.0	5°02.8	4°48.2	0.8 - 0.3	6.8 - 2.3	12.8 - 4.4
9	5°02.2	5°03.1	4°48.5	0.9 - 0.3	6.9 - 2.4	12.9 - 4.4
10	5°02.5	5°03.3	4°48.7	1.0 - 0.3	7.0 - 2.4	13.0 - 4.4
11	5°02.8	5°03.6	4°49.0	1.1 - 0.4	7.1 - 2.4	13.1 - 4.5
12	5°03.0	5°03.8	4°49.2	1.2 - 0.4	7.2 - 2.5	13.2 - 4.5
13	5°03.2	5°04.1	4°49.4	1.3 - 0.4	7.3 - 2.5	13.3 - 4.5
14	5°03.5	5°04.3	4°49.7	1.4 - 0.5	7.4 - 2.5	13.4 - 4.6
15	5°03.8	5°04.6	4°49.9	1.5 - 0.5	7.5 - 2.6	13.5 - 4.6
16	5°04.0	5°04.8	4°50.2	1.6 - 0.5	7.6 - 2.6	13.6 - 4.6
17	5°04.3	5°05.1	4°50.4	1.7 - 0.6	7.7 - 2.6	13.7 - 4.7
18	5°04.5	5°05.3	4°50.6	1.8 - 0.6	7.8 - 2.7	13.8 - 4.7
19	5°04.7	5°05.6	4°50.9	1.9 - 0.6	7.9 - 2.7	13.9 - 4.7
20	5°05.0	5°05.8	4°51.1	2.0 - 0.7	8.0 - 2.7	14.0 - 4.8
21	5°05.3	5°06.1	4°51.3	2.1 - 0.7	8.1 - 2.8	14.1 - 4.8
22	5°05.5	5°06.3	4°51.6	2.2 - 0.8	8.2 - 2.8	14.2 - 4.9
23	5°05.7	5°06.6	4°51.8	2.3 - 0.8	8.3 - 2.8	14.3 - 4.9
24	5°06.0	5°06.8	4°52.1	2.4 - 0.8	8.4 - 2.9	14.4 - 4.9
25	5°06.3	5°07.1	4°52.3	2.5 - 0.9	8.5 - 2.9	14.5 - 5.0
26	5°06.5	5°07.3	4°52.5	2.6 - 0.9	8.6 - 2.9	14.6 - 5.0
27	5°06.7	5°07.6	4°52.8	2.7 - 0.9	8.7 - 3.0	14.7 - 5.0
28	5°07.0	5°07.8	4°53.0	2.8 - 1.0	8.8 - 3.0	14.8 - 5.1
29	5°07.3	5°08.1	4°53.3	2.9 - 1.0	8.9 - 3.0	14.9 - 5.1
30	5°07.5	5°08.3	4°53.5	3.0 - 1.0	9.0 - 3.1	15.0 - 5.1
31	5°07.7	5°08.6	4°53.7	3.1 - 1.1	9.1 - 3.1	15.1 - 5.2
32	5°08.0	5°08.8	4°54.0	3.2 - 1.1	9.2 - 3.1	15.2 - 5.2
33	5°08.3	5°09.1	4°54.2	3.3 - 1.1	9.3 - 3.2	15.3 - 5.2
34	5°08.5	5°09.3	4°54.4	3.4 - 1.2	9.4 - 3.2	15.4 - 5.3
35	5°08.7	5°09.6	4°54.7	3.5 - 1.2	9.5 - 3.2	15.5 - 5.3
36	5°09.0	5°09.8	4°54.9	3.6 - 1.2	9.6 - 3.3	15.6 - 5.3
37	5°09.3	5°10.1	4°55.2	3.7 - 1.3	9.7 - 3.3	15.7 - 5.4
38	5°09.5	5°10.3	4°55.4	3.8 - 1.3	9.8 - 3.3	15.8 - 5.4
39	5°09.7	5°10.6	4°55.6	3.9 - 1.3	9.9 - 3.4	15.9 - 5.4
40	5°10.0	5°10.8	4°55.9	4.0 - 1.4	10.0 - 3.4	16.0 - 5.5
41	5°10.3	5°11.1	4°56.1	4.1 - 1.4	10.1 - 3.5	16.1 - 5.5
42	5°10.5	5°11.3	4°56.4	4.2 - 1.4	10.2 - 3.5	16.2 - 5.5
43	5°10.7	5°11.6	4°56.6	4.3 - 1.5	10.3 - 3.5	16.3 - 5.6
44	5°11.0	5°11.9	4°56.8	4.4 - 1.5	10.4 - 3.6	16.4 - 5.6
45	5°11.3	5°12.1	4°57.1	4.5 - 1.5	10.5 - 3.6	16.5 - 5.6
46	5°11.5	5°12.4	4°57.3	4.6 - 1.6	10.6 - 3.6	16.6 - 5.7
47	5°11.8	5°12.6	4°57.5	4.7 - 1.6	10.7 - 3.7	16.7 - 5.7
48	5°12.0	5°12.9	4°57.8	4.8 - 1.6	10.8 - 3.7	16.8 - 5.7
49	5°12.2	5°13.1	4°58.0	4.9 - 1.7	10.9 - 3.7	16.9 - 5.8
50	5°12.5	5°13.4	4°58.3	5.0 - 1.7	11.0 - 3.8	17.0 - 5.8
51	5°12.8	5°13.6	4°58.5	5.1 - 1.7	11.1 - 3.8	17.1 - 5.8
52	5°13.0	5°13.9	4°58.7	5.2 - 1.8	11.2 - 3.8	17.2 - 5.9
53	5°13.2	5°14.1	4°59.0	5.3 - 1.8	11.3 - 3.9	17.3 - 5.9
54	5°13.5	5°14.4	4°59.2	5.4 - 1.8	11.4 - 3.9	17.4 - 5.9
55	5°13.8	5°14.6	4°59.5	5.5 - 1.9	11.5 - 3.9	17.5 - 6.0
56	5°14.0	5°14.9	4°59.7	5.6 - 1.9	11.6 - 4.0	17.6 - 6.0
57	5°14.2	5°15.1	4°59.9	5.7 - 1.9	11.7 - 4.0	17.7 - 6.0
58	5°14.5	5°15.4	5°00.2	5.8 - 2.0	11.8 - 4.0	17.8 - 6.1
59	5°14.8	5°15.6	5°00.4	5.9 - 2.0	11.9 - 4.1	17.9 - 6.1

Increments and Corrections

m 21	Sun Plan.	Aries	Moon	v and d corr		
0	5°15.0	5°15.9	5°00.6	0.0 - 0.0	6.0 - 2.1	12.0 - 4.3
1	5°15.2	5°16.1	5°00.9	0.1 - 0.0	6.1 - 2.2	12.1 - 4.3
2	5°15.5	5°16.4	5°01.1	0.2 - 0.1	6.2 - 2.2	12.2 - 4.4
3	5°15.8	5°16.6	5°01.4	0.3 - 0.1	6.3 - 2.3	12.3 - 4.4
4	5°16.0	5°16.9	5°01.6	0.4 - 0.1	6.4 - 2.3	12.4 - 4.4
5	5°16.2	5°17.1	5°01.8	0.5 - 0.2	6.5 - 2.3	12.5 - 4.5
6	5°16.5	5°17.4	5°02.1	0.6 - 0.2	6.6 - 2.4	12.6 - 4.5
7	5°16.8	5°17.6	5°02.3	0.7 - 0.3	6.7 - 2.4	12.7 - 4.6
8	5°17.0	5°17.9	5°02.6	0.8 - 0.3	6.8 - 2.4	12.8 - 4.6
9	5°17.2	5°18.1	5°02.8	0.9 - 0.3	6.9 - 2.5	12.9 - 4.6
10	5°17.5	5°18.4	5°03.0	1.0 - 0.4	7.0 - 2.5	13.0 - 4.7
11	5°17.8	5°18.6	5°03.3	1.1 - 0.4	7.1 - 2.5	13.1 - 4.7
12	5°18.0	5°18.9	5°03.5	1.2 - 0.4	7.2 - 2.6	13.2 - 4.7
13	5°18.2	5°19.1	5°03.8	1.3 - 0.5	7.3 - 2.6	13.3 - 4.8
14	5°18.5	5°19.4	5°04.0	1.4 - 0.5	7.4 - 2.7	13.4 - 4.8
15	5°18.8	5°19.6	5°04.2	1.5 - 0.5	7.5 - 2.7	13.5 - 4.8
16	5°19.0	5°19.9	5°04.5	1.6 - 0.6	7.6 - 2.7	13.6 - 4.9
17	5°19.3	5°20.1	5°04.7	1.7 - 0.6	7.7 - 2.8	13.7 - 4.9
18	5°19.5	5°20.4	5°04.9	1.8 - 0.6	7.8 - 2.8	13.8 - 4.9
19	5°19.7	5°20.6	5°05.2	1.9 - 0.7	7.9 - 2.8	13.9 - 5.0
20	5°20.0	5°20.9	5°05.4	2.0 - 0.7	8.0 - 2.9	14.0 - 5.0
21	5°20.3	5°21.1	5°05.7	2.1 - 0.8	8.1 - 2.9	14.1 - 5.1
22	5°20.5	5°21.4	5°05.9	2.2 - 0.8	8.2 - 2.9	14.2 - 5.1
23	5°20.7	5°21.6	5°06.1	2.3 - 0.8	8.3 - 3.0	14.3 - 5.1
24	5°21.0	5°21.9	5°06.4	2.4 - 0.9	8.4 - 3.0	14.4 - 5.2
25	5°21.3	5°22.1	5°06.6	2.5 - 0.9	8.5 - 3.0	14.5 - 5.2
26	5°21.5	5°22.4	5°06.9	2.6 - 0.9	8.6 - 3.1	14.6 - 5.2
27	5°21.7	5°22.6	5°07.1	2.7 - 1.0	8.7 - 3.1	14.7 - 5.3
28	5°22.0	5°22.9	5°07.3	2.8 - 1.0	8.8 - 3.2	14.8 - 5.3
29	5°22.3	5°23.1	5°07.6	2.9 - 1.0	8.9 - 3.2	14.9 - 5.3
30	5°22.5	5°23.4	5°07.8	3.0 - 1.1	9.0 - 3.2	15.0 - 5.4
31	5°22.7	5°23.6	5°08.0	3.1 - 1.1	9.1 - 3.3	15.1 - 5.4
32	5°23.0	5°23.9	5°08.3	3.2 - 1.1	9.2 - 3.3	15.2 - 5.4
33	5°23.3	5°24.1	5°08.5	3.3 - 1.2	9.3 - 3.3	15.3 - 5.5
34	5°23.5	5°24.4	5°08.8	3.4 - 1.2	9.4 - 3.4	15.4 - 5.5
35	5°23.7	5°24.6	5°09.0	3.5 - 1.3	9.5 - 3.4	15.5 - 5.6
36	5°24.0	5°24.9	5°09.2	3.6 - 1.3	9.6 - 3.4	15.6 - 5.6
37	5°24.3	5°25.1	5°09.5	3.7 - 1.3	9.7 - 3.5	15.7 - 5.6
38	5°24.5	5°25.4	5°09.7	3.8 - 1.4	9.8 - 3.5	15.8 - 5.7
39	5°24.7	5°25.6	5°10.0	3.9 - 1.4	9.9 - 3.5	15.9 - 5.7
40	5°25.0	5°25.9	5°10.2	4.0 - 1.4	10.0 - 3.6	16.0 - 5.7
41	5°25.3	5°26.1	5°10.4	4.1 - 1.5	10.1 - 3.6	16.1 - 5.8
42	5°25.5	5°26.4	5°10.7	4.2 - 1.5	10.2 - 3.7	16.2 - 5.8
43	5°25.7	5°26.6	5°10.9	4.3 - 1.5	10.3 - 3.7	16.3 - 5.8
44	5°26.0	5°26.9	5°11.1	4.4 - 1.6	10.4 - 3.7	16.4 - 5.9
45	5°26.3	5°27.1	5°11.4	4.5 - 1.6	10.5 - 3.8	16.5 - 5.9
46	5°26.5	5°27.4	5°11.6	4.6 - 1.6	10.6 - 3.8	16.6 - 5.9
47	5°26.8	5°27.6	5°11.9	4.7 - 1.7	10.7 - 3.8	16.7 - 6.0
48	5°27.0	5°27.9	5°12.1	4.8 - 1.7	10.8 - 3.9	16.8 - 6.0
49	5°27.2	5°28.1	5°12.3	4.9 - 1.8	10.9 - 3.9	16.9 - 6.1
50	5°27.5	5°28.4	5°12.6	5.0 - 1.8	11.0 - 3.9	17.0 - 6.1
51	5°27.8	5°28.6	5°12.8	5.1 - 1.8	11.1 - 4.0	17.1 - 6.1
52	5°28.0	5°28.9	5°13.1	5.2 - 1.9	11.2 - 4.0	17.2 - 6.2
53	5°28.2	5°29.1	5°13.3	5.3 - 1.9	11.3 - 4.0	17.3 - 6.2
54	5°28.5	5°29.4	5°13.5	5.4 - 1.9	11.4 - 4.1	17.4 - 6.2
55	5°28.8	5°29.6	5°13.8	5.5 - 2.0	11.5 - 4.1	17.5 - 6.3
56	5°29.0	5°29.9	5°14.0	5.6 - 2.0	11.6 - 4.2	17.6 - 6.3
57	5°29.2	5°30.1	5°14.3	5.7 - 2.0	11.7 - 4.2	17.7 - 6.3
58	5°29.5	5°30.4	5°14.5	5.8 - 2.1	11.8 - 4.2	17.8 - 6.4
59	5°29.8	5°30.7	5°14.7	5.9 - 2.1	11.9 - 4.3	17.9 - 6.4

m 22	Sun Plan.	Aries	Moon	v and d corr		
0	5°30.0	5°30.9	5°15.0	0.0 - 0.0	6.0 - 2.3	12.0 - 4.5
1	5°30.2	5°31.2	5°15.2	0.1 - 0.0	6.1 - 2.3	12.1 - 4.5
2	5°30.5	5°31.4	5°15.4	0.2 - 0.1	6.2 - 2.3	12.2 - 4.6
3	5°30.8	5°31.7	5°15.7	0.3 - 0.1	6.3 - 2.4	12.3 - 4.6
4	5°31.0	5°31.9	5°15.9	0.4 - 0.2	6.4 - 2.4	12.4 - 4.7
5	5°31.2	5°32.2	5°16.2	0.5 - 0.2	6.5 - 2.4	12.5 - 4.7
6	5°31.5	5°32.4	5°16.4	0.6 - 0.2	6.6 - 2.5	12.6 - 4.7
7	5°31.8	5°32.7	5°16.6	0.7 - 0.3	6.7 - 2.5	12.7 - 4.8
8	5°32.0	5°32.9	5°16.9	0.8 - 0.3	6.8 - 2.5	12.8 - 4.8
9	5°32.2	5°33.2	5°17.1	0.9 - 0.3	6.9 - 2.6	12.9 - 4.8
10	5°32.5	5°33.4	5°17.4	1.0 - 0.4	7.0 - 2.6	13.0 - 4.9
11	5°32.8	5°33.7	5°17.6	1.1 - 0.4	7.1 - 2.7	13.1 - 4.9
12	5°33.0	5°33.9	5°17.8	1.2 - 0.5	7.2 - 2.7	13.2 - 4.9
13	5°33.2	5°34.2	5°18.1	1.3 - 0.5	7.3 - 2.7	13.3 - 5.0
14	5°33.5	5°34.4	5°18.3	1.4 - 0.5	7.4 - 2.8	13.4 - 5.0
15	5°33.8	5°34.7	5°18.5	1.5 - 0.6	7.5 - 2.8	13.5 - 5.1
16	5°34.0	5°34.9	5°18.8	1.6 - 0.6	7.6 - 2.8	13.6 - 5.1
17	5°34.3	5°35.2	5°19.0	1.7 - 0.6	7.7 - 2.9	13.7 - 5.1
18	5°34.5	5°35.4	5°19.3	1.8 - 0.7	7.8 - 2.9	13.8 - 5.2
19	5°34.8	5°35.7	5°19.5	1.9 - 0.7	7.9 - 3.0	13.9 - 5.2
20	5°35.0	5°35.9	5°19.7	2.0 - 0.8	8.0 - 3.0	14.0 - 5.3
21	5°35.3	5°36.2	5°20.0	2.1 - 0.8	8.1 - 3.0	14.1 - 5.3
22	5°35.5	5°36.4	5°20.2	2.2 - 0.8	8.2 - 3.1	14.2 - 5.3
23	5°35.7	5°36.7	5°20.5	2.3 - 0.9	8.3 - 3.1	14.3 - 5.4
24	5°36.0	5°36.9	5°20.7	2.4 - 0.9	8.4 - 3.2	14.4 - 5.4
25	5°36.3	5°37.2	5°20.9	2.5 - 0.9	8.5 - 3.2	14.5 - 5.4
26	5°36.5	5°37.4	5°21.2	2.6 - 1.0	8.6 - 3.2	14.6 - 5.5
27	5°36.7	5°37.7	5°21.4	2.7 - 1.0	8.7 - 3.3	14.7 - 5.5
28	5°37.0	5°37.9	5°21.6	2.8 - 1.1	8.8 - 3.3	14.8 - 5.6
29	5°37.3	5°38.2	5°21.9	2.9 - 1.1	8.9 - 3.3	14.9 - 5.6
30	5°37.5	5°38.4	5°22.1	3.0 - 1.1	9.0 - 3.4	15.0 - 5.6
31	5°37.7	5°38.7	5°22.4	3.1 - 1.2	9.1 - 3.4	15.1 - 5.7
32	5°38.0	5°38.9	5°22.6	3.2 - 1.2	9.2 - 3.4	15.2 - 5.7
33	5°38.3	5°39.2	5°22.8	3.3 - 1.2	9.3 - 3.5	15.3 - 5.7
34	5°38.5	5°39.4	5°23.1	3.4 - 1.3	9.4 - 3.5	15.4 - 5.8
35	5°38.7	5°39.7	5°23.3	3.5 - 1.3	9.5 - 3.6	15.5 - 5.8
36	5°39.0	5°39.9	5°23.6	3.6 - 1.4	9.6 - 3.6	15.6 - 5.8
37	5°39.3	5°40.2	5°23.8	3.7 - 1.4	9.7 - 3.6	15.7 - 5.9
38	5°39.5	5°40.4	5°24.0	3.8 - 1.4	9.8 - 3.7	15.8 - 5.9
39	5°39.7	5°40.7	5°24.3	3.9 - 1.5	9.9 - 3.7	15.9 - 6.0
40	5°40.0	5°40.9	5°24.5	4.0 - 1.5	10.0 - 3.8	16.0 - 6.0
41	5°40.3	5°41.2	5°24.7	4.1 - 1.5	10.1 - 3.8	16.1 - 6.0
42	5°40.5	5°41.4	5°25.0	4.2 - 1.6	10.2 - 3.8	16.2 - 6.1
43	5°40.7	5°41.7	5°25.2	4.3 - 1.6	10.3 - 3.9	16.3 - 6.1
44	5°41.0	5°41.9	5°25.5	4.4 - 1.7	10.4 - 3.9	16.4 - 6.1
45	5°41.3	5°42.2	5°25.7	4.5 - 1.7	10.5 - 3.9	16.5 - 6.2
46	5°41.5	5°42.4	5°25.9	4.6 - 1.7	10.6 - 4.0	16.6 - 6.2
47	5°41.8	5°42.7	5°26.2	4.7 - 1.8	10.7 - 4.0	16.7 - 6.3
48	5°42.0	5°42.9	5°26.4	4.8 - 1.8	10.8 - 4.1	16.8 - 6.3
49	5°42.3	5°43.2	5°26.7	4.9 - 1.8	10.9 - 4.1	16.9 - 6.3
50	5°42.5	5°43.4	5°26.9	5.0 - 1.9	11.0 - 4.1	17.0 - 6.4
51	5°42.8	5°43.7	5°27.1	5.1 - 1.9	11.1 - 4.2	17.1 - 6.4
52	5°43.0	5°43.9	5°27.4	5.2 - 2.0	11.2 - 4.2	17.2 - 6.4
53	5°43.2	5°44.2	5°27.6	5.3 - 2.0	11.3 - 4.2	17.3 - 6.5
54	5°43.5	5°44.4	5°27.9	5.4 - 2.0	11.4 - 4.3	17.4 - 6.5
55	5°43.8	5°44.7	5°28.1	5.5 - 2.1	11.5 - 4.3	17.5 - 6.6
56	5°44.0	5°44.9	5°28.3	5.6 - 2.1	11.6 - 4.4	17.6 - 6.6
57	5°44.2	5°45.2	5°28.6	5.7 - 2.1	11.7 - 4.4	17.7 - 6.6
58	5°44.5	5°45.4	5°28.8	5.8 - 2.2	11.8 - 4.4	17.8 - 6.7
59	5°44.8	5°45.7	5°29.0	5.9 - 2.2	11.9 - 4.5	17.9 - 6.7

m 23	Sun Plan.	Aries	Moon	v and d corr		
0	5°45.0	5°45.9	5°29.3	0.0 - 0.0	6.0 - 2.4	12.0 - 4.7
1	5°45.2	5°46.2	5°29.5	0.1 - 0.0	6.1 - 2.4	12.1 - 4.7
2	5°45.5	5°46.4	5°29.8	0.2 - 0.1	6.2 - 2.4	12.2 - 4.8
3	5°45.8	5°46.7	5°30.0	0.3 - 0.1	6.3 - 2.5	12.3 - 4.8
4	5°46.0	5°46.9	5°30.2	0.4 - 0.2	6.4 - 2.5	12.4 - 4.9
5	5°46.2	5°47.2	5°30.5	0.5 - 0.2	6.5 - 2.5	12.5 - 4.9
6	5°46.5	5°47.4	5°30.7	0.6 - 0.2	6.6 - 2.6	12.6 - 4.9
7	5°46.8	5°47.7	5°31.0	0.7 - 0.3	6.7 - 2.6	12.7 - 5.0
8	5°47.0	5°47.9	5°31.2	0.8 - 0.3	6.8 - 2.7	12.8 - 5.0
9	5°47.2	5°48.2	5°31.4	0.9 - 0.4	6.9 - 2.7	12.9 - 5.1
10	5°47.5	5°48.4	5°31.7	1.0 - 0.4	7.0 - 2.7	13.0 - 5.1
11	5°47.8	5°48.7	5°31.9	1.1 - 0.4	7.1 - 2.8	13.1 - 5.1
12	5°48.0	5°49.0	5°32.1	1.2 - 0.5	7.2 - 2.8	13.2 - 5.2
13	5°48.2	5°49.2	5°32.4	1.3 - 0.5	7.3 - 2.9	13.3 - 5.2
14	5°48.5	5°49.5	5°32.6	1.4 - 0.5	7.4 - 2.9	13.4 - 5.2
15	5°48.8	5°49.7	5°32.9	1.5 - 0.6	7.5 - 2.9	13.5 - 5.3
16	5°49.0	5°50.0	5°33.1	1.6 - 0.6	7.6 - 3.0	13.6 - 5.3
17	5°49.3	5°50.2	5°33.3	1.7 - 0.7	7.7 - 3.0	13.7 - 5.4
18	5°49.5	5°50.5	5°33.6	1.8 - 0.7	7.8 - 3.1	13.8 - 5.4
19	5°49.8	5°50.7	5°33.8	1.9 - 0.7	7.9 - 3.1	13.9 - 5.4
20	5°50.0	5°51.0	5°34.1	2.0 - 0.8	8.0 - 3.1	14.0 - 5.5
21	5°50.3	5°51.2	5°34.3	2.1 - 0.8	8.1 - 3.2	14.1 - 5.5
22	5°50.5	5°51.5	5°34.5	2.2 - 0.9	8.2 - 3.2	14.2 - 5.6
23	5°50.7	5°51.7	5°34.8	2.3 - 0.9	8.3 - 3.3	14.3 - 5.6
24	5°51.0	5°52.0	5°35.0	2.4 - 0.9	8.4 - 3.3	14.4 - 5.6
25	5°51.3	5°52.2	5°35.2	2.5 - 1.0	8.5 - 3.3	14.5 - 5.7
26	5°51.5	5°52.5	5°35.5	2.6 - 1.0	8.6 - 3.4	14.6 - 5.7
27	5°51.7	5°52.7	5°35.7	2.7 - 1.1	8.7 - 3.4	14.7 - 5.8
28	5°52.0	5°53.0	5°36.0	2.8 - 1.1	8.8 - 3.4	14.8 - 5.8
29	5°52.3	5°53.2	5°36.2	2.9 - 1.1	8.9 - 3.5	14.9 - 5.8
30	5°52.5	5°53.5	5°36.4	3.0 - 1.2	9.0 - 3.5	15.0 - 5.9
31	5°52.7	5°53.7	5°36.7	3.1 - 1.2	9.1 - 3.6	15.1 - 5.9
32	5°53.0	5°54.0	5°36.9	3.2 - 1.3	9.2 - 3.6	15.2 - 6.0
33	5°53.3	5°54.2	5°37.2	3.3 - 1.3	9.3 - 3.6	15.3 - 6.0
34	5°53.5	5°54.5	5°37.4	3.4 - 1.3	9.4 - 3.7	15.4 - 6.0
35	5°53.7	5°54.7	5°37.6	3.5 - 1.4	9.5 - 3.7	15.5 - 6.1
36	5°54.0	5°55.0	5°37.9	3.6 - 1.4	9.6 - 3.8	15.6 - 6.1
37	5°54.3	5°55.2	5°38.1	3.7 - 1.4	9.7 - 3.8	15.7 - 6.1
38	5°54.5	5°55.5	5°38.4	3.8 - 1.5	9.8 - 3.8	15.8 - 6.2
39	5°54.7	5°55.7	5°38.6	3.9 - 1.5	9.9 - 3.9	15.9 - 6.2
40	5°55.0	5°56.0	5°38.8	4.0 - 1.6	10.0 - 3.9	16.0 - 6.3
41	5°55.3	5°56.2	5°39.1	4.1 - 1.6	10.1 - 4.0	16.1 - 6.3
42	5°55.5	5°56.5	5°39.3	4.2 - 1.6	10.2 - 4.0	16.2 - 6.3
43	5°55.7	5°56.7	5°39.5	4.3 - 1.7	10.3 - 4.0	16.3 - 6.4
44	5°56.0	5°57.0	5°39.8	4.4 - 1.7	10.4 - 4.1	16.4 - 6.4
45	5°56.3	5°57.2	5°40.0	4.5 - 1.8	10.5 - 4.1	16.5 - 6.5
46	5°56.5	5°57.5	5°40.3	4.6 - 1.8	10.6 - 4.2	16.6 - 6.5
47	5°56.8	5°57.7	5°40.5	4.7 - 1.8	10.7 - 4.2	16.7 - 6.5
48	5°57.0	5°58.0	5°40.7	4.8 - 1.9	10.8 - 4.2	16.8 - 6.6
49	5°57.3	5°58.2	5°41.0	4.9 - 1.9	10.9 - 4.3	16.9 - 6.6
50	5°57.5	5°58.5	5°41.2	5.0 - 2.0	11.0 - 4.3	17.0 - 6.7
51	5°57.8	5°58.7	5°41.5	5.1 - 2.0	11.1 - 4.3	17.1 - 6.7
52	5°58.0	5°59.0	5°41.7	5.2 - 2.0	11.2 - 4.4	17.2 - 6.7
53	5°58.2	5°59.2	5°41.9	5.3 - 2.1	11.3 - 4.4	17.3 - 6.8
54	5°58.5	5°59.5	5°42.2	5.4 - 2.1	11.4 - 4.5	17.4 - 6.8
55	5°58.8	5°59.7	5°42.4	5.5 - 2.2	11.5 - 4.5	17.5 - 6.9
56	5°59.0	6°00.0	5°42.6	5.6 - 2.2	11.6 - 4.5	17.6 - 6.9
57	5°59.2	6°00.2	5°42.9	5.7 - 2.2	11.7 - 4.6	17.7 - 6.9
58	5°59.5	6°00.5	5°43.1	5.8 - 2.3	11.8 - 4.6	17.8 - 7.0
59	5°59.8	6°00.7	5°43.4	5.9 - 2.3	11.9 - 4.7	17.9 - 7.0

Increments and Corrections

m 24	Sun Plan.	Aries	Moon	v and d corr		
0	6°00.0	6°01.0	5°43.6	0.0 - 0.0	6.0 - 2.5	12.0 - 4.9
1	6°00.2	6°01.2	5°43.8	0.1 - 0.0	6.1 - 2.5	12.1 - 4.9
2	6°00.5	6°01.5	5°44.1	0.2 - 0.1	6.2 - 2.5	12.2 - 5.0
3	6°00.8	6°01.7	5°44.3	0.3 - 0.1	6.3 - 2.6	12.3 - 5.0
4	6°01.0	6°02.0	5°44.6	0.4 - 0.2	6.4 - 2.6	12.4 - 5.1
5	6°01.2	6°02.2	5°44.8	0.5 - 0.2	6.5 - 2.7	12.5 - 5.1
6	6°01.5	6°02.5	5°45.0	0.6 - 0.2	6.6 - 2.7	12.6 - 5.1
7	6°01.8	6°02.7	5°45.3	0.7 - 0.3	6.7 - 2.7	12.7 - 5.2
8	6°02.0	6°03.0	5°45.5	0.8 - 0.3	6.8 - 2.8	12.8 - 5.2
9	6°02.2	6°03.2	5°45.7	0.9 - 0.4	6.9 - 2.8	12.9 - 5.3
10	6°02.5	6°03.5	5°46.0	1.0 - 0.4	7.0 - 2.9	13.0 - 5.3
11	6°02.8	6°03.7	5°46.2	1.1 - 0.4	7.1 - 2.9	13.1 - 5.3
12	6°03.0	6°04.0	5°46.5	1.2 - 0.5	7.2 - 2.9	13.2 - 5.4
13	6°03.2	6°04.2	5°46.7	1.3 - 0.5	7.3 - 3.0	13.3 - 5.4
14	6°03.5	6°04.5	5°46.9	1.4 - 0.6	7.4 - 3.0	13.4 - 5.5
15	6°03.8	6°04.7	5°47.2	1.5 - 0.6	7.5 - 3.1	13.5 - 5.5
16	6°04.0	6°05.0	5°47.4	1.6 - 0.7	7.6 - 3.1	13.6 - 5.6
17	6°04.3	6°05.2	5°47.7	1.7 - 0.7	7.7 - 3.1	13.7 - 5.6
18	6°04.5	6°05.5	5°47.9	1.8 - 0.7	7.8 - 3.2	13.8 - 5.6
19	6°04.7	6°05.7	5°48.1	1.9 - 0.8	7.9 - 3.2	13.9 - 5.7
20	6°05.0	6°06.0	5°48.4	2.0 - 0.8	8.0 - 3.3	14.0 - 5.7
21	6°05.3	6°06.2	5°48.6	2.1 - 0.9	8.1 - 3.3	14.1 - 5.8
22	6°05.5	6°06.5	5°48.8	2.2 - 0.9	8.2 - 3.3	14.2 - 5.8
23	6°05.7	6°06.7	5°49.1	2.3 - 0.9	8.3 - 3.4	14.3 - 5.8
24	6°06.0	6°07.0	5°49.3	2.4 - 1.0	8.4 - 3.4	14.4 - 5.9
25	6°06.3	6°07.3	5°49.6	2.5 - 1.0	8.5 - 3.5	14.5 - 5.9
26	6°06.5	6°07.5	5°49.8	2.6 - 1.1	8.6 - 3.5	14.6 - 6.0
27	6°06.7	6°07.8	5°50.0	2.7 - 1.1	8.7 - 3.6	14.7 - 6.0
28	6°07.0	6°08.0	5°50.3	2.8 - 1.1	8.8 - 3.6	14.8 - 6.0
29	6°07.3	6°08.3	5°50.5	2.9 - 1.2	8.9 - 3.6	14.9 - 6.1
30	6°07.5	6°08.5	5°50.8	3.0 - 1.2	9.0 - 3.7	15.0 - 6.1
31	6°07.7	6°08.8	5°51.0	3.1 - 1.3	9.1 - 3.7	15.1 - 6.2
32	6°08.0	6°09.0	5°51.2	3.2 - 1.3	9.2 - 3.8	15.2 - 6.2
33	6°08.3	6°09.3	5°51.5	3.3 - 1.3	9.3 - 3.8	15.3 - 6.2
34	6°08.5	6°09.5	5°51.7	3.4 - 1.4	9.4 - 3.8	15.4 - 6.3
35	6°08.7	6°09.8	5°52.0	3.5 - 1.4	9.5 - 3.9	15.5 - 6.3
36	6°09.0	6°10.0	5°52.2	3.6 - 1.5	9.6 - 3.9	15.6 - 6.4
37	6°09.3	6°10.3	5°52.4	3.7 - 1.5	9.7 - 4.0	15.7 - 6.4
38	6°09.5	6°10.5	5°52.7	3.8 - 1.6	9.8 - 4.0	15.8 - 6.5
39	6°09.7	6°10.8	5°52.9	3.9 - 1.6	9.9 - 4.0	15.9 - 6.5
40	6°10.0	6°11.0	5°53.1	4.0 - 1.6	10.0 - 4.1	16.0 - 6.5
41	6°10.3	6°11.3	5°53.4	4.1 - 1.7	10.1 - 4.1	16.1 - 6.6
42	6°10.5	6°11.5	5°53.6	4.2 - 1.7	10.2 - 4.2	16.2 - 6.6
43	6°10.7	6°11.8	5°53.9	4.3 - 1.8	10.3 - 4.2	16.3 - 6.7
44	6°11.0	6°12.0	5°54.1	4.4 - 1.8	10.4 - 4.2	16.4 - 6.7
45	6°11.3	6°12.3	5°54.3	4.5 - 1.8	10.5 - 4.3	16.5 - 6.7
46	6°11.5	6°12.5	5°54.6	4.6 - 1.9	10.6 - 4.3	16.6 - 6.8
47	6°11.8	6°12.8	5°54.8	4.7 - 1.9	10.7 - 4.4	16.7 - 6.8
48	6°12.0	6°13.0	5°55.1	4.8 - 2.0	10.8 - 4.4	16.8 - 6.9
49	6°12.2	6°13.3	5°55.3	4.9 - 2.0	10.9 - 4.5	16.9 - 6.9
50	6°12.5	6°13.5	5°55.5	5.0 - 2.0	11.0 - 4.5	17.0 - 6.9
51	6°12.8	6°13.8	5°55.8	5.1 - 2.1	11.1 - 4.5	17.1 - 7.0
52	6°13.0	6°14.0	5°56.0	5.2 - 2.1	11.2 - 4.6	17.2 - 7.0
53	6°13.2	6°14.3	5°56.2	5.3 - 2.2	11.3 - 4.6	17.3 - 7.1
54	6°13.5	6°14.5	5°56.5	5.4 - 2.2	11.4 - 4.7	17.4 - 7.1
55	6°13.8	6°14.8	5°56.7	5.5 - 2.2	11.5 - 4.7	17.5 - 7.1
56	6°14.0	6°15.0	5°57.0	5.6 - 2.3	11.6 - 4.7	17.6 - 7.2
57	6°14.2	6°15.3	5°57.2	5.7 - 2.3	11.7 - 4.8	17.7 - 7.2
58	6°14.5	6°15.5	5°57.4	5.8 - 2.4	11.8 - 4.8	17.8 - 7.3
59	6°14.8	6°15.8	5°57.7	5.9 - 2.4	11.9 - 4.9	17.9 - 7.3

m 25	Sun Plan.	Aries	Moon	v and d corr		
0	6°15.0	6°16.0	5°57.9	0.0 - 0.0	6.0 - 2.5	12.0 - 5.1
1	6°15.2	6°16.3	5°58.2	0.1 - 0.0	6.1 - 2.6	12.1 - 5.1
2	6°15.5	6°16.5	5°58.4	0.2 - 0.1	6.2 - 2.6	12.2 - 5.2
3	6°15.8	6°16.8	5°58.6	0.3 - 0.1	6.3 - 2.7	12.3 - 5.2
4	6°16.0	6°17.0	5°58.9	0.4 - 0.2	6.4 - 2.7	12.4 - 5.3
5	6°16.2	6°17.3	5°59.1	0.5 - 0.2	6.5 - 2.8	12.5 - 5.3
6	6°16.5	6°17.5	5°59.3	0.6 - 0.3	6.6 - 2.8	12.6 - 5.4
7	6°16.8	6°17.8	5°59.6	0.7 - 0.3	6.7 - 2.8	12.7 - 5.4
8	6°17.0	6°18.0	5°59.8	0.8 - 0.3	6.8 - 2.9	12.8 - 5.4
9	6°17.2	6°18.3	6°00.1	0.9 - 0.4	6.9 - 2.9	12.9 - 5.5
10	6°17.5	6°18.5	6°00.3	1.0 - 0.4	7.0 - 3.0	13.0 - 5.5
11	6°17.8	6°18.8	6°00.5	1.1 - 0.5	7.1 - 3.0	13.1 - 5.6
12	6°18.0	6°19.0	6°00.8	1.2 - 0.5	7.2 - 3.1	13.2 - 5.6
13	6°18.2	6°19.3	6°01.0	1.3 - 0.6	7.3 - 3.1	13.3 - 5.7
14	6°18.5	6°19.5	6°01.3	1.4 - 0.6	7.4 - 3.1	13.4 - 5.7
15	6°18.8	6°19.8	6°01.5	1.5 - 0.6	7.5 - 3.2	13.5 - 5.7
16	6°19.0	6°20.0	6°01.7	1.6 - 0.7	7.6 - 3.2	13.6 - 5.8
17	6°19.3	6°20.3	6°02.0	1.7 - 0.7	7.7 - 3.3	13.7 - 5.8
18	6°19.5	6°20.5	6°02.2	1.8 - 0.8	7.8 - 3.3	13.8 - 5.9
19	6°19.7	6°20.8	6°02.5	1.9 - 0.8	7.9 - 3.4	13.9 - 5.9
20	6°20.0	6°21.0	6°02.7	2.0 - 0.8	8.0 - 3.4	14.0 - 6.0
21	6°20.3	6°21.3	6°02.9	2.1 - 0.9	8.1 - 3.4	14.1 - 6.0
22	6°20.5	6°21.5	6°03.2	2.2 - 0.9	8.2 - 3.5	14.2 - 6.0
23	6°20.7	6°21.8	6°03.4	2.3 - 1.0	8.3 - 3.5	14.3 - 6.1
24	6°21.0	6°22.0	6°03.6	2.4 - 1.0	8.4 - 3.6	14.4 - 6.1
25	6°21.3	6°22.3	6°03.9	2.5 - 1.1	8.5 - 3.6	14.5 - 6.2
26	6°21.5	6°22.5	6°04.1	2.6 - 1.1	8.6 - 3.7	14.6 - 6.2
27	6°21.7	6°22.8	6°04.4	2.7 - 1.1	8.7 - 3.7	14.7 - 6.2
28	6°22.0	6°23.0	6°04.6	2.8 - 1.2	8.8 - 3.7	14.8 - 6.3
29	6°22.3	6°23.3	6°04.8	2.9 - 1.2	8.9 - 3.8	14.9 - 6.3
30	6°22.5	6°23.5	6°05.1	3.0 - 1.3	9.0 - 3.8	15.0 - 6.4
31	6°22.7	6°23.8	6°05.3	3.1 - 1.3	9.1 - 3.9	15.1 - 6.4
32	6°23.0	6°24.0	6°05.6	3.2 - 1.4	9.2 - 3.9	15.2 - 6.5
33	6°23.3	6°24.3	6°05.8	3.3 - 1.4	9.3 - 4.0	15.3 - 6.5
34	6°23.5	6°24.5	6°06.0	3.4 - 1.4	9.4 - 4.0	15.4 - 6.5
35	6°23.7	6°24.8	6°06.3	3.5 - 1.5	9.5 - 4.0	15.5 - 6.6
36	6°24.0	6°25.0	6°06.5	3.6 - 1.5	9.6 - 4.1	15.6 - 6.6
37	6°24.3	6°25.3	6°06.7	3.7 - 1.6	9.7 - 4.1	15.7 - 6.7
38	6°24.5	6°25.6	6°07.0	3.8 - 1.6	9.8 - 4.2	15.8 - 6.7
39	6°24.7	6°25.8	6°07.2	3.9 - 1.7	9.9 - 4.2	15.9 - 6.8
40	6°25.0	6°26.1	6°07.5	4.0 - 1.7	10.0 - 4.3	16.0 - 6.8
41	6°25.3	6°26.3	6°07.7	4.1 - 1.7	10.1 - 4.3	16.1 - 6.8
42	6°25.5	6°26.6	6°07.9	4.2 - 1.8	10.2 - 4.3	16.2 - 6.9
43	6°25.7	6°26.8	6°08.2	4.3 - 1.8	10.3 - 4.4	16.3 - 6.9
44	6°26.0	6°27.1	6°08.4	4.4 - 1.9	10.4 - 4.4	16.4 - 7.0
45	6°26.3	6°27.3	6°08.7	4.5 - 1.9	10.5 - 4.5	16.5 - 7.0
46	6°26.5	6°27.6	6°08.9	4.6 - 2.0	10.6 - 4.5	16.6 - 7.1
47	6°26.8	6°27.8	6°09.1	4.7 - 2.0	10.7 - 4.5	16.7 - 7.1
48	6°27.0	6°28.1	6°09.4	4.8 - 2.0	10.8 - 4.6	16.8 - 7.1
49	6°27.2	6°28.3	6°09.6	4.9 - 2.1	10.9 - 4.6	16.9 - 7.2
50	6°27.5	6°28.6	6°09.8	5.0 - 2.1	11.0 - 4.7	17.0 - 7.2
51	6°27.8	6°28.8	6°10.1	5.1 - 2.2	11.1 - 4.7	17.1 - 7.3
52	6°28.0	6°29.1	6°10.3	5.2 - 2.2	11.2 - 4.8	17.2 - 7.3
53	6°28.2	6°29.3	6°10.6	5.3 - 2.3	11.3 - 4.8	17.3 - 7.4
54	6°28.5	6°29.6	6°10.8	5.4 - 2.3	11.4 - 4.8	17.4 - 7.4
55	6°28.8	6°29.8	6°11.0	5.5 - 2.3	11.5 - 4.9	17.5 - 7.4
56	6°29.0	6°30.1	6°11.3	5.6 - 2.4	11.6 - 4.9	17.6 - 7.5
57	6°29.2	6°30.3	6°11.5	5.7 - 2.4	11.7 - 5.0	17.7 - 7.5
58	6°29.5	6°30.6	6°11.8	5.8 - 2.5	11.8 - 5.0	17.8 - 7.6
59	6°29.8	6°30.8	6°12.0	5.9 - 2.5	11.9 - 5.1	17.9 - 7.6

m 26	Sun Plan.	Aries	Moon	v and d corr		
0	6°30.0	6°31.1	6°12.2	0.0 - 0.0	6.0 - 2.6	12.0 - 5.3
1	6°30.2	6°31.3	6°12.5	0.1 - 0.0	6.1 - 2.7	12.1 - 5.3
2	6°30.5	6°31.6	6°12.7	0.2 - 0.1	6.2 - 2.7	12.2 - 5.4
3	6°30.8	6°31.8	6°12.9	0.3 - 0.1	6.3 - 2.8	12.3 - 5.4
4	6°31.0	6°32.1	6°13.2	0.4 - 0.2	6.4 - 2.8	12.4 - 5.5
5	6°31.2	6°32.3	6°13.4	0.5 - 0.2	6.5 - 2.9	12.5 - 5.5
6	6°31.5	6°32.6	6°13.7	0.6 - 0.3	6.6 - 2.9	12.6 - 5.6
7	6°31.8	6°32.8	6°13.9	0.7 - 0.3	6.7 - 3.0	12.7 - 5.6
8	6°32.0	6°33.1	6°14.1	0.8 - 0.4	6.8 - 3.0	12.8 - 5.7
9	6°32.2	6°33.3	6°14.4	0.9 - 0.4	6.9 - 3.0	12.9 - 5.7
10	6°32.5	6°33.6	6°14.6	1.0 - 0.4	7.0 - 3.1	13.0 - 5.7
11	6°32.8	6°33.8	6°14.9	1.1 - 0.5	7.1 - 3.1	13.1 - 5.8
12	6°33.0	6°34.1	6°15.1	1.2 - 0.5	7.2 - 3.2	13.2 - 5.8
13	6°33.2	6°34.3	6°15.3	1.3 - 0.6	7.3 - 3.2	13.3 - 5.9
14	6°33.5	6°34.6	6°15.6	1.4 - 0.6	7.4 - 3.3	13.4 - 5.9
15	6°33.8	6°34.8	6°15.8	1.5 - 0.7	7.5 - 3.3	13.5 - 6.0
16	6°34.0	6°35.1	6°16.1	1.6 - 0.7	7.6 - 3.4	13.6 - 6.0
17	6°34.3	6°35.3	6°16.3	1.7 - 0.8	7.7 - 3.4	13.7 - 6.1
18	6°34.5	6°35.6	6°16.5	1.8 - 0.8	7.8 - 3.4	13.8 - 6.1
19	6°34.8	6°35.8	6°16.8	1.9 - 0.8	7.9 - 3.5	13.9 - 6.1
20	6°35.0	6°36.1	6°17.0	2.0 - 0.9	8.0 - 3.5	14.0 - 6.2
21	6°35.3	6°36.3	6°17.2	2.1 - 0.9	8.1 - 3.6	14.1 - 6.2
22	6°35.5	6°36.6	6°17.5	2.2 - 1.0	8.2 - 3.6	14.2 - 6.3
23	6°35.7	6°36.8	6°17.7	2.3 - 1.0	8.3 - 3.7	14.3 - 6.3
24	6°36.0	6°37.1	6°18.0	2.4 - 1.1	8.4 - 3.7	14.4 - 6.4
25	6°36.3	6°37.3	6°18.2	2.5 - 1.1	8.5 - 3.8	14.5 - 6.4
26	6°36.5	6°37.6	6°18.4	2.6 - 1.1	8.6 - 3.8	14.6 - 6.4
27	6°36.7	6°37.8	6°18.7	2.7 - 1.2	8.7 - 3.8	14.7 - 6.5
28	6°37.0	6°38.1	6°18.9	2.8 - 1.2	8.8 - 3.9	14.8 - 6.5
29	6°37.3	6°38.3	6°19.2	2.9 - 1.3	8.9 - 3.9	14.9 - 6.6
30	6°37.5	6°38.6	6°19.4	3.0 - 1.3	9.0 - 4.0	15.0 - 6.6
31	6°37.7	6°38.8	6°19.6	3.1 - 1.4	9.1 - 4.0	15.1 - 6.7
32	6°38.0	6°39.1	6°19.9	3.2 - 1.4	9.2 - 4.1	15.2 - 6.7
33	6°38.3	6°39.3	6°20.1	3.3 - 1.5	9.3 - 4.1	15.3 - 6.8
34	6°38.5	6°39.6	6°20.3	3.4 - 1.5	9.4 - 4.2	15.4 - 6.8
35	6°38.7	6°39.8	6°20.6	3.5 - 1.5	9.5 - 4.2	15.5 - 6.8
36	6°39.0	6°40.1	6°20.8	3.6 - 1.6	9.6 - 4.2	15.6 - 6.9
37	6°39.3	6°40.3	6°21.1	3.7 - 1.6	9.7 - 4.3	15.7 - 6.9
38	6°39.5	6°40.6	6°21.3	3.8 - 1.7	9.8 - 4.3	15.8 - 7.0
39	6°39.7	6°40.8	6°21.5	3.9 - 1.7	9.9 - 4.4	15.9 - 7.0
40	6°40.0	6°41.1	6°21.8	4.0 - 1.8	10.0 - 4.4	16.0 - 7.1
41	6°40.3	6°41.3	6°22.0	4.1 - 1.8	10.1 - 4.5	16.1 - 7.1
42	6°40.5	6°41.6	6°22.3	4.2 - 1.9	10.2 - 4.5	16.2 - 7.2
43	6°40.7	6°41.8	6°22.5	4.3 - 1.9	10.3 - 4.5	16.3 - 7.2
44	6°41.0	6°42.1	6°22.7	4.4 - 1.9	10.4 - 4.6	16.4 - 7.2
45	6°41.3	6°42.3	6°23.0	4.5 - 2.0	10.5 - 4.6	16.5 - 7.3
46	6°41.5	6°42.6	6°23.2	4.6 - 2.0	10.6 - 4.7	16.6 - 7.3
47	6°41.8	6°42.8	6°23.4	4.7 - 2.1	10.7 - 4.7	16.7 - 7.4
48	6°42.0	6°43.1	6°23.7	4.8 - 2.1	10.8 - 4.8	16.8 - 7.4
49	6°42.3	6°43.3	6°23.9	4.9 - 2.2	10.9 - 4.8	16.9 - 7.5
50	6°42.5	6°43.6	6°24.2	5.0 - 2.2	11.0 - 4.9	17.0 - 7.5
51	6°42.8	6°43.9	6°24.4	5.1 - 2.3	11.1 - 4.9	17.1 - 7.6
52	6°43.0	6°44.1	6°24.6	5.2 - 2.3	11.2 - 4.9	17.2 - 7.6
53	6°43.2	6°44.4	6°24.9	5.3 - 2.3	11.3 - 5.0	17.3 - 7.6
54	6°43.5	6°44.6	6°25.1	5.4 - 2.4	11.4 - 5.0	17.4 - 7.7
55	6°43.8	6°44.9	6°25.4	5.5 - 2.4	11.5 - 5.1	17.5 - 7.7
56	6°44.0	6°45.1	6°25.6	5.6 - 2.5	11.6 - 5.1	17.6 - 7.8
57	6°44.2	6°45.4	6°25.8	5.7 - 2.5	11.7 - 5.2	17.7 - 7.8
58	6°44.5	6°45.6	6°26.1	5.8 - 2.6	11.8 - 5.2	17.8 - 7.9
59	6°44.8	6°45.9	6°26.3	5.9 - 2.6	11.9 - 5.3	17.9 - 7.9

Increments and Corrections

m 27	Sun Plan.	Aries	Moon	v and d corr		
0	6°45.0	6°46.1	6°26.5	0.0 - 0.0	6.0 - 2.8	12.0 - 5.5
1	6°45.2	6°46.4	6°26.8	0.1 - 0.0	6.1 - 2.8	12.1 - 5.5
2	6°45.5	6°46.6	6°27.0	0.2 - 0.1	6.2 - 2.8	12.2 - 5.6
3	6°45.8	6°46.9	6°27.3	0.3 - 0.1	6.3 - 2.9	12.3 - 5.6
4	6°46.0	6°47.1	6°27.5	0.4 - 0.2	6.4 - 2.9	12.4 - 5.7
5	6°46.2	6°47.4	6°27.7	0.5 - 0.2	6.5 - 3.0	12.5 - 5.7
6	6°46.5	6°47.6	6°28.0	0.6 - 0.3	6.6 - 3.0	12.6 - 5.8
7	6°46.8	6°47.9	6°28.2	0.7 - 0.3	6.7 - 3.1	12.7 - 5.8
8	6°47.0	6°48.1	6°28.5	0.8 - 0.4	6.8 - 3.1	12.8 - 5.9
9	6°47.2	6°48.4	6°28.7	0.9 - 0.4	6.9 - 3.2	12.9 - 5.9
10	6°47.5	6°48.6	6°28.9	1.0 - 0.5	7.0 - 3.2	13.0 - 6.0
11	6°47.8	6°48.9	6°29.2	1.1 - 0.5	7.1 - 3.3	13.1 - 6.0
12	6°48.0	6°49.1	6°29.4	1.2 - 0.6	7.2 - 3.3	13.2 - 6.0
13	6°48.2	6°49.4	6°29.7	1.3 - 0.6	7.3 - 3.3	13.3 - 6.1
14	6°48.5	6°49.6	6°29.9	1.4 - 0.6	7.4 - 3.4	13.4 - 6.1
15	6°48.8	6°49.9	6°30.1	1.5 - 0.7	7.5 - 3.4	13.5 - 6.2
16	6°49.0	6°50.1	6°30.4	1.6 - 0.7	7.6 - 3.5	13.6 - 6.2
17	6°49.3	6°50.4	6°30.6	1.7 - 0.8	7.7 - 3.5	13.7 - 6.3
18	6°49.5	6°50.6	6°30.8	1.8 - 0.8	7.8 - 3.6	13.8 - 6.3
19	6°49.8	6°50.9	6°31.1	1.9 - 0.9	7.9 - 3.6	13.9 - 6.4
20	6°50.0	6°51.1	6°31.3	2.0 - 0.9	8.0 - 3.7	14.0 - 6.4
21	6°50.3	6°51.4	6°31.6	2.1 - 1.0	8.1 - 3.7	14.1 - 6.5
22	6°50.5	6°51.6	6°31.8	2.2 - 1.0	8.2 - 3.8	14.2 - 6.5
23	6°50.7	6°51.9	6°32.0	2.3 - 1.1	8.3 - 3.8	14.3 - 6.6
24	6°51.0	6°52.1	6°32.3	2.4 - 1.1	8.4 - 3.9	14.4 - 6.6
25	6°51.3	6°52.4	6°32.5	2.5 - 1.1	8.5 - 3.9	14.5 - 6.6
26	6°51.5	6°52.6	6°32.8	2.6 - 1.2	8.6 - 3.9	14.6 - 6.7
27	6°51.7	6°52.9	6°33.0	2.7 - 1.2	8.7 - 4.0	14.7 - 6.7
28	6°52.0	6°53.1	6°33.2	2.8 - 1.3	8.8 - 4.0	14.8 - 6.8
29	6°52.3	6°53.4	6°33.5	2.9 - 1.3	8.9 - 4.1	14.9 - 6.8
30	6°52.5	6°53.6	6°33.7	3.0 - 1.4	9.0 - 4.1	15.0 - 6.9
31	6°52.7	6°53.9	6°33.9	3.1 - 1.4	9.1 - 4.2	15.1 - 6.9
32	6°53.0	6°54.1	6°34.2	3.2 - 1.5	9.2 - 4.2	15.2 - 7.0
33	6°53.3	6°54.4	6°34.4	3.3 - 1.5	9.3 - 4.3	15.3 - 7.0
34	6°53.5	6°54.6	6°34.7	3.4 - 1.6	9.4 - 4.3	15.4 - 7.1
35	6°53.7	6°54.9	6°34.9	3.5 - 1.6	9.5 - 4.4	15.5 - 7.1
36	6°54.0	6°55.1	6°35.1	3.6 - 1.6	9.6 - 4.4	15.6 - 7.1
37	6°54.3	6°55.4	6°35.4	3.7 - 1.7	9.7 - 4.4	15.7 - 7.2
38	6°54.5	6°55.6	6°35.6	3.8 - 1.7	9.8 - 4.5	15.8 - 7.2
39	6°54.7	6°55.9	6°35.9	3.9 - 1.8	9.9 - 4.5	15.9 - 7.3
40	6°55.0	6°56.1	6°36.1	4.0 - 1.8	10.0 - 4.6	16.0 - 7.3
41	6°55.3	6°56.4	6°36.3	4.1 - 1.9	10.1 - 4.6	16.1 - 7.4
42	6°55.5	6°56.6	6°36.6	4.2 - 1.9	10.2 - 4.7	16.2 - 7.4
43	6°55.7	6°56.9	6°36.8	4.3 - 2.0	10.3 - 4.7	16.3 - 7.5
44	6°56.0	6°57.1	6°37.0	4.4 - 2.0	10.4 - 4.8	16.4 - 7.5
45	6°56.3	6°57.4	6°37.3	4.5 - 2.1	10.5 - 4.8	16.5 - 7.6
46	6°56.5	6°57.6	6°37.5	4.6 - 2.1	10.6 - 4.9	16.6 - 7.6
47	6°56.8	6°57.9	6°37.8	4.7 - 2.2	10.7 - 4.9	16.7 - 7.7
48	6°57.0	6°58.1	6°38.0	4.8 - 2.2	10.8 - 5.0	16.8 - 7.7
49	6°57.3	6°58.4	6°38.2	4.9 - 2.2	10.9 - 5.0	16.9 - 7.7
50	6°57.5	6°58.6	6°38.5	5.0 - 2.3	11.0 - 5.0	17.0 - 7.8
51	6°57.8	6°58.9	6°38.7	5.1 - 2.3	11.1 - 5.1	17.1 - 7.8
52	6°58.0	6°59.1	6°39.0	5.2 - 2.4	11.2 - 5.1	17.2 - 7.9
53	6°58.2	6°59.4	6°39.2	5.3 - 2.4	11.3 - 5.2	17.3 - 7.9
54	6°58.5	6°59.6	6°39.4	5.4 - 2.5	11.4 - 5.2	17.4 - 8.0
55	6°58.8	6°59.9	6°39.7	5.5 - 2.5	11.5 - 5.3	17.5 - 8.0
56	6°59.0	7°00.1	6°39.9	5.6 - 2.6	11.6 - 5.3	17.6 - 8.1
57	6°59.2	7°00.4	6°40.2	5.7 - 2.6	11.7 - 5.4	17.7 - 8.1
58	6°59.5	7°00.6	6°40.4	5.8 - 2.7	11.8 - 5.4	17.8 - 8.2
59	6°59.8	7°00.9	6°40.6	5.9 - 2.7	11.9 - 5.5	17.9 - 8.2

m 28	Sun Plan.	Aries	Moon	v and d corr		
0	7°00.0	7°01.1	6°40.9	0.0 - 0.0	6.0 - 2.8	12.0 - 5.7
1	7°00.2	7°01.4	6°41.1	0.1 - 0.0	6.1 - 2.9	12.1 - 5.7
2	7°00.5	7°01.6	6°41.3	0.2 - 0.1	6.2 - 2.9	12.2 - 5.8
3	7°00.8	7°01.9	6°41.6	0.3 - 0.1	6.3 - 3.0	12.3 - 5.8
4	7°01.0	7°02.2	6°41.8	0.4 - 0.2	6.4 - 3.0	12.4 - 5.9
5	7°01.2	7°02.4	6°42.1	0.5 - 0.2	6.5 - 3.1	12.5 - 5.9
6	7°01.5	7°02.7	6°42.3	0.6 - 0.3	6.6 - 3.1	12.6 - 6.0
7	7°01.8	7°02.9	6°42.5	0.7 - 0.3	6.7 - 3.2	12.7 - 6.0
8	7°02.0	7°03.2	6°42.8	0.8 - 0.4	6.8 - 3.2	12.8 - 6.1
9	7°02.2	7°03.4	6°43.0	0.9 - 0.4	6.9 - 3.3	12.9 - 6.1
10	7°02.5	7°03.7	6°43.3	1.0 - 0.5	7.0 - 3.3	13.0 - 6.2
11	7°02.8	7°03.9	6°43.5	1.1 - 0.5	7.1 - 3.4	13.1 - 6.2
12	7°03.0	7°04.2	6°43.7	1.2 - 0.6	7.2 - 3.4	13.2 - 6.3
13	7°03.2	7°04.4	6°44.0	1.3 - 0.6	7.3 - 3.5	13.3 - 6.3
14	7°03.5	7°04.7	6°44.2	1.4 - 0.7	7.4 - 3.5	13.4 - 6.4
15	7°03.8	7°04.9	6°44.4	1.5 - 0.7	7.5 - 3.6	13.5 - 6.4
16	7°04.0	7°05.2	6°44.7	1.6 - 0.8	7.6 - 3.6	13.6 - 6.5
17	7°04.3	7°05.4	6°44.9	1.7 - 0.8	7.7 - 3.7	13.7 - 6.5
18	7°04.5	7°05.7	6°45.2	1.8 - 0.9	7.8 - 3.7	13.8 - 6.6
19	7°04.7	7°05.9	6°45.4	1.9 - 0.9	7.9 - 3.8	13.9 - 6.6
20	7°05.0	7°06.2	6°45.6	2.0 - 0.9	8.0 - 3.8	14.0 - 6.6
21	7°05.3	7°06.4	6°45.9	2.1 - 1.0	8.1 - 3.8	14.1 - 6.7
22	7°05.5	7°06.7	6°46.1	2.2 - 1.0	8.2 - 3.9	14.2 - 6.7
23	7°05.7	7°06.9	6°46.4	2.3 - 1.1	8.3 - 3.9	14.3 - 6.8
24	7°06.0	7°07.2	6°46.6	2.4 - 1.1	8.4 - 4.0	14.4 - 6.8
25	7°06.3	7°07.4	6°46.8	2.5 - 1.2	8.5 - 4.0	14.5 - 6.9
26	7°06.5	7°07.7	6°47.1	2.6 - 1.2	8.6 - 4.1	14.6 - 6.9
27	7°06.7	7°07.9	6°47.3	2.7 - 1.3	8.7 - 4.1	14.7 - 7.0
28	7°07.0	7°08.2	6°47.5	2.8 - 1.3	8.8 - 4.2	14.8 - 7.0
29	7°07.3	7°08.4	6°47.8	2.9 - 1.4	8.9 - 4.2	14.9 - 7.1
30	7°07.5	7°08.7	6°48.0	3.0 - 1.4	9.0 - 4.3	15.0 - 7.1
31	7°07.7	7°08.9	6°48.3	3.1 - 1.5	9.1 - 4.3	15.1 - 7.2
32	7°08.0	7°09.2	6°48.5	3.2 - 1.5	9.2 - 4.4	15.2 - 7.2
33	7°08.3	7°09.4	6°48.7	3.3 - 1.6	9.3 - 4.4	15.3 - 7.3
34	7°08.5	7°09.7	6°49.0	3.4 - 1.6	9.4 - 4.5	15.4 - 7.3
35	7°08.7	7°09.9	6°49.2	3.5 - 1.7	9.5 - 4.5	15.5 - 7.4
36	7°09.0	7°10.2	6°49.5	3.6 - 1.7	9.6 - 4.6	15.6 - 7.4
37	7°09.3	7°10.4	6°49.7	3.7 - 1.8	9.7 - 4.6	15.7 - 7.5
38	7°09.5	7°10.7	6°49.9	3.8 - 1.8	9.8 - 4.7	15.8 - 7.5
39	7°09.7	7°10.9	6°50.2	3.9 - 1.9	9.9 - 4.7	15.9 - 7.6
40	7°10.0	7°11.2	6°50.4	4.0 - 1.9	10.0 - 4.8	16.0 - 7.6
41	7°10.3	7°11.4	6°50.6	4.1 - 1.9	10.1 - 4.8	16.1 - 7.6
42	7°10.5	7°11.7	6°50.9	4.2 - 2.0	10.2 - 4.8	16.2 - 7.7
43	7°10.7	7°11.9	6°51.1	4.3 - 2.0	10.3 - 4.9	16.3 - 7.7
44	7°11.0	7°12.2	6°51.4	4.4 - 2.1	10.4 - 4.9	16.4 - 7.8
45	7°11.3	7°12.4	6°51.6	4.5 - 2.1	10.5 - 5.0	16.5 - 7.8
46	7°11.5	7°12.7	6°51.8	4.6 - 2.2	10.6 - 5.0	16.6 - 7.9
47	7°11.8	7°12.9	6°52.1	4.7 - 2.2	10.7 - 5.1	16.7 - 7.9
48	7°12.0	7°13.2	6°52.3	4.8 - 2.3	10.8 - 5.1	16.8 - 8.0
49	7°12.2	7°13.4	6°52.6	4.9 - 2.3	10.9 - 5.2	16.9 - 8.0
50	7°12.5	7°13.7	6°52.8	5.0 - 2.4	11.0 - 5.2	17.0 - 8.1
51	7°12.8	7°13.9	6°53.0	5.1 - 2.4	11.1 - 5.3	17.1 - 8.1
52	7°13.0	7°14.2	6°53.3	5.2 - 2.5	11.2 - 5.3	17.2 - 8.2
53	7°13.2	7°14.4	6°53.5	5.3 - 2.5	11.3 - 5.4	17.3 - 8.2
54	7°13.5	7°14.7	6°53.8	5.4 - 2.6	11.4 - 5.4	17.4 - 8.3
55	7°13.8	7°14.9	6°54.0	5.5 - 2.6	11.5 - 5.5	17.5 - 8.3
56	7°14.0	7°15.2	6°54.2	5.6 - 2.7	11.6 - 5.5	17.6 - 8.4
57	7°14.2	7°15.4	6°54.5	5.7 - 2.7	11.7 - 5.6	17.7 - 8.4
58	7°14.5	7°15.7	6°54.7	5.8 - 2.8	11.8 - 5.6	17.8 - 8.5
59	7°14.8	7°15.9	6°54.9	5.9 - 2.8	11.9 - 5.7	17.9 - 8.5

m 29	Sun Plan.	Aries	Moon	v and d corr		
0	7°15.0	7°16.2	6°55.2	0.0 - 0.0	6.0 - 2.9	12.0 - 5.9
1	7°15.2	7°16.4	6°55.4	0.1 - 0.0	6.1 - 3.0	12.1 - 5.9
2	7°15.5	7°16.7	6°55.7	0.2 - 0.1	6.2 - 3.0	12.2 - 6.0
3	7°15.8	7°16.9	6°55.9	0.3 - 0.1	6.3 - 3.1	12.3 - 6.0
4	7°16.0	7°17.2	6°56.1	0.4 - 0.2	6.4 - 3.1	12.4 - 6.1
5	7°16.2	7°17.4	6°56.4	0.5 - 0.2	6.5 - 3.2	12.5 - 6.1
6	7°16.5	7°17.7	6°56.6	0.6 - 0.3	6.6 - 3.2	12.6 - 6.2
7	7°16.8	7°17.9	6°56.9	0.7 - 0.3	6.7 - 3.3	12.7 - 6.2
8	7°17.0	7°18.2	6°57.1	0.8 - 0.4	6.8 - 3.3	12.8 - 6.3
9	7°17.2	7°18.4	6°57.3	0.9 - 0.4	6.9 - 3.4	12.9 - 6.3
10	7°17.5	7°18.7	6°57.6	1.0 - 0.5	7.0 - 3.4	13.0 - 6.4
11	7°17.8	7°18.9	6°57.8	1.1 - 0.5	7.1 - 3.5	13.1 - 6.4
12	7°18.0	7°19.2	6°58.0	1.2 - 0.6	7.2 - 3.5	13.2 - 6.5
13	7°18.2	7°19.4	6°58.3	1.3 - 0.6	7.3 - 3.6	13.3 - 6.5
14	7°18.5	7°19.7	6°58.5	1.4 - 0.7	7.4 - 3.6	13.4 - 6.6
15	7°18.8	7°19.9	6°58.8	1.5 - 0.7	7.5 - 3.7	13.5 - 6.6
16	7°19.0	7°20.2	6°59.0	1.6 - 0.8	7.6 - 3.7	13.6 - 6.7
17	7°19.3	7°20.5	6°59.2	1.7 - 0.8	7.7 - 3.8	13.7 - 6.7
18	7°19.5	7°20.7	6°59.5	1.8 - 0.9	7.8 - 3.8	13.8 - 6.8
19	7°19.7	7°21.0	6°59.7	1.9 - 0.9	7.9 - 3.9	13.9 - 6.8
20	7°20.0	7°21.2	7°00.0	2.0 - 1.0	8.0 - 3.9	14.0 - 6.9
21	7°20.3	7°21.5	7°00.2	2.1 - 1.0	8.1 - 4.0	14.1 - 6.9
22	7°20.5	7°21.7	7°00.4	2.2 - 1.1	8.2 - 4.0	14.2 - 7.0
23	7°20.7	7°22.0	7°00.7	2.3 - 1.1	8.3 - 4.1	14.3 - 7.0
24	7°21.0	7°22.2	7°00.9	2.4 - 1.2	8.4 - 4.1	14.4 - 7.1
25	7°21.3	7°22.5	7°01.1	2.5 - 1.2	8.5 - 4.2	14.5 - 7.1
26	7°21.5	7°22.7	7°01.4	2.6 - 1.3	8.6 - 4.2	14.6 - 7.2
27	7°21.7	7°23.0	7°01.6	2.7 - 1.3	8.7 - 4.3	14.7 - 7.2
28	7°22.0	7°23.2	7°01.9	2.8 - 1.4	8.8 - 4.3	14.8 - 7.3
29	7°22.3	7°23.5	7°02.1	2.9 - 1.4	8.9 - 4.4	14.9 - 7.3
30	7°22.5	7°23.7	7°02.3	3.0 - 1.5	9.0 - 4.4	15.0 - 7.4
31	7°22.7	7°24.0	7°02.6	3.1 - 1.5	9.1 - 4.5	15.1 - 7.4
32	7°23.0	7°24.2	7°02.8	3.2 - 1.6	9.2 - 4.5	15.2 - 7.5
33	7°23.3	7°24.5	7°03.1	3.3 - 1.6	9.3 - 4.6	15.3 - 7.5
34	7°23.5	7°24.7	7°03.3	3.4 - 1.7	9.4 - 4.6	15.4 - 7.6
35	7°23.7	7°25.0	7°03.5	3.5 - 1.7	9.5 - 4.7	15.5 - 7.6
36	7°24.0	7°25.2	7°03.8	3.6 - 1.8	9.6 - 4.7	15.6 - 7.7
37	7°24.3	7°25.5	7°04.0	3.7 - 1.8	9.7 - 4.8	15.7 - 7.7
38	7°24.5	7°25.7	7°04.3	3.8 - 1.9	9.8 - 4.8	15.8 - 7.8
39	7°24.7	7°26.0	7°04.5	3.9 - 1.9	9.9 - 4.9	15.9 - 7.8
40	7°25.0	7°26.2	7°04.7	4.0 - 2.0	10.0 - 4.9	16.0 - 7.9
41	7°25.3	7°26.5	7°05.0	4.1 - 2.0	10.1 - 5.0	16.1 - 7.9
42	7°25.5	7°26.7	7°05.2	4.2 - 2.1	10.2 - 5.0	16.2 - 8.0
43	7°25.7	7°27.0	7°05.4	4.3 - 2.1	10.3 - 5.1	16.3 - 8.0
44	7°26.0	7°27.2	7°05.7	4.4 - 2.2	10.4 - 5.1	16.4 - 8.1
45	7°26.3	7°27.5	7°05.9	4.5 - 2.2	10.5 - 5.2	16.5 - 8.1
46	7°26.5	7°27.7	7°06.2	4.6 - 2.3	10.6 - 5.2	16.6 - 8.2
47	7°26.8	7°28.0	7°06.4	4.7 - 2.3	10.7 - 5.3	16.7 - 8.2
48	7°27.0	7°28.2	7°06.6	4.8 - 2.4	10.8 - 5.3	16.8 - 8.3
49	7°27.2	7°28.5	7°06.9	4.9 - 2.4	10.9 - 5.4	16.9 - 8.3
50	7°27.5	7°28.7	7°07.1	5.0 - 2.5	11.0 - 5.4	17.0 - 8.4
51	7°27.8	7°29.0	7°07.4	5.1 - 2.5	11.1 - 5.5	17.1 - 8.4
52	7°28.0	7°29.2	7°07.6	5.2 - 2.6	11.2 - 5.5	17.2 - 8.5
53	7°28.2	7°29.5	7°07.8	5.3 - 2.6	11.3 - 5.6	17.3 - 8.5
54	7°28.5	7°29.7	7°08.1	5.4 - 2.7	11.4 - 5.6	17.4 - 8.6
55	7°28.8	7°30.0	7°08.3	5.5 - 2.7	11.5 - 5.7	17.5 - 8.6
56	7°29.0	7°30.2	7°08.5	5.6 - 2.8	11.6 - 5.7	17.6 - 8.7
57	7°29.2	7°30.5	7°08.8	5.7 - 2.8	11.7 - 5.8	17.7 - 8.7
58	7°29.5	7°30.7	7°09.0	5.8 - 2.9	11.8 - 5.8	17.8 - 8.8
59	7°29.8	7°31.0	7°09.3	5.9 - 2.9	11.9 - 5.9	17.9 - 8.8

Increments and Corrections

m 30	Sun Plan.	Aries	Moon	v and d corr		
0	7°30.0	7°31.2	7°09.5	0.0 - 0.0	6.0 - 3.0	12.0 - 6.1
1	7°30.2	7°31.5	7°09.7	0.1 - 0.1	6.1 - 3.1	12.1 - 6.2
2	7°30.5	7°31.7	7°10.0	0.2 - 0.1	6.2 - 3.2	12.2 - 6.2
3	7°30.8	7°32.0	7°10.2	0.3 - 0.2	6.3 - 3.2	12.3 - 6.3
4	7°31.0	7°32.2	7°10.5	0.4 - 0.2	6.4 - 3.3	12.4 - 6.3
5	7°31.2	7°32.5	7°10.7	0.5 - 0.3	6.5 - 3.3	12.5 - 6.4
6	7°31.5	7°32.7	7°10.9	0.6 - 0.3	6.6 - 3.4	12.6 - 6.4
7	7°31.7	7°33.0	7°11.2	0.7 - 0.4	6.7 - 3.4	12.7 - 6.5
8	7°32.0	7°33.2	7°11.4	0.8 - 0.4	6.8 - 3.5	12.8 - 6.5
9	7°32.2	7°33.5	7°11.6	0.9 - 0.5	6.9 - 3.5	12.9 - 6.6
10	7°32.5	7°33.7	7°11.9	1.0 - 0.5	7.0 - 3.6	13.0 - 6.6
11	7°32.8	7°34.0	7°12.1	1.1 - 0.6	7.1 - 3.6	13.1 - 6.7
12	7°33.0	7°34.2	7°12.4	1.2 - 0.6	7.2 - 3.7	13.2 - 6.7
13	7°33.3	7°34.5	7°12.6	1.3 - 0.7	7.3 - 3.7	13.3 - 6.8
14	7°33.5	7°34.7	7°12.8	1.4 - 0.7	7.4 - 3.8	13.4 - 6.8
15	7°33.8	7°35.0	7°13.1	1.5 - 0.8	7.5 - 3.8	13.5 - 6.9
16	7°34.0	7°35.2	7°13.3	1.6 - 0.8	7.6 - 3.9	13.6 - 6.9
17	7°34.3	7°35.5	7°13.6	1.7 - 0.9	7.7 - 3.9	13.7 - 7.0
18	7°34.5	7°35.7	7°13.8	1.8 - 0.9	7.8 - 4.0	13.8 - 7.0
19	7°34.8	7°36.0	7°14.0	1.9 - 1.0	7.9 - 4.0	13.9 - 7.1
20	7°35.0	7°36.2	7°14.3	2.0 - 1.0	8.0 - 4.1	14.0 - 7.1
21	7°35.3	7°36.5	7°14.5	2.1 - 1.1	8.1 - 4.1	14.1 - 7.2
22	7°35.5	7°36.7	7°14.7	2.2 - 1.1	8.2 - 4.2	14.2 - 7.2
23	7°35.7	7°37.0	7°15.0	2.3 - 1.2	8.3 - 4.2	14.3 - 7.3
24	7°36.0	7°37.2	7°15.2	2.4 - 1.2	8.4 - 4.3	14.4 - 7.3
25	7°36.2	7°37.5	7°15.5	2.5 - 1.3	8.5 - 4.3	14.5 - 7.4
26	7°36.5	7°37.7	7°15.7	2.6 - 1.3	8.6 - 4.4	14.6 - 7.4
27	7°36.7	7°38.0	7°15.9	2.7 - 1.4	8.7 - 4.4	14.7 - 7.5
28	7°37.0	7°38.2	7°16.2	2.8 - 1.4	8.8 - 4.5	14.8 - 7.5
29	7°37.3	7°38.5	7°16.4	2.9 - 1.5	8.9 - 4.5	14.9 - 7.6
30	7°37.5	7°38.8	7°16.7	3.0 - 1.5	9.0 - 4.6	15.0 - 7.6
31	7°37.7	7°39.0	7°16.9	3.1 - 1.6	9.1 - 4.6	15.1 - 7.7
32	7°38.0	7°39.3	7°17.1	3.2 - 1.6	9.2 - 4.7	15.2 - 7.7
33	7°38.3	7°39.5	7°17.4	3.3 - 1.7	9.3 - 4.7	15.3 - 7.8
34	7°38.5	7°39.8	7°17.6	3.4 - 1.7	9.4 - 4.8	15.4 - 7.8
35	7°38.7	7°40.0	7°17.9	3.5 - 1.8	9.5 - 4.8	15.5 - 7.9
36	7°39.0	7°40.3	7°18.1	3.6 - 1.8	9.6 - 4.9	15.6 - 7.9
37	7°39.3	7°40.5	7°18.3	3.7 - 1.9	9.7 - 4.9	15.7 - 8.0
38	7°39.5	7°40.8	7°18.6	3.8 - 1.9	9.8 - 5.0	15.8 - 8.0
39	7°39.8	7°41.0	7°18.8	3.9 - 2.0	9.9 - 5.0	15.9 - 8.1
40	7°40.0	7°41.3	7°19.0	4.0 - 2.0	10.0 - 5.1	16.0 - 8.1
41	7°40.3	7°41.5	7°19.3	4.1 - 2.1	10.1 - 5.1	16.1 - 8.2
42	7°40.5	7°41.8	7°19.5	4.2 - 2.1	10.2 - 5.2	16.2 - 8.2
43	7°40.7	7°42.0	7°19.8	4.3 - 2.2	10.3 - 5.2	16.3 - 8.3
44	7°41.0	7°42.3	7°20.0	4.4 - 2.2	10.4 - 5.3	16.4 - 8.3
45	7°41.2	7°42.5	7°20.2	4.5 - 2.3	10.5 - 5.3	16.5 - 8.4
46	7°41.5	7°42.8	7°20.5	4.6 - 2.3	10.6 - 5.4	16.6 - 8.4
47	7°41.8	7°43.0	7°20.7	4.7 - 2.4	10.7 - 5.4	16.7 - 8.5
48	7°42.0	7°43.3	7°21.0	4.8 - 2.4	10.8 - 5.5	16.8 - 8.5
49	7°42.3	7°43.5	7°21.2	4.9 - 2.5	10.9 - 5.5	16.9 - 8.6
50	7°42.5	7°43.8	7°21.4	5.0 - 2.5	11.0 - 5.6	17.0 - 8.6
51	7°42.8	7°44.0	7°21.7	5.1 - 2.6	11.1 - 5.6	17.1 - 8.7
52	7°43.0	7°44.3	7°21.9	5.2 - 2.6	11.2 - 5.7	17.2 - 8.7
53	7°43.2	7°44.5	7°22.1	5.3 - 2.7	11.3 - 5.7	17.3 - 8.8
54	7°43.5	7°44.8	7°22.4	5.4 - 2.7	11.4 - 5.8	17.4 - 8.8
55	7°43.8	7°45.0	7°22.6	5.5 - 2.8	11.5 - 5.8	17.5 - 8.9
56	7°44.0	7°45.3	7°22.9	5.6 - 2.8	11.6 - 5.9	17.6 - 8.9
57	7°44.3	7°45.5	7°23.1	5.7 - 2.9	11.7 - 5.9	17.7 - 9.0
58	7°44.5	7°45.8	7°23.3	5.8 - 2.9	11.8 - 6.0	17.8 - 9.0
59	7°44.8	7°46.0	7°23.6	5.9 - 3.0	11.9 - 6.0	17.9 - 9.1

m 31	Sun Plan.	Aries	Moon	v and d corr		
0	7°45.0	7°46.3	7°23.8	0.0 - 0.0	6.0 - 3.2	12.0 - 6.3
1	7°45.2	7°46.5	7°24.1	0.1 - 0.1	6.1 - 3.2	12.1 - 6.4
2	7°45.5	7°46.8	7°24.3	0.2 - 0.1	6.2 - 3.3	12.2 - 6.4
3	7°45.7	7°47.0	7°24.5	0.3 - 0.2	6.3 - 3.3	12.3 - 6.5
4	7°46.0	7°47.3	7°24.8	0.4 - 0.2	6.4 - 3.4	12.4 - 6.5
5	7°46.2	7°47.5	7°25.0	0.5 - 0.3	6.5 - 3.4	12.5 - 6.6
6	7°46.5	7°47.8	7°25.2	0.6 - 0.3	6.6 - 3.5	12.6 - 6.6
7	7°46.8	7°48.0	7°25.5	0.7 - 0.4	6.7 - 3.5	12.7 - 6.7
8	7°47.0	7°48.3	7°25.7	0.8 - 0.4	6.8 - 3.6	12.8 - 6.7
9	7°47.2	7°48.5	7°26.0	0.9 - 0.5	6.9 - 3.6	12.9 - 6.8
10	7°47.5	7°48.8	7°26.2	1.0 - 0.5	7.0 - 3.7	13.0 - 6.8
11	7°47.7	7°49.0	7°26.4	1.1 - 0.6	7.1 - 3.7	13.1 - 6.9
12	7°48.0	7°49.3	7°26.7	1.2 - 0.6	7.2 - 3.8	13.2 - 6.9
13	7°48.2	7°49.5	7°26.9	1.3 - 0.7	7.3 - 3.8	13.3 - 7.0
14	7°48.5	7°49.8	7°27.2	1.4 - 0.7	7.4 - 3.9	13.4 - 7.0
15	7°48.8	7°50.0	7°27.4	1.5 - 0.8	7.5 - 3.9	13.5 - 7.1
16	7°49.0	7°50.3	7°27.6	1.6 - 0.8	7.6 - 4.0	13.6 - 7.1
17	7°49.3	7°50.5	7°27.9	1.7 - 0.9	7.7 - 4.0	13.7 - 7.2
18	7°49.5	7°50.8	7°28.1	1.8 - 0.9	7.8 - 4.1	13.8 - 7.2
19	7°49.8	7°51.0	7°28.4	1.9 - 1.0	7.9 - 4.1	13.9 - 7.3
20	7°50.0	7°51.3	7°28.6	2.0 - 1.1	8.0 - 4.2	14.0 - 7.4
21	7°50.3	7°51.5	7°28.8	2.1 - 1.1	8.1 - 4.3	14.1 - 7.4
22	7°50.5	7°51.8	7°29.1	2.2 - 1.2	8.2 - 4.3	14.2 - 7.5
23	7°50.7	7°52.0	7°29.3	2.3 - 1.2	8.3 - 4.4	14.3 - 7.5
24	7°51.0	7°52.3	7°29.5	2.4 - 1.3	8.4 - 4.4	14.4 - 7.6
25	7°51.3	7°52.5	7°29.8	2.5 - 1.3	8.5 - 4.5	14.5 - 7.6
26	7°51.5	7°52.8	7°30.0	2.6 - 1.4	8.6 - 4.5	14.6 - 7.7
27	7°51.7	7°53.0	7°30.3	2.7 - 1.4	8.7 - 4.6	14.7 - 7.7
28	7°52.0	7°53.3	7°30.5	2.8 - 1.5	8.8 - 4.6	14.8 - 7.8
29	7°52.2	7°53.5	7°30.7	2.9 - 1.5	8.9 - 4.7	14.9 - 7.8
30	7°52.5	7°53.8	7°31.0	3.0 - 1.6	9.0 - 4.7	15.0 - 7.9
31	7°52.7	7°54.0	7°31.2	3.1 - 1.6	9.1 - 4.8	15.1 - 7.9
32	7°53.0	7°54.3	7°31.5	3.2 - 1.7	9.2 - 4.8	15.2 - 8.0
33	7°53.3	7°54.5	7°31.7	3.3 - 1.7	9.3 - 4.9	15.3 - 8.0
34	7°53.5	7°54.8	7°31.9	3.4 - 1.8	9.4 - 4.9	15.4 - 8.1
35	7°53.8	7°55.0	7°32.2	3.5 - 1.8	9.5 - 5.0	15.5 - 8.1
36	7°54.0	7°55.3	7°32.4	3.6 - 1.9	9.6 - 5.0	15.6 - 8.2
37	7°54.3	7°55.5	7°32.6	3.7 - 1.9	9.7 - 5.1	15.7 - 8.2
38	7°54.5	7°55.8	7°32.9	3.8 - 2.0	9.8 - 5.1	15.8 - 8.3
39	7°54.7	7°56.0	7°33.1	3.9 - 2.0	9.9 - 5.2	15.9 - 8.3
40	7°55.0	7°56.3	7°33.4	4.0 - 2.1	10.0 - 5.3	16.0 - 8.4
41	7°55.3	7°56.5	7°33.6	4.1 - 2.2	10.1 - 5.3	16.1 - 8.5
42	7°55.5	7°56.8	7°33.8	4.2 - 2.2	10.2 - 5.4	16.2 - 8.5
43	7°55.7	7°57.1	7°34.1	4.3 - 2.3	10.3 - 5.4	16.3 - 8.6
44	7°56.0	7°57.3	7°34.3	4.4 - 2.3	10.4 - 5.5	16.4 - 8.6
45	7°56.3	7°57.6	7°34.6	4.5 - 2.4	10.5 - 5.5	16.5 - 8.7
46	7°56.5	7°57.8	7°34.8	4.6 - 2.4	10.6 - 5.6	16.6 - 8.7
47	7°56.7	7°58.1	7°35.0	4.7 - 2.5	10.7 - 5.6	16.7 - 8.8
48	7°57.0	7°58.3	7°35.3	4.8 - 2.5	10.8 - 5.7	16.8 - 8.8
49	7°57.2	7°58.6	7°35.5	4.9 - 2.6	10.9 - 5.7	16.9 - 8.9
50	7°57.5	7°58.8	7°35.7	5.0 - 2.6	11.0 - 5.8	17.0 - 8.9
51	7°57.8	7°59.1	7°36.0	5.1 - 2.7	11.1 - 5.8	17.1 - 9.0
52	7°58.0	7°59.3	7°36.2	5.2 - 2.7	11.2 - 5.9	17.2 - 9.0
53	7°58.2	7°59.6	7°36.5	5.3 - 2.8	11.3 - 5.9	17.3 - 9.1
54	7°58.5	7°59.8	7°36.7	5.4 - 2.8	11.4 - 6.0	17.4 - 9.1
55	7°58.8	8°00.1	7°36.9	5.5 - 2.9	11.5 - 6.0	17.5 - 9.2
56	7°59.0	8°00.3	7°37.2	5.6 - 2.9	11.6 - 6.1	17.6 - 9.2
57	7°59.2	8°00.6	7°37.4	5.7 - 3.0	11.7 - 6.1	17.7 - 9.3
58	7°59.5	8°00.8	7°37.7	5.8 - 3.0	11.8 - 6.2	17.8 - 9.3
59	7°59.8	8°01.1	7°37.9	5.9 - 3.1	11.9 - 6.2	17.9 - 9.4

m 32	Sun Plan.	Aries	Moon	v and d corr		
0	8°00.0	8°01.3	7°38.1	0.0 - 0.0	6.0 - 3.3	12.0 - 6.5
1	8°00.2	8°01.6	7°38.4	0.1 - 0.1	6.1 - 3.3	12.1 - 6.6
2	8°00.5	8°01.8	7°38.6	0.2 - 0.1	6.2 - 3.4	12.2 - 6.6
3	8°00.7	8°02.1	7°38.8	0.3 - 0.2	6.3 - 3.4	12.3 - 6.7
4	8°01.0	8°02.3	7°39.1	0.4 - 0.2	6.4 - 3.5	12.4 - 6.7
5	8°01.3	8°02.6	7°39.3	0.5 - 0.3	6.5 - 3.5	12.5 - 6.8
6	8°01.5	8°02.8	7°39.6	0.6 - 0.3	6.6 - 3.6	12.6 - 6.8
7	8°01.8	8°03.1	7°39.8	0.7 - 0.4	6.7 - 3.6	12.7 - 6.9
8	8°02.0	8°03.3	7°40.0	0.8 - 0.4	6.8 - 3.7	12.8 - 6.9
9	8°02.2	8°03.6	7°40.3	0.9 - 0.5	6.9 - 3.7	12.9 - 7.0
10	8°02.5	8°03.8	7°40.5	1.0 - 0.5	7.0 - 3.8	13.0 - 7.0
11	8°02.7	8°04.1	7°40.8	1.1 - 0.6	7.1 - 3.8	13.1 - 7.1
12	8°03.0	8°04.3	7°41.0	1.2 - 0.7	7.2 - 3.9	13.2 - 7.1
13	8°03.3	8°04.6	7°41.2	1.3 - 0.7	7.3 - 4.0	13.3 - 7.2
14	8°03.5	8°04.8	7°41.5	1.4 - 0.8	7.4 - 4.0	13.4 - 7.3
15	8°03.8	8°05.1	7°41.7	1.5 - 0.8	7.5 - 4.1	13.5 - 7.3
16	8°04.0	8°05.3	7°42.0	1.6 - 0.9	7.6 - 4.1	13.6 - 7.4
17	8°04.2	8°05.6	7°42.2	1.7 - 0.9	7.7 - 4.2	13.7 - 7.4
18	8°04.5	8°05.8	7°42.4	1.8 - 1.0	7.8 - 4.2	13.8 - 7.5
19	8°04.8	8°06.1	7°42.7	1.9 - 1.0	7.9 - 4.3	13.9 - 7.5
20	8°05.0	8°06.3	7°42.9	2.0 - 1.1	8.0 - 4.3	14.0 - 7.6
21	8°05.3	8°06.6	7°43.1	2.1 - 1.1	8.1 - 4.4	14.1 - 7.6
22	8°05.5	8°06.8	7°43.4	2.2 - 1.2	8.2 - 4.4	14.2 - 7.7
23	8°05.7	8°07.1	7°43.6	2.3 - 1.2	8.3 - 4.5	14.3 - 7.7
24	8°06.0	8°07.3	7°43.9	2.4 - 1.3	8.4 - 4.5	14.4 - 7.8
25	8°06.2	8°07.6	7°44.1	2.5 - 1.4	8.5 - 4.6	14.5 - 7.9
26	8°06.5	8°07.8	7°44.3	2.6 - 1.4	8.6 - 4.7	14.6 - 7.9
27	8°06.8	8°08.1	7°44.6	2.7 - 1.5	8.7 - 4.7	14.7 - 8.0
28	8°07.0	8°08.3	7°44.8	2.8 - 1.5	8.8 - 4.8	14.8 - 8.0
29	8°07.3	8°08.6	7°45.1	2.9 - 1.6	8.9 - 4.8	14.9 - 8.1
30	8°07.5	8°08.8	7°45.3	3.0 - 1.6	9.0 - 4.9	15.0 - 8.1
31	8°07.7	8°09.1	7°45.5	3.1 - 1.7	9.1 - 4.9	15.1 - 8.2
32	8°08.0	8°09.3	7°45.8	3.2 - 1.7	9.2 - 5.0	15.2 - 8.2
33	8°08.2	8°09.6	7°46.0	3.3 - 1.8	9.3 - 5.0	15.3 - 8.3
34	8°08.5	8°09.8	7°46.2	3.4 - 1.8	9.4 - 5.1	15.4 - 8.3
35	8°08.8	8°10.1	7°46.5	3.5 - 1.9	9.5 - 5.1	15.5 - 8.4
36	8°09.0	8°10.3	7°46.7	3.6 - 1.9	9.6 - 5.2	15.6 - 8.4
37	8°09.3	8°10.6	7°47.0	3.7 - 2.0	9.7 - 5.3	15.7 - 8.5
38	8°09.5	8°10.8	7°47.2	3.8 - 2.1	9.8 - 5.3	15.8 - 8.6
39	8°09.7	8°11.1	7°47.4	3.9 - 2.1	9.9 - 5.4	15.9 - 8.6
40	8°10.0	8°11.3	7°47.7	4.0 - 2.2	10.0 - 5.4	16.0 - 8.7
41	8°10.2	8°11.6	7°47.9	4.1 - 2.2	10.1 - 5.5	16.1 - 8.7
42	8°10.5	8°11.8	7°48.2	4.2 - 2.3	10.2 - 5.5	16.2 - 8.8
43	8°10.8	8°12.1	7°48.4	4.3 - 2.3	10.3 - 5.6	16.3 - 8.8
44	8°11.0	8°12.3	7°48.6	4.4 - 2.4	10.4 - 5.6	16.4 - 8.9
45	8°11.3	8°12.6	7°48.9	4.5 - 2.4	10.5 - 5.7	16.5 - 8.9
46	8°11.5	8°12.8	7°49.1	4.6 - 2.5	10.6 - 5.7	16.6 - 9.0
47	8°11.7	8°13.1	7°49.3	4.7 - 2.5	10.7 - 5.8	16.7 - 9.0
48	8°12.0	8°13.3	7°49.6	4.8 - 2.6	10.8 - 5.8	16.8 - 9.1
49	8°12.3	8°13.6	7°49.8	4.9 - 2.7	10.9 - 5.9	16.9 - 9.2
50	8°12.5	8°13.8	7°50.1	5.0 - 2.7	11.0 - 6.0	17.0 - 9.2
51	8°12.8	8°14.1	7°50.3	5.1 - 2.8	11.1 - 6.0	17.1 - 9.3
52	8°13.0	8°14.3	7°50.5	5.2 - 2.8	11.2 - 6.1	17.2 - 9.3
53	8°13.2	8°14.6	7°50.8	5.3 - 2.9	11.3 - 6.1	17.3 - 9.4
54	8°13.5	8°14.8	7°51.0	5.4 - 2.9	11.4 - 6.2	17.4 - 9.4
55	8°13.7	8°15.1	7°51.3	5.5 - 3.0	11.5 - 6.2	17.5 - 9.5
56	8°14.0	8°15.4	7°51.5	5.6 - 3.0	11.6 - 6.3	17.6 - 9.5
57	8°14.3	8°15.6	7°51.7	5.7 - 3.1	11.7 - 6.3	17.7 - 9.6
58	8°14.5	8°15.9	7°52.0	5.8 - 3.1	11.8 - 6.4	17.8 - 9.6
59	8°14.8	8°16.1	7°52.2	5.9 - 3.2	11.9 - 6.4	17.9 - 9.7

Increments and Corrections

m 33	Sun Plan.	Aries	Moon	v and d corr		
0	8°15.0	8°16.4	7°52.5	0.0 - 0.0	6.0 - 3.4	12.0 - 6.7
1	8°15.2	8°16.6	7°52.7	0.1 - 0.1	6.1 - 3.4	12.1 - 6.8
2	8°15.5	8°16.9	7°52.9	0.2 - 0.1	6.2 - 3.5	12.2 - 6.8
3	8°15.7	8°17.1	7°53.2	0.3 - 0.2	6.3 - 3.5	12.3 - 6.9
4	8°16.0	8°17.4	7°53.4	0.4 - 0.2	6.4 - 3.6	12.4 - 6.9
5	8°16.3	8°17.6	7°53.6	0.5 - 0.3	6.5 - 3.6	12.5 - 7.0
6	8°16.5	8°17.9	7°53.9	0.6 - 0.3	6.6 - 3.7	12.6 - 7.0
7	8°16.8	8°18.1	7°54.1	0.7 - 0.4	6.7 - 3.7	12.7 - 7.1
8	8°17.0	8°18.4	7°54.4	0.8 - 0.4	6.8 - 3.8	12.8 - 7.1
9	8°17.2	8°18.6	7°54.6	0.9 - 0.5	6.9 - 3.9	12.9 - 7.2
10	8°17.5	8°18.9	7°54.8	1.0 - 0.6	7.0 - 3.9	13.0 - 7.3
11	8°17.7	8°19.1	7°55.1	1.1 - 0.6	7.1 - 4.0	13.1 - 7.3
12	8°18.0	8°19.4	7°55.3	1.2 - 0.7	7.2 - 4.0	13.2 - 7.4
13	8°18.3	8°19.6	7°55.6	1.3 - 0.7	7.3 - 4.1	13.3 - 7.4
14	8°18.5	8°19.9	7°55.8	1.4 - 0.8	7.4 - 4.1	13.4 - 7.5
15	8°18.8	8°20.1	7°56.0	1.5 - 0.8	7.5 - 4.2	13.5 - 7.5
16	8°19.0	8°20.4	7°56.3	1.6 - 0.9	7.6 - 4.2	13.6 - 7.6
17	8°19.2	8°20.6	7°56.5	1.7 - 0.9	7.7 - 4.3	13.7 - 7.6
18	8°19.5	8°20.9	7°56.7	1.8 - 1.0	7.8 - 4.4	13.8 - 7.7
19	8°19.8	8°21.1	7°57.0	1.9 - 1.1	7.9 - 4.4	13.9 - 7.8
20	8°20.0	8°21.4	7°57.2	2.0 - 1.1	8.0 - 4.5	14.0 - 7.8
21	8°20.3	8°21.6	7°57.5	2.1 - 1.2	8.1 - 4.5	14.1 - 7.9
22	8°20.5	8°21.9	7°57.7	2.2 - 1.2	8.2 - 4.6	14.2 - 7.9
23	8°20.7	8°22.1	7°57.9	2.3 - 1.3	8.3 - 4.6	14.3 - 8.0
24	8°21.0	8°22.4	7°58.2	2.4 - 1.3	8.4 - 4.7	14.4 - 8.0
25	8°21.2	8°22.6	7°58.4	2.5 - 1.4	8.5 - 4.7	14.5 - 8.1
26	8°21.5	8°22.9	7°58.7	2.6 - 1.5	8.6 - 4.8	14.6 - 8.2
27	8°21.8	8°23.1	7°58.9	2.7 - 1.5	8.7 - 4.9	14.7 - 8.2
28	8°22.0	8°23.4	7°59.1	2.8 - 1.6	8.8 - 4.9	14.8 - 8.3
29	8°22.3	8°23.6	7°59.4	2.9 - 1.6	8.9 - 5.0	14.9 - 8.3
30	8°22.5	8°23.9	7°59.6	3.0 - 1.7	9.0 - 5.0	15.0 - 8.4
31	8°22.7	8°24.1	7°59.8	3.1 - 1.7	9.1 - 5.1	15.1 - 8.4
32	8°23.0	8°24.4	8°00.1	3.2 - 1.8	9.2 - 5.1	15.2 - 8.5
33	8°23.2	8°24.6	8°00.3	3.3 - 1.8	9.3 - 5.2	15.3 - 8.5
34	8°23.5	8°24.9	8°00.6	3.4 - 1.9	9.4 - 5.2	15.4 - 8.6
35	8°23.8	8°25.1	8°00.8	3.5 - 2.0	9.5 - 5.3	15.5 - 8.7
36	8°24.0	8°25.4	8°01.0	3.6 - 2.0	9.6 - 5.4	15.6 - 8.7
37	8°24.3	8°25.6	8°01.3	3.7 - 2.1	9.7 - 5.4	15.7 - 8.8
38	8°24.5	8°25.9	8°01.5	3.8 - 2.1	9.8 - 5.5	15.8 - 8.8
39	8°24.7	8°26.1	8°01.8	3.9 - 2.2	9.9 - 5.5	15.9 - 8.9
40	8°25.0	8°26.4	8°02.0	4.0 - 2.2	10.0 - 5.6	16.0 - 8.9
41	8°25.2	8°26.6	8°02.2	4.1 - 2.3	10.1 - 5.6	16.1 - 9.0
42	8°25.5	8°26.9	8°02.5	4.2 - 2.3	10.2 - 5.7	16.2 - 9.0
43	8°25.8	8°27.1	8°02.7	4.3 - 2.4	10.3 - 5.8	16.3 - 9.1
44	8°26.0	8°27.4	8°02.9	4.4 - 2.5	10.4 - 5.8	16.4 - 9.2
45	8°26.3	8°27.6	8°03.2	4.5 - 2.5	10.5 - 5.9	16.5 - 9.2
46	8°26.5	8°27.9	8°03.4	4.6 - 2.6	10.6 - 5.9	16.6 - 9.3
47	8°26.7	8°28.1	8°03.7	4.7 - 2.6	10.7 - 6.0	16.7 - 9.3
48	8°27.0	8°28.4	8°03.9	4.8 - 2.7	10.8 - 6.0	16.8 - 9.4
49	8°27.3	8°28.6	8°04.1	4.9 - 2.7	10.9 - 6.1	16.9 - 9.4
50	8°27.5	8°28.9	8°04.4	5.0 - 2.8	11.0 - 6.1	17.0 - 9.5
51	8°27.8	8°29.1	8°04.6	5.1 - 2.8	11.1 - 6.2	17.1 - 9.5
52	8°28.0	8°29.4	8°04.9	5.2 - 2.9	11.2 - 6.3	17.2 - 9.6
53	8°28.2	8°29.6	8°05.1	5.3 - 3.0	11.3 - 6.3	17.3 - 9.7
54	8°28.5	8°29.9	8°05.3	5.4 - 3.0	11.4 - 6.4	17.4 - 9.7
55	8°28.7	8°30.1	8°05.6	5.5 - 3.1	11.5 - 6.4	17.5 - 9.8
56	8°29.0	8°30.4	8°05.8	5.6 - 3.1	11.6 - 6.5	17.6 - 9.8
57	8°29.3	8°30.6	8°06.1	5.7 - 3.2	11.7 - 6.5	17.7 - 9.9
58	8°29.5	8°30.9	8°06.3	5.8 - 3.2	11.8 - 6.6	17.8 - 9.9
59	8°29.8	8°31.1	8°06.5	5.9 - 3.3	11.9 - 6.6	17.9 - 10.0

m 34	Sun Plan.	Aries	Moon	v and d corr		
0	8°30.0	8°31.4	8°06.8	0.0 - 0.0	6.0 - 3.4	12.0 - 6.9
1	8°30.2	8°31.6	8°07.0	0.1 - 0.1	6.1 - 3.5	12.1 - 7.0
2	8°30.5	8°31.9	8°07.2	0.2 - 0.1	6.2 - 3.6	12.2 - 7.0
3	8°30.7	8°32.1	8°07.5	0.3 - 0.2	6.3 - 3.6	12.3 - 7.1
4	8°31.0	8°32.4	8°07.7	0.4 - 0.2	6.4 - 3.7	12.4 - 7.1
5	8°31.3	8°32.6	8°08.0	0.5 - 0.3	6.5 - 3.7	12.5 - 7.2
6	8°31.5	8°32.9	8°08.2	0.6 - 0.3	6.6 - 3.8	12.6 - 7.2
7	8°31.8	8°33.1	8°08.4	0.7 - 0.4	6.7 - 3.9	12.7 - 7.3
8	8°32.0	8°33.4	8°08.7	0.8 - 0.5	6.8 - 3.9	12.8 - 7.4
9	8°32.2	8°33.7	8°08.9	0.9 - 0.5	6.9 - 4.0	12.9 - 7.4
10	8°32.5	8°33.9	8°09.2	1.0 - 0.6	7.0 - 4.0	13.0 - 7.5
11	8°32.7	8°34.2	8°09.4	1.1 - 0.6	7.1 - 4.1	13.1 - 7.5
12	8°33.0	8°34.4	8°09.6	1.2 - 0.7	7.2 - 4.1	13.2 - 7.6
13	8°33.3	8°34.7	8°09.9	1.3 - 0.7	7.3 - 4.2	13.3 - 7.6
14	8°33.5	8°34.9	8°10.1	1.4 - 0.8	7.4 - 4.3	13.4 - 7.7
15	8°33.8	8°35.2	8°10.3	1.5 - 0.9	7.5 - 4.3	13.5 - 7.8
16	8°34.0	8°35.4	8°10.6	1.6 - 0.9	7.6 - 4.4	13.6 - 7.8
17	8°34.2	8°35.7	8°10.8	1.7 - 1.0	7.7 - 4.4	13.7 - 7.9
18	8°34.5	8°35.9	8°11.1	1.8 - 1.0	7.8 - 4.5	13.8 - 7.9
19	8°34.8	8°36.2	8°11.3	1.9 - 1.1	7.9 - 4.5	13.9 - 8.0
20	8°35.0	8°36.4	8°11.5	2.0 - 1.1	8.0 - 4.6	14.0 - 8.0
21	8°35.3	8°36.7	8°11.8	2.1 - 1.2	8.1 - 4.7	14.1 - 8.1
22	8°35.5	8°36.9	8°12.0	2.2 - 1.3	8.2 - 4.7	14.2 - 8.2
23	8°35.7	8°37.2	8°12.3	2.3 - 1.3	8.3 - 4.8	14.3 - 8.2
24	8°36.0	8°37.4	8°12.5	2.4 - 1.4	8.4 - 4.8	14.4 - 8.3
25	8°36.2	8°37.7	8°12.7	2.5 - 1.4	8.5 - 4.9	14.5 - 8.3
26	8°36.5	8°37.9	8°13.0	2.6 - 1.5	8.6 - 4.9	14.6 - 8.4
27	8°36.8	8°38.2	8°13.2	2.7 - 1.6	8.7 - 5.0	14.7 - 8.5
28	8°37.0	8°38.4	8°13.4	2.8 - 1.6	8.8 - 5.1	14.8 - 8.5
29	8°37.3	8°38.7	8°13.7	2.9 - 1.7	8.9 - 5.1	14.9 - 8.6
30	8°37.5	8°38.9	8°13.9	3.0 - 1.7	9.0 - 5.2	15.0 - 8.6
31	8°37.7	8°39.2	8°14.2	3.1 - 1.8	9.1 - 5.2	15.1 - 8.7
32	8°38.0	8°39.4	8°14.4	3.2 - 1.8	9.2 - 5.3	15.2 - 8.7
33	8°38.2	8°39.7	8°14.6	3.3 - 1.9	9.3 - 5.3	15.3 - 8.8
34	8°38.5	8°39.9	8°14.9	3.4 - 2.0	9.4 - 5.4	15.4 - 8.9
35	8°38.8	8°40.2	8°15.1	3.5 - 2.0	9.5 - 5.5	15.5 - 8.9
36	8°39.0	8°40.4	8°15.4	3.6 - 2.1	9.6 - 5.5	15.6 - 9.0
37	8°39.3	8°40.7	8°15.6	3.7 - 2.1	9.7 - 5.6	15.7 - 9.0
38	8°39.5	8°40.9	8°15.8	3.8 - 2.2	9.8 - 5.6	15.8 - 9.1
39	8°39.7	8°41.2	8°16.1	3.9 - 2.2	9.9 - 5.7	15.9 - 9.1
40	8°40.0	8°41.4	8°16.3	4.0 - 2.3	10.0 - 5.8	16.0 - 9.2
41	8°40.2	8°41.7	8°16.5	4.1 - 2.4	10.1 - 5.8	16.1 - 9.3
42	8°40.5	8°41.9	8°16.8	4.2 - 2.4	10.2 - 5.9	16.2 - 9.3
43	8°40.8	8°42.2	8°17.0	4.3 - 2.5	10.3 - 5.9	16.3 - 9.4
44	8°41.0	8°42.4	8°17.3	4.4 - 2.5	10.4 - 6.0	16.4 - 9.4
45	8°41.3	8°42.7	8°17.5	4.5 - 2.6	10.5 - 6.0	16.5 - 9.5
46	8°41.5	8°42.9	8°17.7	4.6 - 2.6	10.6 - 6.1	16.6 - 9.5
47	8°41.7	8°43.2	8°18.0	4.7 - 2.7	10.7 - 6.2	16.7 - 9.6
48	8°42.0	8°43.4	8°18.2	4.8 - 2.8	10.8 - 6.2	16.8 - 9.7
49	8°42.3	8°43.7	8°18.5	4.9 - 2.8	10.9 - 6.3	16.9 - 9.7
50	8°42.5	8°43.9	8°18.7	5.0 - 2.9	11.0 - 6.3	17.0 - 9.8
51	8°42.8	8°44.2	8°18.9	5.1 - 2.9	11.1 - 6.4	17.1 - 9.8
52	8°43.0	8°44.4	8°19.2	5.2 - 3.0	11.2 - 6.4	17.2 - 9.9
53	8°43.2	8°44.7	8°19.4	5.3 - 3.0	11.3 - 6.5	17.3 - 9.9
54	8°43.5	8°44.9	8°19.7	5.4 - 3.1	11.4 - 6.6	17.4 - 10.0
55	8°43.7	8°45.2	8°19.9	5.5 - 3.2	11.5 - 6.6	17.5 - 10.1
56	8°44.0	8°45.4	8°20.1	5.6 - 3.2	11.6 - 6.7	17.6 - 10.1
57	8°44.3	8°45.7	8°20.4	5.7 - 3.3	11.7 - 6.7	17.7 - 10.2
58	8°44.5	8°45.9	8°20.6	5.8 - 3.3	11.8 - 6.8	17.8 - 10.2
59	8°44.8	8°46.2	8°20.8	5.9 - 3.4	11.9 - 6.8	17.9 - 10.3

m 35	Sun Plan.	Aries	Moon	v and d corr		
0	8°45.0	8°46.4	8°21.1	0.0 - 0.0	6.0 - 3.5	12.0 - 7.1
1	8°45.2	8°46.7	8°21.3	0.1 - 0.1	6.1 - 3.6	12.1 - 7.2
2	8°45.5	8°46.9	8°21.6	0.2 - 0.1	6.2 - 3.7	12.2 - 7.2
3	8°45.7	8°47.2	8°21.8	0.3 - 0.2	6.3 - 3.7	12.3 - 7.3
4	8°46.0	8°47.4	8°22.0	0.4 - 0.2	6.4 - 3.8	12.4 - 7.3
5	8°46.3	8°47.7	8°22.3	0.5 - 0.3	6.5 - 3.8	12.5 - 7.4
6	8°46.5	8°47.9	8°22.5	0.6 - 0.4	6.6 - 3.9	12.6 - 7.5
7	8°46.8	8°48.2	8°22.8	0.7 - 0.4	6.7 - 4.0	12.7 - 7.5
8	8°47.0	8°48.4	8°23.0	0.8 - 0.5	6.8 - 4.0	12.8 - 7.6
9	8°47.2	8°48.7	8°23.2	0.9 - 0.5	6.9 - 4.1	12.9 - 7.6
10	8°47.5	8°48.9	8°23.5	1.0 - 0.6	7.0 - 4.1	13.0 - 7.7
11	8°47.7	8°49.2	8°23.7	1.1 - 0.7	7.1 - 4.2	13.1 - 7.8
12	8°48.0	8°49.4	8°23.9	1.2 - 0.7	7.2 - 4.3	13.2 - 7.8
13	8°48.3	8°49.7	8°24.2	1.3 - 0.8	7.3 - 4.3	13.3 - 7.9
14	8°48.5	8°49.9	8°24.4	1.4 - 0.8	7.4 - 4.4	13.4 - 7.9
15	8°48.8	8°50.2	8°24.7	1.5 - 0.9	7.5 - 4.4	13.5 - 8.0
16	8°49.0	8°50.4	8°24.9	1.6 - 0.9	7.6 - 4.5	13.6 - 8.0
17	8°49.2	8°50.7	8°25.1	1.7 - 1.0	7.7 - 4.6	13.7 - 8.1
18	8°49.5	8°50.9	8°25.4	1.8 - 1.1	7.8 - 4.6	13.8 - 8.2
19	8°49.8	8°51.2	8°25.6	1.9 - 1.1	7.9 - 4.7	13.9 - 8.2
20	8°50.0	8°51.4	8°25.9	2.0 - 1.2	8.0 - 4.7	14.0 - 8.3
21	8°50.3	8°51.7	8°26.1	2.1 - 1.2	8.1 - 4.8	14.1 - 8.3
22	8°50.5	8°52.0	8°26.3	2.2 - 1.3	8.2 - 4.9	14.2 - 8.4
23	8°50.7	8°52.2	8°26.6	2.3 - 1.4	8.3 - 4.9	14.3 - 8.5
24	8°51.0	8°52.5	8°26.8	2.4 - 1.4	8.4 - 5.0	14.4 - 8.5
25	8°51.2	8°52.7	8°27.0	2.5 - 1.5	8.5 - 5.0	14.5 - 8.6
26	8°51.5	8°53.0	8°27.3	2.6 - 1.5	8.6 - 5.1	14.6 - 8.6
27	8°51.8	8°53.2	8°27.5	2.7 - 1.6	8.7 - 5.1	14.7 - 8.7
28	8°52.0	8°53.5	8°27.8	2.8 - 1.7	8.8 - 5.2	14.8 - 8.8
29	8°52.3	8°53.7	8°28.0	2.9 - 1.7	8.9 - 5.3	14.9 - 8.8
30	8°52.5	8°54.0	8°28.2	3.0 - 1.8	9.0 - 5.3	15.0 - 8.9
31	8°52.7	8°54.2	8°28.5	3.1 - 1.8	9.1 - 5.4	15.1 - 8.9
32	8°53.0	8°54.5	8°28.7	3.2 - 1.9	9.2 - 5.4	15.2 - 9.0
33	8°53.2	8°54.7	8°29.0	3.3 - 2.0	9.3 - 5.5	15.3 - 9.1
34	8°53.5	8°55.0	8°29.2	3.4 - 2.0	9.4 - 5.6	15.4 - 9.1
35	8°53.8	8°55.2	8°29.4	3.5 - 2.1	9.5 - 5.6	15.5 - 9.2
36	8°54.0	8°55.5	8°29.7	3.6 - 2.1	9.6 - 5.7	15.6 - 9.2
37	8°54.3	8°55.7	8°29.9	3.7 - 2.2	9.7 - 5.7	15.7 - 9.3
38	8°54.5	8°56.0	8°30.2	3.8 - 2.2	9.8 - 5.8	15.8 - 9.3
39	8°54.7	8°56.2	8°30.4	3.9 - 2.3	9.9 - 5.9	15.9 - 9.4
40	8°55.0	8°56.5	8°30.6	4.0 - 2.4	10.0 - 5.9	16.0 - 9.5
41	8°55.2	8°56.7	8°30.9	4.1 - 2.4	10.1 - 6.0	16.1 - 9.5
42	8°55.5	8°57.0	8°31.1	4.2 - 2.5	10.2 - 6.0	16.2 - 9.6
43	8°55.8	8°57.2	8°31.3	4.3 - 2.5	10.3 - 6.1	16.3 - 9.6
44	8°56.0	8°57.5	8°31.6	4.4 - 2.6	10.4 - 6.2	16.4 - 9.7
45	8°56.3	8°57.7	8°31.8	4.5 - 2.7	10.5 - 6.2	16.5 - 9.8
46	8°56.5	8°58.0	8°32.1	4.6 - 2.7	10.6 - 6.3	16.6 - 9.8
47	8°56.7	8°58.2	8°32.3	4.7 - 2.8	10.7 - 6.3	16.7 - 9.9
48	8°57.0	8°58.5	8°32.5	4.8 - 2.8	10.8 - 6.4	16.8 - 9.9
49	8°57.3	8°58.7	8°32.8	4.9 - 2.9	10.9 - 6.4	16.9 - 10.0
50	8°57.5	8°59.0	8°33.0	5.0 - 3.0	11.0 - 6.5	17.0 - 10.1
51	8°57.8	8°59.2	8°33.3	5.1 - 3.0	11.1 - 6.6	17.1 - 10.1
52	8°58.0	8°59.5	8°33.5	5.2 - 3.1	11.2 - 6.6	17.2 - 10.2
53	8°58.2	8°59.7	8°33.7	5.3 - 3.1	11.3 - 6.7	17.3 - 10.2
54	8°58.5	9°00.0	8°34.0	5.4 - 3.2	11.4 - 6.7	17.4 - 10.3
55	8°58.7	9°00.2	8°34.2	5.5 - 3.3	11.5 - 6.8	17.5 - 10.4
56	8°59.0	9°00.5	8°34.4	5.6 - 3.3	11.6 - 6.9	17.6 - 10.4
57	8°59.3	9°00.7	8°34.7	5.7 - 3.4	11.7 - 6.9	17.7 - 10.5
58	8°59.5	9°01.0	8°34.9	5.8 - 3.4	11.8 - 7.0	17.8 - 10.5
59	8°59.8	9°01.2	8°35.2	5.9 - 3.5	11.9 - 7.0	17.9 - 10.6

Increments and Corrections

m 36	Sun Plan.	Aries	Moon	v and d corr		
0	9°00.0	9°01.5	8°35.4	0.0 - 0.0	6.0 - 3.6	12.0 - 7.3
1	9°00.2	9°01.7	8°35.6	0.1 - 0.1	6.1 - 3.7	12.1 - 7.4
2	9°00.5	9°02.0	8°35.9	0.2 - 0.1	6.2 - 3.8	12.2 - 7.4
3	9°00.7	9°02.2	8°36.1	0.3 - 0.2	6.3 - 3.8	12.3 - 7.5
4	9°01.0	9°02.5	8°36.4	0.4 - 0.2	6.4 - 3.9	12.4 - 7.5
5	9°01.3	9°02.7	8°36.6	0.5 - 0.3	6.5 - 4.0	12.5 - 7.6
6	9°01.5	9°03.0	8°36.8	0.6 - 0.4	6.6 - 4.0	12.6 - 7.7
7	9°01.8	9°03.2	8°37.1	0.7 - 0.4	6.7 - 4.1	12.7 - 7.7
8	9°02.0	9°03.5	8°37.3	0.8 - 0.5	6.8 - 4.1	12.8 - 7.8
9	9°02.2	9°03.7	8°37.5	0.9 - 0.5	6.9 - 4.2	12.9 - 7.8
10	9°02.5	9°04.0	8°37.8	1.0 - 0.6	7.0 - 4.3	13.0 - 7.9
11	9°02.7	9°04.2	8°38.0	1.1 - 0.7	7.1 - 4.3	13.1 - 8.0
12	9°03.0	9°04.5	8°38.3	1.2 - 0.7	7.2 - 4.4	13.2 - 8.0
13	9°03.3	9°04.7	8°38.5	1.3 - 0.8	7.3 - 4.4	13.3 - 8.1
14	9°03.5	9°05.0	8°38.7	1.4 - 0.9	7.4 - 4.5	13.4 - 8.2
15	9°03.8	9°05.2	8°39.0	1.5 - 0.9	7.5 - 4.6	13.5 - 8.2
16	9°04.0	9°05.5	8°39.2	1.6 - 1.0	7.6 - 4.6	13.6 - 8.3
17	9°04.2	9°05.7	8°39.5	1.7 - 1.0	7.7 - 4.7	13.7 - 8.3
18	9°04.5	9°06.0	8°39.7	1.8 - 1.1	7.8 - 4.7	13.8 - 8.4
19	9°04.8	9°06.2	8°39.9	1.9 - 1.2	7.9 - 4.8	13.9 - 8.5
20	9°05.0	9°06.5	8°40.2	2.0 - 1.2	8.0 - 4.9	14.0 - 8.5
21	9°05.3	9°06.7	8°40.4	2.1 - 1.3	8.1 - 4.9	14.1 - 8.6
22	9°05.5	9°07.0	8°40.6	2.2 - 1.3	8.2 - 5.0	14.2 - 8.6
23	9°05.7	9°07.2	8°40.9	2.3 - 1.4	8.3 - 5.0	14.3 - 8.7
24	9°06.0	9°07.5	8°41.1	2.4 - 1.5	8.4 - 5.1	14.4 - 8.8
25	9°06.2	9°07.7	8°41.4	2.5 - 1.5	8.5 - 5.2	14.5 - 8.8
26	9°06.5	9°08.0	8°41.6	2.6 - 1.6	8.6 - 5.2	14.6 - 8.9
27	9°06.8	9°08.2	8°41.8	2.7 - 1.6	8.7 - 5.3	14.7 - 8.9
28	9°07.0	9°08.5	8°42.1	2.8 - 1.7	8.8 - 5.4	14.8 - 9.0
29	9°07.3	9°08.7	8°42.3	2.9 - 1.8	8.9 - 5.4	14.9 - 9.1
30	9°07.5	9°09.0	8°42.6	3.0 - 1.8	9.0 - 5.5	15.0 - 9.1
31	9°07.7	9°09.2	8°42.8	3.1 - 1.9	9.1 - 5.5	15.1 - 9.2
32	9°08.0	9°09.5	8°43.0	3.2 - 1.9	9.2 - 5.6	15.2 - 9.2
33	9°08.2	9°09.7	8°43.3	3.3 - 2.0	9.3 - 5.7	15.3 - 9.3
34	9°08.5	9°10.0	8°43.5	3.4 - 2.1	9.4 - 5.7	15.4 - 9.4
35	9°08.8	9°10.2	8°43.8	3.5 - 2.1	9.5 - 5.8	15.5 - 9.4
36	9°09.0	9°10.5	8°44.0	3.6 - 2.2	9.6 - 5.8	15.6 - 9.5
37	9°09.3	9°10.8	8°44.2	3.7 - 2.3	9.7 - 5.9	15.7 - 9.6
38	9°09.5	9°11.0	8°44.5	3.8 - 2.3	9.8 - 6.0	15.8 - 9.6
39	9°09.7	9°11.3	8°44.7	3.9 - 2.4	9.9 - 6.0	15.9 - 9.7
40	9°10.0	9°11.5	8°44.9	4.0 - 2.4	10.0 - 6.1	16.0 - 9.7
41	9°10.2	9°11.8	8°45.2	4.1 - 2.5	10.1 - 6.1	16.1 - 9.8
42	9°10.5	9°12.0	8°45.4	4.2 - 2.6	10.2 - 6.2	16.2 - 9.9
43	9°10.8	9°12.3	8°45.7	4.3 - 2.6	10.3 - 6.3	16.3 - 9.9
44	9°11.0	9°12.5	8°45.9	4.4 - 2.7	10.4 - 6.3	16.4 - 10.0
45	9°11.3	9°12.8	8°46.1	4.5 - 2.7	10.5 - 6.4	16.5 - 10.0
46	9°11.5	9°13.0	8°46.4	4.6 - 2.8	10.6 - 6.4	16.6 - 10.1
47	9°11.7	9°13.3	8°46.6	4.7 - 2.9	10.7 - 6.5	16.7 - 10.2
48	9°12.0	9°13.5	8°46.9	4.8 - 2.9	10.8 - 6.6	16.8 - 10.2
49	9°12.3	9°13.8	8°47.1	4.9 - 3.0	10.9 - 6.6	16.9 - 10.3
50	9°12.5	9°14.0	8°47.3	5.0 - 3.0	11.0 - 6.7	17.0 - 10.3
51	9°12.8	9°14.3	8°47.6	5.1 - 3.1	11.1 - 6.8	17.1 - 10.4
52	9°13.0	9°14.5	8°47.8	5.2 - 3.2	11.2 - 6.8	17.2 - 10.5
53	9°13.2	9°14.8	8°48.0	5.3 - 3.2	11.3 - 6.9	17.3 - 10.5
54	9°13.5	9°15.0	8°48.3	5.4 - 3.3	11.4 - 6.9	17.4 - 10.6
55	9°13.7	9°15.3	8°48.5	5.5 - 3.3	11.5 - 7.0	17.5 - 10.6
56	9°14.0	9°15.5	8°48.8	5.6 - 3.4	11.6 - 7.1	17.6 - 10.7
57	9°14.3	9°15.8	8°49.0	5.7 - 3.5	11.7 - 7.1	17.7 - 10.8
58	9°14.5	9°16.0	8°49.2	5.8 - 3.5	11.8 - 7.2	17.8 - 10.8
59	9°14.8	9°16.3	8°49.5	5.9 - 3.6	11.9 - 7.2	17.9 - 10.9

m 37	Sun Plan.	Aries	Moon	v and d corr		
0	9°15.0	9°16.5	8°49.7	0.0 - 0.0	6.0 - 3.8	12.0 - 7.5
1	9°15.2	9°16.8	8°50.0	0.1 - 0.1	6.1 - 3.8	12.1 - 7.6
2	9°15.5	9°17.0	8°50.2	0.2 - 0.1	6.2 - 3.9	12.2 - 7.6
3	9°15.7	9°17.3	8°50.4	0.3 - 0.2	6.3 - 3.9	12.3 - 7.7
4	9°16.0	9°17.5	8°50.7	0.4 - 0.3	6.4 - 4.0	12.4 - 7.8
5	9°16.3	9°17.8	8°50.9	0.5 - 0.3	6.5 - 4.1	12.5 - 7.8
6	9°16.5	9°18.0	8°51.1	0.6 - 0.4	6.6 - 4.1	12.6 - 7.9
7	9°16.8	9°18.3	8°51.4	0.7 - 0.4	6.7 - 4.2	12.7 - 7.9
8	9°17.0	9°18.5	8°51.6	0.8 - 0.5	6.8 - 4.3	12.8 - 8.0
9	9°17.2	9°18.8	8°51.9	0.9 - 0.6	6.9 - 4.3	12.9 - 8.1
10	9°17.5	9°19.0	8°52.1	1.0 - 0.6	7.0 - 4.4	13.0 - 8.1
11	9°17.7	9°19.3	8°52.3	1.1 - 0.7	7.1 - 4.4	13.1 - 8.2
12	9°18.0	9°19.5	8°52.6	1.2 - 0.8	7.2 - 4.5	13.2 - 8.3
13	9°18.3	9°19.8	8°52.8	1.3 - 0.8	7.3 - 4.6	13.3 - 8.3
14	9°18.5	9°20.0	8°53.1	1.4 - 0.9	7.4 - 4.6	13.4 - 8.4
15	9°18.8	9°20.3	8°53.3	1.5 - 0.9	7.5 - 4.7	13.5 - 8.4
16	9°19.0	9°20.5	8°53.5	1.6 - 1.0	7.6 - 4.8	13.6 - 8.5
17	9°19.2	9°20.8	8°53.8	1.7 - 1.1	7.7 - 4.8	13.7 - 8.6
18	9°19.5	9°21.0	8°54.0	1.8 - 1.1	7.8 - 4.9	13.8 - 8.6
19	9°19.8	9°21.3	8°54.3	1.9 - 1.2	7.9 - 4.9	13.9 - 8.7
20	9°20.0	9°21.5	8°54.5	2.0 - 1.3	8.0 - 5.0	14.0 - 8.8
21	9°20.3	9°21.8	8°54.7	2.1 - 1.3	8.1 - 5.1	14.1 - 8.8
22	9°20.5	9°22.0	8°55.0	2.2 - 1.4	8.2 - 5.1	14.2 - 8.9
23	9°20.7	9°22.3	8°55.2	2.3 - 1.4	8.3 - 5.2	14.3 - 8.9
24	9°21.0	9°22.5	8°55.4	2.4 - 1.5	8.4 - 5.3	14.4 - 9.0
25	9°21.2	9°22.8	8°55.7	2.5 - 1.6	8.5 - 5.3	14.5 - 9.1
26	9°21.5	9°23.0	8°55.9	2.6 - 1.6	8.6 - 5.4	14.6 - 9.1
27	9°21.8	9°23.3	8°56.2	2.7 - 1.7	8.7 - 5.4	14.7 - 9.2
28	9°22.0	9°23.5	8°56.4	2.8 - 1.8	8.8 - 5.5	14.8 - 9.3
29	9°22.3	9°23.8	8°56.6	2.9 - 1.8	8.9 - 5.6	14.9 - 9.3
30	9°22.5	9°24.0	8°56.9	3.0 - 1.9	9.0 - 5.6	15.0 - 9.4
31	9°22.7	9°24.3	8°57.1	3.1 - 1.9	9.1 - 5.7	15.1 - 9.4
32	9°23.0	9°24.5	8°57.4	3.2 - 2.0	9.2 - 5.8	15.2 - 9.5
33	9°23.2	9°24.8	8°57.6	3.3 - 2.1	9.3 - 5.8	15.3 - 9.6
34	9°23.5	9°25.0	8°57.8	3.4 - 2.1	9.4 - 5.9	15.4 - 9.6
35	9°23.8	9°25.3	8°58.1	3.5 - 2.2	9.5 - 5.9	15.5 - 9.7
36	9°24.0	9°25.5	8°58.3	3.6 - 2.3	9.6 - 6.0	15.6 - 9.8
37	9°24.3	9°25.8	8°58.5	3.7 - 2.3	9.7 - 6.1	15.7 - 9.8
38	9°24.5	9°26.0	8°58.8	3.8 - 2.4	9.8 - 6.1	15.8 - 9.9
39	9°24.7	9°26.3	8°59.0	3.9 - 2.4	9.9 - 6.2	15.9 - 9.9
40	9°25.0	9°26.5	8°59.3	4.0 - 2.5	10.0 - 6.3	16.0 - 10.0
41	9°25.2	9°26.8	8°59.5	4.1 - 2.6	10.1 - 6.3	16.1 - 10.1
42	9°25.5	9°27.0	8°59.7	4.2 - 2.6	10.2 - 6.4	16.2 - 10.1
43	9°25.8	9°27.3	9°00.0	4.3 - 2.7	10.3 - 6.4	16.3 - 10.2
44	9°26.0	9°27.5	9°00.2	4.4 - 2.8	10.4 - 6.5	16.4 - 10.3
45	9°26.3	9°27.8	9°00.5	4.5 - 2.8	10.5 - 6.6	16.5 - 10.3
46	9°26.5	9°28.0	9°00.7	4.6 - 2.9	10.6 - 6.6	16.6 - 10.4
47	9°26.7	9°28.3	9°00.9	4.7 - 2.9	10.7 - 6.7	16.7 - 10.4
48	9°27.0	9°28.5	9°01.2	4.8 - 3.0	10.8 - 6.8	16.8 - 10.5
49	9°27.3	9°28.8	9°01.4	4.9 - 3.1	10.9 - 6.8	16.9 - 10.6
50	9°27.5	9°29.1	9°01.6	5.0 - 3.1	11.0 - 6.9	17.0 - 10.6
51	9°27.8	9°29.3	9°01.9	5.1 - 3.2	11.1 - 6.9	17.1 - 10.7
52	9°28.0	9°29.6	9°02.1	5.2 - 3.3	11.2 - 7.0	17.2 - 10.8
53	9°28.2	9°29.8	9°02.4	5.3 - 3.3	11.3 - 7.1	17.3 - 10.8
54	9°28.5	9°30.1	9°02.6	5.4 - 3.4	11.4 - 7.1	17.4 - 10.9
55	9°28.7	9°30.3	9°02.8	5.5 - 3.4	11.5 - 7.2	17.5 - 10.9
56	9°29.0	9°30.6	9°03.1	5.6 - 3.5	11.6 - 7.3	17.6 - 11.0
57	9°29.3	9°30.8	9°03.3	5.7 - 3.6	11.7 - 7.3	17.7 - 11.1
58	9°29.5	9°31.1	9°03.6	5.8 - 3.6	11.8 - 7.4	17.8 - 11.1
59	9°29.8	9°31.3	9°03.8	5.9 - 3.7	11.9 - 7.4	17.9 - 11.2

m 38	Sun Plan.	Aries	Moon	v and d corr		
0	9°30.0	9°31.6	9°04.0	0.0 - 0.0	6.0 - 3.9	12.0 - 7.7
1	9°30.2	9°31.8	9°04.3	0.1 - 0.1	6.1 - 3.9	12.1 - 7.8
2	9°30.5	9°32.1	9°04.5	0.2 - 0.1	6.2 - 4.0	12.2 - 7.8
3	9°30.7	9°32.3	9°04.7	0.3 - 0.2	6.3 - 4.0	12.3 - 7.9
4	9°31.0	9°32.6	9°05.0	0.4 - 0.3	6.4 - 4.1	12.4 - 8.0
5	9°31.3	9°32.8	9°05.2	0.5 - 0.3	6.5 - 4.2	12.5 - 8.0
6	9°31.5	9°33.1	9°05.5	0.6 - 0.4	6.6 - 4.2	12.6 - 8.1
7	9°31.8	9°33.3	9°05.7	0.7 - 0.4	6.7 - 4.3	12.7 - 8.1
8	9°32.0	9°33.6	9°05.9	0.8 - 0.5	6.8 - 4.4	12.8 - 8.2
9	9°32.2	9°33.8	9°06.2	0.9 - 0.6	6.9 - 4.4	12.9 - 8.3
10	9°32.5	9°34.1	9°06.4	1.0 - 0.6	7.0 - 4.5	13.0 - 8.3
11	9°32.7	9°34.3	9°06.7	1.1 - 0.7	7.1 - 4.6	13.1 - 8.4
12	9°33.0	9°34.6	9°06.9	1.2 - 0.8	7.2 - 4.6	13.2 - 8.5
13	9°33.3	9°34.8	9°07.1	1.3 - 0.8	7.3 - 4.7	13.3 - 8.5
14	9°33.5	9°35.1	9°07.4	1.4 - 0.9	7.4 - 4.7	13.4 - 8.6
15	9°33.8	9°35.3	9°07.6	1.5 - 1.0	7.5 - 4.8	13.5 - 8.7
16	9°34.0	9°35.6	9°07.9	1.6 - 1.0	7.6 - 4.9	13.6 - 8.7
17	9°34.2	9°35.8	9°08.1	1.7 - 1.1	7.7 - 4.9	13.7 - 8.8
18	9°34.5	9°36.1	9°08.3	1.8 - 1.2	7.8 - 5.0	13.8 - 8.9
19	9°34.8	9°36.3	9°08.6	1.9 - 1.2	7.9 - 5.1	13.9 - 8.9
20	9°35.0	9°36.6	9°08.8	2.0 - 1.3	8.0 - 5.1	14.0 - 9.0
21	9°35.3	9°36.8	9°09.0	2.1 - 1.3	8.1 - 5.2	14.1 - 9.0
22	9°35.5	9°37.1	9°09.3	2.2 - 1.4	8.2 - 5.3	14.2 - 9.1
23	9°35.7	9°37.3	9°09.5	2.3 - 1.5	8.3 - 5.3	14.3 - 9.2
24	9°36.0	9°37.6	9°09.8	2.4 - 1.5	8.4 - 5.4	14.4 - 9.2
25	9°36.2	9°37.8	9°10.0	2.5 - 1.6	8.5 - 5.5	14.5 - 9.3
26	9°36.5	9°38.1	9°10.2	2.6 - 1.7	8.6 - 5.5	14.6 - 9.4
27	9°36.8	9°38.3	9°10.5	2.7 - 1.7	8.7 - 5.6	14.7 - 9.4
28	9°37.0	9°38.6	9°10.7	2.8 - 1.8	8.8 - 5.6	14.8 - 9.5
29	9°37.3	9°38.8	9°11.0	2.9 - 1.9	8.9 - 5.7	14.9 - 9.6
30	9°37.5	9°39.1	9°11.2	3.0 - 1.9	9.0 - 5.8	15.0 - 9.6
31	9°37.7	9°39.3	9°11.4	3.1 - 2.0	9.1 - 5.8	15.1 - 9.7
32	9°38.0	9°39.6	9°11.7	3.2 - 2.1	9.2 - 5.9	15.2 - 9.8
33	9°38.2	9°39.8	9°11.9	3.3 - 2.1	9.3 - 6.0	15.3 - 9.8
34	9°38.5	9°40.1	9°12.1	3.4 - 2.2	9.4 - 6.0	15.4 - 9.9
35	9°38.8	9°40.3	9°12.4	3.5 - 2.2	9.5 - 6.1	15.5 - 9.9
36	9°39.0	9°40.6	9°12.6	3.6 - 2.3	9.6 - 6.2	15.6 - 10.0
37	9°39.3	9°40.8	9°12.9	3.7 - 2.4	9.7 - 6.2	15.7 - 10.1
38	9°39.5	9°41.1	9°13.1	3.8 - 2.4	9.8 - 6.3	15.8 - 10.1
39	9°39.7	9°41.3	9°13.3	3.9 - 2.5	9.9 - 6.4	15.9 - 10.2
40	9°40.0	9°41.6	9°13.6	4.0 - 2.6	10.0 - 6.4	16.0 - 10.3
41	9°40.2	9°41.8	9°13.8	4.1 - 2.6	10.1 - 6.5	16.1 - 10.3
42	9°40.5	9°42.1	9°14.1	4.2 - 2.7	10.2 - 6.5	16.2 - 10.4
43	9°40.8	9°42.3	9°14.3	4.3 - 2.8	10.3 - 6.6	16.3 - 10.5
44	9°41.0	9°42.6	9°14.5	4.4 - 2.8	10.4 - 6.7	16.4 - 10.5
45	9°41.3	9°42.8	9°14.8	4.5 - 2.9	10.5 - 6.7	16.5 - 10.6
46	9°41.5	9°43.1	9°15.0	4.6 - 3.0	10.6 - 6.8	16.6 - 10.7
47	9°41.7	9°43.3	9°15.2	4.7 - 3.0	10.7 - 6.9	16.7 - 10.7
48	9°42.0	9°43.6	9°15.5	4.8 - 3.1	10.8 - 6.9	16.8 - 10.8
49	9°42.3	9°43.8	9°15.7	4.9 - 3.1	10.9 - 7.0	16.9 - 10.8
50	9°42.5	9°44.1	9°16.0	5.0 - 3.2	11.0 - 7.1	17.0 - 10.9
51	9°42.8	9°44.3	9°16.2	5.1 - 3.3	11.1 - 7.1	17.1 - 11.0
52	9°43.0	9°44.6	9°16.4	5.2 - 3.3	11.2 - 7.2	17.2 - 11.0
53	9°43.2	9°44.8	9°16.7	5.3 - 3.4	11.3 - 7.3	17.3 - 11.1
54	9°43.5	9°45.1	9°16.9	5.4 - 3.5	11.4 - 7.3	17.4 - 11.2
55	9°43.7	9°45.3	9°17.2	5.5 - 3.5	11.5 - 7.4	17.5 - 11.2
56	9°44.0	9°45.6	9°17.4	5.6 - 3.6	11.6 - 7.4	17.6 - 11.3
57	9°44.3	9°45.8	9°17.6	5.7 - 3.7	11.7 - 7.5	17.7 - 11.4
58	9°44.5	9°46.1	9°17.9	5.8 - 3.7	11.8 - 7.6	17.8 - 11.4
59	9°44.8	9°46.3	9°18.1	5.9 - 3.8	11.9 - 7.6	17.9 - 11.5

Increments and Corrections

m 39	Sun Plan.	Aries	Moon	v and d corr		
0	9°45.0	9°46.6	9°18.4	0.0 - 0.0	6.0 - 4.0	12.0 - 7.9
1	9°45.2	9°46.8	9°18.6	0.1 - 0.1	6.1 - 4.0	12.1 - 8.0
2	9°45.5	9°47.1	9°18.8	0.2 - 0.1	6.2 - 4.1	12.2 - 8.0
3	9°45.7	9°47.4	9°19.1	0.3 - 0.2	6.3 - 4.1	12.3 - 8.1
4	9°46.0	9°47.6	9°19.3	0.4 - 0.3	6.4 - 4.2	12.4 - 8.2
5	9°46.3	9°47.9	9°19.5	0.5 - 0.3	6.5 - 4.3	12.5 - 8.2
6	9°46.5	9°48.1	9°19.8	0.6 - 0.4	6.6 - 4.3	12.6 - 8.3
7	9°46.8	9°48.4	9°20.0	0.7 - 0.5	6.7 - 4.4	12.7 - 8.4
8	9°47.0	9°48.6	9°20.3	0.8 - 0.5	6.8 - 4.5	12.8 - 8.4
9	9°47.2	9°48.9	9°20.5	0.9 - 0.6	6.9 - 4.5	12.9 - 8.5
10	9°47.5	9°49.1	9°20.7	1.0 - 0.7	7.0 - 4.6	13.0 - 8.6
11	9°47.7	9°49.4	9°21.0	1.1 - 0.7	7.1 - 4.7	13.1 - 8.6
12	9°48.0	9°49.6	9°21.2	1.2 - 0.8	7.2 - 4.7	13.2 - 8.7
13	9°48.3	9°49.9	9°21.5	1.3 - 0.9	7.3 - 4.8	13.3 - 8.8
14	9°48.5	9°50.1	9°21.7	1.4 - 0.9	7.4 - 4.9	13.4 - 8.8
15	9°48.8	9°50.4	9°21.9	1.5 - 1.0	7.5 - 4.9	13.5 - 8.9
16	9°49.0	9°50.6	9°22.2	1.6 - 1.1	7.6 - 5.0	13.6 - 9.0
17	9°49.2	9°50.9	9°22.4	1.7 - 1.1	7.7 - 5.1	13.7 - 9.0
18	9°49.5	9°51.1	9°22.6	1.8 - 1.2	7.8 - 5.1	13.8 - 9.1
19	9°49.8	9°51.4	9°22.9	1.9 - 1.3	7.9 - 5.2	13.9 - 9.2
20	9°50.0	9°51.6	9°23.1	2.0 - 1.3	8.0 - 5.3	14.0 - 9.2
21	9°50.3	9°51.9	9°23.4	2.1 - 1.4	8.1 - 5.3	14.1 - 9.3
22	9°50.5	9°52.1	9°23.6	2.2 - 1.4	8.2 - 5.4	14.2 - 9.3
23	9°50.7	9°52.4	9°23.8	2.3 - 1.5	8.3 - 5.5	14.3 - 9.4
24	9°51.0	9°52.6	9°24.1	2.4 - 1.6	8.4 - 5.5	14.4 - 9.5
25	9°51.2	9°52.9	9°24.3	2.5 - 1.6	8.5 - 5.6	14.5 - 9.5
26	9°51.5	9°53.1	9°24.6	2.6 - 1.7	8.6 - 5.7	14.6 - 9.6
27	9°51.8	9°53.4	9°24.8	2.7 - 1.8	8.7 - 5.7	14.7 - 9.7
28	9°52.0	9°53.6	9°25.0	2.8 - 1.8	8.8 - 5.8	14.8 - 9.7
29	9°52.3	9°53.9	9°25.3	2.9 - 1.9	8.9 - 5.9	14.9 - 9.8
30	9°52.5	9°54.1	9°25.5	3.0 - 2.0	9.0 - 5.9	15.0 - 9.9
31	9°52.7	9°54.4	9°25.7	3.1 - 2.0	9.1 - 6.0	15.1 - 9.9
32	9°53.0	9°54.6	9°26.0	3.2 - 2.1	9.2 - 6.1	15.2 - 10.0
33	9°53.2	9°54.9	9°26.2	3.3 - 2.2	9.3 - 6.1	15.3 - 10.1
34	9°53.5	9°55.1	9°26.5	3.4 - 2.2	9.4 - 6.2	15.4 - 10.1
35	9°53.8	9°55.4	9°26.7	3.5 - 2.3	9.5 - 6.3	15.5 - 10.2
36	9°54.0	9°55.6	9°26.9	3.6 - 2.4	9.6 - 6.3	15.6 - 10.3
37	9°54.3	9°55.9	9°27.2	3.7 - 2.4	9.7 - 6.4	15.7 - 10.3
38	9°54.5	9°56.1	9°27.4	3.8 - 2.5	9.8 - 6.5	15.8 - 10.4
39	9°54.7	9°56.4	9°27.7	3.9 - 2.6	9.9 - 6.5	15.9 - 10.5
40	9°55.0	9°56.6	9°27.9	4.0 - 2.6	10.0 - 6.6	16.0 - 10.5
41	9°55.2	9°56.9	9°28.1	4.1 - 2.7	10.1 - 6.6	16.1 - 10.6
42	9°55.5	9°57.1	9°28.4	4.2 - 2.8	10.2 - 6.7	16.2 - 10.7
43	9°55.8	9°57.4	9°28.6	4.3 - 2.8	10.3 - 6.8	16.3 - 10.7
44	9°56.0	9°57.6	9°28.8	4.4 - 2.9	10.4 - 6.8	16.4 - 10.8
45	9°56.3	9°57.9	9°29.1	4.5 - 3.0	10.5 - 6.9	16.5 - 10.9
46	9°56.5	9°58.1	9°29.3	4.6 - 3.0	10.6 - 7.0	16.6 - 10.9
47	9°56.7	9°58.4	9°29.6	4.7 - 3.1	10.7 - 7.0	16.7 - 11.0
48	9°57.0	9°58.6	9°29.8	4.8 - 3.2	10.8 - 7.1	16.8 - 11.1
49	9°57.3	9°58.9	9°30.0	4.9 - 3.2	10.9 - 7.2	16.9 - 11.1
50	9°57.5	9°59.1	9°30.3	5.0 - 3.3	11.0 - 7.2	17.0 - 11.2
51	9°57.8	9°59.4	9°30.5	5.1 - 3.4	11.1 - 7.3	17.1 - 11.3
52	9°58.0	9°59.6	9°30.8	5.2 - 3.4	11.2 - 7.4	17.2 - 11.3
53	9°58.2	9°59.9	9°31.0	5.3 - 3.5	11.3 - 7.4	17.3 - 11.4
54	9°58.5	10°00.1	9°31.2	5.4 - 3.6	11.4 - 7.5	17.4 - 11.5
55	9°58.7	10°00.4	9°31.5	5.5 - 3.6	11.5 - 7.6	17.5 - 11.5
56	9°59.0	10°00.6	9°31.7	5.6 - 3.7	11.6 - 7.6	17.6 - 11.6
57	9°59.3	10°00.9	9°32.0	5.7 - 3.8	11.7 - 7.7	17.7 - 11.7
58	9°59.5	10°01.1	9°32.2	5.8 - 3.8	11.8 - 7.8	17.8 - 11.7
59	9°59.8	10°01.4	9°32.4	5.9 - 3.9	11.9 - 7.8	17.9 - 11.8

m 40	Sun Plan.	Aries	Moon	v and d corr		
0	10°00.0	10°01.6	9°32.7	0.0 - 0.0	6.0 - 4.1	12.0 - 8.1
1	10°00.2	10°01.9	9°32.9	0.1 - 0.1	6.1 - 4.1	12.1 - 8.2
2	10°00.5	10°02.1	9°33.1	0.2 - 0.1	6.2 - 4.2	12.2 - 8.2
3	10°00.7	10°02.4	9°33.4	0.3 - 0.2	6.3 - 4.3	12.3 - 8.3
4	10°01.0	10°02.6	9°33.6	0.4 - 0.3	6.4 - 4.3	12.4 - 8.4
5	10°01.3	10°02.9	9°33.9	0.5 - 0.3	6.5 - 4.4	12.5 - 8.4
6	10°01.5	10°03.1	9°34.1	0.6 - 0.4	6.6 - 4.5	12.6 - 8.5
7	10°01.8	10°03.4	9°34.3	0.7 - 0.5	6.7 - 4.5	12.7 - 8.6
8	10°02.0	10°03.6	9°34.6	0.8 - 0.5	6.8 - 4.6	12.8 - 8.6
9	10°02.2	10°03.9	9°34.8	0.9 - 0.6	6.9 - 4.7	12.9 - 8.7
10	10°02.5	10°04.1	9°35.1	1.0 - 0.7	7.0 - 4.7	13.0 - 8.8
11	10°02.7	10°04.4	9°35.3	1.1 - 0.7	7.1 - 4.8	13.1 - 8.8
12	10°03.0	10°04.6	9°35.5	1.2 - 0.8	7.2 - 4.9	13.2 - 8.9
13	10°03.3	10°04.9	9°35.8	1.3 - 0.9	7.3 - 4.9	13.3 - 9.0
14	10°03.5	10°05.1	9°36.0	1.4 - 0.9	7.4 - 5.0	13.4 - 9.0
15	10°03.8	10°05.4	9°36.2	1.5 - 1.0	7.5 - 5.1	13.5 - 9.1
16	10°04.0	10°05.7	9°36.5	1.6 - 1.1	7.6 - 5.1	13.6 - 9.2
17	10°04.2	10°05.9	9°36.7	1.7 - 1.1	7.7 - 5.2	13.7 - 9.2
18	10°04.5	10°06.2	9°37.0	1.8 - 1.2	7.8 - 5.3	13.8 - 9.3
19	10°04.8	10°06.4	9°37.2	1.9 - 1.3	7.9 - 5.3	13.9 - 9.4
20	10°05.0	10°06.7	9°37.4	2.0 - 1.4	8.0 - 5.4	14.0 - 9.5
21	10°05.3	10°06.9	9°37.7	2.1 - 1.4	8.1 - 5.5	14.1 - 9.5
22	10°05.5	10°07.2	9°37.9	2.2 - 1.5	8.2 - 5.5	14.2 - 9.6
23	10°05.7	10°07.4	9°38.2	2.3 - 1.6	8.3 - 5.6	14.3 - 9.7
24	10°06.0	10°07.7	9°38.4	2.4 - 1.6	8.4 - 5.7	14.4 - 9.7
25	10°06.2	10°07.9	9°38.6	2.5 - 1.7	8.5 - 5.7	14.5 - 9.8
26	10°06.5	10°08.2	9°38.9	2.6 - 1.8	8.6 - 5.8	14.6 - 9.9
27	10°06.8	10°08.4	9°39.1	2.7 - 1.8	8.7 - 5.9	14.7 - 9.9
28	10°07.0	10°08.7	9°39.3	2.8 - 1.9	8.8 - 5.9	14.8 - 10.0
29	10°07.3	10°08.9	9°39.6	2.9 - 2.0	8.9 - 6.0	14.9 - 10.1
30	10°07.5	10°09.2	9°39.8	3.0 - 2.0	9.0 - 6.1	15.0 - 10.1
31	10°07.7	10°09.4	9°40.1	3.1 - 2.1	9.1 - 6.1	15.1 - 10.2
32	10°08.0	10°09.7	9°40.3	3.2 - 2.2	9.2 - 6.2	15.2 - 10.3
33	10°08.2	10°09.9	9°40.5	3.3 - 2.2	9.3 - 6.3	15.3 - 10.3
34	10°08.5	10°10.2	9°40.8	3.4 - 2.3	9.4 - 6.3	15.4 - 10.4
35	10°08.8	10°10.4	9°41.0	3.5 - 2.4	9.5 - 6.4	15.5 - 10.5
36	10°09.0	10°10.7	9°41.3	3.6 - 2.4	9.6 - 6.5	15.6 - 10.5
37	10°09.3	10°10.9	9°41.5	3.7 - 2.5	9.7 - 6.5	15.7 - 10.6
38	10°09.5	10°11.2	9°41.7	3.8 - 2.6	9.8 - 6.6	15.8 - 10.7
39	10°09.7	10°11.4	9°42.0	3.9 - 2.6	9.9 - 6.7	15.9 - 10.7
40	10°10.0	10°11.7	9°42.2	4.0 - 2.7	10.0 - 6.8	16.0 - 10.8
41	10°10.2	10°11.9	9°42.4	4.1 - 2.8	10.1 - 6.8	16.1 - 10.9
42	10°10.5	10°12.2	9°42.7	4.2 - 2.8	10.2 - 6.9	16.2 - 10.9
43	10°10.8	10°12.4	9°42.9	4.3 - 2.9	10.3 - 7.0	16.3 - 11.0
44	10°11.0	10°12.7	9°43.2	4.4 - 3.0	10.4 - 7.0	16.4 - 11.1
45	10°11.3	10°12.9	9°43.4	4.5 - 3.0	10.5 - 7.1	16.5 - 11.1
46	10°11.5	10°13.2	9°43.6	4.6 - 3.1	10.6 - 7.2	16.6 - 11.2
47	10°11.7	10°13.4	9°43.9	4.7 - 3.2	10.7 - 7.2	16.7 - 11.3
48	10°12.0	10°13.7	9°44.1	4.8 - 3.2	10.8 - 7.3	16.8 - 11.3
49	10°12.3	10°13.9	9°44.4	4.9 - 3.3	10.9 - 7.4	16.9 - 11.4
50	10°12.5	10°14.2	9°44.6	5.0 - 3.4	11.0 - 7.4	17.0 - 11.5
51	10°12.8	10°14.4	9°44.8	5.1 - 3.4	11.1 - 7.5	17.1 - 11.5
52	10°13.0	10°14.7	9°45.1	5.2 - 3.5	11.2 - 7.6	17.2 - 11.6
53	10°13.2	10°14.9	9°45.3	5.3 - 3.6	11.3 - 7.6	17.3 - 11.7
54	10°13.5	10°15.2	9°45.6	5.4 - 3.6	11.4 - 7.7	17.4 - 11.7
55	10°13.7	10°15.4	9°45.8	5.5 - 3.7	11.5 - 7.8	17.5 - 11.8
56	10°14.0	10°15.7	9°46.0	5.6 - 3.8	11.6 - 7.8	17.6 - 11.9
57	10°14.3	10°15.9	9°46.3	5.7 - 3.8	11.7 - 7.9	17.7 - 11.9
58	10°14.5	10°16.2	9°46.5	5.8 - 3.9	11.8 - 8.0	17.8 - 12.0
59	10°14.8	10°16.4	9°46.7	5.9 - 4.0	11.9 - 8.0	17.9 - 12.1

m 41	Sun Plan.	Aries	Moon	v and d corr		
0	10°15.0	10°16.7	9°47.0	0.0 - 0.0	6.0 - 4.2	12.0 - 8.3
1	10°15.2	10°16.9	9°47.2	0.1 - 0.1	6.1 - 4.2	12.1 - 8.4
2	10°15.5	10°17.2	9°47.5	0.2 - 0.1	6.2 - 4.3	12.2 - 8.4
3	10°15.7	10°17.4	9°47.7	0.3 - 0.2	6.3 - 4.4	12.3 - 8.5
4	10°16.0	10°17.7	9°47.9	0.4 - 0.3	6.4 - 4.4	12.4 - 8.6
5	10°16.3	10°17.9	9°48.2	0.5 - 0.3	6.5 - 4.5	12.5 - 8.6
6	10°16.5	10°18.2	9°48.4	0.6 - 0.4	6.6 - 4.6	12.6 - 8.7
7	10°16.8	10°18.4	9°48.7	0.7 - 0.5	6.7 - 4.6	12.7 - 8.8
8	10°17.0	10°18.7	9°48.9	0.8 - 0.6	6.8 - 4.7	12.8 - 8.9
9	10°17.2	10°18.9	9°49.1	0.9 - 0.6	6.9 - 4.8	12.9 - 8.9
10	10°17.5	10°19.2	9°49.4	1.0 - 0.7	7.0 - 4.8	13.0 - 9.0
11	10°17.7	10°19.4	9°49.6	1.1 - 0.8	7.1 - 4.9	13.1 - 9.1
12	10°18.0	10°19.7	9°49.8	1.2 - 0.8	7.2 - 5.0	13.2 - 9.1
13	10°18.3	10°19.9	9°50.1	1.3 - 0.9	7.3 - 5.0	13.3 - 9.2
14	10°18.5	10°20.2	9°50.3	1.4 - 1.0	7.4 - 5.1	13.4 - 9.3
15	10°18.8	10°20.4	9°50.6	1.5 - 1.0	7.5 - 5.2	13.5 - 9.3
16	10°19.0	10°20.7	9°50.8	1.6 - 1.1	7.6 - 5.3	13.6 - 9.4
17	10°19.2	10°20.9	9°51.0	1.7 - 1.2	7.7 - 5.3	13.7 - 9.5
18	10°19.5	10°21.2	9°51.3	1.8 - 1.2	7.8 - 5.4	13.8 - 9.5
19	10°19.8	10°21.4	9°51.5	1.9 - 1.3	7.9 - 5.5	13.9 - 9.6
20	10°20.0	10°21.7	9°51.8	2.0 - 1.4	8.0 - 5.5	14.0 - 9.7
21	10°20.3	10°21.9	9°52.0	2.1 - 1.5	8.1 - 5.6	14.1 - 9.8
22	10°20.5	10°22.2	9°52.2	2.2 - 1.5	8.2 - 5.7	14.2 - 9.8
23	10°20.7	10°22.4	9°52.5	2.3 - 1.6	8.3 - 5.7	14.3 - 9.9
24	10°21.0	10°22.7	9°52.7	2.4 - 1.7	8.4 - 5.8	14.4 - 10.0
25	10°21.2	10°22.9	9°52.9	2.5 - 1.7	8.5 - 5.9	14.5 - 10.0
26	10°21.5	10°23.2	9°53.2	2.6 - 1.8	8.6 - 5.9	14.6 - 10.1
27	10°21.8	10°23.4	9°53.4	2.7 - 1.9	8.7 - 6.0	14.7 - 10.2
28	10°22.0	10°23.7	9°53.7	2.8 - 1.9	8.8 - 6.1	14.8 - 10.2
29	10°22.3	10°24.0	9°53.9	2.9 - 2.0	8.9 - 6.2	14.9 - 10.3
30	10°22.5	10°24.2	9°54.1	3.0 - 2.1	9.0 - 6.2	15.0 - 10.4
31	10°22.7	10°24.5	9°54.4	3.1 - 2.1	9.1 - 6.3	15.1 - 10.4
32	10°23.0	10°24.7	9°54.6	3.2 - 2.2	9.2 - 6.4	15.2 - 10.5
33	10°23.2	10°25.0	9°54.9	3.3 - 2.3	9.3 - 6.4	15.3 - 10.6
34	10°23.5	10°25.2	9°55.1	3.4 - 2.4	9.4 - 6.5	15.4 - 10.7
35	10°23.8	10°25.5	9°55.3	3.5 - 2.4	9.5 - 6.6	15.5 - 10.7
36	10°24.0	10°25.7	9°55.6	3.6 - 2.5	9.6 - 6.6	15.6 - 10.8
37	10°24.3	10°26.0	9°55.8	3.7 - 2.6	9.7 - 6.7	15.7 - 10.9
38	10°24.5	10°26.2	9°56.1	3.8 - 2.6	9.8 - 6.8	15.8 - 10.9
39	10°24.7	10°26.5	9°56.3	3.9 - 2.7	9.9 - 6.8	15.9 - 11.0
40	10°25.0	10°26.7	9°56.5	4.0 - 2.8	10.0 - 6.9	16.0 - 11.1
41	10°25.2	10°27.0	9°56.8	4.1 - 2.8	10.1 - 7.0	16.1 - 11.1
42	10°25.5	10°27.2	9°57.0	4.2 - 2.9	10.2 - 7.1	16.2 - 11.2
43	10°25.8	10°27.5	9°57.2	4.3 - 3.0	10.3 - 7.1	16.3 - 11.3
44	10°26.0	10°27.7	9°57.5	4.4 - 3.0	10.4 - 7.2	16.4 - 11.3
45	10°26.3	10°28.0	9°57.7	4.5 - 3.1	10.5 - 7.3	16.5 - 11.4
46	10°26.5	10°28.2	9°58.0	4.6 - 3.2	10.6 - 7.3	16.6 - 11.5
47	10°26.7	10°28.5	9°58.2	4.7 - 3.3	10.7 - 7.4	16.7 - 11.6
48	10°27.0	10°28.7	9°58.4	4.8 - 3.3	10.8 - 7.5	16.8 - 11.6
49	10°27.3	10°29.0	9°58.7	4.9 - 3.4	10.9 - 7.5	16.9 - 11.7
50	10°27.5	10°29.2	9°58.9	5.0 - 3.5	11.0 - 7.6	17.0 - 11.8
51	10°27.8	10°29.5	9°59.2	5.1 - 3.5	11.1 - 7.7	17.1 - 11.8
52	10°28.0	10°29.7	9°59.4	5.2 - 3.6	11.2 - 7.7	17.2 - 11.9
53	10°28.2	10°30.0	9°59.6	5.3 - 3.7	11.3 - 7.8	17.3 - 12.0
54	10°28.5	10°30.2	9°59.9	5.4 - 3.7	11.4 - 7.9	17.4 - 12.0
55	10°28.7	10°30.5	10°00.1	5.5 - 3.8	11.5 - 8.0	17.5 - 12.1
56	10°29.0	10°30.7	10°00.3	5.6 - 3.9	11.6 - 8.0	17.6 - 12.2
57	10°29.3	10°31.0	10°00.6	5.7 - 3.9	11.7 - 8.1	17.7 - 12.2
58	10°29.5	10°31.2	10°00.8	5.8 - 4.0	11.8 - 8.2	17.8 - 12.3
59	10°29.8	10°31.5	10°01.1	5.9 - 4.1	11.9 - 8.2	17.9 - 12.4

Increments and Corrections

m 42	Sun Plan.	Aries	Moon	v and d corr		
0	10°30.0	10°31.7	10°01.3	0.0 - 0.0	6.0 - 4.3	12.0 - 8.5
1	10°30.2	10°32.0	10°01.5	0.1 - 0.1	6.1 - 4.3	12.1 - 8.6
2	10°30.5	10°32.2	10°01.8	0.2 - 0.1	6.2 - 4.4	12.2 - 8.6
3	10°30.7	10°32.5	10°02.0	0.3 - 0.2	6.3 - 4.5	12.3 - 8.7
4	10°31.0	10°32.7	10°02.3	0.4 - 0.3	6.4 - 4.5	12.4 - 8.8
5	10°31.3	10°33.0	10°02.5	0.5 - 0.4	6.5 - 4.6	12.5 - 8.9
6	10°31.5	10°33.2	10°02.7	0.6 - 0.4	6.6 - 4.7	12.6 - 8.9
7	10°31.8	10°33.5	10°03.0	0.7 - 0.5	6.7 - 4.7	12.7 - 9.0
8	10°32.0	10°33.7	10°03.2	0.8 - 0.6	6.8 - 4.8	12.8 - 9.1
9	10°32.2	10°34.0	10°03.4	0.9 - 0.6	6.9 - 4.9	12.9 - 9.1
10	10°32.5	10°34.2	10°03.7	1.0 - 0.7	7.0 - 5.0	13.0 - 9.2
11	10°32.7	10°34.5	10°03.9	1.1 - 0.8	7.1 - 5.0	13.1 - 9.3
12	10°33.0	10°34.7	10°04.2	1.2 - 0.9	7.2 - 5.1	13.2 - 9.3
13	10°33.3	10°35.0	10°04.4	1.3 - 0.9	7.3 - 5.2	13.3 - 9.4
14	10°33.5	10°35.2	10°04.6	1.4 - 1.0	7.4 - 5.2	13.4 - 9.5
15	10°33.8	10°35.5	10°04.9	1.5 - 1.1	7.5 - 5.3	13.5 - 9.6
16	10°34.0	10°35.7	10°05.1	1.6 - 1.1	7.6 - 5.4	13.6 - 9.6
17	10°34.2	10°36.0	10°05.4	1.7 - 1.2	7.7 - 5.5	13.7 - 9.7
18	10°34.5	10°36.2	10°05.6	1.8 - 1.3	7.8 - 5.5	13.8 - 9.8
19	10°34.8	10°36.5	10°05.8	1.9 - 1.3	7.9 - 5.6	13.9 - 9.8
20	10°35.0	10°36.7	10°06.1	2.0 - 1.4	8.0 - 5.7	14.0 - 9.9
21	10°35.3	10°37.0	10°06.3	2.1 - 1.5	8.1 - 5.7	14.1 - 10.0
22	10°35.5	10°37.2	10°06.5	2.2 - 1.6	8.2 - 5.8	14.2 - 10.1
23	10°35.7	10°37.5	10°06.8	2.3 - 1.6	8.3 - 5.9	14.3 - 10.1
24	10°36.0	10°37.7	10°07.0	2.4 - 1.7	8.4 - 6.0	14.4 - 10.2
25	10°36.2	10°38.0	10°07.3	2.5 - 1.8	8.5 - 6.0	14.5 - 10.3
26	10°36.5	10°38.2	10°07.5	2.6 - 1.8	8.6 - 6.1	14.6 - 10.3
27	10°36.8	10°38.5	10°07.7	2.7 - 1.9	8.7 - 6.2	14.7 - 10.4
28	10°37.0	10°38.7	10°08.0	2.8 - 2.0	8.8 - 6.2	14.8 - 10.5
29	10°37.3	10°39.0	10°08.2	2.9 - 2.1	8.9 - 6.3	14.9 - 10.6
30	10°37.5	10°39.2	10°08.5	3.0 - 2.1	9.0 - 6.4	15.0 - 10.6
31	10°37.7	10°39.5	10°08.7	3.1 - 2.2	9.1 - 6.4	15.1 - 10.7
32	10°38.0	10°39.7	10°08.9	3.2 - 2.3	9.2 - 6.5	15.2 - 10.8
33	10°38.2	10°40.0	10°09.2	3.3 - 2.3	9.3 - 6.6	15.3 - 10.8
34	10°38.5	10°40.2	10°09.4	3.4 - 2.4	9.4 - 6.7	15.4 - 10.9
35	10°38.8	10°40.5	10°09.7	3.5 - 2.5	9.5 - 6.7	15.5 - 11.0
36	10°39.0	10°40.7	10°09.9	3.6 - 2.6	9.6 - 6.8	15.6 - 11.1
37	10°39.3	10°41.0	10°10.1	3.7 - 2.6	9.7 - 6.9	15.7 - 11.1
38	10°39.5	10°41.2	10°10.4	3.8 - 2.7	9.8 - 6.9	15.8 - 11.2
39	10°39.7	10°41.5	10°10.6	3.9 - 2.8	9.9 - 7.0	15.9 - 11.3
40	10°40.0	10°41.7	10°10.8	4.0 - 2.8	10.0 - 7.1	16.0 - 11.3
41	10°40.2	10°42.0	10°11.1	4.1 - 2.9	10.1 - 7.2	16.1 - 11.4
42	10°40.5	10°42.3	10°11.3	4.2 - 3.0	10.2 - 7.2	16.2 - 11.5
43	10°40.8	10°42.5	10°11.6	4.3 - 3.0	10.3 - 7.3	16.3 - 11.5
44	10°41.0	10°42.8	10°11.8	4.4 - 3.1	10.4 - 7.4	16.4 - 11.6
45	10°41.3	10°43.0	10°12.0	4.5 - 3.2	10.5 - 7.4	16.5 - 11.7
46	10°41.5	10°43.3	10°12.3	4.6 - 3.3	10.6 - 7.5	16.6 - 11.8
47	10°41.7	10°43.5	10°12.5	4.7 - 3.3	10.7 - 7.6	16.7 - 11.8
48	10°42.0	10°43.8	10°12.8	4.8 - 3.4	10.8 - 7.7	16.8 - 11.9
49	10°42.3	10°44.0	10°13.0	4.9 - 3.5	10.9 - 7.7	16.9 - 12.0
50	10°42.5	10°44.3	10°13.2	5.0 - 3.5	11.0 - 7.8	17.0 - 12.0
51	10°42.8	10°44.5	10°13.5	5.1 - 3.6	11.1 - 7.9	17.1 - 12.1
52	10°43.0	10°44.8	10°13.7	5.2 - 3.7	11.2 - 7.9	17.2 - 12.2
53	10°43.2	10°45.0	10°13.9	5.3 - 3.8	11.3 - 8.0	17.3 - 12.3
54	10°43.5	10°45.3	10°14.2	5.4 - 3.8	11.4 - 8.1	17.4 - 12.3
55	10°43.7	10°45.5	10°14.4	5.5 - 3.9	11.5 - 8.1	17.5 - 12.4
56	10°44.0	10°45.8	10°14.7	5.6 - 4.0	11.6 - 8.2	17.6 - 12.5
57	10°44.3	10°46.0	10°14.9	5.7 - 4.0	11.7 - 8.3	17.7 - 12.5
58	10°44.5	10°46.3	10°15.1	5.8 - 4.1	11.8 - 8.4	17.8 - 12.6
59	10°44.8	10°46.5	10°15.4	5.9 - 4.2	11.9 - 8.4	17.9 - 12.7

m 43	Sun Plan.	Aries	Moon	v and d corr		
0	10°45.0	10°46.8	10°15.6	0.0 - 0.0	6.0 - 4.3	12.0 - 8.7
1	10°45.2	10°47.0	10°15.9	0.1 - 0.1	6.1 - 4.4	12.1 - 8.8
2	10°45.5	10°47.3	10°16.1	0.2 - 0.1	6.2 - 4.5	12.2 - 8.8
3	10°45.7	10°47.5	10°16.3	0.3 - 0.2	6.3 - 4.6	12.3 - 8.9
4	10°46.0	10°47.8	10°16.6	0.4 - 0.3	6.4 - 4.6	12.4 - 9.0
5	10°46.3	10°48.0	10°16.8	0.5 - 0.4	6.5 - 4.7	12.5 - 9.1
6	10°46.5	10°48.3	10°17.0	0.6 - 0.4	6.6 - 4.8	12.6 - 9.1
7	10°46.8	10°48.5	10°17.3	0.7 - 0.5	6.7 - 4.9	12.7 - 9.2
8	10°47.0	10°48.8	10°17.5	0.8 - 0.6	6.8 - 4.9	12.8 - 9.3
9	10°47.2	10°49.0	10°17.8	0.9 - 0.7	6.9 - 5.0	12.9 - 9.4
10	10°47.5	10°49.3	10°18.0	1.0 - 0.7	7.0 - 5.1	13.0 - 9.4
11	10°47.7	10°49.5	10°18.2	1.1 - 0.8	7.1 - 5.1	13.1 - 9.5
12	10°48.0	10°49.8	10°18.5	1.2 - 0.9	7.2 - 5.2	13.2 - 9.6
13	10°48.3	10°50.0	10°18.7	1.3 - 0.9	7.3 - 5.3	13.3 - 9.6
14	10°48.5	10°50.3	10°19.0	1.4 - 1.0	7.4 - 5.4	13.4 - 9.7
15	10°48.8	10°50.5	10°19.2	1.5 - 1.1	7.5 - 5.4	13.5 - 9.8
16	10°49.0	10°50.8	10°19.4	1.6 - 1.2	7.6 - 5.5	13.6 - 9.9
17	10°49.2	10°51.0	10°19.7	1.7 - 1.2	7.7 - 5.6	13.7 - 9.9
18	10°49.5	10°51.3	10°19.9	1.8 - 1.3	7.8 - 5.7	13.8 - 10.0
19	10°49.8	10°51.5	10°20.2	1.9 - 1.4	7.9 - 5.7	13.9 - 10.1
20	10°50.0	10°51.8	10°20.4	2.0 - 1.4	8.0 - 5.8	14.0 - 10.2
21	10°50.3	10°52.0	10°20.6	2.1 - 1.5	8.1 - 5.9	14.1 - 10.2
22	10°50.5	10°52.3	10°20.9	2.2 - 1.6	8.2 - 5.9	14.2 - 10.3
23	10°50.7	10°52.5	10°21.1	2.3 - 1.7	8.3 - 6.0	14.3 - 10.4
24	10°51.0	10°52.8	10°21.3	2.4 - 1.7	8.4 - 6.1	14.4 - 10.4
25	10°51.2	10°53.0	10°21.6	2.5 - 1.8	8.5 - 6.2	14.5 - 10.5
26	10°51.5	10°53.3	10°21.8	2.6 - 1.9	8.6 - 6.2	14.6 - 10.6
27	10°51.8	10°53.5	10°22.1	2.7 - 2.0	8.7 - 6.3	14.7 - 10.7
28	10°52.0	10°53.8	10°22.3	2.8 - 2.0	8.8 - 6.4	14.8 - 10.7
29	10°52.3	10°54.0	10°22.5	2.9 - 2.1	8.9 - 6.5	14.9 - 10.8
30	10°52.5	10°54.3	10°22.8	3.0 - 2.2	9.0 - 6.5	15.0 - 10.9
31	10°52.7	10°54.5	10°23.0	3.1 - 2.2	9.1 - 6.6	15.1 - 10.9
32	10°53.0	10°54.8	10°23.3	3.2 - 2.3	9.2 - 6.7	15.2 - 11.0
33	10°53.2	10°55.0	10°23.5	3.3 - 2.4	9.3 - 6.7	15.3 - 11.1
34	10°53.5	10°55.3	10°23.7	3.4 - 2.5	9.4 - 6.8	15.4 - 11.2
35	10°53.8	10°55.5	10°24.0	3.5 - 2.5	9.5 - 6.9	15.5 - 11.2
36	10°54.0	10°55.8	10°24.2	3.6 - 2.6	9.6 - 7.0	15.6 - 11.3
37	10°54.3	10°56.0	10°24.4	3.7 - 2.7	9.7 - 7.0	15.7 - 11.4
38	10°54.5	10°56.3	10°24.7	3.8 - 2.8	9.8 - 7.1	15.8 - 11.5
39	10°54.7	10°56.5	10°24.9	3.9 - 2.8	9.9 - 7.2	15.9 - 11.5
40	10°55.0	10°56.8	10°25.2	4.0 - 2.9	10.0 - 7.3	16.0 - 11.6
41	10°55.2	10°57.0	10°25.4	4.1 - 3.0	10.1 - 7.3	16.1 - 11.7
42	10°55.5	10°57.3	10°25.6	4.2 - 3.0	10.2 - 7.4	16.2 - 11.7
43	10°55.8	10°57.5	10°25.9	4.3 - 3.1	10.3 - 7.5	16.3 - 11.8
44	10°56.0	10°57.8	10°26.1	4.4 - 3.2	10.4 - 7.5	16.4 - 11.9
45	10°56.3	10°58.0	10°26.4	4.5 - 3.3	10.5 - 7.6	16.5 - 12.0
46	10°56.5	10°58.3	10°26.6	4.6 - 3.3	10.6 - 7.7	16.6 - 12.0
47	10°56.7	10°58.5	10°26.8	4.7 - 3.4	10.7 - 7.8	16.7 - 12.1
48	10°57.0	10°58.8	10°27.1	4.8 - 3.5	10.8 - 7.8	16.8 - 12.2
49	10°57.3	10°59.0	10°27.3	4.9 - 3.6	10.9 - 7.9	16.9 - 12.3
50	10°57.5	10°59.3	10°27.5	5.0 - 3.6	11.0 - 8.0	17.0 - 12.3
51	10°57.8	10°59.5	10°27.8	5.1 - 3.7	11.1 - 8.0	17.1 - 12.4
52	10°58.0	10°59.8	10°28.0	5.2 - 3.8	11.2 - 8.1	17.2 - 12.5
53	10°58.2	11°00.0	10°28.3	5.3 - 3.8	11.3 - 8.2	17.3 - 12.5
54	10°58.5	11°00.3	10°28.5	5.4 - 3.9	11.4 - 8.3	17.4 - 12.6
55	10°58.7	11°00.6	10°28.7	5.5 - 4.0	11.5 - 8.3	17.5 - 12.7
56	10°59.0	11°00.8	10°29.0	5.6 - 4.1	11.6 - 8.4	17.6 - 12.8
57	10°59.3	11°01.1	10°29.2	5.7 - 4.1	11.7 - 8.5	17.7 - 12.8
58	10°59.5	11°01.3	10°29.5	5.8 - 4.2	11.8 - 8.6	17.8 - 12.9
59	10°59.8	11°01.6	10°29.7	5.9 - 4.3	11.9 - 8.6	17.9 - 13.0

m 44	Sun Plan.	Aries	Moon	v and d corr		
0	11°00.0	11°01.8	10°29.9	0.0 - 0.0	6.0 - 4.5	12.0 - 8.9
1	11°00.2	11°02.1	10°30.2	0.1 - 0.1	6.1 - 4.5	12.1 - 9.0
2	11°00.5	11°02.3	10°30.4	0.2 - 0.1	6.2 - 4.6	12.2 - 9.0
3	11°00.7	11°02.6	10°30.6	0.3 - 0.2	6.3 - 4.7	12.3 - 9.1
4	11°01.0	11°02.8	10°30.9	0.4 - 0.3	6.4 - 4.7	12.4 - 9.2
5	11°01.3	11°03.1	10°31.1	0.5 - 0.4	6.5 - 4.8	12.5 - 9.3
6	11°01.5	11°03.3	10°31.4	0.6 - 0.4	6.6 - 4.9	12.6 - 9.3
7	11°01.8	11°03.6	10°31.6	0.7 - 0.5	6.7 - 5.0	12.7 - 9.4
8	11°02.0	11°03.8	10°31.8	0.8 - 0.6	6.8 - 5.0	12.8 - 9.5
9	11°02.2	11°04.1	10°32.1	0.9 - 0.7	6.9 - 5.1	12.9 - 9.6
10	11°02.5	11°04.3	10°32.3	1.0 - 0.7	7.0 - 5.2	13.0 - 9.6
11	11°02.7	11°04.6	10°32.6	1.1 - 0.8	7.1 - 5.3	13.1 - 9.7
12	11°03.0	11°04.8	10°32.8	1.2 - 0.9	7.2 - 5.3	13.2 - 9.8
13	11°03.3	11°05.1	10°33.0	1.3 - 1.0	7.3 - 5.4	13.3 - 9.9
14	11°03.5	11°05.3	10°33.3	1.4 - 1.0	7.4 - 5.5	13.4 - 9.9
15	11°03.8	11°05.6	10°33.5	1.5 - 1.1	7.5 - 5.6	13.5 - 10.0
16	11°04.0	11°05.8	10°33.8	1.6 - 1.2	7.6 - 5.6	13.6 - 10.1
17	11°04.2	11°06.1	10°34.0	1.7 - 1.3	7.7 - 5.7	13.7 - 10.2
18	11°04.5	11°06.3	10°34.2	1.8 - 1.3	7.8 - 5.8	13.8 - 10.2
19	11°04.8	11°06.6	10°34.5	1.9 - 1.4	7.9 - 5.9	13.9 - 10.3
20	11°05.0	11°06.8	10°34.7	2.0 - 1.5	8.0 - 5.9	14.0 - 10.4
21	11°05.3	11°07.1	10°34.9	2.1 - 1.6	8.1 - 6.0	14.1 - 10.5
22	11°05.5	11°07.3	10°35.2	2.2 - 1.6	8.2 - 6.1	14.2 - 10.5
23	11°05.7	11°07.6	10°35.4	2.3 - 1.7	8.3 - 6.2	14.3 - 10.6
24	11°06.0	11°07.8	10°35.7	2.4 - 1.8	8.4 - 6.2	14.4 - 10.7
25	11°06.2	11°08.1	10°35.9	2.5 - 1.9	8.5 - 6.3	14.5 - 10.8
26	11°06.5	11°08.3	10°36.1	2.6 - 1.9	8.6 - 6.4	14.6 - 10.8
27	11°06.8	11°08.6	10°36.4	2.7 - 2.0	8.7 - 6.5	14.7 - 10.9
28	11°07.0	11°08.8	10°36.6	2.8 - 2.1	8.8 - 6.5	14.8 - 11.0
29	11°07.3	11°09.1	10°36.9	2.9 - 2.2	8.9 - 6.6	14.9 - 11.1
30	11°07.5	11°09.3	10°37.1	3.0 - 2.2	9.0 - 6.7	15.0 - 11.1
31	11°07.7	11°09.6	10°37.3	3.1 - 2.3	9.1 - 6.7	15.1 - 11.2
32	11°08.0	11°09.8	10°37.6	3.2 - 2.4	9.2 - 6.8	15.2 - 11.3
33	11°08.2	11°10.1	10°37.8	3.3 - 2.4	9.3 - 6.9	15.3 - 11.3
34	11°08.5	11°10.3	10°38.0	3.4 - 2.5	9.4 - 7.0	15.4 - 11.4
35	11°08.8	11°10.6	10°38.3	3.5 - 2.6	9.5 - 7.0	15.5 - 11.5
36	11°09.0	11°10.8	10°38.5	3.6 - 2.7	9.6 - 7.1	15.6 - 11.6
37	11°09.3	11°11.1	10°38.8	3.7 - 2.7	9.7 - 7.2	15.7 - 11.6
38	11°09.5	11°11.3	10°39.0	3.8 - 2.8	9.8 - 7.3	15.8 - 11.7
39	11°09.7	11°11.6	10°39.2	3.9 - 2.9	9.9 - 7.3	15.9 - 11.8
40	11°10.0	11°11.8	10°39.5	4.0 - 3.0	10.0 - 7.4	16.0 - 11.9
41	11°10.2	11°12.1	10°39.7	4.1 - 3.0	10.1 - 7.5	16.1 - 11.9
42	11°10.5	11°12.3	10°40.0	4.2 - 3.1	10.2 - 7.6	16.2 - 12.0
43	11°10.8	11°12.6	10°40.2	4.3 - 3.2	10.3 - 7.6	16.3 - 12.1
44	11°11.0	11°12.8	10°40.4	4.4 - 3.3	10.4 - 7.7	16.4 - 12.2
45	11°11.3	11°13.1	10°40.7	4.5 - 3.3	10.5 - 7.8	16.5 - 12.2
46	11°11.5	11°13.3	10°40.9	4.6 - 3.4	10.6 - 7.9	16.6 - 12.3
47	11°11.7	11°13.6	10°41.1	4.7 - 3.5	10.7 - 7.9	16.7 - 12.4
48	11°12.0	11°13.8	10°41.4	4.8 - 3.6	10.8 - 8.0	16.8 - 12.5
49	11°12.3	11°14.1	10°41.6	4.9 - 3.6	10.9 - 8.1	16.9 - 12.5
50	11°12.5	11°14.3	10°41.9	5.0 - 3.7	11.0 - 8.2	17.0 - 12.6
51	11°12.8	11°14.6	10°42.1	5.1 - 3.8	11.1 - 8.2	17.1 - 12.7
52	11°13.0	11°14.8	10°42.3	5.2 - 3.9	11.2 - 8.3	17.2 - 12.8
53	11°13.2	11°15.1	10°42.6	5.3 - 3.9	11.3 - 8.4	17.3 - 12.8
54	11°13.5	11°15.3	10°42.8	5.4 - 4.0	11.4 - 8.5	17.4 - 12.9
55	11°13.7	11°15.6	10°43.1	5.5 - 4.1	11.5 - 8.5	17.5 - 13.0
56	11°14.0	11°15.8	10°43.3	5.6 - 4.2	11.6 - 8.6	17.6 - 13.1
57	11°14.3	11°16.1	10°43.5	5.7 - 4.2	11.7 - 8.7	17.7 - 13.1
58	11°14.5	11°16.3	10°43.8	5.8 - 4.3	11.8 - 8.8	17.8 - 13.2
59	11°14.8	11°16.6	10°44.0	5.9 - 4.4	11.9 - 8.8	17.9 - 13.3

Increments and Corrections

m 45	Sun Plan.	Aries	Moon	v and d corr		
0	11°15.0	11°16.8	10°44.3	0.0 - 0.0	6.0 - 4.5	12.0 - 9.1
1	11°15.2	11°17.1	10°44.5	0.1 - 0.1	6.1 - 4.6	12.1 - 9.2
2	11°15.5	11°17.3	10°44.7	0.2 - 0.2	6.2 - 4.7	12.2 - 9.3
3	11°15.7	11°17.6	10°45.0	0.3 - 0.2	6.3 - 4.8	12.3 - 9.3
4	11°16.0	11°17.8	10°45.2	0.4 - 0.3	6.4 - 4.9	12.4 - 9.4
5	11°16.3	11°18.1	10°45.4	0.5 - 0.4	6.5 - 4.9	12.5 - 9.5
6	11°16.5	11°18.3	10°45.7	0.6 - 0.5	6.6 - 5.0	12.6 - 9.6
7	11°16.8	11°18.6	10°45.9	0.7 - 0.5	6.7 - 5.1	12.7 - 9.6
8	11°17.0	11°18.9	10°46.2	0.8 - 0.6	6.8 - 5.2	12.8 - 9.7
9	11°17.2	11°19.1	10°46.4	0.9 - 0.7	6.9 - 5.2	12.9 - 9.8
10	11°17.5	11°19.4	10°46.6	1.0 - 0.8	7.0 - 5.3	13.0 - 9.9
11	11°17.7	11°19.6	10°46.9	1.1 - 0.8	7.1 - 5.4	13.1 - 9.9
12	11°18.0	11°19.9	10°47.1	1.2 - 0.9	7.2 - 5.5	13.2 - 10.0
13	11°18.3	11°20.1	10°47.4	1.3 - 1.0	7.3 - 5.5	13.3 - 10.1
14	11°18.5	11°20.4	10°47.6	1.4 - 1.1	7.4 - 5.6	13.4 - 10.2
15	11°18.8	11°20.6	10°47.8	1.5 - 1.1	7.5 - 5.7	13.5 - 10.2
16	11°19.0	11°20.9	10°48.1	1.6 - 1.2	7.6 - 5.8	13.6 - 10.3
17	11°19.2	11°21.1	10°48.3	1.7 - 1.3	7.7 - 5.8	13.7 - 10.4
18	11°19.5	11°21.4	10°48.5	1.8 - 1.4	7.8 - 5.9	13.8 - 10.5
19	11°19.8	11°21.6	10°48.8	1.9 - 1.4	7.9 - 6.0	13.9 - 10.5
20	11°20.0	11°21.9	10°49.0	2.0 - 1.5	8.0 - 6.1	14.0 - 10.6
21	11°20.3	11°22.1	10°49.3	2.1 - 1.6	8.1 - 6.1	14.1 - 10.7
22	11°20.5	11°22.4	10°49.5	2.2 - 1.7	8.2 - 6.2	14.2 - 10.8
23	11°20.7	11°22.6	10°49.7	2.3 - 1.7	8.3 - 6.3	14.3 - 10.8
24	11°21.0	11°22.9	10°50.0	2.4 - 1.8	8.4 - 6.4	14.4 - 10.9
25	11°21.2	11°23.1	10°50.2	2.5 - 1.9	8.5 - 6.4	14.5 - 11.0
26	11°21.5	11°23.4	10°50.5	2.6 - 2.0	8.6 - 6.5	14.6 - 11.1
27	11°21.8	11°23.6	10°50.7	2.7 - 2.0	8.7 - 6.6	14.7 - 11.1
28	11°22.0	11°23.9	10°50.9	2.8 - 2.1	8.8 - 6.7	14.8 - 11.2
29	11°22.3	11°24.1	10°51.2	2.9 - 2.2	8.9 - 6.7	14.9 - 11.3
30	11°22.5	11°24.4	10°51.4	3.0 - 2.3	9.0 - 6.8	15.0 - 11.4
31	11°22.7	11°24.6	10°51.6	3.1 - 2.4	9.1 - 6.9	15.1 - 11.5
32	11°23.0	11°24.9	10°51.9	3.2 - 2.4	9.2 - 7.0	15.2 - 11.5
33	11°23.2	11°25.1	10°52.1	3.3 - 2.5	9.3 - 7.1	15.3 - 11.6
34	11°23.5	11°25.4	10°52.4	3.4 - 2.6	9.4 - 7.1	15.4 - 11.7
35	11°23.8	11°25.6	10°52.6	3.5 - 2.7	9.5 - 7.2	15.5 - 11.8
36	11°24.0	11°25.9	10°52.8	3.6 - 2.7	9.6 - 7.3	15.6 - 11.8
37	11°24.3	11°26.1	10°53.1	3.7 - 2.8	9.7 - 7.4	15.7 - 11.9
38	11°24.5	11°26.4	10°53.3	3.8 - 2.9	9.8 - 7.4	15.8 - 12.0
39	11°24.7	11°26.6	10°53.6	3.9 - 3.0	9.9 - 7.5	15.9 - 12.1
40	11°25.0	11°26.9	10°53.8	4.0 - 3.0	10.0 - 7.6	16.0 - 12.1
41	11°25.2	11°27.1	10°54.0	4.1 - 3.1	10.1 - 7.7	16.1 - 12.2
42	11°25.5	11°27.4	10°54.3	4.2 - 3.2	10.2 - 7.7	16.2 - 12.3
43	11°25.8	11°27.6	10°54.5	4.3 - 3.3	10.3 - 7.8	16.3 - 12.4
44	11°26.0	11°27.9	10°54.7	4.4 - 3.3	10.4 - 7.9	16.4 - 12.4
45	11°26.3	11°28.1	10°55.0	4.5 - 3.4	10.5 - 8.0	16.5 - 12.5
46	11°26.5	11°28.4	10°55.2	4.6 - 3.5	10.6 - 8.0	16.6 - 12.6
47	11°26.7	11°28.6	10°55.5	4.7 - 3.6	10.7 - 8.1	16.7 - 12.7
48	11°27.0	11°28.9	10°55.7	4.8 - 3.6	10.8 - 8.2	16.8 - 12.7
49	11°27.3	11°29.1	10°55.9	4.9 - 3.7	10.9 - 8.3	16.9 - 12.8
50	11°27.5	11°29.4	10°56.2	5.0 - 3.8	11.0 - 8.3	17.0 - 12.9
51	11°27.8	11°29.6	10°56.4	5.1 - 3.9	11.1 - 8.4	17.1 - 13.0
52	11°28.0	11°29.9	10°56.7	5.2 - 3.9	11.2 - 8.5	17.2 - 13.0
53	11°28.2	11°30.1	10°56.9	5.3 - 4.0	11.3 - 8.6	17.3 - 13.1
54	11°28.5	11°30.4	10°57.1	5.4 - 4.1	11.4 - 8.6	17.4 - 13.2
55	11°28.7	11°30.6	10°57.4	5.5 - 4.2	11.5 - 8.7	17.5 - 13.3
56	11°29.0	11°30.9	10°57.6	5.6 - 4.2	11.6 - 8.8	17.6 - 13.3
57	11°29.3	11°31.1	10°57.9	5.7 - 4.3	11.7 - 8.9	17.7 - 13.4
58	11°29.5	11°31.4	10°58.1	5.8 - 4.4	11.8 - 8.9	17.8 - 13.5
59	11°29.8	11°31.6	10°58.3	5.9 - 4.5	11.9 - 9.0	17.9 - 13.6

m 46	Sun Plan.	Aries	Moon	v and d corr		
0	11°30.0	11°31.9	10°58.6	0.0 - 0.0	6.0 - 4.7	12.0 - 9.3
1	11°30.2	11°32.1	10°58.8	0.1 - 0.1	6.1 - 4.7	12.1 - 9.4
2	11°30.5	11°32.4	10°59.0	0.2 - 0.2	6.2 - 4.8	12.2 - 9.5
3	11°30.7	11°32.6	10°59.3	0.3 - 0.2	6.3 - 4.9	12.3 - 9.5
4	11°31.0	11°32.9	10°59.5	0.4 - 0.3	6.4 - 5.0	12.4 - 9.6
5	11°31.3	11°33.1	10°59.8	0.5 - 0.4	6.5 - 5.0	12.5 - 9.7
6	11°31.5	11°33.4	11°00.0	0.6 - 0.5	6.6 - 5.1	12.6 - 9.8
7	11°31.8	11°33.6	11°00.2	0.7 - 0.5	6.7 - 5.2	12.7 - 9.8
8	11°32.0	11°33.9	11°00.5	0.8 - 0.6	6.8 - 5.3	12.8 - 9.9
9	11°32.2	11°34.1	11°00.7	0.9 - 0.7	6.9 - 5.3	12.9 - 10.0
10	11°32.5	11°34.4	11°01.0	1.0 - 0.8	7.0 - 5.4	13.0 - 10.1
11	11°32.7	11°34.6	11°01.2	1.1 - 0.9	7.1 - 5.5	13.1 - 10.2
12	11°33.0	11°34.9	11°01.4	1.2 - 0.9	7.2 - 5.6	13.2 - 10.2
13	11°33.3	11°35.1	11°01.7	1.3 - 1.0	7.3 - 5.7	13.3 - 10.3
14	11°33.5	11°35.4	11°01.9	1.4 - 1.1	7.4 - 5.7	13.4 - 10.4
15	11°33.8	11°35.6	11°02.1	1.5 - 1.2	7.5 - 5.8	13.5 - 10.5
16	11°34.0	11°35.9	11°02.4	1.6 - 1.2	7.6 - 5.9	13.6 - 10.5
17	11°34.2	11°36.1	11°02.6	1.7 - 1.3	7.7 - 6.0	13.7 - 10.6
18	11°34.5	11°36.4	11°02.9	1.8 - 1.4	7.8 - 6.0	13.8 - 10.7
19	11°34.8	11°36.6	11°03.1	1.9 - 1.5	7.9 - 6.1	13.9 - 10.8
20	11°35.0	11°36.9	11°03.3	2.0 - 1.6	8.0 - 6.2	14.0 - 10.8
21	11°35.3	11°37.2	11°03.6	2.1 - 1.6	8.1 - 6.3	14.1 - 10.9
22	11°35.5	11°37.4	11°03.8	2.2 - 1.7	8.2 - 6.4	14.2 - 11.0
23	11°35.7	11°37.7	11°04.1	2.3 - 1.8	8.3 - 6.4	14.3 - 11.1
24	11°36.0	11°37.9	11°04.3	2.4 - 1.9	8.4 - 6.5	14.4 - 11.2
25	11°36.2	11°38.2	11°04.5	2.5 - 1.9	8.5 - 6.6	14.5 - 11.2
26	11°36.5	11°38.4	11°04.8	2.6 - 2.0	8.6 - 6.7	14.6 - 11.3
27	11°36.8	11°38.7	11°05.0	2.7 - 2.1	8.7 - 6.7	14.7 - 11.4
28	11°37.0	11°38.9	11°05.2	2.8 - 2.2	8.8 - 6.8	14.8 - 11.5
29	11°37.3	11°39.2	11°05.5	2.9 - 2.2	8.9 - 6.9	14.9 - 11.5
30	11°37.5	11°39.4	11°05.7	3.0 - 2.3	9.0 - 7.0	15.0 - 11.6
31	11°37.7	11°39.7	11°06.0	3.1 - 2.4	9.1 - 7.1	15.1 - 11.7
32	11°38.0	11°39.9	11°06.2	3.2 - 2.5	9.2 - 7.1	15.2 - 11.8
33	11°38.2	11°40.2	11°06.4	3.3 - 2.6	9.3 - 7.2	15.3 - 11.9
34	11°38.5	11°40.4	11°06.7	3.4 - 2.6	9.4 - 7.3	15.4 - 11.9
35	11°38.8	11°40.7	11°06.9	3.5 - 2.7	9.5 - 7.4	15.5 - 12.0
36	11°39.0	11°40.9	11°07.2	3.6 - 2.8	9.6 - 7.4	15.6 - 12.1
37	11°39.3	11°41.2	11°07.4	3.7 - 2.9	9.7 - 7.5	15.7 - 12.2
38	11°39.5	11°41.4	11°07.6	3.8 - 2.9	9.8 - 7.6	15.8 - 12.2
39	11°39.7	11°41.7	11°07.9	3.9 - 3.0	9.9 - 7.7	15.9 - 12.3
40	11°40.0	11°41.9	11°08.1	4.0 - 3.1	10.0 - 7.8	16.0 - 12.4
41	11°40.2	11°42.2	11°08.3	4.1 - 3.2	10.1 - 7.8	16.1 - 12.5
42	11°40.5	11°42.4	11°08.6	4.2 - 3.3	10.2 - 7.9	16.2 - 12.6
43	11°40.8	11°42.7	11°08.8	4.3 - 3.3	10.3 - 8.0	16.3 - 12.6
44	11°41.0	11°42.9	11°09.1	4.4 - 3.4	10.4 - 8.1	16.4 - 12.7
45	11°41.3	11°43.2	11°09.3	4.5 - 3.5	10.5 - 8.1	16.5 - 12.8
46	11°41.5	11°43.4	11°09.5	4.6 - 3.6	10.6 - 8.2	16.6 - 12.9
47	11°41.7	11°43.7	11°09.8	4.7 - 3.6	10.7 - 8.3	16.7 - 12.9
48	11°42.0	11°43.9	11°10.0	4.8 - 3.7	10.8 - 8.4	16.8 - 13.0
49	11°42.3	11°44.2	11°10.3	4.9 - 3.8	10.9 - 8.4	16.9 - 13.1
50	11°42.5	11°44.4	11°10.5	5.0 - 3.9	11.0 - 8.5	17.0 - 13.2
51	11°42.8	11°44.7	11°10.7	5.1 - 4.0	11.1 - 8.6	17.1 - 13.3
52	11°43.0	11°44.9	11°11.0	5.2 - 4.0	11.2 - 8.7	17.2 - 13.3
53	11°43.2	11°45.2	11°11.2	5.3 - 4.1	11.3 - 8.8	17.3 - 13.4
54	11°43.5	11°45.4	11°11.5	5.4 - 4.2	11.4 - 8.8	17.4 - 13.5
55	11°43.7	11°45.7	11°11.7	5.5 - 4.3	11.5 - 8.9	17.5 - 13.6
56	11°44.0	11°45.9	11°11.9	5.6 - 4.3	11.6 - 9.0	17.6 - 13.6
57	11°44.3	11°46.2	11°12.2	5.7 - 4.4	11.7 - 9.1	17.7 - 13.7
58	11°44.5	11°46.4	11°12.4	5.8 - 4.5	11.8 - 9.1	17.8 - 13.8
59	11°44.8	11°46.7	11°12.6	5.9 - 4.6	11.9 - 9.2	17.9 - 13.9

m 47	Sun Plan.	Aries	Moon	v and d corr		
0	11°45.0	11°46.9	11°12.9	0.0 - 0.0	6.0 - 4.8	12.0 - 9.5
1	11°45.2	11°47.2	11°13.1	0.1 - 0.1	6.1 - 4.8	12.1 - 9.6
2	11°45.5	11°47.4	11°13.4	0.2 - 0.2	6.2 - 4.9	12.2 - 9.7
3	11°45.7	11°47.7	11°13.6	0.3 - 0.2	6.3 - 5.0	12.3 - 9.7
4	11°46.0	11°47.9	11°13.8	0.4 - 0.3	6.4 - 5.1	12.4 - 9.8
5	11°46.3	11°48.2	11°14.1	0.5 - 0.4	6.5 - 5.1	12.5 - 9.9
6	11°46.5	11°48.4	11°14.3	0.6 - 0.5	6.6 - 5.2	12.6 - 10.0
7	11°46.8	11°48.7	11°14.6	0.7 - 0.6	6.7 - 5.3	12.7 - 10.1
8	11°47.0	11°48.9	11°14.8	0.8 - 0.6	6.8 - 5.4	12.8 - 10.1
9	11°47.2	11°49.2	11°15.0	0.9 - 0.7	6.9 - 5.5	12.9 - 10.2
10	11°47.5	11°49.4	11°15.3	1.0 - 0.8	7.0 - 5.5	13.0 - 10.3
11	11°47.7	11°49.7	11°15.5	1.1 - 0.9	7.1 - 5.6	13.1 - 10.4
12	11°48.0	11°49.9	11°15.7	1.2 - 1.0	7.2 - 5.7	13.2 - 10.4
13	11°48.3	11°50.2	11°16.0	1.3 - 1.0	7.3 - 5.8	13.3 - 10.5
14	11°48.5	11°50.4	11°16.2	1.4 - 1.1	7.4 - 5.9	13.4 - 10.6
15	11°48.8	11°50.7	11°16.5	1.5 - 1.2	7.5 - 5.9	13.5 - 10.7
16	11°49.0	11°50.9	11°16.7	1.6 - 1.3	7.6 - 6.0	13.6 - 10.8
17	11°49.2	11°51.2	11°16.9	1.7 - 1.3	7.7 - 6.1	13.7 - 10.8
18	11°49.5	11°51.4	11°17.2	1.8 - 1.4	7.8 - 6.2	13.8 - 10.9
19	11°49.8	11°51.7	11°17.4	1.9 - 1.5	7.9 - 6.3	13.9 - 11.0
20	11°50.0	11°51.9	11°17.7	2.0 - 1.6	8.0 - 6.3	14.0 - 11.1
21	11°50.3	11°52.2	11°17.9	2.1 - 1.7	8.1 - 6.4	14.1 - 11.2
22	11°50.5	11°52.4	11°18.1	2.2 - 1.7	8.2 - 6.5	14.2 - 11.2
23	11°50.7	11°52.7	11°18.4	2.3 - 1.8	8.3 - 6.6	14.3 - 11.3
24	11°51.0	11°52.9	11°18.6	2.4 - 1.9	8.4 - 6.7	14.4 - 11.4
25	11°51.2	11°53.2	11°18.8	2.5 - 2.0	8.5 - 6.7	14.5 - 11.5
26	11°51.5	11°53.4	11°19.1	2.6 - 2.1	8.6 - 6.8	14.6 - 11.6
27	11°51.8	11°53.7	11°19.3	2.7 - 2.1	8.7 - 6.9	14.7 - 11.6
28	11°52.0	11°53.9	11°19.6	2.8 - 2.2	8.8 - 7.0	14.8 - 11.7
29	11°52.3	11°54.2	11°19.8	2.9 - 2.3	8.9 - 7.0	14.9 - 11.8
30	11°52.5	11°54.4	11°20.0	3.0 - 2.4	9.0 - 7.1	15.0 - 11.9
31	11°52.7	11°54.7	11°20.3	3.1 - 2.5	9.1 - 7.2	15.1 - 12.0
32	11°53.0	11°54.9	11°20.5	3.2 - 2.5	9.2 - 7.3	15.2 - 12.0
33	11°53.2	11°55.2	11°20.8	3.3 - 2.6	9.3 - 7.4	15.3 - 12.1
34	11°53.5	11°55.5	11°21.0	3.4 - 2.7	9.4 - 7.4	15.4 - 12.2
35	11°53.8	11°55.7	11°21.2	3.5 - 2.8	9.5 - 7.5	15.5 - 12.3
36	11°54.0	11°56.0	11°21.5	3.6 - 2.9	9.6 - 7.6	15.6 - 12.3
37	11°54.3	11°56.2	11°21.7	3.7 - 2.9	9.7 - 7.7	15.7 - 12.4
38	11°54.5	11°56.5	11°22.0	3.8 - 3.0	9.8 - 7.8	15.8 - 12.5
39	11°54.7	11°56.7	11°22.2	3.9 - 3.1	9.9 - 7.8	15.9 - 12.6
40	11°55.0	11°57.0	11°22.4	4.0 - 3.2	10.0 - 7.9	16.0 - 12.7
41	11°55.2	11°57.2	11°22.7	4.1 - 3.2	10.1 - 8.0	16.1 - 12.7
42	11°55.5	11°57.5	11°22.9	4.2 - 3.3	10.2 - 8.1	16.2 - 12.8
43	11°55.8	11°57.7	11°23.1	4.3 - 3.4	10.3 - 8.2	16.3 - 12.9
44	11°56.0	11°58.0	11°23.4	4.4 - 3.5	10.4 - 8.2	16.4 - 13.0
45	11°56.3	11°58.2	11°23.6	4.5 - 3.6	10.5 - 8.3	16.5 - 13.1
46	11°56.5	11°58.5	11°23.9	4.6 - 3.6	10.6 - 8.4	16.6 - 13.1
47	11°56.7	11°58.7	11°24.1	4.7 - 3.7	10.7 - 8.5	16.7 - 13.2
48	11°57.0	11°59.0	11°24.3	4.8 - 3.8	10.8 - 8.6	16.8 - 13.3
49	11°57.3	11°59.2	11°24.6	4.9 - 3.9	10.9 - 8.6	16.9 - 13.4
50	11°57.5	11°59.5	11°24.8	5.0 - 4.0	11.0 - 8.7	17.0 - 13.5
51	11°57.8	11°59.7	11°25.1	5.1 - 4.0	11.1 - 8.8	17.1 - 13.5
52	11°58.0	12°00.0	11°25.3	5.2 - 4.1	11.2 - 8.9	17.2 - 13.6
53	11°58.2	12°00.2	11°25.5	5.3 - 4.2	11.3 - 8.9	17.3 - 13.7
54	11°58.5	12°00.5	11°25.8	5.4 - 4.3	11.4 - 9.0	17.4 - 13.8
55	11°58.7	12°00.7	11°26.0	5.5 - 4.4	11.5 - 9.1	17.5 - 13.9
56	11°59.0	12°01.0	11°26.2	5.6 - 4.4	11.6 - 9.2	17.6 - 13.9
57	11°59.3	12°01.2	11°26.5	5.7 - 4.5	11.7 - 9.3	17.7 - 14.0
58	11°59.5	12°01.5	11°26.7	5.8 - 4.6	11.8 - 9.3	17.8 - 14.1
59	11°59.8	12°01.7	11°27.0	5.9 - 4.7	11.9 - 9.4	17.9 - 14.2

Increments and Corrections

m 48	Sun Plan.	Aries	Moon	v and d corr		
0	12°00.0	12°02.0	11°27.2	0.0 - 0.0	6.0 - 4.8	12.0 - 9.7
1	12°00.2	12°02.2	11°27.4	0.1 - 0.1	6.1 - 4.9	12.1 - 9.8
2	12°00.5	12°02.5	11°27.7	0.2 - 0.2	6.2 - 5.0	12.2 - 9.9
3	12°00.7	12°02.7	11°27.9	0.3 - 0.2	6.3 - 5.1	12.3 - 9.9
4	12°01.0	12°03.0	11°28.2	0.4 - 0.3	6.4 - 5.2	12.4 - 10.0
5	12°01.3	12°03.2	11°28.4	0.5 - 0.4	6.5 - 5.3	12.5 - 10.1
6	12°01.5	12°03.5	11°28.6	0.6 - 0.5	6.6 - 5.3	12.6 - 10.2
7	12°01.8	12°03.7	11°28.9	0.7 - 0.6	6.7 - 5.4	12.7 - 10.3
8	12°02.0	12°04.0	11°29.1	0.8 - 0.6	6.8 - 5.5	12.8 - 10.3
9	12°02.2	12°04.2	11°29.3	0.9 - 0.7	6.9 - 5.6	12.9 - 10.4
10	12°02.5	12°04.5	11°29.6	1.0 - 0.8	7.0 - 5.7	13.0 - 10.5
11	12°02.7	12°04.7	11°29.8	1.1 - 0.9	7.1 - 5.7	13.1 - 10.6
12	12°03.0	12°05.0	11°30.1	1.2 - 1.0	7.2 - 5.8	13.2 - 10.7
13	12°03.3	12°05.2	11°30.3	1.3 - 1.1	7.3 - 5.9	13.3 - 10.8
14	12°03.5	12°05.5	11°30.5	1.4 - 1.1	7.4 - 6.0	13.4 - 10.8
15	12°03.8	12°05.7	11°30.8	1.5 - 1.2	7.5 - 6.1	13.5 - 10.9
16	12°04.0	12°06.0	11°31.0	1.6 - 1.3	7.6 - 6.1	13.6 - 11.0
17	12°04.2	12°06.2	11°31.3	1.7 - 1.4	7.7 - 6.2	13.7 - 11.1
18	12°04.5	12°06.5	11°31.5	1.8 - 1.5	7.8 - 6.3	13.8 - 11.2
19	12°04.8	12°06.7	11°31.7	1.9 - 1.5	7.9 - 6.4	13.9 - 11.2
20	12°05.0	12°07.0	11°32.0	2.0 - 1.6	8.0 - 6.5	14.0 - 11.3
21	12°05.3	12°07.2	11°32.2	2.1 - 1.7	8.1 - 6.5	14.1 - 11.4
22	12°05.5	12°07.5	11°32.4	2.2 - 1.8	8.2 - 6.6	14.2 - 11.5
23	12°05.7	12°07.7	11°32.7	2.3 - 1.9	8.3 - 6.7	14.3 - 11.6
24	12°06.0	12°08.0	11°32.9	2.4 - 1.9	8.4 - 6.8	14.4 - 11.6
25	12°06.2	12°08.2	11°33.2	2.5 - 2.0	8.5 - 6.9	14.5 - 11.7
26	12°06.5	12°08.5	11°33.4	2.6 - 2.1	8.6 - 7.0	14.6 - 11.8
27	12°06.8	12°08.7	11°33.6	2.7 - 2.2	8.7 - 7.0	14.7 - 11.9
28	12°07.0	12°09.0	11°33.9	2.8 - 2.3	8.8 - 7.1	14.8 - 12.0
29	12°07.3	12°09.2	11°34.1	2.9 - 2.3	8.9 - 7.2	14.9 - 12.0
30	12°07.5	12°09.5	11°34.4	3.0 - 2.4	9.0 - 7.3	15.0 - 12.1
31	12°07.7	12°09.7	11°34.6	3.1 - 2.5	9.1 - 7.4	15.1 - 12.2
32	12°08.0	12°10.0	11°34.8	3.2 - 2.6	9.2 - 7.4	15.2 - 12.3
33	12°08.2	12°10.2	11°35.1	3.3 - 2.7	9.3 - 7.5	15.3 - 12.4
34	12°08.5	12°10.5	11°35.3	3.4 - 2.7	9.4 - 7.6	15.4 - 12.4
35	12°08.8	12°10.7	11°35.6	3.5 - 2.8	9.5 - 7.7	15.5 - 12.5
36	12°09.0	12°11.0	11°35.8	3.6 - 2.9	9.6 - 7.8	15.6 - 12.6
37	12°09.3	12°11.2	11°36.0	3.7 - 3.0	9.7 - 7.8	15.7 - 12.7
38	12°09.5	12°11.5	11°36.3	3.8 - 3.1	9.8 - 7.9	15.8 - 12.8
39	12°09.7	12°11.7	11°36.5	3.9 - 3.2	9.9 - 8.0	15.9 - 12.9
40	12°10.0	12°12.0	11°36.7	4.0 - 3.2	10.0 - 8.1	16.0 - 12.9
41	12°10.2	12°12.2	11°37.0	4.1 - 3.3	10.1 - 8.2	16.1 - 13.0
42	12°10.5	12°12.5	11°37.2	4.2 - 3.4	10.2 - 8.2	16.2 - 13.1
43	12°10.8	12°12.7	11°37.5	4.3 - 3.5	10.3 - 8.3	16.3 - 13.2
44	12°11.0	12°13.0	11°37.7	4.4 - 3.6	10.4 - 8.4	16.4 - 13.3
45	12°11.3	12°13.2	11°37.9	4.5 - 3.6	10.5 - 8.5	16.5 - 13.3
46	12°11.5	12°13.5	11°38.2	4.6 - 3.7	10.6 - 8.6	16.6 - 13.4
47	12°11.7	12°13.8	11°38.4	4.7 - 3.8	10.7 - 8.6	16.7 - 13.5
48	12°12.0	12°14.0	11°38.7	4.8 - 3.9	10.8 - 8.7	16.8 - 13.6
49	12°12.3	12°14.3	11°38.9	4.9 - 4.0	10.9 - 8.8	16.9 - 13.7
50	12°12.5	12°14.5	11°39.1	5.0 - 4.0	11.0 - 8.9	17.0 - 13.7
51	12°12.8	12°14.8	11°39.4	5.1 - 4.1	11.1 - 9.0	17.1 - 13.8
52	12°13.0	12°15.0	11°39.6	5.2 - 4.2	11.2 - 9.1	17.2 - 13.9
53	12°13.2	12°15.3	11°39.8	5.3 - 4.3	11.3 - 9.1	17.3 - 14.0
54	12°13.5	12°15.5	11°40.1	5.4 - 4.4	11.4 - 9.2	17.4 - 14.1
55	12°13.7	12°15.8	11°40.3	5.5 - 4.4	11.5 - 9.3	17.5 - 14.1
56	12°14.0	12°16.0	11°40.6	5.6 - 4.5	11.6 - 9.4	17.6 - 14.2
57	12°14.3	12°16.3	11°40.8	5.7 - 4.6	11.7 - 9.5	17.7 - 14.3
58	12°14.5	12°16.5	11°41.0	5.8 - 4.7	11.8 - 9.5	17.8 - 14.4
59	12°14.8	12°16.8	11°41.3	5.9 - 4.8	11.9 - 9.6	17.9 - 14.5

m 49	Sun Plan.	Aries	Moon	v and d corr		
0	12°15.0	12°17.0	11°41.5	0.0 - 0.0	6.0 - 4.9	12.0 - 9.9
1	12°15.2	12°17.3	11°41.8	0.1 - 0.1	6.1 - 5.0	12.1 - 10.0
2	12°15.5	12°17.5	11°42.0	0.2 - 0.2	6.2 - 5.1	12.2 - 10.1
3	12°15.7	12°17.8	11°42.2	0.3 - 0.2	6.3 - 5.2	12.3 - 10.1
4	12°16.0	12°18.0	11°42.5	0.4 - 0.3	6.4 - 5.3	12.4 - 10.2
5	12°16.3	12°18.3	11°42.7	0.5 - 0.4	6.5 - 5.4	12.5 - 10.3
6	12°16.5	12°18.5	11°42.9	0.6 - 0.5	6.6 - 5.4	12.6 - 10.4
7	12°16.8	12°18.8	11°43.2	0.7 - 0.6	6.7 - 5.5	12.7 - 10.5
8	12°17.0	12°19.0	11°43.4	0.8 - 0.7	6.8 - 5.6	12.8 - 10.6
9	12°17.2	12°19.3	11°43.7	0.9 - 0.7	6.9 - 5.7	12.9 - 10.6
10	12°17.5	12°19.5	11°43.9	1.0 - 0.8	7.0 - 5.8	13.0 - 10.7
11	12°17.7	12°19.8	11°44.1	1.1 - 0.9	7.1 - 5.9	13.1 - 10.8
12	12°18.0	12°20.0	11°44.4	1.2 - 1.0	7.2 - 5.9	13.2 - 10.9
13	12°18.3	12°20.3	11°44.6	1.3 - 1.1	7.3 - 6.0	13.3 - 11.0
14	12°18.5	12°20.5	11°44.9	1.4 - 1.2	7.4 - 6.1	13.4 - 11.1
15	12°18.8	12°20.8	11°45.1	1.5 - 1.2	7.5 - 6.2	13.5 - 11.1
16	12°19.0	12°21.0	11°45.3	1.6 - 1.3	7.6 - 6.3	13.6 - 11.2
17	12°19.2	12°21.3	11°45.6	1.7 - 1.4	7.7 - 6.4	13.7 - 11.3
18	12°19.5	12°21.5	11°45.8	1.8 - 1.5	7.8 - 6.4	13.8 - 11.4
19	12°19.8	12°21.8	11°46.1	1.9 - 1.6	7.9 - 6.5	13.9 - 11.5
20	12°20.0	12°22.0	11°46.3	2.0 - 1.6	8.0 - 6.6	14.0 - 11.5
21	12°20.3	12°22.3	11°46.5	2.1 - 1.7	8.1 - 6.7	14.1 - 11.6
22	12°20.5	12°22.5	11°46.8	2.2 - 1.8	8.2 - 6.8	14.2 - 11.7
23	12°20.7	12°22.8	11°47.0	2.3 - 1.9	8.3 - 6.8	14.3 - 11.8
24	12°21.0	12°23.0	11°47.2	2.4 - 2.0	8.4 - 6.9	14.4 - 11.9
25	12°21.2	12°23.3	11°47.5	2.5 - 2.1	8.5 - 7.0	14.5 - 12.0
26	12°21.5	12°23.5	11°47.7	2.6 - 2.1	8.6 - 7.1	14.6 - 12.0
27	12°21.8	12°23.8	11°48.0	2.7 - 2.2	8.7 - 7.2	14.7 - 12.1
28	12°22.0	12°24.0	11°48.2	2.8 - 2.3	8.8 - 7.3	14.8 - 12.2
29	12°22.3	12°24.3	11°48.4	2.9 - 2.4	8.9 - 7.3	14.9 - 12.3
30	12°22.5	12°24.5	11°48.7	3.0 - 2.5	9.0 - 7.4	15.0 - 12.4
31	12°22.7	12°24.8	11°48.9	3.1 - 2.6	9.1 - 7.5	15.1 - 12.5
32	12°23.0	12°25.0	11°49.2	3.2 - 2.6	9.2 - 7.6	15.2 - 12.5
33	12°23.2	12°25.3	11°49.4	3.3 - 2.7	9.3 - 7.7	15.3 - 12.6
34	12°23.5	12°25.5	11°49.6	3.4 - 2.8	9.4 - 7.8	15.4 - 12.7
35	12°23.8	12°25.8	11°49.9	3.5 - 2.9	9.5 - 7.8	15.5 - 12.8
36	12°24.0	12°26.0	11°50.1	3.6 - 3.0	9.6 - 7.9	15.6 - 12.9
37	12°24.3	12°26.3	11°50.3	3.7 - 3.1	9.7 - 8.0	15.7 - 13.0
38	12°24.5	12°26.5	11°50.6	3.8 - 3.1	9.8 - 8.1	15.8 - 13.0
39	12°24.7	12°26.8	11°50.8	3.9 - 3.2	9.9 - 8.2	15.9 - 13.1
40	12°25.0	12°27.0	11°51.1	4.0 - 3.3	10.0 - 8.3	16.0 - 13.2
41	12°25.2	12°27.3	11°51.3	4.1 - 3.4	10.1 - 8.3	16.1 - 13.3
42	12°25.5	12°27.5	11°51.5	4.2 - 3.5	10.2 - 8.4	16.2 - 13.4
43	12°25.8	12°27.8	11°51.8	4.3 - 3.5	10.3 - 8.5	16.3 - 13.4
44	12°26.0	12°28.0	11°52.0	4.4 - 3.6	10.4 - 8.6	16.4 - 13.5
45	12°26.3	12°28.3	11°52.3	4.5 - 3.7	10.5 - 8.7	16.5 - 13.6
46	12°26.5	12°28.5	11°52.5	4.6 - 3.8	10.6 - 8.7	16.6 - 13.7
47	12°26.7	12°28.8	11°52.7	4.7 - 3.9	10.7 - 8.8	16.7 - 13.8
48	12°27.0	12°29.0	11°53.0	4.8 - 4.0	10.8 - 8.9	16.8 - 13.9
49	12°27.3	12°29.3	11°53.2	4.9 - 4.0	10.9 - 9.0	16.9 - 13.9
50	12°27.5	12°29.5	11°53.4	5.0 - 4.1	11.0 - 9.1	17.0 - 14.0
51	12°27.8	12°29.8	11°53.7	5.1 - 4.2	11.1 - 9.2	17.1 - 14.1
52	12°28.0	12°30.0	11°53.9	5.2 - 4.3	11.2 - 9.2	17.2 - 14.2
53	12°28.2	12°30.3	11°54.2	5.3 - 4.4	11.3 - 9.3	17.3 - 14.3
54	12°28.5	12°30.5	11°54.4	5.4 - 4.5	11.4 - 9.4	17.4 - 14.4
55	12°28.7	12°30.8	11°54.6	5.5 - 4.5	11.5 - 9.5	17.5 - 14.4
56	12°29.0	12°31.0	11°54.9	5.6 - 4.6	11.6 - 9.6	17.6 - 14.5
57	12°29.3	12°31.3	11°55.1	5.7 - 4.7	11.7 - 9.7	17.7 - 14.6
58	12°29.5	12°31.5	11°55.4	5.8 - 4.8	11.8 - 9.7	17.8 - 14.7
59	12°29.8	12°31.8	11°55.6	5.9 - 4.9	11.9 - 9.8	17.9 - 14.8

m 50	Sun Plan.	Aries	Moon	v and d corr		
0	12°30.0	12°32.1	11°55.8	0.0 - 0.0	6.0 - 5.0	12.0 - 10.1
1	12°30.2	12°32.3	11°56.1	0.1 - 0.1	6.1 - 5.1	12.1 - 10.2
2	12°30.5	12°32.6	11°56.3	0.2 - 0.2	6.2 - 5.2	12.2 - 10.3
3	12°30.7	12°32.8	11°56.5	0.3 - 0.3	6.3 - 5.3	12.3 - 10.4
4	12°31.0	12°33.1	11°56.8	0.4 - 0.3	6.4 - 5.4	12.4 - 10.4
5	12°31.3	12°33.3	11°57.0	0.5 - 0.4	6.5 - 5.5	12.5 - 10.5
6	12°31.5	12°33.6	11°57.3	0.6 - 0.5	6.6 - 5.6	12.6 - 10.6
7	12°31.8	12°33.8	11°57.5	0.7 - 0.6	6.7 - 5.6	12.7 - 10.7
8	12°32.0	12°34.1	11°57.7	0.8 - 0.7	6.8 - 5.7	12.8 - 10.8
9	12°32.2	12°34.3	11°58.0	0.9 - 0.8	6.9 - 5.8	12.9 - 10.9
10	12°32.5	12°34.6	11°58.2	1.0 - 0.8	7.0 - 5.9	13.0 - 10.9
11	12°32.7	12°34.8	11°58.5	1.1 - 0.9	7.1 - 6.0	13.1 - 11.0
12	12°33.0	12°35.1	11°58.7	1.2 - 1.0	7.2 - 6.1	13.2 - 11.1
13	12°33.3	12°35.3	11°58.9	1.3 - 1.1	7.3 - 6.1	13.3 - 11.2
14	12°33.5	12°35.6	11°59.2	1.4 - 1.2	7.4 - 6.2	13.4 - 11.3
15	12°33.8	12°35.8	11°59.4	1.5 - 1.3	7.5 - 6.3	13.5 - 11.4
16	12°34.0	12°36.1	11°59.7	1.6 - 1.3	7.6 - 6.4	13.6 - 11.4
17	12°34.2	12°36.3	11°59.9	1.7 - 1.4	7.7 - 6.5	13.7 - 11.5
18	12°34.5	12°36.6	12°00.1	1.8 - 1.5	7.8 - 6.6	13.8 - 11.6
19	12°34.8	12°36.8	12°00.4	1.9 - 1.6	7.9 - 6.6	13.9 - 11.7
20	12°35.0	12°37.1	12°00.6	2.0 - 1.7	8.0 - 6.7	14.0 - 11.8
21	12°35.3	12°37.3	12°00.8	2.1 - 1.8	8.1 - 6.8	14.1 - 11.9
22	12°35.5	12°37.6	12°01.1	2.2 - 1.9	8.2 - 6.9	14.2 - 12.0
23	12°35.7	12°37.8	12°01.3	2.3 - 1.9	8.3 - 7.0	14.3 - 12.0
24	12°36.0	12°38.1	12°01.6	2.4 - 2.0	8.4 - 7.1	14.4 - 12.1
25	12°36.2	12°38.3	12°01.8	2.5 - 2.1	8.5 - 7.2	14.5 - 12.2
26	12°36.5	12°38.6	12°02.0	2.6 - 2.2	8.6 - 7.2	14.6 - 12.3
27	12°36.8	12°38.8	12°02.3	2.7 - 2.3	8.7 - 7.3	14.7 - 12.4
28	12°37.0	12°39.1	12°02.5	2.8 - 2.4	8.8 - 7.4	14.8 - 12.5
29	12°37.3	12°39.3	12°02.8	2.9 - 2.4	8.9 - 7.5	14.9 - 12.5
30	12°37.5	12°39.6	12°03.0	3.0 - 2.5	9.0 - 7.6	15.0 - 12.6
31	12°37.7	12°39.8	12°03.2	3.1 - 2.6	9.1 - 7.7	15.1 - 12.7
32	12°38.0	12°40.1	12°03.5	3.2 - 2.7	9.2 - 7.7	15.2 - 12.8
33	12°38.2	12°40.3	12°03.7	3.3 - 2.8	9.3 - 7.8	15.3 - 12.9
34	12°38.5	12°40.6	12°03.9	3.4 - 2.9	9.4 - 7.9	15.4 - 13.0
35	12°38.8	12°40.8	12°04.2	3.5 - 2.9	9.5 - 8.0	15.5 - 13.0
36	12°39.0	12°41.1	12°04.4	3.6 - 3.0	9.6 - 8.1	15.6 - 13.1
37	12°39.3	12°41.3	12°04.7	3.7 - 3.1	9.7 - 8.2	15.7 - 13.2
38	12°39.5	12°41.6	12°04.9	3.8 - 3.2	9.8 - 8.2	15.8 - 13.3
39	12°39.7	12°41.8	12°05.1	3.9 - 3.3	9.9 - 8.3	15.9 - 13.4
40	12°40.0	12°42.1	12°05.4	4.0 - 3.4	10.0 - 8.4	16.0 - 13.5
41	12°40.2	12°42.3	12°05.6	4.1 - 3.5	10.1 - 8.5	16.1 - 13.6
42	12°40.5	12°42.6	12°05.9	4.2 - 3.5	10.2 - 8.6	16.2 - 13.6
43	12°40.8	12°42.8	12°06.1	4.3 - 3.6	10.3 - 8.7	16.3 - 13.7
44	12°41.0	12°43.1	12°06.3	4.4 - 3.7	10.4 - 8.8	16.4 - 13.8
45	12°41.3	12°43.3	12°06.6	4.5 - 3.8	10.5 - 8.8	16.5 - 13.9
46	12°41.5	12°43.6	12°06.8	4.6 - 3.9	10.6 - 8.9	16.6 - 14.0
47	12°41.7	12°43.8	12°07.0	4.7 - 4.0	10.7 - 9.0	16.7 - 14.1
48	12°42.0	12°44.1	12°07.3	4.8 - 4.0	10.8 - 9.1	16.8 - 14.1
49	12°42.3	12°44.3	12°07.5	4.9 - 4.1	10.9 - 9.2	16.9 - 14.2
50	12°42.5	12°44.6	12°07.8	5.0 - 4.2	11.0 - 9.3	17.0 - 14.3
51	12°42.8	12°44.8	12°08.0	5.1 - 4.3	11.1 - 9.3	17.1 - 14.4
52	12°43.0	12°45.1	12°08.2	5.2 - 4.4	11.2 - 9.4	17.2 - 14.5
53	12°43.2	12°45.3	12°08.5	5.3 - 4.5	11.3 - 9.5	17.3 - 14.6
54	12°43.5	12°45.6	12°08.7	5.4 - 4.5	11.4 - 9.6	17.4 - 14.6
55	12°43.7	12°45.8	12°09.0	5.5 - 4.6	11.5 - 9.7	17.5 - 14.7
56	12°44.0	12°46.1	12°09.2	5.6 - 4.7	11.6 - 9.8	17.6 - 14.8
57	12°44.3	12°46.3	12°09.4	5.7 - 4.8	11.7 - 9.8	17.7 - 14.9
58	12°44.5	12°46.6	12°09.7	5.8 - 4.9	11.8 - 9.9	17.8 - 15.0
59	12°44.8	12°46.8	12°09.9	5.9 - 5.0	11.9 - 10.0	17.9 - 15.1

Increments and Corrections

m 51	Sun Plan.	Aries	Moon	v and d corr		
0	12°45.0	12°47.1	12°10.1	0.0 - 0.0	6.0 - 5.1	12.0 - 10.3
1	12°45.2	12°47.3	12°10.4	0.1 - 0.1	6.1 - 5.2	12.1 - 10.4
2	12°45.5	12°47.6	12°10.6	0.2 - 0.2	6.2 - 5.3	12.2 - 10.5
3	12°45.7	12°47.8	12°10.9	0.3 - 0.3	6.3 - 5.4	12.3 - 10.6
4	12°46.0	12°48.1	12°11.1	0.4 - 0.3	6.4 - 5.5	12.4 - 10.6
5	12°46.3	12°48.3	12°11.3	0.5 - 0.4	6.5 - 5.6	12.5 - 10.7
6	12°46.5	12°48.6	12°11.6	0.6 - 0.5	6.6 - 5.7	12.6 - 10.8
7	12°46.8	12°48.8	12°11.8	0.7 - 0.6	6.7 - 5.8	12.7 - 10.9
8	12°47.0	12°49.1	12°12.1	0.8 - 0.7	6.8 - 5.8	12.8 - 11.0
9	12°47.2	12°49.3	12°12.3	0.9 - 0.8	6.9 - 5.9	12.9 - 11.1
10	12°47.5	12°49.6	12°12.5	1.0 - 0.9	7.0 - 6.0	13.0 - 11.2
11	12°47.7	12°49.8	12°12.8	1.1 - 0.9	7.1 - 6.1	13.1 - 11.2
12	12°48.0	12°50.1	12°13.0	1.2 - 1.0	7.2 - 6.2	13.2 - 11.3
13	12°48.3	12°50.3	12°13.3	1.3 - 1.1	7.3 - 6.3	13.3 - 11.4
14	12°48.5	12°50.6	12°13.5	1.4 - 1.2	7.4 - 6.4	13.4 - 11.5
15	12°48.8	12°50.9	12°13.7	1.5 - 1.3	7.5 - 6.4	13.5 - 11.6
16	12°49.0	12°51.1	12°14.0	1.6 - 1.4	7.6 - 6.5	13.6 - 11.7
17	12°49.2	12°51.4	12°14.2	1.7 - 1.5	7.7 - 6.6	13.7 - 11.8
18	12°49.5	12°51.6	12°14.4	1.8 - 1.5	7.8 - 6.7	13.8 - 11.8
19	12°49.8	12°51.9	12°14.7	1.9 - 1.6	7.9 - 6.8	13.9 - 11.9
20	12°50.0	12°52.1	12°14.9	2.0 - 1.7	8.0 - 6.9	14.0 - 12.0
21	12°50.3	12°52.4	12°15.2	2.1 - 1.8	8.1 - 7.0	14.1 - 12.1
22	12°50.5	12°52.6	12°15.4	2.2 - 1.9	8.2 - 7.0	14.2 - 12.2
23	12°50.7	12°52.9	12°15.6	2.3 - 2.0	8.3 - 7.1	14.3 - 12.3
24	12°51.0	12°53.1	12°15.9	2.4 - 2.1	8.4 - 7.2	14.4 - 12.4
25	12°51.2	12°53.4	12°16.1	2.5 - 2.1	8.5 - 7.3	14.5 - 12.4
26	12°51.5	12°53.6	12°16.4	2.6 - 2.2	8.6 - 7.4	14.6 - 12.5
27	12°51.8	12°53.9	12°16.6	2.7 - 2.3	8.7 - 7.5	14.7 - 12.6
28	12°52.0	12°54.1	12°16.8	2.8 - 2.4	8.8 - 7.6	14.8 - 12.7
29	12°52.3	12°54.4	12°17.1	2.9 - 2.5	8.9 - 7.6	14.9 - 12.8
30	12°52.5	12°54.6	12°17.3	3.0 - 2.6	9.0 - 7.7	15.0 - 12.9
31	12°52.7	12°54.9	12°17.5	3.1 - 2.7	9.1 - 7.8	15.1 - 13.0
32	12°53.0	12°55.1	12°17.8	3.2 - 2.7	9.2 - 7.9	15.2 - 13.0
33	12°53.2	12°55.4	12°18.0	3.3 - 2.8	9.3 - 8.0	15.3 - 13.1
34	12°53.5	12°55.6	12°18.3	3.4 - 2.9	9.4 - 8.1	15.4 - 13.2
35	12°53.8	12°55.9	12°18.5	3.5 - 3.0	9.5 - 8.2	15.5 - 13.3
36	12°54.0	12°56.1	12°18.7	3.6 - 3.1	9.6 - 8.2	15.6 - 13.4
37	12°54.3	12°56.4	12°19.0	3.7 - 3.2	9.7 - 8.3	15.7 - 13.5
38	12°54.5	12°56.6	12°19.2	3.8 - 3.3	9.8 - 8.4	15.8 - 13.6
39	12°54.7	12°56.9	12°19.5	3.9 - 3.3	9.9 - 8.5	15.9 - 13.6
40	12°55.0	12°57.1	12°19.7	4.0 - 3.4	10.0 - 8.6	16.0 - 13.7
41	12°55.2	12°57.4	12°19.9	4.1 - 3.5	10.1 - 8.7	16.1 - 13.8
42	12°55.5	12°57.6	12°20.2	4.2 - 3.6	10.2 - 8.8	16.2 - 13.9
43	12°55.8	12°57.9	12°20.4	4.3 - 3.7	10.3 - 8.8	16.3 - 14.0
44	12°56.0	12°58.1	12°20.6	4.4 - 3.8	10.4 - 8.9	16.4 - 14.1
45	12°56.3	12°58.4	12°20.9	4.5 - 3.9	10.5 - 9.0	16.5 - 14.2
46	12°56.5	12°58.6	12°21.1	4.6 - 3.9	10.6 - 9.1	16.6 - 14.2
47	12°56.7	12°58.9	12°21.4	4.7 - 4.0	10.7 - 9.2	16.7 - 14.3
48	12°57.0	12°59.1	12°21.6	4.8 - 4.1	10.8 - 9.3	16.8 - 14.4
49	12°57.3	12°59.4	12°21.8	4.9 - 4.2	10.9 - 9.4	16.9 - 14.5
50	12°57.5	12°59.6	12°22.1	5.0 - 4.3	11.0 - 9.4	17.0 - 14.6
51	12°57.8	12°59.9	12°22.3	5.1 - 4.4	11.1 - 9.5	17.1 - 14.7
52	12°58.0	13°00.1	12°22.6	5.2 - 4.5	11.2 - 9.6	17.2 - 14.8
53	12°58.2	13°00.4	12°22.8	5.3 - 4.5	11.3 - 9.7	17.3 - 14.8
54	12°58.5	13°00.6	12°23.0	5.4 - 4.6	11.4 - 9.8	17.4 - 14.9
55	12°58.7	13°00.9	12°23.3	5.5 - 4.7	11.5 - 9.9	17.5 - 15.0
56	12°59.0	13°01.1	12°23.5	5.6 - 4.8	11.6 - 10.0	17.6 - 15.1
57	12°59.3	13°01.4	12°23.8	5.7 - 4.9	11.7 - 10.0	17.7 - 15.2
58	12°59.5	13°01.6	12°24.0	5.8 - 5.0	11.8 - 10.1	17.8 - 15.3
59	12°59.8	13°01.9	12°24.2	5.9 - 5.1	11.9 - 10.2	17.9 - 15.4

m 52	Sun Plan.	Aries	Moon	v and d corr		
0	13°00.0	13°02.1	12°24.5	0.0 - 0.0	6.0 - 5.3	12.0 - 10.5
1	13°00.2	13°02.4	12°24.7	0.1 - 0.1	6.1 - 5.3	12.1 - 10.6
2	13°00.5	13°02.6	12°24.9	0.2 - 0.2	6.2 - 5.4	12.2 - 10.7
3	13°00.7	13°02.9	12°25.2	0.3 - 0.3	6.3 - 5.5	12.3 - 10.8
4	13°01.0	13°03.1	12°25.4	0.4 - 0.4	6.4 - 5.6	12.4 - 10.8
5	13°01.3	13°03.4	12°25.7	0.5 - 0.4	6.5 - 5.7	12.5 - 10.9
6	13°01.5	13°03.6	12°25.9	0.6 - 0.5	6.6 - 5.8	12.6 - 11.0
7	13°01.8	13°03.9	12°26.1	0.7 - 0.6	6.7 - 5.9	12.7 - 11.1
8	13°02.0	13°04.1	12°26.4	0.8 - 0.7	6.8 - 6.0	12.8 - 11.2
9	13°02.2	13°04.4	12°26.6	0.9 - 0.8	6.9 - 6.0	12.9 - 11.3
10	13°02.5	13°04.6	12°26.9	1.0 - 0.9	7.0 - 6.1	13.0 - 11.4
11	13°02.7	13°04.9	12°27.1	1.1 - 1.0	7.1 - 6.2	13.1 - 11.5
12	13°03.0	13°05.1	12°27.3	1.2 - 1.1	7.2 - 6.3	13.2 - 11.5
13	13°03.3	13°05.4	12°27.6	1.3 - 1.1	7.3 - 6.4	13.3 - 11.6
14	13°03.5	13°05.6	12°27.8	1.4 - 1.2	7.4 - 6.5	13.4 - 11.7
15	13°03.8	13°05.9	12°28.0	1.5 - 1.3	7.5 - 6.6	13.5 - 11.8
16	13°04.0	13°06.1	12°28.3	1.6 - 1.4	7.6 - 6.6	13.6 - 11.9
17	13°04.2	13°06.4	12°28.5	1.7 - 1.5	7.7 - 6.7	13.7 - 12.0
18	13°04.5	13°06.6	12°28.8	1.8 - 1.6	7.8 - 6.8	13.8 - 12.1
19	13°04.8	13°06.9	12°29.0	1.9 - 1.7	7.9 - 6.9	13.9 - 12.2
20	13°05.0	13°07.1	12°29.2	2.0 - 1.8	8.0 - 7.0	14.0 - 12.3
21	13°05.3	13°07.4	12°29.5	2.1 - 1.8	8.1 - 7.1	14.1 - 12.3
22	13°05.5	13°07.6	12°29.7	2.2 - 1.9	8.2 - 7.2	14.2 - 12.4
23	13°05.7	13°07.9	12°30.0	2.3 - 2.0	8.3 - 7.3	14.3 - 12.5
24	13°06.0	13°08.1	12°30.2	2.4 - 2.1	8.4 - 7.4	14.4 - 12.6
25	13°06.2	13°08.4	12°30.4	2.5 - 2.2	8.5 - 7.4	14.5 - 12.7
26	13°06.5	13°08.6	12°30.7	2.6 - 2.3	8.6 - 7.5	14.6 - 12.8
27	13°06.8	13°08.9	12°30.9	2.7 - 2.4	8.7 - 7.6	14.7 - 12.9
28	13°07.0	13°09.2	12°31.1	2.8 - 2.5	8.8 - 7.7	14.8 - 13.0
29	13°07.3	13°09.4	12°31.4	2.9 - 2.5	8.9 - 7.8	14.9 - 13.0
30	13°07.5	13°09.7	12°31.6	3.0 - 2.6	9.0 - 7.9	15.0 - 13.1
31	13°07.7	13°09.9	12°31.9	3.1 - 2.7	9.1 - 8.0	15.1 - 13.2
32	13°08.0	13°10.2	12°32.1	3.2 - 2.8	9.2 - 8.0	15.2 - 13.3
33	13°08.2	13°10.4	12°32.3	3.3 - 2.9	9.3 - 8.1	15.3 - 13.4
34	13°08.5	13°10.7	12°32.6	3.4 - 3.0	9.4 - 8.2	15.4 - 13.5
35	13°08.8	13°10.9	12°32.8	3.5 - 3.1	9.5 - 8.3	15.5 - 13.6
36	13°09.0	13°11.2	12°33.1	3.6 - 3.1	9.6 - 8.4	15.6 - 13.7
37	13°09.3	13°11.4	12°33.3	3.7 - 3.2	9.7 - 8.5	15.7 - 13.7
38	13°09.5	13°11.7	12°33.5	3.8 - 3.3	9.8 - 8.6	15.8 - 13.8
39	13°09.7	13°11.9	12°33.8	3.9 - 3.4	9.9 - 8.7	15.9 - 13.9
40	13°10.0	13°12.2	12°34.0	4.0 - 3.5	10.0 - 8.8	16.0 - 14.0
41	13°10.2	13°12.4	12°34.2	4.1 - 3.6	10.1 - 8.8	16.1 - 14.1
42	13°10.5	13°12.7	12°34.5	4.2 - 3.7	10.2 - 8.9	16.2 - 14.2
43	13°10.8	13°12.9	12°34.7	4.3 - 3.8	10.3 - 9.0	16.3 - 14.3
44	13°11.0	13°13.2	12°35.0	4.4 - 3.9	10.4 - 9.1	16.4 - 14.3
45	13°11.3	13°13.4	12°35.2	4.5 - 3.9	10.5 - 9.2	16.5 - 14.4
46	13°11.5	13°13.7	12°35.4	4.6 - 4.0	10.6 - 9.3	16.6 - 14.5
47	13°11.7	13°13.9	12°35.7	4.7 - 4.1	10.7 - 9.4	16.7 - 14.6
48	13°12.0	13°14.2	12°35.9	4.8 - 4.2	10.8 - 9.5	16.8 - 14.7
49	13°12.3	13°14.4	12°36.2	4.9 - 4.3	10.9 - 9.5	16.9 - 14.8
50	13°12.5	13°14.7	12°36.4	5.0 - 4.4	11.0 - 9.6	17.0 - 14.9
51	13°12.8	13°14.9	12°36.6	5.1 - 4.5	11.1 - 9.7	17.1 - 15.0
52	13°13.0	13°15.2	12°36.9	5.2 - 4.5	11.2 - 9.8	17.2 - 15.0
53	13°13.2	13°15.4	12°37.1	5.3 - 4.6	11.3 - 9.9	17.3 - 15.1
54	13°13.5	13°15.7	12°37.4	5.4 - 4.7	11.4 - 10.0	17.4 - 15.2
55	13°13.7	13°15.9	12°37.6	5.5 - 4.8	11.5 - 10.1	17.5 - 15.3
56	13°14.0	13°16.2	12°37.8	5.6 - 4.9	11.6 - 10.2	17.6 - 15.4
57	13°14.3	13°16.4	12°38.1	5.7 - 5.0	11.7 - 10.2	17.7 - 15.5
58	13°14.5	13°16.7	12°38.3	5.8 - 5.1	11.8 - 10.3	17.8 - 15.6
59	13°14.8	13°16.9	12°38.5	5.9 - 5.2	11.9 - 10.4	17.9 - 15.7

m 53	Sun Plan.	Aries	Moon	v and d corr		
0	13°15.0	13°17.2	12°38.8	0.0 - 0.0	6.0 - 5.4	12.0 - 10.7
1	13°15.2	13°17.4	12°39.0	0.1 - 0.1	6.1 - 5.4	12.1 - 10.8
2	13°15.5	13°17.7	12°39.3	0.2 - 0.2	6.2 - 5.5	12.2 - 10.9
3	13°15.7	13°17.9	12°39.5	0.3 - 0.3	6.3 - 5.6	12.3 - 11.0
4	13°16.0	13°18.2	12°39.7	0.4 - 0.4	6.4 - 5.7	12.4 - 11.1
5	13°16.3	13°18.4	12°40.0	0.5 - 0.4	6.5 - 5.8	12.5 - 11.1
6	13°16.5	13°18.7	12°40.2	0.6 - 0.5	6.6 - 5.9	12.6 - 11.2
7	13°16.8	13°18.9	12°40.5	0.7 - 0.6	6.7 - 6.0	12.7 - 11.3
8	13°17.0	13°19.2	12°40.7	0.8 - 0.7	6.8 - 6.1	12.8 - 11.4
9	13°17.2	13°19.4	12°40.9	0.9 - 0.8	6.9 - 6.2	12.9 - 11.5
10	13°17.5	13°19.7	12°41.2	1.0 - 0.9	7.0 - 6.2	13.0 - 11.6
11	13°17.7	13°19.9	12°41.4	1.1 - 1.0	7.1 - 6.3	13.1 - 11.7
12	13°18.0	13°20.2	12°41.6	1.2 - 1.1	7.2 - 6.4	13.2 - 11.8
13	13°18.3	13°20.4	12°41.9	1.3 - 1.2	7.3 - 6.5	13.3 - 11.9
14	13°18.5	13°20.7	12°42.1	1.4 - 1.2	7.4 - 6.6	13.4 - 11.9
15	13°18.8	13°20.9	12°42.4	1.5 - 1.3	7.5 - 6.7	13.5 - 12.0
16	13°19.0	13°21.2	12°42.6	1.6 - 1.4	7.6 - 6.8	13.6 - 12.1
17	13°19.2	13°21.4	12°42.8	1.7 - 1.5	7.7 - 6.9	13.7 - 12.2
18	13°19.5	13°21.7	12°43.1	1.8 - 1.6	7.8 - 7.0	13.8 - 12.3
19	13°19.8	13°21.9	12°43.3	1.9 - 1.7	7.9 - 7.0	13.9 - 12.4
20	13°20.0	13°22.2	12°43.6	2.0 - 1.8	8.0 - 7.1	14.0 - 12.5
21	13°20.3	13°22.4	12°43.8	2.1 - 1.9	8.1 - 7.2	14.1 - 12.6
22	13°20.5	13°22.7	12°44.0	2.2 - 2.0	8.2 - 7.3	14.2 - 12.7
23	13°20.7	13°22.9	12°44.3	2.3 - 2.1	8.3 - 7.4	14.3 - 12.8
24	13°21.0	13°23.2	12°44.5	2.4 - 2.1	8.4 - 7.5	14.4 - 12.8
25	13°21.2	13°23.4	12°44.7	2.5 - 2.2	8.5 - 7.6	14.5 - 12.9
26	13°21.5	13°23.7	12°45.0	2.6 - 2.3	8.6 - 7.7	14.6 - 13.0
27	13°21.8	13°23.9	12°45.2	2.7 - 2.4	8.7 - 7.8	14.7 - 13.1
28	13°22.0	13°24.2	12°45.5	2.8 - 2.5	8.8 - 7.8	14.8 - 13.2
29	13°22.3	13°24.4	12°45.7	2.9 - 2.6	8.9 - 7.9	14.9 - 13.3
30	13°22.5	13°24.7	12°45.9	3.0 - 2.7	9.0 - 8.0	15.0 - 13.4
31	13°22.7	13°24.9	12°46.2	3.1 - 2.8	9.1 - 8.1	15.1 - 13.5
32	13°23.0	13°25.2	12°46.4	3.2 - 2.9	9.2 - 8.2	15.2 - 13.6
33	13°23.2	13°25.4	12°46.7	3.3 - 2.9	9.3 - 8.3	15.3 - 13.6
34	13°23.5	13°25.7	12°46.9	3.4 - 3.0	9.4 - 8.4	15.4 - 13.7
35	13°23.8	13°25.9	12°47.1	3.5 - 3.1	9.5 - 8.5	15.5 - 13.8
36	13°24.0	13°26.2	12°47.4	3.6 - 3.2	9.6 - 8.6	15.6 - 13.9
37	13°24.3	13°26.4	12°47.6	3.7 - 3.3	9.7 - 8.6	15.7 - 14.0
38	13°24.5	13°26.7	12°47.9	3.8 - 3.4	9.8 - 8.7	15.8 - 14.1
39	13°24.7	13°26.9	12°48.1	3.9 - 3.5	9.9 - 8.8	15.9 - 14.2
40	13°25.0	13°27.2	12°48.3	4.0 - 3.6	10.0 - 8.9	16.0 - 14.3
41	13°25.2	13°27.5	12°48.6	4.1 - 3.7	10.1 - 9.0	16.1 - 14.4
42	13°25.5	13°27.7	12°48.8	4.2 - 3.7	10.2 - 9.1	16.2 - 14.4
43	13°25.8	13°28.0	12°49.0	4.3 - 3.8	10.3 - 9.2	16.3 - 14.5
44	13°26.0	13°28.2	12°49.3	4.4 - 3.9	10.4 - 9.3	16.4 - 14.6
45	13°26.3	13°28.5	12°49.5	4.5 - 4.0	10.5 - 9.4	16.5 - 14.7
46	13°26.5	13°28.7	12°49.8	4.6 - 4.1	10.6 - 9.5	16.6 - 14.8
47	13°26.7	13°29.0	12°50.0	4.7 - 4.2	10.7 - 9.5	16.7 - 14.9
48	13°27.0	13°29.2	12°50.2	4.8 - 4.3	10.8 - 9.6	16.8 - 15.0
49	13°27.3	13°29.5	12°50.5	4.9 - 4.4	10.9 - 9.7	16.9 - 15.1
50	13°27.5	13°29.7	12°50.7	5.0 - 4.5	11.0 - 9.8	17.0 - 15.2
51	13°27.8	13°30.0	12°51.0	5.1 - 4.5	11.1 - 9.9	17.1 - 15.2
52	13°28.0	13°30.2	12°51.2	5.2 - 4.6	11.2 - 10.0	17.2 - 15.3
53	13°28.2	13°30.5	12°51.4	5.3 - 4.7	11.3 - 10.1	17.3 - 15.4
54	13°28.5	13°30.7	12°51.7	5.4 - 4.8	11.4 - 10.2	17.4 - 15.5
55	13°28.7	13°31.0	12°51.9	5.5 - 4.9	11.5 - 10.3	17.5 - 15.6
56	13°29.0	13°31.2	12°52.1	5.6 - 5.0	11.6 - 10.3	17.6 - 15.7
57	13°29.3	13°31.5	12°52.4	5.7 - 5.1	11.7 - 10.4	17.7 - 15.8
58	13°29.5	13°31.7	12°52.6	5.8 - 5.2	11.8 - 10.5	17.8 - 15.9
59	13°29.8	13°32.0	12°52.9	5.9 - 5.3	11.9 - 10.6	17.9 - 16.0

Increments and Corrections

m 54	Sun Plan.	Aries	Moon	v and d corr		
0	13°30.0	13°32.2	12°53.1	0.0 - 0.0	6.0 - 5.5	12.0 - 10.9
1	13°30.2	13°32.5	12°53.3	0.1 - 0.1	6.1 - 5.5	12.1 - 11.0
2	13°30.5	13°32.7	12°53.6	0.2 - 0.2	6.2 - 5.6	12.2 - 11.1
3	13°30.7	13°33.0	12°53.8	0.3 - 0.3	6.3 - 5.7	12.3 - 11.2
4	13°31.0	13°33.2	12°54.1	0.4 - 0.4	6.4 - 5.8	12.4 - 11.3
5	13°31.3	13°33.5	12°54.3	0.5 - 0.5	6.5 - 5.9	12.5 - 11.4
6	13°31.5	13°33.7	12°54.5	0.6 - 0.5	6.6 - 6.0	12.6 - 11.4
7	13°31.8	13°34.0	12°54.8	0.7 - 0.6	6.7 - 6.1	12.7 - 11.5
8	13°32.0	13°34.2	12°55.0	0.8 - 0.7	6.8 - 6.2	12.8 - 11.6
9	13°32.2	13°34.5	12°55.2	0.9 - 0.8	6.9 - 6.3	12.9 - 11.7
10	13°32.5	13°34.7	12°55.5	1.0 - 0.9	7.0 - 6.4	13.0 - 11.8
11	13°32.7	13°35.0	12°55.7	1.1 - 1.0	7.1 - 6.4	13.1 - 11.9
12	13°33.0	13°35.2	12°56.0	1.2 - 1.1	7.2 - 6.5	13.2 - 12.0
13	13°33.3	13°35.5	12°56.2	1.3 - 1.2	7.3 - 6.6	13.3 - 12.1
14	13°33.5	13°35.7	12°56.4	1.4 - 1.3	7.4 - 6.7	13.4 - 12.2
15	13°33.8	13°36.0	12°56.7	1.5 - 1.4	7.5 - 6.8	13.5 - 12.3
16	13°34.0	13°36.2	12°56.9	1.6 - 1.5	7.6 - 6.9	13.6 - 12.4
17	13°34.2	13°36.5	12°57.2	1.7 - 1.5	7.7 - 7.0	13.7 - 12.4
18	13°34.5	13°36.7	12°57.4	1.8 - 1.6	7.8 - 7.1	13.8 - 12.5
19	13°34.8	13°37.0	12°57.6	1.9 - 1.7	7.9 - 7.2	13.9 - 12.6
20	13°35.0	13°37.2	12°57.9	2.0 - 1.8	8.0 - 7.3	14.0 - 12.7
21	13°35.3	13°37.5	12°58.1	2.1 - 1.9	8.1 - 7.4	14.1 - 12.8
22	13°35.5	13°37.7	12°58.3	2.2 - 2.0	8.2 - 7.4	14.2 - 12.9
23	13°35.7	13°38.0	12°58.6	2.3 - 2.1	8.3 - 7.5	14.3 - 13.0
24	13°36.0	13°38.2	12°58.8	2.4 - 2.2	8.4 - 7.6	14.4 - 13.1
25	13°36.2	13°38.5	12°59.1	2.5 - 2.3	8.5 - 7.7	14.5 - 13.2
26	13°36.5	13°38.7	12°59.3	2.6 - 2.4	8.6 - 7.8	14.6 - 13.3
27	13°36.8	13°39.0	12°59.5	2.7 - 2.5	8.7 - 7.9	14.7 - 13.4
28	13°37.0	13°39.2	12°59.8	2.8 - 2.5	8.8 - 8.0	14.8 - 13.4
29	13°37.3	13°39.5	13°00.0	2.9 - 2.6	8.9 - 8.1	14.9 - 13.5
30	13°37.5	13°39.7	13°00.3	3.0 - 2.7	9.0 - 8.2	15.0 - 13.6
31	13°37.7	13°40.0	13°00.5	3.1 - 2.8	9.1 - 8.3	15.1 - 13.7
32	13°38.0	13°40.2	13°00.7	3.2 - 2.9	9.2 - 8.4	15.2 - 13.8
33	13°38.2	13°40.5	13°01.0	3.3 - 3.0	9.3 - 8.4	15.3 - 13.9
34	13°38.5	13°40.7	13°01.2	3.4 - 3.1	9.4 - 8.5	15.4 - 14.0
35	13°38.8	13°41.0	13°01.5	3.5 - 3.2	9.5 - 8.6	15.5 - 14.1
36	13°39.0	13°41.2	13°01.7	3.6 - 3.3	9.6 - 8.7	15.6 - 14.2
37	13°39.3	13°41.5	13°01.9	3.7 - 3.4	9.7 - 8.8	15.7 - 14.3
38	13°39.5	13°41.7	13°02.2	3.8 - 3.5	9.8 - 8.9	15.8 - 14.4
39	13°39.7	13°42.0	13°02.4	3.9 - 3.5	9.9 - 9.0	15.9 - 14.4
40	13°40.0	13°42.2	13°02.6	4.0 - 3.6	10.0 - 9.1	16.0 - 14.5
41	13°40.2	13°42.5	13°02.9	4.1 - 3.7	10.1 - 9.2	16.1 - 14.6
42	13°40.5	13°42.7	13°03.1	4.2 - 3.8	10.2 - 9.3	16.2 - 14.7
43	13°40.8	13°43.0	13°03.4	4.3 - 3.9	10.3 - 9.4	16.3 - 14.8
44	13°41.0	13°43.2	13°03.6	4.4 - 4.0	10.4 - 9.4	16.4 - 14.9
45	13°41.3	13°43.5	13°03.8	4.5 - 4.1	10.5 - 9.5	16.5 - 15.0
46	13°41.5	13°43.7	13°04.1	4.6 - 4.2	10.6 - 9.6	16.6 - 15.1
47	13°41.7	13°44.0	13°04.3	4.7 - 4.3	10.7 - 9.7	16.7 - 15.2
48	13°42.0	13°44.2	13°04.6	4.8 - 4.4	10.8 - 9.8	16.8 - 15.3
49	13°42.3	13°44.5	13°04.8	4.9 - 4.5	10.9 - 9.9	16.9 - 15.4
50	13°42.5	13°44.7	13°05.0	5.0 - 4.5	11.0 - 10.0	17.0 - 15.4
51	13°42.8	13°45.0	13°05.3	5.1 - 4.6	11.1 - 10.1	17.1 - 15.5
52	13°43.0	13°45.2	13°05.5	5.2 - 4.7	11.2 - 10.2	17.2 - 15.6
53	13°43.2	13°45.5	13°05.7	5.3 - 4.8	11.3 - 10.3	17.3 - 15.7
54	13°43.5	13°45.8	13°06.0	5.4 - 4.9	11.4 - 10.4	17.4 - 15.8
55	13°43.7	13°46.0	13°06.2	5.5 - 5.0	11.5 - 10.4	17.5 - 15.9
56	13°44.0	13°46.3	13°06.5	5.6 - 5.1	11.6 - 10.5	17.6 - 16.0
57	13°44.3	13°46.5	13°06.7	5.7 - 5.2	11.7 - 10.6	17.7 - 16.1
58	13°44.5	13°46.8	13°06.9	5.8 - 5.3	11.8 - 10.7	17.8 - 16.2
59	13°44.8	13°47.0	13°07.2	5.9 - 5.4	11.9 - 10.8	17.9 - 16.3

m 55	Sun Plan.	Aries	Moon	v and d corr		
0	13°45.0	13°47.3	13°07.4	0.0 - 0.0	6.0 - 5.6	12.0 - 11.1
1	13°45.2	13°47.5	13°07.7	0.1 - 0.1	6.1 - 5.6	12.1 - 11.2
2	13°45.5	13°47.8	13°07.9	0.2 - 0.2	6.2 - 5.7	12.2 - 11.3
3	13°45.7	13°48.0	13°08.1	0.3 - 0.3	6.3 - 5.8	12.3 - 11.4
4	13°46.0	13°48.3	13°08.4	0.4 - 0.4	6.4 - 5.9	12.4 - 11.5
5	13°46.3	13°48.5	13°08.6	0.5 - 0.5	6.5 - 6.0	12.5 - 11.6
6	13°46.5	13°48.8	13°08.8	0.6 - 0.6	6.6 - 6.1	12.6 - 11.7
7	13°46.8	13°49.0	13°09.1	0.7 - 0.6	6.7 - 6.2	12.7 - 11.7
8	13°47.0	13°49.3	13°09.3	0.8 - 0.7	6.8 - 6.3	12.8 - 11.8
9	13°47.2	13°49.5	13°09.6	0.9 - 0.8	6.9 - 6.4	12.9 - 11.9
10	13°47.5	13°49.8	13°09.8	1.0 - 0.9	7.0 - 6.5	13.0 - 12.0
11	13°47.7	13°50.0	13°10.0	1.1 - 1.0	7.1 - 6.6	13.1 - 12.1
12	13°48.0	13°50.3	13°10.3	1.2 - 1.1	7.2 - 6.7	13.2 - 12.2
13	13°48.3	13°50.5	13°10.5	1.3 - 1.2	7.3 - 6.8	13.3 - 12.3
14	13°48.5	13°50.8	13°10.8	1.4 - 1.3	7.4 - 6.8	13.4 - 12.4
15	13°48.8	13°51.0	13°11.0	1.5 - 1.4	7.5 - 6.9	13.5 - 12.5
16	13°49.0	13°51.3	13°11.2	1.6 - 1.5	7.6 - 7.0	13.6 - 12.6
17	13°49.2	13°51.5	13°11.5	1.7 - 1.6	7.7 - 7.1	13.7 - 12.7
18	13°49.5	13°51.8	13°11.7	1.8 - 1.7	7.8 - 7.2	13.8 - 12.8
19	13°49.8	13°52.0	13°12.0	1.9 - 1.8	7.9 - 7.3	13.9 - 12.9
20	13°50.0	13°52.3	13°12.2	2.0 - 1.9	8.0 - 7.4	14.0 - 13.0
21	13°50.3	13°52.5	13°12.4	2.1 - 1.9	8.1 - 7.5	14.1 - 13.0
22	13°50.5	13°52.8	13°12.7	2.2 - 2.0	8.2 - 7.6	14.2 - 13.1
23	13°50.7	13°53.0	13°12.9	2.3 - 2.1	8.3 - 7.7	14.3 - 13.2
24	13°51.0	13°53.3	13°13.1	2.4 - 2.2	8.4 - 7.8	14.4 - 13.3
25	13°51.2	13°53.5	13°13.4	2.5 - 2.3	8.5 - 7.9	14.5 - 13.4
26	13°51.5	13°53.8	13°13.6	2.6 - 2.4	8.6 - 8.0	14.6 - 13.5
27	13°51.8	13°54.0	13°13.9	2.7 - 2.5	8.7 - 8.0	14.7 - 13.6
28	13°52.0	13°54.3	13°14.1	2.8 - 2.6	8.8 - 8.1	14.8 - 13.7
29	13°52.3	13°54.5	13°14.3	2.9 - 2.7	8.9 - 8.2	14.9 - 13.8
30	13°52.5	13°54.8	13°14.6	3.0 - 2.8	9.0 - 8.3	15.0 - 13.9
31	13°52.7	13°55.0	13°14.8	3.1 - 2.9	9.1 - 8.4	15.1 - 14.0
32	13°53.0	13°55.3	13°15.1	3.2 - 3.0	9.2 - 8.5	15.2 - 14.1
33	13°53.2	13°55.5	13°15.3	3.3 - 3.1	9.3 - 8.6	15.3 - 14.2
34	13°53.5	13°55.8	13°15.5	3.4 - 3.1	9.4 - 8.7	15.4 - 14.2
35	13°53.8	13°56.0	13°15.8	3.5 - 3.2	9.5 - 8.8	15.5 - 14.3
36	13°54.0	13°56.3	13°16.0	3.6 - 3.3	9.6 - 8.9	15.6 - 14.4
37	13°54.3	13°56.5	13°16.2	3.7 - 3.4	9.7 - 9.0	15.7 - 14.5
38	13°54.5	13°56.8	13°16.5	3.8 - 3.5	9.8 - 9.1	15.8 - 14.6
39	13°54.7	13°57.0	13°16.7	3.9 - 3.6	9.9 - 9.2	15.9 - 14.7
40	13°55.0	13°57.3	13°17.0	4.0 - 3.7	10.0 - 9.3	16.0 - 14.8
41	13°55.2	13°57.5	13°17.2	4.1 - 3.8	10.1 - 9.3	16.1 - 14.9
42	13°55.5	13°57.8	13°17.4	4.2 - 3.9	10.2 - 9.4	16.2 - 15.0
43	13°55.8	13°58.0	13°17.7	4.3 - 4.0	10.3 - 9.5	16.3 - 15.1
44	13°56.0	13°58.3	13°17.9	4.4 - 4.1	10.4 - 9.6	16.4 - 15.2
45	13°56.3	13°58.5	13°18.2	4.5 - 4.2	10.5 - 9.7	16.5 - 15.3
46	13°56.5	13°58.8	13°18.4	4.6 - 4.3	10.6 - 9.8	16.6 - 15.4
47	13°56.7	13°59.0	13°18.6	4.7 - 4.3	10.7 - 9.9	16.7 - 15.4
48	13°57.0	13°59.3	13°18.9	4.8 - 4.4	10.8 - 10.0	16.8 - 15.5
49	13°57.3	13°59.5	13°19.1	4.9 - 4.5	10.9 - 10.1	16.9 - 15.6
50	13°57.5	13°59.8	13°19.3	5.0 - 4.6	11.0 - 10.2	17.0 - 15.7
51	13°57.8	14°00.0	13°19.6	5.1 - 4.7	11.1 - 10.3	17.1 - 15.8
52	13°58.0	14°00.3	13°19.8	5.2 - 4.8	11.2 - 10.4	17.2 - 15.9
53	13°58.2	14°00.5	13°20.1	5.3 - 4.9	11.3 - 10.5	17.3 - 16.0
54	13°58.5	14°00.8	13°20.3	5.4 - 5.0	11.4 - 10.5	17.4 - 16.1
55	13°58.7	14°01.0	13°20.5	5.5 - 5.1	11.5 - 10.6	17.5 - 16.2
56	13°59.0	14°01.3	13°20.8	5.6 - 5.2	11.6 - 10.7	17.6 - 16.3
57	13°59.3	14°01.5	13°21.0	5.7 - 5.3	11.7 - 10.8	17.7 - 16.4
58	13°59.5	14°01.8	13°21.3	5.8 - 5.4	11.8 - 10.9	17.8 - 16.5
59	13°59.8	14°02.0	13°21.5	5.9 - 5.5	11.9 - 11.0	17.9 - 16.6

m 56	Sun Plan.	Aries	Moon	v and d corr		
0	14°00.0	14°02.3	13°21.7	0.0 - 0.0	6.0 - 5.7	12.0 - 11.3
1	14°00.2	14°02.5	13°22.0	0.1 - 0.1	6.1 - 5.7	12.1 - 11.4
2	14°00.5	14°02.8	13°22.2	0.2 - 0.2	6.2 - 5.8	12.2 - 11.5
3	14°00.7	14°03.0	13°22.4	0.3 - 0.3	6.3 - 5.9	12.3 - 11.6
4	14°01.0	14°03.3	13°22.7	0.4 - 0.4	6.4 - 6.0	12.4 - 11.7
5	14°01.3	14°03.5	13°22.9	0.5 - 0.5	6.5 - 6.1	12.5 - 11.8
6	14°01.5	14°03.8	13°23.2	0.6 - 0.6	6.6 - 6.2	12.6 - 11.9
7	14°01.8	14°04.1	13°23.4	0.7 - 0.7	6.7 - 6.3	12.7 - 12.0
8	14°02.0	14°04.3	13°23.6	0.8 - 0.8	6.8 - 6.4	12.8 - 12.1
9	14°02.2	14°04.6	13°23.9	0.9 - 0.8	6.9 - 6.5	12.9 - 12.1
10	14°02.5	14°04.8	13°24.1	1.0 - 0.9	7.0 - 6.6	13.0 - 12.2
11	14°02.7	14°05.1	13°24.4	1.1 - 1.0	7.1 - 6.7	13.1 - 12.3
12	14°03.0	14°05.3	13°24.6	1.2 - 1.1	7.2 - 6.8	13.2 - 12.4
13	14°03.3	14°05.6	13°24.8	1.3 - 1.2	7.3 - 6.9	13.3 - 12.5
14	14°03.5	14°05.8	13°25.1	1.4 - 1.3	7.4 - 7.0	13.4 - 12.6
15	14°03.8	14°06.1	13°25.3	1.5 - 1.4	7.5 - 7.1	13.5 - 12.7
16	14°04.0	14°06.3	13°25.6	1.6 - 1.5	7.6 - 7.2	13.6 - 12.8
17	14°04.2	14°06.6	13°25.8	1.7 - 1.6	7.7 - 7.3	13.7 - 12.9
18	14°04.5	14°06.8	13°26.0	1.8 - 1.7	7.8 - 7.3	13.8 - 13.0
19	14°04.8	14°07.1	13°26.3	1.9 - 1.8	7.9 - 7.4	13.9 - 13.1
20	14°05.0	14°07.3	13°26.5	2.0 - 1.9	8.0 - 7.5	14.0 - 13.2
21	14°05.3	14°07.6	13°26.7	2.1 - 2.0	8.1 - 7.6	14.1 - 13.3
22	14°05.5	14°07.8	13°27.0	2.2 - 2.1	8.2 - 7.7	14.2 - 13.4
23	14°05.7	14°08.1	13°27.2	2.3 - 2.2	8.3 - 7.8	14.3 - 13.5
24	14°06.0	14°08.3	13°27.5	2.4 - 2.3	8.4 - 7.9	14.4 - 13.6
25	14°06.2	14°08.6	13°27.7	2.5 - 2.4	8.5 - 8.0	14.5 - 13.7
26	14°06.5	14°08.8	13°27.9	2.6 - 2.4	8.6 - 8.1	14.6 - 13.7
27	14°06.8	14°09.1	13°28.2	2.7 - 2.5	8.7 - 8.2	14.7 - 13.8
28	14°07.0	14°09.3	13°28.4	2.8 - 2.6	8.8 - 8.3	14.8 - 13.9
29	14°07.3	14°09.6	13°28.7	2.9 - 2.7	8.9 - 8.4	14.9 - 14.0
30	14°07.5	14°09.8	13°28.9	3.0 - 2.8	9.0 - 8.5	15.0 - 14.1
31	14°07.7	14°10.1	13°29.1	3.1 - 2.9	9.1 - 8.6	15.1 - 14.2
32	14°08.0	14°10.3	13°29.4	3.2 - 3.0	9.2 - 8.7	15.2 - 14.3
33	14°08.2	14°10.6	13°29.6	3.3 - 3.1	9.3 - 8.8	15.3 - 14.4
34	14°08.5	14°10.8	13°29.8	3.4 - 3.2	9.4 - 8.9	15.4 - 14.5
35	14°08.8	14°11.1	13°30.1	3.5 - 3.3	9.5 - 8.9	15.5 - 14.6
36	14°09.0	14°11.3	13°30.3	3.6 - 3.4	9.6 - 9.0	15.6 - 14.7
37	14°09.3	14°11.6	13°30.6	3.7 - 3.5	9.7 - 9.1	15.7 - 14.8
38	14°09.5	14°11.8	13°30.8	3.8 - 3.6	9.8 - 9.2	15.8 - 14.9
39	14°09.7	14°12.1	13°31.0	3.9 - 3.7	9.9 - 9.3	15.9 - 15.0
40	14°10.0	14°12.3	13°31.3	4.0 - 3.8	10.0 - 9.4	16.0 - 15.1
41	14°10.2	14°12.6	13°31.5	4.1 - 3.9	10.1 - 9.5	16.1 - 15.2
42	14°10.5	14°12.8	13°31.8	4.2 - 4.0	10.2 - 9.6	16.2 - 15.3
43	14°10.8	14°13.1	13°32.0	4.3 - 4.0	10.3 - 9.7	16.3 - 15.3
44	14°11.0	14°13.3	13°32.2	4.4 - 4.1	10.4 - 9.8	16.4 - 15.4
45	14°11.3	14°13.6	13°32.5	4.5 - 4.2	10.5 - 9.9	16.5 - 15.5
46	14°11.5	14°13.8	13°32.7	4.6 - 4.3	10.6 - 10.0	16.6 - 15.6
47	14°11.7	14°14.1	13°32.9	4.7 - 4.4	10.7 - 10.1	16.7 - 15.7
48	14°12.0	14°14.3	13°33.2	4.8 - 4.5	10.8 - 10.2	16.8 - 15.8
49	14°12.3	14°14.6	13°33.4	4.9 - 4.6	10.9 - 10.3	16.9 - 15.9
50	14°12.5	14°14.8	13°33.7	5.0 - 4.7	11.0 - 10.4	17.0 - 16.0
51	14°12.8	14°15.1	13°33.9	5.1 - 4.8	11.1 - 10.5	17.1 - 16.1
52	14°13.0	14°15.3	13°34.1	5.2 - 4.9	11.2 - 10.5	17.2 - 16.2
53	14°13.2	14°15.6	13°34.4	5.3 - 5.0	11.3 - 10.6	17.3 - 16.3
54	14°13.5	14°15.8	13°34.6	5.4 - 5.1	11.4 - 10.7	17.4 - 16.4
55	14°13.7	14°16.1	13°34.9	5.5 - 5.2	11.5 - 10.8	17.5 - 16.5
56	14°14.0	14°16.3	13°35.1	5.6 - 5.3	11.6 - 10.9	17.6 - 16.6
57	14°14.3	14°16.6	13°35.3	5.7 - 5.4	11.7 - 11.0	17.7 - 16.7
58	14°14.5	14°16.8	13°35.6	5.8 - 5.5	11.8 - 11.1	17.8 - 16.8
59	14°14.8	14°17.1	13°35.8	5.9 - 5.6	11.9 - 11.2	17.9 - 16.9

Increments and Corrections

m	Sun	Aries	Moon	v and d corr		
57	Plan.					
0	14°15.0	14°17.3	13°36.0	0.0 - 0.0	6.0 - 5.8	12.0 - 11.5
1	14°15.2	14°17.6	13°36.3	0.1 - 0.1	6.1 - 5.8	12.1 - 11.6
2	14°15.5	14°17.8	13°36.5	0.2 - 0.2	6.2 - 5.9	12.2 - 11.7
3	14°15.7	14°18.1	13°36.8	0.3 - 0.3	6.3 - 6.0	12.3 - 11.8
4	14°16.0	14°18.3	13°37.0	0.4 - 0.4	6.4 - 6.1	12.4 - 11.9
5	14°16.3	14°18.6	13°37.2	0.5 - 0.5	6.5 - 6.2	12.5 - 12.0
6	14°16.5	14°18.8	13°37.5	0.6 - 0.6	6.6 - 6.3	12.6 - 12.1
7	14°16.8	14°19.1	13°37.7	0.7 - 0.7	6.7 - 6.4	12.7 - 12.2
8	14°17.0	14°19.3	13°38.0	0.8 - 0.8	6.8 - 6.5	12.8 - 12.3
9	14°17.2	14°19.6	13°38.2	0.9 - 0.9	6.9 - 6.6	12.9 - 12.4
10	14°17.5	14°19.8	13°38.4	1.0 - 1.0	7.0 - 6.7	13.0 - 12.5
11	14°17.7	14°20.1	13°38.7	1.1 - 1.1	7.1 - 6.8	13.1 - 12.6
12	14°18.0	14°20.3	13°38.9	1.2 - 1.2	7.2 - 6.9	13.2 - 12.7
13	14°18.3	14°20.6	13°39.2	1.3 - 1.2	7.3 - 7.0	13.3 - 12.7
14	14°18.5	14°20.8	13°39.4	1.4 - 1.3	7.4 - 7.1	13.4 - 12.8
15	14°18.8	14°21.1	13°39.6	1.5 - 1.4	7.5 - 7.2	13.5 - 12.9
16	14°19.0	14°21.3	13°39.9	1.6 - 1.5	7.6 - 7.3	13.6 - 13.0
17	14°19.2	14°21.6	13°40.1	1.7 - 1.6	7.7 - 7.4	13.7 - 13.1
18	14°19.5	14°21.8	13°40.3	1.8 - 1.7	7.8 - 7.5	13.8 - 13.2
19	14°19.8	14°22.1	13°40.6	1.9 - 1.8	7.9 - 7.6	13.9 - 13.3
20	14°20.0	14°22.4	13°40.8	2.0 - 1.9	8.0 - 7.7	14.0 - 13.4
21	14°20.3	14°22.6	13°41.1	2.1 - 2.0	8.1 - 7.8	14.1 - 13.5
22	14°20.5	14°22.9	13°41.3	2.2 - 2.1	8.2 - 7.9	14.2 - 13.6
23	14°20.7	14°23.1	13°41.5	2.3 - 2.2	8.3 - 8.0	14.3 - 13.7
24	14°21.0	14°23.4	13°41.8	2.4 - 2.3	8.4 - 8.1	14.4 - 13.8
25	14°21.2	14°23.6	13°42.0	2.5 - 2.4	8.5 - 8.1	14.5 - 13.9
26	14°21.5	14°23.9	13°42.3	2.6 - 2.5	8.6 - 8.2	14.6 - 14.0
27	14°21.8	14°24.1	13°42.5	2.7 - 2.6	8.7 - 8.3	14.7 - 14.1
28	14°22.0	14°24.4	13°42.7	2.8 - 2.7	8.8 - 8.4	14.8 - 14.2
29	14°22.3	14°24.6	13°43.0	2.9 - 2.8	8.9 - 8.5	14.9 - 14.3
30	14°22.5	14°24.9	13°43.2	3.0 - 2.9	9.0 - 8.6	15.0 - 14.4
31	14°22.7	14°25.1	13°43.4	3.1 - 3.0	9.1 - 8.7	15.1 - 14.5
32	14°23.0	14°25.4	13°43.7	3.2 - 3.1	9.2 - 8.8	15.2 - 14.6
33	14°23.2	14°25.6	13°43.9	3.3 - 3.2	9.3 - 8.9	15.3 - 14.7
34	14°23.5	14°25.9	13°44.2	3.4 - 3.3	9.4 - 9.0	15.4 - 14.8
35	14°23.8	14°26.1	13°44.4	3.5 - 3.4	9.5 - 9.1	15.5 - 14.9
36	14°24.0	14°26.4	13°44.6	3.6 - 3.5	9.6 - 9.2	15.6 - 15.0
37	14°24.3	14°26.6	13°44.9	3.7 - 3.5	9.7 - 9.3	15.7 - 15.0
38	14°24.5	14°26.9	13°45.1	3.8 - 3.6	9.8 - 9.4	15.8 - 15.1
39	14°24.7	14°27.1	13°45.4	3.9 - 3.7	9.9 - 9.5	15.9 - 15.2
40	14°25.0	14°27.4	13°45.6	4.0 - 3.8	10.0 - 9.6	16.0 - 15.3
41	14°25.2	14°27.6	13°45.8	4.1 - 3.9	10.1 - 9.7	16.1 - 15.4
42	14°25.5	14°27.9	13°46.1	4.2 - 4.0	10.2 - 9.8	16.2 - 15.5
43	14°25.8	14°28.1	13°46.3	4.3 - 4.1	10.3 - 9.9	16.3 - 15.6
44	14°26.0	14°28.4	13°46.5	4.4 - 4.2	10.4 - 10.0	16.4 - 15.7
45	14°26.3	14°28.6	13°46.8	4.5 - 4.3	10.5 - 10.1	16.5 - 15.8
46	14°26.5	14°28.9	13°47.0	4.6 - 4.4	10.6 - 10.2	16.6 - 15.9
47	14°26.7	14°29.1	13°47.3	4.7 - 4.5	10.7 - 10.3	16.7 - 16.0
48	14°27.0	14°29.4	13°47.5	4.8 - 4.6	10.8 - 10.4	16.8 - 16.1
49	14°27.3	14°29.6	13°47.7	4.9 - 4.7	10.9 - 10.4	16.9 - 16.2
50	14°27.5	14°29.9	13°48.0	5.0 - 4.8	11.0 - 10.5	17.0 - 16.3
51	14°27.8	14°30.1	13°48.2	5.1 - 4.9	11.1 - 10.6	17.1 - 16.4
52	14°28.0	14°30.4	13°48.5	5.2 - 5.0	11.2 - 10.7	17.2 - 16.5
53	14°28.2	14°30.6	13°48.7	5.3 - 5.1	11.3 - 10.8	17.3 - 16.6
54	14°28.5	14°30.9	13°48.9	5.4 - 5.2	11.4 - 10.9	17.4 - 16.7
55	14°28.7	14°31.1	13°49.2	5.5 - 5.3	11.5 - 11.0	17.5 - 16.8
56	14°29.0	14°31.4	13°49.4	5.6 - 5.4	11.6 - 11.1	17.6 - 16.9
57	14°29.3	14°31.6	13°49.7	5.7 - 5.5	11.7 - 11.2	17.7 - 17.0
58	14°29.5	14°31.9	13°49.9	5.8 - 5.6	11.8 - 11.3	17.8 - 17.1
59	14°29.8	14°32.1	13°50.1	5.9 - 5.7	11.9 - 11.4	17.9 - 17.2

m	Sun	Aries	Moon	v and d corr		
58	Plan.					
0	14°30.0	14°32.4	13°50.4	0.0 - 0.0	6.0 - 5.8	12.0 - 11.7
1	14°30.2	14°32.6	13°50.6	0.1 - 0.1	6.1 - 5.9	12.1 - 11.8
2	14°30.5	14°32.9	13°50.8	0.2 - 0.2	6.2 - 6.0	12.2 - 11.9
3	14°30.7	14°33.1	13°51.1	0.3 - 0.3	6.3 - 6.1	12.3 - 12.0
4	14°31.0	14°33.4	13°51.3	0.4 - 0.4	6.4 - 6.2	12.4 - 12.1
5	14°31.3	14°33.6	13°51.6	0.5 - 0.5	6.5 - 6.3	12.5 - 12.2
6	14°31.5	14°33.9	13°51.8	0.6 - 0.6	6.6 - 6.4	12.6 - 12.3
7	14°31.8	14°34.1	13°52.0	0.7 - 0.7	6.7 - 6.5	12.7 - 12.4
8	14°32.0	14°34.4	13°52.3	0.8 - 0.8	6.8 - 6.6	12.8 - 12.5
9	14°32.2	14°34.6	13°52.5	0.9 - 0.9	6.9 - 6.7	12.9 - 12.6
10	14°32.5	14°34.9	13°52.8	1.0 - 1.0	7.0 - 6.8	13.0 - 12.7
11	14°32.7	14°35.1	13°53.0	1.1 - 1.1	7.1 - 6.9	13.1 - 12.8
12	14°33.0	14°35.4	13°53.2	1.2 - 1.2	7.2 - 7.0	13.2 - 12.9
13	14°33.3	14°35.6	13°53.5	1.3 - 1.3	7.3 - 7.1	13.3 - 13.0
14	14°33.5	14°35.9	13°53.7	1.4 - 1.4	7.4 - 7.2	13.4 - 13.1
15	14°33.8	14°36.1	13°53.9	1.5 - 1.5	7.5 - 7.3	13.5 - 13.2
16	14°34.0	14°36.4	13°54.2	1.6 - 1.6	7.6 - 7.4	13.6 - 13.3
17	14°34.2	14°36.6	13°54.4	1.7 - 1.7	7.7 - 7.5	13.7 - 13.4
18	14°34.5	14°36.9	13°54.7	1.8 - 1.8	7.8 - 7.6	13.8 - 13.5
19	14°34.8	14°37.1	13°54.9	1.9 - 1.9	7.9 - 7.7	13.9 - 13.6
20	14°35.0	14°37.4	13°55.1	2.0 - 1.9	8.0 - 7.8	14.0 - 13.7
21	14°35.3	14°37.6	13°55.4	2.1 - 2.0	8.1 - 7.9	14.1 - 13.7
22	14°35.5	14°37.9	13°55.6	2.2 - 2.1	8.2 - 8.0	14.2 - 13.8
23	14°35.7	14°38.1	13°55.9	2.3 - 2.2	8.3 - 8.1	14.3 - 13.9
24	14°36.0	14°38.4	13°56.1	2.4 - 2.3	8.4 - 8.2	14.4 - 14.0
25	14°36.2	14°38.6	13°56.3	2.5 - 2.4	8.5 - 8.3	14.5 - 14.1
26	14°36.5	14°38.9	13°56.6	2.6 - 2.5	8.6 - 8.4	14.6 - 14.2
27	14°36.8	14°39.1	13°56.8	2.7 - 2.6	8.7 - 8.5	14.7 - 14.3
28	14°37.0	14°39.4	13°57.0	2.8 - 2.7	8.8 - 8.6	14.8 - 14.4
29	14°37.3	14°39.6	13°57.3	2.9 - 2.8	8.9 - 8.7	14.9 - 14.5
30	14°37.5	14°39.9	13°57.5	3.0 - 2.9	9.0 - 8.8	15.0 - 14.6
31	14°37.7	14°40.1	13°57.8	3.1 - 3.0	9.1 - 8.9	15.1 - 14.7
32	14°38.0	14°40.4	13°58.0	3.2 - 3.1	9.2 - 9.0	15.2 - 14.8
33	14°38.2	14°40.7	13°58.2	3.3 - 3.2	9.3 - 9.1	15.3 - 14.9
34	14°38.5	14°40.9	13°58.5	3.4 - 3.3	9.4 - 9.2	15.4 - 15.0
35	14°38.8	14°41.2	13°58.7	3.5 - 3.4	9.5 - 9.3	15.5 - 15.1
36	14°39.0	14°41.4	13°59.0	3.6 - 3.5	9.6 - 9.4	15.6 - 15.2
37	14°39.3	14°41.7	13°59.2	3.7 - 3.6	9.7 - 9.5	15.7 - 15.3
38	14°39.5	14°41.9	13°59.4	3.8 - 3.7	9.8 - 9.6	15.8 - 15.4
39	14°39.7	14°42.2	13°59.7	3.9 - 3.8	9.9 - 9.7	15.9 - 15.5
40	14°40.0	14°42.4	13°59.9	4.0 - 3.9	10.0 - 9.8	16.0 - 15.6
41	14°40.2	14°42.7	14°00.1	4.1 - 4.0	10.1 - 9.8	16.1 - 15.7
42	14°40.5	14°42.9	14°00.4	4.2 - 4.1	10.2 - 9.9	16.2 - 15.8
43	14°40.8	14°43.2	14°00.6	4.3 - 4.2	10.3 - 10.0	16.3 - 15.9
44	14°41.0	14°43.4	14°00.9	4.4 - 4.3	10.4 - 10.1	16.4 - 16.0
45	14°41.3	14°43.7	14°01.1	4.5 - 4.4	10.5 - 10.2	16.5 - 16.1
46	14°41.5	14°43.9	14°01.3	4.6 - 4.5	10.6 - 10.3	16.6 - 16.2
47	14°41.7	14°44.2	14°01.6	4.7 - 4.6	10.7 - 10.4	16.7 - 16.3
48	14°42.0	14°44.4	14°01.8	4.8 - 4.7	10.8 - 10.5	16.8 - 16.4
49	14°42.3	14°44.7	14°02.1	4.9 - 4.8	10.9 - 10.6	16.9 - 16.5
50	14°42.5	14°44.9	14°02.3	5.0 - 4.9	11.0 - 10.7	17.0 - 16.6
51	14°42.8	14°45.2	14°02.5	5.1 - 5.0	11.1 - 10.8	17.1 - 16.7
52	14°43.0	14°45.4	14°02.8	5.2 - 5.1	11.2 - 10.9	17.2 - 16.8
53	14°43.2	14°45.7	14°03.0	5.3 - 5.2	11.3 - 11.0	17.3 - 16.9
54	14°43.5	14°45.9	14°03.3	5.4 - 5.3	11.4 - 11.1	17.4 - 17.0
55	14°43.7	14°46.2	14°03.5	5.5 - 5.4	11.5 - 11.2	17.5 - 17.1
56	14°44.0	14°46.4	14°03.7	5.6 - 5.5	11.6 - 11.3	17.6 - 17.2
57	14°44.3	14°46.7	14°04.0	5.7 - 5.6	11.7 - 11.4	17.7 - 17.3
58	14°44.5	14°46.9	14°04.2	5.8 - 5.7	11.8 - 11.5	17.8 - 17.4
59	14°44.8	14°47.2	14°04.4	5.9 - 5.8	11.9 - 11.6	17.9 - 17.5

m	Sun	Aries	Moon	v and d corr		
59	Plan.					
0	14°45.0	14°47.4	14°04.7	0.0 - 0.0	6.0 - 6.0	12.0 - 11.9
1	14°45.2	14°47.7	14°04.9	0.1 - 0.1	6.1 - 6.0	12.1 - 12.0
2	14°45.5	14°47.9	14°05.2	0.2 - 0.2	6.2 - 6.1	12.2 - 12.1
3	14°45.7	14°48.2	14°05.4	0.3 - 0.3	6.3 - 6.2	12.3 - 12.2
4	14°46.0	14°48.4	14°05.6	0.4 - 0.4	6.4 - 6.3	12.4 - 12.3
5	14°46.3	14°48.7	14°05.9	0.5 - 0.5	6.5 - 6.4	12.5 - 12.4
6	14°46.5	14°48.9	14°06.1	0.6 - 0.6	6.6 - 6.5	12.6 - 12.5
7	14°46.8	14°49.2	14°06.4	0.7 - 0.7	6.7 - 6.6	12.7 - 12.6
8	14°47.0	14°49.4	14°06.6	0.8 - 0.8	6.8 - 6.7	12.8 - 12.7
9	14°47.2	14°49.7	14°06.8	0.9 - 0.9	6.9 - 6.8	12.9 - 12.8
10	14°47.5	14°49.9	14°07.1	1.0 - 1.0	7.0 - 6.9	13.0 - 12.9
11	14°47.7	14°50.2	14°07.3	1.1 - 1.1	7.1 - 7.0	13.1 - 13.0
12	14°48.0	14°50.4	14°07.5	1.2 - 1.2	7.2 - 7.1	13.2 - 13.1
13	14°48.3	14°50.7	14°07.8	1.3 - 1.3	7.3 - 7.2	13.3 - 13.2
14	14°48.5	14°50.9	14°08.0	1.4 - 1.4	7.4 - 7.3	13.4 - 13.3
15	14°48.8	14°51.2	14°08.3	1.5 - 1.5	7.5 - 7.4	13.5 - 13.4
16	14°49.0	14°51.4	14°08.5	1.6 - 1.6	7.6 - 7.5	13.6 - 13.5
17	14°49.2	14°51.7	14°08.7	1.7 - 1.7	7.7 - 7.6	13.7 - 13.6
18	14°49.5	14°51.9	14°09.0	1.8 - 1.8	7.8 - 7.7	13.8 - 13.7
19	14°49.8	14°52.2	14°09.2	1.9 - 1.9	7.9 - 7.8	13.9 - 13.8
20	14°50.0	14°52.4	14°09.5	2.0 - 2.0	8.0 - 7.9	14.0 - 13.9
21	14°50.3	14°52.7	14°09.7	2.1 - 2.1	8.1 - 8.0	14.1 - 14.0
22	14°50.5	14°52.9	14°09.9	2.2 - 2.2	8.2 - 8.1	14.2 - 14.1
23	14°50.7	14°53.2	14°10.2	2.3 - 2.3	8.3 - 8.2	14.3 - 14.2
24	14°51.0	14°53.4	14°10.4	2.4 - 2.4	8.4 - 8.3	14.4 - 14.3
25	14°51.2	14°53.7	14°10.6	2.5 - 2.5	8.5 - 8.4	14.5 - 14.4
26	14°51.5	14°53.9	14°10.9	2.6 - 2.6	8.6 - 8.5	14.6 - 14.5
27	14°51.8	14°54.2	14°11.1	2.7 - 2.7	8.7 - 8.6	14.7 - 14.6
28	14°52.0	14°54.4	14°11.4	2.8 - 2.8	8.8 - 8.7	14.8 - 14.7
29	14°52.3	14°54.7	14°11.6	2.9 - 2.9	8.9 - 8.8	14.9 - 14.8
30	14°52.5	14°54.9	14°11.8	3.0 - 3.0	9.0 - 8.9	15.0 - 14.9
31	14°52.7	14°55.2	14°12.1	3.1 - 3.1	9.1 - 9.0	15.1 - 15.0
32	14°53.0	14°55.4	14°12.3	3.2 - 3.2	9.2 - 9.1	15.2 - 15.1
33	14°53.2	14°55.7	14°12.6	3.3 - 3.3	9.3 - 9.2	15.3 - 15.2
34	14°53.5	14°55.9	14°12.8	3.4 - 3.4	9.4 - 9.3	15.4 - 15.3
35	14°53.8	14°56.2	14°13.0	3.5 - 3.5	9.5 - 9.4	15.5 - 15.4
36	14°54.0	14°56.4	14°13.3	3.6 - 3.6	9.6 - 9.5	15.6 - 15.5
37	14°54.3	14°56.7	14°13.5	3.7 - 3.7	9.7 - 9.6	15.7 - 15.6
38	14°54.5	14°56.9	14°13.8	3.8 - 3.8	9.8 - 9.7	15.8 - 15.7
39	14°54.7	14°57.2	14°14.0	3.9 - 3.9	9.9 - 9.8	15.9 - 15.8
40	14°55.0	14°57.4	14°14.2	4.0 - 4.0	10.0 - 9.9	16.0 - 15.9
41	14°55.2	14°57.7	14°14.5	4.1 - 4.1	10.1 - 10.0	16.1 - 16.0
42	14°55.5	14°57.9	14°14.7	4.2 - 4.2	10.2 - 10.1	16.2 - 16.1
43	14°55.8	14°58.2	14°14.9	4.3 - 4.3	10.3 - 10.2	16.3 - 16.2
44	14°56.0	14°58.4	14°15.2	4.4 - 4.4	10.4 - 10.3	16.4 - 16.3
45	14°56.3	14°58.7	14°15.4	4.5 - 4.5	10.5 - 10.4	16.5 - 16.4
46	14°56.5	14°59.0	14°15.7	4.6 - 4.6	10.6 - 10.5	16.6 - 16.5
47	14°56.7	14°59.2	14°15.9	4.7 - 4.7	10.7 - 10.6	16.7 - 16.6
48	14°57.0	14°59.5	14°16.1	4.8 - 4.8	10.8 - 10.7	16.8 - 16.7
49	14°57.3	14°59.7	14°16.4	4.9 - 4.9	10.9 - 10.8	16.9 - 16.8
50	14°57.5	15°00.0	14°16.6	5.0 - 5.0	11.0 - 10.9	17.0 - 16.9
51	14°57.8	15°00.2	14°16.9	5.1 - 5.1	11.1 - 11.0	17.1 - 17.0
52	14°58.0	15°00.5	14°17.1	5.2 - 5.2	11.2 - 11.1	17.2 - 17.1
53	14°58.2	15°00.7	14°17.3	5.3 - 5.3	11.3 - 11.2	17.3 - 17.2
54	14°58.5	15°01.0	14°17.6	5.4 - 5.4	11.4 - 11.3	17.4 - 17.3
55	14°58.7	15°01.2	14°17.8	5.5 - 5.5	11.5 - 11.4	17.5 - 17.4
56	14°59.0	15°01.5	14°18.0	5.6 - 5.6	11.6 - 11.5	17.6 - 17.5
57	14°59.3	15°01.7	14°18.3	5.7 - 5.7	11.7 - 11.6	17.7 - 17.6
58	14°59.5	15°02.0	14°18.5	5.8 - 5.8	11.8 - 11.7	17.8 - 17.7
59	14°59.8	15°02.2	14°18.8	5.9 - 5.9	11.9 - 11.8	17.9 - 17.8

Conversion of Arc to Time

0° - 59°		
°	h	m
0	0	00
1	0	04
2	0	08
3	0	12
4	0	16
5	0	20
6	0	24
7	0	28
8	0	32
9	0	36
10	0	40
11	0	44
12	0	48
13	0	52
14	0	56
15	1	00
16	1	04
17	1	08
18	1	12
19	1	16
20	1	20
21	1	24
22	1	28
23	1	32
24	1	36
25	1	40
26	1	44
27	1	48
28	1	52
29	1	56
30	2	00
31	2	04
32	2	08
33	2	12
34	2	16
35	2	20
36	2	24
37	2	28
38	2	32
39	2	36
40	2	40
41	2	44
42	2	48
43	2	52
44	2	56
45	3	00
46	3	04
47	3	08
48	3	12
49	3	16
50	3	20
51	3	24
52	3	28
53	3	32
54	3	36
55	3	40
56	3	44
57	3	48
58	3	52
59	3	56
60	4	00

60° - 119°		
°	h	m
60	4	00
61	4	04
62	4	08
63	4	12
64	4	16
65	4	20
66	4	24
67	4	28
68	4	32
69	4	36
70	4	40
71	4	44
72	4	48
73	4	52
74	4	56
75	5	00
76	5	04
77	5	08
78	5	12
79	5	16
80	5	20
81	5	24
82	5	28
83	5	32
84	5	36
85	5	40
86	5	44
87	5	48
88	5	52
89	5	56
90	6	00
91	6	04
92	6	08
93	6	12
94	6	16
95	6	20
96	6	24
97	6	28
98	6	32
99	6	36
100	6	40
101	6	44
102	6	48
103	6	52
104	6	56
105	7	00
106	7	04
107	7	08
108	7	12
109	7	16
110	7	20
111	7	24
112	7	28
113	7	32
114	7	36
115	7	40
116	7	44
117	7	48
118	7	52
119	7	56
120	8	00

120° - 179°		
°	h	m
120	8	00
121	8	04
122	8	08
123	8	12
124	8	16
125	8	20
126	8	24
127	8	28
128	8	32
129	8	36
130	8	40
131	8	44
132	8	48
133	8	52
134	8	56
135	9	00
136	9	04
137	9	08
138	9	12
139	9	16
140	9	20
141	9	24
142	9	28
143	9	32
144	9	36
145	9	40
146	9	44
147	9	48
148	9	52
149	9	56
150	10	00
151	10	04
152	10	08
153	10	12
154	10	16
155	10	20
156	10	24
157	10	28
158	10	32
159	10	36
160	10	40
161	10	44
162	10	48
163	10	52
164	10	56
165	11	00
166	11	04
167	11	08
168	11	12
169	11	16
170	11	20
171	11	24
172	11	28
173	11	32
174	11	36
175	11	40
176	11	44
177	11	48
178	11	52
179	11	56
180	12	00

180° - 239°		
°	h	m
180	12	00
181	12	04
182	12	08
183	12	12
184	12	16
185	12	20
186	12	24
187	12	28
188	12	32
189	12	36
190	12	40
191	12	44
192	12	48
193	12	52
194	12	56
195	13	00
196	13	04
197	13	08
198	13	12
199	13	16
200	13	20
201	13	24
202	13	28
203	13	32
204	13	36
205	13	40
206	13	44
207	13	48
208	13	52
209	13	56
210	14	00
211	14	04
212	14	08
213	14	12
214	14	16
215	14	20
216	14	24
217	14	28
218	14	32
219	14	36
220	14	40
221	14	44
222	14	48
223	14	52
224	14	56
225	15	00
226	15	04
227	15	08
228	15	12
229	15	16
230	15	20
231	15	24
232	15	28
233	15	32
234	15	36
235	15	40
236	15	44
237	15	48
238	15	52
239	15	56
240	16	00

240° - 299°		
°	h	m
240	16	00
241	16	04
242	16	08
243	16	12
244	16	16
245	16	20
246	16	24
247	16	28
248	16	32
249	16	36
250	16	40
251	16	44
252	16	48
253	16	52
254	16	56
255	17	00
256	17	04
257	17	08
258	17	12
259	17	16
260	17	20
261	17	24
262	17	28
263	17	32
264	17	36
265	17	40
266	17	44
267	17	48
268	17	52
269	17	56
270	18	00
271	18	04
272	18	08
273	18	12
274	18	16
275	18	20
276	18	24
277	18	28
278	18	32
279	18	36
280	18	40
281	18	44
282	18	48
283	18	52
284	18	56
285	19	00
286	19	04
287	19	08
288	19	12
289	19	16
290	19	20
291	19	24
292	19	28
293	19	32
294	19	36
295	19	40
296	19	44
297	19	48
298	19	52
299	19	56
300	20	00

300° - 360°		
°	h	m
300	20	00
301	20	04
302	20	08
303	20	12
304	20	16
305	20	20
306	20	24
307	20	28
308	20	32
309	20	36
310	20	40
311	20	44
312	20	48
313	20	52
314	20	56
315	21	00
316	21	04
317	21	08
318	21	12
319	21	16
320	21	20
321	21	24
322	21	28
323	21	32
324	21	36
325	21	40
326	21	44
327	21	48
328	21	52
329	21	56
330	22	00
331	22	04
332	22	08
333	22	12
334	22	16
335	22	20
336	22	24
337	22	28
338	22	32
339	22	36
340	22	40
341	22	44
342	22	48
343	22	52
344	22	56
345	23	00
346	23	04
347	23	08
348	23	12
349	23	16
350	23	20
351	23	24
352	23	28
353	23	32
354	23	36
355	23	40
356	23	44
357	23	48
358	23	52
359	23	56
360	24	00

0′ - 59′		
′	m	s
0	0	00
1	0	04
2	0	08
3	0	12
4	0	16
5	0	20
6	0	24
7	0	28
8	0	32
9	0	36
10	0	40
11	0	44
12	0	48
13	0	52
14	0	56
15	1	00
16	1	04
17	1	08
18	1	12
19	1	16
20	1	20
21	1	24
22	1	28
23	1	32
24	1	36
25	1	40
26	1	44
27	1	48
28	1	52
29	1	56
30	2	00
31	2	04
32	2	08
33	2	12
34	2	16
35	2	20
36	2	24
37	2	28
38	2	32
39	2	36
40	2	40
41	2	44
42	2	48
43	2	52
44	2	56
45	3	00
46	3	04
47	3	08
48	3	12
49	3	16
50	3	20
51	3	24
52	3	28
53	3	32
54	3	36
55	3	40
56	3	44
57	3	48
58	3	52
59	3	56
60	4	00

0″ - 59″	
″	s
0	0.00
1	0.07
2	0.13
3	0.20
4	0.27
5	0.33
6	0.40
7	0.47
8	0.53
9	0.60
10	0.67
11	0.73
12	0.80
13	0.87
14	0.93
15	1.00
16	1.07
17	1.13
18	1.20
19	1.27
20	1.33
21	1.40
22	1.47
23	1.53
24	1.60
25	1.67
26	1.73
27	1.80
28	1.87
29	1.93
30	2.00
31	2.07
32	2.13
33	2.20
34	2.27
35	2.33
36	2.40
37	2.47
38	2.53
39	2.60
40	2.67
41	2.73
42	2.80
43	2.87
44	2.93
45	3.00
46	3.07
47	3.13
48	3.20
49	3.27
50	3.33
51	3.40
52	3.47
53	3.53
54	3.60
55	3.67
56	3.73
57	3.80
58	3.87
59	3.93
60	4.00

h= hours of time **m**= minutes of time **s** = seconds of time **′** = minutes of arc **″** = seconds of arc

Altitude Correction Tables for 10° to 90° — Sun, Stars, Planets

SUN
October – March

App. Alt.	Lower Limb	Upper Limb
° ′	′	′
9 33	+10.8	– 21.5
9 45	+10.9	– 21.4
9 56	+11.0	– 21.3
10 08	+11.1	– 21.2
10 20	+11.2	– 21.1
10 33	+11.3	– 21.0
10 46	+11.4	– 20.9
11 00	+11.5	– 20.8
11 15	+11.6	– 20.7
11 30	+11.7	– 20.6
11 45	+11.8	– 20.5
12 01	+11.9	– 20.4
12 18	+12.0	– 20.3
12 36	+12.1	– 20.2
12 54	+12.2	– 20.1
13 14	+12.3	– 20.0
13 34	+12.4	– 19.9
13 55	+12.5	– 19.8
14 17	+12.6	– 19.7
14 41	+12.7	– 19.6
15 05	+12.8	– 19.5
15 31	+12.9	– 19.4
15 59	+13.0	– 19.3
16 27	+13.1	– 19.2
16 58	+13.2	– 19.1
17 30	+13.3	– 19.0
18 05	+13.4	– 18.9
18 41	+13.5	– 18.8
19 20	+13.6	– 18.7
20 02	+13.7	– 18.6
20 46	+13.8	– 18.5
21 34	+13.9	– 18.4
22 25	+14.0	– 18.3
23 20	+14.1	– 18.2
24 20	+14.2	– 18.1
25 24	+14.3	– 18.0
26 34	+14.4	– 17.9
27 50	+14.5	– 17.8
29 13	+14.6	– 17.7
30 44	+14.7	– 17.6
32 24	+14.8	– 17.5
34 15	+14.9	– 17.4
36 17	+15.0	– 17.3
38 34	+15.1	– 17.2
41 06	+15.2	– 17.1
43 56	+15.3	– 17.0
47 07	+15.4	– 16.9
50 43	+15.5	– 16.8
54 46	+15.6	– 16.7
59 21	+15.7	– 16.6
64 28	+15.8	– 16.5
70 10	+15.9	– 16.4
76 24	+16.0	– 16.3
83 05	+16.1	– 16.2
90 00		

SUN
April – September

App. Alt.	Lower Limb	Upper Limb
° ′	′	′
9 39	+10.6	– 21.2
9 50	+10.7	– 21.1
10 02	+10.8	– 21.0
10 14	+10.9	– 20.9
10 27	+11.0	– 20.8
10 40	+11.1	– 20.7
10 53	+11.2	– 20.6
11 07	+11.3	– 20.5
11 22	+11.4	– 20.4
11 37	+11.5	– 20.3
11 53	+11.6	– 20.2
12 10	+11.7	– 20.1
12 27	+11.8	– 20.0
14 45	+11.9	– 19.9
13 04	+12.0	– 19.8
13 24	+12.1	– 19.7
13 44	+12.2	– 19.6
14 06	+12.3	– 19.5
14 29	+12.4	– 19.4
14 53	+12.5	– 19.3
15 18	+12.6	– 19.2
15 45	+12.7	– 19.1
16 13	+12.8	– 19.0
16 43	+12.9	– 18.9
17 14	+13.0	– 18.8
17 47	+13.1	– 18.7
18 23	+13.2	– 18.6
19 00	+13.3	– 18.5
19 41	+13.4	– 18.4
20 24	+13.5	– 18.3
21 10	+13.6	– 18.2
21 59	+13.7	– 18.1
22 52	+13.8	– 18.0
23 49	+13.9	– 17.9
24 51	+14.0	– 17.8
25 58	+14.1	– 17.7
27 11	+14.2	– 17.6
28 31	+14.3	– 17.5
29 58	+14.4	– 17.4
31 33	+14.5	– 17.3
33 18	+14.6	– 17.2
35 15	+14.7	– 17.1
37 24	+14.8	– 17.0
39 48	+14.9	– 16.9
42 28	+15.0	– 16.8
45 29	+15.1	– 16.7
48 52	+15.2	– 16.6
51 41	+15.3	– 16.5
56 59	+15.4	– 16.4
61 50	+15.5	– 16.3
67 15	+15.6	– 16.2
73 14	+15.7	– 16.1
79 42	+15.8	– 16.0
86 21	+15.9	– 15.9
90 00		

Stars & Planets

App. Alt.	Corr
° ′	′
9 55	– 5.3
10 07	– 5.2
10 20	– 5.1
10 32	– 5.0
10 46	– 4.9
10 59	– 4.8
11 14	– 4.7
11 29	– 4.6
11 44	– 4.5
12 00	– 4.4
12 17	– 4.3
12 35	– 4.2
12 53	– 4.1
13 12	– 4.0
13 32	– 3.9
13 53	– 3.8
14 16	– 3.7
14 39	– 3.6
15 03	– 3.5
15 29	– 3.4
15 56	– 3.3
16 25	– 3.2
16 55	– 3.1
17 27	– 3.0
18 01	– 2.9
18 37	– 2.8
19 16	– 2.7
19 56	– 2.6
20 40	– 2.5
21 27	– 2.4
22 17	– 2.3
23 11	– 2.2
24 09	– 2.1
25 12	– 2.0
26 20	– 1.9
27 34	– 1.8
28 54	– 1.7
30 22	– 1.6
31 58	– 1.5
33 43	– 1.4
35 38	– 1.3
37 45	– 1.2
40 06	– 1.1
42 42	– 1.0
45 34	– 0.9
48 45	– 0.8
52 16	– 0.7
56 09	– 0.6
60 26	– 0.5
65 06	– 0.4
70 09	– 0.3
75 32	– 0.2
81 12	– 0.1
87 03	0.0
90 00	

Additional Altitude Correction for Mars & Venus

A small additional altitude correction for Mars & Venus can be obtained in the Daily Pages of The Nautical Almanac for the day of the observation.

Find the correction in the block labeled **Horizontal parallax**.

The figure will cover the range of 3 days found on that Daily Page.

The correction is to be added to Apparent Altitude.

Refraction

App. Alt.	Corr
°	′
5.5	– 9.1
6.0	– 8.5
6.5	– 7.9
7.0	– 7.5
7.5	– 7.0
8.0	– 6.6
8.5	– 6.3
9.0	– 5.9
9.5	– 5.7
10.0	– 5.4
10.5	– 5.1
11.0	– 4.9
11.5	– 4.7
12.0	– 4.5
12.5	– 4.4
13.0	– 4.2
13.5	– 4.0
14.0	– 3.9
14.5	– 3.8
15.0	– 3.6
15.5	– 3.5
16.0	– 3.4
16.5	– 3.3
17.0	– 3.2
17.5	– 3.1
18.0	– 3.0
18.5	– 2.9
19.0	– 2.9
19.5	– 2.8
20.0	– 2.7
21.0	– 2.6
22.0	– 2.4
23.0	– 2.3
24.0	– 2.2
25.0	– 2.1
26.0	– 2.0
27.0	– 1.9
28.0	– 1.9
29.0	– 1.8
30.0	– 1.7
31.0	– 1.7
32.0	– 1.6
33.0	– 1.5
34.0	– 1.5
35.0	– 1.4
36.0	– 1.4
37.0	– 1.3
38.0	– 1.3
39.0	– 1.2
40.0	– 1.2
45.0	– 1.0
50.0	– 0.8
55.0	– 0.7
60.0	– 0.6
65.0	– 0.5
70.0	– 0.4
75.0	– 0.3
80.0	– 0.2
85.0	– 0.1

DIP
always subtracted from Hs

Ht. of Eye	Corr	Ht. of Eye	Ht. of Eye	Corr
meters	′	**feet**	**meters**	′
2.4	**– 2.8**	8.0	1.0	**– 1.8**
2.6	**– 2.9**	8.6	1.5	**– 2.2**
2.8	**– 3.0**	9.2	2.0	**– 2.5**
3.0	**– 3.1**	9.8	2.5	**– 2.8**
3.2	**– 3.2**	10.5	3.0	**– 3.0**
3.4	**– 3.3**	11.2	See table ←	
3.6	**– 3.4**	11.9		
3.8	**– 3.5**	12.6	**meters**	
4.0	**– 3.6**	13.3	20	**– 7.9**
4.3	**– 3.7**	14.1	22	**– 8.3**
4.5	**– 3.8**	14.9	24	**– 8.6**
4.7	**– 3.9**	15.7	26	**– 9.0**
5.0	**– 4.0**	16.5	28	**– 9.3**
5.2	**– 4.1**	17.4		
5.5	**– 4.2**	18.3	30	**– 9.6**
5.8	**– 4.3**	19.1	32	**– 10.0**
6.1	**– 4.4**	20.1	34	**– 10.3**
6.3	**– 4.5**	21.0	36	**– 10.6**
6.6	**– 4.6**	22.0	38	**– 10.8**
6.9	**– 4.7**	22.9		
7.2	**– 4.8**	23.9	40	**– 11.1**
7.5	**– 4.9**	24.9	42	**– 11.4**
7.9	**– 5.0**	26.0	44	**– 11.7**
8.2	**– 5.1**	27.1	46	**– 11.9**
8.5	**– 5.2**	28.1	48	**– 12.2**
8.8	**– 5.3**	29.2	**feet**	′
9.2	**– 5.4**	30.4	2	**– 1.4**
9.5	**– 5.5**	31.5	4	**– 1.9**
9.9	**– 5.6**	32.7	6	**– 2.4**
10.3	**– 5.7**	33.9	8	**– 2.7**
10.6	**– 5.8**	35.1	10	**– 3.1**
11.0	**– 5.9**	36.3	See table ←	
11.4	**– 6.0**	37.6		
11.8	**– 6.1**	38.9	**feet**	′
12.2	**– 6.2**	40.1	70	**– 8.1**
12.6	**– 6.3**	41.5	75	**– 8.4**
13.0	**– 6.4**	42.8	80	**– 8.7**
13.4	**– 6.5**	44.2	85	**– 8.9**
13.8	**– 6.6**	45.5	90	**– 9.2**
14.2	**– 6.7**	46.9	95	**9.5**
14.7	**– 6.8**	48.4		
15.1	**– 6.9**	49.8	100	**– 9.7**
15.5	**– 7.0**	51.3	105	**– 9.9**
16.0	**– 7.1**	52.8	110	**– 10.2**
16.5	**– 7.2**	54.3	115	**– 10.4**
16.9	**– 7.3**	55.8	120	**– 10.6**
17.4	**– 7.4**	57.4	125	**– 10.8**
17.9	**– 7.5**	58.9	130	**– 11.1**
18.4	**– 7.6**	60.5	135	**– 11.3**
18.8	**– 7.7**	62.1	140	**– 11.5**
19.3	**– 7.8**	63.8	145	**– 11.7**
19.8	**– 7.9**	65.4	150	**– 11.9**
20.4	**– 8.0**	67.1	155	**– 12.1**
20.9	**– 8.1**	68.8		
21.4		70.5		

App. Alt. = Apparent altitude = Sextant altitude corrected for index error and dip.

Altitude Correction Tables for 0° to 10° — Sun, Stars, Planets

App. Alt.	Sun October – March Lower Limb	Sun October – March Upper Limb	Sun April – September Lower Limb	Sun April – September Upper Limb	Stars & Planets
° ′	′	′	′	′	′
0 00	– 17.5	– 49.8	– 17.8	– 49.6	– 33.8
0 03	16.9	49.2	17.2	49.0	33.2
0 06	16.3	48.6	16.6	48.4	32.6
0 09	15.7	48.0	16.0	47.8	32.0
0 12	15.2	47.5	15.4	47.2	31.5
0 15	14.6	46.9	14.8	46.6	30.9
0 18	– 14.1	– 46.4	– 14.3	– 46.1	– 30.4
0 21	13.5	45.8	13.8	33.8	29.8
0 24	13.0	45.3	13.3	45.1	29.3
0 27	12.5	44.8	12.8	44.6	28.8
0 30	12.0	44.3	12.3	44.1	28.3
0 33	11.6	43.9	11.8	43.6	27.9
0 36	– 11.1	– 10.0	– 11.3	– 43.1	– 27.4
0 39	10.6	42.9	10.9	42.7	26.9
0 42	10.2	42.5	10.5	42.3	26.5
0 45	9.8	42.1	10.0	41.8	26.1
0 48	9.4	41.7	9.6	41.4	25.7
0 51	9.0	41.3	9.2	41.0	25.3
0 54	– 8.6	– 40.9	– 8.8	– 40.6	– 24.9
0 57	8.2	40.5	8.4	40.2	24.5
1 00	7.8	40.1	8.0	39.8	24.1
1 03	7.4	39.7	7.7	39.5	23.7
1 06	7.1	39.4	7.3	39.1	23.4
1 09	6.7	39.0	7.0	38.8	23.0
1 12	– 6.4	– 38.7	– 6.6	– 38.4	– 22.7
1 15	6.0	38.3	6.3	38.1	22.3
1 18	5.7	38.0	6.0	37.8	22.0
1 21	5.4	37.7	5.7	37.5	21.7
1 24	5.1	37.4	5.3	37.1	21.4
1 27	4.8	37.1	5.0	33.8	21.1
1 30	– 4.5	– 36.8	– 4.7	– 36.5	– 20.8
1 35	4.0	36.3	4.3	36.1	20.3
1 40	3.6	35.9	3.8	35.6	19.9
1 45	3.1	35.4	3.4	35.2	19.4
1 50	2.7	35.0	2.9	34.7	19.0
1 55	2.3	34.6	2.5	34.3	18.6
2 00	– 1.9	– 34.2	– 2.1	– 33.9	– 18.2
2 05	1.5	33.8	1.7	33.5	17.8
2 10	1.1	33.4	1.4	33.2	17.4
2 15	0.8	33.1	1.0	32.8	17.1
2 20	0.4	32.7	0.7	32.5	16.7
2 25	– 0.1	32.4	– 0.3	32.1	16.4
2 30	+ 0.2	– 32.1	0.0	– 31.8	– 16.1
2 35	0.5	31.8	+ 0.3	31.5	15.8
2 40	0.8	31.5	0.6	31.2	15.4
2 45	1.1	31.2	0.9	30.9	15.2
2 50	1.4	30.9	1.2	30.6	14.9
2 55	1.7	30.6	1.4	30.4	14.9
3 00	+ 2.0	– 30.3	+ 1.7	– 30.1	– 14.3
3 05	2.2	30.1	2.0	29.8	14.1
3 10	2.5	29.8	2.2	29.6	13.8
3 15	2.7	29.6	2.5	29.3	13.6
3 20	2.9	29.4	2.7	29.1	13.4
3 25	3.2	29.1	2.9	28.9	13.4
3 30	3.4	– 28.9	+ 3.1	– 28.7	– 12.9

App. Alt.	Sun October – March Lower Limb	Sun October – March Upper Limb	Sun April – September Lower Limb	Sun April – September Upper Limb	Stars & Planets
° ′	′	′	′	′	′
3 30	+ 3.4	– 28.9	+ 3.1	– 28.7	– 12.9
3 35	3.6	28.7	3.3	28.5	12.7
3 40	3.8	28.5	3.6	28.2	12.5
3 45	4.0	28.3	3.8	28.0	12.3
3 50	4.2	28.1	4.0	27.8	12.1
3 55	4.4	27.9	4.1	27.7	11.9
4 00	+ 4.6	– 27.7	+ 4.3	– 27.5	– 11.7
4 05	4.8	27.5	4.5	27.3	11.5
4 10	4.9	27.4	4.7	27.1	11.4
4 15	5.1	27.2	4.9	26.9	11.2
4 20	5.3	27.0	5.0	26.8	11.0
4 25	5.4	26.9	5.2	26.6	10.9
4 30	+ 5.6	– 26.7	+ 5.3	– 26.5	– 10.7
4 35	5.7	26.6	5.5	26.3	10.6
4 40	5.9	26.4	5.6	26.2	10.4
4 45	6.0	26.3	5.8	26.0	10.3
4 50	6.2	26.1	5.9	25.9	10.1
4 55	6.3	26.0	6.1	25.7	10.0
5 00	+ 6.4	– 25.9	+ 6.2	– 25.6	– 9.9
5 05	6.6	25.7	6.3	25.5	9.7
5 10	6.7	25.6	6.5	25.3	9.6
5 15	6.8	25.5	6.6	25.2	9.5
5 20	7.0	25.3	6.7	25.1	9.3
5 25	7.1	25.2	6.8	25.0	9.2
5 30	+ 7.2	– 25.1	+ 6.9	– 24.9	– 9.1
5 35	7.3	25.0	7.1	24.7	9.0
5 40	7.4	24.9	7.2	24.6	8.9
5 45	7.5	24.8	7.3	24.5	8.8
5 50	7.6	24.7	7.4	24.4	8.7
5 55	7.7	24.6	7.5	24.3	8.6
6 00	+ 7.8	– 24.5	+ 7.6	– 24.2	– 8.5
6 10	8.0	24.3	7.8	24.0	8.3
6 20	8.2	24.1	8.0	23.8	8.1
6 30	8.4	23.9	8.2	23.6	7.9
6 40	8.6	23.7	8.3	23.5	7.7
6 50	8.7	23.6	8.5	23.3	7.6
7 00	+ 8.9	– 23.4	+ 8.7	– 23.1	– 7.4
7 10	9.1	23.2	8.8	23.0	7.2
7 20	9.2	23.1	9.0	22.8	7.1
7 30	9.3	23.0	9.1	22.7	6.9
7 40	9.5	22.8	9.2	22.6	6.8
7 50	9.6	22.7	9.4	22.4	6.7
8 00	+ 9.7	– 22.6	+ 9.5	– 22.3	– 6.6
8 10	9.9	22.4	9.6	22.2	6.4
8 20	10.0	22.3	9.7	22.1	6.3
8 30	10.1	22.2	9.9	21.9	6.2
8 40	10.2	22.1	10.0	21.8	6.1
8 50	10.3	22.0	10.1	21.7	6.0
9 00	+ 10.4	– 21.9	+ 10.2	– 21.6	– 5.9
9 10	10.5	21.8	10.3	21.5	5.8
9 20	10.6	21.7	10.4	21.4	5.7
9 30	10.7	21.6	10.5	21.3	5.6
9 40	10.8	21.5	10.6	21.2	5.5
9 50	10.9	21.4	10.6	21.2	5.4
10 00	+ 11.0	– 21.3	+ 10.7	– 21.1	– 5.3

For bubble sextant observations- ignore dip and use star corrections for the Sun, planets and stars.

ALTITUDE CORRECTION TABLES 0° – 35° — MOON

App. Alt.	0° – 4°		5° – 9°		10° – 14°		15° – 19°		20° – 24°		25° – 29°		30° – 34°		App. Alt.
	Corrⁿ		Corrⁿ		Corrⁿ		Corrⁿ		Corrⁿ		Corrⁿ		Corrⁿ		
'	'		'		'		'		'		'		'		'
	0°		5°		10°		15°		20°		25°		30°		
00	34.5		58.2		62.1		62.8		62.2		60.8		58.9		00
10	36.5		58.5		62.2		62.8		62.2		60.8		58.8		10
20	38.3		58.7		62.2		62.8		62.1		60.7		58.8		20
30	40.0		58.9		62.3		62.8		62.1		60.7		58.7		30
40	41.5		59.1		62.3		62.8		62.0		60.6		58.6		40
50	42.9		59.3		62.4		62.7		62.0		60.6		58.5		50
	1°		6°		11°		16°		21°		26°		31°		
00	44.2		59.5		62.4		62.7		62.0		60.5		58.5		00
10	45.4		59.7		62.4		62.7		61.9		60.4		58.4		10
20	46.5		59.9		62.5		62.7		61.9		60.4		58.3		20
30	47.5		60.0		62.5		62.7		61.9		60.3		58.2		30
40	48.4		60.2		62.5		62.7		61.8		60.3		58.2		40
50	49.3		60.3		62.6		62.7		61.8		60.2		58.1		50
	2°		7°		12°		17°		22°		27°		32°		
00	50.1		60.5		62.6		62.7		61.7		60.1		58.0		00
10	50.8		60.6		62.6		62.6		61.7		60.1		57.9		10
20	51.5		60.7		62.6		62.6		61.6		60.0		57.8		20
30	52.2		60.9		62.7		62.6		61.6		59.9		57.8		30
40	52.8		61.0		62.7		62.6		61.6		59.9		57.7		40
50	53.4		61.1		62.7		62.6		61.5		59.8		57.6		50
	3°		8°		13°		18°		23°		28°		33°		
00	53.9		61.2		62.7		62.5		61.5		59.7		57.5		00
10	54.4		61.3		62.7		62.5		61.4		59.7		57.4		10
20	54.9		61.4		62.7		62.5		61.4		59.6		57.4		20
30	55.3		61.5		62.8		62.5		61.3		59.5		57.3		30
40	55.7		61.6		62.8		62.4		61.3		59.5		57.2		40
50	56.1		61.6		62.8		62.4		61.2		59.4		57.1		50
	4°		9°		14°		19°		24°		29°		34°		
00	56.4		61.7		62.8		62.4		61.2		59.3		57.0		00
10	56.8		61.8		62.8		62.4		61.1		59.3		56.9		10
20	57.1		61.9		62.8		62.3		61.1		59.2		56.9		20
30	57.4		61.9		62.8		62.3		61.0		59.1		56.8		30
40	57.7		62.0		62.8		62.3		61.0		59.1		56.7		40
50	58.0		62.1		62.8		62.2		60.9		59.0		56.6		50
HP	L	U	L	U	L	U	L	U	L	U	L	U	L	U	HP
'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'
54.0	0.3	0.9	0.3	0.9	0.4	1.0	0.5	1.1	0.6	1.2	0.7	1.3	0.9	1.5	54.0
54.3	0.7	1.1	0.7	1.2	0.8	1.2	0.8	1.3	0.9	1.4	1.1	1.5	1.2	1.7	54.3
54.6	1.1	1.4	1.1	1.4	1.1	1.4	1.2	1.5	1.3	1.6	1.4	1.7	1.5	1.8	54.6
54.9	1.4	1.6	1.4	1.6	1.5	1.6	1.6	1.7	1.6	1.8	1.8	1.9	1.9	2.0	54.9
55.2	1.8	1.8	1.8	1.8	1.9	1.8	1.9	1.9	2.0	2.0	2.1	2.1	2.2	2.2	55.2
55.5	2.2	2.0	2.2	2.0	2.3	2.1	2.3	2.1	2.4	2.2	2.4	2.3	2.5	2.4	55.5
55.8	2.6	2.2	2.6	2.2	2.6	2.3	2.7	2.3	2.7	2.4	2.8	2.4	2.9	2.5	55.8
56.1	3.0	2.4	3.0	2.5	3.0	2.5	3.0	2.5	3.1	2.6	3.1	2.6	3.2	2.7	56.1
56.4	3.3	2.7	3.3	2.7	3.4	2.7	3.4	2.7	3.4	2.8	3.5	2.8	3.5	2.9	56.4
56.7	3.7	2.9	3.7	2.9	3.8	2.9	3.8	2.9	3.8	3.0	3.8	3.0	3.9	3.0	56.7
57.0	4.1	3.1	4.1	3.1	4.1	3.1	4.1	3.1	4.2	3.2	4.2	3.2	4.2	3.2	57.0
57.3	4.5	3.3	4.5	3.3	4.5	3.3	4.5	3.3	4.5	3.3	4.5	3.4	4.6	3.4	57.3
57.6	4.9	3.5	4.9	3.5	4.9	3.5	4.9	3.5	4.9	3.5	4.9	3.5	4.9	3.6	57.6
57.9	5.3	3.8	5.3	3.8	5.2	3.8	5.2	3.7	5.2	3.7	5.2	3.7	5.2	3.7	57.9
58.2	5.6	4.0	5.6	4.0	5.6	4.0	5.6	4.0	5.6	3.9	5.6	3.9	5.6	3.9	58.2
58.5	6.0	4.2	6.0	4.2	6.0	4.2	6.0	4.2	6.0	4.1	5.9	4.1	5.9	4.1	58.5
58.8	6.4	4.4	6.4	4.4	6.4	4.4	6.3	4.4	6.3	4.3	6.3	4.3	6.2	4.2	58.8
59.1	6.8	4.6	6.8	4.6	6.7	4.6	6.7	4.6	6.7	4.5	6.6	4.5	6.6	4.4	59.1
59.4	7.2	4.8	7.1	4.8	7.1	4.8	7.1	4.8	7.0	4.7	7.0	4.7	6.9	4.6	59.4
59.7	7.5	5.1	7.5	5.0	7.5	5.0	7.5	5.0	7.4	4.9	7.3	4.8	7.2	4.8	59.7
60.0	7.9	5.3	7.9	5.3	7.9	5.2	7.8	5.2	7.8	5.1	7.7	5.0	7.6	4.9	60.0
60.3	8.3	5.5	8.3	5.5	8.2	5.4	8.2	5.4	8.1	5.3	8.0	5.2	7.9	5.1	60.3
60.6	8.7	5.7	8.7	5.7	8.6	5.7	8.6	5.6	8.5	5.5	8.4	5.4	8.2	5.3	60.6
60.9	9.1	5.9	9.0	5.9	9.0	5.9	8.9	5.8	8.8	5.7	8.7	5.6	8.6	5.4	60.9
61.2	9.5	6.2	9.4	6.1	9.4	6.1	9.3	6.0	9.2	5.9	9.1	5.8	8.9	5.6	61.2
61.5	9.8	6.4	9.8	6.3	9.7	6.3	9.7	6.2	9.5	6.1	9.4	5.9	9.2	5.8	61.5

DIP					
Ht. of Eye	Corrⁿ	Ht. of Eye	Ht. of Eye	Corrⁿ	Ht. of Eye
m	'	ft	m	'	ft
2.4	-2.8	7.9	9.5	-5.5	31.2
2.6	-2.9	8.5	9.9	-5.6	32.5
2.8	-3.0	9.2	10.3	-5.7	33.8
3.0	-3.1	9.8	10.6	-5.8	34.8
3.2	-3.2	10.5	11.0	-5.9	36.1
3.4	-3.3	11.2	11.4	-6.0	37.4
3.6	-3.4	11.8	11.8	-6.1	38.7
3.8	-3.5	12.5	12.2	-6.2	40.0
4.0	-3.6	13.1	12.6	-6.3	41.3
4.3	-3.7	14.1	13.0	-6.4	42.7
4.5	-3.8	14.8	13.4	-6.5	44.0
4.7	-3.9	15.4	13.8	-6.6	45.3
5.0	-4.0	16.4	14.2	-6.7	46.6
5.2	-4.1	17.1	14.7	-6.8	48.2
5.5	-4.2	18.0	15.1	-6.9	49.5
5.8	-4.3	19.0	15.5	-7.0	50.9
6.1	-4.4	20.0	16.0	-7.1	52.5
6.3	-4.5	20.7	16.5	-7.2	54.1
6.6	-4.6	21.7	16.9	-7.3	55.4
6.9	-4.7	22.6	17.4	-7.4	57.1
7.2	-4.8	23.6	17.9	-7.5	58.7
7.5	-4.9	24.6	18.4	-7.6	60.4
7.9	-5.0	25.9	18.8	-7.7	61.7
8.2	-5.1	26.9	19.3	-7.8	63.3
8.5	-5.2	27.9	19.8	-7.9	65.0
8.8	-5.3	28.9	20.4	-8.0	66.9
9.2	-5.4	30.2	20.9	-8.1	68.6
9.5		31.2	21.4		70.2

MOON CORRECTION TABLE

The correction is in two parts; the first correction is taken from the upper part of the table with argument apparent altitude, and the second from the lower part, with argument HP, in the same column as that from which the first correction was taken. Separate corrections are given in the lower part for lower (L) and upper (U) limbs. All corrections are to be **added** to apparent altitude, *but* 30' *is to be subtracted from the altitude of the upper limb.*

For corrections for pressure and temperature see page A4.

For bubble sextant observations ignore dip, take the mean of upper and lower limb corrections and subtract 15' from the altitude.

App. Alt. = Apparent altitude = Sextant altitude corrected for index error and dip.

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ALTITUDE CORRECTION TABLES 35° – 90° — MOON

App. Alt.	35° – 39°		40° – 44°		45° – 49°		50° – 54°		55° – 59°		60° – 64°		65° – 69°		70° – 74°		75° – 79°		80° – 84°		85° – 89°		App. Alt.
	Corrⁿ		Corrⁿ		Corrⁿ		Corrⁿ		Corrⁿ		Corrⁿ		Corrⁿ		Corrⁿ		Corrⁿ		Corrⁿ		Corrⁿ		
'	35°	'	40°	'	45°	'	50°	'	55°	'	60°	'	65°	'	70°	'	75°	'	80°	'	85°	'	'
00		56.5		53.7		50.5		46.9		43.1		38.9		34.6		30.0		25.3		20.5		15.6	00
10		56.4		53.6		50.4		46.8		42.9		38.8		34.4		29.9		25.2		20.4		15.5	10
20		56.3		53.5		50.2		46.7		42.8		38.7		34.3		29.7		25.0		20.2		15.3	20
30		56.2		53.4		50.1		46.5		42.7		38.5		34.1		29.6		24.9		20.0		15.1	30
40		56.2		53.3		50.0		46.4		42.5		38.4		34.0		29.4		24.7		19.9		15.0	40
50		56.1		53.2		49.9		46.3		42.4		38.2		33.8		29.3		24.5		19.7		14.8	50
	36°		41°		46°		51°		56°		61°		66°		71°		76°		81°		86°		
00		56.0		53.1		49.8		46.2		42.3		38.1		33.7		29.1		24.4		19.6		14.6	00
10		55.9		53.0		49.7		46.0		42.1		37.9		33.5		29.0		24.2		19.4		14.5	10
20		55.8		52.9		49.5		45.9		42.0		37.8		33.4		28.8		24.1		19.2		14.3	20
30		55.7		52.8		49.4		45.8		41.9		37.7		33.2		28.7		23.9		19.1		14.2	30
40		55.6		52.6		49.3		45.7		41.7		37.5		33.1		28.5		23.8		18.9		14.0	40
50		55.5		52.5		49.2		45.5		41.6		37.4		32.9		28.3		23.6		18.7		13.8	50
	37°		42°		47°		52°		57°		62°		67°		72°		77°		82°		87°		
00		55.4		52.4		49.1		45.4		41.4		37.2		32.8		28.2		23.4		18.6		13.7	00
10		55.3		52.3		49.0		45.3		41.3		37.1		32.6		28.0		23.3		18.4		13.5	10
20		55.2		52.2		48.8		45.2		41.2		36.9		32.5		27.9		23.1		18.2		13.3	20
30		55.1		52.1		48.7		45.0		41.0		36.8		32.3		27.7		22.9		18.1		13.2	30
40		55.0		52.0		48.6		44.9		40.9		36.6		32.2		27.6		22.8		17.9		13.0	40
50		55.0		51.9		48.5		44.8		40.8		36.5		32.0		27.4		22.6		17.8		12.8	50
	38°		43°		48°		53°		58°		63°		68°		73°		78°		83°		88°		
00		54.9		51.8		48.4		44.6		40.6		36.4		31.9		27.2		22.5		17.6		12.7	00
10		54.8		51.7		48.3		44.5		40.5		36.2		31.7		27.1		22.3		17.4		12.5	10
20		54.7		51.6		48.1		44.4		40.3		36.1		31.6		26.9		22.1		17.3		12.3	20
30		54.6		51.5		48.0		44.2		40.2		35.9		31.4		26.8		22.0		17.1		12.2	30
40		54.5		51.4		47.9		44.1		40.1		35.8		31.3		26.6		21.8		16.9		12.0	40
50		54.4		51.2		47.8		44.0		39.9		35.6		31.1		26.5		21.7		16.8		11.8	50
	39°		44°		49°		54°		59°		64°		69°		74°		79°		84°		89°		
00		54.3		51.1		47.7		43.9		39.8		35.5		31.0		26.3		21.5		16.6		11.7	00
10		54.2		51.0		47.5		43.7		39.6		35.3		30.8		26.1		21.3		16.4		11.5	10
20		54.1		50.9		47.4		43.6		39.5		35.2		30.7		26.0		21.2		16.3		11.4	20
30		54.0		50.8		47.3		43.5		39.4		35.0		30.5		25.8		21.0		16.1		11.2	30
40		53.9		50.7		47.2		43.3		39.2		34.9		30.4		25.7		20.9		16.0		11.0	40
50		53.8		50.6		47.0		43.2		39.1		34.7		30.2		25.5		20.7		15.8		10.9	50
HP	L	U	L	U	L	U	L	U	L	U	L	U	L	U	L	U	L	U	L	U	L	U	HP
'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'
54.0	1.1	1.7	1.3	1.9	1.5	2.1	1.7	2.4	2.0	2.6	2.3	2.9	2.6	3.2	2.9	3.5	3.2	3.8	3.5	4.1	3.8	4.5	54.0
54.3	1.4	1.8	1.6	2.0	1.8	2.2	2.0	2.5	2.2	2.7	2.5	3.0	2.8	3.2	3.1	3.5	3.3	3.8	3.6	4.1	3.9	4.4	54.3
54.6	1.7	2.0	1.9	2.2	2.1	2.4	2.3	2.6	2.5	2.8	2.7	3.0	3.0	3.3	3.2	3.5	3.5	3.8	3.8	4.0	4.0	4.3	54.6
54.9	2.0	2.2	2.2	2.3	2.4	2.5	2.5	2.7	2.7	2.9	2.9	3.1	3.2	3.3	3.4	3.5	3.6	3.8	3.9	4.0	4.1	4.3	54.9
55.2	2.3	2.3	2.5	2.4	2.6	2.6	2.8	2.8	3.0	2.9	3.2	3.1	3.4	3.3	3.6	3.5	3.8	3.7	4.0	4.0	4.2	4.2	55.2
55.5	2.7	2.5	2.8	2.6	2.9	2.7	3.1	2.9	3.2	3.0	3.4	3.2	3.6	3.4	3.7	3.5	3.9	3.7	4.1	3.9	4.3	4.1	55.5
55.8	3.0	2.6	3.1	2.7	3.2	2.8	3.3	3.0	3.5	3.1	3.6	3.3	3.8	3.4	3.9	3.6	4.1	3.7	4.2	3.9	4.4	4.0	55.8
56.1	3.3	2.8	3.4	2.9	3.5	3.0	3.6	3.1	3.7	3.2	3.8	3.3	4.0	3.4	4.1	3.6	4.2	3.7	4.4	3.8	4.5	4.0	56.1
56.4	3.6	2.9	3.7	3.0	3.8	3.1	3.9	3.2	3.9	3.3	4.0	3.4	4.1	3.5	4.3	3.6	4.4	3.7	4.5	3.8	4.6	3.9	56.4
56.7	3.9	3.1	4.0	3.1	4.1	3.2	4.1	3.3	4.2	3.3	4.3	3.4	4.3	3.5	4.4	3.6	4.5	3.7	4.6	3.8	4.7	3.8	56.7
57.0	4.3	3.2	4.3	3.3	4.3	3.3	4.4	3.4	4.4	3.4	4.5	3.5	4.5	3.5	4.6	3.6	4.7	3.6	4.7	3.7	4.8	3.8	57.0
57.3	4.6	3.4	4.6	3.4	4.6	3.4	4.6	3.5	4.7	3.5	4.7	3.5	4.7	3.6	4.8	3.6	4.8	3.6	4.8	3.7	4.9	3.7	57.3
57.6	4.9	3.6	4.9	3.6	4.9	3.6	4.9	3.6	4.9	3.6	4.9	3.6	4.9	3.6	4.9	3.6	5.0	3.6	5.0	3.6	5.0	3.6	57.6
57.9	5.2	3.7	5.2	3.7	5.2	3.7	5.2	3.7	5.2	3.7	5.1	3.6	5.1	3.6	5.1	3.6	5.1	3.6	5.1	3.6	5.1	3.6	57.9
58.2	5.5	3.9	5.5	3.8	5.5	3.8	5.4	3.8	5.4	3.7	5.4	3.7	5.3	3.7	5.3	3.6	5.2	3.6	5.2	3.5	5.2	3.5	58.2
58.5	5.9	4.0	5.8	4.0	5.8	3.9	5.7	3.9	5.6	3.8	5.6	3.8	5.5	3.7	5.5	3.6	5.4	3.6	5.3	3.5	5.3	3.4	58.5
58.8	6.2	4.2	6.1	4.1	6.0	4.1	6.0	4.0	5.9	3.9	5.8	3.8	5.7	3.7	5.6	3.6	5.5	3.5	5.4	3.5	5.3	3.4	58.8
59.1	6.5	4.3	6.4	4.3	6.3	4.2	6.2	4.1	6.1	4.0	6.0	3.9	5.9	3.8	5.8	3.6	5.7	3.5	5.6	3.4	5.4	3.3	59.1
59.4	6.8	4.5	6.7	4.4	6.6	4.3	6.5	4.2	6.4	4.1	6.2	3.9	6.1	3.8	6.0	3.7	5.8	3.5	5.7	3.4	5.5	3.2	59.4
59.7	7.1	4.7	7.0	4.5	6.9	4.4	6.8	4.3	6.6	4.1	6.5	4.0	6.3	3.8	6.1	3.7	6.0	3.5	5.8	3.3	5.6	3.2	59.7
60.0	7.5	4.8	7.3	4.7	7.2	4.5	7.0	4.4	6.9	4.2	6.7	4.0	6.5	3.9	6.3	3.7	6.1	3.5	5.9	3.3	5.7	3.1	60.0
60.3	7.8	5.0	7.6	4.8	7.5	4.7	7.3	4.5	7.1	4.3	6.9	4.1	6.7	3.9	6.5	3.7	6.3	3.5	6.0	3.2	5.8	3.0	60.3
60.6	8.1	5.1	7.9	5.0	7.7	4.8	7.6	4.6	7.3	4.4	7.1	4.2	6.9	3.9	6.7	3.7	6.4	3.4	6.2	3.2	5.9	2.9	60.6
60.9	8.4	5.3	8.2	5.1	8.0	4.9	7.8	4.7	7.6	4.5	7.3	4.2	7.1	4.0	6.8	3.7	6.6	3.4	6.3	3.2	6.0	2.9	60.9
61.2	8.7	5.4	8.5	5.2	8.3	5.0	8.1	4.8	7.8	4.5	7.6	4.3	7.3	4.0	7.0	3.7	6.7	3.4	6.4	3.1	6.1	2.8	61.2
61.5	9.1	5.6	8.8	5.4	8.6	5.1	8.3	4.9	8.1	4.6	7.8	4.3	7.5	4.0	7.2	3.7	6.9	3.4	6.5	3.1	6.2	2.7	61.5

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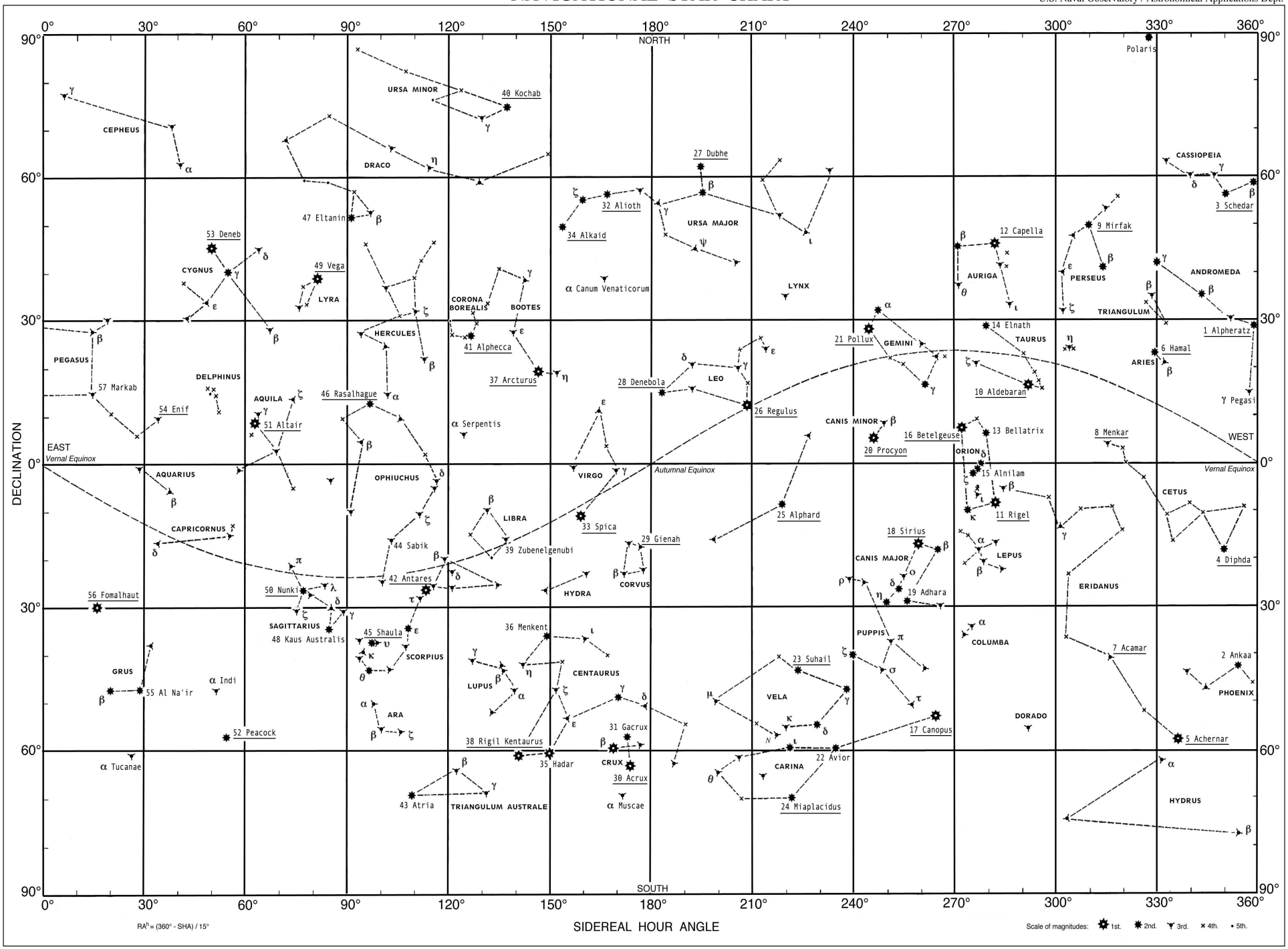
NAVIGATIONAL STAR CHART

U.S. Naval Observatory / Astronomical Applications Dept.



POLARIS (POLE STAR) TABLES,
FOR DETERMINING LATITUDE FROM SEXTANT ALTITUDE AND FOR AZIMUTH

L.H.A. ARIES	0°– 9°	10°– 19°	20°– 29°	30°– 39°	40°– 49°	50°– 59°	60°– 69°	70°– 79°	80°– 89°	90°– 99°	100°– 109°	110°– 119°
	a_0	a_0	a_0	a_0	a_0	a_0	a_0	a_0	a_0	a_0	a_0	a_0
°	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
0	0 17·8	0 13·7	0 10·9	0 09·7	0 09·9	0 11·7	0 14·9	0 19·5	0 25·3	0 32·1	0 39·7	0 47·9
1	17·3	13·3	10·7	09·6	10·1	12·0	15·3	20·0	25·9	32·8	40·5	48·7
2	16·9	13·0	10·6	09·6	10·2	12·2	15·7	20·6	26·6	33·5	41·3	49·6
3	16·4	12·7	10·4	09·6	10·3	12·5	16·2	21·1	27·2	34·3	42·1	50·4
4	16·0	12·4	10·3	09·6	10·5	12·8	16·6	21·7	27·9	35·0	42·9	51·3
5	0 15·6	0 12·1	0 10·1	0 09·6	0 10·6	0 13·1	0 17·1	0 22·3	0 28·6	0 35·8	0 43·7	0 52·1
6	15·2	11·9	10·0	09·7	10·8	13·5	17·5	22·8	29·3	36·6	44·6	53·0
7	14·8	11·6	09·9	09·7	11·0	13·8	18·0	23·4	29·9	37·3	45·4	53·8
8	14·4	11·4	09·8	09·8	11·2	14·2	18·5	24·0	30·6	38·1	46·2	54·7
9	14·0	11·2	09·7	09·8	11·5	14·5	19·0	24·7	31·4	38·9	47·0	55·5
10	0 13·7	0 10·9	0 09·7	0 09·9	0 11·7	0 14·9	0 19·5	0 25·3	0 32·1	0 39·7	0 47·9	0 56·4

Lat.	a_1	a_1	a_1	a_1	a_1	a_1	a_1	a_1	a_1	a_1	a_1	a_1
°	′	′	′	′	′	′	′	′	′	′	′	′
0	0·5	0·6	0·6	0·6	0·6	0·5	0·5	0·4	0·3	0·3	0·2	0·2
10	·5	·6	·6	·6	·6	·6	·5	·4	·4	·3	·3	·2
20	·5	·6	·6	·6	·6	·6	·5	·5	·4	·4	·3	·3
30	·6	·6	·6	·6	·6	·6	·5	·5	·5	·4	·4	·4
40	0·6	0·6	0·6	0·6	0·6	0·6	0·6	0·5	0·5	0·5	0·5	0·5
45	·6	·6	·6	·6	·6	·6	·6	·6	·6	·5	·5	·5
50	·6	·6	·6	·6	·6	·6	·6	·6	·6	·6	·6	·6
55	·6	·6	·6	·6	·6	·6	·6	·6	·7	·7	·7	·7
60	·6	·6	·6	·6	·6	·6	·7	·7	·7	·7	·8	·8
62	0·7	0·6	0·6	0·6	0·6	0·6	0·7	0·7	0·7	0·8	0·8	0·8
64	·7	·6	·6	·6	·6	·6	·7	·7	·8	·8	·9	0·9
66	·7	·6	·6	·6	·6	·7	·7	·8	·8	0·9	0·9	1·0
68	0·7	0·6	0·6	0·6	0·6	0·7	0·7	0·8	0·9	1·0	1·0	1·0

Month	a_2	a_2	a_2	a_2	a_2	a_2	a_2	a_2	a_2	a_2	a_2	a_2
	′	′	′	′	′	′	′	′	′	′	′	′
Jan.	0·7	0·7	0·7	0·7	0·7	0·7	0·7	0·7	0·7	0·6	0·6	0·6
Feb.	·6	·6	·7	·7	·7	·7	·8	·8	·8	·8	·8	·8
Mar.	·5	·5	·6	·6	·7	·7	·8	·8	·8	·9	·9	·9
Apr.	0·3	0·4	0·4	0·5	0·5	0·6	0·7	0·7	0·8	0·8	0·9	0·9
May	·2	·2	·3	·3	·4	·5	·5	·6	·7	·7	·8	·9
June	·2	·2	·2	·2	·3	·3	·4	·5	·5	·6	·7	·7
July	0·2	0·2	0·2	0·2	0·2	0·2	0·3	0·3	0·4	0·4	0·5	0·6
Aug.	·3	·3	·3	·2	·2	·2	·2	·3	·3	·3	·4	·4
Sept.	·5	·5	·4	·4	·3	·3	·3	·3	·3	·3	·3	·3
Oct.	0·7	0·6	0·6	0·5	0·5	0·4	0·4	0·3	0·3	0·3	0·3	0·3
Nov.	0·9	0·8	·8	·7	·6	·6	·5	·5	·4	·3	·3	·3
Dec.	1·0	1·0	0·9	0·9	0·8	0·8	0·7	0·6	0·6	0·5	0·4	0·4

Lat.	AZIMUTH											
°	°	°	°	°	°	°	°	°	°	°	°	°
0	0·4	0·3	0·1	0·0	359·8	359·7	359·6	359·5	359·4	359·3	359·2	359·2
20	0·4	0·3	0·1	0·0	359·8	359·7	359·5	359·4	359·3	359·2	359·2	359·1
40	0·5	0·3	0·2	0·0	359·8	359·6	359·4	359·3	359·2	359·1	359·0	358·9
50	0·6	0·4	0·2	0·0	359·7	359·5	359·3	359·1	359·0	358·9	358·8	358·7
55	0·7	0·5	0·2	0·0	359·7	359·5	359·2	359·0	358·9	358·7	358·6	358·6
60	0·8	0·5	0·2	0·0	359·7	359·4	359·1	358·9	358·7	358·5	358·4	358·4
65	0·9	0·6	0·3	359·9	359·6	359·3	359·0	358·7	358·4	358·3	358·1	358·1

Latitude = Apparent altitude (corrected for refraction) − 1° + a_0 + a_1 + a_2

The table is entered with L.H.A. Aries to determine the column to be used; each column refers to a range of 10°. a_0 is taken, with mental interpolation, from the upper table with the units of L.H.A. Aries in degrees as argument; a_1, a_2 are taken, without interpolation, from the second and third tables with arguments latitude and month respectively. a_0, a_1, a_2 are always positive. The final table gives the azimuth of *Polaris*.

POLARIS (POLE STAR) TABLES, 1981

FOR DETERMINING LATITUDE FROM SEXTANT ALTITUDE AND FOR AZIMUTH

L.H.A. ARIES	120°–129°	130°–139°	140°–149°	150°–159°	160°–169°	170°–179°	180°–189°	190°–199°	200°–209°	210°–219°	220°–229°	230°–239°
	a_0	a_0	a_0	a_0	a_0	a_0	a_0	a_0	a_0	a_0	a_0	a_0
°	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
0	0 56·4	1 05·0	1 13·3	1 21·2	1 28·5	1 34·8	1 40·0	1 44·1	1 46·7	1 47·9	1 47·7	1 46·0
1	57·2	05·8	14·1	22·0	29·1	35·4	40·5	44·4	46·9	48·0	47·6	45·7
2	58·1	06·7	15·0	22·7	29·8	35·9	41·0	44·7	47·1	48·0	47·4	45·4
3	59·0	07·5	15·8	23·5	30·5	36·5	41·4	45·0	47·2	48·0	47·3	45·2
4	0 59·8	08·3	16·6	24·2	31·1	37·0	41·8	45·3	47·4	48·0	47·2	44·9
5	1 00·7	1 09·2	1 17·4	1 25·0	1 31·8	1 37·6	1 42·2	1 45·6	1 47·5	1 48·0	1 47·0	1 44·6
6	01·5	10·0	18·1	25·7	32·4	38·1	42·6	45·8	47·6	47·9	46·8	44·3
7	02·4	10·8	18·9	26·4	33·0	38·6	43·0	46·1	47·7	47·9	46·6	43·9
8	03·2	11·7	19·7	27·1	33·6	39·1	43·4	46·3	47·8	47·8	46·4	43·6
9	04·1	12·5	20·5	27·8	34·2	39·6	43·7	46·5	47·9	47·8	46·2	43·2
10	1 05·0	1 13·3	1 21·2	1 28·5	1 34·8	1 40·0	1 44·1	1 46·7	1 47·9	1 47·7	1 46·0	1 42·8
Lat.	a_1	a_1	a_1	a_1	a_1	a_1	a_1	a_1	a_1	a_1	a_1	a_1
°	′	′	′	′	′	′	′	′	′	′	′	′
0	0·2	0·2	0·2	0·3	0·4	0·4	0·5	0·6	0·6	0·6	0·6	0·5
10	·2	·3	·3	·3	·4	·5	·5	·6	·6	·6	·6	·6
20	·3	·3	·3	·4	·4	·5	·5	·6	·6	·6	·6	·6
30	·4	·4	·4	·4	·5	·5	·6	·6	·6	·6	·6	·6
40	0·5	0·5	0·5	0·5	0·5	0·6	0·6	0·6	0·6	0·6	0·6	0·6
45	·5	·5	·5	·6	·6	·6	·6	·6	·6	·6	·6	·6
50	·6	·6	·6	·6	·6	·6	·6	·6	·6	·6	·6	·6
55	·7	·7	·7	·7	·6	·6	·6	·6	·6	·6	·6	·6
60	·8	·8	·8	·7	·7	·7	·6	·6	·6	·6	·6	·6
62	0·8	0·8	0·8	0·8	0·7	0·7	0·7	0·6	0·6	0·6	0·6	0·6
64	0·9	0·9	·9	·8	·8	·7	·7	·6	·6	·6	·6	·6
66	1·0	1·0	0·9	·9	·8	·7	·7	·6	·6	·6	·6	·7
68	1·1	1·0	1·0	0·9	0·9	0·8	0·7	0·6	0·6	0·6	0·6	0·7
Month	a_2	a_2	a_2	a_2	a_2	a_2	a_2	a_2	a_2	a_2	a_2	a_2
	′	′	′	′	′	′	′	′	′	′	′	′
Jan.	0·6	0·6	0·6	0·6	0·5	0·5	0·5	0·5	0·5	0·5	0·5	0·5
Feb.	·8	·7	·7	·7	·7	·6	·6	·6	·5	·5	·5	·5
Mar.	·9	0·9	0·9	0·8	·8	·8	·7	·7	·6	·6	·5	·5
Apr.	0·9	1·0	1·0	1·0	0·9	0·9	0·9	0·8	0·8	0·7	0·7	0·6
May	·9	1·0	1·0	1·0	1·0	1·0	1·0	1·0	0·9	0·9	·8	·7
June	·8	0·9	0·9	1·0	1·0	1·0	1·0	1·0	1·0	1·0	0·9	0·9
July	0·7	0·7	0·8	0·9	0·9	0·9	1·0	1·0	1·0	1·0	1·0	1·0
Aug.	·5	·6	·6	·7	·7	·8	0·9	0·9	0·9	1·0	1·0	1·0
Sept.	·4	·4	·5	·5	·6	·6	·7	·7	·8	0·8	0·9	0·9
Oct.	0·3	0·3	0·3	0·3	0·4	0·4	0·5	0·6	0·6	0·7	0·7	0·8
Nov.	·2	·2	·2	·2	·3	·3	·3	·4	·4	·5	·6	·6
Dec.	0·3	0·3	0·2	0·2	0·2	0·2	0·2	0·2	0·3	0·3	0·4	0·4

Lat.	AZIMUTH											
°	°	°	°	°	°	°	°	°	°	°	°	°
0	359·2	359·2	359·2	359·3	359·4	359·5	359·6	359·7	359·9	0·0	0·2	0·3
20	359·1	359·1	359·2	359·3	359·4	359·5	359·6	359·7	359·9	0·0	0·2	0·3
40	358·9	359·0	359·0	359·1	359·2	359·3	359·5	359·7	359·8	0·0	0·2	0·4
50	358·7	358·8	358·8	358·9	359·1	359·2	359·4	359·6	359·8	0·0	0·3	0·5
55	358·6	358·6	358·7	358·8	358·9	359·1	359·3	359·6	359·8	0·0	0·3	0·5
60	358·4	358·4	358·5	358·6	358·8	359·0	359·2	359·5	359·8	0·0	0·3	0·6
65	358·1	358·1	358·2	358·4	358·6	358·8	359·1	359·4	359·7	0·1	0·4	0·7

ILLUSTRATION

On 1981 April 21 at G.M.T. 23h 18m 56s in longitude W. 37° 14′ the apparent altitude (corrected for refraction), *Ho*, of

From the daily pages:	° ′
G.H.A. Aries (23h)	194 55·4
Increment (18m 56s)	4 44·8
Longitude (west)	−37 14

	° ′
Ho	49 31·6
a_0 (argument 162° 26′)	1 30·1
a_1 (lat. 50° approx.)	0·6
a_2 (April)	0·9

POLARIS (POLE STAR) TABLES,

FOR DETERMINING LATITUDE FROM SEXTANT ALTITUDE AND FOR AZIMUTH

L.H.A. ARIES	240°– 249°	250°– 259°	260°– 269°	270°– 279°	280°– 289°	290°– 299°	300°– 309°	310°– 319°	320°– 329°	330°– 339°	340°– 349°	350°– 359°
	a_0	a_0	a_0	a_0	a_0	a_0	a_0	a_0	a_0	a_0	a_0	a_0
°	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
0	1 42·8	1 38·4	1 32·8	1 26·1	1 18·6	1 10·5	1 02·1	0 53·5	0 45·0	0 37·0	0 29·7	0 23·2
1	42·5	37·9	32·1	25·4	17·8	09·7	01·2	52·6	44·2	36·3	29·0	22·6
2	42·1	37·4	31·5	24·7	17·0	08·8	1 00·3	51·8	43·4	35·5	28·3	22·0
3	41·6	36·8	30·9	23·9	16·2	08·0	0 59·5	50·9	42·6	34·7	27·6	21·5
4	41·2	36·3	30·2	23·2	15·4	07·2	58·6	50·1	41·8	34·0	27·0	20·9
5	1 40·8	1 35·7	1 29·6	1 22·5	1 14·6	1 06·3	0 57·8	0 49·2	0 41·0	0 33·3	0 26·3	0 20·4
6	40·3	35·2	28·9	21·7	13·8	05·5	56·9	48·4	40·2	32·5	25·7	19·8
7	39·9	34·6	28·2	20·9	13·0	04·6	56·0	47·5	39·4	31·8	25·0	19·3
8	39·4	34·0	27·5	20·2	12·2	03·8	55·2	46·7	38·6	31·1	24·4	18·8
9	38·9	33·4	26·8	19·4	11·3	02·9	54·3	45·9	37·8	30·4	23·8	18·3
10	1 38·4	1 32·8	1 26·1	1 18·6	1 10·5	1 02·1	0 53·5	0 45·0	0 37·0	0 29·7	0 23·2	0 17·8
Lat.	a_1	a_1	a_1	a_1	a_1	a_1	a_1	a_1	a_1	a_1	a_1	a_1
°	′	′	′	′	′	′	′	′	′	′	′	′
0	0·5	0·4	0·3	0·3	0·2	0·2	0·2	0·2	0·2	0·3	0·4	0·4
10	·5	·4	·4	·3	·3	·2	·2	·3	·3	·3	·4	·5
20	·5	·5	·4	·4	·3	·3	·3	·3	·3	·4	·4	·5
30	·5	·5	·5	·4	·4	·4	·4	·4	·4	·4	·5	·5
40	0·6	0·5	0·5	0·5	0·5	0·5	0·5	0·5	0·5	0·5	0·5	0·6
45	·6	·6	·6	·5	·5	·5	·5	·5	·5	·6	·6	·6
50	·6	·6	·6	·6	·6	·6	·6	·6	·6	·6	·6	·6
55	·6	·6	·7	·7	·7	·7	·7	·7	·7	·7	·6	·6
60	·7	·7	·7	·7	·8	·8	·8	·8	·8	·7	·7	·7
62	0·7	0·7	0·7	0·8	0·8	0·8	0·8	0·8	0·8	0·8	0·7	0·7
64	·7	·7	·8	·8	·9	0·9	0·9	0·9	·9	·8	·8	·7
66	·7	·8	·8	0·9	0·9	1·0	1·0	1·0	0·9	·9	·8	·7
68	0·7	0·8	0·9	1·0	1·0	1·0	1·1	1·0	1·0	0·9	0·9	0·8
Month	a_2	a_2	a_2	a_2	a_2	a_2	a_2	a_2	a_2	a_2	a_2	a_2
	′	′	′	′	′	′	′	′	′	′	′	′
Jan.	0·5	0·5	0·5	0·6	0·6	0·6	0·6	0·6	0·6	0·6	0·7	0·7
Feb.	·4	·4	·4	·4	·4	·4	·4	·5	·5	·5	·5	·6
Mar.	·4	·4	·4	·3	·3	·3	·3	·3	·3	·4	·4	·4
Apr.	0·5	0·5	0·4	0·4	0·3	0·3	0·3	0·2	0·2	0·2	0·3	0·3
May	·7	·6	·5	·5	·4	·3	·3	·2	·2	·2	·2	·2
June	·8	·7	·7	·6	·5	·5	·4	·3	·3	·2	·2	·2
July	0·9	0·9	0·8	0·8	0·7	0·6	0·5	0·5	0·4	0·3	0·3	0·3
Aug.	1·0	·9	·9	·9	·8	·8	·7	·6	·6	·5	·5	·4
Sept.	0·9	·9	·9	·9	·9	·9	·8	·8	·7	·7	·6	·6
Oct.	0·8	0·9	0·9	0·9	0·9	0·9	0·9	0·9	0·9	0·9	0·8	0·8
Nov.	·7	·7	·8	·9	·9	·9	1·0	1·0	1·0	1·0	0·9	0·9
Dec.	0·5	0·6	0·6	0·7	0·8	0·8	0·9	0·9	1·0	1·0	1·0	1·0
Lat.	AZIMUTH											
°	°	°	°	°	°	°	°	°	°	°	°	°
0	0·4	0·5	0·6	0·7	0·8	0·8	0·8	0·8	0·8	0·7	0·6	0·5
20	0·5	0·6	0·7	0·8	0·8	0·9	0·9	0·9	0·8	0·7	0·7	0·5
40	0·6	0·7	0·8	0·9	1·0	1·1	1·1	1·1	1·0	0·9	0·8	0·7
50	0·7	0·8	1·0	1·1	1·2	1·3	1·3	1·3	1·2	1·1	1·0	0·8
55	0·7	0·9	1·1	1·2	1·3	1·4	1·4	1·4	1·3	1·2	1·1	0·9
60	0·8	1·1	1·3	1·4	1·5	1·6	1·6	1·6	1·5	1·4	1·2	1·0
65	1·0	1·3	1·5	1·7	1·8	1·9	1·9	1·9	1·8	1·7	1·5	1·2

Latitude = Apparent altitude (corrected for refraction) − 1° + a_0 + a_1 + a_2

The table is entered with L.H.A. Aries to determine the column to be used; each column refers to a range of 10°. a_0 is taken, with mental interpolation, from the upper table with the units of L.H.A. Aries in degrees as argument; a_1, a_2 are taken, without interpolation, from the second and third tables with arguments latitude and month respectively. a_0, a_1, a_2 are always positive. The final table gives the azimuth of *Polaris*.