The Nautical Almanac 2023

TheNauticalAlmanac.com

The Nautical Almanac

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fair winds, clear skies & following seas

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Acknowledgment and Credits

Dr. Enno Rodegerdts

The Nautical Almanac *Daily Pages* and Sun Almanacs found on our site were originally created from PyAlmanac written by the great Norwegian sailor Enno Rodegerdts. PyAlmanac used PyEphem to generate the almanacs and LaTex provided the final formatting. Visit Dr. Rodegerdts site and learn of his voyages at https://sv-inua.net/

Without his work TheNauticalAlmanac.com wouldn't exist.

Andrew Bauer

Mr. Bauer has taken the initial work of Dr. Rodegerdts and improved it to the excellence found in the following Daily Pages. Attending foremost to the accuracy of data and then formatting Mr. Bauer created SkyAlmanac which draws from Brandon Rhodes work *Ephem* and *Skyfield* and provides a clear arrangement of figures required for celestial navigation. To that end his work was determined, tireless and efficient. In our mutual writing across many lines of longitude he has always been pleasant, friendly and most affable.

As he has said, *"The art of celestial navigation should be promoted, not discouraged, even in the modern day".*

To both of these men we all owe a large debt of gratitude and thanks

Disclaimer and Warning

Prior to use verify the accuracy of The Nautical Almanac or data you download from our site. They SHOULD NOT and MUST NOT be relied upon for celestial navigation work of any sorts or any purpose whatsoever. You use them at your own risk or peril.

Errors & Corrections

Contact us if you find any significant errors and describe the correction that should be made.

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freely ye received, freely give

2023

January

wk	Su	M	Tu	W	Th	F	Sa
1	1	2	3	4	5	6	7
2	8	9	10	11	12	13	14
3	15	16	17	18	19	20	21
4	22	23	24	25	26	27	28
5	29	30	31				

February

wk	Su	M	Tu	W	Th	F	Sa
5				1	2	3	4
6	5	6	7	8	9	10	11
7	12	13	14	15	16	17	18
8	19	20	21	22	23	24	25
9	26	27	28				

March

wk	Su	M	Tu	W	Th	F	Sa
9				1	2	3	4
10	5	6	7	8	9	10	11
11	12	13	14	15	16	17	18
12	19	20	21	22	23	24	25
13	26	27	28	29	30	31	

April

wk	Su	M	Tu	W	Th	F	Sa
13							1
14	2	3	4	5	6	7	8
15	9	10	11	12	13	14	15
16	16	17	18	19	20	21	22
17	23	24	25	26	27	28	29
18	30						

May

wk	Su	M	Tu	W	Th	F	Sa
18		1	2	3	4	5	6
19	7	8	9	10	11	12	13
20	14	15	16	17	18	19	20
21	21	22	23	24	25	26	27
22	28	29	30	31			

June

wk	Su	M	Tu	W	Th	F	Sa
22					1	2	3
23	4	5	6	7	8	9	10
24	11	12	13	14	15	16	17
25	18	19	20	21	22	23	24
26	25	26	27	28	29	30	

July

wk	Su	M	Tu	W	Th	F	Sa
26							1
27	2	3	4	5	6	7	8
28	9	10	11	12	13	14	15
29	16	17	18	19	20	21	22
30	23	24	25	26	27	28	29
31	30	31					

August

wk	Su	M	Tu	W	Th	F	Sa
31			1	2	3	4	5
32	6	7	8	9	10	11	12
33	13	14	15	16	17	18	19
34	20	21	22	23	24	25	26
35	27	28	29	30	31		

September

wk	Su	M	Tu	W	Th	F	Sa
35						1	2
36	3	4	5	6	7	8	9
37	10	11	12	13	14	15	16
38	17	18	19	20	21	22	23
39	24	25	26	27	28	29	30

October

wk	Su	M	Tu	W	Th	F	Sa
40	1	2	3	4	5	6	7
41	8	9	10	11	12	13	14
42	15	16	17	18	19	20	21
43	22	23	24	25	26	27	28
44	29	30	31				

November

wk	Su	M	Tu	W	Th	F	Sa
44				1	2	3	4
45	5	6	7	8	9	10	11
46	12	13	14	15	16	17	18
47	19	20	21	22	23	24	25
48	26	27	28	29	30		

December

wk	Su	M	Tu	W	Th	F	Sa
48						1	2
49	3	4	5	6	7	8	9
50	10	11	12	13	14	15	16
51	17	18	19	20	21	22	23
52	24	25	26	27	28	29	30
	31						

2023

Day of Week, Week Number, Day of Year, Remaining Days of Year

Day of Month	1 January		Days remaining	Week number
	Day of Week	Day of Year		
1	Sun	1	364	1
2	Mon	2	363	
3	Tue	3	362	
4	Wed	4	361	
5	Thu	5	360	
6	Fri	6	359	
7	Sat	7	358	
8	Sun	8	357	2
9	Mon	9	356	
10	Tue	10	355	
11	Wed	11	354	
12	Thu	12	353	
13	Fri	13	352	
14	Sat	14	351	
15	Sun	15	350	3
16	Mon	16	349	
17	Tue	17	348	
18	Wed	18	347	
19	Thu	19	346	
20	Fri	20	345	
21	Sat	21	344	
22	Sun	22	343	4
23	Mon	23	342	
24	Tue	24	341	
25	Wed	25	340	
26	Thu	26	339	
27	Fri	27	338	
28	Sat	28	337	
29	Sun	29	336	5
30	Mon	30	335	
31	Tue	31	334	

Day of Month	2 February		Days remaining	Week number
	Day of Week	Day of Year		
1	Wed	32	333	5
2	Thu	33	332	
3	Fri	34	331	
4	Sat	35	330	
5	Sun	36	329	6
6	Mon	37	328	
7	Tue	38	327	
8	Wed	39	326	
9	Thu	40	325	
10	Fri	41	324	
11	Sat	42	323	
12	Sun	43	322	7
13	Mon	44	321	
14	Tue	45	320	
15	Wed	46	319	
16	Thu	47	318	
17	Fri	48	317	
18	Sat	49	316	
19	Sun	50	315	8
20	Mon	51	314	
21	Tue	52	313	
22	Wed	53	312	
23	Thu	54	311	
24	Fri	55	310	
25	Sat	56	309	
26	Sun	57	308	9
27	Mon	58	307	
28	Tue	59	306	

Day of Month	3 March		Days remaining	Week number
	Day of Week	Day of Year		
1	Wed	60	305	9
2	Thu	61	304	
3	Fri	62	303	
4	Sat	63	302	
5	Sun	64	301	10
6	Mon	65	300	
7	Tue	66	299	
8	Wed	67	298	
9	Thu	68	297	
10	Fri	69	296	
11	Sat	70	295	
12	Sun	71	294	11
13	Mon	72	293	
14	Tue	73	292	
15	Wed	74	291	
16	Thu	75	290	
17	Fri	76	289	
18	Sat	77	288	
19	Sun	78	287	12
20	Mon	79	286	
21	Tue	80	285	
22	Wed	81	284	
23	Thu	82	283	
24	Fri	83	282	
25	Sat	84	281	
26	Sun	85	280	13
27	Mon	86	279	
28	Tue	87	278	
29	Wed	88	277	
30	Thu	89	276	
31	Fri	90	275	

Day of Month	4 April		Days remaining	Week number
	Day of Week	Day of Year		
1	Sat	91	274	13
2	Sun	92	273	14
3	Mon	93	272	
4	Tue	94	271	
5	Wed	95	270	
6	Thu	96	269	
7	Fri	97	268	
8	Sat	98	267	
9	Sun	99	266	15
10	Mon	100	265	
11	Tue	101	264	
12	Wed	102	263	
13	Thu	103	262	
14	Fri	104	261	
15	Sat	105	260	
16	Sun	106	259	16
17	Mon	107	258	
18	Tue	108	257	
19	Wed	109	256	
20	Thu	110	255	
21	Fri	111	254	
22	Sat	112	253	
23	Sun	113	252	17
24	Mon	114	251	
25	Tue	115	250	
26	Wed	116	249	
27	Thu	117	248	
28	Fri	118	247	
29	Sat	119	246	
30	Sun	120	245	18

Day of Month	5 May		Days remaining	Week number
	Day of Week	Day of Year		
1	Mon	121	244	18
2	Tue	122	243	
3	Wed	123	242	
4	Thu	124	241	
5	Fri	125	240	
6	Sat	126	239	
7	Sun	127	238	19
8	Mon	128	237	
9	Tue	129	236	
10	Wed	130	235	
11	Thu	131	234	
12	Fri	132	233	
13	Sat	133	232	
14	Sun	134	231	20
15	Mon	135	230	
16	Tue	136	229	
17	Wed	137	228	
18	Thu	138	227	
19	Fri	139	226	
20	Sat	140	225	
21	Sun	141	224	21
22	Mon	142	223	
23	Tue	143	222	
24	Wed	144	221	
25	Thu	145	220	
26	Fri	146	219	
27	Sat	147	218	
28	Sun	148	217	22
29	Mon	149	216	
30	Tue	150	215	
31	Wed	151	214	

Day of Month	6 June		Days remaining	Week number
	Day of Week	Day of Year		
1	Thu	152	213	22
2	Fri	153	212	
3	Sat	154	211	
4	Sun	155	210	23
5	Mon	156	209	
6	Tue	157	208	
7	Wed	158	207	
8	Thu	159	206	
9	Fri	160	205	
10	Sat	161	204	
11	Sun	162	203	24
12	Mon	163	202	
13	Tue	164	201	
14	Wed	165	200	
15	Thu	166	199	
16	Fri	167	198	
17	Sat	168	197	
18	Sun	169	196	25
19	Mon	170	195	
20	Tue	171	194	
21	Wed	172	193	
22	Thu	173	192	
23	Fri	174	191	
24	Sat	175	190	
25	Sun	176	189	26
26	Mon	177	188	
27	Tue	178	187	
28	Wed	179	186	
29	Thu	180	185	
30	Fri	181	184	

Day of Week, Week Number, Day of Year, Remaining Days of Year

Day of Month	7 July		Days remaining	Week number
	Day of Week	Day of Year		
1	Sat	182	183	26
2	Sun	183	182	27
3	Mon	184	181	
4	Tue	185	180	
5	Wed	186	179	
6	Thu	187	178	
7	Fri	188	177	
8	Sat	189	176	
9	Sun	190	175	28
10	Mon	191	174	
11	Tue	192	173	
12	Wed	193	172	
13	Thu	194	171	
14	Fri	195	170	
15	Sat	196	169	
16	Sun	197	168	29
17	Mon	198	167	
18	Tue	199	166	
19	Wed	200	165	
20	Thu	201	164	
21	Fri	202	163	
22	Sat	203	162	
23	Sun	204	161	30
24	Mon	205	160	
25	Tue	206	159	
26	Wed	207	158	
27	Thu	208	157	
28	Fri	209	156	
29	Sat	210	155	
30	Sun	211	154	31
31	Mon	212	153	

Day of Month	8 August		Days remaining	Week number
	Day of Week	Day of Year		
1	Tue	213	152	31
2	Wed	214	151	
3	Thu	215	150	
4	Fri	216	149	
5	Sat	217	148	
6	Sun	218	147	32
7	Mon	219	146	
8	Tue	220	145	
9	Wed	221	144	
10	Thu	222	143	
11	Fri	223	142	
12	Sat	224	141	
13	Sun	225	140	33
14	Mon	226	139	
15	Tue	227	138	
16	Wed	228	137	
17	Thu	229	136	
18	Fri	230	135	
19	Sat	231	134	
20	Sun	232	133	34
21	Mon	233	132	
22	Tue	234	131	
23	Wed	235	130	
24	Thu	236	129	
25	Fri	237	128	
26	Sat	238	127	
27	Sun	239	126	35
28	Mon	240	125	
29	Tue	241	124	
30	Wed	242	123	
31	Thu	243	122	

Day of Month	9 September		Days remaining	Week number
	Day of Week	Day of Year		
1	Fri	244	121	35
2	Sat	245	120	
3	Sun	246	119	36
4	Mon	247	118	
5	Tue	248	117	
6	Wed	249	116	
7	Thu	250	115	
8	Fri	251	114	
9	Sat	252	113	
10	Sun	253	112	37
11	Mon	254	111	
12	Tue	255	110	
13	Wed	256	109	
14	Thu	257	108	
15	Fri	258	107	
16	Sat	259	106	
17	Sun	260	105	38
18	Mon	261	104	
19	Tue	262	103	
20	Wed	263	102	
21	Thu	264	101	
22	Fri	265	100	
23	Sat	266	99	
24	Sun	267	98	39
25	Mon	268	97	
26	Tue	269	96	
27	Wed	270	95	
28	Thu	271	94	
29	Fri	272	93	
30	Sat	273	92	

Day of Month	10 October		Days remaining	Week number
	Day of Week	Day of Year		
1	Sun	274	91	40
2	Mon	275	90	
3	Tue	276	89	
4	Wed	277	88	
5	Thu	278	87	
6	Fri	279	86	
7	Sat	280	85	
8	Sun	281	84	41
9	Mon	282	83	
10	Tue	283	82	
11	Wed	284	81	
12	Thu	285	80	
13	Fri	286	79	
14	Sat	287	78	
15	Sun	288	77	42
16	Mon	289	76	
17	Tue	290	75	
18	Wed	291	74	
19	Thu	292	73	
20	Fri	293	72	
21	Sat	294	71	
22	Sun	295	70	43
23	Mon	296	69	
24	Tue	297	68	
25	Wed	298	67	
26	Thu	299	66	
27	Fri	300	65	
28	Sat	301	64	
29	Sun	302	63	44
30	Mon	303	62	
31	Tue	304	61	

Day of Month	11 November		Days remaining	Week number
	Day of Week	Day of Year		
1	Wed	305	60	44
2	Thu	306	59	
3	Fri	307	58	
4	Sat	308	57	
5	Sun	309	56	45
6	Mon	310	55	
7	Tue	311	54	
8	Wed	312	53	
9	Thu	313	52	
10	Fri	314	51	
11	Sat	315	50	
12	Sun	316	49	46
13	Mon	317	48	
14	Tue	318	47	
15	Wed	319	46	
16	Thu	320	45	
17	Fri	321	44	
18	Sat	322	43	
19	Sun	323	42	47
20	Mon	324	41	
21	Tue	325	40	
22	Wed	326	39	
23	Thu	327	38	
24	Fri	328	37	
25	Sat	329	36	
26	Sun	330	35	48
27	Mon	331	34	
28	Tue	332	33	
29	Wed	333	32	
30	Thu	334	31	

Day of Month	12 December		Days remaining	Week number
	Day of Week	Day of Year		
1	Fri	335	30	48
2	Sat	336	29	
3	Sun	337	28	49
4	Mon	338	27	
5	Tue	339	26	
6	Wed	340	25	
7	Thu	341	24	
8	Fri	342	23	
9	Sat	343	22	
10	Sun	344	21	50
11	Mon	345	20	
12	Tue	346	19	
13	Wed	347	18	
14	Thu	348	17	
15	Fri	349	16	
16	Sat	350	15	
17	Sun	351	14	51
18	Mon	352	13	
19	Tue	353	12	
20	Wed	354	11	
21	Thu	355	10	
22	Fri	356	9	
23	Sat	357	8	
24	Sun	358	7	52
25	Mon	359	6	
26	Tue	360	5	
27	Wed	361	4	
28	Thu	362	3	
29	Fri	363	2	
30	Sat	364	1	
31	Sun	365	0	1

Thirty days hath September, April, June, and November; February has twenty-eight alone, All the rest have thirty-one,
Excepting leap-year, that's the time when February's days are twenty-nine.

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 *2019- The American Practical Navigator*

https://TheNauticalAlmanac.com/2019_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

Epoch 2020 https://www.thenauticalalmanac.com/Pub_No_249_Epoch_2020.html

Epoch 2025 https://www.thenauticalalmanac.com/Pub_No_249_Epoch_2025.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

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
TheNauticalAlmanac.com

Formula Sheet added to NA.odt

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.

Wednesday, February 24, 2021

Explanation_of_The_Nautical_Almanac_Daily_Pages.odt

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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	

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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	

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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

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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

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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	▭

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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 00^h mm:ss	Sun Eqn.of Time 12^h 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

Information in the data page footers

Information pertaining to the IERS EOP data has been added to the odd data page footers if using MiKTeX or TeX Live (2020 or later). The International Earth Rotation Service (IERS) provides accurate data (updated weekly) on the Earth Orientation Parameters (EOP).

Earth's speed of rotation is not constant, i.e. the day length fluctuates.[1] This is due to *internal torques* caused by relative movements and mass redistribution of Earth's core, mantle, oceans, atmosphere, and cryosphere. This has an immediate impact on the GHA values of all celestial objects.

The IERS monitors and measures several parameters taking the actual speed of Earth's rotation into account. Their measured data begins on 2nd Januaray 1973. Predictive data begins following the last day of (obtained) data and extends about 360 days into the future. (The IERS results are published with a delay of about 18-hours between the date of publication and the last available date with measured EOP.[2]) These Nautical Almanac daily pages take the (measured or predicted) UT1-UTC values into account providing highly accurate navigational data especially if the predictions are fairly recent.

As long as either measured or predicted data is available the footer will show:
IERS Earth Orientation data as of dd-mmm-yyyy
This indicates that IERS EOP data is in use - older dates are measured; newer dates are predictions.

If the final date of IERS prediction data is on the current data page, the footer shows:
IERS Earth Orientation predictions end dd-mmm-yyyy

Pages with dates beyond the final date of IERS prediction data have the following footer:
No IERS EOP prediction data available
Skyfield then defaults to using the ΔT and leap second files that ship with Skyfield internally.

The footers mentioned are only displayed as long as **'useIERS = True'** is set in *config.py* to enable use of IERS EOP data.

Brief historical overview

The story begins with the XEphem astronomical library, which is declared 'end of life' by its author, Elwood Charles Downey, as no further updates are planned. He generously gave permission for use of XEphem code in Ephem (also known as Pyephem), an astronomical library authored by Brandon Rhodes. Enno Rodegerdts (https://sv-inua.net/) created the original Nautical Almanac 'daily pages' in Pyalmanac using Python 2 and LaTeX. After contacting him I obtained permission for its future enhancement and maintenance. Pyalmanac uses Ephem.

Meanwhile Brandon Rhodes was working on a far more sophisticated astronomical library, Skyfield. This was 'state of the art' and clearly surpassed the 'Jean Meeus'-based Pyephem/Ephem. Skyfield uses NASA's NAIF (Navigation and Ancillary Information Facility) SPICE algorithms. The results agree with those from the HORIZONS System (*operated by NASA JPL (Jet Propulsion Laboratory) SSD (Solar System Dynamics) group, not by NAIF*). This in turn implies that celestial positions calculated by Skyfield agree with those generated by the United States Naval Observatory and their *Astronomical Almanac* to within 0.0005 arcseconds (half a milliarcsecond).

Pyephem was then in 'maintenance mode'. Clearly Pyalmanac needed adaptation to use Skyfield, and thus SFalmanac was born. However its performance was poor regarding the calculation of 'events' such as: sunrise, sunset, moonrise, moonset, civil twilight start/end and nautical twilight start/end. An interim (faster) solution was required.

A hybrid application, originally named Skyalmanac, was developed using Ephem to calculate 'events' and Skyfield for the rest. This was indeed much faster at the cost of poorer 'event time' data. It took a while to find a better solution: multiprocessing, which was built into SFalmanac. This now could compare to the execution times in Pyalmanac but with improved data.

New functionality was added to SFalmanac, e.g. lunar phase as a graphic; Lunar Distance tables and charts. The original Skyalmanac is deprecated and has now been replaced with the latest SFalmanac code, so Skyalmanac and SFalmanac are now identical apart from the name. Since April 2019 http://thenauticalalmanac.com has been publishing Celestial Navigation related material with software provided here.

[1] https://en.wikipedia.org/wiki/Day_length_fluctuations
[2] https://hpiers.obspm.fr/eoppc/bul/bulb/explanatory.html

January 01, 02, 03 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	100°23.3	160°39.0	S22°02.2	33°29.7	N24°35.3	98°46.9	S00°42.4	135°11.7	S15°12.9
1	115°25.8	175°38.2	01.6	48°32.6	35.3	113°49.1	42.2	150°13.9	12.8
2	130°28.2	190°37.3	01.1	63°35.5	35.2	128°51.3	42.1	165°16.2	12.7
3	145°30.7	205°36.5	22°00.5	78°38.4	·· 35.2	143°53.5	·· 42.0	180°18.4	·· 12.6
4	160°33.2	220°35.6	21°59.9	93°41.3	35.1	158°55.7	41.9	195°20.6	12.6
5	175°35.6	235°34.7	59.4	108°44.2	35.1	173°57.9	41.7	210°22.8	12.5
6	190°38.1	250°33.9	S21°58.8	123°47.1	N24°35.0	189°00.1	S00°41.6	225°25.0	S15°12.4
7	205°40.6	265°33.0	58.2	138°50.0	35.0	204°02.3	41.5	240°27.3	12.3
8	220°43.0	280°32.2	57.6	153°52.9	34.9	219°04.5	41.3	255°29.5	12.2
9	235°45.5	295°31.3	·· 57.1	168°55.8	·· 34.9	234°06.7	·· 41.2	270°31.7	·· 12.1
10	250°48.0	310°30.5	56.5	183°58.7	34.9	249°08.8	41.1	285°33.9	12.1
11	265°50.4	325°29.6	55.9	199°01.6	34.8	264°11.0	40.9	300°36.1	12.0
12	280°52.9	340°28.8	S21°55.3	214°04.4	N24°34.8	279°13.2	S00°40.8	315°38.3	S15°11.9
13	295°55.4	355°27.9	54.8	229°07.3	34.7	294°15.4	40.7	330°40.6	11.8
14	310°57.8	10°27.1	54.2	244°10.2	34.7	309°17.6	40.6	345°42.8	11.7
15	326°00.3	25°26.2	·· 53.6	259°13.1	·· 34.6	324°19.8	·· 40.4	0°45.0	·· 11.7
16	341°02.7	40°25.4	53.0	274°16.0	34.6	339°22.0	40.3	15°47.2	11.6
17	356°05.2	55°24.5	52.4	289°18.8	34.6	354°24.2	40.2	30°49.4	11.5
18	11°07.7	70°23.7	S21°51.8	304°21.7	N24°34.5	9°26.3	S00°40.0	45°51.7	S15°11.4
19	26°10.1	85°22.8	51.3	319°24.6	34.5	24°28.5	39.9	60°53.9	11.3
20	41°12.6	100°22.0	50.7	334°27.4	34.4	39°30.7	39.8	75°56.1	11.2
21	56°15.1	115°21.1	·· 50.1	349°30.3	·· 34.4	54°32.9	·· 39.6	90°58.3	·· 11.2
22	71°17.5	130°20.3	49.5	4°33.2	34.3	69°35.1	39.5	106°00.5	11.1
23	86°20.0	145°19.4	48.9	19°36.0	34.3	84°37.3	39.4	121°02.8	11.0
Mer.pass. 17:16		ν -0.9′ d 0.6′ m -3.92		ν 2.9′ d -0.0′ m -1.21		ν 2.2′ d 0.1′ m -2.35		ν 2.2′ d 0.1′ m 0.86	

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	101°22.5	160°18.6	S21°48.3	34°38.9	N24°34.3	99°39.5	S00°39.2	136°05.0	S15°10.9
1	116°24.9	175°17.7	47.7	49°41.8	34.2	114°41.6	39.1	151°07.2	10.8
2	131°27.4	190°16.9	47.1	64°44.6	34.2	129°43.8	39.0	166°09.4	10.7
3	146°29.8	205°16.0	·· 46.5	79°47.5	·· 34.1	144°46.0	·· 38.8	181°11.6	·· 10.7
4	161°32.3	220°15.2	45.9	94°50.3	34.1	159°48.2	38.7	196°13.8	10.6
5	176°34.8	235°14.4	45.3	109°53.2	34.1	174°50.4	38.6	211°16.1	10.5
6	191°37.2	250°13.5	S21°44.7	124°56.1	N24°34.0	189°52.6	S00°38.4	226°18.3	S15°10.4
7	206°39.7	265°12.7	44.1	139°58.9	34.0	204°54.8	38.3	241°20.5	10.3
8	221°42.2	280°11.8	43.5	155°01.8	33.9	219°56.9	38.2	256°22.7	10.2
9	236°44.6	295°11.0	·· 42.9	170°04.6	·· 33.9	234°59.1	·· 38.0	271°24.9	·· 10.2
10	251°47.1	310°10.1	42.3	185°07.5	33.8	250°01.3	37.9	286°27.1	10.1
11	266°49.6	325°09.3	41.7	200°10.3	33.8	265°03.5	37.8	301°29.4	10.0
12	281°52.0	340°08.5	S21°41.1	215°13.1	N24°33.8	280°05.7	S00°37.7	316°31.6	S15°09.9
13	296°54.5	355°07.6	40.5	230°16.0	33.7	295°07.9	37.5	331°33.8	09.8
14	311°57.0	10°06.8	39.9	245°18.8	33.7	310°10.0	37.4	346°36.0	09.7
15	326°59.4	25°05.9	·· 39.3	260°21.7	·· 33.6	325°12.2	·· 37.3	1°38.2	·· 09.7
16	342°01.9	40°05.1	38.7	275°24.5	33.6	340°14.4	37.1	16°40.4	09.6
17	357°04.3	55°04.3	38.0	290°27.3	33.6	355°16.6	37.0	31°42.7	09.5
18	12°06.8	70°03.4	S21°37.4	305°30.2	N24°33.5	10°18.8	S00°36.8	46°44.9	S15°09.4
19	27°09.3	85°02.6	36.8	320°33.0	33.5	25°20.9	36.7	61°47.1	09.3
20	42°11.7	100°01.8	36.2	335°35.8	33.4	40°23.1	36.6	76°49.3	09.2
21	57°14.2	115°00.9	·· 35.6	350°38.7	·· 33.4	55°25.3	·· 36.4	91°51.5	·· 09.2
22	72°16.7	130°00.1	35.0	5°41.5	33.4	70°27.5	36.3	106°53.7	09.1
23	87°19.1	144°59.2	34.4	20°44.3	33.3	85°29.7	36.2	121°56.0	09.0
Mer.pass. 17:12		ν -0.8′ d 0.6′ m -3.92		ν 2.9′ d -0.0′ m -1.18		ν 2.2′ d 0.1′ m -2.34		ν 2.2′ d 0.1′ m 0.86	

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	102°21.6	159°58.4	S21°33.7	35°47.2	N24°33.3	100°31.8	S00°36.0	136°58.2	S15°08.9
1	117°24.1	174°57.6	33.1	50°50.0	33.2	115°34.0	35.9	152°00.4	08.8
2	132°26.5	189°56.7	32.5	65°52.8	33.2	130°36.2	35.8	167°02.6	08.7
3	147°29.0	204°55.9	·· 31.9	80°55.6	·· 33.2	145°38.4	·· 35.6	182°04.8	·· 08.7
4	162°31.5	219°55.1	31.2	95°58.4	33.1	160°40.6	35.5	197°07.0	08.6
5	177°33.9	234°54.2	30.6	111°01.3	33.1	175°42.7	35.4	212°09.3	08.5
6	192°36.4	249°53.4	S21°30.0	126°04.1	N24°33.1	190°44.9	S00°35.2	227°11.5	S15°08.4
7	207°38.8	264°52.6	29.4	141°06.9	33.0	205°47.1	35.1	242°13.7	08.3
8	222°41.3	279°51.8	28.7	156°09.7	33.0	220°49.3	35.0	257°15.9	08.2
9	237°43.8	294°50.9	·· 28.1	171°12.5	·· 32.9	235°51.4	·· 34.8	272°18.1	·· 08.2
10	252°46.2	309°50.1	27.5	186°15.3	32.9	250°53.6	34.7	287°20.3	08.1
11	267°48.7	324°49.3	26.8	201°18.1	32.9	265°55.8	34.6	302°22.5	08.0
12	282°51.2	339°48.4	S21°26.2	216°20.9	N24°32.8	280°58.0	S00°34.4	317°24.8	S15°07.9
13	297°53.6	354°47.6	25.6	231°23.7	32.8	296°00.2	34.3	332°27.0	07.8
14	312°56.1	9°46.8	24.9	246°26.5	32.7	311°02.3	34.2	347°29.2	07.7
15	327°58.6	24°46.0	·· 24.3	261°29.3	·· 32.7	326°04.5	·· 34.0	2°31.4	·· 07.7
16	343°01.0	39°45.1	23.7	276°32.1	32.7	341°06.7	33.9	17°33.6	07.6
17	358°03.5	54°44.3	23.0	291°34.9	32.6	356°08.9	33.7	32°35.8	07.5
18	13°06.0	69°43.5	S21°22.4	306°37.7	N24°32.6	11°11.0	S00°33.6	47°38.0	S15°07.4
19	28°08.4	84°42.6	21.7	321°40.5	32.6	26°13.2	33.5	62°40.3	07.3
20	43°10.9	99°41.8	21.1	336°43.3	32.5	41°15.4	33.3	77°42.5	07.2
21	58°13.3	114°41.0	·· 20.5	351°46.1	·· 32.5	56°17.6	·· 33.2	92°44.7	·· 07.1
22	73°15.8	129°40.2	19.8	6°48.9	32.5	71°19.7	33.1	107°46.9	07.1
23	88°18.3	144°39.4	19.2	21°51.7	32.4	86°21.9	32.9	122°49.1	07.0
Mer.pass. 17:08		ν -0.8′ d 0.6′ m -3.92		ν 2.8′ d -0.0′ m -1.15		ν 2.2′ d 0.1′ m -2.34		ν 2.2′ d 0.1′ m 0.86	

Stars

	SHA	**Dec**
Alpheratz	357°36.6	29°13.1
Ankaa	353°08.8	-42°11.2
Schedar	349°32.9	56°40.0
Diphda	348°49.0	-17°51.8
Achernar	335°21.3	-57°07.5
Hamal	327°52.9	23°34.3
Polaris	314°31.8	89°21.9
Acamar	315°12.8	-40°13.0
Menkar	314°07.7	4°10.7
Mirfak	308°30.3	49°56.7
Aldebaran	290°41.2	16°33.3
Rigel	281°05.2	-8°10.6
Capella	280°23.9	46°01.3
Bellatrix	278°24.3	6°22.2
Elnath	278°03.6	28°37.6
Alnilam	275°39.1	-1°11.3
Betelgeuse	270°53.6	7°24.7
Canopus	263°52.6	-52°42.5
Sirius	258°27.4	-16°44.9
Adhara	255°06.8	-29°00.2
Procyon	244°52.3	5°10.0
Pollux	243°19.0	27°58.2
Avior	234°14.8	-59°34.8
Suhail	222°47.2	-43°31.3
Miaplacidus	221°37.8	-69°48.4
Alphard	217°49.1	-8°45.4
Regulus	207°36.0	11°51.3
Dubhe	193°42.8	61°37.4
Denebola	182°26.6	14°26.6
Gienah	175°45.3	-17°40.0
Acrux	173°01.9	-63°13.2
Gacrux	171°53.5	-57°14.2
Alioth	166°14.5	55°49.9
Spica	158°24.1	-11°16.8
Alkaid	152°53.5	49°11.7
Hadar	148°38.6	-60°28.7
Menkent	147°59.7	-36°28.8
Arcturus	145°49.6	19°03.7
Rigil Kent.	139°42.9	-60°55.5
Kochab	137°20.5	74°03.4
Zuben'ubi	136°58.1	-16°08.1
Alphecca	126°05.4	26°38.1
Antares	112°18.2	-26°28.9
Atria	107°14.5	-69°03.9
Sabik	102°05.0	-15°45.2
Shaula	96°13.1	-37°07.2
Rasalhague	96°00.4	12°32.5
Eltanin	90°43.5	51°29.0
Kaus Aust.	83°35.1	-34°22.4
Vega	80°34.8	38°48.2
Nunki	75°50.2	-26°16.1
Altair	62°01.9	8°55.7
Peacock	53°08.9	-56°39.8
Deneb	49°27.4	45°21.8
Enif	33°40.7	9°58.8
Al Na'ir	27°35.3	-46°51.2
Fomalhaut	15°16.5	-29°30.3
Scheat	13°47.0	28°12.5
Markab	13°31.7	15°19.7

Jan 01 Sun	**SHA**	**Mer.pass**
Venus	60°15.7	13:18
Mars	293°06.4	21:42
Jupiter	358°23.6	17:22
Saturn	34°48.4	14:57

Jan 02 Mon	**SHA**	**Mer.pass**
Venus	58°56.1	13:20
Mars	293°16.4	21:37
Jupiter	358°17.0	17:19
Saturn	34°42.5	14:53

Jan 03 Tue	**SHA**	**Mer.pass**
Venus	57°36.8	13:21
Mars	293°25.6	21:33
Jupiter	358°10.2	17:15
Saturn	34°36.6	14:50

Horizontal parallax	
Venus:	0.1
Mars:	0.2

DUT1 = UT1-UTC = -0.0169 sec ΔT = TT-UT1 = +69.2009 sec

2023 January 01 to Jan. 03 UT

h	Sun		Moon				
Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°12.1	S23°02.4	68°43.6	13.8′	N12°03.2	13.4′	56.2′
1	194°11.8	02.2	83°16.4	13.8′	12°16.6	13.3′	56.2′
2	209°11.5	02.0	97°49.2	13.8′	12°29.9	13.3′	56.2′
3	224°11.3	·· 01.8	112°22.0	13.8′	12°43.2	13.1′	56.1′
4	239°11.0	01.6	126°54.8	13.7′	12°56.3	13.1′	56.1′
5	254°10.7	01.4	141°27.5	13.7′	13°09.4	13.1′	56.1′
6	269°10.4	S23°01.2	156°00.2	13.7′	N13°22.5	13.0′	56.1′
7	284°10.1	01.0	170°32.9	13.6′	13°35.5	12.9′	56.0′
8	299°09.8	00.8	185°05.5	13.6′	13°48.4	12.8′	56.0′
9	314°09.5	·· 00.6	199°38.2	13.6′	14°01.2	12.8′	56.0′
10	329°09.2	00.4	214°10.7	13.6′	14°14.0	12.6′	55.9′
11	344°08.9	00.2	228°43.3	13.5′	14°26.6	12.7′	55.9′
12	359°08.6	S23°00.0	243°15.8	13.5′	N14°39.3	12.5′	55.9′
13	14°08.3	22°59.8	257°48.3	13.5′	14°51.8	12.5′	55.9′
14	29°08.0	59.6	272°20.8	13.4′	15°04.3	12.4′	55.8′
15	44°07.7	·· 59.3	286°53.2	13.4′	15°16.7	12.3′	55.8′
16	59°07.4	59.1	301°25.6	13.4′	15°29.0	12.2′	55.8′
17	74°07.1	58.9	315°58.0	13.3′	15°41.2	12.1′	55.8′
18	89°06.8	S22°58.7	330°30.3	13.3′	N15°53.3	12.1′	55.7′
19	104°06.5	58.5	345°02.6	13.2′	16°05.4	12.0′	55.7′
20	119°06.2	58.3	359°34.8	13.2′	16°17.4	11.9′	55.7′
21	134°06.0	·· 58.1	14°07.0	13.2′	16°29.3	11.9′	55.7′
22	149°05.7	57.9	28°39.2	13.1′	16°41.2	11.7′	55.7′
23	164°05.4	57.6	43°11.3	13.1′	16°52.9	11.7′	55.6′
	SD = 16.3′	d = 0.2′	SD = 15.3′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°05.1	S22°57.4	57°43.4	13.1′	N17°04.6	11.6′	55.6′
1	194°04.8	57.2	72°15.5	13.0′	17°16.2	11.4′	55.6′
2	209°04.5	57.0	86°47.5	13.0′	17°27.6	11.5′	55.6′
3	224°04.2	·· 56.8	101°19.5	12.9′	17°39.1	11.3′	55.5′
4	239°03.9	56.6	115°51.4	12.9′	17°50.4	11.2′	55.5′
5	254°03.6	56.3	130°23.3	12.8′	18°01.6	11.2′	55.5′
6	269°03.3	S22°56.1	144°55.1	12.8′	N18°12.8	11.0′	55.5′
7	284°03.0	55.9	159°26.9	12.8′	18°23.8	11.0′	55.4′
8	299°02.7	55.7	173°58.7	12.7′	18°34.8	10.9′	55.4′
9	314°02.4	·· 55.5	188°30.4	12.7′	18°45.7	10.7′	55.4′
10	329°02.2	55.2	203°02.1	12.6′	18°56.4	10.7′	55.4′
11	344°01.9	55.0	217°33.7	12.6′	19°07.1	10.6′	55.4′
12	359°01.6	S22°54.8	232°05.3	12.5′	N19°17.7	10.5′	55.3′
13	14°01.3	54.6	246°36.8	12.5′	19°28.2	10.4′	55.3′
14	29°01.0	54.3	261°08.3	12.4′	19°38.6	10.4′	55.3′
15	44°00.7	·· 54.1	275°39.7	12.4′	19°49.0	10.2′	55.3′
16	59°00.4	53.9	290°11.1	12.3′	19°59.2	10.1′	55.3′
17	74°00.1	53.7	304°42.5	12.3′	20°09.3	10.0′	55.2′
18	88°59.8	S22°53.4	319°13.8	12.3′	N20°19.3	9.9′	55.2′
19	103°59.5	53.2	333°45.0	12.2′	20°29.2	9.9′	55.2′
20	118°59.3	53.0	348°16.2	12.2′	20°39.1	9.7′	55.2′
21	133°59.0	·· 52.7	2°47.4	12.1′	20°48.8	9.6′	55.2′
22	148°58.7	52.5	17°18.5	12.1′	20°58.4	9.5′	55.1′
23	163°58.4	52.3	31°49.6	12.0′	21°07.9	9.4′	55.1′
	SD = 16.3′	d = 0.2′	SD = 15.2′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°58.1	S22°52.0	46°20.6	12.0′	N21°17.3	9.4′	55.1′
1	193°57.8	51.8	60°51.5	11.9′	21°26.7	9.2′	55.1′
2	208°57.5	51.6	75°22.5	11.9′	21°35.9	9.1′	55.1′
3	223°57.2	·· 51.3	89°53.3	11.8′	21°45.0	9.0′	55.0′
4	238°56.9	51.1	104°24.2	11.8′	21°54.0	8.9′	55.0′
5	253°56.7	50.8	118°54.9	11.7′	22°02.9	8.7′	55.0′
6	268°56.4	S22°50.6	133°25.7	11.7′	N22°11.6	8.7′	55.0′
7	283°56.1	50.4	147°56.3	11.6′	22°20.3	8.6′	55.0′
8	298°55.8	50.1	162°27.0	11.6′	22°28.9	8.4′	54.9′
9	313°55.5	·· 49.9	176°57.6	11.5′	22°37.3	8.4′	54.9′
10	328°55.2	49.6	191°28.1	11.5′	22°45.7	8.2′	54.9′
11	343°54.9	49.4	205°58.6	11.4′	22°53.9	8.2′	54.9′
12	358°54.6	S22°49.2	220°29.0	11.4′	N23°02.1	8.0′	54.9′
13	13°54.4	48.9	234°59.4	11.4′	23°10.1	7.9′	54.9′
14	28°54.1	48.7	249°29.8	11.3′	23°18.0	7.8′	54.8′
15	43°53.8	·· 48.4	264°00.1	11.3′	23°25.8	7.6′	54.8′
16	58°53.5	48.2	278°30.3	11.2′	23°33.4	7.6′	54.8′
17	73°53.2	47.9	293°00.6	11.2′	23°41.0	7.4′	54.8′
18	88°52.9	S22°47.7	307°30.7	11.1′	N23°48.4	7.4′	54.8′
19	103°52.6	47.4	322°00.8	11.1′	23°55.8	7.2′	54.8′
20	118°52.4	47.2	336°30.9	11.0′	24°03.0	7.1′	54.7′
21	133°52.1	·· 46.9	351°01.0	11.0′	24°10.1	6.9′	54.7′
22	148°51.8	46.7	5°30.9	10.9′	24°17.0	6.9′	54.7′
23	163°51.5	46.4	20°00.9	10.9′	24°23.9	6.7′	54.7′
	SD = 16.3′	d = 0.2′	SD = 15.0′				

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

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

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 9-11 70-86%
01	03:11	03:26	12:03	20:02	07:39	
02	03:40	03:54	12:04	20:48	08:25	
03	04:08	04:21	12:04	21:37	09:13	

January 04, 05, 06 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	103°20.7	159°38.5	S21°18.5	36°54.5	N24°32.4	101°24.1	S00°32.8	137°51.3	S15°06.9
1	118°23.2	174°37.7	17.9	51°57.3	32.3	116°26.3	32.7	152°53.5	06.8
2	133°25.7	189°36.9	17.2	67°00.1	32.3	131°28.4	32.5	167°55.8	06.7
3	148°28.1	204°36.1	·· 16.6	82°02.9	·· 32.3	146°30.6	·· 32.4	182°58.0	·· 06.6
4	163°30.6	219°35.2	15.9	97°05.6	32.2	161°32.8	32.2	198°00.2	06.6
5	178°33.1	234°34.4	15.3	112°08.4	32.2	176°34.9	32.1	213°02.4	06.5
6	193°35.5	249°33.6	S21°14.6	127°11.2	N24°32.2	191°37.1	S00°32.0	228°04.6	S15°06.4
7	208°38.0	264°32.8	14.0	142°14.0	32.1	206°39.3	31.8	243°06.8	06.3
8	223°40.5	279°32.0	13.3	157°16.7	32.1	221°41.5	31.7	258°09.0	06.2
9	238°42.9	294°31.2	·· 12.7	172°19.5	·· 32.1	236°43.6	·· 31.6	273°11.3	·· 06.1
10	253°45.4	309°30.3	12.0	187°22.3	32.0	251°45.8	31.4	288°13.5	06.0
11	268°47.8	324°29.5	11.3	202°25.1	32.0	266°48.0	31.3	303°15.7	06.0
12	283°50.3	339°28.7	S21°10.7	217°27.8	N24°32.0	281°50.1	S00°31.1	318°17.9	S15°05.9
13	298°52.8	354°27.9	10.0	232°30.6	31.9	296°52.3	31.0	333°20.1	05.8
14	313°55.2	9°27.1	09.4	247°33.4	31.9	311°54.5	30.9	348°22.3	05.7
15	328°57.7	24°26.3	·· 08.7	262°36.1	·· 31.8	326°56.7	·· 30.7	3°24.5	·· 05.6
16	344°00.2	39°25.4	08.0	277°38.9	31.8	341°58.8	30.6	18°26.7	05.5
17	359°02.6	54°24.6	07.4	292°41.7	31.8	357°01.0	30.4	33°29.0	05.5
18	14°05.1	69°23.8	S21°06.7	307°44.4	N24°31.7	12°03.2	S00°30.3	48°31.2	S15°05.4
19	29°07.6	84°23.0	06.0	322°47.2	31.7	27°05.3	30.2	63°33.4	05.3
20	44°10.0	99°22.2	05.4	337°49.9	31.7	42°07.5	30.0	78°35.6	05.2
21	59°12.5	114°21.4	·· 04.7	352°52.7	·· 31.6	57°09.7	·· 29.9	93°37.8	·· 05.1
22	74°14.9	129°20.6	04.0	7°55.4	31.6	72°11.8	29.8	108°40.0	05.0
23	89°17.4	144°19.8	03.4	22°58.2	31.6	87°14.0	29.6	123°42.2	04.9
Mer.pass. 17:04		ν -0.8′ d 0.6′ m -3.92		ν 2.8′ d -0.0′ m -1.11		ν 2.2′ d 0.1′ m -2.33		ν 2.2′ d 0.1′ m 0.86	

Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	104°19.9	159°19.0	S21°02.7	38°00.9	N24°31.5	102°16.2	S00°29.5	138°44.4	S15°04.9
1	119°22.3	174°18.1	02.0	53°03.7	31.5	117°18.3	29.3	153°46.7	04.8
2	134°24.8	189°17.3	01.3	68°06.4	31.5	132°20.5	29.2	168°48.9	04.7
3	149°27.3	204°16.5	·· 00.7	83°09.2	·· 31.4	147°22.7	·· 29.1	183°51.1	·· 04.6
4	164°29.7	219°15.7	21°00.0	98°11.9	31.4	162°24.8	28.9	198°53.3	04.5
5	179°32.2	234°14.9	20°59.3	113°14.7	31.4	177°27.0	28.8	213°55.5	04.4
6	194°34.7	249°14.1	S20°58.6	128°17.4	N24°31.3	192°29.2	S00°28.6	228°57.7	S15°04.3
7	209°37.1	264°13.3	58.0	143°20.1	31.3	207°31.3	28.5	243°59.9	04.3
8	224°39.6	279°12.5	57.3	158°22.9	31.3	222°33.5	28.4	259°02.1	04.2
9	239°42.1	294°11.7	·· 56.6	173°25.6	·· 31.2	237°35.7	·· 28.2	274°04.3	·· 04.1
10	254°44.5	309°10.9	55.9	188°28.4	31.2	252°37.8	28.1	289°06.6	04.0
11	269°47.0	324°10.1	55.2	203°31.1	31.2	267°40.0	27.9	304°08.8	03.9
12	284°49.4	339°09.3	S20°54.5	218°33.8	N24°31.2	282°42.2	S00°27.8	319°11.0	S15°03.8
13	299°51.9	354°08.5	53.9	233°36.5	31.1	297°44.3	27.7	334°13.2	03.8
14	314°54.4	9°07.7	53.2	248°39.3	31.1	312°46.5	27.5	349°15.4	03.7
15	329°56.8	24°06.9	·· 52.5	263°42.0	·· 31.1	327°48.7	·· 27.4	4°17.6	·· 03.6
16	344°59.3	39°06.1	51.8	278°44.7	31.0	342°50.8	27.2	19°19.8	03.5
17	0°01.8	54°05.3	51.1	293°47.5	31.0	357°53.0	27.1	34°22.0	03.4
18	15°04.2	69°04.5	S20°50.4	308°50.2	N24°31.0	12°55.1	S00°27.0	49°24.2	S15°03.3
19	30°06.7	84°03.7	49.7	323°52.9	30.9	27°57.3	26.8	64°26.5	03.2
20	45°09.2	99°02.9	49.0	338°55.6	30.9	42°59.5	26.7	79°28.7	03.2
21	60°11.6	114°02.1	·· 48.3	353°58.3	·· 30.9	58°01.6	·· 26.5	94°30.9	·· 03.1
22	75°14.1	129°01.3	47.6	9°01.0	30.8	73°03.8	26.4	109°33.1	03.0
23	90°16.6	144°00.5	46.9	24°03.8	30.8	88°06.0	26.2	124°35.3	02.9
Mer.pass. 17:00		ν -0.8′ d 0.7′ m -3.92		ν 2.7′ d -0.0′ m -1.08		ν 2.2′ d 0.1′ m -2.33		ν 2.2′ d 0.1′ m 0.86	

Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	105°19.0	158°59.7	S20°46.2	39°06.5	N24°30.8	103°08.1	S00°26.1	139°37.5	S15°02.8
1	120°21.5	173°58.9	45.5	54°09.2	30.8	118°10.3	26.0	154°39.7	02.7
2	135°23.9	188°58.1	44.8	69°11.9	30.7	133°12.4	25.8	169°41.9	02.6
3	150°26.4	203°57.3	·· 44.1	84°14.6	·· 30.7	148°14.6	·· 25.7	184°44.1	·· 02.6
4	165°28.9	218°56.5	43.4	99°17.3	30.7	163°16.8	25.5	199°46.3	02.5
5	180°31.3	233°55.7	42.7	114°20.0	30.6	178°18.9	25.4	214°48.6	02.4
6	195°33.8	248°54.9	S20°42.0	129°22.7	N24°30.6	193°21.1	S00°25.3	229°50.8	S15°02.3
7	210°36.3	263°54.1	41.3	144°25.4	30.6	208°23.3	25.1	244°53.0	02.2
8	225°38.7	278°53.3	40.6	159°28.1	30.5	223°25.4	25.0	259°55.2	02.1
9	240°41.2	293°52.5	·· 39.9	174°30.8	·· 30.5	238°27.6	·· 24.8	274°57.4	·· 02.0
10	255°43.7	308°51.7	39.2	189°33.5	30.5	253°29.7	24.7	289°59.6	02.0
11	270°46.1	323°50.9	38.5	204°36.2	30.5	268°31.9	24.5	305°01.8	01.9
12	285°48.6	338°50.1	S20°37.8	219°38.9	N24°30.4	283°34.1	S00°24.4	320°04.0	S15°01.8
13	300°51.1	353°49.4	37.1	234°41.6	30.4	298°36.2	24.3	335°06.2	01.7
14	315°53.5	8°48.6	36.4	249°44.3	30.4	313°38.4	24.1	350°08.4	01.6
15	330°56.0	23°47.8	·· 35.7	264°47.0	·· 30.3	328°40.5	·· 24.0	5°10.6	·· 01.5
16	345°58.4	38°47.0	34.9	279°49.7	30.3	343°42.7	23.8	20°12.9	01.4
17	1°00.9	53°46.2	34.2	294°52.4	30.3	358°44.8	23.7	35°15.1	01.3
18	16°03.4	68°45.4	S20°33.5	309°55.0	N24°30.3	13°47.0	S00°23.5	50°17.3	S15°01.3
19	31°05.8	83°44.6	32.8	324°57.7	30.2	28°49.2	23.4	65°19.5	01.2
20	46°08.3	98°43.8	32.1	340°00.4	30.2	43°51.3	23.2	80°21.7	01.1
21	61°10.8	113°43.1	·· 31.4	355°03.1	·· 30.2	58°53.5	·· 23.1	95°23.9	·· 01.0
22	76°13.2	128°42.3	30.6	10°05.8	30.2	73°55.6	23.0	110°26.1	00.9
23	91°15.7	143°41.5	29.9	25°08.4	30.1	88°57.8	22.8	125°28.3	00.8
Mer.pass. 16:56		ν -0.8′ d 0.7′ m -3.93		ν 2.7′ d -0.0′ m -1.05		ν 2.2′ d 0.1′ m -2.32		ν 2.2′ d 0.1′ m 0.86	

Stars

	SHA	**Dec**
Alpheratz	357°36.6	29°13.1
Ankaa	353°08.8	-42°11.2
Schedar	349°32.9	56°40.0
Diphda	348°49.0	-17°51.8
Achernar	335°21.3	-57°07.5
Hamal	327°52.9	23°34.3
Polaris	314°32.7	89°21.9
Acamar	315°12.8	-40°13.0
Menkar	314°07.7	4°10.7
Mirfak	308°30.3	49°56.7
Aldebaran	290°41.2	16°33.3
Rigel	281°05.2	-8°10.6
Capella	280°23.9	46°01.3
Bellatrix	278°24.3	6°22.2
Elnath	278°03.6	28°37.6
Alnilam	275°39.1	-1°11.3
Betelgeuse	270°53.6	7°24.7
Canopus	263°52.6	-52°42.5
Sirius	258°27.3	-16°44.9
Adhara	255°06.8	-29°00.2
Procyon	244°52.2	5°09.9
Pollux	243°19.0	27°58.2
Avior	234°14.8	-59°34.8
Suhail	222°47.1	-43°31.3
Miaplacidus	221°37.8	-69°48.4
Alphard	217°49.1	-8°45.4
Regulus	207°36.0	11°51.3
Dubhe	193°42.7	61°37.4
Denebola	182°26.6	14°26.6
Gienah	175°45.2	-17°40.0
Acrux	173°01.9	-63°13.2
Gacrux	171°53.4	-57°14.2
Alioth	166°14.5	55°49.9
Spica	158°24.1	-11°16.8
Alkaid	152°53.5	49°11.7
Hadar	148°38.6	-60°28.7
Menkent	147°59.7	-36°28.8
Arcturus	145°49.6	19°03.7
Rigil Kent.	139°42.9	-60°55.5
Kochab	137°20.4	74°03.4
Zuben'ubi	136°58.0	-16°08.1
Alphecca	126°05.4	26°38.1
Antares	112°18.2	-26°28.9
Atria	107°14.4	-69°03.9
Sabik	102°05.0	-15°45.2
Shaula	96°13.0	-37°07.2
Rasalhague	96°00.4	12°32.5
Eltanin	90°43.5	51°29.0
Kaus Aust.	83°35.1	-34°22.4
Vega	80°34.8	38°48.2
Nunki	75°50.2	-26°16.1
Altair	62°01.9	8°55.7
Peacock	53°08.9	-56°39.8
Deneb	49°27.4	45°21.8
Enif	33°40.7	9°58.8
Al Na'ir	27°35.3	-46°51.2
Fomalhaut	15°16.5	-29°30.3
Scheat	13°47.0	28°12.5
Markab	13°31.7	15°19.7

Jan 04 Wed	**SHA**	**Mer.pass**
Venus	56°17.8	13:22
Mars	293°33.8	21:28
Jupiter	358°03.3	17:12
Saturn	34°30.6	14:46

Jan 05 Thu	**SHA**	**Mer.pass**
Venus	54°59.1	13:23
Mars	293°41.1	21:24
Jupiter	357°56.3	17:08
Saturn	34°24.6	14:43

Jan 06 Fri	**SHA**	**Mer.pass**
Venus	53°40.7	13:25
Mars	293°47.5	21:20
Jupiter	357°49.1	17:05
Saturn	34°18.5	14:39

Horizontal parallax	
Venus:	0.1
Mars:	0.2

h	Sun		Moon				
Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°51.2	S22°46.2	34°30.8	10.9′	N24°30.6	6.6′	54.7′
1	193°50.9	45.9	49°00.7	10.8′	24°37.2	6.5′	54.7′
2	208°50.6	45.7	63°30.5	10.8′	24°43.7	6.4′	54.7′
3	223°50.4	·· 45.4	78°00.3	10.7′	24°50.1	6.3′	54.6′
4	238°50.1	45.1	92°30.0	10.7′	24°56.4	6.1′	54.6′
5	253°49.8	44.9	106°59.7	10.7′	25°02.5	6.0′	54.6′
6	268°49.5	S22°44.6	121°29.4	10.6′	N25°08.5	5.9′	54.6′
7	283°49.2	44.4	135°59.0	10.6′	25°14.4	5.7′	54.6′
8	298°48.9	44.1	150°28.6	10.5′	25°20.1	5.7′	54.6′
9	313°48.7	·· 43.9	164°58.1	10.5′	25°25.8	5.5′	54.6′
10	328°48.4	43.6	179°27.6	10.5′	25°31.3	5.4′	54.5′
11	343°48.1	43.3	193°57.1	10.4′	25°36.7	5.2′	54.5′
12	358°47.8	S22°43.1	208°26.5	10.4′	N25°41.9	5.2′	54.5′
13	13°47.5	42.8	222°55.9	10.4′	25°47.1	5.0′	54.5′
14	28°47.2	42.5	237°25.3	10.3′	25°52.1	4.8′	54.5′
15	43°47.0	·· 42.3	251°54.6	10.3′	25°56.9	4.8′	54.5′
16	58°46.7	42.0	266°23.9	10.3′	26°01.7	4.6′	54.5′
17	73°46.4	41.7	280°53.2	10.2′	26°06.3	4.5′	54.4′
18	88°46.1	S22°41.5	295°22.5	10.2′	N26°10.8	4.3′	54.4′
19	103°45.8	41.2	309°51.7	10.2′	26°15.1	4.3′	54.4′
20	118°45.6	40.9	324°20.9	10.2′	26°19.4	4.1′	54.4′
21	133°45.3	·· 40.7	338°50.0	10.1′	26°23.5	3.9′	54.4′
22	148°45.0	40.4	353°19.2	10.1′	26°27.4	3.9′	54.4′
23	163°44.7	40.1	7°48.3	10.1′	26°31.3	3.7′	54.4′
	SD = 16.3′	d = 0.3′	SD = 14.9′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°44.4	S22°39.9	22°17.4	10.1′	N26°35.0	3.6′	54.4′
1	193°44.2	39.6	36°46.4	10.0′	26°38.6	3.4′	54.4′
2	208°43.9	39.3	51°15.5	10.0′	26°42.0	3.3′	54.3′
3	223°43.6	·· 39.0	65°44.5	10.0′	26°45.3	3.2′	54.3′
4	238°43.3	38.8	80°13.5	10.0′	26°48.5	3.1′	54.3′
5	253°43.0	38.5	94°42.5	10.0′	26°51.6	2.9′	54.3′
6	268°42.8	S22°38.2	109°11.4	9.9′	N26°54.5	2.8′	54.3′
7	283°42.5	37.9	123°40.4	9.9′	26°57.3	2.6′	54.3′
8	298°42.2	37.6	138°09.3	9.9′	26°59.9	2.5′	54.3′
9	313°41.9	·· 37.4	152°38.2	9.9′	27°02.4	2.4′	54.3′
10	328°41.6	37.1	167°07.1	9.9′	27°04.8	2.2′	54.3′
11	343°41.4	36.8	181°36.0	9.9′	27°07.0	2.2′	54.2′
12	358°41.1	S22°36.5	196°04.9	9.9′	N27°09.2	1.9′	54.2′
13	13°40.8	36.2	210°33.8	9.9′	27°11.1	1.9′	54.2′
14	28°40.5	36.0	225°02.6	9.9′	27°13.0	1.7′	54.2′
15	43°40.3	·· 35.7	239°31.5	9.8′	27°14.7	1.6′	54.2′
16	58°40.0	35.4	254°00.3	9.8′	27°16.3	1.4′	54.2′
17	73°39.7	35.1	268°29.2	9.8′	27°17.7	1.3′	54.2′
18	88°39.4	S22°34.8	282°58.0	9.8′	N27°19.0	1.2′	54.2′
19	103°39.1	34.5	297°26.8	9.8′	27°20.2	1.0′	54.2′
20	118°38.9	34.2	311°55.7	9.8′	27°21.2	0.9′	54.2′
21	133°38.6	·· 34.0	326°24.5	9.8′	27°22.1	0.8′	54.1′
22	148°38.3	33.7	340°53.4	9.8′	27°22.9	0.6′	54.1′
23	163°38.0	33.4	355°22.2	9.8′	27°23.5	0.5′	54.1′
	SD = 16.3′	d = 0.3′	SD = 14.8′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°37.8	S22°33.1	9°51.0	9.8′	N27°24.0	0.4′	54.1′
1	193°37.5	32.8	24°19.9	9.9′	27°24.4	0.2′	54.1′
2	208°37.2	32.5	38°48.7	9.9′	27°24.6	0.1′	54.1′
3	223°36.9	·· 32.2	53°17.6	9.9′	27°24.7	0.1′	54.1′
4	238°36.7	31.9	67°46.5	9.9′	27°24.6	0.2′	54.1′
5	253°36.4	31.6	82°15.3	9.9′	27°24.4	0.3′	54.1′
6	268°36.1	S22°31.3	96°44.2	9.9′	N27°24.1	0.4′	54.1′
7	283°35.8	31.0	111°13.1	9.9′	27°23.7	0.6′	54.1′
8	298°35.6	30.7	125°42.1	9.9′	27°23.1	0.7′	54.1′
9	313°35.3	·· 30.4	140°11.0	9.9′	27°22.4	0.9′	54.1′
10	328°35.0	30.1	154°39.9	10.0′	27°21.5	0.9′	54.0′
11	343°34.7	29.8	169°08.9	10.0′	27°20.6	1.2′	54.0′
12	358°34.5	S22°29.5	183°37.9	10.0′	N27°19.4	1.2′	54.0′
13	13°34.2	29.2	198°06.9	10.0′	27°18.2	1.4′	54.0′
14	28°33.9	28.9	212°35.9	10.0′	27°16.8	1.5′	54.0′
15	43°33.6	·· 28.6	227°05.0	10.1′	27°15.3	1.7′	54.0′
16	58°33.4	28.3	241°34.0	10.1′	27°13.6	1.7′	54.0′
17	73°33.1	28.0	256°03.1	10.1′	27°11.9	1.9′	54.0′
18	88°32.8	S22°27.7	270°32.2	10.1′	N27°10.0	2.1′	54.0′
19	103°32.6	27.4	285°01.4	10.2′	27°07.9	2.2′	54.0′
20	118°32.3	27.1	299°30.6	10.2′	27°05.7	2.3′	54.0′
21	133°32.0	·· 26.8	313°59.8	10.2′	27°03.4	2.4′	54.0′
22	148°31.7	26.5	328°29.0	10.3′	27°01.0	2.6′	54.0′
23	163°31.5	26.2	342°58.2	10.3′	26°58.4	2.7′	54.0′
	SD = 16.3′	d = 0.3′	SD = 14.8′				

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

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

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 92-99%
04	04:35	04:49	12:05	22:28	10:02	
05	05:02	05:16	12:05	23:19	10:53	
06	05:29	05:42	12:06	–:–	11:45	

January 07, 08, 09 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	106°18.2	158°40.7	S20°29.2	40°11.1	N24°30.1	103°59.9	S00°22.7	140°30.5	S15°00.7
1	121°20.6	173°39.9	28.5	55°13.8	30.1	119°02.1	22.5	155°32.7	00.7
2	136°23.1	188°39.1	27.7	70°16.5	30.0	134°04.3	22.4	170°34.9	00.6
3	151°25.6	203°38.4	·· 27.0	85°19.1	·· 30.0	149°06.4	·· 22.2	185°37.1	·· 00.5
4	166°28.0	218°37.6	26.3	100°21.8	30.0	164°08.6	22.1	200°39.4	00.4
5	181°30.5	233°36.8	25.6	115°24.5	30.0	179°10.7	22.0	215°41.6	00.3
6	196°32.9	248°36.0	S20°24.8	130°27.1	N24°29.9	194°12.9	S00°21.8	230°43.8	S15°00.2
7	211°35.4	263°35.2	24.1	145°29.8	29.9	209°15.0	21.7	245°46.0	00.1
8	226°37.9	278°34.5	23.4	160°32.5	29.9	224°17.2	21.5	260°48.2	00.0
9	241°40.3	293°33.7	·· 22.6	175°35.1	·· 29.9	239°19.3	·· 21.4	275°50.4	15°00.0
10	256°42.8	308°32.9	21.9	190°37.8	29.8	254°21.5	21.2	290°52.6	14°59.9
11	271°45.3	323°32.1	21.2	205°40.4	29.8	269°23.6	21.1	305°54.8	59.8
12	286°47.7	338°31.3	S20°20.4	220°43.1	N24°29.8	284°25.8	S00°20.9	320°57.0	S14°59.7
13	301°50.2	353°30.6	19.7	235°45.8	29.8	299°27.9	20.8	335°59.2	59.6
14	316°52.7	8°29.8	19.0	250°48.4	29.7	314°30.1	20.6	351°01.4	59.5
15	331°55.1	23°29.0	·· 18.2	265°51.1	·· 29.7	329°32.3	·· 20.5	6°03.6	·· 59.4
16	346°57.6	38°28.2	17.5	280°53.7	29.7	344°34.4	20.4	21°05.8	59.4
17	2°00.1	53°27.5	16.7	295°56.4	29.7	359°36.6	20.2	36°08.0	59.3
18	17°02.5	68°26.7	S20°16.0	310°59.0	N24°29.6	14°38.7	S00°20.1	51°10.3	S14°59.2
19	32°05.0	83°25.9	15.3	326°01.7	29.6	29°40.9	19.9	66°12.5	59.1
20	47°07.4	98°25.1	14.5	341°04.3	29.6	44°43.0	19.8	81°14.7	59.0
21	62°09.9	113°24.4	·· 13.8	356°07.0	·· 29.6	59°45.2	·· 19.6	96°16.9	·· 58.9
22	77°12.4	128°23.6	13.0	11°09.6	29.5	74°47.3	19.5	111°19.1	58.8
23	92°14.8	143°22.8	12.3	26°12.2	29.5	89°49.5	19.3	126°21.3	58.7
Mer.pass. 16:52		ν -0.8′ d 0.7′ m -3.93		ν 2.7′ d -0.0′ m -1.02		ν 2.2′ d 0.1′ m -2.31		ν 2.2′ d 0.1′ m 0.86	

Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	107°17.3	158°22.0	S20°11.5	41°14.9	N24°29.5	104°51.6	S00°19.2	141°23.5	S14°58.7
1	122°19.8	173°21.3	10.8	56°17.5	29.5	119°53.8	19.0	156°25.7	58.6
2	137°22.2	188°20.5	10.0	71°20.1	29.4	134°55.9	18.9	171°27.9	58.5
3	152°24.7	203°19.7	·· 09.3	86°22.8	·· 29.4	149°58.1	·· 18.7	186°30.1	·· 58.4
4	167°27.2	218°19.0	08.5	101°25.4	29.4	165°00.2	18.6	201°32.3	58.3
5	182°29.6	233°18.2	07.8	116°28.0	29.4	180°02.4	18.5	216°34.5	58.2
6	197°32.1	248°17.4	S20°07.0	131°30.7	N24°29.4	195°04.5	S00°18.3	231°36.7	S14°58.1
7	212°34.5	263°16.7	06.3	146°33.3	29.3	210°06.7	18.2	246°38.9	58.0
8	227°37.0	278°15.9	05.5	161°35.9	29.3	225°08.8	18.0	261°41.1	58.0
9	242°39.5	293°15.1	·· 04.8	176°38.6	·· 29.3	240°11.0	·· 17.9	276°43.3	·· 57.9
10	257°41.9	308°14.4	04.0	191°41.2	29.3	255°13.1	17.7	291°45.6	57.8
11	272°44.4	323°13.6	03.3	206°43.8	29.2	270°15.3	17.6	306°47.8	57.7
12	287°46.9	338°12.8	S20°02.5	221°46.4	N24°29.2	285°17.4	S00°17.4	321°50.0	S14°57.6
13	302°49.3	353°12.1	01.7	236°49.0	29.2	300°19.6	17.3	336°52.2	57.5
14	317°51.8	8°11.3	01.0	251°51.7	29.2	315°21.7	17.1	351°54.4	57.4
15	332°54.3	23°10.6	20°00.2	266°54.3	·· 29.2	330°23.8	·· 17.0	6°56.6	·· 57.3
16	347°56.7	38°09.8	19°59.4	281°56.9	29.1	345°26.0	16.8	21°58.8	57.3
17	2°59.2	53°09.0	58.7	296°59.5	29.1	0°28.1	16.7	37°01.0	57.2
18	18°01.7	68°08.3	S19°57.9	312°02.1	N24°29.1	15°30.3	S00°16.5	52°03.2	S14°57.1
19	33°04.1	83°07.5	57.2	327°04.7	29.1	30°32.4	16.4	67°05.4	57.0
20	48°06.6	98°06.7	56.4	342°07.3	29.1	45°34.6	16.2	82°07.6	56.9
21	63°09.0	113°06.0	·· 55.6	357°09.9	·· 29.0	60°36.7	·· 16.1	97°09.8	·· 56.8
22	78°11.5	128°05.2	54.8	12°12.5	29.0	75°38.9	15.9	112°12.0	56.7
23	93°14.0	143°04.5	54.1	27°15.1	29.0	90°41.0	15.8	127°14.2	56.6
Mer.pass. 16:48		ν -0.8′ d 0.7′ m -3.93		ν 2.6′ d -0.0′ m -0.98		ν 2.2′ d 0.1′ m -2.31		ν 2.2′ d 0.1′ m 0.87	

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	108°16.4	158°03.7	S19°53.3	42°17.7	N24°29.0	105°43.2	S00°15.6	142°16.4	S14°56.6
1	123°18.9	173°03.0	52.5	57°20.3	29.0	120°45.3	15.5	157°18.6	56.5
2	138°21.4	188°02.2	51.8	72°22.9	28.9	135°47.5	15.3	172°20.8	56.4
3	153°23.8	203°01.4	·· 51.0	87°25.5	·· 28.9	150°49.6	·· 15.2	187°23.0	·· 56.3
4	168°26.3	218°00.7	50.2	102°28.1	28.9	165°51.7	15.0	202°25.2	56.2
5	183°28.8	232°59.9	49.4	117°30.7	28.9	180°53.9	14.9	217°27.4	56.1
6	198°31.2	247°59.2	S19°48.7	132°33.3	N24°28.9	195°56.0	S00°14.8	232°29.6	S14°56.0
7	213°33.7	262°58.4	47.9	147°35.9	28.8	210°58.2	14.6	247°31.9	55.9
8	228°36.2	277°57.7	47.1	162°38.5	28.8	226°00.3	14.5	262°34.1	55.9
9	243°38.6	292°56.9	·· 46.3	177°41.1	·· 28.8	241°02.5	·· 14.3	277°36.3	·· 55.8
10	258°41.1	307°56.2	45.5	192°43.7	28.8	256°04.6	14.2	292°38.5	55.7
11	273°43.5	322°55.4	44.8	207°46.3	28.8	271°06.7	14.0	307°40.7	55.6
12	288°46.0	337°54.7	S19°44.0	222°48.9	N24°28.7	286°08.9	S00°13.9	322°42.9	S14°55.5
13	303°48.5	352°53.9	43.2	237°51.4	28.7	301°11.0	13.7	337°45.1	55.4
14	318°50.9	7°53.2	42.4	252°54.0	28.7	316°13.2	13.6	352°47.3	55.3
15	333°53.4	22°52.4	·· 41.6	267°56.6	·· 28.7	331°15.3	·· 13.4	7°49.5	·· 55.2
16	348°55.9	37°51.7	40.8	282°59.2	28.7	346°17.5	13.3	22°51.7	55.1
17	3°58.3	52°50.9	40.0	298°01.8	28.7	1°19.6	13.1	37°53.9	55.1
18	19°00.8	67°50.2	S19°39.3	313°04.3	N24°28.6	16°21.7	S00°13.0	52°56.1	S14°55.0
19	34°03.3	82°49.4	38.5	328°06.9	28.6	31°23.9	12.8	67°58.3	54.9
20	49°05.7	97°48.7	37.7	343°09.5	28.6	46°26.0	12.7	83°00.5	54.8
21	64°08.2	112°47.9	·· 36.9	358°12.0	·· 28.6	61°28.2	·· 12.5	98°02.7	·· 54.7
22	79°10.7	127°47.2	36.1	13°14.6	28.6	76°30.3	12.3	113°04.9	54.6
23	94°13.1	142°46.4	35.3	28°17.2	28.6	91°32.4	12.2	128°07.1	54.5
Mer.pass. 16:44		ν -0.8′ d 0.8′ m -3.93		ν 2.6′ d -0.0′ m -0.95		ν 2.1′ d 0.1′ m -2.30		ν 2.2′ d 0.1′ m 0.87	

Stars

	SHA	**Dec**
Alpheratz	357°36.6	29°13.1
Ankaa	353°08.9	-42°11.2
Schedar	349°33.0	56°40.0
Diphda	348°49.0	-17°51.8
Achernar	335°21.3	-57°07.5
Hamal	327°53.0	23°34.3
Polaris	314°33.8	89°21.9
Acamar	315°12.8	-40°13.0
Menkar	314°07.7	4°10.7
Mirfak	308°30.3	49°56.7
Aldebaran	290°41.2	16°33.3
Rigel	281°05.1	-8°10.6
Capella	280°23.9	46°01.3
Bellatrix	278°24.3	6°22.2
Elnath	278°03.6	28°37.6
Alnilam	275°39.1	-1°11.3
Betelgeuse	270°53.5	7°24.6
Canopus	263°52.6	-52°42.5
Sirius	258°27.3	-16°44.9
Adhara	255°06.8	-29°00.2
Procyon	244°52.2	5°09.9
Pollux	243°19.0	27°58.2
Avior	234°14.8	-59°34.8
Suhail	222°47.1	-43°31.4
Miaplacidus	221°37.8	-69°48.5
Alphard	217°49.1	-8°45.5
Regulus	207°36.0	11°51.2
Dubhe	193°42.7	61°37.4
Denebola	182°26.5	14°26.5
Gienah	175°45.2	-17°40.1
Acrux	173°01.8	-63°13.2
Gacrux	171°53.4	-57°14.2
Alioth	166°14.4	55°49.8
Spica	158°24.1	-11°16.8
Alkaid	152°53.4	49°11.7
Hadar	148°38.5	-60°28.7
Menkent	147°59.7	-36°28.8
Arcturus	145°49.5	19°03.7
Rigil Kent.	139°42.8	-60°55.5
Kochab	137°20.3	74°03.3
Zuben'ubi	136°58.0	-16°08.1
Alphecca	126°05.4	26°38.1
Antares	112°18.2	-26°28.9
Atria	107°14.4	-69°03.9
Sabik	102°05.0	-15°45.2
Shaula	96°13.0	-37°07.2
Rasalhague	96°00.4	12°32.5
Eltanin	90°43.5	51°29.0
Kaus Aust.	83°35.1	-34°22.4
Vega	80°34.8	38°48.2
Nunki	75°50.2	-26°16.1
Altair	62°01.9	8°55.7
Peacock	53°08.9	-56°39.8
Deneb	49°27.4	45°21.8
Enif	33°40.7	9°58.8
Al Na'ir	27°35.3	-46°51.2
Fomalhaut	15°16.5	-29°30.3
Scheat	13°47.0	28°12.5
Markab	13°31.7	15°19.7

Jan 07 Sat	**SHA**	**Mer.pass**
Venus	52°22.5	13:26
Mars	293°53.0	21:15
Jupiter	357°41.8	17:02
Saturn	34°12.4	14:36

Jan 08 Sun	**SHA**	**Mer.pass**
Venus	51°04.7	13:27
Mars	293°57.6	21:11
Jupiter	357°34.3	16:58
Saturn	34°06.2	14:32

Jan 09 Mon	**SHA**	**Mer.pass**
Venus	49°47.3	13:28
Mars	294°01.3	21:07
Jupiter	357°26.7	16:55
Saturn	34°00.0	14:29

Horizontal parallax	
Venus:	0.1
Mars:	0.2

h Sun Moon

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	178°31.2	S22°25.9	357°27.5	10.3′	N26°55.7	2.8′	54.0′
1	193°30.9	25.6	11°56.9	10.4′	26°52.9	2.9′	54.0′
2	208°30.7	25.3	26°26.2	10.4′	26°50.0	3.1′	54.0′
3	223°30.4	·· 25.0	40°55.6	10.4′	26°46.9	3.2′	54.0′
4	238°30.1	24.6	55°25.1	10.5′	26°43.7	3.3′	53.9′
5	253°29.8	24.3	69°54.5	10.5′	26°40.4	3.5′	53.9′
6	268°29.6	S22°24.0	84°24.0	10.5′	N26°36.9	3.6′	53.9′
7	283°29.3	23.7	98°53.6	10.6′	26°33.3	3.7′	53.9′
8	298°29.0	23.4	113°23.2	10.6′	26°29.6	3.8′	53.9′
9	313°28.8	·· 23.1	127°52.8	10.7′	26°25.8	4.0′	53.9′
10	328°28.5	22.8	142°22.5	10.7′	26°21.8	4.1′	53.9′
11	343°28.2	22.4	156°52.2	10.8′	26°17.7	4.2′	53.9′
12	358°28.0	S22°22.1	171°22.0	10.8′	N26°13.5	4.3′	53.9′
13	13°27.7	21.8	185°51.8	10.8′	26°09.2	4.5′	53.9′
14	28°27.4	21.5	200°21.6	10.9′	26°04.7	4.6′	53.9′
15	43°27.2	·· 21.2	214°51.5	10.9′	26°00.1	4.7′	53.9′
16	58°26.9	20.8	229°21.5	11.0′	25°55.4	4.8′	53.9′
17	73°26.6	20.5	243°51.4	11.0′	25°50.6	4.9′	53.9′
18	88°26.4	S22°20.2	258°21.5	11.1′	N25°45.7	5.1′	53.9′
19	103°26.1	19.9	272°51.6	11.1′	25°40.6	5.2′	53.9′
20	118°25.8	19.5	287°21.7	11.2′	25°35.4	5.2′	53.9′
21	133°25.6	·· 19.2	301°51.9	11.2′	25°30.2	5.5′	53.9′
22	148°25.3	18.9	316°22.1	11.3′	25°24.7	5.5′	53.9′
23	163°25.0	18.6	330°52.4	11.3′	25°19.2	5.6′	53.9′
	SD = 16.3′	d = 0.3′	SD = 14.7′				

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	178°24.8	S22°18.2	345°22.8	11.4′	N25°13.6	5.8′	53.9′
1	193°24.5	17.9	359°53.2	11.5′	25°07.8	5.9′	53.9′
2	208°24.2	17.6	14°23.6	11.5′	25°01.9	6.0′	53.9′
3	223°24.0	·· 17.3	28°54.1	11.6′	24°55.9	6.1′	53.9′
4	238°23.7	16.9	43°24.7	11.6′	24°49.8	6.2′	53.9′
5	253°23.4	16.6	57°55.3	11.7′	24°43.6	6.3′	53.9′
6	268°23.2	S22°16.3	72°26.0	11.7′	N24°37.3	6.4′	53.9′
7	283°22.9	15.9	86°56.7	11.8′	24°30.9	6.6′	53.9′
8	298°22.6	15.6	101°27.5	11.8′	24°24.3	6.7′	53.9′
9	313°22.4	·· 15.3	115°58.3	11.9′	24°17.6	6.7′	53.9′
10	328°22.1	14.9	130°29.2	12.0′	24°10.9	6.9′	53.9′
11	343°21.8	14.6	145°00.2	12.0′	24°04.0	7.0′	53.9′
12	358°21.6	S22°14.3	159°31.2	12.1′	N23°57.0	7.1′	53.9′
13	13°21.3	13.9	174°02.3	12.1′	23°49.9	7.2′	53.9′
14	28°21.1	13.6	188°33.4	12.2′	23°42.7	7.3′	53.9′
15	43°20.8	·· 13.2	203°04.6	12.2′	23°35.4	7.4′	53.9′
16	58°20.5	12.9	217°35.8	12.3′	23°28.0	7.5′	53.9′
17	73°20.3	12.6	232°07.1	12.4′	23°20.5	7.6′	53.9′
18	88°20.0	S22°12.2	246°38.5	12.4′	N23°12.9	7.7′	53.9′
19	103°19.7	11.9	261°09.9	12.5′	23°05.2	7.8′	53.9′
20	118°19.5	11.5	275°41.4	12.5′	22°57.4	7.9′	53.9′
21	133°19.2	·· 11.2	290°13.0	12.6′	22°49.5	8.1′	53.9′
22	148°19.0	10.8	304°44.6	12.7′	22°41.4	8.1′	53.9′
23	163°18.7	10.5	319°16.3	12.7′	22°33.3	8.2′	53.9′
	SD = 16.3′	d = 0.3′	SD = 14.7′				

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	178°18.4	S22°10.2	333°48.0	12.8′	N22°25.1	8.3′	53.9′
1	193°18.2	09.8	348°19.8	12.8′	22°16.8	8.4′	53.9′
2	208°17.9	09.5	2°51.6	12.9′	22°08.4	8.5′	53.9′
3	223°17.7	·· 09.1	17°23.5	13.0′	21°59.9	8.6′	53.9′
4	238°17.4	08.8	31°55.5	13.0′	21°51.3	8.7′	53.9′
5	253°17.1	08.4	46°27.5	13.1′	21°42.6	8.8′	53.9′
6	268°16.9	S22°08.1	60°59.6	13.1′	N21°33.8	8.9′	53.9′
7	283°16.6	07.7	75°31.8	13.2′	21°24.9	8.9′	53.9′
8	298°16.4	07.4	90°04.0	13.3′	21°16.0	9.1′	53.9′
9	313°16.1	·· 07.0	104°36.2	13.3′	21°06.9	9.1′	53.9′
10	328°15.8	06.7	119°08.6	13.4′	20°57.8	9.3′	53.9′
11	343°15.6	06.3	133°41.0	13.4′	20°48.5	9.3′	53.9′
12	358°15.3	S22°06.0	148°13.4	13.5′	N20°39.2	9.4′	53.9′
13	13°15.1	05.6	162°45.9	13.6′	20°29.8	9.5′	53.9′
14	28°14.8	05.2	177°18.5	13.6′	20°20.3	9.6′	54.0′
15	43°14.6	·· 04.9	191°51.1	13.7′	20°10.7	9.7′	54.0′
16	58°14.3	04.5	206°23.8	13.7′	20°01.0	9.7′	54.0′
17	73°14.0	04.2	220°56.5	13.8′	19°51.3	9.9′	54.0′
18	88°13.8	S22°03.8	235°29.3	13.9′	N19°41.4	9.9′	54.0′
19	103°13.5	03.4	250°02.2	13.9′	19°31.5	10.0′	54.0′
20	118°13.3	03.1	264°35.1	14.0′	19°21.5	10.1′	54.0′
21	133°13.0	·· 02.7	279°08.1	14.0′	19°11.4	10.2′	54.0′
22	148°12.8	02.4	293°41.1	14.1′	19°01.2	10.2′	54.0′
23	163°12.5	02.0	308°14.2	14.1′	18°51.0	10.3′	54.0′
	SD = 16.3′	d = 0.3′	SD = 14.7′				

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

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

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 15-17 100-96%
07	05:55	06:08	12:06	00:11	12:36	○
08	06:21	06:34	12:07	01:00	13:25	
09	06:46	06:59	12:07	01:48	14:11	

January 10, 11, 12 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	109°15.6	157°45.7	S19°34.5	43°19.7	N24°28.5	106°34.6	S00°12.0	143°09.3	S14°54.4
1	124°18.0	172°45.0	33.7	58°22.3	28.5	121°36.7	11.9	158°11.5	54.4
2	139°20.5	187°44.2	32.9	73°24.9	28.5	136°38.9	11.7	173°13.7	54.3
3	154°23.0	202°43.5	·· 32.1	88°27.4	·· 28.5	151°41.0	·· 11.6	188°15.9	·· 54.2
4	169°25.4	217°42.7	31.3	103°30.0	28.5	166°43.1	11.4	203°18.1	54.1
5	184°27.9	232°42.0	30.5	118°32.6	28.5	181°45.3	11.3	218°20.3	54.0
6	199°30.4	247°41.2	S19°29.7	133°35.1	N24°28.4	196°47.4	S00°11.1	233°22.5	S14°53.9
7	214°32.8	262°40.5	28.9	148°37.7	28.4	211°49.5	11.0	248°24.7	53.8
8	229°35.3	277°39.8	28.1	163°40.2	28.4	226°51.7	10.8	263°26.9	53.7
9	244°37.8	292°39.0	·· 27.3	178°42.8	·· 28.4	241°53.8	·· 10.7	278°29.1	·· 53.6
10	259°40.2	307°38.3	26.5	193°45.3	28.4	256°56.0	10.5	293°31.3	53.6
11	274°42.7	322°37.6	25.7	208°47.9	28.4	271°58.1	10.4	308°33.5	53.5
12	289°45.1	337°36.8	S19°24.9	223°50.4	N24°28.4	287°00.2	S00°10.2	323°35.7	S14°53.4
13	304°47.6	352°36.1	24.1	238°53.0	28.3	302°02.4	10.1	338°37.9	53.3
14	319°50.1	7°35.3	23.3	253°55.5	28.3	317°04.5	09.9	353°40.1	53.2
15	334°52.5	22°34.6	·· 22.5	268°58.1	·· 28.3	332°06.6	·· 09.8	8°42.3	·· 53.1
16	349°55.0	37°33.9	21.6	284°00.6	28.3	347°08.8	09.6	23°44.5	53.0
17	4°57.5	52°33.1	20.8	299°03.1	28.3	2°10.9	09.5	38°46.7	52.9
18	19°59.9	67°32.4	S19°20.0	314°05.7	N24°28.3	17°13.0	S00°09.3	53°48.9	S14°52.8
19	35°02.4	82°31.7	19.2	329°08.2	28.3	32°15.2	09.2	68°51.1	52.8
20	50°04.9	97°30.9	18.4	344°10.7	28.2	47°17.3	09.0	83°53.3	52.7
21	65°07.3	112°30.2	·· 17.6	359°13.3	·· 28.2	62°19.4	·· 08.9	98°55.5	·· 52.6
22	80°09.8	127°29.5	16.8	14°15.8	28.2	77°21.6	08.7	113°57.8	52.5
23	95°12.3	142°28.7	15.9	29°18.3	28.2	92°23.7	08.6	129°00.0	52.4
Mer.pass. 16:40		ν -0.7′ d 0.8′ m -3.93		ν 2.6′ d -0.0′ m -0.92		ν 2.1′ d 0.2′ m -2.30		ν 2.2′ d 0.1′ m 0.87	

Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	110°14.7	157°28.0	S19°15.1	44°20.9	N24°28.2	107°25.9	S00°08.4	144°02.2	S14°52.3
1	125°17.2	172°27.3	14.3	59°23.4	28.2	122°28.0	08.2	159°04.4	52.2
2	140°19.6	187°26.6	13.5	74°25.9	28.2	137°30.1	08.1	174°06.6	52.1
3	155°22.1	202°25.8	·· 12.7	89°28.5	·· 28.2	152°32.3	·· 07.9	189°08.8	·· 52.0
4	170°24.6	217°25.1	11.8	104°31.0	28.1	167°34.4	07.8	204°11.0	52.0
5	185°27.0	232°24.4	11.0	119°33.5	28.1	182°36.5	07.6	219°13.2	51.9
6	200°29.5	247°23.6	S19°10.2	134°36.0	N24°28.1	197°38.7	S00°07.5	234°15.4	S14°51.8
7	215°32.0	262°22.9	09.4	149°38.5	28.1	212°40.8	07.3	249°17.6	51.7
8	230°34.4	277°22.2	08.6	164°41.1	28.1	227°42.9	07.2	264°19.8	51.6
9	245°36.9	292°21.5	·· 07.7	179°43.6	·· 28.1	242°45.0	·· 07.0	279°22.0	·· 51.5
10	260°39.4	307°20.7	06.9	194°46.1	28.1	257°47.2	06.9	294°24.2	51.4
11	275°41.8	322°20.0	06.1	209°48.6	28.1	272°49.3	06.7	309°26.4	51.3
12	290°44.3	337°19.3	S19°05.2	224°51.1	N24°28.0	287°51.4	S00°06.6	324°28.6	S14°51.2
13	305°46.8	352°18.6	04.4	239°53.6	28.0	302°53.6	06.4	339°30.8	51.1
14	320°49.2	7°17.8	03.6	254°56.1	28.0	317°55.7	06.2	354°33.0	51.1
15	335°51.7	22°17.1	·· 02.7	269°58.6	·· 28.0	332°57.8	·· 06.1	9°35.2	·· 51.0
16	350°54.1	37°16.4	01.9	285°01.2	28.0	348°00.0	05.9	24°37.4	50.9
17	5°56.6	52°15.7	01.1	300°03.7	28.0	3°02.1	05.8	39°39.6	50.8
18	20°59.1	67°15.0	S19°00.2	315°06.2	N24°28.0	18°04.2	S00°05.6	54°41.8	S14°50.7
19	36°01.5	82°14.2	18°59.4	330°08.7	28.0	33°06.4	05.5	69°44.0	50.6
20	51°04.0	97°13.5	58.6	345°11.2	28.0	48°08.5	05.3	84°46.2	50.5
21	66°06.5	112°12.8	·· 57.7	0°13.7	·· 28.0	63°10.6	·· 05.2	99°48.4	·· 50.4
22	81°08.9	127°12.1	56.9	15°16.2	27.9	78°12.7	05.0	114°50.6	50.3
23	96°11.4	142°11.4	56.1	30°18.7	27.9	93°14.9	04.8	129°52.8	50.3
Mer.pass. 16:36		ν -0.7′ d 0.8′ m -3.93		ν 2.5′ d -0.0′ m -0.89		ν 2.1′ d 0.2′ m -2.29		ν 2.2′ d 0.1′ m 0.87	

Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	111°13.9	157°10.7	S18°55.2	45°21.1	N24°27.9	108°17.0	S00°04.7	144°55.0	S14°50.2
1	126°16.3	172°09.9	54.4	60°23.6	27.9	123°19.1	04.5	159°57.2	50.1
2	141°18.8	187°09.2	53.5	75°26.1	27.9	138°21.3	04.4	174°59.4	50.0
3	156°21.2	202°08.5	·· 52.7	90°28.6	·· 27.9	153°23.4	·· 04.2	190°01.6	·· 49.9
4	171°23.7	217°07.8	51.8	105°31.1	27.9	168°25.5	04.1	205°03.8	49.8
5	186°26.2	232°07.1	51.0	120°33.6	27.9	183°27.6	03.9	220°06.0	49.7
6	201°28.6	247°06.4	S18°50.1	135°36.1	N24°27.9	198°29.8	S00°03.8	235°08.2	S14°49.6
7	216°31.1	262°05.7	49.3	150°38.6	27.9	213°31.9	03.6	250°10.3	49.5
8	231°33.6	277°04.9	48.5	165°41.1	27.9	228°34.0	03.4	265°12.5	49.4
9	246°36.0	292°04.2	·· 47.6	180°43.5	·· 27.9	243°36.1	·· 03.3	280°14.7	·· 49.4
10	261°38.5	307°03.5	46.8	195°46.0	27.8	258°38.3	03.1	295°16.9	49.3
11	276°41.0	322°02.8	45.9	210°48.5	27.8	273°40.4	03.0	310°19.1	49.2
12	291°43.4	337°02.1	S18°45.1	225°51.0	N24°27.8	288°42.5	S00°02.8	325°21.3	S14°49.1
13	306°45.9	352°01.4	44.2	240°53.4	27.8	303°44.7	02.7	340°23.5	49.0
14	321°48.4	7°00.7	43.3	255°55.9	27.8	318°46.8	02.5	355°25.7	48.9
15	336°50.8	22°00.0	·· 42.5	270°58.4	·· 27.8	333°48.9	·· 02.4	10°27.9	·· 48.8
16	351°53.3	36°59.3	41.6	286°00.9	27.8	348°51.0	02.2	25°30.1	48.7
17	6°55.7	51°58.6	40.8	301°03.3	27.8	3°53.2	02.0	40°32.3	48.6
18	21°58.2	66°57.8	S18°39.9	316°05.8	N24°27.8	18°55.3	S00°01.9	55°34.5	S14°48.5
19	37°00.7	81°57.1	39.1	331°08.3	27.8	33°57.4	01.7	70°36.7	48.5
20	52°03.1	96°56.4	38.2	346°10.7	27.8	48°59.5	01.6	85°38.9	48.4
21	67°05.6	111°55.7	·· 37.3	1°13.2	·· 27.8	64°01.7	·· 01.4	100°41.1	·· 48.3
22	82°08.1	126°55.0	36.5	16°15.7	27.8	79°03.8	01.3	115°43.3	48.2
23	97°10.5	141°54.3	35.6	31°18.1	27.8	94°05.9	01.1	130°45.5	48.1
Mer.pass. 16:32		ν -0.7′ d 0.8′ m -3.93		ν 2.5′ d -0.0′ m -0.85		ν 2.1′ d 0.2′ m -2.29		ν 2.2′ d 0.1′ m 0.87	

Stars

	SHA	**Dec**
Alpheratz	357°36.6	29°13.1
Ankaa	353°08.9	-42°11.2
Schedar	349°33.0	56°40.0
Diphda	348°49.0	-17°51.8
Achernar	335°21.4	-57°07.5
Hamal	327°53.0	23°34.3
Polaris	314°35.1	89°21.9
Acamar	315°12.8	-40°13.0
Menkar	314°07.7	4°10.7
Mirfak	308°30.3	49°56.7
Aldebaran	290°41.2	16°33.3
Rigel	281°05.2	-8°10.6
Capella	280°23.9	46°01.3
Bellatrix	278°24.3	6°22.2
Elnath	278°03.6	28°37.6
Alnilam	275°39.1	-1°11.3
Betelgeuse	270°53.5	7°24.6
Canopus	263°52.6	-52°42.5
Sirius	258°27.3	-16°44.9
Adhara	255°06.8	-29°00.2
Procyon	244°52.2	5°09.9
Pollux	243°18.9	27°58.2
Avior	234°14.8	-59°34.9
Suhail	222°47.1	-43°31.4
Miaplacidus	221°37.7	-69°48.5
Alphard	217°49.1	-8°45.5
Regulus	207°35.9	11°51.2
Dubhe	193°42.7	61°37.4
Denebola	182°26.5	14°26.5
Gienah	175°45.2	-17°40.1
Acrux	173°01.8	-63°13.3
Gacrux	171°53.4	-57°14.2
Alioth	166°14.4	55°49.8
Spica	158°24.1	-11°16.8
Alkaid	152°53.4	49°11.7
Hadar	148°38.5	-60°28.7
Menkent	147°59.7	-36°28.8
Arcturus	145°49.5	19°03.6
Rigil Kent.	139°42.8	-60°55.5
Kochab	137°20.3	74°03.3
Zuben'ubi	136°58.0	-16°08.2
Alphecca	126°05.4	26°38.1
Antares	112°18.1	-26°28.9
Atria	107°14.3	-69°03.9
Sabik	102°05.0	-15°45.2
Shaula	96°13.0	-37°07.2
Rasalhague	96°00.4	12°32.5
Eltanin	90°43.5	51°29.0
Kaus Aust.	83°35.1	-34°22.4
Vega	80°34.8	38°48.2
Nunki	75°50.2	-26°16.1
Altair	62°01.9	8°55.7
Peacock	53°08.9	-56°39.8
Deneb	49°27.4	45°21.7
Enif	33°40.7	9°58.8
Al Na'ir	27°35.3	-46°51.2
Fomalhaut	15°16.6	-29°30.3
Scheat	13°47.0	28°12.5
Markab	13°31.7	15°19.7

Jan 10 Tue	**SHA**	**Mer.pass**
Venus	48°30.1	13:30
Mars	294°04.2	21:03
Jupiter	357°19.0	16:51
Saturn	33°53.7	14:25

Jan 11 Wed	**SHA**	**Mer.pass**
Venus	47°13.3	13:31
Mars	294°06.2	20:59
Jupiter	357°11.1	16:48
Saturn	33°47.4	14:22

Jan 12 Thu	**SHA**	**Mer.pass**
Venus	45°56.8	13:32
Mars	294°07.3	20:55
Jupiter	357°03.1	16:44
Saturn	33°41.1	14:18

Horizontal parallax	
Venus:	0.1
Mars:	0.2

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°12.2	S22°01.6	322°47.3	14.2′	N18°40.7	10.4′	54.0′
1	193°12.0	01.3	337°20.5	14.2′	18°30.3	10.5′	54.0′
2	208°11.7	00.9	351°53.7	14.3′	18°19.8	10.6′	54.0′
3	223°11.5	·· 00.5	6°27.0	14.4′	18°09.2	10.6′	54.0′
4	238°11.2	22°00.2	21°00.4	14.4′	17°58.6	10.7′	54.0′
5	253°11.0	21°59.8	35°33.8	14.5′	17°47.9	10.8′	54.0′
6	268°10.7	S21°59.4	50°07.3	14.5′	N17°37.1	10.8′	54.1′
7	283°10.5	59.1	64°40.8	14.6′	17°26.3	11.0′	54.1′
8	298°10.2	58.7	79°14.3	14.6′	17°15.3	10.9′	54.1′
9	313°10.0	·· 58.3	93°47.9	14.7′	17°04.4	11.1′	54.1′
10	328°09.7	58.0	108°21.6	14.7′	16°53.3	11.2′	54.1′
11	343°09.5	57.6	122°55.3	14.8′	16°42.1	11.2′	54.1′
12	358°09.2	S21°57.2	137°29.1	14.8′	N16°30.9	11.2′	54.1′
13	13°09.0	56.8	152°02.9	14.9′	16°19.7	11.4′	54.1′
14	28°08.7	56.5	166°36.8	14.9′	16°08.3	11.4′	54.1′
15	43°08.4	·· 56.1	181°10.7	15.0′	15°56.9	11.5′	54.1′
16	58°08.2	55.7	195°44.6	15.0′	15°45.4	11.5′	54.1′
17	73°07.9	55.3	210°18.6	15.0′	15°33.9	11.6′	54.2′
18	88°07.7	S21°55.0	224°52.7	15.1′	N15°22.3	11.7′	54.2′
19	103°07.4	54.6	239°26.7	15.1′	15°10.6	11.7′	54.2′
20	118°07.2	54.2	254°00.9	15.2′	14°58.9	11.8′	54.2′
21	133°06.9	·· 53.8	268°35.1	15.2′	14°47.1	11.8′	54.2′
22	148°06.7	53.5	283°09.3	15.3′	14°35.3	12.0′	54.2′
23	163°06.4	53.1	297°43.5	15.3′	14°23.3	11.9′	54.2′
	SD = 16.3′	d = 0.4′	SD = 14.7′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°06.2	S21°52.7	312°17.8	15.3′	N14°11.4	12.1′	54.2′
1	193°05.9	52.3	326°52.2	15.4′	13°59.3	12.1′	54.2′
2	208°05.7	51.9	341°26.6	15.4′	13°47.2	12.1′	54.3′
3	223°05.4	·· 51.5	356°01.0	15.5′	13°35.1	12.2′	54.3′
4	238°05.2	51.2	10°35.4	15.5′	13°22.9	12.3′	54.3′
5	253°05.0	50.8	25°09.9	15.5′	13°10.6	12.3′	54.3′
6	268°04.7	S21°50.4	39°44.5	15.6′	N12°58.3	12.4′	54.3′
7	283°04.5	50.0	54°19.0	15.6′	12°45.9	12.4′	54.3′
8	298°04.2	49.6	68°53.6	15.6′	12°33.5	12.5′	54.3′
9	313°04.0	·· 49.2	83°28.3	15.7′	12°21.0	12.5′	54.3′
10	328°03.7	48.8	98°02.9	15.7′	12°08.5	12.6′	54.4′
11	343°03.5	48.4	112°37.6	15.7′	11°55.9	12.6′	54.4′
12	358°03.2	S21°48.1	127°12.4	15.8′	N11°43.3	12.7′	54.4′
13	13°03.0	47.7	141°47.1	15.8′	11°30.6	12.7′	54.4′
14	28°02.7	47.3	156°21.9	15.8′	11°17.9	12.8′	54.4′
15	43°02.5	·· 46.9	170°56.7	15.8′	11°05.1	12.9′	54.4′
16	58°02.2	46.5	185°31.6	15.9′	10°52.2	12.8′	54.4′
17	73°02.0	46.1	200°06.5	15.9′	10°39.4	13.0′	54.5′
18	88°01.7	S21°45.7	214°41.4	15.9′	N10°26.4	12.9′	54.5′
19	103°01.5	45.3	229°16.3	15.9′	10°13.5	13.1′	54.5′
20	118°01.3	44.9	243°51.2	16.0′	10°00.4	13.0′	54.5′
21	133°01.0	·· 44.5	258°26.2	16.0′	09°47.4	13.1′	54.5′
22	148°00.8	44.1	273°01.2	16.0′	09°34.3	13.2′	54.5′
23	163°00.5	43.7	287°36.2	16.0′	09°21.1	13.2′	54.6′
	SD = 16.3′	d = 0.4′	SD = 14.8′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°00.3	S21°43.3	302°11.3	16.1′	N09°07.9	13.2′	54.6′
1	193°00.0	42.9	316°46.3	16.1′	08°54.7	13.3′	54.6′
2	207°59.8	42.5	331°21.4	16.1′	08°41.4	13.3′	54.6′
3	222°59.6	·· 42.1	345°56.5	16.1′	08°28.1	13.3′	54.6′
4	237°59.3	41.7	0°31.6	16.1′	08°14.8	13.4′	54.6′
5	252°59.1	41.3	15°06.7	16.1′	08°01.4	13.5′	54.7′
6	267°58.8	S21°40.9	29°41.8	16.1′	N07°47.9	13.4′	54.7′
7	282°58.6	40.5	44°17.0	16.2′	07°34.5	13.5′	54.7′
8	297°58.3	40.1	58°52.2	16.2′	07°21.0	13.6′	54.7′
9	312°58.1	·· 39.7	73°27.3	16.2′	07°07.4	13.5′	54.7′
10	327°57.9	39.3	88°02.5	16.2′	06°53.9	13.7′	54.8′
11	342°57.6	38.9	102°37.7	16.2′	06°40.2	13.6′	54.8′
12	357°57.4	S21°38.5	117°12.9	16.2′	N06°26.6	13.7′	54.8′
13	12°57.1	38.1	131°48.1	16.2′	06°12.9	13.7′	54.8′
14	27°56.9	37.7	146°23.3	16.2′	05°59.2	13.7′	54.8′
15	42°56.7	·· 37.2	160°58.5	16.2′	05°45.5	13.8′	54.9′
16	57°56.4	36.8	175°33.7	16.2′	05°31.7	13.8′	54.9′
17	72°56.2	36.4	190°09.0	16.2′	05°17.9	13.8′	54.9′
18	87°55.9	S21°36.0	204°44.2	16.2′	N05°04.1	13.9′	54.9′
19	102°55.7	35.6	219°19.4	16.2′	04°50.2	13.9′	54.9′
20	117°55.5	35.2	233°54.6	16.2′	04°36.3	13.9′	55.0′
21	132°55.2	·· 34.8	248°29.8	16.2′	04°22.4	14.0′	55.0′
22	147°55.0	34.4	263°05.1	16.2′	04°08.4	13.9′	55.0′
23	162°54.8	33.9	277°40.3	16.2′	03°54.5	14.0′	55.0′
	SD = 16.3′	d = 0.4′	SD = 14.9′				

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

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

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 92-79%
10	07:11	07:23	12:07	02:33	14:55	
11	07:35	07:47	12:08	03:16	15:37	
12	07:59	08:10	12:08	03:58	16:18	

January 13, 14, 15 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	112°13.0	156°53.6	S18°34.8	46°20.6	N24°27.8	109°08.0	S00°00.9	145°47.7	S14°48.0
1	127°15.5	171°52.9	33.9	61°23.0	27.7	124°10.1	00.8	160°49.9	47.9
2	142°17.9	186°52.2	33.0	76°25.5	27.7	139°12.3	00.6	175°52.1	47.8
3	157°20.4	201°51.5	·· 32.2	91°27.9	·· 27.7	154°14.4	·· 00.5	190°54.3	·· 47.7
4	172°22.9	216°50.8	31.3	106°30.4	27.7	169°16.5	00.3	205°56.5	47.6
5	187°25.3	231°50.1	30.4	121°32.8	27.7	184°18.6	S00°00.1	220°58.7	47.5
6	202°27.8	246°49.4	S18°29.6	136°35.3	N24°27.7	199°20.8	N00°00.0	236°00.9	S14°47.5
7	217°30.2	261°48.7	28.7	151°37.7	27.7	214°22.9	00.2	251°03.1	47.4
8	232°32.7	276°48.0	27.8	166°40.2	27.7	229°25.0	00.3	266°05.3	47.3
9	247°35.2	291°47.3	·· 27.0	181°42.6	·· 27.7	244°27.1	·· 00.5	281°07.5	·· 47.2
10	262°37.6	306°46.6	26.1	196°45.1	27.7	259°29.2	00.6	296°09.7	47.1
11	277°40.1	321°45.9	25.2	211°47.5	27.7	274°31.4	00.8	311°11.9	47.0
12	292°42.6	336°45.2	S18°24.3	226°50.0	N24°27.7	289°33.5	N00°01.0	326°14.1	S14°46.9
13	307°45.0	351°44.5	23.5	241°52.4	27.7	304°35.6	01.1	341°16.3	46.8
14	322°47.5	6°43.8	22.6	256°54.9	27.7	319°37.7	01.3	356°18.5	46.7
15	337°50.0	21°43.1	·· 21.7	271°57.3	·· 27.7	334°39.8	·· 01.4	11°20.7	·· 46.6
16	352°52.4	36°42.5	20.8	286°59.7	27.7	349°42.0	01.6	26°22.9	46.6
17	7°54.9	51°41.8	20.0	302°02.2	27.7	4°44.1	01.8	41°25.1	46.5
18	22°57.3	66°41.1	S18°19.1	317°04.6	N24°27.7	19°46.2	N00°01.9	56°27.3	S14°46.4
19	37°59.8	81°40.4	18.2	332°07.0	27.7	34°48.3	02.1	71°29.5	46.3
20	53°02.3	96°39.7	17.3	347°09.5	27.7	49°50.4	02.2	86°31.7	46.2
21	68°04.7	111°39.0	·· 16.4	2°11.9	·· 27.7	64°52.6	·· 02.4	101°33.9	·· 46.1
22	83°07.2	126°38.3	15.5	17°14.3	27.7	79°54.7	02.6	116°36.1	46.0
23	98°09.7	141°37.6	14.7	32°16.7	27.7	94°56.8	02.7	131°38.2	45.9
Mer.pass. 16:28		ν -0.7′ d 0.9′ m -3.93		ν 2.5′ d -0.0′ m -0.82		ν 2.1′ d 0.2′ m -2.28		ν 2.2′ d 0.1′ m 0.87	

Sat	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	113°12.1	156°36.9	S18°13.8	47°19.2	N24°27.7	109°58.9	N00°02.9	146°40.4	S14°45.8
1	128°14.6	171°36.2	12.9	62°21.6	27.7	125°01.0	03.0	161°42.6	45.7
2	143°17.1	186°35.5	12.0	77°24.0	27.7	140°03.1	03.2	176°44.8	45.6
3	158°19.5	201°34.9	·· 11.1	92°26.4	·· 27.7	155°05.3	·· 03.3	191°47.0	·· 45.6
4	173°22.0	216°34.2	10.2	107°28.8	27.7	170°07.4	03.5	206°49.2	45.5
5	188°24.5	231°33.5	09.3	122°31.3	27.7	185°09.5	03.7	221°51.4	45.4
6	203°26.9	246°32.8	S18°08.5	137°33.7	N24°27.7	200°11.6	N00°03.8	236°53.6	S14°45.3
7	218°29.4	261°32.1	07.6	152°36.1	27.7	215°13.7	04.0	251°55.8	45.2
8	233°31.8	276°31.4	06.7	167°38.5	27.7	230°15.9	04.2	266°58.0	45.1
9	248°34.3	291°30.7	·· 05.8	182°40.9	·· 27.7	245°18.0	·· 04.3	282°00.2	·· 45.0
10	263°36.8	306°30.1	04.9	197°43.3	27.7	260°20.1	04.5	297°02.4	44.9
11	278°39.2	321°29.4	04.0	212°45.7	27.7	275°22.2	04.6	312°04.6	44.8
12	293°41.7	336°28.7	S18°03.1	227°48.1	N24°27.7	290°24.3	N00°04.8	327°06.8	S14°44.7
13	308°44.2	351°28.0	02.2	242°50.6	27.7	305°26.4	05.0	342°09.0	44.6
14	323°46.6	6°27.3	01.3	257°53.0	27.7	320°28.5	05.1	357°11.2	44.5
15	338°49.1	21°26.7	18°00.4	272°55.4	·· 27.7	335°30.7	·· 05.3	12°13.4	·· 44.5
16	353°51.6	36°26.0	17°59.5	287°57.8	27.7	350°32.8	05.4	27°15.6	44.4
17	8°54.0	51°25.3	58.6	303°00.2	27.7	5°34.9	05.6	42°17.8	44.3
18	23°56.5	66°24.6	S17°57.7	318°02.6	N24°27.7	20°37.0	N00°05.8	57°20.0	S14°44.2
19	38°59.0	81°23.9	56.8	333°05.0	27.7	35°39.1	05.9	72°22.2	44.1
20	54°01.4	96°23.3	55.9	348°07.4	27.7	50°41.2	06.1	87°24.4	44.0
21	69°03.9	111°22.6	·· 55.0	3°09.7	·· 27.7	65°43.3	·· 06.2	102°26.6	·· 43.9
22	84°06.3	126°21.9	54.1	18°12.1	27.7	80°45.5	06.4	117°28.7	43.8
23	99°08.8	141°21.2	53.2	33°14.5	27.7	95°47.6	06.6	132°30.9	43.7
Mer.pass. 16:24		ν -0.7′ d 0.9′ m -3.93		ν 2.4′ d -0.0′ m -0.79		ν 2.1′ d 0.2′ m -2.27		ν 2.2′ d 0.1′ m 0.87	

Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	114°11.3	156°20.5	S17°52.3	48°16.9	N24°27.7	110°49.7	N00°06.7	147°33.1	S14°43.6
1	129°13.7	171°19.9	51.4	63°19.3	27.7	125°51.8	06.9	162°35.3	43.5
2	144°16.2	186°19.2	50.5	78°21.7	27.7	140°53.9	07.1	177°37.5	43.5
3	159°18.7	201°18.5	·· 49.6	93°24.1	·· 27.7	155°56.0	·· 07.2	192°39.7	·· 43.4
4	174°21.1	216°17.9	48.7	108°26.5	27.7	170°58.1	07.4	207°41.9	43.3
5	189°23.6	231°17.2	47.7	123°28.9	27.7	186°00.2	07.5	222°44.1	43.2
6	204°26.1	246°16.5	S17°46.8	138°31.2	N24°27.7	201°02.4	N00°07.7	237°46.3	S14°43.1
7	219°28.5	261°15.8	45.9	153°33.6	27.7	216°04.5	07.9	252°48.5	43.0
8	234°31.0	276°15.2	45.0	168°36.0	27.7	231°06.6	08.0	267°50.7	42.9
9	249°33.4	291°14.5	·· 44.1	183°38.4	·· 27.7	246°08.7	·· 08.2	282°52.9	·· 42.8
10	264°35.9	306°13.8	43.2	198°40.7	27.7	261°10.8	08.4	297°55.1	42.7
11	279°38.4	321°13.2	42.3	213°43.1	27.7	276°12.9	08.5	312°57.3	42.6
12	294°40.8	336°12.5	S17°41.3	228°45.5	N24°27.7	291°15.0	N00°08.7	327°59.5	S14°42.5
13	309°43.3	351°11.8	40.4	243°47.9	27.7	306°17.1	08.8	343°01.7	42.4
14	324°45.8	6°11.2	39.5	258°50.2	27.7	321°19.2	09.0	358°03.9	42.3
15	339°48.2	21°10.5	·· 38.6	273°52.6	·· 27.7	336°21.3	·· 09.2	13°06.0	·· 42.3
16	354°50.7	36°09.8	37.7	288°55.0	27.7	351°23.5	09.3	28°08.2	42.2
17	9°53.2	51°09.2	36.8	303°57.3	27.7	6°25.6	09.5	43°10.4	42.1
18	24°55.6	66°08.5	S17°35.8	318°59.7	N24°27.7	21°27.7	N00°09.7	58°12.6	S14°42.0
19	39°58.1	81°07.8	34.9	334°02.1	27.7	36°29.8	09.8	73°14.8	41.9
20	55°00.6	96°07.2	34.0	349°04.4	27.7	51°31.9	10.0	88°17.0	41.8
21	70°03.0	111°06.5	·· 33.1	4°06.8	·· 27.7	66°34.0	·· 10.1	103°19.2	·· 41.7
22	85°05.5	126°05.8	32.1	19°09.1	27.7	81°36.1	10.3	118°21.4	41.6
23	100°07.9	141°05.2	31.2	34°11.5	27.8	96°38.2	10.5	133°23.6	41.5
Mer.pass. 16:21		ν -0.7′ d 0.9′ m -3.93		ν 2.4′ d 0.0′ m -0.76		ν 2.1′ d 0.2′ m -2.27		ν 2.2′ d 0.1′ m 0.87	

Stars

	SHA	**Dec**
Alpheratz	357°36.6	29°13.1
Ankaa	353°08.9	-42°11.2
Schedar	349°33.0	56°40.0
Diphda	348°49.0	-17°51.8
Achernar	335°21.4	-57°07.6
Hamal	327°53.0	23°34.3
Polaris	314°36.5	89°21.9
Acamar	315°12.8	-40°13.0
Menkar	314°07.7	4°10.7
Mirfak	308°30.3	49°56.7
Aldebaran	290°41.2	16°33.3
Rigel	281°05.2	-8°10.6
Capella	280°23.9	46°01.3
Bellatrix	278°24.3	6°22.2
Elnath	278°03.6	28°37.6
Alnilam	275°39.1	-1°11.3
Betelgeuse	270°53.5	7°24.6
Canopus	263°52.6	-52°42.5
Sirius	258°27.3	-16°44.9
Adhara	255°06.8	-29°00.2
Procyon	244°52.2	5°09.9
Pollux	243°18.9	27°58.2
Avior	234°14.7	-59°34.9
Suhail	222°47.1	-43°31.4
Miaplacidus	221°37.7	-69°48.5
Alphard	217°49.1	-8°45.5
Regulus	207°35.9	11°51.2
Dubhe	193°42.6	61°37.4
Denebola	182°26.5	14°26.5
Gienah	175°45.2	-17°40.1
Acrux	173°01.7	-63°13.3
Gacrux	171°53.3	-57°14.2
Alioth	166°14.3	55°49.8
Spica	158°24.0	-11°16.8
Alkaid	152°53.4	49°11.6
Hadar	148°38.5	-60°28.7
Menkent	147°59.6	-36°28.8
Arcturus	145°49.5	19°03.6
Rigil Kent.	139°42.8	-60°55.5
Kochab	137°20.2	74°03.3
Zuben'ubi	136°58.0	-16°08.2
Alphecca	126°05.3	26°38.1
Antares	112°18.1	-26°28.9
Atria	107°14.3	-69°03.9
Sabik	102°05.0	-15°45.2
Shaula	96°13.0	-37°07.2
Rasalhague	96°00.4	12°32.5
Eltanin	90°43.4	51°29.0
Kaus Aust.	83°35.1	-34°22.4
Vega	80°34.8	38°48.2
Nunki	75°50.2	-26°16.1
Altair	62°01.9	8°55.7
Peacock	53°08.9	-56°39.8
Deneb	49°27.4	45°21.7
Enif	33°40.7	9°58.8
Al Na'ir	27°35.4	-46°51.2
Fomalhaut	15°16.6	-29°30.3
Scheat	13°47.0	28°12.5
Markab	13°31.7	15°19.7

Jan 13 Fri	**SHA**	**Mer.pass**
Venus	44°40.6	13:33
Mars	294°07.6	20:51
Jupiter	356°55.0	16:41
Saturn	33°34.7	14:15

Jan 14 Sat	**SHA**	**Mer.pass**
Venus	43°24.8	13:34
Mars	294°07.0	20:47
Jupiter	356°46.8	16:38
Saturn	33°28.3	14:11

Jan 15 Sun	**SHA**	**Mer.pass**
Venus	42°09.3	13:35
Mars	294°05.7	20:44
Jupiter	356°38.4	16:34
Saturn	33°21.9	14:08

Horizontal parallax	
Venus:	0.1
Mars:	0.2

h	Sun		Moon				
Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°54.5	S21°33.5	292°15.5	16.2′	N03°40.5	14.1′	55.1′
1	192°54.3	33.1	306°50.7	16.2′	03°26.4	14.0′	55.1′
2	207°54.0	32.7	321°25.9	16.2′	03°12.4	14.1′	55.1′
3	222°53.8	·· 32.3	336°01.0	16.2′	02°58.3	14.1′	55.1′
4	237°53.6	31.8	350°36.2	16.2′	02°44.2	14.1′	55.2′
5	252°53.3	31.4	5°11.4	16.1′	02°30.1	14.1′	55.2′
6	267°53.1	S21°31.0	19°46.5	16.1′	N02°16.0	14.2′	55.2′
7	282°52.9	30.6	34°21.7	16.1′	02°01.8	14.1′	55.2′
8	297°52.6	30.2	48°56.8	16.1′	01°47.7	14.2′	55.3′
9	312°52.4	·· 29.7	63°31.9	16.1′	01°33.5	14.2′	55.3′
10	327°52.2	29.3	78°07.0	16.1′	01°19.3	14.3′	55.3′
11	342°51.9	28.9	92°42.0	16.0′	01°05.0	14.2′	55.3′
12	357°51.7	S21°28.5	107°17.1	16.0′	N00°50.8	14.3′	55.4′
13	12°51.5	28.0	121°52.1	16.0′	00°36.5	14.3′	55.4′
14	27°51.2	27.6	136°27.1	16.0′	00°22.2	14.3′	55.4′
15	42°51.0	·· 27.2	151°02.1	16.0′	N00°07.9	14.3′	55.4′
16	57°50.8	26.8	165°37.1	15.9′	S00°06.4	14.3′	55.5′
17	72°50.5	26.3	180°12.0	15.9′	00°20.7	14.3′	55.5′
18	87°50.3	S21°25.9	194°46.9	15.9′	S00°35.0	14.4′	55.5′
19	102°50.1	25.5	209°21.8	15.8′	00°49.4	14.3′	55.5′
20	117°49.8	25.0	223°56.6	15.8′	01°03.7	14.4′	55.6′
21	132°49.6	·· 24.6	238°31.5	15.8′	01°18.1	14.3′	55.6′
22	147°49.4	24.2	253°06.2	15.8′	01°32.4	14.4′	55.6′
23	162°49.1	23.7	267°41.0	15.7′	01°46.8	14.4′	55.7′
	SD = 16.3′	d = 0.4′	SD = 15.0′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°48.9	S21°23.3	282°15.7	15.7′	S02°01.2	14.4′	55.7′
1	192°48.7	22.9	296°50.4	15.6′	02°15.6	14.4′	55.7′
2	207°48.4	22.4	311°25.0	15.6′	02°30.0	14.4′	55.7′
3	222°48.2	·· 22.0	325°59.6	15.6′	02°44.4	14.4′	55.8′
4	237°48.0	21.6	340°34.2	15.5′	02°58.8	14.4′	55.8′
5	252°47.8	21.1	355°08.7	15.5′	03°13.2	14.4′	55.8′
6	267°47.5	S21°20.7	9°43.2	15.4′	S03°27.6	14.5′	55.9′
7	282°47.3	20.3	24°17.7	15.4′	03°42.1	14.4′	55.9′
8	297°47.1	19.8	38°52.1	15.3′	03°56.5	14.4′	55.9′
9	312°46.8	·· 19.4	53°26.4	15.3′	04°10.9	14.4′	56.0′
10	327°46.6	18.9	68°00.7	15.3′	04°25.3	14.4′	56.0′
11	342°46.4	18.5	82°34.9	15.2′	04°39.7	14.4′	56.0′
12	357°46.2	S21°18.0	97°09.2	15.1′	S04°54.1	14.4′	56.0′
13	12°45.9	17.6	111°43.3	15.1′	05°08.5	14.4′	56.1′
14	27°45.7	17.2	126°17.4	15.0′	05°22.9	14.4′	56.1′
15	42°45.5	·· 16.7	140°51.4	15.0′	05°37.3	14.4′	56.1′
16	57°45.2	16.3	155°25.4	14.9′	05°51.7	14.4′	56.2′
17	72°45.0	15.8	169°59.4	14.9′	06°06.1	14.4′	56.2′
18	87°44.8	S21°15.4	184°33.2	14.8′	S06°20.5	14.3′	56.2′
19	102°44.6	14.9	199°07.0	14.7′	06°34.8	14.4′	56.3′
20	117°44.3	14.5	213°40.8	14.7′	06°49.2	14.3′	56.3′
21	132°44.1	·· 14.0	228°14.5	14.6′	07°03.5	14.4′	56.3′
22	147°43.9	13.6	242°48.1	14.6′	07°17.9	14.3′	56.4′
23	162°43.7	13.1	257°21.7	14.5′	07°32.2	14.3′	56.4′
	SD = 16.3′	d = 0.4′	SD = 15.2′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°43.4	S21°12.7	271°55.1	14.4′	S07°46.5	14.3′	56.4′
1	192°43.2	12.2	286°28.6	14.4′	08°00.8	14.2′	56.5′
2	207°43.0	11.8	301°01.9	14.3′	08°15.0	14.3′	56.5′
3	222°42.8	·· 11.3	315°35.2	14.2′	08°29.3	14.2′	56.5′
4	237°42.5	10.9	330°08.4	14.1′	08°43.5	14.2′	56.6′
5	252°42.3	10.4	344°41.6	14.1′	08°57.7	14.2′	56.6′
6	267°42.1	S21°10.0	359°14.6	14.0′	S09°11.9	14.2′	56.7′
7	282°41.9	09.5	13°47.6	13.9′	09°26.1	14.1′	56.7′
8	297°41.7	09.0	28°20.5	13.8′	09°40.2	14.2′	56.7′
9	312°41.4	·· 08.6	42°53.3	13.7′	09°54.4	14.1′	56.8′
10	327°41.2	08.1	57°26.1	13.7′	10°08.5	14.0′	56.8′
11	342°41.0	07.7	71°58.8	13.6′	10°22.5	14.1′	56.8′
12	357°40.8	S21°07.2	86°31.3	13.5′	S10°36.6	14.0′	56.9′
13	12°40.6	06.8	101°03.8	13.4′	10°50.6	14.0′	56.9′
14	27°40.3	06.3	115°36.3	13.3′	11°04.6	13.9′	56.9′
15	42°40.1	·· 05.8	130°08.6	13.2′	11°18.5	13.9′	57.0′
16	57°39.9	05.4	144°40.8	13.1′	11°32.4	13.9′	57.0′
17	72°39.7	04.9	159°13.0	13.1′	11°46.3	13.9′	57.1′
18	87°39.5	S21°04.4	173°45.0	13.0′	S12°00.2	13.8′	57.1′
19	102°39.2	04.0	188°17.0	12.9′	12°14.0	13.8′	57.1′
20	117°39.0	03.5	202°48.9	12.8′	12°27.8	13.7′	57.2′
21	132°38.8	·· 03.0	217°20.6	12.7′	12°41.5	13.7′	57.2′
22	147°38.6	02.6	231°52.3	12.6′	12°55.2	13.7′	57.2′
23	162°38.4	02.1	246°23.9	12.5′	13°08.9	13.6′	57.3′
	SD = 16.3′	d = 0.5′	SD = 15.4′				

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

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

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 21-23 70-51%
13	08:22	08:33	12:09	04:39	16:59	
14	08:44	08:55	12:09	05:20	17:41	
15	09:06	09:17	12:09	06:03	18:26	

January 16, 17, 18 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	115°10.4	156°04.5	**S**17°30.3	49°13.9	**N**24°27.8	111°40.3	**N**00°10.6	148°25.8	**S**14°41.4
1	130°12.9	171°03.8	29.4	64°16.2	27.8	126°42.4	10.8	163°28.0	41.3
2	145°15.3	186°03.2	28.4	79°18.6	27.8	141°44.5	11.0	178°30.2	41.2
3	160°17.8	201°02.5	·· 27.5	94°20.9	·· 27.8	156°46.6	·· 11.1	193°32.4	·· 41.2
4	175°20.3	216°01.9	26.6	109°23.3	27.8	171°48.8	11.3	208°34.6	41.1
5	190°22.7	231°01.2	25.6	124°25.6	27.8	186°50.9	11.5	223°36.8	41.0
6	205°25.2	246°00.5	**S**17°24.7	139°28.0	**N**24°27.8	201°53.0	**N**00°11.6	238°38.9	**S**14°40.9
7	220°27.7	260°59.9	23.8	154°30.3	27.8	216°55.1	11.8	253°41.1	40.8
8	235°30.1	275°59.2	22.8	169°32.7	27.8	231°57.2	12.0	268°43.3	40.7
9	250°32.6	290°58.6	·· 21.9	184°35.0	·· 27.8	246°59.3	·· 12.1	283°45.5	·· 40.6
10	265°35.1	305°57.9	21.0	199°37.3	27.8	262°01.4	12.3	298°47.7	40.5
11	280°37.5	320°57.3	20.0	214°39.7	27.8	277°03.5	12.4	313°49.9	40.4
12	295°40.0	335°56.6	**S**17°19.1	229°42.0	**N**24°27.8	292°05.6	**N**00°12.6	328°52.1	**S**14°40.3
13	310°42.4	350°56.0	18.2	244°44.4	27.8	307°07.7	12.8	343°54.3	40.2
14	325°44.9	5°55.3	17.2	259°46.7	27.9	322°09.8	12.9	358°56.5	40.1
15	340°47.4	20°54.7	·· 16.3	274°49.0	·· 27.9	337°11.9	·· 13.1	13°58.7	·· 40.0
16	355°49.8	35°54.0	15.4	289°51.4	27.9	352°14.0	13.3	29°00.9	40.0
17	10°52.3	50°53.3	14.4	304°53.7	27.9	7°16.1	13.4	44°03.1	39.9
18	25°54.8	65°52.7	**S**17°13.5	319°56.0	**N**24°27.9	22°18.2	**N**00°13.6	59°05.3	**S**14°39.8
19	40°57.2	80°52.0	12.5	334°58.4	27.9	37°20.3	13.8	74°07.4	39.7
20	55°59.7	95°51.4	11.6	350°00.7	27.9	52°22.4	13.9	89°09.6	39.6
21	71°02.2	110°50.7	·· 10.6	5°03.0	·· 27.9	67°24.5	·· 14.1	104°11.8	·· 39.5
22	86°04.6	125°50.1	09.7	20°05.3	27.9	82°26.6	14.3	119°14.0	39.4
23	101°07.1	140°49.4	08.8	35°07.7	27.9	97°28.7	14.4	134°16.2	39.3
Mer.pass. 16:17		ν -0.7′ d 0.9′	m -3.93	ν 2.4′ d 0.0′	m -0.73	ν 2.1′ d 0.2′	m -2.26	ν 2.2′ d 0.1′	m 0.87

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	116°09.5	155°48.8	**S**17°07.8	50°10.0	**N**24°27.9	112°30.8	**N**00°14.6	149°18.4	**S**14°39.2
1	131°12.0	170°48.1	06.9	65°12.3	27.9	127°33.0	14.8	164°20.6	39.1
2	146°14.5	185°47.5	05.9	80°14.6	28.0	142°35.1	14.9	179°22.8	39.0
3	161°16.9	200°46.9	·· 05.0	95°17.0	·· 28.0	157°37.2	·· 15.1	194°25.0	·· 38.9
4	176°19.4	215°46.2	04.0	110°19.3	28.0	172°39.3	15.3	209°27.2	38.8
5	191°21.9	230°45.6	03.1	125°21.6	28.0	187°41.4	15.4	224°29.4	38.7
6	206°24.3	245°44.9	**S**17°02.1	140°23.9	**N**24°28.0	202°43.5	**N**00°15.6	239°31.6	**S**14°38.7
7	221°26.8	260°44.3	01.2	155°26.2	28.0	217°45.6	15.8	254°33.7	38.6
8	236°29.3	275°43.6	17°00.2	170°28.5	28.0	232°47.7	15.9	269°35.9	38.5
9	251°31.7	290°43.0	16°59.3	185°30.8	·· 28.0	247°49.8	·· 16.1	284°38.1	·· 38.4
10	266°34.2	305°42.3	58.3	200°33.1	28.0	262°51.9	16.3	299°40.3	38.3
11	281°36.7	320°41.7	57.3	215°35.5	28.0	277°54.0	16.4	314°42.5	38.2
12	296°39.1	335°41.1	**S**16°56.4	230°37.8	**N**24°28.1	292°56.1	**N**00°16.6	329°44.7	**S**14°38.1
13	311°41.6	350°40.4	55.4	245°40.1	28.1	307°58.2	16.8	344°46.9	38.0
14	326°44.0	5°39.8	54.5	260°42.4	28.1	323°00.3	16.9	359°49.1	37.9
15	341°46.5	20°39.1	·· 53.5	275°44.7	·· 28.1	338°02.4	·· 17.1	14°51.3	·· 37.8
16	356°49.0	35°38.5	52.6	290°47.0	28.1	353°04.5	17.3	29°53.5	37.7
17	11°51.4	50°37.9	51.6	305°49.3	28.1	8°06.6	17.4	44°55.7	37.6
18	26°53.9	65°37.2	**S**16°50.6	320°51.6	**N**24°28.1	23°08.7	**N**00°17.6	59°57.8	**S**14°37.5
19	41°56.4	80°36.6	49.7	335°53.9	28.1	38°10.8	17.8	75°00.0	37.4
20	56°58.8	95°36.0	48.7	350°56.2	28.2	53°12.9	17.9	90°02.2	37.3
21	72°01.3	110°35.3	·· 47.7	5°58.5	·· 28.2	68°15.0	·· 18.1	105°04.4	·· 37.3
22	87°03.8	125°34.7	46.8	21°00.8	28.2	83°17.1	18.3	120°06.6	37.2
23	102°06.2	140°34.0	45.8	36°03.0	28.2	98°19.2	18.4	135°08.8	37.1
Mer.pass. 16:13		ν -0.6′ d 0.9′	m -3.93	ν 2.3′ d 0.0′	m -0.70	ν 2.1′ d 0.2′	m -2.26	ν 2.2′ d 0.1′	m 0.87

Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	117°08.7	155°33.4	**S**16°44.8	51°05.3	**N**24°28.2	113°21.3	**N**00°18.6	150°11.0	**S**14°37.0
1	132°11.2	170°32.8	43.9	66°07.6	28.2	128°23.3	18.8	165°13.2	36.9
2	147°13.6	185°32.1	42.9	81°09.9	28.2	143°25.4	18.9	180°15.4	36.8
3	162°16.1	200°31.5	·· 41.9	96°12.2	·· 28.2	158°27.5	·· 19.1	195°17.6	·· 36.7
4	177°18.5	215°30.9	41.0	111°14.5	28.3	173°29.6	19.3	210°19.7	36.6
5	192°21.0	230°30.2	40.0	126°16.8	28.3	188°31.7	19.4	225°21.9	36.5
6	207°23.5	245°29.6	**S**16°39.0	141°19.0	**N**24°28.3	203°33.8	**N**00°19.6	240°24.1	**S**14°36.4
7	222°25.9	260°29.0	38.1	156°21.3	28.3	218°35.9	19.8	255°26.3	36.3
8	237°28.4	275°28.4	37.1	171°23.6	28.3	233°38.0	20.0	270°28.5	36.2
9	252°30.9	290°27.7	·· 36.1	186°25.9	·· 28.3	248°40.1	·· 20.1	285°30.7	·· 36.1
10	267°33.3	305°27.1	35.1	201°28.2	28.3	263°42.2	20.3	300°32.9	36.0
11	282°35.8	320°26.5	34.2	216°30.4	28.4	278°44.3	20.5	315°35.1	35.9
12	297°38.3	335°25.8	**S**16°33.2	231°32.7	**N**24°28.4	293°46.4	**N**00°20.6	330°37.3	**S**14°35.9
13	312°40.7	350°25.2	32.2	246°35.0	28.4	308°48.5	20.8	345°39.5	35.8
14	327°43.2	5°24.6	31.2	261°37.2	28.4	323°50.6	21.0	0°41.6	35.7
15	342°45.7	20°24.0	·· 30.3	276°39.5	·· 28.4	338°52.7	·· 21.1	15°43.8	·· 35.6
16	357°48.1	35°23.3	29.3	291°41.8	28.4	353°54.8	21.3	30°46.0	35.5
17	12°50.6	50°22.7	28.3	306°44.1	28.4	8°56.9	21.5	45°48.2	35.4
18	27°53.0	65°22.1	**S**16°27.3	321°46.3	**N**24°28.5	23°59.0	**N**00°21.6	60°50.4	**S**14°35.3
19	42°55.5	80°21.5	26.3	336°48.6	28.5	39°01.1	21.8	75°52.6	35.2
20	57°58.0	95°20.8	25.4	351°50.8	28.5	54°03.2	22.0	90°54.8	35.1
21	73°00.4	110°20.2	·· 24.4	6°53.1	·· 28.5	69°05.3	·· 22.2	105°57.0	·· 35.0
22	88°02.9	125°19.6	23.4	21°55.4	28.5	84°07.3	22.3	120°59.2	34.9
23	103°05.4	140°19.0	22.4	36°57.6	28.5	99°09.4	22.5	136°01.4	34.8
Mer.pass. 16:09		ν -0.6′ d 1.0′	m -3.93	ν 2.3′ d 0.0′	m -0.67	ν 2.1′ d 0.2′	m -2.25	ν 2.2′ d 0.1′	m 0.87

Stars

	SHA	**Dec**
Alpheratz	357°36.6	29°13.1
Ankaa	353°08.9	-42°11.2
Schedar	349°33.0	56°40.0
Diphda	348°49.0	-17°51.8
Achernar	335°21.4	-57°07.6
Hamal	327°53.0	23°34.3
Polaris	314°37.7	89°22.0
Acamar	315°12.9	-40°13.0
Menkar	314°07.7	4°10.7
Mirfak	308°30.4	49°56.7
Aldebaran	290°41.2	16°33.3
Rigel	281°05.2	-8°10.6
Capella	280°23.9	46°01.3
Bellatrix	278°24.3	6°22.2
Elnath	278°03.6	28°37.6
Alnilam	275°39.1	-1°11.3
Betelgeuse	270°53.5	7°24.6
Canopus	263°52.6	-52°42.5
Sirius	258°27.3	-16°44.9
Adhara	255°06.8	-29°00.2
Procyon	244°52.2	5°09.9
Pollux	243°18.9	27°58.2
Avior	234°14.7	-59°34.9
Suhail	222°47.1	-43°31.4
Miaplacidus	221°37.7	-69°48.5
Alphard	217°49.1	-8°45.5
Regulus	207°35.9	11°51.2
Dubhe	193°42.6	61°37.4
Denebola	182°26.5	14°26.5
Gienah	175°45.1	-17°40.1
Acrux	173°01.7	-63°13.3
Gacrux	171°53.3	-57°14.2
Alioth	166°14.3	55°49.8
Spica	158°24.0	-11°16.8
Alkaid	152°53.3	49°11.6
Hadar	148°38.4	-60°28.7
Menkent	147°59.6	-36°28.8
Arcturus	145°49.5	19°03.6
Rigil Kent.	139°42.7	-60°55.5
Kochab	137°20.2	74°03.3
Zuben'ubi	136°57.9	-16°08.2
Alphecca	126°05.3	26°38.1
Antares	112°18.1	-26°28.9
Atria	107°14.2	-69°03.9
Sabik	102°04.9	-15°45.2
Shaula	96°13.0	-37°07.1
Rasalhague	96°00.4	12°32.5
Eltanin	90°43.4	51°29.0
Kaus Aust.	83°35.1	-34°22.4
Vega	80°34.7	38°48.2
Nunki	75°50.2	-26°16.1
Altair	62°01.9	8°55.7
Peacock	53°08.9	-56°39.8
Deneb	49°27.4	45°21.7
Enif	33°40.7	9°58.7
Al Na'ir	27°35.4	-46°51.2
Fomalhaut	15°16.6	-29°30.3
Scheat	13°47.0	28°12.5
Markab	13°31.7	15°19.7

Jan 16 Mon	**SHA**	**Mer.pass**
Venus	40°54.1	13:36
Mars	294°03.5	20:40
Jupiter	356°29.9	16:31
Saturn	33°15.4	14:04

Jan 17 Tue	**SHA**	**Mer.pass**
Venus	39°39.2	13:37
Mars	294°00.4	20:36
Jupiter	356°21.3	16:28
Saturn	33°08.9	14:01

Jan 18 Wed	**SHA**	**Mer.pass**
Venus	38°24.7	13:38
Mars	293°56.6	20:33
Jupiter	356°12.6	16:24
Saturn	33°02.3	13:57

Horizontal parallax	
Venus:	0.1
Mars:	0.2

h	Sun		Moon				
Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°38.1	S21°01.6	260°55.4	12.4′	S13°22.5	13.5′	57.3′
1	192°37.9	01.2	275°26.7	12.3′	13°36.0	13.6′	57.4′
2	207°37.7	00.7	289°58.0	12.2′	13°49.6	13.4′	57.4′
3	222°37.5	21°00.2	304°29.2	12.1′	14°03.0	13.5′	57.4′
4	237°37.3	20°59.8	319°00.3	12.0′	14°16.5	13.3′	57.5′
5	252°37.1	59.3	333°31.2	11.9′	14°29.8	13.4′	57.5′
6	267°36.8	S20°58.8	348°02.1	11.7′	S14°43.2	13.2′	57.5′
7	282°36.6	58.4	2°32.8	11.6′	14°56.4	13.3′	57.6′
8	297°36.4	57.9	17°03.5	11.5′	15°09.7	13.1′	57.6′
9	312°36.2	·· 57.4	31°34.0	11.4′	15°22.8	13.1′	57.7′
10	327°36.0	56.9	46°04.4	11.3′	15°35.9	13.1′	57.7′
11	342°35.8	56.5	60°34.7	11.2′	15°49.0	12.9′	57.7′
12	357°35.6	S20°56.0	75°04.9	11.1′	S16°01.9	13.0′	57.8′
13	12°35.3	55.5	89°35.0	11.0′	16°14.9	12.8′	57.8′
14	27°35.1	55.0	104°04.9	10.8′	16°27.7	12.8′	57.9′
15	42°34.9	·· 54.5	118°34.7	10.7′	16°40.5	12.7′	57.9′
16	57°34.7	54.1	133°04.5	10.6′	16°53.2	12.7′	57.9′
17	72°34.5	53.6	147°34.0	10.5′	17°05.9	12.6′	58.0′
18	87°34.3	S20°53.1	162°03.5	10.3′	S17°18.5	12.5′	58.0′
19	102°34.1	52.6	176°32.9	10.2′	17°31.0	12.4′	58.1′
20	117°33.8	52.1	191°02.1	10.1′	17°43.4	12.4′	58.1′
21	132°33.6	·· 51.7	205°31.2	10.0′	17°55.8	12.2′	58.1′
22	147°33.4	51.2	220°00.2	9.8′	18°08.0	12.2′	58.2′
23	162°33.2	50.7	234°29.0	9.7′	18°20.2	12.2′	58.2′
	SD = 16.3′	d = 0.5′	SD = 15.6′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°33.0	S20°50.2	248°57.7	9.6′	S18°32.4	12.0′	58.3′
1	192°32.8	49.7	263°26.3	9.5′	18°44.4	12.0′	58.3′
2	207°32.6	49.2	277°54.8	9.3′	18°56.4	11.8′	58.3′
3	222°32.4	·· 48.8	292°23.1	9.2′	19°08.2	11.8′	58.4′
4	237°32.2	48.3	306°51.3	9.1′	19°20.0	11.7′	58.4′
5	252°32.0	47.8	321°19.4	8.9′	19°31.7	11.6′	58.5′
6	267°31.7	S20°47.3	335°47.3	8.8′	S19°43.3	11.5′	58.5′
7	282°31.5	46.8	350°15.1	8.7′	19°54.8	11.4′	58.5′
8	297°31.3	46.3	4°42.8	8.5′	20°06.2	11.3′	58.6′
9	312°31.1	·· 45.8	19°10.3	8.4′	20°17.5	11.2′	58.6′
10	327°30.9	45.3	33°37.7	8.3′	20°28.7	11.1′	58.7′
11	342°30.7	44.8	48°05.0	8.1′	20°39.8	11.0′	58.7′
12	357°30.5	S20°44.3	62°32.1	8.0′	S20°50.8	10.9′	58.7′
13	12°30.3	43.8	76°59.1	7.9′	21°01.7	10.8′	58.8′
14	27°30.1	43.4	91°26.0	7.7′	21°12.5	10.7′	58.8′
15	42°29.9	·· 42.9	105°52.7	7.6′	21°23.2	10.5′	58.9′
16	57°29.7	42.4	120°19.3	7.4′	21°33.7	10.5′	58.9′
17	72°29.5	41.9	134°45.7	7.3′	21°44.2	10.3′	58.9′
18	87°29.3	S20°41.4	149°12.0	7.2′	S21°54.5	10.3′	59.0′
19	102°29.1	40.9	163°38.2	7.0′	22°04.8	10.1′	59.0′
20	117°28.9	40.4	178°04.2	6.9′	22°14.9	9.9′	59.1′
21	132°28.6	·· 39.9	192°30.1	6.7′	22°24.8	9.9′	59.1′
22	147°28.4	39.4	206°55.8	6.6′	22°34.7	9.7′	59.1′
23	162°28.2	38.9	221°21.4	6.5′	22°44.4	9.6′	59.2′
	SD = 16.3′	d = 0.5′	SD = 15.9′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°28.0	S20°38.4	235°46.9	6.3′	S22°54.0	9.5′	59.2′
1	192°27.8	37.9	250°12.2	6.2′	23°03.5	9.3′	59.3′
2	207°27.6	37.4	264°37.4	6.1′	23°12.8	9.2′	59.3′
3	222°27.4	·· 36.9	279°02.5	5.9′	23°22.0	9.1′	59.3′
4	237°27.2	36.4	293°27.4	5.8′	23°31.1	8.9′	59.4′
5	252°27.0	35.9	307°52.2	5.6′	23°40.0	8.8′	59.4′
6	267°26.8	S20°35.4	322°16.8	5.5′	S23°48.8	8.7′	59.5′
7	282°26.6	34.8	336°41.3	5.4′	23°57.5	8.5′	59.5′
8	297°26.4	34.3	351°05.7	5.2′	24°06.0	8.3′	59.5′
9	312°26.2	·· 33.8	5°29.9	5.1′	24°14.3	8.2′	59.6′
10	327°26.0	33.3	19°54.0	5.0′	24°22.5	8.1′	59.6′
11	342°25.8	32.8	34°18.0	4.8′	24°30.6	7.9′	59.6′
12	357°25.6	S20°32.3	48°41.8	4.7′	S24°38.5	7.7′	59.7′
13	12°25.4	31.8	63°05.5	4.6′	24°46.2	7.6′	59.7′
14	27°25.2	31.3	77°29.1	4.4′	24°53.8	7.4′	59.8′
15	42°25.0	·· 30.8	91°52.5	4.3′	25°01.2	7.3′	59.8′
16	57°24.8	30.3	106°15.8	4.2′	25°08.5	7.1′	59.8′
17	72°24.6	29.8	120°39.0	4.1′	25°15.6	6.9′	59.9′
18	87°24.4	S20°29.2	135°02.1	3.9′	S25°22.5	6.8′	59.9′
19	102°24.2	28.7	149°25.0	3.8′	25°29.3	6.6′	59.9′
20	117°24.0	28.2	163°47.8	3.7′	25°35.9	6.5′	60.0′
21	132°23.8	·· 27.7	178°10.5	3.6′	25°42.4	6.2′	60.0′
22	147°23.6	27.2	192°33.0	3.4′	25°48.6	6.1′	60.0′
23	162°23.4	26.7	206°55.5	3.3′	25°54.7	5.9′	60.1′
	SD = 16.2′	d = 0.5′	SD = 16.2′				

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

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

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 24-26 41-21%
16	09:27	09:38	12:10	06:49	19:14	
17	09:48	09:58	12:10	07:40	20:08	
18	10:08	10:18	12:10	08:37	21:08	

January 19, 20, 21 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	118°07.8	155°18.4	S16°21.4	51°59.9	N24°28.6	114°11.5	N00°22.7	151°03.5	S14°34.7
1	133°10.3	170°17.7	20.4	67°02.1	28.6	129°13.6	22.8	166°05.7	34.6
2	148°12.8	185°17.1	19.5	82°04.4	28.6	144°15.7	23.0	181°07.9	34.5
3	163°15.2	200°16.5	·· 18.5	97°06.6	·· 28.6	159°17.8	·· 23.2	196°10.1	·· 34.4
4	178°17.7	215°15.9	17.5	112°08.9	28.6	174°19.9	23.3	211°12.3	34.4
5	193°20.2	230°15.3	16.5	127°11.1	28.6	189°22.0	23.5	226°14.5	34.3
6	208°22.6	245°14.6	S16°15.5	142°13.4	N24°28.7	204°24.1	N00°23.7	241°16.7	S14°34.2
7	223°25.1	260°14.0	14.5	157°15.6	28.7	219°26.2	23.9	256°18.9	34.1
8	238°27.5	275°13.4	13.5	172°17.9	28.7	234°28.3	24.0	271°21.0	34.0
9	253°30.0	290°12.8	·· 12.5	187°20.1	·· 28.7	249°30.4	·· 24.2	286°23.2	·· 33.9
10	268°32.5	305°12.2	11.5	202°22.4	28.7	264°32.4	24.4	301°25.4	33.8
11	283°34.9	320°11.6	10.5	217°24.6	28.8	279°34.5	24.5	316°27.6	33.7
12	298°37.4	335°10.9	S16°09.5	232°26.9	N24°28.8	294°36.6	N00°24.7	331°29.8	S14°33.6
13	313°39.9	350°10.3	08.6	247°29.1	28.8	309°38.7	24.9	346°32.0	33.5
14	328°42.3	5°09.7	07.6	262°31.3	28.8	324°40.8	25.1	1°34.2	33.4
15	343°44.8	20°09.1	·· 06.6	277°33.6	·· 28.8	339°42.9	·· 25.2	16°36.4	·· 33.3
16	358°47.3	35°08.5	05.6	292°35.8	28.8	354°45.0	25.4	31°38.6	33.2
17	13°49.7	50°07.9	04.6	307°38.1	28.9	9°47.1	25.6	46°40.7	33.1
18	28°52.2	65°07.3	S16°03.6	322°40.3	N24°28.9	24°49.2	N00°25.7	61°42.9	S14°33.0
19	43°54.7	80°06.7	02.6	337°42.5	28.9	39°51.3	25.9	76°45.1	32.9
20	58°57.1	95°06.1	01.6	352°44.7	28.9	54°53.3	26.1	91°47.3	32.8
21	73°59.6	110°05.4	16°00.6	7°47.0	·· 28.9	69°55.4	·· 26.3	106°49.5	·· 32.8
22	89°02.0	125°04.8	15°59.6	22°49.2	29.0	84°57.5	26.4	121°51.7	32.7
23	104°04.5	140°04.2	58.6	37°51.4	29.0	99°59.6	26.6	136°53.9	32.6
Mer.pass. 16:05		ν -0.6′ d 1.0′	m -3.93	ν 2.3′ d 0.0′	m -0.64	ν 2.1′ d 0.2′	m -2.25	ν 2.2′ d 0.1′	m 0.87

Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	119°07.0	155°03.6	S15°57.6	52°53.7	N24°29.0	115°01.7	N00°26.8	151°56.1	S14°32.5
1	134°09.4	170°03.0	56.6	67°55.9	29.0	130°03.8	26.9	166°58.2	32.4
2	149°11.9	185°02.4	55.5	82°58.1	29.0	145°05.9	27.1	182°00.4	32.3
3	164°14.4	200°01.8	·· 54.5	98°00.3	·· 29.1	160°08.0	·· 27.3	197°02.6	·· 32.2
4	179°16.8	215°01.2	53.5	113°02.5	29.1	175°10.0	27.5	212°04.8	32.1
5	194°19.3	230°00.6	52.5	128°04.8	29.1	190°12.1	27.6	227°07.0	32.0
6	209°21.8	245°00.0	S15°51.5	143°07.0	N24°29.1	205°14.2	N00°27.8	242°09.2	S14°31.9
7	224°24.2	259°59.4	50.5	158°09.2	29.1	220°16.3	28.0	257°11.4	31.8
8	239°26.7	274°58.8	49.5	173°11.4	29.2	235°18.4	28.2	272°13.6	31.7
9	254°29.2	289°58.2	·· 48.5	188°13.6	·· 29.2	250°20.5	·· 28.3	287°15.7	·· 31.6
10	269°31.6	304°57.6	47.5	203°15.8	29.2	265°22.6	28.5	302°17.9	31.5
11	284°34.1	319°57.0	46.5	218°18.0	29.2	280°24.7	28.7	317°20.1	31.4
12	299°36.5	334°56.4	S15°45.5	233°20.3	N24°29.3	295°26.7	N00°28.8	332°22.3	S14°31.3
13	314°39.0	349°55.8	44.4	248°22.5	29.3	310°28.8	29.0	347°24.5	31.2
14	329°41.5	4°55.2	43.4	263°24.7	29.3	325°30.9	29.2	2°26.7	31.1
15	344°43.9	19°54.6	·· 42.4	278°26.9	·· 29.3	340°33.0	·· 29.4	17°28.9	·· 31.0
16	359°46.4	34°54.0	41.4	293°29.1	29.3	355°35.1	29.5	32°31.1	31.0
17	14°48.9	49°53.4	40.4	308°31.3	29.4	10°37.2	29.7	47°33.2	30.9
18	29°51.3	64°52.8	S15°39.4	323°33.5	N24°29.4	25°39.2	N00°29.9	62°35.4	S14°30.8
19	44°53.8	79°52.2	38.3	338°35.7	29.4	40°41.3	30.1	77°37.6	30.7
20	59°56.3	94°51.6	37.3	353°37.9	29.4	55°43.4	30.2	92°39.8	30.6
21	74°58.7	109°51.0	·· 36.3	8°40.1	·· 29.5	70°45.5	·· 30.4	107°42.0	·· 30.5
22	90°01.2	124°50.4	35.3	23°42.3	29.5	85°47.6	30.6	122°44.2	30.4
23	105°03.6	139°49.8	34.3	38°44.5	29.5	100°49.7	30.7	137°46.4	30.3
Mer.pass. 16:01		ν -0.6′ d 1.0′	m -3.93	ν 2.2′ d 0.0′	m -0.61	ν 2.1′ d 0.2′	m -2.24	ν 2.2′ d 0.1′	m 0.87

Sat	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	120°06.1	154°49.2	S15°33.2	53°46.7	N24°29.5	115°51.7	N00°30.9	152°48.5	S14°30.2
1	135°08.6	169°48.6	32.2	68°48.9	29.6	130°53.8	31.1	167°50.7	30.1
2	150°11.0	184°48.0	31.2	83°51.1	29.6	145°55.9	31.3	182°52.9	30.0
3	165°13.5	199°47.4	·· 30.2	98°53.2	·· 29.6	160°58.0	·· 31.4	197°55.1	·· 29.9
4	180°16.0	214°46.8	29.2	113°55.4	29.6	176°00.1	31.6	212°57.3	29.8
5	195°18.4	229°46.2	28.1	128°57.6	29.6	191°02.2	31.8	227°59.5	29.7
6	210°20.9	244°45.7	S15°27.1	143°59.8	N24°29.7	206°04.2	N00°32.0	243°01.7	S14°29.6
7	225°23.4	259°45.1	26.1	159°02.0	29.7	221°06.3	32.1	258°03.9	29.5
8	240°25.8	274°44.5	25.1	174°04.2	29.7	236°08.4	32.3	273°06.0	29.4
9	255°28.3	289°43.9	·· 24.0	189°06.4	·· 29.7	251°10.5	·· 32.5	288°08.2	·· 29.3
10	270°30.8	304°43.3	23.0	204°08.5	29.8	266°12.6	32.7	303°10.4	29.2
11	285°33.2	319°42.7	22.0	219°10.7	29.8	281°14.6	32.8	318°12.6	29.2
12	300°35.7	334°42.1	S15°20.9	234°12.9	N24°29.8	296°16.7	N00°33.0	333°14.8	S14°29.1
13	315°38.1	349°41.5	19.9	249°15.1	29.8	311°18.8	33.2	348°17.0	29.0
14	330°40.6	4°41.0	18.9	264°17.2	29.9	326°20.9	33.4	3°19.2	28.9
15	345°43.1	19°40.4	·· 17.8	279°19.4	·· 29.9	341°23.0	·· 33.5	18°21.3	·· 28.8
16	0°45.5	34°39.8	16.8	294°21.6	29.9	356°25.0	33.7	33°23.5	28.7
17	15°48.0	49°39.2	15.8	309°23.8	30.0	11°27.1	33.9	48°25.7	28.6
18	30°50.5	64°38.6	S15°14.7	324°25.9	N24°30.0	26°29.2	N00°34.1	63°27.9	S14°28.5
19	45°52.9	79°38.0	13.7	339°28.1	30.0	41°31.3	34.2	78°30.1	28.4
20	60°55.4	94°37.4	12.7	354°30.3	30.0	56°33.4	34.4	93°32.3	28.3
21	75°57.9	109°36.9	·· 11.6	9°32.4	·· 30.1	71°35.4	·· 34.6	108°34.5	·· 28.2
22	91°00.3	124°36.3	10.6	24°34.6	30.1	86°37.5	34.8	123°36.6	28.1
23	106°02.8	139°35.7	09.6	39°36.8	30.1	101°39.6	34.9	138°38.8	28.0
Mer.pass. 15:57		ν -0.6′ d 1.0′	m -3.93	ν 2.2′ d 0.0′	m -0.58	ν 2.1′ d 0.2′	m -2.24	ν 2.2′ d 0.1′	m 0.87

Stars

	SHA	**Dec**
Alpheratz	357°36.6	29°13.1
Ankaa	353°08.9	-42°11.2
Schedar	349°33.1	56°40.0
Diphda	348°49.0	-17°51.8
Achernar	335°21.4	-57°07.6
Hamal	327°53.0	23°34.3
Polaris	314°38.8	89°22.0
Acamar	315°12.9	-40°13.0
Menkar	314°07.7	4°10.7
Mirfak	308°30.4	49°56.7
Aldebaran	290°41.2	16°33.3
Rigel	281°05.2	-8°10.6
Capella	280°23.9	46°01.3
Bellatrix	278°24.3	6°22.2
Elnath	278°03.6	28°37.6
Alnilam	275°39.1	-1°11.3
Betelgeuse	270°53.5	7°24.6
Canopus	263°52.6	-52°42.6
Sirius	258°27.3	-16°44.9
Adhara	255°06.8	-29°00.3
Procyon	244°52.2	5°09.9
Pollux	243°18.9	27°58.2
Avior	234°14.7	-59°34.9
Suhail	222°47.1	-43°31.4
Miaplacidus	221°37.7	-69°48.5
Alphard	217°49.0	-8°45.5
Regulus	207°35.9	11°51.2
Dubhe	193°42.5	61°37.4
Denebola	182°26.4	14°26.5
Gienah	175°45.1	-17°40.1
Acrux	173°01.6	-63°13.3
Gacrux	171°53.2	-57°14.2
Alioth	166°14.3	55°49.8
Spica	158°24.0	-11°16.8
Alkaid	152°53.3	49°11.6
Hadar	148°38.4	-60°28.7
Menkent	147°59.6	-36°28.8
Arcturus	145°49.4	19°03.6
Rigil Kent.	139°42.7	-60°55.5
Kochab	137°20.1	74°03.3
Zuben'ubi	136°57.9	-16°08.2
Alphecca	126°05.3	26°38.0
Antares	112°18.1	-26°28.9
Atria	107°14.2	-69°03.9
Sabik	102°04.9	-15°45.2
Shaula	96°12.9	-37°07.1
Rasalhague	96°00.3	12°32.5
Eltanin	90°43.4	51°28.9
Kaus Aust.	83°35.0	-34°22.4
Vega	80°34.7	38°48.1
Nunki	75°50.1	-26°16.1
Altair	62°01.9	8°55.6
Peacock	53°08.9	-56°39.8
Deneb	49°27.4	45°21.7
Enif	33°40.7	9°58.7
Al Na'ir	27°35.4	-46°51.2
Fomalhaut	15°16.6	-29°30.2
Scheat	13°47.0	28°12.5
Markab	13°31.7	15°19.7

Jan 19 Thu	**SHA**	**Mer.pass**
Venus	37°10.5	13:39
Mars	293°52.1	20:29
Jupiter	356°03.7	16:21
Saturn	32°55.7	13:54

Jan 20 Fri	**SHA**	**Mer.pass**
Venus	35°56.6	13:40
Mars	293°46.7	20:25
Jupiter	355°54.7	16:18
Saturn	32°49.1	13:50

Jan 21 Sat	**SHA**	**Mer.pass**
Venus	34°43.1	13:41
Mars	293°40.6	20:22
Jupiter	355°45.6	16:14
Saturn	32°42.4	13:47

Horizontal parallax	
Venus:	0.1
Mars:	0.2

h	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°23.2	S20°26.1	221°17.8	3.2′	S26°00.6	5.7′	60.1′
1	192°23.0	25.6	235°40.0	3.1′	26°06.3	5.6′	60.1′
2	207°22.9	25.1	250°02.1	3.0′	26°11.9	5.3′	60.2′
3	222°22.7	·· 24.6	264°24.1	2.9′	26°17.2	5.2′	60.2′
4	237°22.5	24.1	278°46.0	2.8′	26°22.4	5.0′	60.2′
5	252°22.3	23.5	293°07.8	2.7′	26°27.4	4.8′	60.3′
6	267°22.1	S20°23.0	307°29.4	2.6′	S26°32.2	4.7′	60.3′
7	282°21.9	22.5	321°51.0	2.5′	26°36.9	4.4′	60.3′
8	297°21.7	22.0	336°12.5	2.4′	26°41.3	4.2′	60.4′
9	312°21.5	·· 21.5	350°33.8	2.3′	26°45.5	4.1′	60.4′
10	327°21.3	20.9	4°55.1	2.2′	26°49.6	3.8′	60.4′
11	342°21.1	20.4	19°16.3	2.1′	26°53.4	3.7′	60.5′
12	357°20.9	S20°19.9	33°37.4	2.0′	S26°57.1	3.4′	60.5′
13	12°20.7	19.4	47°58.4	1.9′	27°00.5	3.3′	60.5′
14	27°20.5	18.8	62°19.3	1.8′	27°03.8	3.0′	60.6′
15	42°20.3	·· 18.3	76°40.1	1.8′	27°06.8	2.9′	60.6′
16	57°20.1	17.8	91°00.9	1.7′	27°09.7	2.6′	60.6′
17	72°20.0	17.2	105°21.5	1.6′	27°12.3	2.5′	60.6′
18	87°19.8	S20°16.7	119°42.1	1.5′	S27°14.8	2.2′	60.7′
19	102°19.6	16.2	134°02.7	1.5′	27°17.0	2.0′	60.7′
20	117°19.4	15.7	148°23.1	1.4′	27°19.0	1.9′	60.7′
21	132°19.2	·· 15.1	162°43.5	1.3′	27°20.9	1.6′	60.8′
22	147°19.0	14.6	177°03.9	1.3′	27°22.5	1.4′	60.8′
23	162°18.8	14.1	191°24.2	1.2′	27°23.9	1.2′	60.8′
	SD = 16.2′	d = 0.5′	SD = 16.4′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°18.6	S20°13.5	205°44.4	1.2′	S27°25.1	1.0′	60.8′
1	192°18.4	13.0	220°04.6	1.1′	27°26.1	0.7′	60.9′
2	207°18.2	12.5	234°24.7	1.1′	27°26.8	0.6′	60.9′
3	222°18.1	·· 11.9	248°44.8	1.0′	27°27.4	0.3′	60.9′
4	237°17.9	11.4	263°04.8	1.0′	27°27.7	0.1′	60.9′
5	252°17.7	10.9	277°24.8	1.0′	27°27.8	0.1′	60.9′
6	267°17.5	S20°10.3	291°44.8	0.9′	S27°27.7	0.3′	61.0′
7	282°17.3	09.8	306°04.7	0.9′	27°27.4	0.5′	61.0′
8	297°17.1	09.2	320°24.6	0.9′	27°26.9	0.7′	61.0′
9	312°16.9	·· 08.7	334°44.5	0.9′	27°26.2	1.0′	61.0′
10	327°16.8	08.2	349°04.4	0.9′	27°25.2	1.1′	61.1′
11	342°16.6	07.6	3°24.3	0.8′	27°24.1	1.4′	61.1′
12	357°16.4	S20°07.1	17°44.1	0.8′	S27°22.7	1.6′	61.1′
13	12°16.2	06.5	32°03.9	0.8′	27°21.1	1.9′	61.1′
14	27°16.0	06.0	46°23.8	0.8′	27°19.2	2.0′	61.1′
15	42°15.8	·· 05.5	60°43.6	0.8′	27°17.2	2.3′	61.2′
16	57°15.6	04.9	75°03.4	0.8′	27°14.9	2.4′	61.2′
17	72°15.5	04.4	89°23.2	0.8′	27°12.5	2.7′	61.2′
18	87°15.3	S20°03.8	103°43.1	0.8′	S27°09.8	2.9′	61.2′
19	102°15.1	03.3	118°02.9	0.9′	27°06.9	3.2′	61.2′
20	117°14.9	02.7	132°22.8	0.9′	27°03.7	3.3′	61.2′
21	132°14.7	·· 02.2	146°42.7	0.9′	27°00.4	3.6′	61.2′
22	147°14.6	01.6	161°02.6	0.9′	26°56.8	3.7′	61.3′
23	162°14.4	01.1	175°22.5	1.0′	26°53.1	4.0′	61.3′
	SD = 16.2′	d = 0.5′	SD = 16.6′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°14.2	S20°00.5	189°42.5	1.0′	S26°49.1	4.2′	61.3′
1	192°14.0	20°00.0	204°02.4	1.0′	26°44.9	4.4′	61.3′
2	207°13.8	19°59.4	218°22.5	1.1′	26°40.5	4.7′	61.3′
3	222°13.7	·· 58.9	232°42.5	1.1′	26°35.8	4.8′	61.3′
4	237°13.5	58.3	247°02.6	1.2′	26°31.0	5.0′	61.3′
5	252°13.3	57.8	261°22.8	1.2′	26°26.0	5.3′	61.3′
6	267°13.1	S19°57.2	275°43.0	1.3′	S26°20.7	5.5′	61.4′
7	282°12.9	56.7	290°03.3	1.3′	26°15.2	5.6′	61.4′
8	297°12.8	56.1	304°23.6	1.4′	26°09.6	5.9′	61.4′
9	312°12.6	·· 55.6	318°43.9	1.4′	26°03.7	6.1′	61.4′
10	327°12.4	55.0	333°04.4	1.5′	25°57.6	6.3′	61.4′
11	342°12.2	54.5	347°24.9	1.6′	25°51.3	6.5′	61.4′
12	357°12.0	S19°53.9	1°45.4	1.6′	S25°44.8	6.7′	61.4′
13	12°11.9	53.3	16°06.1	1.7′	25°38.1	6.9′	61.4′
14	27°11.7	52.8	30°26.8	1.8′	25°31.2	7.1′	61.4′
15	42°11.5	·· 52.2	44°47.5	1.9′	25°24.1	7.2′	61.4′
16	57°11.3	51.7	59°08.4	1.9′	25°16.9	7.5′	61.4′
17	72°11.2	51.1	73°29.3	2.0′	25°09.4	7.7′	61.4′
18	87°11.0	S19°50.5	87°50.3	2.1′	S25°01.7	7.9′	61.4′
19	102°10.8	50.0	102°11.4	2.2′	24°53.8	8.0′	61.4′
20	117°10.6	49.4	116°32.6	2.3′	24°45.8	8.3′	61.4′
21	132°10.5	·· 48.9	130°53.9	2.4′	24°37.5	8.4′	61.4′
22	147°10.3	48.3	145°15.3	2.5′	24°29.1	8.6′	61.4′
23	162°10.1	47.7	159°36.7	2.6′	24°20.5	8.8′	61.4′
	SD = 16.2′	d = 0.5′	SD = 16.7′				

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

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

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 12-1%
19	10:27	10:36	12:11	09:39	22:12	
20	10:45	10:54	12:11	10:46	23:19	
21	11:03	11:12	12:11	11:53	–:–	

January 22, 23, 24 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	121°05.3	154°35.1	**S**15°08.5	54°38.9	**N**24°30.1	116°41.7	**N**00°35.1	153°41.0	**S**14°27.9
1	136°07.7	169°34.5	07.5	69°41.1	30.2	131°43.8	35.3	168°43.2	27.8
2	151°10.2	184°34.0	06.4	84°43.2	30.2	146°45.8	35.5	183°45.4	27.7
3	166°12.6	199°33.4	·· 05.4	99°45.4	·· 30.2	161°47.9	·· 35.6	198°47.6	·· 27.6
4	181°15.1	214°32.8	04.4	114°47.6	30.3	176°50.0	35.8	213°49.7	27.5
5	196°17.6	229°32.2	03.3	129°49.7	30.3	191°52.1	36.0	228°51.9	27.4
6	211°20.0	244°31.6	**S**15°02.3	144°51.9	**N**24°30.3	206°54.1	**N**00°36.2	243°54.1	**S**14°27.3
7	226°22.5	259°31.1	01.2	159°54.0	30.3	221°56.2	36.4	258°56.3	27.2
8	241°25.0	274°30.5	15°00.2	174°56.2	30.4	236°58.3	36.5	273°58.5	27.2
9	256°27.4	289°29.9	14°59.1	189°58.3	·· 30.4	252°00.4	·· 36.7	289°00.7	·· 27.1
10	271°29.9	304°29.3	58.1	205°00.5	30.4	267°02.5	36.9	304°02.9	27.0
11	286°32.4	319°28.8	57.0	220°02.6	30.4	282°04.5	37.1	319°05.0	26.9
12	301°34.8	334°28.2	**S**14°56.0	235°04.8	**N**24°30.5	297°06.6	**N**00°37.2	334°07.2	**S**14°26.8
13	316°37.3	349°27.6	55.0	250°06.9	30.5	312°08.7	37.4	349°09.4	26.7
14	331°39.8	4°27.0	53.9	265°09.1	30.5	327°10.8	37.6	4°11.6	26.6
15	346°42.2	19°26.5	·· 52.9	280°11.2	·· 30.6	342°12.8	·· 37.8	19°13.8	·· 26.5
16	1°44.7	34°25.9	51.8	295°13.4	30.6	357°14.9	37.9	34°16.0	26.4
17	16°47.1	49°25.3	50.8	310°15.5	30.6	12°17.0	38.1	49°18.1	26.3
18	31°49.6	64°24.8	**S**14°49.7	325°17.6	**N**24°30.7	27°19.1	**N**00°38.3	64°20.3	**S**14°26.2
19	46°52.1	79°24.2	48.6	340°19.8	30.7	42°21.1	38.5	79°22.5	26.1
20	61°54.5	94°23.6	47.6	355°21.9	30.7	57°23.2	38.7	94°24.7	26.0
21	76°57.0	109°23.0	·· 46.5	10°24.0	·· 30.7	72°25.3	·· 38.8	109°26.9	·· 25.9
22	91°59.5	124°22.5	45.5	25°26.2	30.8	87°27.4	39.0	124°29.1	25.8
23	107°01.9	139°21.9	44.4	40°28.3	30.8	102°29.4	39.2	139°31.3	25.7
Mer.pass. 15:53		ν -0.6′ d 1.0′ m -3.93		ν 2.2′ d 0.0′ m -0.55		ν 2.1′ d 0.2′ m -2.23		ν 2.2′ d 0.1′ m 0.87	

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	122°04.4	154°21.3	**S**14°43.4	55°30.4	**N**24°30.8	117°31.5	**N**00°39.4	154°33.4	**S**14°25.6
1	137°06.9	169°20.8	42.3	70°32.6	30.9	132°33.6	39.5	169°35.6	25.5
2	152°09.3	184°20.2	41.3	85°34.7	30.9	147°35.7	39.7	184°37.8	25.4
3	167°11.8	199°19.6	·· 40.2	100°36.8	·· 30.9	162°37.7	·· 39.9	199°40.0	·· 25.3
4	182°14.3	214°19.1	39.1	115°39.0	31.0	177°39.8	40.1	214°42.2	25.2
5	197°16.7	229°18.5	38.1	130°41.1	31.0	192°41.9	40.3	229°44.4	25.1
6	212°19.2	244°17.9	**S**14°37.0	145°43.2	**N**24°31.0	207°43.9	**N**00°40.4	244°46.5	**S**14°25.0
7	227°21.6	259°17.4	36.0	160°45.3	31.1	222°46.0	40.6	259°48.7	24.9
8	242°24.1	274°16.8	34.9	175°47.5	31.1	237°48.1	40.8	274°50.9	24.9
9	257°26.6	289°16.3	·· 33.8	190°49.6	·· 31.1	252°50.2	·· 41.0	289°53.1	·· 24.8
10	272°29.0	304°15.7	32.8	205°51.7	31.1	267°52.2	41.1	304°55.3	24.7
11	287°31.5	319°15.1	31.7	220°53.8	31.2	282°54.3	41.3	319°57.5	24.6
12	302°34.0	334°14.6	**S**14°30.7	235°55.9	**N**24°31.2	297°56.4	**N**00°41.5	334°59.6	**S**14°24.5
13	317°36.4	349°14.0	29.6	250°58.0	31.2	312°58.4	41.7	350°01.8	24.4
14	332°38.9	4°13.5	28.5	266°00.2	31.3	328°00.5	41.9	5°04.0	24.3
15	347°41.4	19°12.9	·· 27.5	281°02.3	·· 31.3	343°02.6	·· 42.0	20°06.2	·· 24.2
16	2°43.8	34°12.3	26.4	296°04.4	31.3	358°04.7	42.2	35°08.4	24.1
17	17°46.3	49°11.8	25.3	311°06.5	31.4	13°06.7	42.4	50°10.6	24.0
18	32°48.8	64°11.2	**S**14°24.3	326°08.6	**N**24°31.4	28°08.8	**N**00°42.6	65°12.7	**S**14°23.9
19	47°51.2	79°10.7	23.2	341°10.7	31.4	43°10.9	42.8	80°14.9	23.8
20	62°53.7	94°10.1	22.1	356°12.8	31.5	58°12.9	42.9	95°17.1	23.7
21	77°56.1	109°09.5	·· 21.1	11°14.9	·· 31.5	73°15.0	·· 43.1	110°19.3	·· 23.6
22	92°58.6	124°09.0	20.0	26°17.0	31.5	88°17.1	43.3	125°21.5	23.5
23	108°01.1	139°08.4	18.9	41°19.1	31.6	103°19.1	43.5	140°23.7	23.4
Mer.pass. 15:49		ν -0.6′ d 1.1′ m -3.93		ν 2.1′ d 0.0′ m -0.52		ν 2.1′ d 0.2′ m -2.23		ν 2.2′ d 0.1′ m 0.87	

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	123°03.5	154°07.9	**S**14°17.8	56°21.2	**N**24°31.6	118°21.2	**N**00°43.7	155°25.8	**S**14°23.3
1	138°06.0	169°07.3	16.8	71°23.3	31.6	133°23.3	43.8	170°28.0	23.2
2	153°08.5	184°06.8	15.7	86°25.4	31.7	148°25.4	44.0	185°30.2	23.1
3	168°10.9	199°06.2	·· 14.6	101°27.5	·· 31.7	163°27.4	·· 44.2	200°32.4	·· 23.0
4	183°13.4	214°05.7	13.5	116°29.6	31.7	178°29.5	44.4	215°34.6	22.9
5	198°15.9	229°05.1	12.5	131°31.7	31.8	193°31.6	44.5	230°36.8	22.8
6	213°18.3	244°04.6	**S**14°11.4	146°33.8	**N**24°31.8	208°33.6	**N**00°44.7	245°38.9	**S**14°22.7
7	228°20.8	259°04.0	10.3	161°35.9	31.8	223°35.7	44.9	260°41.1	22.6
8	243°23.2	274°03.5	09.2	176°38.0	31.9	238°37.8	45.1	275°43.3	22.5
9	258°25.7	289°02.9	·· 08.2	191°40.1	·· 31.9	253°39.8	·· 45.3	290°45.5	·· 22.4
10	273°28.2	304°02.4	07.1	206°42.2	32.0	268°41.9	45.4	305°47.7	22.4
11	288°30.6	319°01.8	06.0	221°44.3	32.0	283°44.0	45.6	320°49.9	22.3
12	303°33.1	334°01.3	**S**14°04.9	236°46.4	**N**24°32.0	298°46.0	**N**00°45.8	335°52.0	**S**14°22.2
13	318°35.6	349°00.7	03.8	251°48.4	32.1	313°48.1	46.0	350°54.2	22.1
14	333°38.0	4°00.2	02.8	266°50.5	32.1	328°50.2	46.2	5°56.4	22.0
15	348°40.5	18°59.6	·· 01.7	281°52.6	·· 32.1	343°52.2	·· 46.4	20°58.6	·· 21.9
16	3°43.0	33°59.1	14°00.6	296°54.7	32.2	358°54.3	46.5	36°00.8	21.8
17	18°45.4	48°58.5	13°59.5	311°56.8	32.2	13°56.4	46.7	51°02.9	21.7
18	33°47.9	63°58.0	**S**13°58.4	326°58.9	**N**24°32.2	28°58.4	**N**00°46.9	66°05.1	**S**14°21.6
19	48°50.4	78°57.4	57.4	342°00.9	32.3	44°00.5	47.1	81°07.3	21.5
20	63°52.8	93°56.9	56.3	357°03.0	32.3	59°02.6	47.3	96°09.5	21.4
21	78°55.3	108°56.4	·· 55.2	12°05.1	·· 32.3	74°04.6	·· 47.4	111°11.7	·· 21.3
22	93°57.7	123°55.8	54.1	27°07.2	32.4	89°06.7	47.6	126°13.9	21.2
23	109°00.2	138°55.3	53.0	42°09.2	32.4	104°08.8	47.8	141°16.0	21.1
Mer.pass. 15:45		ν -0.6′ d 1.1′ m -3.93		ν 2.1′ d 0.0′ m -0.49		ν 2.1′ d 0.2′ m -2.22		ν 2.2′ d 0.1′ m 0.87	

Stars

	SHA	**Dec**
Alpheratz	357°36.6	29°13.1
Ankaa	353°08.9	-42°11.2
Schedar	349°33.1	56°40.0
Diphda	348°49.0	-17°51.8
Achernar	335°21.5	-57°07.5
Hamal	327°53.0	23°34.3
Polaris	314°40.1	89°22.0
Acamar	315°12.9	-40°13.0
Menkar	314°07.7	4°10.7
Mirfak	308°30.4	49°56.7
Aldebaran	290°41.2	16°33.3
Rigel	281°05.2	-8°10.6
Capella	280°23.9	46°01.3
Bellatrix	278°24.3	6°22.2
Elnath	278°03.6	28°37.6
Alnilam	275°39.1	-1°11.3
Betelgeuse	270°53.5	7°24.6
Canopus	263°52.6	-52°42.6
Sirius	258°27.3	-16°44.9
Adhara	255°06.8	-29°00.3
Procyon	244°52.2	5°09.9
Pollux	243°18.9	27°58.2
Avior	234°14.7	-59°34.9
Suhail	222°47.0	-43°31.5
Miaplacidus	221°37.7	-69°48.5
Alphard	217°49.0	-8°45.5
Regulus	207°35.9	11°51.2
Dubhe	193°42.5	61°37.4
Denebola	182°26.4	14°26.5
Gienah	175°45.1	-17°40.1
Acrux	173°01.6	-63°13.3
Gacrux	171°53.2	-57°14.3
Alioth	166°14.2	55°49.8
Spica	158°23.9	-11°16.9
Alkaid	152°53.3	49°11.6
Hadar	148°38.3	-60°28.7
Menkent	147°59.5	-36°28.8
Arcturus	145°49.4	19°03.6
Rigil Kent.	139°42.6	-60°55.5
Kochab	137°20.0	74°03.3
Zuben'ubi	136°57.9	-16°08.2
Alphecca	126°05.3	26°38.0
Antares	112°18.0	-26°28.9
Atria	107°14.1	-69°03.9
Sabik	102°04.9	-15°45.2
Shaula	96°12.9	-37°07.1
Rasalhague	96°00.3	12°32.5
Eltanin	90°43.4	51°28.9
Kaus Aust.	83°35.0	-34°22.4
Vega	80°34.7	38°48.1
Nunki	75°50.1	-26°16.1
Altair	62°01.9	8°55.6
Peacock	53°08.9	-56°39.7
Deneb	49°27.4	45°21.7
Enif	33°40.7	9°58.7
Al Na'ir	27°35.3	-46°51.2
Fomalhaut	15°16.6	-29°30.2
Scheat	13°47.0	28°12.5
Markab	13°31.7	15°19.7

Jan 22 Sun	**SHA**	**Mer.pass**
Venus	33°29.9	13:42
Mars	293°33.7	20:18
Jupiter	355°36.4	16:11
Saturn	32°35.8	13:43

Jan 23 Mon	**SHA**	**Mer.pass**
Venus	32°16.9	13:43
Mars	293°26.0	20:15
Jupiter	355°27.1	16:08
Saturn	32°29.0	13:40

Jan 24 Tue	**SHA**	**Mer.pass**
Venus	31°04.3	13:44
Mars	293°17.7	20:12
Jupiter	355°17.7	16:04
Saturn	32°22.3	13:36

Horizontal parallax	
Venus:	0.1
Mars:	0.2

h	Sun		Moon				
Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°09.9	S19°47.2	173°58.3	2.7′	S24°11.7	9.0′	61.4′
1	192°09.8	46.6	188°20.0	2.8′	24°02.7	9.2′	61.4′
2	207°09.6	46.0	202°41.7	2.9′	23°53.5	9.3′	61.4′
3	222°09.4	·· 45.5	217°03.6	3.0′	23°44.2	9.5′	61.4′
4	237°09.3	44.9	231°25.5	3.1′	23°34.7	9.7′	61.4′
5	252°09.1	44.3	245°47.6	3.2′	23°25.0	9.9′	61.4′
6	267°08.9	S19°43.8	260°09.8	3.3′	S23°15.1	10.0′	61.4′
7	282°08.7	43.2	274°32.1	3.4′	23°05.1	10.2′	61.4′
8	297°08.6	42.6	288°54.5	3.5′	22°54.9	10.4′	61.4′
9	312°08.4	·· 42.1	303°17.0	3.6′	22°44.5	10.5′	61.4′
10	327°08.2	41.5	317°39.6	3.7′	22°34.0	10.7′	61.4′
11	342°08.1	40.9	332°02.3	3.8′	22°23.3	10.8′	61.4′
12	357°07.9	S19°40.3	346°25.1	4.0′	S22°12.5	11.1′	61.3′
13	12°07.7	39.8	0°48.1	4.1′	22°01.4	11.1′	61.3′
14	27°07.6	39.2	15°11.2	4.2′	21°50.3	11.3′	61.3′
15	42°07.4	·· 38.6	29°34.4	4.3′	21°39.0	11.5′	61.3′
16	57°07.2	38.0	43°57.7	4.4′	21°27.5	11.6′	61.3′
17	72°07.1	37.5	58°21.1	4.5′	21°15.9	11.7′	61.3′
18	87°06.9	S19°36.9	72°44.6	4.7′	S21°04.2	11.9′	61.3′
19	102°06.7	36.3	87°08.3	4.8′	20°52.3	12.0′	61.3′
20	117°06.6	35.7	101°32.1	4.9′	20°40.3	12.2′	61.3′
21	132°06.4	·· 35.2	115°56.0	5.0′	20°28.1	12.3′	61.2′
22	147°06.2	34.6	130°20.0	5.2′	20°15.8	12.5′	61.2′
23	162°06.1	34.0	144°44.2	5.3′	20°03.3	12.5′	61.2′
	SD = 16.2′	d = 0.6′	SD = 16.7′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°05.9	S19°33.4	159°08.5	5.4′	S19°50.8	12.7′	61.2′
1	192°05.7	32.8	173°32.9	5.5′	19°38.1	12.9′	61.2′
2	207°05.6	32.3	187°57.4	5.6′	19°25.2	12.9′	61.2′
3	222°05.4	·· 31.7	202°22.0	5.8′	19°12.3	13.1′	61.1′
4	237°05.2	31.1	216°46.8	5.9′	18°59.2	13.2′	61.1′
5	252°05.1	30.5	231°11.7	6.0′	18°46.0	13.3′	61.1′
6	267°04.9	S19°29.9	245°36.7	6.1′	S18°32.7	13.4′	61.1′
7	282°04.7	29.3	260°01.8	6.3′	18°19.3	13.5′	61.1′
8	297°04.6	28.8	274°27.1	6.4′	18°05.8	13.6′	61.1′
9	312°04.4	·· 28.2	288°52.5	6.5′	17°52.2	13.8′	61.0′
10	327°04.3	27.6	303°18.0	6.6′	17°38.4	13.8′	61.0′
11	342°04.1	27.0	317°43.6	6.7′	17°24.6	14.0′	61.0′
12	357°03.9	S19°26.4	332°09.4	6.9′	S17°10.6	14.0′	61.0′
13	12°03.8	25.8	346°35.2	7.0′	16°56.6	14.2′	60.9′
14	27°03.6	25.2	1°01.2	7.1′	16°42.4	14.2′	60.9′
15	42°03.5	·· 24.7	15°27.3	7.2′	16°28.2	14.4′	60.9′
16	57°03.3	24.1	29°53.6	7.3′	16°13.8	14.4′	60.9′
17	72°03.1	23.5	44°19.9	7.5′	15°59.4	14.5′	60.8′
18	87°03.0	S19°22.9	58°46.4	7.6′	S15°44.9	14.6′	60.8′
19	102°02.8	22.3	73°13.0	7.7′	15°30.3	14.7′	60.8′
20	117°02.7	21.7	87°39.7	7.8′	15°15.6	14.8′	60.8′
21	132°02.5	·· 21.1	102°06.5	7.9′	15°00.8	14.8′	60.7′
22	147°02.3	20.5	116°33.4	8.0′	14°46.0	14.9′	60.7′
23	162°02.2	19.9	131°00.5	8.2′	14°31.1	15.0′	60.7′
	SD = 16.2′	d = 0.6′	SD = 16.7′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°02.0	S19°19.3	145°27.6	8.3′	S14°16.1	15.1′	60.7′
1	192°01.9	18.7	159°54.9	8.4′	14°01.0	15.1′	60.6′
2	207°01.7	18.1	174°22.3	8.5′	13°45.9	15.2′	60.6′
3	222°01.6	·· 17.5	188°49.8	8.6′	13°30.7	15.3′	60.6′
4	237°01.4	16.9	203°17.4	8.7′	13°15.4	15.3′	60.5′
5	252°01.2	16.3	217°45.1	8.8′	13°00.1	15.4′	60.5′
6	267°01.1	S19°15.7	232°13.0	8.9′	S12°44.7	15.5′	60.5′
7	282°00.9	15.1	246°40.9	9.0′	12°29.2	15.5′	60.5′
8	297°00.8	14.5	261°08.9	9.1′	12°13.7	15.5′	60.4′
9	312°00.6	·· 13.9	275°37.1	9.2′	11°58.2	15.7′	60.4′
10	327°00.5	13.3	290°05.3	9.4′	11°42.5	15.6′	60.4′
11	342°00.3	12.7	304°33.7	9.5′	11°26.9	15.7′	60.3′
12	357°00.2	S19°12.1	319°02.1	9.6′	S11°11.2	15.8′	60.3′
13	12°00.0	11.5	333°30.7	9.7′	10°55.4	15.8′	60.3′
14	26°59.9	10.9	347°59.3	9.8′	10°39.6	15.9′	60.2′
15	41°59.7	·· 10.3	2°28.1	9.8′	10°23.7	15.8′	60.2′
16	56°59.6	09.7	16°56.9	9.9′	10°07.9	16.0′	60.2′
17	71°59.4	09.1	31°25.9	10.0′	09°51.9	15.9′	60.1′
18	86°59.3	S19°08.5	45°54.9	10.1′	S09°36.0	16.0′	60.1′
19	101°59.1	07.9	60°24.1	10.2′	09°20.0	16.0′	60.1′
20	116°59.0	07.3	74°53.3	10.3′	09°04.0	16.1′	60.0′
21	131°58.8	·· 06.7	89°22.6	10.4′	08°47.9	16.1′	60.0′
22	146°58.7	06.1	103°52.0	10.5′	08°31.8	16.1′	60.0′
23	161°58.5	05.5	118°21.5	10.6′	08°15.7	16.1′	59.9′
	SD = 16.2′	d = 0.6′	SD = 16.5′				

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

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

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 1-3 0-7%
22	11:20	11:28	12:11	12:57	00:25	
23	11:36	11:44	12:12	13:56	01:27	
24	11:52	11:59	12:12	14:50	02:23	

January 25, 26, 27 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	124°02.7	153°54.7	S13°51.9	57°11.3	N24°32.5	119°10.8	N00°48.0	156°18.2	S14°21.0
1	139°05.1	168°54.2	50.8	72°13.4	32.5	134°12.9	48.2	171°20.4	20.9
2	154°07.6	183°53.6	49.7	87°15.4	32.5	149°15.0	48.3	186°22.6	20.8
3	169°10.1	198°53.1	·· 48.7	102°17.5	·· 32.6	164°17.0	·· 48.5	201°24.8	·· 20.7
4	184°12.5	213°52.6	47.6	117°19.6	32.6	179°19.1	48.7	216°26.9	20.6
5	199°15.0	228°52.0	46.5	132°21.7	32.6	194°21.1	48.9	231°29.1	20.5
6	214°17.5	243°51.5	S13°45.4	147°23.7	N24°32.7	209°23.2	N00°49.1	246°31.3	S14°20.4
7	229°19.9	258°50.9	44.3	162°25.8	32.7	224°25.3	49.2	261°33.5	20.3
8	244°22.4	273°50.4	43.2	177°27.8	32.8	239°27.3	49.4	276°35.7	20.2
9	259°24.8	288°49.9	·· 42.1	192°29.9	·· 32.8	254°29.4	·· 49.6	291°37.9	·· 20.1
10	274°27.3	303°49.3	41.0	207°32.0	32.8	269°31.5	49.8	306°40.0	20.0
11	289°29.8	318°48.8	39.9	222°34.0	32.9	284°33.5	50.0	321°42.2	19.9
12	304°32.2	333°48.3	S13°38.8	237°36.1	N24°32.9	299°35.6	N00°50.2	336°44.4	S14°19.8
13	319°34.7	348°47.7	37.7	252°38.1	32.9	314°37.6	50.3	351°46.6	19.7
14	334°37.2	3°47.2	36.6	267°40.2	33.0	329°39.7	50.5	6°48.8	19.6
15	349°39.6	18°46.7	·· 35.5	282°42.2	·· 33.0	344°41.8	·· 50.7	21°50.9	·· 19.5
16	4°42.1	33°46.1	34.4	297°44.3	33.1	359°43.8	50.9	36°53.1	19.5
17	19°44.6	48°45.6	33.3	312°46.4	33.1	14°45.9	51.1	51°55.3	19.4
18	34°47.0	63°45.1	S13°32.2	327°48.4	N24°33.1	29°48.0	N00°51.3	66°57.5	S14°19.3
19	49°49.5	78°44.5	31.1	342°50.5	33.2	44°50.0	51.4	81°59.7	19.2
20	64°52.0	93°44.0	30.0	357°52.5	33.2	59°52.1	51.6	97°01.9	19.1
21	79°54.4	108°43.5	·· 28.9	12°54.5	·· 33.3	74°54.1	·· 51.8	112°04.0	·· 19.0
22	94°56.9	123°42.9	27.8	27°56.6	33.3	89°56.2	52.0	127°06.2	18.9
23	109°59.3	138°42.4	26.7	42°58.6	33.3	104°58.3	52.2	142°08.4	18.8
Mer.pass. 15:41		ν -0.5′ d 1.1′ m -3.93		ν 2.1′ d 0.0′ m -0.46		ν 2.1′ d 0.2′ m -2.22		ν 2.2′ d 0.1′ m 0.87	

Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	125°01.8	153°41.9	S13°25.6	58°00.7	N24°33.4	120°00.3	N00°52.4	157°10.6	S14°18.7
1	140°04.3	168°41.3	24.5	73°02.7	33.4	135°02.4	52.5	172°12.8	18.6
2	155°06.7	183°40.8	23.4	88°04.8	33.5	150°04.4	52.7	187°14.9	18.5
3	170°09.2	198°40.3	·· 22.3	103°06.8	·· 33.5	165°06.5	·· 52.9	202°17.1	·· 18.4
4	185°11.7	213°39.8	21.2	118°08.8	33.5	180°08.6	53.1	217°19.3	18.3
5	200°14.1	228°39.2	20.1	133°10.9	33.6	195°10.6	53.3	232°21.5	18.2
6	215°16.6	243°38.7	S13°19.0	148°12.9	N24°33.6	210°12.7	N00°53.4	247°23.7	S14°18.1
7	230°19.1	258°38.2	17.9	163°15.0	33.7	225°14.7	53.6	262°25.8	18.0
8	245°21.5	273°37.7	16.8	178°17.0	33.7	240°16.8	53.8	277°28.0	17.9
9	260°24.0	288°37.1	·· 15.7	193°19.0	·· 33.7	255°18.9	·· 54.0	292°30.2	·· 17.8
10	275°26.5	303°36.6	14.6	208°21.1	33.8	270°20.9	54.2	307°32.4	17.7
11	290°28.9	318°36.1	13.5	223°23.1	33.8	285°23.0	54.4	322°34.6	17.6
12	305°31.4	333°35.6	S13°12.4	238°25.1	N24°33.9	300°25.0	N00°54.6	337°36.7	S14°17.5
13	320°33.8	348°35.0	11.2	253°27.1	33.9	315°27.1	54.7	352°38.9	17.4
14	335°36.3	3°34.5	10.1	268°29.2	34.0	330°29.1	54.9	7°41.1	17.3
15	350°38.8	18°34.0	·· 09.0	283°31.2	·· 34.0	345°31.2	·· 55.1	22°43.3	·· 17.2
16	5°41.2	33°33.5	07.9	298°33.2	34.0	0°33.3	55.3	37°45.5	17.1
17	20°43.7	48°33.0	06.8	313°35.2	34.1	15°35.3	55.5	52°47.7	17.0
18	35°46.2	63°32.4	S13°05.7	328°37.3	N24°34.1	30°37.4	N00°55.7	67°49.8	S14°16.9
19	50°48.6	78°31.9	04.6	343°39.3	34.2	45°39.4	55.8	82°52.0	16.8
20	65°51.1	93°31.4	03.5	358°41.3	34.2	60°41.5	56.0	97°54.2	16.7
21	80°53.6	108°30.9	·· 02.3	13°43.3	·· 34.2	75°43.5	·· 56.2	112°56.4	·· 16.6
22	95°56.0	123°30.4	01.2	28°45.3	34.3	90°45.6	56.4	127°58.6	16.5
23	110°58.5	138°29.8	00.1	43°47.4	34.3	105°47.7	56.6	143°00.7	16.4
Mer.pass. 15:37		ν -0.5′ d 1.1′ m -3.93		ν 2.0′ d 0.0′ m -0.43		ν 2.1′ d 0.2′ m -2.21		ν 2.2′ d 0.1′ m 0.87	

Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	126°00.9	153°29.3	S12°59.0	58°49.4	N24°34.4	120°49.7	N00°56.8	158°02.9	S14°16.3
1	141°03.4	168°28.8	57.9	73°51.4	34.4	135°51.8	56.9	173°05.1	16.2
2	156°05.9	183°28.3	56.8	88°53.4	34.5	150°53.8	57.1	188°07.3	16.1
3	171°08.3	198°27.8	·· 55.6	103°55.4	·· 34.5	165°55.9	·· 57.3	203°09.5	·· 16.0
4	186°10.8	213°27.3	54.5	118°57.4	34.5	180°57.9	57.5	218°11.6	15.9
5	201°13.3	228°26.8	53.4	133°59.4	34.6	196°00.0	57.7	233°13.8	15.9
6	216°15.7	243°26.2	S12°52.3	149°01.4	N24°34.6	211°02.0	N00°57.9	248°16.0	S14°15.8
7	231°18.2	258°25.7	51.2	164°03.4	34.7	226°04.1	58.1	263°18.2	15.7
8	246°20.7	273°25.2	50.0	179°05.4	34.7	241°06.2	58.2	278°20.4	15.6
9	261°23.1	288°24.7	·· 48.9	194°07.5	·· 34.8	256°08.2	·· 58.4	293°22.5	·· 15.5
10	276°25.6	303°24.2	47.8	209°09.5	34.8	271°10.3	58.6	308°24.7	15.4
11	291°28.1	318°23.7	46.7	224°11.5	34.9	286°12.3	58.8	323°26.9	15.3
12	306°30.5	333°23.2	S12°45.5	239°13.5	N24°34.9	301°14.4	N00°59.0	338°29.1	S14°15.2
13	321°33.0	348°22.7	44.4	254°15.5	34.9	316°16.4	59.2	353°31.3	15.1
14	336°35.4	3°22.1	43.3	269°17.5	35.0	331°18.5	59.4	8°33.4	15.0
15	351°37.9	18°21.6	·· 42.2	284°19.5	·· 35.0	346°20.5	·· 59.5	23°35.6	·· 14.9
16	6°40.4	33°21.1	41.0	299°21.5	35.1	1°22.6	59.7	38°37.8	14.8
17	21°42.8	48°20.6	39.9	314°23.5	35.1	16°24.6	00°59.9	53°40.0	14.7
18	36°45.3	63°20.1	S12°38.8	329°25.4	N24°35.2	31°26.7	N01°00.1	68°42.1	S14°14.6
19	51°47.8	78°19.6	37.7	344°27.4	35.2	46°28.7	00.3	83°44.3	14.5
20	66°50.2	93°19.1	36.5	359°29.4	35.3	61°30.8	00.5	98°46.5	14.4
21	81°52.7	108°18.6	·· 35.4	14°31.4	·· 35.3	76°32.9	·· 00.7	113°48.7	·· 14.3
22	96°55.2	123°18.1	34.3	29°33.4	35.3	91°34.9	00.8	128°50.9	14.2
23	111°57.6	138°17.6	33.1	44°35.4	35.4	106°37.0	01.0	143°53.0	14.1
Mer.pass. 15:33		ν -0.5′ d 1.1′ m -3.93		ν 2.0′ d 0.0′ m -0.40		ν 2.1′ d 0.2′ m -2.21		ν 2.2′ d 0.1′ m 0.87	

Stars

	SHA	**Dec**
Alpheratz	357°36.6	29°13.1
Ankaa	353°08.9	-42°11.2
Schedar	349°33.1	56°40.0
Diphda	348°49.0	-17°51.8
Achernar	335°21.5	-57°07.5
Hamal	327°53.0	23°34.3
Polaris	314°41.8	89°22.0
Acamar	315°12.9	-40°13.0
Menkar	314°07.8	4°10.7
Mirfak	308°30.4	49°56.7
Aldebaran	290°41.3	16°33.3
Rigel	281°05.2	-8°10.6
Capella	280°23.9	46°01.4
Bellatrix	278°24.3	6°22.2
Elnath	278°03.6	28°37.6
Alnilam	275°39.1	-1°11.3
Betelgeuse	270°53.5	7°24.6
Canopus	263°52.6	-52°42.6
Sirius	258°27.3	-16°44.9
Adhara	255°06.8	-29°00.3
Procyon	244°52.2	5°09.9
Pollux	243°18.9	27°58.2
Avior	234°14.7	-59°35.0
Suhail	222°47.0	-43°31.5
Miaplacidus	221°37.7	-69°48.6
Alphard	217°49.0	-8°45.5
Regulus	207°35.9	11°51.2
Dubhe	193°42.5	61°37.4
Denebola	182°26.4	14°26.5
Gienah	175°45.1	-17°40.1
Acrux	173°01.6	-63°13.3
Gacrux	171°53.2	-57°14.3
Alioth	166°14.2	55°49.8
Spica	158°23.9	-11°16.9
Alkaid	152°53.2	49°11.6
Hadar	148°38.3	-60°28.7
Menkent	147°59.5	-36°28.8
Arcturus	145°49.4	19°03.6
Rigil Kent.	139°42.6	-60°55.5
Kochab	137°20.0	74°03.3
Zuben'ubi	136°57.9	-16°08.2
Alphecca	126°05.2	26°38.0
Antares	112°18.0	-26°28.9
Atria	107°14.1	-69°03.9
Sabik	102°04.9	-15°45.2
Shaula	96°12.9	-37°07.1
Rasalhague	96°00.3	12°32.5
Eltanin	90°43.4	51°28.9
Kaus Aust.	83°35.0	-34°22.4
Vega	80°34.7	38°48.1
Nunki	75°50.1	-26°16.1
Altair	62°01.9	8°55.6
Peacock	53°08.9	-56°39.7
Deneb	49°27.4	45°21.7
Enif	33°40.7	9°58.7
Al Na'ir	27°35.4	-46°51.2
Fomalhaut	15°16.6	-29°30.2
Scheat	13°47.0	28°12.4
Markab	13°31.7	15°19.7

Jan 25 Wed	**SHA**	**Mer.pass**
Venus	29°52.1	13:45
Mars	293°08.6	20:08
Jupiter	355°08.2	16:01
Saturn	32°15.5	13:33

Jan 26 Thu	**SHA**	**Mer.pass**
Venus	28°40.1	13:46
Mars	292°58.9	20:05
Jupiter	354°58.5	15:58
Saturn	32°08.8	13:29

Jan 27 Fri	**SHA**	**Mer.pass**
Venus	27°28.4	13:47
Mars	292°48.4	20:02
Jupiter	354°48.8	15:55
Saturn	32°02.0	13:26

Horizontal parallax	
Venus:	0.1
Mars:	0.2

h	Sun		Moon				
Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°58.4	S19°04.9	132°51.1	10.7′	S07°59.6	16.2′	59.9′
1	191°58.2	04.3	147°20.7	10.7′	07°43.4	16.2′	59.9′
2	206°58.1	03.6	161°50.5	10.8′	07°27.2	16.2′	59.8′
3	221°57.9	·· 03.0	176°20.3	10.9′	07°11.0	16.2′	59.8′
4	236°57.8	02.4	190°50.2	11.0′	06°54.8	16.2′	59.7′
5	251°57.6	01.8	205°20.2	11.1′	06°38.6	16.3′	59.7′
6	266°57.5	S19°01.2	219°50.3	11.1′	S06°22.3	16.3′	59.7′
7	281°57.3	00.6	234°20.4	11.2′	06°06.0	16.2′	59.6′
8	296°57.2	19°00.0	248°50.7	11.3′	05°49.8	16.3′	59.6′
9	311°57.0	18°59.3	263°20.9	11.4′	05°33.5	16.3′	59.6′
10	326°56.9	58.7	277°51.3	11.4′	05°17.2	16.3′	59.5′
11	341°56.8	58.1	292°21.8	11.5′	05°00.9	16.3′	59.5′
12	356°56.6	S18°57.5	306°52.3	11.6′	S04°44.6	16.3′	59.4′
13	11°56.5	56.9	321°22.8	11.6′	04°28.3	16.3′	59.4′
14	26°56.3	56.3	335°53.5	11.7′	04°12.0	16.3′	59.4′
15	41°56.2	·· 55.6	350°24.2	11.8′	03°55.7	16.3′	59.3′
16	56°56.0	55.0	4°55.0	11.8′	03°39.4	16.3′	59.3′
17	71°55.9	54.4	19°25.8	11.9′	03°23.1	16.3′	59.3′
18	86°55.8	S18°53.8	33°56.7	12.0′	S03°06.8	16.3′	59.2′
19	101°55.6	53.2	48°27.7	12.0′	02°50.5	16.2′	59.2′
20	116°55.5	52.5	62°58.7	12.1′	02°34.3	16.3′	59.1′
21	131°55.3	·· 51.9	77°29.8	12.1′	02°18.0	16.2′	59.1′
22	146°55.2	51.3	92°00.9	12.2′	02°01.8	16.3′	59.1′
23	161°55.0	50.7	106°32.1	12.2′	01°45.5	16.2′	59.0′
	SD = 16.2′	d = 0.6′	SD = 16.3′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°54.9	S18°50.1	121°03.4	12.3′	S01°29.3	16.2′	59.0′
1	191°54.8	49.4	135°34.7	12.3′	01°13.1	16.2′	58.9′
2	206°54.6	48.8	150°06.0	12.4′	00°56.9	16.2′	58.9′
3	221°54.5	·· 48.2	164°37.4	12.4′	00°40.7	16.2′	58.9′
4	236°54.4	47.5	179°08.9	12.5′	00°24.5	16.1′	58.8′
5	251°54.2	46.9	193°40.4	12.5′	S00°08.4	16.1′	58.8′
6	266°54.1	S18°46.3	208°11.9	12.6′	N00°07.7	16.1′	58.7′
7	281°53.9	45.7	222°43.5	12.6′	00°23.8	16.1′	58.7′
8	296°53.8	45.0	237°15.1	12.7′	00°39.9	16.0′	58.7′
9	311°53.7	·· 44.4	251°46.8	12.7′	00°55.9	16.0′	58.6′
10	326°53.5	43.8	266°18.5	12.7′	01°11.9	16.0′	58.6′
11	341°53.4	43.1	280°50.2	12.8′	01°27.9	15.9′	58.5′
12	356°53.3	S18°42.5	295°22.0	12.8′	N01°43.8	16.0′	58.5′
13	11°53.1	41.9	309°53.8	12.8′	01°59.8	15.9′	58.5′
14	26°53.0	41.3	324°25.6	12.9′	02°15.7	15.8′	58.4′
15	41°52.9	·· 40.6	338°57.5	12.9′	02°31.5	15.8′	58.4′
16	56°52.7	40.0	353°29.4	12.9′	02°47.3	15.8′	58.3′
17	71°52.6	39.4	8°01.4	13.0′	03°03.1	15.8′	58.3′
18	86°52.4	S18°38.7	22°33.4	13.0′	N03°18.9	15.7′	58.3′
19	101°52.3	38.1	37°05.4	13.0′	03°34.6	15.7′	58.2′
20	116°52.2	37.4	51°37.4	13.1′	03°50.3	15.6′	58.2′
21	131°52.0	·· 36.8	66°09.4	13.1′	04°05.9	15.6′	58.1′
22	146°51.9	36.2	80°41.5	13.1′	04°21.5	15.5′	58.1′
23	161°51.8	35.5	95°13.6	13.1′	04°37.0	15.5′	58.1′
	SD = 16.2′	d = 0.6′	SD = 16.1′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°51.7	S18°34.9	109°45.7	13.1′	N04°52.5	15.5′	58.0′
1	191°51.5	34.3	124°17.9	13.2′	05°08.0	15.4′	58.0′
2	206°51.4	33.6	138°50.0	13.2′	05°23.4	15.4′	57.9′
3	221°51.3	·· 33.0	153°22.2	13.2′	05°38.8	15.3′	57.9′
4	236°51.1	32.3	167°54.4	13.2′	05°54.1	15.3′	57.9′
5	251°51.0	31.7	182°26.6	13.2′	06°09.4	15.2′	57.8′
6	266°50.9	S18°31.1	196°58.8	13.2′	N06°24.6	15.1′	57.8′
7	281°50.7	30.4	211°31.1	13.2′	06°39.7	15.2′	57.7′
8	296°50.6	29.8	226°03.3	13.3′	06°54.9	15.0′	57.7′
9	311°50.5	·· 29.1	240°35.6	13.3′	07°09.9	15.0′	57.7′
10	326°50.4	28.5	255°07.9	13.3′	07°24.9	15.0′	57.6′
11	341°50.2	27.8	269°40.1	13.3′	07°39.9	14.9′	57.6′
12	356°50.1	S18°27.2	284°12.4	13.3′	N07°54.8	14.8′	57.5′
13	11°50.0	26.6	298°44.7	13.3′	08°09.6	14.8′	57.5′
14	26°49.9	25.9	313°17.0	13.3′	08°24.4	14.8′	57.5′
15	41°49.7	·· 25.3	327°49.3	13.3′	08°39.2	14.6′	57.4′
16	56°49.6	24.6	342°21.6	13.3′	08°53.8	14.6′	57.4′
17	71°49.5	24.0	356°53.9	13.3′	09°08.4	14.6′	57.3′
18	86°49.3	S18°23.3	11°26.2	13.3′	N09°23.0	14.5′	57.3′
19	101°49.2	22.7	25°58.5	13.3′	09°37.5	14.4′	57.3′
20	116°49.1	22.0	40°30.8	13.3′	09°51.9	14.3′	57.2′
21	131°49.0	·· 21.4	55°03.1	13.3′	10°06.2	14.3′	57.2′
22	146°48.9	20.7	69°35.4	13.3′	10°20.5	14.2′	57.2′
23	161°48.7	20.1	84°07.7	13.3′	10°34.7	14.2′	57.1′
	SD = 16.2′	d = 0.6′	SD = 15.8′				

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

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

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 4-6 14-33%
25	12:07	12:14	12:12	15:40	03:15	
26	12:20	12:27	12:12	16:27	04:04	
27	12:33	12:40	12:13	17:13	04:50	

January 28, 29, 30 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	127°00.1	153°17.1	S12°32.0	59°37.4	N24°35.4	121°39.0	N01°01.2	158°55.2	S14°14.0
1	142°02.5	168°16.6	30.9	74°39.4	35.5	136°41.1	01.4	173°57.4	13.9
2	157°05.0	183°16.1	29.7	89°41.4	35.5	151°43.1	01.6	188°59.6	13.8
3	172°07.5	198°15.6	·· 28.6	104°43.3	·· 35.6	166°45.2	·· 01.8	204°01.8	·· 13.7
4	187°09.9	213°15.1	27.5	119°45.3	35.6	181°47.2	02.0	219°03.9	13.6
5	202°12.4	228°14.6	26.3	134°47.3	35.7	196°49.3	02.1	234°06.1	13.5
6	217°14.9	243°14.1	S12°25.2	149°49.3	N24°35.7	211°51.3	N01°02.3	249°08.3	S14°13.4
7	232°17.3	258°13.6	24.1	164°51.3	35.8	226°53.4	02.5	264°10.5	13.3
8	247°19.8	273°13.1	22.9	179°53.2	35.8	241°55.4	02.7	279°12.7	13.2
9	262°22.3	288°12.6	·· 21.8	194°55.2	·· 35.8	256°57.5	·· 02.9	294°14.8	·· 13.1
10	277°24.7	303°12.1	20.7	209°57.2	35.9	271°59.5	03.1	309°17.0	13.0
11	292°27.2	318°11.6	19.5	224°59.2	35.9	287°01.6	03.3	324°19.2	12.9
12	307°29.7	333°11.1	S12°18.4	240°01.1	N24°36.0	302°03.6	N01°03.5	339°21.4	S14°12.8
13	322°32.1	348°10.6	17.2	255°03.1	36.0	317°05.7	03.6	354°23.6	12.7
14	337°34.6	3°10.1	16.1	270°05.1	36.1	332°07.7	03.8	9°25.7	12.6
15	352°37.0	18°09.6	·· 15.0	285°07.1	·· 36.1	347°09.8	·· 04.0	24°27.9	·· 12.5
16	7°39.5	33°09.1	13.8	300°09.0	36.2	2°11.8	04.2	39°30.1	12.4
17	22°42.0	48°08.6	12.7	315°11.0	36.2	17°13.9	04.4	54°32.3	12.3
18	37°44.4	63°08.1	S12°11.5	330°13.0	N24°36.3	32°15.9	N01°04.6	69°34.4	S14°12.2
19	52°46.9	78°07.6	10.4	345°14.9	36.3	47°18.0	04.8	84°36.6	12.1
20	67°49.4	93°07.1	09.3	0°16.9	36.4	62°20.0	05.0	99°38.8	12.0
21	82°51.8	108°06.6	·· 08.1	15°18.9	·· 36.4	77°22.1	·· 05.1	114°41.0	·· 11.9
22	97°54.3	123°06.1	07.0	30°20.8	36.5	92°24.1	05.3	129°43.2	11.8
23	112°56.8	138°05.6	05.8	45°22.8	36.5	107°26.1	05.5	144°45.3	11.7
Mer.pass. 15:29		ν -0.5′ d 1.1′ m -3.93		ν 2.0′ d 0.0′ m -0.37		ν 2.1′ d 0.2′ m -2.21		ν 2.2′ d 0.1′ m 0.87	

Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	127°59.2	153°05.1	S12°04.7	60°24.7	N24°36.6	122°28.2	N01°05.7	159°47.5	S14°11.6
1	143°01.7	168°04.6	03.5	75°26.7	36.6	137°30.2	05.9	174°49.7	11.5
2	158°04.2	183°04.1	02.4	90°28.7	36.7	152°32.3	06.1	189°51.9	11.4
3	173°06.6	198°03.6	·· 01.2	105°30.6	·· 36.7	167°34.3	·· 06.3	204°54.1	·· 11.3
4	188°09.1	213°03.1	12°00.1	120°32.6	36.8	182°36.4	06.5	219°56.2	11.2
5	203°11.5	228°02.6	11°59.0	135°34.5	36.8	197°38.4	06.6	234°58.4	11.1
6	218°14.0	243°02.2	S11°57.8	150°36.5	N24°36.9	212°40.5	N01°06.8	250°00.6	S14°11.0
7	233°16.5	258°01.7	56.7	165°38.4	36.9	227°42.5	07.0	265°02.8	11.0
8	248°18.9	273°01.2	55.5	180°40.4	36.9	242°44.6	07.2	280°04.9	10.9
9	263°21.4	288°00.7	·· 54.4	195°42.3	·· 37.0	257°46.6	·· 07.4	295°07.1	·· 10.8
10	278°23.9	303°00.2	53.2	210°44.3	37.0	272°48.7	07.6	310°09.3	10.7
11	293°26.3	317°59.7	52.1	225°46.2	37.1	287°50.7	07.8	325°11.5	10.6
12	308°28.8	332°59.2	S11°50.9	240°48.2	N24°37.1	302°52.8	N01°08.0	340°13.7	S14°10.5
13	323°31.3	347°58.7	49.8	255°50.1	37.2	317°54.8	08.2	355°15.8	10.4
14	338°33.7	2°58.3	48.6	270°52.1	37.2	332°56.8	08.3	10°18.0	10.3
15	353°36.2	17°57.8	·· 47.4	285°54.0	·· 37.3	347°58.9	·· 08.5	25°20.2	·· 10.2
16	8°38.7	32°57.3	46.3	300°56.0	37.3	3°00.9	08.7	40°22.4	10.1
17	23°41.1	47°56.8	45.1	315°57.9	37.4	18°03.0	08.9	55°24.5	10.0
18	38°43.6	62°56.3	S11°44.0	330°59.8	N24°37.4	33°05.0	N01°09.1	70°26.7	S14°09.9
19	53°46.0	77°55.8	42.8	346°01.8	37.5	48°07.1	09.3	85°28.9	09.8
20	68°48.5	92°55.3	41.7	1°03.7	37.5	63°09.1	09.5	100°31.1	09.7
21	83°51.0	107°54.9	·· 40.5	16°05.7	·· 37.6	78°11.2	·· 09.7	115°33.3	·· 09.6
22	98°53.4	122°54.4	39.4	31°07.6	37.6	93°13.2	09.9	130°35.4	09.5
23	113°55.9	137°53.9	38.2	46°09.5	37.7	108°15.2	10.0	145°37.6	09.4
Mer.pass. 15:26		ν -0.5′ d 1.1′ m -3.93		ν 2.0′ d 0.0′ m -0.34		ν 2.0′ d 0.2′ m -2.20		ν 2.2′ d 0.1′ m 0.87	

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	128°58.4	152°53.4	S11°37.0	61°11.5	N24°37.7	123°17.3	N01°10.2	160°39.8	S14°09.3
1	144°00.8	167°52.9	35.9	76°13.4	37.8	138°19.3	10.4	175°42.0	09.2
2	159°03.3	182°52.5	34.7	91°15.3	37.8	153°21.4	10.6	190°44.1	09.1
3	174°05.8	197°52.0	·· 33.6	106°17.3	·· 37.9	168°23.4	·· 10.8	205°46.3	·· 09.0
4	189°08.2	212°51.5	32.4	121°19.2	37.9	183°25.5	11.0	220°48.5	08.9
5	204°10.7	227°51.0	31.3	136°21.1	38.0	198°27.5	11.2	235°50.7	08.8
6	219°13.1	242°50.5	S11°30.1	151°23.1	N24°38.1	213°29.5	N01°11.4	250°52.9	S14°08.7
7	234°15.6	257°50.1	28.9	166°25.0	38.1	228°31.6	11.6	265°55.0	08.6
8	249°18.1	272°49.6	27.8	181°26.9	38.2	243°33.6	11.8	280°57.2	08.5
9	264°20.5	287°49.1	·· 26.6	196°28.8	·· 38.2	258°35.7	·· 11.9	295°59.4	·· 08.4
10	279°23.0	302°48.6	25.4	211°30.8	38.3	273°37.7	12.1	311°01.6	08.3
11	294°25.5	317°48.2	24.3	226°32.7	38.3	288°39.8	12.3	326°03.7	08.2
12	309°27.9	332°47.7	S11°23.1	241°34.6	N24°38.4	303°41.8	N01°12.5	341°05.9	S14°08.1
13	324°30.4	347°47.2	22.0	256°36.5	38.4	318°43.8	12.7	356°08.1	08.0
14	339°32.9	2°46.7	20.8	271°38.4	38.5	333°45.9	12.9	11°10.3	07.9
15	354°35.3	17°46.3	·· 19.6	286°40.4	·· 38.5	348°47.9	·· 13.1	26°12.5	·· 07.8
16	9°37.8	32°45.8	18.5	301°42.3	38.6	3°50.0	13.3	41°14.6	07.7
17	24°40.3	47°45.3	17.3	316°44.2	38.6	18°52.0	13.5	56°16.8	07.6
18	39°42.7	62°44.8	S11°16.1	331°46.1	N24°38.7	33°54.0	N01°13.7	71°19.0	S14°07.5
19	54°45.2	77°44.4	15.0	346°48.0	38.7	48°56.1	13.9	86°21.2	07.4
20	69°47.6	92°43.9	13.8	1°49.9	38.8	63°58.1	14.0	101°23.3	07.3
21	84°50.1	107°43.4	·· 12.6	16°51.8	·· 38.8	79°00.2	·· 14.2	116°25.5	·· 07.2
22	99°52.6	122°43.0	11.5	31°53.7	38.9	94°02.2	14.4	131°27.7	07.1
23	114°55.0	137°42.5	10.3	46°55.7	38.9	109°04.2	14.6	146°29.9	07.0
Mer.pass. 15:22		ν -0.5′ d 1.2′ m -3.93		ν 1.9′ d 0.1′ m -0.31		ν 2.0′ d 0.2′ m -2.20		ν 2.2′ d 0.1′ m 0.87	

Stars

	SHA	**Dec**
Alpheratz	357°36.6	29°13.1
Ankaa	353°08.9	-42°11.1
Schedar	349°33.1	56°40.0
Diphda	348°49.1	-17°51.8
Achernar	335°21.5	-57°07.5
Hamal	327°53.0	23°34.3
Polaris	314°43.2	89°22.0
Acamar	315°12.9	-40°13.0
Menkar	314°07.8	4°10.7
Mirfak	308°30.4	49°56.7
Aldebaran	290°41.3	16°33.3
Rigel	281°05.2	-8°10.6
Capella	280°23.9	46°01.4
Bellatrix	278°24.4	6°22.2
Elnath	278°03.6	28°37.6
Alnilam	275°39.1	-1°11.3
Betelgeuse	270°53.6	7°24.6
Canopus	263°52.6	-52°42.6
Sirius	258°27.3	-16°45.0
Adhara	255°06.8	-29°00.3
Procyon	244°52.2	5°09.9
Pollux	243°18.9	27°58.2
Avior	234°14.7	-59°35.0
Suhail	222°47.0	-43°31.5
Miaplacidus	221°37.7	-69°48.6
Alphard	217°49.0	-8°45.5
Regulus	207°35.8	11°51.2
Dubhe	193°42.4	61°37.4
Denebola	182°26.4	14°26.5
Gienah	175°45.1	-17°40.1
Acrux	173°01.5	-63°13.3
Gacrux	171°53.1	-57°14.3
Alioth	166°14.2	55°49.8
Spica	158°23.9	-11°16.9
Alkaid	152°53.2	49°11.6
Hadar	148°38.2	-60°28.7
Menkent	147°59.5	-36°28.8
Arcturus	145°49.4	19°03.6
Rigil Kent.	139°42.5	-60°55.5
Kochab	137°19.9	74°03.3
Zuben'ubi	136°57.8	-16°08.2
Alphecca	126°05.2	26°38.0
Antares	112°18.0	-26°28.9
Atria	107°14.0	-69°03.9
Sabik	102°04.8	-15°45.2
Shaula	96°12.9	-37°07.1
Rasalhague	96°00.3	12°32.4
Eltanin	90°43.4	51°28.9
Kaus Aust.	83°35.0	-34°22.4
Vega	80°34.7	38°48.1
Nunki	75°50.1	-26°16.1
Altair	62°01.8	8°55.6
Peacock	53°08.8	-56°39.7
Deneb	49°27.4	45°21.7
Enif	33°40.7	9°58.7
Al Na'ir	27°35.4	-46°51.2
Fomalhaut	15°16.6	-29°30.2
Scheat	13°47.0	28°12.4
Markab	13°31.8	15°19.7

Jan 28 Sat	**SHA**	**Mer.pass**
Venus	26°17.0	13:47
Mars	292°37.3	19:59
Jupiter	354°38.9	15:51
Saturn	31°55.1	13:22

Jan 29 Sun	**SHA**	**Mer.pass**
Venus	25°05.9	13:48
Mars	292°25.5	19:56
Jupiter	354°29.0	15:48
Saturn	31°48.3	13:19

Jan 30 Mon	**SHA**	**Mer.pass**
Venus	23°55.1	13:49
Mars	292°13.1	19:53
Jupiter	354°18.9	15:45
Saturn	31°41.4	13:15

Horizontal parallax	
Venus:	0.1
Mars:	0.2

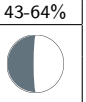
h	Sun		Moon				
Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°48.6	S18°19.4	98°40.0	13.3'	N10°48.9	14.1'	57.1'
1	191°48.5	18.8	113°12.2	13.3'	11°03.0	14.0'	57.0'
2	206°48.4	18.1	127°44.5	13.3'	11°17.0	14.0'	57.0'
3	221°48.2	·· 17.5	142°16.8	13.2'	11°31.0	13.9'	57.0'
4	236°48.1	16.8	156°49.0	13.2'	11°44.9	13.8'	56.9'
5	251°48.0	16.1	171°21.2	13.2'	11°58.7	13.7'	56.9'
6	266°47.9	S18°15.5	185°53.5	13.2'	N12°12.4	13.7'	56.9'
7	281°47.8	14.8	200°25.7	13.2'	12°26.1	13.6'	56.8'
8	296°47.6	14.2	214°57.9	13.2'	12°39.7	13.5'	56.8'
9	311°47.5	·· 13.5	229°30.0	13.2'	12°53.2	13.4'	56.7'
10	326°47.4	12.9	244°02.2	13.1'	13°06.6	13.4'	56.7'
11	341°47.3	12.2	258°34.4	13.1'	13°20.0	13.3'	56.7'
12	356°47.2	S18°11.5	273°06.5	13.1'	N13°33.3	13.2'	56.6'
13	11°47.0	10.9	287°38.6	13.1'	13°46.5	13.1'	56.6'
14	26°46.9	10.2	302°10.7	13.1'	13°59.6	13.1'	56.6'
15	41°46.8	·· 09.6	316°42.8	13.1'	14°12.7	13.0'	56.5'
16	56°46.7	08.9	331°14.8	13.0'	14°25.7	12.9'	56.5'
17	71°46.6	08.2	345°46.9	13.0'	14°38.6	12.8'	56.5'
18	86°46.5	S18°07.6	0°18.9	13.0'	N14°51.4	12.7'	56.4'
19	101°46.3	06.9	14°50.8	13.0'	15°04.1	12.7'	56.4'
20	116°46.2	06.3	29°22.8	12.9'	15°16.8	12.5'	56.4'
21	131°46.1	·· 05.6	43°54.7	12.9'	15°29.3	12.5'	56.3'
22	146°46.0	04.9	58°26.7	12.9'	15°41.8	12.4'	56.3'
23	161°45.9	04.3	72°58.5	12.9'	15°54.2	12.3'	56.3'
	SD = 16.2'	d = 0.7'	SD = 15.6'				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°45.8	S18°03.6	87°30.4	12.8'	N16°06.5	12.2'	56.2'
1	191°45.6	02.9	102°02.2	12.8'	16°18.7	12.2'	56.2'
2	206°45.5	02.3	116°34.0	12.8'	16°30.9	12.0'	56.2'
3	221°45.4	·· 01.6	131°05.8	12.7'	16°42.9	12.0'	56.1'
4	236°45.3	00.9	145°37.5	12.7'	16°54.9	11.8'	56.1'
5	251°45.2	18°00.3	160°09.3	12.7'	17°06.7	11.8'	56.1'
6	266°45.1	S17°59.6	174°40.9	12.7'	N17°18.5	11.7'	56.0'
7	281°45.0	58.9	189°12.6	12.6'	17°30.2	11.6'	56.0'
8	296°44.9	58.2	203°44.2	12.6'	17°41.8	11.5'	56.0'
9	311°44.8	·· 57.6	218°15.8	12.6'	17°53.3	11.4'	55.9'
10	326°44.6	56.9	232°47.3	12.5'	18°04.7	11.3'	55.9'
11	341°44.5	56.2	247°18.9	12.5'	18°16.0	11.2'	55.9'
12	356°44.4	S17°55.6	261°50.3	12.5'	N18°27.2	11.1'	55.9'
13	11°44.3	54.9	276°21.8	12.4'	18°38.3	11.1'	55.8'
14	26°44.2	54.2	290°53.2	12.4'	18°49.4	10.9'	55.8'
15	41°44.1	·· 53.5	305°24.6	12.3'	19°00.3	10.8'	55.8'
16	56°44.0	52.9	319°55.9	12.3'	19°11.1	10.7'	55.7'
17	71°43.9	52.2	334°27.2	12.3'	19°21.8	10.7'	55.7'
18	86°43.8	S17°51.5	348°58.5	12.2'	N19°32.5	10.5'	55.7'
19	101°43.7	50.8	3°29.8	12.2'	19°43.0	10.4'	55.6'
20	116°43.6	50.2	18°00.9	12.2'	19°53.4	10.4'	55.6'
21	131°43.4	·· 49.5	32°32.1	12.1'	20°03.8	10.2'	55.6'
22	146°43.3	48.8	47°03.2	12.1'	20°14.0	10.1'	55.6'
23	161°43.2	48.1	61°34.3	12.0'	20°24.1	10.0'	55.5'
	SD = 16.2'	d = 0.7'	SD = 15.3'				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°43.1	S17°47.4	76°05.4	12.0'	N20°34.1	9.9'	55.5'
1	191°43.0	46.8	90°36.4	12.0'	20°44.0	9.9'	55.5'
2	206°42.9	46.1	105°07.3	11.9'	20°53.9	9.7'	55.5'
3	221°42.8	·· 45.4	119°38.2	11.9'	21°03.6	9.6'	55.4'
4	236°42.7	44.7	134°09.1	11.8'	21°13.2	9.5'	55.4'
5	251°42.6	44.0	148°40.0	11.8'	21°22.7	9.3'	55.4'
6	266°42.5	S17°43.4	163°10.8	11.8'	N21°32.0	9.3'	55.3'
7	281°42.4	42.7	177°41.6	11.7'	21°41.3	9.2'	55.3'
8	296°42.3	42.0	192°12.3	11.7'	21°50.5	9.0'	55.3'
9	311°42.2	·· 41.3	206°43.0	11.6'	21°59.5	9.0'	55.3'
10	326°42.1	40.6	221°13.6	11.6'	22°08.5	8.8'	55.2'
11	341°42.0	39.9	235°44.2	11.6'	22°17.3	8.8'	55.2'
12	356°41.9	S17°39.3	250°14.8	11.5'	N22°26.1	8.6'	55.2'
13	11°41.8	38.6	264°45.3	11.5'	22°34.7	8.5'	55.2'
14	26°41.7	37.9	279°15.8	11.4'	22°43.2	8.4'	55.1'
15	41°41.6	·· 37.2	293°46.2	11.4'	22°51.6	8.3'	55.1'
16	56°41.5	36.5	308°16.7	11.4'	22°59.9	8.1'	55.1'
17	71°41.4	35.8	322°47.0	11.3'	23°08.0	8.1'	55.1'
18	86°41.3	S17°35.1	337°17.3	11.3'	N23°16.1	7.9'	55.1'
19	101°41.2	34.4	351°47.6	11.2'	23°24.0	7.8'	55.0'
20	116°41.1	33.8	6°17.9	11.2'	23°31.8	7.7'	55.0'
21	131°41.0	·· 33.1	20°48.1	11.2'	23°39.5	7.6'	55.0'
22	146°40.9	32.4	35°18.3	11.1'	23°47.1	7.5'	55.0'
23	161°40.8	31.7	49°48.4	11.1'	23°54.6	7.3'	54.9'
	SD = 16.2'	d = 0.7'	SD = 15.1'				

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

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

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 7-9 43-64%
28	12:46	12:51	12:13	17:59	05:36	
29	12:57	13:02	12:13	18:46	06:22	
30	13:07	13:12	12:13	19:34	07:10	

January 31, 01, 02 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	129°57.5	152°42.0	S11°09.1	61°57.6	N24°39.0	124°06.3	N01°14.8	161°32.0	S14°06.9
1	145°00.0	167°41.5	07.9	76°59.5	39.0	139°08.3	15.0	176°34.2	06.8
2	160°02.4	182°41.1	06.8	92°01.4	39.1	154°10.4	15.2	191°36.4	06.7
3	175°04.9	197°40.6	·· 05.6	107°03.3	·· 39.1	169°12.4	·· 15.4	206°38.6	·· 06.6
4	190°07.4	212°40.1	04.4	122°05.2	39.2	184°14.4	15.6	221°40.8	06.5
5	205°09.8	227°39.7	03.3	137°07.1	39.3	199°16.5	15.8	236°42.9	06.4
6	220°12.3	242°39.2	S11°02.1	152°09.0	N24°39.3	214°18.5	N01°16.0	251°45.1	S14°06.3
7	235°14.8	257°38.7	11°00.9	167°10.9	39.4	229°20.6	16.1	266°47.3	06.2
8	250°17.2	272°38.3	10°59.7	182°12.8	39.4	244°22.6	16.3	281°49.5	06.1
9	265°19.7	287°37.8	·· 58.6	197°14.7	·· 39.5	259°24.6	·· 16.5	296°51.6	·· 06.0
10	280°22.1	302°37.3	57.4	212°16.6	39.5	274°26.7	16.7	311°53.8	05.9
11	295°24.6	317°36.9	56.2	227°18.5	39.6	289°28.7	16.9	326°56.0	05.8
12	310°27.1	332°36.4	S10°55.0	242°20.4	N24°39.6	304°30.7	N01°17.1	341°58.2	S14°05.7
13	325°29.5	347°35.9	53.9	257°22.3	39.7	319°32.8	17.3	357°00.3	05.6
14	340°32.0	2°35.5	52.7	272°24.2	39.7	334°34.8	17.5	12°02.5	05.5
15	355°34.5	17°35.0	·· 51.5	287°26.1	·· 39.8	349°36.9	·· 17.7	27°04.7	·· 05.4
16	10°36.9	32°34.6	50.3	302°28.0	39.8	4°38.9	17.9	42°06.9	05.3
17	25°39.4	47°34.1	49.1	317°29.8	39.9	19°40.9	18.1	57°09.0	05.2
18	40°41.9	62°33.6	S10°48.0	332°31.7	N24°40.0	34°43.0	N01°18.3	72°11.2	S14°05.1
19	55°44.3	77°33.2	46.8	347°33.6	40.0	49°45.0	18.4	87°13.4	05.0
20	70°46.8	92°32.7	45.6	2°35.5	40.1	64°47.0	18.6	102°15.6	04.9
21	85°49.3	107°32.2	·· 44.4	17°37.4	·· 40.1	79°49.1	·· 18.8	117°17.8	·· 04.8
22	100°51.7	122°31.8	43.2	32°39.3	40.2	94°51.1	19.0	132°19.9	04.7
23	115°54.2	137°31.3	42.1	47°41.2	40.2	109°53.1	19.2	147°22.1	04.6
Mer.pass. 15:18		ν -0.5′ d 1.2′ m -3.93		ν 1.9′ d 0.1′ m -0.29		ν 2.0′ d 0.2′ m -2.19		ν 2.2′ d 0.1′ m 0.87	

Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	130°56.6	152°30.9	S10°40.9	62°43.0	N24°40.3	124°55.2	N01°19.4	162°24.3	S14°04.5
1	145°59.1	167°30.4	39.7	77°44.9	40.3	139°57.2	19.6	177°26.5	04.4
2	161°01.6	182°30.0	38.5	92°46.8	40.4	154°59.3	19.8	192°28.6	04.3
3	176°04.0	197°29.5	·· 37.3	107°48.7	·· 40.5	170°01.3	·· 20.0	207°30.8	·· 04.2
4	191°06.5	212°29.0	36.2	122°50.6	40.5	185°03.3	20.2	222°33.0	04.1
5	206°09.0	227°28.6	35.0	137°52.4	40.6	200°05.4	20.4	237°35.2	04.0
6	221°11.4	242°28.1	S10°33.8	152°54.3	N24°40.6	215°07.4	N01°20.6	252°37.3	S14°03.9
7	236°13.9	257°27.7	32.6	167°56.2	40.7	230°09.4	20.8	267°39.5	03.8
8	251°16.4	272°27.2	31.4	182°58.1	40.7	245°11.5	21.0	282°41.7	03.7
9	266°18.8	287°26.8	·· 30.2	197°59.9	·· 40.8	260°13.5	·· 21.1	297°43.9	·· 03.6
10	281°21.3	302°26.3	29.0	213°01.8	40.8	275°15.5	21.3	312°46.0	03.5
11	296°23.7	317°25.8	27.9	228°03.7	40.9	290°17.6	21.5	327°48.2	03.4
12	311°26.2	332°25.4	S10°26.7	243°05.6	N24°41.0	305°19.6	N01°21.7	342°50.4	S14°03.3
13	326°28.7	347°24.9	25.5	258°07.4	41.0	320°21.6	21.9	357°52.6	03.2
14	341°31.1	2°24.5	24.3	273°09.3	41.1	335°23.7	22.1	12°54.7	03.1
15	356°33.6	17°24.0	·· 23.1	288°11.2	·· 41.1	350°25.7	·· 22.3	27°56.9	·· 03.0
16	11°36.1	32°23.6	21.9	303°13.0	41.2	5°27.7	22.5	42°59.1	02.9
17	26°38.5	47°23.1	20.7	318°14.9	41.2	20°29.8	22.7	58°01.3	02.8
18	41°41.0	62°22.7	S10°19.5	333°16.8	N24°41.3	35°31.8	N01°22.9	73°03.5	S14°02.7
19	56°43.5	77°22.2	18.3	348°18.6	41.4	50°33.8	23.1	88°05.6	02.6
20	71°45.9	92°21.8	17.2	3°20.5	41.4	65°35.9	23.3	103°07.8	02.5
21	86°48.4	107°21.3	·· 16.0	18°22.4	·· 41.5	80°37.9	·· 23.5	118°10.0	·· 02.4
22	101°50.9	122°20.9	14.8	33°24.2	41.5	95°39.9	23.7	133°12.2	02.3
23	116°53.3	137°20.4	13.6	48°26.1	41.6	110°42.0	23.9	148°14.3	02.2
Mer.pass. 15:14		ν -0.5′ d 1.2′ m -3.93		ν 1.9′ d 0.1′ m -0.26		ν 2.0′ d 0.2′ m -2.19		ν 2.2′ d 0.1′ m 0.87	

Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	131°55.8	152°20.0	S10°12.4	63°27.9	N24°41.6	125°44.0	N01°24.1	163°16.5	S14°02.1
1	146°58.2	167°19.5	11.2	78°29.8	41.7	140°46.0	24.2	178°18.7	02.0
2	162°00.7	182°19.1	10.0	93°31.6	41.7	155°48.0	24.4	193°20.9	01.9
3	177°03.2	197°18.6	·· 08.8	108°33.5	·· 41.8	170°50.1	·· 24.6	208°23.0	·· 01.8
4	192°05.6	212°18.2	07.6	123°35.4	41.9	185°52.1	24.8	223°25.2	01.7
5	207°08.1	227°17.7	06.4	138°37.2	41.9	200°54.1	25.0	238°27.4	01.6
6	222°10.6	242°17.3	S10°05.2	153°39.1	N24°42.0	215°56.2	N01°25.2	253°29.6	S14°01.5
7	237°13.0	257°16.9	04.0	168°40.9	42.0	230°58.2	25.4	268°31.7	01.4
8	252°15.5	272°16.4	02.8	183°42.8	42.1	246°00.2	25.6	283°33.9	01.3
9	267°18.0	287°16.0	·· 01.6	198°44.6	·· 42.2	261°02.3	·· 25.8	298°36.1	·· 01.2
10	282°20.4	302°15.5	10°00.4	213°46.5	42.2	276°04.3	26.0	313°38.3	01.1
11	297°22.9	317°15.1	09°59.2	228°48.3	42.3	291°06.3	26.2	328°40.4	01.0
12	312°25.4	332°14.6	S09°58.0	243°50.2	N24°42.3	306°08.4	N01°26.4	343°42.6	S14°00.9
13	327°27.8	347°14.2	56.8	258°52.0	42.4	321°10.4	26.6	358°44.8	00.8
14	342°30.3	2°13.8	55.6	273°53.8	42.4	336°12.4	26.8	13°47.0	00.7
15	357°32.7	17°13.3	·· 54.4	288°55.7	·· 42.5	351°14.4	·· 27.0	28°49.1	·· 00.6
16	12°35.2	32°12.9	53.2	303°57.5	42.6	6°16.5	27.2	43°51.3	00.5
17	27°37.7	47°12.4	52.0	318°59.4	42.6	21°18.5	27.4	58°53.5	00.4
18	42°40.1	62°12.0	S09°50.8	334°01.2	N24°42.7	36°20.5	N01°27.6	73°55.7	S14°00.3
19	57°42.6	77°11.5	49.6	349°03.0	42.7	51°22.6	27.8	88°57.8	00.2
20	72°45.1	92°11.1	48.4	4°04.9	42.8	66°24.6	27.9	104°00.0	00.1
21	87°47.5	107°10.7	·· 47.2	19°06.7	·· 42.9	81°26.6	·· 28.1	119°02.2	14°00.0
22	102°50.0	122°10.2	46.0	34°08.6	42.9	96°28.6	28.3	134°04.4	13°59.9
23	117°52.5	137°09.8	44.8	49°10.4	43.0	111°30.7	28.5	149°06.5	59.8
Mer.pass. 15:10		ν -0.4′ d 1.2′ m -3.93		ν 1.9′ d 0.1′ m -0.23		ν 2.0′ d 0.2′ m -2.18		ν 2.2′ d 0.1′ m 0.86	

Stars

	SHA	**Dec**
Alpheratz	357°36.6	29°13.1
Ankaa	353°09.0	-42°11.1
Schedar	349°33.1	56°40.0
Diphda	348°49.1	-17°51.8
Achernar	335°21.5	-57°07.5
Hamal	327°53.0	23°34.3
Polaris	314°44.4	89°22.0
Acamar	315°12.9	-40°13.0
Menkar	314°07.8	4°10.7
Mirfak	308°30.4	49°56.7
Aldebaran	290°41.3	16°33.3
Rigel	281°05.2	-8°10.6
Capella	280°23.9	46°01.4
Bellatrix	278°24.4	6°22.2
Elnath	278°03.6	28°37.6
Alnilam	275°39.1	-1°11.3
Betelgeuse	270°53.6	7°24.6
Canopus	263°52.6	-52°42.6
Sirius	258°27.3	-16°45.0
Adhara	255°06.8	-29°00.3
Procyon	244°52.2	5°09.9
Pollux	243°18.9	27°58.2
Avior	234°14.7	-59°35.0
Suhail	222°47.0	-43°31.5
Miaplacidus	221°37.7	-69°48.6
Alphard	217°49.0	-8°45.5
Regulus	207°35.8	11°51.2
Dubhe	193°42.4	61°37.4
Denebola	182°26.3	14°26.5
Gienah	175°45.0	-17°40.1
Acrux	173°01.5	-63°13.3
Gacrux	171°53.1	-57°14.3
Alioth	166°14.1	55°49.8
Spica	158°23.9	-11°16.9
Alkaid	152°53.2	49°11.6
Hadar	148°38.2	-60°28.8
Menkent	147°59.4	-36°28.8
Arcturus	145°49.3	19°03.6
Rigil Kent.	139°42.5	-60°55.5
Kochab	137°19.8	74°03.3
Zuben'ubi	136°57.8	-16°08.2
Alphecca	126°05.2	26°38.0
Antares	112°18.0	-26°28.9
Atria	107°14.0	-69°03.9
Sabik	102°04.8	-15°45.2
Shaula	96°12.8	-37°07.1
Rasalhague	96°00.3	12°32.4
Eltanin	90°43.3	51°28.9
Kaus Aust.	83°35.0	-34°22.4
Vega	80°34.7	38°48.1
Nunki	75°50.1	-26°16.1
Altair	62°01.8	8°55.6
Peacock	53°08.8	-56°39.7
Deneb	49°27.4	45°21.6
Enif	33°40.7	9°58.7
Al Na'ir	27°35.4	-46°51.2
Fomalhaut	15°16.6	-29°30.2
Scheat	13°47.0	28°12.4
Markab	13°31.8	15°19.7

Jan 31 Tue	**SHA**	**Mer.pass**
Venus	22°44.5	13:50
Mars	292°00.1	19:50
Jupiter	354°08.8	15:41
Saturn	31°34.5	13:12

Feb 01 Wed	**SHA**	**Mer.pass**
Venus	21°34.2	13:50
Mars	291°46.4	19:47
Jupiter	353°58.5	15:38
Saturn	31°27.6	13:08

Feb 02 Thu	**SHA**	**Mer.pass**
Venus	20°24.2	13:51
Mars	291°32.1	19:44
Jupiter	353°48.2	15:35
Saturn	31°20.7	13:05

Horizontal parallax	
Venus:	0.1
Mars:	0.2

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°40.7	S17°31.0	64°18.5	11.1′	N24°01.9	7.2′	54.9′
1	191°40.6	30.3	78°48.5	11.0′	24°09.1	7.1′	54.9′
2	206°40.5	29.6	93°18.6	11.0′	24°16.2	7.0′	54.9′
3	221°40.4	·· 28.9	107°48.5	10.9′	24°23.2	6.9′	54.9′
4	236°40.3	28.2	122°18.5	10.9′	24°30.1	6.7′	54.8′
5	251°40.2	27.5	136°48.4	10.9′	24°36.8	6.7′	54.8′
6	266°40.1	S17°26.8	151°18.2	10.8′	N24°43.5	6.5′	54.8′
7	281°40.0	26.1	165°48.1	10.8′	24°50.0	6.3′	54.8′
8	296°39.9	25.4	180°17.9	10.8′	24°56.3	6.3′	54.8′
9	311°39.8	·· 24.7	194°47.6	10.7′	25°02.6	6.1′	54.7′
10	326°39.8	24.0	209°17.4	10.7′	25°08.7	6.0′	54.7′
11	341°39.7	23.3	223°47.0	10.7′	25°14.7	5.9′	54.7′
12	356°39.6	S17°22.6	238°16.7	10.6′	N25°20.6	5.8′	54.7′
13	11°39.5	21.9	252°46.3	10.6′	25°26.4	5.6′	54.7′
14	26°39.4	21.2	267°15.9	10.6′	25°32.0	5.5′	54.6′
15	41°39.3	·· 20.5	281°45.5	10.5′	25°37.5	5.4′	54.6′
16	56°39.2	19.8	296°15.0	10.5′	25°42.9	5.3′	54.6′
17	71°39.1	19.1	310°44.5	10.5′	25°48.2	5.1′	54.6′
18	86°39.0	S17°18.4	325°14.0	10.4′	N25°53.3	5.0′	54.6′
19	101°38.9	17.7	339°43.4	10.4′	25°58.3	4.9′	54.6′
20	116°38.8	17.0	354°12.8	10.4′	26°03.2	4.7′	54.5′
21	131°38.8	·· 16.3	8°42.2	10.4′	26°07.9	4.6′	54.5′
22	146°38.7	15.6	23°11.6	10.3′	26°12.5	4.5′	54.5′
23	161°38.6	14.9	37°40.9	10.3′	26°17.0	4.4′	54.5′
	SD = 16.2′	d = 0.7′	SD = 15.0′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°38.5	S17°14.2	52°10.2	10.3′	N26°21.4	4.2′	54.5′
1	191°38.4	13.5	66°39.5	10.3′	26°25.6	4.1′	54.5′
2	206°38.3	12.8	81°08.7	10.2′	26°29.7	4.0′	54.4′
3	221°38.2	·· 12.1	95°38.0	10.2′	26°33.7	3.8′	54.4′
4	236°38.1	11.4	110°07.2	10.2′	26°37.5	3.7′	54.4′
5	251°38.0	10.7	124°36.4	10.2′	26°41.2	3.6′	54.4′
6	266°38.0	S17°10.0	139°05.5	10.1′	N26°44.8	3.4′	54.4′
7	281°37.9	09.3	153°34.7	10.1′	26°48.2	3.3′	54.4′
8	296°37.8	08.6	168°03.8	10.1′	26°51.5	3.2′	54.4′
9	311°37.7	·· 07.9	182°32.9	10.1′	26°54.7	3.1′	54.3′
10	326°37.6	07.1	197°02.0	10.1′	26°57.8	2.9′	54.3′
11	341°37.5	06.4	211°31.1	10.1′	27°00.7	2.8′	54.3′
12	356°37.5	S17°05.7	226°00.2	10.1′	N27°03.5	2.6′	54.3′
13	11°37.4	05.0	240°29.2	10.0′	27°06.1	2.5′	54.3′
14	26°37.3	04.3	254°58.3	10.0′	27°08.6	2.4′	54.3′
15	41°37.2	·· 03.6	269°27.3	10.0′	27°11.0	2.3′	54.3′
16	56°37.1	02.9	283°56.3	10.0′	27°13.3	2.1′	54.2′
17	71°37.0	02.2	298°25.3	10.0′	27°15.4	2.0′	54.2′
18	86°37.0	S17°01.4	312°54.3	10.0′	N27°17.4	1.8′	54.2′
19	101°36.9	00.7	327°23.3	10.0′	27°19.2	1.7′	54.2′
20	116°36.8	17°00.0	341°52.3	10.0′	27°20.9	1.6′	54.2′
21	131°36.7	16°59.3	356°21.2	10.0′	27°22.5	1.4′	54.2′
22	146°36.6	58.6	10°50.2	10.0′	27°23.9	1.3′	54.2′
23	161°36.6	57.9	25°19.2	10.0′	27°25.2	1.2′	54.2′
	SD = 16.2′	d = 0.7′	SD = 14.9′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°36.5	S16°57.2	39°48.1	10.0′	N27°26.4	1.1′	54.2′
1	191°36.4	56.4	54°17.1	10.0′	27°27.5	0.9′	54.1′
2	206°36.3	55.7	68°46.1	10.0′	27°28.4	0.8′	54.1′
3	221°36.2	·· 55.0	83°15.0	10.0′	27°29.2	0.6′	54.1′
4	236°36.2	54.3	97°44.0	10.0′	27°29.8	0.5′	54.1′
5	251°36.1	53.6	112°13.0	10.0′	27°30.3	0.4′	54.1′
6	266°36.0	S16°52.8	126°41.9	10.0′	N27°30.7	0.2′	54.1′
7	281°35.9	52.1	141°10.9	10.0′	27°30.9	0.1′	54.1′
8	296°35.9	51.4	155°39.9	10.0′	27°31.0	0.0′	54.1′
9	311°35.8	·· 50.7	170°08.9	10.0′	27°31.0	0.2′	54.1′
10	326°35.7	50.0	184°37.9	10.0′	27°30.8	0.3′	54.1′
11	341°35.6	49.2	199°06.9	10.0′	27°30.5	0.4′	54.1′
12	356°35.5	S16°48.5	213°35.9	10.0′	N27°30.1	0.6′	54.0′
13	11°35.5	47.8	228°05.0	10.0′	27°29.5	0.7′	54.0′
14	26°35.4	47.1	242°34.0	10.1′	27°28.8	0.8′	54.0′
15	41°35.3	·· 46.3	257°03.1	10.1′	27°28.0	1.0′	54.0′
16	56°35.2	45.6	271°32.2	10.1′	27°27.0	1.1′	54.0′
17	71°35.2	44.9	286°01.2	10.1′	27°25.9	1.2′	54.0′
18	86°35.1	S16°44.2	300°30.4	10.1′	N27°24.7	1.4′	54.0′
19	101°35.0	43.4	314°59.5	10.1′	27°23.3	1.4′	54.0′
20	116°35.0	42.7	329°28.6	10.2′	27°21.9	1.7′	54.0′
21	131°34.9	·· 42.0	343°57.8	10.2′	27°20.2	1.7′	54.0′
22	146°34.8	41.2	358°27.0	10.2′	27°18.5	1.9′	54.0′
23	161°34.7	40.5	12°56.2	10.2′	27°16.6	2.0′	54.0′
	SD = 16.2′	d = 0.7′	SD = 14.8′				

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

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

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 10-12 73-88%
31	13:17	13:22	12:13	20:24	07:59	
01	13:26	13:30	12:14	21:15	08:49	
02	13:34	13:38	12:14	22:06	09:41	

February 03, 04, 05 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	132°54.9	152°09.3	S09°43.6	64°12.2	N24°43.0	126°32.7	N01°28.7	164°08.7	S13°59.7
1	147°57.4	167°08.9	42.4	79°14.1	43.1	141°34.7	28.9	179°10.9	59.6
2	162°59.9	182°08.5	41.2	94°15.9	43.1	156°36.8	29.1	194°13.1	59.5
3	178°02.3	197°08.0	·· 40.0	109°17.7	·· 43.2	171°38.8	·· 29.3	209°15.2	·· 59.4
4	193°04.8	212°07.6	38.8	124°19.6	43.3	186°40.8	29.5	224°17.4	59.3
5	208°07.2	227°07.2	37.6	139°21.4	43.3	201°42.8	29.7	239°19.6	59.2
6	223°09.7	242°06.7	S09°36.4	154°23.2	N24°43.4	216°44.9	N01°29.9	254°21.8	S13°59.1
7	238°12.2	257°06.3	35.2	169°25.0	43.4	231°46.9	30.1	269°23.9	59.0
8	253°14.6	272°05.9	34.0	184°26.9	43.5	246°48.9	30.3	284°26.1	58.9
9	268°17.1	287°05.4	·· 32.8	199°28.7	·· 43.6	261°50.9	·· 30.5	299°28.3	·· 58.8
10	283°19.6	302°05.0	31.6	214°30.5	43.6	276°53.0	30.7	314°30.5	58.7
11	298°22.0	317°04.6	30.3	229°32.3	43.7	291°55.0	30.9	329°32.6	58.6
12	313°24.5	332°04.1	S09°29.1	244°34.2	N24°43.7	306°57.0	N01°31.1	344°34.8	S13°58.5
13	328°27.0	347°03.7	27.9	259°36.0	43.8	321°59.0	31.3	359°37.0	58.4
14	343°29.4	2°03.3	26.7	274°37.8	43.9	337°01.1	31.5	14°39.2	58.3
15	358°31.9	17°02.8	·· 25.5	289°39.6	·· 43.9	352°03.1	·· 31.7	29°41.3	·· 58.2
16	13°34.4	32°02.4	24.3	304°41.4	44.0	7°05.1	31.9	44°43.5	58.1
17	28°36.8	47°02.0	23.1	319°43.3	44.0	22°07.1	32.1	59°45.7	58.0
18	43°39.3	62°01.5	S09°21.9	334°45.1	N24°44.1	37°09.2	N01°32.3	74°47.9	S13°57.9
19	58°41.7	77°01.1	20.7	349°46.9	44.2	52°11.2	32.5	89°50.0	57.8
20	73°44.2	92°00.7	19.5	4°48.7	44.2	67°13.2	32.7	104°52.2	57.7
21	88°46.7	107°00.2	·· 18.2	19°50.5	·· 44.3	82°15.2	·· 32.9	119°54.4	·· 57.6
22	103°49.1	121°59.8	17.0	34°52.3	44.3	97°17.3	33.0	134°56.6	57.5
23	118°51.6	136°59.4	15.8	49°54.1	44.4	112°19.3	33.2	149°58.7	57.4
Mer.pass. 15:06		ν -0.4′ d 1.2′	m -3.93	ν 1.8′ d 0.1′	m -0.20	ν 2.0′ d 0.2′	m -2.18	ν 2.2′ d 0.1′	m 0.86

Sat	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	133°54.1	151°59.0	S09°14.6	64°56.0	N24°44.5	127°21.3	N01°33.4	165°00.9	S13°57.3
1	148°56.5	166°58.5	13.4	79°57.8	44.5	142°23.3	33.6	180°03.1	57.2
2	163°59.0	181°58.1	12.2	94°59.6	44.6	157°25.4	33.8	195°05.3	57.1
3	179°01.5	196°57.7	·· 11.0	110°01.4	·· 44.6	172°27.4	·· 34.0	210°07.4	·· 57.0
4	194°03.9	211°57.3	09.7	125°03.2	44.7	187°29.4	34.2	225°09.6	56.9
5	209°06.4	226°56.8	08.5	140°05.0	44.8	202°31.4	34.4	240°11.8	56.8
6	224°08.8	241°56.4	S09°07.3	155°06.8	N24°44.8	217°33.5	N01°34.6	255°14.0	S13°56.7
7	239°11.3	256°56.0	06.1	170°08.6	44.9	232°35.5	34.8	270°16.1	56.6
8	254°13.8	271°55.5	04.9	185°10.4	45.0	247°37.5	35.0	285°18.3	56.5
9	269°16.2	286°55.1	·· 03.7	200°12.2	·· 45.0	262°39.5	·· 35.2	300°20.5	·· 56.4
10	284°18.7	301°54.7	02.4	215°14.0	45.1	277°41.6	35.4	315°22.7	56.3
11	299°21.2	316°54.3	01.2	230°15.8	45.1	292°43.6	35.6	330°24.8	56.2
12	314°23.6	331°53.9	S09°00.0	245°17.6	N24°45.2	307°45.6	N01°35.8	345°27.0	S13°56.1
13	329°26.1	346°53.4	08°58.8	260°19.4	45.3	322°47.6	36.0	0°29.2	56.0
14	344°28.6	1°53.0	57.6	275°21.2	45.3	337°49.6	36.2	15°31.3	55.9
15	359°31.0	16°52.6	·· 56.3	290°23.0	·· 45.4	352°51.7	·· 36.4	30°33.5	·· 55.8
16	14°33.5	31°52.2	55.1	305°24.8	45.4	7°53.7	36.6	45°35.7	55.7
17	29°36.0	46°51.7	53.9	320°26.6	45.5	22°55.7	36.8	60°37.9	55.6
18	44°38.4	61°51.3	S08°52.7	335°28.4	N24°45.6	37°57.7	N01°37.0	75°40.0	S13°55.5
19	59°40.9	76°50.9	51.5	350°30.2	45.6	52°59.8	37.2	90°42.2	55.4
20	74°43.3	91°50.5	50.2	5°32.0	45.7	68°01.8	37.4	105°44.4	55.3
21	89°45.8	106°50.1	·· 49.0	20°33.8	·· 45.8	83°03.8	·· 37.6	120°46.6	·· 55.2
22	104°48.3	121°49.6	47.8	35°35.6	45.8	98°05.8	37.8	135°48.7	55.1
23	119°50.7	136°49.2	46.6	50°37.3	45.9	113°07.8	38.0	150°50.9	55.0
Mer.pass. 15:02		ν -0.4′ d 1.2′	m -3.93	ν 1.8′ d 0.1′	m -0.18	ν 2.0′ d 0.2′	m -2.18	ν 2.2′ d 0.1′	m 0.86

Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	134°53.2	151°48.8	S08°45.3	65°39.1	N24°45.9	128°09.9	N01°38.2	165°53.1	S13°54.9
1	149°55.7	166°48.4	44.1	80°40.9	46.0	143°11.9	38.4	180°55.3	54.8
2	164°58.1	181°48.0	42.9	95°42.7	46.1	158°13.9	38.6	195°57.4	54.7
3	180°00.6	196°47.6	·· 41.7	110°44.5	·· 46.1	173°15.9	·· 38.8	210°59.6	·· 54.6
4	195°03.1	211°47.1	40.4	125°46.3	46.2	188°17.9	39.0	226°01.8	54.5
5	210°05.5	226°46.7	39.2	140°48.1	46.3	203°20.0	39.2	241°04.0	54.4
6	225°08.0	241°46.3	S08°38.0	155°49.8	N24°46.3	218°22.0	N01°39.4	256°06.1	S13°54.3
7	240°10.5	256°45.9	36.8	170°51.6	46.4	233°24.0	39.6	271°08.3	54.2
8	255°12.9	271°45.5	35.5	185°53.4	46.4	248°26.0	39.8	286°10.5	54.1
9	270°15.4	286°45.1	·· 34.3	200°55.2	·· 46.5	263°28.0	·· 40.0	301°12.7	·· 54.0
10	285°17.8	301°44.6	33.1	215°57.0	46.6	278°30.1	40.2	316°14.8	53.9
11	300°20.3	316°44.2	31.9	230°58.7	46.6	293°32.1	40.4	331°17.0	53.8
12	315°22.8	331°43.8	S08°30.6	246°00.5	N24°46.7	308°34.1	N01°40.6	346°19.2	S13°53.7
13	330°25.2	346°43.4	29.4	261°02.3	46.8	323°36.1	40.8	1°21.3	53.6
14	345°27.7	1°43.0	28.2	276°04.1	46.8	338°38.1	41.0	16°23.5	53.5
15	0°30.2	16°42.6	·· 26.9	291°05.8	·· 46.9	353°40.1	·· 41.2	31°25.7	·· 53.4
16	15°32.6	31°42.2	25.7	306°07.6	46.9	8°42.2	41.4	46°27.9	53.3
17	30°35.1	46°41.7	24.5	321°09.4	47.0	23°44.2	41.6	61°30.0	53.2
18	45°37.6	61°41.3	S08°23.3	336°11.2	N24°47.1	38°46.2	N01°41.8	76°32.2	S13°53.1
19	60°40.0	76°40.9	22.0	351°12.9	47.1	53°48.2	42.0	91°34.4	53.0
20	75°42.5	91°40.5	20.8	6°14.7	47.2	68°50.2	42.2	106°36.6	52.9
21	90°45.0	106°40.1	·· 19.6	21°16.5	·· 47.3	83°52.3	·· 42.4	121°38.7	·· 52.8
22	105°47.4	121°39.7	18.3	36°18.2	47.3	98°54.3	42.6	136°40.9	52.7
23	120°49.9	136°39.3	17.1	51°20.0	47.4	113°56.3	42.8	151°43.1	52.6
Mer.pass. 14:58		ν -0.4′ d 1.2′	m -3.93	ν 1.8′ d 0.1′	m -0.15	ν 2.0′ d 0.2′	m -2.17	ν 2.2′ d 0.1′	m 0.86

Stars	SHA	Dec
Alpheratz	357°36.7	29°13.1
Ankaa	353°09.0	-42°11.1
Schedar	349°33.2	56°40.0
Diphda	348°49.1	-17°51.8
Achernar	335°21.6	-57°07.5
Hamal	327°53.0	23°34.3
Polaris	314°45.8	89°22.0
Acamar	315°13.0	-40°13.0
Menkar	314°07.8	4°10.7
Mirfak	308°30.4	49°56.7
Aldebaran	290°41.3	16°33.3
Rigel	281°05.2	-8°10.6
Capella	280°23.9	46°01.4
Bellatrix	278°24.4	6°22.2
Elnath	278°03.6	28°37.6
Alnilam	275°39.1	-1°11.3
Betelgeuse	270°53.6	7°24.6
Canopus	263°52.7	-52°42.6
Sirius	258°27.3	-16°45.0
Adhara	255°06.8	-29°00.3
Procyon	244°52.2	5°09.9
Pollux	243°18.9	27°58.2
Avior	234°14.7	-59°35.0
Suhail	222°47.0	-43°31.5
Miaplacidus	221°37.7	-69°48.6
Alphard	217°49.0	-8°45.6
Regulus	207°35.8	11°51.2
Dubhe	193°42.4	61°37.4
Denebola	182°26.3	14°26.5
Gienah	175°45.0	-17°40.2
Acrux	173°01.5	-63°13.4
Gacrux	171°53.1	-57°14.3
Alioth	166°14.1	55°49.8
Spica	158°23.9	-11°16.9
Alkaid	152°53.1	49°11.6
Hadar	148°38.1	-60°28.8
Menkent	147°59.4	-36°28.8
Arcturus	145°49.3	19°03.6
Rigil Kent.	139°42.4	-60°55.5
Kochab	137°19.8	74°03.3
Zuben'ubi	136°57.8	-16°08.2
Alphecca	126°05.2	26°38.0
Antares	112°17.9	-26°28.9
Atria	107°13.9	-69°03.9
Sabik	102°04.8	-15°45.2
Shaula	96°12.8	-37°07.1
Rasalhague	96°00.2	12°32.4
Eltanin	90°43.3	51°28.9
Kaus Aust.	83°34.9	-34°22.4
Vega	80°34.6	38°48.1
Nunki	75°50.0	-26°16.1
Altair	62°01.8	8°55.6
Peacock	53°08.8	-56°39.7
Deneb	49°27.3	45°21.6
Enif	33°40.7	9°58.7
Al Na'ir	27°35.3	-46°51.1
Fomalhaut	15°16.6	-29°30.2
Scheat	13°47.0	28°12.4
Markab	13°31.8	15°19.7

Feb 03 Fri	**SHA**	**Mer.pass**
Venus	19°14.4	13:52
Mars	291°17.3	19:41
Jupiter	353°37.8	15:32
Saturn	31°13.8	13:02

Feb 04 Sat	**SHA**	**Mer.pass**
Venus	18°04.9	13:52
Mars	291°01.9	19:38
Jupiter	353°27.3	15:28
Saturn	31°06.8	12:58

Feb 05 Sun	**SHA**	**Mer.pass**
Venus	16°55.6	13:53
Mars	290°45.9	19:35
Jupiter	353°16.7	15:25
Saturn	30°59.9	12:55

Horizontal parallax	
Venus:	0.1
Mars:	0.2

h	Sun		Moon				
Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°34.7	S16°39.8	27°25.5	10.3′	N27°14.6	2.2′	54.0′
1	191°34.6	39.1	41°54.7	10.3′	27°12.4	2.3′	54.0′
2	206°34.5	38.3	56°24.0	10.3′	27°10.1	2.4′	54.0′
3	221°34.5	·· 37.6	70°53.3	10.3′	27°07.7	2.5′	54.0′
4	236°34.4	36.9	85°22.7	10.4′	27°05.2	2.7′	53.9′
5	251°34.3	36.1	99°52.0	10.4′	27°02.5	2.8′	53.9′
6	266°34.3	S16°35.4	114°21.5	10.4′	N26°59.7	2.9′	53.9′
7	281°34.2	34.7	128°50.9	10.5′	26°56.8	3.1′	53.9′
8	296°34.1	33.9	143°20.4	10.5′	26°53.7	3.2′	53.9′
9	311°34.0	·· 33.2	157°49.9	10.5′	26°50.5	3.3′	53.9′
10	326°34.0	32.5	172°19.4	10.6′	26°47.2	3.4′	53.9′
11	341°33.9	31.7	186°49.0	10.6′	26°43.8	3.6′	53.9′
12	356°33.8	S16°31.0	201°18.6	10.6′	N26°40.2	3.7′	53.9′
13	11°33.8	30.3	215°48.2	10.7′	26°36.5	3.8′	53.9′
14	26°33.7	29.5	230°17.9	10.7′	26°32.7	3.9′	53.9′
15	41°33.6	·· 28.8	244°47.6	10.8′	26°28.8	4.1′	53.9′
16	56°33.6	28.0	259°17.4	10.8′	26°24.7	4.2′	53.9′
17	71°33.5	27.3	273°47.2	10.8′	26°20.5	4.3′	53.9′
18	86°33.5	S16°26.6	288°17.0	10.9′	N26°16.2	4.4′	53.9′
19	101°33.4	25.8	302°46.9	10.9′	26°11.8	4.6′	53.9′
20	116°33.3	25.1	317°16.8	11.0′	26°07.2	4.7′	53.9′
21	131°33.3	·· 24.3	331°46.8	11.0′	26°02.5	4.8′	53.9′
22	146°33.2	23.6	346°16.8	11.1′	25°57.7	4.9′	53.9′
23	161°33.1	22.9	0°46.9	11.1′	25°52.8	5.0′	53.9′
	SD = 16.2′	d = 0.7′	SD = 14.7′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°33.1	S16°22.1	15°17.0	11.2′	N25°47.8	5.2′	53.9′
1	191°33.0	21.4	29°47.1	11.2′	25°42.6	5.3′	53.9′
2	206°32.9	20.6	44°17.3	11.2′	25°37.3	5.4′	53.9′
3	221°32.9	·· 19.9	58°47.6	11.3′	25°31.9	5.5′	53.9′
4	236°32.8	19.2	73°17.9	11.3′	25°26.4	5.6′	53.9′
5	251°32.8	18.4	87°48.2	11.4′	25°20.8	5.8′	53.9′
6	266°32.7	S16°17.7	102°18.6	11.4′	N25°15.0	5.8′	53.9′
7	281°32.6	16.9	116°49.0	11.5′	25°09.2	6.0′	53.9′
8	296°32.6	16.2	131°19.5	11.5′	25°03.2	6.1′	53.9′
9	311°32.5	·· 15.4	145°50.1	11.6′	24°57.1	6.2′	53.9′
10	326°32.5	14.7	160°20.7	11.6′	24°50.9	6.4′	53.9′
11	341°32.4	13.9	174°51.3	11.7′	24°44.5	6.4′	53.9′
12	356°32.3	S16°13.2	189°22.0	11.8′	N24°38.1	6.6′	53.9′
13	11°32.3	12.4	203°52.8	11.8′	24°31.5	6.6′	53.9′
14	26°32.2	11.7	218°23.6	11.9′	24°24.9	6.8′	53.9′
15	41°32.2	·· 10.9	232°54.4	11.9′	24°18.1	6.9′	53.9′
16	56°32.1	10.2	247°25.3	12.0′	24°11.2	7.0′	53.9′
17	71°32.1	09.4	261°56.3	12.0′	24°04.2	7.1′	53.9′
18	86°32.0	S16°08.7	276°27.3	12.1′	N23°57.1	7.2′	53.9′
19	101°32.0	07.9	290°58.4	12.1′	23°49.9	7.3′	53.9′
20	116°31.9	07.2	305°29.6	12.2′	23°42.6	7.4′	53.9′
21	131°31.8	·· 06.4	320°00.7	12.2′	23°35.2	7.5′	53.9′
22	146°31.8	05.7	334°32.0	12.3′	23°27.7	7.6′	53.9′
23	161°31.7	04.9	349°03.3	12.4′	23°20.1	7.8′	53.9′
	SD = 16.2′	d = 0.7′	SD = 14.7′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°31.7	S16°04.2	3°34.7	12.4′	N23°12.3	7.8′	53.9′
1	191°31.6	03.4	18°06.1	12.5′	23°04.5	7.9′	53.9′
2	206°31.6	02.7	32°37.6	12.5′	22°56.6	8.1′	53.9′
3	221°31.5	·· 01.9	47°09.1	12.6′	22°48.5	8.1′	53.9′
4	236°31.5	01.2	61°40.7	12.6′	22°40.4	8.3′	53.9′
5	251°31.4	16°00.4	76°12.3	12.7′	22°32.1	8.3′	53.9′
6	266°31.4	S15°59.7	90°44.0	12.8′	N22°23.8	8.4′	53.9′
7	281°31.3	58.9	105°15.8	12.8′	22°15.4	8.6′	53.9′
8	296°31.3	58.1	119°47.6	12.9′	22°06.8	8.6′	53.9′
9	311°31.2	·· 57.4	134°19.5	12.9′	21°58.2	8.7′	53.9′
10	326°31.2	56.6	148°51.4	13.0′	21°49.5	8.9′	53.9′
11	341°31.1	55.9	163°23.4	13.1′	21°40.6	8.9′	53.9′
12	356°31.1	S15°55.1	177°55.5	13.1′	N21°31.7	9.0′	53.9′
13	11°31.0	54.4	192°27.6	13.2′	21°22.7	9.1′	53.9′
14	26°31.0	53.6	206°59.8	13.2′	21°13.6	9.2′	53.9′
15	41°30.9	·· 52.8	221°32.0	13.3′	21°04.4	9.3′	53.9′
16	56°30.9	52.1	236°04.3	13.3′	20°55.1	9.3′	54.0′
17	71°30.8	51.3	250°36.6	13.4′	20°45.8	9.5′	54.0′
18	86°30.8	S15°50.6	265°09.0	13.5′	N20°36.3	9.6′	54.0′
19	101°30.7	49.8	279°41.5	13.5′	20°26.7	9.6′	54.0′
20	116°30.7	49.0	294°14.0	13.6′	20°17.1	9.7′	54.0′
21	131°30.6	·· 48.3	308°46.6	13.6′	20°07.4	9.8′	54.0′
22	146°30.6	47.5	323°19.2	13.7′	19°57.6	9.9′	54.0′
23	161°30.5	46.7	337°51.9	13.7′	19°47.7	10.0′	54.0′
	SD = 16.2′	d = 0.8′	SD = 14.7′				

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

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

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 13-15 93-99%
03	13:41	13:45	12:14	22:57	10:32	
04	13:48	13:51	12:14	23:45	11:21	
05	13:53	13:56	12:14	–:–	12:09	

February 06, 07, 08 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	135°52.3	151°38.9	S08°15.9	66°21.8	N24°47.5	128°58.3	N01°43.0	166°45.3	S13°52.5
1	150°54.8	166°38.5	14.6	81°23.5	47.5	144°00.3	43.2	181°47.4	52.4
2	165°57.3	181°38.1	13.4	96°25.3	47.6	159°02.3	43.4	196°49.6	52.3
3	180°59.7	196°37.6	·· 12.2	111°27.1	·· 47.6	174°04.4	·· 43.6	211°51.8	·· 52.2
4	196°02.2	211°37.2	10.9	126°28.8	47.7	189°06.4	43.8	226°54.0	52.1
5	211°04.7	226°36.8	09.7	141°30.6	47.8	204°08.4	44.0	241°56.1	52.0
6	226°07.1	241°36.4	S08°08.5	156°32.3	N24°47.8	219°10.4	N01°44.2	256°58.3	S13°51.9
7	241°09.6	256°36.0	07.2	171°34.1	47.9	234°12.4	44.4	272°00.5	51.8
8	256°12.1	271°35.6	06.0	186°35.9	48.0	249°14.4	44.6	287°02.6	51.7
9	271°14.5	286°35.2	·· 04.8	201°37.6	·· 48.0	264°16.4	·· 44.8	302°04.8	·· 51.6
10	286°17.0	301°34.8	03.5	216°39.4	48.1	279°18.5	45.0	317°07.0	51.5
11	301°19.4	316°34.4	02.3	231°41.1	48.2	294°20.5	45.2	332°09.2	51.4
12	316°21.9	331°34.0	S08°01.0	246°42.9	N24°48.2	309°22.5	N01°45.4	347°11.3	S13°51.3
13	331°24.4	346°33.6	07°59.8	261°44.6	48.3	324°24.5	45.6	2°13.5	51.2
14	346°26.8	1°33.2	58.6	276°46.4	48.3	339°26.5	45.8	17°15.7	51.1
15	1°29.3	16°32.8	·· 57.3	291°48.1	·· 48.4	354°28.5	·· 46.0	32°17.9	·· 51.0
16	16°31.8	31°32.4	56.1	306°49.9	48.5	9°30.6	46.2	47°20.0	50.9
17	31°34.2	46°32.0	54.9	321°51.6	48.5	24°32.6	46.4	62°22.2	50.8
18	46°36.7	61°31.6	S07°53.6	336°53.4	N24°48.6	39°34.6	N01°46.6	77°24.4	S13°50.7
19	61°39.2	76°31.2	52.4	351°55.1	48.7	54°36.6	46.8	92°26.6	50.6
20	76°41.6	91°30.8	51.1	6°56.9	48.7	69°38.6	47.0	107°28.7	50.5
21	91°44.1	106°30.4	·· 49.9	21°58.6	·· 48.8	84°40.6	·· 47.2	122°30.9	·· 50.4
22	106°46.6	121°30.0	48.7	37°00.4	48.9	99°42.6	47.4	137°33.1	50.3
23	121°49.0	136°29.6	47.4	52°02.1	48.9	114°44.6	47.6	152°35.2	50.2
Mer.pass. 14:54		ν -0.4′ d 1.2′	m -3.93	ν 1.8′ d 0.1′	m -0.12	ν 2.0′ d 0.2′	m -2.17	ν 2.2′ d 0.1′	m 0.86

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	136°51.5	151°29.2	S07°46.2	67°03.9	N24°49.0	129°46.7	N01°47.8	167°37.4	S13°50.1
1	151°53.9	166°28.8	44.9	82°05.6	49.1	144°48.7	48.0	182°39.6	50.0
2	166°56.4	181°28.4	43.7	97°07.3	49.1	159°50.7	48.2	197°41.8	49.9
3	181°58.9	196°28.0	·· 42.4	112°09.1	·· 49.2	174°52.7	·· 48.4	212°43.9	·· 49.8
4	197°01.3	211°27.6	41.2	127°10.8	49.3	189°54.7	48.6	227°46.1	49.7
5	212°03.8	226°27.2	40.0	142°12.6	49.3	204°56.7	48.8	242°48.3	49.6
6	227°06.3	241°26.8	S07°38.7	157°14.3	N24°49.4	219°58.7	N01°49.0	257°50.5	S13°49.5
7	242°08.7	256°26.4	37.5	172°16.0	49.4	235°00.7	49.2	272°52.6	49.4
8	257°11.2	271°26.0	36.2	187°17.8	49.5	250°02.8	49.4	287°54.8	49.3
9	272°13.7	286°25.6	·· 35.0	202°19.5	·· 49.6	265°04.8	·· 49.6	302°57.0	·· 49.2
10	287°16.1	301°25.2	33.7	217°21.2	49.6	280°06.8	49.8	317°59.1	49.1
11	302°18.6	316°24.8	32.5	232°23.0	49.7	295°08.8	50.0	333°01.3	49.0
12	317°21.1	331°24.4	S07°31.3	247°24.7	N24°49.8	310°10.8	N01°50.2	348°03.5	S13°48.9
13	332°23.5	346°24.0	30.0	262°26.4	49.8	325°12.8	50.4	3°05.7	48.8
14	347°26.0	1°23.6	28.8	277°28.2	49.9	340°14.8	50.6	18°07.8	48.7
15	2°28.4	16°23.2	·· 27.5	292°29.9	·· 50.0	355°16.8	·· 50.8	33°10.0	·· 48.6
16	17°30.9	31°22.8	26.3	307°31.6	50.0	10°18.9	51.0	48°12.2	48.5
17	32°33.4	46°22.4	25.0	322°33.4	50.1	25°20.9	51.2	63°14.4	48.4
18	47°35.8	61°22.0	S07°23.8	337°35.1	N24°50.2	40°22.9	N01°51.4	78°16.5	S13°48.3
19	62°38.3	76°21.6	22.5	352°36.8	50.2	55°24.9	51.6	93°18.7	48.2
20	77°40.8	91°21.2	21.3	7°38.5	50.3	70°26.9	51.8	108°20.9	48.1
21	92°43.2	106°20.8	·· 20.0	22°40.3	·· 50.4	85°28.9	·· 52.0	123°23.1	·· 48.0
22	107°45.7	121°20.4	18.8	37°42.0	50.4	100°30.9	52.2	138°25.2	47.9
23	122°48.2	136°20.0	17.5	52°43.7	50.5	115°32.9	52.4	153°27.4	47.8
Mer.pass. 14:50		ν -0.4′ d 1.2′	m -3.93	ν 1.7′ d 0.1′	m -0.10	ν 2.0′ d 0.2′	m -2.17	ν 2.2′ d 0.1′	m 0.85

Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	137°50.6	151°19.6	S07°16.3	67°45.4	N24°50.6	130°34.9	N01°52.6	168°29.6	S13°47.7
1	152°53.1	166°19.3	15.0	82°47.2	50.6	145°36.9	52.8	183°31.7	47.6
2	167°55.5	181°18.9	13.8	97°48.9	50.7	160°39.0	53.0	198°33.9	47.5
3	182°58.0	196°18.5	·· 12.5	112°50.6	·· 50.8	175°41.0	·· 53.2	213°36.1	·· 47.4
4	198°00.5	211°18.1	11.3	127°52.3	50.8	190°43.0	53.4	228°38.3	47.3
5	213°02.9	226°17.7	10.0	142°54.0	50.9	205°45.0	53.6	243°40.4	47.2
6	228°05.4	241°17.3	S07°08.8	157°55.8	N24°51.0	220°47.0	N01°53.8	258°42.6	S13°47.1
7	243°07.9	256°16.9	07.5	172°57.5	51.0	235°49.0	54.0	273°44.8	47.0
8	258°10.3	271°16.5	06.3	187°59.2	51.1	250°51.0	54.2	288°47.0	46.9
9	273°12.8	286°16.1	·· 05.0	203°00.9	·· 51.2	265°53.0	·· 54.4	303°49.1	·· 46.8
10	288°15.3	301°15.7	03.8	218°02.6	51.2	280°55.0	54.6	318°51.3	46.7
11	303°17.7	316°15.4	02.5	233°04.3	51.3	295°57.0	54.8	333°53.5	46.6
12	318°20.2	331°15.0	S07°01.3	248°06.0	N24°51.4	310°59.0	N01°55.0	348°55.6	S13°46.5
13	333°22.7	346°14.6	07°00.0	263°07.7	51.4	326°01.0	55.2	3°57.8	46.4
14	348°25.1	1°14.2	06°58.8	278°09.5	51.5	341°03.1	55.4	19°00.0	46.3
15	3°27.6	16°13.8	·· 57.5	293°11.2	·· 51.6	356°05.1	·· 55.7	34°02.2	·· 46.2
16	18°30.0	31°13.4	56.3	308°12.9	51.6	11°07.1	55.9	49°04.3	46.1
17	33°32.5	46°13.0	55.0	323°14.6	51.7	26°09.1	56.1	64°06.5	46.0
18	48°35.0	61°12.6	S06°53.7	338°16.3	N24°51.7	41°11.1	N01°56.3	79°08.7	S13°45.9
19	63°37.4	76°12.3	52.5	353°18.0	51.8	56°13.1	56.5	94°10.8	45.8
20	78°39.9	91°11.9	51.2	8°19.7	51.9	71°15.1	56.7	109°13.0	45.7
21	93°42.4	106°11.5	·· 50.0	23°21.4	·· 51.9	86°17.1	·· 56.9	124°15.2	·· 45.6
22	108°44.8	121°11.1	48.7	38°23.1	52.0	101°19.1	57.1	139°17.4	45.5
23	123°47.3	136°10.7	47.5	53°24.8	52.1	116°21.1	57.3	154°19.5	45.4
Mer.pass. 14:46		ν -0.4′ d 1.2′	m -3.94	ν 1.7′ d 0.1′	m -0.07	ν 2.0′ d 0.2′	m -2.16	ν 2.2′ d 0.1′	m 0.85

Stars

	SHA	**Dec**
Alpheratz	357°36.7	29°13.0
Ankaa	353°09.0	-42°11.1
Schedar	349°33.2	56°40.0
Diphda	348°49.1	-17°51.8
Achernar	335°21.6	-57°07.5
Hamal	327°53.1	23°34.3
Polaris	314°47.4	89°22.0
Acamar	315°13.0	-40°13.0
Menkar	314°07.8	4°10.7
Mirfak	308°30.5	49°56.7
Aldebaran	290°41.3	16°33.3
Rigel	281°05.2	-8°10.6
Capella	280°24.0	46°01.4
Bellatrix	278°24.4	6°22.2
Elnath	278°03.6	28°37.6
Alnilam	275°39.1	-1°11.3
Betelgeuse	270°53.6	7°24.6
Canopus	263°52.7	-52°42.6
Sirius	258°27.3	-16°45.0
Adhara	255°06.8	-29°00.3
Procyon	244°52.2	5°09.9
Pollux	243°18.9	27°58.2
Avior	234°14.7	-59°35.0
Suhail	222°47.0	-43°31.5
Miaplacidus	221°37.7	-69°48.6
Alphard	217°49.0	-8°45.6
Regulus	207°35.8	11°51.2
Dubhe	193°42.3	61°37.4
Denebola	182°26.3	14°26.5
Gienah	175°45.0	-17°40.2
Acrux	173°01.4	-63°13.4
Gacrux	171°53.0	-57°14.3
Alioth	166°14.0	55°49.8
Spica	158°23.8	-11°16.9
Alkaid	152°53.1	49°11.6
Hadar	148°38.1	-60°28.8
Menkent	147°59.4	-36°28.9
Arcturus	145°49.3	19°03.6
Rigil Kent.	139°42.4	-60°55.6
Kochab	137°19.7	74°03.3
Zuben'ubi	136°57.8	-16°08.2
Alphecca	126°05.1	26°38.0
Antares	112°17.9	-26°28.9
Atria	107°13.8	-69°03.9
Sabik	102°04.8	-15°45.2
Shaula	96°12.8	-37°07.1
Rasalhague	96°00.2	12°32.4
Eltanin	90°43.3	51°28.8
Kaus Aust.	83°34.9	-34°22.4
Vega	80°34.6	38°48.1
Nunki	75°50.0	-26°16.1
Altair	62°01.8	8°55.6
Peacock	53°08.8	-56°39.7
Deneb	49°27.3	45°21.6
Enif	33°40.7	9°58.7
Al Na'ir	27°35.3	-46°51.1
Fomalhaut	15°16.6	-29°30.2
Scheat	13°47.1	28°12.4
Markab	13°31.8	15°19.7

Feb 06 Mon	**SHA**	**Mer.pass**
Venus	15°46.5	13:54
Mars	290°29.4	19:32
Jupiter	353°06.0	15:22
Saturn	30°52.9	12:51

Feb 07 Tue	**SHA**	**Mer.pass**
Venus	14°37.7	13:54
Mars	290°12.4	19:29
Jupiter	352°55.2	15:19
Saturn	30°45.9	12:48

Feb 08 Wed	**SHA**	**Mer.pass**
Venus	13°29.0	13:55
Mars	289°54.8	19:27
Jupiter	352°44.3	15:16
Saturn	30°38.9	12:44

Horizontal parallax	
Venus:	0.1
Mars:	0.2

h	Sun		Moon				
Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°30.5	S15°46.0	352°24.6	13.8′	N19°37.7	10.1′	54.0′
1	191°30.4	45.2	6°57.4	13.8′	19°27.6	10.2′	54.0′
2	206°30.4	44.4	21°30.2	13.9′	19°17.4	10.2′	54.0′
3	221°30.4	·· 43.7	36°03.1	14.0′	19°07.2	10.3′	54.0′
4	236°30.3	42.9	50°36.1	14.0′	18°56.9	10.4′	54.0′
5	251°30.3	42.1	65°09.1	14.1′	18°46.5	10.5′	54.0′
6	266°30.2	S15°41.4	79°42.2	14.1′	N18°36.0	10.5′	54.0′
7	281°30.2	40.6	94°15.3	14.2′	18°25.5	10.7′	54.0′
8	296°30.1	39.8	108°48.5	14.2′	18°14.8	10.7′	54.0′
9	311°30.1	·· 39.1	123°21.7	14.3′	18°04.1	10.8′	54.1′
10	326°30.0	38.3	137°55.0	14.3′	17°53.3	10.8′	54.1′
11	341°30.0	37.5	152°28.3	14.4′	17°42.5	11.0′	54.1′
12	356°30.0	S15°36.8	167°01.7	14.4′	N17°31.5	11.0′	54.1′
13	11°29.9	36.0	181°35.1	14.5′	17°20.5	11.0′	54.1′
14	26°29.9	35.2	196°08.6	14.5′	17°09.5	11.2′	54.1′
15	41°29.8	·· 34.5	210°42.2	14.6′	16°58.3	11.2′	54.1′
16	56°29.8	33.7	225°15.8	14.6′	16°47.1	11.3′	54.1′
17	71°29.8	32.9	239°49.4	14.7′	16°35.8	11.4′	54.1′
18	86°29.7	S15°32.1	254°23.1	14.7′	N16°24.4	11.4′	54.1′
19	101°29.7	31.4	268°56.8	14.8′	16°13.0	11.5′	54.1′
20	116°29.6	30.6	283°30.6	14.8′	16°01.5	11.6′	54.1′
21	131°29.6	·· 29.8	298°04.4	14.9′	15°49.9	11.6′	54.1′
22	146°29.6	29.0	312°38.3	14.9′	15°38.3	11.7′	54.2′
23	161°29.5	28.3	327°12.2	15.0′	15°26.6	11.8′	54.2′
	SD = 16.2′	d = 0.8′	SD = 14.7′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°29.5	S15°27.5	341°46.2	15.0′	N15°14.8	11.8′	54.2′
1	191°29.5	26.7	356°20.2	15.1′	15°03.0	11.9′	54.2′
2	206°29.4	25.9	10°54.3	15.1′	14°51.1	12.0′	54.2′
3	221°29.4	·· 25.2	25°28.4	15.1′	14°39.1	12.0′	54.2′
4	236°29.3	24.4	40°02.5	15.2′	14°27.1	12.0′	54.2′
5	251°29.3	23.6	54°36.7	15.2′	14°15.1	12.2′	54.2′
6	266°29.3	S15°22.8	69°10.9	15.3′	N14°02.9	12.2′	54.2′
7	281°29.2	22.0	83°45.2	15.3′	13°50.7	12.2′	54.2′
8	296°29.2	21.3	98°19.5	15.3′	13°38.5	12.3′	54.3′
9	311°29.2	·· 20.5	112°53.9	15.4′	13°26.2	12.4′	54.3′
10	326°29.1	19.7	127°28.2	15.4′	13°13.8	12.4′	54.3′
11	341°29.1	18.9	142°02.7	15.5′	13°01.4	12.5′	54.3′
12	356°29.1	S15°18.1	156°37.1	15.5′	N12°48.9	12.5′	54.3′
13	11°29.0	17.4	171°11.6	15.5′	12°36.4	12.6′	54.3′
14	26°29.0	16.6	185°46.2	15.6′	12°23.8	12.7′	54.3′
15	41°29.0	·· 15.8	200°20.8	15.6′	12°11.1	12.6′	54.3′
16	56°28.9	15.0	214°55.4	15.6′	11°58.5	12.8′	54.3′
17	71°28.9	14.2	229°30.0	15.7′	11°45.7	12.8′	54.4′
18	86°28.9	S15°13.5	244°04.7	15.7′	N11°32.9	12.8′	54.4′
19	101°28.9	12.7	258°39.4	15.7′	11°20.1	12.9′	54.4′
20	116°28.8	11.9	273°14.1	15.8′	11°07.2	12.9′	54.4′
21	131°28.8	·· 11.1	287°48.9	15.8′	10°54.3	13.0′	54.4′
22	146°28.8	10.3	302°23.7	15.8′	10°41.3	13.0′	54.4′
23	161°28.7	09.5	316°58.5	15.9′	10°28.3	13.1′	54.4′
	SD = 16.2′	d = 0.8′	SD = 14.8′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°28.7	S15°08.7	331°33.4	15.9′	N10°15.2	13.1′	54.4′
1	191°28.7	08.0	346°08.3	15.9′	10°02.1	13.2′	54.5′
2	206°28.6	07.2	0°43.2	15.9′	09°48.9	13.2′	54.5′
3	221°28.6	·· 06.4	15°18.1	16.0′	09°35.7	13.2′	54.5′
4	236°28.6	05.6	29°53.1	16.0′	09°22.5	13.3′	54.5′
5	251°28.6	04.8	44°28.0	16.0′	09°09.2	13.3′	54.5′
6	266°28.5	S15°04.0	59°03.0	16.0′	N08°55.9	13.4′	54.5′
7	281°28.5	03.2	73°38.1	16.0′	08°42.5	13.4′	54.5′
8	296°28.5	02.4	88°13.1	16.1′	08°29.1	13.4′	54.5′
9	311°28.5	·· 01.6	102°48.2	16.1′	08°15.7	13.5′	54.6′
10	326°28.4	00.9	117°23.3	16.1′	08°02.2	13.5′	54.6′
11	341°28.4	15°00.1	131°58.4	16.1′	07°48.7	13.6′	54.6′
12	356°28.4	S14°59.3	146°33.5	16.1′	N07°35.1	13.6′	54.6′
13	11°28.4	58.5	161°08.6	16.2′	07°21.5	13.6′	54.6′
14	26°28.3	57.7	175°43.8	16.2′	07°07.9	13.6′	54.6′
15	41°28.3	·· 56.9	190°19.0	16.2′	06°54.3	13.7′	54.6′
16	56°28.3	56.1	204°54.2	16.2′	06°40.6	13.7′	54.7′
17	71°28.3	55.3	219°29.4	16.2′	06°26.9	13.8′	54.7′
18	86°28.2	S14°54.5	234°04.6	16.2′	N06°13.1	13.8′	54.7′
19	101°28.2	53.7	248°39.8	16.2′	05°59.3	13.8′	54.7′
20	116°28.2	52.9	263°15.0	16.2′	05°45.5	13.8′	54.7′
21	131°28.2	·· 52.1	277°50.3	16.2′	05°31.7	13.9′	54.7′
22	146°28.1	51.3	292°25.5	16.3′	05°17.8	13.9′	54.8′
23	161°28.1	50.5	307°00.8	16.3′	05°03.9	13.9′	54.8′
	SD = 16.2′	d = 0.8′	SD = 14.8′				

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

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

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 16-18 100-95%
06	13:58	14:00	12:14	00:31	12:53	
07	14:02	14:04	12:14	01:15	13:36	
08	14:05	14:06	12:14	01:57	14:18	

February 09, 10, 11 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	138°49.8	151°10.3	S06°46.2	68°26.5	N24°52.1	131°23.1	N01°57.5	169°21.7	S13°45.3
1	153°52.2	166°10.0	44.9	83°28.2	52.2	146°25.1	57.7	184°23.9	45.2
2	168°54.7	181°09.6	43.7	98°29.9	52.3	161°27.1	57.9	199°26.1	45.1
3	183°57.1	196°09.2	·· 42.4	113°31.6	·· 52.3	176°29.1	·· 58.1	214°28.2	·· 45.0
4	198°59.6	211°08.8	41.2	128°33.3	52.4	191°31.2	58.3	229°30.4	44.9
5	214°02.1	226°08.4	39.9	143°35.0	52.5	206°33.2	58.5	244°32.6	44.8
6	229°04.5	241°08.0	S06°38.7	158°36.7	N24°52.6	221°35.2	N01°58.7	259°34.7	S13°44.6
7	244°07.0	256°07.7	37.4	173°38.4	52.6	236°37.2	58.9	274°36.9	44.5
8	259°09.5	271°07.3	36.1	188°40.1	52.7	251°39.2	59.1	289°39.1	44.4
9	274°11.9	286°06.9	·· 34.9	203°41.8	·· 52.8	266°41.2	·· 59.3	304°41.3	·· 44.3
10	289°14.4	301°06.5	33.6	218°43.5	52.8	281°43.2	59.5	319°43.4	44.2
11	304°16.9	316°06.1	32.4	233°45.2	52.9	296°45.2	59.7	334°45.6	44.1
12	319°19.3	331°05.8	S06°31.1	248°46.9	N24°53.0	311°47.2	N01°59.9	349°47.8	S13°44.0
13	334°21.8	346°05.4	29.8	263°48.5	53.0	326°49.2	02°00.1	4°50.0	43.9
14	349°24.3	1°05.0	28.6	278°50.2	53.1	341°51.2	00.3	19°52.1	43.8
15	4°26.7	16°04.6	·· 27.3	293°51.9	·· 53.2	356°53.2	·· 00.5	34°54.3	·· 43.7
16	19°29.2	31°04.2	26.1	308°53.6	53.2	11°55.2	00.7	49°56.5	43.6
17	34°31.6	46°03.9	24.8	323°55.3	53.3	26°57.2	01.0	64°58.6	43.5
18	49°34.1	61°03.5	S06°23.5	338°57.0	N24°53.4	41°59.2	N02°01.2	80°00.8	S13°43.4
19	64°36.6	76°03.1	22.3	353°58.7	53.4	57°01.2	01.4	95°03.0	43.3
20	79°39.0	91°02.7	21.0	9°00.4	53.5	72°03.2	01.6	110°05.2	43.2
21	94°41.5	106°02.3	·· 19.7	24°02.0	·· 53.6	87°05.2	·· 01.8	125°07.3	·· 43.1
22	109°44.0	121°02.0	18.5	39°03.7	53.6	102°07.2	02.0	140°09.5	43.0
23	124°46.4	136°01.6	17.2	54°05.4	53.7	117°09.2	02.2	155°11.7	42.9
Mer.pass. 14:42		ν -0.4′ d 1.3′ m -3.94		ν 1.7′ d 0.1′ m -0.05		ν 2.0′ d 0.2′ m -2.16		ν 2.2′ d 0.1′ m 0.85	

Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	139°48.9	151°01.2	S06°16.0	69°07.1	N24°53.8	132°11.2	N02°02.4	170°13.8	S13°42.8
1	154°51.4	166°00.8	14.7	84°08.8	53.8	147°13.2	02.6	185°16.0	42.7
2	169°53.8	181°00.5	13.4	99°10.4	53.9	162°15.2	02.8	200°18.2	42.6
3	184°56.3	196°00.1	·· 12.2	114°12.1	·· 54.0	177°17.2	·· 03.0	215°20.4	·· 42.5
4	199°58.7	210°59.7	10.9	129°13.8	54.0	192°19.2	03.2	230°22.5	42.4
5	215°01.2	225°59.3	09.6	144°15.5	54.1	207°21.2	03.4	245°24.7	42.3
6	230°03.7	240°59.0	S06°08.4	159°17.1	N24°54.2	222°23.3	N02°03.6	260°26.9	S13°42.2
7	245°06.1	255°58.6	07.1	174°18.8	54.2	237°25.3	03.8	275°29.1	42.1
8	260°08.6	270°58.2	05.8	189°20.5	54.3	252°27.3	04.0	290°31.2	42.0
9	275°11.1	285°57.8	·· 04.6	204°22.2	·· 54.4	267°29.3	·· 04.2	305°33.4	·· 41.9
10	290°13.5	300°57.5	03.3	219°23.8	54.4	282°31.3	04.4	320°35.6	41.8
11	305°16.0	315°57.1	02.0	234°25.5	54.5	297°33.3	04.6	335°37.7	41.7
12	320°18.5	330°56.7	S06°00.8	249°27.2	N24°54.6	312°35.3	N02°04.8	350°39.9	S13°41.6
13	335°20.9	345°56.3	05°59.5	264°28.9	54.6	327°37.3	05.0	5°42.1	41.5
14	350°23.4	0°56.0	58.2	279°30.5	54.7	342°39.3	05.3	20°44.3	41.4
15	5°25.9	15°55.6	·· 57.0	294°32.2	·· 54.8	357°41.3	·· 05.5	35°46.4	·· 41.3
16	20°28.3	30°55.2	55.7	309°33.9	54.8	12°43.3	05.7	50°48.6	41.2
17	35°30.8	45°54.9	54.4	324°35.5	54.9	27°45.3	05.9	65°50.8	41.1
18	50°33.2	60°54.5	S05°53.2	339°37.2	N24°55.0	42°47.3	N02°06.1	80°52.9	S13°41.0
19	65°35.7	75°54.1	51.9	354°38.9	55.0	57°49.3	06.3	95°55.1	40.9
20	80°38.2	90°53.7	50.6	9°40.5	55.1	72°51.3	06.5	110°57.3	40.8
21	95°40.6	105°53.4	·· 49.3	24°42.2	·· 55.2	87°53.3	·· 06.7	125°59.5	·· 40.7
22	110°43.1	120°53.0	48.1	39°43.8	55.3	102°55.3	06.9	141°01.6	40.6
23	125°45.6	135°52.6	46.8	54°45.5	55.3	117°57.3	07.1	156°03.8	40.5
Mer.pass. 14:38		ν -0.4′ d 1.3′ m -3.94		ν 1.7′ d 0.1′ m -0.02		ν 2.0′ d 0.2′ m -2.15		ν 2.2′ d 0.1′ m 0.84	

Sat	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	140°48.0	150°52.3	S05°45.5	69°47.2	N24°55.4	132°59.3	N02°07.3	171°06.0	S13°40.4
1	155°50.5	165°51.9	44.3	84°48.8	55.5	148°01.3	07.5	186°08.1	40.3
2	170°53.0	180°51.5	43.0	99°50.5	55.5	163°03.3	07.7	201°10.3	40.2
3	185°55.4	195°51.2	·· 41.7	114°52.1	·· 55.6	178°05.3	·· 07.9	216°12.5	·· 40.1
4	200°57.9	210°50.8	40.5	129°53.8	55.7	193°07.3	08.1	231°14.7	40.0
5	216°00.4	225°50.4	39.2	144°55.5	55.7	208°09.3	08.3	246°16.8	39.9
6	231°02.8	240°50.1	S05°37.9	159°57.1	N24°55.8	223°11.3	N02°08.5	261°19.0	S13°39.8
7	246°05.3	255°49.7	36.6	174°58.8	55.9	238°13.3	08.8	276°21.2	39.7
8	261°07.7	270°49.3	35.4	190°00.4	55.9	253°15.3	09.0	291°23.3	39.6
9	276°10.2	285°49.0	·· 34.1	205°02.1	·· 56.0	268°17.3	·· 09.2	306°25.5	·· 39.5
10	291°12.7	300°48.6	32.8	220°03.7	56.1	283°19.3	09.4	321°27.7	39.4
11	306°15.1	315°48.2	31.5	235°05.4	56.1	298°21.3	09.6	336°29.9	39.3
12	321°17.6	330°47.9	S05°30.3	250°07.0	N24°56.2	313°23.3	N02°09.8	351°32.0	S13°39.2
13	336°20.1	345°47.5	29.0	265°08.7	56.3	328°25.2	10.0	6°34.2	39.1
14	351°22.5	0°47.1	27.7	280°10.3	56.3	343°27.2	10.2	21°36.4	39.0
15	6°25.0	15°46.8	·· 26.5	295°12.0	·· 56.4	358°29.2	·· 10.4	36°38.6	·· 38.9
16	21°27.5	30°46.4	25.2	310°13.6	56.5	13°31.2	10.6	51°40.7	38.8
17	36°29.9	45°46.0	23.9	325°15.3	56.5	28°33.2	10.8	66°42.9	38.7
18	51°32.4	60°45.7	S05°22.6	340°16.9	N24°56.6	43°35.2	N02°11.0	81°45.1	S13°38.6
19	66°34.8	75°45.3	21.4	355°18.6	56.7	58°37.2	11.2	96°47.2	38.5
20	81°37.3	90°44.9	20.1	10°20.2	56.8	73°39.2	11.4	111°49.4	38.4
21	96°39.8	105°44.6	·· 18.8	25°21.9	·· 56.8	88°41.2	·· 11.6	126°51.6	·· 38.3
22	111°42.2	120°44.2	17.5	40°23.5	56.9	103°43.2	11.9	141°53.8	38.2
23	126°44.7	135°43.8	16.3	55°25.1	57.0	118°45.2	12.1	156°55.9	38.1
Mer.pass. 14:34		ν -0.4′ d 1.3′ m -3.94		ν 1.7′ d 0.1′ m 0.00		ν 2.0′ d 0.2′ m -2.15		ν 2.2′ d 0.1′ m 0.84	

Stars

	SHA	**Dec**
Alpheratz	357°36.7	29°13.0
Ankaa	353°09.0	-42°11.1
Schedar	349°33.2	56°39.9
Diphda	348°49.1	-17°51.8
Achernar	335°21.6	-57°07.5
Hamal	327°53.1	23°34.3
Polaris	314°49.0	89°22.0
Acamar	315°13.0	-40°13.0
Menkar	314°07.8	4°10.7
Mirfak	308°30.5	49°56.7
Aldebaran	290°41.3	16°33.3
Rigel	281°05.2	-8°10.6
Capella	280°24.0	46°01.4
Bellatrix	278°24.4	6°22.2
Elnath	278°03.7	28°37.6
Alnilam	275°39.1	-1°11.3
Betelgeuse	270°53.6	7°24.6
Canopus	263°52.7	-52°42.7
Sirius	258°27.4	-16°45.0
Adhara	255°06.8	-29°00.3
Procyon	244°52.2	5°09.9
Pollux	243°18.9	27°58.2
Avior	234°14.8	-59°35.0
Suhail	222°47.0	-43°31.6
Miaplacidus	221°37.7	-69°48.7
Alphard	217°49.0	-8°45.6
Regulus	207°35.8	11°51.2
Dubhe	193°42.3	61°37.5
Denebola	182°26.3	14°26.5
Gienah	175°45.0	-17°40.2
Acrux	173°01.4	-63°13.4
Gacrux	171°53.0	-57°14.3
Alioth	166°14.0	55°49.8
Spica	158°23.8	-11°16.9
Alkaid	152°53.1	49°11.6
Hadar	148°38.1	-60°28.8
Menkent	147°59.4	-36°28.9
Arcturus	145°49.3	19°03.6
Rigil Kent.	139°42.4	-60°55.6
Kochab	137°19.6	74°03.3
Zuben'ubi	136°57.7	-16°08.2
Alphecca	126°05.1	26°38.0
Antares	112°17.9	-26°28.9
Atria	107°13.8	-69°03.9
Sabik	102°04.8	-15°45.2
Shaula	96°12.7	-37°07.1
Rasalhague	96°00.2	12°32.4
Eltanin	90°43.3	51°28.8
Kaus Aust.	83°34.9	-34°22.4
Vega	80°34.6	38°48.0
Nunki	75°50.0	-26°16.1
Altair	62°01.8	8°55.6
Peacock	53°08.8	-56°39.7
Deneb	49°27.3	45°21.6
Enif	33°40.7	9°58.7
Al Na'ir	27°35.3	-46°51.1
Fomalhaut	15°16.6	-29°30.2
Scheat	13°47.1	28°12.4
Markab	13°31.8	15°19.7

Feb 09 Thu	**SHA**	**Mer.pass**
Venus	12°20.6	13:56
Mars	289°36.7	19:24
Jupiter	352°33.4	15:12
Saturn	30°32.0	12:41

Feb 10 Fri	**SHA**	**Mer.pass**
Venus	11°12.3	13:56
Mars	289°18.2	19:21
Jupiter	352°22.3	15:09
Saturn	30°25.0	12:37

Feb 11 Sat	**SHA**	**Mer.pass**
Venus	10°04.2	13:57
Mars	288°59.1	19:19
Jupiter	352°11.2	15:06
Saturn	30°17.9	12:34

Horizontal parallax	
Venus:	0.1
Mars:	0.2

h	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°28.1	S14°49.7	321°36.0	16.3′	N04°50.0	13.9′	54.8′
1	191°28.1	48.9	336°11.3	16.3′	04°36.1	14.0′	54.8′
2	206°28.1	48.1	350°46.5	16.3′	04°22.1	14.0′	54.8′
3	221°28.0	·· 47.3	5°21.8	16.3′	04°08.1	14.0′	54.8′
4	236°28.0	46.5	19°57.1	16.3′	03°54.1	14.1′	54.9′
5	251°28.0	45.7	34°32.4	16.3′	03°40.0	14.0′	54.9′
6	266°28.0	S14°44.9	49°07.6	16.3′	N03°26.0	14.1′	54.9′
7	281°28.0	44.1	63°42.9	16.3′	03°11.9	14.1′	54.9′
8	296°27.9	43.3	78°18.2	16.3′	02°57.8	14.1′	54.9′
9	311°27.9	·· 42.5	92°53.5	16.3′	02°43.7	14.2′	54.9′
10	326°27.9	41.7	107°28.7	16.3′	02°29.5	14.1′	55.0′
11	341°27.9	40.9	122°04.0	16.3′	02°15.4	14.2′	55.0′
12	356°27.9	S14°40.1	136°39.2	16.2′	N02°01.2	14.2′	55.0′
13	11°27.9	39.3	151°14.5	16.2′	01°47.0	14.2′	55.0′
14	26°27.8	38.5	165°49.7	16.2′	01°32.8	14.2′	55.0′
15	41°27.8	·· 37.7	180°24.9	16.2′	01°18.6	14.2′	55.1′
16	56°27.8	36.9	195°00.1	16.2′	01°04.4	14.3′	55.1′
17	71°27.8	36.1	209°35.3	16.2′	00°50.1	14.2′	55.1′
18	86°27.8	S14°35.3	224°10.5	16.2′	N00°35.9	14.3′	55.1′
19	101°27.8	34.5	238°45.7	16.2′	00°21.6	14.3′	55.1′
20	116°27.8	33.7	253°20.9	16.1′	N00°07.3	14.3′	55.1′
21	131°27.7	·· 32.9	267°56.0	16.1′	S00°07.0	14.3′	55.2′
22	146°27.7	32.1	282°31.1	16.1′	00°21.3	14.3′	55.2′
23	161°27.7	31.3	297°06.2	16.1′	00°35.6	14.3′	55.2′
	SD = 16.2′	d = 0.8′	SD = 14.9′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°27.7	S14°30.5	311°41.3	16.1′	S00°49.9	14.3′	55.2′
1	191°27.7	29.7	326°16.4	16.0′	01°04.2	14.4′	55.2′
2	206°27.7	28.9	340°51.4	16.0′	01°18.6	14.3′	55.3′
3	221°27.7	·· 28.1	355°26.4	16.0′	01°32.9	14.3′	55.3′
4	236°27.7	27.2	10°01.4	16.0′	01°47.2	14.4′	55.3′
5	251°27.6	26.4	24°36.4	15.9′	02°01.6	14.3′	55.3′
6	266°27.6	S14°25.6	39°11.3	15.9′	S02°15.9	14.3′	55.4′
7	281°27.6	24.8	53°46.3	15.9′	02°30.2	14.4′	55.4′
8	296°27.6	24.0	68°21.2	15.9′	02°44.6	14.3′	55.4′
9	311°27.6	·· 23.2	82°56.0	15.8′	02°58.9	14.4′	55.4′
10	326°27.6	22.4	97°30.8	15.8′	03°13.3	14.3′	55.4′
11	341°27.6	21.6	112°05.6	15.8′	03°27.6	14.3′	55.5′
12	356°27.6	S14°20.8	126°40.4	15.7′	S03°41.9	14.4′	55.5′
13	11°27.6	20.0	141°15.1	15.7′	03°56.3	14.3′	55.5′
14	26°27.6	19.1	155°49.8	15.7′	04°10.6	14.3′	55.5′
15	41°27.5	·· 18.3	170°24.4	15.6′	04°24.9	14.3′	55.6′
16	56°27.5	17.5	184°59.1	15.6′	04°39.2	14.3′	55.6′
17	71°27.5	16.7	199°33.6	15.5′	04°53.5	14.3′	55.6′
18	86°27.5	S14°15.9	214°08.2	15.5′	S05°07.8	14.3′	55.6′
19	101°27.5	15.1	228°42.7	15.4′	05°22.1	14.3′	55.6′
20	116°27.5	14.3	243°17.1	15.4′	05°36.4	14.3′	55.7′
21	131°27.5	·· 13.4	257°51.5	15.4′	05°50.7	14.2′	55.7′
22	146°27.5	12.6	272°25.9	15.3′	06°04.9	14.3′	55.7′
23	161°27.5	11.8	287°00.2	15.3′	06°19.2	14.2′	55.7′
	SD = 16.2′	d = 0.8′	SD = 15.1′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°27.5	S14°11.0	301°34.4	15.2′	S06°33.4	14.2′	55.8′
1	191°27.5	10.2	316°08.6	15.2′	06°47.6	14.2′	55.8′
2	206°27.5	09.3	330°42.8	15.1′	07°01.8	14.2′	55.8′
3	221°27.5	·· 08.5	345°16.9	15.1′	07°16.0	14.2′	55.8′
4	236°27.5	07.7	359°51.0	15.0′	07°30.2	14.1′	55.9′
5	251°27.5	06.9	14°25.0	14.9′	07°44.3	14.2′	55.9′
6	266°27.5	S14°06.1	28°58.9	14.9′	S07°58.5	14.1′	55.9′
7	281°27.5	05.3	43°32.8	14.8′	08°12.6	14.0′	55.9′
8	296°27.5	04.4	58°06.6	14.8′	08°26.6	14.1′	56.0′
9	311°27.5	·· 03.6	72°40.4	14.7′	08°40.7	14.0′	56.0′
10	326°27.5	02.8	87°14.1	14.7′	08°54.7	14.1′	56.0′
11	341°27.5	02.0	101°47.8	14.6′	09°08.8	14.0′	56.0′
12	356°27.5	S14°01.1	116°21.4	14.5′	S09°22.8	13.9′	56.1′
13	11°27.5	14°00.3	130°54.9	14.5′	09°36.7	14.0′	56.1′
14	26°27.5	13°59.5	145°28.4	14.4′	09°50.7	13.9′	56.1′
15	41°27.5	·· 58.7	160°01.7	14.3′	10°04.6	13.8′	56.2′
16	56°27.5	57.9	174°35.1	14.3′	10°18.4	13.9′	56.2′
17	71°27.5	57.0	189°08.3	14.2′	10°32.3	13.8′	56.2′
18	86°27.5	S13°56.2	203°41.5	14.1′	S10°46.1	13.8′	56.2′
19	101°27.5	55.4	218°14.6	14.0′	10°59.9	13.7′	56.3′
20	116°27.5	54.6	232°47.7	14.0′	11°13.6	13.7′	56.3′
21	131°27.5	·· 53.7	247°20.6	13.9′	11°27.3	13.7′	56.3′
22	146°27.5	52.9	261°53.5	13.8′	11°41.0	13.7′	56.3′
23	161°27.5	52.1	276°26.3	13.7′	11°54.7	13.6′	56.4′
	SD = 16.2′	d = 0.8′	SD = 15.2′				

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

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

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 19-21 91-76%
09	14:08	14:08	12:14	02:38	14:58	
10	14:09	14:10	12:14	03:19	15:39	
11	14:10	14:10	12:14	04:01	16:22	

February 12, 13, 14 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	141°47.2	150°43.5	S05°15.0	70°26.8	N24°57.0	133°47.2	N02°12.3	171°58.1	S13°37.9
1	156°49.6	165°43.1	13.7	85°28.4	57.1	148°49.2	12.5	187°00.3	37.8
2	171°52.1	180°42.8	12.4	100°30.1	57.2	163°51.2	12.7	202°02.4	37.7
3	186°54.6	195°42.4	·· 11.1	115°31.7	·· 57.2	178°53.2	·· 12.9	217°04.6	·· 37.6
4	201°57.0	210°42.0	09.9	130°33.3	57.3	193°55.2	13.1	232°06.8	37.5
5	216°59.5	225°41.7	08.6	145°35.0	57.4	208°57.2	13.3	247°09.0	37.4
6	232°02.0	240°41.3	S05°07.3	160°36.6	N24°57.4	223°59.2	N02°13.5	262°11.1	S13°37.3
7	247°04.4	255°41.0	06.0	175°38.2	57.5	239°01.2	13.7	277°13.3	37.2
8	262°06.9	270°40.6	04.8	190°39.9	57.6	254°03.2	13.9	292°15.5	37.1
9	277°09.3	285°40.2	·· 03.5	205°41.5	·· 57.6	269°05.2	·· 14.1	307°17.6	·· 37.0
10	292°11.8	300°39.9	02.2	220°43.1	57.7	284°07.2	14.3	322°19.8	36.9
11	307°14.3	315°39.5	05°00.9	235°44.8	57.8	299°09.2	14.6	337°22.0	36.8
12	322°16.7	330°39.2	S04°59.6	250°46.4	N24°57.9	314°11.2	N02°14.8	352°24.2	S13°36.7
13	337°19.2	345°38.8	58.4	265°48.0	57.9	329°13.2	15.0	7°26.3	36.6
14	352°21.7	0°38.4	57.1	280°49.7	58.0	344°15.2	15.2	22°28.5	36.5
15	7°24.1	15°38.1	·· 55.8	295°51.3	·· 58.1	359°17.1	·· 15.4	37°30.7	·· 36.4
16	22°26.6	30°37.7	54.5	310°52.9	58.1	14°19.1	15.6	52°32.8	36.3
17	37°29.1	45°37.4	53.2	325°54.6	58.2	29°21.1	15.8	67°35.0	36.2
18	52°31.5	60°37.0	S04°52.0	340°56.2	N24°58.3	44°23.1	N02°16.0	82°37.2	S13°36.1
19	67°34.0	75°36.6	50.7	355°57.8	58.3	59°25.1	16.2	97°39.4	36.0
20	82°36.5	90°36.3	49.4	10°59.4	58.4	74°27.1	16.4	112°41.5	35.9
21	97°38.9	105°35.9	·· 48.1	26°01.1	·· 58.5	89°29.1	·· 16.6	127°43.7	·· 35.8
22	112°41.4	120°35.6	46.8	41°02.7	58.5	104°31.1	16.8	142°45.9	35.7
23	127°43.8	135°35.2	45.6	56°04.3	58.6	119°33.1	17.0	157°48.0	35.6
Mer.pass. 14:30		ν -0.4′ d 1.3′ m -3.94		ν 1.6′ d 0.1′ m 0.03		ν 2.0′ d 0.2′ m -2.15		ν 2.2′ d 0.1′ m 0.83	

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	142°46.3	150°34.9	S04°44.3	71°05.9	N24°58.7	134°35.1	N02°17.3	172°50.2	S13°35.5
1	157°48.8	165°34.5	43.0	86°07.5	58.7	149°37.1	17.5	187°52.4	35.4
2	172°51.2	180°34.1	41.7	101°09.2	58.8	164°39.1	17.7	202°54.6	35.3
3	187°53.7	195°33.8	·· 40.4	116°10.8	·· 58.9	179°41.1	·· 17.9	217°56.7	·· 35.2
4	202°56.2	210°33.4	39.1	131°12.4	59.0	194°43.1	18.1	232°58.9	35.1
5	217°58.6	225°33.1	37.9	146°14.0	59.0	209°45.1	18.3	248°01.1	35.0
6	233°01.1	240°32.7	S04°36.6	161°15.6	N24°59.1	224°47.0	N02°18.5	263°03.2	S13°34.9
7	248°03.6	255°32.4	35.3	176°17.3	59.2	239°49.0	18.7	278°05.4	34.8
8	263°06.0	270°32.0	34.0	191°18.9	59.2	254°51.0	18.9	293°07.6	34.7
9	278°08.5	285°31.7	·· 32.7	206°20.5	·· 59.3	269°53.0	·· 19.1	308°09.8	·· 34.6
10	293°10.9	300°31.3	31.4	221°22.1	59.4	284°55.0	19.3	323°11.9	34.5
11	308°13.4	315°31.0	30.2	236°23.7	59.4	299°57.0	19.6	338°14.1	34.4
12	323°15.9	330°30.6	S04°28.9	251°25.3	N24°59.5	314°59.0	N02°19.8	353°16.3	S13°34.3
13	338°18.3	345°30.3	27.6	266°26.9	59.6	330°01.0	20.0	8°18.4	34.2
14	353°20.8	0°29.9	26.3	281°28.5	59.6	345°03.0	20.2	23°20.6	34.1
15	8°23.3	15°29.5	·· 25.0	296°30.2	·· 59.7	0°05.0	·· 20.4	38°22.8	·· 34.0
16	23°25.7	30°29.2	23.7	311°31.8	59.8	15°07.0	20.6	53°25.0	33.9
17	38°28.2	45°28.8	22.5	326°33.4	59.8	30°09.0	20.8	68°27.1	33.8
18	53°30.7	60°28.5	S04°21.2	341°35.0	N24°59.9	45°10.9	N02°21.0	83°29.3	S13°33.7
19	68°33.1	75°28.1	19.9	356°36.6	25°00.0	60°12.9	21.2	98°31.5	33.6
20	83°35.6	90°27.8	18.6	11°38.2	00.1	75°14.9	21.4	113°33.6	33.5
21	98°38.1	105°27.4	·· 17.3	26°39.8	·· 00.1	90°16.9	·· 21.6	128°35.8	·· 33.4
22	113°40.5	120°27.1	16.0	41°41.4	00.2	105°18.9	21.9	143°38.0	33.3
23	128°43.0	135°26.7	14.7	56°43.0	00.3	120°20.9	22.1	158°40.2	33.2
Mer.pass. 14:27		ν -0.4′ d 1.3′ m -3.94		ν 1.6′ d 0.1′ m 0.05		ν 2.0′ d 0.2′ m -2.14		ν 2.2′ d 0.1′ m 0.82	

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	143°45.4	150°26.4	S04°13.4	71°44.6	N25°00.3	135°22.9	N02°22.3	173°42.3	S13°33.1
1	158°47.9	165°26.0	12.2	86°46.2	00.4	150°24.9	22.5	188°44.5	33.0
2	173°50.4	180°25.7	10.9	101°47.8	00.5	165°26.9	22.7	203°46.7	32.9
3	188°52.8	195°25.3	·· 09.6	116°49.4	·· 00.5	180°28.9	·· 22.9	218°48.8	·· 32.8
4	203°55.3	210°25.0	08.3	131°51.0	00.6	195°30.8	23.1	233°51.0	32.6
5	218°57.8	225°24.6	07.0	146°52.6	00.7	210°32.8	23.3	248°53.2	32.5
6	234°00.2	240°24.3	S04°05.7	161°54.2	N25°00.7	225°34.8	N02°23.5	263°55.4	S13°32.4
7	249°02.7	255°23.9	04.4	176°55.8	00.8	240°36.8	23.7	278°57.5	32.3
8	264°05.2	270°23.6	03.1	191°57.4	00.9	255°38.8	23.9	293°59.7	32.2
9	279°07.6	285°23.2	·· 01.9	206°59.0	·· 01.0	270°40.8	·· 24.2	309°01.9	·· 32.1
10	294°10.1	300°22.9	04°00.6	222°00.6	01.0	285°42.8	24.4	324°04.0	32.0
11	309°12.6	315°22.5	03°59.3	237°02.2	01.1	300°44.8	24.6	339°06.2	31.9
12	324°15.0	330°22.2	S03°58.0	252°03.8	N25°01.2	315°46.8	N02°24.8	354°08.4	S13°31.8
13	339°17.5	345°21.8	56.7	267°05.4	01.2	330°48.7	25.0	9°10.6	31.7
14	354°19.9	0°21.5	55.4	282°07.0	01.3	345°50.7	25.2	24°12.7	31.6
15	9°22.4	15°21.2	·· 54.1	297°08.6	·· 01.4	0°52.7	·· 25.4	39°14.9	·· 31.5
16	24°24.9	30°20.8	52.8	312°10.2	01.4	15°54.7	25.6	54°17.1	31.4
17	39°27.3	45°20.5	51.5	327°11.7	01.5	30°56.7	25.8	69°19.2	31.3
18	54°29.8	60°20.1	S03°50.3	342°13.3	N25°01.6	45°58.7	N02°26.0	84°21.4	S13°31.2
19	69°32.3	75°19.8	49.0	357°14.9	01.6	61°00.7	26.3	99°23.6	31.1
20	84°34.7	90°19.4	47.7	12°16.5	01.7	76°02.7	26.5	114°25.8	31.0
21	99°37.2	105°19.1	·· 46.4	27°18.1	·· 01.8	91°04.6	·· 26.7	129°27.9	·· 30.9
22	114°39.7	120°18.7	45.1	42°19.7	01.8	106°06.6	26.9	144°30.1	30.8
23	129°42.1	135°18.4	43.8	57°21.3	01.9	121°08.6	27.1	159°32.3	30.7
Mer.pass. 14:23		ν -0.4′ d 1.3′ m -3.94		ν 1.6′ d 0.1′ m 0.08		ν 2.0′ d 0.2′ m -2.14		ν 2.2′ d 0.1′ m 0.82	

Stars

	SHA	**Dec**
Alpheratz	357°36.7	29°13.0
Ankaa	353°09.0	-42°11.1
Schedar	349°33.2	56°39.9
Diphda	348°49.1	-17°51.8
Achernar	335°21.6	-57°07.5
Hamal	327°53.1	23°34.3
Polaris	314°50.5	89°22.0
Acamar	315°13.0	-40°13.0
Menkar	314°07.8	4°10.7
Mirfak	308°30.5	49°56.7
Aldebaran	290°41.3	16°33.3
Rigel	281°05.2	-8°10.6
Capella	280°24.0	46°01.4
Bellatrix	278°24.4	6°22.2
Elnath	278°03.7	28°37.6
Alnilam	275°39.1	-1°11.3
Betelgeuse	270°53.6	7°24.6
Canopus	263°52.7	-52°42.7
Sirius	258°27.4	-16°45.0
Adhara	255°06.8	-29°00.3
Procyon	244°52.2	5°09.9
Pollux	243°18.9	27°58.2
Avior	234°14.8	-59°35.1
Suhail	222°47.0	-43°31.6
Miaplacidus	221°37.7	-69°48.7
Alphard	217°49.0	-8°45.6
Regulus	207°35.8	11°51.2
Dubhe	193°42.3	61°37.5
Denebola	182°26.3	14°26.5
Gienah	175°45.0	-17°40.2
Acrux	173°01.4	-63°13.4
Gacrux	171°53.0	-57°14.4
Alioth	166°14.0	55°49.8
Spica	158°23.8	-11°16.9
Alkaid	152°53.0	49°11.6
Hadar	148°38.0	-60°28.8
Menkent	147°59.3	-36°28.9
Arcturus	145°49.2	19°03.6
Rigil Kent.	139°42.3	-60°55.6
Kochab	137°19.6	74°03.3
Zuben'ubi	136°57.7	-16°08.2
Alphecca	126°05.1	26°38.0
Antares	112°17.9	-26°28.9
Atria	107°13.7	-69°03.9
Sabik	102°04.7	-15°45.2
Shaula	96°12.7	-37°07.1
Rasalhague	96°00.2	12°32.4
Eltanin	90°43.2	51°28.8
Kaus Aust.	83°34.9	-34°22.4
Vega	80°34.6	38°48.0
Nunki	75°50.0	-26°16.1
Altair	62°01.8	8°55.6
Peacock	53°08.8	-56°39.7
Deneb	49°27.3	45°21.6
Enif	33°40.7	9°58.7
Al Na'ir	27°35.3	-46°51.1
Fomalhaut	15°16.6	-29°30.2
Scheat	13°47.1	28°12.4
Markab	13°31.8	15°19.6

Feb 12 Sun	**SHA**	**Mer.pass**
Venus	8°56.3	13:57
Mars	288°39.6	19:16
Jupiter	352°00.0	15:03
Saturn	30°10.9	12:30

Feb 13 Mon	**SHA**	**Mer.pass**
Venus	7°48.6	13:58
Mars	288°19.6	19:14
Jupiter	351°48.8	15:00
Saturn	30°03.9	12:27

Feb 14 Tue	**SHA**	**Mer.pass**
Venus	6°40.9	13:59
Mars	287°59.2	19:11
Jupiter	351°37.4	14:56
Saturn	29°56.9	12:23

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°27.5	S13°51.2	290°59.1	13.7′	S12°08.3	13.5′	56.4′
1	191°27.5	50.4	305°31.7	13.6′	12°21.8	13.5′	56.4′
2	206°27.5	49.6	320°04.3	13.5′	12°35.3	13.5′	56.5′
3	221°27.5	·· 48.8	334°36.8	13.4′	12°48.8	13.4′	56.5′
4	236°27.5	47.9	349°09.2	13.3′	13°02.2	13.4′	56.5′
5	251°27.5	47.1	3°41.5	13.2′	13°15.6	13.4′	56.5′
6	266°27.5	S13°46.3	18°13.8	13.2′	S13°29.0	13.3′	56.6′
7	281°27.5	45.4	32°45.9	13.1′	13°42.3	13.2′	56.6′
8	296°27.5	44.6	47°18.0	13.0′	13°55.5	13.2′	56.6′
9	311°27.5	·· 43.8	61°50.0	12.9′	14°08.7	13.2′	56.7′
10	326°27.5	43.0	76°21.9	12.8′	14°21.9	13.1′	56.7′
11	341°27.5	42.1	90°53.7	12.7′	14°35.0	13.0′	56.7′
12	356°27.5	S13°41.3	105°25.4	12.6′	S14°48.0	13.0′	56.8′
13	11°27.5	40.5	119°57.0	12.5′	15°01.0	12.9′	56.8′
14	26°27.5	39.6	134°28.5	12.4′	15°13.9	12.9′	56.8′
15	41°27.5	·· 38.8	148°59.9	12.3′	15°26.8	12.8′	56.9′
16	56°27.6	38.0	163°31.3	12.2′	15°39.6	12.8′	56.9′
17	71°27.6	37.1	178°02.5	12.1′	15°52.4	12.7′	56.9′
18	86°27.6	S13°36.3	192°33.6	12.0′	S16°05.1	12.6′	56.9′
19	101°27.6	35.5	207°04.6	11.9′	16°17.7	12.6′	57.0′
20	116°27.6	34.6	221°35.6	11.8′	16°30.3	12.5′	57.0′
21	131°27.6	·· 33.8	236°06.4	11.7′	16°42.8	12.4′	57.0′
22	146°27.6	33.0	250°37.1	11.6′	16°55.2	12.4′	57.1′
23	161°27.6	32.1	265°07.7	11.5′	17°07.6	12.3′	57.1′
	SD = 16.2′	d = 0.8′	SD = 15.4′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°27.6	S13°31.3	279°38.3	11.4′	S17°19.9	12.2′	57.1′
1	191°27.6	30.4	294°08.7	11.3′	17°32.1	12.2′	57.2′
2	206°27.6	29.6	308°39.0	11.2′	17°44.3	12.0′	57.2′
3	221°27.7	·· 28.8	323°09.1	11.1′	17°56.3	12.0′	57.2′
4	236°27.7	27.9	337°39.2	11.0′	18°08.3	12.0′	57.3′
5	251°27.7	27.1	352°09.2	10.9′	18°20.3	11.8′	57.3′
6	266°27.7	S13°26.3	6°39.1	10.7′	S18°32.1	11.8′	57.3′
7	281°27.7	25.4	21°08.8	10.6′	18°43.9	11.7′	57.4′
8	296°27.7	24.6	35°38.4	10.5′	18°55.6	11.6′	57.4′
9	311°27.7	·· 23.7	50°08.0	10.4′	19°07.2	11.5′	57.4′
10	326°27.7	22.9	64°37.4	10.3′	19°18.7	11.4′	57.5′
11	341°27.8	22.1	79°06.6	10.2′	19°30.1	11.4′	57.5′
12	356°27.8	S13°21.2	93°35.8	10.1′	S19°41.5	11.2′	57.5′
13	11°27.8	20.4	108°04.9	9.9′	19°52.7	11.2′	57.6′
14	26°27.8	19.5	122°33.8	9.8′	20°03.9	11.1′	57.6′
15	41°27.8	·· 18.7	137°02.6	9.7′	20°15.0	10.9′	57.6′
16	56°27.8	17.8	151°31.3	9.6′	20°25.9	10.9′	57.7′
17	71°27.9	17.0	165°59.9	9.5′	20°36.8	10.8′	57.7′
18	86°27.9	S13°16.2	180°28.4	9.3′	S20°47.6	10.7′	57.7′
19	101°27.9	15.3	194°56.7	9.2′	20°58.3	10.6′	57.8′
20	116°27.9	14.5	209°24.9	9.1′	21°08.9	10.5′	57.8′
21	131°27.9	·· 13.6	223°53.0	9.0′	21°19.4	10.3′	57.8′
22	146°27.9	12.8	238°21.0	8.8′	21°29.7	10.3′	57.9′
23	161°28.0	11.9	252°48.8	8.7′	21°40.0	10.2′	57.9′
	SD = 16.2′	d = 0.8′	SD = 15.6′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°28.0	S13°11.1	267°16.6	8.6′	S21°50.2	10.0′	57.9′
1	191°28.0	10.2	281°44.2	8.5′	22°00.2	10.0′	58.0′
2	206°28.0	09.4	296°11.6	8.4′	22°10.2	9.8′	58.0′
3	221°28.0	·· 08.6	310°39.0	8.2′	22°20.0	9.7′	58.0′
4	236°28.0	07.7	325°06.2	8.1′	22°29.7	9.6′	58.1′
5	251°28.1	06.9	339°33.3	8.0′	22°39.3	9.5′	58.1′
6	266°28.1	S13°06.0	354°00.3	7.9′	S22°48.8	9.3′	58.1′
7	281°28.1	05.2	8°27.1	7.7′	22°58.1	9.3′	58.2′
8	296°28.1	04.3	22°53.9	7.6′	23°07.4	9.1′	58.2′
9	311°28.1	·· 03.5	37°20.5	7.5′	23°16.5	9.0′	58.3′
10	326°28.2	02.6	51°46.9	7.4′	23°25.5	8.8′	58.3′
11	341°28.2	01.8	66°13.3	7.2′	23°34.3	8.8′	58.3′
12	356°28.2	S13°00.9	80°39.5	7.1′	S23°43.1	8.6′	58.4′
13	11°28.2	13°00.1	95°05.6	7.0′	23°51.7	8.4′	58.4′
14	26°28.3	12°59.2	109°31.6	6.9′	24°00.1	8.4′	58.4′
15	41°28.3	·· 58.4	123°57.4	6.7′	24°08.5	8.2′	58.5′
16	56°28.3	57.5	138°23.2	6.6′	24°16.7	8.0′	58.5′
17	71°28.3	56.7	152°48.8	6.5′	24°24.7	8.0′	58.5′
18	86°28.3	S12°55.8	167°14.3	6.4′	S24°32.7	7.7′	58.6′
19	101°28.4	55.0	181°39.6	6.2′	24°40.4	7.7′	58.6′
20	116°28.4	54.1	196°04.8	6.1′	24°48.1	7.5′	58.6′
21	131°28.4	·· 53.3	210°30.0	6.0′	24°55.6	7.3′	58.7′
22	146°28.4	52.4	224°54.9	5.9′	25°02.9	7.2′	58.7′
23	161°28.5	51.5	239°19.8	5.7′	25°10.1	7.1′	58.7′
	SD = 16.2′	d = 0.8′	SD = 15.8′				

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

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

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 67-46%
12	14:10	14:10	12:14	04:45	17:08	
13	14:09	14:09	12:14	05:32	17:58	
14	14:08	14:07	12:14	06:25	18:53	

February 15, 16, 17 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	144°44.6	150°18.0	S03°42.5	72°22.9	N25°02.0	136°10.6	N02°27.3	174°34.4	S13°30.6
1	159°47.1	165°17.7	41.2	87°24.4	02.1	151°12.6	27.5	189°36.6	30.5
2	174°49.5	180°17.4	39.9	102°26.0	02.1	166°14.6	27.7	204°38.8	30.4
3	189°52.0	195°17.0	·· 38.6	117°27.6	·· 02.2	181°16.6	·· 27.9	219°41.0	·· 30.3
4	204°54.4	210°16.7	37.3	132°29.2	02.3	196°18.6	28.2	234°43.1	30.2
5	219°56.9	225°16.3	36.0	147°30.8	02.3	211°20.5	28.4	249°45.3	30.1
6	234°59.4	240°16.0	S03°34.8	162°32.3	N25°02.4	226°22.5	N02°28.6	264°47.5	S13°30.0
7	250°01.8	255°15.6	33.5	177°33.9	02.5	241°24.5	28.8	279°49.6	29.9
8	265°04.3	270°15.3	32.2	192°35.5	02.5	256°26.5	29.0	294°51.8	29.8
9	280°06.8	285°14.9	·· 30.9	207°37.1	·· 02.6	271°28.5	·· 29.2	309°54.0	·· 29.7
10	295°09.2	300°14.6	29.6	222°38.7	02.7	286°30.5	29.4	324°56.2	29.6
11	310°11.7	315°14.3	28.3	237°40.2	02.7	301°32.5	29.6	339°58.3	29.5
12	325°14.2	330°13.9	S03°27.0	252°41.8	N25°02.8	316°34.4	N02°29.8	355°00.5	S13°29.4
13	340°16.6	345°13.6	25.7	267°43.4	02.9	331°36.4	30.1	10°02.7	29.3
14	355°19.1	0°13.2	24.4	282°45.0	03.0	346°38.4	30.3	25°04.8	29.2
15	10°21.5	15°12.9	·· 23.1	297°46.5	·· 03.0	1°40.4	·· 30.5	40°07.0	·· 29.1
16	25°24.0	30°12.6	21.8	312°48.1	03.1	16°42.4	30.7	55°09.2	29.0
17	40°26.5	45°12.2	20.5	327°49.7	03.2	31°44.4	30.9	70°11.4	28.9
18	55°28.9	60°11.9	S03°19.2	342°51.2	N25°03.2	46°46.3	N02°31.1	85°13.5	S13°28.8
19	70°31.4	75°11.5	17.9	357°52.8	03.3	61°48.3	31.3	100°15.7	28.7
20	85°33.9	90°11.2	16.6	12°54.4	03.4	76°50.3	31.5	115°17.9	28.6
21	100°36.3	105°10.8	·· 15.4	27°56.0	·· 03.4	91°52.3	·· 31.7	130°20.0	·· 28.5
22	115°38.8	120°10.5	14.1	42°57.5	03.5	106°54.3	32.0	145°22.2	28.4
23	130°41.3	135°10.2	12.8	57°59.1	03.6	121°56.3	32.2	160°24.4	28.3
Mer.pass. 14:19		ν -0.3′ d 1.3′ m -3.94		ν 1.6′ d 0.1′ m 0.10		ν 2.0′ d 0.2′ m -2.14		ν 2.2′ d 0.1′ m 0.81	

Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	145°43.7	150°09.8	S03°11.5	73°00.7	N25°03.6	136°58.3	N02°32.4	175°26.6	S13°28.2
1	160°46.2	165°09.5	10.2	88°02.2	03.7	152°00.2	32.6	190°28.7	28.1
2	175°48.7	180°09.1	08.9	103°03.8	03.8	167°02.2	32.8	205°30.9	28.0
3	190°51.1	195°08.8	·· 07.6	118°05.4	·· 03.9	182°04.2	·· 33.0	220°33.1	·· 27.9
4	205°53.6	210°08.5	06.3	133°06.9	03.9	197°06.2	33.2	235°35.2	27.7
5	220°56.0	225°08.1	05.0	148°08.5	04.0	212°08.2	33.4	250°37.4	27.6
6	235°58.5	240°07.8	S03°03.7	163°10.0	N25°04.1	227°10.2	N02°33.7	265°39.6	S13°27.5
7	251°01.0	255°07.5	02.4	178°11.6	04.1	242°12.1	33.9	280°41.8	27.4
8	266°03.4	270°07.1	03°01.1	193°13.2	04.2	257°14.1	34.1	295°43.9	27.3
9	281°05.9	285°06.8	02°59.8	208°14.7	·· 04.3	272°16.1	·· 34.3	310°46.1	·· 27.2
10	296°08.4	300°06.4	58.5	223°16.3	04.3	287°18.1	34.5	325°48.3	27.1
11	311°10.8	315°06.1	57.2	238°17.8	04.4	302°20.1	34.7	340°50.4	27.0
12	326°13.3	330°05.8	S02°55.9	253°19.4	N25°04.5	317°22.0	N02°34.9	355°52.6	S13°26.9
13	341°15.8	345°05.4	54.6	268°21.0	04.5	332°24.0	35.1	10°54.8	26.8
14	356°18.2	0°05.1	53.3	283°22.5	04.6	347°26.0	35.3	25°57.0	26.7
15	11°20.7	15°04.7	·· 52.0	298°24.1	·· 04.7	2°28.0	·· 35.6	40°59.1	·· 26.6
16	26°23.2	30°04.4	50.7	313°25.6	04.7	17°30.0	35.8	56°01.3	26.5
17	41°25.6	45°04.1	49.4	328°27.2	04.8	32°32.0	36.0	71°03.5	26.4
18	56°28.1	60°03.7	S02°48.1	343°28.7	N25°04.9	47°33.9	N02°36.2	86°05.6	S13°26.3
19	71°30.5	75°03.4	46.8	358°30.3	05.0	62°35.9	36.4	101°07.8	26.2
20	86°33.0	90°03.1	45.5	13°31.8	05.0	77°37.9	36.6	116°10.0	26.1
21	101°35.5	105°02.7	·· 44.2	28°33.4	·· 05.1	92°39.9	·· 36.8	131°12.2	·· 26.0
22	116°37.9	120°02.4	42.9	43°34.9	05.2	107°41.9	37.0	146°14.3	25.9
23	131°40.4	135°02.1	41.6	58°36.5	05.2	122°43.8	37.3	161°16.5	25.8
Mer.pass. 14:15		ν -0.3′ d 1.3′ m -3.94		ν 1.6′ d 0.1′ m 0.13		ν 2.0′ d 0.2′ m -2.13		ν 2.2′ d 0.1′ m 0.80	

Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	146°42.9	150°01.7	S02°40.3	73°38.0	N25°05.3	137°45.8	N02°37.5	176°18.7	S13°25.7
1	161°45.3	165°01.4	39.0	88°39.6	05.4	152°47.8	37.7	191°20.8	25.6
2	176°47.8	180°01.1	37.7	103°41.1	05.4	167°49.8	37.9	206°23.0	25.5
3	191°50.3	195°00.7	·· 36.4	118°42.7	·· 05.5	182°51.8	·· 38.1	221°25.2	·· 25.4
4	206°52.7	210°00.4	35.1	133°44.2	05.6	197°53.7	38.3	236°27.4	25.3
5	221°55.2	225°00.1	33.8	148°45.8	05.6	212°55.7	38.5	251°29.5	25.2
6	236°57.7	239°59.7	S02°32.5	163°47.3	N25°05.7	227°57.7	N02°38.7	266°31.7	S13°25.1
7	252°00.1	254°59.4	31.2	178°48.9	05.8	242°59.7	39.0	281°33.9	25.0
8	267°02.6	269°59.0	29.9	193°50.4	05.8	258°01.7	39.2	296°36.0	24.9
9	282°05.0	284°58.7	·· 28.6	208°51.9	·· 05.9	273°03.6	·· 39.4	311°38.2	·· 24.8
10	297°07.5	299°58.4	27.3	223°53.5	06.0	288°05.6	39.6	326°40.4	24.7
11	312°10.0	314°58.0	26.0	238°55.0	06.1	303°07.6	39.8	341°42.6	24.6
12	327°12.4	329°57.7	S02°24.7	253°56.6	N25°06.1	318°09.6	N02°40.0	356°44.7	S13°24.5
13	342°14.9	344°57.4	23.4	268°58.1	06.2	333°11.6	40.2	11°46.9	24.4
14	357°17.4	359°57.0	22.1	283°59.6	06.3	348°13.5	40.5	26°49.1	24.3
15	12°19.8	14°56.7	·· 20.8	299°01.2	·· 06.3	3°15.5	·· 40.7	41°51.3	·· 24.2
16	27°22.3	29°56.4	19.5	314°02.7	06.4	18°17.5	40.9	56°53.4	24.1
17	42°24.8	44°56.1	18.2	329°04.2	06.5	33°19.5	41.1	71°55.6	24.0
18	57°27.2	59°55.7	S02°16.9	344°05.8	N25°06.5	48°21.5	N02°41.3	86°57.8	S13°23.9
19	72°29.7	74°55.4	15.6	359°07.3	06.6	63°23.4	41.5	101°59.9	23.8
20	87°32.2	89°55.1	14.3	14°08.9	06.7	78°25.4	41.7	117°02.1	23.7
21	102°34.6	104°54.7	·· 13.0	29°10.4	·· 06.7	93°27.4	·· 41.9	132°04.3	·· 23.6
22	117°37.1	119°54.4	11.7	44°11.9	06.8	108°29.4	42.2	147°06.5	23.5
23	132°39.5	134°54.1	10.4	59°13.5	06.9	123°31.4	42.4	162°08.6	23.4
Mer.pass. 14:11		ν -0.3′ d 1.3′ m -3.94		ν 1.5′ d 0.1′ m 0.15		ν 2.0′ d 0.2′ m -2.13		ν 2.2′ d 0.1′ m 0.80	

Stars

	SHA	**Dec**
Alpheratz	357°36.7	29°13.0
Ankaa	353°09.0	-42°11.1
Schedar	349°33.2	56°39.9
Diphda	348°49.1	-17°51.8
Achernar	335°21.6	-57°07.5
Hamal	327°53.1	23°34.3
Polaris	314°51.7	89°22.0
Acamar	315°13.0	-40°13.0
Menkar	314°07.8	4°10.7
Mirfak	308°30.5	49°56.7
Aldebaran	290°41.3	16°33.3
Rigel	281°05.2	-8°10.6
Capella	280°24.0	46°01.4
Bellatrix	278°24.4	6°22.2
Elnath	278°03.7	28°37.6
Alnilam	275°39.2	-1°11.3
Betelgeuse	270°53.6	7°24.6
Canopus	263°52.7	-52°42.7
Sirius	258°27.4	-16°45.0
Adhara	255°06.8	-29°00.4
Procyon	244°52.2	5°09.9
Pollux	243°18.9	27°58.2
Avior	234°14.8	-59°35.1
Suhail	222°47.0	-43°31.6
Miaplacidus	221°37.7	-69°48.7
Alphard	217°49.0	-8°45.6
Regulus	207°35.8	11°51.2
Dubhe	193°42.3	61°37.5
Denebola	182°26.3	14°26.5
Gienah	175°44.9	-17°40.2
Acrux	173°01.3	-63°13.4
Gacrux	171°53.0	-57°14.4
Alioth	166°14.0	55°49.8
Spica	158°23.8	-11°16.9
Alkaid	152°53.0	49°11.6
Hadar	148°38.0	-60°28.8
Menkent	147°59.3	-36°28.9
Arcturus	145°49.2	19°03.5
Rigil Kent.	139°42.3	-60°55.6
Kochab	137°19.5	74°03.3
Zuben'ubi	136°57.7	-16°08.3
Alphecca	126°05.1	26°38.0
Antares	112°17.8	-26°28.9
Atria	107°13.7	-69°03.9
Sabik	102°04.7	-15°45.2
Shaula	96°12.7	-37°07.1
Rasalhague	96°00.2	12°32.4
Eltanin	90°43.2	51°28.8
Kaus Aust.	83°34.8	-34°22.4
Vega	80°34.6	38°48.0
Nunki	75°50.0	-26°16.1
Altair	62°01.8	8°55.6
Peacock	53°08.7	-56°39.6
Deneb	49°27.3	45°21.6
Enif	33°40.7	9°58.7
Al Na'ir	27°35.3	-46°51.1
Fomalhaut	15°16.6	-29°30.2
Scheat	13°47.1	28°12.4
Markab	13°31.8	15°19.6

Feb 15 Wed	**SHA**	**Mer.pass**
Venus	5°33.5	13:59
Mars	287°38.3	19:08
Jupiter	351°26.0	14:53
Saturn	29°49.9	12:20

Feb 16 Thu	**SHA**	**Mer.pass**
Venus	4°26.1	14:00
Mars	287°16.9	19:06
Jupiter	351°14.5	14:50
Saturn	29°42.8	12:16

Feb 17 Fri	**SHA**	**Mer.pass**
Venus	3°18.9	14:00
Mars	286°55.2	19:04
Jupiter	351°03.0	14:47
Saturn	29°35.8	12:13

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°28.5	S12°50.7	253°44.6	5.6′	S25°17.2	6.9′	58.8′
1	191°28.5	49.8	268°09.2	5.5′	25°24.1	6.7′	58.8′
2	206°28.5	49.0	282°33.7	5.4′	25°30.8	6.6′	58.8′
3	221°28.6	·· 48.1	296°58.1	5.3′	25°37.4	6.4′	58.9′
4	236°28.6	47.3	311°22.4	5.2′	25°43.8	6.3′	58.9′
5	251°28.6	46.4	325°46.5	5.1′	25°50.1	6.1′	59.0′
6	266°28.7	S12°45.6	340°10.6	4.9′	S25°56.2	6.0′	59.0′
7	281°28.7	44.7	354°34.5	4.8′	26°02.2	5.7′	59.0′
8	296°28.7	43.8	8°58.4	4.7′	26°07.9	5.7′	59.1′
9	311°28.7	·· 43.0	23°22.1	4.6′	26°13.6	5.4′	59.1′
10	326°28.8	42.1	37°45.7	4.5′	26°19.0	5.3′	59.1′
11	341°28.8	41.3	52°09.2	4.4′	26°24.3	5.1′	59.2′
12	356°28.8	S12°40.4	66°32.6	4.3′	S26°29.4	5.0′	59.2′
13	11°28.9	39.5	80°55.9	4.2′	26°34.4	4.7′	59.2′
14	26°28.9	38.7	95°19.1	4.1′	26°39.1	4.6′	59.3′
15	41°28.9	·· 37.8	109°42.1	4.0′	26°43.7	4.4′	59.3′
16	56°28.9	37.0	124°05.1	3.9′	26°48.1	4.3′	59.3′
17	71°29.0	36.1	138°28.0	3.8′	26°52.4	4.0′	59.4′
18	86°29.0	S12°35.2	152°50.8	3.7′	S26°56.4	3.9′	59.4′
19	101°29.0	34.4	167°13.5	3.6′	27°00.3	3.7′	59.4′
20	116°29.1	33.5	181°36.1	3.5′	27°04.0	3.5′	59.5′
21	131°29.1	·· 32.7	195°58.6	3.4′	27°07.5	3.4′	59.5′
22	146°29.1	31.8	210°21.1	3.3′	27°10.9	3.1′	59.5′
23	161°29.2	30.9	224°43.4	3.3′	27°14.0	3.0′	59.6′
	SD = 16.2′	d = 0.9′	SD = 16.0′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°29.2	S12°30.1	239°05.7	3.2′	S27°17.0	2.7′	59.6′
1	191°29.2	29.2	253°27.9	3.1′	27°19.7	2.6′	59.6′
2	206°29.3	28.3	267°50.0	3.0′	27°22.3	2.4′	59.7′
3	221°29.3	·· 27.5	282°12.0	3.0′	27°24.7	2.2′	59.7′
4	236°29.3	26.6	296°33.9	2.9′	27°26.9	2.0′	59.7′
5	251°29.4	25.8	310°55.8	2.8′	27°28.9	1.8′	59.8′
6	266°29.4	S12°24.9	325°17.6	2.7′	S27°30.7	1.6′	59.8′
7	281°29.4	24.0	339°39.4	2.7′	27°32.3	1.4′	59.8′
8	296°29.5	23.2	354°01.0	2.6′	27°33.7	1.2′	59.8′
9	311°29.5	·· 22.3	8°22.7	2.6′	27°34.9	1.0′	59.9′
10	326°29.5	21.4	22°44.2	2.5′	27°35.9	0.9′	59.9′
11	341°29.6	20.6	37°05.7	2.5′	27°36.8	0.6′	59.9′
12	356°29.6	S12°19.7	51°27.2	2.4′	S27°37.4	0.4′	60.0′
13	11°29.7	18.8	65°48.6	2.4′	27°37.8	0.2′	60.0′
14	26°29.7	18.0	80°09.9	2.3′	27°38.0	0.0′	60.0′
15	41°29.7	·· 17.1	94°31.2	2.3′	27°38.0	0.2′	60.1′
16	56°29.8	16.2	108°52.5	2.2′	27°37.8	0.4′	60.1′
17	71°29.8	15.3	123°13.7	2.2′	27°37.4	0.6′	60.1′
18	86°29.8	S12°14.5	137°34.9	2.2′	S27°36.8	0.8′	60.1′
19	101°29.9	13.6	151°56.1	2.1′	27°36.0	1.0′	60.2′
20	116°29.9	12.7	166°17.2	2.1′	27°35.0	1.2′	60.2′
21	131°30.0	·· 11.9	180°38.3	2.1′	27°33.8	1.4′	60.2′
22	146°30.0	11.0	194°59.4	2.1′	27°32.4	1.7′	60.3′
23	161°30.0	10.1	209°20.4	2.0′	27°30.7	1.8′	60.3′
	SD = 16.2′	d = 0.9′	SD = 16.3′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°30.1	S12°09.3	223°41.5	2.0′	S27°28.9	2.0′	60.3′
1	191°30.1	08.4	238°02.5	2.0′	27°26.9	2.3′	60.3′
2	206°30.2	07.5	252°23.5	2.0′	27°24.6	2.4′	60.4′
3	221°30.2	·· 06.6	266°44.5	2.0′	27°22.2	2.7′	60.4′
4	236°30.2	05.8	281°05.5	2.0′	27°19.5	2.9′	60.4′
5	251°30.3	04.9	295°26.5	2.0′	27°16.6	3.0′	60.4′
6	266°30.3	S12°04.0	309°47.5	2.0′	S27°13.6	3.3′	60.5′
7	281°30.4	03.1	324°08.5	2.0′	27°10.3	3.5′	60.5′
8	296°30.4	02.3	338°29.5	2.0′	27°06.8	3.7′	60.5′
9	311°30.5	·· 01.4	352°50.5	2.0′	27°03.1	3.9′	60.5′
10	326°30.5	12°00.5	7°11.5	2.0′	26°59.2	4.1′	60.6′
11	341°30.5	11°59.6	21°32.5	2.1′	26°55.1	4.3′	60.6′
12	356°30.6	S11°58.8	35°53.6	2.1′	S26°50.8	4.5′	60.6′
13	11°30.6	57.9	50°14.7	2.1′	26°46.3	4.7′	60.6′
14	26°30.7	57.0	64°35.8	2.1′	26°41.6	5.0′	60.6′
15	41°30.7	·· 56.1	78°56.9	2.1′	26°36.6	5.1′	60.7′
16	56°30.8	55.3	93°18.0	2.2′	26°31.5	5.3′	60.7′
17	71°30.8	54.4	107°39.2	2.2′	26°26.2	5.6′	60.7′
18	86°30.8	S11°53.5	122°00.4	2.3′	S26°20.6	5.7′	60.7′
19	101°30.9	52.6	136°21.7	2.3′	26°14.9	5.9′	60.7′
20	116°30.9	51.8	150°43.0	2.3′	26°09.0	6.2′	60.8′
21	131°31.0	·· 50.9	165°04.3	2.4′	26°02.8	6.3′	60.8′
22	146°31.0	50.0	179°25.7	2.4′	25°56.5	6.5′	60.8′
23	161°31.1	49.1	193°47.1	2.5′	25°50.0	6.7′	60.8′
	SD = 16.2′	d = 0.9′	SD = 16.4′				

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

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

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 25-27 36-16%
15	14:06	14:05	12:14	07:23	19:53	
16	14:03	14:02	12:14	08:25	20:57	
17	14:00	13:58	12:14	09:30	22:02	

February 18, 19, 20 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	147°42.0	149°53.7	S02°09.1	74°15.0	N25°06.9	138°33.3	N02°42.6	177°10.8	S13°23.2
1	162°44.5	164°53.4	07.8	89°16.5	07.0	153°35.3	42.8	192°13.0	23.1
2	177°46.9	179°53.1	06.5	104°18.0	07.1	168°37.3	43.0	207°15.1	23.0
3	192°49.4	194°52.7	·· 05.2	119°19.6	·· 07.1	183°39.3	·· 43.2	222°17.3	·· 22.9
4	207°51.9	209°52.4	03.9	134°21.1	07.2	198°41.2	43.4	237°19.5	22.8
5	222°54.3	224°52.1	02.6	149°22.6	07.3	213°43.2	43.7	252°21.7	22.7
6	237°56.8	239°51.7	S02°01.3	164°24.2	N25°07.4	228°45.2	N02°43.9	267°23.8	S13°22.6
7	252°59.3	254°51.4	02°00.0	179°25.7	07.4	243°47.2	44.1	282°26.0	22.5
8	268°01.7	269°51.1	01°58.7	194°27.2	07.5	258°49.1	44.3	297°28.2	22.4
9	283°04.2	284°50.8	·· 57.4	209°28.7	·· 07.6	273°51.1	·· 44.5	312°30.3	·· 22.3
10	298°06.7	299°50.4	56.1	224°30.3	07.6	288°53.1	44.7	327°32.5	22.2
11	313°09.1	314°50.1	54.8	239°31.8	07.7	303°55.1	44.9	342°34.7	22.1
12	328°11.6	329°49.8	S01°53.5	254°33.3	N25°07.8	318°57.1	N02°45.2	357°36.9	S13°22.0
13	343°14.0	344°49.4	52.2	269°34.8	07.8	333°59.0	45.4	12°39.0	21.9
14	358°16.5	359°49.1	50.9	284°36.3	07.9	349°01.0	45.6	27°41.2	21.8
15	13°19.0	14°48.8	·· 49.6	299°37.9	·· 08.0	4°03.0	·· 45.8	42°43.4	·· 21.7
16	28°21.4	29°48.5	48.3	314°39.4	08.0	19°05.0	46.0	57°45.5	21.6
17	43°23.9	44°48.1	47.0	329°40.9	08.1	34°06.9	46.2	72°47.7	21.5
18	58°26.4	59°47.8	S01°45.7	344°42.4	N25°08.2	49°08.9	N02°46.4	87°49.9	S13°21.4
19	73°28.8	74°47.5	44.4	359°43.9	08.2	64°10.9	46.7	102°52.1	21.3
20	88°31.3	89°47.1	43.1	14°45.5	08.3	79°12.9	46.9	117°54.2	21.2
21	103°33.8	104°46.8	·· 41.8	29°47.0	·· 08.4	94°14.8	·· 47.1	132°56.4	·· 21.1
22	118°36.2	119°46.5	40.5	44°48.5	08.4	109°16.8	47.3	147°58.6	21.0
23	133°38.7	134°46.2	39.2	59°50.0	08.5	124°18.8	47.5	163°00.7	20.9
Mer.pass. 14:07		ν -0.3′ d 1.3′ m -3.94		ν 1.5′ d 0.1′ m 0.17		ν 2.0′ d 0.2′ m -2.13		ν 2.2′ d 0.1′ m 0.81	

Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	148°41.1	149°45.8	S01°37.9	74°51.5	N25°08.6	139°20.8	N02°47.7	178°02.9	S13°20.8
1	163°43.6	164°45.5	36.6	89°53.0	08.6	154°22.7	47.9	193°05.1	20.7
2	178°46.1	179°45.2	35.3	104°54.5	08.7	169°24.7	48.2	208°07.3	20.6
3	193°48.5	194°44.8	·· 34.0	119°56.1	·· 08.8	184°26.7	·· 48.4	223°09.4	·· 20.5
4	208°51.0	209°44.5	32.6	134°57.6	08.9	199°28.7	48.6	238°11.6	20.4
5	223°53.5	224°44.2	31.3	149°59.1	08.9	214°30.6	48.8	253°13.8	20.3
6	238°55.9	239°43.9	S01°30.0	165°00.6	N25°09.0	229°32.6	N02°49.0	268°15.9	S13°20.2
7	253°58.4	254°43.5	28.7	180°02.1	09.1	244°34.6	49.2	283°18.1	20.1
8	269°00.9	269°43.2	27.4	195°03.6	09.1	259°36.6	49.4	298°20.3	20.0
9	284°03.3	284°42.9	·· 26.1	210°05.1	·· 09.2	274°38.5	·· 49.7	313°22.5	·· 19.9
10	299°05.8	299°42.6	24.8	225°06.6	09.3	289°40.5	49.9	328°24.6	19.8
11	314°08.3	314°42.2	23.5	240°08.1	09.3	304°42.5	50.1	343°26.8	19.7
12	329°10.7	329°41.9	S01°22.2	255°09.6	N25°09.4	319°44.5	N02°50.3	358°29.0	S13°19.6
13	344°13.2	344°41.6	20.9	270°11.1	09.5	334°46.4	50.5	13°31.1	19.5
14	359°15.6	359°41.3	19.6	285°12.7	09.5	349°48.4	50.7	28°33.3	19.4
15	14°18.1	14°40.9	·· 18.3	300°14.2	·· 09.6	4°50.4	·· 51.0	43°35.5	·· 19.3
16	29°20.6	29°40.6	17.0	315°15.7	09.7	19°52.3	51.2	58°37.7	19.2
17	44°23.0	44°40.3	15.7	330°17.2	09.7	34°54.3	51.4	73°39.8	19.1
18	59°25.5	59°40.0	S01°14.4	345°18.7	N25°09.8	49°56.3	N02°51.6	88°42.0	S13°18.9
19	74°28.0	74°39.6	13.1	0°20.2	09.9	64°58.3	51.8	103°44.2	18.8
20	89°30.4	89°39.3	11.8	15°21.7	09.9	80°00.2	52.0	118°46.3	18.7
21	104°32.9	104°39.0	·· 10.5	30°23.2	·· 10.0	95°02.2	·· 52.2	133°48.5	·· 18.6
22	119°35.4	119°38.7	09.2	45°24.7	10.1	110°04.2	52.5	148°50.7	18.5
23	134°37.8	134°38.3	07.9	60°26.2	10.1	125°06.2	52.7	163°52.9	18.4
Mer.pass. 14:03		ν -0.3′ d 1.3′ m -3.94		ν 1.5′ d 0.1′ m 0.20		ν 2.0′ d 0.2′ m -2.13		ν 2.2′ d 0.1′ m 0.82	

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	149°40.3	149°38.0	S01°06.5	75°27.7	N25°10.2	140°08.1	N02°52.9	178°55.0	S13°18.3
1	164°42.8	164°37.7	05.2	90°29.2	10.3	155°10.1	53.1	193°57.2	18.2
2	179°45.2	179°37.4	03.9	105°30.7	10.3	170°12.1	53.3	208°59.4	18.1
3	194°47.7	194°37.0	·· 02.6	120°32.1	·· 10.4	185°14.0	·· 53.5	224°01.5	·· 18.0
4	209°50.1	209°36.7	01.3	135°33.6	10.5	200°16.0	53.8	239°03.7	17.9
5	224°52.6	224°36.4	01°00.0	150°35.1	10.5	215°18.0	54.0	254°05.9	17.8
6	239°55.1	239°36.1	S00°58.7	165°36.6	N25°10.6	230°20.0	N02°54.2	269°08.1	S13°17.7
7	254°57.5	254°35.8	57.4	180°38.1	10.7	245°21.9	54.4	284°10.2	17.6
8	270°00.0	269°35.4	56.1	195°39.6	10.7	260°23.9	54.6	299°12.4	17.5
9	285°02.5	284°35.1	·· 54.8	210°41.1	·· 10.8	275°25.9	·· 54.8	314°14.6	·· 17.4
10	300°04.9	299°34.8	53.5	225°42.6	10.9	290°27.8	55.1	329°16.8	17.3
11	315°07.4	314°34.5	52.2	240°44.1	10.9	305°29.8	55.3	344°18.9	17.2
12	330°09.9	329°34.1	S00°50.9	255°45.6	N25°11.0	320°31.8	N02°55.5	359°21.1	S13°17.1
13	345°12.3	344°33.8	49.6	270°47.1	11.1	335°33.8	55.7	14°23.3	17.0
14	0°14.8	359°33.5	48.3	285°48.6	11.1	350°35.7	55.9	29°25.4	16.9
15	15°17.2	14°33.2	·· 47.0	300°50.0	·· 11.2	5°37.7	·· 56.1	44°27.6	·· 16.8
16	30°19.7	29°32.9	45.6	315°51.5	11.3	20°39.7	56.3	59°29.8	16.7
17	45°22.2	44°32.5	44.3	330°53.0	11.3	35°41.6	56.6	74°32.0	16.6
18	60°24.6	59°32.2	S00°43.0	345°54.5	N25°11.4	50°43.6	N02°56.8	89°34.1	S13°16.5
19	75°27.1	74°31.9	41.7	0°56.0	11.5	65°45.6	57.0	104°36.3	16.4
20	90°29.6	89°31.6	40.4	15°57.5	11.5	80°47.5	57.2	119°38.5	16.3
21	105°32.0	104°31.2	·· 39.1	30°59.0	·· 11.6	95°49.5	·· 57.4	134°40.6	·· 16.2
22	120°34.5	119°30.9	37.8	46°00.4	11.7	110°51.5	57.6	149°42.8	16.1
23	135°37.0	134°30.6	36.5	61°01.9	11.7	125°53.5	57.9	164°45.0	16.0
Mer.pass. 13:59		ν -0.3′ d 1.3′ m -3.94		ν 1.5′ d 0.1′ m 0.22		ν 2.0′ d 0.2′ m -2.12		ν 2.2′ d 0.1′ m 0.83	

Stars

	SHA	**Dec**
Alpheratz	357°36.7	29°13.0
Ankaa	353°09.0	-42°11.1
Schedar	349°33.2	56°39.9
Diphda	348°49.1	-17°51.8
Achernar	335°21.7	-57°07.5
Hamal	327°53.1	23°34.3
Polaris	314°53.1	89°22.0
Acamar	315°13.0	-40°13.0
Menkar	314°07.8	4°10.7
Mirfak	308°30.5	49°56.7
Aldebaran	290°41.3	16°33.3
Rigel	281°05.2	-8°10.6
Capella	280°24.0	46°01.4
Bellatrix	278°24.4	6°22.2
Elnath	278°03.7	28°37.6
Alnilam	275°39.2	-1°11.3
Betelgeuse	270°53.6	7°24.6
Canopus	263°52.8	-52°42.7
Sirius	258°27.4	-16°45.0
Adhara	255°06.8	-29°00.4
Procyon	244°52.2	5°09.9
Pollux	243°18.9	27°58.2
Avior	234°14.8	-59°35.1
Suhail	222°47.0	-43°31.6
Miaplacidus	221°37.7	-69°48.7
Alphard	217°49.0	-8°45.6
Regulus	207°35.8	11°51.2
Dubhe	193°42.3	61°37.5
Denebola	182°26.2	14°26.5
Gienah	175°44.9	-17°40.2
Acrux	173°01.3	-63°13.4
Gacrux	171°52.9	-57°14.4
Alioth	166°13.9	55°49.8
Spica	158°23.7	-11°16.9
Alkaid	152°53.0	49°11.6
Hadar	148°37.9	-60°28.8
Menkent	147°59.3	-36°28.9
Arcturus	145°49.2	19°03.5
Rigil Kent.	139°42.2	-60°55.6
Kochab	137°19.5	74°03.3
Zuben'ubi	136°57.7	-16°08.3
Alphecca	126°05.0	26°38.0
Antares	112°17.8	-26°28.9
Atria	107°13.6	-69°03.9
Sabik	102°04.7	-15°45.2
Shaula	96°12.7	-37°07.1
Rasalhague	96°00.1	12°32.4
Eltanin	90°43.2	51°28.8
Kaus Aust.	83°34.8	-34°22.4
Vega	80°34.5	38°48.0
Nunki	75°49.9	-26°16.1
Altair	62°01.7	8°55.6
Peacock	53°08.7	-56°39.6
Deneb	49°27.3	45°21.6
Enif	33°40.6	9°58.7
Al Na'ir	27°35.3	-46°51.1
Fomalhaut	15°16.6	-29°30.2
Scheat	13°47.1	28°12.4
Markab	13°31.8	15°19.6

Feb 18 Sat	**SHA**	**Mer.pass**
Venus	2°11.7	14:01
Mars	286°33.0	19:01
Jupiter	350°51.3	14:44
Saturn	29°28.8	12:10

Feb 19 Sun	**SHA**	**Mer.pass**
Venus	1°04.7	14:01
Mars	286°10.4	18:59
Jupiter	350°39.6	14:41
Saturn	29°21.8	12:06

Feb 20 Mon	**SHA**	**Mer.pass**
Venus	359°57.7	14:02
Mars	285°47.4	18:56
Jupiter	350°27.8	14:38
Saturn	29°14.7	12:03

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h

Sun			Moon				
Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°31.1	S11°48.2	208°08.6	2.5′	S25°43.3	7.0′	60.8′
1	191°31.2	47.4	222°30.1	2.6′	25°36.3	7.1′	60.9′
2	206°31.2	46.5	236°51.7	2.6′	25°29.2	7.3′	60.9′
3	221°31.3	·· 45.6	251°13.3	2.7′	25°21.9	7.5′	60.9′
4	236°31.3	44.7	265°35.1	2.8′	25°14.4	7.7′	60.9′
5	251°31.4	43.8	279°56.8	2.8′	25°06.7	7.8′	60.9′
6	266°31.4	S11°43.0	294°18.6	2.9′	S24°58.9	8.1′	60.9′
7	281°31.5	42.1	308°40.5	3.0′	24°50.8	8.3′	60.9′
8	296°31.5	41.2	323°02.5	3.0′	24°42.5	8.4′	61.0′
9	311°31.6	·· 40.3	337°24.5	3.1′	24°34.1	8.6′	61.0′
10	326°31.6	39.4	351°46.6	3.2′	24°25.5	8.8′	61.0′
11	341°31.7	38.5	6°08.8	3.3′	24°16.7	9.0′	61.0′
12	356°31.7	S11°37.7	20°31.1	3.3′	S24°07.7	9.2′	61.0′
13	11°31.8	36.8	34°53.4	3.4′	23°58.5	9.3′	61.0′
14	26°31.8	35.9	49°15.8	3.5′	23°49.2	9.6′	61.0′
15	41°31.9	·· 35.0	63°38.3	3.6′	23°39.6	9.7′	61.0′
16	56°31.9	34.1	78°00.9	3.7′	23°29.9	9.8′	61.0′
17	71°32.0	33.2	92°23.6	3.7′	23°20.1	10.1′	61.1′
18	86°32.0	S11°32.4	106°46.3	3.8′	S23°10.0	10.2′	61.1′
19	101°32.1	31.5	121°09.1	3.9′	22°59.8	10.3′	61.1′
20	116°32.1	30.6	135°32.1	4.0′	22°49.5	10.6′	61.1′
21	131°32.2	·· 29.7	149°55.1	4.1′	22°38.9	10.7′	61.1′
22	146°32.2	28.8	164°18.2	4.2′	22°28.2	10.9′	61.1′
23	161°32.3	27.9	178°41.4	4.3′	22°17.3	11.0′	61.1′
	SD = 16.2′	d = 0.9′	SD = 16.6′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°32.3	S11°27.0	193°04.7	4.4′	S22°06.3	11.2′	61.1′
1	191°32.4	26.1	207°28.1	4.5′	21°55.1	11.3′	61.1′
2	206°32.5	25.3	221°51.5	4.6′	21°43.8	11.5′	61.1′
3	221°32.5	·· 24.4	236°15.1	4.7′	21°32.3	11.7′	61.1′
4	236°32.6	23.5	250°38.8	4.8′	21°20.6	11.8′	61.1′
5	251°32.6	22.6	265°02.6	4.9′	21°08.8	11.9′	61.1′
6	266°32.7	S11°21.7	279°26.4	5.0′	S20°56.9	12.1′	61.1′
7	281°32.7	20.8	293°50.4	5.1′	20°44.8	12.2′	61.1′
8	296°32.8	19.9	308°14.5	5.2′	20°32.6	12.4′	61.1′
9	311°32.8	·· 19.0	322°38.7	5.3′	20°20.2	12.5′	61.1′
10	326°32.9	18.1	337°02.9	5.4′	20°07.7	12.7′	61.1′
11	341°33.0	17.3	351°27.3	5.5′	19°55.0	12.8′	61.1′
12	356°33.0	S11°16.4	5°51.8	5.6′	S19°42.2	12.9′	61.1′
13	11°33.1	15.5	20°16.4	5.7′	19°29.3	13.0′	61.1′
14	26°33.1	14.6	34°41.1	5.8′	19°16.3	13.2′	61.1′
15	41°33.2	·· 13.7	49°05.8	5.9′	19°03.1	13.3′	61.1′
16	56°33.3	12.8	63°30.7	6.0′	18°49.8	13.4′	61.1′
17	71°33.3	11.9	77°55.7	6.1′	18°36.4	13.6′	61.1′
18	86°33.4	S11°11.0	92°20.8	6.2′	S18°22.8	13.7′	61.1′
19	101°33.4	10.1	106°46.0	6.3′	18°09.1	13.8′	61.1′
20	116°33.5	09.2	121°11.3	6.4′	17°55.3	13.9′	61.1′
21	131°33.6	·· 08.3	135°36.8	6.5′	17°41.4	14.0′	61.1′
22	146°33.6	07.4	150°02.3	6.6′	17°27.4	14.1′	61.1′
23	161°33.7	06.5	164°27.9	6.7′	17°13.3	14.2′	61.1′
	SD = 16.2′	d = 0.9′	SD = 16.7′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°33.7	S11°05.7	178°53.6	6.8′	S16°59.1	14.4′	61.1′
1	191°33.8	04.8	193°19.4	6.9′	16°44.7	14.4′	61.1′
2	206°33.9	03.9	207°45.4	7.0′	16°30.3	14.6′	61.0′
3	221°33.9	·· 03.0	222°11.4	7.1′	16°15.7	14.6′	61.0′
4	236°34.0	02.1	236°37.5	7.2′	16°01.1	14.8′	61.0′
5	251°34.0	01.2	251°03.7	7.3′	15°46.3	14.8′	61.0′
6	266°34.1	S11°00.3	265°30.1	7.4′	S15°31.5	14.9′	61.0′
7	281°34.2	10°59.4	279°56.5	7.5′	15°16.6	15.1′	61.0′
8	296°34.2	58.5	294°23.1	7.6′	15°01.5	15.1′	61.0′
9	311°34.3	·· 57.6	308°49.7	7.7′	14°46.4	15.2′	61.0′
10	326°34.4	56.7	323°16.4	7.8′	14°31.2	15.2′	61.0′
11	341°34.4	55.8	337°43.2	7.9′	14°16.0	15.4′	60.9′
12	356°34.5	S10°54.9	352°10.2	8.0′	S14°00.6	15.4′	60.9′
13	11°34.6	54.0	6°37.2	8.1′	13°45.2	15.5′	60.9′
14	26°34.6	53.1	21°04.3	8.2′	13°29.7	15.6′	60.9′
15	41°34.7	·· 52.2	35°31.5	8.3′	13°14.1	15.7′	60.9′
16	56°34.8	51.3	49°58.9	8.4′	12°58.4	15.7′	60.9′
17	71°34.8	50.4	64°26.3	8.5′	12°42.7	15.8′	60.8′
18	86°34.9	S10°49.5	78°53.8	8.6′	S12°26.9	15.9′	60.8′
19	101°34.9	48.6	93°21.4	8.7′	12°11.0	15.9′	60.8′
20	116°35.0	47.7	107°49.0	8.8′	11°55.1	16.0′	60.8′
21	131°35.1	·· 46.8	122°16.8	8.9′	11°39.1	16.0′	60.8′
22	146°35.2	45.9	136°44.7	9.0′	11°23.1	16.2′	60.7′
23	161°35.2	45.0	151°12.6	9.0′	11°06.9	16.1′	60.7′
	SD = 16.2′	d = 0.9′	SD = 16.7′				

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

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

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 28-0 8-0%
18	13:55	13:53	12:14	10:34	23:05	
19	13:51	13:48	12:14	11:36	–:–	
20	13:45	13:42	12:14	12:33	00:05	

February 21, 22, 23 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	150°39.4	149°30.3	S00°35.2	76°03.4	N25°11.8	140°55.4	N02°58.1	179°47.2	S13°15.9
1	165°41.9	164°30.0	33.9	91°04.9	11.9	155°57.4	58.3	194°49.3	15.8
2	180°44.4	179°29.6	32.6	106°06.4	11.9	170°59.4	58.5	209°51.5	15.7
3	195°46.8	194°29.3	·· 31.3	121°07.8	·· 12.0	186°01.3	·· 58.7	224°53.7	·· 15.6
4	210°49.3	209°29.0	30.0	136°09.3	12.1	201°03.3	58.9	239°55.8	15.5
5	225°51.7	224°28.7	28.7	151°10.8	12.1	216°05.3	59.2	254°58.0	15.4
6	240°54.2	239°28.4	S00°27.3	166°12.3	N25°12.2	231°07.2	N02°59.4	270°00.2	S13°15.3
7	255°56.7	254°28.0	26.0	181°13.8	12.3	246°09.2	59.6	285°02.4	15.2
8	270°59.1	269°27.7	24.7	196°15.2	12.3	261°11.2	02°59.8	300°04.5	15.1
9	286°01.6	284°27.4	·· 23.4	211°16.7	·· 12.4	276°13.1	03°00.0	315°06.7	·· 15.0
10	301°04.1	299°27.1	22.1	226°18.2	12.5	291°15.1	00.2	330°08.9	14.9
11	316°06.5	314°26.8	20.8	241°19.7	12.5	306°17.1	00.5	345°11.1	14.8
12	331°09.0	329°26.4	S00°19.5	256°21.1	N25°12.6	321°19.1	N03°00.7	0°13.2	S13°14.7
13	346°11.5	344°26.1	18.2	271°22.6	12.7	336°21.0	00.9	15°15.4	14.5
14	1°13.9	359°25.8	16.9	286°24.1	12.7	351°23.0	01.1	30°17.6	14.4
15	16°16.4	14°25.5	·· 15.6	301°25.5	·· 12.8	6°25.0	·· 01.3	45°19.7	·· 14.3
16	31°18.9	29°25.2	14.3	316°27.0	12.9	21°26.9	01.5	60°21.9	14.2
17	46°21.3	44°24.8	13.0	331°28.5	12.9	36°28.9	01.8	75°24.1	14.1
18	61°23.8	59°24.5	S00°11.7	346°30.0	N25°13.0	51°30.9	N03°02.0	90°26.3	S13°14.0
19	76°26.2	74°24.2	10.4	1°31.4	13.1	66°32.8	02.2	105°28.4	13.9
20	91°28.7	89°23.9	09.0	16°32.9	13.1	81°34.8	02.4	120°30.6	13.8
21	106°31.2	104°23.6	·· 07.7	31°34.4	·· 13.2	96°36.8	·· 02.6	135°32.8	·· 13.7
22	121°33.6	119°23.2	06.4	46°35.8	13.3	111°38.7	02.8	150°34.9	13.6
23	136°36.1	134°22.9	05.1	61°37.3	13.3	126°40.7	03.1	165°37.1	13.5
Mer.pass. 13:55		ν -0.3′ d 1.3′ m -3.94		ν 1.5′ d 0.1′ m 0.24		ν 2.0′ d 0.2′ m -2.12		ν 2.2′ d 0.1′ m 0.84	

Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	151°38.6	149°22.6	S00°03.8	76°38.8	N25°13.4	141°42.7	N03°03.3	180°39.3	S13°13.4
1	166°41.0	164°22.3	02.5	91°40.2	13.5	156°44.6	03.5	195°41.5	13.3
2	181°43.5	179°22.0	S00°01.2	106°41.7	13.5	171°46.6	03.7	210°43.6	13.2
3	196°46.0	194°21.7	N00°00.1	121°43.1	·· 13.6	186°48.6	·· 03.9	225°45.8	·· 13.1
4	211°48.4	209°21.3	01.4	136°44.6	13.6	201°50.5	04.2	240°48.0	13.0
5	226°50.9	224°21.0	02.7	151°46.1	13.7	216°52.5	04.4	255°50.2	12.9
6	241°53.3	239°20.7	N00°04.0	166°47.5	N25°13.8	231°54.5	N03°04.6	270°52.3	S13°12.8
7	256°55.8	254°20.4	05.3	181°49.0	13.8	246°56.4	04.8	285°54.5	12.7
8	271°58.3	269°20.1	06.7	196°50.5	13.9	261°58.4	05.0	300°56.7	12.6
9	287°00.7	284°19.7	·· 08.0	211°51.9	·· 14.0	277°00.4	·· 05.2	315°58.8	·· 12.5
10	302°03.2	299°19.4	09.3	226°53.4	14.0	292°02.3	05.5	331°01.0	12.4
11	317°05.7	314°19.1	10.6	241°54.8	14.1	307°04.3	05.7	346°03.2	12.3
12	332°08.1	329°18.8	N00°11.9	256°56.3	N25°14.2	322°06.3	N03°05.9	1°05.4	S13°12.2
13	347°10.6	344°18.5	13.2	271°57.7	14.2	337°08.2	06.1	16°07.5	12.1
14	2°13.1	359°18.2	14.5	286°59.2	14.3	352°10.2	06.3	31°09.7	12.0
15	17°15.5	14°17.8	·· 15.8	302°00.7	·· 14.4	7°12.1	·· 06.5	46°11.9	·· 11.9
16	32°18.0	29°17.5	17.1	317°02.1	14.4	22°14.1	06.8	61°14.1	11.8
17	47°20.5	44°17.2	18.4	332°03.6	14.5	37°16.1	07.0	76°16.2	11.7
18	62°22.9	59°16.9	N00°19.7	347°05.0	N25°14.6	52°18.0	N03°07.2	91°18.4	S13°11.6
19	77°25.4	74°16.6	21.0	2°06.5	14.6	67°20.0	07.4	106°20.6	11.5
20	92°27.8	89°16.3	22.3	17°07.9	14.7	82°22.0	07.6	121°22.7	11.4
21	107°30.3	104°15.9	·· 23.7	32°09.4	·· 14.7	97°23.9	·· 07.9	136°24.9	·· 11.3
22	122°32.8	119°15.6	25.0	47°10.8	14.8	112°25.9	08.1	151°27.1	11.2
23	137°35.2	134°15.3	26.3	62°12.3	14.9	127°27.9	08.3	166°29.3	11.1
Mer.pass. 13:51		ν -0.3′ d 1.3′ m -3.94		ν 1.5′ d 0.1′ m 0.27		ν 2.0′ d 0.2′ m -2.12		ν 2.2′ d 0.1′ m 0.85	

Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	152°37.7	149°15.0	N00°27.6	77°13.7	N25°14.9	142°29.8	N03°08.5	181°31.4	S13°11.0
1	167°40.2	164°14.7	28.9	92°15.2	15.0	157°31.8	08.7	196°33.6	10.9
2	182°42.6	179°14.4	30.2	107°16.6	15.1	172°33.8	08.9	211°35.8	10.8
3	197°45.1	194°14.0	·· 31.5	122°18.1	·· 15.1	187°35.7	·· 09.2	226°38.0	·· 10.7
4	212°47.6	209°13.7	32.8	137°19.5	15.2	202°37.7	09.4	241°40.1	10.6
5	227°50.0	224°13.4	34.1	152°21.0	15.3	217°39.6	09.6	256°42.3	10.5
6	242°52.5	239°13.1	N00°35.4	167°22.4	N25°15.3	232°41.6	N03°09.8	271°44.5	S13°10.4
7	257°54.9	254°12.8	36.7	182°23.9	15.4	247°43.6	10.0	286°46.6	10.3
8	272°57.4	269°12.5	38.0	197°25.3	15.5	262°45.5	10.3	301°48.8	10.2
9	287°59.9	284°12.2	·· 39.4	212°26.7	·· 15.5	277°47.5	·· 10.5	316°51.0	·· 10.1
10	303°02.3	299°11.8	40.7	227°28.2	15.6	292°49.5	10.7	331°53.2	09.9
11	318°04.8	314°11.5	42.0	242°29.6	15.6	307°51.4	10.9	346°55.3	09.8
12	333°07.3	329°11.2	N00°43.3	257°31.1	N25°15.7	322°53.4	N03°11.1	1°57.5	S13°09.7
13	348°09.7	344°10.9	44.6	272°32.5	15.8	337°55.4	11.3	16°59.7	09.6
14	3°12.2	359°10.6	45.9	287°34.0	15.8	352°57.3	11.6	32°01.9	09.5
15	18°14.7	14°10.3	·· 47.2	302°35.4	·· 15.9	7°59.3	·· 11.8	47°04.0	·· 09.4
16	33°17.1	29°09.9	48.5	317°36.8	16.0	23°01.2	12.0	62°06.2	09.3
17	48°19.6	44°09.6	49.8	332°38.3	16.0	38°03.2	12.2	77°08.4	09.2
18	63°22.1	59°09.3	N00°51.1	347°39.7	N25°16.1	53°05.2	N03°12.4	92°10.5	S13°09.1
19	78°24.5	74°09.0	52.4	2°41.2	16.2	68°07.1	12.7	107°12.7	09.0
20	93°27.0	89°08.7	53.7	17°42.6	16.2	83°09.1	12.9	122°14.9	08.9
21	108°29.4	104°08.4	·· 55.1	32°44.0	·· 16.3	98°11.1	·· 13.1	137°17.1	·· 08.8
22	123°31.9	119°08.1	56.4	47°45.5	16.3	113°13.0	13.3	152°19.2	08.7
23	138°34.4	134°07.7	57.7	62°46.9	16.4	128°15.0	13.5	167°21.4	08.6
Mer.pass. 13:47		ν -0.3′ d 1.3′ m -3.94		ν 1.4′ d 0.1′ m 0.29		ν 2.0′ d 0.2′ m -2.11		ν 2.2′ d 0.1′ m 0.86	

Stars

	SHA	**Dec**
Alpheratz	357°36.7	29°13.0
Ankaa	353°09.0	-42°11.1
Schedar	349°33.3	56°39.9
Diphda	348°49.1	-17°51.8
Achernar	335°21.7	-57°07.5
Hamal	327°53.1	23°34.3
Polaris	314°54.7	89°22.0
Acamar	315°13.1	-40°13.0
Menkar	314°07.8	4°10.7
Mirfak	308°30.6	49°56.7
Aldebaran	290°41.3	16°33.3
Rigel	281°05.3	-8°10.6
Capella	280°24.0	46°01.4
Bellatrix	278°24.4	6°22.2
Elnath	278°03.7	28°37.6
Alnilam	275°39.2	-1°11.3
Betelgeuse	270°53.6	7°24.6
Canopus	263°52.8	-52°42.7
Sirius	258°27.4	-16°45.0
Adhara	255°06.8	-29°00.4
Procyon	244°52.2	5°09.9
Pollux	243°18.9	27°58.2
Avior	234°14.8	-59°35.1
Suhail	222°47.0	-43°31.6
Miaplacidus	221°37.7	-69°48.7
Alphard	217°49.0	-8°45.6
Regulus	207°35.8	11°51.2
Dubhe	193°42.2	61°37.5
Denebola	182°26.2	14°26.5
Gienah	175°44.9	-17°40.2
Acrux	173°01.3	-63°13.5
Gacrux	171°52.9	-57°14.4
Alioth	166°13.9	55°49.8
Spica	158°23.7	-11°16.9
Alkaid	152°52.9	49°11.6
Hadar	148°37.9	-60°28.8
Menkent	147°59.3	-36°28.9
Arcturus	145°49.2	19°03.5
Rigil Kent.	139°42.2	-60°55.6
Kochab	137°19.4	74°03.3
Zuben'ubi	136°57.6	-16°08.3
Alphecca	126°05.0	26°38.0
Antares	112°17.8	-26°28.9
Atria	107°13.5	-69°03.9
Sabik	102°04.7	-15°45.2
Shaula	96°12.6	-37°07.1
Rasalhague	96°00.1	12°32.4
Eltanin	90°43.1	51°28.8
Kaus Aust.	83°34.8	-34°22.4
Vega	80°34.5	38°48.0
Nunki	75°49.9	-26°16.1
Altair	62°01.7	8°55.6
Peacock	53°08.7	-56°39.6
Deneb	49°27.3	45°21.5
Enif	33°40.6	9°58.7
Al Na'ir	27°35.3	-46°51.1
Fomalhaut	15°16.6	-29°30.2
Scheat	13°47.1	28°12.4
Markab	13°31.8	15°19.6

Feb 21 Tue	**SHA**	**Mer.pass**
Venus	358°50.9	14:02
Mars	285°24.0	18:54
Jupiter	350°16.0	14:34
Saturn	29°07.7	11:59

Feb 22 Wed	**SHA**	**Mer.pass**
Venus	357°44.0	14:03
Mars	285°00.2	18:52
Jupiter	350°04.1	14:31
Saturn	29°00.7	11:56

Feb 23 Thu	**SHA**	**Mer.pass**
Venus	356°37.3	14:03
Mars	284°36.0	18:49
Jupiter	349°52.1	14:28
Saturn	28°53.7	11:52

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°35.3	S10°44.1	165°40.7	9.1′	S10°50.8	16.2′	60.7′
1	191°35.4	43.2	180°08.8	9.2′	10°34.6	16.3′	60.7′
2	206°35.4	42.3	194°37.0	9.3′	10°18.3	16.3′	60.7′
3	221°35.5	·· 41.4	209°05.3	9.4′	10°02.0	16.3′	60.6′
4	236°35.6	40.5	223°33.7	9.5′	09°45.7	16.4′	60.6′
5	251°35.6	39.6	238°02.2	9.5′	09°29.3	16.5′	60.6′
6	266°35.7	S10°38.7	252°30.7	9.6′	S09°12.8	16.5′	60.6′
7	281°35.8	37.8	266°59.3	9.7′	08°56.3	16.5′	60.5′
8	296°35.8	36.9	281°28.1	9.8′	08°39.8	16.5′	60.5′
9	311°35.9	·· 36.0	295°56.8	9.9′	08°23.3	16.6′	60.5′
10	326°36.0	35.1	310°25.7	9.9′	08°06.7	16.6′	60.5′
11	341°36.1	34.2	324°54.6	10.0′	07°50.1	16.7′	60.4′
12	356°36.1	S10°33.3	339°23.7	10.1′	S07°33.4	16.7′	60.4′
13	11°36.2	32.3	353°52.7	10.2′	07°16.7	16.7′	60.4′
14	26°36.3	31.4	8°21.9	10.2′	07°00.0	16.7′	60.4′
15	41°36.3	·· 30.5	22°51.1	10.3′	06°43.3	16.7′	60.3′
16	56°36.4	29.6	37°20.4	10.4′	06°26.6	16.8′	60.3′
17	71°36.5	28.7	51°49.8	10.4′	06°09.8	16.8′	60.3′
18	86°36.6	S10°27.8	66°19.3	10.5′	S05°53.0	16.8′	60.3′
19	101°36.6	26.9	80°48.8	10.6′	05°36.2	16.8′	60.2′
20	116°36.7	26.0	95°18.3	10.6′	05°19.4	16.8′	60.2′
21	131°36.8	·· 25.1	109°48.0	10.7′	05°02.6	16.8′	60.2′
22	146°36.9	24.2	124°17.7	10.8′	04°45.8	16.9′	60.1′
23	161°36.9	23.3	138°47.4	10.8′	04°28.9	16.8′	60.1′
	SD = 16.2′	d = 0.9′	SD = 16.6′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°37.0	S10°22.4	153°17.2	10.9′	S04°12.1	16.9′	60.1′
1	191°37.1	21.5	167°47.1	10.9′	03°55.2	16.8′	60.0′
2	206°37.2	20.6	182°17.1	11.0′	03°38.4	16.9′	60.0′
3	221°37.2	·· 19.6	196°47.1	11.1′	03°21.5	16.8′	60.0′
4	236°37.3	18.7	211°17.1	11.1′	03°04.7	16.9′	59.9′
5	251°37.4	17.8	225°47.2	11.2′	02°47.8	16.8′	59.9′
6	266°37.5	S10°16.9	240°17.4	11.2′	S02°31.0	16.9′	59.9′
7	281°37.5	16.0	254°47.6	11.3′	02°14.1	16.8′	59.8′
8	296°37.6	15.1	269°17.8	11.3′	01°57.3	16.8′	59.8′
9	311°37.7	·· 14.2	283°48.1	11.4′	01°40.5	16.9′	59.8′
10	326°37.8	13.3	298°18.5	11.4′	01°23.6	16.8′	59.7′
11	341°37.8	12.4	312°48.9	11.4′	01°06.8	16.7′	59.7′
12	356°37.9	S10°11.4	327°19.4	11.5′	S00°50.1	16.8′	59.7′
13	11°38.0	10.5	341°49.9	11.5′	00°33.3	16.8′	59.6′
14	26°38.1	09.6	356°20.4	11.6′	S00°16.5	16.7′	59.6′
15	41°38.2	·· 08.7	10°51.0	11.6′	N00°00.2	16.7′	59.6′
16	56°38.2	07.8	25°21.6	11.7′	00°16.9	16.7′	59.5′
17	71°38.3	06.9	39°52.2	11.7′	00°33.6	16.7′	59.5′
18	86°38.4	S10°06.0	54°22.9	11.7′	N00°50.3	16.6′	59.5′
19	101°38.5	05.1	68°53.7	11.8′	01°06.9	16.6′	59.4′
20	116°38.6	04.1	83°24.4	11.8′	01°23.5	16.6′	59.4′
21	131°38.6	·· 03.2	97°55.2	11.8′	01°40.1	16.6′	59.4′
22	146°38.7	02.3	112°26.1	11.9′	01°56.7	16.5′	59.3′
23	161°38.8	01.4	126°57.0	11.9′	02°13.2	16.5′	59.3′
	SD = 16.2′	d = 0.9′	SD = 16.4′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°38.9	S10°00.5	141°27.9	11.9′	N02°29.7	16.4′	59.2′
1	191°39.0	09°59.6	155°58.8	12.0′	02°46.1	16.5′	59.2′
2	206°39.0	58.7	170°29.7	12.0′	03°02.6	16.3′	59.2′
3	221°39.1	·· 57.7	185°00.7	12.0′	03°18.9	16.4′	59.1′
4	236°39.2	56.8	199°31.7	12.0′	03°35.3	16.3′	59.1′
5	251°39.3	55.9	214°02.8	12.1′	03°51.6	16.3′	59.0′
6	266°39.4	S09°55.0	228°33.8	12.1′	N04°07.9	16.2′	59.0′
7	281°39.5	54.1	243°04.9	12.1′	04°24.1	16.1′	59.0′
8	296°39.5	53.2	257°36.0	12.1′	04°40.2	16.2′	58.9′
9	311°39.6	·· 52.2	272°07.1	12.1′	04°56.4	16.1′	58.9′
10	326°39.7	51.3	286°38.3	12.2′	05°12.5	16.0′	58.9′
11	341°39.8	50.4	301°09.4	12.2′	05°28.5	16.0′	58.8′
12	356°39.9	S09°49.5	315°40.6	12.2′	N05°44.5	15.9′	58.8′
13	11°40.0	48.6	330°11.8	12.2′	06°00.4	15.9′	58.7′
14	26°40.0	47.7	344°43.0	12.2′	06°16.3	15.8′	58.7′
15	41°40.1	·· 46.7	359°14.2	12.2′	06°32.1	15.8′	58.7′
16	56°40.2	45.8	13°45.4	12.2′	06°47.9	15.7′	58.6′
17	71°40.3	44.9	28°16.7	12.2′	07°03.6	15.7′	58.6′
18	86°40.4	S09°44.0	42°47.9	12.3′	N07°19.3	15.6′	58.5′
19	101°40.5	43.1	57°19.2	12.3′	07°34.9	15.5′	58.5′
20	116°40.6	42.1	71°50.4	12.3′	07°50.4	15.5′	58.5′
21	131°40.7	·· 41.2	86°21.7	12.3′	08°05.9	15.4′	58.4′
22	146°40.7	40.3	100°53.0	12.3′	08°21.3	15.4′	58.4′
23	161°40.8	39.4	115°24.3	12.3′	08°36.7	15.3′	58.3′
	SD = 16.2′	d = 0.9′	SD = 16.2′				

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

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

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 1-10%
21	13:39	13:36	12:14	13:25	00:59	
22	13:32	13:28	12:13	14:15	01:51	
23	13:24	13:20	12:13	15:03	02:39	

February 24, 25, 26 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	153°36.8	149°07.4	N00°59.0	77°48.3	N25°16.5	143°16.9	N03°13.8	182°23.6	S13°08.5
1	168°39.3	164°07.1	01°00.3	92°49.8	16.5	158°18.9	14.0	197°25.8	08.4
2	183°41.8	179°06.8	01.6	107°51.2	16.6	173°20.9	14.2	212°27.9	08.3
3	198°44.2	194°06.5	·· 02.9	122°52.6	·· 16.7	188°22.8	·· 14.4	227°30.1	·· 08.2
4	213°46.7	209°06.2	04.2	137°54.1	16.7	203°24.8	14.6	242°32.3	08.1
5	228°49.2	224°05.9	05.5	152°55.5	16.8	218°26.7	14.8	257°34.4	08.0
6	243°51.6	239°05.5	N01°06.8	167°56.9	N25°16.8	233°28.7	N03°15.1	272°36.6	S13°07.9
7	258°54.1	254°05.2	08.1	182°58.4	16.9	248°30.7	15.3	287°38.8	07.8
8	273°56.5	269°04.9	09.4	197°59.8	17.0	263°32.6	15.5	302°41.0	07.7
9	288°59.0	284°04.6	·· 10.7	213°01.2	·· 17.0	278°34.6	·· 15.7	317°43.1	·· 07.6
10	304°01.5	299°04.3	12.1	228°02.6	17.1	293°36.5	15.9	332°45.3	07.5
11	319°03.9	314°04.0	13.4	243°04.1	17.2	308°38.5	16.2	347°47.5	07.4
12	334°06.4	329°03.7	N01°14.7	258°05.5	N25°17.2	323°40.5	N03°16.4	2°49.7	S13°07.3
13	349°08.9	344°03.4	16.0	273°06.9	17.3	338°42.4	16.6	17°51.8	07.2
14	4°11.3	359°03.0	17.3	288°08.4	17.3	353°44.4	16.8	32°54.0	07.1
15	19°13.8	14°02.7	·· 18.6	303°09.8	·· 17.4	8°46.3	·· 17.0	47°56.2	·· 07.0
16	34°16.3	29°02.4	19.9	318°11.2	17.5	23°48.3	17.3	62°58.4	06.9
17	49°18.7	44°02.1	21.2	333°12.6	17.5	38°50.3	17.5	78°00.5	06.8
18	64°21.2	59°01.8	N01°22.5	348°14.1	N25°17.6	53°52.2	N03°17.7	93°02.7	S13°06.7
19	79°23.7	74°01.5	23.8	3°15.5	17.7	68°54.2	17.9	108°04.9	06.6
20	94°26.1	89°01.2	25.1	18°16.9	17.7	83°56.1	18.1	123°07.0	06.5
21	109°28.6	104°00.8	·· 26.4	33°18.3	·· 17.8	98°58.1	·· 18.4	138°09.2	·· 06.4
22	124°31.0	119°00.5	27.7	48°19.7	17.8	114°00.1	18.6	153°11.4	06.3
23	139°33.5	134°00.2	29.1	63°21.2	17.9	129°02.0	18.8	168°13.6	06.2
Mer.pass. 13:43		ν -0.3′ d 1.3′ m -3.94		ν 1.4′ d 0.1′ m 0.31		ν 2.0′ d 0.2′ m -2.11		ν 2.2′ d 0.1′ m 0.86	

Sat	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	154°36.0	148°59.9	N01°30.4	78°22.6	N25°18.0	144°04.0	N03°19.0	183°15.7	S13°06.1
1	169°38.4	163°59.6	31.7	93°24.0	18.0	159°05.9	19.2	198°17.9	06.0
2	184°40.9	178°59.3	33.0	108°25.4	18.1	174°07.9	19.5	213°20.1	05.9
3	199°43.4	193°59.0	·· 34.3	123°26.8	·· 18.1	189°09.9	·· 19.7	228°22.3	·· 05.8
4	214°45.8	208°58.7	35.6	138°28.3	18.2	204°11.8	19.9	243°24.4	05.7
5	229°48.3	223°58.3	36.9	153°29.7	18.3	219°13.8	20.1	258°26.6	05.6
6	244°50.8	238°58.0	N01°38.2	168°31.1	N25°18.3	234°15.7	N03°20.3	273°28.8	S13°05.5
7	259°53.2	253°57.7	39.5	183°32.5	18.4	249°17.7	20.6	288°31.0	05.4
8	274°55.7	268°57.4	40.8	198°33.9	18.5	264°19.7	20.8	303°33.1	05.2
9	289°58.2	283°57.1	·· 42.1	213°35.3	·· 18.5	279°21.6	·· 21.0	318°35.3	·· 05.1
10	305°00.6	298°56.8	43.4	228°36.8	18.6	294°23.6	21.2	333°37.5	05.0
11	320°03.1	313°56.5	44.7	243°38.2	18.6	309°25.5	21.4	348°39.7	04.9
12	335°05.5	328°56.2	N01°46.0	258°39.6	N25°18.7	324°27.5	N03°21.7	3°41.8	S13°04.8
13	350°08.0	343°55.8	47.3	273°41.0	18.8	339°29.4	21.9	18°44.0	04.7
14	5°10.5	358°55.5	48.7	288°42.4	18.8	354°31.4	22.1	33°46.2	04.6
15	20°12.9	13°55.2	·· 50.0	303°43.8	·· 18.9	9°33.4	·· 22.3	48°48.3	·· 04.5
16	35°15.4	28°54.9	51.3	318°45.2	18.9	24°35.3	22.5	63°50.5	04.4
17	50°17.9	43°54.6	52.6	333°46.6	19.0	39°37.3	22.8	78°52.7	04.3
18	65°20.3	58°54.3	N01°53.9	348°48.0	N25°19.1	54°39.2	N03°23.0	93°54.9	S13°04.2
19	80°22.8	73°54.0	55.2	3°49.4	19.1	69°41.2	23.2	108°57.0	04.1
20	95°25.3	88°53.7	56.5	18°50.9	19.2	84°43.1	23.4	123°59.2	04.0
21	110°27.7	103°53.3	·· 57.8	33°52.3	·· 19.2	99°45.1	·· 23.6	139°01.4	·· 03.9
22	125°30.2	118°53.0	01°59.1	48°53.7	19.3	114°47.1	23.9	154°03.6	03.8
23	140°32.6	133°52.7	02°00.4	63°55.1	19.4	129°49.0	24.1	169°05.7	03.7
Mer.pass. 13:39		ν -0.3′ d 1.3′ m -3.94		ν 1.4′ d 0.1′ m 0.33		ν 2.0′ d 0.2′ m -2.11		ν 2.2′ d 0.1′ m 0.87	

Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	155°35.1	148°52.4	N02°01.7	78°56.5	N25°19.4	144°51.0	N03°24.3	184°07.9	S13°03.6
1	170°37.6	163°52.1	03.0	93°57.9	19.5	159°52.9	24.5	199°10.1	03.5
2	185°40.0	178°51.8	04.3	108°59.3	19.5	174°54.9	24.7	214°12.3	03.4
3	200°42.5	193°51.5	·· 05.6	124°00.7	·· 19.6	189°56.8	·· 25.0	229°14.4	·· 03.3
4	215°45.0	208°51.2	06.9	139°02.1	19.7	204°58.8	25.2	244°16.6	03.2
5	230°47.4	223°50.8	08.2	154°03.5	19.7	220°00.8	25.4	259°18.8	03.1
6	245°49.9	238°50.5	N02°09.5	169°04.9	N25°19.8	235°02.7	N03°25.6	274°21.0	S13°03.0
7	260°52.4	253°50.2	10.9	184°06.3	19.8	250°04.7	25.8	289°23.1	02.9
8	275°54.8	268°49.9	12.2	199°07.7	19.9	265°06.6	26.1	304°25.3	02.8
9	290°57.3	283°49.6	·· 13.5	214°09.1	·· 20.0	280°08.6	·· 26.3	319°27.5	·· 02.7
10	305°59.8	298°49.3	14.8	229°10.5	20.0	295°10.5	26.5	334°29.7	02.6
11	321°02.2	313°49.0	16.1	244°11.9	20.1	310°12.5	26.7	349°31.8	02.5
12	336°04.7	328°48.7	N02°17.4	259°13.3	N25°20.1	325°14.4	N03°26.9	4°34.0	S13°02.4
13	351°07.1	343°48.4	18.7	274°14.7	20.2	340°16.4	27.2	19°36.2	02.3
14	6°09.6	358°48.0	20.0	289°16.1	20.3	355°18.4	27.4	34°38.3	02.2
15	21°12.1	13°47.7	·· 21.3	304°17.5	·· 20.3	10°20.3	·· 27.6	49°40.5	·· 02.1
16	36°14.5	28°47.4	22.6	319°18.9	20.4	25°22.3	27.8	64°42.7	02.0
17	51°17.0	43°47.1	23.9	334°20.3	20.4	40°24.2	28.1	79°44.9	01.9
18	66°19.5	58°46.8	N02°25.2	349°21.7	N25°20.5	55°26.2	N03°28.3	94°47.0	S13°01.8
19	81°21.9	73°46.5	26.5	4°23.1	20.6	70°28.1	28.5	109°49.2	01.7
20	96°24.4	88°46.2	27.8	19°24.5	20.6	85°30.1	28.7	124°51.4	01.6
21	111°26.9	103°45.9	·· 29.1	34°25.9	·· 20.7	100°32.0	·· 28.9	139°53.6	·· 01.5
22	126°29.3	118°45.6	30.4	49°27.3	20.7	115°34.0	29.2	154°55.7	01.4
23	141°31.8	133°45.2	31.7	64°28.6	20.8	130°36.0	29.4	169°57.9	01.3
Mer.pass. 13:35		ν -0.3′ d 1.3′ m -3.94		ν 1.4′ d 0.1′ m 0.35		ν 2.0′ d 0.2′ m -2.11		ν 2.2′ d 0.1′ m 0.87	

Stars	SHA	Dec
Alpheratz	357°36.7	29°13.0
Ankaa	353°09.0	-42°11.1
Schedar	349°33.3	56°39.9
Diphda	348°49.1	-17°51.8
Achernar	335°21.7	-57°07.5
Hamal	327°53.1	23°34.3
Polaris	314°56.2	89°22.0
Acamar	315°13.1	-40°13.0
Menkar	314°07.9	4°10.7
Mirfak	308°30.6	49°56.7
Aldebaran	290°41.4	16°33.3
Rigel	281°05.3	-8°10.6
Capella	280°24.1	46°01.4
Bellatrix	278°24.4	6°22.2
Elnath	278°03.7	28°37.6
Alnilam	275°39.2	-1°11.3
Betelgeuse	270°53.6	7°24.6
Canopus	263°52.8	-52°42.7
Sirius	258°27.4	-16°45.0
Adhara	255°06.8	-29°00.4
Procyon	244°52.2	5°09.9
Pollux	243°18.9	27°58.2
Avior	234°14.8	-59°35.1
Suhail	222°47.0	-43°31.6
Miaplacidus	221°37.7	-69°48.8
Alphard	217°49.0	-8°45.6
Regulus	207°35.8	11°51.2
Dubhe	193°42.2	61°37.5
Denebola	182°26.2	14°26.5
Gienah	175°44.9	-17°40.2
Acrux	173°01.3	-63°13.5
Gacrux	171°52.9	-57°14.4
Alioth	166°13.9	55°49.9
Spica	158°23.7	-11°17.0
Alkaid	152°52.9	49°11.6
Hadar	148°37.9	-60°28.8
Menkent	147°59.2	-36°28.9
Arcturus	145°49.2	19°03.5
Rigil Kent.	139°42.2	-60°55.6
Kochab	137°19.3	74°03.3
Zuben'ubi	136°57.6	-16°08.3
Alphecca	126°05.0	26°38.0
Antares	112°17.8	-26°28.9
Atria	107°13.5	-69°03.9
Sabik	102°04.6	-15°45.2
Shaula	96°12.6	-37°07.1
Rasalhague	96°00.1	12°32.4
Eltanin	90°43.1	51°28.8
Kaus Aust.	83°34.8	-34°22.4
Vega	80°34.5	38°48.0
Nunki	75°49.9	-26°16.1
Altair	62°01.7	8°55.6
Peacock	53°08.7	-56°39.6
Deneb	49°27.3	45°21.5
Enif	33°40.6	9°58.7
Al Na'ir	27°35.3	-46°51.1
Fomalhaut	15°16.6	-29°30.2
Scheat	13°47.1	28°12.4
Markab	13°31.8	15°19.6

Feb 24 Fri	**SHA**	**Mer.pass**
Venus	355°30.6	14:04
Mars	284°11.5	18:47
Jupiter	349°40.1	14:25
Saturn	28°46.7	11:49

Feb 25 Sat	**SHA**	**Mer.pass**
Venus	354°23.9	14:04
Mars	283°46.6	18:45
Jupiter	349°28.0	14:22
Saturn	28°39.8	11:45

Feb 26 Sun	**SHA**	**Mer.pass**
Venus	353°17.3	14:05
Mars	283°21.4	18:42
Jupiter	349°15.9	14:19
Saturn	28°32.8	11:42

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°40.9	S09°38.5	129°55.5	12.3′	N08°52.0	15.2′	58.3′
1	191°41.0	37.5	144°26.8	12.3′	09°07.2	15.2′	58.3′
2	206°41.1	36.6	158°58.1	12.3′	09°22.4	15.1′	58.2′
3	221°41.2	·· 35.7	173°29.4	12.3′	09°37.5	15.0′	58.2′
4	236°41.3	34.8	188°00.7	12.3′	09°52.5	15.0′	58.1′
5	251°41.4	33.8	202°32.0	12.3′	10°07.5	14.9′	58.1′
6	266°41.4	S09°32.9	217°03.3	12.3′	N10°22.4	14.8′	58.1′
7	281°41.5	32.0	231°34.6	12.3′	10°37.2	14.7′	58.0′
8	296°41.6	31.1	246°05.8	12.3′	10°51.9	14.7′	58.0′
9	311°41.7	·· 30.1	260°37.1	12.3′	11°06.6	14.6′	57.9′
10	326°41.8	29.2	275°08.4	12.3′	11°21.2	14.5′	57.9′
11	341°41.9	28.3	289°39.6	12.2′	11°35.7	14.5′	57.9′
12	356°42.0	S09°27.4	304°10.9	12.2′	N11°50.2	14.3′	57.8′
13	11°42.1	26.5	318°42.1	12.2′	12°04.5	14.3′	57.8′
14	26°42.2	25.5	333°13.3	12.2′	12°18.8	14.2′	57.7′
15	41°42.3	·· 24.6	347°44.6	12.2′	12°33.0	14.2′	57.7′
16	56°42.4	23.7	2°15.8	12.2′	12°47.2	14.0′	57.7′
17	71°42.5	22.8	16°47.0	12.2′	13°01.2	14.0′	57.6′
18	86°42.5	S09°21.8	31°18.1	12.2′	N13°15.2	13.8′	57.6′
19	101°42.6	20.9	45°49.3	12.2′	13°29.0	13.8′	57.5′
20	116°42.7	20.0	60°20.5	12.1′	13°42.8	13.8′	57.5′
21	131°42.8	·· 19.1	74°51.6	12.1′	13°56.6	13.6′	57.5′
22	146°42.9	18.1	89°22.7	12.1′	14°10.2	13.5′	57.4′
23	161°43.0	17.2	103°53.8	12.1′	14°23.7	13.5′	57.4′
	SD = 16.2′	d = 0.9′	SD = 15.9′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°43.1	S09°16.3	118°24.9	12.1′	N14°37.2	13.3′	57.3′
1	191°43.2	15.3	132°56.0	12.0′	14°50.5	13.3′	57.3′
2	206°43.3	14.4	147°27.0	12.0′	15°03.8	13.2′	57.3′
3	221°43.4	·· 13.5	161°58.1	12.0′	15°17.0	13.0′	57.2′
4	236°43.5	12.6	176°29.1	12.0′	15°30.0	13.0′	57.2′
5	251°43.6	11.6	191°00.1	12.0′	15°43.0	12.9′	57.1′
6	266°43.7	S09°10.7	205°31.0	11.9′	N15°55.9	12.8′	57.1′
7	281°43.8	09.8	220°02.0	11.9′	16°08.7	12.7′	57.1′
8	296°43.9	08.8	234°32.9	11.9′	16°21.4	12.7′	57.0′
9	311°44.0	·· 07.9	249°03.8	11.9′	16°34.1	12.5′	57.0′
10	326°44.1	07.0	263°34.7	11.8′	16°46.6	12.4′	56.9′
11	341°44.2	06.1	278°05.5	11.8′	16°59.0	12.3′	56.9′
12	356°44.3	S09°05.1	292°36.3	11.8′	N17°11.3	12.2′	56.9′
13	11°44.4	04.2	307°07.1	11.8′	17°23.5	12.2′	56.8′
14	26°44.5	03.3	321°37.9	11.7′	17°35.7	12.0′	56.8′
15	41°44.6	·· 02.3	336°08.6	11.7′	17°47.7	11.9′	56.8′
16	56°44.6	01.4	350°39.3	11.7′	17°59.6	11.8′	56.7′
17	71°44.7	09°00.5	5°10.0	11.7′	18°11.4	11.7′	56.7′
18	86°44.8	S08°59.5	19°40.7	11.6′	N18°23.1	11.6′	56.6′
19	101°44.9	58.6	34°11.3	11.6′	18°34.7	11.6′	56.6′
20	116°45.0	57.7	48°41.9	11.6′	18°46.3	11.4′	56.6′
21	131°45.1	·· 56.7	63°12.5	11.5′	18°57.7	11.3′	56.5′
22	146°45.2	55.8	77°43.0	11.5′	19°09.0	11.1′	56.5′
23	161°45.3	54.9	92°13.5	11.5′	19°20.1	11.1′	56.5′
	SD = 16.2′	d = 0.9′	SD = 15.6′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°45.4	S08°54.0	106°44.0	11.4′	N19°31.2	11.0′	56.4′
1	191°45.5	53.0	121°14.5	11.4′	19°42.2	10.9′	56.4′
2	206°45.6	52.1	135°44.9	11.4′	19°53.1	10.7′	56.4′
3	221°45.7	·· 51.2	150°15.3	11.4′	20°03.8	10.7′	56.3′
4	236°45.9	50.2	164°45.6	11.3′	20°14.5	10.5′	56.3′
5	251°46.0	49.3	179°16.0	11.3′	20°25.0	10.4′	56.3′
6	266°46.1	S08°48.4	193°46.2	11.3′	N20°35.4	10.3′	56.2′
7	281°46.2	47.4	208°16.5	11.2′	20°45.7	10.2′	56.2′
8	296°46.3	46.5	222°46.7	11.2′	20°55.9	10.1′	56.1′
9	311°46.4	·· 45.5	237°16.9	11.2′	21°06.0	10.0′	56.1′
10	326°46.5	44.6	251°47.1	11.1′	21°16.0	9.8′	56.1′
11	341°46.6	43.7	266°17.2	11.1′	21°25.8	9.8′	56.0′
12	356°46.7	S08°42.7	280°47.3	11.1′	N21°35.6	9.6′	56.0′
13	11°46.8	41.8	295°17.4	11.0′	21°45.2	9.5′	56.0′
14	26°46.9	40.9	309°47.4	11.0′	21°54.7	9.4′	55.9′
15	41°47.0	·· 39.9	324°17.4	11.0′	22°04.1	9.2′	55.9′
16	56°47.1	39.0	338°47.4	10.9′	22°13.3	9.2′	55.9′
17	71°47.2	38.1	353°17.3	10.9′	22°22.5	9.0′	55.9′
18	86°47.3	S08°37.1	7°47.2	10.9′	N22°31.5	8.9′	55.8′
19	101°47.4	36.2	22°17.1	10.8′	22°40.4	8.8′	55.8′
20	116°47.5	35.3	36°46.9	10.8′	22°49.2	8.7′	55.8′
21	131°47.6	·· 34.3	51°16.7	10.8′	22°57.9	8.6′	55.7′
22	146°47.7	33.4	65°46.5	10.7′	23°06.5	8.4′	55.7′
23	161°47.8	32.4	80°16.2	10.7′	23°14.9	8.3′	55.7′
	SD = 16.1′	d = 0.9′	SD = 15.4′				

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

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

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 18-37%
24	13:16	13:12	12:13	15:51	03:27	
25	13:08	13:03	12:13	16:39	04:15	
26	12:58	12:53	12:13	17:28	05:03	

February 27, 28, 01 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	156°34.3	148°44.9	N02°33.0	79°30.0	N25°20.8	145°37.9	N03°29.6	185°00.1	S13°01.2
1	171°36.7	163°44.6	34.3	94°31.4	20.9	160°39.9	29.8	200°02.3	01.1
2	186°39.2	178°44.3	35.6	109°32.8	21.0	175°41.8	30.0	215°04.4	01.0
3	201°41.6	193°44.0	·· 36.9	124°34.2	·· 21.0	190°43.8	·· 30.3	230°06.6	·· 00.9
4	216°44.1	208°43.7	38.3	139°35.6	21.1	205°45.7	30.5	245°08.8	00.8
5	231°46.6	223°43.4	39.6	154°37.0	21.1	220°47.7	30.7	260°11.0	00.7
6	246°49.0	238°43.1	N02°40.9	169°38.4	N25°21.2	235°49.6	N03°30.9	275°13.1	S13°00.6
7	261°51.5	253°42.7	42.2	184°39.8	21.3	250°51.6	31.1	290°15.3	00.5
8	276°54.0	268°42.4	43.5	199°41.2	21.3	265°53.5	31.4	305°17.5	00.4
9	291°56.4	283°42.1	·· 44.8	214°42.5	·· 21.4	280°55.5	·· 31.6	320°19.7	·· 00.3
10	306°58.9	298°41.8	46.1	229°43.9	21.4	295°57.4	31.8	335°21.8	00.2
11	322°01.4	313°41.5	47.4	244°45.3	21.5	310°59.4	32.0	350°24.0	13°00.0
12	337°03.8	328°41.2	N02°48.7	259°46.7	N25°21.5	326°01.4	N03°32.3	5°26.2	S12°59.9
13	352°06.3	343°40.9	50.0	274°48.1	21.6	341°03.3	32.5	20°28.4	59.8
14	7°08.7	358°40.6	51.3	289°49.5	21.7	356°05.3	32.7	35°30.5	59.7
15	22°11.2	13°40.3	·· 52.6	304°50.8	·· 21.7	11°07.2	·· 32.9	50°32.7	·· 59.6
16	37°13.7	28°39.9	53.9	319°52.2	21.8	26°09.2	33.1	65°34.9	59.5
17	52°16.1	43°39.6	55.2	334°53.6	21.8	41°11.1	33.4	80°37.1	59.4
18	67°18.6	58°39.3	N02°56.5	349°55.0	N25°21.9	56°13.1	N03°33.6	95°39.2	S12°59.3
19	82°21.1	73°39.0	57.8	4°56.4	21.9	71°15.0	33.8	110°41.4	59.2
20	97°23.5	88°38.7	02°59.1	19°57.8	22.0	86°17.0	34.0	125°43.6	59.1
21	112°26.0	103°38.4	03°00.4	34°59.1	·· 22.1	101°18.9	·· 34.3	140°45.8	·· 59.0
22	127°28.5	118°38.1	01.7	50°00.5	22.1	116°20.9	34.5	155°47.9	58.9
23	142°30.9	133°37.8	03.0	65°01.9	22.2	131°22.8	34.7	170°50.1	58.8
Mer.pass. 13:31		ν -0.3′ d 1.3′ m -3.95		ν 1.4′ d 0.1′ m 0.37		ν 2.0′ d 0.2′ m -2.10		ν 2.2′ d 0.1′ m 0.88	

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	157°33.4	148°37.5	N03°04.3	80°03.3	N25°22.2	146°24.8	N03°34.9	185°52.3	S12°58.7
1	172°35.9	163°37.1	05.6	95°04.6	22.3	161°26.7	35.1	200°54.5	58.6
2	187°38.3	178°36.8	06.9	110°06.0	22.3	176°28.7	35.4	215°56.6	58.5
3	202°40.8	193°36.5	·· 08.2	125°07.4	·· 22.4	191°30.6	·· 35.6	230°58.8	·· 58.4
4	217°43.2	208°36.2	09.5	140°08.8	22.5	206°32.6	35.8	246°01.0	58.3
5	232°45.7	223°35.9	10.8	155°10.1	22.5	221°34.5	36.0	261°03.2	58.2
6	247°48.2	238°35.6	N03°12.1	170°11.5	N25°22.6	236°36.5	N03°36.2	276°05.3	S12°58.1
7	262°50.6	253°35.3	13.4	185°12.9	22.6	251°38.4	36.5	291°07.5	58.0
8	277°53.1	268°35.0	14.7	200°14.3	22.7	266°40.4	36.7	306°09.7	57.9
9	292°55.6	283°34.7	·· 16.0	215°15.6	·· 22.7	281°42.4	·· 36.9	321°11.9	·· 57.8
10	307°58.0	298°34.3	17.3	230°17.0	22.8	296°44.3	37.1	336°14.0	57.7
11	323°00.5	313°34.0	18.6	245°18.4	22.8	311°46.3	37.4	351°16.2	57.6
12	338°03.0	328°33.7	N03°19.9	260°19.8	N25°22.9	326°48.2	N03°37.6	6°18.4	S12°57.5
13	353°05.4	343°33.4	21.2	275°21.1	23.0	341°50.2	37.8	21°20.6	57.4
14	8°07.9	358°33.1	22.5	290°22.5	23.0	356°52.1	38.0	36°22.7	57.3
15	23°10.4	13°32.8	·· 23.8	305°23.9	·· 23.1	11°54.1	·· 38.2	51°24.9	·· 57.2
16	38°12.8	28°32.5	25.1	320°25.2	23.1	26°56.0	38.5	66°27.1	57.1
17	53°15.3	43°32.2	26.4	335°26.6	23.2	41°58.0	38.7	81°29.3	57.0
18	68°17.7	58°31.9	N03°27.7	350°28.0	N25°23.2	56°59.9	N03°38.9	96°31.4	S12°56.9
19	83°20.2	73°31.5	29.0	5°29.3	23.3	72°01.9	39.1	111°33.6	56.8
20	98°22.7	88°31.2	30.3	20°30.7	23.3	87°03.8	39.4	126°35.8	56.7
21	113°25.1	103°30.9	·· 31.6	35°32.1	·· 23.4	102°05.8	·· 39.6	141°38.0	·· 56.6
22	128°27.6	118°30.6	32.9	50°33.4	23.5	117°07.7	39.8	156°40.1	56.5
23	143°30.1	133°30.3	34.2	65°34.8	23.5	132°09.7	40.0	171°42.3	56.4
Mer.pass. 13:28		ν -0.3′ d 1.3′ m -3.95		ν 1.4′ d 0.1′ m 0.40		ν 2.0′ d 0.2′ m -2.10		ν 2.2′ d 0.1′ m 0.88	

Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	158°32.5	148°30.0	N03°35.5	80°36.2	N25°23.6	147°11.6	N03°40.2	186°44.5	S12°56.3
1	173°35.0	163°29.7	36.8	95°37.5	23.6	162°13.6	40.5	201°46.7	56.2
2	188°37.5	178°29.4	38.1	110°38.9	23.7	177°15.5	40.7	216°48.9	56.1
3	203°39.9	193°29.1	·· 39.4	125°40.3	·· 23.7	192°17.5	·· 40.9	231°51.0	·· 56.0
4	218°42.4	208°28.7	40.7	140°41.6	23.8	207°19.4	41.1	246°53.2	55.9
5	233°44.9	223°28.4	42.0	155°43.0	23.8	222°21.4	41.4	261°55.4	55.8
6	248°47.3	238°28.1	N03°43.3	170°44.3	N25°23.9	237°23.3	N03°41.6	276°57.6	S12°55.7
7	263°49.8	253°27.8	44.6	185°45.7	23.9	252°25.3	41.8	291°59.7	55.6
8	278°52.2	268°27.5	45.9	200°47.1	24.0	267°27.2	42.0	307°01.9	55.5
9	293°54.7	283°27.2	·· 47.2	215°48.4	·· 24.1	282°29.2	·· 42.3	322°04.1	·· 55.4
10	308°57.2	298°26.9	48.5	230°49.8	24.1	297°31.1	42.5	337°06.3	55.3
11	323°59.6	313°26.6	49.8	245°51.1	24.2	312°33.1	42.7	352°08.4	55.2
12	339°02.1	328°26.2	N03°51.1	260°52.5	N25°24.2	327°35.0	N03°42.9	7°10.6	S12°55.1
13	354°04.6	343°25.9	52.4	275°53.9	24.3	342°36.9	43.1	22°12.8	55.0
14	9°07.0	358°25.6	53.7	290°55.2	24.3	357°38.9	43.4	37°15.0	54.9
15	24°09.5	13°25.3	·· 55.0	305°56.6	·· 24.4	12°40.8	·· 43.6	52°17.1	·· 54.8
16	39°12.0	28°25.0	56.3	320°57.9	24.4	27°42.8	43.8	67°19.3	54.7
17	54°14.4	43°24.7	57.6	335°59.3	24.5	42°44.7	44.0	82°21.5	54.6
18	69°16.9	58°24.4	N03°58.9	351°00.6	N25°24.5	57°46.7	N03°44.3	97°23.7	S12°54.5
19	84°19.4	73°24.1	04°00.2	6°02.0	24.6	72°48.6	44.5	112°25.8	54.4
20	99°21.8	88°23.8	01.5	21°03.4	24.6	87°50.6	44.7	127°28.0	54.3
21	114°24.3	103°23.4	·· 02.8	36°04.7	·· 24.7	102°52.5	·· 44.9	142°30.2	·· 54.2
22	129°26.7	118°23.1	04.1	51°06.1	24.7	117°54.5	45.2	157°32.4	54.1
23	144°29.2	133°22.8	05.4	66°07.4	24.8	132°56.4	45.4	172°34.5	54.0
Mer.pass. 13:24		ν -0.3′ d 1.3′ m -3.95		ν 1.4′ d 0.1′ m 0.42		ν 1.9′ d 0.2′ m -2.10		ν 2.2′ d 0.1′ m 0.89	

Stars

	SHA	**Dec**
Alpheratz	357°36.7	29°13.0
Ankaa	353°09.0	-42°11.1
Schedar	349°33.3	56°39.9
Diphda	348°49.1	-17°51.8
Achernar	335°21.7	-57°07.5
Hamal	327°53.1	23°34.3
Polaris	314°57.3	89°22.0
Acamar	315°13.1	-40°13.0
Menkar	314°07.9	4°10.7
Mirfak	308°30.6	49°56.7
Aldebaran	290°41.4	16°33.3
Rigel	281°05.3	-8°10.7
Capella	280°24.1	46°01.4
Bellatrix	278°24.4	6°22.2
Elnath	278°03.7	28°37.6
Alnilam	275°39.2	-1°11.3
Betelgeuse	270°53.6	7°24.6
Canopus	263°52.8	-52°42.7
Sirius	258°27.4	-16°45.0
Adhara	255°06.9	-29°00.4
Procyon	244°52.2	5°09.9
Pollux	243°18.9	27°58.2
Avior	234°14.8	-59°35.1
Suhail	222°47.0	-43°31.7
Miaplacidus	221°37.7	-69°48.8
Alphard	217°49.0	-8°45.6
Regulus	207°35.8	11°51.2
Dubhe	193°42.2	61°37.5
Denebola	182°26.2	14°26.5
Gienah	175°44.9	-17°40.2
Acrux	173°01.2	-63°13.5
Gacrux	171°52.9	-57°14.4
Alioth	166°13.9	55°49.9
Spica	158°23.7	-11°17.0
Alkaid	152°52.9	49°11.6
Hadar	148°37.8	-60°28.9
Menkent	147°59.2	-36°28.9
Arcturus	145°49.1	19°03.5
Rigil Kent.	139°42.1	-60°55.6
Kochab	137°19.3	74°03.3
Zuben'ubi	136°57.6	-16°08.3
Alphecca	126°05.0	26°38.0
Antares	112°17.7	-26°29.0
Atria	107°13.4	-69°03.9
Sabik	102°04.6	-15°45.2
Shaula	96°12.6	-37°07.1
Rasalhague	96°00.1	12°32.4
Eltanin	90°43.1	51°28.8
Kaus Aust.	83°34.7	-34°22.4
Vega	80°34.5	38°48.0
Nunki	75°49.9	-26°16.1
Altair	62°01.7	8°55.6
Peacock	53°08.6	-56°39.6
Deneb	49°27.3	45°21.5
Enif	33°40.6	9°58.7
Al Na'ir	27°35.3	-46°51.1
Fomalhaut	15°16.6	-29°30.2
Scheat	13°47.1	28°12.4
Markab	13°31.8	15°19.6

Feb 27 Mon	**SHA**	**Mer.pass**
Venus	352°10.7	14:05
Mars	282°55.8	18:40
Jupiter	349°03.7	14:16
Saturn	28°25.8	11:38

Feb 28 Tue	**SHA**	**Mer.pass**
Venus	351°04.1	14:06
Mars	282°29.9	18:38
Jupiter	348°51.4	14:12
Saturn	28°18.9	11:35

Mar 01 Wed	**SHA**	**Mer.pass**
Venus	349°57.5	14:06
Mars	282°03.6	18:36
Jupiter	348°39.1	14:09
Saturn	28°12.0	11:31

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h Sun Moon

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	176°47.9	S08°31.5	94°45.9	10.7′	N23°23.2	8.2′	55.6′
1	191°48.0	30.6	109°15.6	10.6′	23°31.4	8.0′	55.6′
2	206°48.1	29.6	123°45.2	10.6′	23°39.4	8.0′	55.6′
3	221°48.3	·· 28.7	138°14.8	10.6′	23°47.4	7.8′	55.5′
4	236°48.4	27.7	152°44.4	10.5′	23°55.2	7.7′	55.5′
5	251°48.5	26.8	167°13.9	10.5′	24°02.9	7.5′	55.5′
6	266°48.6	S08°25.9	181°43.5	10.5′	N24°10.4	7.5′	55.5′
7	281°48.7	24.9	196°12.9	10.5′	24°17.9	7.3′	55.4′
8	296°48.8	24.0	210°42.4	10.4′	24°25.2	7.2′	55.4′
9	311°48.9	·· 23.0	225°11.8	10.4′	24°32.4	7.0′	55.4′
10	326°49.0	22.1	239°41.2	10.4′	24°39.4	7.0′	55.3′
11	341°49.1	21.2	254°10.6	10.3′	24°46.4	6.8′	55.3′
12	356°49.2	S08°20.2	268°39.9	10.3′	N24°53.2	6.6′	55.3′
13	11°49.3	19.3	283°09.2	10.3′	24°59.8	6.6′	55.3′
14	26°49.4	18.3	297°38.5	10.3′	25°06.4	6.4′	55.2′
15	41°49.6	·· 17.4	312°07.8	10.2′	25°12.8	6.3′	55.2′
16	56°49.7	16.5	326°37.0	10.2′	25°19.1	6.1′	55.2′
17	71°49.8	15.5	341°06.2	10.2′	25°25.2	6.0′	55.2′
18	86°49.9	S08°14.6	355°35.4	10.2′	N25°31.2	5.9′	55.1′
19	101°50.0	13.6	10°04.6	10.1′	25°37.1	5.8′	55.1′
20	116°50.1	12.7	24°33.7	10.1′	25°42.9	5.6′	55.1′
21	131°50.2	·· 11.8	39°02.8	10.1′	25°48.5	5.5′	55.1′
22	146°50.3	10.8	53°31.9	10.1′	25°54.0	5.4′	55.0′
23	161°50.4	09.9	68°01.0	10.0′	25°59.4	5.2′	55.0′
	SD = 16.1′	d = 0.9′	SD = 15.2′				

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	176°50.6	S08°08.9	82°30.0	10.0′	N26°04.6	5.1′	55.0′
1	191°50.7	08.0	96°59.0	10.0′	26°09.7	5.0′	55.0′
2	206°50.8	07.0	111°28.0	10.0′	26°14.7	4.8′	54.9′
3	221°50.9	·· 06.1	125°57.0	10.0′	26°19.5	4.7′	54.9′
4	236°51.0	05.2	140°26.0	9.9′	26°24.2	4.6′	54.9′
5	251°51.1	04.2	154°54.9	9.9′	26°28.8	4.4′	54.9′
6	266°51.2	S08°03.3	169°23.8	9.9′	N26°33.2	4.3′	54.8′
7	281°51.4	02.3	183°52.7	9.9′	26°37.5	4.2′	54.8′
8	296°51.5	01.4	198°21.6	9.9′	26°41.7	4.0′	54.8′
9	311°51.6	08°00.4	212°50.5	9.9′	26°45.7	3.9′	54.8′
10	326°51.7	07°59.5	227°19.4	9.9′	26°49.6	3.7′	54.8′
11	341°51.8	58.5	241°48.2	9.8′	26°53.3	3.7′	54.7′
12	356°51.9	S07°57.6	256°17.1	9.8′	N26°57.0	3.5′	54.7′
13	11°52.0	56.6	270°45.9	9.8′	27°00.5	3.3′	54.7′
14	26°52.2	55.7	285°14.7	9.8′	27°03.8	3.2′	54.7′
15	41°52.3	·· 54.8	299°43.5	9.8′	27°07.0	3.1′	54.7′
16	56°52.4	53.8	314°12.3	9.8′	27°10.1	2.9′	54.6′
17	71°52.5	52.9	328°41.1	9.8′	27°13.0	2.9′	54.6′
18	86°52.6	S07°51.9	343°09.9	9.8′	N27°15.9	2.6′	54.6′
19	101°52.7	51.0	357°38.7	9.8′	27°18.5	2.6′	54.6′
20	116°52.9	50.0	12°07.4	9.8′	27°21.1	2.4′	54.6′
21	131°53.0	·· 49.1	26°36.2	9.8′	27°23.5	2.2′	54.5′
22	146°53.1	48.1	41°05.0	9.8′	27°25.7	2.1′	54.5′
23	161°53.2	47.2	55°33.7	9.8′	27°27.8	2.0′	54.5′
	SD = 16.1′	d = 0.9′	SD = 15.0′				

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	176°53.3	S07°46.2	70°02.5	9.8′	N27°29.8	1.9′	54.5′
1	191°53.4	45.3	84°31.3	9.8′	27°31.7	1.7′	54.5′
2	206°53.6	44.3	99°00.0	9.8′	27°33.4	1.6′	54.5′
3	221°53.7	·· 43.4	113°28.8	9.8′	27°35.0	1.4′	54.4′
4	236°53.8	42.4	127°57.5	9.8′	27°36.4	1.3′	54.4′
5	251°53.9	41.5	142°26.3	9.8′	27°37.7	1.2′	54.4′
6	266°54.0	S07°40.5	156°55.1	9.8′	N27°38.9	1.0′	54.4′
7	281°54.2	39.6	171°23.9	9.8′	27°39.9	0.9′	54.4′
8	296°54.3	38.6	185°52.7	9.8′	27°40.8	0.8′	54.4′
9	311°54.4	·· 37.7	200°21.4	9.8′	27°41.6	0.6′	54.3′
10	326°54.5	36.7	214°50.3	9.8′	27°42.2	0.5′	54.3′
11	341°54.6	35.8	229°19.1	9.8′	27°42.7	0.4′	54.3′
12	356°54.8	S07°34.8	243°47.9	9.8′	N27°43.1	0.2′	54.3′
13	11°54.9	33.9	258°16.7	9.8′	27°43.3	0.1′	54.3′
14	26°55.0	32.9	272°45.6	9.9′	27°43.4	0.1′	54.3′
15	41°55.1	·· 32.0	287°14.4	9.9′	27°43.3	0.2′	54.3′
16	56°55.2	31.0	301°43.3	9.9′	27°43.1	0.3′	54.3′
17	71°55.4	30.1	316°12.2	9.9′	27°42.8	0.5′	54.2′
18	86°55.5	S07°29.1	330°41.1	9.9′	N27°42.3	0.6′	54.2′
19	101°55.6	28.2	345°10.0	9.9′	27°41.7	0.7′	54.2′
20	116°55.7	27.2	359°39.0	10.0′	27°41.0	0.9′	54.2′
21	131°55.9	·· 26.3	14°07.9	10.0′	27°40.1	1.0′	54.2′
22	146°56.0	25.3	28°36.9	10.0′	27°39.1	1.1′	54.2′
23	161°56.1	24.4	43°05.9	10.0′	27°38.0	1.3′	54.2′
	SD = 16.1′	d = 0.9′	SD = 14.9′				

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

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

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 7-9 47-66%
27	12:48	12:43	12:13	18:18	05:53	
28	12:38	12:32	12:13	19:10	06:44	
01	12:27	12:21	12:12	20:01	07:36	

March 02, 03, 04 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	159°31.7	148°22.5	N04°06.6	81°08.8	N25°24.8	147°58.4	N03°45.6	187°36.7	S12°53.8
1	174°34.1	163°22.2	07.9	96°10.1	24.9	163°00.3	45.8	202°38.9	53.7
2	189°36.6	178°21.9	09.2	111°11.5	25.0	178°02.3	46.0	217°41.1	53.6
3	204°39.1	193°21.6	·· 10.5	126°12.8	·· 25.0	193°04.2	·· 46.3	232°43.3	·· 53.5
4	219°41.5	208°21.3	11.8	141°14.2	25.1	208°06.2	46.5	247°45.4	53.4
5	234°44.0	223°20.9	13.1	156°15.5	25.1	223°08.1	46.7	262°47.6	53.3
6	249°46.5	238°20.6	N04°14.4	171°16.9	N25°25.2	238°10.1	N03°46.9	277°49.8	S12°53.2
7	264°48.9	253°20.3	15.7	186°18.2	25.2	253°12.0	47.2	292°52.0	53.1
8	279°51.4	268°20.0	17.0	201°19.6	25.3	268°14.0	47.4	307°54.1	53.0
9	294°53.8	283°19.7	·· 18.3	216°20.9	·· 25.3	283°15.9	·· 47.6	322°56.3	·· 52.9
10	309°56.3	298°19.4	19.6	231°22.3	25.4	298°17.8	47.8	337°58.5	52.8
11	324°58.8	313°19.1	20.9	246°23.6	25.4	313°19.8	48.1	353°00.7	52.7
12	340°01.2	328°18.8	N04°22.2	261°24.9	N25°25.5	328°21.7	N03°48.3	8°02.8	S12°52.6
13	355°03.7	343°18.4	23.5	276°26.3	25.5	343°23.7	48.5	23°05.0	52.5
14	10°06.2	358°18.1	24.8	291°27.6	25.6	358°25.6	48.7	38°07.2	52.4
15	25°08.6	13°17.8	·· 26.1	306°29.0	·· 25.6	13°27.6	·· 48.9	53°09.4	·· 52.3
16	40°11.1	28°17.5	27.4	321°30.3	25.7	28°29.5	49.2	68°11.5	52.2
17	55°13.6	43°17.2	28.7	336°31.7	25.7	43°31.5	49.4	83°13.7	52.1
18	70°16.0	58°16.9	N04°29.9	351°33.0	N25°25.8	58°33.4	N03°49.6	98°15.9	S12°52.0
19	85°18.5	73°16.6	31.2	6°34.3	25.8	73°35.4	49.8	113°18.1	51.9
20	100°21.0	88°16.3	32.5	21°35.7	25.9	88°37.3	50.1	128°20.3	51.8
21	115°23.4	103°15.9	·· 33.8	36°37.0	·· 25.9	103°39.3	·· 50.3	143°22.4	·· 51.7
22	130°25.9	118°15.6	35.1	51°38.4	26.0	118°41.2	50.5	158°24.6	51.6
23	145°28.3	133°15.3	36.4	66°39.7	26.0	133°43.1	50.7	173°26.8	51.5
Mer.pass. 13:20		ν -0.3′ d 1.3′ m -3.95		ν 1.4′ d 0.1′ m 0.44		ν 1.9′ d 0.2′ m -2.10		ν 2.2′ d 0.1′ m 0.89	

Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	160°30.8	148°15.0	N04°37.7	81°41.0	N25°26.1	148°45.1	N03°51.0	188°29.0	S12°51.4
1	175°33.3	163°14.7	39.0	96°42.4	26.1	163°47.0	51.2	203°31.1	51.3
2	190°35.7	178°14.4	40.3	111°43.7	26.2	178°49.0	51.4	218°33.3	51.2
3	205°38.2	193°14.1	·· 41.6	126°45.1	·· 26.2	193°50.9	·· 51.6	233°35.5	·· 51.1
4	220°40.7	208°13.8	42.9	141°46.4	26.3	208°52.9	51.9	248°37.7	51.0
5	235°43.1	223°13.4	44.2	156°47.7	26.3	223°54.8	52.1	263°39.8	50.9
6	250°45.6	238°13.1	N04°45.4	171°49.1	N25°26.4	238°56.8	N03°52.3	278°42.0	S12°50.8
7	265°48.1	253°12.8	46.7	186°50.4	26.4	253°58.7	52.5	293°44.2	50.7
8	280°50.5	268°12.5	48.0	201°51.7	26.5	269°00.7	52.7	308°46.4	50.6
9	295°53.0	283°12.2	·· 49.3	216°53.1	·· 26.5	284°02.6	·· 53.0	323°48.6	·· 50.5
10	310°55.5	298°11.9	50.6	231°54.4	26.6	299°04.5	53.2	338°50.7	50.4
11	325°57.9	313°11.6	51.9	246°55.7	26.6	314°06.5	53.4	353°52.9	50.3
12	341°00.4	328°11.2	N04°53.2	261°57.1	N25°26.7	329°08.4	N03°53.6	8°55.1	S12°50.2
13	356°02.8	343°10.9	54.5	276°58.4	26.7	344°10.4	53.9	23°57.3	50.1
14	11°05.3	358°10.6	55.8	291°59.7	26.8	359°12.3	54.1	38°59.4	50.0
15	26°07.8	13°10.3	·· 57.1	307°01.1	·· 26.8	14°14.3	·· 54.3	54°01.6	·· 49.9
16	41°10.2	28°10.0	58.3	322°02.4	26.9	29°16.2	54.5	69°03.8	49.8
17	56°12.7	43°09.7	04°59.6	337°03.7	26.9	44°18.2	54.8	84°06.0	49.7
18	71°15.2	58°09.4	N05°00.9	352°05.1	N25°27.0	59°20.1	N03°55.0	99°08.2	S12°49.6
19	86°17.6	73°09.0	02.2	7°06.4	27.0	74°22.0	55.2	114°10.3	49.5
20	101°20.1	88°08.7	03.5	22°07.7	27.1	89°24.0	55.4	129°12.5	49.4
21	116°22.6	103°08.4	·· 04.8	37°09.1	·· 27.1	104°25.9	·· 55.7	144°14.7	·· 49.3
22	131°25.0	118°08.1	06.1	52°10.4	27.2	119°27.9	55.9	159°16.9	49.2
23	146°27.5	133°07.8	07.4	67°11.7	27.2	134°29.8	56.1	174°19.0	49.1
Mer.pass. 13:16		ν -0.3′ d 1.3′ m -3.95		ν 1.3′ d 0.1′ m 0.46		ν 1.9′ d 0.2′ m -2.10		ν 2.2′ d 0.1′ m 0.89	

Sat	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	161°29.9	148°07.5	N05°08.6	82°13.0	N25°27.3	149°31.8	N03°56.3	189°21.2	S12°49.0
1	176°32.4	163°07.2	09.9	97°14.4	27.3	164°33.7	56.6	204°23.4	48.9
2	191°34.9	178°06.8	11.2	112°15.7	27.4	179°35.6	56.8	219°25.6	48.8
3	206°37.3	193°06.5	·· 12.5	127°17.0	·· 27.4	194°37.6	·· 57.0	234°27.8	·· 48.7
4	221°39.8	208°06.2	13.8	142°18.3	27.5	209°39.5	57.2	249°29.9	48.6
5	236°42.3	223°05.9	15.1	157°19.7	27.5	224°41.5	57.5	264°32.1	48.5
6	251°44.7	238°05.6	N05°16.4	172°21.0	N25°27.6	239°43.4	N03°57.7	279°34.3	S12°48.4
7	266°47.2	253°05.3	17.7	187°22.3	27.6	254°45.4	57.9	294°36.5	48.3
8	281°49.7	268°05.0	18.9	202°23.6	27.6	269°47.3	58.1	309°38.6	48.2
9	296°52.1	283°04.6	·· 20.2	217°25.0	·· 27.7	284°49.3	·· 58.4	324°40.8	·· 48.1
10	311°54.6	298°04.3	21.5	232°26.3	27.7	299°51.2	58.6	339°43.0	48.0
11	326°57.1	313°04.0	22.8	247°27.6	27.8	314°53.1	58.8	354°45.2	47.9
12	341°59.5	328°03.7	N05°24.1	262°28.9	N25°27.8	329°55.1	N03°59.0	9°47.4	S12°47.8
13	357°02.0	343°03.4	25.4	277°30.2	27.9	344°57.0	59.2	24°49.5	47.7
14	12°04.4	358°03.1	26.7	292°31.6	27.9	359°59.0	59.5	39°51.7	47.6
15	27°06.9	13°02.8	·· 27.9	307°32.9	·· 28.0	15°00.9	·· 59.7	54°53.9	·· 47.5
16	42°09.4	28°02.4	29.2	322°34.2	28.0	30°02.8	03°59.9	69°56.1	47.4
17	57°11.8	43°02.1	30.5	337°35.5	28.1	45°04.8	04°00.1	84°58.2	47.3
18	72°14.3	58°01.8	N05°31.8	352°36.8	N25°28.1	60°06.7	N04°00.4	100°00.4	S12°47.2
19	87°16.8	73°01.5	33.1	7°38.2	28.2	75°08.7	00.6	115°02.6	47.1
20	102°19.2	88°01.2	34.4	22°39.5	28.2	90°10.6	00.8	130°04.8	47.0
21	117°21.7	103°00.9	·· 35.6	37°40.8	·· 28.3	105°12.6	·· 01.0	145°07.0	·· 46.9
22	132°24.2	118°00.5	36.9	52°42.1	28.3	120°14.5	01.3	160°09.1	46.8
23	147°26.6	133°00.2	38.2	67°43.4	28.3	135°16.4	01.5	175°11.3	46.7
Mer.pass. 13:12		ν -0.3′ d 1.3′ m -3.95		ν 1.3′ d 0.0′ m 0.48		ν 1.9′ d 0.2′ m -2.09		ν 2.2′ d 0.1′ m 0.90	

Stars

	SHA	**Dec**
Alpheratz	357°36.7	29°13.0
Ankaa	353°09.0	-42°11.0
Schedar	349°33.3	56°39.9
Diphda	348°49.1	-17°51.8
Achernar	335°21.7	-57°07.4
Hamal	327°53.1	23°34.3
Polaris	314°58.6	89°22.0
Acamar	315°13.1	-40°13.0
Menkar	314°07.9	4°10.7
Mirfak	308°30.6	49°56.7
Aldebaran	290°41.4	16°33.3
Rigel	281°05.3	-8°10.7
Capella	280°24.1	46°01.4
Bellatrix	278°24.5	6°22.2
Elnath	278°03.7	28°37.6
Alnilam	275°39.2	-1°11.3
Betelgeuse	270°53.6	7°24.6
Canopus	263°52.8	-52°42.7
Sirius	258°27.4	-16°45.0
Adhara	255°06.9	-29°00.4
Procyon	244°52.2	5°09.9
Pollux	243°18.9	27°58.2
Avior	234°14.9	-59°35.2
Suhail	222°47.0	-43°31.7
Miaplacidus	221°37.8	-69°48.8
Alphard	217°49.0	-8°45.6
Regulus	207°35.7	11°51.2
Dubhe	193°42.2	61°37.5
Denebola	182°26.2	14°26.5
Gienah	175°44.9	-17°40.3
Acrux	173°01.2	-63°13.5
Gacrux	171°52.9	-57°14.5
Alioth	166°13.8	55°49.9
Spica	158°23.7	-11°17.0
Alkaid	152°52.9	49°11.6
Hadar	148°37.8	-60°28.9
Menkent	147°59.2	-36°28.9
Arcturus	145°49.1	19°03.5
Rigil Kent.	139°42.1	-60°55.6
Kochab	137°19.2	74°03.3
Zuben'ubi	136°57.6	-16°08.3
Alphecca	126°04.9	26°38.0
Antares	112°17.7	-26°29.0
Atria	107°13.4	-69°03.9
Sabik	102°04.6	-15°45.2
Shaula	96°12.5	-37°07.1
Rasalhague	96°00.0	12°32.4
Eltanin	90°43.1	51°28.8
Kaus Aust.	83°34.7	-34°22.4
Vega	80°34.5	38°48.0
Nunki	75°49.8	-26°16.1
Altair	62°01.7	8°55.6
Peacock	53°08.6	-56°39.6
Deneb	49°27.2	45°21.5
Enif	33°40.6	9°58.7
Al Na'ir	27°35.3	-46°51.0
Fomalhaut	15°16.6	-29°30.2
Scheat	13°47.0	28°12.3
Markab	13°31.7	15°19.6

Mar 02 Thu	**SHA**	**Mer.pass**
Venus	348°50.8	14:07
Mars	281°37.1	18:34
Jupiter	348°26.7	14:06
Saturn	28°05.1	11:28

Mar 03 Fri	**SHA**	**Mer.pass**
Venus	347°44.2	14:07
Mars	281°10.2	18:32
Jupiter	348°14.3	14:03
Saturn	27°58.2	11:24

Mar 04 Sat	**SHA**	**Mer.pass**
Venus	346°37.5	14:08
Mars	280°43.1	18:30
Jupiter	348°01.8	14:00
Saturn	27°51.3	11:21

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°56.2	S07°23.4	57°35.0	10.1′	N27°36.7	1.4′	54.2′
1	191°56.3	22.5	72°04.0	10.1′	27°35.3	1.5′	54.2′
2	206°56.5	21.5	86°33.1	10.1′	27°33.8	1.6′	54.1′
3	221°56.6	·· 20.6	101°02.2	10.1′	27°32.2	1.8′	54.1′
4	236°56.7	19.6	115°31.3	10.2′	27°30.4	2.0′	54.1′
5	251°56.8	18.7	130°00.5	10.2′	27°28.4	2.0′	54.1′
6	266°57.0	S07°17.7	144°29.7	10.2′	N27°26.4	2.2′	54.1′
7	281°57.1	16.8	158°58.9	10.2′	27°24.2	2.3′	54.1′
8	296°57.2	15.8	173°28.2	10.3′	27°21.9	2.5′	54.1′
9	311°57.3	·· 14.9	187°57.4	10.3′	27°19.4	2.6′	54.1′
10	326°57.5	13.9	202°26.7	10.3′	27°16.8	2.7′	54.1′
11	341°57.6	12.9	216°56.1	10.4′	27°14.1	2.8′	54.1′
12	356°57.7	S07°12.0	231°25.5	10.4′	N27°11.3	3.0′	54.1′
13	11°57.9	11.0	245°54.9	10.4′	27°08.3	3.1′	54.1′
14	26°58.0	10.1	260°24.3	10.5′	27°05.2	3.2′	54.0′
15	41°58.1	·· 09.1	274°53.8	10.5′	27°02.0	3.4′	54.0′
16	56°58.2	08.2	289°23.3	10.6′	26°58.6	3.5′	54.0′
17	71°58.4	07.2	303°52.9	10.6′	26°55.1	3.6′	54.0′
18	86°58.5	S07°06.3	318°22.5	10.6′	N26°51.5	3.7′	54.0′
19	101°58.6	05.3	332°52.1	10.7′	26°47.8	3.9′	54.0′
20	116°58.7	04.4	347°21.8	10.7′	26°43.9	4.0′	54.0′
21	131°58.9	·· 03.4	1°51.5	10.8′	26°39.9	4.1′	54.0′
22	146°59.0	02.4	16°21.3	10.8′	26°35.8	4.2′	54.0′
23	161°59.1	01.5	30°51.1	10.8′	26°31.6	4.4′	54.0′
	SD = 16.1′	d = 1.0′	SD = 14.8′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°59.3	S07°00.5	45°20.9	10.9′	N26°27.2	4.4′	54.0′
1	191°59.4	06°59.6	59°50.8	10.9′	26°22.8	4.6′	54.0′
2	206°59.5	58.6	74°20.8	11.0′	26°18.2	4.8′	54.0′
3	221°59.6	·· 57.7	88°50.7	11.0′	26°13.4	4.8′	54.0′
4	236°59.8	56.7	103°20.8	11.1′	26°08.6	5.0′	54.0′
5	251°59.9	55.7	117°50.8	11.1′	26°03.6	5.1′	54.0′
6	267°00.0	S06°54.8	132°21.0	11.2′	N25°58.5	5.2′	54.0′
7	282°00.2	53.8	146°51.1	11.2′	25°53.3	5.3′	54.0′
8	297°00.3	52.9	161°21.4	11.3′	25°48.0	5.5′	54.0′
9	312°00.4	·· 51.9	175°51.6	11.3′	25°42.5	5.5′	54.0′
10	327°00.6	51.0	190°21.9	11.4′	25°37.0	5.7′	54.0′
11	342°00.7	50.0	204°52.3	11.4′	25°31.3	5.8′	54.0′
12	357°00.8	S06°49.0	219°22.7	11.5′	N25°25.5	5.9′	54.0′
13	12°00.9	48.1	233°53.2	11.5′	25°19.6	6.1′	54.0′
14	27°01.1	47.1	248°23.7	11.6′	25°13.5	6.1′	54.0′
15	42°01.2	·· 46.2	262°54.3	11.6′	25°07.4	6.3′	54.0′
16	57°01.3	45.2	277°24.9	11.7′	25°01.1	6.4′	54.0′
17	72°01.5	44.2	291°55.5	11.7′	24°54.7	6.4′	54.0′
18	87°01.6	S06°43.3	306°26.3	11.8′	N24°48.3	6.6′	54.0′
19	102°01.7	42.3	320°57.0	11.8′	24°41.7	6.7′	54.0′
20	117°01.9	41.4	335°27.9	11.9′	24°35.0	6.9′	54.0′
21	132°02.0	·· 40.4	349°58.8	11.9′	24°28.1	6.9′	54.0′
22	147°02.1	39.4	4°29.7	12.0′	24°21.2	7.0′	54.0′
23	162°02.3	38.5	19°00.7	12.0′	24°14.2	7.2′	54.0′
	SD = 16.1′	d = 1.0′	SD = 14.7′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°02.4	S06°37.5	33°31.7	12.1′	N24°07.0	7.3′	54.0′
1	192°02.5	36.6	48°02.8	12.2′	23°59.7	7.3′	54.0′
2	207°02.7	35.6	62°34.0	12.2′	23°52.4	7.5′	54.0′
3	222°02.8	·· 34.6	77°05.2	12.3′	23°44.9	7.6′	54.0′
4	237°02.9	33.7	91°36.5	12.3′	23°37.3	7.7′	54.0′
5	252°03.1	32.7	106°07.8	12.4′	23°29.6	7.8′	54.0′
6	267°03.2	S06°31.8	120°39.2	12.4′	N23°21.8	7.8′	54.0′
7	282°03.3	30.8	135°10.6	12.5′	23°14.0	8.0′	54.0′
8	297°03.5	29.8	149°42.1	12.5′	23°06.0	8.1′	54.0′
9	312°03.6	·· 28.9	164°13.6	12.6′	22°57.9	8.2′	54.0′
10	327°03.7	27.9	178°45.2	12.7′	22°49.7	8.3′	54.0′
11	342°03.9	26.9	193°16.9	12.7′	22°41.4	8.4′	54.0′
12	357°04.0	S06°26.0	207°48.6	12.8′	N22°33.0	8.5′	54.0′
13	12°04.2	25.0	222°20.4	12.8′	22°24.5	8.6′	54.0′
14	27°04.3	24.1	236°52.2	12.9′	22°15.9	8.7′	54.0′
15	42°04.4	·· 23.1	251°24.1	12.9′	22°07.2	8.8′	54.0′
16	57°04.6	22.1	265°56.0	13.0′	21°58.4	8.9′	54.0′
17	72°04.7	21.2	280°28.0	13.0′	21°49.5	9.0′	54.0′
18	87°04.8	S06°20.2	295°00.0	13.1′	N21°40.5	9.1′	54.0′
19	102°05.0	19.2	309°32.1	13.2′	21°31.4	9.2′	54.0′
20	117°05.1	18.3	324°04.3	13.2′	21°22.2	9.2′	54.0′
21	132°05.3	·· 17.3	338°36.5	13.3′	21°13.0	9.4′	54.0′
22	147°05.4	16.4	353°08.8	13.3′	21°03.6	9.5′	54.0′
23	162°05.5	15.4	7°41.1	13.4′	20°54.1	9.5′	54.0′
	SD = 16.1′	d = 1.0′	SD = 14.7′				

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

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

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 10-12 75-89%
02	12:15	12:09	12:12	20:52	08:27	
03	12:03	11:57	12:12	21:41	09:17	
04	11:50	11:44	12:12	22:28	10:05	

March 05, 06, 07 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	162°29.1	147°59.9	N05°39.5	82°44.7	N25°28.4	150°18.4	N04°01.7	190°13.5	S12°46.6
1	177°31.6	162°59.6	40.8	97°46.0	28.4	165°20.3	01.9	205°15.7	46.5
2	192°34.0	177°59.3	42.1	112°47.4	28.5	180°22.3	02.2	220°17.9	46.4
3	207°36.5	192°59.0	·· 43.3	127°48.7	·· 28.5	195°24.2	·· 02.4	235°20.0	·· 46.3
4	222°38.9	207°58.6	44.6	142°50.0	28.6	210°26.1	02.6	250°22.2	46.2
5	237°41.4	222°58.3	45.9	157°51.3	28.6	225°28.1	02.8	265°24.4	46.1
6	252°43.9	237°58.0	N05°47.2	172°52.6	N25°28.7	240°30.0	N04°03.1	280°26.6	S12°46.0
7	267°46.3	252°57.7	48.5	187°53.9	28.7	255°32.0	03.3	295°28.7	45.9
8	282°48.8	267°57.4	49.7	202°55.2	28.7	270°33.9	03.5	310°30.9	45.8
9	297°51.3	282°57.1	·· 51.0	217°56.5	·· 28.8	285°35.9	·· 03.7	325°33.1	·· 45.7
10	312°53.7	297°56.7	52.3	232°57.9	28.8	300°37.8	04.0	340°35.3	45.6
11	327°56.2	312°56.4	53.6	247°59.2	28.9	315°39.7	04.2	355°37.5	45.5
12	342°58.7	327°56.1	N05°54.9	263°00.5	N25°28.9	330°41.7	N04°04.4	10°39.6	S12°45.4
13	358°01.1	342°55.8	56.1	278°01.8	29.0	345°43.6	04.6	25°41.8	45.3
14	13°03.6	357°55.5	57.4	293°03.1	29.0	0°45.6	04.9	40°44.0	45.2
15	28°06.0	12°55.2	05°58.7	308°04.4	·· 29.1	15°47.5	·· 05.1	55°46.2	·· 45.1
16	43°08.5	27°54.8	06°00.0	323°05.7	29.1	30°49.4	05.3	70°48.4	45.0
17	58°11.0	42°54.5	01.3	338°07.0	29.1	45°51.4	05.5	85°50.5	44.9
18	73°13.4	57°54.2	N06°02.5	353°08.3	N25°29.2	60°53.3	N04°05.8	100°52.7	S12°44.8
19	88°15.9	72°53.9	03.8	8°09.6	29.2	75°55.3	06.0	115°54.9	44.7
20	103°18.4	87°53.6	05.1	23°10.9	29.3	90°57.2	06.2	130°57.1	44.6
21	118°20.8	102°53.2	·· 06.4	38°12.2	·· 29.3	105°59.1	·· 06.4	145°59.3	·· 44.5
22	133°23.3	117°52.9	07.7	53°13.5	29.4	121°01.1	06.7	161°01.4	44.4
23	148°25.8	132°52.6	08.9	68°14.8	29.4	136°03.0	06.9	176°03.6	44.3
Mer.pass. 13:08		ν -0.3′ d 1.3′ m -3.95		ν 1.3′ d 0.0′ m 0.50		ν 1.9′ d 0.2′ m -2.09		ν 2.2′ d 0.1′ m 0.90	

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	163°28.2	147°52.3	N06°10.2	83°16.2	N25°29.5	151°05.0	N04°07.1	191°05.8	S12°44.2
1	178°30.7	162°52.0	11.5	98°17.5	29.5	166°06.9	07.3	206°08.0	44.1
2	193°33.2	177°51.7	12.8	113°18.8	29.5	181°08.8	07.6	221°10.2	44.0
3	208°35.6	192°51.3	·· 14.0	128°20.1	·· 29.6	196°10.8	·· 07.8	236°12.3	·· 43.9
4	223°38.1	207°51.0	15.3	143°21.4	29.6	211°12.7	08.0	251°14.5	43.8
5	238°40.5	222°50.7	16.6	158°22.7	29.7	226°14.6	08.2	266°16.7	43.7
6	253°43.0	237°50.4	N06°17.9	173°24.0	N25°29.7	241°16.6	N04°08.5	281°18.9	S12°43.6
7	268°45.5	252°50.1	19.1	188°25.3	29.8	256°18.5	08.7	296°21.0	43.5
8	283°47.9	267°49.7	20.4	203°26.6	29.8	271°20.5	08.9	311°23.2	43.4
9	298°50.4	282°49.4	·· 21.7	218°27.9	·· 29.8	286°22.4	·· 09.1	326°25.4	·· 43.3
10	313°52.9	297°49.1	23.0	233°29.2	29.9	301°24.3	09.4	341°27.6	43.1
11	328°55.3	312°48.8	24.2	248°30.5	29.9	316°26.3	09.6	356°29.8	43.0
12	343°57.8	327°48.5	N06°25.5	263°31.8	N25°30.0	331°28.2	N04°09.8	11°31.9	S12°42.9
13	359°00.3	342°48.1	26.8	278°33.1	30.0	346°30.2	10.0	26°34.1	42.8
14	14°02.7	357°47.8	28.1	293°34.4	30.0	1°32.1	10.3	41°36.3	42.7
15	29°05.2	12°47.5	·· 29.3	308°35.6	·· 30.1	16°34.0	·· 10.5	56°38.5	·· 42.6
16	44°07.7	27°47.2	30.6	323°36.9	30.1	31°36.0	10.7	71°40.7	42.5
17	59°10.1	42°46.9	31.9	338°38.2	30.2	46°37.9	11.0	86°42.8	42.4
18	74°12.6	57°46.5	N06°33.2	353°39.5	N25°30.2	61°39.8	N04°11.2	101°45.0	S12°42.3
19	89°15.0	72°46.2	34.4	8°40.8	30.2	76°41.8	11.4	116°47.2	42.2
20	104°17.5	87°45.9	35.7	23°42.1	30.3	91°43.7	11.6	131°49.4	42.1
21	119°20.0	102°45.6	·· 37.0	38°43.4	·· 30.3	106°45.7	·· 11.9	146°51.6	·· 42.0
22	134°22.4	117°45.3	38.2	53°44.7	30.4	121°47.6	12.1	161°53.7	41.9
23	149°24.9	132°44.9	39.5	68°46.0	30.4	136°49.5	12.3	176°55.9	41.8
Mer.pass. 13:04		ν -0.3′ d 1.3′ m -3.95		ν 1.3′ d 0.0′ m 0.52		ν 1.9′ d 0.2′ m -2.09		ν 2.2′ d 0.1′ m 0.90	

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	164°27.4	147°44.6	N06°40.8	83°47.3	N25°30.5	151°51.5	N04°12.5	191°58.1	S12°41.7
1	179°29.8	162°44.3	42.1	98°48.6	30.5	166°53.4	12.8	207°00.3	41.6
2	194°32.3	177°44.0	43.3	113°49.9	30.5	181°55.4	13.0	222°02.5	41.5
3	209°34.8	192°43.6	·· 44.6	128°51.2	·· 30.6	196°57.3	·· 13.2	237°04.6	·· 41.4
4	224°37.2	207°43.3	45.9	143°52.5	30.6	211°59.2	13.4	252°06.8	41.3
5	239°39.7	222°43.0	47.1	158°53.7	30.7	227°01.2	13.7	267°09.0	41.2
6	254°42.1	237°42.7	N06°48.4	173°55.0	N25°30.7	242°03.1	N04°13.9	282°11.2	S12°41.1
7	269°44.6	252°42.4	49.7	188°56.3	30.7	257°05.0	14.1	297°13.4	41.0
8	284°47.1	267°42.0	50.9	203°57.6	30.8	272°07.0	14.3	312°15.6	40.9
9	299°49.5	282°41.7	·· 52.2	218°58.9	·· 30.8	287°08.9	·· 14.6	327°17.7	·· 40.8
10	314°52.0	297°41.4	53.5	234°00.2	30.8	302°10.8	14.8	342°19.9	40.7
11	329°54.5	312°41.1	54.8	249°01.5	30.9	317°12.8	15.0	357°22.1	40.6
12	344°56.9	327°40.7	N06°56.0	264°02.8	N25°30.9	332°14.7	N04°15.2	12°24.3	S12°40.5
13	359°59.4	342°40.4	57.3	279°04.0	31.0	347°16.7	15.5	27°26.5	40.4
14	15°01.9	357°40.1	58.6	294°05.3	31.0	2°18.6	15.7	42°28.6	40.3
15	30°04.3	12°39.8	06°59.8	309°06.6	·· 31.0	17°20.5	·· 15.9	57°30.8	·· 40.2
16	45°06.8	27°39.5	07°01.1	324°07.9	31.1	32°22.5	16.1	72°33.0	40.1
17	60°09.3	42°39.1	02.4	339°09.2	31.1	47°24.4	16.4	87°35.2	40.0
18	75°11.7	57°38.8	N07°03.6	354°10.5	N25°31.2	62°26.3	N04°16.6	102°37.4	S12°39.9
19	90°14.2	72°38.5	04.9	9°11.8	31.2	77°28.3	16.8	117°39.5	39.8
20	105°16.6	87°38.2	06.2	24°13.0	31.2	92°30.2	17.0	132°41.7	39.7
21	120°19.1	102°37.8	·· 07.4	39°14.3	·· 31.3	107°32.1	·· 17.3	147°43.9	·· 39.6
22	135°21.6	117°37.5	08.7	54°15.6	31.3	122°34.1	17.5	162°46.1	39.5
23	150°24.0	132°37.2	10.0	69°16.9	31.3	137°36.0	17.7	177°48.3	39.4
Mer.pass. 13:00		ν -0.3′ d 1.3′ m -3.95		ν 1.3′ d 0.0′ m 0.54		ν 1.9′ d 0.2′ m -2.09		ν 2.2′ d 0.1′ m 0.91	

Stars	SHA	Dec
Alpheratz	357°36.7	29°13.0
Ankaa	353°09.0	-42°11.0
Schedar	349°33.3	56°39.9
Diphda	348°49.1	-17°51.8
Achernar	335°21.7	-57°07.4
Hamal	327°53.1	23°34.2
Polaris	315°00.0	89°22.0
Acamar	315°13.1	-40°13.0
Menkar	314°07.9	4°10.7
Mirfak	308°30.6	49°56.7
Aldebaran	290°41.4	16°33.3
Rigel	281°05.3	-8°10.7
Capella	280°24.1	46°01.4
Bellatrix	278°24.5	6°22.2
Elnath	278°03.7	28°37.6
Alnilam	275°39.2	-1°11.3
Betelgeuse	270°53.6	7°24.6
Canopus	263°52.9	-52°42.7
Sirius	258°27.4	-16°45.0
Adhara	255°06.9	-29°00.4
Procyon	244°52.2	5°09.9
Pollux	243°18.9	27°58.2
Avior	234°14.9	-59°35.2
Suhail	222°47.1	-43°31.7
Miaplacidus	221°37.8	-69°48.8
Alphard	217°49.0	-8°45.6
Regulus	207°35.7	11°51.2
Dubhe	193°42.2	61°37.5
Denebola	182°26.2	14°26.5
Gienah	175°44.9	-17°40.3
Acrux	173°01.2	-63°13.5
Gacrux	171°52.8	-57°14.5
Alioth	166°13.8	55°49.9
Spica	158°23.7	-11°17.0
Alkaid	152°52.8	49°11.6
Hadar	148°37.8	-60°28.9
Menkent	147°59.2	-36°29.0
Arcturus	145°49.1	19°03.5
Rigil Kent.	139°42.0	-60°55.7
Kochab	137°19.1	74°03.3
Zuben'ubi	136°57.5	-16°08.3
Alphecca	126°04.9	26°38.0
Antares	112°17.7	-26°29.0
Atria	107°13.3	-69°03.9
Sabik	102°04.6	-15°45.3
Shaula	96°12.5	-37°07.1
Rasalhague	96°00.0	12°32.4
Eltanin	90°43.0	51°28.8
Kaus Aust.	83°34.7	-34°22.4
Vega	80°34.4	38°48.0
Nunki	75°49.8	-26°16.1
Altair	62°01.7	8°55.6
Peacock	53°08.6	-56°39.6
Deneb	49°27.2	45°21.5
Enif	33°40.6	9°58.7
Al Na'ir	27°35.3	-46°51.0
Fomalhaut	15°16.6	-29°30.1
Scheat	13°47.0	28°12.3
Markab	13°31.7	15°19.6

Mar 05 Sun	**SHA**	**Mer.pass**
Venus	345°30.8	14:08
Mars	280°15.6	18:27
Jupiter	347°49.3	13:57
Saturn	27°44.4	11:17

Mar 06 Mon	**SHA**	**Mer.pass**
Venus	344°24.1	14:09
Mars	279°47.9	18:25
Jupiter	347°36.7	13:54
Saturn	27°37.6	11:14

Mar 07 Tue	**SHA**	**Mer.pass**
Venus	343°17.2	14:09
Mars	279°19.9	18:23
Jupiter	347°24.1	13:51
Saturn	27°30.7	11:11

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°05.7	S06°14.4	22°13.5	13.4′	N20°44.6	9.6′	54.0′
1	192°05.8	13.5	36°45.9	13.5′	20°35.0	9.8′	54.1′
2	207°05.9	12.5	51°18.4	13.5′	20°25.2	9.8′	54.1′
3	222°06.1	· · 11.5	65°50.9	13.6′	20°15.4	9.9′	54.1′
4	237°06.2	10.6	80°23.5	13.7′	20°05.5	10.0′	54.1′
5	252°06.4	09.6	94°56.2	13.7′	19°55.5	10.0′	54.1′
6	267°06.5	S06°08.6	109°28.9	13.8′	N19°45.5	10.2′	54.1′
7	282°06.6	07.7	124°01.7	13.8′	19°35.3	10.2′	54.1′
8	297°06.8	06.7	138°34.5	13.9′	19°25.1	10.4′	54.1′
9	312°06.9	· · 05.7	153°07.3	13.9′	19°14.7	10.4′	54.1′
10	327°07.1	04.8	167°40.2	14.0′	19°04.3	10.5′	54.1′
11	342°07.2	03.8	182°13.2	14.0′	18°53.8	10.5′	54.1′
12	357°07.3	S06°02.8	196°46.2	14.1′	N18°43.3	10.7′	54.1′
13	12°07.5	01.9	211°19.3	14.1′	18°32.6	10.7′	54.1′
14	27°07.6	00.9	225°52.4	14.2′	18°21.9	10.9′	54.1′
15	42°07.8	06°00.0	240°25.6	14.2′	18°11.0	10.8′	54.2′
16	57°07.9	05°59.0	254°58.8	14.3′	18°00.2	11.0′	54.2′
17	72°08.1	58.0	269°32.1	14.3′	17°49.2	11.1′	54.2′
18	87°08.2	S05°57.1	284°05.4	14.4′	N17°38.1	11.1′	54.2′
19	102°08.3	56.1	298°38.8	14.4′	17°27.0	11.2′	54.2′
20	117°08.5	55.1	313°12.2	14.5′	17°15.8	11.3′	54.2′
21	132°08.6	· · 54.2	327°45.6	14.5′	17°04.5	11.3′	54.2′
22	147°08.8	53.2	342°19.1	14.6′	16°53.2	11.4′	54.2′
23	162°08.9	52.2	356°52.7	14.6′	16°41.8	11.5′	54.2′
	SD = 16.1′	d = 1.0′	SD = 14.7′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°09.0	S05°51.2	11°26.3	14.6′	N16°30.3	11.6′	54.2′
1	192°09.2	50.3	25°59.9	14.7′	16°18.7	11.6′	54.2′
2	207°09.3	49.3	40°33.6	14.7′	16°07.1	11.7′	54.3′
3	222°09.5	· · 48.3	55°07.4	14.8′	15°55.4	11.8′	54.3′
4	237°09.6	47.4	69°41.1	14.8′	15°43.6	11.8′	54.3′
5	252°09.8	46.4	84°15.0	14.9′	15°31.8	11.9′	54.3′
6	267°09.9	S05°45.4	98°48.8	14.9′	N15°19.9	12.0′	54.3′
7	282°10.1	44.5	113°22.7	14.9′	15°07.9	12.0′	54.3′
8	297°10.2	43.5	127°56.7	15.0′	14°55.9	12.1′	54.3′
9	312°10.3	· · 42.5	142°30.7	15.0′	14°43.8	12.2′	54.3′
10	327°10.5	41.6	157°04.7	15.1′	14°31.6	12.2′	54.3′
11	342°10.6	40.6	171°38.8	15.1′	14°19.4	12.3′	54.4′
12	357°10.8	S05°39.6	186°12.9	15.1′	N14°07.1	12.3′	54.4′
13	12°10.9	38.7	200°47.0	15.2′	13°54.8	12.5′	54.4′
14	27°11.1	37.7	215°21.2	15.2′	13°42.3	12.4′	54.4′
15	42°11.2	· · 36.7	229°55.4	15.3′	13°29.9	12.6′	54.4′
16	57°11.4	35.8	244°29.7	15.3′	13°17.3	12.5′	54.4′
17	72°11.5	34.8	259°04.0	15.3′	13°04.8	12.7′	54.4′
18	87°11.7	S05°33.8	273°38.3	15.4′	N12°52.1	12.7′	54.4′
19	102°11.8	32.8	288°12.7	15.4′	12°39.4	12.7′	54.5′
20	117°11.9	31.9	302°47.1	15.4′	12°26.7	12.9′	54.5′
21	132°12.1	· · 30.9	317°21.5	15.5′	12°13.8	12.8′	54.5′
22	147°12.2	29.9	331°56.0	15.5′	12°01.0	12.9′	54.5′
23	162°12.4	29.0	346°30.5	15.5′	11°48.1	13.0′	54.5′
	SD = 16.1′	d = 1.0′	SD = 14.8′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°12.5	S05°28.0	1°05.0	15.6′	N11°35.1	13.0′	54.5′
1	192°12.7	27.0	15°39.5	15.6′	11°22.1	13.1′	54.5′
2	207°12.8	26.1	30°14.1	15.6′	11°09.0	13.1′	54.5′
3	222°13.0	· · 25.1	44°48.7	15.6′	10°55.9	13.2′	54.6′
4	237°13.1	24.1	59°23.4	15.7′	10°42.7	13.2′	54.6′
5	252°13.3	23.1	73°58.0	15.7′	10°29.5	13.3′	54.6′
6	267°13.4	S05°22.2	88°32.7	15.7′	N10°16.2	13.3′	54.6′
7	282°13.6	21.2	103°07.4	15.7′	10°02.9	13.3′	54.6′
8	297°13.7	20.2	117°42.2	15.8′	09°49.6	13.4′	54.6′
9	312°13.9	· · 19.3	132°16.9	15.8′	09°36.2	13.5′	54.6′
10	327°14.0	18.3	146°51.7	15.8′	09°22.7	13.5′	54.7′
11	342°14.2	17.3	161°26.5	15.8′	09°09.2	13.5′	54.7′
12	357°14.3	S05°16.3	176°01.3	15.8′	N08°55.7	13.6′	54.7′
13	12°14.5	15.4	190°36.2	15.9′	08°42.1	13.6′	54.7′
14	27°14.6	14.4	205°11.0	15.9′	08°28.5	13.6′	54.7′
15	42°14.8	· · 13.4	219°45.9	15.9′	08°14.9	13.7′	54.7′
16	57°14.9	12.4	234°20.8	15.9′	08°01.2	13.8′	54.7′
17	72°15.1	11.5	248°55.7	15.9′	07°47.4	13.7′	54.8′
18	87°15.2	S05°10.5	263°30.7	15.9′	N07°33.7	13.8′	54.8′
19	102°15.4	09.5	278°05.6	16.0′	07°19.9	13.9′	54.8′
20	117°15.5	08.6	292°40.6	16.0′	07°06.0	13.9′	54.8′
21	132°15.7	· · 07.6	307°15.5	16.0′	06°52.1	13.9′	54.8′
22	147°15.8	06.6	321°50.5	16.0′	06°38.2	13.9′	54.8′
23	162°16.0	05.6	336°25.5	16.0′	06°24.3	14.0′	54.8′
	SD = 16.1′	d = 1.0′	SD = 14.9′				

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

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

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 13-15 94-100%
05	11:37	11:31	12:12	23:13	10:51	○
06	11:24	11:17	12:11	23:56	11:34	
07	11:10	11:03	12:11	–:–	12:16	

March 08, 09, 10 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	165°26.5	147°36.9	N07°11.2	84°18.2	N25°31.4	152°38.0	N04°18.0	192°50.4	S12°39.3
1	180°29.0	162°36.5	12.5	99°19.4	31.4	167°39.9	18.2	207°52.6	39.2
2	195°31.4	177°36.2	13.8	114°20.7	31.5	182°41.8	18.4	222°54.8	39.1
3	210°33.9	192°35.9	·· 15.0	129°22.0	·· 31.5	197°43.8	·· 18.6	237°57.0	·· 39.0
4	225°36.4	207°35.6	16.3	144°23.3	31.5	212°45.7	18.9	252°59.2	38.9
5	240°38.8	222°35.2	17.5	159°24.6	31.6	227°47.6	19.1	268°01.3	38.8
6	255°41.3	237°34.9	N07°18.8	174°25.8	N25°31.6	242°49.6	N04°19.3	283°03.5	S12°38.7
7	270°43.7	252°34.6	20.1	189°27.1	31.6	257°51.5	19.5	298°05.7	38.6
8	285°46.2	267°34.3	21.3	204°28.4	31.7	272°53.4	19.8	313°07.9	38.5
9	300°48.7	282°33.9	·· 22.6	219°29.7	·· 31.7	287°55.4	·· 20.0	328°10.1	·· 38.4
10	315°51.1	297°33.6	23.9	234°31.0	31.8	302°57.3	20.2	343°12.3	38.3
11	330°53.6	312°33.3	25.1	249°32.2	31.8	317°59.2	20.4	358°14.4	38.2
12	345°56.1	327°33.0	N07°26.4	264°33.5	N25°31.8	333°01.2	N04°20.7	13°16.6	S12°38.1
13	0°58.5	342°32.6	27.6	279°34.8	31.9	348°03.1	20.9	28°18.8	38.0
14	16°01.0	357°32.3	28.9	294°36.1	31.9	3°05.0	21.1	43°21.0	37.9
15	31°03.5	12°32.0	·· 30.2	309°37.3	·· 31.9	18°07.0	·· 21.3	58°23.2	·· 37.8
16	46°05.9	27°31.7	31.4	324°38.6	32.0	33°08.9	21.6	73°25.3	37.7
17	61°08.4	42°31.3	32.7	339°39.9	32.0	48°10.8	21.8	88°27.5	37.6
18	76°10.9	57°31.0	N07°33.9	354°41.2	N25°32.0	63°12.8	N04°22.0	103°29.7	S12°37.5
19	91°13.3	72°30.7	35.2	9°42.4	32.1	78°14.7	22.3	118°31.9	37.4
20	106°15.8	87°30.4	36.5	24°43.7	32.1	93°16.7	22.5	133°34.1	37.3
21	121°18.2	102°30.0	·· 37.7	39°45.0	·· 32.1	108°18.6	·· 22.7	148°36.3	·· 37.2
22	136°20.7	117°29.7	39.0	54°46.2	32.2	123°20.5	22.9	163°38.4	37.1
23	151°23.2	132°29.4	40.2	69°47.5	32.2	138°22.5	23.2	178°40.6	37.0
Mer.pass. 12:56		ν -0.3′ d 1.3′ m -3.95		ν 1.3′ d 0.0′ m 0.56		ν 1.9′ d 0.2′ m -2.09		ν 2.2′ d 0.1′ m 0.91	

Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	166°25.6	147°29.0	N07°41.5	84°48.8	N25°32.2	153°24.4	N04°23.4	193°42.8	S12°36.9
1	181°28.1	162°28.7	42.8	99°50.1	32.3	168°26.3	23.6	208°45.0	36.8
2	196°30.6	177°28.4	44.0	114°51.3	32.3	183°28.3	23.8	223°47.2	36.7
3	211°33.0	192°28.1	·· 45.3	129°52.6	·· 32.4	198°30.2	·· 24.1	238°49.3	·· 36.6
4	226°35.5	207°27.7	46.5	144°53.9	32.4	213°32.1	24.3	253°51.5	36.5
5	241°38.0	222°27.4	47.8	159°55.1	32.4	228°34.1	24.5	268°53.7	36.4
6	256°40.4	237°27.1	N07°49.0	174°56.4	N25°32.5	243°36.0	N04°24.7	283°55.9	S12°36.3
7	271°42.9	252°26.7	50.3	189°57.7	32.5	258°37.9	25.0	298°58.1	36.2
8	286°45.3	267°26.4	51.6	204°58.9	32.5	273°39.9	25.2	314°00.3	36.1
9	301°47.8	282°26.1	·· 52.8	220°00.2	·· 32.6	288°41.8	·· 25.4	329°02.4	·· 36.1
10	316°50.3	297°25.8	54.1	235°01.5	32.6	303°43.7	25.6	344°04.6	36.0
11	331°52.7	312°25.4	55.3	250°02.7	32.6	318°45.7	25.9	359°06.8	35.9
12	346°55.2	327°25.1	N07°56.6	265°04.0	N25°32.7	333°47.6	N04°26.1	14°09.0	S12°35.8
13	1°57.7	342°24.8	57.8	280°05.3	32.7	348°49.5	26.3	29°11.2	35.7
14	17°00.1	357°24.4	07°59.1	295°06.5	32.7	3°51.5	26.6	44°13.4	35.6
15	32°02.6	12°24.1	08°00.3	310°07.8	·· 32.8	18°53.4	·· 26.8	59°15.5	·· 35.5
16	47°05.1	27°23.8	01.6	325°09.0	32.8	33°55.3	27.0	74°17.7	35.4
17	62°07.5	42°23.5	02.8	340°10.3	32.8	48°57.3	27.2	89°19.9	35.3
18	77°10.0	57°23.1	N08°04.1	355°11.6	N25°32.9	63°59.2	N04°27.5	104°22.1	S12°35.2
19	92°12.5	72°22.8	05.4	10°12.8	32.9	79°01.1	27.7	119°24.3	35.1
20	107°14.9	87°22.5	06.6	25°14.1	32.9	94°03.0	27.9	134°26.5	35.0
21	122°17.4	102°22.1	·· 07.9	40°15.4	·· 32.9	109°05.0	·· 28.1	149°28.6	·· 34.9
22	137°19.8	117°21.8	09.1	55°16.6	33.0	124°06.9	28.4	164°30.8	34.8
23	152°22.3	132°21.5	10.4	70°17.9	33.0	139°08.8	28.6	179°33.0	34.7
Mer.pass. 12:52		ν -0.3′ d 1.3′ m -3.95		ν 1.3′ d 0.0′ m 0.58		ν 1.9′ d 0.2′ m -2.08		ν 2.2′ d 0.1′ m 0.91	

Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	167°24.8	147°21.1	N08°11.6	85°19.1	N25°33.0	154°10.8	N04°28.8	194°35.2	S12°34.6
1	182°27.2	162°20.8	12.9	100°20.4	33.1	169°12.7	29.1	209°37.4	34.5
2	197°29.7	177°20.5	14.1	115°21.7	33.1	184°14.6	29.3	224°39.5	34.4
3	212°32.2	192°20.1	·· 15.4	130°22.9	·· 33.1	199°16.6	·· 29.5	239°41.7	·· 34.3
4	227°34.6	207°19.8	16.6	145°24.2	33.2	214°18.5	29.7	254°43.9	34.2
5	242°37.1	222°19.5	17.9	160°25.4	33.2	229°20.4	30.0	269°46.1	34.1
6	257°39.6	237°19.1	N08°19.1	175°26.7	N25°33.2	244°22.4	N04°30.2	284°48.3	S12°34.0
7	272°42.0	252°18.8	20.4	190°27.9	33.3	259°24.3	30.4	299°50.5	33.9
8	287°44.5	267°18.5	21.6	205°29.2	33.3	274°26.2	30.6	314°52.6	33.8
9	302°46.9	282°18.1	·· 22.9	220°30.5	·· 33.3	289°28.2	·· 30.9	329°54.8	·· 33.7
10	317°49.4	297°17.8	24.1	235°31.7	33.4	304°30.1	31.1	344°57.0	33.6
11	332°51.9	312°17.5	25.3	250°33.0	33.4	319°32.0	31.3	359°59.2	33.5
12	347°54.3	327°17.1	N08°26.6	265°34.2	N25°33.4	334°34.0	N04°31.5	15°01.4	S12°33.4
13	2°56.8	342°16.8	27.8	280°35.5	33.4	349°35.9	31.8	30°03.6	33.3
14	17°59.3	357°16.5	29.1	295°36.7	33.5	4°37.8	32.0	45°05.7	33.2
15	33°01.7	12°16.1	·· 30.3	310°38.0	·· 33.5	19°39.7	·· 32.2	60°07.9	·· 33.1
16	48°04.2	27°15.8	31.6	325°39.2	33.5	34°41.7	32.5	75°10.1	33.0
17	63°06.7	42°15.5	32.8	340°40.5	33.6	49°43.6	32.7	90°12.3	32.9
18	78°09.1	57°15.1	N08°34.1	355°41.7	N25°33.6	64°45.5	N04°32.9	105°14.5	S12°32.8
19	93°11.6	72°14.8	35.3	10°43.0	33.6	79°47.5	33.1	120°16.7	32.7
20	108°14.1	87°14.5	36.6	25°44.2	33.6	94°49.4	33.4	135°18.9	32.6
21	123°16.5	102°14.1	·· 37.8	40°45.5	·· 33.7	109°51.3	·· 33.6	150°21.0	·· 32.5
22	138°19.0	117°13.8	39.0	55°46.7	33.7	124°53.3	33.8	165°23.2	32.4
23	153°21.4	132°13.5	40.3	70°48.0	33.7	139°55.2	34.0	180°25.4	32.3
Mer.pass. 12:48		ν -0.3′ d 1.3′ m -3.96		ν 1.3′ d 0.0′ m 0.60		ν 1.9′ d 0.2′ m -2.08		ν 2.2′ d 0.1′ m 0.91	

Stars

	SHA	**Dec**
Alpheratz	357°36.7	29°13.0
Ankaa	353°09.0	-42°11.0
Schedar	349°33.3	56°39.8
Diphda	348°49.1	-17°51.8
Achernar	335°21.8	-57°07.4
Hamal	327°53.2	23°34.2
Polaris	315°01.4	89°22.0
Acamar	315°13.1	-40°13.0
Menkar	314°07.9	4°10.7
Mirfak	308°30.7	49°56.7
Aldebaran	290°41.4	16°33.3
Rigel	281°05.3	-8°10.6
Capella	280°24.1	46°01.4
Bellatrix	278°24.5	6°22.2
Elnath	278°03.8	28°37.6
Alnilam	275°39.2	-1°11.3
Betelgeuse	270°53.7	7°24.6
Canopus	263°52.9	-52°42.7
Sirius	258°27.5	-16°45.0
Adhara	255°06.9	-29°00.4
Procyon	244°52.2	5°09.9
Pollux	243°18.9	27°58.2
Avior	234°14.9	-59°35.2
Suhail	222°47.1	-43°31.7
Miaplacidus	221°37.8	-69°48.8
Alphard	217°49.0	-8°45.6
Regulus	207°35.8	11°51.2
Dubhe	193°42.2	61°37.6
Denebola	182°26.2	14°26.5
Gienah	175°44.8	-17°40.3
Acrux	173°01.2	-63°13.6
Gacrux	171°52.8	-57°14.5
Alioth	166°13.8	55°49.9
Spica	158°23.6	-11°17.0
Alkaid	152°52.8	49°11.6
Hadar	148°37.7	-60°28.9
Menkent	147°59.2	-36°29.0
Arcturus	145°49.1	19°03.5
Rigil Kent.	139°42.0	-60°55.7
Kochab	137°19.1	74°03.3
Zuben'ubi	136°57.5	-16°08.3
Alphecca	126°04.9	26°38.0
Antares	112°17.7	-26°29.0
Atria	107°13.3	-69°03.9
Sabik	102°04.5	-15°45.3
Shaula	96°12.5	-37°07.1
Rasalhague	96°00.0	12°32.4
Eltanin	90°43.0	51°28.8
Kaus Aust.	83°34.7	-34°22.4
Vega	80°34.4	38°48.0
Nunki	75°49.8	-26°16.1
Altair	62°01.6	8°55.5
Peacock	53°08.5	-56°39.6
Deneb	49°27.2	45°21.5
Enif	33°40.6	9°58.7
Al Na'ir	27°35.3	-46°51.0
Fomalhaut	15°16.5	-29°30.1
Scheat	13°47.0	28°12.3
Markab	13°31.7	15°19.6

Mar 08 Wed	**SHA**	**Mer.pass**
Venus	342°10.4	14:10
Mars	278°51.7	18:21
Jupiter	347°11.5	13:48
Saturn	27°23.9	11:07

Mar 09 Thu	**SHA**	**Mer.pass**
Venus	341°03.4	14:10
Mars	278°23.1	18:19
Jupiter	346°58.7	13:45
Saturn	27°17.2	11:04

Mar 10 Fri	**SHA**	**Mer.pass**
Venus	339°56.4	14:11
Mars	277°54.4	18:17
Jupiter	346°46.0	13:42
Saturn	27°10.4	11:00

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h — Sun — Moon

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	177°16.1	S05°04.7	351°00.5	16.0′	N06°10.3	14.0′	54.9′
1	192°16.3	03.7	5°35.5	16.0′	05°56.3	14.0′	54.9′
2	207°16.4	02.7	20°10.5	16.0′	05°42.3	14.1′	54.9′
3	222°16.6	·· 01.7	34°45.6	16.0′	05°28.2	14.1′	54.9′
4	237°16.7	05°00.8	49°20.6	16.0′	05°14.1	14.1′	54.9′
5	252°16.9	04°59.8	63°55.7	16.0′	05°00.0	14.2′	54.9′
6	267°17.0	S04°58.8	78°30.7	16.0′	N04°45.8	14.1′	55.0′
7	282°17.2	57.8	93°05.7	16.1′	04°31.7	14.2′	55.0′
8	297°17.3	56.9	107°40.8	16.1′	04°17.5	14.3′	55.0′
9	312°17.5	·· 55.9	122°15.9	16.1′	04°03.2	14.2′	55.0′
10	327°17.6	54.9	136°50.9	16.1′	03°49.0	14.3′	55.0′
11	342°17.8	53.9	151°26.0	16.1′	03°34.7	14.3′	55.0′
12	357°17.9	S04°53.0	166°01.0	16.1′	N03°20.4	14.3′	55.1′
13	12°18.1	52.0	180°36.1	16.0′	03°06.1	14.3′	55.1′
14	27°18.3	51.0	195°11.1	16.0′	02°51.8	14.4′	55.1′
15	42°18.4	·· 50.0	209°46.2	16.0′	02°37.4	14.4′	55.1′
16	57°18.6	49.1	224°21.2	16.0′	02°23.0	14.4′	55.1′
17	72°18.7	48.1	238°56.2	16.0′	02°08.6	14.4′	55.1′
18	87°18.9	S04°47.1	253°31.3	16.0′	N01°54.2	14.4′	55.2′
19	102°19.0	46.1	268°06.3	16.0′	01°39.8	14.4′	55.2′
20	117°19.2	45.2	282°41.3	16.0′	01°25.4	14.5′	55.2′
21	132°19.3	·· 44.2	297°16.3	16.0′	01°10.9	14.5′	55.2′
22	147°19.5	43.2	311°51.3	16.0′	00°56.4	14.4′	55.2′
23	162°19.6	42.2	326°26.2	16.0′	00°42.0	14.5′	55.2′
	SD = 16.1′	d = 1.0′	SD = 15.0′				

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	177°19.8	S04°41.3	341°01.2	15.9′	N00°27.5	14.5′	55.3′
1	192°20.0	40.3	355°36.1	15.9′	N00°13.0	14.6′	55.3′
2	207°20.1	39.3	10°11.1	15.9′	S00°01.6	14.5′	55.3′
3	222°20.3	·· 38.3	24°46.0	15.9′	00°16.1	14.5′	55.3′
4	237°20.4	37.4	39°20.9	15.9′	00°30.6	14.5′	55.3′
5	252°20.6	36.4	53°55.8	15.9′	00°45.1	14.6′	55.3′
6	267°20.7	S04°35.4	68°30.6	15.8′	S00°59.7	14.5′	55.4′
7	282°20.9	34.4	83°05.5	15.8′	01°14.2	14.6′	55.4′
8	297°21.0	33.5	97°40.3	15.8′	01°28.8	14.5′	55.4′
9	312°21.2	·· 32.5	112°15.1	15.8′	01°43.3	14.6′	55.4′
10	327°21.4	31.5	126°49.9	15.7′	01°57.9	14.6′	55.4′
11	342°21.5	30.5	141°24.6	15.7′	02°12.5	14.5′	55.5′
12	357°21.7	S04°29.5	155°59.3	15.7′	S02°27.0	14.6′	55.5′
13	12°21.8	28.6	170°34.0	15.7′	02°41.6	14.5′	55.5′
14	27°22.0	27.6	185°08.7	15.6′	02°56.1	14.6′	55.5′
15	42°22.1	·· 26.6	199°43.3	15.6′	03°10.7	14.5′	55.5′
16	57°22.3	25.6	214°17.9	15.6′	03°25.2	14.6′	55.6′
17	72°22.5	24.7	228°52.5	15.5′	03°39.8	14.5′	55.6′
18	87°22.6	S04°23.7	243°27.1	15.5′	S03°54.3	14.6′	55.6′
19	102°22.8	22.7	258°01.6	15.5′	04°08.9	14.5′	55.6′
20	117°22.9	21.7	272°36.0	15.4′	04°23.4	14.5′	55.6′
21	132°23.1	·· 20.7	287°10.5	15.4′	04°37.9	14.5′	55.6′
22	147°23.3	19.8	301°44.9	15.4′	04°52.4	14.5′	55.7′
23	162°23.4	18.8	316°19.3	15.3′	05°06.9	14.5′	55.7′
	SD = 16.1′	d = 1.0′	SD = 15.1′				

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	177°23.6	S04°17.8	330°53.6	15.3′	S05°21.4	14.5′	55.7′
1	192°23.7	16.8	345°27.9	15.2′	05°35.9	14.5′	55.7′
2	207°23.9	15.8	0°02.1	15.2′	05°50.4	14.4′	55.7′
3	222°24.0	·· 14.9	14°36.3	15.2′	06°04.8	14.5′	55.8′
4	237°24.2	13.9	29°10.5	15.1′	06°19.3	14.4′	55.8′
5	252°24.4	12.9	43°44.6	15.1′	06°33.7	14.4′	55.8′
6	267°24.5	S04°11.9	58°18.7	15.0′	S06°48.1	14.4′	55.8′
7	282°24.7	11.0	72°52.7	15.0′	07°02.5	14.3′	55.8′
8	297°24.8	10.0	87°26.7	14.9′	07°16.8	14.4′	55.9′
9	312°25.0	·· 09.0	102°00.6	14.9′	07°31.2	14.3′	55.9′
10	327°25.2	08.0	116°34.5	14.8′	07°45.5	14.3′	55.9′
11	342°25.3	07.0	131°08.3	14.8′	07°59.8	14.3′	55.9′
12	357°25.5	S04°06.1	145°42.1	14.7′	S08°14.1	14.2′	55.9′
13	12°25.6	05.1	160°15.8	14.7′	08°28.3	14.3′	56.0′
14	27°25.8	04.1	174°49.5	14.6′	08°42.6	14.2′	56.0′
15	42°26.0	·· 03.1	189°23.1	14.6′	08°56.8	14.2′	56.0′
16	57°26.1	02.1	203°56.7	14.5′	09°11.0	14.1′	56.0′
17	72°26.3	01.2	218°30.2	14.4′	09°25.1	14.1′	56.0′
18	87°26.5	S04°00.2	233°03.6	14.4′	S09°39.2	14.1′	56.1′
19	102°26.6	03°59.2	247°37.0	14.3′	09°53.3	14.1′	56.1′
20	117°26.8	58.2	262°10.3	14.3′	10°07.4	14.0′	56.1′
21	132°26.9	·· 57.2	276°43.6	14.2′	10°21.4	14.0′	56.1′
22	147°27.1	56.3	291°16.8	14.1′	10°35.4	13.9′	56.2′
23	162°27.3	55.3	305°49.9	14.1′	10°49.3	13.9′	56.2′
	SD = 16.1′	d = 1.0′	SD = 15.2′				

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

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

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 16-18 100-94%
08	10:56	10:48	12:11	00:37	12:58	
09	10:41	10:33	12:11	01:18	13:39	
10	10:26	10:18	12:10	02:00	14:21	

March 11, 12, 13 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	168°23.9	147°13.1	N08°41.5	85°49.2	N25°33.8	154°57.1	N04°34.3	195°27.6	S12°32.2
1	183°26.4	162°12.8	42.8	100°50.5	33.8	169°59.1	34.5	210°29.8	32.1
2	198°28.8	177°12.5	44.0	115°51.7	33.8	185°01.0	34.7	225°32.0	32.0
3	213°31.3	192°12.1	·· 45.3	130°53.0	·· 33.8	200°02.9	·· 35.0	240°34.1	·· 31.9
4	228°33.8	207°11.8	46.5	145°54.2	33.9	215°04.8	35.2	255°36.3	31.8
5	243°36.2	222°11.5	47.7	160°55.5	33.9	230°06.8	35.4	270°38.5	31.7
6	258°38.7	237°11.1	N08°49.0	175°56.7	N25°33.9	245°08.7	N04°35.6	285°40.7	S12°31.6
7	273°41.2	252°10.8	50.2	190°58.0	34.0	260°10.6	35.9	300°42.9	31.5
8	288°43.6	267°10.4	51.5	205°59.2	34.0	275°12.6	36.1	315°45.1	31.4
9	303°46.1	282°10.1	·· 52.7	221°00.5	·· 34.0	290°14.5	·· 36.3	330°47.2	·· 31.3
10	318°48.6	297°09.8	53.9	236°01.7	34.0	305°16.4	36.5	345°49.4	31.2
11	333°51.0	312°09.4	55.2	251°03.0	34.1	320°18.4	36.8	0°51.6	31.1
12	348°53.5	327°09.1	N08°56.4	266°04.2	N25°34.1	335°20.3	N04°37.0	15°53.8	S12°31.0
13	3°55.9	342°08.8	57.7	281°05.5	34.1	350°22.2	37.2	30°56.0	30.9
14	18°58.4	357°08.4	08°58.9	296°06.7	34.1	5°24.1	37.5	45°58.2	30.8
15	34°00.9	12°08.1	09°00.1	311°07.9	·· 34.2	20°26.1	·· 37.7	61°00.4	·· 30.7
16	49°03.3	27°07.7	01.4	326°09.2	34.2	35°28.0	37.9	76°02.5	30.6
17	64°05.8	42°07.4	02.6	341°10.4	34.2	50°29.9	38.1	91°04.7	30.5
18	79°08.3	57°07.1	N09°03.9	356°11.7	N25°34.3	65°31.9	N04°38.4	106°06.9	S12°30.4
19	94°10.7	72°06.7	05.1	11°12.9	34.3	80°33.8	38.6	121°09.1	30.3
20	109°13.2	87°06.4	06.3	26°14.2	34.3	95°35.7	38.8	136°11.3	30.2
21	124°15.7	102°06.0	·· 07.6	41°15.4	·· 34.3	110°37.6	·· 39.1	151°13.5	·· 30.1
22	139°18.1	117°05.7	08.8	56°16.6	34.4	125°39.6	39.3	166°15.6	30.0
23	154°20.6	132°05.4	10.0	71°17.9	34.4	140°41.5	39.5	181°17.8	29.9
Mer.pass. 12:44		ν -0.3′	d 1.2′	m -3.96	ν 1.2′	d 0.0′	m 0.61	ν 1.9′	d 0.2′ m -2.08 ν 2.2′ d 0.1′ m 0.91

Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	169°23.0	147°05.0	N09°11.3	86°19.1	N25°34.4	155°43.4	N04°39.7	196°20.0	S12°29.8
1	184°25.5	162°04.7	12.5	101°20.4	34.4	170°45.4	40.0	211°22.2	29.7
2	199°28.0	177°04.3	13.7	116°21.6	34.5	185°47.3	40.2	226°24.4	29.6
3	214°30.4	192°04.0	·· 15.0	131°22.8	·· 34.5	200°49.2	·· 40.4	241°26.6	·· 29.5
4	229°32.9	207°03.7	16.2	146°24.1	34.5	215°51.1	40.6	256°28.8	29.4
5	244°35.4	222°03.3	17.4	161°25.3	34.5	230°53.1	40.9	271°30.9	29.3
6	259°37.8	237°03.0	N09°18.7	176°26.5	N25°34.6	245°55.0	N04°41.1	286°33.1	S12°29.2
7	274°40.3	252°02.6	19.9	191°27.8	34.6	260°56.9	41.3	301°35.3	29.1
8	289°42.8	267°02.3	21.1	206°29.0	34.6	275°58.9	41.6	316°37.5	29.0
9	304°45.2	282°02.0	·· 22.4	221°30.3	·· 34.6	291°00.8	·· 41.8	331°39.7	·· 28.9
10	319°47.7	297°01.6	23.6	236°31.5	34.7	306°02.7	42.0	346°41.9	28.8
11	334°50.2	312°01.3	24.8	251°32.7	34.7	321°04.6	42.2	1°44.1	28.7
12	349°52.6	327°00.9	N09°26.1	266°34.0	N25°34.7	336°06.6	N04°42.5	16°46.2	S12°28.6
13	4°55.1	342°00.6	27.3	281°35.2	34.7	351°08.5	42.7	31°48.4	28.5
14	19°57.5	357°00.2	28.5	296°36.4	34.7	6°10.4	42.9	46°50.6	28.4
15	35°00.0	11°59.9	·· 29.7	311°37.7	·· 34.8	21°12.4	·· 43.2	61°52.8	·· 28.3
16	50°02.5	26°59.6	31.0	326°38.9	34.8	36°14.3	43.4	76°55.0	28.2
17	65°04.9	41°59.2	32.2	341°40.1	34.8	51°16.2	43.6	91°57.2	28.1
18	80°07.4	56°58.9	N09°33.4	356°41.4	N25°34.8	66°18.1	N04°43.8	106°59.4	S12°28.0
19	95°09.9	71°58.5	34.7	11°42.6	34.9	81°20.1	44.1	122°01.5	27.9
20	110°12.3	86°58.2	35.9	26°43.8	34.9	96°22.0	44.3	137°03.7	27.8
21	125°14.8	101°57.8	·· 37.1	41°45.1	·· 34.9	111°23.9	·· 44.5	152°05.9	·· 27.7
22	140°17.3	116°57.5	38.3	56°46.3	34.9	126°25.8	44.7	167°08.1	27.6
23	155°19.7	131°57.1	39.6	71°47.5	34.9	141°27.8	45.0	182°10.3	27.5
Mer.pass. 12:40		ν -0.3′	d 1.2′	m -3.96	ν 1.2′	d 0.0′	m 0.63	ν 1.9′	d 0.2′ m -2.08 ν 2.2′ d 0.1′ m 0.92

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	170°22.2	146°56.8	N09°40.8	86°48.7	N25°35.0	156°29.7	N04°45.2	197°12.5	S12°27.4
1	185°24.7	161°56.5	42.0	101°50.0	35.0	171°31.6	45.4	212°14.7	27.3
2	200°27.1	176°56.1	43.2	116°51.2	35.0	186°33.5	45.7	227°16.8	27.2
3	215°29.6	191°55.8	·· 44.5	131°52.4	·· 35.0	201°35.5	·· 45.9	242°19.0	·· 27.1
4	230°32.0	206°55.4	45.7	146°53.7	35.1	216°37.4	46.1	257°21.2	27.0
5	245°34.5	221°55.1	46.9	161°54.9	35.1	231°39.3	46.3	272°23.4	26.9
6	260°37.0	236°54.7	N09°48.1	176°56.1	N25°35.1	246°41.3	N04°46.6	287°25.6	S12°26.8
7	275°39.4	251°54.4	49.4	191°57.3	35.1	261°43.2	46.8	302°27.8	26.7
8	290°41.9	266°54.0	50.6	206°58.6	35.1	276°45.1	47.0	317°30.0	26.6
9	305°44.4	281°53.7	·· 51.8	221°59.8	·· 35.2	291°47.0	·· 47.3	332°32.2	·· 26.6
10	320°46.8	296°53.3	53.0	237°01.0	35.2	306°49.0	47.5	347°34.3	26.5
11	335°49.3	311°53.0	54.3	252°02.2	35.2	321°50.9	47.7	2°36.5	26.4
12	350°51.8	326°52.6	N09°55.5	267°03.5	N25°35.2	336°52.8	N04°47.9	17°38.7	S12°26.3
13	5°54.2	341°52.3	56.7	282°04.7	35.2	351°54.7	48.2	32°40.9	26.2
14	20°56.7	356°51.9	57.9	297°05.9	35.3	6°56.7	48.4	47°43.1	26.1
15	35°59.1	11°51.6	09°59.1	312°07.1	·· 35.3	21°58.6	·· 48.6	62°45.3	·· 26.0
16	51°01.6	26°51.2	10°00.4	327°08.4	35.3	37°00.5	48.9	77°47.5	25.9
17	66°04.1	41°50.9	01.6	342°09.6	35.3	52°02.4	49.1	92°49.6	25.8
18	81°06.5	56°50.6	N10°02.8	357°10.8	N25°35.3	67°04.4	N04°49.3	107°51.8	S12°25.7
19	96°09.0	71°50.2	04.0	12°12.0	35.4	82°06.3	49.5	122°54.0	25.6
20	111°11.5	86°49.9	05.2	27°13.3	35.4	97°08.2	49.8	137°56.2	25.5
21	126°13.9	101°49.5	·· 06.5	42°14.5	·· 35.4	112°10.1	·· 50.0	152°58.4	·· 25.4
22	141°16.4	116°49.2	07.7	57°15.7	35.4	127°12.1	50.2	168°00.6	25.3
23	156°18.9	131°48.8	08.9	72°16.9	35.4	142°14.0	50.4	183°02.8	25.2
Mer.pass. 12:36		ν -0.3′	d 1.2′	m -3.96	ν 1.2′	d 0.0′	m 0.65	ν 1.9′	d 0.2′ m -2.08 ν 2.2′ d 0.1′ m 0.92

Stars

	SHA	**Dec**
Alpheratz	357°36.7	29°13.0
Ankaa	353°09.0	-42°11.0
Schedar	349°33.3	56°39.8
Diphda	348°49.1	-17°51.8
Achernar	335°21.8	-57°07.4
Hamal	327°53.2	23°34.2
Polaris	315°02.6	89°21.9
Acamar	315°13.2	-40°13.0
Menkar	314°07.9	4°10.7
Mirfak	308°30.7	49°56.7
Aldebaran	290°41.4	16°33.3
Rigel	281°05.3	-8°10.7
Capella	280°24.1	46°01.4
Bellatrix	278°24.5	6°22.2
Elnath	278°03.8	28°37.6
Alnilam	275°39.3	-1°11.3
Betelgeuse	270°53.7	7°24.6
Canopus	263°52.9	-52°42.7
Sirius	258°27.5	-16°45.0
Adhara	255°06.9	-29°00.4
Procyon	244°52.3	5°09.9
Pollux	243°19.0	27°58.2
Avior	234°14.9	-59°35.2
Suhail	222°47.1	-43°31.7
Miaplacidus	221°37.8	-69°48.8
Alphard	217°49.0	-8°45.6
Regulus	207°35.8	11°51.2
Dubhe	193°42.2	61°37.6
Denebola	182°26.2	14°26.5
Gienah	175°44.8	-17°40.3
Acrux	173°01.2	-63°13.6
Gacrux	171°52.8	-57°14.5
Alioth	166°13.8	55°49.9
Spica	158°23.6	-11°17.0
Alkaid	152°52.8	49°11.7
Hadar	148°37.7	-60°28.9
Menkent	147°59.1	-36°29.0
Arcturus	145°49.1	19°03.5
Rigil Kent.	139°42.0	-60°55.7
Kochab	137°19.0	74°03.3
Zuben'ubi	136°57.5	-16°08.3
Alphecca	126°04.9	26°38.0
Antares	112°17.6	-26°29.0
Atria	107°13.2	-69°03.9
Sabik	102°04.5	-15°45.3
Shaula	96°12.5	-37°07.1
Rasalhague	96°00.0	12°32.4
Eltanin	90°43.0	51°28.8
Kaus Aust.	83°34.6	-34°22.4
Vega	80°34.4	38°48.0
Nunki	75°49.8	-26°16.1
Altair	62°01.6	8°55.5
Peacock	53°08.5	-56°39.6
Deneb	49°27.2	45°21.5
Enif	33°40.6	9°58.7
Al Na'ir	27°35.2	-46°51.0
Fomalhaut	15°16.5	-29°30.1
Scheat	13°47.0	28°12.3
Markab	13°31.7	15°19.6

Mar 11 Sat	**SHA**	**Mer.pass**
Venus	338°49.2	14:11
Mars	277°25.3	18:15
Jupiter	346°33.2	13:38
Saturn	27°03.7	10:57

Mar 12 Sun	**SHA**	**Mer.pass**
Venus	337°42.0	14:12
Mars	276°56.1	18:13
Jupiter	346°20.4	13:35
Saturn	26°57.0	10:53

Mar 13 Mon	**SHA**	**Mer.pass**
Venus	336°34.6	14:13
Mars	276°26.6	18:11
Jupiter	346°07.5	13:32
Saturn	26°50.3	10:50

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°27.4	S03°54.3	320°23.0	14.0′	S11°03.2	13.9′	56.2′
1	192°27.6	53.3	334°56.0	13.9′	11°17.1	13.8′	56.2′
2	207°27.8	52.3	349°28.9	13.9′	11°30.9	13.8′	56.2′
3	222°27.9	·· 51.3	4°01.8	13.8′	11°44.7	13.8′	56.3′
4	237°28.1	50.4	18°34.6	13.7′	11°58.5	13.7′	56.3′
5	252°28.2	49.4	33°07.3	13.7′	12°12.2	13.7′	56.3′
6	267°28.4	S03°48.4	47°40.0	13.6′	S12°25.9	13.6′	56.3′
7	282°28.6	47.4	62°12.5	13.5′	12°39.5	13.6′	56.3′
8	297°28.7	46.4	76°45.1	13.4′	12°53.1	13.5′	56.4′
9	312°28.9	·· 45.5	91°17.5	13.4′	13°06.6	13.5′	56.4′
10	327°29.1	44.5	105°49.8	13.3′	13°20.1	13.4′	56.4′
11	342°29.2	43.5	120°22.1	13.2′	13°33.5	13.4′	56.4′
12	357°29.4	S03°42.5	134°54.3	13.1′	S13°46.9	13.3′	56.5′
13	12°29.5	41.5	149°26.5	13.0′	14°00.2	13.3′	56.5′
14	27°29.7	40.6	163°58.5	13.0′	14°13.5	13.2′	56.5′
15	42°29.9	·· 39.6	178°30.5	12.9′	14°26.7	13.2′	56.5′
16	57°30.0	38.6	193°02.3	12.8′	14°39.9	13.1′	56.5′
17	72°30.2	37.6	207°34.1	12.7′	14°53.0	13.1′	56.6′
18	87°30.4	S03°36.6	222°05.9	12.6′	S15°06.1	12.9′	56.6′
19	102°30.5	35.6	236°37.5	12.5′	15°19.0	13.0′	56.6′
20	117°30.7	34.7	251°09.0	12.5′	15°32.0	12.8′	56.6′
21	132°30.9	·· 33.7	265°40.5	12.4′	15°44.8	12.8′	56.7′
22	147°31.0	32.7	280°11.9	12.3′	15°57.6	12.8′	56.7′
23	162°31.2	31.7	294°43.1	12.2′	16°10.4	12.6′	56.7′
	SD = 16.1′	d = 1.0′	SD = 15.3′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°31.4	S03°30.7	309°14.3	12.1′	S16°23.0	12.6′	56.7′
1	192°31.5	29.7	323°45.4	12.0′	16°35.6	12.6′	56.8′
2	207°31.7	28.8	338°16.4	11.9′	16°48.2	12.4′	56.8′
3	222°31.9	·· 27.8	352°47.4	11.8′	17°00.6	12.4′	56.8′
4	237°32.0	26.8	7°18.2	11.7′	17°13.0	12.4′	56.8′
5	252°32.2	25.8	21°48.9	11.6′	17°25.4	12.2′	56.8′
6	267°32.4	S03°24.8	36°19.6	11.5′	S17°37.6	12.2′	56.9′
7	282°32.5	23.8	50°50.1	11.4′	17°49.8	12.1′	56.9′
8	297°32.7	22.9	65°20.5	11.3′	18°01.9	12.0′	56.9′
9	312°32.9	·· 21.9	79°50.9	11.2′	18°13.9	11.9′	56.9′
10	327°33.0	20.9	94°21.1	11.1′	18°25.8	11.8′	57.0′
11	342°33.2	19.9	108°51.3	11.1′	18°37.6	11.8′	57.0′
12	357°33.4	S03°18.9	123°21.3	11.0′	S18°49.4	11.7′	57.0′
13	12°33.5	17.9	137°51.3	10.8′	19°01.1	11.6′	57.0′
14	27°33.7	17.0	152°21.1	10.7′	19°12.7	11.5′	57.1′
15	42°33.9	·· 16.0	166°50.9	10.6′	19°24.2	11.4′	57.1′
16	57°34.0	15.0	181°20.5	10.5′	19°35.6	11.3′	57.1′
17	72°34.2	14.0	195°50.1	10.4′	19°46.9	11.3′	57.1′
18	87°34.4	S03°13.0	210°19.5	10.3′	S19°58.2	11.1′	57.2′
19	102°34.5	12.0	224°48.8	10.2′	20°09.3	11.1′	57.2′
20	117°34.7	11.1	239°18.1	10.1′	20°20.4	10.9′	57.2′
21	132°34.9	·· 10.1	253°47.2	10.0′	20°31.3	10.9′	57.2′
22	147°35.0	09.1	268°16.2	9.9′	20°42.2	10.7′	57.3′
23	162°35.2	08.1	282°45.1	9.8′	20°52.9	10.7′	57.3′
	SD = 16.1′	d = 1.0′	SD = 15.5′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°35.4	S03°07.1	297°13.9	9.7′	S21°03.6	10.6′	57.3′
1	192°35.5	06.1	311°42.6	9.6′	21°14.2	10.4′	57.3′
2	207°35.7	05.2	326°11.2	9.5′	21°24.6	10.3′	57.3′
3	222°35.9	·· 04.2	340°39.7	9.4′	21°34.9	10.3′	57.4′
4	237°36.0	03.2	355°08.1	9.3′	21°45.2	10.1′	57.4′
5	252°36.2	02.2	9°36.4	9.2′	21°55.3	10.0′	57.4′
6	267°36.4	S03°01.2	24°04.5	9.1′	S22°05.3	9.9′	57.4′
7	282°36.5	03°00.2	38°32.6	8.9′	22°15.2	9.8′	57.5′
8	297°36.7	02°59.2	53°00.6	8.8′	22°25.0	9.7′	57.5′
9	312°36.9	·· 58.3	67°28.4	8.7′	22°34.7	9.6′	57.5′
10	327°37.1	57.3	81°56.1	8.6′	22°44.3	9.4′	57.5′
11	342°37.2	56.3	96°23.7	8.5′	22°53.7	9.3′	57.6′
12	357°37.4	S02°55.3	110°51.3	8.4′	S23°03.0	9.2′	57.6′
13	12°37.6	54.3	125°18.7	8.3′	23°12.2	9.1′	57.6′
14	27°37.7	53.3	139°45.9	8.2′	23°21.3	9.0′	57.6′
15	42°37.9	·· 52.4	154°13.1	8.1′	23°30.3	8.8′	57.7′
16	57°38.1	51.4	168°40.2	8.0′	23°39.1	8.7′	57.7′
17	72°38.2	50.4	183°07.2	7.9′	23°47.8	8.6′	57.7′
18	87°38.4	S02°49.4	197°34.0	7.8′	S23°56.4	8.5′	57.7′
19	102°38.6	48.4	212°00.8	7.6′	24°04.9	8.3′	57.8′
20	117°38.8	47.4	226°27.4	7.5′	24°13.2	8.2′	57.8′
21	132°38.9	·· 46.4	240°54.0	7.4′	24°21.4	8.0′	57.8′
22	147°39.1	45.5	255°20.4	7.3′	24°29.4	7.9′	57.9′
23	162°39.3	44.5	269°46.7	7.2′	24°37.3	7.8′	57.9′
	SD = 16.1′	d = 1.0′	SD = 15.6′				

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

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

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 88-72%
11	10:10	10:02	12:10	02:43	15:06	
12	09:55	09:47	12:10	03:30	15:54	
13	09:39	09:30	12:10	04:20	16:47	

March 14, 15, 16 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	171°21.3	146°48.5	N10°10.1	87°18.1	N25°35.5	157°15.9	N04°50.7	198°05.0	S12°25.1
1	186°23.8	161°48.1	11.3	102°19.4	35.5	172°17.8	50.9	213°07.1	25.0
2	201°26.3	176°47.8	12.5	117°20.6	35.5	187°19.8	51.1	228°09.3	24.9
3	216°28.7	191°47.4	·· 13.8	132°21.8	·· 35.5	202°21.7	·· 51.4	243°11.5	·· 24.8
4	231°31.2	206°47.0	15.0	147°23.0	35.5	217°23.6	51.6	258°13.7	24.7
5	246°33.6	221°46.7	16.2	162°24.2	35.5	232°25.5	51.8	273°15.9	24.6
6	261°36.1	236°46.3	N10°17.4	177°25.5	N25°35.6	247°27.5	N04°52.0	288°18.1	S12°24.5
7	276°38.6	251°46.0	18.6	192°26.7	35.6	262°29.4	52.3	303°20.3	24.4
8	291°41.0	266°45.6	19.8	207°27.9	35.6	277°31.3	52.5	318°22.5	24.3
9	306°43.5	281°45.3	·· 21.0	222°29.1	·· 35.6	292°33.2	·· 52.7	333°24.6	·· 24.2
10	321°46.0	296°44.9	22.3	237°30.3	35.6	307°35.2	53.0	348°26.8	24.1
11	336°48.4	311°44.6	23.5	252°31.5	35.7	322°37.1	53.2	3°29.0	24.0
12	351°50.9	326°44.2	N10°24.7	267°32.8	N25°35.7	337°39.0	N04°53.4	18°31.2	S12°23.9
13	6°53.4	341°43.9	25.9	282°34.0	35.7	352°40.9	53.6	33°33.4	23.8
14	21°55.8	356°43.5	27.1	297°35.2	35.7	7°42.9	53.9	48°35.6	23.7
15	36°58.3	11°43.2	·· 28.3	312°36.4	·· 35.7	22°44.8	·· 54.1	63°37.8	·· 23.6
16	52°00.8	26°42.8	29.5	327°37.6	35.7	37°46.7	54.3	78°40.0	23.5
17	67°03.2	41°42.5	30.7	342°38.8	35.7	52°48.6	54.6	93°42.1	23.4
18	82°05.7	56°42.1	N10°31.9	357°40.0	N25°35.8	67°50.6	N04°54.8	108°44.3	S12°23.3
19	97°08.1	71°41.8	33.2	12°41.3	35.8	82°52.5	55.0	123°46.5	23.2
20	112°10.6	86°41.4	34.4	27°42.5	35.8	97°54.4	55.2	138°48.7	23.1
21	127°13.1	101°41.0	·· 35.6	42°43.7	·· 35.8	112°56.3	·· 55.5	153°50.9	·· 23.0
22	142°15.5	116°40.7	36.8	57°44.9	35.8	127°58.3	55.7	168°53.1	22.9
23	157°18.0	131°40.3	38.0	72°46.1	35.8	143°00.2	55.9	183°55.3	22.8
Mer.pass. 12:33		ν -0.4′ d 1.2′ m -3.96		ν 1.2′ d 0.0′ m 0.67		ν 1.9′ d 0.2′ m -2.08		ν 2.2′ d 0.1′ m 0.92	

Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	172°20.5	146°40.0	N10°39.2	87°47.3	N25°35.9	158°02.1	N04°56.2	198°57.5	S12°22.7
1	187°22.9	161°39.6	40.4	102°48.5	35.9	173°04.0	56.4	213°59.7	22.6
2	202°25.4	176°39.3	41.6	117°49.7	35.9	188°06.0	56.6	229°01.8	22.5
3	217°27.9	191°38.9	·· 42.8	132°50.9	·· 35.9	203°07.9	·· 56.8	244°04.0	·· 22.4
4	232°30.3	206°38.5	44.0	147°52.2	35.9	218°09.8	57.1	259°06.2	22.3
5	247°32.8	221°38.2	45.2	162°53.4	35.9	233°11.7	57.3	274°08.4	22.2
6	262°35.3	236°37.8	N10°46.4	177°54.6	N25°35.9	248°13.7	N04°57.5	289°10.6	S12°22.1
7	277°37.7	251°37.5	47.6	192°55.8	36.0	263°15.6	57.8	304°12.8	22.0
8	292°40.2	266°37.1	48.8	207°57.0	36.0	278°17.5	58.0	319°15.0	21.9
9	307°42.6	281°36.8	·· 50.0	222°58.2	·· 36.0	293°19.4	·· 58.2	334°17.2	·· 21.9
10	322°45.1	296°36.4	51.2	237°59.4	36.0	308°21.3	58.4	349°19.4	21.8
11	337°47.6	311°36.0	52.4	253°00.6	36.0	323°23.3	58.7	4°21.5	21.7
12	352°50.0	326°35.7	N10°53.6	268°01.8	N25°36.0	338°25.2	N04°58.9	19°23.7	S12°21.6
13	7°52.5	341°35.3	54.8	283°03.0	36.0	353°27.1	59.1	34°25.9	21.5
14	22°55.0	356°35.0	56.0	298°04.2	36.1	8°29.0	59.4	49°28.1	21.4
15	37°57.4	11°34.6	·· 57.2	313°05.4	·· 36.1	23°31.0	·· 59.6	64°30.3	·· 21.3
16	52°59.9	26°34.2	58.4	328°06.6	36.1	38°32.9	04°59.8	79°32.5	21.2
17	68°02.4	41°33.9	10°59.6	343°07.8	36.1	53°34.8	05°00.0	94°34.7	21.1
18	83°04.8	56°33.5	N11°00.8	358°09.0	N25°36.1	68°36.7	N05°00.3	109°36.9	S12°21.0
19	98°07.3	71°33.2	02.0	13°10.3	36.1	83°38.6	00.5	124°39.1	20.9
20	113°09.8	86°32.8	03.2	28°11.5	36.1	98°40.6	00.7	139°41.2	20.8
21	128°12.2	101°32.4	·· 04.4	43°12.7	·· 36.1	113°42.5	·· 01.0	154°43.4	·· 20.7
22	143°14.7	116°32.1	05.6	58°13.9	36.2	128°44.4	01.2	169°45.6	20.6
23	158°17.1	131°31.7	06.8	73°15.1	36.2	143°46.3	01.4	184°47.8	20.5
Mer.pass. 12:29		ν -0.4′ d 1.2′ m -3.96		ν 1.2′ d 0.0′ m 0.69		ν 1.9′ d 0.2′ m -2.07		ν 2.2′ d 0.1′ m 0.92	

Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	173°19.6	146°31.4	N11°08.0	88°16.3	N25°36.2	158°48.3	N05°01.7	199°50.0	S12°20.4
1	188°22.1	161°31.0	09.2	103°17.5	36.2	173°50.2	01.9	214°52.2	20.3
2	203°24.5	176°30.6	10.4	118°18.7	36.2	188°52.1	02.1	229°54.4	20.2
3	218°27.0	191°30.3	·· 11.6	133°19.9	·· 36.2	203°54.0	·· 02.3	244°56.6	·· 20.1
4	233°29.5	206°29.9	12.8	148°21.1	36.2	218°55.9	02.6	259°58.8	20.0
5	248°31.9	221°29.5	14.0	163°22.3	36.2	233°57.9	02.8	275°01.0	19.9
6	263°34.4	236°29.2	N11°15.2	178°23.5	N25°36.2	248°59.8	N05°03.0	290°03.1	S12°19.8
7	278°36.9	251°28.8	16.4	193°24.7	36.3	264°01.7	03.3	305°05.3	19.7
8	293°39.3	266°28.5	17.6	208°25.9	36.3	279°03.6	03.5	320°07.5	19.6
9	308°41.8	281°28.1	·· 18.8	223°27.1	·· 36.3	294°05.6	·· 03.7	335°09.7	·· 19.5
10	323°44.2	296°27.7	20.0	238°28.3	36.3	309°07.5	03.9	350°11.9	19.4
11	338°46.7	311°27.4	21.2	253°29.5	36.3	324°09.4	04.2	5°14.1	19.3
12	353°49.2	326°27.0	N11°22.4	268°30.7	N25°36.3	339°11.3	N05°04.4	20°16.3	S12°19.2
13	8°51.6	341°26.6	23.6	283°31.9	36.3	354°13.2	04.6	35°18.5	19.1
14	23°54.1	356°26.3	24.7	298°33.0	36.3	9°15.2	04.9	50°20.7	19.0
15	38°56.6	11°25.9	·· 25.9	313°34.2	·· 36.3	24°17.1	·· 05.1	65°22.9	·· 18.9
16	53°59.0	26°25.5	27.1	328°35.4	36.3	39°19.0	05.3	80°25.0	18.8
17	69°01.5	41°25.2	28.3	343°36.6	36.3	54°20.9	05.5	95°27.2	18.7
18	84°04.0	56°24.8	N11°29.5	358°37.8	N25°36.4	69°22.9	N05°05.8	110°29.4	S12°18.6
19	99°06.4	71°24.4	30.7	13°39.0	36.4	84°24.8	06.0	125°31.6	18.5
20	114°08.9	86°24.1	31.9	28°40.2	36.4	99°26.7	06.2	140°33.8	18.4
21	129°11.4	101°23.7	·· 33.1	43°41.4	·· 36.4	114°28.6	·· 06.5	155°36.0	·· 18.4
22	144°13.8	116°23.3	34.3	58°42.6	36.4	129°30.5	06.7	170°38.2	18.3
23	159°16.3	131°23.0	35.4	73°43.8	36.4	144°32.5	06.9	185°40.4	18.2
Mer.pass. 12:25		ν -0.4′ d 1.2′ m -3.96		ν 1.2′ d 0.0′ m 0.71		ν 1.9′ d 0.2′ m -2.07		ν 2.2′ d 0.1′ m 0.92	

Stars

	SHA	**Dec**
Alpheratz	357°36.7	29°13.0
Ankaa	353°09.0	-42°11.0
Schedar	349°33.3	56°39.8
Diphda	348°49.1	-17°51.8
Achernar	335°21.8	-57°07.4
Hamal	327°53.2	23°34.2
Polaris	315°03.6	89°21.9
Acamar	315°13.2	-40°13.0
Menkar	314°07.9	4°10.7
Mirfak	308°30.7	49°56.7
Aldebaran	290°41.4	16°33.3
Rigel	281°05.3	-8°10.7
Capella	280°24.2	46°01.4
Bellatrix	278°24.5	6°22.2
Elnath	278°03.8	28°37.6
Alnilam	275°39.3	-1°11.4
Betelgeuse	270°53.7	7°24.6
Canopus	263°53.0	-52°42.7
Sirius	258°27.5	-16°45.0
Adhara	255°06.9	-29°00.4
Procyon	244°52.3	5°09.9
Pollux	243°19.0	27°58.2
Avior	234°14.9	-59°35.2
Suhail	222°47.1	-43°31.7
Miaplacidus	221°37.9	-69°48.9
Alphard	217°49.0	-8°45.6
Regulus	207°35.8	11°51.2
Dubhe	193°42.2	61°37.6
Denebola	182°26.2	14°26.5
Gienah	175°44.8	-17°40.3
Acrux	173°01.1	-63°13.6
Gacrux	171°52.8	-57°14.5
Alioth	166°13.8	55°49.9
Spica	158°23.6	-11°17.0
Alkaid	152°52.8	49°11.7
Hadar	148°37.7	-60°28.9
Menkent	147°59.1	-36°29.0
Arcturus	145°49.0	19°03.5
Rigil Kent.	139°42.0	-60°55.7
Kochab	137°19.0	74°03.3
Zuben'ubi	136°57.5	-16°08.3
Alphecca	126°04.9	26°38.0
Antares	112°17.6	-26°29.0
Atria	107°13.1	-69°03.9
Sabik	102°04.5	-15°45.3
Shaula	96°12.4	-37°07.1
Rasalhague	96°00.0	12°32.4
Eltanin	90°42.9	51°28.8
Kaus Aust.	83°34.6	-34°22.4
Vega	80°34.4	38°48.0
Nunki	75°49.8	-26°16.1
Altair	62°01.6	8°55.5
Peacock	53°08.5	-56°39.5
Deneb	49°27.2	45°21.5
Enif	33°40.6	9°58.7
Al Na'ir	27°35.2	-46°51.0
Fomalhaut	15°16.5	-29°30.1
Scheat	13°47.0	28°12.3
Markab	13°31.7	15°19.6

Mar 14 Tue	**SHA**	**Mer.pass**
Venus	335°27.1	14:13
Mars	275°56.8	18:09
Jupiter	345°54.6	13:29
Saturn	26°43.6	10:46

Mar 15 Wed	**SHA**	**Mer.pass**
Venus	334°19.5	14:14
Mars	275°26.8	18:07
Jupiter	345°41.6	13:26
Saturn	26°37.0	10:43

Mar 16 Thu	**SHA**	**Mer.pass**
Venus	333°11.8	14:14
Mars	274°56.7	18:05
Jupiter	345°28.7	13:23
Saturn	26°30.4	10:39

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°39.4	S02°43.5	284°12.9	7.1′	S24°45.1	7.6′	57.9′
1	192°39.6	42.5	298°39.0	7.0′	24°52.7	7.5′	57.9′
2	207°39.8	41.5	313°05.0	6.9′	25°00.2	7.4′	58.0′
3	222°40.0	·· 40.5	327°30.9	6.8′	25°07.6	7.2′	58.0′
4	237°40.1	39.5	341°56.7	6.7′	25°14.8	7.1′	58.0′
5	252°40.3	38.6	356°22.4	6.6′	25°21.9	6.9′	58.0′
6	267°40.5	S02°37.6	10°48.0	6.5′	S25°28.8	6.7′	58.1′
7	282°40.6	36.6	25°13.5	6.4′	25°35.5	6.7′	58.1′
8	297°40.8	35.6	39°38.9	6.3′	25°42.2	6.4′	58.1′
9	312°41.0	·· 34.6	54°04.2	6.2′	25°48.6	6.4′	58.1′
10	327°41.2	33.6	68°29.4	6.1′	25°55.0	6.1′	58.2′
11	342°41.3	32.6	82°54.5	6.0′	26°01.1	6.0′	58.2′
12	357°41.5	S02°31.6	97°19.5	5.9′	S26°07.1	5.9′	58.2′
13	12°41.7	30.7	111°44.4	5.8′	26°13.0	5.7′	58.2′
14	27°41.8	29.7	126°09.2	5.7′	26°18.7	5.5′	58.3′
15	42°42.0	·· 28.7	140°33.9	5.6′	26°24.2	5.4′	58.3′
16	57°42.2	27.7	154°58.5	5.5′	26°29.6	5.2′	58.3′
17	72°42.4	26.7	169°23.0	5.4′	26°34.8	5.0′	58.3′
18	87°42.5	S02°25.7	183°47.5	5.3′	S26°39.8	4.9′	58.4′
19	102°42.7	24.7	198°11.8	5.3′	26°44.7	4.7′	58.4′
20	117°42.9	23.8	212°36.1	5.2′	26°49.4	4.6′	58.4′
21	132°43.1	·· 22.8	227°00.2	5.1′	26°54.0	4.4′	58.4′
22	147°43.2	21.8	241°24.3	5.0′	26°58.4	4.2′	58.5′
23	162°43.4	20.8	255°48.3	4.9′	27°02.6	4.0′	58.5′
	SD = 16.1′	d = 1.0′	SD = 15.8′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°43.6	S02°19.8	270°12.3	4.9′	S27°06.6	3.9′	58.5′
1	192°43.7	18.8	284°36.1	4.8′	27°10.5	3.7′	58.5′
2	207°43.9	17.8	298°59.9	4.7′	27°14.2	3.5′	58.6′
3	222°44.1	·· 16.8	313°23.6	4.6′	27°17.7	3.3′	58.6′
4	237°44.3	15.9	327°47.2	4.6′	27°21.0	3.2′	58.6′
5	252°44.4	14.9	342°10.8	4.5′	27°24.2	3.0′	58.6′
6	267°44.6	S02°13.9	356°34.2	4.4′	S27°27.2	2.8′	58.7′
7	282°44.8	12.9	10°57.7	4.3′	27°30.0	2.7′	58.7′
8	297°45.0	11.9	25°21.0	4.3′	27°32.7	2.4′	58.7′
9	312°45.1	·· 10.9	39°44.3	4.2′	27°35.1	2.3′	58.7′
10	327°45.3	09.9	54°07.5	4.2′	27°37.4	2.1′	58.8′
11	342°45.5	08.9	68°30.7	4.1′	27°39.5	1.9′	58.8′
12	357°45.7	S02°08.0	82°53.8	4.0′	S27°41.4	1.7′	58.8′
13	12°45.8	07.0	97°16.8	4.0′	27°43.1	1.5′	58.8′
14	27°46.0	06.0	111°39.8	3.9′	27°44.6	1.4′	58.9′
15	42°46.2	·· 05.0	126°02.7	3.9′	27°46.0	1.1′	58.9′
16	57°46.4	04.0	140°25.6	3.8′	27°47.1	1.0′	58.9′
17	72°46.5	03.0	154°48.5	3.8′	27°48.1	0.8′	58.9′
18	87°46.7	S02°02.0	169°11.3	3.8′	S27°48.9	0.6′	59.0′
19	102°46.9	01.0	183°34.0	3.7′	27°49.5	0.4′	59.0′
20	117°47.1	02°00.1	197°56.8	3.7′	27°49.9	0.2′	59.0′
21	132°47.2	01°59.1	212°19.4	3.6′	27°50.1	0.1′	59.0′
22	147°47.4	58.1	226°42.1	3.6′	27°50.2	0.2′	59.1′
23	162°47.6	57.1	241°04.7	3.6′	27°50.0	0.4′	59.1′
	SD = 16.1′	d = 1.0′	SD = 16.0′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°47.8	S01°56.1	255°27.3	3.6′	S27°49.6	0.5′	59.1′
1	192°47.9	55.1	269°49.8	3.5′	27°49.1	0.7′	59.1′
2	207°48.1	54.1	284°12.3	3.5′	27°48.4	1.0′	59.2′
3	222°48.3	·· 53.1	298°34.8	3.5′	27°47.4	1.1′	59.2′
4	237°48.5	52.2	312°57.3	3.5′	27°46.3	1.3′	59.2′
5	252°48.6	51.2	327°19.8	3.4′	27°45.0	1.5′	59.2′
6	267°48.8	S01°50.2	341°42.2	3.4′	S27°43.5	1.7′	59.3′
7	282°49.0	49.2	356°04.7	3.4′	27°41.8	1.9′	59.3′
8	297°49.2	48.2	10°27.1	3.4′	27°39.9	2.1′	59.3′
9	312°49.3	·· 47.2	24°49.5	3.4′	27°37.8	2.3′	59.3′
10	327°49.5	46.2	39°11.9	3.4′	27°35.5	2.4′	59.4′
11	342°49.7	45.2	53°34.3	3.4′	27°33.1	2.7′	59.4′
12	357°49.9	S01°44.2	67°56.7	3.4′	S27°30.4	2.9′	59.4′
13	12°50.1	43.3	82°19.1	3.4′	27°27.5	3.0′	59.4′
14	27°50.2	42.3	96°41.5	3.4′	27°24.5	3.3′	59.4′
15	42°50.4	·· 41.3	111°03.9	3.4′	27°21.2	3.4′	59.5′
16	57°50.6	40.3	125°26.4	3.4′	27°17.8	3.6′	59.5′
17	72°50.8	39.3	139°48.8	3.4′	27°14.2	3.9′	59.5′
18	87°50.9	S01°38.3	154°11.2	3.5′	S27°10.3	4.0′	59.5′
19	102°51.1	37.3	168°33.7	3.5′	27°06.3	4.2′	59.6′
20	117°51.3	36.3	182°56.2	3.5′	27°02.1	4.4′	59.6′
21	132°51.5	·· 35.4	197°18.7	3.5′	26°57.7	4.6′	59.6′
22	147°51.6	34.4	211°41.2	3.5′	26°53.1	4.8′	59.6′
23	162°51.8	33.4	226°03.7	3.6′	26°48.3	4.9′	59.6′
	SD = 16.1′	d = 1.0′	SD = 16.1′				

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

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

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 22-24 62-40%
14	09:22	09:14	12:09	05:15	17:44	
15	09:06	08:57	12:09	06:14	18:45	
16	08:49	08:40	12:09	07:16	19:48	

March 17, 18, 19 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	174°18.7	146°22.6	N11°36.6	88°45.0	N25°36.4	159°34.4	N05°07.1	200°42.6	S12°18.1
1	189°21.2	161°22.2	37.8	103°46.2	36.4	174°36.3	07.4	215°44.8	18.0
2	204°23.7	176°21.9	39.0	118°47.4	36.4	189°38.2	07.6	230°47.0	17.9
3	219°26.1	191°21.5	·· 40.2	133°48.6	·· 36.4	204°40.1	·· 07.8	245°49.1	·· 17.8
4	234°28.6	206°21.1	41.4	148°49.8	36.4	219°42.1	08.1	260°51.3	17.7
5	249°31.1	221°20.8	42.6	163°51.0	36.4	234°44.0	08.3	275°53.5	17.6
6	264°33.5	236°20.4	N11°43.7	178°52.1	N25°36.5	249°45.9	N05°08.5	290°55.7	S12°17.5
7	279°36.0	251°20.0	44.9	193°53.3	36.5	264°47.8	08.8	305°57.9	17.4
8	294°38.5	266°19.6	46.1	208°54.5	36.5	279°49.7	09.0	321°00.1	17.3
9	309°40.9	281°19.3	·· 47.3	223°55.7	·· 36.5	294°51.7	·· 09.2	336°02.3	·· 17.2
10	324°43.4	296°18.9	48.5	238°56.9	36.5	309°53.6	09.4	351°04.5	17.1
11	339°45.9	311°18.5	49.6	253°58.1	36.5	324°55.5	09.7	6°06.7	17.0
12	354°48.3	326°18.2	N11°50.8	268°59.3	N25°36.5	339°57.4	N05°09.9	21°08.9	S12°16.9
13	9°50.8	341°17.8	52.0	284°00.5	36.5	354°59.3	10.1	36°11.1	16.8
14	24°53.2	356°17.4	53.2	299°01.7	36.5	10°01.3	10.4	51°13.2	16.7
15	39°55.7	11°17.0	·· 54.4	314°02.8	·· 36.5	25°03.2	·· 10.6	66°15.4	·· 16.6
16	54°58.2	26°16.7	55.5	329°04.0	36.5	40°05.1	10.8	81°17.6	16.5
17	70°00.6	41°16.3	56.7	344°05.2	36.5	55°07.0	11.0	96°19.8	16.4
18	85°03.1	56°15.9	N11°57.9	359°06.4	N25°36.5	70°08.9	N05°11.3	111°22.0	S12°16.3
19	100°05.6	71°15.6	11°59.1	14°07.6	36.5	85°10.9	11.5	126°24.2	16.2
20	115°08.0	86°15.2	12°00.3	29°08.8	36.5	100°12.8	11.7	141°26.4	16.1
21	130°10.5	101°14.8	·· 01.4	44°10.0	·· 36.5	115°14.7	·· 12.0	156°28.6	·· 16.0
22	145°13.0	116°14.4	02.6	59°11.1	36.5	130°16.6	12.2	171°30.8	15.9
23	160°15.4	131°14.1	03.8	74°12.3	36.5	145°18.5	12.4	186°33.0	15.8
Mer.pass. 12:21		ν -0.4′ d 1.2′ m -3.96		ν 1.2′ d 0.0′ m 0.72		ν 1.9′ d 0.2′ m -2.07		ν 2.2′ d 0.1′ m 0.93	

Sat	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	175°17.9	146°13.7	N12°05.0	89°13.5	N25°36.5	160°20.5	N05°12.6	201°35.2	S12°15.7
1	190°20.4	161°13.3	06.1	104°14.7	36.6	175°22.4	12.9	216°37.4	15.6
2	205°22.8	176°12.9	07.3	119°15.9	36.6	190°24.3	13.1	231°39.6	15.5
3	220°25.3	191°12.6	·· 08.5	134°17.1	·· 36.6	205°26.2	·· 13.3	246°41.7	·· 15.5
4	235°27.7	206°12.2	09.7	149°18.2	36.6	220°28.1	13.6	261°43.9	15.4
5	250°30.2	221°11.8	10.8	164°19.4	36.6	235°30.1	13.8	276°46.1	15.3
6	265°32.7	236°11.4	N12°12.0	179°20.6	N25°36.6	250°32.0	N05°14.0	291°48.3	S12°15.2
7	280°35.1	251°11.1	13.2	194°21.8	36.6	265°33.9	14.3	306°50.5	15.1
8	295°37.6	266°10.7	14.3	209°23.0	36.6	280°35.8	14.5	321°52.7	15.0
9	310°40.1	281°10.3	·· 15.5	224°24.2	·· 36.6	295°37.7	·· 14.7	336°54.9	·· 14.9
10	325°42.5	296°09.9	16.7	239°25.3	36.6	310°39.6	14.9	351°57.1	14.8
11	340°45.0	311°09.5	17.8	254°26.5	36.6	325°41.6	15.2	6°59.3	14.7
12	355°47.5	326°09.2	N12°19.0	269°27.7	N25°36.6	340°43.5	N05°15.4	22°01.5	S12°14.6
13	10°49.9	341°08.8	20.2	284°28.9	36.6	355°45.4	15.6	37°03.7	14.5
14	25°52.4	356°08.4	21.4	299°30.1	36.6	10°47.3	15.9	52°05.9	14.4
15	40°54.8	11°08.0	·· 22.5	314°31.2	·· 36.6	25°49.2	·· 16.1	67°08.1	·· 14.3
16	55°57.3	26°07.6	23.7	329°32.4	36.6	40°51.2	16.3	82°10.3	14.2
17	70°59.8	41°07.3	24.9	344°33.6	36.6	55°53.1	16.5	97°12.4	14.1
18	86°02.2	56°06.9	N12°26.0	359°34.8	N25°36.6	70°55.0	N05°16.8	112°14.6	S12°14.0
19	101°04.7	71°06.5	27.2	14°35.9	36.6	85°56.9	17.0	127°16.8	13.9
20	116°07.2	86°06.1	28.4	29°37.1	36.6	100°58.8	17.2	142°19.0	13.8
21	131°09.6	101°05.7	·· 29.5	44°38.3	·· 36.6	116°00.7	·· 17.5	157°21.2	·· 13.7
22	146°12.1	116°05.4	30.7	59°39.5	36.6	131°02.7	17.7	172°23.4	13.6
23	161°14.6	131°05.0	31.8	74°40.6	36.6	146°04.6	17.9	187°25.6	13.5
Mer.pass. 12:17		ν -0.4′ d 1.2′ m -3.97		ν 1.2′ d 0.0′ m 0.74		ν 1.9′ d 0.2′ m -2.07		ν 2.2′ d 0.1′ m 0.93	

Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	176°17.0	146°04.6	N12°33.0	89°41.8	N25°36.6	161°06.5	N05°18.2	202°27.8	S12°13.4
1	191°19.5	161°04.2	34.2	104°43.0	36.6	176°08.4	18.4	217°30.0	13.3
2	206°22.0	176°03.8	35.3	119°44.2	36.6	191°10.3	18.6	232°32.2	13.2
3	221°24.4	191°03.5	·· 36.5	134°45.3	·· 36.6	206°12.3	·· 18.8	247°34.4	·· 13.1
4	236°26.9	206°03.1	37.7	149°46.5	36.6	221°14.2	19.1	262°36.6	13.1
5	251°29.3	221°02.7	38.8	164°47.7	36.6	236°16.1	19.3	277°38.8	13.0
6	266°31.8	236°02.3	N12°40.0	179°48.9	N25°36.6	251°18.0	N05°19.5	292°41.0	S12°12.9
7	281°34.3	251°01.9	41.1	194°50.0	36.6	266°19.9	19.8	307°43.2	12.8
8	296°36.7	266°01.5	42.3	209°51.2	36.6	281°21.8	20.0	322°45.4	12.7
9	311°39.2	281°01.2	·· 43.5	224°52.4	·· 36.6	296°23.8	·· 20.2	337°47.5	·· 12.6
10	326°41.7	296°00.8	44.6	239°53.6	36.6	311°25.7	20.4	352°49.7	12.5
11	341°44.1	311°00.4	45.8	254°54.7	36.6	326°27.6	20.7	7°51.9	12.4
12	356°46.6	326°00.0	N12°46.9	269°55.9	N25°36.6	341°29.5	N05°20.9	22°54.1	S12°12.3
13	11°49.1	340°59.6	48.1	284°57.1	36.6	356°31.4	21.1	37°56.3	12.2
14	26°51.5	355°59.2	49.2	299°58.2	36.6	11°33.3	21.4	52°58.5	12.1
15	41°54.0	10°58.8	·· 50.4	314°59.4	·· 36.6	26°35.3	·· 21.6	68°00.7	·· 12.0
16	56°56.5	25°58.5	51.5	330°00.6	36.6	41°37.2	21.8	83°02.9	11.9
17	71°58.9	40°58.1	52.7	345°01.7	36.6	56°39.1	22.1	98°05.1	11.8
18	87°01.4	55°57.7	N12°53.9	0°02.9	N25°36.6	71°41.0	N05°22.3	113°07.3	S12°11.7
19	102°03.8	70°57.3	55.0	15°04.1	36.6	86°42.9	22.5	128°09.5	11.6
20	117°06.3	85°56.9	56.2	30°05.3	36.6	101°44.9	22.7	143°11.7	11.5
21	132°08.8	100°56.5	·· 57.3	45°06.4	·· 36.6	116°46.8	·· 23.0	158°13.9	·· 11.4
22	147°11.2	115°56.1	58.5	60°07.6	36.6	131°48.7	23.2	173°16.1	11.3
23	162°13.7	130°55.7	59.6	75°08.8	36.6	146°50.6	23.4	188°18.3	11.2
Mer.pass. 12:13		ν -0.4′ d 1.2′ m -3.97		ν 1.2′ d 0.0′ m 0.76		ν 1.9′ d 0.2′ m -2.07		ν 2.2′ d 0.1′ m 0.93	

Stars

	SHA	**Dec**
Alpheratz	357°36.7	29°12.9
Ankaa	353°09.0	-42°11.0
Schedar	349°33.3	56°39.8
Diphda	348°49.1	-17°51.8
Achernar	335°21.8	-57°07.4
Hamal	327°53.2	23°34.2
Polaris	315°04.6	89°21.9
Acamar	315°13.2	-40°13.0
Menkar	314°07.9	4°10.7
Mirfak	308°30.7	49°56.7
Aldebaran	290°41.4	16°33.3
Rigel	281°05.4	-8°10.7
Capella	280°24.2	46°01.4
Bellatrix	278°24.5	6°22.2
Elnath	278°03.8	28°37.6
Alnilam	275°39.3	-1°11.4
Betelgeuse	270°53.7	7°24.6
Canopus	263°53.0	-52°42.7
Sirius	258°27.5	-16°45.1
Adhara	255°06.9	-29°00.4
Procyon	244°52.3	5°09.9
Pollux	243°19.0	27°58.2
Avior	234°15.0	-59°35.2
Suhail	222°47.1	-43°31.7
Miaplacidus	221°37.9	-69°48.9
Alphard	217°49.0	-8°45.6
Regulus	207°35.7	11°51.2
Dubhe	193°42.2	61°37.6
Denebola	182°26.2	14°26.5
Gienah	175°44.8	-17°40.3
Acrux	173°01.1	-63°13.6
Gacrux	171°52.8	-57°14.5
Alioth	166°13.7	55°49.9
Spica	158°23.6	-11°17.0
Alkaid	152°52.8	49°11.7
Hadar	148°37.6	-60°28.9
Menkent	147°59.1	-36°29.0
Arcturus	145°49.0	19°03.5
Rigil Kent.	139°41.9	-60°55.7
Kochab	137°18.9	74°03.3
Zuben'ubi	136°57.5	-16°08.3
Alphecca	126°04.8	26°38.0
Antares	112°17.6	-26°29.0
Atria	107°13.1	-69°03.9
Sabik	102°04.5	-15°45.3
Shaula	96°12.4	-37°07.1
Rasalhague	95°59.9	12°32.4
Eltanin	90°42.9	51°28.8
Kaus Aust.	83°34.6	-34°22.4
Vega	80°34.3	38°48.0
Nunki	75°49.7	-26°16.1
Altair	62°01.6	8°55.5
Peacock	53°08.4	-56°39.5
Deneb	49°27.1	45°21.5
Enif	33°40.5	9°58.7
Al Na'ir	27°35.2	-46°51.0
Fomalhaut	15°16.5	-29°30.1
Scheat	13°47.0	28°12.3
Markab	13°31.7	15°19.6

Mar 17 Fri	**SHA**	**Mer.pass**
Venus	332°03.8	14:15
Mars	274°26.2	18:04
Jupiter	345°15.6	13:20
Saturn	26°23.8	10:36

Mar 18 Sat	**SHA**	**Mer.pass**
Venus	330°55.8	14:15
Mars	273°55.6	18:02
Jupiter	345°02.6	13:17
Saturn	26°17.3	10:32

Mar 19 Sun	**SHA**	**Mer.pass**
Venus	329°47.6	14:16
Mars	273°24.8	18:00
Jupiter	344°49.5	13:14
Saturn	26°10.8	10:29

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°52.0	S01°32.4	240°26.3	3.6′	S26°43.4	5.2′	59.7′
1	192°52.2	31.4	254°48.9	3.6′	26°38.2	5.4′	59.7′
2	207°52.4	30.4	269°11.6	3.7′	26°32.8	5.5′	59.7′
3	222°52.5	·· 29.4	283°34.2	3.7′	26°27.3	5.7′	59.7′
4	237°52.7	28.4	297°56.9	3.7′	26°21.6	5.9′	59.7′
5	252°52.9	27.4	312°19.7	3.8′	26°15.7	6.2′	59.8′
6	267°53.1	S01°26.5	326°42.5	3.8′	S26°09.5	6.2′	59.8′
7	282°53.2	25.5	341°05.3	3.9′	26°03.3	6.5′	59.8′
8	297°53.4	24.5	355°28.2	3.9′	25°56.8	6.7′	59.8′
9	312°53.6	·· 23.5	9°51.1	4.0′	25°50.1	6.8′	59.8′
10	327°53.8	22.5	24°14.0	4.0′	25°43.3	7.0′	59.9′
11	342°54.0	21.5	38°37.1	4.1′	25°36.3	7.2′	59.9′
12	357°54.1	S01°20.5	53°00.1	4.1′	S25°29.1	7.4′	59.9′
13	12°54.3	19.5	67°23.2	4.2′	25°21.7	7.6′	59.9′
14	27°54.5	18.5	81°46.4	4.2′	25°14.1	7.7′	59.9′
15	42°54.7	·· 17.6	96°09.6	4.3′	25°06.4	7.9′	59.9′
16	57°54.9	16.6	110°32.9	4.4′	24°58.5	8.1′	60.0′
17	72°55.0	15.6	124°56.3	4.4′	24°50.4	8.3′	60.0′
18	87°55.2	S01°14.6	139°19.7	4.5′	S24°42.1	8.4′	60.0′
19	102°55.4	13.6	153°43.2	4.5′	24°33.7	8.7′	60.0′
20	117°55.6	12.6	168°06.7	4.6′	24°25.0	8.7′	60.0′
21	132°55.8	·· 11.6	182°30.3	4.7′	24°16.3	9.0′	60.0′
22	147°55.9	10.6	196°54.0	4.7′	24°07.3	9.1′	60.1′
23	162°56.1	09.6	211°17.8	4.8′	23°58.2	9.3′	60.1′
	SD = 16.1′	d = 1.0′	SD = 16.3′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°56.3	S01°08.7	225°41.6	4.9′	S23°48.9	9.5′	60.1′
1	192°56.5	07.7	240°05.5	5.0′	23°39.4	9.6′	60.1′
2	207°56.6	06.7	254°29.4	5.0′	23°29.8	9.8′	60.1′
3	222°56.8	·· 05.7	268°53.4	5.1′	23°20.0	9.9′	60.1′
4	237°57.0	04.7	283°17.6	5.2′	23°10.1	10.1′	60.1′
5	252°57.2	03.7	297°41.7	5.3′	23°00.0	10.3′	60.2′
6	267°57.4	S01°02.7	312°06.0	5.3′	S22°49.7	10.4′	60.2′
7	282°57.5	01.7	326°30.3	5.4′	22°39.3	10.6′	60.2′
8	297°57.7	01°00.7	340°54.8	5.5′	22°28.7	10.7′	60.2′
9	312°57.9	00°59.8	355°19.2	5.6′	22°18.0	10.9′	60.2′
10	327°58.1	58.8	9°43.8	5.7′	22°07.1	11.0′	60.2′
11	342°58.3	57.8	24°08.5	5.7′	21°56.1	11.2′	60.2′
12	357°58.4	S00°56.8	38°33.2	5.8′	S21°44.9	11.3′	60.2′
13	12°58.6	55.8	52°58.0	5.9′	21°33.6	11.5′	60.2′
14	27°58.8	54.8	67°23.0	6.0′	21°22.1	11.6′	60.3′
15	42°59.0	·· 53.8	81°47.9	6.1′	21°10.5	11.7′	60.3′
16	57°59.2	52.8	96°13.0	6.2′	20°58.8	11.9′	60.3′
17	72°59.4	51.8	110°38.2	6.2′	20°46.9	12.1′	60.3′
18	87°59.5	S00°50.8	125°03.4	6.3′	S20°34.8	12.2′	60.3′
19	102°59.7	49.9	139°28.7	6.4′	20°22.6	12.3′	60.3′
20	117°59.9	48.9	153°54.2	6.5′	20°10.3	12.4′	60.3′
21	133°00.1	·· 47.9	168°19.7	6.6′	19°57.9	12.6′	60.3′
22	148°00.3	46.9	182°45.2	6.7′	19°45.3	12.7′	60.3′
23	163°00.4	45.9	197°10.9	6.8′	19°32.6	12.8′	60.3′
	SD = 16.1′	d = 1.0′	SD = 16.4′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°00.6	S00°44.9	211°36.7	6.8′	S19°19.8	13.0′	60.3′
1	193°00.8	43.9	226°02.5	6.9′	19°06.8	13.0′	60.3′
2	208°01.0	42.9	240°28.4	7.0′	18°53.8	13.2′	60.3′
3	223°01.2	·· 41.9	254°54.5	7.1′	18°40.6	13.4′	60.4′
4	238°01.3	41.0	269°20.6	7.2′	18°27.2	13.4′	60.4′
5	253°01.5	40.0	283°46.8	7.3′	18°13.8	13.6′	60.4′
6	268°01.7	S00°39.0	298°13.0	7.4′	S18°00.2	13.6′	60.4′
7	283°01.9	38.0	312°39.4	7.4′	17°46.6	13.8′	60.4′
8	298°02.1	37.0	327°05.8	7.5′	17°32.8	13.9′	60.4′
9	313°02.3	·· 36.0	341°32.4	7.6′	17°18.9	14.0′	60.4′
10	328°02.4	35.0	355°59.0	7.7′	17°04.9	14.1′	60.4′
11	343°02.6	34.0	10°25.7	7.8′	16°50.8	14.2′	60.4′
12	358°02.8	S00°33.0	24°52.5	7.9′	S16°36.6	14.4′	60.4′
13	13°03.0	32.1	39°19.4	8.0′	16°22.2	14.4′	60.4′
14	28°03.2	31.1	53°46.3	8.0′	16°07.8	14.5′	60.4′
15	43°03.3	·· 30.1	68°13.4	8.1′	15°53.3	14.6′	60.4′
16	58°03.5	29.1	82°40.5	8.2′	15°38.7	14.7′	60.4′
17	73°03.7	28.1	97°07.7	8.3′	15°24.0	14.8′	60.4′
18	88°03.9	S00°27.1	111°35.0	8.4′	S15°09.2	14.9′	60.4′
19	103°04.1	26.1	126°02.4	8.5′	14°54.3	15.0′	60.4′
20	118°04.3	25.1	140°29.8	8.5′	14°39.3	15.1′	60.4′
21	133°04.4	·· 24.1	154°57.3	8.6′	14°24.2	15.1′	60.4′
22	148°04.6	23.2	169°25.0	8.7′	14°09.1	15.3′	60.4′
23	163°04.8	22.2	183°52.7	8.8′	13°53.8	15.3′	60.4′
	SD = 16.1′	d = 1.0′	SD = 16.5′				

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

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

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 25-27 29-10%
17	08:32	08:23	12:08	08:19	20:50	
18	08:15	08:06	12:08	09:19	21:49	
19	07:58	07:49	12:08	10:17	22:44	

March 20, 21, 22 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	177°16.2	145°55.4	N13°00.8	90°09.9	N25°36.6	161°52.5	N05°23.7	203°20.5	S12°11.1
1	192°18.6	160°55.0	01.9	105°11.1	36.6	176°54.4	23.9	218°22.7	11.0
2	207°21.1	175°54.6	03.1	120°12.3	36.5	191°56.4	24.1	233°24.9	10.9
3	222°23.6	190°54.2	·· 04.2	135°13.4	·· 36.5	206°58.3	·· 24.3	248°27.1	·· 10.9
4	237°26.0	205°53.8	05.4	150°14.6	36.5	222°00.2	24.6	263°29.2	10.8
5	252°28.5	220°53.4	06.5	165°15.8	36.5	237°02.1	24.8	278°31.4	10.7
6	267°30.9	235°53.0	N13°07.7	180°16.9	N25°36.5	252°04.0	N05°25.0	293°33.6	S12°10.6
7	282°33.4	250°52.6	08.8	195°18.1	36.5	267°05.9	25.3	308°35.8	10.5
8	297°35.9	265°52.2	10.0	210°19.3	36.5	282°07.8	25.5	323°38.0	10.4
9	312°38.3	280°51.9	·· 11.1	225°20.4	·· 36.5	297°09.8	·· 25.7	338°40.2	·· 10.3
10	327°40.8	295°51.5	12.3	240°21.6	36.5	312°11.7	26.0	353°42.4	10.2
11	342°43.3	310°51.1	13.4	255°22.7	36.5	327°13.6	26.2	8°44.6	10.1
12	357°45.7	325°50.7	N13°14.5	270°23.9	N25°36.5	342°15.5	N05°26.4	23°46.8	S12°10.0
13	12°48.2	340°50.3	15.7	285°25.1	36.5	357°17.4	26.6	38°49.0	09.9
14	27°50.7	355°49.9	16.8	300°26.2	36.5	12°19.3	26.9	53°51.2	09.8
15	42°53.1	10°49.5	·· 18.0	315°27.4	·· 36.5	27°21.3	·· 27.1	68°53.4	·· 09.7
16	57°55.6	25°49.1	19.1	330°28.6	36.5	42°23.2	27.3	83°55.6	09.6
17	72°58.1	40°48.7	20.3	345°29.7	36.5	57°25.1	27.6	98°57.8	09.5
18	88°00.5	55°48.3	N13°21.4	0°30.9	N25°36.5	72°27.0	N05°27.8	114°00.0	S12°09.4
19	103°03.0	70°47.9	22.5	15°32.0	36.5	87°28.9	28.0	129°02.2	09.3
20	118°05.4	85°47.5	23.7	30°33.2	36.4	102°30.8	28.3	144°04.4	09.2
21	133°07.9	100°47.1	·· 24.8	45°34.4	·· 36.4	117°32.8	·· 28.5	159°06.6	·· 09.1
22	148°10.4	115°46.7	26.0	60°35.5	36.4	132°34.7	28.7	174°08.8	09.0
23	163°12.8	130°46.3	27.1	75°36.7	36.4	147°36.6	28.9	189°11.0	09.0
Mer.pass. 12:09		ν -0.4′ d 1.2′ m -3.97		ν 1.2′ d -0.0′ m 0.78		ν 1.9′ d 0.2′ m -2.07		ν 2.2′ d 0.1′ m 0.93	

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	178°15.3	145°45.9	N13°28.2	90°37.8	N25°36.4	162°38.5	N05°29.2	204°13.2	S12°08.9
1	193°17.8	160°45.5	29.4	105°39.0	36.4	177°40.4	29.4	219°15.4	08.8
2	208°20.2	175°45.2	30.5	120°40.1	36.4	192°42.3	29.6	234°17.6	08.7
3	223°22.7	190°44.8	·· 31.6	135°41.3	·· 36.4	207°44.2	·· 29.9	249°19.8	·· 08.6
4	238°25.2	205°44.4	32.8	150°42.5	36.4	222°46.2	30.1	264°22.0	08.5
5	253°27.6	220°44.0	33.9	165°43.6	36.4	237°48.1	30.3	279°24.1	08.4
6	268°30.1	235°43.6	N13°35.1	180°44.8	N25°36.4	252°50.0	N05°30.5	294°26.3	S12°08.3
7	283°32.5	250°43.2	36.2	195°45.9	36.4	267°51.9	30.8	309°28.5	08.2
8	298°35.0	265°42.8	37.3	210°47.1	36.4	282°53.8	31.0	324°30.7	08.1
9	313°37.5	280°42.4	·· 38.5	225°48.2	·· 36.3	297°55.7	·· 31.2	339°32.9	·· 08.0
10	328°39.9	295°42.0	39.6	240°49.4	36.3	312°57.7	31.5	354°35.1	07.9
11	343°42.4	310°41.6	40.7	255°50.6	36.3	327°59.6	31.7	9°37.3	07.8
12	358°44.9	325°41.2	N13°41.8	270°51.7	N25°36.3	343°01.5	N05°31.9	24°39.5	S12°07.7
13	13°47.3	340°40.8	43.0	285°52.9	36.3	358°03.4	32.2	39°41.7	07.6
14	28°49.8	355°40.4	44.1	300°54.0	36.3	13°05.3	32.4	54°43.9	07.5
15	43°52.3	10°40.0	·· 45.2	315°55.2	·· 36.3	28°07.2	·· 32.6	69°46.1	·· 07.4
16	58°54.7	25°39.6	46.4	330°56.3	36.3	43°09.1	32.8	84°48.3	07.3
17	73°57.2	40°39.2	47.5	345°57.5	36.3	58°11.1	33.1	99°50.5	07.2
18	88°59.7	55°38.8	N13°48.6	0°58.6	N25°36.3	73°13.0	N05°33.3	114°52.7	S12°07.2
19	104°02.1	70°38.4	49.8	15°59.8	36.2	88°14.9	33.5	129°54.9	07.1
20	119°04.6	85°38.0	50.9	31°00.9	36.2	103°16.8	33.8	144°57.1	07.0
21	134°07.0	100°37.6	·· 52.0	46°02.1	·· 36.2	118°18.7	·· 34.0	159°59.3	·· 06.9
22	149°09.5	115°37.2	53.1	61°03.2	36.2	133°20.6	34.2	175°01.5	06.8
23	164°12.0	130°36.8	54.3	76°04.4	36.2	148°22.5	34.5	190°03.7	06.7
Mer.pass. 12:05		ν -0.4′ d 1.1′ m -3.97		ν 1.2′ d -0.0′ m 0.79		ν 1.9′ d 0.2′ m -2.07		ν 2.2′ d 0.1′ m 0.93	

Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	179°14.4	145°36.4	N13°55.4	91°05.5	N25°36.2	163°24.5	N05°34.7	205°05.9	S12°06.6
1	194°16.9	160°35.9	56.5	106°06.7	36.2	178°26.4	34.9	220°08.1	06.5
2	209°19.4	175°35.5	57.6	121°07.8	36.2	193°28.3	35.1	235°10.3	06.4
3	224°21.8	190°35.1	·· 58.8	136°09.0	·· 36.1	208°30.2	·· 35.4	250°12.5	·· 06.3
4	239°24.3	205°34.7	13°59.9	151°10.1	36.1	223°32.1	35.6	265°14.7	06.2
5	254°26.8	220°34.3	14°01.0	166°11.3	36.1	238°34.0	35.8	280°16.9	06.1
6	269°29.2	235°33.9	N14°02.1	181°12.4	N25°36.1	253°35.9	N05°36.1	295°19.1	S12°06.0
7	284°31.7	250°33.5	03.2	196°13.6	36.1	268°37.9	36.3	310°21.3	05.9
8	299°34.1	265°33.1	04.4	211°14.7	36.1	283°39.8	36.5	325°23.5	05.8
9	314°36.6	280°32.7	·· 05.5	226°15.9	·· 36.1	298°41.7	·· 36.8	340°25.7	·· 05.7
10	329°39.1	295°32.3	06.6	241°17.0	36.1	313°43.6	37.0	355°27.9	05.6
11	344°41.5	310°31.9	07.7	256°18.2	36.0	328°45.5	37.2	10°30.1	05.5
12	359°44.0	325°31.5	N14°08.8	271°19.3	N25°36.0	343°47.4	N05°37.4	25°32.3	S12°05.5
13	14°46.5	340°31.1	10.0	286°20.5	36.0	358°49.3	37.7	40°34.5	05.4
14	29°48.9	355°30.7	11.1	301°21.6	36.0	13°51.2	37.9	55°36.7	05.3
15	44°51.4	10°30.3	·· 12.2	316°22.8	·· 36.0	28°53.2	·· 38.1	70°38.9	·· 05.2
16	59°53.9	25°29.9	13.3	331°23.9	36.0	43°55.1	38.4	85°41.1	05.1
17	74°56.3	40°29.4	14.4	346°25.1	36.0	58°57.0	38.6	100°43.3	05.0
18	89°58.8	55°29.0	N14°15.5	1°26.2	N25°35.9	73°58.9	N05°38.8	115°45.5	S12°04.9
19	105°01.3	70°28.6	16.6	16°27.4	35.9	89°00.8	39.0	130°47.7	04.8
20	120°03.7	85°28.2	17.8	31°28.5	35.9	104°02.7	39.3	145°49.9	04.7
21	135°06.2	100°27.8	·· 18.9	46°29.6	·· 35.9	119°04.6	·· 39.5	160°52.1	·· 04.6
22	150°08.6	115°27.4	20.0	61°30.8	35.9	134°06.6	39.7	175°54.3	04.5
23	165°11.1	130°27.0	21.1	76°31.9	35.9	149°08.5	40.0	190°56.5	04.4
Mer.pass. 12:01		ν -0.4′ d 1.1′ m -3.97		ν 1.2′ d -0.0′ m 0.81		ν 1.9′ d 0.2′ m -2.06		ν 2.2′ d 0.1′ m 0.93	

Stars

	SHA	**Dec**
Alpheratz	357°36.7	29°12.9
Ankaa	353°09.0	-42°11.0
Schedar	349°33.3	56°39.8
Diphda	348°49.1	-17°51.8
Achernar	335°21.8	-57°07.4
Hamal	327°53.2	23°34.2
Polaris	315°05.8	89°21.9
Acamar	315°13.2	-40°13.0
Menkar	314°07.9	4°10.7
Mirfak	308°30.7	49°56.7
Aldebaran	290°41.5	16°33.3
Rigel	281°05.4	-8°10.6
Capella	280°24.2	46°01.4
Bellatrix	278°24.5	6°22.2
Elnath	278°03.8	28°37.6
Alnilam	275°39.3	-1°11.3
Betelgeuse	270°53.7	7°24.6
Canopus	263°53.0	-52°42.7
Sirius	258°27.5	-16°45.0
Adhara	255°07.0	-29°00.4
Procyon	244°52.3	5°09.9
Pollux	243°19.0	27°58.3
Avior	234°15.0	-59°35.2
Suhail	222°47.1	-43°31.7
Miaplacidus	221°37.9	-69°48.9
Alphard	217°49.0	-8°45.6
Regulus	207°35.8	11°51.2
Dubhe	193°42.2	61°37.6
Denebola	182°26.2	14°26.5
Gienah	175°44.8	-17°40.3
Acrux	173°01.1	-63°13.6
Gacrux	171°52.8	-57°14.6
Alioth	166°13.7	55°49.9
Spica	158°23.6	-11°17.0
Alkaid	152°52.7	49°11.7
Hadar	148°37.6	-60°29.0
Menkent	147°59.1	-36°29.0
Arcturus	145°49.0	19°03.5
Rigil Kent.	139°41.9	-60°55.7
Kochab	137°18.9	74°03.3
Zuben'ubi	136°57.4	-16°08.3
Alphecca	126°04.8	26°38.0
Antares	112°17.5	-26°29.0
Atria	107°13.0	-69°03.9
Sabik	102°04.4	-15°45.3
Shaula	96°12.4	-37°07.2
Rasalhague	95°59.9	12°32.4
Eltanin	90°42.9	51°28.8
Kaus Aust.	83°34.5	-34°22.4
Vega	80°34.3	38°47.9
Nunki	75°49.7	-26°16.1
Altair	62°01.6	8°55.5
Peacock	53°08.4	-56°39.5
Deneb	49°27.1	45°21.4
Enif	33°40.5	9°58.7
Al Na'ir	27°35.2	-46°51.0
Fomalhaut	15°16.5	-29°30.1
Scheat	13°47.0	28°12.3
Markab	13°31.7	15°19.6

Mar 20 Mon	**SHA**	**Mer.pass**
Venus	328°39.2	14:17
Mars	272°53.8	17:58
Jupiter	344°36.4	13:11
Saturn	26°04.3	10:25

Mar 21 Tue	**SHA**	**Mer.pass**
Venus	327°30.6	14:17
Mars	272°22.5	17:56
Jupiter	344°23.2	13:08
Saturn	25°57.9	10:22

Mar 22 Wed	**SHA**	**Mer.pass**
Venus	326°21.9	14:18
Mars	271°51.1	17:54
Jupiter	344°10.0	13:05
Saturn	25°51.5	10:18

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°05.0	S00°21.2	198°20.4	8.8′	S13°38.5	15.4′	60.4′
1	193°05.2	20.2	212°48.3	8.9′	13°23.1	15.5′	60.4′
2	208°05.4	19.2	227°16.2	9.0′	13°07.6	15.5′	60.4′
3	223°05.5	·· 18.2	241°44.2	9.1′	12°52.1	15.6′	60.4′
4	238°05.7	17.2	256°12.3	9.2′	12°36.5	15.7′	60.3′
5	253°05.9	16.2	270°40.4	9.2′	12°20.8	15.8′	60.3′
6	268°06.1	S00°15.2	285°08.7	9.3′	S12°05.0	15.8′	60.3′
7	283°06.3	14.3	299°36.9	9.4′	11°49.2	15.9′	60.3′
8	298°06.4	13.3	314°05.3	9.4′	11°33.3	16.0′	60.3′
9	313°06.6	·· 12.3	328°33.8	9.5′	11°17.3	16.0′	60.3′
10	328°06.8	11.3	343°02.3	9.6′	11°01.3	16.1′	60.3′
11	343°07.0	10.3	357°30.9	9.7′	10°45.2	16.1′	60.3′
12	358°07.2	S00°09.3	11°59.5	9.7′	S10°29.1	16.2′	60.3′
13	13°07.4	08.3	26°28.2	9.8′	10°12.9	16.3′	60.3′
14	28°07.5	07.3	40°57.0	9.9′	09°56.6	16.3′	60.3′
15	43°07.7	·· 06.3	55°25.9	9.9′	09°40.3	16.3′	60.3′
16	58°07.9	05.4	69°54.8	10.0′	09°24.0	16.4′	60.2′
17	73°08.1	04.4	84°23.8	10.0′	09°07.6	16.5′	60.2′
18	88°08.3	S00°03.4	98°52.8	10.1′	S08°51.1	16.5′	60.2′
19	103°08.5	02.4	113°21.9	10.2′	08°34.6	16.5′	60.2′
20	118°08.7	01.4	127°51.1	10.2′	08°18.1	16.6′	60.2′
21	133°08.8	S00°00.4	142°20.3	10.3′	08°01.5	16.6′	60.2′
22	148°09.0	N00°00.6	156°49.6	10.3′	07°44.9	16.6′	60.2′
23	163°09.2	01.6	171°18.9	10.4′	07°28.3	16.7′	60.2′
	SD = 16.1′	d = 1.0′	SD = 16.5′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°09.4	N00°02.6	185°48.3	10.5′	S07°11.6	16.7′	60.1′
1	193°09.6	03.5	200°17.8	10.5′	06°54.9	16.7′	60.1′
2	208°09.8	04.5	214°47.3	10.6′	06°38.2	16.8′	60.1′
3	223°09.9	·· 05.5	229°16.8	10.6′	06°21.4	16.8′	60.1′
4	238°10.1	06.5	243°46.4	10.7′	06°04.6	16.8′	60.1′
5	253°10.3	07.5	258°16.1	10.7′	05°47.8	16.9′	60.1′
6	268°10.5	N00°08.5	272°45.8	10.8′	S05°30.9	16.8′	60.1′
7	283°10.7	09.5	287°15.6	10.8′	05°14.1	16.9′	60.0′
8	298°10.9	10.5	301°45.4	10.9′	04°57.2	16.9′	60.0′
9	313°11.0	·· 11.5	316°15.2	10.9′	04°40.3	16.9′	60.0′
10	328°11.2	12.4	330°45.1	10.9′	04°23.4	16.9′	60.0′
11	343°11.4	13.4	345°15.1	11.0′	04°06.5	17.0′	60.0′
12	358°11.6	N00°14.4	359°45.1	11.0′	S03°49.5	16.9′	59.9′
13	13°11.8	15.4	14°15.1	11.1′	03°32.6	17.0′	59.9′
14	28°12.0	16.4	28°45.2	11.1′	03°15.6	17.0′	59.9′
15	43°12.2	·· 17.4	43°15.3	11.1′	02°58.6	16.9′	59.9′
16	58°12.3	18.4	57°45.4	11.2′	02°41.7	17.0′	59.9′
17	73°12.5	19.4	72°15.6	11.2′	02°24.7	17.0′	59.8′
18	88°12.7	N00°20.3	86°45.8	11.3′	S02°07.7	16.9′	59.8′
19	103°12.9	21.3	101°16.1	11.3′	01°50.8	17.0′	59.8′
20	118°13.1	22.3	115°46.4	11.3′	01°33.8	17.0′	59.8′
21	133°13.3	·· 23.3	130°16.7	11.4′	01°16.8	16.9′	59.8′
22	148°13.4	24.3	144°47.1	11.4′	00°59.9	17.0′	59.7′
23	163°13.6	25.3	159°17.4	11.4′	00°42.9	16.9′	59.7′
	SD = 16.1′	d = 1.0′	SD = 16.4′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°13.8	N00°26.3	173°47.9	11.4′	S00°26.0	17.0′	59.7′
1	193°14.0	27.3	188°18.3	11.5′	S00°09.0	16.9′	59.7′
2	208°14.2	28.2	202°48.8	11.5′	N00°07.9	16.9′	59.6′
3	223°14.4	·· 29.2	217°19.3	11.5′	00°24.8	16.9′	59.6′
4	238°14.6	30.2	231°49.8	11.5′	00°41.7	16.8′	59.6′
5	253°14.7	31.2	246°20.3	11.6′	00°58.5	16.9′	59.6′
6	268°14.9	N00°32.2	260°50.9	11.6′	N01°15.4	16.8′	59.5′
7	283°15.1	33.2	275°21.5	11.6′	01°32.2	16.8′	59.5′
8	298°15.3	34.2	289°52.1	11.6′	01°49.0	16.8′	59.5′
9	313°15.5	·· 35.2	304°22.7	11.6′	02°05.8	16.8′	59.5′
10	328°15.7	36.1	318°53.4	11.7′	02°22.6	16.7′	59.4′
11	343°15.9	37.1	333°24.0	11.7′	02°39.3	16.7′	59.4′
12	358°16.0	N00°38.1	347°54.7	11.7′	N02°56.0	16.7′	59.4′
13	13°16.2	39.1	2°25.4	11.7′	03°12.7	16.6′	59.4′
14	28°16.4	40.1	16°56.1	11.7′	03°29.3	16.6′	59.3′
15	43°16.6	·· 41.1	31°26.8	11.7′	03°45.9	16.6′	59.3′
16	58°16.8	42.1	45°57.6	11.7′	04°02.5	16.5′	59.3′
17	73°17.0	43.1	60°28.3	11.7′	04°19.0	16.5′	59.2′
18	88°17.2	N00°44.0	74°59.0	11.8′	N04°35.5	16.5′	59.2′
19	103°17.3	45.0	89°29.8	11.8′	04°52.0	16.4′	59.2′
20	118°17.5	46.0	104°00.6	11.8′	05°08.4	16.3′	59.2′
21	133°17.7	·· 47.0	118°31.3	11.8′	05°24.7	16.4′	59.1′
22	148°17.9	48.0	133°02.1	11.8′	05°41.1	16.2′	59.1′
23	163°18.1	49.0	147°32.9	11.8′	05°57.3	16.3′	59.1′
	SD = 16.0′	d = 1.0′	SD = 16.3′				

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

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

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 28-1 4-0%
20	07:40	07:31	12:08	11:10	23:36	
21	07:22	07:14	12:07	12:01	–:–	
22	07:05	06:56	12:07	12:50	00:26	

March 23, 24, 25 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	180°13.6	145°26.6	N14°22.2	91°33.1	N25°35.8	164°10.4	N05°40.2	205°58.7	S12°04.3
1	195°16.0	160°26.2	23.3	106°34.2	35.8	179°12.3	40.4	221°00.9	04.2
2	210°18.5	175°25.8	24.4	121°35.4	35.8	194°14.2	40.7	236°03.1	04.1
3	225°21.0	190°25.3	·· 25.5	136°36.5	·· 35.8	209°16.1	·· 40.9	251°05.3	·· 04.0
4	240°23.4	205°24.9	26.6	151°37.6	35.8	224°18.0	41.1	266°07.5	04.0
5	255°25.9	220°24.5	27.8	166°38.8	35.8	239°19.9	41.3	281°09.7	03.9
6	270°28.4	235°24.1	N14°28.9	181°39.9	N25°35.7	254°21.9	N05°41.6	296°11.9	S12°03.8
7	285°30.8	250°23.7	30.0	196°41.1	35.7	269°23.8	41.8	311°14.1	03.7
8	300°33.3	265°23.3	31.1	211°42.2	35.7	284°25.7	42.0	326°16.3	03.6
9	315°35.8	280°22.9	·· 32.2	226°43.3	·· 35.7	299°27.6	·· 42.3	341°18.5	·· 03.5
10	330°38.2	295°22.4	33.3	241°44.5	35.7	314°29.5	42.5	356°20.7	03.4
11	345°40.7	310°22.0	34.4	256°45.6	35.7	329°31.4	42.7	11°22.9	03.3
12	0°43.1	325°21.6	N14°35.5	271°46.8	N25°35.6	344°33.3	N05°43.0	26°25.1	S12°03.2
13	15°45.6	340°21.2	36.6	286°47.9	35.6	359°35.2	43.2	41°27.3	03.1
14	30°48.1	355°20.8	37.7	301°49.0	35.6	14°37.2	43.4	56°29.5	03.0
15	45°50.5	10°20.4	·· 38.8	316°50.2	·· 35.6	29°39.1	·· 43.6	71°31.7	·· 02.9
16	60°53.0	25°20.0	39.9	331°51.3	35.6	44°41.0	43.9	86°33.9	02.8
17	75°55.5	40°19.5	41.0	346°52.5	35.5	59°42.9	44.1	101°36.1	02.7
18	90°57.9	55°19.1	N14°42.1	1°53.6	N25°35.5	74°44.8	N05°44.3	116°38.3	S12°02.6
19	106°00.4	70°18.7	43.2	16°54.7	35.5	89°46.7	44.6	131°40.5	02.5
20	121°02.9	85°18.3	44.3	31°55.9	35.5	104°48.6	44.8	146°42.7	02.5
21	136°05.3	100°17.9	·· 45.4	46°57.0	·· 35.5	119°50.5	·· 45.0	161°44.9	·· 02.4
22	151°07.8	115°17.5	46.5	61°58.1	35.4	134°52.5	45.3	176°47.1	02.3
23	166°10.2	130°17.0	47.6	76°59.3	35.4	149°54.4	45.5	191°49.3	02.2
Mer.pass. 11:57		ν -0.4′ d 1.1′ m -3.97		ν 1.1′ d -0.0′ m 0.83		ν 1.9′ d 0.2′ m -2.06		ν 2.2′ d 0.1′ m 0.94	

Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	181°12.7	145°16.6	N14°48.7	92°00.4	N25°35.4	164°56.3	N05°45.7	206°51.5	S12°02.1
1	196°15.2	160°16.2	49.8	107°01.5	35.4	179°58.2	45.9	221°53.7	02.0
2	211°17.6	175°15.8	50.9	122°02.7	35.4	195°00.1	46.2	236°55.9	01.9
3	226°20.1	190°15.4	·· 52.0	137°03.8	·· 35.3	210°02.0	·· 46.4	251°58.1	·· 01.8
4	241°22.6	205°14.9	53.1	152°05.0	35.3	225°03.9	46.6	267°00.3	01.7
5	256°25.0	220°14.5	54.2	167°06.1	35.3	240°05.8	46.9	282°02.5	01.6
6	271°27.5	235°14.1	N14°55.3	182°07.2	N25°35.3	255°07.7	N05°47.1	297°04.7	S12°01.5
7	286°30.0	250°13.7	56.4	197°08.4	35.3	270°09.7	47.3	312°06.9	01.4
8	301°32.4	265°13.3	57.4	212°09.5	35.2	285°11.6	47.6	327°09.1	01.3
9	316°34.9	280°12.8	·· 58.5	227°10.6	·· 35.2	300°13.5	·· 47.8	342°11.3	·· 01.2
10	331°37.4	295°12.4	14°59.6	242°11.8	35.2	315°15.4	48.0	357°13.5	01.1
11	346°39.8	310°12.0	15°00.7	257°12.9	35.2	330°17.3	48.2	12°15.7	01.1
12	1°42.3	325°11.6	N15°01.8	272°14.0	N25°35.1	345°19.2	N05°48.5	27°17.9	S12°01.0
13	16°44.7	340°11.1	02.9	287°15.1	35.1	0°21.1	48.7	42°20.1	00.9
14	31°47.2	355°10.7	04.0	302°16.3	35.1	15°23.0	48.9	57°22.3	00.8
15	46°49.7	10°10.3	·· 05.1	317°17.4	·· 35.1	30°24.9	·· 49.2	72°24.5	·· 00.7
16	61°52.1	25°09.9	06.2	332°18.5	35.1	45°26.9	49.4	87°26.7	00.6
17	76°54.6	40°09.4	07.2	347°19.7	35.0	60°28.8	49.6	102°28.9	00.5
18	91°57.1	55°09.0	N15°08.3	2°20.8	N25°35.0	75°30.7	N05°49.8	117°31.1	S12°00.4
19	106°59.5	70°08.6	09.4	17°21.9	35.0	90°32.6	50.1	132°33.3	00.3
20	122°02.0	85°08.2	10.5	32°23.1	35.0	105°34.5	50.3	147°35.5	00.2
21	137°04.5	100°07.7	·· 11.6	47°24.2	·· 34.9	120°36.4	·· 50.5	162°37.7	·· 00.1
22	152°06.9	115°07.3	12.7	62°25.3	34.9	135°38.3	50.8	177°39.9	12°00.0
23	167°09.4	130°06.9	13.8	77°26.4	34.9	150°40.2	51.0	192°42.1	11°59.9
Mer.pass. 11:53		ν -0.4′ d 1.1′ m -3.98		ν 1.1′ d -0.0′ m 0.84		ν 1.9′ d 0.2′ m -2.06		ν 2.2′ d 0.1′ m 0.94	

Sat	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	182°11.8	145°06.5	N15°14.8	92°27.6	N25°34.9	165°42.1	N05°51.2	207°44.3	S11°59.8
1	197°14.3	160°06.0	15.9	107°28.7	34.8	180°44.1	51.5	222°46.5	59.8
2	212°16.8	175°05.6	17.0	122°29.8	34.8	195°46.0	51.7	237°48.7	59.7
3	227°19.2	190°05.2	·· 18.1	137°31.0	·· 34.8	210°47.9	·· 51.9	252°50.9	·· 59.6
4	242°21.7	205°04.8	19.2	152°32.1	34.8	225°49.8	52.1	267°53.1	59.5
5	257°24.2	220°04.3	20.2	167°33.2	34.7	240°51.7	52.4	282°55.3	59.4
6	272°26.6	235°03.9	N15°21.3	182°34.3	N25°34.7	255°53.6	N05°52.6	297°57.5	S11°59.3
7	287°29.1	250°03.5	22.4	197°35.5	34.7	270°55.5	52.8	312°59.7	59.2
8	302°31.6	265°03.0	23.5	212°36.6	34.7	285°57.4	53.1	328°01.9	59.1
9	317°34.0	280°02.6	·· 24.5	227°37.7	·· 34.6	300°59.3	·· 53.3	343°04.2	·· 59.0
10	332°36.5	295°02.2	25.6	242°38.8	34.6	316°01.3	53.5	358°06.4	58.9
11	347°39.0	310°01.7	26.7	257°40.0	34.6	331°03.2	53.8	13°08.6	58.8
12	2°41.4	325°01.3	N15°27.8	272°41.1	N25°34.6	346°05.1	N05°54.0	28°10.8	S11°58.7
13	17°43.9	340°00.9	28.8	287°42.2	34.5	1°07.0	54.2	43°13.0	58.6
14	32°46.3	355°00.5	29.9	302°43.3	34.5	16°08.9	54.4	58°15.2	58.6
15	47°48.8	10°00.0	·· 31.0	317°44.5	·· 34.5	31°10.8	·· 54.7	73°17.4	·· 58.5
16	62°51.3	24°59.6	32.1	332°45.6	34.4	46°12.7	54.9	88°19.6	58.4
17	77°53.7	39°59.2	33.1	347°46.7	34.4	61°14.6	55.1	103°21.8	58.3
18	92°56.2	54°58.7	N15°34.2	2°47.8	N25°34.4	76°16.5	N05°55.4	118°24.0	S11°58.2
19	107°58.7	69°58.3	35.3	17°49.0	34.4	91°18.4	55.6	133°26.2	58.1
20	123°01.1	84°57.9	36.3	32°50.1	34.3	106°20.4	55.8	148°28.4	58.0
21	138°03.6	99°57.4	·· 37.4	47°51.2	·· 34.3	121°22.3	·· 56.1	163°30.6	·· 57.9
22	153°06.1	114°57.0	38.5	62°52.3	34.3	136°24.2	56.3	178°32.8	57.8
23	168°08.5	129°56.6	39.5	77°53.4	34.2	151°26.1	56.5	193°35.0	57.7
Mer.pass. 11:49		ν -0.4′ d 1.1′ m -3.98		ν 1.1′ d -0.0′ m 0.86		ν 1.9′ d 0.2′ m -2.06		ν 2.2′ d 0.1′ m 0.94	

Stars

	SHA	**Dec**
Alpheratz	357°36.7	29°12.9
Ankaa	353°09.0	-42°11.0
Schedar	349°33.3	56°39.8
Diphda	348°49.1	-17°51.8
Achernar	335°21.8	-57°07.3
Hamal	327°53.2	23°34.2
Polaris	315°06.9	89°21.9
Acamar	315°13.2	-40°12.9
Menkar	314°07.9	4°10.7
Mirfak	308°30.7	49°56.7
Aldebaran	290°41.5	16°33.3
Rigel	281°05.4	-8°10.6
Capella	280°24.2	46°01.4
Bellatrix	278°24.6	6°22.2
Elnath	278°03.8	28°37.6
Alnilam	275°39.3	-1°11.3
Betelgeuse	270°53.7	7°24.6
Canopus	263°53.0	-52°42.7
Sirius	258°27.5	-16°45.1
Adhara	255°07.0	-29°00.4
Procyon	244°52.3	5°09.9
Pollux	243°19.0	27°58.3
Avior	234°15.0	-59°35.2
Suhail	222°47.1	-43°31.7
Miaplacidus	221°38.0	-69°48.9
Alphard	217°49.0	-8°45.6
Regulus	207°35.8	11°51.2
Dubhe	193°42.2	61°37.6
Denebola	182°26.2	14°26.5
Gienah	175°44.8	-17°40.3
Acrux	173°01.1	-63°13.6
Gacrux	171°52.8	-57°14.6
Alioth	166°13.7	55°50.0
Spica	158°23.6	-11°17.0
Alkaid	152°52.7	49°11.7
Hadar	148°37.6	-60°29.0
Menkent	147°59.1	-36°29.0
Arcturus	145°49.0	19°03.5
Rigil Kent.	139°41.9	-60°55.7
Kochab	137°18.9	74°03.4
Zuben'ubi	136°57.4	-16°08.3
Alphecca	126°04.8	26°38.0
Antares	112°17.5	-26°29.0
Atria	107°13.0	-69°03.9
Sabik	102°04.4	-15°45.3
Shaula	96°12.3	-37°07.2
Rasalhague	95°59.9	12°32.4
Eltanin	90°42.8	51°28.8
Kaus Aust.	83°34.5	-34°22.4
Vega	80°34.3	38°47.9
Nunki	75°49.7	-26°16.1
Altair	62°01.5	8°55.5
Peacock	53°08.4	-56°39.5
Deneb	49°27.1	45°21.4
Enif	33°40.5	9°58.7
Al Na'ir	27°35.2	-46°51.0
Fomalhaut	15°16.5	-29°30.1
Scheat	13°47.0	28°12.3
Markab	13°31.7	15°19.6

Mar 23 Thu	**SHA**	**Mer.pass**
Venus	325°13.0	14:19
Mars	271°19.5	17:52
Jupiter	343°56.8	13:02
Saturn	25°45.1	10:15

Mar 24 Fri	**SHA**	**Mer.pass**
Venus	324°03.9	14:19
Mars	270°47.7	17:51
Jupiter	343°43.6	12:59
Saturn	25°38.8	10:11

Mar 25 Sat	**SHA**	**Mer.pass**
Venus	322°54.6	14:20
Mars	270°15.7	17:49
Jupiter	343°30.3	12:56
Saturn	25°32.5	10:08

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°18.3	N00°50.0	162°03.7	11.8′	N06°13.6	16.2′	59.0′
1	193°18.5	51.0	176°34.5	11.8′	06°29.8	16.1′	59.0′
2	208°18.6	51.9	191°05.3	11.8′	06°45.9	16.1′	59.0′
3	223°18.8	·· 52.9	205°36.0	11.8′	07°02.0	16.0′	58.9′
4	238°19.0	53.9	220°06.8	11.8′	07°18.0	16.0′	58.9′
5	253°19.2	54.9	234°37.6	11.8′	07°34.0	15.9′	58.9′
6	268°19.4	N00°55.9	249°08.4	11.8′	N07°49.9	15.8′	58.8′
7	283°19.6	56.9	263°39.2	11.8′	08°05.7	15.8′	58.8′
8	298°19.8	57.9	278°09.9	11.8′	08°21.5	15.8′	58.8′
9	313°19.9	·· 58.9	292°40.7	11.8′	08°37.3	15.7′	58.7′
10	328°20.1	00°59.8	307°11.5	11.8′	08°53.0	15.6′	58.7′
11	343°20.3	01°00.8	321°42.2	11.7′	09°08.6	15.5′	58.7′
12	358°20.5	N01°01.8	336°13.0	11.7′	N09°24.1	15.5′	58.6′
13	13°20.7	02.8	350°43.7	11.7′	09°39.6	15.4′	58.6′
14	28°20.9	03.8	5°14.4	11.7′	09°55.0	15.4′	58.6′
15	43°21.1	·· 04.8	19°45.1	11.7′	10°10.4	15.3′	58.5′
16	58°21.3	05.8	34°15.8	11.7′	10°25.7	15.2′	58.5′
17	73°21.4	06.7	48°46.5	11.7′	10°40.9	15.1′	58.5′
18	88°21.6	N01°07.7	63°17.2	11.7′	N10°56.0	15.1′	58.4′
19	103°21.8	08.7	77°47.8	11.6′	11°11.1	15.0′	58.4′
20	118°22.0	09.7	92°18.5	11.6′	11°26.1	14.9′	58.4′
21	133°22.2	·· 10.7	106°49.1	11.6′	11°41.0	14.8′	58.3′
22	148°22.4	11.7	121°19.7	11.6′	11°55.8	14.8′	58.3′
23	163°22.6	12.7	135°50.3	11.6′	12°10.6	14.7′	58.3′
	SD = 16.0′	d = 1.0′	SD = 16.1′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°22.7	N01°13.6	150°20.9	11.6′	N12°25.3	14.6′	58.2′
1	193°22.9	14.6	164°51.4	11.5′	12°39.9	14.5′	58.2′
2	208°23.1	15.6	179°22.0	11.5′	12°54.4	14.4′	58.2′
3	223°23.3	·· 16.6	193°52.5	11.5′	13°08.8	14.4′	58.1′
4	238°23.5	17.6	208°23.0	11.5′	13°23.2	14.2′	58.1′
5	253°23.7	18.6	222°53.4	11.4′	13°37.4	14.2′	58.1′
6	268°23.9	N01°19.6	237°23.9	11.4′	N13°51.6	14.1′	58.0′
7	283°24.1	20.5	251°54.3	11.4′	14°05.7	14.0′	58.0′
8	298°24.2	21.5	266°24.7	11.4′	14°19.7	13.9′	57.9′
9	313°24.4	·· 22.5	280°55.1	11.4′	14°33.6	13.8′	57.9′
10	328°24.6	23.5	295°25.4	11.3′	14°47.4	13.8′	57.9′
11	343°24.8	24.5	309°55.8	11.3′	15°01.2	13.6′	57.8′
12	358°25.0	N01°25.5	324°26.1	11.3′	N15°14.8	13.5′	57.8′
13	13°25.2	26.5	338°56.3	11.2′	15°28.3	13.5′	57.8′
14	28°25.4	27.4	353°26.6	11.2′	15°41.8	13.3′	57.7′
15	43°25.6	·· 28.4	7°56.8	11.2′	15°55.1	13.3′	57.7′
16	58°25.7	29.4	22°27.0	11.2′	16°08.4	13.2′	57.7′
17	73°25.9	30.4	36°57.1	11.1′	16°21.6	13.0′	57.6′
18	88°26.1	N01°31.4	51°27.3	11.1′	N16°34.6	13.0′	57.6′
19	103°26.3	32.4	65°57.4	11.1′	16°47.6	12.8′	57.6′
20	118°26.5	33.3	80°27.5	11.0′	17°00.4	12.8′	57.5′
21	133°26.7	·· 34.3	94°57.5	11.0′	17°13.2	12.6′	57.5′
22	148°26.9	35.3	109°27.5	11.0′	17°25.8	12.6′	57.4′
23	163°27.1	36.3	123°57.5	10.9′	17°38.4	12.4′	57.4′
	SD = 16.0′	d = 1.0′	SD = 15.9′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°27.2	N01°37.3	138°27.4	10.9′	N17°50.8	12.3′	57.4′
1	193°27.4	38.3	152°57.3	10.9′	18°03.1	12.3′	57.3′
2	208°27.6	39.2	167°27.2	10.8′	18°15.4	12.1′	57.3′
3	223°27.8	·· 40.2	181°57.1	10.8′	18°27.5	12.0′	57.3′
4	238°28.0	41.2	196°26.9	10.8′	18°39.5	11.9′	57.2′
5	253°28.2	42.2	210°56.7	10.8′	18°51.4	11.8′	57.2′
6	268°28.4	N01°43.2	225°26.4	10.7′	N19°03.2	11.7′	57.2′
7	283°28.6	44.2	239°56.1	10.7′	19°14.9	11.5′	57.1′
8	298°28.7	45.2	254°25.8	10.7′	19°26.4	11.5′	57.1′
9	313°28.9	·· 46.1	268°55.5	10.6′	19°37.9	11.3′	57.0′
10	328°29.1	47.1	283°25.1	10.6′	19°49.2	11.2′	57.0′
11	343°29.3	48.1	297°54.7	10.5′	20°00.4	11.1′	57.0′
12	358°29.5	N01°49.1	312°24.2	10.5′	N20°11.5	11.0′	56.9′
13	13°29.7	50.1	326°53.7	10.5′	20°22.5	10.9′	56.9′
14	28°29.9	51.1	341°23.2	10.4′	20°33.4	10.8′	56.9′
15	43°30.1	·· 52.0	355°52.7	10.4′	20°44.2	10.6′	56.8′
16	58°30.2	53.0	10°22.1	10.4′	20°54.8	10.5′	56.8′
17	73°30.4	54.0	24°51.5	10.3′	21°05.3	10.4′	56.8′
18	88°30.6	N01°55.0	39°20.8	10.3′	N21°15.7	10.3′	56.7′
19	103°30.8	56.0	53°50.1	10.3′	21°26.0	10.1′	56.7′
20	118°31.0	56.9	68°19.4	10.2′	21°36.1	10.0′	56.7′
21	133°31.2	·· 57.9	82°48.6	10.2′	21°46.1	9.9′	56.6′
22	148°31.4	58.9	97°17.8	10.2′	21°56.0	9.8′	56.6′
23	163°31.6	59.9	111°47.0	10.1′	22°05.8	9.7′	56.6′
	SD = 16.0′	d = 1.0′	SD = 15.6′				

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

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

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 2-13%
23	06:47	06:38	12:07	13:38	01:14	
24	06:29	06:20	12:06	14:27	02:03	
25	06:11	06:02	12:06	15:17	02:52	

March 26, 27, 28 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	183°11.0	144°56.1	N15°40.6	92°54.6	N25°34.2	166°28.0	N05°56.7	208°37.2	S11°57.6
1	198°13.5	159°55.7	41.7	107°55.7	34.2	181°29.9	57.0	223°39.4	57.5
2	213°15.9	174°55.2	42.7	122°56.8	34.2	196°31.8	57.2	238°41.6	57.4
3	228°18.4	189°54.8	·· 43.8	137°57.9	·· 34.1	211°33.7	·· 57.4	253°43.8	·· 57.4
4	243°20.8	204°54.4	44.9	152°59.0	34.1	226°35.6	57.7	268°46.0	57.3
5	258°23.3	219°53.9	45.9	168°00.2	34.1	241°37.5	57.9	283°48.2	57.2
6	273°25.8	234°53.5	N15°47.0	183°01.3	N25°34.0	256°39.5	N05°58.1	298°50.4	S11°57.1
7	288°28.2	249°53.1	48.1	198°02.4	34.0	271°41.4	58.4	313°52.6	57.0
8	303°30.7	264°52.6	49.1	213°03.5	34.0	286°43.3	58.6	328°54.8	56.9
9	318°33.2	279°52.2	·· 50.2	228°04.6	·· 33.9	301°45.2	·· 58.8	343°57.1	·· 56.8
10	333°35.6	294°51.8	51.2	243°05.8	33.9	316°47.1	59.0	358°59.3	56.7
11	348°38.1	309°51.3	52.3	258°06.9	33.9	331°49.0	59.3	14°01.5	56.6
12	3°40.6	324°50.9	N15°53.4	273°08.0	N25°33.9	346°50.9	N05°59.5	29°03.7	S11°56.5
13	18°43.0	339°50.4	54.4	288°09.1	33.8	1°52.8	05°59.7	44°05.9	56.4
14	33°45.5	354°50.0	55.5	303°10.2	33.8	16°54.7	06°00.0	59°08.1	56.3
15	48°48.0	9°49.6	·· 56.5	318°11.4	·· 33.8	31°56.6	·· 00.2	74°10.3	·· 56.3
16	63°50.4	24°49.1	57.6	333°12.5	33.7	46°58.5	00.4	89°12.5	56.2
17	78°52.9	39°48.7	58.6	348°13.6	33.7	62°00.5	00.6	104°14.7	56.1
18	93°55.3	54°48.2	N15°59.7	3°14.7	N25°33.7	77°02.4	N06°00.9	119°16.9	S11°56.0
19	108°57.8	69°47.8	16°00.8	18°15.8	33.6	92°04.3	01.1	134°19.1	55.9
20	124°00.3	84°47.3	01.8	33°16.9	33.6	107°06.2	01.3	149°21.3	55.8
21	139°02.7	99°46.9	·· 02.9	48°18.0	·· 33.6	122°08.1	·· 01.6	164°23.5	·· 55.7
22	154°05.2	114°46.5	03.9	63°19.2	33.5	137°10.0	01.8	179°25.7	55.6
23	169°07.7	129°46.0	05.0	78°20.3	33.5	152°11.9	02.0	194°27.9	55.5
Mer.pass. 11:45		ν -0.4′ d 1.1′ m -3.98		ν 1.1′ d -0.0′ m 0.87		ν 1.9′ d 0.2′ m -2.06		ν 2.2′ d 0.1′ m 0.94	

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	184°10.1	144°45.6	N16°06.0	93°21.4	N25°33.5	167°13.8	N06°02.3	209°30.1	S11°55.4
1	199°12.6	159°45.1	07.1	108°22.5	33.4	182°15.7	02.5	224°32.3	55.3
2	214°15.1	174°44.7	08.1	123°23.6	33.4	197°17.6	02.7	239°34.6	55.2
3	229°17.5	189°44.2	·· 09.2	138°24.7	·· 33.4	212°19.5	·· 02.9	254°36.8	·· 55.2
4	244°20.0	204°43.8	10.2	153°25.8	33.3	227°21.5	03.2	269°39.0	55.1
5	259°22.4	219°43.4	11.3	168°27.0	33.3	242°23.4	03.4	284°41.2	55.0
6	274°24.9	234°42.9	N16°12.3	183°28.1	N25°33.3	257°25.3	N06°03.6	299°43.4	S11°54.9
7	289°27.4	249°42.5	13.4	198°29.2	33.2	272°27.2	03.9	314°45.6	54.8
8	304°29.8	264°42.0	14.4	213°30.3	33.2	287°29.1	04.1	329°47.8	54.7
9	319°32.3	279°41.6	·· 15.4	228°31.4	·· 33.2	302°31.0	·· 04.3	344°50.0	·· 54.6
10	334°34.8	294°41.1	16.5	243°32.5	33.1	317°32.9	04.6	359°52.2	54.5
11	349°37.2	309°40.7	17.5	258°33.6	33.1	332°34.8	04.8	14°54.4	54.4
12	4°39.7	324°40.2	N16°18.6	273°34.7	N25°33.0	347°36.7	N06°05.0	29°56.6	S11°54.3
13	19°42.2	339°39.8	19.6	288°35.9	33.0	2°38.6	05.2	44°58.8	54.2
14	34°44.6	354°39.3	20.7	303°37.0	33.0	17°40.5	05.5	60°01.0	54.1
15	49°47.1	9°38.9	·· 21.7	318°38.1	·· 32.9	32°42.4	·· 05.7	75°03.2	·· 54.1
16	64°49.6	24°38.4	22.7	333°39.2	32.9	47°44.4	05.9	90°05.4	54.0
17	79°52.0	39°38.0	23.8	348°40.3	32.9	62°46.3	06.2	105°07.7	53.9
18	94°54.5	54°37.5	N16°24.8	3°41.4	N25°32.8	77°48.2	N06°06.4	120°09.9	S11°53.8
19	109°56.9	69°37.1	25.9	18°42.5	32.8	92°50.1	06.6	135°12.1	53.7
20	124°59.4	84°36.6	26.9	33°43.6	32.8	107°52.0	06.9	150°14.3	53.6
21	140°01.9	99°36.2	·· 27.9	48°44.7	·· 32.7	122°53.9	·· 07.1	165°16.5	·· 53.5
22	155°04.3	114°35.7	29.0	63°45.8	32.7	137°55.8	07.3	180°18.7	53.4
23	170°06.8	129°35.3	30.0	78°47.0	32.6	152°57.7	07.5	195°20.9	53.3
Mer.pass. 11:41		ν -0.4′ d 1.1′ m -3.98		ν 1.1′ d -0.0′ m 0.89		ν 1.9′ d 0.2′ m -2.06		ν 2.2′ d 0.1′ m 0.94	

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	185°09.3	144°34.8	N16°31.0	93°48.1	N25°32.6	167°59.6	N06°07.8	210°23.1	S11°53.2
1	200°11.7	159°34.4	32.1	108°49.2	32.6	183°01.5	08.0	225°25.3	53.1
2	215°14.2	174°33.9	33.1	123°50.3	32.5	198°03.4	08.2	240°27.5	53.1
3	230°16.7	189°33.5	·· 34.1	138°51.4	·· 32.5	213°05.3	·· 08.5	255°29.7	·· 53.0
4	245°19.1	204°33.0	35.2	153°52.5	32.4	228°07.3	08.7	270°31.9	52.9
5	260°21.6	219°32.6	36.2	168°53.6	32.4	243°09.2	08.9	285°34.1	52.8
6	275°24.1	234°32.1	N16°37.2	183°54.7	N25°32.4	258°11.1	N06°09.1	300°36.4	S11°52.7
7	290°26.5	249°31.7	38.3	198°55.8	32.3	273°13.0	09.4	315°38.6	52.6
8	305°29.0	264°31.2	39.3	213°56.9	32.3	288°14.9	09.6	330°40.8	52.5
9	320°31.4	279°30.8	·· 40.3	228°58.0	·· 32.3	303°16.8	·· 09.8	345°43.0	·· 52.4
10	335°33.9	294°30.3	41.3	243°59.1	32.2	318°18.7	10.1	0°45.2	52.3
11	350°36.4	309°29.9	42.4	259°00.2	32.2	333°20.6	10.3	15°47.4	52.2
12	5°38.8	324°29.4	N16°43.4	274°01.3	N25°32.1	348°22.5	N06°10.5	30°49.6	S11°52.2
13	20°41.3	339°28.9	44.4	289°02.4	32.1	3°24.4	10.8	45°51.8	52.1
14	35°43.8	354°28.5	45.4	304°03.5	32.0	18°26.3	11.0	60°54.0	52.0
15	50°46.2	9°28.0	·· 46.5	319°04.6	·· 32.0	33°28.2	·· 11.2	75°56.2	·· 51.9
16	65°48.7	24°27.6	47.5	334°05.7	32.0	48°30.1	11.4	90°58.4	51.8
17	80°51.2	39°27.1	48.5	349°06.9	31.9	63°32.1	11.7	106°00.7	51.7
18	95°53.6	54°26.7	N16°49.5	4°08.0	N25°31.9	78°34.0	N06°11.9	121°02.9	S11°51.6
19	110°56.1	69°26.2	50.6	19°09.1	31.8	93°35.9	12.1	136°05.1	51.5
20	125°58.6	84°25.7	51.6	34°10.2	31.8	108°37.8	12.4	151°07.3	51.4
21	141°01.0	99°25.3	·· 52.6	49°11.3	·· 31.8	123°39.7	·· 12.6	166°09.5	·· 51.3
22	156°03.5	114°24.8	53.6	64°12.4	31.7	138°41.6	12.8	181°11.7	51.2
23	171°05.9	129°24.4	54.6	79°13.5	31.7	153°43.5	13.1	196°13.9	51.2
Mer.pass. 11:37		ν -0.5′ d 1.0′ m -3.98		ν 1.1′ d -0.0′ m 0.91		ν 1.9′ d 0.2′ m -2.06		ν 2.2′ d 0.1′ m 0.94	

Stars

	SHA	**Dec**
Alpheratz	357°36.7	29°12.9
Ankaa	353°09.0	-42°10.9
Schedar	349°33.3	56°39.8
Diphda	348°49.1	-17°51.7
Achernar	335°21.8	-57°07.3
Hamal	327°53.2	23°34.2
Polaris	315°07.6	89°21.9
Acamar	315°13.2	-40°12.9
Menkar	314°08.0	4°10.7
Mirfak	308°30.7	49°56.7
Aldebaran	290°41.5	16°33.3
Rigel	281°05.4	-8°10.6
Capella	280°24.2	46°01.4
Bellatrix	278°24.6	6°22.2
Elnath	278°03.8	28°37.6
Alnilam	275°39.3	-1°11.3
Betelgeuse	270°53.7	7°24.6
Canopus	263°53.1	-52°42.7
Sirius	258°27.5	-16°45.1
Adhara	255°07.0	-29°00.4
Procyon	244°52.3	5°09.9
Pollux	243°19.0	27°58.3
Avior	234°15.1	-59°35.2
Suhail	222°47.1	-43°31.8
Miaplacidus	221°38.0	-69°48.9
Alphard	217°49.0	-8°45.7
Regulus	207°35.8	11°51.2
Dubhe	193°42.2	61°37.6
Denebola	182°26.2	14°26.5
Gienah	175°44.8	-17°40.3
Acrux	173°01.1	-63°13.7
Gacrux	171°52.8	-57°14.6
Alioth	166°13.7	55°50.0
Spica	158°23.6	-11°17.0
Alkaid	152°52.7	49°11.7
Hadar	148°37.6	-60°29.0
Menkent	147°59.0	-36°29.0
Arcturus	145°49.0	19°03.5
Rigil Kent.	139°41.8	-60°55.7
Kochab	137°18.8	74°03.4
Zuben'ubi	136°57.4	-16°08.3
Alphecca	126°04.8	26°38.0
Antares	112°17.5	-26°29.0
Atria	107°12.9	-69°03.9
Sabik	102°04.4	-15°45.3
Shaula	96°12.3	-37°07.2
Rasalhague	95°59.9	12°32.4
Eltanin	90°42.8	51°28.8
Kaus Aust.	83°34.5	-34°22.4
Vega	80°34.3	38°47.9
Nunki	75°49.7	-26°16.1
Altair	62°01.5	8°55.5
Peacock	53°08.4	-56°39.5
Deneb	49°27.1	45°21.4
Enif	33°40.5	9°58.7
Al Na'ir	27°35.2	-46°50.9
Fomalhaut	15°16.5	-29°30.1
Scheat	13°47.0	28°12.3
Markab	13°31.7	15°19.6

Mar 26 Sun	**SHA**	**Mer.pass**
Venus	321°45.1	14:21
Mars	269°43.6	17:47
Jupiter	343°17.0	12:52
Saturn	25°26.2	10:04

Mar 27 Mon	**SHA**	**Mer.pass**
Venus	320°35.5	14:21
Mars	269°11.3	17:45
Jupiter	343°03.7	12:49
Saturn	25°20.0	10:01

Mar 28 Tue	**SHA**	**Mer.pass**
Venus	319°25.6	14:22
Mars	268°38.8	17:43
Jupiter	342°50.4	12:46
Saturn	25°13.8	09:57

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°31.7	N02°00.9	126°16.1	10.1′	N22°15.5	9.5′	56.5′
1	193°31.9	01.9	140°45.3	10.1′	22°25.0	9.4′	56.5′
2	208°32.1	02.8	155°14.3	10.0′	22°34.4	9.3′	56.5′
3	223°32.3	·· 03.8	169°43.4	10.0′	22°43.7	9.1′	56.4′
4	238°32.5	04.8	184°12.4	10.0′	22°52.8	9.1′	56.4′
5	253°32.7	05.8	198°41.4	9.9′	23°01.9	8.9′	56.4′
6	268°32.9	N02°06.8	213°10.3	9.9′	N23°10.8	8.7′	56.3′
7	283°33.1	07.8	227°39.2	9.9′	23°19.5	8.6′	56.3′
8	298°33.3	08.7	242°08.1	9.9′	23°28.1	8.5′	56.3′
9	313°33.4	·· 09.7	256°37.0	9.8′	23°36.6	8.4′	56.2′
10	328°33.6	10.7	271°05.8	9.8′	23°45.0	8.3′	56.2′
11	343°33.8	11.7	285°34.6	9.8′	23°53.3	8.1′	56.2′
12	358°34.0	N02°12.7	300°03.3	9.7′	N24°01.4	7.9′	56.1′
13	13°34.2	13.6	314°32.1	9.7′	24°09.3	7.9′	56.1′
14	28°34.4	14.6	329°00.8	9.7′	24°17.2	7.7′	56.1′
15	43°34.6	·· 15.6	343°29.4	9.7′	24°24.9	7.6′	56.0′
16	58°34.8	16.6	357°58.1	9.6′	24°32.5	7.4′	56.0′
17	73°34.9	17.6	12°26.7	9.6′	24°39.9	7.3′	56.0′
18	88°35.1	N02°18.6	26°55.3	9.6′	N24°47.2	7.2′	55.9′
19	103°35.3	19.5	41°23.9	9.5′	24°54.4	7.0′	55.9′
20	118°35.5	20.5	55°52.4	9.5′	25°01.4	6.9′	55.9′
21	133°35.7	·· 21.5	70°21.0	9.5′	25°08.3	6.8′	55.8′
22	148°35.9	22.5	84°49.5	9.5′	25°15.1	6.6′	55.8′
23	163°36.1	23.5	99°17.9	9.5′	25°21.7	6.5′	55.8′
	SD = 16.0′	d = 1.0′	SD = 15.4′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°36.3	N02°24.4	113°46.4	9.4′	N25°28.2	6.3′	55.7′
1	193°36.4	25.4	128°14.8	9.4′	25°34.5	6.2′	55.7′
2	208°36.6	26.4	142°43.2	9.4′	25°40.7	6.1′	55.7′
3	223°36.8	·· 27.4	157°11.6	9.4′	25°46.8	5.9′	55.7′
4	238°37.0	28.4	171°40.0	9.4′	25°52.7	5.8′	55.6′
5	253°37.2	29.3	186°08.3	9.3′	25°58.5	5.7′	55.6′
6	268°37.4	N02°30.3	200°36.7	9.3′	N26°04.2	5.5′	55.6′
7	283°37.6	31.3	215°05.0	9.3′	26°09.7	5.3′	55.5′
8	298°37.8	32.3	229°33.3	9.3′	26°15.0	5.3′	55.5′
9	313°38.0	·· 33.3	244°01.6	9.3′	26°20.3	5.1′	55.5′
10	328°38.1	34.2	258°29.8	9.3′	26°25.4	4.9′	55.5′
11	343°38.3	35.2	272°58.1	9.2′	26°30.3	4.8′	55.4′
12	358°38.5	N02°36.2	287°26.3	9.2′	N26°35.1	4.7′	55.4′
13	13°38.7	37.2	301°54.6	9.2′	26°39.8	4.5′	55.4′
14	28°38.9	38.2	316°22.8	9.2′	26°44.3	4.4′	55.3′
15	43°39.1	·· 39.1	330°51.0	9.2′	26°48.7	4.2′	55.3′
16	58°39.3	40.1	345°19.2	9.2′	26°52.9	4.1′	55.3′
17	73°39.5	41.1	359°47.4	9.2′	26°57.0	4.0′	55.3′
18	88°39.6	N02°42.1	14°15.6	9.2′	N27°01.0	3.8′	55.2′
19	103°39.8	43.0	28°43.8	9.2′	27°04.8	3.7′	55.2′
20	118°40.0	44.0	43°12.0	9.2′	27°08.5	3.5′	55.2′
21	133°40.2	·· 45.0	57°40.1	9.2′	27°12.0	3.4′	55.2′
22	148°40.4	46.0	72°08.3	9.2′	27°15.4	3.3′	55.1′
23	163°40.6	47.0	86°36.5	9.2′	27°18.7	3.1′	55.1′
	SD = 16.0′	d = 1.0′	SD = 15.2′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°40.8	N02°47.9	101°04.6	9.2′	N27°21.8	2.9′	55.1′
1	193°41.0	48.9	115°32.8	9.2′	27°24.7	2.9′	55.1′
2	208°41.2	49.9	130°01.0	9.2′	27°27.6	2.6′	55.0′
3	223°41.3	·· 50.9	144°29.1	9.2′	27°30.2	2.6′	55.0′
4	238°41.5	51.8	158°57.3	9.2′	27°32.8	2.4′	55.0′
5	253°41.7	52.8	173°25.5	9.2′	27°35.2	2.2′	55.0′
6	268°41.9	N02°53.8	187°53.7	9.2′	N27°37.4	2.1′	55.0′
7	283°42.1	54.8	202°21.9	9.2′	27°39.5	2.0′	54.9′
8	298°42.3	55.8	216°50.1	9.2′	27°41.5	1.8′	54.9′
9	313°42.5	·· 56.7	231°18.3	9.2′	27°43.3	1.7′	54.9′
10	328°42.7	57.7	245°46.5	9.2′	27°45.0	1.5′	54.9′
11	343°42.8	58.7	260°14.7	9.2′	27°46.5	1.4′	54.8′
12	358°43.0	N02°59.7	274°42.9	9.3′	N27°47.9	1.3′	54.8′
13	13°43.2	03°00.6	289°11.2	9.3′	27°49.2	1.1′	54.8′
14	28°43.4	01.6	303°39.5	9.3′	27°50.3	1.0′	54.8′
15	43°43.6	·· 02.6	318°07.7	9.3′	27°51.3	0.8′	54.8′
16	58°43.8	03.6	332°36.0	9.3′	27°52.1	0.7′	54.7′
17	73°44.0	04.6	347°04.3	9.3′	27°52.8	0.6′	54.7′
18	88°44.2	N03°05.5	1°32.7	9.4′	N27°53.4	0.4′	54.7′
19	103°44.4	06.5	16°01.0	9.4′	27°53.8	0.3′	54.7′
20	118°44.5	07.5	30°29.4	9.4′	27°54.1	0.1′	54.7′
21	133°44.7	·· 08.5	44°57.8	9.4′	27°54.2	0.0′	54.6′
22	148°44.9	09.4	59°26.2	9.4′	27°54.2	0.2′	54.6′
23	163°45.1	10.4	73°54.6	9.5′	27°54.0	0.3′	54.6′
	SD = 16.0′	d = 1.0′	SD = 15.0′				

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

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

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 5-7 21-39%
26	05:53	05:44	12:06	16:08	03:43	
27	05:35	05:26	12:05	17:01	04:35	
28	05:17	05:08	12:05	17:54	05:27	

March 29, 30, 31 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	186°08.4	144°23.9	N16°55.7	94°14.6	N25°31.6	168°45.4	N06°13.3	211°16.1	S11°51.1
1	201°10.9	159°23.4	56.7	109°15.7	31.6	183°47.3	13.5	226°18.3	51.0
2	216°13.3	174°23.0	57.7	124°16.8	31.5	198°49.2	13.7	241°20.5	50.9
3	231°15.8	189°22.5	·· 58.7	139°17.9	·· 31.5	213°51.1	·· 14.0	256°22.7	·· 50.8
4	246°18.3	204°22.1	16°59.7	154°19.0	31.5	228°53.0	14.2	271°25.0	50.7
5	261°20.7	219°21.6	17°00.7	169°20.1	31.4	243°54.9	14.4	286°27.2	50.6
6	276°23.2	234°21.1	N17°01.7	184°21.2	N25°31.4	258°56.8	N06°14.7	301°29.4	S11°50.5
7	291°25.7	249°20.7	02.8	199°22.3	31.3	273°58.8	14.9	316°31.6	50.4
8	306°28.1	264°20.2	03.8	214°23.4	31.3	289°00.7	15.1	331°33.8	50.3
9	321°30.6	279°19.7	·· 04.8	229°24.5	·· 31.2	304°02.6	·· 15.3	346°36.0	·· 50.3
10	336°33.0	294°19.3	05.8	244°25.6	31.2	319°04.5	15.6	1°38.2	50.2
11	351°35.5	309°18.8	06.8	259°26.7	31.1	334°06.4	15.8	16°40.4	50.1
12	6°38.0	324°18.4	N17°07.8	274°27.8	N25°31.1	349°08.3	N06°16.0	31°42.6	S11°50.0
13	21°40.4	339°17.9	08.8	289°28.9	31.1	4°10.2	16.3	46°44.9	49.9
14	36°42.9	354°17.4	09.8	304°30.0	31.0	19°12.1	16.5	61°47.1	49.8
15	51°45.4	9°17.0	·· 10.8	319°31.1	·· 31.0	34°14.0	·· 16.7	76°49.3	·· 49.7
16	66°47.8	24°16.5	11.8	334°32.2	30.9	49°15.9	17.0	91°51.5	49.6
17	81°50.3	39°16.0	12.8	349°33.3	30.9	64°17.8	17.2	106°53.7	49.5
18	96°52.8	54°15.6	N17°13.9	4°34.4	N25°30.8	79°19.7	N06°17.4	121°55.9	S11°49.4
19	111°55.2	69°15.1	14.9	19°35.4	30.8	94°21.6	17.6	136°58.1	49.4
20	126°57.7	84°14.6	15.9	34°36.5	30.7	109°23.5	17.9	152°00.3	49.3
21	142°00.2	99°14.2	·· 16.9	49°37.6	·· 30.7	124°25.4	·· 18.1	167°02.5	·· 49.2
22	157°02.6	114°13.7	17.9	64°38.7	30.6	139°27.4	18.3	182°04.8	49.1
23	172°05.1	129°13.2	18.9	79°39.8	30.6	154°29.3	18.6	197°07.0	49.0
Mer.pass. 11:34		ν -0.5′ d 1.0′ m -3.99		ν 1.1′ d -0.0′ m 0.92		ν 1.9′ d 0.2′ m -2.06		ν 2.2′ d 0.1′ m 0.94	

Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	187°07.5	144°12.8	N17°19.9	94°40.9	N25°30.5	169°31.2	N06°18.8	212°09.2	S11°48.9
1	202°10.0	159°12.3	20.9	109°42.0	30.5	184°33.1	19.0	227°11.4	48.8
2	217°12.5	174°11.8	21.9	124°43.1	30.5	199°35.0	19.2	242°13.6	48.7
3	232°14.9	189°11.4	·· 22.9	139°44.2	·· 30.4	214°36.9	·· 19.5	257°15.8	·· 48.6
4	247°17.4	204°10.9	23.9	154°45.3	30.4	229°38.8	19.7	272°18.0	48.6
5	262°19.9	219°10.4	24.9	169°46.4	30.3	244°40.7	19.9	287°20.2	48.5
6	277°22.3	234°09.9	N17°25.9	184°47.5	N25°30.3	259°42.6	N06°20.2	302°22.4	S11°48.4
7	292°24.8	249°09.5	26.9	199°48.6	30.2	274°44.5	20.4	317°24.7	48.3
8	307°27.3	264°09.0	27.8	214°49.7	30.2	289°46.4	20.6	332°26.9	48.2
9	322°29.7	279°08.5	·· 28.8	229°50.8	·· 30.1	304°48.3	·· 20.9	347°29.1	·· 48.1
10	337°32.2	294°08.1	29.8	244°51.9	30.1	319°50.2	21.1	2°31.3	48.0
11	352°34.7	309°07.6	30.8	259°53.0	30.0	334°52.1	21.3	17°33.5	47.9
12	7°37.1	324°07.1	N17°31.8	274°54.1	N25°30.0	349°54.0	N06°21.5	32°35.7	S11°47.8
13	22°39.6	339°06.6	32.8	289°55.1	29.9	4°55.9	21.8	47°37.9	47.7
14	37°42.0	354°06.2	33.8	304°56.2	29.9	19°57.9	22.0	62°40.1	47.7
15	52°44.5	9°05.7	·· 34.8	319°57.3	·· 29.8	34°59.8	·· 22.2	77°42.4	·· 47.6
16	67°47.0	24°05.2	35.8	334°58.4	29.8	50°01.7	22.5	92°44.6	47.5
17	82°49.4	39°04.7	36.8	349°59.5	29.7	65°03.6	22.7	107°46.8	47.4
18	97°51.9	54°04.3	N17°37.8	5°00.6	N25°29.7	80°05.5	N06°22.9	122°49.0	S11°47.3
19	112°54.4	69°03.8	38.7	20°01.7	29.6	95°07.4	23.1	137°51.2	47.2
20	127°56.8	84°03.3	39.7	35°02.8	29.6	110°09.3	23.4	152°53.4	47.1
21	142°59.3	99°02.8	·· 40.7	50°03.9	·· 29.5	125°11.2	·· 23.6	167°55.6	·· 47.0
22	158°01.8	114°02.4	41.7	65°05.0	29.5	140°13.1	23.8	182°57.8	46.9
23	173°04.2	129°01.9	42.7	80°06.1	29.4	155°15.0	24.1	198°00.1	46.9
Mer.pass. 11:30		ν -0.5′ d 1.0′ m -3.99		ν 1.1′ d -0.0′ m 0.94		ν 1.9′ d 0.2′ m -2.06		ν 2.2′ d 0.1′ m 0.94	

Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	188°06.7	144°01.4	N17°43.7	95°07.1	N25°29.4	170°16.9	N06°24.3	213°02.3	S11°46.8
1	203°09.1	159°00.9	44.6	110°08.2	29.3	185°18.8	24.5	228°04.5	46.7
2	218°11.6	174°00.5	45.6	125°09.3	29.2	200°20.7	24.8	243°06.7	46.6
3	233°14.1	189°00.0	·· 46.6	140°10.4	·· 29.2	215°22.6	·· 25.0	258°08.9	·· 46.5
4	248°16.5	203°59.5	47.6	155°11.5	29.1	230°24.5	25.2	273°11.1	46.4
5	263°19.0	218°59.0	48.6	170°12.6	29.1	245°26.4	25.4	288°13.3	46.3
6	278°21.5	233°58.5	N17°49.5	185°13.7	N25°29.0	260°28.3	N06°25.7	303°15.6	S11°46.2
7	293°23.9	248°58.1	50.5	200°14.8	29.0	275°30.2	25.9	318°17.8	46.1
8	308°26.4	263°57.6	51.5	215°15.9	28.9	290°32.2	26.1	333°20.0	46.1
9	323°28.9	278°57.1	·· 52.5	230°16.9	·· 28.9	305°34.1	·· 26.4	348°22.2	·· 46.0
10	338°31.3	293°56.6	53.4	245°18.0	28.8	320°36.0	26.6	3°24.4	45.9
11	353°33.8	308°56.2	54.4	260°19.1	28.8	335°37.9	26.8	18°26.6	45.8
12	8°36.3	323°55.7	N17°55.4	275°20.2	N25°28.7	350°39.8	N06°27.0	33°28.8	S11°45.7
13	23°38.7	338°55.2	56.4	290°21.3	28.7	5°41.7	27.3	48°31.1	45.6
14	38°41.2	353°54.7	57.3	305°22.4	28.6	20°43.6	27.5	63°33.3	45.5
15	53°43.6	8°54.2	·· 58.3	320°23.5	·· 28.5	35°45.5	·· 27.7	78°35.5	·· 45.4
16	68°46.1	23°53.7	17°59.3	335°24.5	28.5	50°47.4	28.0	93°37.7	45.4
17	83°48.6	38°53.3	18°00.3	350°25.6	28.4	65°49.3	28.2	108°39.9	45.3
18	98°51.0	53°52.8	N18°01.2	5°26.7	N25°28.4	80°51.2	N06°28.4	123°42.1	S11°45.2
19	113°53.5	68°52.3	02.2	20°27.8	28.3	95°53.1	28.6	138°44.3	45.1
20	128°56.0	83°51.8	03.2	35°28.9	28.3	110°55.0	28.9	153°46.6	45.0
21	143°58.4	98°51.3	·· 04.1	50°30.0	·· 28.2	125°56.9	·· 29.1	168°48.8	·· 44.9
22	159°00.9	113°50.8	05.1	65°31.1	28.2	140°58.8	29.3	183°51.0	44.8
23	174°03.4	128°50.4	06.1	80°32.1	28.1	156°00.7	29.6	198°53.2	44.7
Mer.pass. 11:26		ν -0.5′ d 1.0′ m -3.99		ν 1.1′ d -0.1′ m 0.95		ν 1.9′ d 0.2′ m -2.06		ν 2.2′ d 0.1′ m 0.94	

Stars

	SHA	**Dec**
Alpheratz	357°36.7	29°12.9
Ankaa	353°09.0	-42°10.9
Schedar	349°33.3	56°39.8
Diphda	348°49.1	-17°51.7
Achernar	335°21.8	-57°07.3
Hamal	327°53.2	23°34.2
Polaris	315°08.3	89°21.9
Acamar	315°13.2	-40°12.9
Menkar	314°08.0	4°10.7
Mirfak	308°30.8	49°56.7
Aldebaran	290°41.5	16°33.3
Rigel	281°05.4	-8°10.6
Capella	280°24.2	46°01.4
Bellatrix	278°24.6	6°22.2
Elnath	278°03.9	28°37.6
Alnilam	275°39.3	-1°11.3
Betelgeuse	270°53.8	7°24.6
Canopus	263°53.1	-52°42.7
Sirius	258°27.5	-16°45.1
Adhara	255°07.0	-29°00.4
Procyon	244°52.3	5°09.9
Pollux	243°19.0	27°58.3
Avior	234°15.1	-59°35.3
Suhail	222°47.1	-43°31.8
Miaplacidus	221°38.0	-69°48.9
Alphard	217°49.0	-8°45.7
Regulus	207°35.8	11°51.2
Dubhe	193°42.2	61°37.7
Denebola	182°26.1	14°26.5
Gienah	175°44.8	-17°40.3
Acrux	173°01.1	-63°13.7
Gacrux	171°52.7	-57°14.6
Alioth	166°13.7	55°50.0
Spica	158°23.6	-11°17.0
Alkaid	152°52.7	49°11.7
Hadar	148°37.6	-60°29.0
Menkent	147°59.0	-36°29.0
Arcturus	145°49.0	19°03.5
Rigil Kent.	139°41.8	-60°55.8
Kochab	137°18.8	74°03.4
Zuben'ubi	136°57.4	-16°08.3
Alphecca	126°04.7	26°38.0
Antares	112°17.5	-26°29.0
Atria	107°12.8	-69°03.9
Sabik	102°04.4	-15°45.3
Shaula	96°12.3	-37°07.2
Rasalhague	95°59.8	12°32.4
Eltanin	90°42.8	51°28.8
Kaus Aust.	83°34.5	-34°22.4
Vega	80°34.2	38°47.9
Nunki	75°49.6	-26°16.1
Altair	62°01.5	8°55.5
Peacock	53°08.3	-56°39.5
Deneb	49°27.1	45°21.4
Enif	33°40.5	9°58.7
Al Na'ir	27°35.1	-46°50.9
Fomalhaut	15°16.5	-29°30.1
Scheat	13°47.0	28°12.3
Markab	13°31.7	15°19.6

Mar 29 Wed	**SHA**	**Mer.pass**
Venus	318°15.5	14:23
Mars	268°06.2	17:42
Jupiter	342°37.0	12:43
Saturn	25°07.7	09:53

Mar 30 Thu	**SHA**	**Mer.pass**
Venus	317°05.2	14:24
Mars	267°33.4	17:40
Jupiter	342°23.6	12:40
Saturn	25°01.6	09:50

Mar 31 Fri	**SHA**	**Mer.pass**
Venus	315°54.7	14:24
Mars	267°00.5	17:38
Jupiter	342°10.2	12:37
Saturn	24°55.6	09:46

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°45.3	N03°11.4	88°23.1	9.5′	N27°53.7	0.4′	54.6′
1	193°45.5	12.4	102°51.6	9.5′	27°53.3	0.5′	54.6′
2	208°45.7	13.3	117°20.1	9.5′	27°52.8	0.7′	54.6′
3	223°45.9	·· 14.3	131°48.6	9.6′	27°52.1	0.9′	54.5′
4	238°46.0	15.3	146°17.2	9.6′	27°51.2	1.0′	54.5′
5	253°46.2	16.3	160°45.8	9.6′	27°50.2	1.1′	54.5′
6	268°46.4	N03°17.2	175°14.4	9.7′	N27°49.1	1.2′	54.5′
7	283°46.6	18.2	189°43.1	9.7′	27°47.9	1.4′	54.5′
8	298°46.8	19.2	204°11.8	9.7′	27°46.5	1.5′	54.5′
9	313°47.0	·· 20.2	218°40.5	9.8′	27°45.0	1.7′	54.4′
10	328°47.2	21.1	233°09.3	9.8′	27°43.3	1.8′	54.4′
11	343°47.4	22.1	247°38.1	9.8′	27°41.5	1.9′	54.4′
12	358°47.6	N03°23.1	262°06.9	9.9′	N27°39.6	2.1′	54.4′
13	13°47.7	24.1	276°35.8	9.9′	27°37.5	2.2′	54.4′
14	28°47.9	25.0	291°04.7	9.9′	27°35.3	2.3′	54.4′
15	43°48.1	·· 26.0	305°33.7	10.0′	27°33.0	2.4′	54.4′
16	58°48.3	27.0	320°02.6	10.0′	27°30.6	2.6′	54.4′
17	73°48.5	28.0	334°31.7	10.1′	27°28.0	2.8′	54.3′
18	88°48.7	N03°28.9	349°00.7	10.1′	N27°25.2	2.8′	54.3′
19	103°48.9	29.9	3°29.9	10.2′	27°22.4	3.0′	54.3′
20	118°49.1	30.9	17°59.0	10.2′	27°19.4	3.1′	54.3′
21	133°49.2	·· 31.8	32°28.2	10.2′	27°16.3	3.3′	54.3′
22	148°49.4	32.8	46°57.4	10.3′	27°13.0	3.3′	54.3′
23	163°49.6	33.8	61°26.7	10.3′	27°09.7	3.5′	54.3′
	SD = 16.0′	d = 1.0′	SD = 14.9′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°49.8	N03°34.8	75°56.1	10.4′	N27°06.2	3.7′	54.3′
1	193°50.0	35.7	90°25.5	10.4′	27°02.5	3.7′	54.2′
2	208°50.2	36.7	104°54.9	10.5′	26°58.8	3.9′	54.2′
3	223°50.4	·· 37.7	119°24.4	10.5′	26°54.9	4.0′	54.2′
4	238°50.6	38.7	133°53.9	10.6′	26°50.9	4.2′	54.2′
5	253°50.7	39.6	148°23.5	10.6′	26°46.7	4.2′	54.2′
6	268°50.9	N03°40.6	162°53.1	10.7′	N26°42.5	4.4′	54.2′
7	283°51.1	41.6	177°22.8	10.7′	26°38.1	4.5′	54.2′
8	298°51.3	42.5	191°52.5	10.8′	26°33.6	4.7′	54.2′
9	313°51.5	·· 43.5	206°22.3	10.8′	26°28.9	4.7′	54.2′
10	328°51.7	44.5	220°52.1	10.9′	26°24.2	4.9′	54.2′
11	343°51.9	45.5	235°22.0	10.9′	26°19.3	5.0′	54.2′
12	358°52.1	N03°46.4	249°51.9	11.0′	N26°14.3	5.1′	54.2′
13	13°52.2	47.4	264°21.9	11.0′	26°09.2	5.3′	54.2′
14	28°52.4	48.4	278°52.0	11.1′	26°03.9	5.4′	54.1′
15	43°52.6	·· 49.3	293°22.1	11.2′	25°58.5	5.4′	54.1′
16	58°52.8	50.3	307°52.2	11.2′	25°53.1	5.6′	54.1′
17	73°53.0	51.3	322°22.4	11.3′	25°47.5	5.8′	54.1′
18	88°53.2	N03°52.3	336°52.7	11.3′	N25°41.7	5.8′	54.1′
19	103°53.4	53.2	351°23.0	11.4′	25°35.9	5.9′	54.1′
20	118°53.6	54.2	5°53.4	11.4′	25°30.0	6.1′	54.1′
21	133°53.7	·· 55.2	20°23.8	11.5′	25°23.9	6.2′	54.1′
22	148°53.9	56.1	34°54.3	11.6′	25°17.7	6.3′	54.1′
23	163°54.1	57.1	49°24.9	11.6′	25°11.4	6.4′	54.1′
	SD = 16.0′	d = 1.0′	SD = 14.8′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°54.3	N03°58.1	63°55.5	11.7′	N25°05.0	6.5′	54.1′
1	193°54.5	03°59.0	78°26.1	11.7′	24°58.5	6.7′	54.1′
2	208°54.7	04°00.0	92°56.9	11.8′	24°51.8	6.7′	54.1′
3	223°54.9	·· 01.0	107°27.7	11.8′	24°45.1	6.9′	54.1′
4	238°55.1	02.0	121°58.5	11.9′	24°38.2	6.9′	54.1′
5	253°55.2	02.9	136°29.4	12.0′	24°31.3	7.1′	54.1′
6	268°55.4	N04°03.9	151°00.4	12.0′	N24°24.2	7.2′	54.1′
7	283°55.6	04.9	165°31.4	12.1′	24°17.0	7.3′	54.1′
8	298°55.8	05.8	180°02.4	12.1′	24°09.7	7.4′	54.1′
9	313°56.0	·· 06.8	194°33.6	12.2′	24°02.3	7.5′	54.1′
10	328°56.2	07.8	209°04.8	12.3′	23°54.8	7.6′	54.1′
11	343°56.4	08.7	223°36.0	12.3′	23°47.2	7.7′	54.1′
12	358°56.5	N04°09.7	238°07.3	12.4′	N23°39.5	7.8′	54.1′
13	13°56.7	10.7	252°38.7	12.4′	23°31.7	8.0′	54.1′
14	28°56.9	11.6	267°10.2	12.5′	23°23.7	8.0′	54.1′
15	43°57.1	·· 12.6	281°41.6	12.5′	23°15.7	8.1′	54.1′
16	58°57.3	13.6	296°13.2	12.6′	23°07.6	8.2′	54.1′
17	73°57.5	14.5	310°44.8	12.7′	22°59.4	8.4′	54.1′
18	88°57.7	N04°15.5	325°16.5	12.7′	N22°51.0	8.4′	54.1′
19	103°57.9	16.5	339°48.2	12.8′	22°42.6	8.5′	54.1′
20	118°58.0	17.4	354°20.0	12.8′	22°34.1	8.7′	54.1′
21	133°58.2	·· 18.4	8°51.8	12.9′	22°25.4	8.7′	54.1′
22	148°58.4	19.4	23°23.7	13.0′	22°16.7	8.8′	54.1′
23	163°58.6	20.3	37°55.7	13.0′	22°07.9	8.9′	54.1′
	SD = 16.0′	d = 1.0′	SD = 14.8′				

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

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

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%
29	04:59	04:50	12:05	18:46	06:20	
30	04:41	04:32	12:05	19:36	07:11	
31	04:23	04:14	12:04	20:23	08:00	

April 01, 02, 03 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	189°05.8	143°49.9	N18°07.0	95°33.2	N25°28.0	171°02.6	N06°29.8	213°55.4	S11°44.6
1	204°08.3	158°49.4	08.0	110°34.3	28.0	186°04.5	30.0	228°57.6	44.6
2	219°10.8	173°48.9	08.9	125°35.4	27.9	201°06.4	30.3	243°59.8	44.5
3	234°13.2	188°48.4	·· 09.9	140°36.5	·· 27.9	216°08.3	·· 30.5	259°02.1	·· 44.4
4	249°15.7	203°47.9	10.9	155°37.6	27.8	231°10.3	30.7	274°04.3	44.3
5	264°18.1	218°47.4	11.8	170°38.6	27.8	246°12.2	30.9	289°06.5	44.2
6	279°20.6	233°47.0	N18°12.8	185°39.7	N25°27.7	261°14.1	N06°31.2	304°08.7	S11°44.1
7	294°23.1	248°46.5	13.8	200°40.8	27.6	276°16.0	31.4	319°10.9	44.0
8	309°25.5	263°46.0	14.7	215°41.9	27.6	291°17.9	31.6	334°13.1	43.9
9	324°28.0	278°45.5	·· 15.7	230°43.0	·· 27.5	306°19.8	·· 31.9	349°15.4	·· 43.9
10	339°30.5	293°45.0	16.6	245°44.0	27.5	321°21.7	32.1	4°17.6	43.8
11	354°32.9	308°44.5	17.6	260°45.1	27.4	336°23.6	32.3	19°19.8	43.7
12	9°35.4	323°44.0	N18°18.5	275°46.2	N25°27.3	351°25.5	N06°32.5	34°22.0	S11°43.6
13	24°37.9	338°43.5	19.5	290°47.3	27.3	6°27.4	32.8	49°24.2	43.5
14	39°40.3	353°43.0	20.4	305°48.4	27.2	21°29.3	33.0	64°26.4	43.4
15	54°42.8	8°42.5	·· 21.4	320°49.5	·· 27.2	36°31.2	·· 33.2	79°28.7	·· 43.3
16	69°45.2	23°42.1	22.3	335°50.5	27.1	51°33.1	33.5	94°30.9	43.2
17	84°47.7	38°41.6	23.3	350°51.6	27.0	66°35.0	33.7	109°33.1	43.2
18	99°50.2	53°41.1	N18°24.3	5°52.7	N25°27.0	81°36.9	N06°33.9	124°35.3	S11°43.1
19	114°52.6	68°40.6	25.2	20°53.8	26.9	96°38.8	34.1	139°37.5	43.0
20	129°55.1	83°40.1	26.1	35°54.9	26.9	111°40.7	34.4	154°39.7	42.9
21	144°57.6	98°39.6	·· 27.1	50°55.9	·· 26.8	126°42.6	·· 34.6	169°42.0	·· 42.8
22	160°00.0	113°39.1	28.0	65°57.0	26.7	141°44.5	34.8	184°44.2	42.7
23	175°02.5	128°38.6	29.0	80°58.1	26.7	156°46.4	35.1	199°46.4	42.6
Mer.pass. 11:22		ν -0.5′ d 1.0′ m -3.99		ν 1.1′ d -0.1′ m 0.97		ν 1.9′ d 0.2′ m -2.05		ν 2.2′ d 0.1′ m 0.94	

Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	190°05.0	143°38.1	N18°29.9	95°59.2	N25°26.6	171°48.3	N06°35.3	214°48.6	S11°42.5
1	205°07.4	158°37.6	30.9	111°00.2	26.5	186°50.2	35.5	229°50.8	42.5
2	220°09.9	173°37.1	31.8	126°01.3	26.5	201°52.2	35.7	244°53.0	42.4
3	235°12.4	188°36.6	·· 32.8	141°02.4	·· 26.4	216°54.1	·· 36.0	259°55.3	·· 42.3
4	250°14.8	203°36.1	33.7	156°03.5	26.4	231°56.0	36.2	274°57.5	42.2
5	265°17.3	218°35.6	34.7	171°04.6	26.3	246°57.9	36.4	289°59.7	42.1
6	280°19.7	233°35.1	N18°35.6	186°05.6	N25°26.2	261°59.8	N06°36.7	305°01.9	S11°42.0
7	295°22.2	248°34.7	36.5	201°06.7	26.2	277°01.7	36.9	320°04.1	41.9
8	310°24.7	263°34.2	37.5	216°07.8	26.1	292°03.6	37.1	335°06.3	41.8
9	325°27.1	278°33.7	·· 38.4	231°08.9	·· 26.0	307°05.5	·· 37.3	350°08.6	·· 41.8
10	340°29.6	293°33.2	39.4	246°09.9	26.0	322°07.4	37.6	5°10.8	41.7
11	355°32.1	308°32.7	40.3	261°11.0	25.9	337°09.3	37.8	20°13.0	41.6
12	10°34.5	323°32.2	N18°41.2	276°12.1	N25°25.9	352°11.2	N06°38.0	35°15.2	S11°41.5
13	25°37.0	338°31.7	42.2	291°13.2	25.8	7°13.1	38.3	50°17.4	41.4
14	40°39.5	353°31.2	43.1	306°14.2	25.7	22°15.0	38.5	65°19.7	41.3
15	55°41.9	8°30.7	·· 44.0	321°15.3	·· 25.7	37°16.9	·· 38.7	80°21.9	·· 41.2
16	70°44.4	23°30.2	45.0	336°16.4	25.6	52°18.8	38.9	95°24.1	41.1
17	85°46.9	38°29.7	45.9	351°17.5	25.5	67°20.7	39.2	110°26.3	41.1
18	100°49.3	53°29.2	N18°46.8	6°18.5	N25°25.5	82°22.6	N06°39.4	125°28.5	S11°41.0
19	115°51.8	68°28.7	47.8	21°19.6	25.4	97°24.5	39.6	140°30.8	40.9
20	130°54.2	83°28.2	48.7	36°20.7	25.3	112°26.4	39.9	155°33.0	40.8
21	145°56.7	98°27.7	·· 49.6	51°21.8	·· 25.3	127°28.3	·· 40.1	170°35.2	·· 40.7
22	160°59.2	113°27.2	50.5	66°22.8	25.2	142°30.2	40.3	185°37.4	40.6
23	176°01.6	128°26.7	51.5	81°23.9	25.1	157°32.1	40.5	200°39.6	40.5
Mer.pass. 11:18		ν -0.5′ d 0.9′ m -4.00		ν 1.1′ d -0.1′ m 0.98		ν 1.9′ d 0.2′ m -2.05		ν 2.2′ d 0.1′ m 0.94	

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	191°04.1	143°26.2	N18°52.4	96°25.0	N25°25.1	172°34.0	N06°40.8	215°41.8	S11°40.4
1	206°06.6	158°25.7	53.3	111°26.1	25.0	187°35.9	41.0	230°44.1	40.4
2	221°09.0	173°25.2	54.3	126°27.1	24.9	202°37.8	41.2	245°46.3	40.3
3	236°11.5	188°24.7	·· 55.2	141°28.2	·· 24.9	217°39.7	·· 41.5	260°48.5	·· 40.2
4	251°14.0	203°24.2	56.1	156°29.3	24.8	232°41.7	41.7	275°50.7	40.1
5	266°16.4	218°23.6	57.0	171°30.3	24.7	247°43.6	41.9	290°52.9	40.0
6	281°18.9	233°23.1	N18°57.9	186°31.4	N25°24.7	262°45.5	N06°42.1	305°55.2	S11°39.9
7	296°21.3	248°22.6	58.9	201°32.5	24.6	277°47.4	42.4	320°57.4	39.8
8	311°23.8	263°22.1	18°59.8	216°33.6	24.5	292°49.3	42.6	335°59.6	39.8
9	326°26.3	278°21.6	19°00.7	231°34.6	·· 24.5	307°51.2	·· 42.8	351°01.8	·· 39.7
10	341°28.7	293°21.1	01.6	246°35.7	24.4	322°53.1	43.1	6°04.0	39.6
11	356°31.2	308°20.6	02.5	261°36.8	24.3	337°55.0	43.3	21°06.3	39.5
12	11°33.7	323°20.1	N19°03.5	276°37.8	N25°24.2	352°56.9	N06°43.5	36°08.5	S11°39.4
13	26°36.1	338°19.6	04.4	291°38.9	24.2	7°58.8	43.7	51°10.7	39.3
14	41°38.6	353°19.1	05.3	306°40.0	24.1	23°00.7	44.0	66°12.9	39.2
15	56°41.1	8°18.6	·· 06.2	321°41.1	·· 24.0	38°02.6	·· 44.2	81°15.1	·· 39.2
16	71°43.5	23°18.1	07.1	336°42.1	24.0	53°04.5	44.4	96°17.4	39.1
17	86°46.0	38°17.6	08.0	351°43.2	23.9	68°06.4	44.7	111°19.6	39.0
18	101°48.5	53°17.1	N19°08.9	6°44.3	N25°23.8	83°08.3	N06°44.9	126°21.8	S11°38.9
19	116°50.9	68°16.6	09.9	21°45.3	23.8	98°10.2	45.1	141°24.0	38.8
20	131°53.4	83°16.0	10.8	36°46.4	23.7	113°12.1	45.3	156°26.2	38.7
21	146°55.8	98°15.5	·· 11.7	51°47.5	·· 23.6	128°14.0	·· 45.6	171°28.5	·· 38.6
22	161°58.3	113°15.0	12.6	66°48.5	23.5	143°15.9	45.8	186°30.7	38.6
23	177°00.8	128°14.5	13.5	81°49.6	23.5	158°17.8	46.0	201°32.9	38.5
Mer.pass. 11:14		ν -0.5′ d 0.9′ m -4.00		ν 1.1′ d -0.1′ m 1.00		ν 1.9′ d 0.2′ m -2.05		ν 2.2′ d 0.1′ m 0.95	

Stars

	SHA	**Dec**
Alpheratz	357°36.7	29°12.9
Ankaa	353°09.0	-42°10.9
Schedar	349°33.3	56°39.7
Diphda	348°49.1	-17°51.7
Achernar	335°21.8	-57°07.3
Hamal	327°53.2	23°34.2
Polaris	315°09.2	89°21.9
Acamar	315°13.2	-40°12.9
Menkar	314°08.0	4°10.7
Mirfak	308°30.8	49°56.6
Aldebaran	290°41.5	16°33.3
Rigel	281°05.4	-8°10.6
Capella	280°24.3	46°01.4
Bellatrix	278°24.6	6°22.2
Elnath	278°03.9	28°37.6
Alnilam	275°39.3	-1°11.3
Betelgeuse	270°53.8	7°24.6
Canopus	263°53.1	-52°42.7
Sirius	258°27.6	-16°45.1
Adhara	255°07.0	-29°00.4
Procyon	244°52.3	5°09.9
Pollux	243°19.0	27°58.3
Avior	234°15.1	-59°35.3
Suhail	222°47.2	-43°31.8
Miaplacidus	221°38.1	-69°48.9
Alphard	217°49.0	-8°45.7
Regulus	207°35.8	11°51.2
Dubhe	193°42.2	61°37.7
Denebola	182°26.1	14°26.5
Gienah	175°44.8	-17°40.3
Acrux	173°01.1	-63°13.7
Gacrux	171°52.7	-57°14.6
Alioth	166°13.7	55°50.0
Spica	158°23.6	-11°17.0
Alkaid	152°52.7	49°11.7
Hadar	148°37.5	-60°29.0
Menkent	147°59.0	-36°29.1
Arcturus	145°49.0	19°03.6
Rigil Kent.	139°41.8	-60°55.8
Kochab	137°18.7	74°03.4
Zuben'ubi	136°57.4	-16°08.3
Alphecca	126°04.7	26°38.0
Antares	112°17.5	-26°29.0
Atria	107°12.8	-69°03.9
Sabik	102°04.3	-15°45.3
Shaula	96°12.3	-37°07.2
Rasalhague	95°59.8	12°32.4
Eltanin	90°42.8	51°28.8
Kaus Aust.	83°34.4	-34°22.4
Vega	80°34.2	38°47.9
Nunki	75°49.6	-26°16.1
Altair	62°01.5	8°55.5
Peacock	53°08.3	-56°39.5
Deneb	49°27.0	45°21.4
Enif	33°40.5	9°58.7
Al Na'ir	27°35.1	-46°50.9
Fomalhaut	15°16.5	-29°30.1
Scheat	13°47.0	28°12.3
Markab	13°31.7	15°19.6

Apr 01 Sat	**SHA**	**Mer.pass**
Venus	314°44.0	14:25
Mars	266°27.4	17:37
Jupiter	341°56.8	12:34
Saturn	24°49.6	09:43

Apr 02 Sun	**SHA**	**Mer.pass**
Venus	313°33.2	14:26
Mars	265°54.2	17:35
Jupiter	341°43.4	12:31
Saturn	24°43.6	09:39

Apr 03 Mon	**SHA**	**Mer.pass**
Venus	312°22.1	14:27
Mars	265°20.9	17:33
Jupiter	341°29.9	12:28
Saturn	24°37.7	09:36

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°58.8	N04°21.3	52°27.7	13.1′	N21°59.0	9.0′	54.1′
1	193°59.0	22.3	66°59.8	13.1′	21°50.0	9.2′	54.1′
2	208°59.2	23.2	81°31.9	13.2′	21°40.8	9.2′	54.1′
3	223°59.3	·· 24.2	96°04.1	13.2′	21°31.6	9.2′	54.1′
4	238°59.5	25.2	110°36.4	13.3′	21°22.4	9.4′	54.1′
5	253°59.7	26.1	125°08.7	13.4′	21°13.0	9.5′	54.1′
6	268°59.9	N04°27.1	139°41.0	13.4′	N21°03.5	9.6′	54.1′
7	284°00.1	28.1	154°13.4	13.5′	20°53.9	9.6′	54.1′
8	299°00.3	29.0	168°45.9	13.5′	20°44.3	9.8′	54.1′
9	314°00.5	·· 30.0	183°18.4	13.6′	20°34.5	9.8′	54.1′
10	329°00.7	31.0	197°51.0	13.6′	20°24.7	10.0′	54.2′
11	344°00.8	31.9	212°23.7	13.7′	20°14.7	10.0′	54.2′
12	359°01.0	N04°32.9	226°56.4	13.7′	N20°04.7	10.1′	54.2′
13	14°01.2	33.9	241°29.1	13.8′	19°54.6	10.2′	54.2′
14	29°01.4	34.8	256°01.9	13.9′	19°44.4	10.2′	54.2′
15	44°01.6	·· 35.8	270°34.8	13.9′	19°34.2	10.4′	54.2′
16	59°01.8	36.8	285°07.7	14.0′	19°23.8	10.4′	54.2′
17	74°02.0	37.7	299°40.6	14.0′	19°13.4	10.5′	54.2′
18	89°02.1	N04°38.7	314°13.6	14.1′	N19°02.9	10.7′	54.2′
19	104°02.3	39.6	328°46.7	14.1′	18°52.2	10.6′	54.2′
20	119°02.5	40.6	343°19.8	14.2′	18°41.6	10.8′	54.2′
21	134°02.7	·· 41.6	357°53.0	14.2′	18°30.8	10.8′	54.2′
22	149°02.9	42.5	12°26.2	14.3′	18°20.0	11.0′	54.2′
23	164°03.1	43.5	26°59.4	14.3′	18°09.0	11.0′	54.2′
	SD = 16.0′	d = 1.0′	SD = 14.8′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°03.3	N04°44.5	41°32.8	14.4′	N17°58.0	11.0′	54.3′
1	194°03.4	45.4	56°06.1	14.4′	17°47.0	11.2′	54.3′
2	209°03.6	46.4	70°39.5	14.5′	17°35.8	11.2′	54.3′
3	224°03.8	·· 47.4	85°13.0	14.5′	17°24.6	11.3′	54.3′
4	239°04.0	48.3	99°46.5	14.5′	17°13.3	11.4′	54.3′
5	254°04.2	49.3	114°20.0	14.6′	17°01.9	11.5′	54.3′
6	269°04.4	N04°50.2	128°53.6	14.6′	N16°50.4	11.5′	54.3′
7	284°04.5	51.2	143°27.3	14.7′	16°38.9	11.6′	54.3′
8	299°04.7	52.2	158°00.9	14.7′	16°27.3	11.7′	54.3′
9	314°04.9	·· 53.1	172°34.7	14.8′	16°15.6	11.7′	54.4′
10	329°05.1	54.1	187°08.4	14.8′	16°03.9	11.8′	54.4′
11	344°05.3	55.0	201°42.2	14.8′	15°52.1	11.9′	54.4′
12	359°05.5	N04°56.0	216°16.1	14.9′	N15°40.2	11.9′	54.4′
13	14°05.7	57.0	230°50.0	14.9′	15°28.3	12.0′	54.4′
14	29°05.8	57.9	245°23.9	15.0′	15°16.3	12.1′	54.4′
15	44°06.0	·· 58.9	259°57.9	15.0′	15°04.2	12.2′	54.4′
16	59°06.2	04°59.9	274°31.9	15.0′	14°52.0	12.2′	54.4′
17	74°06.4	05°00.8	289°05.9	15.1′	14°39.8	12.3′	54.4′
18	89°06.6	N05°01.8	303°40.0	15.1′	N14°27.5	12.3′	54.5′
19	104°06.8	02.7	318°14.1	15.2′	14°15.2	12.4′	54.5′
20	119°06.9	03.7	332°48.3	15.2′	14°02.8	12.5′	54.5′
21	134°07.1	·· 04.7	347°22.5	15.2′	13°50.3	12.5′	54.5′
22	149°07.3	05.6	1°56.7	15.3′	13°37.8	12.6′	54.5′
23	164°07.5	06.6	16°30.9	15.3′	13°25.2	12.6′	54.5′
	SD = 16.0′	d = 1.0′	SD = 14.8′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°07.7	N05°07.5	31°05.2	15.3′	N13°12.6	12.7′	54.5′
1	194°07.9	08.5	45°39.6	15.4′	12°59.9	12.8′	54.6′
2	209°08.1	09.5	60°13.9	15.4′	12°47.1	12.8′	54.6′
3	224°08.2	·· 10.4	74°48.3	15.4′	12°34.3	12.9′	54.6′
4	239°08.4	11.4	89°22.7	15.4′	12°21.4	12.9′	54.6′
5	254°08.6	12.3	103°57.1	15.5′	12°08.5	13.0′	54.6′
6	269°08.8	N05°13.3	118°31.6	15.5′	N11°55.5	13.1′	54.6′
7	284°09.0	14.2	133°06.1	15.5′	11°42.4	13.0′	54.6′
8	299°09.2	15.2	147°40.6	15.5′	11°29.4	13.2′	54.7′
9	314°09.3	·· 16.2	162°15.2	15.6′	11°16.2	13.2′	54.7′
10	329°09.5	17.1	176°49.8	15.6′	11°03.0	13.3′	54.7′
11	344°09.7	18.1	191°24.3	15.6′	10°49.7	13.3′	54.7′
12	359°09.9	N05°19.0	205°59.0	15.6′	N10°36.4	13.3′	54.7′
13	14°10.1	20.0	220°33.6	15.7′	10°23.1	13.4′	54.7′
14	29°10.3	20.9	235°08.3	15.7′	10°09.7	13.5′	54.8′
15	44°10.4	·· 21.9	249°42.9	15.7′	09°56.2	13.5′	54.8′
16	59°10.6	22.9	264°17.6	15.7′	09°42.7	13.5′	54.8′
17	74°10.8	23.8	278°52.4	15.7′	09°29.2	13.6′	54.8′
18	89°11.0	N05°24.8	293°27.1	15.8′	N09°15.6	13.6′	54.8′
19	104°11.2	25.7	308°01.9	15.8′	09°02.0	13.7′	54.8′
20	119°11.4	26.7	322°36.6	15.8′	08°48.3	13.7′	54.9′
21	134°11.5	·· 27.6	337°11.4	15.8′	08°34.6	13.8′	54.9′
22	149°11.7	28.6	351°46.2	15.8′	08°20.8	13.8′	54.9′
23	164°11.9	29.6	6°21.0	15.8′	08°07.0	13.9′	54.9′
	SD = 16.0′	d = 1.0′	SD = 14.9′				

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

Lat.	**Moonrise** Sat	Sun	Mon	**Moonset** Sat	Sun	Mon
N 72°	▭	11:36	14:08	▭	07:47	06:45
N 70°	▭	12:16	14:25	▭	07:05	06:26
68°	10:26	12:44	14:38	07:22	06:36	06:11
66°	11:09	13:04	14:49	06:38	06:14	05:58
64°	11:38	13:21	14:58	06:08	05:57	05:48
62°	12:00	13:34	15:05	05:46	05:42	05:39
60°	12:17	13:46	15:12	05:27	05:30	05:31
N 58°	12:32	13:55	15:18	05:12	05:19	05:24
56°	12:44	14:04	15:23	04:59	05:10	05:18
54°	12:55	14:11	15:27	04:48	05:02	05:12
52°	13:04	14:18	15:31	04:38	04:54	05:08
50°	13:13	14:24	15:35	04:29	04:48	05:03
45°	13:31	14:37	15:43	04:09	04:33	04:53
N 40°	13:46	14:48	15:50	03:54	04:21	04:45
35°	13:58	14:57	15:56	03:40	04:11	04:38
30°	14:09	15:05	16:01	03:29	04:02	04:32
20°	14:27	15:19	16:09	03:09	03:46	04:21
N 10°	14:43	15:31	16:17	02:51	03:32	04:11
0°	14:58	15:42	16:24	02:35	03:19	04:02
S 10°	15:13	15:53	16:31	02:18	03:06	03:53
20°	15:29	16:05	16:38	02:00	02:52	03:43
30°	15:47	16:18	16:47	01:40	02:36	03:32
35°	15:57	16:26	16:52	01:27	02:27	03:25
40°	16:09	16:34	16:57	01:13	02:16	03:18
45°	16:23	16:45	17:04	00:57	02:03	03:09
S 50°	16:40	16:57	17:11	00:36	01:47	02:58
52°	16:48	17:03	17:15	00:26	01:40	02:53
54°	16:57	17:09	17:18	00:15	01:32	02:48
56°	17:07	17:16	17:23	00:02	01:22	02:42
58°	17:18	17:24	17:27	·· ··	01:12	02:35
S 60°	17:31	17:32	17:33	·· ··	01:00	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 11-13 76-90%
01	04:05	03:56	12:04	21:09	08:46	
02	03:47	03:38	12:04	21:52	09:31	
03	03:29	03:20	12:03	22:34	10:13	

April 04, 05, 06 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	192°03.2	143°14.0	N19°14.4	96°50.7	N25°23.4	173°19.7	N06°46.3	216°35.1	S11°38.4
1	207°05.7	158°13.5	15.3	111°51.7	23.3	188°21.6	46.5	231°37.4	38.3
2	222°08.2	173°13.0	16.2	126°52.8	23.3	203°23.5	46.7	246°39.6	38.2
3	237°10.6	188°12.5	·· 17.1	141°53.9	·· 23.2	218°25.4	·· 46.9	261°41.8	·· 38.1
4	252°13.1	203°12.0	18.0	156°54.9	23.1	233°27.3	47.2	276°44.0	38.0
5	267°15.6	218°11.4	18.9	171°56.0	23.0	248°29.2	47.4	291°46.2	37.9
6	282°18.0	233°10.9	N19°19.8	186°57.1	N25°23.0	263°31.1	N06°47.6	306°48.5	S11°37.9
7	297°20.5	248°10.4	20.7	201°58.1	22.9	278°33.0	47.9	321°50.7	37.8
8	312°22.9	263°09.9	21.6	216°59.2	22.8	293°34.9	48.1	336°52.9	37.7
9	327°25.4	278°09.4	·· 22.5	232°00.3	·· 22.7	308°36.8	·· 48.3	351°55.1	·· 37.6
10	342°27.9	293°08.9	23.4	247°01.3	22.7	323°38.7	48.5	6°57.3	37.5
11	357°30.3	308°08.4	24.3	262°02.4	22.6	338°40.6	48.8	21°59.6	37.4
12	12°32.8	323°07.9	N19°25.2	277°03.5	N25°22.5	353°42.6	N06°49.0	37°01.8	S11°37.4
13	27°35.3	338°07.3	26.1	292°04.5	22.5	8°44.5	49.2	52°04.0	37.3
14	42°37.7	353°06.8	27.0	307°05.6	22.4	23°46.4	49.5	67°06.2	37.2
15	57°40.2	8°06.3	·· 27.9	322°06.7	·· 22.3	38°48.3	·· 49.7	82°08.5	·· 37.1
16	72°42.7	23°05.8	28.8	337°07.7	22.2	53°50.2	49.9	97°10.7	37.0
17	87°45.1	38°05.3	29.7	352°08.8	22.2	68°52.1	50.1	112°12.9	36.9
18	102°47.6	53°04.8	N19°30.6	7°09.9	N25°22.1	83°54.0	N06°50.4	127°15.1	S11°36.8
19	117°50.1	68°04.2	31.5	22°10.9	22.0	98°55.9	50.6	142°17.4	36.8
20	132°52.5	83°03.7	32.4	37°12.0	21.9	113°57.8	50.8	157°19.6	36.7
21	147°55.0	98°03.2	·· 33.3	52°13.0	·· 21.8	128°59.7	·· 51.1	172°21.8	·· 36.6
22	162°57.4	113°02.7	34.1	67°14.1	21.8	144°01.6	51.3	187°24.0	36.5
23	177°59.9	128°02.2	35.0	82°15.2	21.7	159°03.5	51.5	202°26.2	36.4
Mer.pass. 11:10		ν -0.5′ d 0.9′ m -4.00		ν 1.1′ d -0.1′ m 1.01		ν 1.9′ d 0.2′ m -2.05		ν 2.2′ d 0.1′ m 0.95	

Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	193°02.4	143°01.6	N19°35.9	97°16.2	N25°21.6	174°05.4	N06°51.7	217°28.5	S11°36.3
1	208°04.8	158°01.1	36.8	112°17.3	21.5	189°07.3	52.0	232°30.7	36.2
2	223°07.3	173°00.6	37.7	127°18.4	21.5	204°09.2	52.2	247°32.9	36.2
3	238°09.8	188°00.1	·· 38.6	142°19.4	·· 21.4	219°11.1	·· 52.4	262°35.1	·· 36.1
4	253°12.2	202°59.6	39.5	157°20.5	21.3	234°13.0	52.6	277°37.4	36.0
5	268°14.7	217°59.0	40.3	172°21.6	21.2	249°14.9	52.9	292°39.6	35.9
6	283°17.2	232°58.5	N19°41.2	187°22.6	N25°21.2	264°16.8	N06°53.1	307°41.8	S11°35.8
7	298°19.6	247°58.0	42.1	202°23.7	21.1	279°18.7	53.3	322°44.0	35.7
8	313°22.1	262°57.5	43.0	217°24.7	21.0	294°20.6	53.6	337°46.3	35.6
9	328°24.5	277°57.0	·· 43.9	232°25.8	·· 20.9	309°22.5	·· 53.8	352°48.5	·· 35.6
10	343°27.0	292°56.4	44.7	247°26.9	20.8	324°24.4	54.0	7°50.7	35.5
11	358°29.5	307°55.9	45.6	262°27.9	20.8	339°26.3	54.2	22°52.9	35.4
12	13°31.9	322°55.4	N19°46.5	277°29.0	N25°20.7	354°28.2	N06°54.5	37°55.2	S11°35.3
13	28°34.4	337°54.9	47.4	292°30.0	20.6	9°30.1	54.7	52°57.4	35.2
14	43°36.9	352°54.3	48.3	307°31.1	20.5	24°32.0	54.9	67°59.6	35.1
15	58°39.3	7°53.8	·· 49.1	322°32.2	·· 20.4	39°33.9	·· 55.2	83°01.8	·· 35.1
16	73°41.8	22°53.3	50.0	337°33.2	20.4	54°35.8	55.4	98°04.0	35.0
17	88°44.3	37°52.8	50.9	352°34.3	20.3	69°37.7	55.6	113°06.3	34.9
18	103°46.7	52°52.2	N19°51.7	7°35.3	N25°20.2	84°39.6	N06°55.8	128°08.5	S11°34.8
19	118°49.2	67°51.7	52.6	22°36.4	20.1	99°41.5	56.1	143°10.7	34.7
20	133°51.7	82°51.2	53.5	37°37.5	20.0	114°43.4	56.3	158°12.9	34.6
21	148°54.1	97°50.7	·· 54.4	52°38.5	·· 20.0	129°45.3	·· 56.5	173°15.2	·· 34.5
22	163°56.6	112°50.1	55.2	67°39.6	19.9	144°47.2	56.8	188°17.4	34.5
23	178°59.0	127°49.6	56.1	82°40.6	19.8	159°49.1	57.0	203°19.6	34.4
Mer.pass. 11:06		ν -0.5′ d 0.9′ m -4.00		ν 1.1′ d -0.1′ m 1.02		ν 1.9′ d 0.2′ m -2.05		ν 2.2′ d 0.1′ m 0.95	

Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	194°01.5	142°49.1	N19°57.0	97°41.7	N25°19.7	174°51.0	N06°57.2	218°21.8	S11°34.3
1	209°04.0	157°48.6	57.8	112°42.7	19.6	189°52.9	57.4	233°24.1	34.2
2	224°06.4	172°48.0	58.7	127°43.8	19.5	204°54.8	57.7	248°26.3	34.1
3	239°08.9	187°47.5	19°59.6	142°44.9	·· 19.5	219°56.7	·· 57.9	263°28.5	·· 34.0
4	254°11.4	202°47.0	20°00.4	157°45.9	19.4	234°58.6	58.1	278°30.8	34.0
5	269°13.8	217°46.4	01.3	172°47.0	19.3	250°00.5	58.3	293°33.0	33.9
6	284°16.3	232°45.9	N20°02.1	187°48.0	N25°19.2	265°02.4	N06°58.6	308°35.2	S11°33.8
7	299°18.8	247°45.4	03.0	202°49.1	19.1	280°04.4	58.8	323°37.4	33.7
8	314°21.2	262°44.9	03.9	217°50.2	19.1	295°06.3	59.0	338°39.7	33.6
9	329°23.7	277°44.3	·· 04.7	232°51.2	·· 19.0	310°08.2	·· 59.3	353°41.9	·· 33.5
10	344°26.2	292°43.8	05.6	247°52.3	18.9	325°10.1	59.5	8°44.1	33.4
11	359°28.6	307°43.3	06.4	262°53.3	18.8	340°12.0	59.7	23°46.3	33.4
12	14°31.1	322°42.7	N20°07.3	277°54.4	N25°18.7	355°13.9	N06°59.9	38°48.6	S11°33.3
13	29°33.5	337°42.2	08.1	292°55.4	18.6	10°15.8	07°00.2	53°50.8	33.2
14	44°36.0	352°41.7	09.0	307°56.5	18.5	25°17.7	00.4	68°53.0	33.1
15	59°38.5	7°41.1	·· 09.9	322°57.5	·· 18.5	40°19.6	·· 00.6	83°55.2	·· 33.0
16	74°40.9	22°40.6	10.7	337°58.6	18.4	55°21.5	00.9	98°57.5	32.9
17	89°43.4	37°40.1	11.6	352°59.7	18.3	70°23.4	01.1	113°59.7	32.9
18	104°45.9	52°39.5	N20°12.4	8°00.7	N25°18.2	85°25.3	N07°01.3	129°01.9	S11°32.8
19	119°48.3	67°39.0	13.3	23°01.8	18.1	100°27.2	01.5	144°04.1	32.7
20	134°50.8	82°38.5	14.1	38°02.8	18.0	115°29.1	01.8	159°06.4	32.6
21	149°53.3	97°37.9	·· 15.0	53°03.9	·· 17.9	130°31.0	·· 02.0	174°08.6	·· 32.5
22	164°55.7	112°37.4	15.8	68°04.9	17.9	145°32.9	02.2	189°10.8	32.4
23	179°58.2	127°36.9	16.7	83°06.0	17.8	160°34.8	02.4	204°13.1	32.4
Mer.pass. 11:02		ν -0.5′ d 0.9′ m -4.01		ν 1.1′ d -0.1′ m 1.04		ν 1.9′ d 0.2′ m -2.05		ν 2.2′ d 0.1′ m 0.95	

Stars

	SHA	**Dec**
Alpheratz	357°36.7	29°12.9
Ankaa	353°09.0	-42°10.9
Schedar	349°33.3	56°39.7
Diphda	348°49.1	-17°51.7
Achernar	335°21.8	-57°07.3
Hamal	327°53.2	23°34.2
Polaris	315°10.1	89°21.9
Acamar	315°13.2	-40°12.9
Menkar	314°08.0	4°10.7
Mirfak	308°30.8	49°56.6
Aldebaran	290°41.5	16°33.3
Rigel	281°05.4	-8°10.6
Capella	280°24.3	46°01.4
Bellatrix	278°24.6	6°22.2
Elnath	278°03.9	28°37.6
Alnilam	275°39.3	-1°11.3
Betelgeuse	270°53.8	7°24.6
Canopus	263°53.1	-52°42.7
Sirius	258°27.6	-16°45.0
Adhara	255°07.0	-29°00.4
Procyon	244°52.3	5°09.9
Pollux	243°19.1	27°58.3
Avior	234°15.1	-59°35.3
Suhail	222°47.2	-43°31.8
Miaplacidus	221°38.1	-69°48.9
Alphard	217°49.0	-8°45.7
Regulus	207°35.8	11°51.2
Dubhe	193°42.2	61°37.7
Denebola	182°26.1	14°26.5
Gienah	175°44.8	-17°40.3
Acrux	173°01.1	-63°13.7
Gacrux	171°52.7	-57°14.6
Alioth	166°13.7	55°50.0
Spica	158°23.5	-11°17.0
Alkaid	152°52.7	49°11.7
Hadar	148°37.5	-60°29.0
Menkent	147°59.0	-36°29.1
Arcturus	145°48.9	19°03.6
Rigil Kent.	139°41.8	-60°55.8
Kochab	137°18.7	74°03.4
Zuben'ubi	136°57.4	-16°08.4
Alphecca	126°04.7	26°38.0
Antares	112°17.4	-26°29.0
Atria	107°12.7	-69°03.9
Sabik	102°04.3	-15°45.3
Shaula	96°12.2	-37°07.2
Rasalhague	95°59.8	12°32.4
Eltanin	90°42.7	51°28.8
Kaus Aust.	83°34.4	-34°22.4
Vega	80°34.2	38°47.9
Nunki	75°49.6	-26°16.1
Altair	62°01.5	8°55.5
Peacock	53°08.2	-56°39.5
Deneb	49°27.0	45°21.4
Enif	33°40.5	9°58.7
Al Na'ir	27°35.1	-46°50.9
Fomalhaut	15°16.4	-29°30.0
Scheat	13°47.0	28°12.3
Markab	13°31.7	15°19.6

Apr 04 Tue	**SHA**	**Mer.pass**
Venus	311°10.8	14:28
Mars	264°47.4	17:31
Jupiter	341°16.5	12:25
Saturn	24°31.9	09:32

Apr 05 Wed	**SHA**	**Mer.pass**
Venus	309°59.3	14:28
Mars	264°13.9	17:30
Jupiter	341°03.0	12:22
Saturn	24°26.1	09:29

Apr 06 Thu	**SHA**	**Mer.pass**
Venus	308°47.6	14:29
Mars	263°40.2	17:28
Jupiter	340°49.5	12:19
Saturn	24°20.3	09:25

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°12.1	N05°30.5	20°55.8	15.8′	N07°53.1	13.9′	54.9′
1	194°12.3	31.5	35°30.7	15.8′	07°39.2	13.9′	54.9′
2	209°12.5	32.4	50°05.5	15.9′	07°25.3	14.0′	55.0′
3	224°12.6	·· 33.4	64°40.4	15.9′	07°11.3	14.0′	55.0′
4	239°12.8	34.3	79°15.2	15.9′	06°57.3	14.0′	55.0′
5	254°13.0	35.3	93°50.1	15.9′	06°43.3	14.1′	55.0′
6	269°13.2	N05°36.2	108°25.0	15.9′	N06°29.2	14.1′	55.0′
7	284°13.4	37.2	122°59.9	15.9′	06°15.1	14.1′	55.1′
8	299°13.5	38.1	137°34.8	15.9′	06°01.0	14.2′	55.1′
9	314°13.7	·· 39.1	152°09.6	15.9′	05°46.8	14.2′	55.1′
10	329°13.9	40.1	166°44.5	15.9′	05°32.6	14.3′	55.1′
11	344°14.1	41.0	181°19.4	15.9′	05°18.3	14.3′	55.1′
12	359°14.3	N05°42.0	195°54.3	15.9′	N05°04.0	14.3′	55.2′
13	14°14.5	42.9	210°29.2	15.9′	04°49.7	14.3′	55.2′
14	29°14.6	43.9	225°04.1	15.9′	04°35.4	14.4′	55.2′
15	44°14.8	·· 44.8	239°39.0	15.9′	04°21.0	14.4′	55.2′
16	59°15.0	45.8	254°13.9	15.9′	04°06.6	14.4′	55.2′
17	74°15.2	46.7	268°48.8	15.9′	03°52.2	14.4′	55.2′
18	89°15.4	N05°47.7	283°23.7	15.9′	N03°37.8	14.5′	55.3′
19	104°15.5	48.6	297°58.5	15.9′	03°23.3	14.5′	55.3′
20	119°15.7	49.6	312°33.4	15.9′	03°08.8	14.5′	55.3′
21	134°15.9	·· 50.5	327°08.3	15.8′	02°54.3	14.6′	55.3′
22	149°16.1	51.5	341°43.1	15.8′	02°39.7	14.5′	55.3′
23	164°16.3	52.4	356°17.9	15.8′	02°25.2	14.6′	55.4′
	SD = 16.0′	d = 1.0′	SD = 15.0′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°16.5	N05°53.4	10°52.8	15.8′	N02°10.6	14.6′	55.4′
1	194°16.6	54.3	25°27.6	15.8′	01°56.0	14.7′	55.4′
2	209°16.8	55.3	40°02.4	15.8′	01°41.3	14.6′	55.4′
3	224°17.0	·· 56.2	54°37.2	15.8′	01°26.7	14.7′	55.5′
4	239°17.2	57.2	69°11.9	15.8′	01°12.0	14.6′	55.5′
5	254°17.4	58.1	83°46.7	15.7′	00°57.4	14.7′	55.5′
6	269°17.5	N05°59.1	98°21.4	15.7′	N00°42.7	14.7′	55.5′
7	284°17.7	06°00.0	112°56.1	15.7′	00°28.0	14.7′	55.5′
8	299°17.9	01.0	127°30.8	15.7′	N00°13.3	14.8′	55.6′
9	314°18.1	·· 01.9	142°05.5	15.7′	S00°01.5	14.7′	55.6′
10	329°18.3	02.9	156°40.2	15.6′	00°16.2	14.8′	55.6′
11	344°18.4	03.8	171°14.8	15.6′	00°31.0	14.7′	55.6′
12	359°18.6	N06°04.8	185°49.4	15.6′	S00°45.7	14.8′	55.6′
13	14°18.8	05.7	200°24.0	15.6′	01°00.5	14.8′	55.7′
14	29°19.0	06.7	214°58.6	15.5′	01°15.3	14.8′	55.7′
15	44°19.2	·· 07.6	229°33.1	15.5′	01°30.1	14.7′	55.7′
16	59°19.3	08.6	244°07.6	15.5′	01°44.8	14.8′	55.7′
17	74°19.5	09.5	258°42.1	15.4′	01°59.6	14.8′	55.7′
18	89°19.7	N06°10.5	273°16.5	15.4′	S02°14.4	14.8′	55.8′
19	104°19.9	11.4	287°50.9	15.4′	02°29.2	14.8′	55.8′
20	119°20.1	12.4	302°25.3	15.3′	02°44.0	14.8′	55.8′
21	134°20.2	·· 13.3	316°59.7	15.3′	02°58.8	14.9′	55.8′
22	149°20.4	14.3	331°34.0	15.3′	03°13.7	14.8′	55.8′
23	164°20.6	15.2	346°08.3	15.2′	03°28.5	14.8′	55.9′
	SD = 16.0′	d = 1.0′	SD = 15.1′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°20.8	N06°16.2	0°42.5	15.2′	S03°43.3	14.7′	55.9′
1	194°21.0	17.1	15°16.7	15.2′	03°58.0	14.8′	55.9′
2	209°21.1	18.1	29°50.9	15.1′	04°12.8	14.8′	55.9′
3	224°21.3	·· 19.0	44°25.0	15.1′	04°27.6	14.8′	56.0′
4	239°21.5	19.9	58°59.1	15.0′	04°42.4	14.8′	56.0′
5	254°21.7	20.9	73°33.1	15.0′	04°57.2	14.7′	56.0′
6	269°21.8	N06°21.8	88°07.1	15.0′	S05°11.9	14.8′	56.0′
7	284°22.0	22.8	102°41.1	14.9′	05°26.7	14.7′	56.0′
8	299°22.2	23.7	117°15.0	14.9′	05°41.4	14.8′	56.1′
9	314°22.4	·· 24.7	131°48.9	14.8′	05°56.2	14.7′	56.1′
10	329°22.6	25.6	146°22.7	14.8′	06°10.9	14.7′	56.1′
11	344°22.7	26.6	160°56.5	14.7′	06°25.6	14.7′	56.1′
12	359°22.9	N06°27.5	175°30.2	14.7′	S06°40.3	14.6′	56.2′
13	14°23.1	28.5	190°03.8	14.6′	06°54.9	14.7′	56.2′
14	29°23.3	29.4	204°37.5	14.6′	07°09.6	14.6′	56.2′
15	44°23.5	·· 30.3	219°11.0	14.5′	07°24.2	14.7′	56.2′
16	59°23.6	31.3	233°44.5	14.5′	07°38.9	14.5′	56.2′
17	74°23.8	32.2	248°18.0	14.4′	07°53.4	14.6′	56.3′
18	89°24.0	N06°33.2	262°51.4	14.3′	S08°08.0	14.6′	56.3′
19	104°24.2	34.1	277°24.7	14.3′	08°22.6	14.5′	56.3′
20	119°24.3	35.1	291°58.0	14.2′	08°37.1	14.5′	56.3′
21	134°24.5	·· 36.0	306°31.3	14.2′	08°51.6	14.5′	56.3′
22	149°24.7	36.9	321°04.4	14.1′	09°06.1	14.4′	56.4′
23	164°24.9	37.9	335°37.5	14.0′	09°20.5	14.4′	56.4′
	SD = 16.0′	d = 0.9′	SD = 15.2′				

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

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

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%
04	03:12	03:03	12:03	23:15	10:55	
05	02:54	02:46	12:03	23:57	11:36	
06	02:37	02:28	12:02	–:–	12:19	

April 07, 08, 09 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	195°00.6	142°36.3	N20°17.5	98°07.0	N25°17.7	175°36.7	N07°02.7	219°15.3	S11°32.3
1	210°03.1	157°35.8	18.3	113°08.1	17.6	190°38.6	02.9	234°17.5	32.2
2	225°05.6	172°35.3	19.2	128°09.1	17.5	205°40.5	03.1	249°19.7	32.1
3	240°08.0	187°34.7	·· 20.0	143°10.2	·· 17.4	220°42.4	·· 03.4	264°22.0	·· 32.0
4	255°10.5	202°34.2	20.9	158°11.2	17.3	235°44.3	03.6	279°24.2	31.9
5	270°13.0	217°33.6	21.7	173°12.3	17.2	250°46.2	03.8	294°26.4	31.9
6	285°15.4	232°33.1	N20°22.6	188°13.3	N25°17.2	265°48.1	N07°04.0	309°28.7	S11°31.8
7	300°17.9	247°32.6	23.4	203°14.4	17.1	280°50.0	04.3	324°30.9	31.7
8	315°20.4	262°32.0	24.2	218°15.5	17.0	295°51.9	04.5	339°33.1	31.6
9	330°22.8	277°31.5	·· 25.1	233°16.5	·· 16.9	310°53.8	·· 04.7	354°35.3	·· 31.5
10	345°25.3	292°31.0	25.9	248°17.6	16.8	325°55.7	04.9	9°37.6	31.4
11	0°27.8	307°30.4	26.7	263°18.6	16.7	340°57.6	05.2	24°39.8	31.4
12	15°30.2	322°29.9	N20°27.6	278°19.7	N25°16.6	355°59.5	N07°05.4	39°42.0	S11°31.3
13	30°32.7	337°29.3	28.4	293°20.7	16.5	11°01.4	05.6	54°44.2	31.2
14	45°35.1	352°28.8	29.2	308°21.8	16.4	26°03.3	05.9	69°46.5	31.1
15	60°37.6	7°28.3	·· 30.1	323°22.8	·· 16.4	41°05.2	·· 06.1	84°48.7	·· 31.0
16	75°40.1	22°27.7	30.9	338°23.9	16.3	56°07.1	06.3	99°50.9	30.9
17	90°42.5	37°27.2	31.7	353°24.9	16.2	71°09.0	06.5	114°53.2	30.9
18	105°45.0	52°26.6	N20°32.6	8°26.0	N25°16.1	86°10.9	N07°06.8	129°55.4	S11°30.8
19	120°47.5	67°26.1	33.4	23°27.0	16.0	101°12.8	07.0	144°57.6	30.7
20	135°49.9	82°25.5	34.2	38°28.1	15.9	116°14.7	07.2	159°59.9	30.6
21	150°52.4	97°25.0	·· 35.1	53°29.1	·· 15.8	131°16.6	·· 07.4	175°02.1	·· 30.5
22	165°54.9	112°24.5	35.9	68°30.2	15.7	146°18.5	07.7	190°04.3	30.4
23	180°57.3	127°23.9	36.7	83°31.2	15.6	161°20.4	07.9	205°06.5	30.4
Mer.pass. 10:58		ν -0.5′ d 0.8′	m -4.01	ν 1.1′ d -0.1′	m 1.05	ν 1.9′ d 0.2′	m -2.05	ν 2.2′ d 0.1′	m 0.95

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	195°59.8	142°23.4	N20°37.5	98°32.3	N25°15.5	176°22.3	N07°08.1	220°08.8	S11°30.3
1	211°02.2	157°22.8	38.4	113°33.3	15.4	191°24.2	08.4	235°11.0	30.2
2	226°04.7	172°22.3	39.2	128°34.4	15.3	206°26.1	08.6	250°13.2	30.1
3	241°07.2	187°21.7	·· 40.0	143°35.4	·· 15.3	221°28.0	·· 08.8	265°15.5	·· 30.0
4	256°09.6	202°21.2	40.8	158°36.5	15.2	236°29.9	09.0	280°17.7	29.9
5	271°12.1	217°20.6	41.6	173°37.5	15.1	251°31.8	09.3	295°19.9	29.9
6	286°14.6	232°20.1	N20°42.5	188°38.6	N25°15.0	266°33.7	N07°09.5	310°22.1	S11°29.8
7	301°17.0	247°19.6	43.3	203°39.6	14.9	281°35.6	09.7	325°24.4	29.7
8	316°19.5	262°19.0	44.1	218°40.7	14.8	296°37.5	09.9	340°26.6	29.6
9	331°22.0	277°18.5	·· 44.9	233°41.7	·· 14.7	311°39.4	·· 10.2	355°28.8	·· 29.5
10	346°24.4	292°17.9	45.7	248°42.7	14.6	326°41.3	10.4	10°31.1	29.5
11	1°26.9	307°17.4	46.5	263°43.8	14.5	341°43.2	10.6	25°33.3	29.4
12	16°29.4	322°16.8	N20°47.4	278°44.8	N25°14.4	356°45.1	N07°10.8	40°35.5	S11°29.3
13	31°31.8	337°16.3	48.2	293°45.9	14.3	11°47.0	11.1	55°37.8	29.2
14	46°34.3	352°15.7	49.0	308°46.9	14.2	26°48.9	11.3	70°40.0	29.1
15	61°36.7	7°15.2	·· 49.8	323°48.0	·· 14.1	41°50.8	·· 11.5	85°42.2	·· 29.0
16	76°39.2	22°14.6	50.6	338°49.0	14.0	56°52.7	11.8	100°44.5	29.0
17	91°41.7	37°14.1	51.4	353°50.1	13.9	71°54.6	12.0	115°46.7	28.9
18	106°44.1	52°13.5	N20°52.2	8°51.1	N25°13.8	86°56.5	N07°12.2	130°48.9	S11°28.8
19	121°46.6	67°13.0	53.0	23°52.2	13.7	101°58.4	12.4	145°51.1	28.7
20	136°49.1	82°12.4	53.8	38°53.2	13.6	117°00.3	12.7	160°53.4	28.6
21	151°51.5	97°11.9	·· 54.6	53°54.3	·· 13.6	132°02.2	·· 12.9	175°55.6	·· 28.5
22	166°54.0	112°11.3	55.4	68°55.3	13.5	147°04.1	13.1	190°57.8	28.5
23	181°56.5	127°10.8	56.2	83°56.3	13.4	162°06.0	13.3	206°00.1	28.4
Mer.pass. 10:54		ν -0.5′ d 0.8′	m -4.01	ν 1.0′ d -0.1′	m 1.07	ν 1.9′ d 0.2′	m -2.05	ν 2.2′ d 0.1′	m 0.95

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	196°58.9	142°10.2	N20°57.0	98°57.4	N25°13.3	177°07.9	N07°13.6	221°02.3	S11°28.3
1	212°01.4	157°09.7	57.8	113°58.4	13.2	192°09.8	13.8	236°04.5	28.2
2	227°03.9	172°09.1	58.6	128°59.5	13.1	207°11.7	14.0	251°06.8	28.1
3	242°06.3	187°08.6	20°59.4	144°00.5	·· 13.0	222°13.6	·· 14.3	266°09.0	·· 28.1
4	257°08.8	202°08.0	21°00.2	159°01.6	12.9	237°15.5	14.5	281°11.2	28.0
5	272°11.2	217°07.5	01.0	174°02.6	12.8	252°17.4	14.7	296°13.5	27.9
6	287°13.7	232°06.9	N21°01.8	189°03.7	N25°12.7	267°19.3	N07°14.9	311°15.7	S11°27.8
7	302°16.2	247°06.4	02.6	204°04.7	12.6	282°21.2	15.2	326°17.9	27.7
8	317°18.6	262°05.8	03.4	219°05.7	12.5	297°23.1	15.4	341°20.2	27.6
9	332°21.1	277°05.2	·· 04.2	234°06.8	·· 12.4	312°25.0	·· 15.6	356°22.4	·· 27.6
10	347°23.6	292°04.7	05.0	249°07.8	12.3	327°26.9	15.8	11°24.6	27.5
11	2°26.0	307°04.1	05.8	264°08.9	12.2	342°28.8	16.1	26°26.9	27.4
12	17°28.5	322°03.6	N21°06.6	279°09.9	N25°12.1	357°30.7	N07°16.3	41°29.1	S11°27.3
13	32°31.0	337°03.0	07.4	294°11.0	12.0	12°32.6	16.5	56°31.3	27.2
14	47°33.4	352°02.5	08.2	309°12.0	11.9	27°34.5	16.7	71°33.6	27.2
15	62°35.9	7°01.9	·· 09.0	324°13.0	·· 11.8	42°36.4	·· 17.0	86°35.8	·· 27.1
16	77°38.3	22°01.4	09.8	339°14.1	11.7	57°38.3	17.2	101°38.0	27.0
17	92°40.8	37°00.8	10.6	354°15.1	11.6	72°40.2	17.4	116°40.3	26.9
18	107°43.3	52°00.2	N21°11.3	9°16.2	N25°11.5	87°42.1	N07°17.7	131°42.5	S11°26.8
19	122°45.7	66°59.7	12.1	24°17.2	11.4	102°44.0	17.9	146°44.7	26.8
20	137°48.2	81°59.1	12.9	39°18.3	11.3	117°45.9	18.1	161°47.0	26.7
21	152°50.7	96°58.6	·· 13.7	54°19.3	·· 11.2	132°47.8	·· 18.3	176°49.2	·· 26.6
22	167°53.1	111°58.0	14.5	69°20.3	11.1	147°49.7	18.6	191°51.4	26.5
23	182°55.6	126°57.4	15.3	84°21.4	11.0	162°51.6	18.8	206°53.7	26.4
Mer.pass. 10:50		ν -0.6′ d 0.8′	m -4.02	ν 1.0′ d -0.1′	m 1.08	ν 1.9′ d 0.2′	m -2.05	ν 2.2′ d 0.1′	m 0.95

Stars	SHA	Dec
Alpheratz	357°36.7	29°12.9
Ankaa	353°09.0	-42°10.9
Schedar	349°33.3	56°39.7
Diphda	348°49.1	-17°51.7
Achernar	335°21.9	-57°07.3
Hamal	327°53.2	23°34.2
Polaris	315°10.7	89°21.8
Acamar	315°13.3	-40°12.9
Menkar	314°08.0	4°10.7
Mirfak	308°30.8	49°56.6
Aldebaran	290°41.5	16°33.3
Rigel	281°05.4	-8°10.6
Capella	280°24.3	46°01.4
Bellatrix	278°24.6	6°22.2
Elnath	278°03.9	28°37.6
Alnilam	275°39.4	-1°11.3
Betelgeuse	270°53.8	7°24.6
Canopus	263°53.2	-52°42.7
Sirius	258°27.6	-16°45.0
Adhara	255°07.1	-29°00.4
Procyon	244°52.4	5°09.9
Pollux	243°19.1	27°58.3
Avior	234°15.2	-59°35.3
Suhail	222°47.2	-43°31.8
Miaplacidus	221°38.2	-69°49.0
Alphard	217°49.0	-8°45.7
Regulus	207°35.8	11°51.2
Dubhe	193°42.2	61°37.7
Denebola	182°26.2	14°26.5
Gienah	175°44.8	-17°40.3
Acrux	173°01.1	-63°13.7
Gacrux	171°52.7	-57°14.7
Alioth	166°13.7	55°50.0
Spica	158°23.5	-11°17.0
Alkaid	152°52.7	49°11.7
Hadar	148°37.5	-60°29.1
Menkent	147°59.0	-36°29.1
Arcturus	145°48.9	19°03.6
Rigil Kent.	139°41.8	-60°55.8
Kochab	137°18.7	74°03.4
Zuben'ubi	136°57.4	-16°08.4
Alphecca	126°04.7	26°38.0
Antares	112°17.4	-26°29.0
Atria	107°12.7	-69°03.9
Sabik	102°04.3	-15°45.3
Shaula	96°12.2	-37°07.2
Rasalhague	95°59.8	12°32.4
Eltanin	90°42.7	51°28.8
Kaus Aust.	83°34.4	-34°22.4
Vega	80°34.2	38°48.0
Nunki	75°49.6	-26°16.1
Altair	62°01.4	8°55.6
Peacock	53°08.2	-56°39.5
Deneb	49°27.0	45°21.4
Enif	33°40.4	9°58.7
Al Na'ir	27°35.1	-46°50.9
Fomalhaut	15°16.4	-29°30.0
Scheat	13°46.9	28°12.3
Markab	13°31.6	15°19.6

Apr 07 Fri	SHA	Mer.pass
Venus	307°35.7	14:30
Mars	263°06.4	17:26
Jupiter	340°36.0	12:16
Saturn	24°14.6	09:22

Apr 08 Sat	SHA	Mer.pass
Venus	306°23.6	14:31
Mars	262°32.5	17:25
Jupiter	340°22.5	12:13
Saturn	24°09.0	09:18

Apr 09 Sun	SHA	Mer.pass
Venus	305°11.3	14:32
Mars	261°58.5	17:23
Jupiter	340°09.0	12:10
Saturn	24°03.4	09:14

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°25.1	N06°38.8	350°10.6	14.0′	S09°34.9	14.4′	56.4′
1	194°25.2	39.8	4°43.6	13.9′	09°49.3	14.3′	56.4′
2	209°25.4	40.7	19°16.5	13.8′	10°03.6	14.4′	56.5′
3	224°25.6	·· 41.7	33°49.3	13.8′	10°18.0	14.2′	56.5′
4	239°25.8	42.6	48°22.1	13.7′	10°32.2	14.3′	56.5′
5	254°25.9	43.5	62°54.8	13.6′	10°46.5	14.2′	56.5′
6	269°26.1	N06°44.5	77°27.5	13.6′	S11°00.7	14.2′	56.5′
7	284°26.3	45.4	92°00.0	13.5′	11°14.9	14.1′	56.6′
8	299°26.5	46.4	106°32.5	13.4′	11°29.0	14.1′	56.6′
9	314°26.6	·· 47.3	121°05.0	13.4′	11°43.1	14.1′	56.6′
10	329°26.8	48.2	135°37.3	13.3′	11°57.2	14.0′	56.6′
11	344°27.0	49.2	150°09.6	13.2′	12°11.2	13.9′	56.6′
12	359°27.2	N06°50.1	164°41.8	13.1′	S12°25.1	13.9′	56.7′
13	14°27.3	51.1	179°14.0	13.1′	12°39.0	13.9′	56.7′
14	29°27.5	52.0	193°46.0	13.0′	12°52.9	13.8′	56.7′
15	44°27.7	·· 52.9	208°18.0	12.9′	13°06.7	13.8′	56.7′
16	59°27.9	53.9	222°49.9	12.8′	13°20.5	13.7′	56.8′
17	74°28.0	54.8	237°21.8	12.7′	13°34.2	13.7′	56.8′
18	89°28.2	N06°55.8	251°53.5	12.7′	S13°47.9	13.6′	56.8′
19	104°28.4	56.7	266°25.2	12.6′	14°01.5	13.6′	56.8′
20	119°28.6	57.6	280°56.8	12.5′	14°15.1	13.5′	56.8′
21	134°28.7	·· 58.6	295°28.3	12.4′	14°28.6	13.4′	56.9′
22	149°28.9	06°59.5	309°59.7	12.3′	14°42.0	13.4′	56.9′
23	164°29.1	07°00.4	324°31.0	12.2′	14°55.4	13.3′	56.9′
	SD = 16.0′	d = 0.9′	SD = 15.4′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°29.3	N07°01.4	339°02.2	12.2′	S15°08.7	13.3′	56.9′
1	194°29.4	02.3	353°33.4	12.1′	15°22.0	13.1′	56.9′
2	209°29.6	03.3	8°04.5	12.0′	15°35.1	13.2′	57.0′
3	224°29.8	·· 04.2	22°35.5	11.9′	15°48.3	13.0′	57.0′
4	239°30.0	05.1	37°06.4	11.8′	16°01.3	13.0′	57.0′
5	254°30.1	06.1	51°37.2	11.7′	16°14.3	13.0′	57.0′
6	269°30.3	N07°07.0	66°07.9	11.6′	S16°27.3	12.8′	57.0′
7	284°30.5	07.9	80°38.5	11.5′	16°40.1	12.8′	57.1′
8	299°30.7	08.9	95°09.0	11.4′	16°52.9	12.7′	57.1′
9	314°30.8	·· 09.8	109°39.5	11.3′	17°05.6	12.6′	57.1′
10	329°31.0	10.7	124°09.8	11.2′	17°18.2	12.6′	57.1′
11	344°31.2	11.7	138°40.0	11.2′	17°30.8	12.4′	57.2′
12	359°31.4	N07°12.6	153°10.2	11.1′	S17°43.2	12.4′	57.2′
13	14°31.5	13.5	167°40.3	11.0′	17°55.6	12.4′	57.2′
14	29°31.7	14.5	182°10.2	10.9′	18°08.0	12.2′	57.2′
15	44°31.9	·· 15.4	196°40.1	10.8′	18°20.2	12.1′	57.2′
16	59°32.1	16.4	211°09.8	10.7′	18°32.3	12.1′	57.3′
17	74°32.2	17.3	225°39.5	10.6′	18°44.4	12.0′	57.3′
18	89°32.4	N07°18.2	240°09.1	10.5′	S18°56.4	11.8′	57.3′
19	104°32.6	19.2	254°38.6	10.4′	19°08.2	11.8′	57.3′
20	119°32.7	20.1	269°07.9	10.3′	19°20.0	11.7′	57.3′
21	134°32.9	·· 21.0	283°37.2	10.2′	19°31.7	11.6′	57.4′
22	149°33.1	21.9	298°06.4	10.1′	19°43.3	11.5′	57.4′
23	164°33.3	22.9	312°35.4	10.0′	19°54.8	11.5′	57.4′
	SD = 16.0′	d = 0.9′	SD = 15.5′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°33.4	N07°23.8	327°04.4	9.9′	S20°06.3	11.3′	57.4′
1	194°33.6	24.7	341°33.3	9.8′	20°17.6	11.2′	57.4′
2	209°33.8	25.7	356°02.0	9.7′	20°28.8	11.1′	57.5′
3	224°33.9	·· 26.6	10°30.7	9.6′	20°39.9	11.0′	57.5′
4	239°34.1	27.5	24°59.2	9.5′	20°50.9	10.9′	57.5′
5	254°34.3	28.5	39°27.7	9.4′	21°01.8	10.8′	57.5′
6	269°34.5	N07°29.4	53°56.1	9.2′	S21°12.6	10.7′	57.5′
7	284°34.6	30.3	68°24.3	9.1′	21°23.3	10.6′	57.6′
8	299°34.8	31.3	82°52.4	9.0′	21°33.9	10.4′	57.6′
9	314°35.0	·· 32.2	97°20.5	8.9′	21°44.3	10.4′	57.6′
10	329°35.1	33.1	111°48.4	8.8′	21°54.7	10.2′	57.6′
11	344°35.3	34.1	126°16.3	8.7′	22°04.9	10.2′	57.6′
12	359°35.5	N07°35.0	140°44.0	8.6′	S22°15.1	10.0′	57.6′
13	14°35.7	35.9	155°11.6	8.5′	22°25.1	9.8′	57.7′
14	29°35.8	36.8	169°39.1	8.4′	22°34.9	9.8′	57.7′
15	44°36.0	·· 37.8	184°06.6	8.3′	22°44.7	9.7′	57.7′
16	59°36.2	38.7	198°33.9	8.2′	22°54.4	9.5′	57.7′
17	74°36.3	39.6	213°01.1	8.1′	23°03.9	9.4′	57.7′
18	89°36.5	N07°40.6	227°28.2	8.0′	S23°13.3	9.3′	57.8′
19	104°36.7	41.5	241°55.2	7.9′	23°22.6	9.1′	57.8′
20	119°36.9	42.4	256°22.1	7.8′	23°31.7	9.0′	57.8′
21	134°37.0	·· 43.3	270°48.9	7.7′	23°40.7	8.9′	57.8′
22	149°37.2	44.3	285°15.6	7.6′	23°49.6	8.7′	57.8′
23	164°37.4	45.2	299°42.2	7.5′	23°58.3	8.7′	57.9′
	SD = 16.0′	d = 0.9′	SD = 15.7′				

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

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

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 17-19 99-91%
07	02:20	02:11	12:02	00:41	13:03	
08	02:03	01:55	12:02	01:27	13:51	
09	01:46	01:38	12:02	02:16	14:43	

April 10, 11, 12 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	197°58.1	141°56.9	N21°16.0	99°22.4	N25°10.9	177°53.5	N07°19.0	221°55.9	S11°26.3
1	213°00.5	156°56.3	16.8	114°23.5	10.8	192°55.4	19.2	236°58.1	26.3
2	228°03.0	171°55.8	17.6	129°24.5	10.7	207°57.3	19.5	252°00.4	26.2
3	243°05.5	186°55.2	·· 18.4	144°25.5	·· 10.6	222°59.2	·· 19.7	267°02.6	·· 26.1
4	258°07.9	201°54.6	19.2	159°26.6	10.4	238°01.1	19.9	282°04.8	26.0
5	273°10.4	216°54.1	19.9	174°27.6	10.3	253°03.0	20.1	297°07.1	25.9
6	288°12.8	231°53.5	N21°20.7	189°28.7	N25°10.2	268°04.9	N07°20.4	312°09.3	S11°25.9
7	303°15.3	246°53.0	21.5	204°29.7	10.1	283°06.8	20.6	327°11.5	25.8
8	318°17.8	261°52.4	22.2	219°30.7	10.0	298°08.7	20.8	342°13.8	25.7
9	333°20.2	276°51.8	·· 23.0	234°31.8	·· 09.9	313°10.6	·· 21.0	357°16.0	·· 25.6
10	348°22.7	291°51.3	23.8	249°32.8	09.8	328°12.5	21.3	12°18.2	25.5
11	3°25.2	306°50.7	24.6	264°33.9	09.7	343°14.4	21.5	27°20.5	25.5
12	18°27.6	321°50.2	N21°25.3	279°34.9	N25°09.6	358°16.3	N07°21.7	42°22.7	S11°25.4
13	33°30.1	336°49.6	26.1	294°35.9	09.5	13°18.2	22.0	57°24.9	25.3
14	48°32.6	351°49.0	26.9	309°37.0	09.4	28°20.1	22.2	72°27.2	25.2
15	63°35.0	6°48.5	·· 27.6	324°38.0	·· 09.3	43°22.0	·· 22.4	87°29.4	·· 25.1
16	78°37.5	21°47.9	28.4	339°39.0	09.2	58°23.9	22.6	102°31.7	25.1
17	93°40.0	36°47.3	29.2	354°40.1	09.1	73°25.8	22.9	117°33.9	25.0
18	108°42.4	51°46.8	N21°29.9	9°41.1	N25°09.0	88°27.7	N07°23.1	132°36.1	S11°24.9
19	123°44.9	66°46.2	30.7	24°42.2	08.9	103°29.6	23.3	147°38.4	24.8
20	138°47.3	81°45.6	31.5	39°43.2	08.8	118°31.5	23.5	162°40.6	24.7
21	153°49.8	96°45.1	·· 32.2	54°44.2	·· 08.7	133°33.4	·· 23.8	177°42.8	·· 24.6
22	168°52.3	111°44.5	33.0	69°45.3	08.5	148°35.3	24.0	192°45.1	24.6
23	183°54.7	126°43.9	33.7	84°46.3	08.4	163°37.2	24.2	207°47.3	24.5
Mer.pass. 10:46		ν -0.6′ d 0.8′	m -4.02	ν 1.0′ d -0.1′	m 1.09	ν 1.9′ d 0.2′	m -2.05	ν 2.2′ d 0.1′	m 0.95

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	198°57.2	141°43.4	N21°34.5	99°47.3	N25°08.3	178°39.1	N07°24.4	222°49.5	S11°24.4
1	213°59.7	156°42.8	35.3	114°48.4	08.2	193°41.0	24.7	237°51.8	24.3
2	229°02.1	171°42.2	36.0	129°49.4	08.1	208°42.9	24.9	252°54.0	24.2
3	244°04.6	186°41.7	·· 36.8	144°50.4	·· 08.0	223°44.8	·· 25.1	267°56.2	·· 24.2
4	259°07.1	201°41.1	37.5	159°51.5	07.9	238°46.7	25.3	282°58.5	24.1
5	274°09.5	216°40.5	38.3	174°52.5	07.8	253°48.6	25.6	298°00.7	24.0
6	289°12.0	231°40.0	N21°39.0	189°53.6	N25°07.7	268°50.5	N07°25.8	313°03.0	S11°23.9
7	304°14.5	246°39.4	39.8	204°54.6	07.6	283°52.4	26.0	328°05.2	23.8
8	319°16.9	261°38.8	40.5	219°55.6	07.5	298°54.3	26.2	343°07.4	23.8
9	334°19.4	276°38.3	·· 41.3	234°56.7	·· 07.4	313°56.2	·· 26.5	358°09.7	·· 23.7
10	349°21.8	291°37.7	42.0	249°57.7	07.2	328°58.1	26.7	13°11.9	23.6
11	4°24.3	306°37.1	42.8	264°58.7	07.1	344°00.0	26.9	28°14.1	23.5
12	19°26.8	321°36.5	N21°43.5	279°59.8	N25°07.0	359°01.9	N07°27.1	43°16.4	S11°23.4
13	34°29.2	336°36.0	44.3	295°00.8	06.9	14°03.8	27.4	58°18.6	23.4
14	49°31.7	351°35.4	45.0	310°01.8	06.8	29°05.7	27.6	73°20.9	23.3
15	64°34.2	6°34.8	·· 45.8	325°02.9	·· 06.7	44°07.6	·· 27.8	88°23.1	·· 23.2
16	79°36.6	21°34.3	46.5	340°03.9	06.6	59°09.5	28.1	103°25.3	23.1
17	94°39.1	36°33.7	47.2	355°04.9	06.5	74°11.4	28.3	118°27.6	23.0
18	109°41.6	51°33.1	N21°48.0	10°06.0	N25°06.4	89°13.3	N07°28.5	133°29.8	S11°23.0
19	124°44.0	66°32.5	48.7	25°07.0	06.2	104°15.2	28.7	148°32.0	22.9
20	139°46.5	81°32.0	49.5	40°08.0	06.1	119°17.1	29.0	163°34.3	22.8
21	154°49.0	96°31.4	·· 50.2	55°09.1	·· 06.0	134°19.0	·· 29.2	178°36.5	·· 22.7
22	169°51.4	111°30.8	50.9	70°10.1	05.9	149°20.9	29.4	193°38.8	22.6
23	184°53.9	126°30.2	51.7	85°11.1	05.8	164°22.8	29.6	208°41.0	22.6
Mer.pass. 10:42		ν -0.6′ d 0.8′	m -4.02	ν 1.0′ d -0.1′	m 1.11	ν 1.9′ d 0.2′	m -2.05	ν 2.2′ d 0.1′	m 0.95

Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	199°56.3	141°29.7	N21°52.4	100°12.2	N25°05.7	179°24.7	N07°29.9	223°43.2	S11°22.5
1	214°58.8	156°29.1	53.1	115°13.2	05.6	194°26.6	30.1	238°45.5	22.4
2	230°01.3	171°28.5	53.9	130°14.2	05.5	209°28.5	30.3	253°47.7	22.3
3	245°03.7	186°27.9	·· 54.6	145°15.3	·· 05.3	224°30.4	·· 30.5	268°50.0	·· 22.3
4	260°06.2	201°27.4	55.3	160°16.3	05.2	239°32.3	30.8	283°52.2	22.2
5	275°08.7	216°26.8	56.1	175°17.3	05.1	254°34.2	31.0	298°54.4	22.1
6	290°11.1	231°26.2	N21°56.8	190°18.4	N25°05.0	269°36.1	N07°31.2	313°56.7	S11°22.0
7	305°13.6	246°25.6	57.5	205°19.4	04.9	284°38.0	31.4	328°58.9	21.9
8	320°16.1	261°25.1	58.3	220°20.4	04.8	299°39.9	31.7	344°01.2	21.9
9	335°18.5	276°24.5	·· 59.0	235°21.5	·· 04.7	314°41.8	·· 31.9	359°03.4	·· 21.8
10	350°21.0	291°23.9	21°59.7	250°22.5	04.5	329°43.7	32.1	14°05.6	21.7
11	5°23.4	306°23.3	22°00.4	265°23.5	04.4	344°45.6	32.3	29°07.9	21.6
12	20°25.9	321°22.8	N22°01.2	280°24.6	N25°04.3	359°47.5	N07°32.6	44°10.1	S11°21.5
13	35°28.4	336°22.2	01.9	295°25.6	04.2	14°49.4	32.8	59°12.3	21.5
14	50°30.8	351°21.6	02.6	310°26.6	04.1	29°51.3	33.0	74°14.6	21.4
15	65°33.3	6°21.0	·· 03.3	325°27.6	·· 04.0	44°53.2	·· 33.2	89°16.8	·· 21.3
16	80°35.8	21°20.4	04.0	340°28.7	03.8	59°55.1	33.5	104°19.1	21.2
17	95°38.2	36°19.9	04.8	355°29.7	03.7	74°57.0	33.7	119°21.3	21.1
18	110°40.7	51°19.3	N22°05.5	10°30.7	N25°03.6	89°58.9	N07°33.9	134°23.5	S11°21.1
19	125°43.2	66°18.7	06.2	25°31.8	03.5	105°00.8	34.1	149°25.8	21.0
20	140°45.6	81°18.1	06.9	40°32.8	03.4	120°02.7	34.4	164°28.0	20.9
21	155°48.1	96°17.5	·· 07.6	55°33.8	·· 03.3	135°04.6	·· 34.6	179°30.3	·· 20.8
22	170°50.6	111°17.0	08.3	70°34.9	03.1	150°06.5	34.8	194°32.5	20.8
23	185°53.0	126°16.4	09.1	85°35.9	03.0	165°08.4	35.0	209°34.8	20.7
Mer.pass. 10:38		ν -0.6′ d 0.7′	m -4.03	ν 1.0′ d -0.1′	m 1.12	ν 1.9′ d 0.2′	m -2.05	ν 2.2′ d 0.1′	m 0.95

Stars

	SHA	**Dec**
Alpheratz	357°36.6	29°12.9
Ankaa	353°09.0	-42°10.9
Schedar	349°33.3	56°39.7
Diphda	348°49.1	-17°51.7
Achernar	335°21.9	-57°07.2
Hamal	327°53.2	23°34.2
Polaris	315°11.0	89°21.8
Acamar	315°13.3	-40°12.9
Menkar	314°08.0	4°10.7
Mirfak	308°30.8	49°56.6
Aldebaran	290°41.5	16°33.3
Rigel	281°05.5	-8°10.6
Capella	280°24.3	46°01.4
Bellatrix	278°24.6	6°22.2
Elnath	278°03.9	28°37.6
Alnilam	275°39.4	-1°11.3
Betelgeuse	270°53.8	7°24.6
Canopus	263°53.2	-52°42.7
Sirius	258°27.6	-16°45.0
Adhara	255°07.1	-29°00.4
Procyon	244°52.4	5°09.9
Pollux	243°19.1	27°58.3
Avior	234°15.2	-59°35.3
Suhail	222°47.2	-43°31.8
Miaplacidus	221°38.2	-69°49.0
Alphard	217°49.0	-8°45.7
Regulus	207°35.8	11°51.2
Dubhe	193°42.3	61°37.7
Denebola	182°26.2	14°26.5
Gienah	175°44.8	-17°40.4
Acrux	173°01.1	-63°13.7
Gacrux	171°52.7	-57°14.7
Alioth	166°13.7	55°50.0
Spica	158°23.5	-11°17.0
Alkaid	152°52.7	49°11.8
Hadar	148°37.5	-60°29.1
Menkent	147°59.0	-36°29.1
Arcturus	145°48.9	19°03.6
Rigil Kent.	139°41.7	-60°55.8
Kochab	137°18.7	74°03.4
Zuben'ubi	136°57.3	-16°08.4
Alphecca	126°04.7	26°38.0
Antares	112°17.4	-26°29.0
Atria	107°12.6	-69°03.9
Sabik	102°04.3	-15°45.3
Shaula	96°12.2	-37°07.2
Rasalhague	95°59.8	12°32.4
Eltanin	90°42.7	51°28.8
Kaus Aust.	83°34.4	-34°22.4
Vega	80°34.1	38°48.0
Nunki	75°49.5	-26°16.1
Altair	62°01.4	8°55.6
Peacock	53°08.2	-56°39.5
Deneb	49°27.0	45°21.4
Enif	33°40.4	9°58.7
Al Na'ir	27°35.0	-46°50.9
Fomalhaut	15°16.4	-29°30.0
Scheat	13°46.9	28°12.3
Markab	13°31.6	15°19.6

Apr 10 Mon	**SHA**	**Mer.pass**
Venus	303°58.8	14:33
Mars	261°24.4	17:21
Jupiter	339°55.5	12:07
Saturn	23°57.8	09:11

Apr 11 Tue	**SHA**	**Mer.pass**
Venus	302°46.2	14:34
Mars	260°50.1	17:20
Jupiter	339°41.9	12:04
Saturn	23°52.3	09:07

Apr 12 Wed	**SHA**	**Mer.pass**
Venus	301°33.3	14:35
Mars	260°15.8	17:18
Jupiter	339°28.4	12:01
Saturn	23°46.9	09:04

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°37.5	N07°46.1	314°08.7	7.4′	S24°07.0	8.4′	57.9′
1	194°37.7	47.1	328°35.1	7.3′	24°15.4	8.4′	57.9′
2	209°37.9	48.0	343°01.4	7.2′	24°23.8	8.2′	57.9′
3	224°38.0	·· 48.9	357°27.6	7.1′	24°32.0	8.0′	57.9′
4	239°38.2	49.8	11°53.7	7.0′	24°40.0	8.0′	57.9′
5	254°38.4	50.8	26°19.8	6.9′	24°48.0	7.7′	58.0′
6	269°38.5	N07°51.7	40°45.7	6.8′	S24°55.7	7.7′	58.0′
7	284°38.7	52.6	55°11.5	6.7′	25°03.4	7.4′	58.0′
8	299°38.9	53.5	69°37.2	6.6′	25°10.8	7.4′	58.0′
9	314°39.1	·· 54.5	84°02.8	6.5′	25°18.2	7.2′	58.0′
10	329°39.2	55.4	98°28.4	6.4′	25°25.4	7.0′	58.1′
11	344°39.4	56.3	112°53.8	6.3′	25°32.4	6.9′	58.1′
12	359°39.6	N07°57.2	127°19.1	6.3′	S25°39.3	6.7′	58.1′
13	14°39.7	58.2	141°44.4	6.2′	25°46.0	6.6′	58.1′
14	29°39.9	07°59.1	156°09.6	6.1′	25°52.6	6.4′	58.1′
15	44°40.1	08°00.0	170°34.6	6.0′	25°59.0	6.3′	58.1′
16	59°40.2	00.9	184°59.6	5.9′	26°05.3	6.1′	58.2′
17	74°40.4	01.9	199°24.5	5.8′	26°11.4	6.0′	58.2′
18	89°40.6	N08°02.8	213°49.4	5.7′	S26°17.4	5.7′	58.2′
19	104°40.7	03.7	228°14.1	5.7′	26°23.1	5.7′	58.2′
20	119°40.9	04.6	242°38.8	5.6′	26°28.8	5.4′	58.2′
21	134°41.1	·· 05.5	257°03.4	5.5′	26°34.2	5.3′	58.2′
22	149°41.2	06.5	271°27.9	5.4′	26°39.5	5.2′	58.3′
23	164°41.4	07.4	285°52.3	5.3′	26°44.7	4.9′	58.3′
	SD = 16.0′	d = 0.9′	SD = 15.8′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°41.6	N08°08.3	300°16.6	5.3′	S26°49.6	4.8′	58.3′
1	194°41.7	09.2	314°40.9	5.2′	26°54.4	4.7′	58.3′
2	209°41.9	10.2	329°05.1	5.1′	26°59.1	4.4′	58.3′
3	224°42.1	·· 11.1	343°29.2	5.1′	27°03.5	4.3′	58.3′
4	239°42.2	12.0	357°53.3	5.0′	27°07.8	4.1′	58.4′
5	254°42.4	12.9	12°17.3	4.9′	27°11.9	3.9′	58.4′
6	269°42.6	N08°13.8	26°41.2	4.9′	S27°15.8	3.8′	58.4′
7	284°42.7	14.8	41°05.1	4.8′	27°19.6	3.6′	58.4′
8	299°42.9	15.7	55°28.9	4.7′	27°23.2	3.4′	58.4′
9	314°43.1	·· 16.6	69°52.6	4.7′	27°26.6	3.3′	58.4′
10	329°43.2	17.5	84°16.3	4.6′	27°29.9	3.0′	58.5′
11	344°43.4	18.4	98°40.0	4.6′	27°32.9	2.9′	58.5′
12	359°43.5	N08°19.3	113°03.5	4.5′	S27°35.8	2.7′	58.5′
13	14°43.7	20.3	127°27.1	4.5′	27°38.5	2.5′	58.5′
14	29°43.9	21.2	141°50.5	4.4′	27°41.0	2.4′	58.5′
15	44°44.0	·· 22.1	156°14.0	4.4′	27°43.4	2.1′	58.5′
16	59°44.2	23.0	170°37.4	4.3′	27°45.5	2.0′	58.5′
17	74°44.4	23.9	185°00.7	4.3′	27°47.5	1.8′	58.6′
18	89°44.5	N08°24.9	199°24.0	4.3′	S27°49.3	1.6′	58.6′
19	104°44.7	25.8	213°47.3	4.2′	27°50.9	1.4′	58.6′
20	119°44.9	26.7	228°10.5	4.2′	27°52.3	1.3′	58.6′
21	134°45.0	·· 27.6	242°33.7	4.2′	27°53.6	1.0′	58.6′
22	149°45.2	28.5	256°56.8	4.1′	27°54.6	0.9′	58.6′
23	164°45.4	29.4	271°20.0	4.1′	27°55.5	0.7′	58.7′
	SD = 16.0′	d = 0.9′	SD = 15.9′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°45.5	N08°30.4	285°43.1	4.1′	S27°56.2	0.5′	58.7′
1	194°45.7	31.3	300°06.1	4.1′	27°56.7	0.3′	58.7′
2	209°45.8	32.2	314°29.2	4.0′	27°57.0	0.1′	58.7′
3	224°46.0	·· 33.1	328°52.2	4.0′	27°57.1	0.0′	58.7′
4	239°46.2	34.0	343°15.2	4.0′	27°57.1	0.3′	58.7′
5	254°46.3	34.9	357°38.2	4.0′	27°56.8	0.4′	58.7′
6	269°46.5	N08°35.8	12°01.2	4.0′	S27°56.4	0.6′	58.8′
7	284°46.7	36.8	26°24.2	4.0′	27°55.8	0.9′	58.8′
8	299°46.8	37.7	40°47.2	4.0′	27°54.9	1.0′	58.8′
9	314°47.0	·· 38.6	55°10.1	4.0′	27°53.9	1.2′	58.8′
10	329°47.1	39.5	69°33.1	4.0′	27°52.7	1.3′	58.8′
11	344°47.3	40.4	83°56.0	4.0′	27°51.4	1.6′	58.8′
12	359°47.5	N08°41.3	98°19.0	4.0′	S27°49.8	1.8′	58.8′
13	14°47.6	42.2	112°41.9	4.0′	27°48.0	1.9′	58.9′
14	29°47.8	43.2	127°04.9	4.0′	27°46.1	2.1′	58.9′
15	44°47.9	·· 44.1	141°27.9	4.0′	27°44.0	2.3′	58.9′
16	59°48.1	45.0	155°50.9	4.0′	27°41.7	2.5′	58.9′
17	74°48.3	45.9	170°13.8	4.0′	27°39.2	2.7′	58.9′
18	89°48.4	N08°46.8	184°36.8	4.0′	S27°36.5	2.9′	58.9′
19	104°48.6	47.7	198°59.9	4.0′	27°33.6	3.1′	58.9′
20	119°48.8	48.6	213°22.9	4.1′	27°30.5	3.2′	58.9′
21	134°48.9	·· 49.5	227°46.0	4.1′	27°27.3	3.5′	59.0′
22	149°49.1	50.4	242°09.1	4.1′	27°23.8	3.6′	59.0′
23	164°49.2	51.4	256°32.2	4.1′	27°20.2	3.8′	59.0′
	SD = 16.0′	d = 0.9′	SD = 16.0′				

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

Lat.	**Moonrise** Mon	Tue	Wed	**Moonset** Mon	Tue	Wed
N 72°	▬	▬	▬	▬	▬	▬
N 70°	▬	▬	▬	▬	▬	▬
68°	▬	▬	▬	▬	▬	▬
66°	▬	▬	▬	▬	▬	▬
64°	01:44	▬	▬	04:26	▬	▬
62°	01:00	03:07	▬	05:11	05:05	▬
60°	00:31	02:15	03:37	05:40	05:58	06:44
N 58°	00:09	01:43	02:59	06:03	06:30	07:21
56°	·· ··	01:19	02:33	06:22	06:54	07:47
54°	·· ··	01:00	02:12	06:37	07:13	08:08
52°	·· ··	00:44	01:54	06:51	07:30	08:26
50°	·· ··	00:30	01:39	07:03	07:44	08:41
45°	·· ··	00:02	01:09	07:28	08:13	09:11
N 40°	23:39	·· ··	00:46	07:47	08:35	09:34
35°	23:21	·· ··	00:26	08:04	08:54	09:54
30°	23:05	·· ··	00:10	08:18	09:10	10:10
20°	22:39	23:42	·· ··	08:43	09:38	10:38
N 10°	22:16	23:18	·· ··	09:04	10:01	11:02
0°	21:55	22:55	23:57	09:24	10:23	11:25
S 10°	21:33	22:33	23:35	09:44	10:45	11:47
20°	21:11	22:09	23:12	10:06	11:09	12:11
30°	20:45	21:41	22:45	10:30	11:36	12:38
35°	20:30	21:25	22:28	10:45	11:52	12:55
40°	20:12	21:05	22:10	11:02	12:11	13:14
45°	19:51	20:42	21:47	11:23	12:34	13:37
S 50°	19:24	20:13	21:18	11:49	13:04	14:06
52°	19:11	19:58	21:04	12:01	13:18	14:20
54°	18:56	19:41	20:47	12:16	13:35	14:37
56°	18:39	19:21	20:28	12:33	13:55	14:57
58°	18:18	18:56	20:03	12:53	14:20	15:22
S 60°	17:52	18:22	19:30	13:19	14:54	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 20-22 84-65%
10	01:30	01:22	12:01	03:11	15:39	
11	01:14	01:06	12:01	04:09	16:39	
12	00:58	00:50	12:01	05:10	17:41	

April 13, 14, 15 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	200°55.5	141°15.8	N22°09.8	100°36.9	N25°02.9	180°10.3	N07°35.3	224°37.0	S11°20.6
1	215°57.9	156°15.2	10.5	115°37.9	02.8	195°12.2	35.5	239°39.2	20.5
2	231°00.4	171°14.6	11.2	130°39.0	02.7	210°14.1	35.7	254°41.5	20.4
3	246°02.9	186°14.0	·· 11.9	145°40.0	·· 02.5	225°16.0	·· 35.9	269°43.7	·· 20.4
4	261°05.3	201°13.5	12.6	160°41.0	02.4	240°17.9	36.2	284°46.0	20.3
5	276°07.8	216°12.9	13.3	175°42.1	02.3	255°19.8	36.4	299°48.2	20.2
6	291°10.3	231°12.3	N22°14.0	190°43.1	N25°02.2	270°21.7	N07°36.6	314°50.4	S11°20.1
7	306°12.7	246°11.7	14.7	205°44.1	02.1	285°23.6	36.8	329°52.7	20.0
8	321°15.2	261°11.1	15.4	220°45.1	01.9	300°25.5	37.1	344°54.9	20.0
9	336°17.7	276°10.5	·· 16.1	235°46.2	·· 01.8	315°27.4	·· 37.3	359°57.2	·· 19.9
10	351°20.1	291°10.0	16.8	250°47.2	01.7	330°29.3	37.5	14°59.4	19.8
11	6°22.6	306°09.4	17.5	265°48.2	01.6	345°31.2	37.7	30°01.6	19.7
12	21°25.1	321°08.8	N22°18.2	280°49.2	N25°01.5	0°33.1	N07°38.0	45°03.9	S11°19.7
13	36°27.5	336°08.2	18.9	295°50.3	01.3	15°35.0	38.2	60°06.1	19.6
14	51°30.0	351°07.6	19.6	310°51.3	01.2	30°36.9	38.4	75°08.4	19.5
15	66°32.4	6°07.0	·· 20.3	325°52.3	·· 01.1	45°38.8	·· 38.6	90°10.6	·· 19.4
16	81°34.9	21°06.4	21.0	340°53.4	01.0	60°40.7	38.9	105°12.9	19.3
17	96°37.4	36°05.9	21.7	355°54.4	00.9	75°42.6	39.1	120°15.1	19.3
18	111°39.8	51°05.3	N22°22.4	10°55.4	N25°00.7	90°44.5	N07°39.3	135°17.3	S11°19.2
19	126°42.3	66°04.7	23.1	25°56.4	00.6	105°46.4	39.5	150°19.6	19.1
20	141°44.8	81°04.1	23.8	40°57.5	00.5	120°48.3	39.8	165°21.8	19.0
21	156°47.2	96°03.5	·· 24.5	55°58.5	·· 00.4	135°50.2	·· 40.0	180°24.1	·· 19.0
22	171°49.7	111°02.9	25.2	70°59.5	00.2	150°52.1	40.2	195°26.3	18.9
23	186°52.2	126°02.3	25.9	86°00.5	00.1	165°54.0	40.4	210°28.6	18.8
Mer.pass. 10:35		ν -0.6′ d 0.7′ m -4.03		ν 1.0′ d -0.1′ m 1.13		ν 1.9′ d 0.2′ m -2.05		ν 2.2′ d 0.1′ m 0.95	

Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	201°54.6	141°01.7	N22°26.6	101°01.6	N25°00.0	180°55.9	N07°40.7	225°30.8	S11°18.7
1	216°57.1	156°01.2	27.2	116°02.6	24°59.9	195°57.8	40.9	240°33.0	18.6
2	231°59.6	171°00.6	27.9	131°03.6	59.7	210°59.7	41.1	255°35.3	18.6
3	247°02.0	186°00.0	·· 28.6	146°04.6	·· 59.6	226°01.6	·· 41.3	270°37.5	·· 18.5
4	262°04.5	200°59.4	29.3	161°05.7	59.5	241°03.5	41.6	285°39.8	18.4
5	277°06.9	215°58.8	30.0	176°06.7	59.4	256°05.4	41.8	300°42.0	18.3
6	292°09.4	230°58.2	N22°30.7	191°07.7	N24°59.2	271°07.3	N07°42.0	315°44.3	S11°18.3
7	307°11.9	245°57.6	31.4	206°08.7	59.1	286°09.2	42.2	330°46.5	18.2
8	322°14.3	260°57.0	32.0	221°09.8	59.0	301°11.1	42.5	345°48.8	18.1
9	337°16.8	275°56.4	·· 32.7	236°10.8	·· 58.9	316°13.0	·· 42.7	0°51.0	·· 18.0
10	352°19.3	290°55.8	33.4	251°11.8	58.7	331°14.9	42.9	15°53.2	17.9
11	7°21.7	305°55.3	34.1	266°12.8	58.6	346°16.8	43.1	30°55.5	17.9
12	22°24.2	320°54.7	N22°34.7	281°13.8	N24°58.5	1°18.7	N07°43.4	45°57.7	S11°17.8
13	37°26.7	335°54.1	35.4	296°14.9	58.4	16°20.6	43.6	61°00.0	17.7
14	52°29.1	350°53.5	36.1	311°15.9	58.2	31°22.5	43.8	76°02.2	17.6
15	67°31.6	5°52.9	·· 36.8	326°16.9	·· 58.1	46°24.4	·· 44.0	91°04.5	·· 17.6
16	82°34.1	20°52.3	37.4	341°17.9	58.0	61°26.3	44.3	106°06.7	17.5
17	97°36.5	35°51.7	38.1	356°19.0	57.9	76°28.2	44.5	121°09.0	17.4
18	112°39.0	50°51.1	N22°38.8	11°20.0	N24°57.7	91°30.1	N07°44.7	136°11.2	S11°17.3
19	127°41.4	65°50.5	39.5	26°21.0	57.6	106°32.0	44.9	151°13.4	17.3
20	142°43.9	80°49.9	40.1	41°22.0	57.5	121°33.9	45.2	166°15.7	17.2
21	157°46.4	95°49.3	·· 40.8	56°23.1	·· 57.3	136°35.8	·· 45.4	181°17.9	·· 17.1
22	172°48.8	110°48.7	41.5	71°24.1	57.2	151°37.7	45.6	196°20.2	17.0
23	187°51.3	125°48.1	42.1	86°25.1	57.1	166°39.6	45.8	211°22.4	16.9
Mer.pass. 10:31		ν -0.6′ d 0.7′ m -4.03		ν 1.0′ d -0.1′ m 1.14		ν 1.9′ d 0.2′ m -2.05		ν 2.2′ d 0.1′ m 0.95	

Sat	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	202°53.8	140°47.5	N22°42.8	101°26.1	N24°57.0	181°41.5	N07°46.1	226°24.7	S11°16.9
1	217°56.2	155°46.9	43.5	116°27.1	56.8	196°43.4	46.3	241°26.9	16.8
2	232°58.7	170°46.4	44.1	131°28.2	56.7	211°45.3	46.5	256°29.2	16.7
3	248°01.2	185°45.8	·· 44.8	146°29.2	·· 56.6	226°47.2	·· 46.7	271°31.4	·· 16.6
4	263°03.6	200°45.2	45.4	161°30.2	56.4	241°49.1	47.0	286°33.7	16.6
5	278°06.1	215°44.6	46.1	176°31.2	56.3	256°51.0	47.2	301°35.9	16.5
6	293°08.5	230°44.0	N22°46.8	191°32.2	N24°56.2	271°52.9	N07°47.4	316°38.1	S11°16.4
7	308°11.0	245°43.4	47.4	206°33.3	56.1	286°54.8	47.6	331°40.4	16.3
8	323°13.5	260°42.8	48.1	221°34.3	55.9	301°56.7	47.9	346°42.6	16.3
9	338°15.9	275°42.2	·· 48.7	236°35.3	·· 55.8	316°58.6	·· 48.1	1°44.9	·· 16.2
10	353°18.4	290°41.6	49.4	251°36.3	55.7	332°00.5	48.3	16°47.1	16.1
11	8°20.9	305°41.0	50.0	266°37.3	55.5	347°02.4	48.5	31°49.4	16.0
12	23°23.3	320°40.4	N22°50.7	281°38.4	N24°55.4	2°04.3	N07°48.8	46°51.6	S11°16.0
13	38°25.8	335°39.8	51.3	296°39.4	55.3	17°06.2	49.0	61°53.9	15.9
14	53°28.3	350°39.2	52.0	311°40.4	55.1	32°08.1	49.2	76°56.1	15.8
15	68°30.7	5°38.6	·· 52.6	326°41.4	·· 55.0	47°10.0	·· 49.4	91°58.4	·· 15.7
16	83°33.2	20°38.0	53.3	341°42.4	54.9	62°11.9	49.6	107°00.6	15.6
17	98°35.7	35°37.4	53.9	356°43.5	54.7	77°13.8	49.9	122°02.9	15.6
18	113°38.1	50°36.8	N22°54.6	11°44.5	N24°54.6	92°15.7	N07°50.1	137°05.1	S11°15.5
19	128°40.6	65°36.2	55.2	26°45.5	54.5	107°17.6	50.3	152°07.4	15.4
20	143°43.0	80°35.6	55.9	41°46.5	54.3	122°19.5	50.5	167°09.6	15.3
21	158°45.5	95°35.0	·· 56.5	56°47.5	·· 54.2	137°21.4	·· 50.8	182°11.9	·· 15.3
22	173°48.0	110°34.4	57.2	71°48.6	54.1	152°23.3	51.0	197°14.1	15.2
23	188°50.4	125°33.8	57.8	86°49.6	53.9	167°25.2	51.2	212°16.3	15.1
Mer.pass. 10:27		ν -0.6′ d 0.7′ m -4.04		ν 1.0′ d -0.1′ m 1.16		ν 1.9′ d 0.2′ m -2.05		ν 2.2′ d 0.1′ m 0.95	

Stars

	SHA	**Dec**
Alpheratz	357°36.6	29°12.9
Ankaa	353°09.0	-42°10.9
Schedar	349°33.3	56°39.7
Diphda	348°49.1	-17°51.7
Achernar	335°21.8	-57°07.2
Hamal	327°53.2	23°34.2
Polaris	315°11.4	89°21.8
Acamar	315°13.3	-40°12.9
Menkar	314°08.0	4°10.7
Mirfak	308°30.8	49°56.6
Aldebaran	290°41.5	16°33.3
Rigel	281°05.5	-8°10.6
Capella	280°24.3	46°01.4
Bellatrix	278°24.6	6°22.2
Elnath	278°03.9	28°37.6
Alnilam	275°39.4	-1°11.3
Betelgeuse	270°53.8	7°24.6
Canopus	263°53.2	-52°42.7
Sirius	258°27.6	-16°45.0
Adhara	255°07.1	-29°00.4
Procyon	244°52.4	5°09.9
Pollux	243°19.1	27°58.3
Avior	234°15.2	-59°35.3
Suhail	222°47.2	-43°31.8
Miaplacidus	221°38.2	-69°49.0
Alphard	217°49.0	-8°45.7
Regulus	207°35.8	11°51.2
Dubhe	193°42.3	61°37.7
Denebola	182°26.1	14°26.5
Gienah	175°44.8	-17°40.4
Acrux	173°01.1	-63°13.8
Gacrux	171°52.7	-57°14.7
Alioth	166°13.7	55°50.0
Spica	158°23.5	-11°17.0
Alkaid	152°52.7	49°11.8
Hadar	148°37.5	-60°29.1
Menkent	147°59.0	-36°29.1
Arcturus	145°48.9	19°03.6
Rigil Kent.	139°41.7	-60°55.8
Kochab	137°18.6	74°03.5
Zuben'ubi	136°57.3	-16°08.4
Alphecca	126°04.7	26°38.0
Antares	112°17.4	-26°29.0
Atria	107°12.6	-69°03.9
Sabik	102°04.3	-15°45.3
Shaula	96°12.1	-37°07.2
Rasalhague	95°59.7	12°32.4
Eltanin	90°42.6	51°28.8
Kaus Aust.	83°34.3	-34°22.4
Vega	80°34.1	38°48.0
Nunki	75°49.5	-26°16.1
Altair	62°01.4	8°55.6
Peacock	53°08.1	-56°39.5
Deneb	49°26.9	45°21.4
Enif	33°40.4	9°58.7
Al Na'ir	27°35.0	-46°50.9
Fomalhaut	15°16.4	-29°30.0
Scheat	13°46.9	28°12.3
Markab	13°31.6	15°19.6

Apr 13 Thu	**SHA**	**Mer.pass**
Venus	300°20.3	14:36
Mars	259°41.4	17:16
Jupiter	339°14.9	11:58
Saturn	23°41.5	09:00

Apr 14 Fri	**SHA**	**Mer.pass**
Venus	299°07.1	14:36
Mars	259°06.9	17:15
Jupiter	339°01.3	11:55
Saturn	23°36.2	08:57

Apr 15 Sat	**SHA**	**Mer.pass**
Venus	297°53.8	14:37
Mars	258°32.4	17:13
Jupiter	338°47.7	11:52
Saturn	23°30.9	08:53

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°49.4	N08°52.3	270°55.3	4.2′	S27°16.4	4.0′	59.0′
1	194°49.6	53.2	285°18.5	4.2′	27°12.4	4.2′	59.0′
2	209°49.7	54.1	299°41.7	4.2′	27°08.2	4.4′	59.0′
3	224°49.9	·· 55.0	314°04.9	4.3′	27°03.8	4.5′	59.0′
4	239°50.0	55.9	328°28.2	4.3′	26°59.3	4.7′	59.0′
5	254°50.2	56.8	342°51.5	4.4′	26°54.6	4.9′	59.1′
6	269°50.3	N08°57.7	357°14.9	4.4′	S26°49.7	5.1′	59.1′
7	284°50.5	58.6	11°38.2	4.4′	26°44.6	5.3′	59.1′
8	299°50.7	08°59.5	26°01.7	4.5′	26°39.3	5.4′	59.1′
9	314°50.8	09°00.4	40°25.2	4.5′	26°33.9	5.7′	59.1′
10	329°51.0	01.4	54°48.7	4.6′	26°28.2	5.8′	59.1′
11	344°51.1	02.3	69°12.3	4.6′	26°22.4	6.0′	59.1′
12	359°51.3	N09°03.2	83°35.9	4.7′	S26°16.4	6.1′	59.1′
13	14°51.5	04.1	97°59.6	4.7′	26°10.3	6.4′	59.1′
14	29°51.6	05.0	112°23.3	4.8′	26°03.9	6.5′	59.2′
15	44°51.8	·· 05.9	126°47.1	4.9′	25°57.4	6.7′	59.2′
16	59°51.9	06.8	141°11.0	4.9′	25°50.7	6.8′	59.2′
17	74°52.1	07.7	155°34.9	5.0′	25°43.9	7.0′	59.2′
18	89°52.2	N09°08.6	169°58.9	5.0′	S25°36.9	7.2′	59.2′
19	104°52.4	09.5	184°22.9	5.1′	25°29.7	7.4′	59.2′
20	119°52.6	10.4	198°47.0	5.2′	25°22.3	7.5′	59.2′
21	134°52.7	·· 11.3	213°11.2	5.2′	25°14.8	7.7′	59.2′
22	149°52.9	12.2	227°35.4	5.3′	25°07.1	7.9′	59.2′
23	164°53.0	13.1	241°59.7	5.4′	24°59.2	8.0′	59.3′
	SD = 15.9′	d = 0.9′	SD = 16.1′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°53.2	N09°14.0	256°24.0	5.4′	S24°51.2	8.2′	59.3′
1	194°53.3	14.9	270°48.5	5.5′	24°43.0	8.4′	59.3′
2	209°53.5	15.8	285°13.0	5.6′	24°34.6	8.5′	59.3′
3	224°53.7	·· 16.7	299°37.6	5.7′	24°26.1	8.7′	59.3′
4	239°53.8	17.6	314°02.2	5.7′	24°17.4	8.8′	59.3′
5	254°54.0	18.5	328°27.0	5.8′	24°08.6	9.0′	59.3′
6	269°54.1	N09°19.4	342°51.8	5.9′	S23°59.6	9.2′	59.3′
7	284°54.3	20.3	357°16.6	6.0′	23°50.4	9.3′	59.3′
8	299°54.4	21.2	11°41.6	6.0′	23°41.1	9.4′	59.3′
9	314°54.6	·· 22.1	26°06.6	6.1′	23°31.7	9.6′	59.3′
10	329°54.7	23.1	40°31.8	6.2′	23°22.1	9.8′	59.3′
11	344°54.9	24.0	54°56.9	6.3′	23°12.3	9.9′	59.4′
12	359°55.0	N09°24.9	69°22.2	6.4′	S23°02.4	10.1′	59.4′
13	14°55.2	25.8	83°47.6	6.4′	22°52.3	10.2′	59.4′
14	29°55.4	26.7	98°13.0	6.5′	22°42.1	10.3′	59.4′
15	44°55.5	·· 27.6	112°38.5	6.6′	22°31.8	10.5′	59.4′
16	59°55.7	28.5	127°04.1	6.7′	22°21.3	10.6′	59.4′
17	74°55.8	29.4	141°29.8	6.8′	22°10.7	10.8′	59.4′
18	89°56.0	N09°30.3	155°55.6	6.9′	S21°59.9	10.9′	59.4′
19	104°56.1	31.1	170°21.4	6.9′	21°49.0	11.1′	59.4′
20	119°56.3	32.0	184°47.4	7.0′	21°37.9	11.2′	59.4′
21	134°56.4	·· 32.9	199°13.4	7.1′	21°26.7	11.3′	59.4′
22	149°56.6	33.8	213°39.5	7.2′	21°15.4	11.4′	59.4′
23	164°56.7	34.7	228°05.7	7.3′	21°04.0	11.6′	59.4′
	SD = 15.9′	d = 0.9′	SD = 16.2′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°56.9	N09°35.6	242°32.0	7.4′	S20°52.4	11.7′	59.4′
1	194°57.0	36.5	256°58.3	7.4′	20°40.7	11.9′	59.4′
2	209°57.2	37.4	271°24.8	7.5′	20°28.8	11.9′	59.5′
3	224°57.3	·· 38.3	285°51.3	7.6′	20°16.9	12.1′	59.5′
4	239°57.5	39.2	300°17.9	7.7′	20°04.8	12.2′	59.5′
5	254°57.7	40.1	314°44.6	7.8′	19°52.6	12.4′	59.5′
6	269°57.8	N09°41.0	329°11.4	7.9′	S19°40.2	12.4′	59.5′
7	284°58.0	41.9	343°38.2	8.0′	19°27.8	12.6′	59.5′
8	299°58.1	42.8	358°05.2	8.0′	19°15.2	12.7′	59.5′
9	314°58.3	·· 43.7	12°32.2	8.1′	19°02.5	12.8′	59.5′
10	329°58.4	44.6	26°59.3	8.2′	18°49.7	12.9′	59.5′
11	344°58.6	45.5	41°26.5	8.3′	18°36.8	13.0′	59.5′
12	359°58.7	N09°46.4	55°53.8	8.4′	S18°23.8	13.2′	59.5′
13	14°58.9	47.3	70°21.2	8.5′	18°10.6	13.2′	59.5′
14	29°59.0	48.2	84°48.6	8.5′	17°57.4	13.4′	59.5′
15	44°59.2	·· 49.1	99°16.2	8.6′	17°44.0	13.4′	59.5′
16	59°59.3	50.0	113°43.8	8.7′	17°30.6	13.6′	59.5′
17	74°59.5	50.9	128°11.5	8.8′	17°17.0	13.6′	59.5′
18	89°59.6	N09°51.7	142°39.3	8.9′	S17°03.4	13.8′	59.5′
19	104°59.8	52.6	157°07.1	8.9′	16°49.6	13.9′	59.5′
20	119°59.9	53.5	171°35.1	9.0′	16°35.7	13.9′	59.5′
21	135°00.1	·· 54.4	186°03.1	9.1′	16°21.8	14.1′	59.5′
22	150°00.2	55.3	200°31.2	9.2′	16°07.7	14.1′	59.5′
23	165°00.4	56.2	214°59.3	9.2′	15°53.6	14.2′	59.5′
	SD = 15.9′	d = 0.9′	SD = 16.2′				

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

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

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 23-25 54-32%
13	00:42	00:35	12:01	06:11	18:42	
14	00:27	00:20	12:00	07:11	19:40	
15	00:12	00:05	12:00	08:08	20:35	

April 16, 17, 18 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	203°52.9	140°33.2	N22°58.4	101°50.6	N24°53.8	182°27.1	N07°51.4	227°18.6	S11°15.0
1	218°55.4	155°32.6	59.1	116°51.6	53.7	197°29.0	51.7	242°20.8	15.0
2	233°57.8	170°32.0	22°59.7	131°52.6	53.5	212°30.9	51.9	257°23.1	14.9
3	249°00.3	185°31.4	23°00.3	146°53.6	·· 53.4	227°32.8	·· 52.1	272°25.3	·· 14.8
4	264°02.8	200°30.8	01.0	161°54.7	53.3	242°34.7	52.3	287°27.6	14.7
5	279°05.2	215°30.2	01.6	176°55.7	53.1	257°36.6	52.6	302°29.8	14.7
6	294°07.7	230°29.6	N23°02.3	191°56.7	N24°53.0	272°38.5	N07°52.8	317°32.1	S11°14.6
7	309°10.2	245°29.0	02.9	206°57.7	52.8	287°40.4	53.0	332°34.3	14.5
8	324°12.6	260°28.4	03.5	221°58.7	52.7	302°42.3	53.2	347°36.6	14.4
9	339°15.1	275°27.8	·· 04.2	236°59.7	·· 52.6	317°44.2	·· 53.5	2°38.8	·· 14.4
10	354°17.5	290°27.2	04.8	252°00.8	52.4	332°46.1	53.7	17°41.1	14.3
11	9°20.0	305°26.6	05.4	267°01.8	52.3	347°48.0	53.9	32°43.3	14.2
12	24°22.5	320°26.0	N23°06.0	282°02.8	N24°52.2	2°49.9	N07°54.1	47°45.6	S11°14.1
13	39°24.9	335°25.3	06.7	297°03.8	52.0	17°51.8	54.3	62°47.8	14.1
14	54°27.4	350°24.7	07.3	312°04.8	51.9	32°53.7	54.6	77°50.1	14.0
15	69°29.9	5°24.1	·· 07.9	327°05.8	·· 51.8	47°55.6	·· 54.8	92°52.3	·· 13.9
16	84°32.3	20°23.5	08.5	342°06.9	51.6	62°57.5	55.0	107°54.6	13.8
17	99°34.8	35°22.9	09.2	357°07.9	51.5	77°59.4	55.2	122°56.8	13.8
18	114°37.3	50°22.3	N23°09.8	12°08.9	N24°51.3	93°01.3	N07°55.5	137°59.1	S11°13.7
19	129°39.7	65°21.7	10.4	27°09.9	51.2	108°03.2	55.7	153°01.3	13.6
20	144°42.2	80°21.1	11.0	42°10.9	51.1	123°05.1	55.9	168°03.6	13.5
21	159°44.6	95°20.5	·· 11.6	57°11.9	·· 50.9	138°07.0	·· 56.1	183°05.8	·· 13.5
22	174°47.1	110°19.9	12.3	72°13.0	50.8	153°08.9	56.4	198°08.1	13.4
23	189°49.6	125°19.3	12.9	87°14.0	50.6	168°10.8	56.6	213°10.3	13.3
Mer.pass. 10:23		ν -0.6′ d 0.6′	m -4.04	ν 1.0′ d -0.1′	m 1.17	ν 1.9′ d 0.2′	m -2.05	ν 2.2′ d 0.1′	m 0.95

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	204°52.0	140°18.7	N23°13.5	102°15.0	N24°50.5	183°12.7	N07°56.8	228°12.6	S11°13.2
1	219°54.5	155°18.1	14.1	117°16.0	50.4	198°14.6	57.0	243°14.8	13.2
2	234°57.0	170°17.5	14.7	132°17.0	50.2	213°16.5	57.3	258°17.1	13.1
3	249°59.4	185°16.9	·· 15.3	147°18.0	·· 50.1	228°18.4	·· 57.5	273°19.3	·· 13.0
4	265°01.9	200°16.3	15.9	162°19.0	49.9	243°20.3	57.7	288°21.6	12.9
5	280°04.4	215°15.6	16.6	177°20.1	49.8	258°22.2	57.9	303°23.8	12.9
6	295°06.8	230°15.0	N23°17.2	192°21.1	N24°49.7	273°24.1	N07°58.1	318°26.1	S11°12.8
7	310°09.3	245°14.4	17.8	207°22.1	49.5	288°26.0	58.4	333°28.3	12.7
8	325°11.8	260°13.8	18.4	222°23.1	49.4	303°27.9	58.6	348°30.6	12.6
9	340°14.2	275°13.2	·· 19.0	237°24.1	·· 49.2	318°29.8	·· 58.8	3°32.8	·· 12.6
10	355°16.7	290°12.6	19.6	252°25.1	49.1	333°31.7	59.0	18°35.1	12.5
11	10°19.1	305°12.0	20.2	267°26.1	48.9	348°33.6	59.3	33°37.3	12.4
12	25°21.6	320°11.4	N23°20.8	282°27.2	N24°48.8	3°35.5	N07°59.5	48°39.6	S11°12.3
13	40°24.1	335°10.8	21.4	297°28.2	48.7	18°37.4	59.7	63°41.9	12.3
14	55°26.5	350°10.2	22.0	312°29.2	48.5	33°39.3	07°59.9	78°44.1	12.2
15	70°29.0	5°09.6	·· 22.6	327°30.2	·· 48.4	48°41.2	08°00.2	93°46.4	·· 12.1
16	85°31.5	20°08.9	23.2	342°31.2	48.2	63°43.1	00.4	108°48.6	12.0
17	100°33.9	35°08.3	23.8	357°32.2	48.1	78°45.0	00.6	123°50.9	12.0
18	115°36.4	50°07.7	N23°24.4	12°33.2	N24°47.9	93°46.9	N08°00.8	138°53.1	S11°11.9
19	130°38.9	65°07.1	25.0	27°34.2	47.8	108°48.8	01.0	153°55.4	11.8
20	145°41.3	80°06.5	25.6	42°35.3	47.7	123°50.7	01.3	168°57.6	11.8
21	160°43.8	95°05.9	·· 26.2	57°36.3	·· 47.5	138°52.5	·· 01.5	183°59.9	·· 11.7
22	175°46.2	110°05.3	26.8	72°37.3	47.4	153°54.4	01.7	199°02.1	11.6
23	190°48.7	125°04.7	27.4	87°38.3	47.2	168°56.3	01.9	214°04.4	11.5
Mer.pass. 10:19		ν -0.6′ d 0.6′	m -4.04	ν 1.0′ d -0.1′	m 1.18	ν 1.9′ d 0.2′	m -2.05	ν 2.3′ d 0.1′	m 0.95

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	205°51.2	140°04.0	N23°28.0	102°39.3	N24°47.1	183°58.2	N08°02.2	229°06.6	S11°11.5
1	220°53.6	155°03.4	28.6	117°40.3	46.9	199°00.1	02.4	244°08.9	11.4
2	235°56.1	170°02.8	29.1	132°41.3	46.8	214°02.0	02.6	259°11.1	11.3
3	250°58.6	185°02.2	·· 29.7	147°42.3	·· 46.6	229°03.9	·· 02.8	274°13.4	·· 11.2
4	266°01.0	200°01.6	30.3	162°43.3	46.5	244°05.8	03.0	289°15.6	11.2
5	281°03.5	215°01.0	30.9	177°44.4	46.3	259°07.7	03.3	304°17.9	11.1
6	296°06.0	230°00.4	N23°31.5	192°45.4	N24°46.2	274°09.6	N08°03.5	319°20.2	S11°11.0
7	311°08.4	244°59.8	32.1	207°46.4	46.0	289°11.5	03.7	334°22.4	10.9
8	326°10.9	259°59.1	32.6	222°47.4	45.9	304°13.4	03.9	349°24.7	10.9
9	341°13.4	274°58.5	·· 33.2	237°48.4	·· 45.8	319°15.3	·· 04.2	4°26.9	·· 10.8
10	356°15.8	289°57.9	33.8	252°49.4	45.6	334°17.2	04.4	19°29.2	10.7
11	11°18.3	304°57.3	34.4	267°50.4	45.5	349°19.1	04.6	34°31.4	10.6
12	26°20.7	319°56.7	N23°35.0	282°51.4	N24°45.3	4°21.0	N08°04.8	49°33.7	S11°10.6
13	41°23.2	334°56.1	35.5	297°52.4	45.2	19°22.9	05.1	64°35.9	10.5
14	56°25.7	349°55.5	36.1	312°53.4	45.0	34°24.8	05.3	79°38.2	10.4
15	71°28.1	4°54.8	·· 36.7	327°54.5	·· 44.9	49°26.7	·· 05.5	94°40.4	·· 10.4
16	86°30.6	19°54.2	37.3	342°55.5	44.7	64°28.6	05.7	109°42.7	10.3
17	101°33.1	34°53.6	37.8	357°56.5	44.6	79°30.5	05.9	124°45.0	10.2
18	116°35.5	49°53.0	N23°38.4	12°57.5	N24°44.4	94°32.4	N08°06.2	139°47.2	S11°10.1
19	131°38.0	64°52.4	39.0	27°58.5	44.3	109°34.3	06.4	154°49.5	10.1
20	146°40.5	79°51.8	39.6	42°59.5	44.1	124°36.2	06.6	169°51.7	10.0
21	161°42.9	94°51.1	·· 40.1	58°00.5	·· 44.0	139°38.1	·· 06.8	184°54.0	·· 09.9
22	176°45.4	109°50.5	40.7	73°01.5	43.8	154°40.0	07.1	199°56.2	09.8
23	191°47.8	124°49.9	41.3	88°02.5	43.7	169°41.9	07.3	214°58.5	09.8
Mer.pass. 10:15		ν -0.6′ d 0.6′	m -4.05	ν 1.0′ d -0.1′	m 1.19	ν 1.9′ d 0.2′	m -2.05	ν 2.3′ d 0.1′	m 0.94

Stars

	SHA	**Dec**
Alpheratz	357°36.6	29°12.9
Ankaa	353°09.0	-42°10.8
Schedar	349°33.3	56°39.7
Diphda	348°49.1	-17°51.7
Achernar	335°21.8	-57°07.2
Hamal	327°53.2	23°34.2
Polaris	315°12.0	89°21.8
Acamar	315°13.3	-40°12.8
Menkar	314°08.0	4°10.7
Mirfak	308°30.8	49°56.6
Aldebaran	290°41.5	16°33.3
Rigel	281°05.5	-8°10.6
Capella	280°24.3	46°01.4
Bellatrix	278°24.6	6°22.2
Elnath	278°03.9	28°37.6
Alnilam	275°39.4	-1°11.3
Betelgeuse	270°53.8	7°24.6
Canopus	263°53.2	-52°42.7
Sirius	258°27.6	-16°45.0
Adhara	255°07.1	-29°00.4
Procyon	244°52.4	5°09.9
Pollux	243°19.1	27°58.3
Avior	234°15.3	-59°35.3
Suhail	222°47.2	-43°31.8
Miaplacidus	221°38.3	-69°49.0
Alphard	217°49.1	-8°45.7
Regulus	207°35.8	11°51.2
Dubhe	193°42.3	61°37.7
Denebola	182°26.2	14°26.5
Gienah	175°44.8	-17°40.4
Acrux	173°01.1	-63°13.8
Gacrux	171°52.7	-57°14.7
Alioth	166°13.7	55°50.1
Spica	158°23.5	-11°17.0
Alkaid	152°52.7	49°11.8
Hadar	148°37.5	-60°29.1
Menkent	147°59.0	-36°29.1
Arcturus	145°48.9	19°03.6
Rigil Kent.	139°41.7	-60°55.8
Kochab	137°18.6	74°03.5
Zuben'ubi	136°57.3	-16°08.4
Alphecca	126°04.7	26°38.0
Antares	112°17.3	-26°29.0
Atria	107°12.5	-69°04.0
Sabik	102°04.2	-15°45.3
Shaula	96°12.1	-37°07.2
Rasalhague	95°59.7	12°32.4
Eltanin	90°42.6	51°28.8
Kaus Aust.	83°34.3	-34°22.4
Vega	80°34.1	38°48.0
Nunki	75°49.5	-26°16.1
Altair	62°01.4	8°55.6
Peacock	53°08.1	-56°39.4
Deneb	49°26.9	45°21.4
Enif	33°40.4	9°58.7
Al Na'ir	27°35.0	-46°50.8
Fomalhaut	15°16.4	-29°30.0
Scheat	13°46.9	28°12.3
Markab	13°31.6	15°19.6

Apr 16 Sun	**SHA**	**Mer.pass**
Venus	296°40.3	14:38
Mars	257°57.7	17:11
Jupiter	338°34.2	11:49
Saturn	23°25.7	08:49

Apr 17 Mon	**SHA**	**Mer.pass**
Venus	295°26.6	14:39
Mars	257°22.9	17:10
Jupiter	338°20.6	11:46
Saturn	23°20.5	08:46

Apr 18 Tue	**SHA**	**Mer.pass**
Venus	294°12.9	14:40
Mars	256°48.1	17:08
Jupiter	338°07.1	11:43
Saturn	23°15.5	08:42

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°00.5	N09°57.1	229°27.6	9.3′	S15°39.4	14.4′	59.5′
1	195°00.7	58.0	243°55.9	9.4′	15°25.0	14.4′	59.5′
2	210°00.8	58.9	258°24.3	9.5′	15°10.6	14.5′	59.5′
3	225°01.0	09°59.8	272°52.8	9.6′	14°56.1	14.5′	59.5′
4	240°01.1	10°00.7	287°21.3	9.6′	14°41.6	14.7′	59.5′
5	255°01.2	01.5	301°50.0	9.7′	14°26.9	14.8′	59.5′
6	270°01.4	N10°02.4	316°18.7	9.8′	S14°12.1	14.8′	59.5′
7	285°01.5	03.3	330°47.4	9.8′	13°57.3	14.9′	59.5′
8	300°01.7	04.2	345°16.3	9.9′	13°42.4	15.0′	59.5′
9	315°01.8	·· 05.1	359°45.2	10.0′	13°27.4	15.0′	59.5′
10	330°02.0	06.0	14°14.2	10.1′	13°12.4	15.1′	59.5′
11	345°02.1	06.9	28°43.2	10.1′	12°57.3	15.2′	59.5′
12	0°02.3	N10°07.8	43°12.3	10.2′	S12°42.1	15.3′	59.5′
13	15°02.4	08.6	57°41.5	10.3′	12°26.8	15.3′	59.5′
14	30°02.6	09.5	72°10.8	10.3′	12°11.5	15.4′	59.5′
15	45°02.7	·· 10.4	86°40.1	10.4′	11°56.1	15.5′	59.5′
16	60°02.9	11.3	101°09.5	10.4′	11°40.6	15.5′	59.5′
17	75°03.0	12.2	115°38.9	10.5′	11°25.1	15.6′	59.5′
18	90°03.2	N10°13.1	130°08.4	10.6′	S11°09.5	15.7′	59.5′
19	105°03.3	14.0	144°38.0	10.6′	10°53.8	15.7′	59.5′
20	120°03.4	14.8	159°07.6	10.7′	10°38.1	15.7′	59.5′
21	135°03.6	·· 15.7	173°37.3	10.7′	10°22.4	15.8′	59.5′
22	150°03.7	16.6	188°07.0	10.8′	10°06.6	15.9′	59.5′
23	165°03.9	17.5	202°36.8	10.9′	09°50.7	15.9′	59.5′
	SD = 15.9′	d = 0.9′	SD = 16.2′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°04.0	N10°18.4	217°06.7	10.9′	S09°34.8	16.0′	59.5′
1	195°04.2	19.3	231°36.6	11.0′	09°18.8	16.0′	59.5′
2	210°04.3	20.2	246°06.6	11.0′	09°02.8	16.0′	59.4′
3	225°04.5	·· 21.0	260°36.6	11.1′	08°46.8	16.1′	59.4′
4	240°04.6	21.9	275°06.6	11.1′	08°30.7	16.2′	59.4′
5	255°04.8	22.8	289°36.8	11.2′	08°14.5	16.2′	59.4′
6	270°04.9	N10°23.7	304°06.9	11.2′	S07°58.3	16.2′	59.4′
7	285°05.0	24.6	318°37.1	11.3′	07°42.1	16.3′	59.4′
8	300°05.2	25.4	333°07.4	11.3′	07°25.8	16.3′	59.4′
9	315°05.3	·· 26.3	347°37.7	11.4′	07°09.5	16.3′	59.4′
10	330°05.5	27.2	2°08.1	11.4′	06°53.2	16.3′	59.4′
11	345°05.6	28.1	16°38.4	11.4′	06°36.9	16.4′	59.4′
12	0°05.8	N10°29.0	31°08.9	11.5′	S06°20.5	16.5′	59.4′
13	15°05.9	29.8	45°39.4	11.5′	06°04.0	16.4′	59.4′
14	30°06.0	30.7	60°09.9	11.6′	05°47.6	16.5′	59.4′
15	45°06.2	·· 31.6	74°40.4	11.6′	05°31.1	16.5′	59.3′
16	60°06.3	32.5	89°11.0	11.6′	05°14.6	16.5′	59.3′
17	75°06.5	33.4	103°41.7	11.7′	04°58.1	16.5′	59.3′
18	90°06.6	N10°34.2	118°12.3	11.7′	S04°41.6	16.6′	59.3′
19	105°06.7	35.1	132°43.0	11.7′	04°25.0	16.6′	59.3′
20	120°06.9	36.0	147°13.8	11.8′	04°08.4	16.6′	59.3′
21	135°07.0	·· 36.9	161°44.5	11.8′	03°51.8	16.6′	59.3′
22	150°07.2	37.8	176°15.3	11.8′	03°35.2	16.6′	59.3′
23	165°07.3	38.6	190°46.2	11.9′	03°18.6	16.6′	59.3′
	SD = 15.9′	d = 0.9′	SD = 16.2′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°07.5	N10°39.5	205°17.0	11.9′	S03°02.0	16.7′	59.2′
1	195°07.6	40.4	219°47.9	11.9′	02°45.3	16.6′	59.2′
2	210°07.7	41.3	234°18.8	11.9′	02°28.7	16.7′	59.2′
3	225°07.9	·· 42.1	248°49.7	12.0′	02°12.0	16.7′	59.2′
4	240°08.0	43.0	263°20.7	12.0′	01°55.3	16.6′	59.2′
5	255°08.2	43.9	277°51.7	12.0′	01°38.7	16.7′	59.2′
6	270°08.3	N10°44.8	292°22.7	12.0′	S01°22.0	16.7′	59.2′
7	285°08.4	45.6	306°53.7	12.0′	01°05.3	16.6′	59.2′
8	300°08.6	46.5	321°24.7	12.1′	00°48.7	16.7′	59.1′
9	315°08.7	·· 47.4	335°55.8	12.1′	00°32.0	16.6′	59.1′
10	330°08.9	48.3	350°26.9	12.1′	S00°15.4	16.7′	59.1′
11	345°09.0	49.1	4°57.9	12.1′	N00°01.3	16.6′	59.1′
12	0°09.1	N10°50.0	19°29.0	12.1′	N00°17.9	16.7′	59.1′
13	15°09.3	50.9	34°00.2	12.1′	00°34.6	16.6′	59.1′
14	30°09.4	51.7	48°31.3	12.1′	00°51.2	16.6′	59.1′
15	45°09.5	·· 52.6	63°02.4	12.1′	01°07.8	16.6′	59.0′
16	60°09.7	53.5	77°33.6	12.2′	01°24.4	16.6′	59.0′
17	75°09.8	54.4	92°04.7	12.2′	01°41.0	16.6′	59.0′
18	90°10.0	N10°55.2	106°35.9	12.2′	N01°57.6	16.5′	59.0′
19	105°10.1	56.1	121°07.1	12.2′	02°14.1	16.5′	59.0′
20	120°10.2	57.0	135°38.3	12.2′	02°30.6	16.5′	59.0′
21	135°10.4	·· 57.8	150°09.4	12.2′	02°47.1	16.5′	58.9′
22	150°10.5	58.7	164°40.6	12.2′	03°03.6	16.5′	58.9′
23	165°10.6	59.6	179°11.8	12.2′	03°20.1	16.4′	58.9′
	SD = 15.9′	d = 0.9′	SD = 16.2′				

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

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

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 26-28 22-6%
16	00:02	00:09	12:00	09:01	21:26	
17	00:16	00:23	12:00	09:51	22:15	
18	00:30	00:37	11:59	10:39	23:03	

April 19, 20, 21 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	206°50.3	139°49.3	N23°41.8	103°03.5	N24°43.5	184°43.8	N08°07.5	230°00.7	S11°09.7
1	221°52.8	154°48.7	42.4	118°04.5	43.4	199°45.7	07.7	245°03.0	09.6
2	236°55.2	169°48.1	43.0	133°05.6	43.2	214°47.6	07.9	260°05.3	09.6
3	251°57.7	184°47.4	·· 43.5	148°06.6	·· 43.1	229°49.5	·· 08.2	275°07.5	·· 09.5
4	267°00.2	199°46.8	44.1	163°07.6	42.9	244°51.4	08.4	290°09.8	09.4
5	282°02.6	214°46.2	44.6	178°08.6	42.8	259°53.3	08.6	305°12.0	09.3
6	297°05.1	229°45.6	N23°45.2	193°09.6	N24°42.6	274°55.2	N08°08.8	320°14.3	S11°09.3
7	312°07.6	244°45.0	45.8	208°10.6	42.5	289°57.1	09.1	335°16.5	09.2
8	327°10.0	259°44.3	46.3	223°11.6	42.3	304°59.0	09.3	350°18.8	09.1
9	342°12.5	274°43.7	·· 46.9	238°12.6	·· 42.1	320°00.9	·· 09.5	5°21.0	·· 09.0
10	357°15.0	289°43.1	47.4	253°13.6	42.0	335°02.8	09.7	20°23.3	09.0
11	12°17.4	304°42.5	48.0	268°14.6	41.8	350°04.7	09.9	35°25.6	08.9
12	27°19.9	319°41.9	N23°48.5	283°15.6	N24°41.7	5°06.6	N08°10.2	50°27.8	S11°08.8
13	42°22.3	334°41.2	49.1	298°16.6	41.5	20°08.5	10.4	65°30.1	08.8
14	57°24.8	349°40.6	49.6	313°17.6	41.4	35°10.4	10.6	80°32.3	08.7
15	72°27.3	4°40.0	·· 50.2	328°18.7	·· 41.2	50°12.3	·· 10.8	95°34.6	·· 08.6
16	87°29.7	19°39.4	50.7	343°19.7	41.1	65°14.2	11.0	110°36.8	08.5
17	102°32.2	34°38.8	51.3	358°20.7	40.9	80°16.1	11.3	125°39.1	08.5
18	117°34.7	49°38.1	N23°51.8	13°21.7	N24°40.8	95°18.0	N08°11.5	140°41.4	S11°08.4
19	132°37.1	64°37.5	52.4	28°22.7	40.6	110°19.9	11.7	155°43.6	08.3
20	147°39.6	79°36.9	52.9	43°23.7	40.4	125°21.8	11.9	170°45.9	08.3
21	162°42.1	94°36.3	·· 53.5	58°24.7	·· 40.3	140°23.7	·· 12.2	185°48.1	·· 08.2
22	177°44.5	109°35.7	54.0	73°25.7	40.1	155°25.6	12.4	200°50.4	08.1
23	192°47.0	124°35.0	54.5	88°26.7	40.0	170°27.5	12.6	215°52.7	08.0
Mer.pass. 10:11		ν -0.6′ d 0.6′ m -4.05		ν 1.0′ d -0.2′ m 1.21		ν 1.9′ d 0.2′ m -2.05		ν 2.3′ d 0.1′ m 0.94	

Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	207°49.5	139°34.4	N23°55.1	103°27.7	N24°39.8	185°29.4	N08°12.8	230°54.9	S11°08.0
1	222°51.9	154°33.8	55.6	118°28.7	39.7	200°31.3	13.0	245°57.2	07.9
2	237°54.4	169°33.2	56.2	133°29.7	39.5	215°33.2	13.3	260°59.4	07.8
3	252°56.8	184°32.5	·· 56.7	148°30.7	·· 39.3	230°35.1	·· 13.5	276°01.7	·· 07.8
4	267°59.3	199°31.9	57.2	163°31.7	39.2	245°37.0	13.7	291°03.9	07.7
5	283°01.8	214°31.3	57.8	178°32.7	39.0	260°38.9	13.9	306°06.2	07.6
6	298°04.2	229°30.7	N23°58.3	193°33.7	N24°38.9	275°40.8	N08°14.2	321°08.5	S11°07.5
7	313°06.7	244°30.1	58.8	208°34.7	38.7	290°42.7	14.4	336°10.7	07.5
8	328°09.2	259°29.4	59.4	223°35.7	38.6	305°44.6	14.6	351°13.0	07.4
9	343°11.6	274°28.8	23°59.9	238°36.7	·· 38.4	320°46.5	·· 14.8	6°15.2	·· 07.3
10	358°14.1	289°28.2	24°00.4	253°37.8	38.2	335°48.4	15.0	21°17.5	07.3
11	13°16.6	304°27.6	00.9	268°38.8	38.1	350°50.3	15.3	36°19.8	07.2
12	28°19.0	319°26.9	N24°01.5	283°39.8	N24°37.9	5°52.2	N08°15.5	51°22.0	S11°07.1
13	43°21.5	334°26.3	02.0	298°40.8	37.8	20°54.1	15.7	66°24.3	07.0
14	58°23.9	349°25.7	02.5	313°41.8	37.6	35°56.0	15.9	81°26.5	07.0
15	73°26.4	4°25.1	·· 03.0	328°42.8	·· 37.4	50°57.9	·· 16.1	96°28.8	·· 06.9
16	88°28.9	19°24.4	03.6	343°43.8	37.3	65°59.8	16.4	111°31.1	06.8
17	103°31.3	34°23.8	04.1	358°44.8	37.1	81°01.7	16.6	126°33.3	06.8
18	118°33.8	49°23.2	N24°04.6	13°45.8	N24°37.0	96°03.6	N08°16.8	141°35.6	S11°06.7
19	133°36.3	64°22.6	05.1	28°46.8	36.8	111°05.5	17.0	156°37.8	06.6
20	148°38.7	79°21.9	05.6	43°47.8	36.6	126°07.4	17.2	171°40.1	06.5
21	163°41.2	94°21.3	·· 06.2	58°48.8	·· 36.5	141°09.3	·· 17.5	186°42.4	·· 06.5
22	178°43.7	109°20.7	06.7	73°49.8	36.3	156°11.2	17.7	201°44.6	06.4
23	193°46.1	124°20.1	07.2	88°50.8	36.2	171°13.1	17.9	216°46.9	06.3
Mer.pass. 10:07		ν -0.6′ d 0.5′ m -4.06		ν 1.0′ d -0.2′ m 1.22		ν 1.9′ d 0.2′ m -2.05		ν 2.3′ d 0.1′ m 0.94	

Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	208°48.6	139°19.4	N24°07.7	103°51.8	N24°36.0	186°15.0	N08°18.1	231°49.1	S11°06.3
1	223°51.1	154°18.8	08.2	118°52.8	35.8	201°16.9	18.4	246°51.4	06.2
2	238°53.5	169°18.2	08.7	133°53.8	35.7	216°18.8	18.6	261°53.7	06.1
3	253°56.0	184°17.6	·· 09.2	148°54.8	·· 35.5	231°20.7	·· 18.8	276°55.9	·· 06.0
4	268°58.4	199°16.9	09.8	163°55.8	35.3	246°22.6	19.0	291°58.2	06.0
5	284°00.9	214°16.3	10.3	178°56.8	35.2	261°24.5	19.2	307°00.5	05.9
6	299°03.4	229°15.7	N24°10.8	193°57.8	N24°35.0	276°26.4	N08°19.5	322°02.7	S11°05.8
7	314°05.8	244°15.1	11.3	208°58.8	34.9	291°28.3	19.7	337°05.0	05.8
8	329°08.3	259°14.4	11.8	223°59.8	34.7	306°30.2	19.9	352°07.2	05.7
9	344°10.8	274°13.8	·· 12.3	239°00.8	·· 34.5	321°32.1	·· 20.1	7°09.5	·· 05.6
10	359°13.2	289°13.2	12.8	254°01.8	34.4	336°34.0	20.3	22°11.8	05.6
11	14°15.7	304°12.5	13.3	269°02.8	34.2	351°35.9	20.6	37°14.0	05.5
12	29°18.2	319°11.9	N24°13.8	284°03.8	N24°34.0	6°37.8	N08°20.8	52°16.3	S11°05.4
13	44°20.6	334°11.3	14.3	299°04.8	33.9	21°39.7	21.0	67°18.6	05.3
14	59°23.1	349°10.7	14.8	314°05.8	33.7	36°41.6	21.2	82°20.8	05.3
15	74°25.6	4°10.0	·· 15.3	329°06.8	·· 33.5	51°43.5	·· 21.4	97°23.1	·· 05.2
16	89°28.0	19°09.4	15.8	344°07.8	33.4	66°45.4	21.7	112°25.3	05.1
17	104°30.5	34°08.8	16.3	359°08.8	33.2	81°47.3	21.9	127°27.6	05.1
18	119°32.9	49°08.2	N24°16.8	14°09.8	N24°33.0	96°49.2	N08°22.1	142°29.9	S11°05.0
19	134°35.4	64°07.5	17.3	29°10.8	32.9	111°51.1	22.3	157°32.1	04.9
20	149°37.9	79°06.9	17.8	44°11.8	32.7	126°53.0	22.5	172°34.4	04.9
21	164°40.3	94°06.3	·· 18.3	59°12.8	·· 32.5	141°54.9	·· 22.8	187°36.7	·· 04.8
22	179°42.8	109°05.6	18.7	74°13.8	32.4	156°56.8	23.0	202°38.9	04.7
23	194°45.3	124°05.0	19.2	89°14.8	32.2	171°58.7	23.2	217°41.2	04.6
Mer.pass. 10:03		ν -0.6′ d 0.5′ m -4.06		ν 1.0′ d -0.2′ m 1.23		ν 1.9′ d 0.2′ m -2.05		ν 2.3′ d 0.1′ m 0.94	

Stars

	SHA	**Dec**
Alpheratz	357°36.6	29°12.9
Ankaa	353°09.0	-42°10.8
Schedar	349°33.3	56°39.7
Diphda	348°49.1	-17°51.7
Achernar	335°21.8	-57°07.2
Hamal	327°53.2	23°34.2
Polaris	315°12.4	89°21.8
Acamar	315°13.3	-40°12.8
Menkar	314°08.0	4°10.7
Mirfak	308°30.8	49°56.6
Aldebaran	290°41.6	16°33.3
Rigel	281°05.5	-8°10.6
Capella	280°24.3	46°01.4
Bellatrix	278°24.6	6°22.2
Elnath	278°03.9	28°37.6
Alnilam	275°39.4	-1°11.3
Betelgeuse	270°53.8	7°24.6
Canopus	263°53.3	-52°42.7
Sirius	258°27.6	-16°45.0
Adhara	255°07.1	-29°00.4
Procyon	244°52.4	5°09.9
Pollux	243°19.1	27°58.3
Avior	234°15.3	-59°35.3
Suhail	222°47.3	-43°31.8
Miaplacidus	221°38.3	-69°49.0
Alphard	217°49.1	-8°45.7
Regulus	207°35.8	11°51.2
Dubhe	193°42.3	61°37.7
Denebola	182°26.2	14°26.5
Gienah	175°44.8	-17°40.4
Acrux	173°01.1	-63°13.8
Gacrux	171°52.7	-57°14.7
Alioth	166°13.7	55°50.1
Spica	158°23.5	-11°17.0
Alkaid	152°52.7	49°11.8
Hadar	148°37.4	-60°29.1
Menkent	147°58.9	-36°29.1
Arcturus	145°48.9	19°03.6
Rigil Kent.	139°41.7	-60°55.9
Kochab	137°18.6	74°03.5
Zuben'ubi	136°57.3	-16°08.4
Alphecca	126°04.6	26°38.0
Antares	112°17.3	-26°29.0
Atria	107°12.5	-69°04.0
Sabik	102°04.2	-15°45.3
Shaula	96°12.1	-37°07.2
Rasalhague	95°59.7	12°32.4
Eltanin	90°42.6	51°28.8
Kaus Aust.	83°34.3	-34°22.4
Vega	80°34.1	38°48.0
Nunki	75°49.5	-26°16.1
Altair	62°01.4	8°55.6
Peacock	53°08.1	-56°39.4
Deneb	49°26.9	45°21.4
Enif	33°40.4	9°58.7
Al Na'ir	27°35.0	-46°50.8
Fomalhaut	15°16.4	-29°30.0
Scheat	13°46.9	28°12.3
Markab	13°31.6	15°19.6

Apr 19 Wed	**SHA**	**Mer.pass**
Venus	292°59.0	14:41
Mars	256°13.2	17:07
Jupiter	337°53.5	11:40
Saturn	23°10.4	08:39

Apr 20 Thu	**SHA**	**Mer.pass**
Venus	291°45.0	14:42
Mars	255°38.3	17:05
Jupiter	337°40.0	11:37
Saturn	23°05.5	08:35

Apr 21 Fri	**SHA**	**Mer.pass**
Venus	290°30.9	14:43
Mars	255°03.2	17:03
Jupiter	337°26.4	11:34
Saturn	23°00.6	08:31

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°10.8	N11°00.5	193°43.0	12.2′	N03°36.5	16.4′	58.9′
1	195°10.9	01.3	208°14.2	12.2′	03°52.9	16.4′	58.9′
2	210°11.0	02.2	222°45.4	12.2′	04°09.3	16.3′	58.8′
3	225°11.2	·· 03.1	237°16.5	12.2′	04°25.6	16.4′	58.8′
4	240°11.3	03.9	251°47.7	12.2′	04°42.0	16.2′	58.8′
5	255°11.5	04.8	266°18.9	12.2′	04°58.2	16.3′	58.8′
6	270°11.6	N11°05.7	280°50.1	12.2′	N05°14.5	16.2′	58.8′
7	285°11.7	06.5	295°21.2	12.2′	05°30.7	16.2′	58.7′
8	300°11.9	07.4	309°52.4	12.1′	05°46.9	16.1′	58.7′
9	315°12.0	·· 08.3	324°23.5	12.1′	06°03.0	16.1′	58.7′
10	330°12.1	09.1	338°54.7	12.1′	06°19.1	16.0′	58.7′
11	345°12.3	10.0	353°25.8	12.1′	06°35.1	16.0′	58.7′
12	0°12.4	N11°10.9	7°56.9	12.1′	N06°51.1	16.0′	58.6′
13	15°12.5	11.7	22°28.0	12.1′	07°07.1	15.9′	58.6′
14	30°12.7	12.6	36°59.1	12.1′	07°23.0	15.9′	58.6′
15	45°12.8	·· 13.5	51°30.2	12.1′	07°38.9	15.8′	58.6′
16	60°12.9	14.3	66°01.2	12.0′	07°54.7	15.7′	58.5′
17	75°13.1	15.2	80°32.3	12.0′	08°10.4	15.7′	58.5′
18	90°13.2	N11°16.0	95°03.3	12.0′	N08°26.1	15.7′	58.5′
19	105°13.3	16.9	109°34.3	12.0′	08°41.8	15.6′	58.5′
20	120°13.5	17.8	124°05.3	12.0′	08°57.4	15.5′	58.5′
21	135°13.6	·· 18.6	138°36.3	11.9′	09°12.9	15.5′	58.4′
22	150°13.7	19.5	153°07.2	11.9′	09°28.4	15.5′	58.4′
23	165°13.9	20.4	167°38.1	11.9′	09°43.9	15.3′	58.4′
	SD = 15.9′	d = 0.9′	SD = 16.1′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°14.0	N11°21.2	182°09.0	11.9′	N09°59.2	15.3′	58.4′
1	195°14.1	22.1	196°39.9	11.9′	10°14.5	15.3′	58.3′
2	210°14.3	22.9	211°10.7	11.8′	10°29.8	15.2′	58.3′
3	225°14.4	·· 23.8	225°41.6	11.8′	10°45.0	15.1′	58.3′
4	240°14.5	24.7	240°12.4	11.8′	11°00.1	15.0′	58.3′
5	255°14.7	25.5	254°43.1	11.7′	11°15.1	15.0′	58.2′
6	270°14.8	N11°26.4	269°13.9	11.7′	N11°30.1	14.9′	58.2′
7	285°14.9	27.2	283°44.6	11.7′	11°45.0	14.8′	58.2′
8	300°15.1	28.1	298°15.3	11.7′	11°59.8	14.8′	58.2′
9	315°15.2	·· 29.0	312°46.0	11.6′	12°14.6	14.7′	58.1′
10	330°15.3	29.8	327°16.6	11.6′	12°29.3	14.6′	58.1′
11	345°15.4	30.7	341°47.2	11.6′	12°43.9	14.5′	58.1′
12	0°15.6	N11°31.5	356°17.7	11.5′	N12°58.4	14.5′	58.1′
13	15°15.7	32.4	10°48.3	11.5′	13°12.9	14.3′	58.0′
14	30°15.8	33.2	25°18.8	11.5′	13°27.2	14.3′	58.0′
15	45°16.0	·· 34.1	39°49.2	11.4′	13°41.5	14.2′	58.0′
16	60°16.1	35.0	54°19.7	11.4′	13°55.7	14.2′	58.0′
17	75°16.2	35.8	68°50.1	11.4′	14°09.9	14.0′	57.9′
18	90°16.3	N11°36.7	83°20.4	11.3′	N14°23.9	14.0′	57.9′
19	105°16.5	37.5	97°50.7	11.3′	14°37.9	13.9′	57.9′
20	120°16.6	38.4	112°21.0	11.2′	14°51.8	13.7′	57.8′
21	135°16.7	·· 39.2	126°51.3	11.2′	15°05.5	13.7′	57.8′
22	150°16.9	40.1	141°21.5	11.2′	15°19.2	13.6′	57.8′
23	165°17.0	40.9	155°51.6	11.1′	15°32.8	13.5′	57.8′
	SD = 15.9′	d = 0.9′	SD = 15.9′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°17.1	N11°41.8	170°21.8	11.1′	N15°46.3	13.5′	57.7′
1	195°17.2	42.6	184°51.9	11.1′	15°59.8	13.3′	57.7′
2	210°17.4	43.5	199°21.9	11.0′	16°13.1	13.2′	57.7′
3	225°17.5	·· 44.4	213°51.9	11.0′	16°26.3	13.2′	57.6′
4	240°17.6	45.2	228°21.9	10.9′	16°39.5	13.0′	57.6′
5	255°17.8	46.1	242°51.8	10.9′	16°52.5	12.9′	57.6′
6	270°17.9	N11°46.9	257°21.7	10.8′	N17°05.4	12.9′	57.6′
7	285°18.0	47.8	271°51.6	10.8′	17°18.3	12.7′	57.5′
8	300°18.1	48.6	286°21.4	10.8′	17°31.0	12.6′	57.5′
9	315°18.3	·· 49.5	300°51.1	10.7′	17°43.6	12.6′	57.5′
10	330°18.4	50.3	315°20.9	10.7′	17°56.2	12.4′	57.4′
11	345°18.5	51.2	329°50.5	10.6′	18°08.6	12.3′	57.4′
12	0°18.6	N11°52.0	344°20.2	10.6′	N18°20.9	12.2′	57.4′
13	15°18.8	52.9	358°49.8	10.6′	18°33.1	12.1′	57.4′
14	30°18.9	53.7	13°19.3	10.5′	18°45.2	12.0′	57.3′
15	45°19.0	·· 54.6	27°48.8	10.5′	18°57.2	11.9′	57.3′
16	60°19.1	55.4	42°18.3	10.4′	19°09.1	11.8′	57.3′
17	75°19.3	56.3	56°47.7	10.4′	19°20.9	11.6′	57.2′
18	90°19.4	N11°57.1	71°17.1	10.3′	N19°32.5	11.6′	57.2′
19	105°19.5	58.0	85°46.4	10.3′	19°44.1	11.4′	57.2′
20	120°19.6	58.8	100°15.7	10.2′	19°55.5	11.4′	57.2′
21	135°19.8	11°59.6	114°45.0	10.2′	20°06.9	11.2′	57.1′
22	150°19.9	12°00.5	129°14.2	10.2′	20°18.1	11.0′	57.1′
23	165°20.0	01.3	143°43.3	10.1′	20°29.1	11.0′	57.1′
	SD = 15.9′	d = 0.9′	SD = 15.7′				

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

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

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 29-1 2-1%
19	00:43	00:50	11:59	11:27	23:51	
20	00:56	01:02	11:59	12:15	–:–	●
21	01:08	01:15	11:59	13:05	00:40	

April 22, 23, 24 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	209°47.7	139°04.4	N24°19.7	104°15.8	N24°32.0	187°00.6	N08°23.4	232°43.4	S11°04.6
1	224°50.2	154°03.8	20.2	119°16.8	31.9	202°02.5	23.6	247°45.7	04.5
2	239°52.7	169°03.1	20.7	134°17.8	31.7	217°04.4	23.9	262°48.0	04.4
3	254°55.1	184°02.5	·· 21.2	149°18.8	·· 31.5	232°06.3	·· 24.1	277°50.2	·· 04.4
4	269°57.6	199°01.9	21.7	164°19.8	31.4	247°08.2	24.3	292°52.5	04.3
5	285°00.0	214°01.2	22.2	179°20.8	31.2	262°10.1	24.5	307°54.8	04.2
6	300°02.5	229°00.6	N24°22.6	194°21.8	N24°31.0	277°12.0	N08°24.7	322°57.0	S11°04.2
7	315°05.0	244°00.0	23.1	209°22.8	30.9	292°13.9	25.0	337°59.3	04.1
8	330°07.4	258°59.3	23.6	224°23.8	30.7	307°15.8	25.2	353°01.6	04.0
9	345°09.9	273°58.7	·· 24.1	239°24.8	·· 30.5	322°17.7	·· 25.4	8°03.8	·· 03.9
10	0°12.4	288°58.1	24.5	254°25.8	30.3	337°19.6	25.6	23°06.1	03.9
11	15°14.8	303°57.5	25.0	269°26.8	30.2	352°21.5	25.8	38°08.4	03.8
12	30°17.3	318°56.8	N24°25.5	284°27.8	N24°30.0	7°23.4	N08°26.1	53°10.6	S11°03.7
13	45°19.8	333°56.2	26.0	299°28.8	29.8	22°25.3	26.3	68°12.9	03.7
14	60°22.2	348°55.6	26.4	314°29.8	29.7	37°27.2	26.5	83°15.2	03.6
15	75°24.7	3°54.9	·· 26.9	329°30.8	·· 29.5	52°29.1	·· 26.7	98°17.4	·· 03.5
16	90°27.2	18°54.3	27.4	344°31.8	29.3	67°31.0	26.9	113°19.7	03.5
17	105°29.6	33°53.7	27.9	359°32.8	29.1	82°32.9	27.2	128°21.9	03.4
18	120°32.1	48°53.0	N24°28.3	14°33.8	N24°29.0	97°34.8	N08°27.4	143°24.2	S11°03.3
19	135°34.5	63°52.4	28.8	29°34.8	28.8	112°36.7	27.6	158°26.5	03.3
20	150°37.0	78°51.8	29.3	44°35.8	28.6	127°38.6	27.8	173°28.7	03.2
21	165°39.5	93°51.1	·· 29.7	59°36.8	·· 28.5	142°40.5	·· 28.0	188°31.0	·· 03.1
22	180°41.9	108°50.5	30.2	74°37.8	28.3	157°42.4	28.3	203°33.3	03.1
23	195°44.4	123°49.9	30.7	89°38.8	28.1	172°44.3	28.5	218°35.5	03.0
Mer.pass. 09:59		ν -0.6′ d 0.5′ m -4.07		ν 1.0′ d -0.2′ m 1.24		ν 1.9′ d 0.2′ m -2.05		ν 2.3′ d 0.1′ m 0.94	

Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	210°46.9	138°49.2	N24°31.1	104°39.8	N24°27.9	187°46.2	N08°28.7	233°37.8	S11°02.9
1	225°49.3	153°48.6	31.6	119°40.8	27.8	202°48.1	28.9	248°40.1	02.8
2	240°51.8	168°48.0	32.0	134°41.8	27.6	217°50.0	29.1	263°42.3	02.8
3	255°54.3	183°47.4	·· 32.5	149°42.8	·· 27.4	232°51.9	·· 29.4	278°44.6	·· 02.7
4	270°56.7	198°46.7	32.9	164°43.8	27.2	247°53.8	29.6	293°46.9	02.6
5	285°59.2	213°46.1	33.4	179°44.8	27.1	262°55.7	29.8	308°49.1	02.6
6	301°01.7	228°45.5	N24°33.9	194°45.8	N24°26.9	277°57.6	N08°30.0	323°51.4	S11°02.5
7	316°04.1	243°44.8	34.3	209°46.8	26.7	292°59.5	30.2	338°53.7	02.4
8	331°06.6	258°44.2	34.8	224°47.8	26.5	308°01.4	30.5	353°55.9	02.4
9	346°09.0	273°43.6	·· 35.2	239°48.8	·· 26.4	323°03.3	·· 30.7	8°58.2	·· 02.3
10	1°11.5	288°42.9	35.7	254°49.8	26.2	338°05.2	30.9	24°00.5	02.2
11	16°14.0	303°42.3	36.1	269°50.8	26.0	353°07.1	31.1	39°02.8	02.2
12	31°16.4	318°41.7	N24°36.6	284°51.8	N24°25.8	8°09.0	N08°31.3	54°05.0	S11°02.1
13	46°18.9	333°41.0	37.0	299°52.8	25.7	23°10.9	31.6	69°07.3	02.0
14	61°21.4	348°40.4	37.5	314°53.8	25.5	38°12.8	31.8	84°09.6	02.0
15	76°23.8	3°39.8	·· 37.9	329°54.7	·· 25.3	53°14.7	·· 32.0	99°11.8	·· 01.9
16	91°26.3	18°39.1	38.4	344°55.7	25.1	68°16.6	32.2	114°14.1	01.8
17	106°28.8	33°38.5	38.8	359°56.7	25.0	83°18.5	32.4	129°16.4	01.8
18	121°31.2	48°37.9	N24°39.2	14°57.7	N24°24.8	98°20.4	N08°32.7	144°18.6	S11°01.7
19	136°33.7	63°37.2	39.7	29°58.7	24.6	113°22.3	32.9	159°20.9	01.6
20	151°36.2	78°36.6	40.1	44°59.7	24.4	128°24.2	33.1	174°23.2	01.6
21	166°38.6	93°36.0	·· 40.6	60°00.7	·· 24.2	143°26.1	·· 33.3	189°25.4	·· 01.5
22	181°41.1	108°35.3	41.0	75°01.7	24.1	158°28.0	33.5	204°27.7	01.4
23	196°43.5	123°34.7	41.4	90°02.7	23.9	173°29.9	33.8	219°30.0	01.3
Mer.pass. 09:55		ν -0.6′ d 0.5′ m -4.07		ν 1.0′ d -0.2′ m 1.25		ν 1.9′ d 0.2′ m -2.05		ν 2.3′ d 0.1′ m 0.94	

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	211°46.0	138°34.1	N24°41.9	105°03.7	N24°23.7	188°31.8	N08°34.0	234°32.2	S11°01.3
1	226°48.5	153°33.4	42.3	120°04.7	23.5	203°33.7	34.2	249°34.5	01.2
2	241°50.9	168°32.8	42.7	135°05.7	23.4	218°35.6	34.4	264°36.8	01.1
3	256°53.4	183°32.2	·· 43.2	150°06.7	·· 23.2	233°37.5	·· 34.6	279°39.1	·· 01.1
4	271°55.9	198°31.5	43.6	165°07.7	23.0	248°39.4	34.8	294°41.3	01.0
5	286°58.3	213°30.9	44.0	180°08.7	22.8	263°41.3	35.1	309°43.6	00.9
6	302°00.8	228°30.3	N24°44.5	195°09.7	N24°22.6	278°43.2	N08°35.3	324°45.9	S11°00.9
7	317°03.3	243°29.6	44.9	210°10.7	22.5	293°45.1	35.5	339°48.1	00.8
8	332°05.7	258°29.0	45.3	225°11.7	22.3	308°47.0	35.7	354°50.4	00.7
9	347°08.2	273°28.4	·· 45.7	240°12.7	·· 22.1	323°48.9	·· 35.9	9°52.7	·· 00.7
10	2°10.6	288°27.7	46.2	255°13.7	21.9	338°50.8	36.2	24°54.9	00.6
11	17°13.1	303°27.1	46.6	270°14.6	21.7	353°52.7	36.4	39°57.2	00.5
12	32°15.6	318°26.4	N24°47.0	285°15.6	N24°21.5	8°54.6	N08°36.6	54°59.5	S11°00.5
13	47°18.0	333°25.8	47.4	300°16.6	21.4	23°56.5	36.8	70°01.8	00.4
14	62°20.5	348°25.2	47.8	315°17.6	21.2	38°58.4	37.0	85°04.0	00.3
15	77°23.0	3°24.5	·· 48.3	330°18.6	·· 21.0	54°00.3	·· 37.3	100°06.3	·· 00.3
16	92°25.4	18°23.9	48.7	345°19.6	20.8	69°02.2	37.5	115°08.6	00.2
17	107°27.9	33°23.3	49.1	0°20.6	20.6	84°04.1	37.7	130°10.8	00.1
18	122°30.4	48°22.6	N24°49.5	15°21.6	N24°20.5	99°06.0	N08°37.9	145°13.1	S11°00.1
19	137°32.8	63°22.0	49.9	30°22.6	20.3	114°07.9	38.1	160°15.4	11°00.0
20	152°35.3	78°21.4	50.3	45°23.6	20.1	129°09.8	38.3	175°17.7	10°59.9
21	167°37.8	93°20.7	·· 50.7	60°24.6	·· 19.9	144°11.7	·· 38.6	190°19.9	·· 59.9
22	182°40.2	108°20.1	51.2	75°25.6	19.7	159°13.6	38.8	205°22.2	59.8
23	197°42.7	123°19.5	51.6	90°26.6	19.5	174°15.5	39.0	220°24.5	59.7
Mer.pass. 09:51		ν -0.6′ d 0.4′ m -4.08		ν 1.0′ d -0.2′ m 1.26		ν 1.9′ d 0.2′ m -2.05		ν 2.3′ d 0.1′ m 0.94	

Stars

	SHA	**Dec**
Alpheratz	357°36.6	29°12.9
Ankaa	353°08.9	-42°10.8
Schedar	349°33.2	56°39.7
Diphda	348°49.1	-17°51.7
Achernar	335°21.8	-57°07.2
Hamal	327°53.2	23°34.2
Polaris	315°12.4	89°21.8
Acamar	315°13.3	-40°12.8
Menkar	314°08.0	4°10.7
Mirfak	308°30.8	49°56.6
Aldebaran	290°41.6	16°33.3
Rigel	281°05.5	-8°10.6
Capella	280°24.4	46°01.3
Bellatrix	278°24.7	6°22.2
Elnath	278°03.9	28°37.6
Alnilam	275°39.4	-1°11.3
Betelgeuse	270°53.8	7°24.6
Canopus	263°53.3	-52°42.7
Sirius	258°27.7	-16°45.0
Adhara	255°07.1	-29°00.4
Procyon	244°52.4	5°09.9
Pollux	243°19.1	27°58.3
Avior	234°15.3	-59°35.3
Suhail	222°47.3	-43°31.8
Miaplacidus	221°38.4	-69°49.0
Alphard	217°49.1	-8°45.7
Regulus	207°35.8	11°51.2
Dubhe	193°42.3	61°37.7
Denebola	182°26.2	14°26.5
Gienah	175°44.8	-17°40.4
Acrux	173°01.1	-63°13.8
Gacrux	171°52.7	-57°14.7
Alioth	166°13.7	55°50.1
Spica	158°23.5	-11°17.0
Alkaid	152°52.7	49°11.8
Hadar	148°37.4	-60°29.1
Menkent	147°58.9	-36°29.1
Arcturus	145°48.9	19°03.6
Rigil Kent.	139°41.7	-60°55.9
Kochab	137°18.6	74°03.5
Zuben'ubi	136°57.3	-16°08.4
Alphecca	126°04.6	26°38.0
Antares	112°17.3	-26°29.0
Atria	107°12.4	-69°04.0
Sabik	102°04.2	-15°45.3
Shaula	96°12.1	-37°07.2
Rasalhague	95°59.7	12°32.4
Eltanin	90°42.6	51°28.8
Kaus Aust.	83°34.3	-34°22.4
Vega	80°34.0	38°48.0
Nunki	75°49.4	-26°16.1
Altair	62°01.3	8°55.6
Peacock	53°08.0	-56°39.4
Deneb	49°26.8	45°21.4
Enif	33°40.3	9°58.7
Al Na'ir	27°34.9	-46°50.8
Fomalhaut	15°16.3	-29°30.0
Scheat	13°46.9	28°12.3
Markab	13°31.6	15°19.6

Apr 22 Sat	**SHA**	**Mer.pass**
Venus	289°16.7	14:44
Mars	254°28.1	17:02
Jupiter	337°12.8	11:31
Saturn	22°55.7	08:28

Apr 23 Sun	**SHA**	**Mer.pass**
Venus	288°02.4	14:45
Mars	253°52.9	17:00
Jupiter	336°59.3	11:27
Saturn	22°50.9	08:24

Apr 24 Mon	**SHA**	**Mer.pass**
Venus	286°48.1	14:46
Mars	253°17.7	16:59
Jupiter	336°45.8	11:24
Saturn	22°46.2	08:21

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°20.1	N12°02.2	158°12.4	10.1′	N20°40.1	10.9′	57.0′
1	195°20.3	03.0	172°41.5	10.0′	20°51.0	10.7′	57.0′
2	210°20.4	03.9	187°10.6	10.0′	21°01.7	10.6′	57.0′
3	225°20.5	·· 04.7	201°39.5	9.9′	21°12.3	10.5′	56.9′
4	240°20.6	05.6	216°08.5	9.9′	21°22.8	10.4′	56.9′
5	255°20.7	06.4	230°37.4	9.9′	21°33.2	10.2′	56.9′
6	270°20.9	N12°07.2	245°06.2	9.8′	N21°43.4	10.1′	56.9′
7	285°21.0	08.1	259°35.1	9.8′	21°53.5	10.0′	56.8′
8	300°21.1	08.9	274°03.8	9.7′	22°03.5	9.9′	56.8′
9	315°21.2	·· 09.8	288°32.6	9.7′	22°13.4	9.7′	56.8′
10	330°21.4	10.6	303°01.3	9.7′	22°23.1	9.6′	56.7′
11	345°21.5	11.5	317°29.9	9.6′	22°32.7	9.5′	56.7′
12	0°21.6	N12°12.3	331°58.5	9.6′	N22°42.2	9.4′	56.7′
13	15°21.7	13.1	346°27.1	9.5′	22°51.6	9.2′	56.6′
14	30°21.8	14.0	0°55.6	9.5′	23°00.8	9.1′	56.6′
15	45°22.0	·· 14.8	15°24.1	9.5′	23°09.9	9.0′	56.6′
16	60°22.1	15.7	29°52.6	9.4′	23°18.9	8.8′	56.6′
17	75°22.2	16.5	44°21.0	9.4′	23°27.7	8.7′	56.5′
18	90°22.3	N12°17.3	58°49.4	9.3′	N23°36.4	8.5′	56.5′
19	105°22.4	18.2	73°17.7	9.3′	23°44.9	8.5′	56.5′
20	120°22.6	19.0	87°46.0	9.3′	23°53.4	8.3′	56.4′
21	135°22.7	·· 19.9	102°14.3	9.2′	24°01.7	8.1′	56.4′
22	150°22.8	20.7	116°42.5	9.2′	24°09.8	8.0′	56.4′
23	165°22.9	21.5	131°10.7	9.2′	24°17.8	7.9′	56.4′
	SD = 15.9′	d = 0.8′	SD = 15.6′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°23.0	N12°22.4	145°38.9	9.1′	N24°25.7	7.8′	56.3′
1	195°23.1	23.2	160°07.1	9.1′	24°33.5	7.6′	56.3′
2	210°23.3	24.0	174°35.2	9.1′	24°41.1	7.4′	56.3′
3	225°23.4	·· 24.9	189°03.2	9.0′	24°48.5	7.4′	56.2′
4	240°23.5	25.7	203°31.3	9.0′	24°55.9	7.2′	56.2′
5	255°23.6	26.5	217°59.3	9.0′	25°03.1	7.0′	56.2′
6	270°23.7	N12°27.4	232°27.3	9.0′	N25°10.1	6.9′	56.1′
7	285°23.9	28.2	246°55.2	8.9′	25°17.0	6.8′	56.1′
8	300°24.0	29.1	261°23.2	8.9′	25°23.8	6.6′	56.1′
9	315°24.1	·· 29.9	275°51.1	8.9′	25°30.4	6.5′	56.1′
10	330°24.2	30.7	290°18.9	8.9′	25°36.9	6.3′	56.0′
11	345°24.3	31.6	304°46.8	8.8′	25°43.2	6.2′	56.0′
12	0°24.4	N12°32.4	319°14.6	8.8′	N25°49.4	6.1′	56.0′
13	15°24.6	33.2	333°42.4	8.8′	25°55.5	5.9′	56.0′
14	30°24.7	34.1	348°10.2	8.8′	26°01.4	5.8′	55.9′
15	45°24.8	·· 34.9	2°38.0	8.7′	26°07.2	5.6′	55.9′
16	60°24.9	35.7	17°05.7	8.7′	26°12.8	5.5′	55.9′
17	75°25.0	36.5	31°33.5	8.7′	26°18.3	5.3′	55.8′
18	90°25.1	N12°37.4	46°01.2	8.7′	N26°23.6	5.2′	55.8′
19	105°25.2	38.2	60°28.9	8.7′	26°28.8	5.0′	55.8′
20	120°25.4	39.0	74°56.6	8.7′	26°33.8	4.9′	55.8′
21	135°25.5	·· 39.9	89°24.2	8.7′	26°38.7	4.8′	55.7′
22	150°25.6	40.7	103°51.9	8.6′	26°43.5	4.6′	55.7′
23	165°25.7	41.5	118°19.5	8.6′	26°48.1	4.4′	55.7′
	SD = 15.9′	d = 0.8′	SD = 15.4′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°25.8	N12°42.4	132°47.2	8.6′	N26°52.5	4.3′	55.7′
1	195°25.9	43.2	147°14.8	8.6′	26°56.8	4.2′	55.6′
2	210°26.0	44.0	161°42.4	8.6′	27°01.0	4.0′	55.6′
3	225°26.2	·· 44.8	176°10.0	8.6′	27°05.0	3.9′	55.6′
4	240°26.3	45.7	190°37.6	8.6′	27°08.9	3.7′	55.5′
5	255°26.4	46.5	205°05.2	8.6′	27°12.6	3.6′	55.5′
6	270°26.5	N12°47.3	219°32.8	8.6′	N27°16.2	3.4′	55.5′
7	285°26.6	48.1	234°00.4	8.6′	27°19.6	3.3′	55.5′
8	300°26.7	49.0	248°28.0	8.6′	27°22.9	3.1′	55.4′
9	315°26.8	·· 49.8	262°55.6	8.6′	27°26.0	3.0′	55.4′
10	330°26.9	50.6	277°23.2	8.6′	27°29.0	2.8′	55.4′
11	345°27.1	51.4	291°50.8	8.6′	27°31.8	2.7′	55.4′
12	0°27.2	N12°52.3	306°18.4	8.6′	N27°34.5	2.5′	55.3′
13	15°27.3	53.1	320°46.1	8.6′	27°37.0	2.4′	55.3′
14	30°27.4	53.9	335°13.7	8.6′	27°39.4	2.3′	55.3′
15	45°27.5	·· 54.7	349°41.3	8.6′	27°41.7	2.1′	55.3′
16	60°27.6	55.6	4°08.9	8.6′	27°43.8	1.9′	55.2′
17	75°27.7	56.4	18°36.6	8.7′	27°45.7	1.8′	55.2′
18	90°27.8	N12°57.2	33°04.3	8.7′	N27°47.5	1.7′	55.2′
19	105°27.9	58.0	47°31.9	8.7′	27°49.2	1.5′	55.2′
20	120°28.1	58.8	61°59.6	8.7′	27°50.7	1.3′	55.2′
21	135°28.2	12°59.7	76°27.3	8.7′	27°52.0	1.2′	55.1′
22	150°28.3	13°00.5	90°55.0	8.7′	27°53.2	1.1′	55.1′
23	165°28.4	01.3	105°22.8	8.8′	27°54.3	0.9′	55.1′
	SD = 15.9′	d = 0.8′	SD = 15.2′				

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

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

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 2-4 4-16%
22	01:21	01:26	11:59	13:56	01:30	
23	01:32	01:38	11:58	14:49	02:22	
24	01:43	01:49	11:58	15:43	03:16	

April 25, 26, 27 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	212°45.1	138°18.8	N24°52.0	105°27.6	N24°19.4	189°17.4	N08°39.2	235°26.7	S10°59.7
1	227°47.6	153°18.2	52.4	120°28.6	19.2	204°19.3	39.4	250°29.0	59.6
2	242°50.1	168°17.6	52.8	135°29.5	19.0	219°21.2	39.7	265°31.3	59.5
3	257°52.5	183°16.9	·· 53.2	150°30.5	·· 18.8	234°23.1	·· 39.9	280°33.6	·· 59.5
4	272°55.0	198°16.3	53.6	165°31.5	18.6	249°25.0	40.1	295°35.8	59.4
5	287°57.5	213°15.6	54.0	180°32.5	18.4	264°26.9	40.3	310°38.1	59.3
6	302°59.9	228°15.0	N24°54.4	195°33.5	N24°18.2	279°28.8	N08°40.5	325°40.4	S10°59.3
7	318°02.4	243°14.4	54.8	210°34.5	18.1	294°30.7	40.7	340°42.6	59.2
8	333°04.9	258°13.7	55.2	225°35.5	17.9	309°32.6	41.0	355°44.9	59.1
9	348°07.3	273°13.1	·· 55.6	240°36.5	·· 17.7	324°34.5	·· 41.2	10°47.2	·· 59.1
10	3°09.8	288°12.5	56.0	255°37.5	17.5	339°36.4	41.4	25°49.5	59.0
11	18°12.3	303°11.8	56.4	270°38.5	17.3	354°38.3	41.6	40°51.7	58.9
12	33°14.7	318°11.2	N24°56.8	285°39.5	N24°17.1	9°40.2	N08°41.8	55°54.0	S10°58.9
13	48°17.2	333°10.6	57.2	300°40.5	16.9	24°42.1	42.1	70°56.3	58.8
14	63°19.6	348°09.9	57.6	315°41.5	16.7	39°44.0	42.3	85°58.6	58.7
15	78°22.1	3°09.3	·· 58.0	330°42.4	·· 16.6	54°45.9	·· 42.5	101°00.8	·· 58.7
16	93°24.6	18°08.7	58.4	345°43.4	16.4	69°47.8	42.7	116°03.1	58.6
17	108°27.0	33°08.0	58.8	0°44.4	16.2	84°49.7	42.9	131°05.4	58.6
18	123°29.5	48°07.4	N24°59.1	15°45.4	N24°16.0	99°51.6	N08°43.1	146°07.7	S10°58.5
19	138°32.0	63°06.7	59.5	30°46.4	15.8	114°53.5	43.4	161°09.9	58.4
20	153°34.4	78°06.1	24°59.9	45°47.4	15.6	129°55.4	43.6	176°12.2	58.4
21	168°36.9	93°05.5	25°00.3	60°48.4	·· 15.4	144°57.3	·· 43.8	191°14.5	·· 58.3
22	183°39.4	108°04.8	00.7	75°49.4	15.2	159°59.2	44.0	206°16.8	58.2
23	198°41.8	123°04.2	01.1	90°50.4	15.0	175°01.1	44.2	221°19.0	58.2
Mer.pass. 09:47		ν -0.6′ d 0.4′ m -4.08		ν 1.0′ d -0.2′ m 1.28		ν 1.9′ d 0.2′ m -2.05		ν 2.3′ d 0.1′ m 0.94	

Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	213°44.3	138°03.6	N25°01.4	105°51.4	N24°14.9	190°03.0	N08°44.4	236°21.3	S10°58.1
1	228°46.8	153°02.9	01.8	120°52.4	14.7	205°04.9	44.7	251°23.6	58.0
2	243°49.2	168°02.3	02.2	135°53.3	14.5	220°06.8	44.9	266°25.9	58.0
3	258°51.7	183°01.7	·· 02.6	150°54.3	·· 14.3	235°08.7	·· 45.1	281°28.1	·· 57.9
4	273°54.1	198°01.0	03.0	165°55.3	14.1	250°10.6	45.3	296°30.4	57.8
5	288°56.6	213°00.4	03.3	180°56.3	13.9	265°12.5	45.5	311°32.7	57.8
6	303°59.1	227°59.8	N25°03.7	195°57.3	N24°13.7	280°14.4	N08°45.8	326°35.0	S10°57.7
7	319°01.5	242°59.1	04.1	210°58.3	13.5	295°16.3	46.0	341°37.2	57.6
8	334°04.0	257°58.5	04.5	225°59.3	13.3	310°18.2	46.2	356°39.5	57.6
9	349°06.5	272°57.8	·· 04.8	241°00.3	·· 13.1	325°20.1	·· 46.4	11°41.8	·· 57.5
10	4°08.9	287°57.2	05.2	256°01.3	12.9	340°22.0	46.6	26°44.1	57.4
11	19°11.4	302°56.6	05.6	271°02.3	12.7	355°23.9	46.8	41°46.3	57.4
12	34°13.9	317°55.9	N25°05.9	286°03.3	N24°12.6	10°25.8	N08°47.1	56°48.6	S10°57.3
13	49°16.3	332°55.3	06.3	301°04.2	12.4	25°27.7	47.3	71°50.9	57.2
14	64°18.8	347°54.7	06.7	316°05.2	12.2	40°29.6	47.5	86°53.2	57.2
15	79°21.2	2°54.0	·· 07.0	331°06.2	·· 12.0	55°31.5	·· 47.7	101°55.4	·· 57.1
16	94°23.7	17°53.4	07.4	346°07.2	11.8	70°33.4	47.9	116°57.7	57.1
17	109°26.2	32°52.8	07.8	1°08.2	11.6	85°35.3	48.1	132°00.0	57.0
18	124°28.6	47°52.1	N25°08.1	16°09.2	N24°11.4	100°37.2	N08°48.4	147°02.3	S10°56.9
19	139°31.1	62°51.5	08.5	31°10.2	11.2	115°39.1	48.6	162°04.6	56.9
20	154°33.6	77°50.8	08.8	46°11.2	11.0	130°41.0	48.8	177°06.8	56.8
21	169°36.0	92°50.2	·· 09.2	61°12.2	·· 10.8	145°42.9	·· 49.0	192°09.1	·· 56.7
22	184°38.5	107°49.6	09.6	76°13.1	10.6	160°44.8	49.2	207°11.4	56.7
23	199°41.0	122°48.9	09.9	91°14.1	10.4	175°46.7	49.4	222°13.7	56.6
Mer.pass. 09:43		ν -0.6′ d 0.4′ m -4.09		ν 1.0′ d -0.2′ m 1.29		ν 1.9′ d 0.2′ m -2.05		ν 2.3′ d 0.1′ m 0.94	

Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	214°43.4	137°48.3	N25°10.3	106°15.1	N24°10.2	190°48.6	N08°49.7	237°15.9	S10°56.5
1	229°45.9	152°47.7	10.6	121°16.1	10.0	205°50.5	49.9	252°18.2	56.5
2	244°48.4	167°47.0	11.0	136°17.1	09.8	220°52.4	50.1	267°20.5	56.4
3	259°50.8	182°46.4	·· 11.3	151°18.1	·· 09.6	235°54.3	·· 50.3	282°22.8	·· 56.3
4	274°53.3	197°45.8	11.7	166°19.1	09.4	250°56.2	50.5	297°25.1	56.3
5	289°55.7	212°45.1	12.0	181°20.1	09.2	265°58.1	50.7	312°27.3	56.2
6	304°58.2	227°44.5	N25°12.4	196°21.1	N24°09.0	281°00.0	N08°51.0	327°29.6	S10°56.2
7	320°00.7	242°43.8	12.7	211°22.0	08.8	296°01.9	51.2	342°31.9	56.1
8	335°03.1	257°43.2	13.1	226°23.0	08.6	311°03.8	51.4	357°34.2	56.0
9	350°05.6	272°42.6	·· 13.4	241°24.0	·· 08.4	326°05.7	·· 51.6	12°36.4	·· 56.0
10	5°08.1	287°41.9	13.8	256°25.0	08.3	341°07.6	51.8	27°38.7	55.9
11	20°10.5	302°41.3	14.1	271°26.0	08.1	356°09.5	52.0	42°41.0	55.8
12	35°13.0	317°40.7	N25°14.4	286°27.0	N24°07.9	11°11.4	N08°52.3	57°43.3	S10°55.8
13	50°15.5	332°40.0	14.8	301°28.0	07.7	26°13.3	52.5	72°45.6	55.7
14	65°17.9	347°39.4	15.1	316°29.0	07.5	41°15.3	52.7	87°47.8	55.6
15	80°20.4	2°38.8	·· 15.5	331°29.9	·· 07.3	56°17.2	·· 52.9	102°50.1	·· 55.6
16	95°22.9	17°38.1	15.8	346°30.9	07.1	71°19.1	53.1	117°52.4	55.5
17	110°25.3	32°37.5	16.1	1°31.9	06.9	86°21.0	53.3	132°54.7	55.5
18	125°27.8	47°36.8	N25°16.5	16°32.9	N24°06.7	101°22.9	N08°53.6	147°57.0	S10°55.4
19	140°30.2	62°36.2	16.8	31°33.9	06.5	116°24.8	53.8	162°59.2	55.3
20	155°32.7	77°35.6	17.1	46°34.9	06.3	131°26.7	54.0	178°01.5	55.3
21	170°35.2	92°34.9	·· 17.5	61°35.9	·· 06.1	146°28.6	·· 54.2	193°03.8	·· 55.2
22	185°37.6	107°34.3	17.8	76°36.9	05.9	161°30.5	54.4	208°06.1	55.1
23	200°40.1	122°33.7	18.1	91°37.8	05.7	176°32.4	54.6	223°08.4	55.1
Mer.pass. 09:40		ν -0.6′ d 0.4′ m -4.09		ν 1.0′ d -0.2′ m 1.30		ν 1.9′ d 0.2′ m -2.05		ν 2.3′ d 0.1′ m 0.94	

Stars

	SHA	**Dec**
Alpheratz	357°36.6	29°12.9
Ankaa	353°08.9	-42°10.8
Schedar	349°33.2	56°39.7
Diphda	348°49.0	-17°51.6
Achernar	335°21.8	-57°07.1
Hamal	327°53.2	23°34.2
Polaris	315°12.4	89°21.8
Acamar	315°13.3	-40°12.8
Menkar	314°08.0	4°10.7
Mirfak	308°30.8	49°56.6
Aldebaran	290°41.6	16°33.3
Rigel	281°05.5	-8°10.6
Capella	280°24.4	46°01.3
Bellatrix	278°24.7	6°22.2
Elnath	278°03.9	28°37.6
Alnilam	275°39.4	-1°11.3
Betelgeuse	270°53.8	7°24.6
Canopus	263°53.3	-52°42.7
Sirius	258°27.7	-16°45.0
Adhara	255°07.1	-29°00.4
Procyon	244°52.4	5°09.9
Pollux	243°19.1	27°58.3
Avior	234°15.3	-59°35.3
Suhail	222°47.3	-43°31.8
Miaplacidus	221°38.4	-69°49.0
Alphard	217°49.1	-8°45.7
Regulus	207°35.8	11°51.2
Dubhe	193°42.3	61°37.8
Denebola	182°26.2	14°26.5
Gienah	175°44.8	-17°40.4
Acrux	173°01.1	-63°13.8
Gacrux	171°52.7	-57°14.7
Alioth	166°13.7	55°50.1
Spica	158°23.5	-11°17.0
Alkaid	152°52.7	49°11.8
Hadar	148°37.4	-60°29.1
Menkent	147°58.9	-36°29.1
Arcturus	145°48.9	19°03.6
Rigil Kent.	139°41.6	-60°55.9
Kochab	137°18.6	74°03.5
Zuben'ubi	136°57.3	-16°08.4
Alphecca	126°04.6	26°38.0
Antares	112°17.3	-26°29.0
Atria	107°12.4	-69°04.0
Sabik	102°04.2	-15°45.3
Shaula	96°12.0	-37°07.2
Rasalhague	95°59.7	12°32.4
Eltanin	90°42.5	51°28.8
Kaus Aust.	83°34.2	-34°22.3
Vega	80°34.0	38°48.0
Nunki	75°49.4	-26°16.0
Altair	62°01.3	8°55.6
Peacock	53°08.0	-56°39.4
Deneb	49°26.8	45°21.4
Enif	33°40.3	9°58.7
Al Na'ir	27°34.9	-46°50.8
Fomalhaut	15°16.3	-29°30.0
Scheat	13°46.8	28°12.3
Markab	13°31.5	15°19.6

Apr 25 Tue	**SHA**	**Mer.pass**
Venus	285°33.7	14:47
Mars	252°42.4	16:57
Jupiter	336°32.2	11:21
Saturn	22°41.6	08:17

Apr 26 Wed	**SHA**	**Mer.pass**
Venus	284°19.3	14:48
Mars	252°07.1	16:55
Jupiter	336°18.7	11:18
Saturn	22°37.0	08:13

Apr 27 Thu	**SHA**	**Mer.pass**
Venus	283°04.9	14:49
Mars	251°31.7	16:54
Jupiter	336°05.2	11:15
Saturn	22°32.5	08:10

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°28.5	N13°02.1	119°50.6	8.8′	N27°55.2	0.8′	55.1′
1	195°28.6	02.9	134°18.3	8.8′	27°56.0	0.6′	55.0′
2	210°28.7	03.8	148°46.1	8.8′	27°56.6	0.5′	55.0′
3	225°28.8	·· 04.6	163°14.0	8.9′	27°57.1	0.4′	55.0′
4	240°28.9	05.4	177°41.8	8.9′	27°57.5	0.2′	55.0′
5	255°29.0	06.2	192°09.7	8.9′	27°57.7	0.0′	55.0′
6	270°29.1	N13°07.0	206°37.6	8.9′	N27°57.7	0.1′	54.9′
7	285°29.3	07.8	221°05.5	9.0′	27°57.6	0.2′	54.9′
8	300°29.4	08.7	235°33.5	9.0′	27°57.4	0.4′	54.9′
9	315°29.5	·· 09.5	250°01.5	9.0′	27°57.0	0.5′	54.9′
10	330°29.6	10.3	264°29.5	9.1′	27°56.5	0.6′	54.9′
11	345°29.7	11.1	278°57.6	9.1′	27°55.9	0.8′	54.8′
12	0°29.8	N13°11.9	293°25.7	9.1′	N27°55.1	1.0′	54.8′
13	15°29.9	12.7	307°53.8	9.2′	27°54.1	1.1′	54.8′
14	30°30.0	13.6	322°22.0	9.2′	27°53.0	1.2′	54.8′
15	45°30.1	·· 14.4	336°50.2	9.2′	27°51.8	1.4′	54.8′
16	60°30.2	15.2	351°18.4	9.3′	27°50.4	1.5′	54.7′
17	75°30.3	16.0	5°46.7	9.3′	27°48.9	1.6′	54.7′
18	90°30.4	N13°16.8	20°15.1	9.4′	N27°47.3	1.8′	54.7′
19	105°30.5	17.6	34°43.4	9.4′	27°45.5	1.9′	54.7′
20	120°30.6	18.4	49°11.8	9.5′	27°43.6	2.1′	54.7′
21	135°30.7	·· 19.2	63°40.3	9.5′	27°41.5	2.2′	54.7′
22	150°30.8	20.1	78°08.8	9.5′	27°39.3	2.3′	54.6′
23	165°31.0	20.9	92°37.3	9.6′	27°37.0	2.5′	54.6′
	SD = 15.9′	d = 0.8′	SD = 15.0′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°31.1	N13°21.7	107°05.9	9.6′	N27°34.5	2.6′	54.6′
1	195°31.2	22.5	121°34.6	9.7′	27°31.9	2.7′	54.6′
2	210°31.3	23.3	136°03.3	9.7′	27°29.2	2.9′	54.6′
3	225°31.4	·· 24.1	150°32.0	9.8′	27°26.3	3.0′	54.6′
4	240°31.5	24.9	165°00.8	9.8′	27°23.3	3.1′	54.5′
5	255°31.6	25.7	179°29.6	9.9′	27°20.2	3.3′	54.5′
6	270°31.7	N13°26.5	193°58.5	9.9′	N27°16.9	3.4′	54.5′
7	285°31.8	27.3	208°27.5	10.0′	27°13.5	3.5′	54.5′
8	300°31.9	28.1	222°56.5	10.1′	27°10.0	3.6′	54.5′
9	315°32.0	·· 29.0	237°25.5	10.1′	27°06.4	3.8′	54.5′
10	330°32.1	29.8	251°54.6	10.2′	27°02.6	4.0′	54.5′
11	345°32.2	30.6	266°23.8	10.2′	26°58.6	4.0′	54.5′
12	0°32.3	N13°31.4	280°53.0	10.3′	N26°54.6	4.2′	54.4′
13	15°32.4	32.2	295°22.3	10.3′	26°50.4	4.3′	54.4′
14	30°32.5	33.0	309°51.6	10.4′	26°46.1	4.4′	54.4′
15	45°32.6	·· 33.8	324°21.0	10.5′	26°41.7	4.6′	54.4′
16	60°32.7	34.6	338°50.5	10.5′	26°37.1	4.6′	54.4′
17	75°32.8	35.4	353°20.0	10.6′	26°32.5	4.8′	54.4′
18	90°32.9	N13°36.2	7°49.6	10.6′	N26°27.7	5.0′	54.4′
19	105°33.0	37.0	22°19.2	10.7′	26°22.7	5.0′	54.4′
20	120°33.1	37.8	36°48.9	10.8′	26°17.7	5.2′	54.3′
21	135°33.2	·· 38.6	51°18.7	10.8′	26°12.5	5.3′	54.3′
22	150°33.3	39.4	65°48.5	10.9′	26°07.2	5.4′	54.3′
23	165°33.4	40.2	80°18.4	10.9′	26°01.8	5.5′	54.3′
	SD = 15.9′	d = 0.8′	SD = 14.9′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°33.5	N13°41.0	94°48.3	11.0′	N25°56.3	5.6′	54.3′
1	195°33.6	41.8	109°18.3	11.1′	25°50.7	5.8′	54.3′
2	210°33.7	42.6	123°48.4	11.1′	25°44.9	5.9′	54.3′
3	225°33.8	·· 43.4	138°18.5	11.2′	25°39.0	6.0′	54.3′
4	240°33.9	44.2	152°48.7	11.3′	25°33.0	6.1′	54.3′
5	255°34.0	45.0	167°19.0	11.3′	25°26.9	6.2′	54.3′
6	270°34.1	N13°45.8	181°49.3	11.4′	N25°20.7	6.4′	54.3′
7	285°34.2	46.6	196°19.7	11.5′	25°14.3	6.4′	54.2′
8	300°34.3	47.4	210°50.2	11.5′	25°07.9	6.6′	54.2′
9	315°34.4	·· 48.2	225°20.7	11.6′	25°01.3	6.7′	54.2′
10	330°34.5	49.0	239°51.3	11.7′	24°54.6	6.8′	54.2′
11	345°34.6	49.8	254°22.0	11.7′	24°47.8	6.9′	54.2′
12	0°34.7	N13°50.6	268°52.7	11.8′	N24°40.9	7.0′	54.2′
13	15°34.8	51.4	283°23.5	11.9′	24°33.9	7.1′	54.2′
14	30°34.9	52.2	297°54.3	11.9′	24°26.8	7.2′	54.2′
15	45°35.0	·· 53.0	312°25.3	12.0′	24°19.6	7.3′	54.2′
16	60°35.1	53.8	326°56.2	12.1′	24°12.3	7.5′	54.2′
17	75°35.2	54.6	341°27.3	12.1′	24°04.8	7.5′	54.2′
18	90°35.3	N13°55.4	355°58.4	12.2′	N23°57.3	7.7′	54.2′
19	105°35.3	56.2	10°29.6	12.3′	23°49.6	7.7′	54.2′
20	120°35.4	57.0	25°00.9	12.3′	23°41.9	7.9′	54.2′
21	135°35.5	·· 57.7	39°32.2	12.4′	23°34.0	8.0′	54.2′
22	150°35.6	58.5	54°03.6	12.5′	23°26.0	8.0′	54.2′
23	165°35.7	59.3	68°35.0	12.5′	23°18.0	8.2′	54.2′
	SD = 15.9′	d = 0.8′	SD = 14.8′				

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

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

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%
25	01:54	01:59	11:58	16:36	04:10	
26	02:04	02:09	11:58	17:28	05:02	
27	02:14	02:19	11:58	18:17	05:52	

April 28, 29, 30 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	215°42.6	137°33.0	N25°18.4	106°38.8	N24°05.5	191°34.3	N08°54.9	238°10.6	S10°55.0
1	230°45.0	152°32.4	18.8	121°39.8	05.3	206°36.2	55.1	253°12.9	55.0
2	245°47.5	167°31.8	19.1	136°40.8	05.1	221°38.1	55.3	268°15.2	54.9
3	260°50.0	182°31.1	·· 19.4	151°41.8	·· 04.8	236°40.0	·· 55.5	283°17.5	·· 54.8
4	275°52.4	197°30.5	19.7	166°42.8	04.6	251°41.9	55.7	298°19.8	54.8
5	290°54.9	212°29.9	20.1	181°43.8	04.4	266°43.8	55.9	313°22.0	54.7
6	305°57.4	227°29.2	N25°20.4	196°44.8	N24°04.2	281°45.7	N08°56.1	328°24.3	S10°54.6
7	320°59.8	242°28.6	20.7	211°45.7	04.0	296°47.6	56.4	343°26.6	54.6
8	336°02.3	257°28.0	21.0	226°46.7	03.8	311°49.5	56.6	358°28.9	54.5
9	351°04.7	272°27.3	·· 21.3	241°47.7	·· 03.6	326°51.4	·· 56.8	13°31.2	·· 54.5
10	6°07.2	287°26.7	21.7	256°48.7	03.4	341°53.3	57.0	28°33.5	54.4
11	21°09.7	302°26.0	22.0	271°49.7	03.2	356°55.2	57.2	43°35.7	54.3
12	36°12.1	317°25.4	N25°22.3	286°50.7	N24°03.0	11°57.1	N08°57.4	58°38.0	S10°54.3
13	51°14.6	332°24.8	22.6	301°51.7	02.8	26°59.0	57.7	73°40.3	54.2
14	66°17.1	347°24.1	22.9	316°52.6	02.6	42°00.9	57.9	88°42.6	54.1
15	81°19.5	2°23.5	·· 23.2	331°53.6	·· 02.4	57°02.8	·· 58.1	103°44.9	·· 54.1
16	96°22.0	17°22.9	23.5	346°54.6	02.2	72°04.7	58.3	118°47.2	54.0
17	111°24.5	32°22.2	23.8	1°55.6	02.0	87°06.6	58.5	133°49.4	54.0
18	126°26.9	47°21.6	N25°24.1	16°56.6	N24°01.8	102°08.5	N08°58.7	148°51.7	S10°53.9
19	141°29.4	62°21.0	24.4	31°57.6	01.6	117°10.4	59.0	163°54.0	53.8
20	156°31.8	77°20.3	24.8	46°58.6	01.4	132°12.3	59.2	178°56.3	53.8
21	171°34.3	92°19.7	·· 25.1	61°59.5	·· 01.2	147°14.2	·· 59.4	193°58.6	·· 53.7
22	186°36.8	107°19.1	25.4	77°00.5	01.0	162°16.1	59.6	209°00.9	53.6
23	201°39.2	122°18.4	25.7	92°01.5	00.8	177°18.0	59.8	224°03.1	53.6
Mer.pass. 09:36		ν -0.6′ d 0.3′	m -4.10	ν 1.0′ d -0.2′	m 1.31	ν 1.9′ d 0.2′	m -2.05	ν 2.3′ d 0.1′	m 0.94

Sat	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	216°41.7	137°17.8	N25°26.0	107°02.5	N24°00.6	192°19.9	N09°00.0	239°05.4	S10°53.5
1	231°44.2	152°17.2	26.3	122°03.5	00.3	207°21.8	00.2	254°07.7	53.5
2	246°46.6	167°16.5	26.6	137°04.5	24°00.1	222°23.7	00.5	269°10.0	53.4
3	261°49.1	182°15.9	·· 26.9	152°05.5	23°59.9	237°25.6	·· 00.7	284°12.3	·· 53.3
4	276°51.6	197°15.3	27.1	167°06.4	59.7	252°27.5	00.9	299°14.6	53.3
5	291°54.0	212°14.6	27.4	182°07.4	59.5	267°29.4	01.1	314°16.8	53.2
6	306°56.5	227°14.0	N25°27.7	197°08.4	N23°59.3	282°31.3	N09°01.3	329°19.1	S10°53.1
7	321°59.0	242°13.4	28.0	212°09.4	59.1	297°33.2	01.5	344°21.4	53.1
8	337°01.4	257°12.7	28.3	227°10.4	58.9	312°35.1	01.7	359°23.7	53.0
9	352°03.9	272°12.1	·· 28.6	242°11.4	·· 58.7	327°37.0	·· 02.0	14°26.0	·· 53.0
10	7°06.3	287°11.5	28.9	257°12.4	58.5	342°38.9	02.2	29°28.3	52.9
11	22°08.8	302°10.8	29.2	272°13.3	58.3	357°40.9	02.4	44°30.5	52.8
12	37°11.3	317°10.2	N25°29.5	287°14.3	N23°58.0	12°42.8	N09°02.6	59°32.8	S10°52.8
13	52°13.7	332°09.6	29.8	302°15.3	57.8	27°44.7	02.8	74°35.1	52.7
14	67°16.2	347°08.9	30.0	317°16.3	57.6	42°46.6	03.0	89°37.4	52.7
15	82°18.7	2°08.3	·· 30.3	332°17.3	·· 57.4	57°48.5	·· 03.3	104°39.7	·· 52.6
16	97°21.1	17°07.7	30.6	347°18.3	57.2	72°50.4	03.5	119°42.0	52.5
17	112°23.6	32°07.0	30.9	2°19.2	57.0	87°52.3	03.7	134°44.3	52.5
18	127°26.1	47°06.4	N25°31.2	17°20.2	N23°56.8	102°54.2	N09°03.9	149°46.5	S10°52.4
19	142°28.5	62°05.8	31.4	32°21.2	56.6	117°56.1	04.1	164°48.8	52.4
20	157°31.0	77°05.1	31.7	47°22.2	56.4	132°58.0	04.3	179°51.1	52.3
21	172°33.5	92°04.5	·· 32.0	62°23.2	·· 56.2	147°59.9	·· 04.5	194°53.4	·· 52.2
22	187°35.9	107°03.9	32.3	77°24.2	55.9	163°01.8	04.8	209°55.7	52.2
23	202°38.4	122°03.2	32.5	92°25.2	55.7	178°03.7	05.0	224°58.0	52.1
Mer.pass. 09:32		ν -0.6′ d 0.3′	m -4.10	ν 1.0′ d -0.2′	m 1.32	ν 1.9′ d 0.2′	m -2.06	ν 2.3′ d 0.1′	m 0.93

Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	217°40.8	137°02.6	N25°32.8	107°26.1	N23°55.5	193°05.6	N09°05.2	240°00.3	S10°52.0
1	232°43.3	152°02.0	33.1	122°27.1	55.3	208°07.5	05.4	255°02.5	52.0
2	247°45.8	167°01.3	33.4	137°28.1	55.1	223°09.4	05.6	270°04.8	51.9
3	262°48.2	182°00.7	·· 33.6	152°29.1	·· 54.9	238°11.3	·· 05.8	285°07.1	·· 51.9
4	277°50.7	197°00.1	33.9	167°30.1	54.7	253°13.2	06.0	300°09.4	51.8
5	292°53.2	211°59.4	34.2	182°31.1	54.4	268°15.1	06.3	315°11.7	51.7
6	307°55.6	226°58.8	N25°34.4	197°32.0	N23°54.2	283°17.0	N09°06.5	330°14.0	S10°51.7
7	322°58.1	241°58.2	34.7	212°33.0	54.0	298°18.9	06.7	345°16.3	51.6
8	338°00.6	256°57.5	35.0	227°34.0	53.8	313°20.8	06.9	0°18.6	51.6
9	353°03.0	271°56.9	·· 35.2	242°35.0	·· 53.6	328°22.7	·· 07.1	15°20.8	·· 51.5
10	8°05.5	286°56.3	35.5	257°36.0	53.4	343°24.6	07.3	30°23.1	51.4
11	23°07.9	301°55.7	35.7	272°37.0	53.2	358°26.5	07.5	45°25.4	51.4
12	38°10.4	316°55.0	N25°36.0	287°37.9	N23°52.9	13°28.4	N09°07.8	60°27.7	S10°51.3
13	53°12.9	331°54.4	36.3	302°38.9	52.7	28°30.3	08.0	75°30.0	51.3
14	68°15.3	346°53.8	36.5	317°39.9	52.5	43°32.2	08.2	90°32.3	51.2
15	83°17.8	1°53.1	·· 36.8	332°40.9	·· 52.3	58°34.1	·· 08.4	105°34.6	·· 51.1
16	98°20.3	16°52.5	37.0	347°41.9	52.1	73°36.0	08.6	120°36.9	51.1
17	113°22.7	31°51.9	37.3	2°42.9	51.9	88°37.9	08.8	135°39.2	51.0
18	128°25.2	46°51.2	N25°37.5	17°43.8	N23°51.6	103°39.9	N09°09.0	150°41.4	S10°51.0
19	143°27.7	61°50.6	37.8	32°44.8	51.4	118°41.8	09.2	165°43.7	50.9
20	158°30.1	76°50.0	38.0	47°45.8	51.2	133°43.7	09.5	180°46.0	50.8
21	173°32.6	91°49.3	·· 38.3	62°46.8	·· 51.0	148°45.6	·· 09.7	195°48.3	·· 50.8
22	188°35.1	106°48.7	38.5	77°47.8	50.8	163°47.5	09.9	210°50.6	50.7
23	203°37.5	121°48.1	38.8	92°48.8	50.6	178°49.4	10.1	225°52.9	50.7
Mer.pass. 09:28		ν -0.6′ d 0.3′	m -4.11	ν 1.0′ d -0.2′	m 1.33	ν 1.9′ d 0.2′	m -2.06	ν 2.3′ d 0.1′	m 0.93

Stars

	SHA	**Dec**
Alpheratz	357°36.5	29°12.9
Ankaa	353°08.9	-42°10.8
Schedar	349°33.2	56°39.7
Diphda	348°49.0	-17°51.6
Achernar	335°21.8	-57°07.1
Hamal	327°53.2	23°34.2
Polaris	315°12.5	89°21.7
Acamar	315°13.3	-40°12.8
Menkar	314°08.0	4°10.7
Mirfak	308°30.8	49°56.6
Aldebaran	290°41.6	16°33.3
Rigel	281°05.5	-8°10.6
Capella	280°24.4	46°01.3
Bellatrix	278°24.7	6°22.2
Elnath	278°04.0	28°37.6
Alnilam	275°39.4	-1°11.3
Betelgeuse	270°53.9	7°24.6
Canopus	263°53.3	-52°42.7
Sirius	258°27.7	-16°45.0
Adhara	255°07.2	-29°00.4
Procyon	244°52.4	5°09.9
Pollux	243°19.1	27°58.3
Avior	234°15.4	-59°35.3
Suhail	222°47.3	-43°31.8
Miaplacidus	221°38.5	-69°49.0
Alphard	217°49.1	-8°45.7
Regulus	207°35.8	11°51.2
Dubhe	193°42.3	61°37.8
Denebola	182°26.2	14°26.5
Gienah	175°44.8	-17°40.4
Acrux	173°01.1	-63°13.8
Gacrux	171°52.8	-57°14.8
Alioth	166°13.7	55°50.1
Spica	158°23.5	-11°17.1
Alkaid	152°52.6	49°11.8
Hadar	148°37.4	-60°29.2
Menkent	147°58.9	-36°29.1
Arcturus	145°48.9	19°03.6
Rigil Kent.	139°41.6	-60°55.9
Kochab	137°18.6	74°03.5
Zuben'ubi	136°57.3	-16°08.4
Alphecca	126°04.6	26°38.1
Antares	112°17.3	-26°29.0
Atria	107°12.3	-69°04.0
Sabik	102°04.2	-15°45.3
Shaula	96°12.0	-37°07.2
Rasalhague	95°59.6	12°32.4
Eltanin	90°42.5	51°28.8
Kaus Aust.	83°34.2	-34°22.4
Vega	80°34.0	38°48.0
Nunki	75°49.4	-26°16.0
Altair	62°01.3	8°55.6
Peacock	53°07.9	-56°39.4
Deneb	49°26.8	45°21.4
Enif	33°40.3	9°58.7
Al Na'ir	27°34.9	-46°50.8
Fomalhaut	15°16.3	-29°30.0
Scheat	13°46.8	28°12.3
Markab	13°31.5	15°19.6

Apr 28 Fri	**SHA**	**Mer.pass**
Venus	281°50.5	14:50
Mars	250°56.3	16:52
Jupiter	335°51.7	11:12
Saturn	22°28.1	08:06

Apr 29 Sat	**SHA**	**Mer.pass**
Venus	280°36.1	14:51
Mars	250°20.8	16:51
Jupiter	335°38.2	11:09
Saturn	22°23.7	08:02

Apr 30 Sun	**SHA**	**Mer.pass**
Venus	279°21.8	14:52
Mars	249°45.3	16:49
Jupiter	335°24.7	11:06
Saturn	22°19.4	07:59

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°35.8	N14°00.1	83°06.5	12.6′	N23°09.8	8.2′	54.2′
1	195°35.9	00.9	97°38.1	12.6′	23°01.6	8.4′	54.2′
2	210°36.0	01.7	112°09.8	12.7′	22°53.2	8.5′	54.2′
3	225°36.1	·· 02.5	126°41.5	12.8′	22°44.7	8.5′	54.2′
4	240°36.2	03.3	141°13.2	12.8′	22°36.2	8.7′	54.2′
5	255°36.3	04.1	155°45.1	12.9′	22°27.5	8.7′	54.2′
6	270°36.4	N14°04.9	170°17.0	13.0′	N22°18.8	8.9′	54.2′
7	285°36.5	05.6	184°49.0	13.0′	22°09.9	8.9′	54.2′
8	300°36.6	06.4	199°21.0	13.1′	22°01.0	9.0′	54.2′
9	315°36.7	·· 07.2	213°53.1	13.2′	21°52.0	9.2′	54.2′
10	330°36.8	08.0	228°25.2	13.2′	21°42.8	9.2′	54.2′
11	345°36.8	08.8	242°57.5	13.3′	21°33.6	9.3′	54.2′
12	0°36.9	N14°09.6	257°29.8	13.3′	N21°24.3	9.4′	54.2′
13	15°37.0	10.4	272°02.1	13.4′	21°14.9	9.5′	54.2′
14	30°37.1	11.2	286°34.5	13.5′	21°05.4	9.6′	54.2′
15	45°37.2	·· 11.9	301°07.0	13.5′	20°55.8	9.6′	54.2′
16	60°37.3	12.7	315°39.5	13.6′	20°46.2	9.8′	54.2′
17	75°37.4	13.5	330°12.1	13.6′	20°36.4	9.8′	54.2′
18	90°37.5	N14°14.3	344°44.7	13.7′	N20°26.6	10.0′	54.2′
19	105°37.6	15.1	359°17.5	13.8′	20°16.6	10.0′	54.2′
20	120°37.7	15.9	13°50.2	13.8′	20°06.6	10.1′	54.2′
21	135°37.8	·· 16.6	28°23.0	13.9′	19°56.5	10.2′	54.2′
22	150°37.8	17.4	42°55.9	13.9′	19°46.3	10.2′	54.2′
23	165°37.9	18.2	57°28.9	14.0′	19°36.1	10.4′	54.2′
	SD = 15.9′	d = 0.8′	SD = 14.8′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°38.0	N14°19.0	72°01.9	14.1′	N19°25.7	10.4′	54.2′
1	195°38.1	19.8	86°34.9	14.1′	19°15.3	10.5′	54.2′
2	210°38.2	20.6	101°08.0	14.2′	19°04.8	10.6′	54.2′
3	225°38.3	·· 21.3	115°41.2	14.2′	18°54.2	10.7′	54.2′
4	240°38.4	22.1	130°14.4	14.3′	18°43.5	10.7′	54.2′
5	255°38.5	22.9	144°47.7	14.3′	18°32.8	10.8′	54.2′
6	270°38.5	N14°23.7	159°21.0	14.4′	N18°22.0	10.9′	54.2′
7	285°38.6	24.5	173°54.4	14.4′	18°11.1	11.0′	54.3′
8	300°38.7	25.2	188°27.8	14.5′	18°00.1	11.1′	54.3′
9	315°38.8	·· 26.0	203°01.3	14.5′	17°49.0	11.1′	54.3′
10	330°38.9	26.8	217°34.8	14.6′	17°37.9	11.2′	54.3′
11	345°39.0	27.6	232°08.4	14.6′	17°26.7	11.3′	54.3′
12	0°39.1	N14°28.3	246°42.0	14.7′	N17°15.4	11.3′	54.3′
13	15°39.2	29.1	261°15.7	14.7′	17°04.1	11.4′	54.3′
14	30°39.2	29.9	275°49.4	14.8′	16°52.7	11.5′	54.3′
15	45°39.3	·· 30.7	290°23.2	14.8′	16°41.2	11.6′	54.3′
16	60°39.4	31.4	304°57.0	14.9′	16°29.6	11.6′	54.3′
17	75°39.5	32.2	319°30.9	14.9′	16°18.0	11.7′	54.3′
18	90°39.6	N14°33.0	334°04.8	15.0′	N16°06.3	11.8′	54.3′
19	105°39.7	33.8	348°38.7	15.0′	15°54.5	11.8′	54.4′
20	120°39.8	34.5	3°12.7	15.0′	15°42.7	11.9′	54.4′
21	135°39.8	·· 35.3	17°46.8	15.1′	15°30.8	12.0′	54.4′
22	150°39.9	36.1	32°20.9	15.1′	15°18.8	12.0′	54.4′
23	165°40.0	36.9	46°55.0	15.2′	15°06.8	12.1′	54.4′
	SD = 15.9′	d = 0.8′	SD = 14.8′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°40.1	N14°37.6	61°29.1	15.2′	N14°54.7	12.2′	54.4′
1	195°40.2	38.4	76°03.3	15.2′	14°42.5	12.2′	54.4′
2	210°40.3	39.2	90°37.6	15.3′	14°30.3	12.3′	54.4′
3	225°40.3	·· 39.9	105°11.8	15.3′	14°18.0	12.3′	54.5′
4	240°40.4	40.7	119°46.1	15.3′	14°05.7	12.4′	54.5′
5	255°40.5	41.5	134°20.5	15.4′	13°53.3	12.5′	54.5′
6	270°40.6	N14°42.2	148°54.9	15.4′	N13°40.8	12.5′	54.5′
7	285°40.7	43.0	163°29.3	15.4′	13°28.3	12.6′	54.5′
8	300°40.8	43.8	178°03.7	15.5′	13°15.7	12.7′	54.5′
9	315°40.8	·· 44.6	192°38.2	15.5′	13°03.0	12.7′	54.5′
10	330°40.9	45.3	207°12.7	15.5′	12°50.3	12.7′	54.5′
11	345°41.0	46.1	221°47.3	15.6′	12°37.6	12.9′	54.6′
12	0°41.1	N14°46.9	236°21.8	15.6′	N12°24.7	12.8′	54.6′
13	15°41.2	47.6	250°56.4	15.6′	12°11.9	13.0′	54.6′
14	30°41.2	48.4	265°31.0	15.7′	11°58.9	13.0′	54.6′
15	45°41.3	·· 49.2	280°05.7	15.7′	11°45.9	13.0′	54.6′
16	60°41.4	49.9	294°40.4	15.7′	11°32.9	13.1′	54.6′
17	75°41.5	50.7	309°15.1	15.7′	11°19.8	13.1′	54.7′
18	90°41.6	N14°51.4	323°49.8	15.7′	N11°06.7	13.2′	54.7′
19	105°41.6	52.2	338°24.5	15.8′	10°53.5	13.3′	54.7′
20	120°41.7	53.0	352°59.3	15.8′	10°40.2	13.2′	54.7′
21	135°41.8	·· 53.7	7°34.1	15.8′	10°27.0	13.4′	54.7′
22	150°41.9	54.5	22°08.9	15.8′	10°13.6	13.4′	54.7′
23	165°42.0	55.3	36°43.7	15.8′	10°00.2	13.4′	54.8′
	SD = 15.9′	d = 0.8′	SD = 14.8′				

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

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

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 8-10 51-70%
28	02:23	02:28	11:58	19:03	06:40	
29	02:32	02:36	11:57	19:47	07:25	
30	02:40	02:44	11:57	20:29	08:08	

May 01, 02, 03 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	218°40.0	136°47.5	N25°39.0	107°49.7	N23°50.3	193°51.3	N09°10.3	240°55.2	S10°50.6
1	233°42.4	151°46.8	39.3	122°50.7	50.1	208°53.2	10.5	255°57.5	50.5
2	248°44.9	166°46.2	39.5	137°51.7	49.9	223°55.1	10.7	270°59.8	50.5
3	263°47.4	181°45.6	·· 39.8	152°52.7	·· 49.7	238°57.0	·· 11.0	286°02.0	·· 50.4
4	278°49.8	196°44.9	40.0	167°53.7	49.5	253°58.9	11.2	301°04.3	50.4
5	293°52.3	211°44.3	40.2	182°54.6	49.2	269°00.8	11.4	316°06.6	50.3
6	308°54.8	226°43.7	N25°40.5	197°55.6	N23°49.0	284°02.7	N09°11.6	331°08.9	S10°50.3
7	323°57.2	241°43.1	40.7	212°56.6	48.8	299°04.6	11.8	346°11.2	50.2
8	338°59.7	256°42.4	40.9	227°57.6	48.6	314°06.5	12.0	1°13.5	50.1
9	354°02.2	271°41.8	·· 41.2	242°58.6	·· 48.4	329°08.4	·· 12.2	16°15.8	·· 50.1
10	9°04.6	286°41.2	41.4	257°59.6	48.1	344°10.3	12.5	31°18.1	50.0
11	24°07.1	301°40.5	41.6	273°00.5	47.9	359°12.2	12.7	46°20.4	50.0
12	39°09.5	316°39.9	N25°41.9	288°01.5	N23°47.7	14°14.1	N09°12.9	61°22.7	S10°49.9
13	54°12.0	331°39.3	42.1	303°02.5	47.5	29°16.0	13.1	76°25.0	49.8
14	69°14.5	346°38.7	42.3	318°03.5	47.3	44°17.9	13.3	91°27.2	49.8
15	84°16.9	1°38.0	·· 42.6	333°04.5	·· 47.0	59°19.8	·· 13.5	106°29.5	·· 49.7
16	99°19.4	16°37.4	42.8	348°05.5	46.8	74°21.7	13.7	121°31.8	49.7
17	114°21.9	31°36.8	43.0	3°06.4	46.6	89°23.6	13.9	136°34.1	49.6
18	129°24.3	46°36.2	N25°43.2	18°07.4	N23°46.4	104°25.5	N09°14.2	151°36.4	S10°49.5
19	144°26.8	61°35.5	43.5	33°08.4	46.1	119°27.4	14.4	166°38.7	49.5
20	159°29.3	76°34.9	43.7	48°09.4	45.9	134°29.4	14.6	181°41.0	49.4
21	174°31.7	91°34.3	·· 43.9	63°10.4	·· 45.7	149°31.3	·· 14.8	196°43.3	·· 49.4
22	189°34.2	106°33.6	44.1	78°11.3	45.5	164°33.2	15.0	211°45.6	49.3
23	204°36.7	121°33.0	44.3	93°12.3	45.3	179°35.1	15.2	226°47.9	49.3
Mer.pass. 09:24		ν -0.6′ d 0.2′ m -4.11		ν 1.0′ d -0.2′ m 1.34		ν 1.9′ d 0.2′ m -2.06		ν 2.3′ d 0.1′ m 0.93	

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	219°39.1	136°32.4	N25°44.6	108°13.3	N23°45.0	194°37.0	N09°15.4	241°50.2	S10°49.2
1	234°41.6	151°31.8	44.8	123°14.3	44.8	209°38.9	15.6	256°52.5	49.1
2	249°44.0	166°31.1	45.0	138°15.3	44.6	224°40.8	15.9	271°54.8	49.1
3	264°46.5	181°30.5	·· 45.2	153°16.2	·· 44.4	239°42.7	·· 16.1	286°57.0	·· 49.0
4	279°49.0	196°29.9	45.4	168°17.2	44.1	254°44.6	16.3	301°59.3	49.0
5	294°51.4	211°29.3	45.6	183°18.2	43.9	269°46.5	16.5	317°01.6	48.9
6	309°53.9	226°28.6	N25°45.8	198°19.2	N23°43.7	284°48.4	N09°16.7	332°03.9	S10°48.8
7	324°56.4	241°28.0	46.1	213°20.2	43.5	299°50.3	16.9	347°06.2	48.8
8	339°58.8	256°27.4	46.3	228°21.2	43.2	314°52.2	17.1	2°08.5	48.7
9	355°01.3	271°26.8	·· 46.5	243°22.1	·· 43.0	329°54.1	·· 17.3	17°10.8	·· 48.7
10	10°03.8	286°26.1	46.7	258°23.1	42.8	344°56.0	17.6	32°13.1	48.6
11	25°06.2	301°25.5	46.9	273°24.1	42.6	359°57.9	17.8	47°15.4	48.6
12	40°08.7	316°24.9	N25°47.1	288°25.1	N23°42.3	14°59.8	N09°18.0	62°17.7	S10°48.5
13	55°11.2	331°24.3	47.3	303°26.1	42.1	30°01.7	18.2	77°20.0	48.4
14	70°13.6	346°23.7	47.5	318°27.0	41.9	45°03.6	18.4	92°22.3	48.4
15	85°16.1	1°23.0	·· 47.7	333°28.0	·· 41.6	60°05.5	·· 18.6	107°24.6	·· 48.3
16	100°18.5	16°22.4	47.9	348°29.0	41.4	75°07.4	18.8	122°26.9	48.3
17	115°21.0	31°21.8	48.1	3°30.0	41.2	90°09.3	19.0	137°29.2	48.2
18	130°23.5	46°21.2	N25°48.3	18°31.0	N23°41.0	105°11.3	N09°19.3	152°31.5	S10°48.2
19	145°25.9	61°20.5	48.5	33°31.9	40.7	120°13.2	19.5	167°33.7	48.1
20	160°28.4	76°19.9	48.7	48°32.9	40.5	135°15.1	19.7	182°36.0	48.0
21	175°30.9	91°19.3	·· 48.9	63°33.9	·· 40.3	150°17.0	·· 19.9	197°38.3	·· 48.0
22	190°33.3	106°18.7	49.1	78°34.9	40.0	165°18.9	20.1	212°40.6	47.9
23	205°35.8	121°18.1	49.3	93°35.9	39.8	180°20.8	20.3	227°42.9	47.9
Mer.pass. 09:20		ν -0.6′ d 0.2′ m -4.12		ν 1.0′ d -0.2′ m 1.35		ν 1.9′ d 0.2′ m -2.06		ν 2.3′ d 0.1′ m 0.93	

Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	220°38.3	136°17.4	N25°49.4	108°36.8	N23°39.6	195°22.7	N09°20.5	242°45.2	S10°47.8
1	235°40.7	151°16.8	49.6	123°37.8	39.4	210°24.6	20.7	257°47.5	47.8
2	250°43.2	166°16.2	49.8	138°38.8	39.1	225°26.5	20.9	272°49.8	47.7
3	265°45.6	181°15.6	·· 50.0	153°39.8	·· 38.9	240°28.4	·· 21.2	287°52.1	·· 47.6
4	280°48.1	196°14.9	50.2	168°40.8	38.7	255°30.3	21.4	302°54.4	47.6
5	295°50.6	211°14.3	50.4	183°41.7	38.4	270°32.2	21.6	317°56.7	47.5
6	310°53.0	226°13.7	N25°50.6	198°42.7	N23°38.2	285°34.1	N09°21.8	332°59.0	S10°47.5
7	325°55.5	241°13.1	50.7	213°43.7	38.0	300°36.0	22.0	348°01.3	47.4
8	340°58.0	256°12.5	50.9	228°44.7	37.7	315°37.9	22.2	3°03.6	47.4
9	356°00.4	271°11.8	·· 51.1	243°45.7	·· 37.5	330°39.8	·· 22.4	18°05.9	·· 47.3
10	11°02.9	286°11.2	51.3	258°46.6	37.3	345°41.7	22.6	33°08.2	47.2
11	26°05.4	301°10.6	51.5	273°47.6	37.0	0°43.6	22.9	48°10.5	47.2
12	41°07.8	316°10.0	N25°51.6	288°48.6	N23°36.8	15°45.5	N09°23.1	63°12.8	S10°47.1
13	56°10.3	331°09.4	51.8	303°49.6	36.6	30°47.5	23.3	78°15.1	47.1
14	71°12.8	346°08.7	52.0	318°50.6	36.4	45°49.4	23.5	93°17.4	47.0
15	86°15.2	1°08.1	·· 52.2	333°51.5	·· 36.1	60°51.3	·· 23.7	108°19.7	·· 47.0
16	101°17.7	16°07.5	52.3	348°52.5	35.9	75°53.2	23.9	123°22.0	46.9
17	116°20.1	31°06.9	52.5	3°53.5	35.7	90°55.1	24.1	138°24.3	46.9
18	131°22.6	46°06.3	N25°52.7	18°54.5	N23°35.4	105°57.0	N09°24.3	153°26.6	S10°46.8
19	146°25.1	61°05.7	52.8	33°55.5	35.2	120°58.9	24.5	168°28.9	46.7
20	161°27.5	76°05.0	53.0	48°56.4	34.9	136°00.8	24.8	183°31.2	46.7
21	176°30.0	91°04.4	·· 53.2	63°57.4	·· 34.7	151°02.7	·· 25.0	198°33.5	·· 46.6
22	191°32.5	106°03.8	53.3	78°58.4	34.5	166°04.6	25.2	213°35.8	46.6
23	206°34.9	121°03.2	53.5	93°59.4	34.2	181°06.5	25.4	228°38.1	46.5
Mer.pass. 09:16		ν -0.6′ d 0.2′ m -4.12		ν 1.0′ d -0.2′ m 1.36		ν 1.9′ d 0.2′ m -2.06		ν 2.3′ d 0.1′ m 0.93	

Stars

	SHA	**Dec**
Alpheratz	357°36.5	29°12.9
Ankaa	353°08.9	-42°10.8
Schedar	349°33.2	56°39.6
Diphda	348°49.0	-17°51.6
Achernar	335°21.8	-57°07.1
Hamal	327°53.2	23°34.2
Polaris	315°12.7	89°21.7
Acamar	315°13.3	-40°12.8
Menkar	314°08.0	4°10.7
Mirfak	308°30.8	49°56.6
Aldebaran	290°41.6	16°33.3
Rigel	281°05.5	-8°10.6
Capella	280°24.4	46°01.3
Bellatrix	278°24.7	6°22.2
Elnath	278°04.0	28°37.6
Alnilam	275°39.4	-1°11.3
Betelgeuse	270°53.9	7°24.6
Canopus	263°53.4	-52°42.7
Sirius	258°27.7	-16°45.0
Adhara	255°07.2	-29°00.4
Procyon	244°52.4	5°09.9
Pollux	243°19.2	27°58.3
Avior	234°15.4	-59°35.3
Suhail	222°47.3	-43°31.8
Miaplacidus	221°38.5	-69°49.0
Alphard	217°49.1	-8°45.7
Regulus	207°35.9	11°51.2
Dubhe	193°42.4	61°37.8
Denebola	182°26.2	14°26.5
Gienah	175°44.8	-17°40.4
Acrux	173°01.1	-63°13.9
Gacrux	171°52.8	-57°14.8
Alioth	166°13.7	55°50.1
Spica	158°23.5	-11°17.1
Alkaid	152°52.6	49°11.8
Hadar	148°37.4	-60°29.2
Menkent	147°58.9	-36°29.1
Arcturus	145°48.9	19°03.6
Rigil Kent.	139°41.6	-60°55.9
Kochab	137°18.6	74°03.5
Zuben'ubi	136°57.3	-16°08.4
Alphecca	126°04.6	26°38.1
Antares	112°17.3	-26°29.0
Atria	107°12.3	-69°04.0
Sabik	102°04.1	-15°45.3
Shaula	96°12.0	-37°07.2
Rasalhague	95°59.6	12°32.4
Eltanin	90°42.5	51°28.8
Kaus Aust.	83°34.2	-34°22.4
Vega	80°34.0	38°48.0
Nunki	75°49.3	-26°16.0
Altair	62°01.3	8°55.6
Peacock	53°07.9	-56°39.4
Deneb	49°26.8	45°21.4
Enif	33°40.3	9°58.7
Al Na'ir	27°34.8	-46°50.8
Fomalhaut	15°16.3	-29°29.9
Scheat	13°46.8	28°12.3
Markab	13°31.5	15°19.6

May 01 Mon	**SHA**	**Mer.pass**
Venus	278°07.5	14:53
Mars	249°09.8	16:48
Jupiter	335°11.3	11:03
Saturn	22°15.2	07:55

May 02 Tue	**SHA**	**Mer.pass**
Venus	276°53.3	14:54
Mars	248°34.2	16:46
Jupiter	334°57.9	11:00
Saturn	22°11.0	07:51

May 03 Wed	**SHA**	**Mer.pass**
Venus	275°39.2	14:55
Mars	247°58.6	16:44
Jupiter	334°44.4	10:57
Saturn	22°07.0	07:48

Horizontal parallax	
Venus:	0.2
Mars:	0.1

h	Sun		Moon				
Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°42.0	N14°56.0	51°18.6	15.9′	N09°46.8	13.5′	54.8′
1	195°42.1	56.8	65°53.5	15.9′	09°33.3	13.5′	54.8′
2	210°42.2	57.5	80°28.3	15.9′	09°19.8	13.6′	54.8′
3	225°42.3	·· 58.3	95°03.2	15.9′	09°06.2	13.6′	54.8′
4	240°42.4	59.1	109°38.1	15.9′	08°52.6	13.7′	54.8′
5	255°42.4	14°59.8	124°13.1	15.9′	08°38.9	13.7′	54.9′
6	270°42.5	N15°00.6	138°48.0	15.9′	N08°25.2	13.8′	54.9′
7	285°42.6	01.3	153°22.9	16.0′	08°11.4	13.7′	54.9′
8	300°42.7	02.1	167°57.9	16.0′	07°57.7	13.9′	54.9′
9	315°42.7	·· 02.9	182°32.9	16.0′	07°43.8	13.9′	54.9′
10	330°42.8	03.6	197°07.8	16.0′	07°29.9	13.9′	55.0′
11	345°42.9	04.4	211°42.8	16.0′	07°16.0	13.9′	55.0′
12	0°43.0	N15°05.1	226°17.8	16.0′	N07°02.1	14.0′	55.0′
13	15°43.0	05.9	240°52.8	16.0′	06°48.1	14.0′	55.0′
14	30°43.1	06.6	255°27.8	16.0′	06°34.1	14.1′	55.0′
15	45°43.2	·· 07.4	270°02.8	16.0′	06°20.0	14.1′	55.1′
16	60°43.3	08.1	284°37.8	16.0′	06°05.9	14.1′	55.1′
17	75°43.3	08.9	299°12.8	16.0′	05°51.8	14.2′	55.1′
18	90°43.4	N15°09.7	313°47.8	16.0′	N05°37.6	14.2′	55.1′
19	105°43.5	10.4	328°22.8	16.0′	05°23.4	14.3′	55.2′
20	120°43.6	11.2	342°57.8	16.0′	05°09.1	14.2′	55.2′
21	135°43.6	·· 11.9	357°32.8	16.0′	04°54.9	14.3′	55.2′
22	150°43.7	12.7	12°07.7	16.0′	04°40.6	14.4′	55.2′
23	165°43.8	13.4	26°42.7	16.0′	04°26.2	14.3′	55.2′
	SD = 15.9′	d = 0.8′	SD = 14.9′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°43.9	N15°14.2	41°17.7	16.0′	N04°11.9	14.4′	55.3′
1	195°43.9	14.9	55°52.7	16.0′	03°57.5	14.4′	55.3′
2	210°44.0	15.7	70°27.6	15.9′	03°43.1	14.5′	55.3′
3	225°44.1	·· 16.4	85°02.6	15.9′	03°28.6	14.5′	55.3′
4	240°44.1	17.2	99°37.5	15.9′	03°14.1	14.5′	55.4′
5	255°44.2	17.9	114°12.4	15.9′	02°59.6	14.5′	55.4′
6	270°44.3	N15°18.7	128°47.3	15.9′	N02°45.1	14.5′	55.4′
7	285°44.4	19.4	143°22.2	15.9′	02°30.6	14.6′	55.4′
8	300°44.4	20.2	157°57.1	15.9′	02°16.0	14.6′	55.5′
9	315°44.5	·· 20.9	172°32.0	15.8′	02°01.4	14.6′	55.5′
10	330°44.6	21.6	187°06.8	15.8′	01°46.8	14.6′	55.5′
11	345°44.6	22.4	201°41.6	15.8′	01°32.2	14.7′	55.5′
12	0°44.7	N15°23.1	216°16.4	15.8′	N01°17.5	14.7′	55.6′
13	15°44.8	23.9	230°51.2	15.8′	01°02.8	14.7′	55.6′
14	30°44.9	24.6	245°26.0	15.7′	00°48.1	14.7′	55.6′
15	45°44.9	·· 25.4	260°00.7	15.7′	00°33.4	14.7′	55.6′
16	60°45.0	26.1	274°35.4	15.7′	00°18.7	14.8′	55.7′
17	75°45.1	26.9	289°10.1	15.7′	N00°03.9	14.7′	55.7′
18	90°45.1	N15°27.6	303°44.8	15.6′	S00°10.8	14.8′	55.7′
19	105°45.2	28.3	318°19.4	15.6′	00°25.6	14.8′	55.7′
20	120°45.3	29.1	332°54.0	15.6′	00°40.4	14.8′	55.8′
21	135°45.3	·· 29.8	347°28.6	15.5′	00°55.2	14.8′	55.8′
22	150°45.4	30.6	2°03.1	15.5′	01°10.0	14.8′	55.8′
23	165°45.5	31.3	16°37.6	15.5′	01°24.8	14.8′	55.8′
	SD = 15.9′	d = 0.8′	SD = 15.1′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°45.5	N15°32.1	31°12.1	15.4′	S01°39.6	14.8′	55.9′
1	195°45.6	32.8	45°46.5	15.4′	01°54.4	14.9′	55.9′
2	210°45.7	33.5	60°20.9	15.4′	02°09.3	14.8′	55.9′
3	225°45.7	·· 34.3	74°55.3	15.3′	02°24.1	14.9′	55.9′
4	240°45.8	35.0	89°29.6	15.3′	02°39.0	14.9′	56.0′
5	255°45.9	35.7	104°03.9	15.2′	02°53.9	14.8′	56.0′
6	270°45.9	N15°36.5	118°38.2	15.2′	S03°08.7	14.9′	56.0′
7	285°46.0	37.2	133°12.4	15.2′	03°23.6	14.8′	56.0′
8	300°46.1	38.0	147°46.5	15.1′	03°38.4	14.9′	56.1′
9	315°46.1	·· 38.7	162°20.6	15.1′	03°53.3	14.9′	56.1′
10	330°46.2	39.4	176°54.7	15.0′	04°08.2	14.8′	56.1′
11	345°46.3	40.2	191°28.7	15.0′	04°23.0	14.9′	56.1′
12	0°46.3	N15°40.9	206°02.7	14.9′	S04°37.9	14.8′	56.2′
13	15°46.4	41.6	220°36.6	14.9′	04°52.7	14.9′	56.2′
14	30°46.5	42.4	235°10.5	14.8′	05°07.6	14.8′	56.2′
15	45°46.5	·· 43.1	249°44.3	14.8′	05°22.4	14.9′	56.3′
16	60°46.6	43.8	264°18.1	14.7′	05°37.3	14.8′	56.3′
17	75°46.7	44.6	278°51.8	14.7′	05°52.1	14.8′	56.3′
18	90°46.7	N15°45.3	293°25.5	14.6′	S06°06.9	14.8′	56.3′
19	105°46.8	46.0	307°59.1	14.6′	06°21.7	14.8′	56.4′
20	120°46.8	46.8	322°32.6	14.5′	06°36.5	14.8′	56.4′
21	135°46.9	·· 47.5	337°06.1	14.4′	06°51.3	14.8′	56.4′
22	150°47.0	48.2	351°39.6	14.4′	07°06.1	14.7′	56.4′
23	165°47.0	49.0	6°12.9	14.3′	07°20.8	14.8′	56.5′
	SD = 15.9′	d = 0.7′	SD = 15.2′				

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

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

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 11-13 78-92%
01	02:48	02:52	11:57	21:10	08:50	
02	02:55	02:59	11:57	21:52	09:31	
03	03:02	03:05	11:57	22:34	10:13	

May 04, 05, 06 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	221°37.4	136°02.6	N25°53.7	109°00.3	N23°34.0	196°08.4	N09°25.6	243°40.4	S10°46.5
1	236°39.9	151°02.0	53.8	124°01.3	33.8	211°10.3	25.8	258°42.7	46.4
2	251°42.3	166°01.3	54.0	139°02.3	33.5	226°12.2	26.0	273°45.0	46.3
3	266°44.8	181°00.7	·· 54.1	154°03.3	·· 33.3	241°14.1	·· 26.2	288°47.3	·· 46.3
4	281°47.2	196°00.1	54.3	169°04.3	33.1	256°16.0	26.4	303°49.6	46.2
5	296°49.7	210°59.5	54.5	184°05.2	32.8	271°17.9	26.7	318°51.9	46.2
6	311°52.2	225°58.9	N25°54.6	199°06.2	N23°32.6	286°19.9	N09°26.9	333°54.2	S10°46.1
7	326°54.6	240°58.3	54.8	214°07.2	32.4	301°21.8	27.1	348°56.5	46.1
8	341°57.1	255°57.7	54.9	229°08.2	32.1	316°23.7	27.3	3°58.8	46.0
9	356°59.6	270°57.0	·· 55.1	244°09.2	·· 31.9	331°25.6	·· 27.5	19°01.1	·· 46.0
10	12°02.0	285°56.4	55.2	259°10.1	31.6	346°27.5	27.7	34°03.4	45.9
11	27°04.5	300°55.8	55.4	274°11.1	31.4	1°29.4	27.9	49°05.7	45.8
12	42°07.0	315°55.2	N25°55.5	289°12.1	N23°31.2	16°31.3	N09°28.1	64°08.0	S10°45.8
13	57°09.4	330°54.6	55.7	304°13.1	30.9	31°33.2	28.3	79°10.3	45.7
14	72°11.9	345°54.0	55.8	319°14.1	30.7	46°35.1	28.5	94°12.6	45.7
15	87°14.4	0°53.4	·· 56.0	334°15.0	·· 30.5	61°37.0	·· 28.8	109°14.9	·· 45.6
16	102°16.8	15°52.7	56.1	349°16.0	30.2	76°38.9	29.0	124°17.2	45.6
17	117°19.3	30°52.1	56.3	4°17.0	30.0	91°40.8	29.2	139°19.5	45.5
18	132°21.7	45°51.5	N25°56.4	19°18.0	N23°29.7	106°42.7	N09°29.4	154°21.8	S10°45.5
19	147°24.2	60°50.9	56.5	34°18.9	29.5	121°44.6	29.6	169°24.1	45.4
20	162°26.7	75°50.3	56.7	49°19.9	29.3	136°46.5	29.8	184°26.4	45.4
21	177°29.1	90°49.7	·· 56.8	64°20.9	·· 29.0	151°48.4	·· 30.0	199°28.7	·· 45.3
22	192°31.6	105°49.1	57.0	79°21.9	28.8	166°50.4	30.2	214°31.0	45.2
23	207°34.1	120°48.5	57.1	94°22.9	28.5	181°52.3	30.4	229°33.3	45.2
Mer.pass. 09:12		ν -0.6′ d 0.2′	m -4.13	ν 1.0′ d -0.2′	m 1.37	ν 1.9′ d 0.2′	m -2.06	ν 2.3′ d 0.1′	m 0.93

Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	222°36.5	135°47.9	N25°57.2	109°23.8	N23°28.3	196°54.2	N09°30.7	244°35.6	S10°45.1
1	237°39.0	150°47.2	57.4	124°24.8	28.1	211°56.1	30.9	259°37.9	45.1
2	252°41.5	165°46.6	57.5	139°25.8	27.8	226°58.0	31.1	274°40.2	45.0
3	267°43.9	180°46.0	·· 57.6	154°26.8	·· 27.6	241°59.9	·· 31.3	289°42.5	·· 45.0
4	282°46.4	195°45.4	57.8	169°27.7	27.3	257°01.8	31.5	304°44.8	44.9
5	297°48.9	210°44.8	57.9	184°28.7	27.1	272°03.7	31.7	319°47.1	44.9
6	312°51.3	225°44.2	N25°58.0	199°29.7	N23°26.8	287°05.6	N09°31.9	334°49.4	S10°44.8
7	327°53.8	240°43.6	58.1	214°30.7	26.6	302°07.5	32.1	349°51.7	44.8
8	342°56.2	255°43.0	58.3	229°31.7	26.4	317°09.4	32.3	4°54.0	44.7
9	357°58.7	270°42.4	·· 58.4	244°32.6	·· 26.1	332°11.3	·· 32.5	19°56.3	·· 44.6
10	13°01.2	285°41.8	58.5	259°33.6	25.9	347°13.2	32.7	34°58.6	44.6
11	28°03.6	300°41.2	58.6	274°34.6	25.6	2°15.1	33.0	50°00.9	44.5
12	43°06.1	315°40.5	N25°58.8	289°35.6	N23°25.4	17°17.0	N09°33.2	65°03.2	S10°44.5
13	58°08.6	330°39.9	58.9	304°36.5	25.1	32°19.0	33.4	80°05.5	44.4
14	73°11.0	345°39.3	59.0	319°37.5	24.9	47°20.9	33.6	95°07.8	44.4
15	88°13.5	0°38.7	·· 59.1	334°38.5	·· 24.7	62°22.8	·· 33.8	110°10.1	·· 44.3
16	103°16.0	15°38.1	59.2	349°39.5	24.4	77°24.7	34.0	125°12.4	44.3
17	118°18.4	30°37.5	59.3	4°40.5	24.2	92°26.6	34.2	140°14.7	44.2
18	133°20.9	45°36.9	N25°59.5	19°41.4	N23°23.9	107°28.5	N09°34.4	155°17.0	S10°44.2
19	148°23.3	60°36.3	59.6	34°42.4	23.7	122°30.4	34.6	170°19.3	44.1
20	163°25.8	75°35.7	59.7	49°43.4	23.4	137°32.3	34.8	185°21.6	44.1
21	178°28.3	90°35.1	·· 59.8	64°44.4	·· 23.2	152°34.2	·· 35.1	200°23.9	·· 44.0
22	193°30.7	105°34.5	25°59.9	79°45.3	22.9	167°36.1	35.3	215°26.2	43.9
23	208°33.2	120°33.9	26°00.0	94°46.3	22.7	182°38.0	35.5	230°28.5	43.9
Mer.pass. 09:08		ν -0.6′ d 0.1′	m -4.14	ν 1.0′ d -0.2′	m 1.38	ν 1.9′ d 0.2′	m -2.06	ν 2.3′ d 0.1′	m 0.92

Sat	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	223°35.7	135°33.3	N26°00.1	109°47.3	N23°22.4	197°39.9	N09°35.7	245°30.9	S10°43.8
1	238°38.1	150°32.7	00.2	124°48.3	22.2	212°41.8	35.9	260°33.2	43.8
2	253°40.6	165°32.1	00.3	139°49.3	22.0	227°43.8	36.1	275°35.5	43.7
3	268°43.1	180°31.5	·· 00.4	154°50.2	·· 21.7	242°45.7	·· 36.3	290°37.8	·· 43.7
4	283°45.5	195°30.9	00.5	169°51.2	21.5	257°47.6	36.5	305°40.1	43.6
5	298°48.0	210°30.3	00.6	184°52.2	21.2	272°49.5	36.7	320°42.4	43.6
6	313°50.5	225°29.7	N26°00.7	199°53.2	N23°21.0	287°51.4	N09°36.9	335°44.7	S10°43.5
7	328°52.9	240°29.1	00.8	214°54.1	20.7	302°53.3	37.1	350°47.0	43.5
8	343°55.4	255°28.5	00.9	229°55.1	20.5	317°55.2	37.4	5°49.3	43.4
9	358°57.8	270°27.9	·· 01.0	244°56.1	·· 20.2	332°57.1	·· 37.6	20°51.6	·· 43.4
10	14°00.3	285°27.3	01.1	259°57.1	20.0	347°59.0	37.8	35°53.9	43.3
11	29°02.8	300°26.7	01.2	274°58.0	19.7	3°00.9	38.0	50°56.2	43.3
12	44°05.2	315°26.1	N26°01.3	289°59.0	N23°19.5	18°02.8	N09°38.2	65°58.5	S10°43.2
13	59°07.7	330°25.5	01.4	305°00.0	19.2	33°04.7	38.4	81°00.8	43.1
14	74°10.2	345°24.9	01.5	320°01.0	19.0	48°06.6	38.6	96°03.1	43.1
15	89°12.6	0°24.3	·· 01.6	335°02.0	·· 18.7	63°08.6	·· 38.8	111°05.4	·· 43.0
16	104°15.1	15°23.7	01.7	350°02.9	18.5	78°10.5	39.0	126°07.7	43.0
17	119°17.6	30°23.1	01.8	5°03.9	18.2	93°12.4	39.2	141°10.1	42.9
18	134°20.0	45°22.5	N26°01.9	20°04.9	N23°18.0	108°14.3	N09°39.4	156°12.4	S10°42.9
19	149°22.5	60°21.9	02.0	35°05.9	17.7	123°16.2	39.6	171°14.7	42.8
20	164°25.0	75°21.3	02.0	50°06.8	17.5	138°18.1	39.9	186°17.0	42.8
21	179°27.4	90°20.7	·· 02.1	65°07.8	·· 17.2	153°20.0	·· 40.1	201°19.3	·· 42.7
22	194°29.9	105°20.1	02.2	80°08.8	17.0	168°21.9	40.3	216°21.6	42.7
23	209°32.3	120°19.5	02.3	95°09.8	16.7	183°23.8	40.5	231°23.9	42.6
Mer.pass. 09:04		ν -0.6′ d 0.1′	m -4.14	ν 1.0′ d -0.2′	m 1.39	ν 1.9′ d 0.2′	m -2.06	ν 2.3′ d 0.1′	m 0.92

Stars

	SHA	**Dec**
Alpheratz	357°36.5	29°12.9
Ankaa	353°08.9	-42°10.7
Schedar	349°33.2	56°39.6
Diphda	348°49.0	-17°51.6
Achernar	335°21.8	-57°07.1
Hamal	327°53.2	23°34.2
Polaris	315°12.6	89°21.7
Acamar	315°13.3	-40°12.8
Menkar	314°08.0	4°10.7
Mirfak	308°30.8	49°56.6
Aldebaran	290°41.6	16°33.3
Rigel	281°05.5	-8°10.6
Capella	280°24.4	46°01.3
Bellatrix	278°24.7	6°22.2
Elnath	278°04.0	28°37.6
Alnilam	275°39.4	-1°11.3
Betelgeuse	270°53.9	7°24.6
Canopus	263°53.4	-52°42.7
Sirius	258°27.7	-16°45.0
Adhara	255°07.2	-29°00.4
Procyon	244°52.5	5°09.9
Pollux	243°19.2	27°58.3
Avior	234°15.4	-59°35.3
Suhail	222°47.4	-43°31.8
Miaplacidus	221°38.6	-69°49.0
Alphard	217°49.1	-8°45.7
Regulus	207°35.9	11°51.2
Dubhe	193°42.4	61°37.8
Denebola	182°26.2	14°26.5
Gienah	175°44.8	-17°40.4
Acrux	173°01.2	-63°13.9
Gacrux	171°52.8	-57°14.8
Alioth	166°13.7	55°50.1
Spica	158°23.5	-11°17.0
Alkaid	152°52.7	49°11.9
Hadar	148°37.4	-60°29.2
Menkent	147°58.9	-36°29.2
Arcturus	145°48.9	19°03.6
Rigil Kent.	139°41.6	-60°55.9
Kochab	137°18.6	74°03.6
Zuben'ubi	136°57.3	-16°08.4
Alphecca	126°04.6	26°38.1
Antares	112°17.2	-26°29.0
Atria	107°12.3	-69°04.0
Sabik	102°04.1	-15°45.3
Shaula	96°12.0	-37°07.2
Rasalhague	95°59.6	12°32.4
Eltanin	90°42.5	51°28.9
Kaus Aust.	83°34.1	-34°22.4
Vega	80°33.9	38°48.0
Nunki	75°49.3	-26°16.0
Altair	62°01.2	8°55.6
Peacock	53°07.9	-56°39.4
Deneb	49°26.7	45°21.4
Enif	33°40.3	9°58.7
Al Na'ir	27°34.8	-46°50.8
Fomalhaut	15°16.3	-29°29.9
Scheat	13°46.8	28°12.3
Markab	13°31.5	15°19.6

May 04 Thu	**SHA**	**Mer.pass**
Venus	274°25.2	14:56
Mars	247°23.0	16:43
Jupiter	334°31.0	10:54
Saturn	22°03.0	07:44

May 05 Fri	**SHA**	**Mer.pass**
Venus	273°11.3	14:57
Mars	246°47.3	16:41
Jupiter	334°17.6	10:51
Saturn	21°59.0	07:40

May 06 Sat	**SHA**	**Mer.pass**
Venus	271°57.6	14:58
Mars	246°11.6	16:40
Jupiter	334°04.3	10:48
Saturn	21°55.2	07:37

Horizontal parallax	
Venus:	0.2
Mars:	0.1

h	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°47.1	N15°49.7	20°46.3	14.2′	S07°35.6	14.7′	56.5′
1	195°47.2	50.4	35°19.5	14.2′	07°50.3	14.7′	56.5′
2	210°47.2	51.1	49°52.7	14.1′	08°05.0	14.7′	56.5′
3	225°47.3	·· 51.9	64°25.8	14.1′	08°19.7	14.6′	56.6′
4	240°47.3	52.6	78°58.9	14.0′	08°34.3	14.7′	56.6′
5	255°47.4	53.3	93°31.8	13.9′	08°49.0	14.6′	56.6′
6	270°47.5	N15°54.1	108°04.7	13.8′	S09°03.6	14.6′	56.7′
7	285°47.5	54.8	122°37.6	13.8′	09°18.2	14.5′	56.7′
8	300°47.6	55.5	137°10.4	13.7′	09°32.7	14.6′	56.7′
9	315°47.6	·· 56.2	151°43.1	13.6′	09°47.3	14.5′	56.7′
10	330°47.7	57.0	166°15.7	13.6′	10°01.8	14.5′	56.8′
11	345°47.8	57.7	180°48.3	13.5′	10°16.3	14.4′	56.8′
12	0°47.8	N15°58.4	195°20.7	13.4′	S10°30.7	14.4′	56.8′
13	15°47.9	59.1	209°53.1	13.3′	10°45.1	14.4′	56.8′
14	30°47.9	15°59.8	224°25.5	13.2′	10°59.5	14.4′	56.9′
15	45°48.0	16°00.6	238°57.7	13.2′	11°13.9	14.3′	56.9′
16	60°48.1	01.3	253°29.9	13.1′	11°28.2	14.2′	56.9′
17	75°48.1	02.0	268°01.9	13.0′	11°42.4	14.3′	57.0′
18	90°48.2	N16°02.7	282°34.0	12.9′	S11°56.7	14.1′	57.0′
19	105°48.2	03.5	297°05.9	12.8′	12°10.8	14.2′	57.0′
20	120°48.3	04.2	311°37.7	12.7′	12°25.0	14.1′	57.0′
21	135°48.3	·· 04.9	326°09.5	12.7′	12°39.1	14.0′	57.1′
22	150°48.4	05.6	340°41.1	12.6′	12°53.1	14.1′	57.1′
23	165°48.5	06.3	355°12.7	12.5′	13°07.2	13.9′	57.1′
	SD = 15.9′	d = 0.7′	SD = 15.4′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°48.5	N16°07.1	9°44.2	12.4′	S13°21.1	13.9′	57.1′
1	195°48.6	07.8	24°15.6	12.3′	13°35.0	13.9′	57.2′
2	210°48.6	08.5	38°46.9	12.2′	13°48.9	13.8′	57.2′
3	225°48.7	·· 09.2	53°18.1	12.1′	14°02.7	13.8′	57.2′
4	240°48.7	09.9	67°49.2	12.0′	14°16.5	13.7′	57.3′
5	255°48.8	10.6	82°20.3	11.9′	14°30.2	13.6′	57.3′
6	270°48.8	N16°11.4	96°51.2	11.8′	S14°43.8	13.6′	57.3′
7	285°48.9	12.1	111°22.0	11.7′	14°57.4	13.5′	57.3′
8	300°48.9	12.8	125°52.8	11.6′	15°10.9	13.5′	57.4′
9	315°49.0	·· 13.5	140°23.4	11.6′	15°24.4	13.4′	57.4′
10	330°49.1	14.2	154°54.0	11.5′	15°37.8	13.3′	57.4′
11	345°49.1	14.9	169°24.4	11.4′	15°51.1	13.3′	57.4′
12	0°49.2	N16°15.6	183°54.8	11.3′	S16°04.4	13.1′	57.5′
13	15°49.2	16.3	198°25.0	11.2′	16°17.5	13.2′	57.5′
14	30°49.3	17.1	212°55.2	11.0′	16°30.7	13.0′	57.5′
15	45°49.3	·· 17.8	227°25.2	10.9′	16°43.7	13.0′	57.5′
16	60°49.4	18.5	241°55.2	10.8′	16°56.7	12.9′	57.6′
17	75°49.4	19.2	256°25.0	10.7′	17°09.6	12.8′	57.6′
18	90°49.5	N16°19.9	270°54.8	10.6′	S17°22.4	12.8′	57.6′
19	105°49.5	20.6	285°24.4	10.5′	17°35.2	12.7′	57.6′
20	120°49.6	21.3	299°53.9	10.4′	17°47.9	12.6′	57.7′
21	135°49.6	·· 22.0	314°23.4	10.3′	18°00.5	12.5′	57.7′
22	150°49.7	22.7	328°52.7	10.2′	18°13.0	12.4′	57.7′
23	165°49.7	23.4	343°21.9	10.1′	18°25.4	12.3′	57.7′
	SD = 15.9′	d = 0.7′	SD = 15.6′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°49.8	N16°24.2	357°51.0	10.0′	S18°37.7	12.3′	57.8′
1	195°49.8	24.9	12°20.0	9.9′	18°50.0	12.1′	57.8′
2	210°49.9	25.6	26°48.9	9.8′	19°02.1	12.1′	57.8′
3	225°49.9	·· 26.3	41°17.6	9.7′	19°14.2	12.0′	57.8′
4	240°50.0	27.0	55°46.3	9.6′	19°26.2	11.9′	57.9′
5	255°50.0	27.7	70°14.9	9.4′	19°38.1	11.7′	57.9′
6	270°50.1	N16°28.4	84°43.3	9.3′	S19°49.8	11.7′	57.9′
7	285°50.1	29.1	99°11.6	9.2′	20°01.5	11.6′	57.9′
8	300°50.2	29.8	113°39.9	9.1′	20°13.1	11.5′	57.9′
9	315°50.2	·· 30.5	128°08.0	9.0′	20°24.6	11.4′	58.0′
10	330°50.3	31.2	142°36.0	8.9′	20°36.0	11.2′	58.0′
11	345°50.3	31.9	157°03.9	8.8′	20°47.2	11.2′	58.0′
12	0°50.4	N16°32.6	171°31.7	8.7′	S20°58.4	11.1′	58.0′
13	15°50.4	33.3	185°59.3	8.6′	21°09.5	10.9′	58.1′
14	30°50.5	34.0	200°26.9	8.4′	21°20.4	10.8′	58.1′
15	45°50.5	·· 34.7	214°54.3	8.3′	21°31.2	10.8′	58.1′
16	60°50.6	35.4	229°21.6	8.2′	21°42.0	10.6′	58.1′
17	75°50.6	36.1	243°48.9	8.1′	21°52.6	10.4′	58.1′
18	90°50.6	N16°36.8	258°16.0	8.0′	S22°03.0	10.4′	58.2′
19	105°50.7	37.5	272°43.0	7.9′	22°13.4	10.2′	58.2′
20	120°50.7	38.2	287°09.8	7.8′	22°23.6	10.2′	58.2′
21	135°50.8	·· 38.9	301°36.6	7.7′	22°33.8	10.0′	58.2′
22	150°50.8	39.6	316°03.3	7.5′	22°43.8	9.8′	58.3′
23	165°50.9	40.3	330°29.8	7.4′	22°53.6	9.8′	58.3′
	SD = 15.9′	d = 0.7′	SD = 15.8′				

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

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

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 14-16 97-100%
04	03:08	03:11	11:57	23:20	10:57	
05	03:14	03:17	11:57	–:–	11:44	
06	03:19	03:21	11:57	00:09	12:35	

May 07, 08, 09 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	224°34.8	135°18.9	N26°02.4	110°10.7	N23°16.5	198°25.7	N09°40.7	246°26.2	S10°42.6
1	239°37.3	150°18.3	02.4	125°11.7	16.2	213°27.6	40.9	261°28.5	42.5
2	254°39.7	165°17.7	02.5	140°12.7	16.0	228°29.5	41.1	276°30.8	42.5
3	269°42.2	180°17.1	·· 02.6	155°13.7	·· 15.7	243°31.5	·· 41.3	291°33.1	·· 42.4
4	284°44.7	195°16.5	02.7	170°14.6	15.4	258°33.4	41.5	306°35.4	42.4
5	299°47.1	210°15.9	02.7	185°15.6	15.2	273°35.3	41.7	321°37.8	42.3
6	314°49.6	225°15.3	N26°02.8	200°16.6	N23°14.9	288°37.2	N09°41.9	336°40.1	S10°42.3
7	329°52.1	240°14.7	02.9	215°17.6	14.7	303°39.1	42.1	351°42.4	42.2
8	344°54.5	255°14.1	03.0	230°18.6	14.4	318°41.0	42.4	6°44.7	42.2
9	359°57.0	270°13.5	·· 03.0	245°19.5	·· 14.2	333°42.9	·· 42.6	21°47.0	·· 42.1
10	14°59.5	285°12.9	03.1	260°20.5	13.9	348°44.8	42.8	36°49.3	42.1
11	30°01.9	300°12.3	03.2	275°21.5	13.7	3°46.7	43.0	51°51.6	42.0
12	45°04.4	315°11.7	N26°03.2	290°22.5	N23°13.4	18°48.6	N09°43.2	66°53.9	S10°41.9
13	60°06.8	330°11.2	03.3	305°23.4	13.2	33°50.5	43.4	81°56.2	41.9
14	75°09.3	345°10.6	03.4	320°24.4	12.9	48°52.4	43.6	96°58.5	41.8
15	90°11.8	0°10.0	·· 03.4	335°25.4	·· 12.6	63°54.4	·· 43.8	112°00.8	·· 41.8
16	105°14.2	15°09.4	03.5	350°26.4	12.4	78°56.3	44.0	127°03.2	41.7
17	120°16.7	30°08.8	03.6	5°27.3	12.1	93°58.2	44.2	142°05.5	41.7
18	135°19.2	45°08.2	N26°03.6	20°28.3	N23°11.9	109°00.1	N09°44.4	157°07.8	S10°41.6
19	150°21.6	60°07.6	03.7	35°29.3	11.6	124°02.0	44.6	172°10.1	41.6
20	165°24.1	75°07.0	03.7	50°30.3	11.4	139°03.9	44.8	187°12.4	41.5
21	180°26.6	90°06.4	·· 03.8	65°31.2	·· 11.1	154°05.8	·· 45.1	202°14.7	·· 41.5
22	195°29.0	105°05.8	03.8	80°32.2	10.9	169°07.7	45.3	217°17.0	41.4
23	210°31.5	120°05.3	03.9	95°33.2	10.6	184°09.6	45.5	232°19.3	41.4
Mer.pass. 09:00		ν -0.6′ d 0.1′ m -4.15		ν 1.0′ d -0.3′ m 1.40		ν 1.9′ d 0.2′ m -2.06		ν 2.3′ d 0.1′ m 0.92	

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	225°33.9	135°04.7	N26°03.9	110°34.2	N23°10.3	199°11.5	N09°45.7	247°21.6	S10°41.3
1	240°36.4	150°04.1	04.0	125°35.1	10.1	214°13.4	45.9	262°24.0	41.3
2	255°38.9	165°03.5	04.1	140°36.1	09.8	229°15.4	46.1	277°26.3	41.2
3	270°41.3	180°02.9	·· 04.1	155°37.1	·· 09.6	244°17.3	·· 46.3	292°28.6	·· 41.2
4	285°43.8	195°02.3	04.2	170°38.1	09.3	259°19.2	46.5	307°30.9	41.1
5	300°46.3	210°01.7	04.2	185°39.0	09.0	274°21.1	46.7	322°33.2	41.1
6	315°48.7	225°01.1	N26°04.2	200°40.0	N23°08.8	289°23.0	N09°46.9	337°35.5	S10°41.0
7	330°51.2	240°00.6	04.3	215°41.0	08.5	304°24.9	47.1	352°37.8	41.0
8	345°53.7	255°00.0	04.3	230°42.0	08.3	319°26.8	47.3	7°40.1	40.9
9	0°56.1	269°59.4	·· 04.4	245°42.9	·· 08.0	334°28.7	·· 47.5	22°42.5	·· 40.9
10	15°58.6	284°58.8	04.4	260°43.9	07.7	349°30.6	47.7	37°44.8	40.8
11	31°01.1	299°58.2	04.5	275°44.9	07.5	4°32.5	48.0	52°47.1	40.8
12	46°03.5	314°57.6	N26°04.5	290°45.9	N23°07.2	19°34.5	N09°48.2	67°49.4	S10°40.7
13	61°06.0	329°57.0	04.5	305°46.8	07.0	34°36.4	48.4	82°51.7	40.7
14	76°08.4	344°56.5	04.6	320°47.8	06.7	49°38.3	48.6	97°54.0	40.6
15	91°10.9	359°55.9	·· 04.6	335°48.8	·· 06.4	64°40.2	·· 48.8	112°56.3	·· 40.6
16	106°13.4	14°55.3	04.6	350°49.8	06.2	79°42.1	49.0	127°58.6	40.5
17	121°15.8	29°54.7	04.7	5°50.7	05.9	94°44.0	49.2	143°01.0	40.5
18	136°18.3	44°54.1	N26°04.7	20°51.7	N23°05.7	109°45.9	N09°49.4	158°03.3	S10°40.4
19	151°20.8	59°53.6	04.7	35°52.7	05.4	124°47.8	49.6	173°05.6	40.4
20	166°23.2	74°53.0	04.8	50°53.7	05.1	139°49.7	49.8	188°07.9	40.3
21	181°25.7	89°52.4	·· 04.8	65°54.6	·· 04.9	154°51.6	·· 50.0	203°10.2	·· 40.3
22	196°28.2	104°51.8	04.8	80°55.6	04.6	169°53.6	50.2	218°12.5	40.2
23	211°30.6	119°51.2	04.9	95°56.6	04.3	184°55.5	50.4	233°14.8	40.2
Mer.pass. 08:56		ν -0.6′ d 0.1′ m -4.15		ν 1.0′ d -0.3′ m 1.41		ν 1.9′ d 0.2′ m -2.06		ν 2.3′ d 0.1′ m 0.92	

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	226°33.1	134°50.7	N26°04.9	110°57.6	N23°04.1	199°57.4	N09°50.6	248°17.2	S10°40.1
1	241°35.6	149°50.1	04.9	125°58.6	03.8	214°59.3	50.8	263°19.5	40.1
2	256°38.0	164°49.5	04.9	140°59.5	03.6	230°01.2	51.1	278°21.8	40.0
3	271°40.5	179°48.9	·· 05.0	156°00.5	·· 03.3	245°03.1	·· 51.3	293°24.1	·· 40.0
4	286°42.9	194°48.3	05.0	171°01.5	03.0	260°05.0	51.5	308°26.4	39.9
5	301°45.4	209°47.8	05.0	186°02.5	02.8	275°06.9	51.7	323°28.7	39.9
6	316°47.9	224°47.2	N26°05.0	201°03.4	N23°02.5	290°08.8	N09°51.9	338°31.0	S10°39.8
7	331°50.3	239°46.6	05.0	216°04.4	02.2	305°10.7	52.1	353°33.4	39.8
8	346°52.8	254°46.0	05.0	231°05.4	02.0	320°12.7	52.3	8°35.7	39.7
9	1°55.3	269°45.5	·· 05.1	246°06.3	·· 01.7	335°14.6	·· 52.5	23°38.0	·· 39.7
10	16°57.7	284°44.9	05.1	261°07.3	01.4	350°16.5	52.7	38°40.3	39.6
11	32°00.2	299°44.3	05.1	276°08.3	01.2	5°18.4	52.9	53°42.6	39.6
12	47°02.7	314°43.7	N26°05.1	291°09.3	N23°00.9	20°20.3	N09°53.1	68°44.9	S10°39.5
13	62°05.1	329°43.2	05.1	306°10.2	00.6	35°22.2	53.3	83°47.3	39.5
14	77°07.6	344°42.6	05.1	321°11.2	00.4	50°24.1	53.5	98°49.6	39.4
15	92°10.1	359°42.0	·· 05.1	336°12.2	23°00.1	65°26.0	·· 53.7	113°51.9	·· 39.4
16	107°12.5	14°41.4	05.1	351°13.2	22°59.8	80°27.9	53.9	128°54.2	39.3
17	122°15.0	29°40.9	05.1	6°14.1	59.6	95°29.9	54.1	143°56.5	39.3
18	137°17.4	44°40.3	N26°05.2	21°15.1	N22°59.3	110°31.8	N09°54.4	158°58.8	S10°39.2
19	152°19.9	59°39.7	05.2	36°16.1	59.0	125°33.7	54.6	174°01.2	39.2
20	167°22.4	74°39.2	05.2	51°17.1	58.8	140°35.6	54.8	189°03.5	39.1
21	182°24.8	89°38.6	·· 05.2	66°18.0	·· 58.5	155°37.5	·· 55.0	204°05.8	·· 39.1
22	197°27.3	104°38.0	05.2	81°19.0	58.2	170°39.4	55.2	219°08.1	39.1
23	212°29.8	119°37.4	05.2	96°20.0	58.0	185°41.3	55.4	234°10.4	39.0
Mer.pass. 08:52		ν -0.6′ d 0.0′ m -4.16		ν 1.0′ d -0.3′ m 1.42		ν 1.9′ d 0.2′ m -2.06		ν 2.3′ d 0.0′ m 0.92	

Stars

	SHA	**Dec**
Alpheratz	357°36.5	29°12.9
Ankaa	353°08.9	-42°10.7
Schedar	349°33.1	56°39.6
Diphda	348°49.0	-17°51.6
Achernar	335°21.8	-57°07.1
Hamal	327°53.1	23°34.2
Polaris	315°12.2	89°21.7
Acamar	315°13.3	-40°12.7
Menkar	314°08.0	4°10.7
Mirfak	308°30.8	49°56.5
Aldebaran	290°41.6	16°33.3
Rigel	281°05.5	-8°10.6
Capella	280°24.4	46°01.3
Bellatrix	278°24.7	6°22.2
Elnath	278°04.0	28°37.6
Alnilam	275°39.4	-1°11.3
Betelgeuse	270°53.9	7°24.6
Canopus	263°53.4	-52°42.7
Sirius	258°27.7	-16°45.0
Adhara	255°07.2	-29°00.4
Procyon	244°52.5	5°09.9
Pollux	243°19.2	27°58.3
Avior	234°15.5	-59°35.3
Suhail	222°47.4	-43°31.8
Miaplacidus	221°38.6	-69°49.0
Alphard	217°49.1	-8°45.7
Regulus	207°35.9	11°51.2
Dubhe	193°42.4	61°37.8
Denebola	182°26.2	14°26.5
Gienah	175°44.8	-17°40.4
Acrux	173°01.2	-63°13.9
Gacrux	171°52.8	-57°14.8
Alioth	166°13.7	55°50.1
Spica	158°23.5	-11°17.0
Alkaid	152°52.7	49°11.9
Hadar	148°37.4	-60°29.2
Menkent	147°58.9	-36°29.2
Arcturus	145°48.9	19°03.6
Rigil Kent.	139°41.6	-60°55.9
Kochab	137°18.6	74°03.6
Zuben'ubi	136°57.3	-16°08.4
Alphecca	126°04.6	26°38.1
Antares	112°17.2	-26°29.0
Atria	107°12.2	-69°04.0
Sabik	102°04.1	-15°45.3
Shaula	96°12.0	-37°07.2
Rasalhague	95°59.6	12°32.4
Eltanin	90°42.4	51°28.9
Kaus Aust.	83°34.1	-34°22.4
Vega	80°33.9	38°48.0
Nunki	75°49.3	-26°16.0
Altair	62°01.2	8°55.6
Peacock	53°07.8	-56°39.4
Deneb	49°26.7	45°21.4
Enif	33°40.2	9°58.7
Al Na'ir	27°34.8	-46°50.8
Fomalhaut	15°16.2	-29°29.9
Scheat	13°46.7	28°12.3
Markab	13°31.5	15°19.6

May 07 Sun	**SHA**	**Mer.pass**
Venus	270°44.1	14:59
Mars	245°35.9	16:38
Jupiter	333°50.9	10:45
Saturn	21°51.4	07:33

May 08 Mon	**SHA**	**Mer.pass**
Venus	269°30.7	15:00
Mars	245°00.2	16:37
Jupiter	333°37.6	10:42
Saturn	21°47.7	07:29

May 09 Tue	**SHA**	**Mer.pass**
Venus	268°17.6	15:01
Mars	244°24.5	16:35
Jupiter	333°24.3	10:39
Saturn	21°44.1	07:26

Horizontal parallax	
Venus:	0.2
Mars:	0.1

h	Sun		Moon				
Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°50.9	N16°41.0	344°56.3	7.3′	S23°03.4	9.6′	58.3′
1	195°51.0	41.7	359°22.6	7.2′	23°13.0	9.4′	58.3′
2	210°51.0	42.4	13°48.8	7.1′	23°22.4	9.4′	58.3′
3	225°51.1	·· 43.1	28°14.9	7.0′	23°31.8	9.2′	58.4′
4	240°51.1	43.8	42°40.9	6.9′	23°41.0	9.1′	58.4′
5	255°51.1	44.5	57°06.8	6.8′	23°50.1	8.9′	58.4′
6	270°51.2	N16°45.1	71°32.6	6.7′	S23°59.0	8.8′	58.4′
7	285°51.2	45.8	85°58.3	6.6′	24°07.8	8.6′	58.4′
8	300°51.3	46.5	100°23.8	6.5′	24°16.4	8.5′	58.5′
9	315°51.3	·· 47.2	114°49.3	6.4′	24°24.9	8.4′	58.5′
10	330°51.3	47.9	129°14.7	6.3′	24°33.3	8.2′	58.5′
11	345°51.4	48.6	143°39.9	6.2′	24°41.5	8.1′	58.5′
12	0°51.4	N16°49.3	158°05.1	6.1′	S24°49.6	7.9′	58.5′
13	15°51.5	50.0	172°30.1	6.0′	24°57.5	7.7′	58.5′
14	30°51.5	50.7	186°55.1	5.9′	25°05.2	7.7′	58.6′
15	45°51.6	·· 51.4	201°20.0	5.8′	25°12.9	7.4′	58.6′
16	60°51.6	52.0	215°44.7	5.7′	25°20.3	7.3′	58.6′
17	75°51.6	52.7	230°09.4	5.6′	25°27.6	7.1′	58.6′
18	90°51.7	N16°53.4	244°33.9	5.5′	S25°34.7	7.0′	58.6′
19	105°51.7	54.1	258°58.4	5.4′	25°41.7	6.8′	58.6′
20	120°51.8	54.8	273°22.8	5.3′	25°48.5	6.7′	58.7′
21	135°51.8	·· 55.5	287°47.1	5.2′	25°55.2	6.5′	58.7′
22	150°51.8	56.2	302°11.3	5.1′	26°01.7	6.3′	58.7′
23	165°51.9	56.8	316°35.4	5.0′	26°08.0	6.2′	58.7′
	SD = 15.8′	d = 0.7′	SD = 15.9′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°51.9	N16°57.5	330°59.4	4.9′	S26°14.2	6.0′	58.7′
1	195°51.9	58.2	345°23.4	4.9′	26°20.2	5.8′	58.7′
2	210°52.0	58.9	359°47.2	4.8′	26°26.0	5.6′	58.8′
3	225°52.0	16°59.6	14°11.0	4.7′	26°31.6	5.5′	58.8′
4	240°52.1	17°00.3	28°34.7	4.6′	26°37.1	5.3′	58.8′
5	255°52.1	00.9	42°58.3	4.5′	26°42.4	5.1′	58.8′
6	270°52.1	N17°01.6	57°21.9	4.5′	S26°47.5	5.0′	58.8′
7	285°52.2	02.3	71°45.3	4.4′	26°52.5	4.8′	58.8′
8	300°52.2	03.0	86°08.7	4.3′	26°57.3	4.6′	58.8′
9	315°52.2	·· 03.7	100°32.0	4.3′	27°01.9	4.4′	58.9′
10	330°52.3	04.3	114°55.3	4.2′	27°06.3	4.2′	58.9′
11	345°52.3	05.0	129°18.5	4.1′	27°10.5	4.1′	58.9′
12	0°52.4	N17°05.7	143°41.6	4.1′	S27°14.6	3.9′	58.9′
13	15°52.4	06.4	158°04.7	4.0′	27°18.5	3.7′	58.9′
14	30°52.4	07.1	172°27.7	4.0′	27°22.2	3.5′	58.9′
15	45°52.5	·· 07.7	186°50.7	3.9′	27°25.7	3.3′	58.9′
16	60°52.5	08.4	201°13.6	3.8′	27°29.0	3.1′	58.9′
17	75°52.5	09.1	215°36.4	3.8′	27°32.1	3.0′	59.0′
18	90°52.6	N17°09.8	229°59.2	3.7′	S27°35.1	2.8′	59.0′
19	105°52.6	10.4	244°22.0	3.7′	27°37.9	2.5′	59.0′
20	120°52.6	11.1	258°44.7	3.7′	27°40.4	2.4′	59.0′
21	135°52.7	·· 11.8	273°07.3	3.6′	27°42.8	2.2′	59.0′
22	150°52.7	12.5	287°29.9	3.6′	27°45.0	2.1′	59.0′
23	165°52.7	13.1	301°52.5	3.6′	27°47.1	1.8′	59.0′
	SD = 15.8′	d = 0.7′	SD = 16.0′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°52.8	N17°13.8	316°15.1	3.5′	S27°48.9	1.6′	59.0′
1	195°52.8	14.5	330°37.6	3.5′	27°50.5	1.4′	59.0′
2	210°52.8	15.1	345°00.1	3.5′	27°51.9	1.3′	59.1′
3	225°52.9	·· 15.8	359°22.5	3.4′	27°53.2	1.0′	59.1′
4	240°52.9	16.5	13°45.0	3.4′	27°54.2	0.9′	59.1′
5	255°52.9	17.2	28°07.4	3.4′	27°55.1	0.7′	59.1′
6	270°52.9	N17°17.8	42°29.8	3.4′	S27°55.8	0.4′	59.1′
7	285°53.0	18.5	56°52.2	3.4′	27°56.2	0.3′	59.1′
8	300°53.0	19.2	71°14.5	3.4′	27°56.5	0.1′	59.1′
9	315°53.0	·· 19.8	85°36.9	3.3′	27°56.6	0.1′	59.1′
10	330°53.1	20.5	99°59.2	3.3′	27°56.5	0.3′	59.1′
11	345°53.1	21.2	114°21.6	3.3′	27°56.2	0.5′	59.1′
12	0°53.1	N17°21.8	128°43.9	3.3′	S27°55.7	0.7′	59.1′
13	15°53.2	22.5	143°06.3	3.3′	27°55.0	0.9′	59.2′
14	30°53.2	23.2	157°28.6	3.3′	27°54.1	1.0′	59.2′
15	45°53.2	·· 23.8	171°50.9	3.4′	27°53.1	1.3′	59.2′
16	60°53.2	24.5	186°13.3	3.4′	27°51.8	1.5′	59.2′
17	75°53.3	25.2	200°35.7	3.4′	27°50.3	1.6′	59.2′
18	90°53.3	N17°25.8	214°58.0	3.4′	S27°48.7	1.9′	59.2′
19	105°53.3	26.5	229°20.4	3.4′	27°46.8	2.0′	59.2′
20	120°53.4	27.1	243°42.8	3.4′	27°44.8	2.3′	59.2′
21	135°53.4	·· 27.8	258°05.3	3.5′	27°42.5	2.4′	59.2′
22	150°53.4	28.5	272°27.7	3.5′	27°40.1	2.6′	59.2′
23	165°53.4	29.1	286°50.2	3.5′	27°37.5	2.8′	59.2′
	SD = 15.8′	d = 0.7′	SD = 16.1′				

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

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

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 17-19 98-87%
07	03:24	03:26	11:57	01:03	13:31	
08	03:28	03:29	11:57	02:01	14:31	
09	03:31	03:33	11:56	03:03	15:34	

May 10, 11, 12 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	227°32.2	134°36.9	N26°05.2	111°21.0	N22°57.7	200°43.2	N09°55.6	249°12.7	S10°39.0
1	242°34.7	149°36.3	05.2	126°21.9	57.4	215°45.1	55.8	264°15.1	38.9
2	257°37.2	164°35.7	05.2	141°22.9	57.2	230°47.1	56.0	279°17.4	38.9
3	272°39.6	179°35.2	·· 05.2	156°23.9	·· 56.9	245°49.0	·· 56.2	294°19.7	·· 38.8
4	287°42.1	194°34.6	05.1	171°24.9	56.6	260°50.9	56.4	309°22.0	38.8
5	302°44.6	209°34.0	05.1	186°25.8	56.4	275°52.8	56.6	324°24.3	38.7
6	317°47.0	224°33.5	N26°05.1	201°26.8	N22°56.1	290°54.7	N09°56.8	339°26.7	S10°38.7
7	332°49.5	239°32.9	05.1	216°27.8	55.8	305°56.6	57.0	354°29.0	38.6
8	347°51.9	254°32.3	05.1	231°28.8	55.5	320°58.5	57.2	9°31.3	38.6
9	2°54.4	269°31.8	·· 05.1	246°29.7	·· 55.3	336°00.4	·· 57.4	24°33.6	·· 38.5
10	17°56.9	284°31.2	05.1	261°30.7	55.0	351°02.3	57.6	39°35.9	38.5
11	32°59.3	299°30.6	05.1	276°31.7	54.7	6°04.3	57.8	54°38.2	38.4
12	48°01.8	314°30.1	N26°05.1	291°32.7	N22°54.5	21°06.2	N09°58.0	69°40.6	S10°38.4
13	63°04.3	329°29.5	05.0	306°33.6	54.2	36°08.1	58.3	84°42.9	38.3
14	78°06.7	344°28.9	05.0	321°34.6	53.9	51°10.0	58.5	99°45.2	38.3
15	93°09.2	359°28.4	·· 05.0	336°35.6	·· 53.6	66°11.9	·· 58.7	114°47.5	·· 38.2
16	108°11.7	14°27.8	05.0	351°36.6	53.4	81°13.8	58.9	129°49.8	38.2
17	123°14.1	29°27.3	05.0	6°37.5	53.1	96°15.7	59.1	144°52.2	38.1
18	138°16.6	44°26.7	N26°04.9	21°38.5	N22°52.8	111°17.6	N09°59.3	159°54.5	S10°38.1
19	153°19.1	59°26.1	04.9	36°39.5	52.5	126°19.6	59.5	174°56.8	38.0
20	168°21.5	74°25.6	04.9	51°40.5	52.3	141°21.5	59.7	189°59.1	38.0
21	183°24.0	89°25.0	·· 04.9	66°41.4	·· 52.0	156°23.4	09°59.9	205°01.4	·· 38.0
22	198°26.4	104°24.4	04.8	81°42.4	51.7	171°25.3	10°00.1	220°03.8	37.9
23	213°28.9	119°23.9	04.8	96°43.4	51.5	186°27.2	00.3	235°06.1	37.9
Mer.pass. 08:48		ν -0.6′ d -0.0′ m -4.17		ν 1.0′ d -0.3′ m 1.43		ν 1.9′ d 0.2′ m -2.07		ν 2.3′ d 0.0′ m 0.92	

Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	228°31.4	134°23.3	N26°04.8	111°44.3	N22°51.2	201°29.1	N10°00.5	250°08.4	S10°37.8
1	243°33.8	149°22.8	04.8	126°45.3	50.9	216°31.0	00.7	265°10.7	37.8
2	258°36.3	164°22.2	04.7	141°46.3	50.6	231°32.9	00.9	280°13.1	37.7
3	273°38.8	179°21.7	·· 04.7	156°47.3	·· 50.4	246°34.8	·· 01.1	295°15.4	·· 37.7
4	288°41.2	194°21.1	04.7	171°48.2	50.1	261°36.8	01.3	310°17.7	37.6
5	303°43.7	209°20.5	04.6	186°49.2	49.8	276°38.7	01.5	325°20.0	37.6
6	318°46.2	224°20.0	N26°04.6	201°50.2	N22°49.5	291°40.6	N10°01.7	340°22.3	S10°37.5
7	333°48.6	239°19.4	04.6	216°51.2	49.2	306°42.5	01.9	355°24.7	37.5
8	348°51.1	254°18.9	04.5	231°52.1	49.0	321°44.4	02.1	10°27.0	37.4
9	3°53.6	269°18.3	·· 04.5	246°53.1	·· 48.7	336°46.3	·· 02.3	25°29.3	·· 37.4
10	18°56.0	284°17.8	04.5	261°54.1	48.4	351°48.2	02.5	40°31.6	37.3
11	33°58.5	299°17.2	04.4	276°55.1	48.1	6°50.2	02.8	55°33.9	37.3
12	49°00.9	314°16.7	N26°04.4	291°56.0	N22°47.9	21°52.1	N10°03.0	70°36.3	S10°37.3
13	64°03.4	329°16.1	04.3	306°57.0	47.6	36°54.0	03.2	85°38.6	37.2
14	79°05.9	344°15.5	04.3	321°58.0	47.3	51°55.9	03.4	100°40.9	37.2
15	94°08.3	359°15.0	·· 04.2	336°59.0	·· 47.0	66°57.8	·· 03.6	115°43.2	·· 37.1
16	109°10.8	14°14.4	04.2	351°59.9	46.8	81°59.7	03.8	130°45.6	37.1
17	124°13.3	29°13.9	04.1	7°00.9	46.5	97°01.6	04.0	145°47.9	37.0
18	139°15.7	44°13.3	N26°04.1	22°01.9	N22°46.2	112°03.5	N10°04.2	160°50.2	S10°37.0
19	154°18.2	59°12.8	04.0	37°02.8	45.9	127°05.5	04.4	175°52.5	36.9
20	169°20.7	74°12.2	04.0	52°03.8	45.6	142°07.4	04.6	190°54.9	36.9
21	184°23.1	89°11.7	·· 03.9	67°04.8	·· 45.4	157°09.3	·· 04.8	205°57.2	·· 36.8
22	199°25.6	104°11.1	03.9	82°05.8	45.1	172°11.2	05.0	220°59.5	36.8
23	214°28.0	119°10.6	03.8	97°06.7	44.8	187°13.1	05.2	236°01.8	36.7
Mer.pass. 08:44		ν -0.6′ d -0.0′ m -4.17		ν 1.0′ d -0.3′ m 1.43		ν 1.9′ d 0.2′ m -2.07		ν 2.3′ d 0.0′ m 0.91	

Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	229°30.5	134°10.0	N26°03.8	112°07.7	N22°44.5	202°15.0	N10°05.4	251°04.2	S10°36.7
1	244°33.0	149°09.5	03.7	127°08.7	44.2	217°16.9	05.6	266°06.5	36.7
2	259°35.4	164°08.9	03.7	142°09.7	44.0	232°18.8	05.8	281°08.8	36.6
3	274°37.9	179°08.4	·· 03.6	157°10.6	·· 43.7	247°20.8	·· 06.0	296°11.1	·· 36.6
4	289°40.4	194°07.9	03.6	172°11.6	43.4	262°22.7	06.2	311°13.5	36.5
5	304°42.8	209°07.3	03.5	187°12.6	43.1	277°24.6	06.4	326°15.8	36.5
6	319°45.3	224°06.8	N26°03.4	202°13.6	N22°42.8	292°26.5	N10°06.6	341°18.1	S10°36.4
7	334°47.8	239°06.2	03.4	217°14.5	42.6	307°28.4	06.8	356°20.4	36.4
8	349°50.2	254°05.7	03.3	232°15.5	42.3	322°30.3	07.0	11°22.8	36.3
9	4°52.7	269°05.1	·· 03.2	247°16.5	·· 42.0	337°32.2	·· 07.2	26°25.1	·· 36.3
10	19°55.2	284°04.6	03.2	262°17.4	41.7	352°34.2	07.4	41°27.4	36.2
11	34°57.6	299°04.0	03.1	277°18.4	41.4	7°36.1	07.6	56°29.7	36.2
12	50°00.1	314°03.5	N26°03.0	292°19.4	N22°41.1	22°38.0	N10°07.8	71°32.1	S10°36.2
13	65°02.5	329°03.0	03.0	307°20.4	40.9	37°39.9	08.0	86°34.4	36.1
14	80°05.0	344°02.4	02.9	322°21.3	40.6	52°41.8	08.2	101°36.7	36.1
15	95°07.5	359°01.9	·· 02.8	337°22.3	·· 40.3	67°43.7	·· 08.4	116°39.0	·· 36.0
16	110°09.9	14°01.3	02.8	352°23.3	40.0	82°45.6	08.6	131°41.4	36.0
17	125°12.4	29°00.8	02.7	7°24.3	39.7	97°47.6	08.9	146°43.7	35.9
18	140°14.9	44°00.3	N26°02.6	22°25.2	N22°39.4	112°49.5	N10°09.1	161°46.0	S10°35.9
19	155°17.3	58°59.7	02.5	37°26.2	39.2	127°51.4	09.3	176°48.3	35.8
20	170°19.8	73°59.2	02.5	52°27.2	38.9	142°53.3	09.5	191°50.7	35.8
21	185°22.3	88°58.6	·· 02.4	67°28.2	·· 38.6	157°55.2	·· 09.7	206°53.0	·· 35.8
22	200°24.7	103°58.1	02.3	82°29.1	38.3	172°57.1	09.9	221°55.3	35.7
23	215°27.2	118°57.6	02.2	97°30.1	38.0	187°59.0	10.1	236°57.7	35.7
Mer.pass. 08:41		ν -0.5′ d -0.1′ m -4.18		ν 1.0′ d -0.3′ m 1.44		ν 1.9′ d 0.2′ m -2.07		ν 2.3′ d 0.0′ m 0.91	

Stars

	SHA	**Dec**
Alpheratz	357°36.5	29°12.9
Ankaa	353°08.8	-42°10.7
Schedar	349°33.1	56°39.6
Diphda	348°49.0	-17°51.6
Achernar	335°21.8	-57°07.1
Hamal	327°53.1	23°34.2
Polaris	315°11.8	89°21.7
Acamar	315°13.3	-40°12.7
Menkar	314°07.9	4°10.8
Mirfak	308°30.8	49°56.5
Aldebaran	290°41.6	16°33.3
Rigel	281°05.5	-8°10.6
Capella	280°24.4	46°01.3
Bellatrix	278°24.7	6°22.2
Elnath	278°04.0	28°37.6
Alnilam	275°39.4	-1°11.3
Betelgeuse	270°53.9	7°24.6
Canopus	263°53.4	-52°42.7
Sirius	258°27.7	-16°45.0
Adhara	255°07.2	-29°00.4
Procyon	244°52.5	5°09.9
Pollux	243°19.2	27°58.3
Avior	234°15.5	-59°35.3
Suhail	222°47.4	-43°31.8
Miaplacidus	221°38.6	-69°49.0
Alphard	217°49.1	-8°45.7
Regulus	207°35.9	11°51.2
Dubhe	193°42.4	61°37.8
Denebola	182°26.2	14°26.5
Gienah	175°44.8	-17°40.4
Acrux	173°01.2	-63°13.9
Gacrux	171°52.8	-57°14.8
Alioth	166°13.7	55°50.2
Spica	158°23.5	-11°17.1
Alkaid	152°52.7	49°11.9
Hadar	148°37.4	-60°29.2
Menkent	147°58.9	-36°29.2
Arcturus	145°48.9	19°03.6
Rigil Kent.	139°41.6	-60°56.0
Kochab	137°18.6	74°03.6
Zuben'ubi	136°57.2	-16°08.4
Alphecca	126°04.6	26°38.1
Antares	112°17.2	-26°29.0
Atria	107°12.2	-69°04.0
Sabik	102°04.1	-15°45.3
Shaula	96°11.9	-37°07.2
Rasalhague	95°59.6	12°32.4
Eltanin	90°42.4	51°28.9
Kaus Aust.	83°34.1	-34°22.4
Vega	80°33.9	38°48.0
Nunki	75°49.3	-26°16.0
Altair	62°01.2	8°55.6
Peacock	53°07.8	-56°39.4
Deneb	49°26.7	45°21.5
Enif	33°40.2	9°58.7
Al Na'ir	27°34.8	-46°50.8
Fomalhaut	15°16.2	-29°29.9
Scheat	13°46.7	28°12.3
Markab	13°31.4	15°19.6

May 10 Wed	**SHA**	**Mer.pass**
Venus	267°04.6	15:02
Mars	243°48.7	16:34
Jupiter	333°11.0	10:36
Saturn	21°40.5	07:22

May 11 Thu	**SHA**	**Mer.pass**
Venus	265°52.0	15:03
Mars	243°13.0	16:32
Jupiter	332°57.7	10:33
Saturn	21°37.0	07:18

May 12 Fri	**SHA**	**Mer.pass**
Venus	264°39.5	15:04
Mars	242°37.2	16:30
Jupiter	332°44.5	10:30
Saturn	21°33.6	07:15

Horizontal parallax	
Venus:	0.2
Mars:	0.1

h	Sun		Moon				
Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°53.5	N17°29.8	301°12.7	3.5′	S27°34.7	3.0′	59.2′
1	195°53.5	30.4	315°35.2	3.6′	27°31.7	3.2′	59.2′
2	210°53.5	31.1	329°57.8	3.6′	27°28.5	3.4′	59.2′
3	225°53.5	·· 31.8	344°20.4	3.6′	27°25.1	3.6′	59.2′
4	240°53.6	32.4	358°43.1	3.7′	27°21.5	3.7′	59.2′
5	255°53.6	33.1	13°05.8	3.7′	27°17.8	4.0′	59.2′
6	270°53.6	N17°33.7	27°28.5	3.8′	S27°13.8	4.1′	59.3′
7	285°53.6	34.4	41°51.3	3.8′	27°09.7	4.3′	59.3′
8	300°53.7	35.1	56°14.1	3.9′	27°05.4	4.5′	59.3′
9	315°53.7	·· 35.7	70°37.0	3.9′	27°00.9	4.7′	59.3′
10	330°53.7	36.4	84°59.9	4.0′	26°56.2	4.9′	59.3′
11	345°53.7	37.0	99°22.9	4.0′	26°51.3	5.0′	59.3′
12	0°53.8	N17°37.7	113°45.9	4.1′	S26°46.3	5.3′	59.3′
13	15°53.8	38.3	128°09.0	4.2′	26°41.0	5.4′	59.3′
14	30°53.8	39.0	142°32.1	4.2′	26°35.6	5.6′	59.3′
15	45°53.8	·· 39.6	156°55.3	4.3′	26°30.0	5.8′	59.3′
16	60°53.8	40.3	171°18.6	4.3′	26°24.2	5.9′	59.3′
17	75°53.9	40.9	185°42.0	4.4′	26°18.3	6.2′	59.3′
18	90°53.9	N17°41.6	200°05.4	4.5′	S26°12.1	6.3′	59.3′
19	105°53.9	42.2	214°28.8	4.5′	26°05.8	6.5′	59.3′
20	120°53.9	42.9	228°52.4	4.6′	25°59.3	6.6′	59.3′
21	135°54.0	·· 43.5	243°16.0	4.7′	25°52.7	6.8′	59.3′
22	150°54.0	44.2	257°39.7	4.8′	25°45.9	7.0′	59.3′
23	165°54.0	44.8	272°03.5	4.8′	25°38.9	7.2′	59.3′
	SD = 15.8′	d = 0.7′	SD = 16.2′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°54.0	N17°45.5	286°27.3	4.9′	S25°31.7	7.3′	59.3′
1	195°54.0	46.1	300°51.3	5.0′	25°24.4	7.6′	59.3′
2	210°54.1	46.8	315°15.3	5.1′	25°16.8	7.6′	59.3′
3	225°54.1	·· 47.4	329°39.3	5.2′	25°09.2	7.9′	59.3′
4	240°54.1	48.1	344°03.5	5.3′	25°01.3	8.0′	59.3′
5	255°54.1	48.7	358°27.8	5.3′	24°53.3	8.1′	59.3′
6	270°54.1	N17°49.4	12°52.1	5.4′	S24°45.2	8.3′	59.3′
7	285°54.2	50.0	27°16.5	5.5′	24°36.9	8.5′	59.3′
8	300°54.2	50.6	41°41.0	5.6′	24°28.4	8.6′	59.3′
9	315°54.2	·· 51.3	56°05.6	5.7′	24°19.8	8.8′	59.3′
10	330°54.2	51.9	70°30.3	5.8′	24°11.0	9.0′	59.3′
11	345°54.2	52.6	84°55.1	5.9′	24°02.0	9.1′	59.3′
12	0°54.2	N17°53.2	99°20.0	6.0′	S23°52.9	9.2′	59.3′
13	15°54.3	53.9	113°44.9	6.1′	23°43.7	9.4′	59.3′
14	30°54.3	54.5	128°10.0	6.1′	23°34.3	9.6′	59.3′
15	45°54.3	·· 55.1	142°35.1	6.2′	23°24.7	9.6′	59.3′
16	60°54.3	55.8	157°00.4	6.3′	23°15.1	9.9′	59.3′
17	75°54.3	56.4	171°25.7	6.4′	23°05.2	10.0′	59.3′
18	90°54.3	N17°57.1	185°51.1	6.5′	S22°55.2	10.1′	59.3′
19	105°54.4	57.7	200°16.7	6.6′	22°45.1	10.2′	59.3′
20	120°54.4	58.3	214°42.3	6.7′	22°34.9	10.5′	59.3′
21	135°54.4	·· 59.0	229°08.0	6.8′	22°24.4	10.5′	59.3′
22	150°54.4	17°59.6	243°33.8	6.9′	22°13.9	10.7′	59.3′
23	165°54.4	18°00.2	257°59.7	7.0′	22°03.2	10.8′	59.3′
	SD = 15.8′	d = 0.6′	SD = 16.2′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°54.4	N18°00.9	272°25.7	7.1′	S21°52.4	10.9′	59.3′
1	195°54.4	01.5	286°51.8	7.2′	21°41.5	11.1′	59.3′
2	210°54.5	02.1	301°18.0	7.3′	21°30.4	11.2′	59.3′
3	225°54.5	·· 02.8	315°44.3	7.4′	21°19.2	11.3′	59.3′
4	240°54.5	03.4	330°10.7	7.5′	21°07.9	11.5′	59.3′
5	255°54.5	04.0	344°37.2	7.6′	20°56.4	11.5′	59.3′
6	270°54.5	N18°04.7	359°03.8	7.7′	S20°44.9	11.7′	59.3′
7	285°54.5	05.3	13°30.5	7.8′	20°33.2	11.8′	59.2′
8	300°54.5	05.9	27°57.2	7.9′	20°21.4	12.0′	59.2′
9	315°54.5	·· 06.6	42°24.1	8.0′	20°09.4	12.0′	59.2′
10	330°54.6	07.2	56°51.1	8.1′	19°57.4	12.2′	59.2′
11	345°54.6	07.8	71°18.1	8.2′	19°45.2	12.3′	59.2′
12	0°54.6	N18°08.5	85°45.3	8.3′	S19°32.9	12.4′	59.2′
13	15°54.6	09.1	100°12.6	8.4′	19°20.5	12.5′	59.2′
14	30°54.6	09.7	114°39.9	8.5′	19°08.0	12.6′	59.2′
15	45°54.6	·· 10.3	129°07.4	8.5′	18°55.4	12.7′	59.2′
16	60°54.6	11.0	143°34.9	8.6′	18°42.7	12.8′	59.2′
17	75°54.6	11.6	158°02.6	8.7′	18°29.9	13.0′	59.2′
18	90°54.6	N18°12.2	172°30.3	8.8′	S18°16.9	13.0′	59.2′
19	105°54.6	12.9	186°58.1	8.9′	18°03.9	13.1′	59.2′
20	120°54.7	13.5	201°26.0	9.0′	17°50.8	13.2′	59.2′
21	135°54.7	·· 14.1	215°54.0	9.1′	17°37.6	13.4′	59.2′
22	150°54.7	14.7	230°22.1	9.2′	17°24.2	13.4′	59.2′
23	165°54.7	15.4	244°50.3	9.3′	17°10.8	13.5′	59.2′
	SD = 15.8′	d = 0.6′	SD = 16.2′				

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

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

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 20-22 78-57%
10	03:34	03:35	11:56	04:05	16:36	
11	03:36	03:37	11:56	05:06	17:36	
12	03:38	03:38	11:56	06:04	18:31	

May 13, 14, 15 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	230°29.7	133°57.0	N26°02.1	112°31.1	N22°37.7	203°01.0	N10°10.3	252°00.0	S10°35.6
1	245°32.1	148°56.5	02.1	127°32.0	37.4	218°02.9	10.5	267°02.3	35.6
2	260°34.6	163°56.0	02.0	142°33.0	37.2	233°04.8	10.7	282°04.6	35.5
3	275°37.0	178°55.4	·· 01.9	157°34.0	·· 36.9	248°06.7	·· 10.9	297°07.0	·· 35.5
4	290°39.5	193°54.9	01.8	172°35.0	36.6	263°08.6	11.1	312°09.3	35.4
5	305°42.0	208°54.4	01.7	187°35.9	36.3	278°10.5	11.3	327°11.6	35.4
6	320°44.4	223°53.8	N26°01.6	202°36.9	N22°36.0	293°12.4	N10°11.5	342°13.9	S10°35.4
7	335°46.9	238°53.3	01.5	217°37.9	35.7	308°14.4	11.7	357°16.3	35.3
8	350°49.4	253°52.8	01.4	232°38.9	35.4	323°16.3	11.9	12°18.6	35.3
9	5°51.8	268°52.2	·· 01.4	247°39.8	·· 35.2	338°18.2	·· 12.1	27°20.9	·· 35.2
10	20°54.3	283°51.7	01.3	262°40.8	34.9	353°20.1	12.3	42°23.3	35.2
11	35°56.8	298°51.2	01.2	277°41.8	34.6	8°22.0	12.5	57°25.6	35.1
12	50°59.2	313°50.6	N26°01.1	292°42.7	N22°34.3	23°23.9	N10°12.7	72°27.9	S10°35.1
13	66°01.7	328°50.1	01.0	307°43.7	34.0	38°25.8	12.9	87°30.3	35.0
14	81°04.1	343°49.6	00.9	322°44.7	33.7	53°27.8	13.1	102°32.6	35.0
15	96°06.6	358°49.1	·· 00.8	337°45.7	·· 33.4	68°29.7	·· 13.3	117°34.9	·· 35.0
16	111°09.1	13°48.5	00.7	352°46.6	33.1	83°31.6	13.5	132°37.2	34.9
17	126°11.5	28°48.0	00.6	7°47.6	32.8	98°33.5	13.7	147°39.6	34.9
18	141°14.0	43°47.5	N26°00.5	22°48.6	N22°32.6	113°35.4	N10°13.9	162°41.9	S10°34.8
19	156°16.5	58°47.0	00.4	37°49.6	32.3	128°37.3	14.1	177°44.2	34.8
20	171°18.9	73°46.4	00.3	52°50.5	32.0	143°39.3	14.3	192°46.6	34.7
21	186°21.4	88°45.9	·· 00.2	67°51.5	·· 31.7	158°41.2	·· 14.5	207°48.9	·· 34.7
22	201°23.9	103°45.4	00.1	82°52.5	31.4	173°43.1	14.7	222°51.2	34.7
23	216°26.3	118°44.9	00.0	97°53.4	31.1	188°45.0	14.9	237°53.6	34.6
Mer.pass. 08:37		ν -0.5′ d -0.1′ m -4.19		ν 1.0′ d -0.3′ m 1.45		ν 1.9′ d 0.2′ m -2.07		ν 2.3′ d 0.0′ m 0.91	

Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	231°28.8	133°44.3	N25°59.9	112°54.4	N22°30.8	203°46.9	N10°15.1	252°55.9	S10°34.6
1	246°31.3	148°43.8	59.7	127°55.4	30.5	218°48.8	15.3	267°58.2	34.5
2	261°33.7	163°43.3	59.6	142°56.4	30.2	233°50.7	15.5	283°00.6	34.5
3	276°36.2	178°42.8	·· 59.5	157°57.3	·· 29.9	248°52.7	·· 15.7	298°02.9	·· 34.4
4	291°38.6	193°42.2	59.4	172°58.3	29.6	263°54.6	15.9	313°05.2	34.4
5	306°41.1	208°41.7	59.3	187°59.3	29.4	278°56.5	16.1	328°07.5	34.4
6	321°43.6	223°41.2	N25°59.2	203°00.3	N22°29.1	293°58.4	N10°16.3	343°09.9	S10°34.3
7	336°46.0	238°40.7	59.1	218°01.2	28.8	309°00.3	16.5	358°12.2	34.3
8	351°48.5	253°40.2	58.9	233°02.2	28.5	324°02.2	16.7	13°14.5	34.2
9	6°51.0	268°39.6	·· 58.8	248°03.2	·· 28.2	339°04.2	·· 16.9	28°16.9	·· 34.2
10	21°53.4	283°39.1	58.7	263°04.1	27.9	354°06.1	17.1	43°19.2	34.1
11	36°55.9	298°38.6	58.6	278°05.1	27.6	9°08.0	17.3	58°21.5	34.1
12	51°58.4	313°38.1	N25°58.5	293°06.1	N22°27.3	24°09.9	N10°17.5	73°23.9	S10°34.1
13	67°00.8	328°37.6	58.3	308°07.1	27.0	39°11.8	17.7	88°26.2	34.0
14	82°03.3	343°37.1	58.2	323°08.0	26.7	54°13.7	17.9	103°28.5	34.0
15	97°05.8	358°36.5	·· 58.1	338°09.0	·· 26.4	69°15.7	·· 18.1	118°30.9	·· 33.9
16	112°08.2	13°36.0	58.0	353°10.0	26.1	84°17.6	18.3	133°33.2	33.9
17	127°10.7	28°35.5	57.9	8°10.9	25.8	99°19.5	18.5	148°35.5	33.9
18	142°13.1	43°35.0	N25°57.7	23°11.9	N22°25.5	114°21.4	N10°18.7	163°37.9	S10°33.8
19	157°15.6	58°34.5	57.6	38°12.9	25.2	129°23.3	18.9	178°40.2	33.8
20	172°18.1	73°34.0	57.5	53°13.9	24.9	144°25.2	19.1	193°42.5	33.7
21	187°20.5	88°33.5	·· 57.3	68°14.8	·· 24.6	159°27.2	·· 19.3	208°44.9	·· 33.7
22	202°23.0	103°33.0	57.2	83°15.8	24.4	174°29.1	19.5	223°47.2	33.6
23	217°25.5	118°32.5	57.1	98°16.8	24.1	189°31.0	19.7	238°49.5	33.6
Mer.pass. 08:33		ν -0.5′ d -0.1′ m -4.20		ν 1.0′ d -0.3′ m 1.46		ν 1.9′ d 0.2′ m -2.07		ν 2.3′ d 0.0′ m 0.91	

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	232°27.9	133°31.9	N25°56.9	113°17.8	N22°23.8	204°32.9	N10°19.9	253°51.9	S10°33.6
1	247°30.4	148°31.4	56.8	128°18.7	23.5	219°34.8	20.1	268°54.2	33.5
2	262°32.9	163°30.9	56.7	143°19.7	23.2	234°36.7	20.3	283°56.5	33.5
3	277°35.3	178°30.4	·· 56.5	158°20.7	·· 22.9	249°38.7	·· 20.5	298°58.9	·· 33.4
4	292°37.8	193°29.9	56.4	173°21.6	22.6	264°40.6	20.7	314°01.2	33.4
5	307°40.2	208°29.4	56.3	188°22.6	22.3	279°42.5	20.9	329°03.6	33.4
6	322°42.7	223°28.9	N25°56.1	203°23.6	N22°22.0	294°44.4	N10°21.1	344°05.9	S10°33.3
7	337°45.2	238°28.4	56.0	218°24.6	21.7	309°46.3	21.3	359°08.2	33.3
8	352°47.6	253°27.9	55.8	233°25.5	21.4	324°48.2	21.5	14°10.6	33.2
9	7°50.1	268°27.4	·· 55.7	248°26.5	·· 21.1	339°50.2	·· 21.7	29°12.9	·· 33.2
10	22°52.6	283°26.9	55.5	263°27.5	20.8	354°52.1	21.9	44°15.2	33.1
11	37°55.0	298°26.4	55.4	278°28.4	20.5	9°54.0	22.1	59°17.6	33.1
12	52°57.5	313°25.9	N25°55.2	293°29.4	N22°20.2	24°55.9	N10°22.3	74°19.9	S10°33.1
13	68°00.0	328°25.4	55.1	308°30.4	19.9	39°57.8	22.5	89°22.2	33.0
14	83°02.4	343°24.9	54.9	323°31.4	19.6	54°59.8	22.7	104°24.6	33.0
15	98°04.9	358°24.4	·· 54.8	338°32.3	·· 19.3	70°01.7	·· 22.9	119°26.9	·· 32.9
16	113°07.4	13°23.9	54.6	353°33.3	19.0	85°03.6	23.1	134°29.2	32.9
17	128°09.8	28°23.4	54.5	8°34.3	18.7	100°05.5	23.3	149°31.6	32.9
18	143°12.3	43°22.9	N25°54.3	23°35.3	N22°18.4	115°07.4	N10°23.5	164°33.9	S10°32.8
19	158°14.7	58°22.4	54.2	38°36.2	18.1	130°09.3	23.7	179°36.3	32.8
20	173°17.2	73°21.9	54.0	53°37.2	17.8	145°11.3	23.9	194°38.6	32.7
21	188°19.7	88°21.4	·· 53.9	68°38.2	·· 17.5	160°13.2	·· 24.1	209°40.9	·· 32.7
22	203°22.1	103°20.9	53.7	83°39.1	17.2	175°15.1	24.3	224°43.3	32.7
23	218°24.6	118°20.4	53.6	98°40.1	16.9	190°17.0	24.5	239°45.6	32.6
Mer.pass. 08:29		ν -0.5′ d -0.1′ m -4.20		ν 1.0′ d -0.3′ m 1.47		ν 1.9′ d 0.2′ m -2.07		ν 2.3′ d 0.0′ m 0.90	

Stars

	SHA	**Dec**
Alpheratz	357°36.5	29°12.9
Ankaa	353°08.8	-42°10.7
Schedar	349°33.1	56°39.6
Diphda	348°48.9	-17°51.6
Achernar	335°21.7	-57°07.0
Hamal	327°53.1	23°34.2
Polaris	315°11.6	89°21.7
Acamar	315°13.3	-40°12.7
Menkar	314°07.9	4°10.8
Mirfak	308°30.8	49°56.5
Aldebaran	290°41.6	16°33.3
Rigel	281°05.5	-8°10.6
Capella	280°24.4	46°01.3
Bellatrix	278°24.7	6°22.2
Elnath	278°04.0	28°37.6
Alnilam	275°39.4	-1°11.3
Betelgeuse	270°53.9	7°24.6
Canopus	263°53.4	-52°42.6
Sirius	258°27.7	-16°45.0
Adhara	255°07.2	-29°00.4
Procyon	244°52.5	5°09.9
Pollux	243°19.2	27°58.3
Avior	234°15.5	-59°35.3
Suhail	222°47.4	-43°31.8
Miaplacidus	221°38.7	-69°49.0
Alphard	217°49.1	-8°45.7
Regulus	207°35.9	11°51.2
Dubhe	193°42.5	61°37.8
Denebola	182°26.2	14°26.5
Gienah	175°44.8	-17°40.4
Acrux	173°01.2	-63°13.9
Gacrux	171°52.8	-57°14.8
Alioth	166°13.7	55°50.2
Spica	158°23.5	-11°17.1
Alkaid	152°52.7	49°11.9
Hadar	148°37.4	-60°29.2
Menkent	147°58.9	-36°29.2
Arcturus	145°48.9	19°03.6
Rigil Kent.	139°41.6	-60°56.0
Kochab	137°18.6	74°03.6
Zuben'ubi	136°57.2	-16°08.4
Alphecca	126°04.6	26°38.1
Antares	112°17.2	-26°29.0
Atria	107°12.2	-69°04.1
Sabik	102°04.1	-15°45.3
Shaula	96°11.9	-37°07.2
Rasalhague	95°59.5	12°32.4
Eltanin	90°42.4	51°28.9
Kaus Aust.	83°34.1	-34°22.4
Vega	80°33.9	38°48.1
Nunki	75°49.2	-26°16.0
Altair	62°01.2	8°55.6
Peacock	53°07.7	-56°39.4
Deneb	49°26.6	45°21.5
Enif	33°40.2	9°58.7
Al Na'ir	27°34.7	-46°50.7
Fomalhaut	15°16.2	-29°29.9
Scheat	13°46.7	28°12.3
Markab	13°31.4	15°19.6

May 13 Sat	**SHA**	**Mer.pass**
Venus	263°27.4	15:05
Mars	242°01.4	16:29
Jupiter	332°31.3	10:27
Saturn	21°30.3	07:11

May 14 Sun	**SHA**	**Mer.pass**
Venus	262°15.5	15:06
Mars	241°25.6	16:27
Jupiter	332°18.1	10:24
Saturn	21°27.1	07:07

May 15 Mon	**SHA**	**Mer.pass**
Venus	261°04.0	15:06
Mars	240°49.8	16:26
Jupiter	332°05.0	10:20
Saturn	21°23.9	07:03

Horizontal parallax	
Venus:	0.2
Mars:	0.1

h	Sun		Moon				
Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°54.7	N18°16.0	259°18.6	9.4'	S16°57.3	13.6'	59.2'
1	195°54.7	16.6	273°47.0	9.5'	16°43.7	13.7'	59.2'
2	210°54.7	17.2	288°15.4	9.5'	16°30.0	13.8'	59.1'
3	225°54.7	·· 17.8	302°44.0	9.6'	16°16.2	13.9'	59.1'
4	240°54.7	18.5	317°12.6	9.7'	16°02.3	13.9'	59.1'
5	255°54.7	19.1	331°41.3	9.8'	15°48.4	14.1'	59.1'
6	270°54.7	N18°19.7	346°10.1	9.9'	S15°34.3	14.1'	59.1'
7	285°54.7	20.3	0°39.0	10.0'	15°20.2	14.2'	59.1'
8	300°54.7	20.9	15°08.0	10.1'	15°06.0	14.3'	59.1'
9	315°54.7	·· 21.6	29°37.0	10.1'	14°51.7	14.3'	59.1'
10	330°54.8	22.2	44°06.2	10.2'	14°37.4	14.5'	59.1'
11	345°54.8	22.8	58°35.4	10.3'	14°22.9	14.5'	59.1'
12	0°54.8	N18°23.4	73°04.7	10.4'	S14°08.4	14.5'	59.1'
13	15°54.8	24.0	87°34.1	10.4'	13°53.9	14.7'	59.1'
14	30°54.8	24.6	102°03.5	10.5'	13°39.2	14.7'	59.1'
15	45°54.8	·· 25.3	116°33.0	10.6'	13°24.5	14.8'	59.0'
16	60°54.8	25.9	131°02.6	10.7'	13°09.7	14.9'	59.0'
17	75°54.8	26.5	145°32.3	10.7'	12°54.8	14.9'	59.0'
18	90°54.8	N18°27.1	160°02.0	10.8'	S12°39.9	15.0'	59.0'
19	105°54.8	27.7	174°31.9	10.9'	12°24.9	15.0'	59.0'
20	120°54.8	28.3	189°01.8	11.0'	12°09.9	15.1'	59.0'
21	135°54.8	·· 28.9	203°31.7	11.0'	11°54.8	15.1'	59.0'
22	150°54.8	29.5	218°01.8	11.1'	11°39.7	15.3'	59.0'
23	165°54.8	30.2	232°31.9	11.2'	11°24.4	15.2'	59.0'
	SD = 15.8'	d = 0.6'	SD = 16.1'				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°54.8	N18°30.8	247°02.0	11.2'	S11°09.2	15.4'	59.0'
1	195°54.8	31.4	261°32.2	11.3'	10°53.8	15.3'	59.0'
2	210°54.8	32.0	276°02.5	11.4'	10°38.5	15.4'	59.0'
3	225°54.8	·· 32.6	290°32.9	11.4'	10°23.1	15.5'	58.9'
4	240°54.8	33.2	305°03.3	11.5'	10°07.6	15.5'	58.9'
5	255°54.8	33.8	319°33.8	11.5'	09°52.1	15.6'	58.9'
6	270°54.8	N18°34.4	334°04.3	11.6'	S09°36.5	15.6'	58.9'
7	285°54.8	35.0	348°34.9	11.7'	09°20.9	15.7'	58.9'
8	300°54.8	35.6	3°05.6	11.7'	09°05.2	15.7'	58.9'
9	315°54.8	·· 36.2	17°36.3	11.8'	08°49.5	15.7'	58.9'
10	330°54.8	36.8	32°07.1	11.8'	08°33.8	15.8'	58.9'
11	345°54.8	37.4	46°37.9	11.9'	08°18.0	15.8'	58.9'
12	0°54.8	N18°38.0	61°08.8	11.9'	S08°02.2	15.8'	58.8'
13	15°54.8	38.6	75°39.7	12.0'	07°46.4	15.9'	58.8'
14	30°54.8	39.2	90°10.7	12.0'	07°30.5	15.9'	58.8'
15	45°54.8	·· 39.9	104°41.7	12.1'	07°14.6	15.9'	58.8'
16	60°54.8	40.5	119°12.7	12.1'	06°58.7	16.0'	58.8'
17	75°54.8	41.1	133°43.9	12.2'	06°42.7	16.0'	58.8'
18	90°54.8	N18°41.7	148°15.0	12.2'	S06°26.7	16.0'	58.8'
19	105°54.8	42.3	162°46.2	12.2'	06°10.7	16.1'	58.8'
20	120°54.8	42.9	177°17.5	12.3'	05°54.6	16.0'	58.8'
21	135°54.8	·· 43.5	191°48.7	12.3'	05°38.6	16.1'	58.7'
22	150°54.8	44.0	206°20.1	12.4'	05°22.5	16.1'	58.7'
23	165°54.8	44.6	220°51.4	12.4'	05°06.4	16.2'	58.7'
	SD = 15.8'	d = 0.6'	SD = 16.1'				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°54.8	N18°45.2	235°22.8	12.4'	S04°50.2	16.1'	58.7'
1	195°54.8	45.8	249°54.3	12.5'	04°34.1	16.2'	58.7'
2	210°54.8	46.4	264°25.7	12.5'	04°17.9	16.2'	58.7'
3	225°54.7	·· 47.0	278°57.2	12.5'	04°01.7	16.2'	58.7'
4	240°54.7	47.6	293°28.8	12.6'	03°45.5	16.2'	58.7'
5	255°54.7	48.2	308°00.3	12.6'	03°29.3	16.2'	58.6'
6	270°54.7	N18°48.8	322°31.9	12.6'	S03°13.1	16.2'	58.6'
7	285°54.7	49.4	337°03.6	12.6'	02°56.9	16.2'	58.6'
8	300°54.7	50.0	351°35.2	12.7'	02°40.7	16.3'	58.6'
9	315°54.7	·· 50.6	6°06.9	12.7'	02°24.4	16.2'	58.6'
10	330°54.7	51.2	20°38.6	12.7'	02°08.2	16.3'	58.6'
11	345°54.7	51.8	35°10.3	12.7'	01°51.9	16.2'	58.6'
12	0°54.7	N18°52.4	49°42.0	12.8'	S01°35.7	16.3'	58.5'
13	15°54.7	53.0	64°13.8	12.8'	01°19.4	16.2'	58.5'
14	30°54.7	53.5	78°45.6	12.8'	01°03.2	16.3'	58.5'
15	45°54.7	·· 54.1	93°17.4	12.8'	00°46.9	16.2'	58.5'
16	60°54.7	54.7	107°49.2	12.8'	00°30.7	16.3'	58.5'
17	75°54.7	55.3	122°21.0	12.8'	S00°14.4	16.2'	58.5'
18	90°54.6	N18°55.9	136°52.9	12.9'	N00°01.8	16.2'	58.5'
19	105°54.6	56.5	151°24.7	12.9'	00°18.0	16.3'	58.4'
20	120°54.6	57.1	165°56.6	12.9'	00°34.3	16.2'	58.4'
21	135°54.6	·· 57.7	180°28.5	12.9'	00°50.5	16.2'	58.4'
22	150°54.6	58.2	195°00.4	12.9'	01°06.7	16.2'	58.4'
23	165°54.6	58.8	209°32.3	12.9'	01°22.9	16.1'	58.4'
	SD = 15.8'	d = 0.6'	SD = 16.0'				

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

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

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 23-25 45-24%
13	03:39	03:39	11:56	06:57	19:23	
14	03:39	03:39	11:56	07:47	20:11	
15	03:39	03:39	11:56	08:35	20:58	

May 16, 17, 18 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	233°27.1	133°19.9	**N**25°53.4	113°41.1	**N**22°16.6	205°18.9	**N**10°24.7	254°47.9	**S**10°32.6
1	248°29.5	148°19.4	53.2	128°42.1	16.3	220°20.8	24.9	269°50.3	32.5
2	263°32.0	163°18.9	53.1	143°43.0	16.0	235°22.8	25.1	284°52.6	32.5
3	278°34.5	178°18.4	·· 52.9	158°44.0	·· 15.7	250°24.7	·· 25.3	299°55.0	·· 32.5
4	293°36.9	193°17.9	52.7	173°45.0	15.4	265°26.6	25.5	314°57.3	32.4
5	308°39.4	208°17.4	52.6	188°45.9	15.1	280°28.5	25.7	329°59.6	32.4
6	323°41.8	223°16.9	**N**25°52.4	203°46.9	**N**22°14.8	295°30.4	**N**10°25.9	345°02.0	**S**10°32.3
7	338°44.3	238°16.4	52.2	218°47.9	14.4	310°32.4	26.1	0°04.3	32.3
8	353°46.8	253°15.9	52.1	233°48.9	14.1	325°34.3	26.3	15°06.7	32.3
9	8°49.2	268°15.5	·· 51.9	248°49.8	·· 13.8	340°36.2	·· 26.5	30°09.0	·· 32.2
10	23°51.7	283°15.0	51.7	263°50.8	13.5	355°38.1	26.7	45°11.3	32.2
11	38°54.2	298°14.5	51.6	278°51.8	13.2	10°40.0	26.9	60°13.7	32.1
12	53°56.6	313°14.0	**N**25°51.4	293°52.7	**N**22°12.9	25°42.0	**N**10°27.1	75°16.0	**S**10°32.1
13	68°59.1	328°13.5	51.2	308°53.7	12.6	40°43.9	27.3	90°18.4	32.1
14	84°01.6	343°13.0	51.0	323°54.7	12.3	55°45.8	27.5	105°20.7	32.0
15	99°04.0	358°12.5	·· 50.9	338°55.7	·· 12.0	70°47.7	·· 27.7	120°23.0	·· 32.0
16	114°06.5	13°12.0	50.7	353°56.6	11.7	85°49.6	27.9	135°25.4	31.9
17	129°09.0	28°11.6	50.5	8°57.6	11.4	100°51.5	28.1	150°27.7	31.9
18	144°11.4	43°11.1	**N**25°50.3	23°58.6	**N**22°11.1	115°53.5	**N**10°28.3	165°30.1	**S**10°31.9
19	159°13.9	58°10.6	50.2	38°59.5	10.8	130°55.4	28.5	180°32.4	31.8
20	174°16.3	73°10.1	50.0	54°00.5	10.5	145°57.3	28.7	195°34.7	31.8
21	189°18.8	88°09.6	·· 49.8	69°01.5	·· 10.2	160°59.2	·· 28.9	210°37.1	·· 31.7
22	204°21.3	103°09.1	49.6	84°02.5	09.9	176°01.1	29.1	225°39.4	31.7
23	219°23.7	118°08.7	49.4	99°03.4	09.6	191°03.1	29.3	240°41.8	31.7
Mer.pass. 08:25		ν -0.5′ d -0.2′ m -4.21		ν 1.0′ d -0.3′ m 1.48		ν 1.9′ d 0.2′ m -2.07		ν 2.3′ d 0.0′ m 0.90	

Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	234°26.2	133°08.2	**N**25°49.2	114°04.4	**N**22°09.2	206°05.0	**N**10°29.5	255°44.1	**S**10°31.6
1	249°28.7	148°07.7	49.1	129°05.4	08.9	221°06.9	29.7	270°46.4	31.6
2	264°31.1	163°07.2	48.9	144°06.3	08.6	236°08.8	29.9	285°48.8	31.6
3	279°33.6	178°06.7	·· 48.7	159°07.3	·· 08.3	251°10.7	·· 30.1	300°51.1	·· 31.5
4	294°36.1	193°06.3	48.5	174°08.3	08.0	266°12.7	30.3	315°53.5	31.5
5	309°38.5	208°05.8	48.3	189°09.3	07.7	281°14.6	30.5	330°55.8	31.4
6	324°41.0	223°05.3	**N**25°48.1	204°10.2	**N**22°07.4	296°16.5	**N**10°30.7	345°58.2	**S**10°31.4
7	339°43.5	238°04.8	47.9	219°11.2	07.1	311°18.4	30.9	1°00.5	31.4
8	354°45.9	253°04.4	47.7	234°12.2	06.8	326°20.3	31.1	16°02.8	31.3
9	9°48.4	268°03.9	·· 47.5	249°13.2	·· 06.5	341°22.3	·· 31.3	31°05.2	·· 31.3
10	24°50.8	283°03.4	47.3	264°14.1	06.2	356°24.2	31.5	46°07.5	31.2
11	39°53.3	298°02.9	47.1	279°15.1	05.8	11°26.1	31.7	61°09.9	31.2
12	54°55.8	313°02.5	**N**25°46.9	294°16.1	**N**22°05.5	26°28.0	**N**10°31.9	76°12.2	**S**10°31.2
13	69°58.2	328°02.0	46.7	309°17.0	05.2	41°29.9	32.1	91°14.6	31.1
14	85°00.7	343°01.5	46.5	324°18.0	04.9	56°31.9	32.3	106°16.9	31.1
15	100°03.2	358°01.1	·· 46.3	339°19.0	·· 04.6	71°33.8	·· 32.5	121°19.2	·· 31.1
16	115°05.6	13°00.6	46.1	354°20.0	04.3	86°35.7	32.7	136°21.6	31.0
17	130°08.1	28°00.1	45.9	9°20.9	04.0	101°37.6	32.9	151°23.9	31.0
18	145°10.6	42°59.7	**N**25°45.7	24°21.9	**N**22°03.7	116°39.5	**N**10°33.1	166°26.3	**S**10°30.9
19	160°13.0	57°59.2	45.5	39°22.9	03.4	131°41.5	33.3	181°28.6	30.9
20	175°15.5	72°58.7	45.3	54°23.8	03.0	146°43.4	33.4	196°31.0	30.9
21	190°17.9	87°58.3	·· 45.1	69°24.8	·· 02.7	161°45.3	·· 33.6	211°33.3	·· 30.8
22	205°20.4	102°57.8	44.9	84°25.8	02.4	176°47.2	33.8	226°35.6	30.8
23	220°22.9	117°57.3	44.7	99°26.8	02.1	191°49.1	34.0	241°38.0	30.8
Mer.pass. 08:21		ν -0.5′ d -0.2′ m -4.22		ν 1.0′ d -0.3′ m 1.49		ν 1.9′ d 0.2′ m -2.08		ν 2.3′ d 0.0′ m 0.90	

Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	235°25.3	132°56.9	**N**25°44.5	114°27.7	**N**22°01.8	206°51.1	**N**10°34.2	256°40.3	**S**10°30.7
1	250°27.8	147°56.4	44.3	129°28.7	01.5	221°53.0	34.4	271°42.7	30.7
2	265°30.3	162°55.9	44.0	144°29.7	01.2	236°54.9	34.6	286°45.0	30.6
3	280°32.7	177°55.5	·· 43.8	159°30.6	·· 00.9	251°56.8	·· 34.8	301°47.4	·· 30.6
4	295°35.2	192°55.0	43.6	174°31.6	00.5	266°58.8	35.0	316°49.7	30.6
5	310°37.7	207°54.5	43.4	189°32.6	22°00.2	282°00.7	35.2	331°52.1	30.5
6	325°40.1	222°54.1	**N**25°43.2	204°33.6	**N**21°59.9	297°02.6	**N**10°35.4	346°54.4	**S**10°30.5
7	340°42.6	237°53.6	43.0	219°34.5	59.6	312°04.5	35.6	1°56.8	30.5
8	355°45.1	252°53.2	42.7	234°35.5	59.3	327°06.4	35.8	16°59.1	30.4
9	10°47.5	267°52.7	·· 42.5	249°36.5	·· 59.0	342°08.4	·· 36.0	32°01.4	·· 30.4
10	25°50.0	282°52.3	42.3	264°37.4	58.7	357°10.3	36.2	47°03.8	30.3
11	40°52.4	297°51.8	42.1	279°38.4	58.3	12°12.2	36.4	62°06.1	30.3
12	55°54.9	312°51.3	**N**25°41.9	294°39.4	**N**21°58.0	27°14.1	**N**10°36.6	77°08.5	**S**10°30.3
13	70°57.4	327°50.9	41.6	309°40.4	57.7	42°16.0	36.8	92°10.8	30.2
14	85°59.8	342°50.4	41.4	324°41.3	57.4	57°18.0	37.0	107°13.2	30.2
15	101°02.3	357°50.0	·· 41.2	339°42.3	·· 57.1	72°19.9	·· 37.2	122°15.5	·· 30.2
16	116°04.8	12°49.5	41.0	354°43.3	56.8	87°21.8	37.4	137°17.9	30.1
17	131°07.2	27°49.1	40.7	9°44.2	56.4	102°23.7	37.6	152°20.2	30.1
18	146°09.7	42°48.6	**N**25°40.5	24°45.2	**N**21°56.1	117°25.7	**N**10°37.8	167°22.6	**S**10°30.1
19	161°12.2	57°48.2	40.3	39°46.2	55.8	132°27.6	38.0	182°24.9	30.0
20	176°14.6	72°47.7	40.0	54°47.2	55.5	147°29.5	38.2	197°27.3	30.0
21	191°17.1	87°47.3	·· 39.8	69°48.1	·· 55.2	162°31.4	·· 38.4	212°29.6	·· 29.9
22	206°19.6	102°46.8	39.6	84°49.1	54.8	177°33.3	38.6	227°32.0	29.9
23	221°22.0	117°46.4	39.3	99°50.1	54.5	192°35.3	38.8	242°34.3	29.9
Mer.pass. 08:17		ν -0.5′ d -0.2′ m -4.23		ν 1.0′ d -0.3′ m 1.49		ν 1.9′ d 0.2′ m -2.08		ν 2.3′ d 0.0′ m 0.90	

Stars

	SHA	**Dec**
Alpheratz	357°36.4	29°12.9
Ankaa	353°08.8	-42°10.7
Schedar	349°33.0	56°39.6
Diphda	348°48.9	-17°51.6
Achernar	335°21.7	-57°07.0
Hamal	327°53.1	23°34.2
Polaris	315°11.3	89°21.6
Acamar	315°13.3	-40°12.7
Menkar	314°07.9	4°10.8
Mirfak	308°30.8	49°56.5
Aldebaran	290°41.6	16°33.3
Rigel	281°05.5	-8°10.6
Capella	280°24.4	46°01.3
Bellatrix	278°24.7	6°22.2
Elnath	278°04.0	28°37.6
Alnilam	275°39.4	-1°11.3
Betelgeuse	270°53.9	7°24.6
Canopus	263°53.4	-52°42.6
Sirius	258°27.7	-16°45.0
Adhara	255°07.2	-29°00.4
Procyon	244°52.5	5°09.9
Pollux	243°19.2	27°58.3
Avior	234°15.6	-59°35.3
Suhail	222°47.4	-43°31.8
Miaplacidus	221°38.7	-69°49.0
Alphard	217°49.2	-8°45.7
Regulus	207°35.9	11°51.2
Dubhe	193°42.5	61°37.8
Denebola	182°26.2	14°26.6
Gienah	175°44.8	-17°40.4
Acrux	173°01.2	-63°13.9
Gacrux	171°52.8	-57°14.8
Alioth	166°13.8	55°50.2
Spica	158°23.5	-11°17.1
Alkaid	152°52.7	49°11.9
Hadar	148°37.4	-60°29.2
Menkent	147°58.9	-36°29.2
Arcturus	145°48.9	19°03.7
Rigil Kent.	139°41.6	-60°56.0
Kochab	137°18.6	74°03.6
Zuben'ubi	136°57.2	-16°08.4
Alphecca	126°04.6	26°38.1
Antares	112°17.2	-26°29.0
Atria	107°12.1	-69°04.1
Sabik	102°04.1	-15°45.3
Shaula	96°11.9	-37°07.2
Rasalhague	95°59.5	12°32.5
Eltanin	90°42.4	51°28.9
Kaus Aust.	83°34.0	-34°22.4
Vega	80°33.8	38°48.1
Nunki	75°49.2	-26°16.0
Altair	62°01.1	8°55.6
Peacock	53°07.7	-56°39.4
Deneb	49°26.6	45°21.5
Enif	33°40.2	9°58.7
Al Na'ir	27°34.7	-46°50.7
Fomalhaut	15°16.2	-29°29.9
Scheat	13°46.7	28°12.3
Markab	13°31.4	15°19.6

May 16 Tue	**SHA**	**Mer.pass**
Venus	259°52.8	15:07
Mars	240°14.0	16:24
Jupiter	331°51.9	10:17
Saturn	21°20.9	07:00

May 17 Wed	**SHA**	**Mer.pass**
Venus	258°42.0	15:08
Mars	239°38.2	16:23
Jupiter	331°38.8	10:14
Saturn	21°17.9	06:56

May 18 Thu	**SHA**	**Mer.pass**
Venus	257°31.5	15:09
Mars	239°02.4	16:21
Jupiter	331°25.7	10:11
Saturn	21°15.0	06:52

Horizontal parallax	
Venus:	0.2
Mars:	0.1

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°54.6	N18°59.4	224°04.2	12.9′	N01°39.0	16.2′	58.4′
1	195°54.6	19°00.0	238°36.1	12.9′	01°55.2	16.1′	58.4′
2	210°54.6	00.6	253°08.0	12.9′	02°11.3	16.2′	58.3′
3	225°54.5	·· 01.2	267°39.9	12.9′	02°27.5	16.1′	58.3′
4	240°54.5	01.7	282°11.9	12.9′	02°43.6	16.0′	58.3′
5	255°54.5	02.3	296°43.8	12.9′	02°59.6	16.1′	58.3′
6	270°54.5	N19°02.9	311°15.7	12.9′	N03°15.7	16.1′	58.3′
7	285°54.5	03.5	325°47.6	12.9′	03°31.8	16.0′	58.3′
8	300°54.5	04.1	340°19.5	12.9′	03°47.8	16.0′	58.2′
9	315°54.5	·· 04.6	354°51.5	12.9′	04°03.8	15.9′	58.2′
10	330°54.5	05.2	9°23.4	12.9′	04°19.7	15.9′	58.2′
11	345°54.5	05.8	23°55.3	12.9′	04°35.6	16.0′	58.2′
12	0°54.4	N19°06.4	38°27.2	12.9′	N04°51.6	15.8′	58.2′
13	15°54.4	06.9	52°59.0	12.9′	05°07.4	15.9′	58.2′
14	30°54.4	07.5	67°30.9	12.9′	05°23.3	15.8′	58.1′
15	45°54.4	·· 08.1	82°02.8	12.9′	05°39.1	15.7′	58.1′
16	60°54.4	08.7	96°34.6	12.8′	05°54.8	15.8′	58.1′
17	75°54.4	09.2	111°06.5	12.8′	06°10.6	15.7′	58.1′
18	90°54.4	N19°09.8	125°38.3	12.8′	N06°26.3	15.6′	58.1′
19	105°54.3	10.4	140°10.1	12.8′	06°41.9	15.7′	58.1′
20	120°54.3	11.0	154°41.9	12.8′	06°57.6	15.5′	58.0′
21	135°54.3	·· 11.5	169°13.7	12.8′	07°13.1	15.6′	58.0′
22	150°54.3	12.1	183°45.4	12.7′	07°28.7	15.5′	58.0′
23	165°54.3	12.7	198°17.2	12.7′	07°44.2	15.4′	58.0′
	SD = 15.8′	d = 0.6′	SD = 15.9′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°54.3	N19°13.2	212°48.9	12.7′	N07°59.6	15.4′	58.0′
1	195°54.2	13.8	227°20.6	12.7′	08°15.0	15.3′	57.9′
2	210°54.2	14.4	241°52.3	12.6′	08°30.3	15.3′	57.9′
3	225°54.2	·· 15.0	256°23.9	12.6′	08°45.6	15.3′	57.9′
4	240°54.2	15.5	270°55.5	12.6′	09°00.9	15.2′	57.9′
5	255°54.2	16.1	285°27.1	12.6′	09°16.1	15.1′	57.9′
6	270°54.2	N19°16.7	299°58.7	12.5′	N09°31.2	15.1′	57.9′
7	285°54.1	17.2	314°30.2	12.5′	09°46.3	15.1′	57.8′
8	300°54.1	17.8	329°01.8	12.5′	10°01.4	14.9′	57.8′
9	315°54.1	·· 18.4	343°33.3	12.5′	10°16.3	15.0′	57.8′
10	330°54.1	18.9	358°04.7	12.4′	10°31.3	14.8′	57.8′
11	345°54.1	19.5	12°36.1	12.4′	10°46.1	14.8′	57.8′
12	0°54.0	N19°20.0	27°07.5	12.4′	N11°00.9	14.8′	57.7′
13	15°54.0	20.6	41°38.9	12.3′	11°15.7	14.6′	57.7′
14	30°54.0	21.2	56°10.2	12.3′	11°30.3	14.6′	57.7′
15	45°54.0	·· 21.7	70°41.5	12.3′	11°44.9	14.6′	57.7′
16	60°54.0	22.3	85°12.8	12.2′	11°59.5	14.5′	57.7′
17	75°53.9	22.9	99°44.0	12.2′	12°14.0	14.4′	57.6′
18	90°53.9	N19°23.4	114°15.2	12.1′	N12°28.4	14.3′	57.6′
19	105°53.9	24.0	128°46.3	12.1′	12°42.7	14.3′	57.6′
20	120°53.9	24.5	143°17.4	12.1′	12°57.0	14.2′	57.6′
21	135°53.9	·· 25.1	157°48.5	12.0′	13°11.2	14.1′	57.6′
22	150°53.8	25.7	172°19.6	12.0′	13°25.3	14.0′	57.5′
23	165°53.8	26.2	186°50.5	11.9′	13°39.3	14.0′	57.5′
	SD = 15.8′	d = 0.6′	SD = 15.8′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°53.8	N19°26.8	201°21.5	11.9′	N13°53.3	13.9′	57.5′
1	195°53.8	27.3	215°52.4	11.9′	14°07.2	13.8′	57.5′
2	210°53.7	27.9	230°23.3	11.8′	14°21.0	13.8′	57.5′
3	225°53.7	·· 28.4	244°54.1	11.8′	14°34.8	13.6′	57.4′
4	240°53.7	29.0	259°24.9	11.7′	14°48.4	13.6′	57.4′
5	255°53.7	29.5	273°55.6	11.7′	15°02.0	13.5′	57.4′
6	270°53.6	N19°30.1	288°26.3	11.6′	N15°15.5	13.4′	57.4′
7	285°53.6	30.6	302°56.9	11.6′	15°28.9	13.3′	57.3′
8	300°53.6	31.2	317°27.5	11.5′	15°42.2	13.2′	57.3′
9	315°53.6	·· 31.7	331°58.1	11.5′	15°55.4	13.2′	57.3′
10	330°53.5	32.3	346°28.6	11.5′	16°08.6	13.1′	57.3′
11	345°53.5	32.9	0°59.0	11.4′	16°21.7	12.9′	57.3′
12	0°53.5	N19°33.4	15°29.4	11.4′	N16°34.6	12.9′	57.2′
13	15°53.5	34.0	29°59.8	11.3′	16°47.5	12.8′	57.2′
14	30°53.4	34.5	44°30.1	11.3′	17°00.3	12.7′	57.2′
15	45°53.4	·· 35.0	59°00.4	11.2′	17°13.0	12.6′	57.2′
16	60°53.4	35.6	73°30.6	11.2′	17°25.6	12.5′	57.1′
17	75°53.4	36.1	88°00.7	11.1′	17°38.1	12.4′	57.1′
18	90°53.3	N19°36.7	102°30.8	11.1′	N17°50.5	12.3′	57.1′
19	105°53.3	37.2	117°00.9	11.0′	18°02.8	12.2′	57.1′
20	120°53.3	37.8	131°30.9	11.0′	18°15.0	12.1′	57.1′
21	135°53.3	·· 38.3	146°00.9	10.9′	18°27.1	12.0′	57.0′
22	150°53.2	38.9	160°30.8	10.9′	18°39.1	11.9′	57.0′
23	165°53.2	39.4	175°00.6	10.8′	18°51.0	11.8′	57.0′
	SD = 15.8′	d = 0.6′	SD = 15.7′				

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

Lat.	**Moonrise** Tue	Wed	Thu	**Moonset** Tue	Wed	Thu
N 72°	02:41	02:05	01:16	16:51	19:21	▭
N 70°	02:44	02:17	01:43	16:42	18:56	21:44
68°	02:47	02:27	02:03	16:34	18:37	20:56
66°	02:49	02:35	02:20	16:28	18:22	20:25
64°	02:50	02:42	02:33	16:23	18:10	20:03
62°	02:52	02:48	02:45	16:19	18:00	19:45
60°	02:53	02:54	02:54	16:15	17:51	19:30
N 58°	02:55	02:58	03:03	16:12	17:44	19:18
56°	02:56	03:03	03:11	16:09	17:37	19:07
54°	02:57	03:06	03:18	16:06	17:31	18:57
52°	02:58	03:10	03:24	16:03	17:26	18:49
50°	02:58	03:13	03:29	16:01	17:21	18:41
45°	03:00	03:20	03:42	15:57	17:11	18:26
N 40°	03:02	03:26	03:52	15:53	17:02	18:12
35°	03:03	03:31	04:00	15:49	16:55	18:01
30°	03:04	03:35	04:08	15:46	16:49	17:52
20°	03:07	03:43	04:21	15:41	16:38	17:35
N 10°	03:08	03:50	04:33	15:37	16:28	17:21
0°	03:10	03:57	04:44	15:32	16:19	17:08
S 10°	03:12	04:03	04:56	15:28	16:10	16:54
20°	03:14	04:11	05:08	15:24	16:01	16:40
30°	03:16	04:19	05:22	15:18	15:50	16:24
35°	03:18	04:24	05:30	15:16	15:44	16:15
40°	03:19	04:29	05:39	15:12	15:37	16:04
45°	03:21	04:35	05:50	15:08	15:29	15:52
S 50°	03:23	04:43	06:03	15:04	15:19	15:37
52°	03:24	04:47	06:09	15:02	15:15	15:30
54°	03:25	04:51	06:16	15:00	15:10	15:22
56°	03:26	04:55	06:24	14:57	15:04	15:14
58°	03:28	05:00	06:33	14:54	14:58	15:04
S 60°	03:29	05:05	06:43	14:51	14:52	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 26-28 15-3%
16	03:38	03:38	11:56	09:21	21:44	
17	03:37	03:36	11:56	10:08	22:32	
18	03:35	03:34	11:56	10:56	23:21	

May 19, 20, 21 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	236°24.5	132°45.9	N25°39.1	114°51.0	N21°54.2	207°37.2	N10°39.0	257°36.7	S10°29.8
1	251°26.9	147°45.5	38.9	129°52.0	53.9	222°39.1	39.1	272°39.0	29.8
2	266°29.4	162°45.0	38.6	144°53.0	53.6	237°41.0	39.3	287°41.4	29.8
3	281°31.9	177°44.6	·· 38.4	159°54.0	·· 53.3	252°43.0	·· 39.5	302°43.7	·· 29.7
4	296°34.3	192°44.1	38.1	174°54.9	52.9	267°44.9	39.7	317°46.1	29.7
5	311°36.8	207°43.7	37.9	189°55.9	52.6	282°46.8	39.9	332°48.4	29.7
6	326°39.3	222°43.3	N25°37.7	204°56.9	N21°52.3	297°48.7	N10°40.1	347°50.8	S10°29.6
7	341°41.7	237°42.8	37.4	219°57.8	52.0	312°50.7	40.3	2°53.1	29.6
8	356°44.2	252°42.4	37.2	234°58.8	51.7	327°52.6	40.5	17°55.5	29.5
9	11°46.7	267°41.9	·· 36.9	249°59.8	·· 51.3	342°54.5	·· 40.7	32°57.8	·· 29.5
10	26°49.1	282°41.5	36.7	265°00.8	51.0	357°56.4	40.9	48°00.2	29.5
11	41°51.6	297°41.0	36.4	280°01.7	50.7	12°58.3	41.1	63°02.5	29.4
12	56°54.1	312°40.6	N25°36.2	295°02.7	N21°50.4	28°00.3	N10°41.3	78°04.9	S10°29.4
13	71°56.5	327°40.2	35.9	310°03.7	50.0	43°02.2	41.5	93°07.2	29.4
14	86°59.0	342°39.7	35.7	325°04.6	49.7	58°04.1	41.7	108°09.6	29.3
15	102°01.4	357°39.3	·· 35.4	340°05.6	·· 49.4	73°06.0	·· 41.9	123°11.9	·· 29.3
16	117°03.9	12°38.9	35.2	355°06.6	49.1	88°08.0	42.1	138°14.3	29.3
17	132°06.4	27°38.4	34.9	10°07.6	48.8	103°09.9	42.3	153°16.6	29.2
18	147°08.8	42°38.0	N25°34.7	25°08.5	N21°48.4	118°11.8	N10°42.5	168°19.0	S10°29.2
19	162°11.3	57°37.6	34.4	40°09.5	48.1	133°13.7	42.7	183°21.3	29.2
20	177°13.8	72°37.1	34.2	55°10.5	47.8	148°15.7	42.9	198°23.7	29.1
21	192°16.2	87°36.7	·· 33.9	70°11.4	·· 47.5	163°17.6	·· 43.1	213°26.0	·· 29.1
22	207°18.7	102°36.3	33.7	85°12.4	47.1	178°19.5	43.2	228°28.4	29.1
23	222°21.2	117°35.8	33.4	100°13.4	46.8	193°21.4	43.4	243°30.7	29.0
Mer.pass. 08:13		ν -0.4′ d -0.2′ m -4.23		ν 1.0′ d -0.3′ m 1.50		ν 1.9′ d 0.2′ m -2.08		ν 2.3′ d 0.0′ m 0.89	

Sat	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	237°23.6	132°35.4	N25°33.1	115°14.4	N21°46.5	208°23.3	N10°43.6	258°33.1	S10°29.0
1	252°26.1	147°35.0	32.9	130°15.3	46.2	223°25.3	43.8	273°35.4	29.0
2	267°28.5	162°34.5	32.6	145°16.3	45.8	238°27.2	44.0	288°37.8	28.9
3	282°31.0	177°34.1	·· 32.3	160°17.3	·· 45.5	253°29.1	·· 44.2	303°40.1	·· 28.9
4	297°33.5	192°33.7	32.1	175°18.2	45.2	268°31.0	44.4	318°42.5	28.9
5	312°35.9	207°33.3	31.8	190°19.2	44.9	283°33.0	44.6	333°44.8	28.8
6	327°38.4	222°32.8	N25°31.5	205°20.2	N21°44.5	298°34.9	N10°44.8	348°47.2	S10°28.8
7	342°40.9	237°32.4	31.3	220°21.2	44.2	313°36.8	45.0	3°49.5	28.7
8	357°43.3	252°32.0	31.0	235°22.1	43.9	328°38.7	45.2	18°51.9	28.7
9	12°45.8	267°31.6	·· 30.7	250°23.1	·· 43.6	343°40.7	·· 45.4	33°54.2	·· 28.7
10	27°48.3	282°31.1	30.5	265°24.1	43.2	358°42.6	45.6	48°56.6	28.6
11	42°50.7	297°30.7	30.2	280°25.0	42.9	13°44.5	45.8	63°58.9	28.6
12	57°53.2	312°30.3	N25°29.9	295°26.0	N21°42.6	28°46.4	N10°46.0	79°01.3	S10°28.6
13	72°55.7	327°29.9	29.7	310°27.0	42.3	43°48.4	46.2	94°03.7	28.5
14	87°58.1	342°29.5	29.4	325°28.0	41.9	58°50.3	46.4	109°06.0	28.5
15	103°00.6	357°29.0	·· 29.1	340°28.9	·· 41.6	73°52.2	·· 46.6	124°08.4	·· 28.5
16	118°03.0	12°28.6	28.8	355°29.9	41.3	88°54.1	46.7	139°10.7	28.4
17	133°05.5	27°28.2	28.5	10°30.9	40.9	103°56.1	46.9	154°13.1	28.4
18	148°08.0	42°27.8	N25°28.3	25°31.8	N21°40.6	118°58.0	N10°47.1	169°15.4	S10°28.4
19	163°10.4	57°27.4	28.0	40°32.8	40.3	133°59.9	47.3	184°17.8	28.3
20	178°12.9	72°27.0	27.7	55°33.8	40.0	149°01.8	47.5	199°20.1	28.3
21	193°15.4	87°26.5	·· 27.4	70°34.8	·· 39.6	164°03.8	·· 47.7	214°22.5	·· 28.3
22	208°17.8	102°26.1	27.1	85°35.7	39.3	179°05.7	47.9	229°24.8	28.2
23	223°20.3	117°25.7	26.9	100°36.7	39.0	194°07.6	48.1	244°27.2	28.2
Mer.pass. 08:09		ν -0.4′ d -0.3′ m -4.24		ν 1.0′ d -0.3′ m 1.51		ν 1.9′ d 0.2′ m -2.08		ν 2.4′ d 0.0′ m 0.89	

Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	238°22.8	132°25.3	N25°26.6	115°37.7	N21°38.6	209°09.5	N10°48.3	259°29.6	S10°28.2
1	253°25.2	147°24.9	26.3	130°38.6	38.3	224°11.5	48.5	274°31.9	28.1
2	268°27.7	162°24.5	26.0	145°39.6	38.0	239°13.4	48.7	289°34.3	28.1
3	283°30.2	177°24.1	·· 25.7	160°40.6	·· 37.7	254°15.3	·· 48.9	304°36.6	·· 28.1
4	298°32.6	192°23.7	25.4	175°41.6	37.3	269°17.2	49.1	319°39.0	28.0
5	313°35.1	207°23.3	25.1	190°42.5	37.0	284°19.2	49.3	334°41.3	28.0
6	328°37.5	222°22.9	N25°24.8	205°43.5	N21°36.7	299°21.1	N10°49.5	349°43.7	S10°28.0
7	343°40.0	237°22.4	24.6	220°44.5	36.3	314°23.0	49.6	4°46.1	27.9
8	358°42.5	252°22.0	24.3	235°45.4	36.0	329°25.0	49.8	19°48.4	27.9
9	13°44.9	267°21.6	·· 24.0	250°46.4	·· 35.7	344°26.9	·· 50.0	34°50.8	·· 27.9
10	28°47.4	282°21.2	23.7	265°47.4	35.3	359°28.8	50.2	49°53.1	27.8
11	43°49.9	297°20.8	23.4	280°48.4	35.0	14°30.7	50.4	64°55.5	27.8
12	58°52.3	312°20.4	N25°23.1	295°49.3	N21°34.7	29°32.7	N10°50.6	79°57.8	S10°27.8
13	73°54.8	327°20.0	22.8	310°50.3	34.3	44°34.6	50.8	95°00.2	27.7
14	88°57.3	342°19.6	22.5	325°51.3	34.0	59°36.5	51.0	110°02.6	27.7
15	103°59.7	357°19.2	·· 22.2	340°52.2	·· 33.7	74°38.4	·· 51.2	125°04.9	·· 27.7
16	119°02.2	12°18.8	21.9	355°53.2	33.3	89°40.4	51.4	140°07.3	27.7
17	134°04.7	27°18.4	21.6	10°54.2	33.0	104°42.3	51.6	155°09.6	27.6
18	149°07.1	42°18.0	N25°21.3	25°55.2	N21°32.7	119°44.2	N10°51.8	170°12.0	S10°27.6
19	164°09.6	57°17.6	21.0	40°56.1	32.3	134°46.1	52.0	185°14.3	27.6
20	179°12.0	72°17.2	20.7	55°57.1	32.0	149°48.1	52.2	200°16.7	27.5
21	194°14.5	87°16.8	·· 20.4	70°58.1	·· 31.7	164°50.0	·· 52.3	215°19.1	·· 27.5
22	209°17.0	102°16.5	20.1	85°59.1	31.3	179°51.9	52.5	230°21.4	27.5
23	224°19.4	117°16.1	19.7	101°00.0	31.0	194°53.9	52.7	245°23.8	27.4
Mer.pass. 08:05		ν -0.4′ d -0.3′ m -4.25		ν 1.0′ d -0.3′ m 1.52		ν 1.9′ d 0.2′ m -2.08		ν 2.4′ d 0.0′ m 0.89	

Stars

	SHA	**Dec**
Alpheratz	357°36.4	29°12.9
Ankaa	353°08.8	-42°10.7
Schedar	349°33.0	56°39.6
Diphda	348°48.9	-17°51.6
Achernar	335°21.7	-57°07.0
Hamal	327°53.1	23°34.2
Polaris	315°10.6	89°21.6
Acamar	315°13.2	-40°12.7
Menkar	314°07.9	4°10.8
Mirfak	308°30.8	49°56.5
Aldebaran	290°41.6	16°33.3
Rigel	281°05.5	-8°10.6
Capella	280°24.4	46°01.3
Bellatrix	278°24.7	6°22.2
Elnath	278°04.0	28°37.6
Alnilam	275°39.4	-1°11.3
Betelgeuse	270°53.9	7°24.6
Canopus	263°53.5	-52°42.6
Sirius	258°27.7	-16°45.0
Adhara	255°07.2	-29°00.4
Procyon	244°52.5	5°09.9
Pollux	243°19.2	27°58.3
Avior	234°15.6	-59°35.3
Suhail	222°47.4	-43°31.8
Miaplacidus	221°38.8	-69°49.0
Alphard	217°49.2	-8°45.7
Regulus	207°35.9	11°51.2
Dubhe	193°42.5	61°37.8
Denebola	182°26.2	14°26.6
Gienah	175°44.8	-17°40.4
Acrux	173°01.2	-63°13.9
Gacrux	171°52.8	-57°14.8
Alioth	166°13.8	55°50.2
Spica	158°23.5	-11°17.1
Alkaid	152°52.7	49°11.9
Hadar	148°37.4	-60°29.3
Menkent	147°58.9	-36°29.2
Arcturus	145°48.9	19°03.7
Rigil Kent.	139°41.6	-60°56.0
Kochab	137°18.6	74°03.6
Zuben'ubi	136°57.2	-16°08.4
Alphecca	126°04.5	26°38.1
Antares	112°17.2	-26°29.0
Atria	107°12.1	-69°04.1
Sabik	102°04.0	-15°45.3
Shaula	96°11.9	-37°07.2
Rasalhague	95°59.5	12°32.5
Eltanin	90°42.4	51°28.9
Kaus Aust.	83°34.0	-34°22.4
Vega	80°33.8	38°48.1
Nunki	75°49.2	-26°16.0
Altair	62°01.1	8°55.6
Peacock	53°07.7	-56°39.4
Deneb	49°26.6	45°21.5
Enif	33°40.1	9°58.7
Al Na'ir	27°34.7	-46°50.7
Fomalhaut	15°16.1	-29°29.9
Scheat	13°46.7	28°12.3
Markab	13°31.4	15°19.6

May 19 Fri	**SHA**	**Mer.pass**
Venus	256°21.4	15:09
Mars	238°26.6	16:20
Jupiter	331°12.7	10:08
Saturn	21°12.2	06:48

May 20 Sat	**SHA**	**Mer.pass**
Venus	255°11.8	15:10
Mars	237°50.7	16:18
Jupiter	330°59.7	10:05
Saturn	21°09.4	06:45

May 21 Sun	**SHA**	**Mer.pass**
Venus	254°02.5	15:11
Mars	237°14.9	16:16
Jupiter	330°46.8	10:02
Saturn	21°06.8	06:41

Horizontal parallax	
Venus:	0.2
Mars:	0.1

h	Sun		Moon				
Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°53.2	N19°40.0	189°30.4	10.8′	N19°02.8	11.7′	57.0′
1	195°53.1	40.5	204°00.2	10.7′	19°14.5	11.5′	56.9′
2	210°53.1	41.0	218°29.9	10.6′	19°26.0	11.5′	56.9′
3	225°53.1	·· 41.6	232°59.5	10.6′	19°37.5	11.4′	56.9′
4	240°53.1	42.1	247°29.1	10.5′	19°48.9	11.2′	56.9′
5	255°53.0	42.7	261°58.7	10.5′	20°00.1	11.2′	56.9′
6	270°53.0	N19°43.2	276°28.2	10.4′	N20°11.3	11.0′	56.8′
7	285°53.0	43.7	290°57.6	10.4′	20°22.3	10.9′	56.8′
8	300°52.9	44.3	305°27.0	10.3′	20°33.2	10.9′	56.8′
9	315°52.9	·· 44.8	319°56.3	10.3′	20°44.1	10.7′	56.8′
10	330°52.9	45.3	334°25.6	10.2′	20°54.8	10.5′	56.7′
11	345°52.8	45.9	348°54.9	10.2′	21°05.3	10.5′	56.7′
12	0°52.8	N19°46.4	3°24.0	10.1′	N21°15.8	10.3′	56.7′
13	15°52.8	47.0	17°53.2	10.1′	21°26.1	10.3′	56.7′
14	30°52.8	47.5	32°22.3	10.0′	21°36.4	10.1′	56.6′
15	45°52.7	·· 48.0	46°51.3	10.0′	21°46.5	10.0′	56.6′
16	60°52.7	48.6	61°20.3	9.9′	21°56.5	9.8′	56.6′
17	75°52.7	49.1	75°49.2	9.9′	22°06.3	9.8′	56.6′
18	90°52.6	N19°49.6	90°18.1	9.8′	N22°16.1	9.6′	56.6′
19	105°52.6	50.2	104°46.9	9.8′	22°25.7	9.5′	56.5′
20	120°52.6	50.7	119°15.7	9.7′	22°35.2	9.3′	56.5′
21	135°52.5	·· 51.2	133°44.4	9.7′	22°44.5	9.3′	56.5′
22	150°52.5	51.7	148°13.1	9.6′	22°53.8	9.1′	56.5′
23	165°52.5	52.3	162°41.7	9.6′	23°02.9	9.0′	56.4′
	SD = 15.8′	d = 0.5′	SD = 15.5′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°52.4	N19°52.8	177°10.3	9.5′	N23°11.9	8.8′	56.4′
1	195°52.4	53.3	191°38.8	9.5′	23°20.7	8.8′	56.4′
2	210°52.4	53.9	206°07.3	9.4′	23°29.5	8.6′	56.4′
3	225°52.3	·· 54.4	220°35.8	9.4′	23°38.1	8.4′	56.3′
4	240°52.3	54.9	235°04.2	9.4′	23°46.5	8.4′	56.3′
5	255°52.3	55.4	249°32.6	9.3′	23°54.9	8.2′	56.3′
6	270°52.2	N19°56.0	264°00.9	9.3′	N24°03.1	8.0′	56.3′
7	285°52.2	56.5	278°29.1	9.2′	24°11.1	8.0′	56.2′
8	300°52.1	57.0	292°57.4	9.2′	24°19.1	7.8′	56.2′
9	315°52.1	·· 57.5	307°25.6	9.1′	24°26.9	7.6′	56.2′
10	330°52.1	58.1	321°53.7	9.1′	24°34.5	7.5′	56.2′
11	345°52.0	58.6	336°21.8	9.1′	24°42.0	7.4′	56.2′
12	0°52.0	N19°59.1	350°49.9	9.0′	N24°49.4	7.3′	56.1′
13	15°52.0	19°59.6	5°17.9	9.0′	24°56.7	7.1′	56.1′
14	30°51.9	20°00.1	19°45.9	9.0′	25°03.8	7.0′	56.1′
15	45°51.9	·· 00.7	34°13.9	8.9′	25°10.8	6.8′	56.1′
16	60°51.9	01.2	48°41.8	8.9′	25°17.6	6.7′	56.0′
17	75°51.8	01.7	63°09.7	8.9′	25°24.3	6.6′	56.0′
18	90°51.8	N20°02.2	77°37.5	8.8′	N25°30.9	6.4′	56.0′
19	105°51.7	02.7	92°05.4	8.8′	25°37.3	6.2′	56.0′
20	120°51.7	03.3	106°33.2	8.8′	25°43.5	6.2′	55.9′
21	135°51.7	·· 03.8	121°00.9	8.7′	25°49.7	5.9′	55.9′
22	150°51.6	04.3	135°28.7	8.7′	25°55.6	5.9′	55.9′
23	165°51.6	04.8	149°56.4	8.7′	26°01.5	5.7′	55.9′
	SD = 15.8′	d = 0.5′	SD = 15.4′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°51.5	N20°05.3	164°24.0	8.7′	N26°07.2	5.5′	55.8′
1	195°51.5	05.8	178°51.7	8.6′	26°12.7	5.4′	55.8′
2	210°51.5	06.3	193°19.3	8.6′	26°18.1	5.3′	55.8′
3	225°51.4	·· 06.9	207°46.9	8.6′	26°23.4	5.1′	55.8′
4	240°51.4	07.4	222°14.5	8.6′	26°28.5	5.0′	55.8′
5	255°51.3	07.9	236°42.1	8.5′	26°33.5	4.8′	55.7′
6	270°51.3	N20°08.4	251°09.6	8.5′	N26°38.3	4.7′	55.7′
7	285°51.3	08.9	265°37.2	8.5′	26°43.0	4.5′	55.7′
8	300°51.2	09.4	280°04.7	8.5′	26°47.5	4.4′	55.7′
9	315°51.2	·· 09.9	294°32.2	8.5′	26°51.9	4.3′	55.6′
10	330°51.1	10.4	308°59.6	8.5′	26°56.2	4.0′	55.6′
11	345°51.1	10.9	323°27.1	8.5′	27°00.2	4.0′	55.6′
12	0°51.1	N20°11.4	337°54.5	8.4′	N27°04.2	3.8′	55.6′
13	15°51.0	11.9	352°22.0	8.4′	27°08.0	3.6′	55.6′
14	30°51.0	12.5	6°49.4	8.4′	27°11.6	3.5′	55.5′
15	45°50.9	·· 13.0	21°16.9	8.4′	27°15.1	3.4′	55.5′
16	60°50.9	13.5	35°44.3	8.4′	27°18.5	3.2′	55.5′
17	75°50.8	14.0	50°11.7	8.4′	27°21.7	3.0′	55.5′
18	90°50.8	N20°14.5	64°39.1	8.4′	N27°24.7	2.9′	55.4′
19	105°50.7	15.0	79°06.5	8.4′	27°27.6	2.8′	55.4′
20	120°50.7	15.5	93°33.9	8.4′	27°30.4	2.6′	55.4′
21	135°50.7	·· 16.0	108°01.3	8.4′	27°33.0	2.4′	55.4′
22	150°50.6	16.5	122°28.8	8.4′	27°35.4	2.3′	55.4′
23	165°50.6	17.0	136°56.2	8.4′	27°37.7	2.2′	55.3′
	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°	–:–	–:–	01:18	22:41	–:–	–:–
66°	–:–	–:–	02:03	21:53	–:–	–:–
64°	–:–	00:20	02:32	21:23	–:–	–:–
62°	–:–	01:30	02:54	21:01	22:27	–:–
60°	–:–	02:04	03:12	20:43	21:52	–:–
N 58°	00:17	02:28	03:27	20:28	21:27	–:–
56°	01:22	02:47	03:39	20:15	21:08	22:35
54°	01:53	03:03	03:50	20:04	20:52	22:03
52°	02:15	03:16	03:59	19:55	20:38	21:40
50°	02:33	03:28	04:08	19:46	20:26	21:21
45°	03:07	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	04:38	05:04	18:49	19:16	19:48
20°	04:30	04:59	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°	05:20	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	17:20	17:53
45°	06:08	06:44	07:16	16:36	17:09	17:45
S 50°	06:17	06:57	07:33	16:20	16:56	17:36
52°	06:21	07:02	07:41	16:12	16:50	17:32
54°	06:25	07:09	07:50	16:03	16:44	17:28
56°	06:29	07:16	07:59	15:53	16:37	17:23
58°	06:34	07:24	08:10	15:42	16:29	17:18
S 60°	06:39	07:32	08:23	15:29	16:20	17:13

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

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	Age 0-2 1-2%
19	03:33	03:31	11:56	11:46	–:–	
20	03:30	03:28	11:57	12:38	00:12	
21	03:26	03:24	11:57	13:32	01:05	

May 22, 23, 24 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	239°21.9	132°15.7	**N**25°19.4	116°01.0	**N**21°30.7	209°55.8	**N**10°52.9	260°26.1	**S**10°27.4
1	254°24.4	147°15.3	19.1	131°02.0	30.3	224°57.7	53.1	275°28.5	27.4
2	269°26.8	162°14.9	18.8	146°02.9	30.0	239°59.6	53.3	290°30.9	27.3
3	284°29.3	177°14.5	·· 18.5	161°03.9	·· 29.7	255°01.6	·· 53.5	305°33.2	·· 27.3
4	299°31.8	192°14.1	18.2	176°04.9	29.3	270°03.5	53.7	320°35.6	27.3
5	314°34.2	207°13.7	17.9	191°05.9	29.0	285°05.4	53.9	335°37.9	27.2
6	329°36.7	222°13.3	**N**25°17.6	206°06.8	**N**21°28.6	300°07.3	**N**10°54.1	350°40.3	**S**10°27.2
7	344°39.2	237°12.9	17.3	221°07.8	28.3	315°09.3	54.3	5°42.7	27.2
8	359°41.6	252°12.6	16.9	236°08.8	28.0	330°11.2	54.5	20°45.0	27.1
9	14°44.1	267°12.2	·· 16.6	251°09.7	·· 27.6	345°13.1	·· 54.7	35°47.4	·· 27.1
10	29°46.5	282°11.8	16.3	266°10.7	27.3	0°15.1	54.8	50°49.7	27.1
11	44°49.0	297°11.4	16.0	281°11.7	27.0	15°17.0	55.0	65°52.1	27.1
12	59°51.5	312°11.0	**N**25°15.7	296°12.7	**N**21°26.6	30°18.9	**N**10°55.2	80°54.5	**S**10°27.0
13	74°53.9	327°10.6	15.3	311°13.6	26.3	45°20.8	55.4	95°56.8	27.0
14	89°56.4	342°10.3	15.0	326°14.6	25.9	60°22.8	55.6	110°59.2	27.0
15	104°58.9	357°09.9	·· 14.7	341°15.6	·· 25.6	75°24.7	·· 55.8	126°01.5	·· 26.9
16	120°01.3	12°09.5	14.4	356°16.5	25.3	90°26.6	56.0	141°03.9	26.9
17	135°03.8	27°09.1	14.0	11°17.5	24.9	105°28.6	56.2	156°06.3	26.9
18	150°06.3	42°08.7	**N**25°13.7	26°18.5	**N**21°24.6	120°30.5	**N**10°56.4	171°08.6	**S**10°26.8
19	165°08.7	57°08.4	13.4	41°19.5	24.3	135°32.4	56.6	186°11.0	26.8
20	180°11.2	72°08.0	13.1	56°20.4	23.9	150°34.3	56.8	201°13.4	26.8
21	195°13.6	87°07.6	·· 12.7	71°21.4	·· 23.6	165°36.3	·· 57.0	216°15.7	·· 26.7
22	210°16.1	102°07.2	12.4	86°22.4	23.2	180°38.2	57.1	231°18.1	26.7
23	225°18.6	117°06.9	12.1	101°23.3	22.9	195°40.1	57.3	246°20.4	26.7
Mer.pass. 08:01		ν -0.4′ d -0.3′ m -4.26		ν 1.0′ d -0.3′ m 1.52		ν 1.9′ d 0.2′ m -2.08		ν 2.4′ d 0.0′ m 0.88	

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	240°21.0	132°06.5	**N**25°11.7	116°24.3	**N**21°22.6	210°42.1	**N**10°57.5	261°22.8	**S**10°26.7
1	255°23.5	147°06.1	11.4	131°25.3	22.2	225°44.0	57.7	276°25.2	26.6
2	270°26.0	162°05.8	11.1	146°26.3	21.9	240°45.9	57.9	291°27.5	26.6
3	285°28.4	177°05.4	·· 10.7	161°27.2	·· 21.5	255°47.8	·· 58.1	306°29.9	·· 26.6
4	300°30.9	192°05.0	10.4	176°28.2	21.2	270°49.8	58.3	321°32.3	26.5
5	315°33.4	207°04.7	10.1	191°29.2	20.8	285°51.7	58.5	336°34.6	26.5
6	330°35.8	222°04.3	**N**25°09.7	206°30.2	**N**21°20.5	300°53.6	**N**10°58.7	351°37.0	**S**10°26.5
7	345°38.3	237°03.9	09.4	221°31.1	20.2	315°55.6	58.9	6°39.3	26.4
8	0°40.8	252°03.6	09.0	236°32.1	19.8	330°57.5	59.1	21°41.7	26.4
9	15°43.2	267°03.2	·· 08.7	251°33.1	·· 19.5	345°59.4	·· 59.2	36°44.1	·· 26.4
10	30°45.7	282°02.8	08.4	266°34.0	19.1	1°01.3	59.4	51°46.4	26.4
11	45°48.1	297°02.5	08.0	281°35.0	18.8	16°03.3	59.6	66°48.8	26.3
12	60°50.6	312°02.1	**N**25°07.7	296°36.0	**N**21°18.5	31°05.2	**N**10°59.8	81°51.2	**S**10°26.3
13	75°53.1	327°01.7	07.3	311°37.0	18.1	46°07.1	11°00.0	96°53.5	26.3
14	90°55.5	342°01.4	07.0	326°37.9	17.8	61°09.1	00.2	111°55.9	26.2
15	105°58.0	357°01.0	·· 06.6	341°38.9	·· 17.4	76°11.0	·· 00.4	126°58.3	·· 26.2
16	121°00.5	12°00.7	06.3	356°39.9	17.1	91°12.9	00.6	142°00.6	26.2
17	136°02.9	27°00.3	05.9	11°40.8	16.7	106°14.9	00.8	157°03.0	26.1
18	151°05.4	41°59.9	**N**25°05.6	26°41.8	**N**21°16.4	121°16.8	**N**11°01.0	172°05.4	**S**10°26.1
19	166°07.9	56°59.6	05.2	41°42.8	16.0	136°18.7	01.1	187°07.7	26.1
20	181°10.3	71°59.2	04.9	56°43.8	15.7	151°20.6	01.3	202°10.1	26.1
21	196°12.8	86°58.9	·· 04.5	71°44.7	·· 15.4	166°22.6	·· 01.5	217°12.5	·· 26.0
22	211°15.3	101°58.5	04.2	86°45.7	15.0	181°24.5	01.7	232°14.8	26.0
23	226°17.7	116°58.2	03.8	101°46.7	14.7	196°26.4	01.9	247°17.2	26.0
Mer.pass. 07:57		ν -0.4′ d -0.3′ m -4.27		ν 1.0′ d -0.3′ m 1.53		ν 1.9′ d 0.2′ m -2.09		ν 2.4′ d 0.0′ m 0.88	

Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	241°20.2	131°57.8	**N**25°03.5	116°47.7	**N**21°14.3	211°28.4	**N**11°02.1	262°19.6	**S**10°25.9
1	256°22.6	146°57.5	03.1	131°48.6	14.0	226°30.3	02.3	277°21.9	25.9
2	271°25.1	161°57.1	02.8	146°49.6	13.6	241°32.2	02.5	292°24.3	25.9
3	286°27.6	176°56.8	·· 02.4	161°50.6	·· 13.3	256°34.2	·· 02.7	307°26.7	·· 25.9
4	301°30.0	191°56.4	02.0	176°51.5	12.9	271°36.1	02.9	322°29.0	25.8
5	316°32.5	206°56.1	01.7	191°52.5	12.6	286°38.0	03.0	337°31.4	25.8
6	331°35.0	221°55.7	**N**25°01.3	206°53.5	**N**21°12.2	301°40.0	**N**11°03.2	352°33.8	**S**10°25.8
7	346°37.4	236°55.4	01.0	221°54.5	11.9	316°41.9	03.4	7°36.1	25.7
8	1°39.9	251°55.0	00.6	236°55.4	11.5	331°43.8	03.6	22°38.5	25.7
9	16°42.4	266°54.7	25°00.2	251°56.4	·· 11.2	346°45.7	·· 03.8	37°40.9	·· 25.7
10	31°44.8	281°54.4	24°59.9	266°57.4	10.8	1°47.7	04.0	52°43.2	25.7
11	46°47.3	296°54.0	59.5	281°58.3	10.5	16°49.6	04.2	67°45.6	25.6
12	61°49.8	311°53.7	**N**24°59.1	296°59.3	**N**21°10.2	31°51.5	**N**11°04.4	82°48.0	**S**10°25.6
13	76°52.2	326°53.3	58.8	312°00.3	09.8	46°53.5	04.6	97°50.3	25.6
14	91°54.7	341°53.0	58.4	327°01.3	09.5	61°55.4	04.8	112°52.7	25.5
15	106°57.1	356°52.7	·· 58.0	342°02.2	·· 09.1	76°57.3	·· 04.9	127°55.1	·· 25.5
16	121°59.6	11°52.3	57.6	357°03.2	08.8	91°59.3	05.1	142°57.4	25.5
17	137°02.1	26°52.0	57.3	12°04.2	08.4	107°01.2	05.3	157°59.8	25.5
18	152°04.5	41°51.7	**N**24°56.9	27°05.2	**N**21°08.1	122°03.1	**N**11°05.5	173°02.2	**S**10°25.4
19	167°07.0	56°51.3	56.5	42°06.1	07.7	137°05.1	05.7	188°04.5	25.4
20	182°09.5	71°51.0	56.2	57°07.1	07.4	152°07.0	05.9	203°06.9	25.4
21	197°11.9	86°50.7	·· 55.8	72°08.1	·· 07.0	167°08.9	·· 06.1	218°09.3	·· 25.4
22	212°14.4	101°50.3	55.4	87°09.0	06.7	182°10.9	06.3	233°11.7	25.3
23	227°16.9	116°50.0	55.0	102°10.0	06.3	197°12.8	06.5	248°14.0	25.3
Mer.pass. 07:53		ν -0.4′ d -0.4′ m -4.28		ν 1.0′ d -0.3′ m 1.54		ν 1.9′ d 0.2′ m -2.09		ν 2.4′ d 0.0′ m 0.88	

Stars

	SHA	**Dec**
Alpheratz	357°36.4	29°12.9
Ankaa	353°08.7	-42°10.7
Schedar	349°33.0	56°39.6
Diphda	348°48.9	-17°51.5
Achernar	335°21.7	-57°07.0
Hamal	327°53.1	23°34.2
Polaris	315°09.9	89°21.6
Acamar	315°13.2	-40°12.7
Menkar	314°07.9	4°10.8
Mirfak	308°30.7	49°56.5
Aldebaran	290°41.5	16°33.3
Rigel	281°05.5	-8°10.5
Capella	280°24.4	46°01.3
Bellatrix	278°24.7	6°22.2
Elnath	278°04.0	28°37.6
Alnilam	275°39.4	-1°11.3
Betelgeuse	270°53.9	7°24.6
Canopus	263°53.5	-52°42.6
Sirius	258°27.7	-16°45.0
Adhara	255°07.2	-29°00.3
Procyon	244°52.5	5°09.9
Pollux	243°19.2	27°58.3
Avior	234°15.6	-59°35.3
Suhail	222°47.5	-43°31.8
Miaplacidus	221°38.8	-69°49.0
Alphard	217°49.2	-8°45.6
Regulus	207°35.9	11°51.2
Dubhe	193°42.5	61°37.8
Denebola	182°26.2	14°26.6
Gienah	175°44.8	-17°40.4
Acrux	173°01.2	-63°13.9
Gacrux	171°52.8	-57°14.8
Alioth	166°13.8	55°50.2
Spica	158°23.5	-11°17.1
Alkaid	152°52.7	49°11.9
Hadar	148°37.4	-60°29.3
Menkent	147°58.9	-36°29.2
Arcturus	145°48.9	19°03.7
Rigil Kent.	139°41.6	-60°56.0
Kochab	137°18.6	74°03.7
Zuben'ubi	136°57.2	-16°08.4
Alphecca	126°04.5	26°38.1
Antares	112°17.2	-26°29.0
Atria	107°12.1	-69°04.1
Sabik	102°04.0	-15°45.3
Shaula	96°11.8	-37°07.2
Rasalhague	95°59.5	12°32.5
Eltanin	90°42.3	51°28.9
Kaus Aust.	83°34.0	-34°22.4
Vega	80°33.8	38°48.1
Nunki	75°49.2	-26°16.0
Altair	62°01.1	8°55.7
Peacock	53°07.6	-56°39.4
Deneb	49°26.6	45°21.5
Enif	33°40.1	9°58.7
Al Na'ir	27°34.6	-46°50.7
Fomalhaut	15°16.1	-29°29.9
Scheat	13°46.6	28°12.3
Markab	13°31.3	15°19.6

May 22 Mon	**SHA**	**Mer.pass**
Venus	252°53.8	15:11
Mars	236°39.1	16:15
Jupiter	330°33.9	09:59
Saturn	21°04.2	06:37

May 23 Tue	**SHA**	**Mer.pass**
Venus	251°45.5	15:12
Mars	236°03.3	16:13
Jupiter	330°21.0	09:56
Saturn	21°01.8	06:33

May 24 Wed	**SHA**	**Mer.pass**
Venus	250°37.6	15:12
Mars	235°27.5	16:12
Jupiter	330°08.2	09:53
Saturn	20°59.4	06:30

Horizontal parallax	
Venus:	0.2
Mars:	0.1

h	Sun		Moon				
Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°50.5	N20°17.5	151°23.6	8.4′	N27°39.9	2.0′	55.3′
1	195°50.5	18.0	165°51.0	8.4′	27°41.9	1.9′	55.3′
2	210°50.4	18.5	180°18.5	8.4′	27°43.8	1.7′	55.3′
3	225°50.4	·· 19.0	194°45.9	8.5′	27°45.5	1.6′	55.2′
4	240°50.3	19.5	209°13.4	8.5′	27°47.1	1.4′	55.2′
5	255°50.3	20.0	223°40.9	8.5′	27°48.5	1.2′	55.2′
6	270°50.3	N20°20.5	238°08.3	8.5′	N27°49.7	1.2′	55.2′
7	285°50.2	21.0	252°35.8	8.5′	27°50.9	0.9′	55.2′
8	300°50.2	21.5	267°03.4	8.5′	27°51.8	0.9′	55.1′
9	315°50.1	·· 22.0	281°30.9	8.6′	27°52.7	0.6′	55.1′
10	330°50.1	22.5	295°58.5	8.6′	27°53.3	0.6′	55.1′
11	345°50.0	22.9	310°26.0	8.6′	27°53.9	0.3′	55.1′
12	0°50.0	N20°23.4	324°53.6	8.6′	N27°54.2	0.3′	55.1′
13	15°49.9	23.9	339°21.3	8.7′	27°54.5	0.1′	55.0′
14	30°49.9	24.4	353°48.9	8.7′	27°54.6	0.1′	55.0′
15	45°49.8	·· 24.9	8°16.6	8.7′	27°54.5	0.2′	55.0′
16	60°49.8	25.4	22°44.3	8.7′	27°54.3	0.3′	55.0′
17	75°49.7	25.9	37°12.0	8.8′	27°54.0	0.5′	55.0′
18	90°49.7	N20°26.4	51°39.8	8.8′	N27°53.5	0.7′	55.0′
19	105°49.6	26.9	66°07.6	8.8′	27°52.8	0.7′	54.9′
20	120°49.6	27.4	80°35.4	8.9′	27°52.1	1.0′	54.9′
21	135°49.5	·· 27.8	95°03.3	8.9′	27°51.1	1.0′	54.9′
22	150°49.5	28.3	109°31.2	8.9′	27°50.1	1.2′	54.9′
23	165°49.4	28.8	123°59.2	9.0′	27°48.9	1.4′	54.9′
	SD = 15.8′	d = 0.5′	SD = 15.1′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°49.4	N20°29.3	138°27.1	9.0′	N27°47.5	1.5′	54.8′
1	195°49.3	29.8	152°55.2	9.1′	27°46.0	1.6′	54.8′
2	210°49.3	30.3	167°23.2	9.1′	27°44.4	1.8′	54.8′
3	225°49.2	·· 30.8	181°51.3	9.1′	27°42.6	1.9′	54.8′
4	240°49.2	31.2	196°19.5	9.2′	27°40.7	2.1′	54.8′
5	255°49.1	31.7	210°47.7	9.2′	27°38.6	2.2′	54.8′
6	270°49.1	N20°32.2	225°15.9	9.3′	N27°36.4	2.3′	54.7′
7	285°49.0	32.7	239°44.2	9.3′	27°34.1	2.5′	54.7′
8	300°49.0	33.2	254°12.5	9.4′	27°31.6	2.6′	54.7′
9	315°48.9	·· 33.6	268°40.9	9.4′	27°29.0	2.7′	54.7′
10	330°48.9	34.1	283°09.4	9.5′	27°26.3	2.9′	54.7′
11	345°48.8	34.6	297°37.8	9.5′	27°23.4	3.0′	54.7′
12	0°48.8	N20°35.1	312°06.4	9.6′	N27°20.4	3.1′	54.6′
13	15°48.7	35.6	326°35.0	9.6′	27°17.3	3.3′	54.6′
14	30°48.6	36.0	341°03.6	9.7′	27°14.0	3.4′	54.6′
15	45°48.6	·· 36.5	355°32.3	9.8′	27°10.6	3.6′	54.6′
16	60°48.5	37.0	10°01.1	9.8′	27°07.0	3.7′	54.6′
17	75°48.5	37.5	24°29.9	9.9′	27°03.3	3.8′	54.6′
18	90°48.4	N20°37.9	38°58.8	9.9′	N26°59.5	3.9′	54.6′
19	105°48.4	38.4	53°27.7	10.0′	26°55.6	4.1′	54.5′
20	120°48.3	38.9	67°56.7	10.1′	26°51.5	4.2′	54.5′
21	135°48.3	·· 39.4	82°25.8	10.1′	26°47.3	4.3′	54.5′
22	150°48.2	39.8	96°54.9	10.2′	26°43.0	4.5′	54.5′
23	165°48.2	40.3	111°24.1	10.2′	26°38.5	4.6′	54.5′
	SD = 15.8′	d = 0.5′	SD = 15.0′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°48.1	N20°40.8	125°53.3	10.3′	N26°33.9	4.7′	54.5′
1	195°48.0	41.2	140°22.6	10.4′	26°29.2	4.8′	54.5′
2	210°48.0	41.7	154°52.0	10.4′	26°24.4	4.9′	54.4′
3	225°47.9	·· 42.2	169°21.4	10.5′	26°19.5	5.1′	54.4′
4	240°47.9	42.6	183°50.9	10.6′	26°14.4	5.2′	54.4′
5	255°47.8	43.1	198°20.5	10.6′	26°09.2	5.4′	54.4′
6	270°47.8	N20°43.6	212°50.1	10.7′	N26°03.8	5.4′	54.4′
7	285°47.7	44.0	227°19.8	10.8′	25°58.4	5.6′	54.4′
8	300°47.7	44.5	241°49.6	10.8′	25°52.8	5.6′	54.4′
9	315°47.6	·· 45.0	256°19.4	10.9′	25°47.2	5.8′	54.4′
10	330°47.5	45.4	270°49.3	11.0′	25°41.4	6.0′	54.4′
11	345°47.5	45.9	285°19.3	11.0′	25°35.4	6.0′	54.3′
12	0°47.4	N20°46.4	299°49.3	11.1′	N25°29.4	6.2′	54.3′
13	15°47.4	46.8	314°19.4	11.2′	25°23.2	6.2′	54.3′
14	30°47.3	47.3	328°49.6	11.2′	25°17.0	6.4′	54.3′
15	45°47.2	·· 47.8	343°19.8	11.3′	25°10.6	6.5′	54.3′
16	60°47.2	48.2	357°50.1	11.4′	25°04.1	6.6′	54.3′
17	75°47.1	48.7	12°20.5	11.5′	24°57.5	6.7′	54.3′
18	90°47.1	N20°49.1	26°51.0	11.5′	N24°50.8	6.9′	54.3′
19	105°47.0	49.6	41°21.5	11.6′	24°43.9	6.9′	54.3′
20	120°46.9	50.1	55°52.1	11.7′	24°37.0	7.0′	54.3′
21	135°46.9	·· 50.5	70°22.8	11.7′	24°30.0	7.2′	54.3′
22	150°46.8	51.0	84°53.5	11.8′	24°22.8	7.3′	54.2′
23	165°46.8	51.4	99°24.4	11.9′	24°15.5	7.3′	54.2′
	SD = 15.8′	d = 0.5′	SD = 14.9′				

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

Lat.	**Moonrise** Mon	Tue	Wed	**Moonset** Mon	Tue	Wed
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	▭	▭	▭	▭	▭	▭
66°	▭	▭	▭	▭	▭	▭
64°	▭	▭	▭	▭	▭	▭
62°	02:40	03:36	05:21	01:15	02:11	02:14
60°	03:41	04:37	05:58	00:14	01:10	01:36
N 58°	04:15	05:11	06:25	·· ··	00:36	01:09
56°	04:40	05:36	06:46	·· ··	00:11	00:48
54°	05:00	05:56	07:03	23:51	·· ··	00:30
52°	05:17	06:12	07:18	23:34	·· ··	00:15
50°	05:31	06:27	07:31	23:20	·· ··	00:02
45°	06:01	06:56	07:57	22:50	23:35	·· ··
N 40°	06:24	07:18	08:18	22:27	23:14	23:52
35°	06:43	07:37	08:35	22:08	22:56	23:36
30°	06:59	07:53	08:50	21:52	22:41	23:23
20°	07:27	08:21	09:15	21:25	22:15	23:00
N 10°	07:51	08:44	09:37	21:01	21:52	22:40
0°	08:13	09:06	09:57	20:39	21:31	22:21
S 10°	08:35	09:28	10:17	20:16	21:10	22:02
20°	08:59	09:51	10:39	19:52	20:47	21:41
30°	09:27	10:18	11:04	19:25	20:20	21:18
35°	09:43	10:34	11:18	19:08	20:05	21:04
40°	10:02	10:53	11:35	18:49	19:46	20:47
45°	10:26	11:15	11:55	18:26	19:24	20:28
S 50°	10:55	11:44	12:20	17:56	18:56	20:04
52°	11:10	11:58	12:33	17:41	18:42	19:52
54°	11:28	12:14	12:47	17:24	18:26	19:38
56°	11:48	12:34	13:03	17:03	18:07	19:22
58°	12:14	12:58	13:22	16:37	17:43	19:04
S 60°	12:51	13:29	13:46	16:01	17:12	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 3-5 6-18%
22	03:22	03:20	11:57	14:26	01:59	
23	03:18	03:15	11:57	15:18	02:52	
24	03:12	03:10	11:57	16:09	03:44	

May 25, 26, 27 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	242°19.3	131°49.7	N24°54.6	117°11.0	N21°06.0	212°14.7	N11°06.6	263°16.4	S10°25.3
1	257°21.8	146°49.3	54.3	132°12.0	05.6	227°16.7	06.8	278°18.8	25.2
2	272°24.3	161°49.0	53.9	147°12.9	05.3	242°18.6	07.0	293°21.1	25.2
3	287°26.7	176°48.7	·· 53.5	162°13.9	·· 04.9	257°20.5	·· 07.2	308°23.5	·· 25.2
4	302°29.2	191°48.4	53.1	177°14.9	04.5	272°22.5	07.4	323°25.9	25.2
5	317°31.6	206°48.0	52.7	192°15.9	04.2	287°24.4	07.6	338°28.2	25.1
6	332°34.1	221°47.7	N24°52.4	207°16.8	N21°03.8	302°26.3	N11°07.8	353°30.6	S10°25.1
7	347°36.6	236°47.4	52.0	222°17.8	03.5	317°28.3	08.0	8°33.0	25.1
8	2°39.0	251°47.1	51.6	237°18.8	03.1	332°30.2	08.1	23°35.4	25.1
9	17°41.5	266°46.7	·· 51.2	252°19.7	·· 02.8	347°32.1	·· 08.3	38°37.7	·· 25.0
10	32°44.0	281°46.4	50.8	267°20.7	02.4	2°34.1	08.5	53°40.1	25.0
11	47°46.4	296°46.1	50.4	282°21.7	02.1	17°36.0	08.7	68°42.5	25.0
12	62°48.9	311°45.8	N24°50.0	297°22.7	N21°01.7	32°37.9	N11°08.9	83°44.8	S10°24.9
13	77°51.4	326°45.5	49.6	312°23.6	01.4	47°39.9	09.1	98°47.2	24.9
14	92°53.8	341°45.1	49.3	327°24.6	01.0	62°41.8	09.3	113°49.6	24.9
15	107°56.3	356°44.8	·· 48.9	342°25.6	·· 00.7	77°43.7	·· 09.5	128°52.0	·· 24.9
16	122°58.7	11°44.5	48.5	357°26.6	00.3	92°45.7	09.6	143°54.3	24.8
17	138°01.2	26°44.2	48.1	12°27.5	21°00.0	107°47.6	09.8	158°56.7	24.8
18	153°03.7	41°43.9	N24°47.7	27°28.5	N20°59.6	122°49.5	N11°10.0	173°59.1	S10°24.8
19	168°06.1	56°43.6	47.3	42°29.5	59.2	137°51.5	10.2	189°01.5	24.8
20	183°08.6	71°43.3	46.9	57°30.4	58.9	152°53.4	10.4	204°03.8	24.7
21	198°11.1	86°43.0	·· 46.5	72°31.4	·· 58.5	167°55.3	·· 10.6	219°06.2	·· 24.7
22	213°13.5	101°42.6	46.1	87°32.4	58.2	182°57.3	10.8	234°08.6	24.7
23	228°16.0	116°42.3	45.7	102°33.4	57.8	197°59.2	11.0	249°10.9	24.7
Mer.pass. 07:49		ν -0.3′ d -0.4′ m -4.28		ν 1.0′ d -0.4′ m 1.55		ν 1.9′ d 0.2′ m -2.09		ν 2.4′ d 0.0′ m 0.88	

Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	243°18.5	131°42.0	N24°45.3	117°34.3	N20°57.5	213°01.1	N11°11.2	264°13.3	S10°24.6
1	258°20.9	146°41.7	44.9	132°35.3	57.1	228°03.1	11.3	279°15.7	24.6
2	273°23.4	161°41.4	44.5	147°36.3	56.7	243°05.0	11.5	294°18.1	24.6
3	288°25.9	176°41.1	·· 44.1	162°37.3	·· 56.4	258°06.9	·· 11.7	309°20.4	·· 24.6
4	303°28.3	191°40.8	43.7	177°38.2	56.0	273°08.9	11.9	324°22.8	24.5
5	318°30.8	206°40.5	43.3	192°39.2	55.7	288°10.8	12.1	339°25.2	24.5
6	333°33.2	221°40.2	N24°42.9	207°40.2	N20°55.3	303°12.7	N11°12.3	354°27.6	S10°24.5
7	348°35.7	236°39.9	42.5	222°41.2	55.0	318°14.7	12.5	9°29.9	24.5
8	3°38.2	251°39.6	42.1	237°42.1	54.6	333°16.6	12.6	24°32.3	24.4
9	18°40.6	266°39.3	·· 41.6	252°43.1	·· 54.2	348°18.5	·· 12.8	39°34.7	·· 24.4
10	33°43.1	281°39.0	41.2	267°44.1	53.9	3°20.5	13.0	54°37.1	24.4
11	48°45.6	296°38.7	40.8	282°45.0	53.5	18°22.4	13.2	69°39.4	24.4
12	63°48.0	311°38.4	N24°40.4	297°46.0	N20°53.2	33°24.3	N11°13.4	84°41.8	S10°24.3
13	78°50.5	326°38.1	40.0	312°47.0	52.8	48°26.3	13.6	99°44.2	24.3
14	93°53.0	341°37.8	39.6	327°48.0	52.4	63°28.2	13.8	114°46.6	24.3
15	108°55.4	356°37.5	·· 39.2	342°48.9	·· 52.1	78°30.2	·· 14.0	129°48.9	·· 24.3
16	123°57.9	11°37.2	38.8	357°49.9	51.7	93°32.1	14.1	144°51.3	24.2
17	139°00.4	26°37.0	38.3	12°50.9	51.4	108°34.0	14.3	159°53.7	24.2
18	154°02.8	41°36.7	N24°37.9	27°51.9	N20°51.0	123°36.0	N11°14.5	174°56.1	S10°24.2
19	169°05.3	56°36.4	37.5	42°52.8	50.6	138°37.9	14.7	189°58.5	24.2
20	184°07.7	71°36.1	37.1	57°53.8	50.3	153°39.8	14.9	205°00.8	24.1
21	199°10.2	86°35.8	·· 36.7	72°54.8	·· 49.9	168°41.8	·· 15.1	220°03.2	·· 24.1
22	214°12.7	101°35.5	36.2	87°55.8	49.6	183°43.7	15.3	235°05.6	24.1
23	229°15.1	116°35.2	35.8	102°56.7	49.2	198°45.6	15.4	250°08.0	24.1
Mer.pass. 07:45		ν -0.3′ d -0.4′ m -4.29		ν 1.0′ d -0.4′ m 1.55		ν 1.9′ d 0.2′ m -2.09		ν 2.4′ d 0.0′ m 0.87	

Sat	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	244°17.6	131°34.9	N24°35.4	117°57.7	N20°48.8	213°47.6	N11°15.6	265°10.3	S10°24.0
1	259°20.1	146°34.7	35.0	132°58.7	48.5	228°49.5	15.8	280°12.7	24.0
2	274°22.5	161°34.4	34.6	147°59.7	48.1	243°51.4	16.0	295°15.1	24.0
3	289°25.0	176°34.1	·· 34.1	163°00.6	·· 47.8	258°53.4	·· 16.2	310°17.5	·· 24.0
4	304°27.5	191°33.8	33.7	178°01.6	47.4	273°55.3	16.4	325°19.8	23.9
5	319°29.9	206°33.5	33.3	193°02.6	47.0	288°57.3	16.6	340°22.2	23.9
6	334°32.4	221°33.3	N24°32.9	208°03.5	N20°46.7	303°59.2	N11°16.7	355°24.6	S10°23.9
7	349°34.9	236°33.0	32.4	223°04.5	46.3	319°01.1	16.9	10°27.0	23.9
8	4°37.3	251°32.7	32.0	238°05.5	45.9	334°03.1	17.1	25°29.4	23.8
9	19°39.8	266°32.4	·· 31.6	253°06.5	·· 45.6	349°05.0	·· 17.3	40°31.7	·· 23.8
10	34°42.2	281°32.2	31.1	268°07.4	45.2	4°06.9	17.5	55°34.1	23.8
11	49°44.7	296°31.9	30.7	283°08.4	44.9	19°08.9	17.7	70°36.5	23.8
12	64°47.2	311°31.6	N24°30.3	298°09.4	N20°44.5	34°10.8	N11°17.9	85°38.9	S10°23.7
13	79°49.6	326°31.3	29.8	313°10.4	44.1	49°12.8	18.0	100°41.3	23.7
14	94°52.1	341°31.1	29.4	328°11.3	43.8	64°14.7	18.2	115°43.6	23.7
15	109°54.6	356°30.8	·· 29.0	343°12.3	·· 43.4	79°16.6	·· 18.4	130°46.0	·· 23.7
16	124°57.0	11°30.5	28.5	358°13.3	43.0	94°18.6	18.6	145°48.4	23.6
17	139°59.5	26°30.3	28.1	13°14.3	42.7	109°20.5	18.8	160°50.8	23.6
18	155°02.0	41°30.0	N24°27.6	28°15.2	N20°42.3	124°22.4	N11°19.0	175°53.2	S10°23.6
19	170°04.4	56°29.7	27.2	43°16.2	41.9	139°24.4	19.2	190°55.5	23.6
20	185°06.9	71°29.5	26.8	58°17.2	41.6	154°26.3	19.3	205°57.9	23.6
21	200°09.3	86°29.2	·· 26.3	73°18.2	·· 41.2	169°28.3	·· 19.5	221°00.3	·· 23.5
22	215°11.8	101°28.9	25.9	88°19.1	40.8	184°30.2	19.7	236°02.7	23.5
23	230°14.3	116°28.7	25.4	103°20.1	40.5	199°32.1	19.9	251°05.1	23.5
Mer.pass. 07:42		ν -0.3′ d -0.4′ m -4.30		ν 1.0′ d -0.4′ m 1.56		ν 1.9′ d 0.2′ m -2.09		ν 2.4′ d 0.0′ m 0.87	

Stars

	SHA	**Dec**
Alpheratz	357°36.4	29°12.9
Ankaa	353°08.7	-42°10.6
Schedar	349°32.9	56°39.6
Diphda	348°48.9	-17°51.5
Achernar	335°21.7	-57°07.0
Hamal	327°53.0	23°34.2
Polaris	315°09.3	89°21.6
Acamar	315°13.2	-40°12.6
Menkar	314°07.9	4°10.8
Mirfak	308°30.7	49°56.5
Aldebaran	290°41.5	16°33.3
Rigel	281°05.5	-8°10.5
Capella	280°24.4	46°01.3
Bellatrix	278°24.7	6°22.2
Elnath	278°04.0	28°37.6
Alnilam	275°39.4	-1°11.3
Betelgeuse	270°53.9	7°24.7
Canopus	263°53.5	-52°42.6
Sirius	258°27.7	-16°45.0
Adhara	255°07.2	-29°00.3
Procyon	244°52.5	5°09.9
Pollux	243°19.2	27°58.3
Avior	234°15.6	-59°35.3
Suhail	222°47.5	-43°31.8
Miaplacidus	221°38.9	-69°49.0
Alphard	217°49.2	-8°45.6
Regulus	207°35.9	11°51.2
Dubhe	193°42.6	61°37.8
Denebola	182°26.2	14°26.6
Gienah	175°44.8	-17°40.4
Acrux	173°01.3	-63°13.9
Gacrux	171°52.9	-57°14.9
Alioth	166°13.8	55°50.2
Spica	158°23.5	-11°17.1
Alkaid	152°52.7	49°11.9
Hadar	148°37.4	-60°29.3
Menkent	147°58.9	-36°29.2
Arcturus	145°48.9	19°03.7
Rigil Kent.	139°41.6	-60°56.0
Kochab	137°18.6	74°03.7
Zuben'ubi	136°57.2	-16°08.4
Alphecca	126°04.5	26°38.1
Antares	112°17.1	-26°29.1
Atria	107°12.0	-69°04.1
Sabik	102°04.0	-15°45.3
Shaula	96°11.8	-37°07.2
Rasalhague	95°59.5	12°32.5
Eltanin	90°42.3	51°29.0
Kaus Aust.	83°34.0	-34°22.4
Vega	80°33.8	38°48.1
Nunki	75°49.2	-26°16.0
Altair	62°01.1	8°55.7
Peacock	53°07.6	-56°39.4
Deneb	49°26.5	45°21.5
Enif	33°40.1	9°58.8
Al Na'ir	27°34.6	-46°50.7
Fomalhaut	15°16.1	-29°29.8
Scheat	13°46.6	28°12.3
Markab	13°31.3	15°19.7

May 25 Thu	**SHA**	**Mer.pass**
Venus	249°30.3	15:13
Mars	234°51.7	16:10
Jupiter	329°55.4	09:50
Saturn	20°57.1	06:26

May 26 Fri	**SHA**	**Mer.pass**
Venus	248°23.6	15:14
Mars	234°15.9	16:09
Jupiter	329°42.7	09:47
Saturn	20°54.9	06:22

May 27 Sat	**SHA**	**Mer.pass**
Venus	247°17.3	15:14
Mars	233°40.1	16:07
Jupiter	329°30.0	09:44
Saturn	20°52.7	06:18

Horizontal parallax	
Venus:	0.2
Mars:	0.1

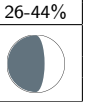
h	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°46.7	N20°51.9	113°55.2	12.0′	N24°08.2	7.5′	54.2′
1	195°46.6	52.3	128°26.2	12.0′	24°00.7	7.6′	54.2′
2	210°46.6	52.8	142°57.2	12.1′	23°53.1	7.7′	54.2′
3	225°46.5	·· 53.2	157°28.3	12.2′	23°45.4	7.8′	54.2′
4	240°46.5	53.7	171°59.5	12.2′	23°37.6	7.9′	54.2′
5	255°46.4	54.2	186°30.8	12.3′	23°29.7	8.0′	54.2′
6	270°46.3	N20°54.6	201°02.1	12.4′	N23°21.7	8.0′	54.2′
7	285°46.3	55.1	215°33.5	12.5′	23°13.7	8.2′	54.2′
8	300°46.2	55.5	230°04.9	12.5′	23°05.5	8.3′	54.2′
9	315°46.1	·· 56.0	244°36.4	12.6′	22°57.2	8.4′	54.2′
10	330°46.1	56.4	259°08.0	12.7′	22°48.8	8.5′	54.2′
11	345°46.0	56.9	273°39.7	12.7′	22°40.3	8.6′	54.2′
12	0°46.0	N20°57.3	288°11.5	12.8′	N22°31.7	8.7′	54.2′
13	15°45.9	57.7	302°43.3	12.9′	22°23.0	8.7′	54.2′
14	30°45.8	58.2	317°15.2	13.0′	22°14.3	8.9′	54.2′
15	45°45.8	·· 58.6	331°47.1	13.0′	22°05.4	9.0′	54.2′
16	60°45.7	59.1	346°19.1	13.1′	21°56.4	9.0′	54.1′
17	75°45.6	20°59.5	0°51.2	13.2′	21°47.4	9.1′	54.1′
18	90°45.6	N21°00.0	15°23.4	13.2′	N21°38.3	9.3′	54.1′
19	105°45.5	00.4	29°55.6	13.3′	21°29.0	9.3′	54.1′
20	120°45.4	00.9	44°27.9	13.4′	21°19.7	9.4′	54.1′
21	135°45.4	·· 01.3	59°00.3	13.4′	21°10.3	9.5′	54.1′
22	150°45.3	01.7	73°32.7	13.5′	21°00.8	9.6′	54.1′
23	165°45.3	02.2	88°05.2	13.6′	20°51.2	9.6′	54.1′
	SD = 15.8′	d = 0.5′	SD = 14.8′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°45.2	N21°02.6	102°37.8	13.6′	N20°41.6	9.8′	54.1′
1	195°45.1	03.1	117°10.4	13.7′	20°31.8	9.8′	54.1′
2	210°45.1	03.5	131°43.1	13.8′	20°22.0	10.0′	54.1′
3	225°45.0	·· 03.9	146°15.8	13.8′	20°12.0	10.0′	54.1′
4	240°44.9	04.4	160°48.7	13.9′	20°02.0	10.0′	54.1′
5	255°44.9	04.8	175°21.6	14.0′	19°52.0	10.2′	54.1′
6	270°44.8	N21°05.3	189°54.5	14.0′	N19°41.8	10.3′	54.1′
7	285°44.7	05.7	204°27.5	14.1′	19°31.5	10.3′	54.1′
8	300°44.7	06.1	219°00.6	14.1′	19°21.2	10.4′	54.1′
9	315°44.6	·· 06.6	233°33.7	14.2′	19°10.8	10.5′	54.1′
10	330°44.5	07.0	248°06.9	14.3′	19°00.3	10.5′	54.1′
11	345°44.5	07.4	262°40.2	14.3′	18°49.8	10.7′	54.1′
12	0°44.4	N21°07.9	277°13.5	14.4′	N18°39.1	10.7′	54.2′
13	15°44.3	08.3	291°46.9	14.4′	18°28.4	10.8′	54.2′
14	30°44.2	08.7	306°20.3	14.5′	18°17.6	10.8′	54.2′
15	45°44.2	·· 09.2	320°53.8	14.5′	18°06.8	11.0′	54.2′
16	60°44.1	09.6	335°27.4	14.6′	17°55.8	11.0′	54.2′
17	75°44.0	10.0	350°01.0	14.7′	17°44.8	11.1′	54.2′
18	90°44.0	N21°10.5	4°34.6	14.7′	N17°33.7	11.1′	54.2′
19	105°43.9	10.9	19°08.3	14.8′	17°22.6	11.2′	54.2′
20	120°43.8	11.3	33°42.1	14.8′	17°11.4	11.3′	54.2′
21	135°43.8	·· 11.7	48°15.9	14.9′	17°00.1	11.4′	54.2′
22	150°43.7	12.2	62°49.8	14.9′	16°48.7	11.4′	54.2′
23	165°43.6	12.6	77°23.7	15.0′	16°37.3	11.5′	54.2′
	SD = 15.8′	d = 0.4′	SD = 14.8′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°43.5	N21°13.0	91°57.7	15.0′	N16°25.8	11.6′	54.2′
1	195°43.5	13.4	106°31.7	15.1′	16°14.2	11.6′	54.2′
2	210°43.4	13.9	121°05.8	15.1′	16°02.6	11.7′	54.2′
3	225°43.3	·· 14.3	135°39.9	15.2′	15°50.9	11.7′	54.2′
4	240°43.3	14.7	150°14.1	15.2′	15°39.2	11.9′	54.2′
5	255°43.2	15.1	164°48.3	15.3′	15°27.3	11.8′	54.2′
6	270°43.1	N21°15.6	179°22.6	15.3′	N15°15.5	12.0′	54.3′
7	285°43.1	16.0	193°56.9	15.4′	15°03.5	12.0′	54.3′
8	300°43.0	16.4	208°31.2	15.4′	14°51.5	12.1′	54.3′
9	315°42.9	·· 16.8	223°05.6	15.4′	14°39.4	12.1′	54.3′
10	330°42.8	17.2	237°40.1	15.5′	14°27.3	12.2′	54.3′
11	345°42.8	17.7	252°14.5	15.5′	14°15.1	12.2′	54.3′
12	0°42.7	N21°18.1	266°49.1	15.6′	N14°02.9	12.3′	54.3′
13	15°42.6	18.5	281°23.6	15.6′	13°50.6	12.4′	54.3′
14	30°42.5	18.9	295°58.2	15.6′	13°38.2	12.4′	54.3′
15	45°42.5	·· 19.3	310°32.9	15.7′	13°25.8	12.5′	54.3′
16	60°42.4	19.7	325°07.5	15.7′	13°13.3	12.5′	54.4′
17	75°42.3	20.1	339°42.2	15.7′	13°00.8	12.6′	54.4′
18	90°42.2	N21°20.6	354°17.0	15.8′	N12°48.2	12.6′	54.4′
19	105°42.2	21.0	8°51.8	15.8′	12°35.6	12.7′	54.4′
20	120°42.1	21.4	23°26.6	15.8′	12°22.9	12.8′	54.4′
21	135°42.0	·· 21.8	38°01.4	15.9′	12°10.1	12.8′	54.4′
22	150°41.9	22.2	52°36.3	15.9′	11°57.3	12.8′	54.4′
23	165°41.9	22.6	67°11.2	15.9′	11°44.5	12.9′	54.4′
	SD = 15.8′	d = 0.4′	SD = 14.8′				

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

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

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 6-8 26-44%
25	03:07	03:04	11:57	16:56	04:33	
26	03:01	02:58	11:57	17:41	05:19	
27	02:54	02:51	11:57	18:24	06:03	

May 28, 29, 30 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	245°16.7	131°28.4	**N**24°25.0	118°21.1	**N**20°40.1	214°34.1	**N**11°20.1	266°07.4	**S**10°23.5
1	260°19.2	146°28.2	24.6	133°22.1	39.7	229°36.0	20.3	281°09.8	23.4
2	275°21.7	161°27.9	24.1	148°23.0	39.4	244°37.9	20.4	296°12.2	23.4
3	290°24.1	176°27.6	·· 23.7	163°24.0	·· 39.0	259°39.9	·· 20.6	311°14.6	·· 23.4
4	305°26.6	191°27.4	23.2	178°25.0	38.6	274°41.8	20.8	326°17.0	23.4
5	320°29.1	206°27.1	22.8	193°26.0	38.3	289°43.8	21.0	341°19.3	23.4
6	335°31.5	221°26.9	**N**24°22.3	208°26.9	**N**20°37.9	304°45.7	**N**11°21.2	356°21.7	**S**10°23.3
7	350°34.0	236°26.6	21.9	223°27.9	37.5	319°47.6	21.4	11°24.1	23.3
8	5°36.5	251°26.4	21.4	238°28.9	37.2	334°49.6	21.6	26°26.5	23.3
9	20°38.9	266°26.1	·· 21.0	253°29.9	·· 36.8	349°51.5	·· 21.7	41°28.9	·· 23.3
10	35°41.4	281°25.9	20.5	268°30.8	36.4	4°53.5	21.9	56°31.3	23.2
11	50°43.8	296°25.6	20.1	283°31.8	36.0	19°55.4	22.1	71°33.6	23.2
12	65°46.3	311°25.4	**N**24°19.6	298°32.8	**N**20°35.7	34°57.3	**N**11°22.3	86°36.0	**S**10°23.2
13	80°48.8	326°25.1	19.1	313°33.7	35.3	49°59.3	22.5	101°38.4	23.2
14	95°51.2	341°24.9	18.7	328°34.7	34.9	65°01.2	22.7	116°40.8	23.2
15	110°53.7	356°24.6	·· 18.2	343°35.7	·· 34.6	80°03.2	·· 22.8	131°43.2	·· 23.1
16	125°56.2	11°24.4	17.8	358°36.7	34.2	95°05.1	23.0	146°45.6	23.1
17	140°58.6	26°24.2	17.3	13°37.6	33.8	110°07.0	23.2	161°47.9	23.1
18	156°01.1	41°23.9	**N**24°16.9	28°38.6	**N**20°33.5	125°09.0	**N**11°23.4	176°50.3	**S**10°23.1
19	171°03.6	56°23.7	16.4	43°39.6	33.1	140°10.9	23.6	191°52.7	23.0
20	186°06.0	71°23.4	15.9	58°40.6	32.7	155°12.9	23.8	206°55.1	23.0
21	201°08.5	86°23.2	·· 15.5	73°41.5	·· 32.3	170°14.8	·· 23.9	221°57.5	·· 23.0
22	216°10.9	101°23.0	15.0	88°42.5	32.0	185°16.7	24.1	236°59.9	23.0
23	231°13.4	116°22.7	14.6	103°43.5	31.6	200°18.7	24.3	252°02.3	23.0
Mer.pass. 07:38		ν -0.3′ d -0.4′ m -4.31		ν 1.0′ d -0.4′ m 1.57		ν 1.9′ d 0.2′ m -2.10		ν 2.4′ d 0.0′ m 0.87	

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	246°15.9	131°22.5	**N**24°14.1	118°44.5	**N**20°31.2	215°20.6	**N**11°24.5	267°04.6	**S**10°22.9
1	261°18.3	146°22.3	13.6	133°45.4	30.9	230°22.6	24.7	282°07.0	22.9
2	276°20.8	161°22.0	13.2	148°46.4	30.5	245°24.5	24.9	297°09.4	22.9
3	291°23.3	176°21.8	·· 12.7	163°47.4	·· 30.1	260°26.4	·· 25.0	312°11.8	·· 22.9
4	306°25.7	191°21.6	12.2	178°48.4	29.7	275°28.4	25.2	327°14.2	22.8
5	321°28.2	206°21.3	11.7	193°49.3	29.4	290°30.3	25.4	342°16.6	22.8
6	336°30.7	221°21.1	**N**24°11.3	208°50.3	**N**20°29.0	305°32.3	**N**11°25.6	357°18.9	**S**10°22.8
7	351°33.1	236°20.9	10.8	223°51.3	28.6	320°34.2	25.8	12°21.3	22.8
8	6°35.6	251°20.6	10.3	238°52.3	28.2	335°36.1	26.0	27°23.7	22.8
9	21°38.1	266°20.4	·· 09.9	253°53.2	·· 27.9	350°38.1	·· 26.1	42°26.1	·· 22.7
10	36°40.5	281°20.2	09.4	268°54.2	27.5	5°40.0	26.3	57°28.5	22.7
11	51°43.0	296°20.0	08.9	283°55.2	27.1	20°42.0	26.5	72°30.9	22.7
12	66°45.4	311°19.7	**N**24°08.4	298°56.2	**N**20°26.7	35°43.9	**N**11°26.7	87°33.3	**S**10°22.7
13	81°47.9	326°19.5	08.0	313°57.2	26.4	50°45.8	26.9	102°35.7	22.7
14	96°50.4	341°19.3	07.5	328°58.1	26.0	65°47.8	27.1	117°38.0	22.6
15	111°52.8	356°19.1	·· 07.0	343°59.1	·· 25.6	80°49.7	·· 27.2	132°40.4	·· 22.6
16	126°55.3	11°18.9	06.5	359°00.1	25.2	95°51.7	27.4	147°42.8	22.6
17	141°57.8	26°18.6	06.1	14°01.1	24.9	110°53.6	27.6	162°45.2	22.6
18	157°00.2	41°18.4	**N**24°05.6	29°02.0	**N**20°24.5	125°55.6	**N**11°27.8	177°47.6	**S**10°22.6
19	172°02.7	56°18.2	05.1	44°03.0	24.1	140°57.5	28.0	192°50.0	22.5
20	187°05.2	71°18.0	04.6	59°04.0	23.7	155°59.4	28.2	207°52.4	22.5
21	202°07.6	86°17.8	·· 04.1	74°05.0	·· 23.4	171°01.4	·· 28.3	222°54.8	·· 22.5
22	217°10.1	101°17.6	03.6	89°05.9	23.0	186°03.3	28.5	237°57.1	22.5
23	232°12.6	116°17.4	03.2	104°06.9	22.6	201°05.3	28.7	252°59.5	22.5
Mer.pass. 07:34		ν -0.2′ d -0.5′ m -4.32		ν 1.0′ d -0.4′ m 1.57		ν 1.9′ d 0.2′ m -2.10		ν 2.4′ d 0.0′ m 0.86	

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	247°15.0	131°17.2	**N**24°02.7	119°07.9	**N**20°22.2	216°07.2	**N**11°28.9	268°01.9	**S**10°22.4
1	262°17.5	146°16.9	02.2	134°08.9	21.9	231°09.1	29.1	283°04.3	22.4
2	277°19.9	161°16.7	01.7	149°09.8	21.5	246°11.1	29.2	298°06.7	22.4
3	292°22.4	176°16.5	·· 01.2	164°10.8	·· 21.1	261°13.0	·· 29.4	313°09.1	·· 22.4
4	307°24.9	191°16.3	00.7	179°11.8	20.7	276°15.0	29.6	328°11.5	22.4
5	322°27.3	206°16.1	24°00.2	194°12.8	20.3	291°16.9	29.8	343°13.9	22.3
6	337°29.8	221°15.9	**N**23°59.7	209°13.7	**N**20°20.0	306°18.9	**N**11°30.0	358°16.3	**S**10°22.3
7	352°32.3	236°15.7	59.3	224°14.7	19.6	321°20.8	30.2	13°18.6	22.3
8	7°34.7	251°15.5	58.8	239°15.7	19.2	336°22.7	30.3	28°21.0	22.3
9	22°37.2	266°15.3	·· 58.3	254°16.7	·· 18.8	351°24.7	·· 30.5	43°23.4	·· 22.3
10	37°39.7	281°15.1	57.8	269°17.6	18.5	6°26.6	30.7	58°25.8	22.2
11	52°42.1	296°14.9	57.3	284°18.6	18.1	21°28.6	30.9	73°28.2	22.2
12	67°44.6	311°14.7	**N**23°56.8	299°19.6	**N**20°17.7	36°30.5	**N**11°31.1	88°30.6	**S**10°22.2
13	82°47.0	326°14.5	56.3	314°20.6	17.3	51°32.5	31.2	103°33.0	22.2
14	97°49.5	341°14.3	55.8	329°21.5	16.9	66°34.4	31.4	118°35.4	22.2
15	112°52.0	356°14.1	·· 55.3	344°22.5	·· 16.6	81°36.3	·· 31.6	133°37.8	·· 22.1
16	127°54.4	11°13.9	54.8	359°23.5	16.2	96°38.3	31.8	148°40.2	22.1
17	142°56.9	26°13.8	54.3	14°24.5	15.8	111°40.2	32.0	163°42.5	22.1
18	157°59.4	41°13.6	**N**23°53.8	29°25.4	**N**20°15.4	126°42.2	**N**11°32.1	178°44.9	**S**10°22.1
19	173°01.8	56°13.4	53.3	44°26.4	15.0	141°44.1	32.3	193°47.3	22.1
20	188°04.3	71°13.2	52.8	59°27.4	14.6	156°46.1	32.5	208°49.7	22.1
21	203°06.8	86°13.0	·· 52.3	74°28.4	·· 14.3	171°48.0	·· 32.7	223°52.1	·· 22.0
22	218°09.2	101°12.8	51.8	89°29.4	13.9	186°50.0	32.9	238°54.5	22.0
23	233°11.7	116°12.6	51.3	104°30.3	13.5	201°51.9	33.1	253°56.9	22.0
Mer.pass. 07:30		ν -0.2′ d -0.5′ m -4.33		ν 1.0′ d -0.4′ m 1.58		ν 1.9′ d 0.2′ m -2.10		ν 2.4′ d 0.0′ m 0.86	

Stars

	SHA	**Dec**
Alpheratz	357°36.3	29°12.9
Ankaa	353°08.7	-42°10.6
Schedar	349°32.9	56°39.6
Diphda	348°48.8	-17°51.5
Achernar	335°21.6	-57°07.0
Hamal	327°53.0	23°34.2
Polaris	315°08.7	89°21.6
Acamar	315°13.2	-40°12.6
Menkar	314°07.9	4°10.8
Mirfak	308°30.7	49°56.5
Aldebaran	290°41.5	16°33.3
Rigel	281°05.5	-8°10.5
Capella	280°24.4	46°01.3
Bellatrix	278°24.7	6°22.2
Elnath	278°04.0	28°37.6
Alnilam	275°39.4	-1°11.3
Betelgeuse	270°53.9	7°24.7
Canopus	263°53.5	-52°42.6
Sirius	258°27.7	-16°45.0
Adhara	255°07.2	-29°00.3
Procyon	244°52.5	5°09.9
Pollux	243°19.2	27°58.3
Avior	234°15.7	-59°35.2
Suhail	222°47.5	-43°31.8
Miaplacidus	221°38.9	-69°49.0
Alphard	217°49.2	-8°45.6
Regulus	207°35.9	11°51.2
Dubhe	193°42.6	61°37.8
Denebola	182°26.2	14°26.6
Gienah	175°44.8	-17°40.4
Acrux	173°01.3	-63°13.9
Gacrux	171°52.9	-57°14.9
Alioth	166°13.8	55°50.2
Spica	158°23.5	-11°17.1
Alkaid	152°52.7	49°12.0
Hadar	148°37.4	-60°29.3
Menkent	147°58.9	-36°29.2
Arcturus	145°48.9	19°03.7
Rigil Kent.	139°41.6	-60°56.0
Kochab	137°18.7	74°03.7
Zuben'ubi	136°57.2	-16°08.4
Alphecca	126°04.5	26°38.2
Antares	112°17.1	-26°29.1
Atria	107°12.0	-69°04.1
Sabik	102°04.0	-15°45.3
Shaula	96°11.8	-37°07.2
Rasalhague	95°59.5	12°32.5
Eltanin	90°42.3	51°29.0
Kaus Aust.	83°34.0	-34°22.4
Vega	80°33.8	38°48.1
Nunki	75°49.1	-26°16.0
Altair	62°01.1	8°55.7
Peacock	53°07.5	-56°39.4
Deneb	49°26.5	45°21.5
Enif	33°40.1	9°58.8
Al Na'ir	27°34.6	-46°50.7
Fomalhaut	15°16.1	-29°29.8
Scheat	13°46.6	28°12.3
Markab	13°31.3	15°19.7

May 28 Sun	**SHA**	**Mer.pass**
Venus	246°11.7	15:14
Mars	233°04.3	16:06
Jupiter	329°17.3	09:40
Saturn	20°50.7	06:15

May 29 Mon	**SHA**	**Mer.pass**
Venus	245°06.6	15:15
Mars	232°28.6	16:04
Jupiter	329°04.7	09:37
Saturn	20°48.8	06:11

May 30 Tue	**SHA**	**Mer.pass**
Venus	244°02.1	15:15
Mars	231°52.9	16:02
Jupiter	328°52.2	09:34
Saturn	20°46.9	06:07

Horizontal parallax	
Venus:	0.2
Mars:	0.1

h	Sun		Moon				
Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°41.8	N21°23.0	81°46.1	16.0′	N11°31.6	12.9′	54.5′
1	195°41.7	23.4	96°21.1	16.0′	11°18.7	13.0′	54.5′
2	210°41.6	23.9	110°56.1	16.0′	11°05.7	13.1′	54.5′
3	225°41.6	·· 24.3	125°31.1	16.0′	10°52.6	13.1′	54.5′
4	240°41.5	24.7	140°06.1	16.1′	10°39.5	13.1′	54.5′
5	255°41.4	25.1	154°41.2	16.1′	10°26.4	13.2′	54.5′
6	270°41.3	N21°25.5	169°16.2	16.1′	N10°13.2	13.2′	54.5′
7	285°41.3	25.9	183°51.4	16.1′	10°00.0	13.3′	54.6′
8	300°41.2	26.3	198°26.5	16.1′	09°46.7	13.3′	54.6′
9	315°41.1	·· 26.7	213°01.6	16.2′	09°33.4	13.4′	54.6′
10	330°41.0	27.1	227°36.8	16.2′	09°20.0	13.4′	54.6′
11	345°41.0	27.5	242°12.0	16.2′	09°06.6	13.4′	54.6′
12	0°40.9	N21°27.9	256°47.2	16.2′	N08°53.2	13.5′	54.6′
13	15°40.8	28.3	271°22.4	16.2′	08°39.7	13.6′	54.7′
14	30°40.7	28.7	285°57.6	16.2′	08°26.1	13.5′	54.7′
15	45°40.6	·· 29.1	300°32.9	16.3′	08°12.6	13.6′	54.7′
16	60°40.6	29.5	315°08.1	16.3′	07°59.0	13.7′	54.7′
17	75°40.5	29.9	329°43.4	16.3′	07°45.3	13.7′	54.7′
18	90°40.4	N21°30.3	344°18.6	16.3′	N07°31.6	13.7′	54.7′
19	105°40.3	30.7	358°53.9	16.3′	07°17.9	13.8′	54.8′
20	120°40.3	31.1	13°29.2	16.3′	07°04.1	13.8′	54.8′
21	135°40.2	·· 31.5	28°04.5	16.3′	06°50.3	13.8′	54.8′
22	150°40.1	31.9	42°39.8	16.3′	06°36.5	13.9′	54.8′
23	165°40.0	32.3	57°15.1	16.3′	06°22.6	13.9′	54.8′
	SD = 15.8′	d = 0.4′	SD = 14.9′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°39.9	N21°32.7	71°50.4	16.3′	N06°08.7	13.9′	54.9′
1	195°39.9	33.1	86°25.8	16.3′	05°54.8	14.0′	54.9′
2	210°39.8	33.5	101°01.1	16.3′	05°40.8	14.0′	54.9′
3	225°39.7	·· 33.9	115°36.4	16.3′	05°26.8	14.1′	54.9′
4	240°39.6	34.2	130°11.7	16.3′	05°12.7	14.0′	54.9′
5	255°39.5	34.6	144°47.0	16.3′	04°58.7	14.1′	55.0′
6	270°39.5	N21°35.0	159°22.3	16.3′	N04°44.6	14.1′	55.0′
7	285°39.4	35.4	173°57.6	16.3′	04°30.5	14.2′	55.0′
8	300°39.3	35.8	188°32.9	16.3′	04°16.3	14.2′	55.0′
9	315°39.2	·· 36.2	203°08.2	16.3′	04°02.1	14.2′	55.1′
10	330°39.1	36.6	217°43.5	16.3′	03°47.9	14.2′	55.1′
11	345°39.0	37.0	232°18.8	16.3′	03°33.7	14.3′	55.1′
12	0°39.0	N21°37.4	246°54.0	16.3′	N03°19.4	14.3′	55.1′
13	15°38.9	37.7	261°29.3	16.2′	03°05.1	14.3′	55.2′
14	30°38.8	38.1	276°04.5	16.2′	02°50.8	14.4′	55.2′
15	45°38.7	·· 38.5	290°39.7	16.2′	02°36.4	14.3′	55.2′
16	60°38.6	38.9	305°15.0	16.2′	02°22.1	14.4′	55.2′
17	75°38.6	39.3	319°50.1	16.2′	02°07.7	14.4′	55.3′
18	90°38.5	N21°39.7	334°25.3	16.2′	N01°53.3	14.4′	55.3′
19	105°38.4	40.0	349°00.5	16.1′	01°38.9	14.5′	55.3′
20	120°38.3	40.4	3°35.6	16.1′	01°24.4	14.5′	55.3′
21	135°38.2	·· 40.8	18°10.7	16.1′	01°09.9	14.4′	55.4′
22	150°38.1	41.2	32°45.8	16.1′	00°55.5	14.5′	55.4′
23	165°38.1	41.6	47°20.9	16.0′	00°41.0	14.6′	55.4′
	SD = 15.8′	d = 0.4′	SD = 15.0′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°38.0	N21°41.9	61°55.9	16.0′	N00°26.4	14.5′	55.4′
1	195°37.9	42.3	76°31.0	16.0′	N00°11.9	14.6′	55.5′
2	210°37.8	42.7	91°05.9	16.0′	S00°02.7	14.5′	55.5′
3	225°37.7	·· 43.1	105°40.9	15.9′	00°17.2	14.6′	55.5′
4	240°37.6	43.5	120°15.8	15.9′	00°31.8	14.6′	55.5′
5	255°37.5	43.8	134°50.7	15.9′	00°46.4	14.6′	55.6′
6	270°37.5	N21°44.2	149°25.6	15.8′	S01°01.0	14.6′	55.6′
7	285°37.4	44.6	164°00.4	15.8′	01°15.6	14.7′	55.6′
8	300°37.3	45.0	178°35.2	15.8′	01°30.3	14.6′	55.6′
9	315°37.2	·· 45.3	193°10.0	15.7′	01°44.9	14.7′	55.7′
10	330°37.1	45.7	207°44.7	15.7′	01°59.6	14.6′	55.7′
11	345°37.0	46.1	222°19.4	15.6′	02°14.2	14.7′	55.7′
12	0°36.9	N21°46.4	236°54.1	15.6′	S02°28.9	14.6′	55.8′
13	15°36.9	46.8	251°28.7	15.6′	02°43.5	14.7′	55.8′
14	30°36.8	47.2	266°03.2	15.5′	02°58.2	14.7′	55.8′
15	45°36.7	·· 47.6	280°37.8	15.5′	03°12.9	14.7′	55.8′
16	60°36.6	47.9	295°12.2	15.4′	03°27.6	14.7′	55.9′
17	75°36.5	48.3	309°46.7	15.4′	03°42.3	14.7′	55.9′
18	90°36.4	N21°48.7	324°21.0	15.3′	S03°57.0	14.6′	55.9′
19	105°36.3	49.0	338°55.4	15.3′	04°11.6	14.7′	56.0′
20	120°36.2	49.4	353°29.7	15.2′	04°26.3	14.7′	56.0′
21	135°36.2	·· 49.8	8°03.9	15.2′	04°41.0	14.7′	56.0′
22	150°36.1	50.1	22°38.1	15.1′	04°55.7	14.7′	56.1′
23	165°36.0	50.5	37°12.2	15.1′	05°10.4	14.7′	56.1′
	SD = 15.8′	d = 0.4′	SD = 15.1′				

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

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 9-11 53-72%
28	02:47	02:44	11:57	19:05	06:44	
29	02:40	02:36	11:57	19:45	07:25	
30	02:32	02:28	11:58	20:27	08:06	

May 31, 01, 02 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	248°14.2	131°12.4	**N**23°50.8	119°31.3	**N**20°13.1	216°53.8	**N**11°33.2	268°59.3	**S**10°22.0
1	263°16.6	146°12.3	50.3	134°32.3	12.7	231°55.8	33.4	284°01.7	22.0
2	278°19.1	161°12.1	49.8	149°33.3	12.4	246°57.7	33.6	299°04.1	21.9
3	293°21.5	176°11.9	·· 49.3	164°34.2	·· 12.0	261°59.7	·· 33.8	314°06.5	·· 21.9
4	308°24.0	191°11.7	48.8	179°35.2	11.6	277°01.6	34.0	329°08.9	21.9
5	323°26.5	206°11.5	48.2	194°36.2	11.2	292°03.6	34.1	344°11.3	21.9
6	338°28.9	221°11.4	**N**23°47.7	209°37.2	**N**20°10.8	307°05.5	**N**11°34.3	359°13.6	**S**10°21.9
7	353°31.4	236°11.2	47.2	224°38.1	10.4	322°07.5	34.5	14°16.0	21.9
8	8°33.9	251°11.0	46.7	239°39.1	10.0	337°09.4	34.7	29°18.4	21.8
9	23°36.3	266°10.8	·· 46.2	254°40.1	·· 09.7	352°11.3	·· 34.9	44°20.8	·· 21.8
10	38°38.8	281°10.7	45.7	269°41.1	09.3	7°13.3	35.0	59°23.2	21.8
11	53°41.3	296°10.5	45.2	284°42.1	08.9	22°15.2	35.2	74°25.6	21.8
12	68°43.7	311°10.3	**N**23°44.7	299°43.0	**N**20°08.5	37°17.2	**N**11°35.4	89°28.0	**S**10°21.8
13	83°46.2	326°10.2	44.1	314°44.0	08.1	52°19.1	35.6	104°30.4	21.7
14	98°48.7	341°10.0	43.6	329°45.0	07.7	67°21.1	35.8	119°32.8	21.7
15	113°51.1	356°09.8	·· 43.1	344°46.0	·· 07.4	82°23.0	·· 35.9	134°35.2	·· 21.7
16	128°53.6	11°09.7	42.6	359°46.9	07.0	97°25.0	36.1	149°37.6	21.7
17	143°56.0	26°09.5	42.1	14°47.9	06.6	112°26.9	36.3	164°40.0	21.7
18	158°58.5	41°09.3	**N**23°41.6	29°48.9	**N**20°06.2	127°28.9	**N**11°36.5	179°42.4	**S**10°21.7
19	174°01.0	56°09.2	41.0	44°49.9	05.8	142°30.8	36.7	194°44.8	21.6
20	189°03.4	71°09.0	40.5	59°50.8	05.4	157°32.8	36.8	209°47.2	21.6
21	204°05.9	86°08.8	·· 40.0	74°51.8	·· 05.0	172°34.7	·· 37.0	224°49.6	·· 21.6
22	219°08.4	101°08.7	39.5	89°52.8	04.7	187°36.6	37.2	239°52.0	21.6
23	234°10.8	116°08.5	38.9	104°53.8	04.3	202°38.6	37.4	254°54.4	21.6
Mer.pass. 07:26		ν -0.2′ d -0.5′ m -4.34		ν 1.0′ d -0.4′ m 1.59		ν 1.9′ d 0.2′ m -2.10		ν 2.4′ d 0.0′ m 0.86	

Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	249°13.3	131°08.4	**N**23°38.4	119°54.8	**N**20°03.9	217°40.5	**N**11°37.6	269°56.8	**S**10°21.6
1	264°15.8	146°08.2	37.9	134°55.7	03.5	232°42.5	37.7	284°59.2	21.5
2	279°18.2	161°08.1	37.4	149°56.7	03.1	247°44.4	37.9	300°01.5	21.5
3	294°20.7	176°07.9	·· 36.8	164°57.7	·· 02.7	262°46.4	·· 38.1	315°03.9	·· 21.5
4	309°23.1	191°07.8	36.3	179°58.7	02.3	277°48.3	38.3	330°06.3	21.5
5	324°25.6	206°07.6	35.8	194°59.6	01.9	292°50.3	38.5	345°08.7	21.5
6	339°28.1	221°07.5	**N**23°35.3	210°00.6	**N**20°01.5	307°52.2	**N**11°38.6	0°11.1	**S**10°21.5
7	354°30.5	236°07.3	34.7	225°01.6	01.2	322°54.2	38.8	15°13.5	21.4
8	9°33.0	251°07.2	34.2	240°02.6	00.8	337°56.1	39.0	30°15.9	21.4
9	24°35.5	266°07.0	·· 33.7	255°03.6	·· 00.4	352°58.1	·· 39.2	45°18.3	·· 21.4
10	39°37.9	281°06.9	33.1	270°04.5	20°00.0	8°00.0	39.3	60°20.7	21.4
11	54°40.4	296°06.7	32.6	285°05.5	19°59.6	23°02.0	39.5	75°23.1	21.4
12	69°42.9	311°06.6	**N**23°32.1	300°06.5	**N**19°59.2	38°03.9	**N**11°39.7	90°25.5	**S**10°21.4
13	84°45.3	326°06.4	31.5	315°07.5	58.8	53°05.9	39.9	105°27.9	21.3
14	99°47.8	341°06.3	31.0	330°08.4	58.4	68°07.8	40.1	120°30.3	21.3
15	114°50.3	356°06.2	·· 30.5	345°09.4	·· 58.0	83°09.7	·· 40.2	135°32.7	·· 21.3
16	129°52.7	11°06.0	29.9	0°10.4	57.6	98°11.7	40.4	150°35.1	21.3
17	144°55.2	26°05.9	29.4	15°11.4	57.3	113°13.6	40.6	165°37.5	21.3
18	159°57.6	41°05.7	**N**23°28.9	30°12.4	**N**19°56.9	128°15.6	**N**11°40.8	180°39.9	**S**10°21.3
19	175°00.1	56°05.6	28.3	45°13.3	56.5	143°17.5	41.0	195°42.3	21.2
20	190°02.6	71°05.5	27.8	60°14.3	56.1	158°19.5	41.1	210°44.7	21.2
21	205°05.0	86°05.3	·· 27.2	75°15.3	·· 55.7	173°21.4	·· 41.3	225°47.1	·· 21.2
22	220°07.5	101°05.2	26.7	90°16.3	55.3	188°23.4	41.5	240°49.5	21.2
23	235°10.0	116°05.1	26.1	105°17.2	54.9	203°25.3	41.7	255°51.9	21.2
Mer.pass. 07:22		ν -0.2′ d -0.5′ m -4.35		ν 1.0′ d -0.4′ m 1.59		ν 1.9′ d 0.2′ m -2.10		ν 2.4′ d 0.0′ m 0.85	

Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	250°12.4	131°05.0	**N**23°25.6	120°18.2	**N**19°54.5	218°27.3	**N**11°41.8	270°54.3	**S**10°21.2
1	265°14.9	146°04.8	25.1	135°19.2	54.1	233°29.2	42.0	285°56.7	21.2
2	280°17.4	161°04.7	24.5	150°20.2	53.7	248°31.2	42.2	300°59.1	21.1
3	295°19.8	176°04.6	·· 24.0	165°21.2	·· 53.3	263°33.1	·· 42.4	316°01.5	·· 21.1
4	310°22.3	191°04.4	23.4	180°22.1	52.9	278°35.1	42.6	331°03.9	21.1
5	325°24.8	206°04.3	22.9	195°23.1	52.5	293°37.0	42.7	346°06.3	21.1
6	340°27.2	221°04.2	**N**23°22.3	210°24.1	**N**19°52.2	308°39.0	**N**11°42.9	1°08.7	**S**10°21.1
7	355°29.7	236°04.1	21.8	225°25.1	51.8	323°40.9	43.1	16°11.1	21.1
8	10°32.1	251°04.0	21.2	240°26.0	51.4	338°42.9	43.3	31°13.5	21.0
9	25°34.6	266°03.8	·· 20.7	255°27.0	·· 51.0	353°44.8	·· 43.4	46°15.9	·· 21.0
10	40°37.1	281°03.7	20.1	270°28.0	50.6	8°46.8	43.6	61°18.3	21.0
11	55°39.5	296°03.6	19.6	285°29.0	50.2	23°48.7	43.8	76°20.7	21.0
12	70°42.0	311°03.5	**N**23°19.0	300°30.0	**N**19°49.8	38°50.7	**N**11°44.0	91°23.1	**S**10°21.0
13	85°44.5	326°03.4	18.5	315°30.9	49.4	53°52.6	44.2	106°25.5	21.0
14	100°46.9	341°03.3	17.9	330°31.9	49.0	68°54.6	44.3	121°27.9	21.0
15	115°49.4	356°03.2	·· 17.4	345°32.9	·· 48.6	83°56.5	·· 44.5	136°30.3	·· 20.9
16	130°51.9	11°03.0	16.8	0°33.9	48.2	98°58.5	44.7	151°32.7	20.9
17	145°54.3	26°02.9	16.3	15°34.9	47.8	114°00.4	44.9	166°35.1	20.9
18	160°56.8	41°02.8	**N**23°15.7	30°35.8	**N**19°47.4	129°02.4	**N**11°45.0	181°37.5	**S**10°20.9
19	175°59.2	56°02.7	15.1	45°36.8	47.0	144°04.3	45.2	196°39.9	20.9
20	191°01.7	71°02.6	14.6	60°37.8	46.6	159°06.3	45.4	211°42.3	20.9
21	206°04.2	86°02.5	·· 14.0	75°38.8	·· 46.2	174°08.2	·· 45.6	226°44.7	·· 20.9
22	221°06.6	101°02.4	13.5	90°39.7	45.8	189°10.2	45.7	241°47.1	20.8
23	236°09.1	116°02.3	12.9	105°40.7	45.4	204°12.1	45.9	256°49.5	20.8
Mer.pass. 07:18		ν -0.1′ d -0.5′ m -4.36		ν 1.0′ d -0.4′ m 1.60		ν 1.9′ d 0.2′ m -2.11		ν 2.4′ d 0.0′ m 0.85	

Stars

	SHA	**Dec**
Alpheratz	357°36.3	29°12.9
Ankaa	353°08.7	-42°10.6
Schedar	349°32.9	56°39.6
Diphda	348°48.8	-17°51.5
Achernar	335°21.6	-57°06.9
Hamal	327°53.0	23°34.2
Polaris	315°08.0	89°21.6
Acamar	315°13.2	-40°12.6
Menkar	314°07.9	4°10.8
Mirfak	308°30.7	49°56.5
Aldebaran	290°41.5	16°33.3
Rigel	281°05.5	-8°10.5
Capella	280°24.4	46°01.3
Bellatrix	278°24.7	6°22.2
Elnath	278°04.0	28°37.6
Alnilam	275°39.4	-1°11.3
Betelgeuse	270°53.9	7°24.7
Canopus	263°53.5	-52°42.6
Sirius	258°27.7	-16°44.9
Adhara	255°07.3	-29°00.3
Procyon	244°52.5	5°09.9
Pollux	243°19.2	27°58.3
Avior	234°15.7	-59°35.2
Suhail	222°47.5	-43°31.8
Miaplacidus	221°38.9	-69°49.0
Alphard	217°49.2	-8°45.6
Regulus	207°35.9	11°51.3
Dubhe	193°42.6	61°37.8
Denebola	182°26.2	14°26.6
Gienah	175°44.9	-17°40.4
Acrux	173°01.3	-63°14.0
Gacrux	171°52.9	-57°14.9
Alioth	166°13.8	55°50.2
Spica	158°23.5	-11°17.0
Alkaid	152°52.7	49°12.0
Hadar	148°37.4	-60°29.3
Menkent	147°58.9	-36°29.2
Arcturus	145°48.9	19°03.7
Rigil Kent.	139°41.6	-60°56.0
Kochab	137°18.7	74°03.7
Zuben'ubi	136°57.2	-16°08.4
Alphecca	126°04.5	26°38.2
Antares	112°17.1	-26°29.1
Atria	107°12.0	-69°04.1
Sabik	102°04.0	-15°45.3
Shaula	96°11.8	-37°07.2
Rasalhague	95°59.5	12°32.5
Eltanin	90°42.3	51°29.0
Kaus Aust.	83°33.9	-34°22.4
Vega	80°33.8	38°48.1
Nunki	75°49.1	-26°16.0
Altair	62°01.0	8°55.7
Peacock	53°07.5	-56°39.4
Deneb	49°26.5	45°21.5
Enif	33°40.0	9°58.8
Al Na'ir	27°34.5	-46°50.7
Fomalhaut	15°16.0	-29°29.8
Scheat	13°46.6	28°12.3
Markab	13°31.3	15°19.7

May 31 Wed	**SHA**	**Mer.pass**
Venus	242°58.3	15:15
Mars	231°17.2	16:01
Jupiter	328°39.7	09:31
Saturn	20°45.1	06:03

Jun 01 Thu	**SHA**	**Mer.pass**
Venus	241°55.1	15:16
Mars	230°41.5	15:59
Jupiter	328°27.2	09:28
Saturn	20°43.5	05:59

Jun 02 Fri	**SHA**	**Mer.pass**
Venus	240°52.5	15:16
Mars	230°05.8	15:58
Jupiter	328°14.9	09:25
Saturn	20°41.9	05:55

Horizontal parallax	
Venus:	0.2
Mars:	0.1

h	Sun		Moon				
Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°35.9	N21°50.8	51°46.3	15.0′	S05°25.1	14.6′	56.1′
1	195°35.8	51.2	66°20.3	15.0′	05°39.7	14.7′	56.2′
2	210°35.7	51.6	80°54.2	14.9′	05°54.4	14.7′	56.2′
3	225°35.6	·· 51.9	95°28.1	14.8′	06°09.1	14.6′	56.2′
4	240°35.5	52.3	110°02.0	14.8′	06°23.7	14.7′	56.2′
5	255°35.4	52.6	124°35.8	14.7′	06°38.4	14.6′	56.3′
6	270°35.4	N21°53.0	139°09.5	14.6′	S06°53.0	14.6′	56.3′
7	285°35.3	53.4	153°43.1	14.6′	07°07.6	14.6′	56.3′
8	300°35.2	53.7	168°16.7	14.5′	07°22.2	14.6′	56.4′
9	315°35.1	·· 54.1	182°50.2	14.4′	07°36.8	14.6′	56.4′
10	330°35.0	54.4	197°23.7	14.4′	07°51.4	14.6′	56.4′
11	345°34.9	54.8	211°57.0	14.3′	08°06.0	14.5′	56.5′
12	0°34.8	N21°55.1	226°30.4	14.2′	S08°20.5	14.6′	56.5′
13	15°34.7	55.5	241°03.6	14.2′	08°35.1	14.5′	56.5′
14	30°34.6	55.9	255°36.8	14.1′	08°49.6	14.5′	56.6′
15	45°34.5	·· 56.2	270°09.8	14.0′	09°04.1	14.4′	56.6′
16	60°34.5	56.6	284°42.9	13.9′	09°18.5	14.5′	56.6′
17	75°34.4	56.9	299°15.8	13.9′	09°33.0	14.4′	56.7′
18	90°34.3	N21°57.3	313°48.6	13.8′	S09°47.4	14.4′	56.7′
19	105°34.2	57.6	328°21.4	13.7′	10°01.8	14.4′	56.7′
20	120°34.1	58.0	342°54.1	13.6′	10°16.2	14.3′	56.8′
21	135°34.0	·· 58.3	357°26.7	13.5′	10°30.5	14.3′	56.8′
22	150°33.9	58.7	11°59.3	13.4′	10°44.8	14.3′	56.8′
23	165°33.8	59.0	26°31.7	13.4′	10°59.1	14.3′	56.9′
	SD = 15.8′	d = 0.4′	SD = 15.3′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°33.7	N21°59.4	41°04.1	13.3′	S11°13.4	14.2′	56.9′
1	195°33.6	21°59.7	55°36.4	13.2′	11°27.6	14.2′	56.9′
2	210°33.5	22°00.0	70°08.5	13.1′	11°41.8	14.1′	57.0′
3	225°33.4	·· 00.4	84°40.6	13.0′	11°55.9	14.1′	57.0′
4	240°33.3	00.7	99°12.6	12.9′	12°10.0	14.1′	57.0′
5	255°33.3	01.1	113°44.6	12.8′	12°24.1	14.0′	57.1′
6	270°33.2	N22°01.4	128°16.4	12.7′	S12°38.1	14.0′	57.1′
7	285°33.1	01.8	142°48.1	12.6′	12°52.1	14.0′	57.1′
8	300°33.0	02.1	157°19.7	12.5′	13°06.1	13.9′	57.2′
9	315°32.9	·· 02.4	171°51.3	12.4′	13°20.0	13.8′	57.2′
10	330°32.8	02.8	186°22.7	12.3′	13°33.8	13.9′	57.2′
11	345°32.7	03.1	200°54.1	12.2′	13°47.7	13.7′	57.3′
12	0°32.6	N22°03.5	215°25.3	12.1′	S14°01.4	13.7′	57.3′
13	15°32.5	03.8	229°56.4	12.0′	14°15.1	13.7′	57.3′
14	30°32.4	04.1	244°27.5	11.9′	14°28.8	13.6′	57.4′
15	45°32.3	·· 04.5	258°58.4	11.8′	14°42.4	13.6′	57.4′
16	60°32.2	04.8	273°29.2	11.7′	14°56.0	13.5′	57.4′
17	75°32.1	05.2	287°59.9	11.6′	15°09.5	13.4′	57.5′
18	90°32.0	N22°05.5	302°30.6	11.5′	S15°22.9	13.4′	57.5′
19	105°31.9	05.8	317°01.1	11.4′	15°36.3	13.3′	57.5′
20	120°31.8	06.2	331°31.5	11.3′	15°49.6	13.3′	57.6′
21	135°31.7	·· 06.5	346°01.8	11.2′	16°02.9	13.2′	57.6′
22	150°31.6	06.8	0°31.9	11.1′	16°16.1	13.1′	57.6′
23	165°31.5	07.2	15°02.0	11.0′	16°29.2	13.0′	57.7′
	SD = 15.8′	d = 0.3′	SD = 15.5′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°31.4	N22°07.5	29°32.0	10.8′	S16°42.2	13.0′	57.7′
1	195°31.3	07.8	44°01.8	10.7′	16°55.2	12.9′	57.7′
2	210°31.3	08.1	58°31.5	10.6′	17°08.1	12.9′	57.8′
3	225°31.2	·· 08.5	73°01.1	10.5′	17°21.0	12.8′	57.8′
4	240°31.1	08.8	87°30.6	10.4′	17°33.8	12.7′	57.8′
5	255°31.0	09.1	102°00.0	10.3′	17°46.5	12.6′	57.9′
6	270°30.9	N22°09.5	116°29.3	10.1′	S17°59.1	12.5′	57.9′
7	285°30.8	09.8	130°58.4	10.0′	18°11.6	12.5′	57.9′
8	300°30.7	10.1	145°27.4	9.9′	18°24.1	12.3′	58.0′
9	315°30.6	·· 10.4	159°56.3	9.8′	18°36.4	12.3′	58.0′
10	330°30.5	10.8	174°25.1	9.7′	18°48.7	12.2′	58.0′
11	345°30.4	11.1	188°53.8	9.5′	19°00.9	12.1′	58.0′
12	0°30.3	N22°11.4	203°22.3	9.4′	S19°13.0	12.0′	58.1′
13	15°30.2	11.7	217°50.7	9.3′	19°25.0	12.0′	58.1′
14	30°30.1	12.0	232°19.0	9.2′	19°37.0	11.8′	58.1′
15	45°30.0	·· 12.4	246°47.2	9.0′	19°48.8	11.7′	58.2′
16	60°29.9	12.7	261°15.3	8.9′	20°00.5	11.7′	58.2′
17	75°29.8	13.0	275°43.2	8.8′	20°12.2	11.5′	58.2′
18	90°29.7	N22°13.3	290°11.0	8.7′	S20°23.7	11.5′	58.3′
19	105°29.6	13.6	304°38.7	8.5′	20°35.2	11.3′	58.3′
20	120°29.5	14.0	319°06.2	8.4′	20°46.5	11.2′	58.3′
21	135°29.4	·· 14.3	333°33.6	8.3′	20°57.7	11.1′	58.4′
22	150°29.3	14.6	348°00.9	8.2′	21°08.8	11.0′	58.4′
23	165°29.2	14.9	2°28.1	8.0′	21°19.8	10.9′	58.4′
	SD = 15.8′	d = 0.3′	SD = 15.7′				

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

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

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 12-14 81-94%
31	02:24	02:19	11:58	21:11	08:48	
01	02:15	02:10	11:58	21:58	09:34	
02	02:06	02:01	11:58	22:50	10:23	

June 03, 04, 05 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	251°11.6	131°02.2	**N**23°12.3	120°41.7	**N**19°45.0	219°14.1	**N**11°46.1	271°52.0	**S**10°20.8
1	266°14.0	146°02.1	11.8	135°42.7	44.6	234°16.0	46.3	286°54.4	20.8
2	281°16.5	161°02.0	11.2	150°43.7	44.2	249°18.0	46.5	301°56.8	20.8
3	296°19.0	176°01.9	·· 10.7	165°44.6	·· 43.8	264°19.9	·· 46.6	316°59.2	·· 20.8
4	311°21.4	191°01.8	10.1	180°45.6	43.4	279°21.9	46.8	332°01.6	20.8
5	326°23.9	206°01.7	09.5	195°46.6	43.0	294°23.8	47.0	347°04.0	20.7
6	341°26.4	221°01.6	**N**23°09.0	210°47.6	**N**19°42.6	309°25.8	**N**11°47.2	2°06.4	**S**10°20.7
7	356°28.8	236°01.5	08.4	225°48.6	42.2	324°27.7	47.3	17°08.8	20.7
8	11°31.3	251°01.4	07.8	240°49.5	41.8	339°29.7	47.5	32°11.2	20.7
9	26°33.7	266°01.4	·· 07.3	255°50.5	·· 41.4	354°31.6	·· 47.7	47°13.6	·· 20.7
10	41°36.2	281°01.3	06.7	270°51.5	41.0	9°33.6	47.9	62°16.0	20.7
11	56°38.7	296°01.2	06.1	285°52.5	40.6	24°35.5	48.0	77°18.4	20.7
12	71°41.1	311°01.1	**N**23°05.5	300°53.5	**N**19°40.2	39°37.5	**N**11°48.2	92°20.8	**S**10°20.7
13	86°43.6	326°01.0	05.0	315°54.4	39.8	54°39.5	48.4	107°23.2	20.6
14	101°46.1	341°00.9	04.4	330°55.4	39.4	69°41.4	48.6	122°25.6	20.6
15	116°48.5	356°00.8	·· 03.8	345°56.4	·· 39.0	84°43.4	·· 48.7	137°28.0	·· 20.6
16	131°51.0	11°00.8	03.3	0°57.4	38.6	99°45.3	48.9	152°30.4	20.6
17	146°53.5	26°00.7	02.7	15°58.4	38.2	114°47.3	49.1	167°32.8	20.6
18	161°55.9	41°00.6	**N**23°02.1	30°59.3	**N**19°37.8	129°49.2	**N**11°49.3	182°35.2	**S**10°20.6
19	176°58.4	56°00.5	01.5	46°00.3	37.4	144°51.2	49.4	197°37.7	20.6
20	192°00.9	71°00.4	01.0	61°01.3	37.0	159°53.1	49.6	212°40.1	20.6
21	207°03.3	86°00.4	23°00.4	76°02.3	·· 36.6	174°55.1	·· 49.8	227°42.5	·· 20.5
22	222°05.8	101°00.3	22°59.8	91°03.3	36.2	189°57.0	50.0	242°44.9	20.5
23	237°08.2	116°00.2	59.2	106°04.2	35.8	204°59.0	50.1	257°47.3	20.5
Mer.pass. 07:14		ν -0.1′ d -0.6′ m -4.37		ν 1.0′ d -0.4′ m 1.61		ν 2.0′ d 0.2′ m -2.11		ν 2.4′ d 0.0′ m 0.85	

Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	252°10.7	131°00.2	**N**22°58.6	121°05.2	**N**19°35.4	220°00.9	**N**11°50.3	272°49.7	**S**10°20.5
1	267°13.2	146°00.1	58.1	136°06.2	35.0	235°02.9	50.5	287°52.1	20.5
2	282°15.6	161°00.0	57.5	151°07.2	34.6	250°04.8	50.7	302°54.5	20.5
3	297°18.1	175°59.9	·· 56.9	166°08.2	·· 34.2	265°06.8	·· 50.8	317°56.9	·· 20.5
4	312°20.6	190°59.9	56.3	181°09.1	33.8	280°08.7	51.0	332°59.3	20.5
5	327°23.0	205°59.8	55.7	196°10.1	33.4	295°10.7	51.2	348°01.7	20.4
6	342°25.5	220°59.7	**N**22°55.2	211°11.1	**N**19°33.0	310°12.7	**N**11°51.4	3°04.1	**S**10°20.4
7	357°28.0	235°59.7	54.6	226°12.1	32.6	325°14.6	51.5	18°06.5	20.4
8	12°30.4	250°59.6	54.0	241°13.1	32.2	340°16.6	51.7	33°09.0	20.4
9	27°32.9	265°59.6	·· 53.4	256°14.0	·· 31.8	355°18.5	·· 51.9	48°11.4	·· 20.4
10	42°35.4	280°59.5	52.8	271°15.0	31.4	10°20.5	52.1	63°13.8	20.4
11	57°37.8	295°59.4	52.2	286°16.0	31.0	25°22.4	52.2	78°16.2	20.4
12	72°40.3	310°59.4	**N**22°51.6	301°17.0	**N**19°30.6	40°24.4	**N**11°52.4	93°18.6	**S**10°20.4
13	87°42.7	325°59.3	51.0	316°18.0	30.2	55°26.3	52.6	108°21.0	20.3
14	102°45.2	340°59.3	50.5	331°18.9	29.8	70°28.3	52.8	123°23.4	20.3
15	117°47.7	355°59.2	·· 49.9	346°19.9	·· 29.4	85°30.2	·· 52.9	138°25.8	·· 20.3
16	132°50.1	10°59.2	49.3	1°20.9	29.0	100°32.2	53.1	153°28.2	20.3
17	147°52.6	25°59.1	48.7	16°21.9	28.6	115°34.2	53.3	168°30.6	20.3
18	162°55.1	40°59.1	**N**22°48.1	31°22.9	**N**19°28.1	130°36.1	**N**11°53.5	183°33.0	**S**10°20.3
19	177°57.5	55°59.0	47.5	46°23.8	27.7	145°38.1	53.6	198°35.5	20.3
20	193°00.0	70°59.0	46.9	61°24.8	27.3	160°40.0	53.8	213°37.9	20.3
21	208°02.5	85°58.9	·· 46.3	76°25.8	·· 26.9	175°42.0	·· 54.0	228°40.3	·· 20.3
22	223°04.9	100°58.9	45.7	91°26.8	26.5	190°43.9	54.2	243°42.7	20.2
23	238°07.4	115°58.8	45.1	106°27.8	26.1	205°45.9	54.3	258°45.1	20.2
Mer.pass. 07:10		ν -0.1′ d -0.6′ m -4.38		ν 1.0′ d -0.4′ m 1.61		ν 2.0′ d 0.2′ m -2.11		ν 2.4′ d 0.0′ m 0.84	

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	253°09.9	130°58.8	**N**22°44.5	121°28.7	**N**19°25.7	220°47.8	**N**11°54.5	273°47.5	**S**10°20.2
1	268°12.3	145°58.8	43.9	136°29.7	25.3	235°49.8	54.7	288°49.9	20.2
2	283°14.8	160°58.7	43.3	151°30.7	24.9	250°51.8	54.9	303°52.3	20.2
3	298°17.2	175°58.7	·· 42.7	166°31.7	·· 24.5	265°53.7	·· 55.0	318°54.7	·· 20.2
4	313°19.7	190°58.6	42.1	181°32.7	24.1	280°55.7	55.2	333°57.2	20.2
5	328°22.2	205°58.6	41.5	196°33.6	23.7	295°57.6	55.4	348°59.6	20.2
6	343°24.6	220°58.6	**N**22°40.9	211°34.6	**N**19°23.3	310°59.6	**N**11°55.6	4°02.0	**S**10°20.2
7	358°27.1	235°58.5	40.3	226°35.6	22.8	326°01.5	55.7	19°04.4	20.1
8	13°29.6	250°58.5	39.7	241°36.6	22.4	341°03.5	55.9	34°06.8	20.1
9	28°32.0	265°58.5	·· 39.1	256°37.6	·· 22.0	356°05.4	·· 56.1	49°09.2	·· 20.1
10	43°34.5	280°58.4	38.5	271°38.6	21.6	11°07.4	56.2	64°11.6	20.1
11	58°37.0	295°58.4	37.9	286°39.5	21.2	26°09.4	56.4	79°14.0	20.1
12	73°39.4	310°58.4	**N**22°37.3	301°40.5	**N**19°20.8	41°11.3	**N**11°56.6	94°16.5	**S**10°20.1
13	88°41.9	325°58.4	36.7	316°41.5	20.4	56°13.3	56.8	109°18.9	20.1
14	103°44.4	340°58.3	36.1	331°42.5	20.0	71°15.2	56.9	124°21.3	20.1
15	118°46.8	355°58.3	·· 35.5	346°43.5	·· 19.6	86°17.2	·· 57.1	139°23.7	·· 20.1
16	133°49.3	10°58.3	34.9	1°44.4	19.2	101°19.1	57.3	154°26.1	20.1
17	148°51.7	25°58.3	34.3	16°45.4	18.7	116°21.1	57.5	169°28.5	20.0
18	163°54.2	40°58.3	**N**22°33.7	31°46.4	**N**19°18.3	131°23.1	**N**11°57.6	184°30.9	**S**10°20.0
19	178°56.7	55°58.2	33.1	46°47.4	17.9	146°25.0	57.8	199°33.4	20.0
20	193°59.1	70°58.2	32.5	61°48.4	17.5	161°27.0	58.0	214°35.8	20.0
21	209°01.6	85°58.2	·· 31.8	76°49.4	·· 17.1	176°28.9	·· 58.2	229°38.2	·· 20.0
22	224°04.1	100°58.2	31.2	91°50.3	16.7	191°30.9	58.3	244°40.6	20.0
23	239°06.5	115°58.2	30.6	106°51.3	16.3	206°32.8	58.5	259°43.0	20.0
Mer.pass. 07:06		ν -0.0′ d -0.6′ m -4.39		ν 1.0′ d -0.4′ m 1.62		ν 2.0′ d 0.2′ m -2.11		ν 2.4′ d 0.0′ m 0.84	

Stars

	SHA	**Dec**
Alpheratz	357°36.3	29°12.9
Ankaa	353°08.7	-42°10.6
Schedar	349°32.8	56°39.6
Diphda	348°48.8	-17°51.5
Achernar	335°21.6	-57°06.9
Hamal	327°53.0	23°34.2
Polaris	315°06.9	89°21.6
Acamar	315°13.2	-40°12.6
Menkar	314°07.9	4°10.8
Mirfak	308°30.7	49°56.5
Aldebaran	290°41.5	16°33.3
Rigel	281°05.5	-8°10.5
Capella	280°24.4	46°01.3
Bellatrix	278°24.7	6°22.2
Elnath	278°04.0	28°37.6
Alnilam	275°39.4	-1°11.3
Betelgeuse	270°53.9	7°24.7
Canopus	263°53.5	-52°42.6
Sirius	258°27.7	-16°44.9
Adhara	255°07.3	-29°00.3
Procyon	244°52.5	5°09.9
Pollux	243°19.2	27°58.3
Avior	234°15.7	-59°35.2
Suhail	222°47.5	-43°31.8
Miaplacidus	221°39.0	-69°49.0
Alphard	217°49.2	-8°45.6
Regulus	207°36.0	11°51.3
Dubhe	193°42.6	61°37.8
Denebola	182°26.3	14°26.6
Gienah	175°44.9	-17°40.4
Acrux	173°01.3	-63°14.0
Gacrux	171°52.9	-57°14.9
Alioth	166°13.9	55°50.2
Spica	158°23.5	-11°17.0
Alkaid	152°52.7	49°12.0
Hadar	148°37.4	-60°29.3
Menkent	147°58.9	-36°29.2
Arcturus	145°48.9	19°03.7
Rigil Kent.	139°41.6	-60°56.1
Kochab	137°18.7	74°03.7
Zuben'ubi	136°57.2	-16°08.4
Alphecca	126°04.5	26°38.2
Antares	112°17.1	-26°29.1
Atria	107°12.0	-69°04.1
Sabik	102°04.0	-15°45.3
Shaula	96°11.8	-37°07.2
Rasalhague	95°59.5	12°32.5
Eltanin	90°42.3	51°29.0
Kaus Aust.	83°33.9	-34°22.4
Vega	80°33.7	38°48.2
Nunki	75°49.1	-26°16.0
Altair	62°01.0	8°55.7
Peacock	53°07.5	-56°39.4
Deneb	49°26.5	45°21.5
Enif	33°40.0	9°58.8
Al Na'ir	27°34.5	-46°50.7
Fomalhaut	15°16.0	-29°29.8
Scheat	13°46.5	28°12.3
Markab	13°31.3	15°19.7

Jun 03 Sat	**SHA**	**Mer.pass**
Venus	239°50.6	15:16
Mars	229°30.1	15:56
Jupiter	328°02.5	09:22
Saturn	20°40.4	05:52

Jun 04 Sun	**SHA**	**Mer.pass**
Venus	238°49.4	15:16
Mars	228°54.5	15:55
Jupiter	327°50.2	09:19
Saturn	20°39.0	05:48

Jun 05 Mon	**SHA**	**Mer.pass**
Venus	237°48.9	15:16
Mars	228°18.9	15:53
Jupiter	327°38.0	09:16
Saturn	20°37.7	05:44

Horizontal parallax	
Venus:	0.2
Mars:	0.1

h	Sun		Moon				
Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°29.1	N22°15.2	16°55.1	7.9′	S21°30.7	10.8′	58.5′
1	195°29.0	15.5	31°22.1	7.8′	21°41.5	10.7′	58.5′
2	210°28.9	15.9	45°48.9	7.7′	21°52.2	10.5′	58.5′
3	225°28.8	·· 16.2	60°15.5	7.5′	22°02.7	10.5′	58.5′
4	240°28.7	16.5	74°42.1	7.4′	22°13.2	10.3′	58.6′
5	255°28.6	16.8	89°08.5	7.3′	22°23.5	10.1′	58.6′
6	270°28.5	N22°17.1	103°34.8	7.2′	S22°33.6	10.1′	58.6′
7	285°28.4	17.4	118°00.9	7.0′	22°43.7	9.9′	58.7′
8	300°28.3	17.7	132°27.0	6.9′	22°53.6	9.8′	58.7′
9	315°28.2	·· 18.0	146°52.9	6.8′	23°03.4	9.7′	58.7′
10	330°28.1	18.3	161°18.7	6.7′	23°13.1	9.5′	58.7′
11	345°28.0	18.6	175°44.3	6.5′	23°22.6	9.5′	58.8′
12	0°27.9	N22°19.0	190°09.9	6.4′	S23°32.1	9.2′	58.8′
13	15°27.8	19.3	204°35.3	6.3′	23°41.3	9.1′	58.8′
14	30°27.7	19.6	219°00.6	6.2′	23°50.4	9.0′	58.9′
15	45°27.6	·· 19.9	233°25.8	6.1′	23°59.4	8.9′	58.9′
16	60°27.5	20.2	247°50.8	5.9′	24°08.3	8.7′	58.9′
17	75°27.3	20.5	262°15.8	5.8′	24°17.0	8.5′	58.9′
18	90°27.2	N22°20.8	276°40.6	5.7′	S24°25.5	8.4′	59.0′
19	105°27.1	21.1	291°05.3	5.6′	24°33.9	8.3′	59.0′
20	120°27.0	21.4	305°29.8	5.5′	24°42.2	8.1′	59.0′
21	135°26.9	·· 21.7	319°54.3	5.3′	24°50.3	7.9′	59.0′
22	150°26.8	22.0	334°18.6	5.2′	24°58.2	7.8′	59.1′
23	165°26.7	22.3	348°42.9	5.1′	25°06.0	7.7′	59.1′
	SD = 15.8′	d = 0.3′	SD = 15.9′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°26.6	N22°22.6	3°07.0	5.0′	S25°13.7	7.4′	59.1′
1	195°26.5	22.9	17°31.0	4.9′	25°21.1	7.4′	59.1′
2	210°26.4	23.2	31°54.9	4.8′	25°28.5	7.1′	59.2′
3	225°26.3	·· 23.5	46°18.7	4.7′	25°35.6	7.0′	59.2′
4	240°26.2	23.8	60°42.4	4.6′	25°42.6	6.8′	59.2′
5	255°26.1	24.1	75°05.9	4.5′	25°49.4	6.7′	59.2′
6	270°26.0	N22°24.4	89°29.4	4.4′	S25°56.1	6.5′	59.3′
7	285°25.9	24.7	103°52.8	4.3′	26°02.6	6.3′	59.3′
8	300°25.8	24.9	118°16.0	4.2′	26°08.9	6.1′	59.3′
9	315°25.7	·· 25.2	132°39.2	4.1′	26°15.0	6.0′	59.3′
10	330°25.6	25.5	147°02.3	4.0′	26°21.0	5.8′	59.3′
11	345°25.5	25.8	161°25.2	3.9′	26°26.8	5.6′	59.4′
12	0°25.4	N22°26.1	175°48.1	3.8′	S26°32.4	5.4′	59.4′
13	15°25.3	26.4	190°10.9	3.7′	26°37.8	5.2′	59.4′
14	30°25.1	26.7	204°33.6	3.6′	26°43.0	5.1′	59.4′
15	45°25.0	·· 27.0	218°56.2	3.5′	26°48.1	4.9′	59.5′
16	60°24.9	27.3	233°18.8	3.4′	26°53.0	4.7′	59.5′
17	75°24.8	27.6	247°41.2	3.4′	26°57.7	4.5′	59.5′
18	90°24.7	N22°27.8	262°03.6	3.3′	S27°02.2	4.3′	59.5′
19	105°24.6	28.1	276°25.9	3.2′	27°06.5	4.2′	59.5′
20	120°24.5	28.4	290°48.1	3.1′	27°10.7	3.9′	59.6′
21	135°24.4	·· 28.7	305°10.2	3.1′	27°14.6	3.8′	59.6′
22	150°24.3	29.0	319°32.3	3.0′	27°18.4	3.6′	59.6′
23	165°24.2	29.3	333°54.3	2.9′	27°22.0	3.3′	59.6′
	SD = 15.8′	d = 0.3′	SD = 16.1′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°24.1	N22°29.5	348°16.2	2.9′	S27°25.3	3.2′	59.6′
1	195°24.0	29.8	2°38.1	2.8′	27°28.5	3.0′	59.6′
2	210°23.9	30.1	16°59.9	2.8′	27°31.5	2.8′	59.7′
3	225°23.8	·· 30.4	31°21.7	2.7′	27°34.3	2.6′	59.7′
4	240°23.6	30.7	45°43.4	2.7′	27°36.9	2.4′	59.7′
5	255°23.5	30.9	60°05.0	2.6′	27°39.3	2.2′	59.7′
6	270°23.4	N22°31.2	74°26.6	2.6′	S27°41.5	2.0′	59.7′
7	285°23.3	31.5	88°48.2	2.5′	27°43.5	1.8′	59.7′
8	300°23.2	31.8	103°09.7	2.5′	27°45.3	1.6′	59.7′
9	315°23.1	·· 32.1	117°31.2	2.4′	27°46.9	1.4′	59.8′
10	330°23.0	32.3	131°52.6	2.4′	27°48.3	1.1′	59.8′
11	345°22.9	32.6	146°14.1	2.4′	27°49.4	1.0′	59.8′
12	0°22.8	N22°32.9	160°35.4	2.4′	S27°50.4	0.8′	59.8′
13	15°22.7	33.2	174°56.8	2.3′	27°51.2	0.6′	59.8′
14	30°22.6	33.4	189°18.1	2.3′	27°51.8	0.4′	59.8′
15	45°22.4	·· 33.7	203°39.4	2.3′	27°52.2	0.2′	59.8′
16	60°22.3	34.0	218°00.7	2.3′	27°52.4	0.1′	59.8′
17	75°22.2	34.2	232°22.0	2.3′	27°52.3	0.2′	59.9′
18	90°22.1	N22°34.5	246°43.3	2.3′	S27°52.1	0.4′	59.9′
19	105°22.0	34.8	261°04.5	2.3′	27°51.7	0.7′	59.9′
20	120°21.9	35.0	275°25.8	2.2′	27°51.0	0.8′	59.9′
21	135°21.8	·· 35.3	289°47.0	2.3′	27°50.2	1.1′	59.9′
22	150°21.7	35.6	304°08.3	2.3′	27°49.1	1.2′	59.9′
23	165°21.6	35.8	318°29.5	2.3′	27°47.9	1.5′	59.9′
	SD = 15.8′	d = 0.3′	SD = 16.3′				

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

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

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 15-17 98-99%
03	01:56	01:51	11:58	23:47	11:18	○
04	01:46	01:41	11:58	–:–	12:18	
05	01:36	01:31	11:58	00:49	13:21	

June 06, 07, 08 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	254°09.0	130°58.2	**N**22°30.0	121°52.3	**N**19°15.9	221°34.8	**N**11°58.7	274°45.4	**S**10°20.0
1	269°11.5	145°58.2	29.4	136°53.3	15.4	236°36.8	58.8	289°47.8	20.0
2	284°13.9	160°58.1	28.8	151°54.3	15.0	251°38.7	59.0	304°50.3	20.0
3	299°16.4	175°58.1	·· 28.2	166°55.2	·· 14.6	266°40.7	·· 59.2	319°52.7	·· 20.0
4	314°18.9	190°58.1	27.6	181°56.2	14.2	281°42.6	59.4	334°55.1	19.9
5	329°21.3	205°58.1	26.9	196°57.2	13.8	296°44.6	59.5	349°57.5	19.9
6	344°23.8	220°58.1	**N**22°26.3	211°58.2	**N**19°13.4	311°46.6	**N**11°59.7	4°59.9	**S**10°19.9
7	359°26.2	235°58.1	25.7	226°59.2	13.0	326°48.5	11°59.9	20°02.3	19.9
8	14°28.7	250°58.1	25.1	242°00.2	12.6	341°50.5	12°00.0	35°04.8	19.9
9	29°31.2	265°58.1	·· 24.5	257°01.1	·· 12.1	356°52.4	·· 00.2	50°07.2	·· 19.9
10	44°33.6	280°58.1	23.8	272°02.1	11.7	11°54.4	00.4	65°09.6	19.9
11	59°36.1	295°58.1	23.2	287°03.1	11.3	26°56.4	00.6	80°12.0	19.9
12	74°38.6	310°58.1	**N**22°22.6	302°04.1	**N**19°10.9	41°58.3	**N**12°00.7	95°14.4	**S**10°19.9
13	89°41.0	325°58.1	22.0	317°05.1	10.5	57°00.3	00.9	110°16.8	19.9
14	104°43.5	340°58.1	21.4	332°06.0	10.1	72°02.2	01.1	125°19.3	19.9
15	119°46.0	355°58.1	·· 20.7	347°07.0	·· 09.7	87°04.2	·· 01.2	140°21.7	·· 19.8
16	134°48.4	10°58.2	20.1	2°08.0	09.2	102°06.1	01.4	155°24.1	19.8
17	149°50.9	25°58.2	19.5	17°09.0	08.8	117°08.1	01.6	170°26.5	19.8
18	164°53.4	40°58.2	**N**22°18.9	32°10.0	**N**19°08.4	132°10.1	**N**12°01.8	185°28.9	**S**10°19.8
19	179°55.8	55°58.2	18.2	47°11.0	08.0	147°12.0	01.9	200°31.3	19.8
20	194°58.3	70°58.2	17.6	62°11.9	07.6	162°14.0	02.1	215°33.8	19.8
21	210°00.7	85°58.2	·· 17.0	77°12.9	·· 07.2	177°15.9	·· 02.3	230°36.2	·· 19.8
22	225°03.2	100°58.2	16.4	92°13.9	06.7	192°17.9	02.4	245°38.6	19.8
23	240°05.7	115°58.3	15.7	107°14.9	06.3	207°19.9	02.6	260°41.0	19.8
Mer.pass. 07:02		ν -0.0′ d -0.6′ m -4.40		ν 1.0′ d -0.4′ m 1.62		ν 2.0′ d 0.2′ m -2.12		ν 2.4′ d 0.0′ m 0.83	

Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	255°08.1	130°58.3	**N**22°15.1	122°15.9	**N**19°05.9	222°21.8	**N**12°02.8	275°43.4	**S**10°19.8
1	270°10.6	145°58.3	14.5	137°16.9	05.5	237°23.8	03.0	290°45.9	19.8
2	285°13.1	160°58.3	13.8	152°17.8	05.1	252°25.8	03.1	305°48.3	19.8
3	300°15.5	175°58.3	·· 13.2	167°18.8	·· 04.7	267°27.7	·· 03.3	320°50.7	·· 19.7
4	315°18.0	190°58.4	12.6	182°19.8	04.2	282°29.7	03.5	335°53.1	19.7
5	330°20.5	205°58.4	12.0	197°20.8	03.8	297°31.6	03.6	350°55.5	19.7
6	345°22.9	220°58.4	**N**22°11.3	212°21.8	**N**19°03.4	312°33.6	**N**12°03.8	5°58.0	**S**10°19.7
7	0°25.4	235°58.4	10.7	227°22.8	03.0	327°35.6	04.0	21°00.4	19.7
8	15°27.9	250°58.5	10.1	242°23.7	02.6	342°37.5	04.2	36°02.8	19.7
9	30°30.3	265°58.5	·· 09.4	257°24.7	·· 02.1	357°39.5	·· 04.3	51°05.2	·· 19.7
10	45°32.8	280°58.5	08.8	272°25.7	01.7	12°41.4	04.5	66°07.6	19.7
11	60°35.2	295°58.6	08.1	287°26.7	01.3	27°43.4	04.7	81°10.1	19.7
12	75°37.7	310°58.6	**N**22°07.5	302°27.7	**N**19°00.9	42°45.4	**N**12°04.8	96°12.5	**S**10°19.7
13	90°40.2	325°58.6	06.9	317°28.7	00.5	57°47.3	05.0	111°14.9	19.7
14	105°42.6	340°58.7	06.2	332°29.6	19°00.0	72°49.3	05.2	126°17.3	19.7
15	120°45.1	355°58.7	·· 05.6	347°30.6	18°59.6	87°51.3	·· 05.4	141°19.7	·· 19.7
16	135°47.6	10°58.8	05.0	2°31.6	59.2	102°53.2	05.5	156°22.2	19.7
17	150°50.0	25°58.8	04.3	17°32.6	58.8	117°55.2	05.7	171°24.6	19.6
18	165°52.5	40°58.8	**N**22°03.7	32°33.6	**N**18°58.4	132°57.1	**N**12°05.9	186°27.0	**S**10°19.6
19	180°55.0	55°58.9	03.0	47°34.6	57.9	147°59.1	06.0	201°29.4	19.6
20	195°57.4	70°58.9	02.4	62°35.5	57.5	163°01.1	06.2	216°31.8	19.6
21	210°59.9	85°59.0	·· 01.8	77°36.5	·· 57.1	178°03.0	·· 06.4	231°34.3	·· 19.6
22	226°02.3	100°59.0	01.1	92°37.5	56.7	193°05.0	06.5	246°36.7	19.6
23	241°04.8	115°59.1	00.5	107°38.5	56.3	208°07.0	06.7	261°39.1	19.6
Mer.pass. 06:58		ν 0.0′ d -0.6′ m -4.41		ν 1.0′ d -0.4′ m 1.63		ν 2.0′ d 0.2′ m -2.12		ν 2.4′ d 0.0′ m 0.83	

Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	256°07.3	130°59.1	**N**21°59.8	122°39.5	**N**18°55.8	223°08.9	**N**12°06.9	276°41.5	**S**10°19.6
1	271°09.7	145°59.2	59.2	137°40.5	55.4	238°10.9	07.0	291°44.0	19.6
2	286°12.2	160°59.2	58.5	152°41.4	55.0	253°12.8	07.2	306°46.4	19.6
3	301°14.7	175°59.3	·· 57.9	167°42.4	·· 54.6	268°14.8	·· 07.4	321°48.8	·· 19.6
4	316°17.1	190°59.3	57.2	182°43.4	54.1	283°16.8	07.6	336°51.2	19.6
5	331°19.6	205°59.4	56.6	197°44.4	53.7	298°18.7	07.7	351°53.7	19.6
6	346°22.1	220°59.5	**N**21°55.9	212°45.4	**N**18°53.3	313°20.7	**N**12°07.9	6°56.1	**S**10°19.6
7	1°24.5	235°59.5	55.3	227°46.4	52.9	328°22.7	08.1	21°58.5	19.6
8	16°27.0	250°59.6	54.6	242°47.3	52.4	343°24.6	08.2	37°00.9	19.6
9	31°29.5	265°59.6	·· 54.0	257°48.3	·· 52.0	358°26.6	·· 08.4	52°03.3	·· 19.5
10	46°31.9	280°59.7	53.3	272°49.3	51.6	13°28.6	08.6	67°05.8	19.5
11	61°34.4	295°59.8	52.7	287°50.3	51.2	28°30.5	08.7	82°08.2	19.5
12	76°36.8	310°59.8	**N**21°52.0	302°51.3	**N**18°50.7	43°32.5	**N**12°08.9	97°10.6	**S**10°19.5
13	91°39.3	325°59.9	51.4	317°52.3	50.3	58°34.4	09.1	112°13.0	19.5
14	106°41.8	341°00.0	50.7	332°53.2	49.9	73°36.4	09.2	127°15.5	19.5
15	121°44.2	356°00.0	·· 50.1	347°54.2	·· 49.5	88°38.4	·· 09.4	142°17.9	·· 19.5
16	136°46.7	11°00.1	49.4	2°55.2	49.0	103°40.3	09.6	157°20.3	19.5
17	151°49.2	26°00.2	48.8	17°56.2	48.6	118°42.3	09.8	172°22.7	19.5
18	166°51.6	41°00.3	**N**21°48.1	32°57.2	**N**18°48.2	133°44.3	**N**12°09.9	187°25.2	**S**10°19.5
19	181°54.1	56°00.3	47.5	47°58.2	47.8	148°46.2	10.1	202°27.6	19.5
20	196°56.6	71°00.4	46.8	62°59.2	47.3	163°48.2	10.3	217°30.0	19.5
21	211°59.0	86°00.5	·· 46.2	78°00.1	·· 46.9	178°50.2	·· 10.4	232°32.5	·· 19.5
22	227°01.5	101°00.6	45.5	93°01.1	46.5	193°52.1	10.6	247°34.9	19.5
23	242°04.0	116°00.7	44.8	108°02.1	46.1	208°54.1	10.8	262°37.3	19.5
Mer.pass. 06:54		ν 0.1′ d -0.6′ m -4.42		ν 1.0′ d -0.4′ m 1.63		ν 2.0′ d 0.2′ m -2.12		ν 2.4′ d 0.0′ m 0.83	

Stars

	SHA	**Dec**
Alpheratz	357°36.3	29°12.9
Ankaa	353°08.6	-42°10.6
Schedar	349°32.8	56°39.6
Diphda	348°48.8	-17°51.5
Achernar	335°21.6	-57°06.9
Hamal	327°53.0	23°34.2
Polaris	315°05.8	89°21.6
Acamar	315°13.2	-40°12.6
Menkar	314°07.8	4°10.8
Mirfak	308°30.6	49°56.5
Aldebaran	290°41.5	16°33.3
Rigel	281°05.5	-8°10.5
Capella	280°24.3	46°01.2
Bellatrix	278°24.6	6°22.2
Elnath	278°03.9	28°37.6
Alnilam	275°39.4	-1°11.2
Betelgeuse	270°53.9	7°24.7
Canopus	263°53.5	-52°42.5
Sirius	258°27.7	-16°44.9
Adhara	255°07.3	-29°00.3
Procyon	244°52.5	5°09.9
Pollux	243°19.2	27°58.3
Avior	234°15.7	-59°35.2
Suhail	222°47.5	-43°31.8
Miaplacidus	221°39.0	-69°49.0
Alphard	217°49.2	-8°45.6
Regulus	207°36.0	11°51.3
Dubhe	193°42.7	61°37.8
Denebola	182°26.3	14°26.6
Gienah	175°44.9	-17°40.4
Acrux	173°01.3	-63°14.0
Gacrux	171°52.9	-57°14.9
Alioth	166°13.9	55°50.2
Spica	158°23.5	-11°17.0
Alkaid	152°52.7	49°12.0
Hadar	148°37.4	-60°29.3
Menkent	147°58.9	-36°29.2
Arcturus	145°48.9	19°03.7
Rigil Kent.	139°41.6	-60°56.1
Kochab	137°18.8	74°03.7
Zuben'ubi	136°57.2	-16°08.4
Alphecca	126°04.5	26°38.2
Antares	112°17.1	-26°29.1
Atria	107°12.0	-69°04.2
Sabik	102°04.0	-15°45.2
Shaula	96°11.8	-37°07.2
Rasalhague	95°59.4	12°32.5
Eltanin	90°42.3	51°29.0
Kaus Aust.	83°33.9	-34°22.4
Vega	80°33.7	38°48.2
Nunki	75°49.1	-26°16.0
Altair	62°01.0	8°55.7
Peacock	53°07.4	-56°39.4
Deneb	49°26.4	45°21.6
Enif	33°40.0	9°58.8
Al Na'ir	27°34.5	-46°50.7
Fomalhaut	15°16.0	-29°29.8
Scheat	13°46.5	28°12.3
Markab	13°31.2	15°19.7

Jun 06 Tue	**SHA**	**Mer.pass**
Venus	236°49.2	15:16
Mars	227°43.3	15:51
Jupiter	327°25.8	09:12
Saturn	20°36.4	05:40

Jun 07 Wed	**SHA**	**Mer.pass**
Venus	235°50.1	15:16
Mars	227°07.7	15:50
Jupiter	327°13.7	09:09
Saturn	20°35.3	05:36

Jun 08 Thu	**SHA**	**Mer.pass**
Venus	234°51.8	15:16
Mars	226°32.2	15:48
Jupiter	327°01.6	09:06
Saturn	20°34.3	05:32

Horizontal parallax	
Venus:	0.2
Mars:	0.1

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°21.4	N22°36.1	332°50.8	2.3′	S27°46.4	1.7′	59.9′
1	195°21.3	36.4	347°12.1	2.3′	27°44.7	1.8′	59.9′
2	210°21.2	36.6	1°33.3	2.3′	27°42.9	2.1′	59.9′
3	225°21.1	·· 36.9	15°54.6	2.3′	27°40.8	2.3′	60.0′
4	240°21.0	37.2	30°16.0	2.3′	27°38.5	2.4′	60.0′
5	255°20.9	37.4	44°37.3	2.4′	27°36.1	2.7′	60.0′
6	270°20.8	N22°37.7	58°58.7	2.4′	S27°33.4	2.9′	60.0′
7	285°20.7	38.0	73°20.1	2.4′	27°30.5	3.1′	60.0′
8	300°20.6	38.2	87°41.5	2.5′	27°27.4	3.3′	60.0′
9	315°20.4	·· 38.5	102°03.0	2.5′	27°24.1	3.5′	60.0′
10	330°20.3	38.7	116°24.5	2.5′	27°20.6	3.6′	60.0′
11	345°20.2	39.0	130°46.0	2.6′	27°17.0	3.9′	60.0′
12	0°20.1	N22°39.3	145°07.6	2.6′	S27°13.1	4.1′	60.0′
13	15°20.0	39.5	159°29.2	2.7′	27°09.0	4.3′	60.0′
14	30°19.9	39.8	173°50.9	2.7′	27°04.7	4.5′	60.0′
15	45°19.8	·· 40.0	188°12.6	2.8′	27°00.2	4.6′	60.0′
16	60°19.6	40.3	202°34.4	2.8′	26°55.6	4.9′	60.0′
17	75°19.5	40.5	216°56.3	2.9′	26°50.7	5.0′	60.0′
18	90°19.4	N22°40.8	231°18.2	3.0′	S26°45.7	5.3′	60.0′
19	105°19.3	41.0	245°40.1	3.0′	26°40.4	5.4′	60.0′
20	120°19.2	41.3	260°02.2	3.1′	26°35.0	5.7′	60.0′
21	135°19.1	·· 41.5	274°24.3	3.2′	26°29.3	5.8′	60.0′
22	150°19.0	41.8	288°46.4	3.2′	26°23.5	6.0′	60.0′
23	165°18.8	42.0	303°08.6	3.3′	26°17.5	6.2′	60.0′
	SD = 15.8′	d = 0.3′	SD = 16.3′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°18.7	N22°42.3	317°31.0	3.4′	S26°11.3	6.4′	60.0′
1	195°18.6	42.5	331°53.3	3.5′	26°04.9	6.5′	60.0′
2	210°18.5	42.8	346°15.8	3.5′	25°58.4	6.8′	60.0′
3	225°18.4	·· 43.0	0°38.3	3.6′	25°51.6	6.9′	60.0′
4	240°18.3	43.3	15°01.0	3.7′	25°44.7	7.1′	60.0′
5	255°18.2	43.5	29°23.7	3.8′	25°37.6	7.3′	60.0′
6	270°18.0	N22°43.8	43°46.4	3.9′	S25°30.3	7.5′	60.0′
7	285°17.9	44.0	58°09.3	4.0′	25°22.8	7.6′	60.0′
8	300°17.8	44.3	72°32.3	4.1′	25°15.2	7.8′	60.0′
9	315°17.7	·· 44.5	86°55.3	4.1′	25°07.4	8.0′	60.0′
10	330°17.6	44.7	101°18.5	4.2′	24°59.4	8.1′	60.0′
11	345°17.5	45.0	115°41.7	4.3′	24°51.3	8.4′	60.0′
12	0°17.3	N22°45.2	130°05.1	4.4′	S24°42.9	8.5′	60.0′
13	15°17.2	45.5	144°28.5	4.5′	24°34.4	8.6′	60.0′
14	30°17.1	45.7	158°52.0	4.6′	24°25.8	8.8′	60.0′
15	45°17.0	·· 46.0	173°15.6	4.7′	24°17.0	9.0′	60.0′
16	60°16.9	46.2	187°39.4	4.8′	24°08.0	9.2′	60.0′
17	75°16.8	46.4	202°03.2	4.9′	23°58.8	9.3′	60.0′
18	90°16.6	N22°46.7	216°27.1	5.0′	S23°49.5	9.4′	60.0′
19	105°16.5	46.9	230°51.2	5.1′	23°40.1	9.6′	60.0′
20	120°16.4	47.1	245°15.3	5.2′	23°30.5	9.8′	60.0′
21	135°16.3	·· 47.4	259°39.5	5.3′	23°20.7	9.9′	59.9′
22	150°16.2	47.6	274°03.9	5.5′	23°10.8	10.1′	59.9′
23	165°16.1	47.8	288°28.3	5.6′	23°00.7	10.2′	59.9′
	SD = 15.8′	d = 0.2′	SD = 16.4′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°15.9	N22°48.1	302°52.9	5.7′	S22°50.5	10.3′	59.9′
1	195°15.8	48.3	317°17.6	5.8′	22°40.2	10.5′	59.9′
2	210°15.7	48.5	331°42.4	5.9′	22°29.7	10.7′	59.9′
3	225°15.6	·· 48.8	346°07.3	6.0′	22°19.0	10.8′	59.9′
4	240°15.5	49.0	0°32.3	6.1′	22°08.2	10.9′	59.9′
5	255°15.4	49.2	14°57.4	6.2′	21°57.3	11.0′	59.9′
6	270°15.2	N22°49.5	29°22.6	6.3′	S21°46.3	11.2′	59.9′
7	285°15.1	49.7	43°47.9	6.4′	21°35.1	11.4′	59.9′
8	300°15.0	49.9	58°13.4	6.6′	21°23.7	11.4′	59.9′
9	315°14.9	·· 50.1	72°38.9	6.7′	21°12.3	11.6′	59.8′
10	330°14.8	50.4	87°04.6	6.8′	21°00.7	11.7′	59.8′
11	345°14.6	50.6	101°30.3	6.9′	20°49.0	11.9′	59.8′
12	0°14.5	N22°50.8	115°56.2	7.0′	S20°37.1	11.9′	59.8′
13	15°14.4	51.0	130°22.2	7.1′	20°25.2	12.1′	59.8′
14	30°14.3	51.3	144°48.3	7.2′	20°13.1	12.2′	59.8′
15	45°14.2	·· 51.5	159°14.5	7.3′	20°00.9	12.3′	59.8′
16	60°14.0	51.7	173°40.9	7.4′	19°48.6	12.5′	59.8′
17	75°13.9	51.9	188°07.3	7.5′	19°36.1	12.5′	59.8′
18	90°13.8	N22°52.1	202°33.9	7.7′	S19°23.6	12.7′	59.7′
19	105°13.7	52.4	217°00.5	7.8′	19°10.9	12.7′	59.7′
20	120°13.6	52.6	231°27.3	7.9′	18°58.2	12.9′	59.7′
21	135°13.4	·· 52.8	245°54.2	8.0′	18°45.3	13.0′	59.7′
22	150°13.3	53.0	260°21.2	8.1′	18°32.3	13.1′	59.7′
23	165°13.2	53.2	274°48.2	8.2′	18°19.2	13.1′	59.7′
	SD = 15.8′	d = 0.2′	SD = 16.3′				

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

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

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 95-80%
06	01:26	01:20	11:59	01:53	14:26	
07	01:15	01:09	11:59	02:57	15:28	
08	01:04	00:58	11:59	03:58	16:26	

June 09, 10, 11 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	257°06.4	131°00.7	N21°44.2	123°03.1	N18°45.6	223°56.1	N12°10.9	277°39.7	S10°19.5
1	272°08.9	146°00.8	43.5	138°04.1	45.2	238°58.0	11.1	292°42.2	19.5
2	287°11.3	161°00.9	42.9	153°05.1	44.8	254°00.0	11.3	307°44.6	19.5
3	302°13.8	176°01.0	·· 42.2	168°06.0	·· 44.4	269°02.0	·· 11.4	322°47.0	·· 19.5
4	317°16.3	191°01.1	41.5	183°07.0	43.9	284°03.9	11.6	337°49.4	19.5
5	332°18.7	206°01.2	40.9	198°08.0	43.5	299°05.9	11.8	352°51.9	19.4
6	347°21.2	221°01.3	N21°40.2	213°09.0	N18°43.1	314°07.9	N12°11.9	7°54.3	S10°19.4
7	2°23.7	236°01.4	39.5	228°10.0	42.6	329°09.8	12.1	22°56.7	19.4
8	17°26.1	251°01.5	38.9	243°11.0	42.2	344°11.8	12.3	37°59.1	19.4
9	32°28.6	266°01.6	·· 38.2	258°12.0	·· 41.8	359°13.8	·· 12.4	53°01.6	·· 19.4
10	47°31.1	281°01.6	37.6	273°12.9	41.4	14°15.7	12.6	68°04.0	19.4
11	62°33.5	296°01.7	36.9	288°13.9	40.9	29°17.7	12.8	83°06.4	19.4
12	77°36.0	311°01.8	N21°36.2	303°14.9	N18°40.5	44°19.7	N12°12.9	98°08.9	S10°19.4
13	92°38.5	326°01.9	35.6	318°15.9	40.1	59°21.6	13.1	113°11.3	19.4
14	107°40.9	341°02.0	34.9	333°16.9	39.6	74°23.6	13.3	128°13.7	19.4
15	122°43.4	356°02.2	·· 34.2	348°17.9	·· 39.2	89°25.6	·· 13.4	143°16.1	·· 19.4
16	137°45.8	11°02.3	33.6	3°18.8	38.8	104°27.5	13.6	158°18.6	19.4
17	152°48.3	26°02.4	32.9	18°19.8	38.4	119°29.5	13.8	173°21.0	19.4
18	167°50.8	41°02.5	N21°32.2	33°20.8	N18°37.9	134°31.5	N12°14.0	188°23.4	S10°19.4
19	182°53.2	56°02.6	31.5	48°21.8	37.5	149°33.4	14.1	203°25.9	19.4
20	197°55.7	71°02.7	30.9	63°22.8	37.1	164°35.4	14.3	218°28.3	19.4
21	212°58.2	86°02.8	·· 30.2	78°23.8	·· 36.6	179°37.4	·· 14.5	233°30.7	·· 19.4
22	228°00.6	101°02.9	29.5	93°24.8	36.2	194°39.3	14.6	248°33.2	19.4
23	243°03.1	116°03.0	28.9	108°25.7	35.8	209°41.3	14.8	263°35.6	19.4
Mer.pass. 06:50		ν 0.1′	d -0.7′	m -4.43	ν 1.0′	d -0.4′	m 1.64	ν 2.0′	d 0.2′ m -2.13	ν 2.4′	d 0.0′ m 0.82

Sat	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	258°05.6	131°03.1	N21°28.2	123°26.7	N18°35.3	224°43.3	N12°15.0	278°38.0	S10°19.4
1	273°08.0	146°03.3	27.5	138°27.7	34.9	239°45.2	15.1	293°40.4	19.4
2	288°10.5	161°03.4	26.8	153°28.7	34.5	254°47.2	15.3	308°42.9	19.4
3	303°12.9	176°03.5	·· 26.2	168°29.7	·· 34.0	269°49.2	·· 15.5	323°45.3	·· 19.4
4	318°15.4	191°03.6	25.5	183°30.7	33.6	284°51.1	15.6	338°47.7	19.4
5	333°17.9	206°03.7	24.8	198°31.7	33.2	299°53.1	15.8	353°50.2	19.4
6	348°20.3	221°03.9	N21°24.1	213°32.6	N18°32.7	314°55.1	N12°16.0	8°52.6	S10°19.4
7	3°22.8	236°04.0	23.5	228°33.6	32.3	329°57.0	16.1	23°55.0	19.4
8	18°25.3	251°04.1	22.8	243°34.6	31.9	344°59.0	16.3	38°57.5	19.4
9	33°27.7	266°04.2	·· 22.1	258°35.6	·· 31.4	0°01.0	·· 16.4	53°59.9	·· 19.3
10	48°30.2	281°04.4	21.4	273°36.6	31.0	15°03.0	16.6	69°02.3	19.3
11	63°32.7	296°04.5	20.7	288°37.6	30.6	30°04.9	16.8	84°04.8	19.3
12	78°35.1	311°04.6	N21°20.1	303°38.6	N18°30.1	45°06.9	N12°16.9	99°07.2	S10°19.3
13	93°37.6	326°04.8	19.4	318°39.5	29.7	60°08.9	17.1	114°09.6	19.3
14	108°40.1	341°04.9	18.7	333°40.5	29.3	75°10.8	17.3	129°12.1	19.3
15	123°42.5	356°05.0	·· 18.0	348°41.5	·· 28.8	90°12.8	·· 17.4	144°14.5	·· 19.3
16	138°45.0	11°05.2	17.3	3°42.5	28.4	105°14.8	17.6	159°16.9	19.3
17	153°47.4	26°05.3	16.7	18°43.5	28.0	120°16.7	17.8	174°19.4	19.3
18	168°49.9	41°05.5	N21°16.0	33°44.5	N18°27.5	135°18.7	N12°17.9	189°21.8	S10°19.3
19	183°52.4	56°05.6	15.3	48°45.5	27.1	150°20.7	18.1	204°24.2	19.3
20	198°54.8	71°05.7	14.6	63°46.4	26.7	165°22.7	18.3	219°26.7	19.3
21	213°57.3	86°05.9	·· 13.9	78°47.4	·· 26.2	180°24.6	·· 18.4	234°29.1	·· 19.3
22	228°59.8	101°06.0	13.2	93°48.4	25.8	195°26.6	18.6	249°31.5	19.3
23	244°02.2	116°06.2	12.5	108°49.4	25.4	210°28.6	18.8	264°34.0	19.3
Mer.pass. 06:47		ν 0.1′	d -0.7′	m -4.44	ν 1.0′	d -0.4′	m 1.65	ν 2.0′	d 0.2′ m -2.13	ν 2.4′	d 0.0′ m 0.82

Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	259°04.7	131°06.3	N21°11.9	123°50.4	N18°24.9	225°30.5	N12°18.9	279°36.4	S10°19.3
1	274°07.2	146°06.5	11.2	138°51.4	24.5	240°32.5	19.1	294°38.8	19.3
2	289°09.6	161°06.6	10.5	153°52.4	24.0	255°34.5	19.3	309°41.3	19.3
3	304°12.1	176°06.8	·· 09.8	168°53.4	·· 23.6	270°36.5	·· 19.4	324°43.7	·· 19.3
4	319°14.6	191°06.9	09.1	183°54.3	23.2	285°38.4	19.6	339°46.1	19.3
5	334°17.0	206°07.1	08.4	198°55.3	22.7	300°40.4	19.8	354°48.6	19.3
6	349°19.5	221°07.3	N21°07.7	213°56.3	N18°22.3	315°42.4	N12°19.9	9°51.0	S10°19.3
7	4°21.9	236°07.4	07.0	228°57.3	21.9	330°44.3	20.1	24°53.4	19.3
8	19°24.4	251°07.6	06.3	243°58.3	21.4	345°46.3	20.3	39°55.9	19.3
9	34°26.9	266°07.7	·· 05.6	258°59.3	·· 21.0	0°48.3	·· 20.4	54°58.3	·· 19.3
10	49°29.3	281°07.9	05.0	274°00.3	20.5	15°50.3	20.6	70°00.7	19.3
11	64°31.8	296°08.1	04.3	289°01.2	20.1	30°52.2	20.7	85°03.2	19.3
12	79°34.3	311°08.2	N21°03.6	304°02.2	N18°19.7	45°54.2	N12°20.9	100°05.6	S10°19.3
13	94°36.7	326°08.4	02.9	319°03.2	19.2	60°56.2	21.1	115°08.1	19.3
14	109°39.2	341°08.6	02.2	334°04.2	18.8	75°58.1	21.2	130°10.5	19.3
15	124°41.7	356°08.7	·· 01.5	349°05.2	·· 18.3	91°00.1	·· 21.4	145°12.9	·· 19.3
16	139°44.1	11°08.9	00.8	4°06.2	17.9	106°02.1	21.6	160°15.4	19.3
17	154°46.6	26°09.1	21°00.1	19°07.2	17.5	121°04.1	21.7	175°17.8	19.3
18	169°49.0	41°09.3	N20°59.4	34°08.2	N18°17.0	136°06.0	N12°21.9	190°20.2	S10°19.3
19	184°51.5	56°09.4	58.7	49°09.1	16.6	151°08.0	22.1	205°22.7	19.3
20	199°54.0	71°09.6	58.0	64°10.1	16.1	166°10.0	22.2	220°25.1	19.3
21	214°56.4	86°09.8	·· 57.3	79°11.1	·· 15.7	181°12.0	·· 22.4	235°27.6	·· 19.3
22	229°58.9	101°10.0	56.6	94°12.1	15.3	196°13.9	22.6	250°30.0	19.3
23	245°01.4	116°10.2	55.9	109°13.1	14.8	211°15.9	22.7	265°32.4	19.3
Mer.pass. 06:43		ν 0.2′	d -0.7′	m -4.45	ν 1.0′	d -0.4′	m 1.65	ν 2.0′	d 0.2′ m -2.13	ν 2.4′	d 0.0′ m 0.81

Stars

	SHA	**Dec**
Alpheratz	357°36.2	29°12.9
Ankaa	353°08.6	-42°10.6
Schedar	349°32.8	56°39.6
Diphda	348°48.8	-17°51.5
Achernar	335°21.5	-57°06.9
Hamal	327°52.9	23°34.2
Polaris	315°05.0	89°21.5
Acamar	315°13.1	-40°12.6
Menkar	314°07.8	4°10.8
Mirfak	308°30.6	49°56.5
Aldebaran	290°41.5	16°33.3
Rigel	281°05.5	-8°10.5
Capella	280°24.3	46°01.2
Bellatrix	278°24.6	6°22.2
Elnath	278°03.9	28°37.6
Alnilam	275°39.4	-1°11.2
Betelgeuse	270°53.9	7°24.7
Canopus	263°53.5	-52°42.5
Sirius	258°27.7	-16°44.9
Adhara	255°07.3	-29°00.3
Procyon	244°52.5	5°09.9
Pollux	243°19.2	27°58.3
Avior	234°15.7	-59°35.2
Suhail	222°47.5	-43°31.8
Miaplacidus	221°39.1	-69°49.0
Alphard	217°49.2	-8°45.6
Regulus	207°36.0	11°51.3
Dubhe	193°42.7	61°37.8
Denebola	182°26.3	14°26.6
Gienah	175°44.9	-17°40.4
Acrux	173°01.4	-63°14.0
Gacrux	171°52.9	-57°14.9
Alioth	166°13.9	55°50.2
Spica	158°23.5	-11°17.0
Alkaid	152°52.7	49°12.0
Hadar	148°37.4	-60°29.3
Menkent	147°58.9	-36°29.2
Arcturus	145°48.9	19°03.7
Rigil Kent.	139°41.6	-60°56.1
Kochab	137°18.8	74°03.7
Zuben'ubi	136°57.2	-16°08.4
Alphecca	126°04.5	26°38.2
Antares	112°17.1	-26°29.1
Atria	107°11.9	-69°04.2
Sabik	102°04.0	-15°45.3
Shaula	96°11.7	-37°07.2
Rasalhague	95°59.4	12°32.5
Eltanin	90°42.3	51°29.0
Kaus Aust.	83°33.9	-34°22.4
Vega	80°33.7	38°48.2
Nunki	75°49.1	-26°16.0
Altair	62°01.0	8°55.7
Peacock	53°07.4	-56°39.4
Deneb	49°26.4	45°21.6
Enif	33°40.0	9°58.8
Al Na'ir	27°34.4	-46°50.7
Fomalhaut	15°15.9	-29°29.8
Scheat	13°46.5	28°12.4
Markab	13°31.2	15°19.7

Jun 09 Fri	**SHA**	**Mer.pass**
Venus	233°54.3	15:16
Mars	225°56.7	15:47
Jupiter	326°49.6	09:03
Saturn	20°33.3	05:28

Jun 10 Sat	**SHA**	**Mer.pass**
Venus	232°57.6	15:16
Mars	225°21.2	15:45
Jupiter	326°37.7	09:00
Saturn	20°32.5	05:25

Jun 11 Sun	**SHA**	**Mer.pass**
Venus	232°01.6	15:15
Mars	224°45.7	15:44
Jupiter	326°25.8	08:57
Saturn	20°31.7	05:21

Horizontal parallax	
Venus:	0.2
Mars:	0.1

h	Sun		Moon				
Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°13.1	N22°53.5	289°15.5	8.3′	S18°06.1	13.3′	59.7′
1	195°13.0	53.7	303°42.8	8.4′	17°52.8	13.4′	59.6′
2	210°12.8	53.9	318°10.2	8.5′	17°39.4	13.5′	59.6′
3	225°12.7	·· 54.1	332°37.7	8.6′	17°25.9	13.6′	59.6′
4	240°12.6	54.3	347°05.3	8.7′	17°12.3	13.6′	59.6′
5	255°12.5	54.5	1°33.1	8.8′	16°58.7	13.8′	59.6′
6	270°12.4	N22°54.7	16°00.9	8.9′	S16°44.9	13.8′	59.6′
7	285°12.2	54.9	30°28.8	9.0′	16°31.1	13.9′	59.6′
8	300°12.1	55.2	44°56.9	9.1′	16°17.2	14.1′	59.5′
9	315°12.0	·· 55.4	59°25.0	9.2′	16°03.1	14.1′	59.5′
10	330°11.9	55.6	73°53.2	9.3′	15°49.0	14.1′	59.5′
11	345°11.7	55.8	88°21.6	9.4′	15°34.9	14.3′	59.5′
12	0°11.6	N22°56.0	102°50.0	9.5′	S15°20.6	14.3′	59.5′
13	15°11.5	56.2	117°18.6	9.6′	15°06.3	14.4′	59.5′
14	30°11.4	56.4	131°47.2	9.7′	14°51.9	14.5′	59.4′
15	45°11.3	·· 56.6	146°15.9	9.8′	14°37.4	14.6′	59.4′
16	60°11.1	56.8	160°44.7	9.9′	14°22.8	14.6′	59.4′
17	75°11.0	57.0	175°13.6	10.0′	14°08.2	14.7′	59.4′
18	90°10.9	N22°57.2	189°42.7	10.1′	S13°53.5	14.7′	59.4′
19	105°10.8	57.4	204°11.8	10.2′	13°38.8	14.9′	59.4′
20	120°10.6	57.6	218°40.9	10.3′	13°23.9	14.9′	59.3′
21	135°10.5	·· 57.8	233°10.2	10.4′	13°09.0	14.9′	59.3′
22	150°10.4	58.0	247°39.6	10.5′	12°54.1	15.0′	59.3′
23	165°10.3	58.2	262°09.0	10.5′	12°39.1	15.1′	59.3′
	SD = 15.8′	d = 0.2′	SD = 16.3′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°10.2	N22°58.4	276°38.6	10.6′	S12°24.0	15.1′	59.3′
1	195°10.0	58.6	291°08.2	10.7′	12°08.9	15.2′	59.3′
2	210°09.9	58.8	305°37.9	10.8′	11°53.7	15.2′	59.2′
3	225°09.8	·· 59.0	320°07.7	10.9′	11°38.5	15.3′	59.2′
4	240°09.7	59.2	334°37.6	10.9′	11°23.2	15.3′	59.2′
5	255°09.5	59.4	349°07.5	11.0′	11°07.9	15.4′	59.2′
6	270°09.4	N22°59.6	3°37.5	11.1′	S10°52.5	15.5′	59.2′
7	285°09.3	22°59.8	18°07.7	11.2′	10°37.0	15.4′	59.1′
8	300°09.2	23°00.0	32°37.8	11.3′	10°21.6	15.5′	59.1′
9	315°09.0	·· 00.2	47°08.1	11.3′	10°06.1	15.6′	59.1′
10	330°08.9	00.4	61°38.4	11.4′	09°50.5	15.6′	59.1′
11	345°08.8	00.6	76°08.8	11.5′	09°34.9	15.6′	59.1′
12	0°08.7	N23°00.8	90°39.3	11.5′	S09°19.3	15.7′	59.0′
13	15°08.5	01.0	105°09.8	11.6′	09°03.6	15.7′	59.0′
14	30°08.4	01.1	119°40.4	11.7′	08°47.9	15.8′	59.0′
15	45°08.3	·· 01.3	134°11.1	11.7′	08°32.1	15.7′	59.0′
16	60°08.2	01.5	148°41.9	11.8′	08°16.4	15.8′	59.0′
17	75°08.0	01.7	163°12.7	11.9′	08°00.6	15.9′	58.9′
18	90°07.9	N23°01.9	177°43.5	11.9′	S07°44.7	15.8′	58.9′
19	105°07.8	02.1	192°14.4	12.0′	07°28.9	15.9′	58.9′
20	120°07.7	02.3	206°45.4	12.0′	07°13.0	16.0′	58.9′
21	135°07.5	·· 02.5	221°16.5	12.1′	06°57.0	15.9′	58.9′
22	150°07.4	02.6	235°47.6	12.2′	06°41.1	16.0′	58.8′
23	165°07.3	02.8	250°18.7	12.2′	06°25.1	15.9′	58.8′
	SD = 15.7′	d = 0.2′	SD = 16.2′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°07.2	N23°03.0	264°50.0	12.3′	S06°09.2	16.0′	58.8′
1	195°07.0	03.2	279°21.2	12.3′	05°53.2	16.1′	58.8′
2	210°06.9	03.4	293°52.5	12.4′	05°37.1	16.0′	58.8′
3	225°06.8	·· 03.5	308°23.9	12.4′	05°21.1	16.0′	58.7′
4	240°06.7	03.7	322°55.3	12.5′	05°05.1	16.1′	58.7′
5	255°06.5	03.9	337°26.8	12.5′	04°49.0	16.1′	58.7′
6	270°06.4	N23°04.1	351°58.3	12.6′	S04°32.9	16.1′	58.7′
7	285°06.3	04.3	6°29.9	12.6′	04°16.8	16.0′	58.7′
8	300°06.1	04.4	21°01.5	12.6′	04°00.8	16.2′	58.6′
9	315°06.0	·· 04.6	35°33.1	12.7′	03°44.6	16.1′	58.6′
10	330°05.9	04.8	50°04.8	12.7′	03°28.5	16.1′	58.6′
11	345°05.8	05.0	64°36.5	12.8′	03°12.4	16.1′	58.6′
12	0°05.6	N23°05.1	79°08.3	12.8′	S02°56.3	16.1′	58.6′
13	15°05.5	05.3	93°40.0	12.8′	02°40.2	16.1′	58.5′
14	30°05.4	05.5	108°11.9	12.9′	02°24.1	16.2′	58.5′
15	45°05.3	·· 05.7	122°43.7	12.9′	02°07.9	16.1′	58.5′
16	60°05.1	05.8	137°15.6	12.9′	01°51.8	16.1′	58.5′
17	75°05.0	06.0	151°47.6	13.0′	01°35.7	16.1′	58.4′
18	90°04.9	N23°06.2	166°19.5	13.0′	S01°19.6	16.1′	58.4′
19	105°04.7	06.3	180°51.5	13.0′	01°03.5	16.1′	58.4′
20	120°04.6	06.5	195°23.5	13.0′	00°47.4	16.1′	58.4′
21	135°04.5	·· 06.7	209°55.5	13.1′	00°31.3	16.1′	58.4′
22	150°04.4	06.8	224°27.6	13.1′	S00°15.2	16.1′	58.3′
23	165°04.2	07.0	238°59.7	13.1′	N00°00.9	16.0′	58.3′
	SD = 15.7′	d = 0.2′	SD = 16.0′				

Lat.	**Twilight** Naut.	**Twilight** Civil	**Sunrise**	**Sunset**	**Twilight** Civil	**Twilight** Naut.
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	▭	▭	▭	▭	▭	▭
66°	–:–	–:–	00:30	23:35	–:–	–:–
64°	–:–	–:–	01:40	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	21:45	–:–
54°	00:58	02:35	03:29	20:30	21:24	23:03
52°	01:38	02:53	03:41	20:18	21:07	22:22
50°	02:04	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°	03:40	04:16	04:46	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°	04:49	05:16	05:39	18:20	18:43	19:10
0°	05:07	05:33	05:56	18:03	18:26	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	06:26	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	15:55	16:35	17:19
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	08:41	15:17	16:08	17:01
S 60°	07:05	08:02	08:58	15:00	15:57	16:53

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

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 21-23 70-48%
09	00:52	00:47	11:59	04:54	17:20	
10	00:41	00:35	11:59	05:45	18:09	
11	00:29	00:23	12:00	06:33	18:56	

June 12, 13, 14 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	260°03.8	131°10.3	N20°55.2	124°14.1	N18°14.4	226°17.9	N12°22.9	280°34.9	S10°19.3
1	275°06.3	146°10.5	54.5	139°15.1	13.9	241°19.8	23.0	295°37.3	19.3
2	290°08.8	161°10.7	53.8	154°16.1	13.5	256°21.8	23.2	310°39.7	19.3
3	305°11.2	176°10.9	·· 53.1	169°17.0	·· 13.1	271°23.8	·· 23.4	325°42.2	·· 19.3
4	320°13.7	191°11.1	52.4	184°18.0	12.6	286°25.8	23.5	340°44.6	19.3
5	335°16.2	206°11.3	51.7	199°19.0	12.2	301°27.7	23.7	355°47.1	19.3
6	350°18.6	221°11.5	N20°51.0	214°20.0	N18°11.7	316°29.7	N12°23.9	10°49.5	S10°19.3
7	5°21.1	236°11.7	50.3	229°21.0	11.3	331°31.7	24.0	25°51.9	19.3
8	20°23.5	251°11.9	49.6	244°22.0	10.8	346°33.7	24.2	40°54.4	19.3
9	35°26.0	266°12.1	·· 48.9	259°23.0	·· 10.4	1°35.6	·· 24.3	55°56.8	·· 19.3
10	50°28.5	281°12.3	48.2	274°24.0	10.0	16°37.6	24.5	70°59.3	19.3
11	65°30.9	296°12.5	47.5	289°24.9	09.5	31°39.6	24.7	86°01.7	19.3
12	80°33.4	311°12.7	N20°46.8	304°25.9	N18°09.1	46°41.6	N12°24.8	101°04.1	S10°19.3
13	95°35.9	326°12.9	46.1	319°26.9	08.6	61°43.5	25.0	116°06.6	19.3
14	110°38.3	341°13.1	45.4	334°27.9	08.2	76°45.5	25.2	131°09.0	19.3
15	125°40.8	356°13.3	·· 44.6	349°28.9	·· 07.7	91°47.5	·· 25.3	146°11.5	·· 19.3
16	140°43.3	11°13.5	43.9	4°29.9	07.3	106°49.5	25.5	161°13.9	19.3
17	155°45.7	26°13.7	43.2	19°30.9	06.9	121°51.4	25.7	176°16.3	19.3
18	170°48.2	41°13.9	N20°42.5	34°31.9	N18°06.4	136°53.4	N12°25.8	191°18.8	S10°19.3
19	185°50.6	56°14.1	41.8	49°32.8	06.0	151°55.4	26.0	206°21.2	19.3
20	200°53.1	71°14.3	41.1	64°33.8	05.5	166°57.4	26.1	221°23.7	19.3
21	215°55.6	86°14.5	·· 40.4	79°34.8	·· 05.1	181°59.3	·· 26.3	236°26.1	·· 19.3
22	230°58.0	101°14.7	39.7	94°35.8	04.6	197°01.3	26.5	251°28.5	19.3
23	246°00.5	116°15.0	39.0	109°36.8	04.2	212°03.3	26.6	266°31.0	19.3
Mer.pass. 06:39		ν 0.2′	d -0.7′	m -4.46	ν 1.0′	d -0.4′	m 1.66	ν 2.0′	d 0.2′ m -2.13	ν 2.4′	d 0.0′ m 0.81

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	261°03.0	131°15.2	N20°38.3	124°37.8	N18°03.7	227°05.3	N12°26.8	281°33.4	S10°19.3
1	276°05.4	146°15.4	37.5	139°38.8	03.3	242°07.3	27.0	296°35.9	19.3
2	291°07.9	161°15.6	36.8	154°39.8	02.8	257°09.2	27.1	311°38.3	19.3
3	306°10.4	176°15.8	·· 36.1	169°40.8	·· 02.4	272°11.2	·· 27.3	326°40.8	·· 19.3
4	321°12.8	191°16.1	35.4	184°41.7	01.9	287°13.2	27.4	341°43.2	19.3
5	336°15.3	206°16.3	34.7	199°42.7	01.5	302°15.2	27.6	356°45.6	19.3
6	351°17.8	221°16.5	N20°34.0	214°43.7	N18°01.1	317°17.1	N12°27.8	11°48.1	S10°19.3
7	6°20.2	236°16.7	33.3	229°44.7	00.6	332°19.1	27.9	26°50.5	19.3
8	21°22.7	251°17.0	32.5	244°45.7	18°00.2	347°21.1	28.1	41°53.0	19.3
9	36°25.1	266°17.2	·· 31.8	259°46.7	17°59.7	2°23.1	·· 28.2	56°55.4	·· 19.3
10	51°27.6	281°17.4	31.1	274°47.7	59.3	17°25.0	28.4	71°57.9	19.3
11	66°30.1	296°17.7	30.4	289°48.7	58.8	32°27.0	28.6	87°00.3	19.3
12	81°32.5	311°17.9	N20°29.7	304°49.7	N17°58.4	47°29.0	N12°28.7	102°02.7	S10°19.3
13	96°35.0	326°18.1	28.9	319°50.6	57.9	62°31.0	28.9	117°05.2	19.3
14	111°37.5	341°18.4	28.2	334°51.6	57.5	77°33.0	29.1	132°07.6	19.3
15	126°39.9	356°18.6	·· 27.5	349°52.6	·· 57.0	92°34.9	·· 29.2	147°10.1	·· 19.3
16	141°42.4	11°18.9	26.8	4°53.6	56.6	107°36.9	29.4	162°12.5	19.3
17	156°44.9	26°19.1	26.1	19°54.6	56.1	122°38.9	29.5	177°15.0	19.3
18	171°47.3	41°19.4	N20°25.3	34°55.6	N17°55.7	137°40.9	N12°29.7	192°17.4	S10°19.3
19	186°49.8	56°19.6	24.6	49°56.6	55.2	152°42.9	29.9	207°19.9	19.4
20	201°52.3	71°19.9	23.9	64°57.6	54.8	167°44.8	30.0	222°22.3	19.4
21	216°54.7	86°20.1	·· 23.2	79°58.6	·· 54.3	182°46.8	·· 30.2	237°24.8	·· 19.4
22	231°57.2	101°20.4	22.5	94°59.5	53.9	197°48.8	30.3	252°27.2	19.4
23	246°59.6	116°20.6	21.7	110°00.5	53.4	212°50.8	30.5	267°29.6	19.4
Mer.pass. 06:35		ν 0.2′	d -0.7′	m -4.47	ν 1.0′	d -0.4′	m 1.66	ν 2.0′	d 0.2′ m -2.14	ν 2.4′	d -0.0′ m 0.81

Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	262°02.1	131°20.9	N20°21.0	125°01.5	N17°53.0	227°52.7	N12°30.7	282°32.1	S10°19.4
1	277°04.6	146°21.1	20.3	140°02.5	52.5	242°54.7	30.8	297°34.5	19.4
2	292°07.0	161°21.4	19.6	155°03.5	52.1	257°56.7	31.0	312°37.0	19.4
3	307°09.5	176°21.6	·· 18.8	170°04.5	·· 51.6	272°58.7	·· 31.1	327°39.4	·· 19.4
4	322°12.0	191°21.9	18.1	185°05.5	51.2	288°00.7	31.3	342°41.9	19.4
5	337°14.4	206°22.2	17.4	200°06.5	50.7	303°02.6	31.5	357°44.3	19.4
6	352°16.9	221°22.4	N20°16.7	215°07.5	N17°50.3	318°04.6	N12°31.6	12°46.8	S10°19.4
7	7°19.4	236°22.7	15.9	230°08.4	49.8	333°06.6	31.8	27°49.2	19.4
8	22°21.8	251°22.9	15.2	245°09.4	49.4	348°08.6	31.9	42°51.7	19.4
9	37°24.3	266°23.2	·· 14.5	260°10.4	·· 48.9	3°10.6	·· 32.1	57°54.1	·· 19.4
10	52°26.7	281°23.5	13.7	275°11.4	48.5	18°12.5	32.3	72°56.6	19.4
11	67°29.2	296°23.8	13.0	290°12.4	48.0	33°14.5	32.4	87°59.0	19.4
12	82°31.7	311°24.0	N20°12.3	305°13.4	N17°47.6	48°16.5	N12°32.6	103°01.5	S10°19.4
13	97°34.1	326°24.3	11.6	320°14.4	47.1	63°18.5	32.7	118°03.9	19.4
14	112°36.6	341°24.6	10.8	335°15.4	46.6	78°20.5	32.9	133°06.4	19.4
15	127°39.1	356°24.8	·· 10.1	350°16.4	·· 46.2	93°22.5	·· 33.1	148°08.8	·· 19.4
16	142°41.5	11°25.1	09.4	5°17.4	45.7	108°24.4	33.2	163°11.2	19.4
17	157°44.0	26°25.4	08.6	20°18.3	45.3	123°26.4	33.4	178°13.7	19.4
18	172°46.5	41°25.7	N20°07.9	35°19.3	N17°44.8	138°28.4	N12°33.5	193°16.1	S10°19.4
19	187°48.9	56°26.0	07.2	50°20.3	44.4	153°30.4	33.7	208°18.6	19.4
20	202°51.4	71°26.3	06.4	65°21.3	43.9	168°32.4	33.9	223°21.0	19.4
21	217°53.9	86°26.5	·· 05.7	80°22.3	·· 43.5	183°34.3	·· 34.0	238°23.5	·· 19.4
22	232°56.3	101°26.8	05.0	95°23.3	43.0	198°36.3	34.2	253°25.9	19.4
23	247°58.8	116°27.1	04.2	110°24.3	42.6	213°38.3	34.3	268°28.4	19.4
Mer.pass. 06:31		ν 0.3′	d -0.7′	m -4.48	ν 1.0′	d -0.5′	m 1.67	ν 2.0′	d 0.2′ m -2.14	ν 2.4′	d -0.0′ m 0.80

Stars

	SHA	**Dec**
Alpheratz	357°36.2	29°13.0
Ankaa	353°08.6	-42°10.6
Schedar	349°32.7	56°39.6
Diphda	348°48.7	-17°51.5
Achernar	335°21.5	-57°06.9
Hamal	327°52.9	23°34.2
Polaris	315°04.1	89°21.5
Acamar	315°13.1	-40°12.5
Menkar	314°07.8	4°10.8
Mirfak	308°30.6	49°56.5
Aldebaran	290°41.5	16°33.3
Rigel	281°05.5	-8°10.5
Capella	280°24.3	46°01.2
Bellatrix	278°24.6	6°22.2
Elnath	278°03.9	28°37.6
Alnilam	275°39.4	-1°11.2
Betelgeuse	270°53.9	7°24.7
Canopus	263°53.5	-52°42.5
Sirius	258°27.7	-16°44.9
Adhara	255°07.3	-29°00.3
Procyon	244°52.5	5°09.9
Pollux	243°19.2	27°58.3
Avior	234°15.8	-59°35.2
Suhail	222°47.6	-43°31.8
Miaplacidus	221°39.1	-69°49.0
Alphard	217°49.2	-8°45.6
Regulus	207°36.0	11°51.3
Dubhe	193°42.7	61°37.8
Denebola	182°26.3	14°26.6
Gienah	175°44.9	-17°40.4
Acrux	173°01.4	-63°14.0
Gacrux	171°53.0	-57°14.9
Alioth	166°13.9	55°50.3
Spica	158°23.5	-11°17.0
Alkaid	152°52.8	49°12.0
Hadar	148°37.5	-60°29.3
Menkent	147°58.9	-36°29.2
Arcturus	145°48.9	19°03.7
Rigil Kent.	139°41.6	-60°56.1
Kochab	137°18.8	74°03.7
Zuben'ubi	136°57.2	-16°08.4
Alphecca	126°04.5	26°38.2
Antares	112°17.1	-26°29.1
Atria	107°11.9	-69°04.2
Sabik	102°03.9	-15°45.2
Shaula	96°11.7	-37°07.2
Rasalhague	95°59.4	12°32.5
Eltanin	90°42.3	51°29.1
Kaus Aust.	83°33.9	-34°22.4
Vega	80°33.7	38°48.2
Nunki	75°49.0	-26°16.0
Altair	62°01.0	8°55.7
Peacock	53°07.4	-56°39.4
Deneb	49°26.4	45°21.6
Enif	33°39.9	9°58.8
Al Na'ir	27°34.4	-46°50.7
Fomalhaut	15°15.9	-29°29.8
Scheat	13°46.4	28°12.4
Markab	13°31.2	15°19.7

Jun 12 Mon	**SHA**	**Mer.pass**
Venus	231°06.5	15:15
Mars	224°10.2	15:42
Jupiter	326°14.0	08:54
Saturn	20°31.0	05:17

Jun 13 Tue	**SHA**	**Mer.pass**
Venus	230°12.2	15:15
Mars	223°34.8	15:40
Jupiter	326°02.3	08:50
Saturn	20°30.5	05:13

Jun 14 Wed	**SHA**	**Mer.pass**
Venus	229°18.8	15:14
Mars	222°59.4	15:39
Jupiter	325°50.6	08:47
Saturn	20°30.0	05:09

Horizontal parallax	
Venus:	0.2
Mars:	0.1

h	Sun		Moon				
Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°04.1	N23°07.2	253°31.8	13.1′	N00°16.9	16.1′	58.3′
1	195°04.0	07.3	268°03.9	13.1′	00°33.0	16.0′	58.3′
2	210°03.8	07.5	282°36.1	13.2′	00°49.0	16.0′	58.2′
3	225°03.7	·· 07.7	297°08.2	13.2′	01°05.0	16.1′	58.2′
4	240°03.6	07.8	311°40.4	13.2′	01°21.1	15.9′	58.2′
5	255°03.5	08.0	326°12.6	13.2′	01°37.0	16.0′	58.2′
6	270°03.3	N23°08.2	340°44.8	13.2′	N01°53.0	16.0′	58.2′
7	285°03.2	08.3	355°17.0	13.2′	02°09.0	15.9′	58.1′
8	300°03.1	08.5	9°49.2	13.2′	02°24.9	15.9′	58.1′
9	315°02.9	·· 08.6	24°21.5	13.2′	02°40.8	15.9′	58.1′
10	330°02.8	08.8	38°53.7	13.3′	02°56.7	15.8′	58.1′
11	345°02.7	08.9	53°26.0	13.3′	03°12.5	15.9′	58.1′
12	0°02.6	N23°09.1	67°58.2	13.3′	N03°28.4	15.8′	58.0′
13	15°02.4	09.3	82°30.5	13.3′	03°44.2	15.7′	58.0′
14	30°02.3	09.4	97°02.8	13.3′	03°59.9	15.8′	58.0′
15	45°02.2	·· 09.6	111°35.0	13.3′	04°15.7	15.7′	58.0′
16	60°02.0	09.7	126°07.3	13.3′	04°31.4	15.7′	57.9′
17	75°01.9	09.9	140°39.6	13.3′	04°47.1	15.6′	57.9′
18	90°01.8	N23°10.0	155°11.8	13.3′	N05°02.7	15.6′	57.9′
19	105°01.7	10.2	169°44.1	13.3′	05°18.3	15.6′	57.9′
20	120°01.5	10.3	184°16.4	13.3′	05°33.9	15.5′	57.9′
21	135°01.4	·· 10.5	198°48.6	13.2′	05°49.4	15.6′	57.8′
22	150°01.3	10.6	213°20.9	13.2′	06°05.0	15.4′	57.8′
23	165°01.1	10.8	227°53.1	13.2′	06°20.4	15.4′	57.8′
	SD = 15.7′	d = 0.2′	SD = 15.9′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°01.0	N23°10.9	242°25.3	13.2′	N06°35.8	15.4′	57.8′
1	195°00.9	11.1	256°57.6	13.2′	06°51.2	15.4′	57.7′
2	210°00.7	11.2	271°29.8	13.2′	07°06.6	15.3′	57.7′
3	225°00.6	·· 11.4	286°02.0	13.2′	07°21.9	15.2′	57.7′
4	240°00.5	11.5	300°34.1	13.2′	07°37.1	15.2′	57.7′
5	255°00.3	11.7	315°06.3	13.2′	07°52.3	15.2′	57.7′
6	270°00.2	N23°11.8	329°38.5	13.1′	N08°07.5	15.1′	57.6′
7	285°00.1	12.0	344°10.6	13.1′	08°22.6	15.0′	57.6′
8	300°00.0	12.1	358°42.7	13.1′	08°37.6	15.1′	57.6′
9	314°59.8	·· 12.2	13°14.8	13.1′	08°52.7	14.9′	57.6′
10	329°59.7	12.4	27°46.9	13.1′	09°07.6	14.9′	57.5′
11	344°59.6	12.5	42°19.0	13.0′	09°22.5	14.9′	57.5′
12	359°59.4	N23°12.7	56°51.0	13.0′	N09°37.4	14.8′	57.5′
13	14°59.3	12.8	71°23.0	13.0′	09°52.2	14.7′	57.5′
14	29°59.2	12.9	85°55.0	13.0′	10°06.9	14.7′	57.5′
15	44°59.0	·· 13.1	100°27.0	12.9′	10°21.6	14.6′	57.4′
16	59°58.9	13.2	114°58.9	12.9′	10°36.2	14.6′	57.4′
17	74°58.8	13.4	129°30.8	12.9′	10°50.8	14.5′	57.4′
18	89°58.6	N23°13.5	144°02.7	12.9′	N11°05.3	14.4′	57.4′
19	104°58.5	13.6	158°34.5	12.8′	11°19.7	14.4′	57.3′
20	119°58.4	13.8	173°06.3	12.8′	11°34.1	14.3′	57.3′
21	134°58.2	·· 13.9	187°38.1	12.8′	11°48.4	14.3′	57.3′
22	149°58.1	14.0	202°09.9	12.7′	12°02.7	14.2′	57.3′
23	164°58.0	14.2	216°41.6	12.7′	12°16.9	14.1′	57.3′
	SD = 15.7′	d = 0.1′	SD = 15.8′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°57.8	N23°14.3	231°13.3	12.7′	N12°31.0	14.1′	57.2′
1	194°57.7	14.4	245°45.0	12.6′	12°45.1	13.9′	57.2′
2	209°57.6	14.5	260°16.6	12.6′	12°59.0	13.9′	57.2′
3	224°57.4	·· 14.7	274°48.2	12.5′	13°12.9	13.9′	57.2′
4	239°57.3	14.8	289°19.7	12.5′	13°26.8	13.8′	57.1′
5	254°57.2	14.9	303°51.2	12.5′	13°40.6	13.7′	57.1′
6	269°57.1	N23°15.1	318°22.7	12.4′	N13°54.3	13.6′	57.1′
7	284°56.9	15.2	332°54.1	12.4′	14°07.9	13.5′	57.1′
8	299°56.8	15.3	347°25.5	12.3′	14°21.4	13.5′	57.1′
9	314°56.7	·· 15.4	1°56.8	12.3′	14°34.9	13.4′	57.0′
10	329°56.5	15.6	16°28.1	12.3′	14°48.3	13.3′	57.0′
11	344°56.4	15.7	30°59.4	12.2′	15°01.6	13.2′	57.0′
12	359°56.3	N23°15.8	45°30.6	12.2′	N15°14.8	13.1′	57.0′
13	14°56.1	15.9	60°01.8	12.1′	15°27.9	13.1′	57.0′
14	29°56.0	16.1	74°32.9	12.1′	15°41.0	13.0′	56.9′
15	44°55.9	·· 16.2	89°04.0	12.0′	15°54.0	12.9′	56.9′
16	59°55.7	16.3	103°35.0	12.0′	16°06.9	12.8′	56.9′
17	74°55.6	16.4	118°06.0	11.9′	16°19.7	12.7′	56.9′
18	89°55.5	N23°16.5	132°37.0	11.9′	N16°32.4	12.7′	56.8′
19	104°55.3	16.7	147°07.9	11.8′	16°45.1	12.5′	56.8′
20	119°55.2	16.8	161°38.7	11.8′	16°57.6	12.5′	56.8′
21	134°55.1	·· 16.9	176°09.5	11.8′	17°10.1	12.3′	56.8′
22	149°54.9	17.0	190°40.3	11.7′	17°22.4	12.3′	56.8′
23	164°54.8	17.1	205°11.0	11.7′	17°34.7	12.2′	56.7′
	SD = 15.7′	d = 0.1′	SD = 15.6′				

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

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

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 24-26 37-18%
12	00:16	00:10	12:00	07:19	19:42	
13	00:04	00:02	12:00	08:05	20:28	
14	00:09	00:15	12:00	08:52	21:16	

June 15, 16, 17 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	263°01.2	131°27.4	N20°03.5	125°25.3	N17°42.1	228°40.3	N12°34.5	283°30.8	S10°19.5
1	278°03.7	146°27.7	02.8	140°26.3	41.6	243°42.3	34.7	298°33.3	19.5
2	293°06.2	161°28.0	02.0	155°27.3	41.2	258°44.3	34.8	313°35.7	19.5
3	308°08.6	176°28.3	·· 01.3	170°28.2	·· 40.7	273°46.2	·· 35.0	328°38.2	·· 19.5
4	323°11.1	191°28.6	20°00.5	185°29.2	40.3	288°48.2	35.1	343°40.6	19.5
5	338°13.6	206°28.9	19°59.8	200°30.2	39.8	303°50.2	35.3	358°43.1	19.5
6	353°16.0	221°29.2	N19°59.1	215°31.2	N17°39.4	318°52.2	N12°35.5	13°45.5	S10°19.5
7	8°18.5	236°29.5	58.3	230°32.2	38.9	333°54.2	35.6	28°48.0	19.5
8	23°21.0	251°29.8	57.6	245°33.2	38.5	348°56.2	35.8	43°50.4	19.5
9	38°23.4	266°30.1	·· 56.9	260°34.2	·· 38.0	3°58.1	·· 35.9	58°52.9	·· 19.5
10	53°25.9	281°30.4	56.1	275°35.2	37.5	19°00.1	36.1	73°55.4	19.5
11	68°28.4	296°30.7	55.4	290°36.2	37.1	34°02.1	36.2	88°57.8	19.5
12	83°30.8	311°31.0	N19°54.6	305°37.2	N17°36.6	49°04.1	N12°36.4	104°00.3	S10°19.5
13	98°33.3	326°31.3	53.9	320°38.1	36.2	64°06.1	36.6	119°02.7	19.5
14	113°35.7	341°31.6	53.2	335°39.1	35.7	79°08.1	36.7	134°05.2	19.5
15	128°38.2	356°31.9	·· 52.4	350°40.1	·· 35.3	94°10.0	·· 36.9	149°07.6	·· 19.5
16	143°40.7	11°32.3	51.7	5°41.1	34.8	109°12.0	37.0	164°10.1	19.5
17	158°43.1	26°32.6	50.9	20°42.1	34.3	124°14.0	37.2	179°12.5	19.5
18	173°45.6	41°32.9	N19°50.2	35°43.1	N17°33.9	139°16.0	N12°37.3	194°15.0	S10°19.5
19	188°48.1	56°33.2	49.4	50°44.1	33.4	154°18.0	37.5	209°17.4	19.5
20	203°50.5	71°33.5	48.7	65°45.1	33.0	169°20.0	37.7	224°19.9	19.6
21	218°53.0	86°33.9	·· 48.0	80°46.1	·· 32.5	184°22.0	·· 37.8	239°22.3	·· 19.6
22	233°55.5	101°34.2	47.2	95°47.1	32.0	199°23.9	38.0	254°24.8	19.6
23	248°57.9	116°34.5	46.5	110°48.1	31.6	214°25.9	38.1	269°27.2	19.6
Mer.pass. 06:27		ν 0.3′ d -0.7′ m -4.50		ν 1.0′ d -0.5′ m 1.67		ν 2.0′ d 0.2′ m -2.14		ν 2.5′ d -0.0′ m 0.80	

Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	264°00.4	131°34.8	N19°45.7	125°49.0	N17°31.1	229°27.9	N12°38.3	284°29.7	S10°19.6
1	279°02.9	146°35.2	45.0	140°50.0	30.7	244°29.9	38.5	299°32.1	19.6
2	294°05.3	161°35.5	44.2	155°51.0	30.2	259°31.9	38.6	314°34.6	19.6
3	309°07.8	176°35.8	·· 43.5	170°52.0	·· 29.7	274°33.9	·· 38.8	329°37.1	·· 19.6
4	324°10.2	191°36.2	42.7	185°53.0	29.3	289°35.8	38.9	344°39.5	19.6
5	339°12.7	206°36.5	42.0	200°54.0	28.8	304°37.8	39.1	359°42.0	19.6
6	354°15.2	221°36.8	N19°41.2	215°55.0	N17°28.4	319°39.8	N12°39.2	14°44.4	S10°19.6
7	9°17.6	236°37.2	40.5	230°56.0	27.9	334°41.8	39.4	29°46.9	19.6
8	24°20.1	251°37.5	39.7	245°57.0	27.4	349°43.8	39.6	44°49.3	19.6
9	39°22.6	266°37.9	·· 39.0	260°58.0	·· 27.0	4°45.8	·· 39.7	59°51.8	·· 19.6
10	54°25.0	281°38.2	38.2	275°59.0	26.5	19°47.8	39.9	74°54.2	19.6
11	69°27.5	296°38.5	37.5	291°00.0	26.0	34°49.8	40.0	89°56.7	19.6
12	84°30.0	311°38.9	N19°36.7	306°00.9	N17°25.6	49°51.7	N12°40.2	104°59.2	S10°19.7
13	99°32.4	326°39.2	36.0	321°01.9	25.1	64°53.7	40.3	120°01.6	19.7
14	114°34.9	341°39.6	35.2	336°02.9	24.7	79°55.7	40.5	135°04.1	19.7
15	129°37.4	356°39.9	·· 34.5	351°03.9	·· 24.2	94°57.7	·· 40.7	150°06.5	·· 19.7
16	144°39.8	11°40.3	33.7	6°04.9	23.7	109°59.7	40.8	165°09.0	19.7
17	159°42.3	26°40.6	33.0	21°05.9	23.3	125°01.7	41.0	180°11.4	19.7
18	174°44.7	41°41.0	N19°32.2	36°06.9	N17°22.8	140°03.7	N12°41.1	195°13.9	S10°19.7
19	189°47.2	56°41.4	31.5	51°07.9	22.3	155°05.7	41.3	210°16.3	19.7
20	204°49.7	71°41.7	30.7	66°08.9	21.9	170°07.6	41.4	225°18.8	19.7
21	219°52.1	86°42.1	·· 30.0	81°09.9	·· 21.4	185°09.6	·· 41.6	240°21.3	·· 19.7
22	234°54.6	101°42.4	29.2	96°10.9	21.0	200°11.6	41.7	255°23.7	19.7
23	249°57.1	116°42.8	28.4	111°11.9	20.5	215°13.6	41.9	270°26.2	19.7
Mer.pass. 06:23		ν 0.3′ d -0.7′ m -4.51		ν 1.0′ d -0.5′ m 1.68		ν 2.0′ d 0.2′ m -2.15		ν 2.5′ d -0.0′ m 0.79	

Sat	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	264°59.5	131°43.2	N19°27.7	126°12.8	N17°20.0	230°15.6	N12°42.1	285°28.6	S10°19.7
1	280°02.0	146°43.5	26.9	141°13.8	19.6	245°17.6	42.2	300°31.1	19.7
2	295°04.5	161°43.9	26.2	156°14.8	19.1	260°19.6	42.4	315°33.5	19.8
3	310°06.9	176°44.3	·· 25.4	171°15.8	·· 18.6	275°21.6	·· 42.5	330°36.0	·· 19.8
4	325°09.4	191°44.6	24.7	186°16.8	18.2	290°23.6	42.7	345°38.5	19.8
5	340°11.8	206°45.0	23.9	201°17.8	17.7	305°25.5	42.8	0°40.9	19.8
6	355°14.3	221°45.4	N19°23.2	216°18.8	N17°17.2	320°27.5	N12°43.0	15°43.4	S10°19.8
7	10°16.8	236°45.8	22.4	231°19.8	16.8	335°29.5	43.1	30°45.8	19.8
8	25°19.2	251°46.2	21.6	246°20.8	16.3	350°31.5	43.3	45°48.3	19.8
9	40°21.7	266°46.5	·· 20.9	261°21.8	·· 15.8	5°33.5	·· 43.5	60°50.8	·· 19.8
10	55°24.2	281°46.9	20.1	276°22.8	15.4	20°35.5	43.6	75°53.2	19.8
11	70°26.6	296°47.3	19.4	291°23.8	14.9	35°37.5	43.8	90°55.7	19.8
12	85°29.1	311°47.7	N19°18.6	306°24.8	N17°14.4	50°39.5	N12°43.9	105°58.1	S10°19.8
13	100°31.6	326°48.1	17.8	321°25.7	14.0	65°41.5	44.1	121°00.6	19.8
14	115°34.0	341°48.5	17.1	336°26.7	13.5	80°43.4	44.2	136°03.1	19.9
15	130°36.5	356°48.8	·· 16.3	351°27.7	·· 13.0	95°45.4	·· 44.4	151°05.5	·· 19.9
16	145°39.0	11°49.2	15.6	6°28.7	12.6	110°47.4	44.5	166°08.0	19.9
17	160°41.4	26°49.6	14.8	21°29.7	12.1	125°49.4	44.7	181°10.4	19.9
18	175°43.9	41°50.0	N19°14.0	36°30.7	N17°11.6	140°51.4	N12°44.9	196°12.9	S10°19.9
19	190°46.3	56°50.4	13.3	51°31.7	11.2	155°53.4	45.0	211°15.4	19.9
20	205°48.8	71°50.8	12.5	66°32.7	10.7	170°55.4	45.2	226°17.8	19.9
21	220°51.3	86°51.2	·· 11.7	81°33.7	·· 10.2	185°57.4	·· 45.3	241°20.3	·· 19.9
22	235°53.7	101°51.6	11.0	96°34.7	09.8	200°59.4	45.5	256°22.7	19.9
23	250°56.2	116°52.0	10.2	111°35.7	09.3	216°01.4	45.6	271°25.2	19.9
Mer.pass. 06:19		ν 0.4′ d -0.8′ m -4.52		ν 1.0′ d -0.5′ m 1.68		ν 2.0′ d 0.2′ m -2.15		ν 2.5′ d -0.0′ m 0.79	

Stars

	SHA	**Dec**
Alpheratz	357°36.2	29°13.0
Ankaa	353°08.5	-42°10.6
Schedar	349°32.7	56°39.6
Diphda	348°48.7	-17°51.4
Achernar	335°21.5	-57°06.9
Hamal	327°52.9	23°34.2
Polaris	315°02.9	89°21.5
Acamar	315°13.1	-40°12.5
Menkar	314°07.8	4°10.8
Mirfak	308°30.6	49°56.5
Aldebaran	290°41.5	16°33.3
Rigel	281°05.5	-8°10.5
Capella	280°24.3	46°01.2
Bellatrix	278°24.6	6°22.2
Elnath	278°03.9	28°37.6
Alnilam	275°39.4	-1°11.2
Betelgeuse	270°53.9	7°24.7
Canopus	263°53.5	-52°42.5
Sirius	258°27.7	-16°44.9
Adhara	255°07.3	-29°00.3
Procyon	244°52.5	5°09.9
Pollux	243°19.2	27°58.3
Avior	234°15.8	-59°35.2
Suhail	222°47.6	-43°31.8
Miaplacidus	221°39.1	-69°49.0
Alphard	217°49.2	-8°45.6
Regulus	207°36.0	11°51.3
Dubhe	193°42.7	61°37.8
Denebola	182°26.3	14°26.6
Gienah	175°44.9	-17°40.4
Acrux	173°01.4	-63°14.0
Gacrux	171°53.0	-57°14.9
Alioth	166°13.9	55°50.3
Spica	158°23.5	-11°17.0
Alkaid	152°52.8	49°12.0
Hadar	148°37.5	-60°29.3
Menkent	147°58.9	-36°29.2
Arcturus	145°48.9	19°03.7
Rigil Kent.	139°41.6	-60°56.1
Kochab	137°18.9	74°03.8
Zuben'ubi	136°57.2	-16°08.4
Alphecca	126°04.5	26°38.2
Antares	112°17.1	-26°29.1
Atria	107°11.9	-69°04.2
Sabik	102°03.9	-15°45.2
Shaula	96°11.7	-37°07.2
Rasalhague	95°59.4	12°32.6
Eltanin	90°42.2	51°29.1
Kaus Aust.	83°33.9	-34°22.4
Vega	80°33.7	38°48.2
Nunki	75°49.0	-26°16.0
Altair	62°00.9	8°55.7
Peacock	53°07.3	-56°39.4
Deneb	49°26.4	45°21.6
Enif	33°39.9	9°58.8
Al Na'ir	27°34.4	-46°50.7
Fomalhaut	15°15.9	-29°29.8
Scheat	13°46.4	28°12.4
Markab	13°31.2	15°19.7

Jun 15 Thu	**SHA**	**Mer.pass**
Venus	228°26.2	15:14
Mars	222°24.0	15:37
Jupiter	325°39.0	08:44
Saturn	20°29.6	05:05

Jun 16 Fri	**SHA**	**Mer.pass**
Venus	227°34.4	15:13
Mars	221°48.7	15:36
Jupiter	325°27.5	08:41
Saturn	20°29.3	05:01

Jun 17 Sat	**SHA**	**Mer.pass**
Venus	226°43.6	15:13
Mars	221°13.3	15:34
Jupiter	325°16.1	08:38
Saturn	20°29.1	04:57

Horizontal parallax	
Venus:	0.2
Mars:	0.1

h	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°54.7	N23°17.2	219°41.6	11.6′	N17°46.9	12.1′	56.7′
1	194°54.5	17.3	234°12.2	11.6′	17°59.0	12.0′	56.7′
2	209°54.4	17.5	248°42.8	11.5′	18°11.0	11.8′	56.7′
3	224°54.3	·· 17.6	263°13.3	11.4′	18°22.8	11.8′	56.6′
4	239°54.1	17.7	277°43.7	11.4′	18°34.6	11.7′	56.6′
5	254°54.0	17.8	292°14.1	11.3′	18°46.3	11.6′	56.6′
6	269°53.8	N23°17.9	306°44.5	11.3′	N18°57.9	11.5′	56.6′
7	284°53.7	18.0	321°14.8	11.2′	19°09.4	11.4′	56.6′
8	299°53.6	18.1	335°45.0	11.2′	19°20.8	11.3′	56.5′
9	314°53.4	·· 18.2	350°15.2	11.1′	19°32.1	11.2′	56.5′
10	329°53.3	18.3	4°45.3	11.1′	19°43.3	11.1′	56.5′
11	344°53.2	18.4	19°15.4	11.0′	19°54.4	11.0′	56.5′
12	359°53.0	N23°18.5	33°45.4	11.0′	N20°05.4	10.9′	56.5′
13	14°52.9	18.7	48°15.4	10.9′	20°16.3	10.7′	56.4′
14	29°52.8	18.8	62°45.3	10.9′	20°27.0	10.7′	56.4′
15	44°52.6	·· 18.9	77°15.2	10.8′	20°37.7	10.5′	56.4′
16	59°52.5	19.0	91°45.0	10.8′	20°48.2	10.5′	56.4′
17	74°52.4	19.1	106°14.7	10.7′	20°58.7	10.3′	56.4′
18	89°52.2	N23°19.2	120°44.4	10.6′	N21°09.0	10.2′	56.3′
19	104°52.1	19.3	135°14.1	10.6′	21°19.2	10.1′	56.3′
20	119°52.0	19.4	149°43.7	10.5′	21°29.3	10.0′	56.3′
21	134°51.8	·· 19.5	164°13.2	10.5′	21°39.3	9.9′	56.3′
22	149°51.7	19.6	178°42.7	10.4′	21°49.2	9.7′	56.2′
23	164°51.6	19.7	193°12.2	10.4′	21°58.9	9.6′	56.2′
	SD = 15.7′	d = 0.1′	SD = 15.5′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°51.4	N23°19.8	207°41.5	10.3′	N22°08.5	9.6′	56.2′
1	194°51.3	19.9	222°10.9	10.3′	22°18.1	9.4′	56.2′
2	209°51.2	20.0	236°40.2	10.2′	22°27.5	9.2′	56.2′
3	224°51.0	·· 20.0	251°09.4	10.2′	22°36.7	9.2′	56.1′
4	239°50.9	20.1	265°38.6	10.1′	22°45.9	9.0′	56.1′
5	254°50.7	20.2	280°07.7	10.1′	22°54.9	8.9′	56.1′
6	269°50.6	N23°20.3	294°36.7	10.0′	N23°03.8	8.8′	56.1′
7	284°50.5	20.4	309°05.8	10.0′	23°12.6	8.7′	56.1′
8	299°50.3	20.5	323°34.7	9.9′	23°21.3	8.5′	56.0′
9	314°50.2	·· 20.6	338°03.7	9.9′	23°29.8	8.5′	56.0′
10	329°50.1	20.7	352°32.5	9.8′	23°38.3	8.2′	56.0′
11	344°49.9	20.8	7°01.4	9.8′	23°46.5	8.2′	56.0′
12	359°49.8	N23°20.9	21°30.1	9.7′	N23°54.7	8.0′	56.0′
13	14°49.7	21.0	35°58.9	9.7′	24°02.7	7.9′	55.9′
14	29°49.5	21.0	50°27.5	9.6′	24°10.6	7.8′	55.9′
15	44°49.4	·· 21.1	64°56.2	9.6′	24°18.4	7.7′	55.9′
16	59°49.3	21.2	79°24.8	9.5′	24°26.1	7.5′	55.9′
17	74°49.1	21.3	93°53.3	9.5′	24°33.6	7.4′	55.9′
18	89°49.0	N23°21.4	108°21.8	9.5′	N24°41.0	7.2′	55.8′
19	104°48.9	21.5	122°50.2	9.4′	24°48.2	7.1′	55.8′
20	119°48.7	21.6	137°18.7	9.4′	24°55.3	7.0′	55.8′
21	134°48.6	·· 21.6	151°47.0	9.3′	25°02.3	6.8′	55.8′
22	149°48.4	21.7	166°15.4	9.3′	25°09.1	6.8′	55.8′
23	164°48.3	21.8	180°43.6	9.2′	25°15.9	6.5′	55.7′
	SD = 15.7′	d = 0.1′	SD = 15.3′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°48.2	N23°21.9	195°11.9	9.2′	N25°22.4	6.5′	55.7′
1	194°48.0	22.0	209°40.1	9.2′	25°28.9	6.3′	55.7′
2	209°47.9	22.0	224°08.3	9.1′	25°35.2	6.1′	55.7′
3	224°47.8	·· 22.1	238°36.4	9.1′	25°41.3	6.0′	55.7′
4	239°47.6	22.2	253°04.5	9.1′	25°47.3	5.9′	55.6′
5	254°47.5	22.3	267°32.6	9.0′	25°53.2	5.8′	55.6′
6	269°47.4	N23°22.3	282°00.6	9.0′	N25°59.0	5.6′	55.6′
7	284°47.2	22.4	296°28.6	9.0′	26°04.6	5.4′	55.6′
8	299°47.1	22.5	310°56.6	8.9′	26°10.0	5.4′	55.6′
9	314°46.9	·· 22.6	325°24.5	8.9′	26°15.4	5.1′	55.5′
10	329°46.8	22.6	339°52.4	8.9′	26°20.5	5.1′	55.5′
11	344°46.7	22.7	354°20.3	8.9′	26°25.6	4.9′	55.5′
12	359°46.5	N23°22.8	8°48.1	8.8′	N26°30.5	4.7′	55.5′
13	14°46.4	22.9	23°16.0	8.8′	26°35.2	4.6′	55.5′
14	29°46.3	22.9	37°43.8	8.8′	26°39.8	4.5′	55.4′
15	44°46.1	·· 23.0	52°11.6	8.8′	26°44.3	4.3′	55.4′
16	59°46.0	23.1	66°39.3	8.7′	26°48.6	4.2′	55.4′
17	74°45.9	23.1	81°07.1	8.7′	26°52.8	4.0′	55.4′
18	89°45.7	N23°23.2	95°34.8	8.7′	N26°56.8	3.9′	55.4′
19	104°45.6	23.3	110°02.5	8.7′	27°00.7	3.8′	55.4′
20	119°45.4	23.3	124°30.2	8.7′	27°04.5	3.6′	55.3′
21	134°45.3	·· 23.4	138°57.8	8.7′	27°08.1	3.4′	55.3′
22	149°45.2	23.5	153°25.5	8.6′	27°11.5	3.3′	55.3′
23	164°45.0	23.5	167°53.1	8.6′	27°14.8	3.2′	55.3′
	SD = 15.7′	d = 0.1′	SD = 15.2′				

Lat.	**Twilight** Naut.	**Twilight** Civil	**Sunrise**	**Sunset**	**Twilight** Civil	**Twilight** Naut.
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	▭	▭	▭	▭	▭	▭
66°	▭	▭	▭	▭	▭	▭
64°	–:–	–:–	01:33	22:29	–:–	–:–
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	19:46	20:22
30°	03:58	04:31	04:59	19:03	19:30	20:04
20°	04:27	04:56	05:21	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	05:52	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	18:04
35°	06:07	06:38	07:06	16:55	17:23	17:55
40°	06:16	06:50	07:21	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	15:54	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	17:00
S 60°	07:09	08:06	09:04	14:58	15:55	16:52

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

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 27-29 10-2%
15	00:21	00:28	12:00	09:40	22:05	
16	00:34	00:41	12:01	10:31	22:57	
17	00:47	00:54	12:01	11:23	23:50	

June 18, 19, 20 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	265°58.7	131°52.4	N19°09.4	126°36.7	N17°08.8	231°03.4	N12°45.8	286°27.7	S10°19.9
1	281°01.1	146°52.8	08.7	141°37.7	08.4	246°05.4	45.9	301°30.1	20.0
2	296°03.6	161°53.2	07.9	156°38.7	07.9	261°07.3	46.1	316°32.6	20.0
3	311°06.1	176°53.7	·· 07.2	171°39.6	·· 07.4	276°09.3	·· 46.2	331°35.1	·· 20.0
4	326°08.5	191°54.1	06.4	186°40.6	07.0	291°11.3	46.4	346°37.5	20.0
5	341°11.0	206°54.5	05.6	201°41.6	06.5	306°13.3	46.5	1°40.0	20.0
6	356°13.5	221°54.9	N19°04.9	216°42.6	N17°06.0	321°15.3	N12°46.7	16°42.4	S10°20.0
7	11°15.9	236°55.3	04.1	231°43.6	05.5	336°17.3	46.9	31°44.9	20.0
8	26°18.4	251°55.7	03.3	246°44.6	05.1	351°19.3	47.0	46°47.4	20.0
9	41°20.8	266°56.1	·· 02.5	261°45.6	·· 04.6	6°21.3	·· 47.2	61°49.8	·· 20.0
10	56°23.3	281°56.6	01.8	276°46.6	04.1	21°23.3	47.3	76°52.3	20.0
11	71°25.8	296°57.0	01.0	291°47.6	03.7	36°25.3	47.5	91°54.8	20.0
12	86°28.2	311°57.4	N19°00.2	306°48.6	N17°03.2	51°27.3	N12°47.6	106°57.2	S10°20.1
13	101°30.7	326°57.8	18°59.5	321°49.6	02.7	66°29.3	47.8	121°59.7	20.1
14	116°33.2	341°58.3	58.7	336°50.6	02.2	81°31.3	47.9	137°02.1	20.1
15	131°35.6	356°58.7	·· 57.9	351°51.6	·· 01.8	96°33.3	·· 48.1	152°04.6	·· 20.1
16	146°38.1	11°59.1	57.2	6°52.6	01.3	111°35.2	48.2	167°07.1	20.1
17	161°40.6	26°59.6	56.4	21°53.6	00.8	126°37.2	48.4	182°09.5	20.1
18	176°43.0	42°00.0	N18°55.6	36°54.6	N17°00.4	141°39.2	N12°48.5	197°12.0	S10°20.1
19	191°45.5	57°00.4	54.9	51°55.5	16°59.9	156°41.2	48.7	212°14.5	20.1
20	206°48.0	72°00.9	54.1	66°56.5	59.4	171°43.2	48.9	227°16.9	20.1
21	221°50.4	87°01.3	·· 53.3	81°57.5	·· 58.9	186°45.2	·· 49.0	242°19.4	·· 20.1
22	236°52.9	102°01.7	52.5	96°58.5	58.5	201°47.2	49.2	257°21.9	20.2
23	251°55.3	117°02.2	51.8	111°59.5	58.0	216°49.2	49.3	272°24.3	20.2
Mer.pass. 06:15		ν 0.4′ d -0.8′ m -4.53		ν 1.0′ d -0.5′ m 1.68		ν 2.0′ d 0.2′ m -2.15		ν 2.5′ d -0.0′ m 0.78	

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	266°57.8	132°02.6	N18°51.0	127°00.5	N16°57.5	231°51.2	N12°49.5	287°26.8	S10°20.2
1	282°00.3	147°03.1	50.2	142°01.5	57.0	246°53.2	49.6	302°29.3	20.2
2	297°02.7	162°03.5	49.4	157°02.5	56.6	261°55.2	49.8	317°31.7	20.2
3	312°05.2	177°04.0	·· 48.7	172°03.5	·· 56.1	276°57.2	·· 49.9	332°34.2	·· 20.2
4	327°07.7	192°04.4	47.9	187°04.5	55.6	291°59.2	50.1	347°36.7	20.2
5	342°10.1	207°04.9	47.1	202°05.5	55.2	307°01.2	50.2	2°39.1	20.2
6	357°12.6	222°05.3	N18°46.3	217°06.5	N16°54.7	322°03.2	N12°50.4	17°41.6	S10°20.2
7	12°15.1	237°05.8	45.6	232°07.5	54.2	337°05.2	50.5	32°44.1	20.3
8	27°17.5	252°06.3	44.8	247°08.5	53.7	352°07.2	50.7	47°46.5	20.3
9	42°20.0	267°06.7	·· 44.0	262°09.5	·· 53.3	7°09.2	·· 50.8	62°49.0	·· 20.3
10	57°22.5	282°07.2	43.2	277°10.5	52.8	22°11.2	51.0	77°51.5	20.3
11	72°24.9	297°07.6	42.5	292°11.5	52.3	37°13.2	51.1	92°53.9	20.3
12	87°27.4	312°08.1	N18°41.7	307°12.4	N16°51.8	52°15.2	N12°51.3	107°56.4	S10°20.3
13	102°29.8	327°08.6	40.9	322°13.4	51.4	67°17.1	51.4	122°58.9	20.3
14	117°32.3	342°09.0	40.1	337°14.4	50.9	82°19.1	51.6	138°01.3	20.3
15	132°34.8	357°09.5	·· 39.4	352°15.4	·· 50.4	97°21.1	·· 51.7	153°03.8	·· 20.3
16	147°37.2	12°10.0	38.6	7°16.4	49.9	112°23.1	51.9	168°06.3	20.4
17	162°39.7	27°10.5	37.8	22°17.4	49.4	127°25.1	52.0	183°08.7	20.4
18	177°42.2	42°10.9	N18°37.0	37°18.4	N16°49.0	142°27.1	N12°52.2	198°11.2	S10°20.4
19	192°44.6	57°11.4	36.2	52°19.4	48.5	157°29.1	52.4	213°13.7	20.4
20	207°47.1	72°11.9	35.5	67°20.4	48.0	172°31.1	52.5	228°16.1	20.4
21	222°49.6	87°12.4	·· 34.7	82°21.4	·· 47.5	187°33.1	·· 52.7	243°18.6	·· 20.4
22	237°52.0	102°12.8	33.9	97°22.4	47.1	202°35.1	52.8	258°21.1	20.4
23	252°54.5	117°13.3	33.1	112°23.4	46.6	217°37.1	53.0	273°23.5	20.4
Mer.pass. 06:11		ν 0.4′ d -0.8′ m -4.54		ν 1.0′ d -0.5′ m 1.69		ν 2.0′ d 0.2′ m -2.16		ν 2.5′ d -0.0′ m 0.78	

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	267°57.0	132°13.8	N18°32.3	127°24.4	N16°46.1	232°39.1	N12°53.1	288°26.0	S10°20.5
1	282°59.4	147°14.3	31.6	142°25.4	45.6	247°41.1	53.3	303°28.5	20.5
2	298°01.9	162°14.8	30.8	157°26.4	45.2	262°43.1	53.4	318°31.0	20.5
3	313°04.3	177°15.3	·· 30.0	172°27.4	·· 44.7	277°45.1	·· 53.6	333°33.4	·· 20.5
4	328°06.8	192°15.8	29.2	187°28.4	44.2	292°47.1	53.7	348°35.9	20.5
5	343°09.3	207°16.3	28.4	202°29.4	43.7	307°49.1	53.9	3°38.4	20.5
6	358°11.7	222°16.8	N18°27.6	217°30.4	N16°43.2	322°51.1	N12°54.0	18°40.8	S10°20.5
7	13°14.2	237°17.3	26.9	232°31.4	42.8	337°53.1	54.2	33°43.3	20.5
8	28°16.7	252°17.8	26.1	247°32.3	42.3	352°55.1	54.3	48°45.8	20.6
9	43°19.1	267°18.3	·· 25.3	262°33.3	·· 41.8	7°57.1	·· 54.5	63°48.3	·· 20.6
10	58°21.6	282°18.8	24.5	277°34.3	41.3	22°59.1	54.6	78°50.7	20.6
11	73°24.1	297°19.3	23.7	292°35.3	40.8	38°01.1	54.8	93°53.2	20.6
12	88°26.5	312°19.8	N18°22.9	307°36.3	N16°40.4	53°03.1	N12°54.9	108°55.7	S10°20.6
13	103°29.0	327°20.3	22.2	322°37.3	39.9	68°05.1	55.1	123°58.1	20.6
14	118°31.4	342°20.8	21.4	337°38.3	39.4	83°07.1	55.2	139°00.6	20.6
15	133°33.9	357°21.3	·· 20.6	352°39.3	·· 38.9	98°09.1	·· 55.4	154°03.1	·· 20.6
16	148°36.4	12°21.8	19.8	7°40.3	38.4	113°11.1	55.5	169°05.6	20.7
17	163°38.8	27°22.3	19.0	22°41.3	38.0	128°13.1	55.7	184°08.0	20.7
18	178°41.3	42°22.8	N18°18.2	37°42.3	N16°37.5	143°15.1	N12°55.8	199°10.5	S10°20.7
19	193°43.8	57°23.4	17.4	52°43.3	37.0	158°17.1	56.0	214°13.0	20.7
20	208°46.2	72°23.9	16.7	67°44.3	36.5	173°19.1	56.1	229°15.4	20.7
21	223°48.7	87°24.4	·· 15.9	82°45.3	·· 36.0	188°21.1	·· 56.3	244°17.9	·· 20.7
22	238°51.2	102°24.9	15.1	97°46.3	35.6	203°23.1	56.4	259°20.4	20.7
23	253°53.6	117°25.5	14.3	112°47.3	35.1	218°25.1	56.6	274°22.9	20.7
Mer.pass. 06:07		ν 0.5′ d -0.8′ m -4.55		ν 1.0′ d -0.5′ m 1.69		ν 2.0′ d 0.2′ m -2.16		ν 2.5′ d -0.0′ m 0.78	

Stars

	SHA	**Dec**
Alpheratz	357°36.2	29°13.0
Ankaa	353°08.5	-42°10.5
Schedar	349°32.7	56°39.6
Diphda	348°48.7	-17°51.4
Achernar	335°21.4	-57°06.8
Hamal	327°52.9	23°34.2
Polaris	315°01.6	89°21.5
Acamar	315°13.1	-40°12.5
Menkar	314°07.8	4°10.8
Mirfak	308°30.5	49°56.5
Aldebaran	290°41.5	16°33.3
Rigel	281°05.5	-8°10.5
Capella	280°24.3	46°01.2
Bellatrix	278°24.6	6°22.2
Elnath	278°03.9	28°37.6
Alnilam	275°39.4	-1°11.2
Betelgeuse	270°53.8	7°24.7
Canopus	263°53.5	-52°42.5
Sirius	258°27.7	-16°44.9
Adhara	255°07.3	-29°00.2
Procyon	244°52.5	5°09.9
Pollux	243°19.2	27°58.3
Avior	234°15.8	-59°35.2
Suhail	222°47.6	-43°31.7
Miaplacidus	221°39.2	-69°49.0
Alphard	217°49.2	-8°45.6
Regulus	207°36.0	11°51.3
Dubhe	193°42.7	61°37.8
Denebola	182°26.3	14°26.6
Gienah	175°44.9	-17°40.4
Acrux	173°01.4	-63°14.0
Gacrux	171°53.0	-57°14.9
Alioth	166°14.0	55°50.3
Spica	158°23.5	-11°17.0
Alkaid	152°52.8	49°12.0
Hadar	148°37.5	-60°29.4
Menkent	147°58.9	-36°29.2
Arcturus	145°48.9	19°03.7
Rigil Kent.	139°41.6	-60°56.1
Kochab	137°18.9	74°03.8
Zuben'ubi	136°57.2	-16°08.4
Alphecca	126°04.5	26°38.2
Antares	112°17.1	-26°29.1
Atria	107°11.9	-69°04.2
Sabik	102°03.9	-15°45.2
Shaula	96°11.7	-37°07.2
Rasalhague	95°59.4	12°32.6
Eltanin	90°42.2	51°29.1
Kaus Aust.	83°33.8	-34°22.4
Vega	80°33.7	38°48.2
Nunki	75°49.0	-26°16.0
Altair	62°00.9	8°55.7
Peacock	53°07.3	-56°39.4
Deneb	49°26.3	45°21.6
Enif	33°39.9	9°58.8
Al Na'ir	27°34.3	-46°50.7
Fomalhaut	15°15.9	-29°29.8
Scheat	13°46.4	28°12.4
Markab	13°31.1	15°19.7

Jun 18 Sun	**SHA**	**Mer.pass**
Venus	225°53.8	15:12
Mars	220°38.0	15:33
Jupiter	325°04.7	08:35
Saturn	20°29.0	04:53

Jun 19 Mon	**SHA**	**Mer.pass**
Venus	225°04.8	15:11
Mars	220°02.7	15:31
Jupiter	324°53.4	08:31
Saturn	20°29.0	04:49

Jun 20 Tue	**SHA**	**Mer.pass**
Venus	224°16.9	15:11
Mars	219°27.4	15:29
Jupiter	324°42.2	08:28
Saturn	20°29.1	04:45

Horizontal parallax	
Venus:	0.3
Mars:	0.1

h Sun Moon

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	179°44.9	N23°23.6	182°20.8	8.6′	N27°18.0	3.0′	55.3′
1	194°44.8	23.6	196°48.4	8.6′	27°21.0	2.9′	55.2′
2	209°44.6	23.7	211°16.0	8.6′	27°23.9	2.7′	55.2′
3	224°44.5	·· 23.8	225°43.6	8.6′	27°26.6	2.6′	55.2′
4	239°44.3	23.8	240°11.2	8.6′	27°29.2	2.4′	55.2′
5	254°44.2	23.9	254°38.8	8.6′	27°31.6	2.3′	55.2′
6	269°44.1	N23°23.9	269°06.4	8.6′	N27°33.9	2.1′	55.2′
7	284°43.9	24.0	283°34.0	8.6′	27°36.0	2.0′	55.1′
8	299°43.8	24.1	298°01.6	8.6′	27°38.0	1.9′	55.1′
9	314°43.7	·· 24.1	312°29.2	8.6′	27°39.9	1.6′	55.1′
10	329°43.5	24.2	326°56.8	8.6′	27°41.5	1.6′	55.1′
11	344°43.4	24.2	341°24.4	8.6′	27°43.1	1.4′	55.1′
12	359°43.3	N23°24.3	355°52.0	8.6′	N27°44.5	1.2′	55.0′
13	14°43.1	24.3	10°19.6	8.6′	27°45.7	1.2′	55.0′
14	29°43.0	24.4	24°47.3	8.6′	27°46.9	0.9′	55.0′
15	44°42.8	·· 24.4	39°14.9	8.7′	27°47.8	0.8′	55.0′
16	59°42.7	24.5	53°42.6	8.7′	27°48.6	0.7′	55.0′
17	74°42.6	24.5	68°10.2	8.7′	27°49.3	0.5′	55.0′
18	89°42.4	N23°24.6	82°37.9	8.7′	N27°49.8	0.4′	54.9′
19	104°42.3	24.6	97°05.6	8.7′	27°50.2	0.2′	54.9′
20	119°42.2	24.7	111°33.4	8.7′	27°50.4	0.1′	54.9′
21	134°42.0	·· 24.7	126°01.1	8.8′	27°50.5	0.1′	54.9′
22	149°41.9	24.8	140°28.9	8.8′	27°50.4	0.2′	54.9′
23	164°41.7	24.8	154°56.6	8.8′	27°50.2	0.3′	54.9′
	SD = 15.7′	d = 0.1′		SD = 15.1′			

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	179°41.6	N23°24.9	169°24.4	8.8′	N27°49.9	0.5′	54.8′
1	194°41.5	24.9	183°52.3	8.9′	27°49.4	0.6′	54.8′
2	209°41.3	25.0	198°20.1	8.9′	27°48.8	0.8′	54.8′
3	224°41.2	·· 25.0	212°48.0	8.9′	27°48.0	0.9′	54.8′
4	239°41.1	25.1	227°16.0	9.0′	27°47.1	1.1′	54.8′
5	254°40.9	25.1	241°43.9	9.0′	27°46.0	1.2′	54.8′
6	269°40.8	N23°25.1	256°11.9	9.0′	N27°44.8	1.4′	54.8′
7	284°40.6	25.2	270°39.9	9.1′	27°43.4	1.5′	54.7′
8	299°40.5	25.2	285°08.0	9.1′	27°41.9	1.6′	54.7′
9	314°40.4	·· 25.3	299°36.0	9.1′	27°40.3	1.8′	54.7′
10	329°40.2	25.3	314°04.2	9.2′	27°38.5	1.9′	54.7′
11	344°40.1	25.3	328°32.3	9.2′	27°36.6	2.0′	54.7′
12	359°40.0	N23°25.4	343°00.6	9.3′	N27°34.6	2.2′	54.7′
13	14°39.8	25.4	357°28.8	9.3′	27°32.4	2.4′	54.6′
14	29°39.7	25.4	11°57.1	9.3′	27°30.0	2.4′	54.6′
15	44°39.5	·· 25.5	26°25.4	9.4′	27°27.6	2.6′	54.6′
16	59°39.4	25.5	40°53.8	9.4′	27°25.0	2.8′	54.6′
17	74°39.3	25.5	55°22.2	9.5′	27°22.2	2.9′	54.6′
18	89°39.1	N23°25.6	69°50.7	9.5′	N27°19.3	3.0′	54.6′
19	104°39.0	25.6	84°19.3	9.6′	27°16.3	3.1′	54.6′
20	119°38.9	25.6	98°47.8	9.6′	27°13.2	3.3′	54.5′
21	134°38.7	·· 25.7	113°16.5	9.7′	27°09.9	3.4′	54.5′
22	149°38.6	25.7	127°45.1	9.7′	27°06.5	3.6′	54.5′
23	164°38.4	25.7	142°13.9	9.8′	27°02.9	3.7′	54.5′
	SD = 15.7′	d = 0.0′		SD = 15.0′			

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	179°38.3	N23°25.8	156°42.7	9.8′	N26°59.2	3.8′	54.5′
1	194°38.2	25.8	171°11.5	9.9′	26°55.4	3.9′	54.5′
2	209°38.0	25.8	185°40.4	10.0′	26°51.5	4.1′	54.5′
3	224°37.9	·· 25.8	200°09.4	10.0′	26°47.4	4.2′	54.5′
4	239°37.8	25.9	214°38.4	10.1′	26°43.2	4.3′	54.4′
5	254°37.6	25.9	229°07.5	10.1′	26°38.9	4.5′	54.4′
6	269°37.5	N23°25.9	243°36.6	10.2′	N26°34.4	4.6′	54.4′
7	284°37.3	25.9	258°05.8	10.3′	26°29.8	4.7′	54.4′
8	299°37.2	26.0	272°35.0	10.3′	26°25.1	4.9′	54.4′
9	314°37.1	·· 26.0	287°04.4	10.4′	26°20.2	4.9′	54.4′
10	329°36.9	26.0	301°33.7	10.4′	26°15.3	5.1′	54.4′
11	344°36.8	26.0	316°03.2	10.5′	26°10.2	5.2′	54.4′
12	359°36.7	N23°26.0	330°32.7	10.6′	N26°05.0	5.4′	54.3′
13	14°36.5	26.1	345°02.3	10.6′	25°59.6	5.4′	54.3′
14	29°36.4	26.1	359°31.9	10.7′	25°54.2	5.6′	54.3′
15	44°36.3	·· 26.1	14°01.6	10.8′	25°48.6	5.7′	54.3′
16	59°36.1	26.1	28°31.4	10.8′	25°42.9	5.8′	54.3′
17	74°36.0	26.1	43°01.3	10.9′	25°37.1	5.9′	54.3′
18	89°35.8	N23°26.1	57°31.2	11.0′	N25°31.2	6.1′	54.3′
19	104°35.7	26.2	72°01.1	11.1′	25°25.1	6.1′	54.3′
20	119°35.6	26.2	86°31.2	11.1′	25°19.0	6.3′	54.3′
21	134°35.4	·· 26.2	101°01.3	11.2′	25°12.7	6.4′	54.3′
22	149°35.3	26.2	115°31.5	11.3′	25°06.3	6.5′	54.2′
23	164°35.2	26.2	130°01.8	11.3′	24°59.8	6.7′	54.2′
	SD = 15.7′	d = 0.0′		SD = 14.9′			

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°	–:–	00:50	02:36	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	02:33	03:27	20:36	21:30	23:18
52°	01:32	02:51	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°	03:40	04:16	04:46	19:17	19:46	20:23
30°	03:58	04:32	04:59	19:04	19:31	20:05
20°	04:27	04:57	05:21	18:42	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	18:28	18:54
S 10°	05:26	05:52	06:15	17:48	18:10	18:37
20°	05:42	06:10	06:34	17:29	17:53	18:21
30°	05:59	06:29	06:55	17:08	17:34	18:04
35°	06:07	06:39	07:07	16:55	17:24	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	07:21	07:59	16:04	16:42	17:24
52°	06:44	07:28	08:09	15:54	16:35	17:18
54°	06:50	07:36	08:20	15:43	16:26	17:13
56°	06:56	07:45	08:33	15:30	16:17	17:06
58°	07:03	07:56	08:48	15:15	16:07	17:00
S 60°	07:10	08:07	09:05	14:58	15:55	16:52

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

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 0-2 0-3%
18	01:00	01:07	12:01	12:17	–:–	
19	01:14	01:20	12:01	13:10	00:44	
20	01:27	01:33	12:02	14:02	01:36	

June 21, 22, 23 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	268°56.1	132°26.0	N18°13.5	127°48.3	N16°34.6	233°27.1	N12°56.7	289°25.3	S10°20.8
1	283°58.6	147°26.5	12.7	142°49.3	34.1	248°29.1	56.9	304°27.8	20.8
2	299°01.0	162°27.0	11.9	157°50.3	33.6	263°31.1	57.0	319°30.3	20.8
3	314°03.5	177°27.6	·· 11.1	172°51.3	·· 33.1	278°33.1	·· 57.2	334°32.8	·· 20.8
4	329°05.9	192°28.1	10.4	187°52.3	32.7	293°35.1	57.3	349°35.2	20.8
5	344°08.4	207°28.6	09.6	202°53.3	32.2	308°37.1	57.5	4°37.7	20.8
6	359°10.9	222°29.2	N18°08.8	217°54.3	N16°31.7	323°39.1	N12°57.6	19°40.2	S10°20.8
7	14°13.3	237°29.7	08.0	232°55.3	31.2	338°41.1	57.8	34°42.7	20.9
8	29°15.8	252°30.3	07.2	247°56.3	30.7	353°43.1	57.9	49°45.1	20.9
9	44°18.3	267°30.8	·· 06.4	262°57.2	·· 30.2	8°45.1	·· 58.1	64°47.6	·· 20.9
10	59°20.7	282°31.4	05.6	277°58.2	29.8	23°47.1	58.2	79°50.1	20.9
11	74°23.2	297°31.9	04.8	292°59.2	29.3	38°49.1	58.4	94°52.6	20.9
12	89°25.7	312°32.5	N18°04.0	308°00.2	N16°28.8	53°51.2	N12°58.5	109°55.0	S10°20.9
13	104°28.1	327°33.0	03.2	323°01.2	28.3	68°53.2	58.6	124°57.5	20.9
14	119°30.6	342°33.6	02.5	338°02.2	27.8	83°55.2	58.8	140°00.0	21.0
15	134°33.1	357°34.1	·· 01.7	353°03.2	·· 27.3	98°57.2	·· 58.9	155°02.5	·· 21.0
16	149°35.5	12°34.7	00.9	8°04.2	26.9	113°59.2	59.1	170°04.9	21.0
17	164°38.0	27°35.2	18°00.1	23°05.2	26.4	129°01.2	59.2	185°07.4	21.0
18	179°40.4	42°35.8	N17°59.3	38°06.2	N16°25.9	144°03.2	N12°59.4	200°09.9	S10°21.0
19	194°42.9	57°36.3	58.5	53°07.2	25.4	159°05.2	59.5	215°12.4	21.0
20	209°45.4	72°36.9	57.7	68°08.2	24.9	174°07.2	59.7	230°14.8	21.0
21	224°47.8	87°37.5	·· 56.9	83°09.2	·· 24.4	189°09.2	12°59.8	245°17.3	·· 21.1
22	239°50.3	102°38.0	56.1	98°10.2	23.9	204°11.2	13°00.0	260°19.8	21.1
23	254°52.8	117°38.6	55.3	113°11.2	23.5	219°13.2	00.1	275°22.3	21.1
Mer.pass. 06:03		ν 0.5′ d -0.8′ m -4.56		ν 1.0′ d -0.5′ m 1.70		ν 2.0′ d 0.1′ m -2.16		ν 2.5′ d -0.0′ m 0.77	

Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	269°55.2	132°39.2	N17°54.5	128°12.2	N16°23.0	234°15.2	N13°00.3	290°24.7	S10°21.1
1	284°57.7	147°39.7	53.7	143°13.2	22.5	249°17.2	00.4	305°27.2	21.1
2	300°00.2	162°40.3	52.9	158°14.2	22.0	264°19.2	00.6	320°29.7	21.1
3	315°02.6	177°40.9	·· 52.1	173°15.2	·· 21.5	279°21.2	·· 00.7	335°32.2	·· 21.2
4	330°05.1	192°41.5	51.4	188°16.2	21.0	294°23.2	00.9	350°34.7	21.2
5	345°07.6	207°42.1	50.6	203°17.2	20.5	309°25.2	01.0	5°37.1	21.2
6	0°10.0	222°42.6	N17°49.8	218°18.2	N16°20.0	324°27.2	N13°01.2	20°39.6	S10°21.2
7	15°12.5	237°43.2	49.0	233°19.2	19.6	339°29.2	01.3	35°42.1	21.2
8	30°14.9	252°43.8	48.2	248°20.2	19.1	354°31.3	01.5	50°44.6	21.2
9	45°17.4	267°44.4	·· 47.4	263°21.2	·· 18.6	9°33.3	·· 01.6	65°47.0	·· 21.2
10	60°19.9	282°45.0	46.6	278°22.2	18.1	24°35.3	01.8	80°49.5	21.3
11	75°22.3	297°45.6	45.8	293°23.2	17.6	39°37.3	01.9	95°52.0	21.3
12	90°24.8	312°46.2	N17°45.0	308°24.2	N16°17.1	54°39.3	N13°02.0	110°54.5	S10°21.3
13	105°27.3	327°46.8	44.2	323°25.2	16.6	69°41.3	02.2	125°57.0	21.3
14	120°29.7	342°47.3	43.4	338°26.2	16.1	84°43.3	02.3	140°59.4	21.3
15	135°32.2	357°47.9	·· 42.6	353°27.2	·· 15.7	99°45.3	·· 02.5	156°01.9	·· 21.3
16	150°34.7	12°48.5	41.8	8°28.2	15.2	114°47.3	02.6	171°04.4	21.4
17	165°37.1	27°49.1	41.0	23°29.2	14.7	129°49.3	02.8	186°06.9	21.4
18	180°39.6	42°49.8	N17°40.2	38°30.2	N16°14.2	144°51.3	N13°02.9	201°09.4	S10°21.4
19	195°42.1	57°50.4	39.4	53°31.2	13.7	159°53.3	03.1	216°11.8	21.4
20	210°44.5	72°51.0	38.6	68°32.2	13.2	174°55.3	03.2	231°14.3	21.4
21	225°47.0	87°51.6	·· 37.8	83°33.2	·· 12.7	189°57.3	·· 03.4	246°16.8	·· 21.4
22	240°49.4	102°52.2	37.0	98°34.2	12.2	204°59.4	03.5	261°19.3	21.5
23	255°51.9	117°52.8	36.2	113°35.2	11.7	220°01.4	03.7	276°21.8	21.5
Mer.pass. 05:59		ν 0.6′ d -0.8′ m -4.57		ν 1.0′ d -0.5′ m 1.70		ν 2.0′ d 0.1′ m -2.17		ν 2.5′ d -0.0′ m 0.77	

Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	270°54.4	132°53.4	N17°35.4	128°36.1	N16°11.2	235°03.4	N13°03.8	291°24.2	S10°21.5
1	285°56.8	147°54.0	34.6	143°37.1	10.8	250°05.4	03.9	306°26.7	21.5
2	300°59.3	162°54.6	33.8	158°38.1	10.3	265°07.4	04.1	321°29.2	21.5
3	316°01.8	177°55.3	·· 33.0	173°39.1	·· 09.8	280°09.4	·· 04.2	336°31.7	·· 21.5
4	331°04.2	192°55.9	32.2	188°40.1	09.3	295°11.4	04.4	351°34.2	21.6
5	346°06.7	207°56.5	31.4	203°41.1	08.8	310°13.4	04.5	6°36.7	21.6
6	1°09.2	222°57.1	N17°30.6	218°42.1	N16°08.3	325°15.4	N13°04.7	21°39.1	S10°21.6
7	16°11.6	237°57.8	29.8	233°43.1	07.8	340°17.4	04.8	36°41.6	21.6
8	31°14.1	252°58.4	29.0	248°44.1	07.3	355°19.4	05.0	51°44.1	21.6
9	46°16.5	267°59.0	·· 28.2	263°45.1	·· 06.8	10°21.5	·· 05.1	66°46.6	·· 21.6
10	61°19.0	282°59.7	27.4	278°46.1	06.3	25°23.5	05.3	81°49.1	21.7
11	76°21.5	298°00.3	26.6	293°47.1	05.8	40°25.5	05.4	96°51.5	21.7
12	91°23.9	313°00.9	N17°25.8	308°48.1	N16°05.3	55°27.5	N13°05.6	111°54.0	S10°21.7
13	106°26.4	328°01.6	25.0	323°49.1	04.9	70°29.5	05.7	126°56.5	21.7
14	121°28.9	343°02.2	24.2	338°50.1	04.4	85°31.5	05.8	141°59.0	21.7
15	136°31.3	358°02.8	·· 23.4	353°51.1	·· 03.9	100°33.5	·· 06.0	157°01.5	·· 21.8
16	151°33.8	13°03.5	22.6	8°52.1	03.4	115°35.5	06.1	172°04.0	21.8
17	166°36.3	28°04.1	21.8	23°53.1	02.9	130°37.5	06.3	187°06.4	21.8
18	181°38.7	43°04.8	N17°21.0	38°54.1	N16°02.4	145°39.6	N13°06.4	202°08.9	S10°21.8
19	196°41.2	58°05.4	20.2	53°55.1	01.9	160°41.6	06.6	217°11.4	21.8
20	211°43.7	73°06.1	19.4	68°56.1	01.4	175°43.6	06.7	232°13.9	21.8
21	226°46.1	88°06.7	·· 18.6	83°57.1	·· 00.9	190°45.6	·· 06.9	247°16.4	·· 21.9
22	241°48.6	103°07.4	17.8	98°58.1	16°00.4	205°47.6	07.0	262°18.9	21.9
23	256°51.0	118°08.1	17.0	113°59.1	15°59.9	220°49.6	07.1	277°21.4	21.9
Mer.pass. 05:55		ν 0.6′ d -0.8′ m -4.58		ν 1.0′ d -0.5′ m 1.71		ν 2.0′ d 0.1′ m -2.17		ν 2.5′ d -0.0′ m 0.76	

Stars

	SHA	**Dec**
Alpheratz	357°36.1	29°13.0
Ankaa	353°08.5	-42°10.5
Schedar	349°32.6	56°39.6
Diphda	348°48.7	-17°51.4
Achernar	335°21.4	-57°06.8
Hamal	327°52.8	23°34.2
Polaris	315°00.4	89°21.5
Acamar	315°13.1	-40°12.5
Menkar	314°07.7	4°10.9
Mirfak	308°30.5	49°56.5
Aldebaran	290°41.4	16°33.3
Rigel	281°05.4	-8°10.5
Capella	280°24.3	46°01.2
Bellatrix	278°24.6	6°22.2
Elnath	278°03.9	28°37.6
Alnilam	275°39.4	-1°11.2
Betelgeuse	270°53.8	7°24.7
Canopus	263°53.5	-52°42.5
Sirius	258°27.7	-16°44.9
Adhara	255°07.3	-29°00.2
Procyon	244°52.5	5°09.9
Pollux	243°19.2	27°58.3
Avior	234°15.8	-59°35.2
Suhail	222°47.6	-43°31.7
Miaplacidus	221°39.2	-69°49.0
Alphard	217°49.2	-8°45.6
Regulus	207°36.0	11°51.3
Dubhe	193°42.8	61°37.8
Denebola	182°26.3	14°26.6
Gienah	175°44.9	-17°40.4
Acrux	173°01.5	-63°14.0
Gacrux	171°53.0	-57°14.9
Alioth	166°14.0	55°50.3
Spica	158°23.5	-11°17.0
Alkaid	152°52.8	49°12.0
Hadar	148°37.5	-60°29.4
Menkent	147°58.9	-36°29.2
Arcturus	145°48.9	19°03.7
Rigil Kent.	139°41.7	-60°56.1
Kochab	137°18.9	74°03.8
Zuben'ubi	136°57.2	-16°08.4
Alphecca	126°04.5	26°38.2
Antares	112°17.1	-26°29.1
Atria	107°11.9	-69°04.2
Sabik	102°03.9	-15°45.2
Shaula	96°11.7	-37°07.3
Rasalhague	95°59.4	12°32.6
Eltanin	90°42.2	51°29.1
Kaus Aust.	83°33.8	-34°22.4
Vega	80°33.7	38°48.2
Nunki	75°49.0	-26°16.0
Altair	62°00.9	8°55.8
Peacock	53°07.3	-56°39.4
Deneb	49°26.3	45°21.6
Enif	33°39.9	9°58.9
Al Na'ir	27°34.3	-46°50.7
Fomalhaut	15°15.8	-29°29.8
Scheat	13°46.4	28°12.4
Markab	13°31.1	15°19.7

Jun 21 Wed	**SHA**	**Mer.pass**
Venus	223°29.9	15:10
Mars	218°52.2	15:28
Jupiter	324°31.0	08:25
Saturn	20°29.2	04:42

Jun 22 Thu	**SHA**	**Mer.pass**
Venus	222°43.9	15:09
Mars	218°17.0	15:26
Jupiter	324°20.0	08:22
Saturn	20°29.5	04:38

Jun 23 Fri	**SHA**	**Mer.pass**
Venus	221°59.0	15:08
Mars	217°41.8	15:25
Jupiter	324°09.0	08:19
Saturn	20°29.9	04:34

Horizontal parallax	
Venus:	0.3
Mars:	0.1

h	Sun		Moon				
Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°35.0	N23°26.2	144°32.1	11.4′	N24°53.1	6.7′	54.2′
1	194°34.9	26.2	159°02.5	11.5′	24°46.4	6.8′	54.2′
2	209°34.7	26.2	173°33.0	11.5′	24°39.6	7.0′	54.2′
3	224°34.6	·· 26.3	188°03.5	11.6′	24°32.6	7.1′	54.2′
4	239°34.5	26.3	202°34.1	11.7′	24°25.5	7.1′	54.2′
5	254°34.3	26.3	217°04.8	11.8′	24°18.4	7.3′	54.2′
6	269°34.2	N23°26.3	231°35.6	11.8′	N24°11.1	7.4′	54.2′
7	284°34.1	26.3	246°06.4	11.9′	24°03.7	7.5′	54.2′
8	299°33.9	26.3	260°37.3	12.0′	23°56.2	7.6′	54.2′
9	314°33.8	·· 26.3	275°08.3	12.1′	23°48.6	7.7′	54.1′
10	329°33.6	26.3	289°39.4	12.1′	23°40.9	7.8′	54.1′
11	344°33.5	26.3	304°10.5	12.2′	23°33.1	7.9′	54.1′
12	359°33.4	N23°26.3	318°41.7	12.3′	N23°25.2	8.0′	54.1′
13	14°33.2	26.3	333°13.0	12.3′	23°17.2	8.1′	54.1′
14	29°33.1	26.3	347°44.3	12.4′	23°09.1	8.2′	54.1′
15	44°33.0	·· 26.3	2°15.7	12.5′	23°00.9	8.4′	54.1′
16	59°32.8	26.3	16°47.2	12.6′	22°52.5	8.4′	54.1′
17	74°32.7	26.3	31°18.8	12.6′	22°44.1	8.5′	54.1′
18	89°32.5	N23°26.3	45°50.4	12.7′	N22°35.6	8.6′	54.1′
19	104°32.4	26.3	60°22.1	12.8′	22°27.0	8.6′	54.1′
20	119°32.3	26.3	74°53.9	12.9′	22°18.4	8.8′	54.1′
21	134°32.1	·· 26.3	89°25.8	12.9′	22°09.6	8.9′	54.1′
22	149°32.0	26.3	103°57.7	13.0′	22°00.7	9.0′	54.1′
23	164°31.9	26.3	118°29.7	13.1′	21°51.7	9.0′	54.1′
	SD = 15.7′	d = 0.0′	SD = 14.8′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°31.7	N23°26.3	133°01.8	13.1′	N21°42.7	9.2′	54.1′
1	194°31.6	26.3	147°33.9	13.2′	21°33.5	9.2′	54.1′
2	209°31.5	26.3	162°06.2	13.3′	21°24.3	9.4′	54.1′
3	224°31.3	·· 26.3	176°38.4	13.4′	21°14.9	9.4′	54.0′
4	239°31.2	26.2	191°10.8	13.4′	21°05.5	9.5′	54.0′
5	254°31.0	26.2	205°43.2	13.5′	20°56.0	9.6′	54.0′
6	269°30.9	N23°26.2	220°15.7	13.6′	N20°46.4	9.6′	54.0′
7	284°30.8	26.2	234°48.3	13.6′	20°36.8	9.8′	54.0′
8	299°30.6	26.2	249°20.9	13.7′	20°27.0	9.8′	54.0′
9	314°30.5	·· 26.2	263°53.6	13.8′	20°17.2	9.9′	54.0′
10	329°30.4	26.2	278°26.4	13.8′	20°07.3	10.1′	54.0′
11	344°30.2	26.2	292°59.2	13.9′	19°57.2	10.0′	54.0′
12	359°30.1	N23°26.1	307°32.1	14.0′	N19°47.2	10.2′	54.0′
13	14°30.0	26.1	322°05.1	14.0′	19°37.0	10.2′	54.0′
14	29°29.8	26.1	336°38.2	14.1′	19°26.8	10.4′	54.0′
15	44°29.7	·· 26.1	351°11.3	14.2′	19°16.4	10.4′	54.0′
16	59°29.5	26.1	5°44.4	14.2′	19°06.0	10.4′	54.0′
17	74°29.4	26.1	20°17.7	14.3′	18°55.6	10.6′	54.0′
18	89°29.3	N23°26.0	34°51.0	14.4′	N18°45.0	10.6′	54.0′
19	104°29.1	26.0	49°24.3	14.4′	18°34.4	10.7′	54.0′
20	119°29.0	26.0	63°57.8	14.5′	18°23.7	10.8′	54.0′
21	134°28.9	·· 26.0	78°31.3	14.6′	18°12.9	10.8′	54.0′
22	149°28.7	26.0	93°04.8	14.6′	18°02.1	10.9′	54.0′
23	164°28.6	25.9	107°38.4	14.7′	17°51.2	11.0′	54.0′
	SD = 15.7′	d = -0.0′	SD = 14.7′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°28.5	N23°25.9	122°12.1	14.7′	N17°40.2	11.0′	54.0′
1	194°28.3	25.9	136°45.8	14.8′	17°29.2	11.2′	54.0′
2	209°28.2	25.9	151°19.6	14.9′	17°18.0	11.2′	54.0′
3	224°28.0	·· 25.8	165°53.5	14.9′	17°06.8	11.2′	54.0′
4	239°27.9	25.8	180°27.4	15.0′	16°55.6	11.3′	54.0′
5	254°27.8	25.8	195°01.3	15.0′	16°44.3	11.4′	54.0′
6	269°27.6	N23°25.8	209°35.4	15.1′	N16°32.9	11.5′	54.0′
7	284°27.5	25.7	224°09.4	15.1′	16°21.4	11.5′	54.0′
8	299°27.4	25.7	238°43.6	15.2′	16°09.9	11.6′	54.0′
9	314°27.2	·· 25.7	253°17.8	15.2′	15°58.3	11.6′	54.0′
10	329°27.1	25.6	267°52.0	15.3′	15°46.7	11.7′	54.0′
11	344°27.0	25.6	282°26.3	15.3′	15°35.0	11.8′	54.1′
12	359°26.8	N23°25.6	297°00.6	15.4′	N15°23.2	11.8′	54.1′
13	14°26.7	25.5	311°35.0	15.4′	15°11.4	11.9′	54.1′
14	29°26.6	25.5	326°09.5	15.5′	14°59.5	11.9′	54.1′
15	44°26.4	·· 25.5	340°44.0	15.5′	14°47.6	12.0′	54.1′
16	59°26.3	25.4	355°18.5	15.6′	14°35.6	12.1′	54.1′
17	74°26.1	25.4	9°53.1	15.6′	14°23.5	12.1′	54.1′
18	89°26.0	N23°25.4	24°27.7	15.7′	N14°11.4	12.1′	54.1′
19	104°25.9	25.3	39°02.4	15.7′	13°59.3	12.3′	54.1′
20	119°25.7	25.3	53°37.1	15.8′	13°47.0	12.2′	54.1′
21	134°25.6	·· 25.3	68°11.9	15.8′	13°34.8	12.4′	54.1′
22	149°25.5	25.2	82°46.7	15.9′	13°22.4	12.4′	54.1′
23	164°25.3	25.2	97°21.5	15.9′	13°10.0	12.4′	54.1′
	SD = 15.7′	d = -0.0′	SD = 14.7′				

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

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

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 3-5 8-20%
21	01:40	01:47	12:02	14:51	02:27	
22	01:53	02:00	12:02	15:36	03:14	
23	02:06	02:13	12:02	16:19	03:58	

June 24, 25, 26 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	271°53.5	133°08.7	N17°16.2	129°00.1	N15°59.4	235°51.6	N13°07.3	292°23.8	S10°21.9
1	286°56.0	148°09.4	15.4	144°01.1	58.9	250°53.6	07.4	307°26.3	21.9
2	301°58.4	163°10.0	14.6	159°02.1	58.4	265°55.6	07.6	322°28.8	22.0
3	317°00.9	178°10.7	·· 13.7	174°03.1	·· 57.9	280°57.7	·· 07.7	337°31.3	·· 22.0
4	332°03.4	193°11.4	12.9	189°04.1	57.4	295°59.7	07.9	352°33.8	22.0
5	347°05.8	208°12.0	12.1	204°05.1	56.9	311°01.7	08.0	7°36.3	22.0
6	2°08.3	223°12.7	N17°11.3	219°06.1	N15°56.4	326°03.7	N13°08.2	22°38.8	S10°22.0
7	17°10.8	238°13.4	10.5	234°07.1	55.9	341°05.7	08.3	37°41.2	22.0
8	32°13.2	253°14.1	09.7	249°08.1	55.5	356°07.7	08.4	52°43.7	22.1
9	47°15.7	268°14.7	·· 08.9	264°09.1	·· 55.0	11°09.7	·· 08.6	67°46.2	·· 22.1
10	62°18.2	283°15.4	08.1	279°10.1	54.5	26°11.8	08.7	82°48.7	22.1
11	77°20.6	298°16.1	07.3	294°11.1	54.0	41°13.8	08.9	97°51.2	22.1
12	92°23.1	313°16.8	N17°06.5	309°12.1	N15°53.5	56°15.8	N13°09.0	112°53.7	S10°22.1
13	107°25.5	328°17.5	05.7	324°13.1	53.0	71°17.8	09.2	127°56.2	22.2
14	122°28.0	343°18.2	04.9	339°14.1	52.5	86°19.8	09.3	142°58.6	22.2
15	137°30.5	358°18.8	·· 04.1	354°15.1	·· 52.0	101°21.8	·· 09.4	158°01.1	·· 22.2
16	152°32.9	13°19.5	03.3	9°16.1	51.5	116°23.8	09.6	173°03.6	22.2
17	167°35.4	28°20.2	02.5	24°17.1	51.0	131°25.9	09.7	188°06.1	22.2
18	182°37.9	43°20.9	N17°01.7	39°18.1	N15°50.5	146°27.9	N13°09.9	203°08.6	S10°22.3
19	197°40.3	58°21.6	00.9	54°19.1	50.0	161°29.9	10.0	218°11.1	22.3
20	212°42.8	73°22.3	17°00.0	69°20.1	49.5	176°31.9	10.2	233°13.6	22.3
21	227°45.3	88°23.0	16°59.2	84°21.1	·· 49.0	191°33.9	·· 10.3	248°16.1	·· 22.3
22	242°47.7	103°23.7	58.4	99°22.1	48.5	206°35.9	10.4	263°18.5	22.3
23	257°50.2	118°24.4	57.6	114°23.1	48.0	221°37.9	10.6	278°21.0	22.4
Mer.pass. 05:51		ν 0.7′	d -0.8′	m -4.59	ν 1.0′	d -0.5′	m 1.71	ν 2.0′	d 0.1′ m -2.17	ν 2.5′ d -0.0′ m 0.76

Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	272°52.6	133°25.1	N16°56.8	129°24.1	N15°47.5	236°40.0	N13°10.7	293°23.5	S10°22.4
1	287°55.1	148°25.8	56.0	144°25.1	47.0	251°42.0	10.9	308°26.0	22.4
2	302°57.6	163°26.5	55.2	159°26.1	46.5	266°44.0	11.0	323°28.5	22.4
3	318°00.0	178°27.3	·· 54.4	174°27.1	·· 46.0	281°46.0	·· 11.2	338°31.0	·· 22.4
4	333°02.5	193°28.0	53.6	189°28.1	45.5	296°48.0	11.3	353°33.5	22.4
5	348°05.0	208°28.7	52.8	204°29.1	45.0	311°50.0	11.4	8°36.0	22.5
6	3°07.4	223°29.4	N16°52.0	219°30.1	N15°44.5	326°52.1	N13°11.6	23°38.5	S10°22.5
7	18°09.9	238°30.1	51.2	234°31.1	44.0	341°54.1	11.7	38°41.0	22.5
8	33°12.4	253°30.8	50.3	249°32.1	43.5	356°56.1	11.9	53°43.4	22.5
9	48°14.8	268°31.6	·· 49.5	264°33.1	·· 43.0	11°58.1	·· 12.0	68°45.9	·· 22.6
10	63°17.3	283°32.3	48.7	279°34.1	42.5	27°00.1	12.2	83°48.4	22.6
11	78°19.8	298°33.0	47.9	294°35.1	42.0	42°02.1	12.3	98°50.9	22.6
12	93°22.2	313°33.7	N16°47.1	309°36.1	N15°41.5	57°04.2	N13°12.4	113°53.4	S10°22.6
13	108°24.7	328°34.5	46.3	324°37.1	41.0	72°06.2	12.6	128°55.9	22.6
14	123°27.1	343°35.2	45.5	339°38.1	40.5	87°08.2	12.7	143°58.4	22.7
15	138°29.6	358°35.9	·· 44.7	354°39.1	·· 40.0	102°10.2	·· 12.9	159°00.9	·· 22.7
16	153°32.1	13°36.7	43.9	9°40.1	39.5	117°12.2	13.0	174°03.4	22.7
17	168°34.5	28°37.4	43.1	24°41.1	39.0	132°14.3	13.1	189°05.9	22.7
18	183°37.0	43°38.2	N16°42.2	39°42.1	N15°38.5	147°16.3	N13°13.3	204°08.4	S10°22.7
19	198°39.5	58°38.9	41.4	54°43.1	38.0	162°18.3	13.4	219°10.8	22.8
20	213°41.9	73°39.7	40.6	69°44.1	37.5	177°20.3	13.6	234°13.3	22.8
21	228°44.4	88°40.4	·· 39.8	84°45.1	·· 37.0	192°22.3	·· 13.7	249°15.8	·· 22.8
22	243°46.9	103°41.2	39.0	99°46.1	36.5	207°24.4	13.9	264°18.3	22.8
23	258°49.3	118°41.9	38.2	114°47.1	36.0	222°26.4	14.0	279°20.8	22.8
Mer.pass. 05:48		ν 0.7′	d -0.8′	m -4.60	ν 1.0′	d -0.5′	m 1.71	ν 2.0′	d 0.1′ m -2.18	ν 2.5′ d -0.0′ m 0.75

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	273°51.8	133°42.7	N16°37.4	129°48.1	N15°35.5	237°28.4	N13°14.1	294°23.3	S10°22.9
1	288°54.2	148°43.4	36.6	144°49.1	35.0	252°30.4	14.3	309°25.8	22.9
2	303°56.7	163°44.2	35.8	159°50.2	34.5	267°32.4	14.4	324°28.3	22.9
3	318°59.2	178°44.9	·· 34.9	174°51.2	·· 34.0	282°34.5	·· 14.6	339°30.8	·· 22.9
4	334°01.6	193°45.7	34.1	189°52.2	33.5	297°36.5	14.7	354°33.3	22.9
5	349°04.1	208°46.5	33.3	204°53.2	32.9	312°38.5	14.8	9°35.8	23.0
6	4°06.6	223°47.2	N16°32.5	219°54.2	N15°32.4	327°40.5	N13°15.0	24°38.3	S10°23.0
7	19°09.0	238°48.0	31.7	234°55.2	31.9	342°42.5	15.1	39°40.8	23.0
8	34°11.5	253°48.8	30.9	249°56.2	31.4	357°44.6	15.3	54°43.3	23.0
9	49°14.0	268°49.5	·· 30.1	264°57.2	·· 30.9	12°46.6	·· 15.4	69°45.7	·· 23.1
10	64°16.4	283°50.3	29.3	279°58.2	30.4	27°48.6	15.5	84°48.2	23.1
11	79°18.9	298°51.1	28.5	294°59.2	29.9	42°50.6	15.7	99°50.7	23.1
12	94°21.4	313°51.9	N16°27.6	310°00.2	N15°29.4	57°52.6	N13°15.8	114°53.2	S10°23.1
13	109°23.8	328°52.6	26.8	325°01.2	28.9	72°54.7	16.0	129°55.7	23.1
14	124°26.3	343°53.4	26.0	340°02.2	28.4	87°56.7	16.1	144°58.2	23.2
15	139°28.7	358°54.2	·· 25.2	355°03.2	·· 27.9	102°58.7	·· 16.2	160°00.7	·· 23.2
16	154°31.2	13°55.0	24.4	10°04.2	27.4	118°00.7	16.4	175°03.2	23.2
17	169°33.7	28°55.8	23.6	25°05.2	26.9	133°02.7	16.5	190°05.7	23.2
18	184°36.1	43°56.6	N16°22.8	40°06.2	N15°26.4	148°04.8	N13°16.7	205°08.2	S10°23.3
19	199°38.6	58°57.4	21.9	55°07.2	25.9	163°06.8	16.8	220°10.7	23.3
20	214°41.1	73°58.2	21.1	70°08.2	25.4	178°08.8	16.9	235°13.2	23.3
21	229°43.5	88°59.0	·· 20.3	85°09.2	·· 24.9	193°10.8	·· 17.1	250°15.7	·· 23.3
22	244°46.0	103°59.8	19.5	100°10.2	24.4	208°12.9	17.2	265°18.2	23.3
23	259°48.5	119°00.6	18.7	115°11.2	23.9	223°14.9	17.4	280°20.7	23.4
Mer.pass. 05:44		ν 0.8′	d -0.8′	m -4.61	ν 1.0′	d -0.5′	m 1.72	ν 2.0′	d 0.1′ m -2.18	ν 2.5′ d -0.0′ m 0.75

Stars

	SHA	**Dec**
Alpheratz	357°36.1	29°13.0
Ankaa	353°08.4	-42°10.5
Schedar	349°32.6	56°39.6
Diphda	348°48.6	-17°51.4
Achernar	335°21.4	-57°06.8
Hamal	327°52.8	23°34.2
Polaris	314°59.3	89°21.5
Acamar	315°13.0	-40°12.5
Menkar	314°07.7	4°10.9
Mirfak	308°30.5	49°56.5
Aldebaran	290°41.4	16°33.3
Rigel	281°05.4	-8°10.4
Capella	280°24.3	46°01.2
Bellatrix	278°24.6	6°22.3
Elnath	278°03.9	28°37.6
Alnilam	275°39.4	-1°11.2
Betelgeuse	270°53.8	7°24.7
Canopus	263°53.5	-52°42.4
Sirius	258°27.7	-16°44.9
Adhara	255°07.3	-29°00.2
Procyon	244°52.5	5°09.9
Pollux	243°19.2	27°58.3
Avior	234°15.8	-59°35.2
Suhail	222°47.6	-43°31.7
Miaplacidus	221°39.2	-69°48.9
Alphard	217°49.2	-8°45.6
Regulus	207°36.0	11°51.3
Dubhe	193°42.8	61°37.8
Denebola	182°26.3	14°26.6
Gienah	175°44.9	-17°40.4
Acrux	173°01.5	-63°14.0
Gacrux	171°53.0	-57°14.9
Alioth	166°14.0	55°50.3
Spica	158°23.5	-11°17.0
Alkaid	152°52.8	49°12.0
Hadar	148°37.5	-60°29.4
Menkent	147°58.9	-36°29.2
Arcturus	145°48.9	19°03.7
Rigil Kent.	139°41.7	-60°56.1
Kochab	137°19.0	74°03.8
Zuben'ubi	136°57.2	-16°08.4
Alphecca	126°04.5	26°38.2
Antares	112°17.1	-26°29.1
Atria	107°11.9	-69°04.2
Sabik	102°03.9	-15°45.2
Shaula	96°11.7	-37°07.3
Rasalhague	95°59.4	12°32.6
Eltanin	90°42.2	51°29.1
Kaus Aust.	83°33.8	-34°22.4
Vega	80°33.7	38°48.3
Nunki	75°49.0	-26°16.0
Altair	62°00.9	8°55.8
Peacock	53°07.2	-56°39.4
Deneb	49°26.3	45°21.6
Enif	33°39.9	9°58.9
Al Na'ir	27°34.3	-46°50.7
Fomalhaut	15°15.8	-29°29.8
Scheat	13°46.3	28°12.4
Markab	13°31.1	15°19.8

Jun 24 Sat	**SHA**	**Mer.pass**
Venus	221°15.2	15:07
Mars	217°06.6	15:23
Jupiter	323°58.1	08:15
Saturn	20°30.3	04:30

Jun 25 Sun	**SHA**	**Mer.pass**
Venus	220°32.5	15:06
Mars	216°31.5	15:21
Jupiter	323°47.3	08:12
Saturn	20°30.9	04:26

Jun 26 Mon	**SHA**	**Mer.pass**
Venus	219°50.9	15:04
Mars	215°56.4	15:20
Jupiter	323°36.6	08:09
Saturn	20°31.5	04:22

Horizontal parallax	
Venus:	0.3
Mars:	0.1

h	Sun		Moon				
Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°25.2	N23°25.1	111°56.4	15.9′	N12°57.6	12.5′	54.1′
1	194°25.1	25.1	126°31.4	16.0′	12°45.1	12.5′	54.1′
2	209°24.9	25.1	141°06.3	16.0′	12°32.6	12.6′	54.1′
3	224°24.8	·· 25.0	155°41.3	16.0′	12°20.0	12.6′	54.2′
4	239°24.7	25.0	170°16.4	16.1′	12°07.4	12.7′	54.2′
5	254°24.5	24.9	184°51.5	16.1′	11°54.7	12.7′	54.2′
6	269°24.4	N23°24.9	199°26.6	16.2′	N11°42.0	12.8′	54.2′
7	284°24.3	24.8	214°01.7	16.2′	11°29.2	12.8′	54.2′
8	299°24.1	24.8	228°36.9	16.2′	11°16.4	12.9′	54.2′
9	314°24.0	·· 24.7	243°12.1	16.2′	11°03.5	12.9′	54.2′
10	329°23.9	24.7	257°47.4	16.3′	10°50.6	13.0′	54.2′
11	344°23.7	24.6	272°22.7	16.3′	10°37.6	13.0′	54.2′
12	359°23.6	N23°24.6	286°58.0	16.3′	N10°24.6	13.0′	54.2′
13	14°23.4	24.5	301°33.3	16.4′	10°11.6	13.1′	54.3′
14	29°23.3	24.5	316°08.7	16.4′	09°58.5	13.1′	54.3′
15	44°23.2	·· 24.4	330°44.0	16.4′	09°45.4	13.2′	54.3′
16	59°23.0	24.4	345°19.5	16.4′	09°32.2	13.2′	54.3′
17	74°22.9	24.3	359°54.9	16.5′	09°19.0	13.3′	54.3′
18	89°22.8	N23°24.3	14°30.4	16.5′	N09°05.7	13.3′	54.3′
19	104°22.6	24.2	29°05.8	16.5′	08°52.4	13.3′	54.3′
20	119°22.5	24.2	43°41.3	16.5′	08°39.1	13.3′	54.3′
21	134°22.4	·· 24.1	58°16.9	16.5′	08°25.8	13.4′	54.4′
22	149°22.2	24.1	72°52.4	16.6′	08°12.4	13.5′	54.4′
23	164°22.1	24.0	87°28.0	16.6′	07°58.9	13.4′	54.4′
	SD = 15.7′	d = -0.0′	SD = 14.8′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°22.0	N23°24.0	102°03.6	16.6′	N07°45.5	13.6′	54.4′
1	194°21.8	23.9	116°39.1	16.6′	07°31.9	13.5′	54.4′
2	209°21.7	23.8	131°14.8	16.6′	07°18.4	13.6′	54.4′
3	224°21.6	·· 23.8	145°50.4	16.6′	07°04.8	13.6′	54.4′
4	239°21.4	23.7	160°26.0	16.6′	06°51.2	13.6′	54.5′
5	254°21.3	23.7	175°01.6	16.7′	06°37.6	13.7′	54.5′
6	269°21.2	N23°23.6	189°37.3	16.7′	N06°23.9	13.7′	54.5′
7	284°21.0	23.5	204°13.0	16.7′	06°10.2	13.7′	54.5′
8	299°20.9	23.5	218°48.6	16.7′	05°56.5	13.8′	54.5′
9	314°20.8	·· 23.4	233°24.3	16.7′	05°42.7	13.8′	54.5′
10	329°20.6	23.3	248°00.0	16.7′	05°28.9	13.8′	54.6′
11	344°20.5	23.3	262°35.7	16.7′	05°15.1	13.8′	54.6′
12	359°20.4	N23°23.2	277°11.4	16.7′	N05°01.3	13.9′	54.6′
13	14°20.2	23.1	291°47.1	16.7′	04°47.4	13.9′	54.6′
14	29°20.1	23.1	306°22.8	16.7′	04°33.5	13.9′	54.6′
15	44°20.0	·· 23.0	320°58.5	16.7′	04°19.6	14.0′	54.6′
16	59°19.8	22.9	335°34.1	16.7′	04°05.6	14.0′	54.7′
17	74°19.7	22.9	350°09.8	16.7′	03°51.6	13.9′	54.7′
18	89°19.6	N23°22.8	4°45.5	16.7′	N03°37.7	14.1′	54.7′
19	104°19.4	22.7	19°21.2	16.7′	03°23.6	14.0′	54.7′
20	119°19.3	22.6	33°56.9	16.7′	03°09.6	14.1′	54.7′
21	134°19.2	·· 22.6	48°32.5	16.7′	02°55.5	14.1′	54.8′
22	149°19.0	22.5	63°08.2	16.6′	02°41.4	14.1′	54.8′
23	164°18.9	22.4	77°43.8	16.6′	02°27.3	14.1′	54.8′
	SD = 15.7′	d = -0.1′	SD = 14.8′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°18.8	N23°22.3	92°19.5	16.6′	N02°13.2	14.1′	54.8′
1	194°18.6	22.3	106°55.1	16.6′	01°59.1	14.2′	54.8′
2	209°18.5	22.2	121°30.7	16.6′	01°44.9	14.2′	54.9′
3	224°18.4	·· 22.1	136°06.3	16.6′	01°30.7	14.2′	54.9′
4	239°18.3	22.0	150°41.9	16.6′	01°16.5	14.2′	54.9′
5	254°18.1	22.0	165°17.5	16.5′	01°02.3	14.2′	54.9′
6	269°18.0	N23°21.9	179°53.0	16.5′	N00°48.1	14.3′	55.0′
7	284°17.9	21.8	194°28.5	16.5′	00°33.8	14.2′	55.0′
8	299°17.7	21.7	209°04.0	16.5′	00°19.6	14.3′	55.0′
9	314°17.6	·· 21.6	223°39.5	16.5′	N00°05.3	14.3′	55.0′
10	329°17.5	21.6	238°15.0	16.4′	S00°09.0	14.3′	55.1′
11	344°17.3	21.5	252°50.4	16.4′	00°23.3	14.3′	55.1′
12	359°17.2	N23°21.4	267°25.8	16.4′	S00°37.6	14.3′	55.1′
13	14°17.1	21.3	282°01.2	16.4′	00°51.9	14.3′	55.1′
14	29°16.9	21.2	296°36.6	16.3′	01°06.2	14.4′	55.2′
15	44°16.8	·· 21.1	311°11.9	16.3′	01°20.6	14.3′	55.2′
16	59°16.7	21.1	325°47.2	16.3′	01°34.9	14.4′	55.2′
17	74°16.5	21.0	340°22.5	16.2′	01°49.3	14.3′	55.2′
18	89°16.4	N23°20.9	354°57.7	16.2′	S02°03.6	14.4′	55.3′
19	104°16.3	20.8	9°32.9	16.2′	02°18.0	14.4′	55.3′
20	119°16.1	20.7	24°08.1	16.1′	02°32.4	14.4′	55.3′
21	134°16.0	·· 20.6	38°43.2	16.1′	02°46.8	14.3′	55.3′
22	149°15.9	20.5	53°18.3	16.0′	03°01.1	14.4′	55.4′
23	164°15.8	20.4	67°53.3	16.0′	03°15.5	14.4′	55.4′
	SD = 15.7′	d = -0.1′	SD = 15.0′				

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

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

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 6-8 28-47%
24	02:19	02:26	12:02	17:00	04:40	
25	02:32	02:39	12:03	17:40	05:20	
26	02:45	02:51	12:03	18:21	06:00	

June 27, 28, 29 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	274°50.9	134°01.4	**N**16°17.9	130°12.2	**N**15°23.3	238°16.9	**N**13°17.5	295°23.2	**S**10°23.4
1	289°53.4	149°02.2	17.1	145°13.2	22.8	253°18.9	17.6	310°25.7	23.4
2	304°55.9	164°03.0	16.3	160°14.2	22.3	268°21.0	17.8	325°28.2	23.4
3	319°58.3	179°03.8	·· 15.4	175°15.2	·· 21.8	283°23.0	·· 17.9	340°30.7	·· 23.5
4	335°00.8	194°04.6	14.6	190°16.2	21.3	298°25.0	18.1	355°33.2	23.5
5	350°03.2	209°05.4	13.8	205°17.2	20.8	313°27.0	18.2	10°35.7	23.5
6	5°05.7	224°06.2	**N**16°13.0	220°18.2	**N**15°20.3	328°29.1	**N**13°18.3	25°38.2	**S**10°23.5
7	20°08.2	239°07.0	12.2	235°19.2	19.8	343°31.1	18.5	40°40.7	23.6
8	35°10.6	254°07.8	11.4	250°20.2	19.3	358°33.1	18.6	55°43.2	23.6
9	50°13.1	269°08.7	·· 10.6	265°21.2	·· 18.8	13°35.1	·· 18.7	70°45.7	·· 23.6
10	65°15.6	284°09.5	09.7	280°22.2	18.3	28°37.2	18.9	85°48.1	23.6
11	80°18.0	299°10.3	08.9	295°23.2	17.8	43°39.2	19.0	100°50.6	23.6
12	95°20.5	314°11.1	**N**16°08.1	310°24.2	**N**15°17.2	58°41.2	**N**13°19.2	115°53.1	**S**10°23.7
13	110°23.0	329°12.0	07.3	325°25.2	16.7	73°43.2	19.3	130°55.6	23.7
14	125°25.4	344°12.8	06.5	340°26.2	16.2	88°45.3	19.4	145°58.1	23.7
15	140°27.9	359°13.6	·· 05.7	355°27.2	·· 15.7	103°47.3	·· 19.6	161°00.6	·· 23.7
16	155°30.3	14°14.5	04.9	10°28.3	15.2	118°49.3	19.7	176°03.1	23.8
17	170°32.8	29°15.3	04.0	25°29.3	14.7	133°51.3	19.8	191°05.6	23.8
18	185°35.3	44°16.2	**N**16°03.2	40°30.3	**N**15°14.2	148°53.4	**N**13°20.0	206°08.1	**S**10°23.8
19	200°37.7	59°17.0	02.4	55°31.3	13.7	163°55.4	20.1	221°10.6	23.8
20	215°40.2	74°17.8	01.6	70°32.3	13.2	178°57.4	20.3	236°13.1	23.9
21	230°42.7	89°18.7	·· 00.8	85°33.3	·· 12.7	193°59.4	·· 20.4	251°15.6	·· 23.9
22	245°45.1	104°19.5	16°00.0	100°34.3	12.1	209°01.5	20.5	266°18.1	23.9
23	260°47.6	119°20.4	15°59.2	115°35.3	11.6	224°03.5	20.7	281°20.6	23.9
Mer.pass. 05:40		ν 0.8′ d -0.8′ m -4.62		ν 1.0′ d -0.5′ m 1.72		ν 2.0′ d 0.1′ m -2.19		ν 2.5′ d -0.0′ m 0.74	

Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	275°50.1	134°21.2	**N**15°58.3	130°36.3	**N**15°11.1	239°05.5	**N**13°20.8	296°23.1	**S**10°24.0
1	290°52.5	149°22.1	57.5	145°37.3	10.6	254°07.5	21.0	311°25.6	24.0
2	305°55.0	164°23.0	56.7	160°38.3	10.1	269°09.6	21.1	326°28.1	24.0
3	320°57.5	179°23.8	·· 55.9	175°39.3	·· 09.6	284°11.6	·· 21.2	341°30.6	·· 24.0
4	335°59.9	194°24.7	55.1	190°40.3	09.1	299°13.6	21.4	356°33.1	24.0
5	351°02.4	209°25.5	54.3	205°41.3	08.6	314°15.7	21.5	11°35.6	24.1
6	6°04.8	224°26.4	**N**15°53.5	220°42.3	**N**15°08.1	329°17.7	**N**13°21.6	26°38.1	**S**10°24.1
7	21°07.3	239°27.3	52.6	235°43.3	07.5	344°19.7	21.8	41°40.6	24.1
8	36°09.8	254°28.1	51.8	250°44.3	07.0	359°21.7	21.9	56°43.1	24.1
9	51°12.2	269°29.0	·· 51.0	265°45.3	·· 06.5	14°23.8	·· 22.0	71°45.6	·· 24.2
10	66°14.7	284°29.9	50.2	280°46.3	06.0	29°25.8	22.2	86°48.1	24.2
11	81°17.2	299°30.8	49.4	295°47.3	05.5	44°27.8	22.3	101°50.7	24.2
12	96°19.6	314°31.6	**N**15°48.6	310°48.3	**N**15°05.0	59°29.9	**N**13°22.5	116°53.2	**S**10°24.2
13	111°22.1	329°32.5	47.7	325°49.3	04.5	74°31.9	22.6	131°55.7	24.3
14	126°24.6	344°33.4	46.9	340°50.3	04.0	89°33.9	22.7	146°58.2	24.3
15	141°27.0	359°34.3	·· 46.1	355°51.3	·· 03.4	104°35.9	·· 22.9	162°00.7	·· 24.3
16	156°29.5	14°35.2	45.3	10°52.3	02.9	119°38.0	23.0	177°03.2	24.3
17	171°32.0	29°36.1	44.5	25°53.4	02.4	134°40.0	23.1	192°05.7	24.4
18	186°34.4	44°37.0	**N**15°43.7	40°54.4	**N**15°01.9	149°42.0	**N**13°23.3	207°08.2	**S**10°24.4
19	201°36.9	59°37.8	42.9	55°55.4	01.4	164°44.1	23.4	222°10.7	24.4
20	216°39.3	74°38.7	42.0	70°56.4	00.9	179°46.1	23.5	237°13.2	24.4
21	231°41.8	89°39.6	·· 41.2	85°57.4	15°00.4	194°48.1	·· 23.7	252°15.7	·· 24.5
22	246°44.3	104°40.5	40.4	100°58.4	14°59.8	209°50.2	23.8	267°18.2	24.5
23	261°46.7	119°41.4	39.6	115°59.4	59.3	224°52.2	24.0	282°20.7	24.5
Mer.pass. 05:36		ν 0.9′ d -0.8′ m -4.63		ν 1.0′ d -0.5′ m 1.72		ν 2.0′ d 0.1′ m -2.19		ν 2.5′ d -0.0′ m 0.74	

Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	276°49.2	134°42.3	**N**15°38.8	131°00.4	**N**14°58.8	239°54.2	**N**13°24.1	297°23.2	**S**10°24.5
1	291°51.7	149°43.3	38.0	146°01.4	58.3	254°56.2	24.2	312°25.7	24.6
2	306°54.1	164°44.2	37.1	161°02.4	57.8	269°58.3	24.4	327°28.2	24.6
3	321°56.6	179°45.1	·· 36.3	176°03.4	·· 57.3	285°00.3	·· 24.5	342°30.7	·· 24.6
4	336°59.1	194°46.0	35.5	191°04.4	56.7	300°02.3	24.6	357°33.2	24.7
5	352°01.5	209°46.9	34.7	206°05.4	56.2	315°04.4	24.8	12°35.7	24.7
6	7°04.0	224°47.8	**N**15°33.9	221°06.4	**N**14°55.7	330°06.4	**N**13°24.9	27°38.2	**S**10°24.7
7	22°06.4	239°48.7	33.1	236°07.4	55.2	345°08.4	25.0	42°40.7	24.7
8	37°08.9	254°49.7	32.2	251°08.4	54.7	0°10.5	25.2	57°43.2	24.8
9	52°11.4	269°50.6	·· 31.4	266°09.4	·· 54.2	15°12.5	·· 25.3	72°45.7	·· 24.8
10	67°13.8	284°51.5	30.6	281°10.4	53.7	30°14.5	25.4	87°48.2	24.8
11	82°16.3	299°52.4	29.8	296°11.4	53.1	45°16.6	25.6	102°50.7	24.8
12	97°18.8	314°53.4	**N**15°29.0	311°12.5	**N**14°52.6	60°18.6	**N**13°25.7	117°53.3	**S**10°24.9
13	112°21.2	329°54.3	28.2	326°13.5	52.1	75°20.6	25.8	132°55.8	24.9
14	127°23.7	344°55.2	27.4	341°14.5	51.6	90°22.7	26.0	147°58.3	24.9
15	142°26.2	359°56.2	·· 26.5	356°15.5	·· 51.1	105°24.7	·· 26.1	163°00.8	·· 24.9
16	157°28.6	14°57.1	25.7	11°16.5	50.5	120°26.7	26.3	178°03.3	25.0
17	172°31.1	29°58.1	24.9	26°17.5	50.0	135°28.8	26.4	193°05.8	25.0
18	187°33.6	44°59.0	**N**15°24.1	41°18.5	**N**14°49.5	150°30.8	**N**13°26.5	208°08.3	**S**10°25.0
19	202°36.0	59°59.9	23.3	56°19.5	49.0	165°32.8	26.7	223°10.8	25.0
20	217°38.5	75°00.9	22.5	71°20.5	48.5	180°34.9	26.8	238°13.3	25.1
21	232°40.9	90°01.8	·· 21.6	86°21.5	·· 48.0	195°36.9	·· 26.9	253°15.8	·· 25.1
22	247°43.4	105°02.8	20.8	101°22.5	47.4	210°38.9	27.1	268°18.3	25.1
23	262°45.9	120°03.8	20.0	116°23.5	46.9	225°41.0	27.2	283°20.8	25.2
Mer.pass. 05:32		ν 0.9′ d -0.8′ m -4.64		ν 1.0′ d -0.5′ m 1.73		ν 2.0′ d 0.1′ m -2.19		ν 2.5′ d -0.0′ m 0.73	

Stars

	SHA	**Dec**
Alpheratz	357°36.1	29°13.0
Ankaa	353°08.4	-42°10.5
Schedar	349°32.6	56°39.6
Diphda	348°48.6	-17°51.4
Achernar	335°21.3	-57°06.8
Hamal	327°52.8	23°34.3
Polaris	314°58.1	89°21.5
Acamar	315°13.0	-40°12.5
Menkar	314°07.7	4°10.9
Mirfak	308°30.5	49°56.5
Aldebaran	290°41.4	16°33.3
Rigel	281°05.4	-8°10.4
Capella	280°24.3	46°01.2
Bellatrix	278°24.6	6°22.3
Elnath	278°03.9	28°37.6
Alnilam	275°39.4	-1°11.2
Betelgeuse	270°53.8	7°24.7
Canopus	263°53.5	-52°42.4
Sirius	258°27.7	-16°44.9
Adhara	255°07.3	-29°00.2
Procyon	244°52.5	5°09.9
Pollux	243°19.2	27°58.3
Avior	234°15.8	-59°35.1
Suhail	222°47.6	-43°31.7
Miaplacidus	221°39.3	-69°48.9
Alphard	217°49.3	-8°45.6
Regulus	207°36.0	11°51.3
Dubhe	193°42.8	61°37.8
Denebola	182°26.3	14°26.6
Gienah	175°44.9	-17°40.4
Acrux	173°01.5	-63°14.0
Gacrux	171°53.1	-57°14.9
Alioth	166°14.0	55°50.3
Spica	158°23.6	-11°17.0
Alkaid	152°52.8	49°12.0
Hadar	148°37.5	-60°29.4
Menkent	147°59.0	-36°29.2
Arcturus	145°48.9	19°03.8
Rigil Kent.	139°41.7	-60°56.1
Kochab	137°19.0	74°03.8
Zuben'ubi	136°57.2	-16°08.4
Alphecca	126°04.5	26°38.3
Antares	112°17.1	-26°29.1
Atria	107°11.9	-69°04.3
Sabik	102°03.9	-15°45.2
Shaula	96°11.7	-37°07.3
Rasalhague	95°59.4	12°32.6
Eltanin	90°42.2	51°29.1
Kaus Aust.	83°33.8	-34°22.4
Vega	80°33.7	38°48.3
Nunki	75°49.0	-26°16.0
Altair	62°00.9	8°55.8
Peacock	53°07.2	-56°39.4
Deneb	49°26.3	45°21.7
Enif	33°39.8	9°58.9
Al Na'ir	27°34.2	-46°50.7
Fomalhaut	15°15.8	-29°29.8
Scheat	13°46.3	28°12.4
Markab	13°31.1	15°19.8

Jun 27 Tue	**SHA**	**Mer.pass**
Venus	219°10.4	15:03
Mars	215°21.3	15:18
Jupiter	323°26.0	08:06
Saturn	20°32.3	04:18

Jun 28 Wed	**SHA**	**Mer.pass**
Venus	218°31.2	15:02
Mars	214°46.2	15:17
Jupiter	323°15.5	08:03
Saturn	20°33.1	04:14

Jun 29 Thu	**SHA**	**Mer.pass**
Venus	217°53.1	15:00
Mars	214°11.2	15:15
Jupiter	323°05.0	07:59
Saturn	20°34.0	04:10

Horizontal parallax	
Venus:	0.3
Mars:	0.1

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°15.6	N23°20.3	82°28.3	16.0′	S03°29.9	14.4′	55.4′
1	194°15.5	20.2	97°03.3	15.9′	03°44.3	14.4′	55.4′
2	209°15.4	20.2	111°38.2	15.9′	03°58.7	14.4′	55.5′
3	224°15.2	·· 20.1	126°13.1	15.8′	04°13.1	14.4′	55.5′
4	239°15.1	20.0	140°47.9	15.8′	04°27.5	14.3′	55.5′
5	254°15.0	19.9	155°22.7	15.7′	04°41.8	14.4′	55.6′
6	269°14.8	N23°19.8	169°57.4	15.7′	S04°56.2	14.4′	55.6′
7	284°14.7	19.7	184°32.1	15.6′	05°10.6	14.4′	55.6′
8	299°14.6	19.6	199°06.7	15.6′	05°25.0	14.3′	55.6′
9	314°14.5	·· 19.5	213°41.3	15.5′	05°39.3	14.4′	55.7′
10	329°14.3	19.4	228°15.8	15.5′	05°53.7	14.4′	55.7′
11	344°14.2	19.3	242°50.3	15.4′	06°08.1	14.3′	55.7′
12	359°14.1	N23°19.2	257°24.7	15.4′	S06°22.4	14.3′	55.8′
13	14°13.9	19.1	271°59.1	15.3′	06°36.7	14.4′	55.8′
14	29°13.8	19.0	286°33.4	15.2′	06°51.1	14.3′	55.8′
15	44°13.7	·· 18.9	301°07.6	15.2′	07°05.4	14.3′	55.9′
16	59°13.5	18.8	315°41.8	15.1′	07°19.7	14.3′	55.9′
17	74°13.4	18.7	330°15.9	15.0′	07°34.0	14.3′	55.9′
18	89°13.3	N23°18.6	344°49.9	15.0′	S07°48.3	14.2′	56.0′
19	104°13.2	18.5	359°23.9	14.9′	08°02.5	14.3′	56.0′
20	119°13.0	18.3	13°57.8	14.8′	08°16.8	14.2′	56.0′
21	134°12.9	·· 18.2	28°31.6	14.8′	08°31.0	14.2′	56.1′
22	149°12.8	18.1	43°05.4	14.7′	08°45.2	14.2′	56.1′
23	164°12.6	18.0	57°39.1	14.6′	08°59.4	14.2′	56.1′
	SD = 15.7′	d = -0.1′	SD = 15.1′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°12.5	N23°17.9	72°12.7	14.5′	S09°13.6	14.1′	56.2′
1	194°12.4	17.8	86°46.3	14.5′	09°27.7	14.2′	56.2′
2	209°12.3	17.7	101°19.7	14.4′	09°41.9	14.1′	56.2′
3	224°12.1	·· 17.6	115°53.1	14.3′	09°56.0	14.0′	56.3′
4	239°12.0	17.5	130°26.4	14.2′	10°10.0	14.1′	56.3′
5	254°11.9	17.4	144°59.7	14.2′	10°24.1	14.0′	56.3′
6	269°11.7	N23°17.2	159°32.8	14.1′	S10°38.1	14.0′	56.4′
7	284°11.6	17.1	174°05.9	14.0′	10°52.1	14.0′	56.4′
8	299°11.5	17.0	188°38.9	13.9′	11°06.1	13.9′	56.4′
9	314°11.4	·· 16.9	203°11.8	13.8′	11°20.0	14.0′	56.5′
10	329°11.2	16.8	217°44.6	13.7′	11°34.0	13.8′	56.5′
11	344°11.1	16.7	232°17.4	13.6′	11°47.8	13.9′	56.5′
12	359°11.0	N23°16.5	246°50.0	13.6′	S12°01.7	13.8′	56.6′
13	14°10.8	16.4	261°22.6	13.5′	12°15.5	13.8′	56.6′
14	29°10.7	16.3	275°55.0	13.4′	12°29.3	13.7′	56.6′
15	44°10.6	·· 16.2	290°27.4	13.3′	12°43.0	13.7′	56.7′
16	59°10.5	16.1	304°59.7	13.2′	12°56.7	13.7′	56.7′
17	74°10.3	15.9	319°31.8	13.1′	13°10.4	13.6′	56.7′
18	89°10.2	N23°15.8	334°03.9	13.0′	S13°24.0	13.6′	56.8′
19	104°10.1	15.7	348°35.9	12.9′	13°37.6	13.5′	56.8′
20	119°10.0	15.6	3°07.8	12.8′	13°51.1	13.5′	56.9′
21	134°09.8	·· 15.5	17°39.6	12.7′	14°04.6	13.4′	56.9′
22	149°09.7	15.3	32°11.2	12.6′	14°18.0	13.4′	56.9′
23	164°09.6	15.2	46°42.8	12.5′	14°31.4	13.4′	57.0′
	SD = 15.7′	d = -0.1′	SD = 15.3′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°09.5	N23°15.1	61°14.3	12.4′	S14°44.8	13.2′	57.0′
1	194°09.3	15.0	75°45.6	12.3′	14°58.0	13.3′	57.0′
2	209°09.2	14.8	90°16.9	12.1′	15°11.3	13.2′	57.1′
3	224°09.1	·· 14.7	104°48.1	12.0′	15°24.5	13.1′	57.1′
4	239°08.9	14.6	119°19.1	11.9′	15°37.6	13.1′	57.2′
5	254°08.8	14.4	133°50.0	11.8′	15°50.7	13.0′	57.2′
6	269°08.7	N23°14.3	148°20.8	11.7′	S16°03.7	12.9′	57.2′
7	284°08.6	14.2	162°51.5	11.6′	16°16.6	12.9′	57.3′
8	299°08.4	14.0	177°22.1	11.5′	16°29.5	12.9′	57.3′
9	314°08.3	·· 13.9	191°52.6	11.4′	16°42.4	12.7′	57.3′
10	329°08.2	13.8	206°23.0	11.2′	16°55.1	12.7′	57.4′
11	344°08.1	13.6	220°53.2	11.1′	17°07.8	12.6′	57.4′
12	359°07.9	N23°13.5	235°23.3	11.0′	S17°20.4	12.6′	57.5′
13	14°07.8	13.4	249°53.3	10.9′	17°33.0	12.5′	57.5′
14	29°07.7	13.2	264°23.2	10.8′	17°45.5	12.4′	57.5′
15	44°07.6	·· 13.1	278°53.0	10.6′	17°57.9	12.4′	57.6′
16	59°07.4	13.0	293°22.6	10.5′	18°10.3	12.2′	57.6′
17	74°07.3	12.8	307°52.1	10.4′	18°22.5	12.2′	57.6′
18	89°07.2	N23°12.7	322°21.5	10.3′	S18°34.7	12.1′	57.7′
19	104°07.1	12.5	336°50.8	10.1′	18°46.8	12.0′	57.7′
20	119°06.9	12.4	351°19.9	10.0′	18°58.8	12.0′	57.8′
21	134°06.8	·· 12.3	5°49.0	9.9′	19°10.8	11.8′	57.8′
22	149°06.7	12.1	20°17.9	9.8′	19°22.6	11.8′	57.8′
23	164°06.6	12.0	34°46.6	9.6′	19°34.4	11.7′	57.9′
	SD = 15.7′	d = -0.1′	SD = 15.5′				

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

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 9-11 57-76%
27	02:58	03:04	12:03	19:02	06:41	
28	03:10	03:16	12:03	19:47	07:24	
29	03:22	03:28	12:03	20:36	08:11	

June 30, 01, 02 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	277°48.3	135°04.7	N15°19.2	131°24.5	N14°46.4	240°43.0	N13°27.3	298°23.3	S10°25.2
1	292°50.8	150°05.7	18.4	146°25.5	45.9	255°45.0	27.5	313°25.8	25.2
2	307°53.3	165°06.6	17.6	161°26.5	45.4	270°47.1	27.6	328°28.4	25.2
3	322°55.7	180°07.6	·· 16.8	176°27.5	·· 44.8	285°49.1	·· 27.7	343°30.9	·· 25.3
4	337°58.2	195°08.6	15.9	191°28.5	44.3	300°51.2	27.9	358°33.4	25.3
5	353°00.7	210°09.5	15.1	206°29.6	43.8	315°53.2	28.0	13°35.9	25.3
6	8°03.1	225°10.5	N15°14.3	221°30.6	N14°43.3	330°55.2	N13°28.1	28°38.4	S10°25.3
7	23°05.6	240°11.5	13.5	236°31.6	42.8	345°57.3	28.3	43°40.9	25.4
8	38°08.1	255°12.5	12.7	251°32.6	42.2	0°59.3	28.4	58°43.4	25.4
9	53°10.5	270°13.4	·· 11.9	266°33.6	·· 41.7	16°01.3	·· 28.5	73°45.9	·· 25.4
10	68°13.0	285°14.4	11.1	281°34.6	41.2	31°03.4	28.7	88°48.4	25.5
11	83°15.4	300°15.4	10.2	296°35.6	40.7	46°05.4	28.8	103°50.9	25.5
12	98°17.9	315°16.4	N15°09.4	311°36.6	N14°40.2	61°07.4	N13°28.9	118°53.4	S10°25.5
13	113°20.4	330°17.4	08.6	326°37.6	39.6	76°09.5	29.1	133°55.9	25.5
14	128°22.8	345°18.4	07.8	341°38.6	39.1	91°11.5	29.2	148°58.5	25.6
15	143°25.3	0°19.3	·· 07.0	356°39.6	·· 38.6	106°13.6	·· 29.3	164°01.0	·· 25.6
16	158°27.8	15°20.3	06.2	11°40.6	38.1	121°15.6	29.5	179°03.5	25.6
17	173°30.2	30°21.3	05.3	26°41.6	37.6	136°17.6	29.6	194°06.0	25.6
18	188°32.7	45°22.3	N15°04.5	41°42.6	N14°37.0	151°19.7	N13°29.7	209°08.5	S10°25.7
19	203°35.2	60°23.3	03.7	56°43.6	36.5	166°21.7	29.9	224°11.0	25.7
20	218°37.6	75°24.3	02.9	71°44.7	36.0	181°23.7	30.0	239°13.5	25.7
21	233°40.1	90°25.3	·· 02.1	86°45.7	·· 35.5	196°25.8	·· 30.1	254°16.0	·· 25.8
22	248°42.6	105°26.3	01.3	101°46.7	34.9	211°27.8	30.3	269°18.5	25.8
23	263°45.0	120°27.4	00.5	116°47.7	34.4	226°29.9	30.4	284°21.1	25.8
Mer.pass. 05:28		ν 1.0′	d -0.8′	m -4.65	ν 1.0′	d -0.5′	m 1.73	ν 2.0′	d 0.1′ m -2.20	ν 2.5′	d -0.0′ m 0.73

Sat	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	278°47.5	135°28.4	N14°59.6	131°48.7	N14°33.9	241°31.9	N13°30.5	299°23.6	S10°25.8
1	293°49.9	150°29.4	58.8	146°49.7	33.4	256°33.9	30.7	314°26.1	25.9
2	308°52.4	165°30.4	58.0	161°50.7	32.9	271°36.0	30.8	329°28.6	25.9
3	323°54.9	180°31.4	·· 57.2	176°51.7	·· 32.3	286°38.0	·· 30.9	344°31.1	·· 25.9
4	338°57.3	195°32.4	56.4	191°52.7	31.8	301°40.1	31.0	359°33.6	26.0
5	353°59.8	210°33.5	55.6	206°53.7	31.3	316°42.1	31.2	14°36.1	26.0
6	9°02.3	225°34.5	N14°54.8	221°54.7	N14°30.8	331°44.1	N13°31.3	29°38.6	S10°26.0
7	24°04.7	240°35.5	54.0	236°55.7	30.2	346°46.2	31.4	44°41.2	26.0
8	39°07.2	255°36.5	53.1	251°56.7	29.7	1°48.2	31.6	59°43.7	26.1
9	54°09.7	270°37.6	·· 52.3	266°57.7	·· 29.2	16°50.3	·· 31.7	74°46.2	·· 26.1
10	69°12.1	285°38.6	51.5	281°58.8	28.7	31°52.3	31.8	89°48.7	26.1
11	84°14.6	300°39.7	50.7	296°59.8	28.1	46°54.3	32.0	104°51.2	26.2
12	99°17.1	315°40.7	N14°49.9	312°00.8	N14°27.6	61°56.4	N13°32.1	119°53.7	S10°26.2
13	114°19.5	330°41.7	49.1	327°01.8	27.1	76°58.4	32.2	134°56.2	26.2
14	129°22.0	345°42.8	48.3	342°02.8	26.6	92°00.5	32.4	149°58.7	26.2
15	144°24.4	0°43.8	·· 47.4	357°03.8	·· 26.0	107°02.5	·· 32.5	165°01.3	·· 26.3
16	159°26.9	15°44.9	46.6	12°04.8	25.5	122°04.6	32.6	180°03.8	26.3
17	174°29.4	30°45.9	45.8	27°05.8	25.0	137°06.6	32.8	195°06.3	26.3
18	189°31.8	45°47.0	N14°45.0	42°06.8	N14°24.5	152°08.6	N13°32.9	210°08.8	S10°26.4
19	204°34.3	60°48.0	44.2	57°07.8	23.9	167°10.7	33.0	225°11.3	26.4
20	219°36.8	75°49.1	43.4	72°08.8	23.4	182°12.7	33.1	240°13.8	26.4
21	234°39.2	90°50.2	·· 42.6	87°09.8	·· 22.9	197°14.8	·· 33.3	255°16.3	·· 26.5
22	249°41.7	105°51.2	41.8	102°10.9	22.4	212°16.8	33.4	270°18.9	26.5
23	264°44.2	120°52.3	40.9	117°11.9	21.8	227°18.9	33.5	285°21.4	26.5
Mer.pass. 05:24		ν 1.0′	d -0.8′	m -4.66	ν 1.0′	d -0.5′	m 1.73	ν 2.0′	d 0.1′ m -2.20	ν 2.5′	d -0.0′ m 0.72

Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	279°46.6	135°53.4	N14°40.1	132°12.9	N14°21.3	242°20.9	N13°33.7	300°23.9	S10°26.5
1	294°49.1	150°54.4	39.3	147°13.9	20.8	257°22.9	33.8	315°26.4	26.6
2	309°51.6	165°55.5	38.5	162°14.9	20.3	272°25.0	33.9	330°28.9	26.6
3	324°54.0	180°56.6	·· 37.7	177°15.9	·· 19.7	287°27.0	·· 34.1	345°31.4	·· 26.6
4	339°56.5	195°57.6	36.9	192°16.9	19.2	302°29.1	34.2	0°34.0	26.7
5	354°58.9	210°58.7	36.1	207°17.9	18.7	317°31.1	34.3	15°36.5	26.7
6	10°01.4	225°59.8	N14°35.3	222°18.9	N14°18.1	332°33.2	N13°34.5	30°39.0	S10°26.7
7	25°03.9	241°00.9	34.5	237°19.9	17.6	347°35.2	34.6	45°41.5	26.8
8	40°06.3	256°02.0	33.6	252°20.9	17.1	2°37.2	34.7	60°44.0	26.8
9	55°08.8	271°03.1	·· 32.8	267°21.9	·· 16.6	17°39.3	·· 34.8	75°46.5	·· 26.8
10	70°11.3	286°04.2	32.0	282°23.0	16.0	32°41.3	35.0	90°49.0	26.8
11	85°13.7	301°05.3	31.2	297°24.0	15.5	47°43.4	35.1	105°51.6	26.9
12	100°16.2	316°06.4	N14°30.4	312°25.0	N14°15.0	62°45.4	N13°35.2	120°54.1	S10°26.9
13	115°18.7	331°07.5	29.6	327°26.0	14.4	77°47.5	35.4	135°56.6	26.9
14	130°21.1	346°08.6	28.8	342°27.0	13.9	92°49.5	35.5	150°59.1	27.0
15	145°23.6	1°09.7	·· 28.0	357°28.0	·· 13.4	107°51.6	·· 35.6	166°01.6	·· 27.0
16	160°26.0	16°10.8	27.2	12°29.0	12.9	122°53.6	35.7	181°04.2	27.0
17	175°28.5	31°11.9	26.3	27°30.0	12.3	137°55.7	35.9	196°06.7	27.1
18	190°31.0	46°13.0	N14°25.5	42°31.0	N14°11.8	152°57.7	N13°36.0	211°09.2	S10°27.1
19	205°33.4	61°14.1	24.7	57°32.0	11.3	167°59.7	36.1	226°11.7	27.1
20	220°35.9	76°15.2	23.9	72°33.0	10.7	183°01.8	36.3	241°14.2	27.2
21	235°38.4	91°16.3	·· 23.1	87°34.1	·· 10.2	198°03.8	·· 36.4	256°16.7	·· 27.2
22	250°40.8	106°17.4	22.3	102°35.1	09.7	213°05.9	36.5	271°19.3	27.2
23	265°43.3	121°18.6	21.5	117°36.1	09.1	228°07.9	36.7	286°21.8	27.2
Mer.pass. 05:20		ν 1.1′	d -0.8′	m -4.67	ν 1.0′	d -0.5′	m 1.74	ν 2.0′	d 0.1′ m -2.21	ν 2.5′	d -0.0′ m 0.72

Stars

	SHA	**Dec**
Alpheratz	357°36.1	29°13.0
Ankaa	353°08.4	-42°10.5
Schedar	349°32.5	56°39.6
Diphda	348°48.6	-17°51.4
Achernar	335°21.3	-57°06.8
Hamal	327°52.8	23°34.3
Polaris	314°56.6	89°21.5
Acamar	315°13.0	-40°12.5
Menkar	314°07.7	4°10.9
Mirfak	308°30.4	49°56.5
Aldebaran	290°41.4	16°33.3
Rigel	281°05.4	-8°10.4
Capella	280°24.2	46°01.2
Bellatrix	278°24.6	6°22.3
Elnath	278°03.8	28°37.6
Alnilam	275°39.4	-1°11.2
Betelgeuse	270°53.8	7°24.7
Canopus	263°53.5	-52°42.4
Sirius	258°27.7	-16°44.9
Adhara	255°07.3	-29°00.2
Procyon	244°52.5	5°09.9
Pollux	243°19.2	27°58.3
Avior	234°15.8	-59°35.1
Suhail	222°47.6	-43°31.7
Miaplacidus	221°39.3	-69°48.9
Alphard	217°49.3	-8°45.6
Regulus	207°36.0	11°51.3
Dubhe	193°42.8	61°37.8
Denebola	182°26.3	14°26.6
Gienah	175°44.9	-17°40.4
Acrux	173°01.6	-63°14.0
Gacrux	171°53.1	-57°14.9
Alioth	166°14.0	55°50.3
Spica	158°23.6	-11°17.0
Alkaid	152°52.8	49°12.0
Hadar	148°37.6	-60°29.4
Menkent	147°59.0	-36°29.2
Arcturus	145°48.9	19°03.8
Rigil Kent.	139°41.7	-60°56.1
Kochab	137°19.1	74°03.8
Zuben'ubi	136°57.2	-16°08.4
Alphecca	126°04.6	26°38.3
Antares	112°17.1	-26°29.1
Atria	107°11.9	-69°04.3
Sabik	102°03.9	-15°45.2
Shaula	96°11.7	-37°07.3
Rasalhague	95°59.4	12°32.6
Eltanin	90°42.2	51°29.2
Kaus Aust.	83°33.8	-34°22.4
Vega	80°33.6	38°48.3
Nunki	75°49.0	-26°16.0
Altair	62°00.9	8°55.8
Peacock	53°07.2	-56°39.4
Deneb	49°26.3	45°21.7
Enif	33°39.8	9°58.9
Al Na'ir	27°34.2	-46°50.7
Fomalhaut	15°15.8	-29°29.8
Scheat	13°46.3	28°12.4
Markab	13°31.0	15°19.8

Jun 30 Fri	**SHA**	**Mer.pass**
Venus	217°16.4	14:59
Mars	213°36.2	15:13
Jupiter	322°54.7	07:56
Saturn	20°35.0	04:06

Jul 01 Sat	**SHA**	**Mer.pass**
Venus	216°40.9	14:57
Mars	213°01.2	15:12
Jupiter	322°44.4	07:53
Saturn	20°36.1	04:02

Jul 02 Sun	**SHA**	**Mer.pass**
Venus	216°06.7	14:55
Mars	212°26.2	15:10
Jupiter	322°34.3	07:50
Saturn	20°37.3	03:58

Horizontal parallax	
Venus:	0.3
Mars:	0.1

h	Sun		Moon				
Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°06.4	N23°11.8	49°15.2	9.5′	S19°46.1	11.6′	57.9′
1	194°06.3	11.7	63°43.7	9.4′	19°57.7	11.5′	58.0′
2	209°06.2	11.6	78°12.1	9.2′	20°09.2	11.4′	58.0′
3	224°06.1	·· 11.4	92°40.3	9.1′	20°20.6	11.3′	58.0′
4	239°06.0	11.3	107°08.4	9.0′	20°31.9	11.2′	58.1′
5	254°05.8	11.1	121°36.4	8.8′	20°43.1	11.1′	58.1′
6	269°05.7	N23°11.0	136°04.3	8.7′	S20°54.2	11.0′	58.1′
7	284°05.6	10.8	150°32.0	8.6′	21°05.2	11.0′	58.2′
8	299°05.5	10.7	164°59.5	8.4′	21°16.2	10.8′	58.2′
9	314°05.3	·· 10.5	179°27.0	8.3′	21°27.0	10.6′	58.3′
10	329°05.2	10.4	193°54.3	8.2′	21°37.6	10.6′	58.3′
11	344°05.1	10.2	208°21.5	8.0′	21°48.2	10.5′	58.3′
12	359°05.0	N23°10.1	222°48.5	7.9′	S21°58.7	10.4′	58.4′
13	14°04.8	09.9	237°15.4	7.8′	22°09.1	10.2′	58.4′
14	29°04.7	09.8	251°42.2	7.6′	22°19.3	10.1′	58.4′
15	44°04.6	·· 09.6	266°08.8	7.5′	22°29.4	10.0′	58.5′
16	59°04.5	09.5	280°35.3	7.4′	22°39.4	9.9′	58.5′
17	74°04.4	09.3	295°01.6	7.2′	22°49.3	9.8′	58.6′
18	89°04.2	N23°09.1	309°27.9	7.1′	S22°59.1	9.6′	58.6′
19	104°04.1	09.0	323°53.9	7.0′	23°08.7	9.5′	58.6′
20	119°04.0	08.8	338°19.9	6.8′	23°18.2	9.4′	58.7′
21	134°03.9	·· 08.7	352°45.7	6.7′	23°27.6	9.3′	58.7′
22	149°03.7	08.5	7°11.4	6.5′	23°36.9	9.1′	58.7′
23	164°03.6	08.4	21°36.9	6.4′	23°46.0	9.0′	58.8′
	SD = 15.7′	d = -0.1′	SD = 15.8′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°03.5	N23°08.2	36°02.3	6.3′	S23°55.0	8.8′	58.8′
1	194°03.4	08.0	50°27.6	6.1′	24°03.8	8.7′	58.9′
2	209°03.3	07.9	64°52.8	6.0′	24°12.5	8.6′	58.9′
3	224°03.1	·· 07.7	79°17.8	5.9′	24°21.1	8.4′	58.9′
4	239°03.0	07.5	93°42.7	5.7′	24°29.5	8.3′	59.0′
5	254°02.9	07.4	108°07.4	5.6′	24°37.8	8.1′	59.0′
6	269°02.8	N23°07.2	122°32.0	5.5′	S24°45.9	8.0′	59.0′
7	284°02.7	07.1	136°56.5	5.4′	24°53.9	7.8′	59.1′
8	299°02.5	06.9	151°20.9	5.2′	25°01.7	7.7′	59.1′
9	314°02.4	·· 06.7	165°45.1	5.1′	25°09.4	7.5′	59.1′
10	329°02.3	06.6	180°09.2	5.0′	25°16.9	7.4′	59.2′
11	344°02.2	06.4	194°33.2	4.9′	25°24.3	7.2′	59.2′
12	359°02.1	N23°06.2	208°57.0	4.7′	S25°31.5	7.0′	59.2′
13	14°01.9	06.1	223°20.8	4.6′	25°38.5	6.9′	59.3′
14	29°01.8	05.9	237°44.4	4.5′	25°45.4	6.7′	59.3′
15	44°01.7	·· 05.7	252°07.9	4.4′	25°52.1	6.6′	59.3′
16	59°01.6	05.5	266°31.2	4.3′	25°58.7	6.4′	59.4′
17	74°01.5	05.4	280°54.5	4.1′	26°05.1	6.2′	59.4′
18	89°01.3	N23°05.2	295°17.6	4.0′	S26°11.3	6.0′	59.4′
19	104°01.2	05.0	309°40.6	3.9′	26°17.3	5.9′	59.5′
20	119°01.1	04.8	324°03.5	3.8′	26°23.2	5.7′	59.5′
21	134°01.0	·· 04.7	338°26.3	3.7′	26°28.9	5.5′	59.5′
22	149°00.9	04.5	352°49.0	3.6′	26°34.4	5.3′	59.6′
23	164°00.7	04.3	7°11.6	3.5′	26°39.7	5.2′	59.6′
	SD = 15.7′	d = -0.2′	SD = 16.0′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°00.6	N23°04.1	21°34.1	3.4′	S26°44.9	4.9′	59.6′
1	194°00.5	04.0	35°56.5	3.3′	26°49.8	4.8′	59.7′
2	209°00.4	03.8	50°18.7	3.2′	26°54.6	4.6′	59.7′
3	224°00.3	·· 03.6	64°40.9	3.1′	26°59.2	4.4′	59.7′
4	239°00.2	03.4	79°03.0	3.0′	27°03.6	4.3′	59.8′
5	254°00.0	03.3	93°25.0	2.9′	27°07.9	4.0′	59.8′
6	268°59.9	N23°03.1	107°46.9	2.8′	S27°11.9	3.8′	59.8′
7	283°59.8	02.9	122°08.7	2.7′	27°15.7	3.7′	59.8′
8	298°59.7	02.7	136°30.4	2.6′	27°19.4	3.4′	59.9′
9	313°59.6	·· 02.5	150°52.0	2.6′	27°22.8	3.3′	59.9′
10	328°59.4	02.3	165°13.6	2.5′	27°26.1	3.1′	59.9′
11	343°59.3	02.2	179°35.1	2.4′	27°29.2	2.8′	60.0′
12	358°59.2	N23°02.0	193°56.5	2.3′	S27°32.0	2.7′	60.0′
13	13°59.1	01.8	208°17.8	2.3′	27°34.7	2.5′	60.0′
14	28°59.0	01.6	222°39.0	2.2′	27°37.2	2.2′	60.0′
15	43°58.9	·· 01.4	237°00.2	2.1′	27°39.4	2.1′	60.1′
16	58°58.7	01.2	251°21.4	2.1′	27°41.5	1.9′	60.1′
17	73°58.6	01.0	265°42.4	2.0′	27°43.4	1.6′	60.1′
18	88°58.5	N23°00.8	280°03.4	2.0′	S27°45.0	1.5′	60.1′
19	103°58.4	00.7	294°24.4	1.9′	27°46.5	1.2′	60.2′
20	118°58.3	00.5	308°45.3	1.9′	27°47.7	1.0′	60.2′
21	133°58.2	·· 00.3	323°06.1	1.8′	27°48.7	0.9′	60.2′
22	148°58.0	23°00.1	337°26.9	1.8′	27°49.6	0.6′	60.2′
23	163°57.9	22°59.9	351°47.7	1.7′	27°50.2	0.4′	60.3′
	SD = 15.7′	d = -0.2′	SD = 16.3′				

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

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

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 12-14 84-97%
30	03:34	03:40	12:04	21:30	09:02	
01	03:46	03:52	12:04	22:30	09:59	
02	03:57	04:03	12:04	23:34	11:02	

July 03, 04, 05 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	280°45.8	136°19.7	N14°20.7	132°37.1	N14°08.6	243°10.0	N13°36.8	301°24.3	S10°27.3
1	295°48.2	151°20.8	19.9	147°38.1	08.1	258°12.0	36.9	316°26.8	27.3
2	310°50.7	166°22.0	19.1	162°39.1	07.6	273°14.1	37.0	331°29.3	27.3
3	325°53.2	181°23.1	·· 18.3	177°40.1	·· 07.0	288°16.1	·· 37.2	346°31.9	·· 27.4
4	340°55.6	196°24.2	17.4	192°41.1	06.5	303°18.2	37.3	1°34.4	27.4
5	355°58.1	211°25.4	16.6	207°42.1	06.0	318°20.2	37.4	16°36.9	27.4
6	11°00.5	226°26.5	N14°15.8	222°43.1	N14°05.4	333°22.3	N13°37.6	31°39.4	S10°27.5
7	26°03.0	241°27.6	15.0	237°44.1	04.9	348°24.3	37.7	46°41.9	27.5
8	41°05.5	256°28.8	14.2	252°45.2	04.4	3°26.4	37.8	61°44.5	27.5
9	56°07.9	271°29.9	·· 13.4	267°46.2	·· 03.8	18°28.4	·· 37.9	76°47.0	·· 27.6
10	71°10.4	286°31.1	12.6	282°47.2	03.3	33°30.5	38.1	91°49.5	27.6
11	86°12.9	301°32.2	11.8	297°48.2	02.8	48°32.5	38.2	106°52.0	27.6
12	101°15.3	316°33.4	N14°11.0	312°49.2	N14°02.2	63°34.6	N13°38.3	121°54.5	S10°27.7
13	116°17.8	331°34.6	10.2	327°50.2	01.7	78°36.6	38.4	136°57.1	27.7
14	131°20.3	346°35.7	09.4	342°51.2	01.2	93°38.7	38.6	151°59.6	27.7
15	146°22.7	1°36.9	·· 08.6	357°52.2	·· 00.6	108°40.7	·· 38.7	167°02.1	·· 27.8
16	161°25.2	16°38.0	07.8	12°53.2	14°00.1	123°42.8	38.8	182°04.6	27.8
17	176°27.7	31°39.2	07.0	27°54.2	13°59.6	138°44.8	39.0	197°07.1	27.8
18	191°30.1	46°40.4	N14°06.1	42°55.3	N13°59.0	153°46.9	N13°39.1	212°09.7	S10°27.8
19	206°32.6	61°41.5	05.3	57°56.3	58.5	168°48.9	39.2	227°12.2	27.9
20	221°35.0	76°42.7	04.5	72°57.3	58.0	183°51.0	39.3	242°14.7	27.9
21	236°37.5	91°43.9	·· 03.7	87°58.3	·· 57.4	198°53.0	·· 39.5	257°17.2	·· 27.9
22	251°40.0	106°45.1	02.9	102°59.3	56.9	213°55.1	39.6	272°19.8	28.0
23	266°42.4	121°46.3	02.1	118°00.3	56.4	228°57.1	39.7	287°22.3	28.0
Mer.pass. 05:16		ν 1.1′	d -0.8′	m -4.68	ν 1.0′	d -0.5′	m 1.74	ν 2.0′	d 0.1′ m -2.21
								ν 2.5′	d -0.0′ m 0.71

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	281°44.9	136°47.4	N14°01.3	133°01.3	N13°55.8	243°59.2	N13°39.8	302°24.8	S10°28.0
1	296°47.4	151°48.6	14°00.5	148°02.3	55.3	259°01.2	40.0	317°27.3	28.1
2	311°49.8	166°49.8	13°59.7	163°03.3	54.8	274°03.3	40.1	332°29.8	28.1
3	326°52.3	181°51.0	·· 58.9	178°04.3	·· 54.2	289°05.3	·· 40.2	347°32.4	·· 28.1
4	341°54.8	196°52.2	58.1	193°05.4	53.7	304°07.4	40.4	2°34.9	28.2
5	356°57.2	211°53.4	57.3	208°06.4	53.2	319°09.4	40.5	17°37.4	28.2
6	11°59.7	226°54.6	N13°56.5	223°07.4	N13°52.6	334°11.5	N13°40.6	32°39.9	S10°28.2
7	27°02.2	241°55.8	55.7	238°08.4	52.1	349°13.5	40.7	47°42.5	28.3
8	42°04.6	256°57.0	54.9	253°09.4	51.6	4°15.6	40.9	62°45.0	28.3
9	57°07.1	271°58.2	·· 54.1	268°10.4	·· 51.0	19°17.6	·· 41.0	77°47.5	·· 28.3
10	72°09.5	286°59.4	53.3	283°11.4	50.5	34°19.7	41.1	92°50.0	28.4
11	87°12.0	302°00.6	52.5	298°12.4	50.0	49°21.7	41.2	107°52.6	28.4
12	102°14.5	317°01.9	N13°51.7	313°13.4	N13°49.4	64°23.8	N13°41.4	122°55.1	S10°28.4
13	117°16.9	332°03.1	50.9	328°14.5	48.9	79°25.9	41.5	137°57.6	28.5
14	132°19.4	347°04.3	50.1	343°15.5	48.4	94°27.9	41.6	153°00.1	28.5
15	147°21.9	2°05.5	·· 49.3	358°16.5	·· 47.8	109°30.0	·· 41.7	168°02.7	·· 28.5
16	162°24.3	17°06.7	48.5	13°17.5	47.3	124°32.0	41.9	183°05.2	28.6
17	177°26.8	32°08.0	47.7	28°18.5	46.7	139°34.1	42.0	198°07.7	28.6
18	192°29.3	47°09.2	N13°46.9	43°19.5	N13°46.2	154°36.1	N13°42.1	213°10.2	S10°28.6
19	207°31.7	62°10.4	46.0	58°20.5	45.7	169°38.2	42.2	228°12.8	28.7
20	222°34.2	77°11.7	45.2	73°21.5	45.1	184°40.2	42.4	243°15.3	28.7
21	237°36.7	92°12.9	·· 44.4	88°22.5	·· 44.6	199°42.3	·· 42.5	258°17.8	·· 28.7
22	252°39.1	107°14.1	43.6	103°23.6	44.1	214°44.3	42.6	273°20.3	28.8
23	267°41.6	122°15.4	42.8	118°24.6	43.5	229°46.4	42.7	288°22.9	28.8
Mer.pass. 05:12		ν 1.2′	d -0.8′	m -4.69	ν 1.0′	d -0.5′	m 1.74	ν 2.1′	d 0.1′ m -2.22
								ν 2.5′	d -0.0′ m 0.71

Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	282°44.0	137°16.6	N13°42.0	133°25.6	N13°43.0	244°48.5	N13°42.9	303°25.4	S10°28.8
1	297°46.5	152°17.9	41.2	148°26.6	42.4	259°50.5	43.0	318°27.9	28.9
2	312°49.0	167°19.1	40.4	163°27.6	41.9	274°52.6	43.1	333°30.4	28.9
3	327°51.4	182°20.4	·· 39.6	178°28.6	·· 41.4	289°54.6	·· 43.2	348°33.0	·· 28.9
4	342°53.9	197°21.6	38.8	193°29.6	40.8	304°56.7	43.4	3°35.5	29.0
5	357°56.4	212°22.9	38.0	208°30.6	40.3	319°58.7	43.5	18°38.0	29.0
6	12°58.8	227°24.2	N13°37.2	223°31.6	N13°39.8	335°00.8	N13°43.6	33°40.5	S10°29.0
7	28°01.3	242°25.4	36.4	238°32.7	39.2	350°02.9	43.7	48°43.1	29.1
8	43°03.8	257°26.7	35.7	253°33.7	38.7	5°04.9	43.9	63°45.6	29.1
9	58°06.2	272°28.0	·· 34.9	268°34.7	·· 38.1	20°07.0	·· 44.0	78°48.1	·· 29.2
10	73°08.7	287°29.2	34.1	283°35.7	37.6	35°09.0	44.1	93°50.7	29.2
11	88°11.2	302°30.5	33.3	298°36.7	37.1	50°11.1	44.2	108°53.2	29.2
12	103°13.6	317°31.8	N13°32.5	313°37.7	N13°36.5	65°13.1	N13°44.4	123°55.7	S10°29.3
13	118°16.1	332°33.0	31.7	328°38.7	36.0	80°15.2	44.5	138°58.2	29.3
14	133°18.5	347°34.3	30.9	343°39.7	35.4	95°17.3	44.6	154°00.8	29.3
15	148°21.0	2°35.6	·· 30.1	358°40.8	·· 34.9	110°19.3	·· 44.7	169°03.3	·· 29.4
16	163°23.5	17°36.9	29.3	13°41.8	34.4	125°21.4	44.9	184°05.8	29.4
17	178°25.9	32°38.2	28.5	28°42.8	33.8	140°23.4	45.0	199°08.4	29.4
18	193°28.4	47°39.5	N13°27.7	43°43.8	N13°33.3	155°25.5	N13°45.1	214°10.9	S10°29.5
19	208°30.9	62°40.8	26.9	58°44.8	32.7	170°27.6	45.2	229°13.4	29.5
20	223°33.3	77°42.1	26.1	73°45.8	32.2	185°29.6	45.4	244°15.9	29.5
21	238°35.8	92°43.4	·· 25.3	88°46.8	·· 31.7	200°31.7	·· 45.5	259°18.5	·· 29.6
22	253°38.3	107°44.7	24.5	103°47.8	31.1	215°33.7	45.6	274°21.0	29.6
23	268°40.7	122°46.0	23.7	118°48.8	30.6	230°35.8	45.7	289°23.5	29.6
Mer.pass. 05:08		ν 1.2′	d -0.8′	m -4.69	ν 1.0′	d -0.5′	m 1.75	ν 2.1′	d 0.1′ m -2.22
								ν 2.5′	d -0.0′ m 0.70

Stars

	SHA	**Dec**
Alpheratz	357°36.0	29°13.0
Ankaa	353°08.4	-42°10.5
Schedar	349°32.5	56°39.7
Diphda	348°48.6	-17°51.4
Achernar	335°21.3	-57°06.8
Hamal	327°52.7	23°34.3
Polaris	314°55.1	89°21.5
Acamar	315°13.0	-40°12.4
Menkar	314°07.7	4°10.9
Mirfak	308°30.4	49°56.5
Aldebaran	290°41.4	16°33.3
Rigel	281°05.4	-8°10.4
Capella	280°24.2	46°01.2
Bellatrix	278°24.6	6°22.3
Elnath	278°03.8	28°37.6
Alnilam	275°39.3	-1°11.2
Betelgeuse	270°53.8	7°24.7
Canopus	263°53.5	-52°42.4
Sirius	258°27.7	-16°44.8
Adhara	255°07.2	-29°00.2
Procyon	244°52.5	5°09.9
Pollux	243°19.2	27°58.2
Avior	234°15.9	-59°35.1
Suhail	222°47.6	-43°31.7
Miaplacidus	221°39.3	-69°48.9
Alphard	217°49.3	-8°45.6
Regulus	207°36.0	11°51.3
Dubhe	193°42.8	61°37.8
Denebola	182°26.3	14°26.6
Gienah	175°44.9	-17°40.4
Acrux	173°01.6	-63°14.0
Gacrux	171°53.1	-57°14.9
Alioth	166°14.0	55°50.3
Spica	158°23.6	-11°17.0
Alkaid	152°52.9	49°12.0
Hadar	148°37.6	-60°29.4
Menkent	147°59.0	-36°29.3
Arcturus	145°48.9	19°03.8
Rigil Kent.	139°41.7	-60°56.1
Kochab	137°19.1	74°03.8
Zuben'ubi	136°57.2	-16°08.4
Alphecca	126°04.6	26°38.3
Antares	112°17.1	-26°29.1
Atria	107°11.9	-69°04.3
Sabik	102°03.9	-15°45.2
Shaula	96°11.7	-37°07.3
Rasalhague	95°59.4	12°32.6
Eltanin	90°42.2	51°29.2
Kaus Aust.	83°33.8	-34°22.4
Vega	80°33.6	38°48.3
Nunki	75°48.9	-26°16.0
Altair	62°00.9	8°55.8
Peacock	53°07.2	-56°39.4
Deneb	49°26.2	45°21.7
Enif	33°39.8	9°58.9
Al Na'ir	27°34.2	-46°50.7
Fomalhaut	15°15.7	-29°29.7
Scheat	13°46.3	28°12.4
Markab	13°31.0	15°19.8

Jul 03 Mon	**SHA**	**Mer.pass**
Venus	215°33.9	14:54
Mars	211°51.3	15:09
Jupiter	322°24.2	07:46
Saturn	20°38.5	03:54

Jul 04 Tue	**SHA**	**Mer.pass**
Venus	215°02.5	14:52
Mars	211°16.4	15:07
Jupiter	322°14.3	07:43
Saturn	20°39.9	03:50

Jul 05 Wed	**SHA**	**Mer.pass**
Venus	214°32.6	14:50
Mars	210°41.5	15:05
Jupiter	322°04.4	07:40
Saturn	20°41.3	03:46

Horizontal parallax	
Venus:	0.3
Mars:	0.1

h

Mon	Sun GHA	Sun Dec	Moon GHA	ν	Moon Dec	d	HP
0	178°57.8	N22°59.7	6°08.4	1.7′	S27°50.6	0.2′	60.3′
1	193°57.7	59.5	20°29.1	1.7′	27°50.8	0.0′	60.3′
2	208°57.6	59.3	34°49.8	1.6′	27°50.8	0.2′	60.3′
3	223°57.5	·· 59.1	49°10.4	1.6′	27°50.6	0.5′	60.3′
4	238°57.4	58.9	63°31.0	1.6′	27°50.1	0.6′	60.4′
5	253°57.2	58.7	77°51.6	1.6′	27°49.5	0.9′	60.4′
6	268°57.1	N22°58.5	92°12.2	1.6′	S27°48.6	1.0′	60.4′
7	283°57.0	58.3	106°32.7	1.5′	27°47.6	1.3′	60.4′
8	298°56.9	58.1	120°53.3	1.5′	27°46.3	1.5′	60.4′
9	313°56.8	·· 57.9	135°13.8	1.5′	27°44.8	1.7′	60.5′
10	328°56.7	57.7	149°34.3	1.5′	27°43.1	1.9′	60.5′
11	343°56.6	57.5	163°54.8	1.5′	27°41.2	2.1′	60.5′
12	358°56.4	N22°57.3	178°15.4	1.5′	S27°39.1	2.4′	60.5′
13	13°56.3	57.1	192°35.9	1.5′	27°36.7	2.5′	60.5′
14	28°56.2	56.9	206°56.4	1.6′	27°34.2	2.8′	60.5′
15	43°56.1	·· 56.7	221°17.0	1.6′	27°31.4	3.0′	60.6′
16	58°56.0	56.5	235°37.6	1.6′	27°28.4	3.1′	60.6′
17	73°55.9	56.3	249°58.1	1.6′	27°25.3	3.4′	60.6′
18	88°55.8	N22°56.1	264°18.7	1.6′	S27°21.9	3.6′	60.6′
19	103°55.6	55.9	278°39.4	1.7′	27°18.3	3.9′	60.6′
20	118°55.5	55.7	293°00.0	1.7′	27°14.4	4.0′	60.6′
21	133°55.4	·· 55.5	307°20.7	1.7′	27°10.4	4.2′	60.6′
22	148°55.3	55.3	321°41.5	1.8′	27°06.2	4.4′	60.7′
23	163°55.2	55.1	336°02.2	1.8′	27°01.8	4.7′	60.7′
	SD = 15.7′	d = -0.2′		SD = 16.4′			

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	178°55.1	N22°54.8	350°23.0	1.8′	S26°57.1	4.8′	60.7′
1	193°55.0	54.6	4°43.9	1.9′	26°52.3	5.1′	60.7′
2	208°54.9	54.4	19°04.8	1.9′	26°47.2	5.3′	60.7′
3	223°54.7	·· 54.2	33°25.7	2.0′	26°41.9	5.4′	60.7′
4	238°54.6	54.0	47°46.7	2.1′	26°36.5	5.7′	60.7′
5	253°54.5	53.8	62°07.8	2.1′	26°30.8	5.8′	60.7′
6	268°54.4	N22°53.6	76°28.9	2.2′	S26°25.0	6.1′	60.7′
7	283°54.3	53.4	90°50.1	2.2′	26°18.9	6.3′	60.7′
8	298°54.2	53.1	105°11.3	2.3′	26°12.6	6.4′	60.8′
9	313°54.1	·· 52.9	119°32.6	2.4′	26°06.2	6.7′	60.8′
10	328°54.0	52.7	133°54.0	2.4′	25°59.5	6.8′	60.8′
11	343°53.9	52.5	148°15.4	2.5′	25°52.7	7.1′	60.8′
12	358°53.7	N22°52.3	162°36.9	2.6′	S25°45.6	7.2′	60.8′
13	13°53.6	52.0	176°58.5	2.7′	25°38.4	7.5′	60.8′
14	28°53.5	51.8	191°20.2	2.8′	25°30.9	7.6′	60.8′
15	43°53.4	·· 51.6	205°42.0	2.8′	25°23.3	7.8′	60.8′
16	58°53.3	51.4	220°03.8	2.9′	25°15.5	8.0′	60.8′
17	73°53.2	51.2	234°25.7	3.0′	25°07.5	8.1′	60.8′
18	88°53.1	N22°50.9	248°47.7	3.1′	S24°59.4	8.4′	60.8′
19	103°53.0	50.7	263°09.8	3.2′	24°51.0	8.5′	60.8′
20	118°52.9	50.5	277°32.0	3.3′	24°42.5	8.7′	60.8′
21	133°52.7	·· 50.3	291°54.3	3.4′	24°33.8	8.9′	60.8′
22	148°52.6	50.0	306°16.7	3.5′	24°24.9	9.1′	60.8′
23	163°52.5	49.8	320°39.2	3.6′	24°15.8	9.3′	60.8′
	SD = 15.7′	d = -0.2′		SD = 16.6′			

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	178°52.4	N22°49.6	335°01.7	3.7′	S24°06.5	9.4′	60.8′
1	193°52.3	49.4	349°24.4	3.8′	23°57.1	9.6′	60.8′
2	208°52.2	49.1	3°47.2	3.9′	23°47.5	9.7′	60.8′
3	223°52.1	·· 48.9	18°10.0	4.0′	23°37.8	9.9′	60.8′
4	238°52.0	48.7	32°33.0	4.1′	23°27.9	10.1′	60.8′
5	253°51.9	48.4	46°56.1	4.2′	23°17.8	10.3′	60.8′
6	268°51.8	N22°48.2	61°19.3	4.3′	S23°07.5	10.4′	60.8′
7	283°51.7	48.0	75°42.6	4.4′	22°57.1	10.5′	60.8′
8	298°51.6	47.8	90°06.0	4.5′	22°46.6	10.7′	60.8′
9	313°51.4	·· 47.5	104°29.5	4.6′	22°35.9	10.9′	60.8′
10	328°51.3	47.3	118°53.2	4.7′	22°25.0	11.0′	60.8′
11	343°51.2	47.1	133°16.9	4.9′	22°14.0	11.2′	60.8′
12	358°51.1	N22°46.8	147°40.8	5.0′	S22°02.8	11.3′	60.8′
13	13°51.0	46.6	162°04.7	5.1′	21°51.5	11.5′	60.8′
14	28°50.9	46.3	176°28.8	5.2′	21°40.0	11.6′	60.8′
15	43°50.8	·· 46.1	190°53.0	5.3′	21°28.4	11.8′	60.7′
16	58°50.7	45.9	205°17.3	5.4′	21°16.6	11.9′	60.7′
17	73°50.6	45.6	219°41.7	5.5′	21°04.7	12.0′	60.7′
18	88°50.5	N22°45.4	234°06.2	5.7′	S20°52.7	12.2′	60.7′
19	103°50.4	45.2	248°30.9	5.8′	20°40.5	12.3′	60.7′
20	118°50.3	44.9	262°55.7	5.9′	20°28.2	12.4′	60.7′
21	133°50.2	·· 44.7	277°20.6	6.0′	20°15.8	12.5′	60.7′
22	148°50.1	44.4	291°45.6	6.1′	20°03.3	12.7′	60.7′
23	163°49.9	44.2	306°10.7	6.2′	19°50.6	12.8′	60.7′
	SD = 15.7′	d = -0.2′		SD = 16.6′			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	▭	▭	▭	▭	▭	▭
66°	–:–	–:–	00:40	23:24	–:–	–:–
64°	–:–	–:–	01:46	22:21	–:–	–:–
62°	–:–	–:–	02:21	21:47	–:–	–:–
60°	–:–	01:10	02:45	21:23	22:56	–:–
N 58°	–:–	01:53	03:05	21:03	22:15	–:–
56°	–:–	02:20	03:21	20:47	21:48	–:–
54°	01:05	02:41	03:35	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	20:12	20:55	21:59
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	20:24
30°	04:03	04:36	05:04	19:05	19:32	20:05
20°	04:32	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	18:31	18:57
S 10°	05:29	05:55	06:18	17:51	18:14	18:40
20°	05:45	06:12	06:36	17:33	17:57	18:24
30°	06:01	06:30	06:57	17:12	17:39	18:08
35°	06:09	06:41	07:09	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	07:21	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	08:06	09:02	15:07	16:04	17:00

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

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	Moon Age 15-17 100-96%
03	04:09	04:14	12:04	–:–	12:07	○
04	04:20	04:25	12:04	00:40	13:13	
05	04:30	04:36	12:05	01:44	14:15	

July 06, 07, 08 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	283°43.2	137°47.3	N13°22.9	133°49.9	N13°30.0	245°37.9	N13°45.9	304°26.1	S10°29.7
1	298°45.7	152°48.6	22.1	148°50.9	29.5	260°39.9	46.0	319°28.6	29.7
2	313°48.1	167°49.9	21.3	163°51.9	29.0	275°42.0	46.1	334°31.1	29.7
3	328°50.6	182°51.2	·· 20.5	178°52.9	·· 28.4	290°44.0	·· 46.2	349°33.6	·· 29.8
4	343°53.0	197°52.5	19.7	193°53.9	27.9	305°46.1	46.3	4°36.2	29.8
5	358°55.5	212°53.9	18.9	208°54.9	27.3	320°48.2	46.5	19°38.7	29.9
6	13°58.0	227°55.2	N13°18.1	223°55.9	N13°26.8	335°50.2	N13°46.6	34°41.2	S10°29.9
7	29°00.4	242°56.5	17.4	238°56.9	26.2	350°52.3	46.7	49°43.8	29.9
8	44°02.9	257°57.8	16.6	253°58.0	25.7	5°54.3	46.8	64°46.3	30.0
9	59°05.4	272°59.2	·· 15.8	268°59.0	·· 25.2	20°56.4	·· 47.0	79°48.8	·· 30.0
10	74°07.8	288°00.5	15.0	284°00.0	24.6	35°58.5	47.1	94°51.4	30.0
11	89°10.3	303°01.8	14.2	299°01.0	24.1	51°00.5	47.2	109°53.9	30.1
12	104°12.8	318°03.2	N13°13.4	314°02.0	N13°23.5	66°02.6	N13°47.3	124°56.4	S10°30.1
13	119°15.2	333°04.5	12.6	329°03.0	23.0	81°04.6	47.4	139°59.0	30.1
14	134°17.7	348°05.9	11.8	344°04.0	22.4	96°06.7	47.6	155°01.5	30.2
15	149°20.1	3°07.2	·· 11.0	359°05.0	·· 21.9	111°08.8	·· 47.7	170°04.0	·· 30.2
16	164°22.6	18°08.6	10.2	14°06.1	21.4	126°10.8	47.8	185°06.6	30.3
17	179°25.1	33°09.9	09.4	29°07.1	20.8	141°12.9	47.9	200°09.1	30.3
18	194°27.5	48°11.3	N13°08.7	44°08.1	N13°20.3	156°15.0	N13°48.1	215°11.6	S10°30.3
19	209°30.0	63°12.6	07.9	59°09.1	19.7	171°17.0	48.2	230°14.2	30.4
20	224°32.5	78°14.0	07.1	74°10.1	19.2	186°19.1	48.3	245°16.7	30.4
21	239°34.9	93°15.4	·· 06.3	89°11.1	·· 18.6	201°21.2	·· 48.4	260°19.2	·· 30.4
22	254°37.4	108°16.7	05.5	104°12.1	18.1	216°23.2	48.5	275°21.7	30.5
23	269°39.9	123°18.1	04.7	119°13.2	17.5	231°25.3	48.7	290°24.3	30.5
Mer.pass. 05:04		ν 1.3′ d -0.8′ m -4.70		ν 1.0′ d -0.5′ m 1.75		ν 2.1′ d 0.1′ m -2.22		ν 2.5′ d -0.0′ m 0.70	

Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	284°42.3	138°19.5	N13°03.9	134°14.2	N13°17.0	246°27.3	N13°48.8	305°26.8	S10°30.5
1	299°44.8	153°20.8	03.1	149°15.2	16.5	261°29.4	48.9	320°29.3	30.6
2	314°47.3	168°22.2	02.3	164°16.2	15.9	276°31.5	49.0	335°31.9	30.6
3	329°49.7	183°23.6	·· 01.6	179°17.2	·· 15.4	291°33.5	·· 49.2	350°34.4	·· 30.7
4	344°52.2	198°25.0	00.8	194°18.2	14.8	306°35.6	49.3	5°37.0	30.7
5	359°54.6	213°26.4	13°00.0	209°19.2	14.3	321°37.7	49.4	20°39.5	30.7
6	14°57.1	228°27.7	N12°59.2	224°20.2	N13°13.7	336°39.7	N13°49.5	35°42.0	S10°30.8
7	29°59.6	243°29.1	58.4	239°21.3	13.2	351°41.8	49.6	50°44.6	30.8
8	45°02.0	258°30.5	57.6	254°22.3	12.6	6°43.9	49.8	65°47.1	30.8
9	60°04.5	273°31.9	·· 56.8	269°23.3	·· 12.1	21°45.9	·· 49.9	80°49.6	·· 30.9
10	75°07.0	288°33.3	56.1	284°24.3	11.5	36°48.0	50.0	95°52.2	30.9
11	90°09.4	303°34.7	55.3	299°25.3	11.0	51°50.1	50.1	110°54.7	31.0
12	105°11.9	318°36.1	N12°54.5	314°26.3	N13°10.5	66°52.1	N13°50.2	125°57.2	S10°31.0
13	120°14.4	333°37.5	53.7	329°27.3	09.9	81°54.2	50.4	140°59.8	31.0
14	135°16.8	348°38.9	52.9	344°28.4	09.4	96°56.3	50.5	156°02.3	31.1
15	150°19.3	3°40.4	·· 52.1	359°29.4	·· 08.8	111°58.3	·· 50.6	171°04.8	·· 31.1
16	165°21.8	18°41.8	51.4	14°30.4	08.3	127°00.4	50.7	186°07.4	31.1
17	180°24.2	33°43.2	50.6	29°31.4	07.7	142°02.5	50.8	201°09.9	31.2
18	195°26.7	48°44.6	N12°49.8	44°32.4	N13°07.2	157°04.5	N13°51.0	216°12.4	S10°31.2
19	210°29.1	63°46.0	49.0	59°33.4	06.6	172°06.6	51.1	231°15.0	31.3
20	225°31.6	78°47.5	48.2	74°34.4	06.1	187°08.7	51.2	246°17.5	31.3
21	240°34.1	93°48.9	·· 47.4	89°35.4	·· 05.5	202°10.7	·· 51.3	261°20.1	·· 31.3
22	255°36.5	108°50.3	46.7	104°36.5	05.0	217°12.8	51.4	276°22.6	31.4
23	270°39.0	123°51.8	45.9	119°37.5	04.4	232°14.9	51.6	291°25.1	31.4
Mer.pass. 05:00		ν 1.4′ d -0.8′ m -4.71		ν 1.0′ d -0.5′ m 1.75		ν 2.1′ d 0.1′ m -2.23		ν 2.5′ d -0.0′ m 0.69	

Sat	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	285°41.5	138°53.2	N12°45.1	134°38.5	N13°03.9	247°17.0	N13°51.7	306°27.7	S10°31.4
1	300°43.9	153°54.6	44.3	149°39.5	03.3	262°19.0	51.8	321°30.2	31.5
2	315°46.4	168°56.1	43.5	164°40.5	02.8	277°21.1	51.9	336°32.7	31.5
3	330°48.9	183°57.5	·· 42.8	179°41.5	·· 02.2	292°23.2	·· 52.0	351°35.3	·· 31.6
4	345°51.3	198°59.0	42.0	194°42.5	01.7	307°25.2	52.2	6°37.8	31.6
5	0°53.8	214°00.4	41.2	209°43.6	01.1	322°27.3	52.3	21°40.3	31.6
6	15°56.2	229°01.9	N12°40.4	224°44.6	N13°00.6	337°29.4	N13°52.4	36°42.9	S10°31.7
7	30°58.7	244°03.3	39.7	239°45.6	13°00.0	352°31.4	52.5	51°45.4	31.7
8	46°01.2	259°04.8	38.9	254°46.6	12°59.5	7°33.5	52.6	66°48.0	31.7
9	61°03.6	274°06.3	·· 38.1	269°47.6	·· 58.9	22°35.6	·· 52.8	81°50.5	·· 31.8
10	76°06.1	289°07.7	37.3	284°48.6	58.4	37°37.7	52.9	96°53.0	31.8
11	91°08.6	304°09.2	36.6	299°49.6	57.8	52°39.7	53.0	111°55.6	31.9
12	106°11.0	319°10.7	N12°35.8	314°50.7	N12°57.3	67°41.8	N13°53.1	126°58.1	S10°31.9
13	121°13.5	334°12.1	35.0	329°51.7	56.7	82°43.9	53.2	142°00.7	31.9
14	136°16.0	349°13.6	34.2	344°52.7	56.2	97°45.9	53.3	157°03.2	32.0
15	151°18.4	4°15.1	·· 33.4	359°53.7	·· 55.6	112°48.0	·· 53.5	172°05.7	·· 32.0
16	166°20.9	19°16.6	32.7	14°54.7	55.1	127°50.1	53.6	187°08.3	32.1
17	181°23.4	34°18.0	31.9	29°55.7	54.5	142°52.2	53.7	202°10.8	32.1
18	196°25.8	49°19.5	N12°31.1	44°56.7	N12°54.0	157°54.2	N13°53.8	217°13.4	S10°32.1
19	211°28.3	64°21.0	30.4	59°57.8	53.4	172°56.3	53.9	232°15.9	32.2
20	226°30.7	79°22.5	29.6	74°58.8	52.9	187°58.4	54.1	247°18.4	32.2
21	241°33.2	94°24.0	·· 28.8	89°59.8	·· 52.3	203°00.4	·· 54.2	262°21.0	·· 32.3
22	256°35.7	109°25.5	28.0	105°00.8	51.8	218°02.5	54.3	277°23.5	32.3
23	271°38.1	124°27.0	27.3	120°01.8	51.2	233°04.6	54.4	292°26.1	32.3
Mer.pass. 04:56		ν 1.4′ d -0.8′ m -4.71		ν 1.0′ d -0.5′ m 1.75		ν 2.1′ d 0.1′ m -2.23		ν 2.5′ d -0.0′ m 0.69	

Stars

	SHA	**Dec**
Alpheratz	357°36.0	29°13.0
Ankaa	353°08.3	-42°10.5
Schedar	349°32.4	56°39.7
Diphda	348°48.5	-17°51.4
Achernar	335°21.2	-57°06.8
Hamal	327°52.7	23°34.3
Polaris	314°53.8	89°21.5
Acamar	315°12.9	-40°12.4
Menkar	314°07.6	4°10.9
Mirfak	308°30.4	49°56.5
Aldebaran	290°41.3	16°33.4
Rigel	281°05.4	-8°10.4
Capella	280°24.2	46°01.2
Bellatrix	278°24.5	6°22.3
Elnath	278°03.8	28°37.6
Alnilam	275°39.3	-1°11.2
Betelgeuse	270°53.8	7°24.7
Canopus	263°53.5	-52°42.4
Sirius	258°27.7	-16°44.8
Adhara	255°07.2	-29°00.2
Procyon	244°52.5	5°10.0
Pollux	243°19.2	27°58.2
Avior	234°15.9	-59°35.1
Suhail	222°47.6	-43°31.7
Miaplacidus	221°39.3	-69°48.9
Alphard	217°49.3	-8°45.6
Regulus	207°36.0	11°51.3
Dubhe	193°42.9	61°37.8
Denebola	182°26.3	14°26.6
Gienah	175°44.9	-17°40.4
Acrux	173°01.6	-63°14.0
Gacrux	171°53.1	-57°14.9
Alioth	166°14.1	55°50.3
Spica	158°23.6	-11°17.0
Alkaid	152°52.9	49°12.0
Hadar	148°37.6	-60°29.4
Menkent	147°59.0	-36°29.3
Arcturus	145°48.9	19°03.8
Rigil Kent.	139°41.7	-60°56.1
Kochab	137°19.2	74°03.8
Zuben'ubi	136°57.2	-16°08.4
Alphecca	126°04.6	26°38.3
Antares	112°17.1	-26°29.1
Atria	107°11.9	-69°04.3
Sabik	102°03.9	-15°45.2
Shaula	96°11.7	-37°07.3
Rasalhague	95°59.4	12°32.6
Eltanin	90°42.2	51°29.2
Kaus Aust.	83°33.8	-34°22.4
Vega	80°33.6	38°48.3
Nunki	75°48.9	-26°16.0
Altair	62°00.8	8°55.8
Peacock	53°07.1	-56°39.5
Deneb	49°26.2	45°21.7
Enif	33°39.8	9°58.9
Al Na'ir	27°34.1	-46°50.7
Fomalhaut	15°15.7	-29°29.7
Scheat	13°46.2	28°12.5
Markab	13°31.0	15°19.8

Jul 06 Thu	**SHA**	**Mer.pass**
Venus	214°04.1	14:48
Mars	210°06.7	15:04
Jupiter	321°54.7	07:36
Saturn	20°42.9	03:42

Jul 07 Fri	**SHA**	**Mer.pass**
Venus	213°37.1	14:45
Mars	209°31.8	15:02
Jupiter	321°45.0	07:33
Saturn	20°44.5	03:38

Jul 08 Sat	**SHA**	**Mer.pass**
Venus	213°11.7	14:43
Mars	208°57.0	15:00
Jupiter	321°35.5	07:30
Saturn	20°46.2	03:34

Horizontal parallax	
Venus:	0.3
Mars:	0.1

h	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°49.8	N22°43.9	320°35.9	6.3′	S19°37.8	13.0′	60.7′
1	193°49.7	43.7	335°01.3	6.5′	19°24.8	13.0′	60.6′
2	208°49.6	43.5	349°26.7	6.6′	19°11.8	13.2′	60.6′
3	223°49.5	·· 43.2	3°52.3	6.7′	18°58.6	13.2′	60.6′
4	238°49.4	43.0	18°18.0	6.8′	18°45.4	13.4′	60.6′
5	253°49.3	42.7	32°43.8	6.9′	18°32.0	13.5′	60.6′
6	268°49.2	N22°42.5	47°09.7	7.0′	S18°18.5	13.6′	60.6′
7	283°49.1	42.2	61°35.8	7.2′	18°04.9	13.8′	60.6′
8	298°49.0	42.0	76°01.9	7.3′	17°51.1	13.8′	60.5′
9	313°48.9	·· 41.7	90°28.2	7.4′	17°37.3	13.9′	60.5′
10	328°48.8	41.5	104°54.6	7.5′	17°23.4	14.0′	60.5′
11	343°48.7	41.2	119°21.1	7.6′	17°09.4	14.2′	60.5′
12	358°48.6	N22°41.0	133°47.7	7.7′	S16°55.2	14.2′	60.5′
13	13°48.5	40.7	148°14.4	7.8′	16°41.0	14.3′	60.5′
14	28°48.4	40.5	162°41.3	7.9′	16°26.7	14.4′	60.4′
15	43°48.3	·· 40.2	177°08.2	8.1′	16°12.3	14.5′	60.4′
16	58°48.2	40.0	191°35.3	8.2′	15°57.8	14.5′	60.4′
17	73°48.1	39.7	206°02.4	8.3′	15°43.3	14.7′	60.4′
18	88°48.0	N22°39.5	220°29.7	8.4′	S15°28.6	14.7′	60.4′
19	103°47.9	39.2	234°57.1	8.5′	15°13.9	14.9′	60.4′
20	118°47.8	38.9	249°24.6	8.6′	14°59.0	14.9′	60.3′
21	133°47.7	·· 38.7	263°52.2	8.7′	14°44.1	14.9′	60.3′
22	148°47.6	38.4	278°19.9	8.8′	14°29.2	15.1′	60.3′
23	163°47.5	38.2	292°47.7	8.9′	14°14.1	15.1′	60.3′
	SD = 15.7′	d = -0.2′	SD = 16.5′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°47.3	N22°37.9	307°15.6	9.0′	S13°59.0	15.2′	60.3′
1	193°47.2	37.6	321°43.6	9.1′	13°43.8	15.3′	60.2′
2	208°47.1	37.4	336°11.7	9.2′	13°28.5	15.3′	60.2′
3	223°47.0	·· 37.1	350°39.9	9.3′	13°13.2	15.4′	60.2′
4	238°46.9	36.9	5°08.3	9.4′	12°57.8	15.4′	60.2′
5	253°46.8	36.6	19°36.7	9.5′	12°42.4	15.5′	60.1′
6	268°46.7	N22°36.3	34°05.2	9.6′	S12°26.9	15.6′	60.1′
7	283°46.6	36.1	48°33.8	9.7′	12°11.3	15.6′	60.1′
8	298°46.5	35.8	63°02.5	9.8′	11°55.7	15.7′	60.1′
9	313°46.4	·· 35.5	77°31.3	9.9′	11°40.0	15.7′	60.1′
10	328°46.3	35.3	92°00.1	10.0′	11°24.3	15.8′	60.0′
11	343°46.2	35.0	106°29.1	10.1′	11°08.5	15.8′	60.0′
12	358°46.1	N22°34.7	120°58.2	10.2′	S10°52.7	15.9′	60.0′
13	13°46.0	34.5	135°27.3	10.2′	10°36.8	15.9′	60.0′
14	28°45.9	34.2	149°56.6	10.3′	10°20.9	16.0′	59.9′
15	43°45.8	·· 33.9	164°25.9	10.4′	10°04.9	16.0′	59.9′
16	58°45.7	33.7	178°55.3	10.5′	09°48.9	16.0′	59.9′
17	73°45.6	33.4	193°24.8	10.6′	09°32.9	16.1′	59.9′
18	88°45.5	N22°33.1	207°54.4	10.7′	S09°16.8	16.1′	59.8′
19	103°45.4	32.8	222°24.0	10.7′	09°00.7	16.2′	59.8′
20	118°45.3	32.6	236°53.7	10.8′	08°44.5	16.2′	59.8′
21	133°45.2	·· 32.3	251°23.6	10.9′	08°28.3	16.2′	59.8′
22	148°45.1	32.0	265°53.4	11.0′	08°12.1	16.2′	59.7′
23	163°45.0	31.8	280°23.4	11.0′	07°55.9	16.3′	59.7′
	SD = 15.7′	d = -0.3′	SD = 16.4′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°44.9	N22°31.5	294°53.5	11.1′	S07°39.6	16.3′	59.7′
1	193°44.8	31.2	309°23.6	11.2′	07°23.3	16.3′	59.6′
2	208°44.7	30.9	323°53.7	11.3′	07°07.0	16.3′	59.6′
3	223°44.6	·· 30.6	338°24.0	11.3′	06°50.7	16.4′	59.6′
4	238°44.6	30.4	352°54.3	11.4′	06°34.3	16.3′	59.6′
5	253°44.5	30.1	7°24.7	11.5′	06°18.0	16.4′	59.5′
6	268°44.4	N22°29.8	21°55.2	11.5′	S06°01.6	16.4′	59.5′
7	283°44.3	29.5	36°25.7	11.6′	05°45.2	16.4′	59.5′
8	298°44.2	29.2	50°56.3	11.6′	05°28.8	16.5′	59.5′
9	313°44.1	·· 29.0	65°26.9	11.7′	05°12.3	16.4′	59.4′
10	328°44.0	28.7	79°57.6	11.8′	04°55.9	16.5′	59.4′
11	343°43.9	28.4	94°28.4	11.8′	04°39.4	16.4′	59.4′
12	358°43.8	N22°28.1	108°59.2	11.9′	S04°23.0	16.5′	59.3′
13	13°43.7	27.8	123°30.0	11.9′	04°06.5	16.4′	59.3′
14	28°43.6	27.5	138°01.0	12.0′	03°50.1	16.5′	59.3′
15	43°43.5	·· 27.3	152°32.0	12.0′	03°33.6	16.5′	59.2′
16	58°43.4	27.0	167°03.0	12.1′	03°17.1	16.4′	59.2′
17	73°43.3	26.7	181°34.1	12.1′	03°00.7	16.5′	59.2′
18	88°43.2	N22°26.4	196°05.2	12.2′	S02°44.2	16.4′	59.2′
19	103°43.1	26.1	210°36.4	12.2′	02°27.8	16.5′	59.1′
20	118°43.0	25.8	225°07.6	12.3′	02°11.3	16.4′	59.1′
21	133°42.9	·· 25.5	239°38.9	12.3′	01°54.9	16.5′	59.1′
22	148°42.8	25.2	254°10.2	12.4′	01°38.4	16.4′	59.0′
23	163°42.7	24.9	268°41.5	12.4′	01°22.0	16.4′	59.0′
	SD = 15.7′	d = -0.3′	SD = 16.3′				

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

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

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 91-73%
06	04:41	04:46	12:05	02:44	15:12	
07	04:51	04:55	12:05	03:39	16:04	
08	05:00	05:05	12:05	04:29	16:54	

July 09, 10, 11 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	286°40.6	139°28.5	N12°26.5	135°02.8	N12°50.7	248°06.7	N13°54.5	307°28.6	S10°32.4
1	301°43.1	154°30.0	25.7	150°03.9	50.1	263°08.7	54.6	322°31.1	32.4
2	316°45.5	169°31.5	25.0	165°04.9	49.6	278°10.8	54.8	337°33.7	32.5
3	331°48.0	184°33.1	·· 24.2	180°05.9	·· 49.0	293°12.9	·· 54.9	352°36.2	·· 32.5
4	346°50.5	199°34.6	23.4	195°06.9	48.5	308°15.0	55.0	7°38.8	32.5
5	1°52.9	214°36.1	22.6	210°07.9	47.9	323°17.0	55.1	22°41.3	32.6
6	16°55.4	229°37.6	N12°21.9	225°08.9	N12°47.4	338°19.1	N13°55.2	37°43.8	S10°32.6
7	31°57.9	244°39.1	21.1	240°09.9	46.8	353°21.2	55.3	52°46.4	32.7
8	47°00.3	259°40.7	20.3	255°11.0	46.3	8°23.3	55.5	67°48.9	32.7
9	62°02.8	274°42.2	·· 19.6	270°12.0	·· 45.7	23°25.3	·· 55.6	82°51.5	·· 32.7
10	77°05.2	289°43.7	18.8	285°13.0	45.2	38°27.4	55.7	97°54.0	32.8
11	92°07.7	304°45.3	18.0	300°14.0	44.6	53°29.5	55.8	112°56.5	32.8
12	107°10.2	319°46.8	N12°17.3	315°15.0	N12°44.0	68°31.6	N13°55.9	127°59.1	S10°32.9
13	122°12.6	334°48.3	16.5	330°16.0	43.5	83°33.6	56.1	143°01.6	32.9
14	137°15.1	349°49.9	15.7	345°17.0	42.9	98°35.7	56.2	158°04.2	32.9
15	152°17.6	4°51.4	·· 15.0	0°18.1	·· 42.4	113°37.8	·· 56.3	173°06.7	·· 33.0
16	167°20.0	19°53.0	14.2	15°19.1	41.8	128°39.9	56.4	188°09.3	33.0
17	182°22.5	34°54.5	13.4	30°20.1	41.3	143°41.9	56.5	203°11.8	33.1
18	197°25.0	49°56.1	N12°12.7	45°21.1	N12°40.7	158°44.0	N13°56.6	218°14.3	S10°33.1
19	212°27.4	64°57.6	11.9	60°22.1	40.2	173°46.1	56.7	233°16.9	33.1
20	227°29.9	79°59.2	11.1	75°23.1	39.6	188°48.2	56.9	248°19.4	33.2
21	242°32.3	95°00.8	·· 10.4	90°24.2	·· 39.1	203°50.3	·· 57.0	263°22.0	·· 33.2
22	257°34.8	110°02.3	09.6	105°25.2	38.5	218°52.3	57.1	278°24.5	33.3
23	272°37.3	125°03.9	08.9	120°26.2	37.9	233°54.4	57.2	293°27.1	33.3
Mer.pass. 04:52		ν 1.5′	d -0.8′	m -4.72	ν 1.0′	d -0.6′	m 1.76	ν 2.1′	d 0.1′	m -2.24	ν 2.5′	d -0.0′	m 0.68

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	287°39.7	140°05.5	N12°08.1	135°27.2	N12°37.4	248°56.5	N13°57.3	308°29.6	S10°33.3
1	302°42.2	155°07.1	07.3	150°28.2	36.8	263°58.6	57.4	323°32.2	33.4
2	317°44.7	170°08.6	06.6	165°29.2	36.3	279°00.7	57.6	338°34.7	33.4
3	332°47.1	185°10.2	·· 05.8	180°30.2	·· 35.7	294°02.7	·· 57.7	353°37.2	·· 33.5
4	347°49.6	200°11.8	05.1	195°31.3	35.2	309°04.8	57.8	8°39.8	33.5
5	2°52.1	215°13.4	04.3	210°32.3	34.6	324°06.9	57.9	23°42.3	33.5
6	17°54.5	230°15.0	N12°03.5	225°33.3	N12°34.1	339°09.0	N13°58.0	38°44.9	S10°33.6
7	32°57.0	245°16.6	02.8	240°34.3	33.5	354°11.0	58.1	53°47.4	33.6
8	47°59.5	260°18.2	02.0	255°35.3	32.9	9°13.1	58.3	68°50.0	33.7
9	63°01.9	275°19.8	·· 01.3	270°36.3	·· 32.4	24°15.2	·· 58.4	83°52.5	·· 33.7
10	78°04.4	290°21.4	12°00.5	285°37.4	31.8	39°17.3	58.5	98°55.1	33.7
11	93°06.8	305°23.0	11°59.8	300°38.4	31.3	54°19.4	58.6	113°57.6	33.8
12	108°09.3	320°24.6	N11°59.0	315°39.4	N12°30.7	69°21.4	N13°58.7	129°00.1	S10°33.8
13	123°11.8	335°26.2	58.2	330°40.4	30.2	84°23.5	58.8	144°02.7	33.9
14	138°14.2	350°27.8	57.5	345°41.4	29.6	99°25.6	58.9	159°05.2	33.9
15	153°16.7	5°29.4	·· 56.7	0°42.4	·· 29.0	114°27.7	·· 59.1	174°07.8	·· 34.0
16	168°19.2	20°31.1	56.0	15°43.5	28.5	129°29.8	59.2	189°10.3	34.0
17	183°21.6	35°32.7	55.2	30°44.5	27.9	144°31.9	59.3	204°12.9	34.0
18	198°24.1	50°34.3	N11°54.5	45°45.5	N12°27.4	159°33.9	N13°59.4	219°15.4	S10°34.1
19	213°26.6	65°35.9	53.7	60°46.5	26.8	174°36.0	59.5	234°18.0	34.1
20	228°29.0	80°37.6	53.0	75°47.5	26.3	189°38.1	59.6	249°20.5	34.2
21	243°31.5	95°39.2	·· 52.2	90°48.5	·· 25.7	204°40.2	·· 59.7	264°23.1	·· 34.2
22	258°34.0	110°40.9	51.5	105°49.6	25.1	219°42.3	13°59.9	279°25.6	34.2
23	273°36.4	125°42.5	50.7	120°50.6	24.6	234°44.3	14°00.0	294°28.2	34.3
Mer.pass. 04:49		ν 1.6′	d -0.8′	m -4.72	ν 1.0′	d -0.6′	m 1.76	ν 2.1′	d 0.1′	m -2.24	ν 2.5′	d -0.0′	m 0.68

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	288°38.9	140°44.1	N11°50.0	135°51.6	N12°24.0	249°46.4	N14°00.1	309°30.7	S10°34.3
1	303°41.3	155°45.8	49.2	150°52.6	23.5	264°48.5	00.2	324°33.3	34.4
2	318°43.8	170°47.4	48.5	165°53.6	22.9	279°50.6	00.3	339°35.8	34.4
3	333°46.3	185°49.1	·· 47.7	180°54.6	·· 22.3	294°52.7	·· 00.4	354°38.4	·· 34.5
4	348°48.7	200°50.7	47.0	195°55.7	21.8	309°54.8	00.5	9°40.9	34.5
5	3°51.2	215°52.4	46.2	210°56.7	21.2	324°56.8	00.7	24°43.4	34.5
6	18°53.7	230°54.1	N11°45.5	225°57.7	N12°20.7	339°58.9	N14°00.8	39°46.0	S10°34.6
7	33°56.1	245°55.7	44.7	240°58.7	20.1	355°01.0	00.9	54°48.5	34.6
8	48°58.6	260°57.4	44.0	255°59.7	19.5	10°03.1	01.0	69°51.1	34.7
9	64°01.1	275°59.1	·· 43.2	271°00.7	·· 19.0	25°05.2	·· 01.1	84°53.6	·· 34.7
10	79°03.5	291°00.8	42.5	286°01.7	18.4	40°07.3	01.2	99°56.2	34.8
11	94°06.0	306°02.4	41.7	301°02.8	17.9	55°09.4	01.3	114°58.7	34.8
12	109°08.4	321°04.1	N11°41.0	316°03.8	N12°17.3	70°11.4	N14°01.4	130°01.3	S10°34.8
13	124°10.9	336°05.8	40.2	331°04.8	16.7	85°13.5	01.6	145°03.8	34.9
14	139°13.4	351°07.5	39.5	346°05.8	16.2	100°15.6	01.7	160°06.4	34.9
15	154°15.8	6°09.2	·· 38.7	1°06.8	·· 15.6	115°17.7	·· 01.8	175°08.9	·· 35.0
16	169°18.3	21°10.9	38.0	16°07.8	15.1	130°19.8	01.9	190°11.5	35.0
17	184°20.8	36°12.6	37.3	31°08.9	14.5	145°21.9	02.0	205°14.0	35.1
18	199°23.2	51°14.3	N11°36.5	46°09.9	N12°13.9	160°24.0	N14°02.1	220°16.6	S10°35.1
19	214°25.7	66°16.0	35.8	61°10.9	13.4	175°26.0	02.2	235°19.1	35.1
20	229°28.2	81°17.7	35.0	76°11.9	12.8	190°28.1	02.3	250°21.7	35.2
21	244°30.6	96°19.4	·· 34.3	91°12.9	·· 12.3	205°30.2	·· 02.5	265°24.2	·· 35.2
22	259°33.1	111°21.1	33.6	106°14.0	11.7	220°32.3	02.6	280°26.8	35.3
23	274°35.6	126°22.8	32.8	121°15.0	11.1	235°34.4	02.7	295°29.3	35.3
Mer.pass. 04:45		ν 1.6′	d -0.8′	m -4.73	ν 1.0′	d -0.6′	m 1.76	ν 2.1′	d 0.1′	m -2.25	ν 2.5′	d -0.0′	m 0.67

Stars

	SHA	**Dec**
Alpheratz	357°36.0	29°13.0
Ankaa	353°08.3	-42°10.5
Schedar	349°32.4	56°39.7
Diphda	348°48.5	-17°51.4
Achernar	335°21.2	-57°06.8
Hamal	327°52.7	23°34.3
Polaris	314°52.5	89°21.5
Acamar	315°12.9	-40°12.4
Menkar	314°07.6	4°10.9
Mirfak	308°30.3	49°56.5
Aldebaran	290°41.3	16°33.4
Rigel	281°05.4	-8°10.4
Capella	280°24.2	46°01.2
Bellatrix	278°24.5	6°22.3
Elnath	278°03.8	28°37.6
Alnilam	275°39.3	-1°11.2
Betelgeuse	270°53.8	7°24.7
Canopus	263°53.5	-52°42.4
Sirius	258°27.7	-16°44.8
Adhara	255°07.2	-29°00.2
Procyon	244°52.5	5°10.0
Pollux	243°19.2	27°58.2
Avior	234°15.9	-59°35.1
Suhail	222°47.6	-43°31.7
Miaplacidus	221°39.4	-69°48.9
Alphard	217°49.3	-8°45.6
Regulus	207°36.0	11°51.3
Dubhe	193°42.9	61°37.8
Denebola	182°26.3	14°26.6
Gienah	175°44.9	-17°40.4
Acrux	173°01.6	-63°14.0
Gacrux	171°53.1	-57°14.9
Alioth	166°14.1	55°50.3
Spica	158°23.6	-11°17.0
Alkaid	152°52.9	49°12.1
Hadar	148°37.6	-60°29.4
Menkent	147°59.0	-36°29.3
Arcturus	145°48.9	19°03.8
Rigil Kent.	139°41.8	-60°56.1
Kochab	137°19.2	74°03.8
Zuben'ubi	136°57.2	-16°08.4
Alphecca	126°04.6	26°38.3
Antares	112°17.1	-26°29.1
Atria	107°11.9	-69°04.3
Sabik	102°03.9	-15°45.2
Shaula	96°11.7	-37°07.3
Rasalhague	95°59.4	12°32.6
Eltanin	90°42.2	51°29.2
Kaus Aust.	83°33.8	-34°22.4
Vega	80°33.6	38°48.3
Nunki	75°48.9	-26°16.0
Altair	62°00.8	8°55.8
Peacock	53°07.1	-56°39.5
Deneb	49°26.2	45°21.7
Enif	33°39.8	9°58.9
Al Na'ir	27°34.1	-46°50.7
Fomalhaut	15°15.7	-29°29.7
Scheat	13°46.2	28°12.5
Markab	13°31.0	15°19.8

Jul 09 Sun	**SHA**	**Mer.pass**
Venus	212°47.9	14:41
Mars	208°22.2	14:59
Jupiter	321°26.1	07:27
Saturn	20°48.0	03:30

Jul 10 Mon	**SHA**	**Mer.pass**
Venus	212°25.7	14:38
Mars	207°47.5	14:57
Jupiter	321°16.8	07:23
Saturn	20°49.9	03:25

Jul 11 Tue	**SHA**	**Mer.pass**
Venus	212°05.3	14:35
Mars	207°12.7	14:56
Jupiter	321°07.6	07:20
Saturn	20°51.8	03:21

Horizontal parallax	
Venus:	0.3
Mars:	0.1

h	Sun		Moon				
Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°42.6	N22°24.7	283°12.9	12.4′	S01°05.6	16.4′	59.0′
1	193°42.5	24.4	297°44.3	12.5′	00°49.2	16.4′	58.9′
2	208°42.4	24.1	312°15.8	12.5′	00°32.8	16.4′	58.9′
3	223°42.3	·· 23.8	326°47.3	12.5′	00°16.4	16.4′	58.9′
4	238°42.3	23.5	341°18.9	12.6′	S00°00.0	16.3′	58.9′
5	253°42.2	23.2	355°50.4	12.6′	N00°16.3	16.4′	58.8′
6	268°42.1	N22°22.9	10°22.0	12.6′	N00°32.7	16.3′	58.8′
7	283°42.0	22.6	24°53.7	12.7′	00°49.0	16.3′	58.8′
8	298°41.9	22.3	39°25.3	12.7′	01°05.3	16.2′	58.7′
9	313°41.8	·· 22.0	53°57.0	12.7′	01°21.5	16.3′	58.7′
10	328°41.7	21.7	68°28.7	12.7′	01°37.8	16.2′	58.7′
11	343°41.6	21.4	83°00.5	12.8′	01°54.0	16.2′	58.6′
12	358°41.5	N22°21.1	97°32.2	12.8′	N02°10.2	16.1′	58.6′
13	13°41.4	20.8	112°04.0	12.8′	02°26.3	16.2′	58.6′
14	28°41.3	20.5	126°35.8	12.8′	02°42.5	16.1′	58.5′
15	43°41.2	·· 20.2	141°07.6	12.8′	02°58.6	16.0′	58.5′
16	58°41.1	19.9	155°39.5	12.9′	03°14.6	16.1′	58.5′
17	73°41.0	19.6	170°11.3	12.9′	03°30.7	16.0′	58.5′
18	88°41.0	N22°19.3	184°43.2	12.9′	N03°46.7	15.9′	58.4′
19	103°40.9	19.0	199°15.1	12.9′	04°02.6	16.0′	58.4′
20	118°40.8	18.7	213°47.0	12.9′	04°18.6	15.9′	58.4′
21	133°40.7	·· 18.4	228°18.9	12.9′	04°34.5	15.8′	58.3′
22	148°40.6	18.1	242°50.8	12.9′	04°50.3	15.8′	58.3′
23	163°40.5	17.8	257°22.8	12.9′	05°06.1	15.8′	58.3′
	SD = 15.7′	d = -0.3′	SD = 16.1′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°40.4	N22°17.4	271°54.7	12.9′	N05°21.9	15.8′	58.2′
1	193°40.3	17.1	286°26.7	13.0′	05°37.7	15.6′	58.2′
2	208°40.2	16.8	300°58.6	13.0′	05°53.3	15.7′	58.2′
3	223°40.1	·· 16.5	315°30.6	13.0′	06°09.0	15.6′	58.1′
4	238°40.1	16.2	330°02.5	13.0′	06°24.6	15.5′	58.1′
5	253°40.0	15.9	344°34.5	13.0′	06°40.1	15.6′	58.1′
6	268°39.9	N22°15.6	359°06.5	13.0′	N06°55.7	15.4′	58.1′
7	283°39.8	15.3	13°38.4	13.0′	07°11.1	15.4′	58.0′
8	298°39.7	15.0	28°10.4	13.0′	07°26.5	15.4′	58.0′
9	313°39.6	·· 14.6	42°42.3	12.9′	07°41.9	15.3′	58.0′
10	328°39.5	14.3	57°14.3	12.9′	07°57.2	15.2′	57.9′
11	343°39.4	14.0	71°46.2	12.9′	08°12.4	15.2′	57.9′
12	358°39.3	N22°13.7	86°18.1	12.9′	N08°27.6	15.2′	57.9′
13	13°39.3	13.4	100°50.1	12.9′	08°42.8	15.1′	57.8′
14	28°39.2	13.1	115°22.0	12.9′	08°57.9	15.0′	57.8′
15	43°39.1	·· 12.7	129°53.9	12.9′	09°12.9	15.0′	57.8′
16	58°39.0	12.4	144°25.8	12.9′	09°27.9	14.9′	57.7′
17	73°38.9	12.1	158°57.7	12.9′	09°42.8	14.8′	57.7′
18	88°38.8	N22°11.8	173°29.5	12.9′	N09°57.6	14.8′	57.7′
19	103°38.7	11.5	188°01.4	12.8′	10°12.4	14.7′	57.7′
20	118°38.6	11.1	202°33.2	12.8′	10°27.1	14.7′	57.6′
21	133°38.6	·· 10.8	217°05.1	12.8′	10°41.8	14.6′	57.6′
22	148°38.5	10.5	231°36.9	12.8′	10°56.4	14.5′	57.6′
23	163°38.4	10.2	246°08.6	12.8′	11°10.9	14.5′	57.5′
	SD = 15.7′	d = -0.3′	SD = 15.9′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°38.3	N22°09.9	260°40.4	12.7′	N11°25.4	14.4′	57.5′
1	193°38.2	09.5	275°12.1	12.7′	11°39.8	14.3′	57.5′
2	208°38.1	09.2	289°43.9	12.7′	11°54.1	14.3′	57.4′
3	223°38.0	·· 08.9	304°15.6	12.7′	12°08.4	14.2′	57.4′
4	238°38.0	08.5	318°47.2	12.6′	12°22.6	14.1′	57.4′
5	253°37.9	08.2	333°18.9	12.6′	12°36.7	14.0′	57.4′
6	268°37.8	N22°07.9	347°50.5	12.6′	N12°50.7	14.0′	57.3′
7	283°37.7	07.6	2°22.1	12.6′	13°04.7	13.9′	57.3′
8	298°37.6	07.2	16°53.7	12.5′	13°18.6	13.8′	57.3′
9	313°37.5	·· 06.9	31°25.2	12.5′	13°32.4	13.7′	57.2′
10	328°37.4	06.6	45°56.7	12.5′	13°46.1	13.7′	57.2′
11	343°37.4	06.2	60°28.2	12.4′	13°59.8	13.6′	57.2′
12	358°37.3	N22°05.9	74°59.6	12.4′	N14°13.4	13.5′	57.2′
13	13°37.2	05.6	89°31.1	12.4′	14°26.9	13.4′	57.1′
14	28°37.1	05.2	104°02.4	12.3′	14°40.3	13.3′	57.1′
15	43°37.0	·· 04.9	118°33.8	12.3′	14°53.6	13.3′	57.1′
16	58°36.9	04.6	133°05.1	12.3′	15°06.9	13.2′	57.0′
17	73°36.9	04.2	147°36.4	12.2′	15°20.1	13.1′	57.0′
18	88°36.8	N22°03.9	162°07.6	12.2′	N15°33.2	13.0′	57.0′
19	103°36.7	03.6	176°38.8	12.2′	15°46.2	12.9′	57.0′
20	118°36.6	03.2	191°10.0	12.1′	15°59.1	12.8′	56.9′
21	133°36.5	·· 02.9	205°41.1	12.1′	16°11.9	12.7′	56.9′
22	148°36.4	02.6	220°12.2	12.1′	16°24.6	12.7′	56.9′
23	163°36.4	02.2	234°43.3	12.0′	16°37.3	12.6′	56.8′
	SD = 15.7′	d = -0.3′	SD = 15.7′				

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

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

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 21-23 62-40%
09	05:09	05:14	12:05	05:17	17:41	
10	05:18	05:23	12:05	06:04	18:27	
11	05:27	05:31	12:06	06:50	19:14	

July 12, 13, 14 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	289°38.0	141°24.5	N11°32.1	136°16.0	N12°10.6	250°36.5	N14°02.8	310°31.9	S10°35.4
1	304°40.5	156°26.2	31.3	151°17.0	10.0	265°38.6	02.9	325°34.4	35.4
2	319°42.9	171°28.0	30.6	166°18.0	09.4	280°40.7	03.0	340°37.0	35.4
3	334°45.4	186°29.7	·· 29.9	181°19.0	·· 08.9	295°42.7	·· 03.1	355°39.5	·· 35.5
4	349°47.9	201°31.4	29.1	196°20.1	08.3	310°44.8	03.2	10°42.1	35.5
5	4°50.3	216°33.2	28.4	211°21.1	07.8	325°46.9	03.4	25°44.7	35.6
6	19°52.8	231°34.9	N11°27.7	226°22.1	N12°07.2	340°49.0	N14°03.5	40°47.2	S10°35.6
7	34°55.3	246°36.6	26.9	241°23.1	06.6	355°51.1	03.6	55°49.8	35.7
8	49°57.7	261°38.4	26.2	256°24.1	06.1	10°53.2	03.7	70°52.3	35.7
9	65°00.2	276°40.1	·· 25.5	271°25.1	·· 05.5	25°55.3	·· 03.8	85°54.9	·· 35.7
10	80°02.7	291°41.9	24.7	286°26.2	04.9	40°57.4	03.9	100°57.4	35.8
11	95°05.1	306°43.6	24.0	301°27.2	04.4	55°59.5	04.0	116°00.0	35.8
12	110°07.6	321°45.4	N11°23.3	316°28.2	N12°03.8	71°01.6	N14°04.1	131°02.5	S10°35.9
13	125°10.1	336°47.1	22.5	331°29.2	03.2	86°03.6	04.2	146°05.1	35.9
14	140°12.5	351°48.9	21.8	346°30.2	02.7	101°05.7	04.4	161°07.6	36.0
15	155°15.0	6°50.7	·· 21.1	1°31.2	·· 02.1	116°07.8	·· 04.5	176°10.2	·· 36.0
16	170°17.4	21°52.4	20.3	16°32.3	01.6	131°09.9	04.6	191°12.7	36.1
17	185°19.9	36°54.2	19.6	31°33.3	01.0	146°12.0	04.7	206°15.3	36.1
18	200°22.4	51°56.0	N11°18.9	46°34.3	N12°00.4	161°14.1	N14°04.8	221°17.8	S10°36.1
19	215°24.8	66°57.8	18.1	61°35.3	11°59.9	176°16.2	04.9	236°20.4	36.2
20	230°27.3	81°59.5	17.4	76°36.3	59.3	191°18.3	05.0	251°22.9	36.2
21	245°29.8	97°01.3	·· 16.7	91°37.3	·· 58.7	206°20.4	·· 05.1	266°25.5	·· 36.3
22	260°32.2	112°03.1	16.0	106°38.4	58.2	221°22.5	05.2	281°28.1	36.3
23	275°34.7	127°04.9	15.2	121°39.4	57.6	236°24.6	05.4	296°30.6	36.4
Mer.pass. 04:41		ν 1.7′	d -0.7′	m -4.73	ν 1.0′	d -0.6′	m 1.76	ν 2.1′	d 0.1′ m -2.25
								ν 2.6′	d -0.0′ m 0.67

Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	290°37.2	142°06.7	N11°14.5	136°40.4	N11°57.0	251°26.7	N14°05.5	311°33.2	S10°36.4
1	305°39.6	157°08.5	13.8	151°41.4	56.5	266°28.7	05.6	326°35.7	36.5
2	320°42.1	172°10.3	13.1	166°42.4	55.9	281°30.8	05.7	341°38.3	36.5
3	335°44.5	187°12.1	·· 12.3	181°43.5	·· 55.3	296°32.9	·· 05.8	356°40.8	·· 36.5
4	350°47.0	202°13.9	11.6	196°44.5	54.8	311°35.0	05.9	11°43.4	36.6
5	5°49.5	217°15.7	10.9	211°45.5	54.2	326°37.1	06.0	26°45.9	36.6
6	20°51.9	232°17.5	N11°10.2	226°46.5	N11°53.6	341°39.2	N14°06.1	41°48.5	S10°36.7
7	35°54.4	247°19.3	09.4	241°47.5	53.1	356°41.3	06.2	56°51.0	36.7
8	50°56.9	262°21.1	08.7	256°48.5	52.5	11°43.4	06.3	71°53.6	36.8
9	65°59.3	277°23.0	·· 08.0	271°49.6	·· 51.9	26°45.5	·· 06.5	86°56.2	·· 36.8
10	81°01.8	292°24.8	07.3	286°50.6	51.4	41°47.6	06.6	101°58.7	36.9
11	96°04.3	307°26.6	06.6	301°51.6	50.8	56°49.7	06.7	117°01.3	36.9
12	111°06.7	322°28.4	N11°05.8	316°52.6	N11°50.2	71°51.8	N14°06.8	132°03.8	S10°36.9
13	126°09.2	337°30.3	05.1	331°53.6	49.7	86°53.9	06.9	147°06.4	37.0
14	141°11.7	352°32.1	04.4	346°54.6	49.1	101°56.0	07.0	162°08.9	37.0
15	156°14.1	7°34.0	·· 03.7	1°55.7	·· 48.5	116°58.1	·· 07.1	177°11.5	·· 37.1
16	171°16.6	22°35.8	03.0	16°56.7	48.0	132°00.2	07.2	192°14.0	37.1
17	186°19.0	37°37.7	02.3	31°57.7	47.4	147°02.3	07.3	207°16.6	37.2
18	201°21.5	52°39.5	N11°01.5	46°58.7	N11°46.8	162°04.4	N14°07.4	222°19.2	S10°37.2
19	216°24.0	67°41.4	00.8	61°59.7	46.3	177°06.5	07.5	237°21.7	37.3
20	231°26.4	82°43.2	11°00.1	77°00.8	45.7	192°08.6	07.6	252°24.3	37.3
21	246°28.9	97°45.1	10°59.4	92°01.8	·· 45.1	207°10.6	·· 07.8	267°26.8	·· 37.4
22	261°31.4	112°46.9	58.7	107°02.8	44.6	222°12.7	07.9	282°29.4	37.4
23	276°33.8	127°48.8	58.0	122°03.8	44.0	237°14.8	08.0	297°31.9	37.4
Mer.pass. 04:37		ν 1.8′	d -0.7′	m -4.73	ν 1.0′	d -0.6′	m 1.76	ν 2.1′	d 0.1′ m -2.26
								ν 2.6′	d -0.0′ m 0.66

Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	291°36.3	142°50.7	N10°57.3	137°04.8	N11°43.4	252°16.9	N14°08.1	312°34.5	S10°37.5
1	306°38.8	157°52.5	56.6	152°05.8	42.8	267°19.0	08.2	327°37.1	37.5
2	321°41.2	172°54.4	55.8	167°06.9	42.3	282°21.1	08.3	342°39.6	37.6
3	336°43.7	187°56.3	·· 55.1	182°07.9	·· 41.7	297°23.2	·· 08.4	357°42.2	·· 37.6
4	351°46.2	202°58.2	54.4	197°08.9	41.1	312°25.3	08.5	12°44.7	37.7
5	6°48.6	218°00.1	53.7	212°09.9	40.6	327°27.4	08.6	27°47.3	37.7
6	21°51.1	233°02.0	N10°53.0	227°10.9	N11°40.0	342°29.5	N14°08.7	42°49.9	S10°37.8
7	36°53.5	248°03.9	52.3	242°12.0	39.4	357°31.6	08.8	57°52.4	37.8
8	51°56.0	263°05.8	51.6	257°13.0	38.9	12°33.7	08.9	72°55.0	37.9
9	66°58.5	278°07.6	·· 50.9	272°14.0	·· 38.3	27°35.8	·· 09.1	87°57.5	·· 37.9
10	82°00.9	293°09.6	50.2	287°15.0	37.7	42°37.9	09.2	103°00.1	38.0
11	97°03.4	308°11.5	49.5	302°16.0	37.2	57°40.0	09.3	118°02.7	38.0
12	112°05.9	323°13.4	N10°48.8	317°17.0	N11°36.6	72°42.1	N14°09.4	133°05.2	S10°38.0
13	127°08.3	338°15.3	48.1	332°18.1	36.0	87°44.2	09.5	148°07.8	38.1
14	142°10.8	353°17.2	47.4	347°19.1	35.4	102°46.3	09.6	163°10.3	38.1
15	157°13.3	8°19.1	·· 46.7	2°20.1	·· 34.9	117°48.4	·· 09.7	178°12.9	·· 38.2
16	172°15.7	23°21.0	46.0	17°21.1	34.3	132°50.5	09.8	193°15.5	38.2
17	187°18.2	38°23.0	45.3	32°22.1	33.7	147°52.6	09.9	208°18.0	38.3
18	202°20.7	53°24.9	N10°44.6	47°23.2	N11°33.2	162°54.7	N14°10.0	223°20.6	S10°38.3
19	217°23.1	68°26.8	43.9	62°24.2	32.6	177°56.8	10.1	238°23.1	38.4
20	232°25.6	83°28.8	43.2	77°25.2	32.0	192°58.9	10.2	253°25.7	38.4
21	247°28.0	98°30.7	·· 42.5	92°26.2	·· 31.4	208°01.0	·· 10.3	268°28.3	·· 38.5
22	262°30.5	113°32.6	41.8	107°27.2	30.9	223°03.1	10.4	283°30.8	38.5
23	277°33.0	128°34.6	41.1	122°28.3	30.3	238°05.2	10.5	298°33.4	38.6
Mer.pass. 04:33		ν 1.9′	d -0.7′	m -4.73	ν 1.0′	d -0.6′	m 1.77	ν 2.1′	d 0.1′ m -2.26
								ν 2.6′	d -0.0′ m 0.66

Stars

	SHA	**Dec**
Alpheratz	357°35.9	29°13.1
Ankaa	353°08.3	-42°10.5
Schedar	349°32.4	56°39.7
Diphda	348°48.5	-17°51.4
Achernar	335°21.2	-57°06.8
Hamal	327°52.7	23°34.3
Polaris	314°51.0	89°21.5
Acamar	315°12.9	-40°12.4
Menkar	314°07.6	4°10.9
Mirfak	308°30.3	49°56.5
Aldebaran	290°41.3	16°33.4
Rigel	281°05.4	-8°10.4
Capella	280°24.1	46°01.2
Bellatrix	278°24.5	6°22.3
Elnath	278°03.8	28°37.6
Alnilam	275°39.3	-1°11.2
Betelgeuse	270°53.7	7°24.7
Canopus	263°53.5	-52°42.3
Sirius	258°27.7	-16°44.8
Adhara	255°07.2	-29°00.1
Procyon	244°52.5	5°10.0
Pollux	243°19.2	27°58.2
Avior	234°15.9	-59°35.1
Suhail	222°47.6	-43°31.7
Miaplacidus	221°39.4	-69°48.9
Alphard	217°49.3	-8°45.6
Regulus	207°36.0	11°51.3
Dubhe	193°42.9	61°37.8
Denebola	182°26.3	14°26.6
Gienah	175°45.0	-17°40.4
Acrux	173°01.7	-63°14.0
Gacrux	171°53.2	-57°14.9
Alioth	166°14.1	55°50.3
Spica	158°23.6	-11°17.0
Alkaid	152°52.9	49°12.1
Hadar	148°37.6	-60°29.4
Menkent	147°59.0	-36°29.3
Arcturus	145°49.0	19°03.8
Rigil Kent.	139°41.8	-60°56.2
Kochab	137°19.3	74°03.8
Zuben'ubi	136°57.2	-16°08.4
Alphecca	126°04.6	26°38.3
Antares	112°17.1	-26°29.1
Atria	107°11.9	-69°04.3
Sabik	102°03.9	-15°45.2
Shaula	96°11.7	-37°07.3
Rasalhague	95°59.4	12°32.6
Eltanin	90°42.2	51°29.2
Kaus Aust.	83°33.8	-34°22.4
Vega	80°33.6	38°48.4
Nunki	75°48.9	-26°16.0
Altair	62°00.8	8°55.8
Peacock	53°07.1	-56°39.5
Deneb	49°26.2	45°21.7
Enif	33°39.7	9°58.9
Al Na'ir	27°34.1	-46°50.7
Fomalhaut	15°15.7	-29°29.7
Scheat	13°46.2	28°12.5
Markab	13°30.9	15°19.8

Jul 12 Wed	**SHA**	**Mer.pass**
Venus	211°46.5	14:33
Mars	206°38.0	14:54
Jupiter	320°58.5	07:17
Saturn	20°53.9	03:17

Jul 13 Thu	**SHA**	**Mer.pass**
Venus	211°29.5	14:30
Mars	206°03.2	14:52
Jupiter	320°49.5	07:13
Saturn	20°56.0	03:13

Jul 14 Fri	**SHA**	**Mer.pass**
Venus	211°14.4	14:27
Mars	205°28.5	14:51
Jupiter	320°40.6	07:10
Saturn	20°58.2	03:09

Horizontal parallax	
Venus:	0.4
Mars:	0.1

h	Sun		Moon				
Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°36.3	N22°01.9	249°14.3	12.0′	N16°49.9	12.4′	56.8′
1	193°36.2	01.5	263°45.2	11.9′	17°02.3	12.4′	56.8′
2	208°36.1	01.2	278°16.2	11.9′	17°14.7	12.3′	56.8′
3	223°36.0	·· 00.9	292°47.1	11.8′	17°27.0	12.2′	56.7′
4	238°36.0	00.5	307°17.9	11.8′	17°39.2	12.1′	56.7′
5	253°35.9	22°00.2	321°48.7	11.8′	17°51.3	12.0′	56.7′
6	268°35.8	N21°59.8	336°19.5	11.7′	N18°03.3	11.9′	56.7′
7	283°35.7	59.5	350°50.2	11.7′	18°15.2	11.8′	56.6′
8	298°35.6	59.1	5°20.9	11.6′	18°27.0	11.7′	56.6′
9	313°35.6	·· 58.8	19°51.5	11.6′	18°38.7	11.6′	56.6′
10	328°35.5	58.4	34°22.1	11.5′	18°50.3	11.5′	56.5′
11	343°35.4	58.1	48°52.6	11.5′	19°01.8	11.4′	56.5′
12	358°35.3	N21°57.7	63°23.1	11.4′	N19°13.2	11.3′	56.5′
13	13°35.2	57.4	77°53.5	11.4′	19°24.5	11.2′	56.5′
14	28°35.2	57.0	92°23.9	11.4′	19°35.7	11.1′	56.4′
15	43°35.1	·· 56.7	106°54.3	11.3′	19°46.8	10.9′	56.4′
16	58°35.0	56.3	121°24.6	11.3′	19°57.7	10.9′	56.4′
17	73°34.9	56.0	135°54.9	11.2′	20°08.6	10.8′	56.4′
18	88°34.8	N21°55.6	150°25.1	11.2′	N20°19.4	10.7′	56.3′
19	103°34.8	55.3	164°55.2	11.1′	20°30.1	10.5′	56.3′
20	118°34.7	54.9	179°25.3	11.1′	20°40.6	10.5′	56.3′
21	133°34.6	·· 54.6	193°55.4	11.0′	20°51.1	10.3′	56.3′
22	148°34.5	54.2	208°25.4	11.0′	21°01.4	10.2′	56.2′
23	163°34.5	53.9	222°55.4	10.9′	21°11.6	10.1′	56.2′
	SD = 15.7′	d = -0.3′	SD = 15.5′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°34.4	N21°53.5	237°25.3	10.9′	N21°21.7	10.0′	56.2′
1	193°34.3	53.2	251°55.2	10.8′	21°31.7	9.9′	56.2′
2	208°34.2	52.8	266°25.0	10.8′	21°41.6	9.8′	56.1′
3	223°34.1	·· 52.5	280°54.8	10.7′	21°51.4	9.7′	56.1′
4	238°34.1	52.1	295°24.5	10.7′	22°01.1	9.5′	56.1′
5	253°34.0	51.7	309°54.2	10.6′	22°10.6	9.4′	56.1′
6	268°33.9	N21°51.4	324°23.8	10.6′	N22°20.0	9.3′	56.0′
7	283°33.8	51.0	338°53.4	10.5′	22°29.3	9.2′	56.0′
8	298°33.8	50.7	353°22.9	10.5′	22°38.5	9.1′	56.0′
9	313°33.7	·· 50.3	7°52.4	10.4′	22°47.6	8.9′	56.0′
10	328°33.6	49.9	22°21.8	10.4′	22°56.5	8.8′	55.9′
11	343°33.5	49.6	36°51.2	10.3′	23°05.3	8.7′	55.9′
12	358°33.5	N21°49.2	51°20.6	10.3′	N23°14.0	8.6′	55.9′
13	13°33.4	48.8	65°49.9	10.2′	23°22.6	8.5′	55.9′
14	28°33.3	48.5	80°19.1	10.2′	23°31.1	8.3′	55.9′
15	43°33.2	·· 48.1	94°48.3	10.2′	23°39.4	8.2′	55.8′
16	58°33.2	47.7	109°17.5	10.1′	23°47.6	8.1′	55.8′
17	73°33.1	47.4	123°46.6	10.1′	23°55.7	8.0′	55.8′
18	88°33.0	N21°47.0	138°15.7	10.0′	N24°03.7	7.8′	55.8′
19	103°33.0	46.6	152°44.7	10.0′	24°11.5	7.7′	55.7′
20	118°32.9	46.3	167°13.7	9.9′	24°19.2	7.6′	55.7′
21	133°32.8	·· 45.9	181°42.6	9.9′	24°26.8	7.4′	55.7′
22	148°32.7	45.5	196°11.5	9.8′	24°34.2	7.3′	55.7′
23	163°32.7	45.2	210°40.3	9.8′	24°41.5	7.2′	55.7′
	SD = 15.7′	d = -0.4′	SD = 15.3′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°32.6	N21°44.8	225°09.1	9.8′	N24°48.7	7.1′	55.6′
1	193°32.5	44.4	239°37.9	9.7′	24°55.8	6.9′	55.6′
2	208°32.4	44.0	254°06.6	9.7′	25°02.7	6.8′	55.6′
3	223°32.4	·· 43.7	268°35.3	9.6′	25°09.5	6.6′	55.6′
4	238°32.3	43.3	283°04.0	9.6′	25°16.1	6.6′	55.5′
5	253°32.2	42.9	297°32.6	9.6′	25°22.7	6.4′	55.5′
6	268°32.2	N21°42.5	312°01.1	9.5′	N25°29.1	6.2′	55.5′
7	283°32.1	42.2	326°29.7	9.5′	25°35.3	6.1′	55.5′
8	298°32.0	41.8	340°58.2	9.5′	25°41.4	6.0′	55.5′
9	313°31.9	·· 41.4	355°26.6	9.4′	25°47.4	5.9′	55.4′
10	328°31.9	41.0	9°55.1	9.4′	25°53.3	5.7′	55.4′
11	343°31.8	40.7	24°23.5	9.4′	25°59.0	5.6′	55.4′
12	358°31.7	N21°40.3	38°51.8	9.3′	N26°04.6	5.4′	55.4′
13	13°31.7	39.9	53°20.1	9.3′	26°10.0	5.3′	55.4′
14	28°31.6	39.5	67°48.4	9.3′	26°15.3	5.2′	55.3′
15	43°31.5	·· 39.1	82°16.7	9.2′	26°20.5	5.0′	55.3′
16	58°31.5	38.8	96°45.0	9.2′	26°25.5	4.9′	55.3′
17	73°31.4	38.4	111°13.2	9.2′	26°30.4	4.7′	55.3′
18	88°31.3	N21°38.0	125°41.4	9.2′	N26°35.1	4.6′	55.3′
19	103°31.3	37.6	140°09.5	9.1′	26°39.7	4.5′	55.2′
20	118°31.2	37.2	154°37.7	9.1′	26°44.2	4.3′	55.2′
21	133°31.1	·· 36.8	169°05.8	9.1′	26°48.5	4.2′	55.2′
22	148°31.1	36.5	183°33.9	9.1′	26°52.7	4.0′	55.2′
23	163°31.0	36.1	198°01.9	9.1′	26°56.7	3.9′	55.2′
	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°	–:–	–:–	01:25	22:43	–:–	–:–
64°	–:–	–:–	02:09	22:00	–:–	–:–
62°	–:–	00:27	02:38	21:32	23:33	–:–
60°	–:–	01:38	02:59	21:11	22:31	–:–
N 58°	–:–	02:11	03:17	20:54	21:59	–:–
56°	00:25	02:34	03:32	20:39	21:36	23:36
54°	01:29	02:53	03:44	20:27	21:17	22:40
52°	02:00	03:09	03:55	20:16	21:02	22:10
50°	02:23	03:22	04:05	20:06	20:48	21:48
45°	03:02	03:49	04:26	19:46	20:22	21:09
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	18:26	18:48	19:15
0°	05:14	05:40	06:02	18:09	18:32	18:58
S 10°	05:30	05:56	06:18	17:53	18:16	18:42
20°	05:45	06:12	06:35	17:36	18:00	18:27
30°	06:00	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°	06:36	07:16	07:54	16:18	16:56	17:36
52°	06:40	07:23	08:03	16:09	16:49	17:32
54°	06:45	07:30	08:12	15:59	16:42	17:27
56°	06:50	07:38	08:24	15:48	16:34	17:21
58°	06:56	07:47	08:37	15:35	16:25	17:16
S 60°	07:03	07:58	08:52	15:20	16:14	17:09

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

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 24-26 30-13%
12	05:35	05:39	12:06	07:38	20:02	
13	05:42	05:46	12:06	08:27	20:53	
14	05:50	05:53	12:06	09:19	21:45	

July 15, 16, 17 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	292°35.4	143°36.5	N10°40.4	137°29.3	N11°29.7	253°07.4	N14°10.7	313°35.9	S10°38.6
1	307°37.9	158°38.5	39.7	152°30.3	29.2	268°09.5	10.8	328°38.5	38.7
2	322°40.4	173°40.4	39.0	167°31.3	28.6	283°11.6	10.9	343°41.1	38.7
3	337°42.8	188°42.4	·· 38.3	182°32.3	·· 28.0	298°13.7	·· 11.0	358°43.6	·· 38.7
4	352°45.3	203°44.4	37.6	197°33.3	27.4	313°15.8	11.1	13°46.2	38.8
5	7°47.8	218°46.3	36.9	212°34.4	26.9	328°17.9	11.2	28°48.7	38.8
6	22°50.2	233°48.3	N10°36.2	227°35.4	N11°26.3	343°20.0	N14°11.3	43°51.3	S10°38.9
7	37°52.7	248°50.3	35.5	242°36.4	25.7	358°22.1	11.4	58°53.9	38.9
8	52°55.2	263°52.2	34.8	257°37.4	25.1	13°24.2	11.5	73°56.4	39.0
9	67°57.6	278°54.2	·· 34.2	272°38.4	·· 24.6	28°26.3	·· 11.6	88°59.0	·· 39.0
10	83°00.1	293°56.2	33.5	287°39.5	24.0	43°28.4	11.7	104°01.6	39.1
11	98°02.5	308°58.2	32.8	302°40.5	23.4	58°30.5	11.8	119°04.1	39.1
12	113°05.0	324°00.2	N10°32.1	317°41.5	N11°22.9	73°32.6	N14°11.9	134°06.7	S10°39.2
13	128°07.5	339°02.2	31.4	332°42.5	22.3	88°34.7	12.0	149°09.2	39.2
14	143°09.9	354°04.2	30.7	347°43.5	21.7	103°36.8	12.1	164°11.8	39.3
15	158°12.4	9°06.2	·· 30.0	2°44.6	·· 21.1	118°38.9	·· 12.2	179°14.4	·· 39.3
16	173°14.9	24°08.2	29.3	17°45.6	20.6	133°41.0	12.3	194°16.9	39.4
17	188°17.3	39°10.2	28.7	32°46.6	20.0	148°43.1	12.5	209°19.5	39.4
18	203°19.8	54°12.2	N10°28.0	47°47.6	N11°19.4	163°45.2	N14°12.6	224°22.1	S10°39.5
19	218°22.3	69°14.2	27.3	62°48.6	18.8	178°47.3	12.7	239°24.6	39.5
20	233°24.7	84°16.2	26.6	77°49.7	18.3	193°49.5	12.8	254°27.2	39.6
21	248°27.2	99°18.2	·· 25.9	92°50.7	·· 17.7	208°51.6	·· 12.9	269°29.8	·· 39.6
22	263°29.7	114°20.3	25.2	107°51.7	17.1	223°53.7	13.0	284°32.3	39.7
23	278°32.1	129°22.3	24.6	122°52.7	16.5	238°55.8	13.1	299°34.9	39.7
Mer.pass. 04:29		ν 2.0′	d -0.7′	m -4.73	ν 1.0′	d -0.6′	m 1.77	ν 2.1′	d 0.1′ m -2.27	ν 2.6′ d -0.0′ m 0.65

Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	293°34.6	144°24.3	N10°23.9	137°53.7	N11°16.0	253°57.9	N14°13.2	314°37.4	S10°39.7
1	308°37.0	159°26.4	23.2	152°54.8	15.4	269°00.0	13.3	329°40.0	39.8
2	323°39.5	174°28.4	22.5	167°55.8	14.8	284°02.1	13.4	344°42.6	39.8
3	338°42.0	189°30.4	·· 21.9	182°56.8	·· 14.2	299°04.2	·· 13.5	359°45.1	·· 39.9
4	353°44.4	204°32.5	21.2	197°57.8	13.7	314°06.3	13.6	14°47.7	39.9
5	8°46.9	219°34.5	20.5	212°58.8	13.1	329°08.4	13.7	29°50.3	40.0
6	23°49.4	234°36.6	N10°19.8	227°59.8	N11°12.5	344°10.5	N14°13.8	44°52.8	S10°40.0
7	38°51.8	249°38.6	19.2	243°00.9	11.9	359°12.6	13.9	59°55.4	40.1
8	53°54.3	264°40.7	18.5	258°01.9	11.4	14°14.8	14.0	74°58.0	40.1
9	68°56.8	279°42.7	·· 17.8	273°02.9	·· 10.8	29°16.9	·· 14.1	90°00.5	·· 40.2
10	83°59.2	294°44.8	17.1	288°03.9	10.2	44°19.0	14.2	105°03.1	40.2
11	99°01.7	309°46.9	16.5	303°04.9	09.6	59°21.1	14.3	120°05.7	40.3
12	114°04.1	324°48.9	N10°15.8	318°06.0	N11°09.0	74°23.2	N14°14.4	135°08.2	S10°40.3
13	129°06.6	339°51.0	15.1	333°07.0	08.5	89°25.3	14.5	150°10.8	40.4
14	144°09.1	354°53.1	14.5	348°08.0	07.9	104°27.4	14.6	165°13.4	40.4
15	159°11.5	9°55.2	·· 13.8	3°09.0	·· 07.3	119°29.5	·· 14.7	180°15.9	·· 40.5
16	174°14.0	24°57.3	13.1	18°10.0	06.7	134°31.6	14.8	195°18.5	40.5
17	189°16.5	39°59.4	12.5	33°11.1	06.2	149°33.8	14.9	210°21.1	40.6
18	204°18.9	55°01.5	N10°11.8	48°12.1	N11°05.6	164°35.9	N14°15.0	225°23.6	S10°40.6
19	219°21.4	70°03.5	11.1	63°13.1	05.0	179°38.0	15.1	240°26.2	40.7
20	234°23.9	85°05.6	10.5	78°14.1	04.4	194°40.1	15.3	255°28.8	40.7
21	249°26.3	100°07.7	·· 09.8	93°15.1	·· 03.9	209°42.2	·· 15.4	270°31.3	·· 40.8
22	264°28.8	115°09.9	09.1	108°16.2	03.3	224°44.3	15.5	285°33.9	40.8
23	279°31.3	130°12.0	08.5	123°17.2	02.7	239°46.4	15.6	300°36.5	40.9
Mer.pass. 04:25		ν 2.0′	d -0.7′	m -4.72	ν 1.0′	d -0.6′	m 1.77	ν 2.1′	d 0.1′ m -2.27	ν 2.6′ d -0.0′ m 0.65

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	294°33.7	145°14.1	N10°07.8	138°18.2	N11°02.1	254°48.5	N14°15.7	315°39.0	S10°40.9
1	309°36.2	160°16.2	07.2	153°19.2	01.5	269°50.7	15.8	330°41.6	41.0
2	324°38.6	175°18.3	06.5	168°20.2	01.0	284°52.8	15.9	345°44.2	41.0
3	339°41.1	190°20.4	·· 05.8	183°21.3	11°00.4	299°54.9	·· 16.0	0°46.7	·· 41.1
4	354°43.6	205°22.6	05.2	198°22.3	10°59.8	314°57.0	16.1	15°49.3	41.1
5	9°46.0	220°24.7	04.5	213°23.3	59.2	329°59.1	16.2	30°51.9	41.2
6	24°48.5	235°26.8	N10°03.9	228°24.3	N10°58.6	345°01.2	N14°16.3	45°54.4	S10°41.2
7	39°51.0	250°29.0	03.2	243°25.3	58.1	0°03.3	16.4	60°57.0	41.3
8	54°53.4	265°31.1	02.6	258°26.4	57.5	15°05.5	16.5	75°59.6	41.3
9	69°55.9	280°33.3	·· 01.9	273°27.4	·· 56.9	30°07.6	·· 16.6	91°02.1	·· 41.4
10	84°58.4	295°35.4	01.2	288°28.4	56.3	45°09.7	16.7	106°04.7	41.4
11	100°00.8	310°37.6	10°00.6	303°29.4	55.7	60°11.8	16.8	121°07.3	41.5
12	115°03.3	325°39.7	N09°59.9	318°30.4	N10°55.2	75°13.9	N14°16.9	136°09.9	S10°41.5
13	130°05.8	340°41.9	59.3	333°31.5	54.6	90°16.0	17.0	151°12.4	41.6
14	145°08.2	355°44.0	58.6	348°32.5	54.0	105°18.2	17.1	166°15.0	41.6
15	160°10.7	10°46.2	·· 58.0	3°33.5	·· 53.4	120°20.3	·· 17.2	181°17.6	·· 41.7
16	175°13.1	25°48.4	57.3	18°34.5	52.8	135°22.4	17.3	196°20.1	41.7
17	190°15.6	40°50.5	56.7	33°35.5	52.3	150°24.5	17.4	211°22.7	41.8
18	205°18.1	55°52.7	N09°56.0	48°36.6	N10°51.7	165°26.6	N14°17.5	226°25.3	S10°41.8
19	220°20.5	70°54.9	55.4	63°37.6	51.1	180°28.7	17.6	241°27.8	41.9
20	235°23.0	85°57.1	54.8	78°38.6	50.5	195°30.9	17.7	256°30.4	41.9
21	250°25.5	100°59.3	·· 54.1	93°39.6	·· 49.9	210°33.0	·· 17.8	271°33.0	·· 42.0
22	265°27.9	116°01.5	53.5	108°40.6	49.4	225°35.1	17.9	286°35.6	42.0
23	280°30.4	131°03.7	52.8	123°41.7	48.8	240°37.2	18.0	301°38.1	42.1
Mer.pass. 04:21		ν 2.1′	d -0.7′	m -4.72	ν 1.0′	d -0.6′	m 1.77	ν 2.1′	d 0.1′ m -2.28	ν 2.6′ d -0.0′ m 0.64

Stars

	SHA	**Dec**
Alpheratz	357°35.9	29°13.1
Ankaa	353°08.2	-42°10.5
Schedar	349°32.3	56°39.7
Diphda	348°48.5	-17°51.3
Achernar	335°21.1	-57°06.8
Hamal	327°52.6	23°34.3
Polaris	314°49.3	89°21.5
Acamar	315°12.9	-40°12.4
Menkar	314°07.6	4°10.9
Mirfak	308°30.3	49°56.5
Aldebaran	290°41.3	16°33.4
Rigel	281°05.3	-8°10.4
Capella	280°24.1	46°01.2
Bellatrix	278°24.5	6°22.3
Elnath	278°03.8	28°37.6
Alnilam	275°39.3	-1°11.1
Betelgeuse	270°53.7	7°24.7
Canopus	263°53.5	-52°42.3
Sirius	258°27.7	-16°44.8
Adhara	255°07.2	-29°00.1
Procyon	244°52.5	5°10.0
Pollux	243°19.2	27°58.2
Avior	234°15.9	-59°35.1
Suhail	222°47.6	-43°31.6
Miaplacidus	221°39.4	-69°48.9
Alphard	217°49.3	-8°45.6
Regulus	207°36.0	11°51.3
Dubhe	193°42.9	61°37.8
Denebola	182°26.3	14°26.6
Gienah	175°45.0	-17°40.4
Acrux	173°01.7	-63°14.0
Gacrux	171°53.2	-57°14.9
Alioth	166°14.1	55°50.3
Spica	158°23.6	-11°17.0
Alkaid	152°52.9	49°12.1
Hadar	148°37.6	-60°29.4
Menkent	147°59.0	-36°29.3
Arcturus	145°49.0	19°03.8
Rigil Kent.	139°41.8	-60°56.2
Kochab	137°19.3	74°03.8
Zuben'ubi	136°57.3	-16°08.4
Alphecca	126°04.6	26°38.3
Antares	112°17.1	-26°29.1
Atria	107°11.9	-69°04.3
Sabik	102°03.9	-15°45.2
Shaula	96°11.7	-37°07.3
Rasalhague	95°59.4	12°32.6
Eltanin	90°42.3	51°29.2
Kaus Aust.	83°33.7	-34°22.4
Vega	80°33.6	38°48.4
Nunki	75°48.9	-26°16.0
Altair	62°00.8	8°55.8
Peacock	53°07.1	-56°39.5
Deneb	49°26.2	45°21.8
Enif	33°39.7	9°58.9
Al Na'ir	27°34.1	-46°50.7
Fomalhaut	15°15.6	-29°29.7
Scheat	13°46.2	28°12.5
Markab	13°30.9	15°19.8

Jul 15 Sat	**SHA**	**Mer.pass**
Venus	211°01.1	14:24
Mars	204°53.8	14:49
Jupiter	320°31.9	07:07
Saturn	21°00.5	03:05

Jul 16 Sun	**SHA**	**Mer.pass**
Venus	210°49.7	14:20
Mars	204°19.2	14:47
Jupiter	320°23.3	07:03
Saturn	21°02.9	03:01

Jul 17 Mon	**SHA**	**Mer.pass**
Venus	210°40.4	14:17
Mars	203°44.5	14:46
Jupiter	320°14.8	07:00
Saturn	21°05.3	02:57

Horizontal parallax	
Venus:	0.4
Mars:	0.1

h	Sun		Moon				
Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°30.9	N21°35.7	212°30.0	9.0′	N27°00.6	3.8′	55.2′
1	193°30.9	35.3	226°58.0	9.0′	27°04.4	3.6′	55.1′
2	208°30.8	34.9	241°26.0	9.0′	27°08.0	3.4′	55.1′
3	223°30.7	·· 34.5	255°54.0	9.0′	27°11.4	3.4′	55.1′
4	238°30.7	34.1	270°22.0	9.0′	27°14.8	3.2′	55.1′
5	253°30.6	33.7	284°50.0	9.0′	27°18.0	3.0′	55.1′
6	268°30.5	N21°33.4	299°17.9	8.9′	N27°21.0	2.9′	55.0′
7	283°30.5	33.0	313°45.9	8.9′	27°23.9	2.7′	55.0′
8	298°30.4	32.6	328°13.8	8.9′	27°26.6	2.7′	55.0′
9	313°30.3	·· 32.2	342°41.8	8.9′	27°29.3	2.4′	55.0′
10	328°30.3	31.8	357°09.7	8.9′	27°31.7	2.3′	55.0′
11	343°30.2	31.4	11°37.6	8.9′	27°34.0	2.2′	55.0′
12	358°30.1	N21°31.0	26°05.5	8.9′	N27°36.2	2.1′	54.9′
13	13°30.1	30.6	40°33.4	8.9′	27°38.3	1.9′	54.9′
14	28°30.0	30.2	55°01.3	8.9′	27°40.2	1.7′	54.9′
15	43°29.9	·· 29.8	69°29.2	8.9′	27°41.9	1.6′	54.9′
16	58°29.9	29.4	83°57.1	8.9′	27°43.5	1.5′	54.9′
17	73°29.8	29.0	98°25.0	8.9′	27°45.0	1.3′	54.9′
18	88°29.7	N21°28.6	112°52.9	8.9′	N27°46.3	1.1′	54.8′
19	103°29.7	28.2	127°20.9	8.9′	27°47.4	1.1′	54.8′
20	118°29.6	27.8	141°48.8	8.9′	27°48.5	0.8′	54.8′
21	133°29.6	·· 27.4	156°16.7	8.9′	27°49.3	0.8′	54.8′
22	148°29.5	27.0	170°44.7	9.0′	27°50.1	0.6′	54.8′
23	163°29.4	26.6	185°12.6	9.0′	27°50.7	0.4′	54.8′
	SD = 15.7′	d = -0.4′	SD = 15.0′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°29.4	N21°26.2	199°40.6	9.0′	N27°51.1	0.3′	54.7′
1	193°29.3	25.8	214°08.6	9.0′	27°51.4	0.2′	54.7′
2	208°29.2	25.4	228°36.6	9.0′	27°51.6	0.0′	54.7′
3	223°29.2	·· 25.0	243°04.6	9.0′	27°51.6	0.1′	54.7′
4	238°29.1	24.6	257°32.6	9.0′	27°51.5	0.3′	54.7′
5	253°29.1	24.2	272°00.6	9.1′	27°51.2	0.4′	54.7′
6	268°29.0	N21°23.8	286°28.7	9.1′	N27°50.8	0.6′	54.7′
7	283°28.9	23.4	300°56.8	9.1′	27°50.2	0.6′	54.6′
8	298°28.9	23.0	315°24.9	9.1′	27°49.6	0.9′	54.6′
9	313°28.8	·· 22.6	329°53.0	9.2′	27°48.7	1.0′	54.6′
10	328°28.8	22.2	344°21.2	9.2′	27°47.7	1.1′	54.6′
11	343°28.7	21.8	358°49.4	9.2′	27°46.6	1.2′	54.6′
12	358°28.6	N21°21.3	13°17.6	9.2′	N27°45.4	1.4′	54.6′
13	13°28.6	20.9	27°45.8	9.3′	27°44.0	1.6′	54.6′
14	28°28.5	20.5	42°14.1	9.3′	27°42.4	1.6′	54.5′
15	43°28.5	·· 20.1	56°42.4	9.3′	27°40.8	1.9′	54.5′
16	58°28.4	19.7	71°10.8	9.4′	27°38.9	1.9′	54.5′
17	73°28.3	19.3	85°39.2	9.4′	27°37.0	2.1′	54.5′
18	88°28.3	N21°18.9	100°07.6	9.5′	N27°34.9	2.2′	54.5′
19	103°28.2	18.5	114°36.0	9.5′	27°32.7	2.4′	54.5′
20	118°28.2	18.0	129°04.5	9.5′	27°30.3	2.5′	54.5′
21	133°28.1	·· 17.6	143°33.1	9.6′	27°27.8	2.7′	54.5′
22	148°28.1	17.2	158°01.6	9.6′	27°25.1	2.7′	54.4′
23	163°28.0	16.8	172°30.2	9.7′	27°22.4	3.0′	54.4′
	SD = 15.7′	d = -0.4′	SD = 14.9′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°27.9	N21°16.4	186°58.9	9.7′	N27°19.4	3.0′	54.4′
1	193°27.9	16.0	201°27.6	9.7′	27°16.4	3.2′	54.4′
2	208°27.8	15.5	215°56.4	9.8′	27°13.2	3.3′	54.4′
3	223°27.8	·· 15.1	230°25.2	9.8′	27°09.9	3.4′	54.4′
4	238°27.7	14.7	244°54.0	9.9′	27°06.5	3.6′	54.4′
5	253°27.7	14.3	259°22.9	9.9′	27°02.9	3.7′	54.4′
6	268°27.6	N21°13.9	273°51.8	10.0′	N26°59.2	3.9′	54.3′
7	283°27.6	13.4	288°20.8	10.0′	26°55.3	4.0′	54.3′
8	298°27.5	13.0	302°49.9	10.1′	26°51.3	4.1′	54.3′
9	313°27.4	·· 12.6	317°19.0	10.2′	26°47.2	4.2′	54.3′
10	328°27.4	12.2	331°48.1	10.2′	26°43.0	4.3′	54.3′
11	343°27.3	11.8	346°17.3	10.3′	26°38.7	4.5′	54.3′
12	358°27.3	N21°11.3	0°46.6	10.3′	N26°34.2	4.6′	54.3′
13	13°27.2	10.9	15°15.9	10.4′	26°29.6	4.8′	54.3′
14	28°27.2	10.5	29°45.3	10.4′	26°24.8	4.8′	54.3′
15	43°27.1	·· 10.0	44°14.7	10.5′	26°20.0	5.0′	54.2′
16	58°27.1	09.6	58°44.2	10.6′	26°15.0	5.1′	54.2′
17	73°27.0	09.2	73°13.8	10.6′	26°09.9	5.3′	54.2′
18	88°27.0	N21°08.8	87°43.4	10.7′	N26°04.6	5.3′	54.2′
19	103°26.9	08.3	102°13.1	10.7′	25°59.3	5.5′	54.2′
20	118°26.9	07.9	116°42.8	10.8′	25°53.8	5.6′	54.2′
21	133°26.8	·· 07.5	131°12.6	10.9′	25°48.2	5.7′	54.2′
22	148°26.8	07.0	145°42.5	10.9′	25°42.5	5.9′	54.2′
23	163°26.7	06.6	160°12.4	11.0′	25°36.6	5.9′	54.2′
	SD = 15.7′	d = -0.4′	SD = 14.8′				

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

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

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 7-1%
15	05:56	05:59	12:06	10:12	22:38	●
16	06:03	06:05	12:06	11:05	23:31	
17	06:08	06:11	12:06	11:57	–:–	

July 18, 19, 20 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	295°32.9	146°05.9	N09°52.2	138°42.7	N10°48.2	255°39.3	N14°18.1	316°40.7	S10°42.1
1	310°35.3	161°08.1	51.5	153°43.7	47.6	270°41.4	18.2	331°43.3	42.2
2	325°37.8	176°10.3	50.9	168°44.7	47.0	285°43.6	18.3	346°45.8	42.2
3	340°40.3	191°12.5	·· 50.3	183°45.8	·· 46.5	300°45.7	·· 18.4	1°48.4	·· 42.3
4	355°42.7	206°14.7	49.6	198°46.8	45.9	315°47.8	18.5	16°51.0	42.3
5	10°45.2	221°16.9	49.0	213°47.8	45.3	330°49.9	18.6	31°53.6	42.4
6	25°47.6	236°19.1	N09°48.4	228°48.8	N10°44.7	345°52.0	N14°18.7	46°56.1	S10°42.4
7	40°50.1	251°21.3	47.7	243°49.8	44.1	0°54.2	18.8	61°58.7	42.5
8	55°52.6	266°23.6	47.1	258°50.9	43.5	15°56.3	18.9	77°01.3	42.5
9	70°55.0	281°25.8	·· 46.5	273°51.9	·· 43.0	30°58.4	·· 19.0	92°03.8	·· 42.6
10	85°57.5	296°28.0	45.8	288°52.9	42.4	46°00.5	19.1	107°06.4	42.6
11	101°00.0	311°30.3	45.2	303°53.9	41.8	61°02.6	19.2	122°09.0	42.7
12	116°02.4	326°32.5	N09°44.6	318°54.9	N10°41.2	76°04.8	N14°19.3	137°11.6	S10°42.7
13	131°04.9	341°34.8	43.9	333°56.0	40.6	91°06.9	19.4	152°14.1	42.8
14	146°07.4	356°37.0	43.3	348°57.0	40.0	106°09.0	19.5	167°16.7	42.8
15	161°09.8	11°39.3	·· 42.7	3°58.0	·· 39.5	121°11.1	·· 19.6	182°19.3	·· 42.9
16	176°12.3	26°41.5	42.0	18°59.0	38.9	136°13.3	19.7	197°21.8	42.9
17	191°14.8	41°43.8	41.4	34°00.0	38.3	151°15.4	19.8	212°24.4	43.0
18	206°17.2	56°46.0	N09°40.8	49°01.1	N10°37.7	166°17.5	N14°19.9	227°27.0	S10°43.0
19	221°19.7	71°48.3	40.2	64°02.1	37.1	181°19.6	20.0	242°29.6	43.1
20	236°22.1	86°50.6	39.5	79°03.1	36.5	196°21.7	20.1	257°32.1	43.1
21	251°24.6	101°52.8	·· 38.9	94°04.1	·· 36.0	211°23.9	·· 20.2	272°34.7	·· 43.2
22	266°27.1	116°55.1	38.3	109°05.1	35.4	226°26.0	20.3	287°37.3	43.2
23	281°29.5	131°57.4	37.7	124°06.2	34.8	241°28.1	20.4	302°39.9	43.3
Mer.pass. 04:17		ν 2.2′ d -0.6′ m -4.71		ν 1.0′ d -0.6′ m 1.77		ν 2.1′ d 0.1′ m -2.28		ν 2.6′ d -0.1′ m 0.64	

Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	296°32.0	146°59.7	N09°37.0	139°07.2	N10°34.2	256°30.2	N14°20.5	317°42.4	S10°43.3
1	311°34.5	162°02.0	36.4	154°08.2	33.6	271°32.4	20.6	332°45.0	43.4
2	326°36.9	177°04.3	35.8	169°09.2	33.0	286°34.5	20.7	347°47.6	43.4
3	341°39.4	192°06.6	·· 35.2	184°10.2	·· 32.5	301°36.6	·· 20.8	2°50.2	·· 43.5
4	356°41.9	207°08.9	34.6	199°11.3	31.9	316°38.7	20.9	17°52.7	43.6
5	11°44.3	222°11.2	34.0	214°12.3	31.3	331°40.9	21.0	32°55.3	43.6
6	26°46.8	237°13.5	N09°33.3	229°13.3	N10°30.7	346°43.0	N14°21.1	47°57.9	S10°43.7
7	41°49.2	252°15.8	32.7	244°14.3	30.1	1°45.1	21.2	63°00.5	43.7
8	56°51.7	267°18.1	32.1	259°15.4	29.5	16°47.2	21.3	78°03.0	43.8
9	71°54.2	282°20.4	·· 31.5	274°16.4	·· 28.9	31°49.4	·· 21.4	93°05.6	·· 43.8
10	86°56.6	297°22.7	30.9	289°17.4	28.4	46°51.5	21.5	108°08.2	43.9
11	101°59.1	312°25.1	30.3	304°18.4	27.8	61°53.6	21.6	123°10.8	43.9
12	117°01.6	327°27.4	N09°29.7	319°19.4	N10°27.2	76°55.7	N14°21.7	138°13.3	S10°44.0
13	132°04.0	342°29.7	29.1	334°20.5	26.6	91°57.9	21.7	153°15.9	44.0
14	147°06.5	357°32.1	28.4	349°21.5	26.0	107°00.0	21.8	168°18.5	44.1
15	162°09.0	12°34.4	·· 27.8	4°22.5	·· 25.4	122°02.1	·· 21.9	183°21.1	·· 44.1
16	177°11.4	27°36.8	27.2	19°23.5	24.8	137°04.3	22.0	198°23.6	44.2
17	192°13.9	42°39.1	26.6	34°24.5	24.3	152°06.4	22.1	213°26.2	44.2
18	207°16.4	57°41.5	N09°26.0	49°25.6	N10°23.7	167°08.5	N14°22.2	228°28.8	S10°44.3
19	222°18.8	72°43.8	25.4	64°26.6	23.1	182°10.6	22.3	243°31.4	44.3
20	237°21.3	87°46.2	24.8	79°27.6	22.5	197°12.8	22.4	258°33.9	44.4
21	252°23.7	102°48.5	·· 24.2	94°28.6	·· 21.9	212°14.9	·· 22.5	273°36.5	·· 44.4
22	267°26.2	117°50.9	23.6	109°29.7	21.3	227°17.0	22.6	288°39.1	44.5
23	282°28.7	132°53.3	23.0	124°30.7	20.7	242°19.2	22.7	303°41.7	44.5
Mer.pass. 04:13		ν 2.3′ d -0.6′ m -4.71		ν 1.0′ d -0.6′ m 1.77		ν 2.1′ d 0.1′ m -2.29		ν 2.6′ d -0.1′ m 0.63	

Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	297°31.1	147°55.6	N09°22.4	139°31.7	N10°20.1	257°21.3	N14°22.8	318°44.2	S10°44.6
1	312°33.6	162°58.0	21.8	154°32.7	19.6	272°23.4	22.9	333°46.8	44.7
2	327°36.1	178°00.4	21.2	169°33.7	19.0	287°25.5	23.0	348°49.4	44.7
3	342°38.5	193°02.8	·· 20.6	184°34.8	·· 18.4	302°27.7	·· 23.1	3°52.0	·· 44.8
4	357°41.0	208°05.2	20.0	199°35.8	17.8	317°29.8	23.2	18°54.6	44.8
5	12°43.5	223°07.6	19.4	214°36.8	17.2	332°31.9	23.3	33°57.1	44.9
6	27°45.9	238°10.0	N09°18.8	229°37.8	N10°16.6	347°34.1	N14°23.4	48°59.7	S10°44.9
7	42°48.4	253°12.4	18.3	244°38.8	16.0	2°36.2	23.5	64°02.3	45.0
8	57°50.9	268°14.8	17.7	259°39.9	15.4	17°38.3	23.6	79°04.9	45.0
9	72°53.3	283°17.2	·· 17.1	274°40.9	·· 14.9	32°40.5	·· 23.7	94°07.4	·· 45.1
10	87°55.8	298°19.6	16.5	289°41.9	14.3	47°42.6	23.8	109°10.0	45.1
11	102°58.2	313°22.0	15.9	304°42.9	13.7	62°44.7	23.9	124°12.6	45.2
12	118°00.7	328°24.4	N09°15.3	319°44.0	N10°13.1	77°46.9	N14°24.0	139°15.2	S10°45.2
13	133°03.2	343°26.8	14.7	334°45.0	12.5	92°49.0	24.1	154°17.8	45.3
14	148°05.6	358°29.3	14.1	349°46.0	11.9	107°51.1	24.2	169°20.3	45.3
15	163°08.1	13°31.7	·· 13.6	4°47.0	·· 11.3	122°53.3	·· 24.2	184°22.9	·· 45.4
16	178°10.6	28°34.1	13.0	19°48.0	10.7	137°55.4	24.3	199°25.5	45.4
17	193°13.0	43°36.6	12.4	34°49.1	10.1	152°57.5	24.4	214°28.1	45.5
18	208°15.5	58°39.0	N09°11.8	49°50.1	N10°09.6	167°59.7	N14°24.5	229°30.7	S10°45.6
19	223°18.0	73°41.5	11.2	64°51.1	09.0	183°01.8	24.6	244°33.2	45.6
20	238°20.4	88°43.9	10.7	79°52.1	08.4	198°03.9	24.7	259°35.8	45.7
21	253°22.9	103°46.4	·· 10.1	94°53.1	·· 07.8	213°06.1	·· 24.8	274°38.4	·· 45.7
22	268°25.3	118°48.8	09.5	109°54.2	07.2	228°08.2	24.9	289°41.0	45.8
23	283°27.8	133°51.3	08.9	124°55.2	06.6	243°10.3	25.0	304°43.6	45.8
Mer.pass. 04:09		ν 2.4′ d -0.6′ m -4.70		ν 1.0′ d -0.6′ m 1.78		ν 2.1′ d 0.1′ m -2.30		ν 2.6′ d -0.1′ m 0.63	

Stars

	SHA	**Dec**
Alpheratz	357°35.9	29°13.1
Ankaa	353°08.2	-42°10.5
Schedar	349°32.3	56°39.7
Diphda	348°48.4	-17°51.3
Achernar	335°21.1	-57°06.7
Hamal	327°52.6	23°34.3
Polaris	314°47.8	89°21.5
Acamar	315°12.8	-40°12.4
Menkar	314°07.5	4°10.9
Mirfak	308°30.2	49°56.5
Aldebaran	290°41.3	16°33.4
Rigel	281°05.3	-8°10.4
Capella	280°24.1	46°01.2
Bellatrix	278°24.5	6°22.3
Elnath	278°03.7	28°37.6
Alnilam	275°39.3	-1°11.1
Betelgeuse	270°53.7	7°24.7
Canopus	263°53.5	-52°42.3
Sirius	258°27.7	-16°44.8
Adhara	255°07.2	-29°00.1
Procyon	244°52.4	5°10.0
Pollux	243°19.2	27°58.2
Avior	234°15.9	-59°35.0
Suhail	222°47.6	-43°31.6
Miaplacidus	221°39.4	-69°48.9
Alphard	217°49.3	-8°45.6
Regulus	207°36.0	11°51.3
Dubhe	193°42.9	61°37.7
Denebola	182°26.3	14°26.6
Gienah	175°45.0	-17°40.4
Acrux	173°01.7	-63°14.0
Gacrux	171°53.2	-57°14.9
Alioth	166°14.1	55°50.3
Spica	158°23.6	-11°17.0
Alkaid	152°52.9	49°12.1
Hadar	148°37.7	-60°29.4
Menkent	147°59.0	-36°29.3
Arcturus	145°49.0	19°03.8
Rigil Kent.	139°41.8	-60°56.2
Kochab	137°19.4	74°03.8
Zuben'ubi	136°57.3	-16°08.4
Alphecca	126°04.6	26°38.3
Antares	112°17.1	-26°29.1
Atria	107°12.0	-69°04.3
Sabik	102°03.9	-15°45.2
Shaula	96°11.7	-37°07.3
Rasalhague	95°59.4	12°32.6
Eltanin	90°42.3	51°29.2
Kaus Aust.	83°33.7	-34°22.4
Vega	80°33.6	38°48.4
Nunki	75°48.9	-26°16.0
Altair	62°00.8	8°55.8
Peacock	53°07.0	-56°39.5
Deneb	49°26.2	45°21.8
Enif	33°39.7	9°59.0
Al Na'ir	27°34.0	-46°50.7
Fomalhaut	15°15.6	-29°29.7
Scheat	13°46.2	28°12.5
Markab	13°30.9	15°19.9

Jul 18 Tue	**SHA**	**Mer.pass**
Venus	210°33.0	14:13
Mars	203°09.8	14:44
Jupiter	320°06.5	06:56
Saturn	21°07.8	02:53

Jul 19 Wed	**SHA**	**Mer.pass**
Venus	210°27.7	14:10
Mars	202°35.2	14:43
Jupiter	319°58.2	06:53
Saturn	21°10.4	02:49

Jul 20 Thu	**SHA**	**Mer.pass**
Venus	210°24.5	14:06
Mars	202°00.6	14:41
Jupiter	319°50.1	06:50
Saturn	21°13.1	02:45

Horizontal parallax	
Venus:	0.4
Mars:	0.1

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°26.7	N21°06.2	174°42.4	11.1′	N25°30.7	6.1′	54.2′
1	193°26.6	05.8	189°12.5	11.1′	25°24.6	6.2′	54.2′
2	208°26.5	05.3	203°42.6	11.2′	25°18.4	6.3′	54.1′
3	223°26.5	·· 04.9	218°12.8	11.3′	25°12.1	6.4′	54.1′
4	238°26.4	04.4	232°43.1	11.3′	25°05.7	6.6′	54.1′
5	253°26.4	04.0	247°13.4	11.4′	24°59.1	6.6′	54.1′
6	268°26.3	N21°03.6	261°43.8	11.5′	N24°52.5	6.8′	54.1′
7	283°26.3	03.1	276°14.3	11.5′	24°45.7	6.8′	54.1′
8	298°26.2	02.7	290°44.8	11.6′	24°38.9	7.0′	54.1′
9	313°26.2	·· 02.3	305°15.4	11.7′	24°31.9	7.1′	54.1′
10	328°26.2	01.8	319°46.1	11.7′	24°24.8	7.2′	54.1′
11	343°26.1	01.4	334°16.8	11.8′	24°17.6	7.3′	54.1′
12	358°26.1	N21°00.9	348°47.6	11.9′	N24°10.3	7.4′	54.1′
13	13°26.0	00.5	3°18.5	11.9′	24°02.9	7.6′	54.1′
14	28°26.0	21°00.1	17°49.4	12.0′	23°55.3	7.6′	54.0′
15	43°25.9	20°59.6	32°20.5	12.1′	23°47.7	7.7′	54.0′
16	58°25.9	59.2	46°51.5	12.2′	23°40.0	7.8′	54.0′
17	73°25.8	58.7	61°22.7	12.2′	23°32.2	8.0′	54.0′
18	88°25.8	N20°58.3	75°53.9	12.3′	N23°24.2	8.0′	54.0′
19	103°25.7	57.9	90°25.2	12.4′	23°16.2	8.2′	54.0′
20	118°25.7	57.4	104°56.6	12.4′	23°08.0	8.2′	54.0′
21	133°25.6	·· 57.0	119°28.1	12.5′	22°59.8	8.3′	54.0′
22	148°25.6	56.5	133°59.6	12.6′	22°51.5	8.5′	54.0′
23	163°25.5	56.1	148°31.2	12.7′	22°43.0	8.5′	54.0′
	SD = 15.7′	d = -0.4′	SD = 14.8′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°25.5	N20°55.6	163°02.8	12.7′	N22°34.5	8.6′	54.0′
1	193°25.4	55.2	177°34.6	12.8′	22°25.9	8.8′	54.0′
2	208°25.4	54.7	192°06.4	12.9′	22°17.1	8.8′	54.0′
3	223°25.4	·· 54.3	206°38.2	12.9′	22°08.3	8.9′	54.0′
4	238°25.3	53.8	221°10.2	13.0′	21°59.4	9.0′	54.0′
5	253°25.3	53.4	235°42.2	13.1′	21°50.4	9.1′	54.0′
6	268°25.2	N20°52.9	250°14.3	13.2′	N21°41.3	9.2′	54.0′
7	283°25.2	52.5	264°46.4	13.2′	21°32.1	9.2′	54.0′
8	298°25.1	52.0	279°18.7	13.3′	21°22.9	9.4′	53.9′
9	313°25.1	·· 51.6	293°51.0	13.4′	21°13.5	9.4′	53.9′
10	328°25.0	51.1	308°23.3	13.4′	21°04.1	9.6′	53.9′
11	343°25.0	50.7	322°55.8	13.5′	20°54.5	9.6′	53.9′
12	358°25.0	N20°50.2	337°28.3	13.6′	N20°44.9	9.7′	53.9′
13	13°24.9	49.8	352°00.9	13.6′	20°35.2	9.8′	53.9′
14	28°24.9	49.3	6°33.5	13.7′	20°25.4	9.9′	53.9′
15	43°24.8	·· 48.9	21°06.2	13.8′	20°15.5	9.9′	53.9′
16	58°24.8	48.4	35°39.0	13.9′	20°05.6	10.1′	53.9′
17	73°24.8	47.9	50°11.8	13.9′	19°55.5	10.1′	53.9′
18	88°24.7	N20°47.5	64°44.8	14.0′	N19°45.4	10.2′	53.9′
19	103°24.7	47.0	79°17.8	14.1′	19°35.2	10.3′	53.9′
20	118°24.6	46.6	93°50.8	14.1′	19°24.9	10.3′	53.9′
21	133°24.6	·· 46.1	108°23.9	14.2′	19°14.6	10.5′	53.9′
22	148°24.6	45.6	122°57.1	14.2′	19°04.1	10.5′	53.9′
23	163°24.5	45.2	137°30.4	14.3′	18°53.6	10.5′	53.9′
	SD = 15.7′	d = -0.4′	SD = 14.7′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°24.5	N20°44.7	152°03.7	14.4′	N18°43.1	10.7′	53.9′
1	193°24.4	44.3	166°37.0	14.4′	18°32.4	10.7′	53.9′
2	208°24.4	43.8	181°10.5	14.5′	18°21.7	10.8′	53.9′
3	223°24.4	·· 43.3	195°44.0	14.6′	18°10.9	10.9′	53.9′
4	238°24.3	42.9	210°17.6	14.6′	18°00.0	10.9′	53.9′
5	253°24.3	42.4	224°51.2	14.7′	17°49.1	11.1′	53.9′
6	268°24.2	N20°41.9	239°24.9	14.8′	N17°38.0	11.0′	53.9′
7	283°24.2	41.5	253°58.6	14.8′	17°27.0	11.2′	53.9′
8	298°24.2	41.0	268°32.4	14.9′	17°15.8	11.2′	53.9′
9	313°24.1	·· 40.5	283°06.3	14.9′	17°04.6	11.3′	53.9′
10	328°24.1	40.1	297°40.3	15.0′	16°53.3	11.3′	53.9′
11	343°24.0	39.6	312°14.2	15.0′	16°42.0	11.5′	53.9′
12	358°24.0	N20°39.1	326°48.3	15.1′	N16°30.5	11.4′	53.9′
13	13°24.0	38.7	341°22.4	15.2′	16°19.1	11.6′	53.9′
14	28°23.9	38.2	355°56.6	15.2′	16°07.5	11.6′	53.9′
15	43°23.9	·· 37.7	10°30.8	15.3′	15°55.9	11.6′	53.9′
16	58°23.9	37.3	25°05.1	15.3′	15°44.3	11.8′	53.9′
17	73°23.8	36.8	39°39.4	15.4′	15°32.5	11.8′	53.9′
18	88°23.8	N20°36.3	54°13.8	15.4′	N15°20.7	11.8′	53.9′
19	103°23.8	35.8	68°48.2	15.5′	15°08.9	11.9′	53.9′
20	118°23.7	35.4	83°22.7	15.5′	14°57.0	12.0′	53.9′
21	133°23.7	·· 34.9	97°57.2	15.6′	14°45.0	12.0′	53.9′
22	148°23.7	34.4	112°31.8	15.6′	14°33.0	12.0′	53.9′
23	163°23.6	33.9	127°06.4	15.7′	14°21.0	12.2′	53.9′
	SD = 15.7′	d = -0.5′	SD = 14.7′				

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

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 1-3 0-5%
18	06:13	06:16	12:06	12:46	00:22	
19	06:18	06:20	12:06	13:33	01:10	
20	06:22	06:24	12:06	14:17	01:55	

July 21, 22, 23 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	298°30.3	148°53.7	N09°08.3	139°56.2	N10°06.0	258°12.5	N14°25.1	319°46.1	S10°45.9
1	313°32.7	163°56.2	07.8	154°57.2	05.4	273°14.6	25.2	334°48.7	45.9
2	328°35.2	178°58.7	07.2	169°58.3	04.8	288°16.7	25.3	349°51.3	46.0
3	343°37.7	194°01.2	·· 06.6	184°59.3	·· 04.2	303°18.9	·· 25.4	4°53.9	·· 46.0
4	358°40.1	209°03.6	06.1	200°00.3	03.7	318°21.0	25.5	19°56.5	46.1
5	13°42.6	224°06.1	05.5	215°01.3	03.1	333°23.1	25.6	34°59.0	46.1
6	28°45.1	239°08.6	N09°04.9	230°02.3	N10°02.5	348°25.3	N14°25.7	50°01.6	S10°46.2
7	43°47.5	254°11.1	04.3	245°03.4	01.9	3°27.4	25.8	65°04.2	46.3
8	58°50.0	269°13.6	03.8	260°04.4	01.3	18°29.5	25.9	80°06.8	46.3
9	73°52.5	284°16.1	·· 03.2	275°05.4	·· 00.7	33°31.7	·· 25.9	95°09.4	·· 46.4
10	88°54.9	299°18.6	02.7	290°06.4	10°00.1	48°33.8	26.0	110°11.9	46.4
11	103°57.4	314°21.1	02.1	305°07.5	09°59.5	63°36.0	26.1	125°14.5	46.5
12	118°59.8	329°23.6	N09°01.5	320°08.5	N09°58.9	78°38.1	N14°26.2	140°17.1	S10°46.5
13	134°02.3	344°26.1	01.0	335°09.5	58.3	93°40.2	26.3	155°19.7	46.6
14	149°04.8	359°28.6	09°00.4	350°10.5	57.7	108°42.4	26.4	170°22.3	46.6
15	164°07.2	14°31.2	08°59.8	5°11.5	·· 57.2	123°44.5	·· 26.5	185°24.9	·· 46.7
16	179°09.7	29°33.7	59.3	20°12.6	56.6	138°46.7	26.6	200°27.4	46.7
17	194°12.2	44°36.2	58.7	35°13.6	56.0	153°48.8	26.7	215°30.0	46.8
18	209°14.6	59°38.7	N08°58.2	50°14.6	N09°55.4	168°50.9	N14°26.8	230°32.6	S10°46.9
19	224°17.1	74°41.3	57.6	65°15.6	54.8	183°53.1	26.9	245°35.2	46.9
20	239°19.6	89°43.8	57.1	80°16.7	54.2	198°55.2	27.0	260°37.8	47.0
21	254°22.0	104°46.4	·· 56.5	95°17.7	·· 53.6	213°57.4	·· 27.1	275°40.4	·· 47.0
22	269°24.5	119°48.9	56.0	110°18.7	53.0	228°59.5	27.2	290°42.9	47.1
23	284°27.0	134°51.5	55.4	125°19.7	52.4	244°01.6	27.2	305°45.5	47.1
Mer.pass. 04:05		ν 2.5′ d -0.6′	m -4.69	ν 1.0′ d -0.6′	m 1.78	ν 2.1′ d 0.1′	m -2.30	ν 2.6′ d -0.1′	m 0.62

Sat	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	299°29.4	149°54.0	N08°54.9	140°20.7	N09°51.8	259°03.8	N14°27.3	320°48.1	S10°47.2
1	314°31.9	164°56.6	54.3	155°21.8	51.2	274°05.9	27.4	335°50.7	47.2
2	329°34.3	179°59.1	53.8	170°22.8	50.6	289°08.1	27.5	350°53.3	47.3
3	344°36.8	195°01.7	·· 53.2	185°23.8	·· 50.0	304°10.2	·· 27.6	5°55.8	·· 47.4
4	359°39.3	210°04.3	52.7	200°24.8	49.4	319°12.3	27.7	20°58.4	47.4
5	14°41.7	225°06.9	52.1	215°25.9	48.9	334°14.5	27.8	36°01.0	47.5
6	29°44.2	240°09.4	N08°51.6	230°26.9	N09°48.3	349°16.6	N14°27.9	51°03.6	S10°47.5
7	44°46.7	255°12.0	51.0	245°27.9	47.7	4°18.8	28.0	66°06.2	47.6
8	59°49.1	270°14.6	50.5	260°28.9	47.1	19°20.9	28.1	81°08.8	47.6
9	74°51.6	285°17.2	·· 50.0	275°29.9	·· 46.5	34°23.0	·· 28.2	96°11.4	·· 47.7
10	89°54.1	300°19.8	49.4	290°31.0	45.9	49°25.2	28.3	111°13.9	47.7
11	104°56.5	315°22.4	48.9	305°32.0	45.3	64°27.3	28.3	126°16.5	47.8
12	119°59.0	330°25.0	N08°48.3	320°33.0	N09°44.7	79°29.5	N14°28.4	141°19.1	S10°47.8
13	135°01.4	345°27.6	47.8	335°34.0	44.1	94°31.6	28.5	156°21.7	47.9
14	150°03.9	0°30.2	47.3	350°35.1	43.5	109°33.8	28.6	171°24.3	48.0
15	165°06.4	15°32.8	·· 46.7	5°36.1	·· 42.9	124°35.9	·· 28.7	186°26.9	·· 48.0
16	180°08.8	30°35.4	46.2	20°37.1	42.3	139°38.1	28.8	201°29.4	48.1
17	195°11.3	45°38.1	45.7	35°38.1	41.7	154°40.2	28.9	216°32.0	48.1
18	210°13.8	60°40.7	N08°45.1	50°39.1	N09°41.1	169°42.3	N14°29.0	231°34.6	S10°48.2
19	225°16.2	75°43.3	44.6	65°40.2	40.5	184°44.5	29.1	246°37.2	48.2
20	240°18.7	90°46.0	44.1	80°41.2	39.9	199°46.6	29.2	261°39.8	48.3
21	255°21.2	105°48.6	·· 43.6	95°42.2	·· 39.3	214°48.8	·· 29.3	276°42.4	·· 48.3
22	270°23.6	120°51.2	43.0	110°43.2	38.7	229°50.9	29.3	291°45.0	48.4
23	285°26.1	135°53.9	42.5	125°44.3	38.1	244°53.1	29.4	306°47.5	48.5
Mer.pass. 04:01		ν 2.6′ d -0.5′	m -4.67	ν 1.0′ d -0.6′	m 1.78	ν 2.1′ d 0.1′	m -2.31	ν 2.6′ d -0.1′	m 0.62

Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	300°28.6	150°56.5	N08°42.0	140°45.3	N09°37.6	259°55.2	N14°29.5	321°50.1	S10°48.5
1	315°31.0	165°59.2	41.5	155°46.3	37.0	274°57.4	29.6	336°52.7	48.6
2	330°33.5	181°01.8	40.9	170°47.3	36.4	289°59.5	29.7	351°55.3	48.6
3	345°35.9	196°04.5	·· 40.4	185°48.4	·· 35.8	305°01.7	·· 29.8	6°57.9	·· 48.7
4	0°38.4	211°07.2	39.9	200°49.4	35.2	320°03.8	29.9	22°00.5	48.7
5	15°40.9	226°09.8	39.4	215°50.4	34.6	335°06.0	30.0	37°03.1	48.8
6	30°43.3	241°12.5	N08°38.9	230°51.4	N09°34.0	350°08.1	N14°30.1	52°05.6	S10°48.9
7	45°45.8	256°15.2	38.4	245°52.4	33.4	5°10.3	30.2	67°08.2	48.9
8	60°48.3	271°17.9	37.8	260°53.5	32.8	20°12.4	30.2	82°10.8	49.0
9	75°50.7	286°20.5	·· 37.3	275°54.5	·· 32.2	35°14.5	·· 30.3	97°13.4	·· 49.0
10	90°53.2	301°23.2	36.8	290°55.5	31.6	50°16.7	30.4	112°16.0	49.1
11	105°55.7	316°25.9	36.3	305°56.5	31.0	65°18.8	30.5	127°18.6	49.1
12	120°58.1	331°28.6	N08°35.8	320°57.6	N09°30.4	80°21.0	N14°30.6	142°21.2	S10°49.2
13	136°00.6	346°31.3	35.3	335°58.6	29.8	95°23.1	30.7	157°23.8	49.2
14	151°03.1	1°34.0	34.8	350°59.6	29.2	110°25.3	30.8	172°26.3	49.3
15	166°05.5	16°36.7	·· 34.3	6°00.6	·· 28.6	125°27.4	·· 30.9	187°28.9	·· 49.4
16	181°08.0	31°39.4	33.8	21°01.7	28.0	140°29.6	31.0	202°31.5	49.4
17	196°10.4	46°42.2	33.3	36°02.7	27.4	155°31.7	31.0	217°34.1	49.5
18	211°12.9	61°44.9	N08°32.8	51°03.7	N09°26.8	170°33.9	N14°31.1	232°36.7	S10°49.5
19	226°15.4	76°47.6	32.3	66°04.7	26.2	185°36.0	31.2	247°39.3	49.6
20	241°17.8	91°50.3	31.8	81°05.7	25.6	200°38.2	31.3	262°41.9	49.6
21	256°20.3	106°53.1	·· 31.3	96°06.8	·· 25.0	215°40.4	·· 31.4	277°44.5	·· 49.7
22	271°22.8	121°55.8	30.8	111°07.8	24.4	230°42.5	31.5	292°47.1	49.8
23	286°25.2	136°58.5	30.3	126°08.8	23.8	245°44.7	31.6	307°49.6	49.8
Mer.pass. 03:57		ν 2.7′ d -0.5′	m -4.65	ν 1.0′ d -0.6′	m 1.78	ν 2.1′ d 0.1′	m -2.31	ν 2.6′ d -0.1′	m 0.61

Stars	SHA	Dec
Alpheratz	357°35.9	29°13.1
Ankaa	353°08.2	-42°10.5
Schedar	349°32.3	56°39.7
Diphda	348°48.4	-17°51.3
Achernar	335°21.1	-57°06.7
Hamal	327°52.6	23°34.3
Polaris	314°46.4	89°21.5
Acamar	315°12.8	-40°12.4
Menkar	314°07.5	4°10.9
Mirfak	308°30.2	49°56.5
Aldebaran	290°41.2	16°33.4
Rigel	281°05.3	-8°10.4
Capella	280°24.1	46°01.2
Bellatrix	278°24.5	6°22.3
Elnath	278°03.7	28°37.6
Alnilam	275°39.2	-1°11.1
Betelgeuse	270°53.7	7°24.7
Canopus	263°53.4	-52°42.3
Sirius	258°27.6	-16°44.8
Adhara	255°07.2	-29°00.1
Procyon	244°52.4	5°10.0
Pollux	243°19.2	27°58.2
Avior	234°15.9	-59°35.0
Suhail	222°47.6	-43°31.6
Miaplacidus	221°39.4	-69°48.8
Alphard	217°49.3	-8°45.5
Regulus	207°36.0	11°51.3
Dubhe	193°42.9	61°37.7
Denebola	182°26.4	14°26.6
Gienah	175°45.0	-17°40.3
Acrux	173°01.7	-63°14.0
Gacrux	171°53.2	-57°14.9
Alioth	166°14.2	55°50.3
Spica	158°23.6	-11°17.0
Alkaid	152°53.0	49°12.1
Hadar	148°37.7	-60°29.4
Menkent	147°59.0	-36°29.3
Arcturus	145°49.0	19°03.8
Rigil Kent.	139°41.9	-60°56.2
Kochab	137°19.4	74°03.8
Zuben'ubi	136°57.3	-16°08.4
Alphecca	126°04.6	26°38.3
Antares	112°17.1	-26°29.1
Atria	107°12.0	-69°04.3
Sabik	102°03.9	-15°45.2
Shaula	96°11.7	-37°07.3
Rasalhague	95°59.4	12°32.7
Eltanin	90°42.3	51°29.3
Kaus Aust.	83°33.7	-34°22.4
Vega	80°33.6	38°48.4
Nunki	75°48.9	-26°16.0
Altair	62°00.8	8°55.9
Peacock	53°07.0	-56°39.5
Deneb	49°26.2	45°21.8
Enif	33°39.7	9°59.0
Al Na'ir	27°34.0	-46°50.7
Fomalhaut	15°15.6	-29°29.7
Scheat	13°46.1	28°12.5
Markab	13°30.9	15°19.9

Jul 21 Fri	**SHA**	**Mer.pass**
Venus	210°23.5	14:02
Mars	201°25.9	14:39
Jupiter	319°42.2	06:46
Saturn	21°15.9	02:40

Jul 22 Sat	**SHA**	**Mer.pass**
Venus	210°24.6	13:58
Mars	200°51.3	14:38
Jupiter	319°34.4	06:43
Saturn	21°18.7	02:36

Jul 23 Sun	**SHA**	**Mer.pass**
Venus	210°28.0	13:54
Mars	200°16.7	14:36
Jupiter	319°26.7	06:39
Saturn	21°21.6	02:32

Horizontal parallax	
Venus:	0.4
Mars:	0.1

h

Fri	Sun GHA	Sun Dec	Moon GHA	ν	Moon Dec	d	HP
0	178°23.6	N20°33.5	141°41.1	15.7′	N14°08.8	12.2′	53.9′
1	193°23.6	33.0	156°15.9	15.8′	13°56.6	12.2′	53.9′
2	208°23.5	32.5	170°50.7	15.8′	13°44.4	12.3′	53.9′
3	223°23.5	·· 32.0	185°25.5	15.9′	13°32.1	12.3′	53.9′
4	238°23.5	31.6	200°00.4	15.9′	13°19.8	12.4′	53.9′
5	253°23.4	31.1	214°35.3	16.0′	13°07.4	12.4′	53.9′
6	268°23.4	N20°30.6	229°10.3	16.0′	N12°55.0	12.5′	54.0′
7	283°23.4	30.1	243°45.3	16.1′	12°42.5	12.6′	54.0′
8	298°23.3	29.6	258°20.3	16.1′	12°29.9	12.5′	54.0′
9	313°23.3	·· 29.2	272°55.4	16.1′	12°17.4	12.7′	54.0′
10	328°23.3	28.7	287°30.5	16.2′	12°04.7	12.6′	54.0′
11	343°23.2	28.2	302°05.7	16.2′	11°52.1	12.8′	54.0′
12	358°23.2	N20°27.7	316°40.9	16.3′	N11°39.3	12.7′	54.0′
13	13°23.2	27.2	331°16.2	16.3′	11°26.6	12.8′	54.0′
14	28°23.1	26.7	345°51.5	16.3′	11°13.8	12.9′	54.0′
15	43°23.1	·· 26.3	0°26.8	16.4′	11°00.9	12.9′	54.0′
16	58°23.1	25.8	15°02.2	16.4′	10°48.0	12.9′	54.0′
17	73°23.1	25.3	29°37.6	16.4′	10°35.1	13.0′	54.0′
18	88°23.0	N20°24.8	44°13.0	16.5′	N10°22.1	13.0′	54.0′
19	103°23.0	24.3	58°48.4	16.5′	10°09.1	13.1′	54.0′
20	118°23.0	23.8	73°23.9	16.5′	09°56.0	13.1′	54.0′
21	133°22.9	·· 23.3	87°59.5	16.6′	09°42.9	13.1′	54.0′
22	148°22.9	22.8	102°35.0	16.6′	09°29.8	13.2′	54.1′
23	163°22.9	22.3	117°10.6	16.6′	09°16.6	13.2′	54.1′
	SD = 15.7′	d = -0.5′	SD = 14.7′				

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	178°22.9	N20°21.9	131°46.2	16.6′	N09°03.4	13.2′	54.1′
1	193°22.8	21.4	146°21.8	16.7′	08°50.2	13.3′	54.1′
2	208°22.8	20.9	160°57.5	16.7′	08°36.9	13.3′	54.1′
3	223°22.8	·· 20.4	175°33.2	16.7′	08°23.6	13.4′	54.1′
4	238°22.7	19.9	190°08.9	16.7′	08°10.2	13.4′	54.1′
5	253°22.7	19.4	204°44.6	16.8′	07°56.8	13.4′	54.1′
6	268°22.7	N20°18.9	219°20.4	16.8′	N07°43.4	13.4′	54.1′
7	283°22.7	18.4	233°56.2	16.8′	07°30.0	13.5′	54.1′
8	298°22.6	17.9	248°31.9	16.8′	07°16.5	13.5′	54.1′
9	313°22.6	·· 17.4	263°07.8	16.8′	07°03.0	13.6′	54.2′
10	328°22.6	16.9	277°43.6	16.8′	06°49.4	13.5′	54.2′
11	343°22.6	16.4	292°19.4	16.9′	06°35.9	13.6′	54.2′
12	358°22.5	N20°15.9	306°55.3	16.9′	N06°22.3	13.6′	54.2′
13	13°22.5	15.4	321°31.2	16.9′	06°08.7	13.7′	54.2′
14	28°22.5	14.9	336°07.1	16.9′	05°55.0	13.7′	54.2′
15	43°22.5	·· 14.4	350°43.0	16.9′	05°41.3	13.7′	54.2′
16	58°22.4	13.9	5°18.9	16.9′	05°27.6	13.7′	54.2′
17	73°22.4	13.4	19°54.8	16.9′	05°13.9	13.7′	54.3′
18	88°22.4	N20°12.9	34°30.7	16.9′	N05°00.2	13.8′	54.3′
19	103°22.4	12.4	49°06.7	16.9′	04°46.4	13.8′	54.3′
20	118°22.4	11.9	63°42.6	17.0′	04°32.6	13.8′	54.3′
21	133°22.3	·· 11.4	78°18.6	17.0′	04°18.8	13.9′	54.3′
22	148°22.3	10.9	92°54.6	17.0′	04°04.9	13.8′	54.3′
23	163°22.3	10.4	107°30.5	17.0′	03°51.1	13.9′	54.3′
	SD = 15.7′	d = -0.5′	SD = 14.7′				

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	178°22.3	N20°09.9	122°06.5	17.0′	N03°37.2	13.9′	54.3′
1	193°22.2	09.4	136°42.5	17.0′	03°23.3	13.9′	54.4′
2	208°22.2	08.9	151°18.4	17.0′	03°09.4	14.0′	54.4′
3	223°22.2	·· 08.4	165°54.4	17.0′	02°55.4	13.9′	54.4′
4	238°22.2	07.9	180°30.4	17.0′	02°41.5	14.0′	54.4′
5	253°22.2	07.4	195°06.3	17.0′	02°27.5	14.0′	54.4′
6	268°22.1	N20°06.9	209°42.3	17.0′	N02°13.5	14.0′	54.4′
7	283°22.1	06.4	224°18.2	16.9′	01°59.5	14.0′	54.5′
8	298°22.1	05.9	238°54.2	16.9′	01°45.5	14.0′	54.5′
9	313°22.1	·· 05.3	253°30.1	16.9′	01°31.5	14.1′	54.5′
10	328°22.1	04.8	268°06.0	16.9′	01°17.4	14.0′	54.5′
11	343°22.0	04.3	282°42.0	16.9′	01°03.4	14.1′	54.5′
12	358°22.0	N20°03.8	297°17.9	16.9′	N00°49.3	14.1′	54.5′
13	13°22.0	03.3	311°53.8	16.9′	00°35.2	14.1′	54.6′
14	28°22.0	02.8	326°29.7	16.9′	00°21.1	14.1′	54.6′
15	43°22.0	·· 02.3	341°05.5	16.9′	N00°07.0	14.1′	54.6′
16	58°22.0	01.8	355°41.4	16.8′	S00°07.1	14.1′	54.6′
17	73°21.9	01.3	10°17.2	16.8′	00°21.2	14.1′	54.6′
18	88°21.9	N20°00.7	24°53.0	16.8′	S00°35.3	14.2′	54.6′
19	103°21.9	20°00.2	39°28.8	16.8′	00°49.5	14.1′	54.7′
20	118°21.9	19°59.7	54°04.6	16.8′	01°03.6	14.2′	54.7′
21	133°21.9	·· 59.2	68°40.4	16.7′	01°17.8	14.1′	54.7′
22	148°21.9	58.7	83°16.1	16.7′	01°31.9	14.2′	54.7′
23	163°21.8	58.2	97°51.8	16.7′	01°46.1	14.1′	54.7′
	SD = 15.7′	d = -0.5′	SD = 14.8′				

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

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

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 9-23%
21	06:26	06:27	12:06	14:58	02:38	
22	06:29	06:30	12:06	15:38	03:18	
23	06:31	06:32	12:07	16:18	03:58	

July 24, 25, 26 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	301°27.7	152°01.3	N08°29.8	141°09.8	N09°23.2	260°46.8	N14°31.7	322°52.2	S10°49.9
1	316°30.2	167°04.0	29.3	156°10.9	22.6	275°49.0	31.8	337°54.8	49.9
2	331°32.6	182°06.8	28.8	171°11.9	22.0	290°51.1	31.8	352°57.4	50.0
3	346°35.1	197°09.5	·· 28.3	186°12.9	·· 21.4	305°53.3	·· 31.9	8°00.0	·· 50.0
4	1°37.5	212°12.3	27.8	201°13.9	20.8	320°55.4	32.0	23°02.6	50.1
5	16°40.0	227°15.0	27.3	216°15.0	20.2	335°57.6	32.1	38°05.2	50.2
6	31°42.5	242°17.8	N08°26.8	231°16.0	N09°19.6	350°59.7	N14°32.2	53°07.8	S10°50.2
7	46°44.9	257°20.6	26.3	246°17.0	19.0	6°01.9	32.3	68°10.4	50.3
8	61°47.4	272°23.4	25.8	261°18.0	18.4	21°04.0	32.4	83°12.9	50.3
9	76°49.9	287°26.1	·· 25.4	276°19.0	·· 17.8	36°06.2	·· 32.5	98°15.5	·· 50.4
10	91°52.3	302°28.9	24.9	291°20.1	17.2	51°08.3	32.5	113°18.1	50.4
11	106°54.8	317°31.7	24.4	306°21.1	16.6	66°10.5	32.6	128°20.7	50.5
12	121°57.3	332°34.5	N08°23.9	321°22.1	N09°16.0	81°12.7	N14°32.7	143°23.3	S10°50.6
13	136°59.7	347°37.3	23.4	336°23.1	15.4	96°14.8	32.8	158°25.9	50.6
14	152°02.2	2°40.1	23.0	351°24.2	14.8	111°17.0	32.9	173°28.5	50.7
15	167°04.7	17°42.9	·· 22.5	6°25.2	·· 14.2	126°19.1	·· 33.0	188°31.1	·· 50.7
16	182°07.1	32°45.7	22.0	21°26.2	13.6	141°21.3	33.1	203°33.7	50.8
17	197°09.6	47°48.5	21.5	36°27.2	13.0	156°23.4	33.1	218°36.3	50.8
18	212°12.0	62°51.3	N08°21.0	51°28.3	N09°12.4	171°25.6	N14°33.2	233°38.9	S10°50.9
19	227°14.5	77°54.1	20.6	66°29.3	11.8	186°27.7	33.3	248°41.4	51.0
20	242°17.0	92°57.0	20.1	81°30.3	11.2	201°29.9	33.4	263°44.0	51.0
21	257°19.4	107°59.8	·· 19.6	96°31.3	·· 10.6	216°32.1	·· 33.5	278°46.6	·· 51.1
22	272°21.9	123°02.6	19.2	111°32.3	10.0	231°34.2	33.6	293°49.2	51.1
23	287°24.4	138°05.4	18.7	126°33.4	09.4	246°36.4	33.7	308°51.8	51.2
Mer.pass. 03:54		ν 2.7′ d -0.5′ m -4.64		ν 1.0′ d -0.6′ m 1.78		ν 2.2′ d 0.1′ m -2.32		ν 2.6′ d -0.1′ m 0.61	

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	302°26.8	153°08.3	N08°18.2	141°34.4	N09°08.8	261°38.5	N14°33.8	323°54.4	S10°51.2
1	317°29.3	168°11.1	17.8	156°35.4	08.2	276°40.7	33.8	338°57.0	51.3
2	332°31.8	183°14.0	17.3	171°36.4	07.6	291°42.8	33.9	353°59.6	51.4
3	347°34.2	198°16.8	·· 16.8	186°37.5	·· 07.0	306°45.0	·· 34.0	9°02.2	·· 51.4
4	2°36.7	213°19.7	16.4	201°38.5	06.4	321°47.2	34.1	24°04.8	51.5
5	17°39.1	228°22.5	15.9	216°39.5	05.8	336°49.3	34.2	39°07.4	51.5
6	32°41.6	243°25.4	N08°15.5	231°40.5	N09°05.2	351°51.5	N14°34.3	54°10.0	S10°51.6
7	47°44.1	258°28.3	15.0	246°41.6	04.6	6°53.6	34.4	69°12.5	51.7
8	62°46.5	273°31.1	14.5	261°42.6	04.0	21°55.8	34.4	84°15.1	51.7
9	77°49.0	288°34.0	·· 14.1	276°43.6	·· 03.4	36°58.0	·· 34.5	99°17.7	·· 51.8
10	92°51.5	303°36.9	13.6	291°44.6	02.8	52°00.1	34.6	114°20.3	51.8
11	107°53.9	318°39.8	13.2	306°45.7	02.2	67°02.3	34.7	129°22.9	51.9
12	122°56.4	333°42.6	N08°12.7	321°46.7	N09°01.6	82°04.4	N14°34.8	144°25.5	S10°51.9
13	137°58.9	348°45.5	12.3	336°47.7	01.0	97°06.6	34.9	159°28.1	52.0
14	153°01.3	3°48.4	11.8	351°48.7	09°00.4	112°08.8	34.9	174°30.7	52.1
15	168°03.8	18°51.3	·· 11.4	6°49.7	08°59.8	127°10.9	·· 35.0	189°33.3	·· 52.1
16	183°06.3	33°54.2	10.9	21°50.8	59.2	142°13.1	35.1	204°35.9	52.2
17	198°08.7	48°57.1	10.5	36°51.8	58.6	157°15.3	35.2	219°38.5	52.2
18	213°11.2	64°00.0	N08°10.1	51°52.8	N08°58.0	172°17.4	N14°35.3	234°41.1	S10°52.3
19	228°13.6	79°02.9	09.6	66°53.8	57.4	187°19.6	35.4	249°43.7	52.4
20	243°16.1	94°05.9	09.2	81°54.9	56.8	202°21.7	35.5	264°46.3	52.4
21	258°18.6	109°08.8	·· 08.7	96°55.9	·· 56.2	217°23.9	·· 35.5	279°48.9	·· 52.5
22	273°21.0	124°11.7	08.3	111°56.9	55.6	232°26.1	35.6	294°51.4	52.5
23	288°23.5	139°14.6	07.9	126°57.9	55.0	247°28.2	35.7	309°54.0	52.6
Mer.pass. 03:50		ν 2.8′ d -0.5′ m -4.61		ν 1.0′ d -0.6′ m 1.78		ν 2.2′ d 0.1′ m -2.32		ν 2.6′ d -0.1′ m 0.60	

Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	303°26.0	154°17.6	N08°07.4	141°59.0	N08°54.4	262°30.4	N14°35.8	324°56.6	S10°52.7
1	318°28.4	169°20.5	07.0	157°00.0	53.8	277°32.6	35.9	339°59.2	52.7
2	333°30.9	184°23.4	06.6	172°01.0	53.2	292°34.7	36.0	355°01.8	52.8
3	348°33.4	199°26.4	·· 06.1	187°02.0	·· 52.6	307°36.9	·· 36.0	10°04.4	·· 52.8
4	3°35.8	214°29.3	05.7	202°03.1	51.9	322°39.1	36.1	25°07.0	52.9
5	18°38.3	229°32.3	05.3	217°04.1	51.3	337°41.2	36.2	40°09.6	52.9
6	33°40.8	244°35.2	N08°04.8	232°05.1	N08°50.7	352°43.4	N14°36.3	55°12.2	S10°53.0
7	48°43.2	259°38.2	04.4	247°06.1	50.1	7°45.6	36.4	70°14.8	53.1
8	63°45.7	274°41.2	04.0	262°07.2	49.5	22°47.7	36.5	85°17.4	53.1
9	78°48.1	289°44.1	·· 03.6	277°08.2	·· 48.9	37°49.9	·· 36.5	100°20.0	·· 53.2
10	93°50.6	304°47.1	03.1	292°09.2	48.3	52°52.1	36.6	115°22.6	53.2
11	108°53.1	319°50.1	02.7	307°10.2	47.7	67°54.2	36.7	130°25.2	53.3
12	123°55.5	334°53.1	N08°02.3	322°11.2	N08°47.1	82°56.4	N14°36.8	145°27.8	S10°53.4
13	138°58.0	349°56.0	01.9	337°12.3	46.5	97°58.6	36.9	160°30.4	53.4
14	154°00.5	4°59.0	01.5	352°13.3	45.9	113°00.7	37.0	175°33.0	53.5
15	169°02.9	20°02.0	·· 01.0	7°14.3	·· 45.3	128°02.9	·· 37.0	190°35.6	·· 53.5
16	184°05.4	35°05.0	00.6	22°15.3	44.7	143°05.1	37.1	205°38.2	53.6
17	199°07.9	50°08.0	08°00.2	37°16.4	44.1	158°07.2	37.2	220°40.8	53.7
18	214°10.3	65°11.0	N07°59.8	52°17.4	N08°43.5	173°09.4	N14°37.3	235°43.4	S10°53.7
19	229°12.8	80°14.0	59.4	67°18.4	42.9	188°11.6	37.4	250°46.0	53.8
20	244°15.2	95°17.0	59.0	82°19.4	42.3	203°13.7	37.5	265°48.5	53.8
21	259°17.7	110°20.1	·· 58.6	97°20.5	·· 41.7	218°15.9	·· 37.5	280°51.1	·· 53.9
22	274°20.2	125°23.1	58.2	112°21.5	41.1	233°18.1	37.6	295°53.7	54.0
23	289°22.6	140°26.1	57.8	127°22.5	40.4	248°20.2	37.7	310°56.3	54.0
Mer.pass. 03:46		ν 2.9′ d -0.4′ m -4.59		ν 1.0′ d -0.6′ m 1.78		ν 2.2′ d 0.1′ m -2.33		ν 2.6′ d -0.1′ m 0.60	

Stars

	SHA	**Dec**
Alpheratz	357°35.9	29°13.1
Ankaa	353°08.2	-42°10.5
Schedar	349°32.2	56°39.7
Diphda	348°48.4	-17°51.3
Achernar	335°21.0	-57°06.7
Hamal	327°52.6	23°34.3
Polaris	314°45.0	89°21.5
Acamar	315°12.8	-40°12.4
Menkar	314°07.5	4°11.0
Mirfak	308°30.2	49°56.5
Aldebaran	290°41.2	16°33.4
Rigel	281°05.3	-8°10.3
Capella	280°24.0	46°01.2
Bellatrix	278°24.4	6°22.3
Elnath	278°03.7	28°37.6
Alnilam	275°39.2	-1°11.1
Betelgeuse	270°53.7	7°24.7
Canopus	263°53.4	-52°42.3
Sirius	258°27.6	-16°44.8
Adhara	255°07.2	-29°00.1
Procyon	244°52.4	5°10.0
Pollux	243°19.2	27°58.2
Avior	234°15.9	-59°35.0
Suhail	222°47.6	-43°31.6
Miaplacidus	221°39.5	-69°48.8
Alphard	217°49.3	-8°45.5
Regulus	207°36.0	11°51.3
Dubhe	193°43.0	61°37.7
Denebola	182°26.4	14°26.6
Gienah	175°45.0	-17°40.3
Acrux	173°01.8	-63°14.0
Gacrux	171°53.2	-57°14.9
Alioth	166°14.2	55°50.3
Spica	158°23.6	-11°17.0
Alkaid	152°53.0	49°12.1
Hadar	148°37.7	-60°29.4
Menkent	147°59.0	-36°29.3
Arcturus	145°49.0	19°03.8
Rigil Kent.	139°41.9	-60°56.2
Kochab	137°19.5	74°03.8
Zuben'ubi	136°57.3	-16°08.4
Alphecca	126°04.6	26°38.3
Antares	112°17.1	-26°29.1
Atria	107°12.0	-69°04.4
Sabik	102°03.9	-15°45.2
Shaula	96°11.7	-37°07.3
Rasalhague	95°59.4	12°32.7
Eltanin	90°42.3	51°29.3
Kaus Aust.	83°33.7	-34°22.4
Vega	80°33.6	38°48.4
Nunki	75°48.9	-26°16.0
Altair	62°00.8	8°55.9
Peacock	53°07.0	-56°39.5
Deneb	49°26.2	45°21.8
Enif	33°39.7	9°59.0
Al Na'ir	27°34.0	-46°50.7
Fomalhaut	15°15.6	-29°29.7
Scheat	13°46.1	28°12.5
Markab	13°30.9	15°19.9

Jul 24 Mon	**SHA**	**Mer.pass**
Venus	210°33.6	13:49
Mars	199°42.1	14:34
Jupiter	319°19.1	06:36
Saturn	21°24.5	02:28

Jul 25 Tue	**SHA**	**Mer.pass**
Venus	210°41.5	13:45
Mars	199°07.6	14:33
Jupiter	319°11.7	06:32
Saturn	21°27.6	02:24

Jul 26 Wed	**SHA**	**Mer.pass**
Venus	210°51.6	13:40
Mars	198°33.0	14:31
Jupiter	319°04.4	06:29
Saturn	21°30.7	02:20

Horizontal parallax	
Venus:	0.4
Mars:	0.1

h	Sun		Moon				
Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°21.8	N19°57.6	112°27.5	16.7′	S02°00.2	14.2′	54.8′
1	193°21.8	57.1	127°03.2	16.6′	02°14.4	14.2′	54.8′
2	208°21.8	56.6	141°38.8	16.6′	02°28.6	14.1′	54.8′
3	223°21.8	·· 56.1	156°14.4	16.6′	02°42.7	14.2′	54.8′
4	238°21.8	55.6	170°50.0	16.5′	02°56.9	14.1′	54.9′
5	253°21.7	55.0	185°25.5	16.5′	03°11.0	14.2′	54.9′
6	268°21.7	N19°54.5	200°01.1	16.5′	S03°25.2	14.2′	54.9′
7	283°21.7	54.0	214°36.5	16.4′	03°39.4	14.1′	54.9′
8	298°21.7	53.5	229°12.0	16.4′	03°53.5	14.2′	54.9′
9	313°21.7	·· 52.9	243°47.4	16.4′	04°07.7	14.1′	55.0′
10	328°21.7	52.4	258°22.7	16.3′	04°21.8	14.2′	55.0′
11	343°21.7	51.9	272°58.1	16.3′	04°36.0	14.1′	55.0′
12	358°21.7	N19°51.4	287°33.4	16.2′	S04°50.1	14.2′	55.0′
13	13°21.6	50.8	302°08.6	16.2′	05°04.3	14.1′	55.1′
14	28°21.6	50.3	316°43.8	16.2′	05°18.4	14.1′	55.1′
15	43°21.6	·· 49.8	331°19.0	16.1′	05°32.5	14.1′	55.1′
16	58°21.6	49.3	345°54.1	16.1′	05°46.6	14.1′	55.1′
17	73°21.6	48.7	0°29.2	16.0′	06°00.7	14.1′	55.2′
18	88°21.6	N19°48.2	15°04.2	16.0′	S06°14.8	14.1′	55.2′
19	103°21.6	47.7	29°39.2	15.9′	06°28.9	14.1′	55.2′
20	118°21.6	47.1	44°14.1	15.9′	06°43.0	14.0′	55.2′
21	133°21.6	·· 46.6	58°49.0	15.8′	06°57.0	14.1′	55.3′
22	148°21.5	46.1	73°23.8	15.8′	07°11.1	14.0′	55.3′
23	163°21.5	45.6	87°58.6	15.7′	07°25.1	14.0′	55.3′
	SD = 15.7′	d = -0.5′	SD = 14.9′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°21.5	N19°45.0	102°33.3	15.7′	S07°39.1	14.0′	55.3′
1	193°21.5	44.5	117°07.9	15.6′	07°53.1	14.0′	55.4′
2	208°21.5	44.0	131°42.5	15.5′	08°07.1	13.9′	55.4′
3	223°21.5	·· 43.4	146°17.1	15.5′	08°21.0	14.0′	55.4′
4	238°21.5	42.9	160°51.5	15.4′	08°35.0	13.9′	55.5′
5	253°21.5	42.4	175°26.0	15.4′	08°48.9	13.9′	55.5′
6	268°21.5	N19°41.8	190°00.3	15.3′	S09°02.8	13.9′	55.5′
7	283°21.5	41.3	204°34.6	15.2′	09°16.7	13.8′	55.5′
8	298°21.5	40.7	219°08.8	15.2′	09°30.5	13.9′	55.6′
9	313°21.5	·· 40.2	233°43.0	15.1′	09°44.4	13.8′	55.6′
10	328°21.5	39.7	248°17.1	15.0′	09°58.2	13.8′	55.6′
11	343°21.4	39.1	262°51.1	14.9′	10°12.0	13.7′	55.7′
12	358°21.4	N19°38.6	277°25.0	14.9′	S10°25.7	13.7′	55.7′
13	13°21.4	38.1	291°58.9	14.8′	10°39.4	13.7′	55.7′
14	28°21.4	37.5	306°32.7	14.7′	10°53.1	13.7′	55.7′
15	43°21.4	·· 37.0	321°06.4	14.6′	11°06.8	13.7′	55.8′
16	58°21.4	36.4	335°40.1	14.6′	11°20.5	13.6′	55.8′
17	73°21.4	35.9	350°13.6	14.5′	11°34.1	13.5′	55.8′
18	88°21.4	N19°35.3	4°47.1	14.4′	S11°47.6	13.6′	55.9′
19	103°21.4	34.8	19°20.5	14.3′	12°01.2	13.5′	55.9′
20	118°21.4	34.3	33°53.9	14.2′	12°14.7	13.4′	55.9′
21	133°21.4	·· 33.7	48°27.1	14.2′	12°28.1	13.5′	56.0′
22	148°21.4	33.2	63°00.3	14.1′	12°41.6	13.4′	56.0′
23	163°21.4	32.6	77°33.4	14.0′	12°55.0	13.3′	56.0′
	SD = 15.7′	d = -0.5′	SD = 15.1′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°21.4	N19°32.1	92°06.4	13.9′	S13°08.3	13.3′	56.1′
1	193°21.4	31.5	106°39.3	13.8′	13°21.6	13.3′	56.1′
2	208°21.4	31.0	121°12.1	13.7′	13°34.9	13.2′	56.1′
3	223°21.4	·· 30.4	135°44.8	13.6′	13°48.1	13.2′	56.2′
4	238°21.4	29.9	150°17.4	13.5′	14°01.3	13.2′	56.2′
5	253°21.4	29.3	164°50.0	13.4′	14°14.5	13.1′	56.2′
6	268°21.4	N19°28.8	179°22.4	13.3′	S14°27.6	13.0′	56.3′
7	283°21.4	28.2	193°54.8	13.3′	14°40.6	13.0′	56.3′
8	298°21.4	27.7	208°27.0	13.2′	14°53.6	13.0′	56.3′
9	313°21.4	·· 27.1	222°59.2	13.1′	15°06.6	12.9′	56.4′
10	328°21.4	26.6	237°31.2	13.0′	15°19.5	12.8′	56.4′
11	343°21.4	26.0	252°03.2	12.9′	15°32.3	12.8′	56.4′
12	358°21.4	N19°25.5	266°35.0	12.8′	S15°45.1	12.7′	56.5′
13	13°21.4	24.9	281°06.8	12.6′	15°57.8	12.7′	56.5′
14	28°21.4	24.4	295°38.4	12.5′	16°10.5	12.6′	56.5′
15	43°21.4	·· 23.8	310°10.0	12.4′	16°23.1	12.6′	56.6′
16	58°21.4	23.3	324°41.4	12.3′	16°35.7	12.5′	56.6′
17	73°21.4	22.7	339°12.7	12.2′	16°48.2	12.4′	56.6′
18	88°21.4	N19°22.2	353°44.0	12.1′	S17°00.6	12.4′	56.7′
19	103°21.4	21.6	8°15.1	12.0′	17°13.0	12.3′	56.7′
20	118°21.4	21.1	22°46.1	11.9′	17°25.3	12.2′	56.8′
21	133°21.4	·· 20.5	37°16.9	11.8′	17°37.5	12.2′	56.8′
22	148°21.4	19.9	51°47.7	11.7′	17°49.7	12.1′	56.8′
23	163°21.4	19.4	66°18.4	11.5′	18°01.8	12.0′	56.9′
	SD = 15.7′	d = -0.5′	SD = 15.3′				

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

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

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 7-9 31-51%
24	06:33	06:33	12:07	16:58	04:38	
25	06:34	06:34	12:07	17:40	05:19	
26	06:34	06:34	12:07	18:26	06:03	

July 27, 28, 29 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	304°25.1	155°29.1	N07°57.4	142°23.5	N08°39.8	263°22.4	N14°37.8	325°58.9	S10°54.1
1	319°27.6	170°32.2	57.0	157°24.6	39.2	278°24.6	37.9	341°01.5	54.1
2	334°30.0	185°35.2	56.6	172°25.6	38.6	293°26.7	37.9	356°04.1	54.2
3	349°32.5	200°38.2	·· 56.2	187°26.6	·· 38.0	308°28.9	·· 38.0	11°06.7	·· 54.3
4	4°35.0	215°41.3	55.8	202°27.6	37.4	323°31.1	38.1	26°09.3	54.3
5	19°37.4	230°44.3	55.4	217°28.7	36.8	338°33.3	38.2	41°11.9	54.4
6	34°39.9	245°47.4	N07°55.0	232°29.7	N08°36.2	353°35.4	N14°38.3	56°14.5	S10°54.4
7	49°42.4	260°50.4	54.6	247°30.7	35.6	8°37.6	38.4	71°17.1	54.5
8	64°44.8	275°53.5	54.2	262°31.7	35.0	23°39.8	38.4	86°19.7	54.6
9	79°47.3	290°56.6	·· 53.8	277°32.8	·· 34.4	38°41.9	·· 38.5	101°22.3	·· 54.6
10	94°49.7	305°59.6	53.4	292°33.8	33.8	53°44.1	38.6	116°24.9	54.7
11	109°52.2	321°02.7	53.0	307°34.8	33.2	68°46.3	38.7	131°27.5	54.7
12	124°54.7	336°05.8	N07°52.6	322°35.8	N08°32.6	83°48.5	N14°38.8	146°30.1	S10°54.8
13	139°57.1	351°08.8	52.2	337°36.8	32.0	98°50.6	38.8	161°32.7	54.9
14	154°59.6	6°11.9	51.9	352°37.9	31.3	113°52.8	38.9	176°35.3	54.9
15	170°02.1	21°15.0	·· 51.5	7°38.9	·· 30.7	128°55.0	·· 39.0	191°37.9	·· 55.0
16	185°04.5	36°18.1	51.1	22°39.9	30.1	143°57.2	39.1	206°40.5	55.0
17	200°07.0	51°21.2	50.7	37°40.9	29.5	158°59.3	39.2	221°43.1	55.1
18	215°09.5	66°24.3	N07°50.3	52°42.0	N08°28.9	174°01.5	N14°39.2	236°45.7	S10°55.2
19	230°11.9	81°27.4	50.0	67°43.0	28.3	189°03.7	39.3	251°48.3	55.2
20	245°14.4	96°30.5	49.6	82°44.0	27.7	204°05.9	39.4	266°50.9	55.3
21	260°16.9	111°33.6	·· 49.2	97°45.0	·· 27.1	219°08.0	·· 39.5	281°53.5	·· 55.3
22	275°19.3	126°36.7	48.8	112°46.1	26.5	234°10.2	39.6	296°56.1	55.4
23	290°21.8	141°39.8	48.5	127°47.1	25.9	249°12.4	39.6	311°58.7	55.5
Mer.pass. 03:42		ν 3.0′ d -0.4′ m -4.56		ν 1.0′ d -0.6′ m 1.78		ν 2.2′ d 0.1′ m -2.34		ν 2.6′ d -0.1′ m 0.60	

Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	305°24.2	156°43.0	N07°48.1	142°48.1	N08°25.3	264°14.6	N14°39.7	327°01.3	S10°55.5
1	320°26.7	171°46.1	47.7	157°49.1	24.7	279°16.7	39.8	342°03.9	55.6
2	335°29.2	186°49.2	47.3	172°50.2	24.0	294°18.9	39.9	357°06.5	55.6
3	350°31.6	201°52.4	·· 47.0	187°51.2	·· 23.4	309°21.1	·· 40.0	12°09.1	·· 55.7
4	5°34.1	216°55.5	46.6	202°52.2	22.8	324°23.3	40.0	27°11.7	55.8
5	20°36.6	231°58.6	46.3	217°53.2	22.2	339°25.4	40.1	42°14.3	55.8
6	35°39.0	247°01.8	N07°45.9	232°54.3	N08°21.6	354°27.6	N14°40.2	57°16.9	S10°55.9
7	50°41.5	262°04.9	45.5	247°55.3	21.0	9°29.8	40.3	72°19.5	55.9
8	65°44.0	277°08.1	45.2	262°56.3	20.4	24°32.0	40.4	87°22.1	56.0
9	80°46.4	292°11.2	·· 44.8	277°57.3	·· 19.8	39°34.2	·· 40.4	102°24.7	·· 56.1
10	95°48.9	307°14.4	44.5	292°58.4	19.2	54°36.3	40.5	117°27.3	56.1
11	110°51.4	322°17.6	44.1	307°59.4	18.6	69°38.5	40.6	132°29.9	56.2
12	125°53.8	337°20.7	N07°43.8	323°00.4	N08°17.9	84°40.7	N14°40.7	147°32.5	S10°56.2
13	140°56.3	352°23.9	43.4	338°01.4	17.3	99°42.9	40.8	162°35.1	56.3
14	155°58.7	7°27.1	43.0	353°02.5	16.7	114°45.1	40.8	177°37.7	56.4
15	171°01.2	22°30.3	·· 42.7	8°03.5	·· 16.1	129°47.2	·· 40.9	192°40.3	·· 56.4
16	186°03.7	37°33.4	42.4	23°04.5	15.5	144°49.4	41.0	207°42.9	56.5
17	201°06.1	52°36.6	42.0	38°05.5	14.9	159°51.6	41.1	222°45.5	56.6
18	216°08.6	67°39.8	N07°41.7	53°06.6	N08°14.3	174°53.8	N14°41.1	237°48.1	S10°56.6
19	231°11.1	82°43.0	41.3	68°07.6	13.7	189°56.0	41.2	252°50.7	56.7
20	246°13.5	97°46.2	41.0	83°08.6	13.1	204°58.1	41.3	267°53.3	56.7
21	261°16.0	112°49.4	·· 40.6	98°09.6	·· 12.5	220°00.3	·· 41.4	282°55.9	·· 56.8
22	276°18.5	127°52.6	40.3	113°10.7	11.8	235°02.5	41.5	297°58.5	56.9
23	291°20.9	142°55.8	40.0	128°11.7	11.2	250°04.7	41.5	313°01.1	56.9
Mer.pass. 03:38		ν 3.1′ d -0.4′ m -4.53		ν 1.0′ d -0.6′ m 1.78		ν 2.2′ d 0.1′ m -2.34		ν 2.6′ d -0.1′ m 0.59	

Sat	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	306°23.4	157°59.0	N07°39.6	143°12.7	N08°10.6	265°06.9	N14°41.6	328°03.7	S10°57.0
1	321°25.9	173°02.3	39.3	158°13.7	10.0	280°09.0	41.7	343°06.3	57.0
2	336°28.3	188°05.5	39.0	173°14.8	09.4	295°11.2	41.8	358°08.9	57.1
3	351°30.8	203°08.7	·· 38.6	188°15.8	·· 08.8	310°13.4	·· 41.8	13°11.5	·· 57.2
4	6°33.2	218°11.9	38.3	203°16.8	08.2	325°15.6	41.9	28°14.1	57.2
5	21°35.7	233°15.2	38.0	218°17.8	07.6	340°17.8	42.0	43°16.7	57.3
6	36°38.2	248°18.4	N07°37.6	233°18.8	N08°06.9	355°20.0	N14°42.1	58°19.3	S10°57.4
7	51°40.6	263°21.7	37.3	248°19.9	06.3	10°22.1	42.2	73°21.9	57.4
8	66°43.1	278°24.9	37.0	263°20.9	05.7	25°24.3	42.2	88°24.5	57.5
9	81°45.6	293°28.1	·· 36.7	278°21.9	·· 05.1	40°26.5	·· 42.3	103°27.2	·· 57.5
10	96°48.0	308°31.4	36.3	293°22.9	04.5	55°28.7	42.4	118°29.8	57.6
11	111°50.5	323°34.7	36.0	308°24.0	03.9	70°30.9	42.5	133°32.4	57.7
12	126°53.0	338°37.9	N07°35.7	323°25.0	N08°03.3	85°33.1	N14°42.5	148°35.0	S10°57.7
13	141°55.4	353°41.2	35.4	338°26.0	02.7	100°35.3	42.6	163°37.6	57.8
14	156°57.9	8°44.4	35.1	353°27.0	02.1	115°37.4	42.7	178°40.2	57.8
15	172°00.3	23°47.7	·· 34.8	8°28.1	·· 01.4	130°39.6	·· 42.8	193°42.8	·· 57.9
16	187°02.8	38°51.0	34.4	23°29.1	00.8	145°41.8	42.8	208°45.4	58.0
17	202°05.3	53°54.3	34.1	38°30.1	08°00.2	160°44.0	42.9	223°48.0	58.0
18	217°07.7	68°57.6	N07°33.8	53°31.1	N07°59.6	175°46.2	N14°43.0	238°50.6	S10°58.1
19	232°10.2	84°00.8	33.5	68°32.2	59.0	190°48.4	43.1	253°53.2	58.2
20	247°12.7	99°04.1	33.2	83°33.2	58.4	205°50.6	43.1	268°55.8	58.2
21	262°15.1	114°07.4	·· 32.9	98°34.2	·· 57.8	220°52.7	·· 43.2	283°58.4	·· 58.3
22	277°17.6	129°10.7	32.6	113°35.2	57.1	235°54.9	43.3	299°01.0	58.3
23	292°20.1	144°14.0	32.3	128°36.3	56.5	250°57.1	43.4	314°03.6	58.4
Mer.pass. 03:34		ν 3.2′ d -0.3′ m -4.49		ν 1.0′ d -0.6′ m 1.78		ν 2.2′ d 0.1′ m -2.35		ν 2.6′ d -0.1′ m 0.59	

Stars

	SHA	**Dec**
Alpheratz	357°35.8	29°13.1
Ankaa	353°08.1	-42°10.5
Schedar	349°32.2	56°39.7
Diphda	348°48.4	-17°51.3
Achernar	335°21.0	-57°06.7
Hamal	327°52.6	23°34.3
Polaris	314°43.3	89°21.5
Acamar	315°12.8	-40°12.4
Menkar	314°07.5	4°11.0
Mirfak	308°30.1	49°56.5
Aldebaran	290°41.2	16°33.4
Rigel	281°05.3	-8°10.3
Capella	280°24.0	46°01.2
Bellatrix	278°24.4	6°22.3
Elnath	278°03.7	28°37.6
Alnilam	275°39.2	-1°11.1
Betelgeuse	270°53.7	7°24.8
Canopus	263°53.4	-52°42.3
Sirius	258°27.6	-16°44.8
Adhara	255°07.2	-29°00.1
Procyon	244°52.4	5°10.0
Pollux	243°19.2	27°58.2
Avior	234°15.9	-59°35.0
Suhail	222°47.6	-43°31.6
Miaplacidus	221°39.5	-69°48.8
Alphard	217°49.3	-8°45.5
Regulus	207°36.0	11°51.3
Dubhe	193°43.0	61°37.7
Denebola	182°26.4	14°26.6
Gienah	175°45.0	-17°40.3
Acrux	173°01.8	-63°14.0
Gacrux	171°53.3	-57°14.9
Alioth	166°14.2	55°50.3
Spica	158°23.6	-11°17.0
Alkaid	152°53.0	49°12.1
Hadar	148°37.7	-60°29.4
Menkent	147°59.1	-36°29.2
Arcturus	145°49.0	19°03.8
Rigil Kent.	139°41.9	-60°56.2
Kochab	137°19.5	74°03.8
Zuben'ubi	136°57.3	-16°08.4
Alphecca	126°04.6	26°38.3
Antares	112°17.1	-26°29.1
Atria	107°12.0	-69°04.4
Sabik	102°03.9	-15°45.2
Shaula	96°11.7	-37°07.3
Rasalhague	95°59.4	12°32.7
Eltanin	90°42.3	51°29.3
Kaus Aust.	83°33.7	-34°22.4
Vega	80°33.6	38°48.4
Nunki	75°48.9	-26°16.0
Altair	62°00.8	8°55.9
Peacock	53°07.0	-56°39.5
Deneb	49°26.2	45°21.8
Enif	33°39.7	9°59.0
Al Na'ir	27°34.0	-46°50.7
Fomalhaut	15°15.6	-29°29.7
Scheat	13°46.1	28°12.5
Markab	13°30.8	15°19.9

Jul 27 Thu	**SHA**	**Mer.pass**
Venus	211°04.0	13:35
Mars	197°58.4	14:29
Jupiter	318°57.3	06:26
Saturn	21°33.8	02:16

Jul 28 Fri	**SHA**	**Mer.pass**
Venus	211°18.7	13:30
Mars	197°23.9	14:28
Jupiter	318°50.3	06:22
Saturn	21°37.1	02:12

Jul 29 Sat	**SHA**	**Mer.pass**
Venus	211°35.7	13:25
Mars	196°49.3	14:26
Jupiter	318°43.5	06:19
Saturn	21°40.3	02:07

Horizontal parallax	
Venus:	0.5
Mars:	0.1

h	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°21.4	N19°18.8	80°48.9	11.4′	S18°13.8	12.0′	56.9′
1	193°21.4	18.3	95°19.3	11.3′	18°25.8	11.9′	56.9′
2	208°21.4	17.7	109°49.6	11.2′	18°37.7	11.8′	57.0′
3	223°21.4	·· 17.1	124°19.8	11.1′	18°49.5	11.7′	57.0′
4	238°21.4	16.6	138°49.9	10.9′	19°01.2	11.7′	57.1′
5	253°21.4	16.0	153°19.8	10.8′	19°12.9	11.6′	57.1′
6	268°21.4	N19°15.5	167°49.7	10.7′	S19°24.5	11.5′	57.1′
7	283°21.4	14.9	182°19.4	10.6′	19°36.0	11.4′	57.2′
8	298°21.4	14.3	196°49.0	10.5′	19°47.4	11.3′	57.2′
9	313°21.5	·· 13.8	211°18.4	10.3′	19°58.7	11.2′	57.2′
10	328°21.5	13.2	225°47.7	10.2′	20°09.9	11.2′	57.3′
11	343°21.5	12.6	240°16.9	10.1′	20°21.1	11.0′	57.3′
12	358°21.5	N19°12.1	254°46.0	10.0′	S20°32.1	11.0′	57.4′
13	13°21.5	11.5	269°15.0	9.8′	20°43.1	10.9′	57.4′
14	28°21.5	10.9	283°43.8	9.7′	20°54.0	10.8′	57.4′
15	43°21.5	·· 10.4	298°12.5	9.6′	21°04.8	10.7′	57.5′
16	58°21.5	09.8	312°41.1	9.4′	21°15.5	10.5′	57.5′
17	73°21.5	09.2	327°09.5	9.3′	21°26.0	10.5′	57.6′
18	88°21.5	N19°08.7	341°37.8	9.2′	S21°36.5	10.4′	57.6′
19	103°21.5	08.1	356°06.0	9.0′	21°46.9	10.3′	57.6′
20	118°21.5	07.5	10°34.0	8.9′	21°57.2	10.2′	57.7′
21	133°21.5	·· 07.0	25°01.9	8.8′	22°07.4	10.0′	57.7′
22	148°21.6	06.4	39°29.7	8.6′	22°17.4	10.0′	57.8′
23	163°21.6	05.8	53°57.4	8.5′	22°27.4	9.8′	57.8′
	SD = 15.7′	d = -0.6′	SD = 15.5′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°21.6	N19°05.2	68°24.9	8.4′	S22°37.2	9.8′	57.8′
1	193°21.6	04.7	82°52.3	8.2′	22°47.0	9.6′	57.9′
2	208°21.6	04.1	97°19.5	8.1′	22°56.6	9.5′	57.9′
3	223°21.6	·· 03.5	111°46.6	8.0′	23°06.1	9.4′	58.0′
4	238°21.6	02.9	126°13.6	7.8′	23°15.5	9.3′	58.0′
5	253°21.6	02.4	140°40.4	7.7′	23°24.8	9.1′	58.0′
6	268°21.6	N19°01.8	155°07.1	7.6′	S23°33.9	9.0′	58.1′
7	283°21.7	01.2	169°33.7	7.4′	23°42.9	8.9′	58.1′
8	298°21.7	00.6	184°00.1	7.3′	23°51.8	8.8′	58.2′
9	313°21.7	19°00.1	198°26.4	7.2′	24°00.6	8.6′	58.2′
10	328°21.7	18°59.5	212°52.6	7.0′	24°09.2	8.5′	58.2′
11	343°21.7	58.9	227°18.7	6.9′	24°17.7	8.4′	58.3′
12	358°21.7	N18°58.3	241°44.6	6.8′	S24°26.1	8.2′	58.3′
13	13°21.7	57.8	256°10.3	6.6′	24°34.3	8.1′	58.4′
14	28°21.7	57.2	270°36.0	6.5′	24°42.4	8.0′	58.4′
15	43°21.8	·· 56.6	285°01.5	6.4′	24°50.4	7.8′	58.4′
16	58°21.8	56.0	299°26.8	6.2′	24°58.2	7.7′	58.5′
17	73°21.8	55.4	313°52.1	6.1′	25°05.9	7.5′	58.5′
18	88°21.8	N18°54.8	328°17.2	6.0′	S25°13.4	7.4′	58.6′
19	103°21.8	54.3	342°42.2	5.8′	25°20.8	7.2′	58.6′
20	118°21.8	53.7	357°07.0	5.7′	25°28.0	7.1′	58.6′
21	133°21.9	·· 53.1	11°31.7	5.6′	25°35.1	7.0′	58.7′
22	148°21.9	52.5	25°56.3	5.5′	25°42.1	6.7′	58.7′
23	163°21.9	51.9	40°20.8	5.3′	25°48.8	6.7′	58.8′
	SD = 15.7′	d = -0.6′	SD = 15.8′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°21.9	N18°51.3	54°45.1	5.2′	S25°55.5	6.4′	58.8′
1	193°21.9	50.8	69°09.4	5.1′	26°01.9	6.3′	58.8′
2	208°21.9	50.2	83°33.4	5.0′	26°08.2	6.2′	58.9′
3	223°22.0	·· 49.6	97°57.4	4.8′	26°14.4	6.0′	58.9′
4	238°22.0	49.0	112°21.3	4.7′	26°20.4	5.8′	59.0′
5	253°22.0	48.4	126°45.0	4.6′	26°26.2	5.6′	59.0′
6	268°22.0	N18°47.8	141°08.6	4.5′	S26°31.8	5.5′	59.0′
7	283°22.0	47.2	155°32.1	4.4′	26°37.3	5.3′	59.1′
8	298°22.0	46.6	169°55.5	4.3′	26°42.6	5.2′	59.1′
9	313°22.1	·· 46.1	184°18.7	4.1′	26°47.8	4.9′	59.1′
10	328°22.1	45.5	198°41.9	4.0′	26°52.7	4.8′	59.2′
11	343°22.1	44.9	213°04.9	3.9′	26°57.5	4.6′	59.2′
12	358°22.1	N18°44.3	227°27.8	3.8′	S27°02.1	4.5′	59.3′
13	13°22.1	43.7	241°50.7	3.7′	27°06.6	4.2′	59.3′
14	28°22.2	43.1	256°13.4	3.6′	27°10.8	4.1′	59.3′
15	43°22.2	·· 42.5	270°36.0	3.5′	27°14.9	3.9′	59.4′
16	58°22.2	41.9	284°58.5	3.4′	27°18.8	3.7′	59.4′
17	73°22.2	41.3	299°20.9	3.3′	27°22.5	3.5′	59.5′
18	88°22.2	N18°40.7	313°43.2	3.2′	S27°26.0	3.3′	59.5′
19	103°22.3	40.1	328°05.4	3.1′	27°29.3	3.2′	59.5′
20	118°22.3	39.5	342°27.6	3.0′	27°32.5	2.9′	59.6′
21	133°22.3	·· 38.9	356°49.6	3.0′	27°35.4	2.8′	59.6′
22	148°22.3	38.3	11°11.6	2.9′	27°38.2	2.6′	59.6′
23	163°22.4	37.7	25°33.4	2.8′	27°40.8	2.3′	59.7′
	SD = 15.7′	d = -0.6′	SD = 16.0′				

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

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

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 10-12 61-81%
27	06:34	06:34	12:07	19:16	06:50	
28	06:34	06:33	12:07	20:12	07:43	
29	06:32	06:32	12:07	21:13	08:42	

July 30, 31, 01 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	307°22.5	159°17.3	N07°32.0	143°37.3	N07°55.9	265°59.3	N14°43.5	329°06.2	S10°58.5
1	322°25.0	174°20.6	31.7	158°38.3	55.3	281°01.5	43.5	344°08.8	58.5
2	337°27.5	189°24.0	31.4	173°39.3	54.7	296°03.7	43.6	359°11.4	58.6
3	352°29.9	204°27.3	·· 31.1	188°40.4	·· 54.1	311°05.9	·· 43.7	14°14.0	·· 58.7
4	7°32.4	219°30.6	30.8	203°41.4	53.5	326°08.1	43.8	29°16.6	58.7
5	22°34.8	234°33.9	30.5	218°42.4	52.9	341°10.3	43.8	44°19.2	58.8
6	37°37.3	249°37.2	N07°30.2	233°43.4	N07°52.2	356°12.4	N14°43.9	59°21.8	S10°58.8
7	52°39.8	264°40.6	29.9	248°44.5	51.6	11°14.6	44.0	74°24.4	58.9
8	67°42.2	279°43.9	29.7	263°45.5	51.0	26°16.8	44.1	89°27.1	59.0
9	82°44.7	294°47.3	·· 29.4	278°46.5	·· 50.4	41°19.0	·· 44.1	104°29.7	·· 59.0
10	97°47.2	309°50.6	29.1	293°47.5	49.8	56°21.2	44.2	119°32.3	59.1
11	112°49.6	324°53.9	28.8	308°48.6	49.2	71°23.4	44.3	134°34.9	59.2
12	127°52.1	339°57.3	N07°28.5	323°49.6	N07°48.6	86°25.6	N14°44.4	149°37.5	S10°59.2
13	142°54.6	355°00.6	28.2	338°50.6	47.9	101°27.8	44.4	164°40.1	59.3
14	157°57.0	10°04.0	28.0	353°51.6	47.3	116°30.0	44.5	179°42.7	59.3
15	172°59.5	25°07.4	·· 27.7	8°52.7	·· 46.7	131°32.2	·· 44.6	194°45.3	·· 59.4
16	188°02.0	40°10.7	27.4	23°53.7	46.1	146°34.4	44.7	209°47.9	59.5
17	203°04.4	55°14.1	27.1	38°54.7	45.5	161°36.6	44.7	224°50.5	59.5
18	218°06.9	70°17.5	N07°26.9	53°55.7	N07°44.9	176°38.7	N14°44.8	239°53.1	S10°59.6
19	233°09.3	85°20.9	26.6	68°56.8	44.2	191°40.9	44.9	254°55.7	59.7
20	248°11.8	100°24.2	26.3	83°57.8	43.6	206°43.1	44.9	269°58.3	59.7
21	263°14.3	115°27.6	·· 26.0	98°58.8	·· 43.0	221°45.3	·· 45.0	285°00.9	·· 59.8
22	278°16.7	130°31.0	25.8	113°59.8	42.4	236°47.5	45.1	300°03.5	59.8
23	293°19.2	145°34.4	25.5	129°00.9	41.8	251°49.7	45.2	315°06.1	59.9
Mer.pass. 03:30		ν 3.3′	d -0.3′	m -4.45	ν 1.0′	d -0.6′	m 1.78	ν 2.2′	d 0.1′ m -2.35	ν 2.6′ d -0.1′ m 0.58

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	308°21.7	160°37.8	N07°25.3	144°01.9	N07°41.2	266°51.9	N14°45.2	330°08.8	S11°00.0
1	323°24.1	175°41.2	25.0	159°02.9	40.6	281°54.1	45.3	345°11.4	00.0
2	338°26.6	190°44.6	24.7	174°03.9	39.9	296°56.3	45.4	0°14.0	00.1
3	353°29.1	205°48.0	·· 24.5	189°05.0	·· 39.3	311°58.5	·· 45.5	15°16.6	·· 00.2
4	8°31.5	220°51.4	24.2	204°06.0	38.7	327°00.7	45.5	30°19.2	00.2
5	23°34.0	235°54.8	24.0	219°07.0	38.1	342°02.9	45.6	45°21.8	00.3
6	38°36.5	250°58.2	N07°23.7	234°08.0	N07°37.5	357°05.1	N14°45.7	60°24.4	S11°00.3
7	53°38.9	266°01.7	23.4	249°09.1	36.9	12°07.3	45.8	75°27.0	00.4
8	68°41.4	281°05.1	23.2	264°10.1	36.2	27°09.5	45.8	90°29.6	00.5
9	83°43.8	296°08.5	·· 22.9	279°11.1	·· 35.6	42°11.7	·· 45.9	105°32.2	·· 00.5
10	98°46.3	311°11.9	22.7	294°12.1	35.0	57°13.9	46.0	120°34.8	00.6
11	113°48.8	326°15.4	22.5	309°13.2	34.4	72°16.1	46.0	135°37.4	00.7
12	128°51.2	341°18.8	N07°22.2	324°14.2	N07°33.8	87°18.3	N14°46.1	150°40.0	S11°00.7
13	143°53.7	356°22.2	22.0	339°15.2	33.2	102°20.5	46.2	165°42.7	00.8
14	158°56.2	11°25.7	21.7	354°16.2	32.5	117°22.7	46.3	180°45.3	00.9
15	173°58.6	26°29.1	·· 21.5	9°17.3	·· 31.9	132°24.9	·· 46.3	195°47.9	·· 00.9
16	189°01.1	41°32.6	21.2	24°18.3	31.3	147°27.1	46.4	210°50.5	01.0
17	204°03.6	56°36.0	21.0	39°19.3	30.7	162°29.3	46.5	225°53.1	01.0
18	219°06.0	71°39.5	N07°20.8	54°20.3	N07°30.1	177°31.5	N14°46.6	240°55.7	S11°01.1
19	234°08.5	86°43.0	20.5	69°21.4	29.4	192°33.7	46.6	255°58.3	01.2
20	249°11.0	101°46.4	20.3	84°22.4	28.8	207°35.9	46.7	271°00.9	01.2
21	264°13.4	116°49.9	·· 20.1	99°23.4	·· 28.2	222°38.1	·· 46.8	286°03.5	·· 01.3
22	279°15.9	131°53.4	19.8	114°24.4	27.6	237°40.3	46.8	301°06.1	01.4
23	294°18.3	146°56.9	19.6	129°25.5	27.0	252°42.5	46.9	316°08.7	01.4
Mer.pass. 03:26		ν 3.4′	d -0.3′	m -4.41	ν 1.0′	d -0.6′	m 1.78	ν 2.2′	d 0.1′ m -2.36	ν 2.6′ d -0.1′ m 0.58

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	309°20.8	162°00.3	N07°19.4	144°26.5	N07°26.4	267°44.7	N14°47.0	331°11.4	S11°01.5
1	324°23.3	177°03.8	19.2	159°27.5	25.7	282°46.9	47.1	346°14.0	01.6
2	339°25.7	192°07.3	18.9	174°28.5	25.1	297°49.1	47.1	1°16.6	01.6
3	354°28.2	207°10.8	·· 18.7	189°29.6	·· 24.5	312°51.3	·· 47.2	16°19.2	·· 01.7
4	9°30.7	222°14.3	18.5	204°30.6	23.9	327°53.5	47.3	31°21.8	01.7
5	24°33.1	237°17.8	18.3	219°31.6	23.3	342°55.7	47.3	46°24.4	01.8
6	39°35.6	252°21.3	N07°18.1	234°32.6	N07°22.6	357°57.9	N14°47.4	61°27.0	S11°01.9
7	54°38.1	267°24.8	17.8	249°33.7	22.0	13°00.1	47.5	76°29.6	01.9
8	69°40.5	282°28.3	17.6	264°34.7	21.4	28°02.3	47.6	91°32.2	02.0
9	84°43.0	297°31.8	·· 17.4	279°35.7	·· 20.8	43°04.5	·· 47.6	106°34.8	·· 02.1
10	99°45.5	312°35.3	17.2	294°36.7	20.2	58°06.7	47.7	121°37.5	02.1
11	114°47.9	327°38.9	17.0	309°37.8	19.6	73°08.9	47.8	136°40.1	02.2
12	129°50.4	342°42.4	N07°16.8	324°38.8	N07°18.9	88°11.1	N14°47.8	151°42.7	S11°02.3
13	144°52.8	357°45.9	16.6	339°39.8	18.3	103°13.3	47.9	166°45.3	02.3
14	159°55.3	12°49.4	16.4	354°40.8	17.7	118°15.5	48.0	181°47.9	02.4
15	174°57.8	27°53.0	·· 16.2	9°41.9	·· 17.1	133°17.7	·· 48.0	196°50.5	·· 02.5
16	190°00.2	42°56.5	16.0	24°42.9	16.5	148°19.9	48.1	211°53.1	02.5
17	205°02.7	58°00.0	15.8	39°43.9	15.8	163°22.1	48.2	226°55.7	02.6
18	220°05.2	73°03.6	N07°15.6	54°44.9	N07°15.2	178°24.3	N14°48.3	241°58.3	S11°02.6
19	235°07.6	88°07.1	15.4	69°46.0	14.6	193°26.5	48.3	257°01.0	02.7
20	250°10.1	103°10.7	15.2	84°47.0	14.0	208°28.7	48.4	272°03.6	02.8
21	265°12.6	118°14.2	·· 15.0	99°48.0	·· 13.4	223°30.9	·· 48.5	287°06.2	·· 02.8
22	280°15.0	133°17.8	14.8	114°49.0	12.7	238°33.1	48.5	302°08.8	02.9
23	295°17.5	148°21.3	14.6	129°50.1	12.1	253°35.4	48.6	317°11.4	03.0
Mer.pass. 03:22		ν 3.5′	d -0.2′	m -4.37	ν 1.0′	d -0.6′	m 1.79	ν 2.2′	d 0.1′ m -2.37	ν 2.6′ d -0.1′ m 0.57

Stars

	SHA	**Dec**
Alpheratz	357°35.8	29°13.1
Ankaa	353°08.1	-42°10.5
Schedar	349°32.2	56°39.8
Diphda	348°48.3	-17°51.3
Achernar	335°21.0	-57°06.7
Hamal	327°52.5	23°34.3
Polaris	314°41.5	89°21.5
Acamar	315°12.7	-40°12.3
Menkar	314°07.5	4°11.0
Mirfak	308°30.1	49°56.5
Aldebaran	290°41.2	16°33.4
Rigel	281°05.2	-8°10.3
Capella	280°24.0	46°01.2
Bellatrix	278°24.4	6°22.3
Elnath	278°03.6	28°37.6
Alnilam	275°39.2	-1°11.1
Betelgeuse	270°53.6	7°24.8
Canopus	263°53.4	-52°42.3
Sirius	258°27.6	-16°44.8
Adhara	255°07.2	-29°00.1
Procyon	244°52.4	5°10.0
Pollux	243°19.1	27°58.2
Avior	234°15.9	-59°35.0
Suhail	222°47.6	-43°31.6
Miaplacidus	221°39.5	-69°48.8
Alphard	217°49.2	-8°45.5
Regulus	207°36.0	11°51.3
Dubhe	193°43.0	61°37.7
Denebola	182°26.4	14°26.6
Gienah	175°45.0	-17°40.3
Acrux	173°01.8	-63°14.0
Gacrux	171°53.3	-57°14.9
Alioth	166°14.2	55°50.2
Spica	158°23.6	-11°17.0
Alkaid	152°53.0	49°12.1
Hadar	148°37.8	-60°29.4
Menkent	147°59.1	-36°29.2
Arcturus	145°49.0	19°03.8
Rigil Kent.	139°41.9	-60°56.2
Kochab	137°19.6	74°03.8
Zuben'ubi	136°57.3	-16°08.4
Alphecca	126°04.6	26°38.3
Antares	112°17.1	-26°29.1
Atria	107°12.0	-69°04.4
Sabik	102°03.9	-15°45.2
Shaula	96°11.7	-37°07.3
Rasalhague	95°59.4	12°32.7
Eltanin	90°42.3	51°29.3
Kaus Aust.	83°33.7	-34°22.4
Vega	80°33.6	38°48.4
Nunki	75°48.9	-26°16.0
Altair	62°00.8	8°55.9
Peacock	53°07.0	-56°39.5
Deneb	49°26.1	45°21.8
Enif	33°39.7	9°59.0
Al Na'ir	27°34.0	-46°50.7
Fomalhaut	15°15.5	-29°29.7
Scheat	13°46.1	28°12.6
Markab	13°30.8	15°19.9

Jul 30 Sun	**SHA**	**Mer.pass**
Venus	211°54.8	13:20
Mars	196°14.8	14:25
Jupiter	318°36.8	06:15
Saturn	21°43.7	02:03

Jul 31 Mon	**SHA**	**Mer.pass**
Venus	212°16.1	13:14
Mars	195°40.2	14:23
Jupiter	318°30.2	06:12
Saturn	21°47.1	01:59

Aug 01 Tue	**SHA**	**Mer.pass**
Venus	212°39.5	13:09
Mars	195°05.7	14:21
Jupiter	318°23.8	06:08
Saturn	21°50.5	01:55

Horizontal parallax	
Venus:	0.5
Mars:	0.1

h Sun Moon

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	178°22.4	N18°37.1	39°55.2	2.7′	S27°43.1	2.2′	59.7′
1	193°22.4	36.5	54°16.9	2.6′	27°45.3	2.0′	59.7′
2	208°22.4	35.9	68°38.5	2.6′	27°47.3	1.8′	59.8′
3	223°22.5	·· 35.3	83°00.1	2.5′	27°49.1	1.5′	59.8′
4	238°22.5	34.7	97°21.6	2.4′	27°50.6	1.4′	59.9′
5	253°22.5	34.1	111°43.0	2.3′	27°52.0	1.2′	59.9′
6	268°22.5	N18°33.5	126°04.3	2.3′	S27°53.2	1.0′	59.9′
7	283°22.6	32.9	140°25.6	2.2′	27°54.2	0.7′	60.0′
8	298°22.6	32.3	154°46.8	2.2′	27°54.9	0.6′	60.0′
9	313°22.6	·· 31.7	169°08.0	2.1′	27°55.5	0.3′	60.0′
10	328°22.6	31.1	183°29.1	2.1′	27°55.8	0.2′	60.1′
11	343°22.7	30.5	197°50.2	2.0′	27°56.0	0.1′	60.1′
12	358°22.7	N18°29.9	212°11.2	2.0′	S27°55.9	0.2′	60.1′
13	13°22.7	29.3	226°32.1	1.9′	27°55.7	0.5′	60.2′
14	28°22.7	28.7	240°53.0	1.9′	27°55.2	0.7′	60.2′
15	43°22.8	·· 28.1	255°13.9	1.8′	27°54.5	0.9′	60.2′
16	58°22.8	27.5	269°34.8	1.8′	27°53.6	1.1′	60.2′
17	73°22.8	26.9	283°55.6	1.8′	27°52.5	1.3′	60.3′
18	88°22.8	N18°26.3	298°16.4	1.8′	S27°51.2	1.5′	60.3′
19	103°22.9	25.7	312°37.1	1.7′	27°49.7	1.7′	60.3′
20	118°22.9	25.1	326°57.9	1.7′	27°48.0	2.0′	60.4′
21	133°22.9	·· 24.5	341°18.6	1.7′	27°46.0	2.1′	60.4′
22	148°23.0	23.9	355°39.3	1.7′	27°43.9	2.4′	60.4′
23	163°23.0	23.2	10°00.0	1.7′	27°41.5	2.6′	60.5′
	SD = 15.7′	d = -0.6′		SD = 16.3′			

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	178°23.0	N18°22.6	24°20.6	1.7′	S27°38.9	2.7′	60.5′
1	193°23.0	22.0	38°41.3	1.7′	27°36.2	3.0′	60.5′
2	208°23.1	21.4	53°02.0	1.7′	27°33.2	3.3′	60.5′
3	223°23.1	·· 20.8	67°22.6	1.7′	27°29.9	3.4′	60.6′
4	238°23.1	20.2	81°43.3	1.7′	27°26.5	3.6′	60.6′
5	253°23.2	19.6	96°04.0	1.7′	27°22.9	3.9′	60.6′
6	268°23.2	N18°19.0	110°24.6	1.7′	S27°19.0	4.0′	60.6′
7	283°23.2	18.3	124°45.3	1.7′	27°15.0	4.3′	60.7′
8	298°23.3	17.7	139°06.0	1.7′	27°10.7	4.5′	60.7′
9	313°23.3	·· 17.1	153°26.8	1.8′	27°06.2	4.7′	60.7′
10	328°23.3	16.5	167°47.5	1.8′	27°01.5	4.9′	60.7′
11	343°23.4	15.9	182°08.3	1.8′	26°56.6	5.1′	60.8′
12	358°23.4	N18°15.3	196°29.1	1.8′	S26°51.5	5.3′	60.8′
13	13°23.4	14.7	210°49.9	1.9′	26°46.2	5.5′	60.8′
14	28°23.5	14.0	225°10.8	1.9′	26°40.7	5.7′	60.8′
15	43°23.5	·· 13.4	239°31.7	1.9′	26°35.0	6.0′	60.9′
16	58°23.5	12.8	253°52.7	2.0′	26°29.0	6.1′	60.9′
17	73°23.6	12.2	268°13.7	2.0′	26°22.9	6.3′	60.9′
18	88°23.6	N18°11.6	282°34.7	2.1′	S26°16.6	6.6′	60.9′
19	103°23.6	10.9	296°55.8	2.1′	26°10.0	6.7′	60.9′
20	118°23.7	10.3	311°16.9	2.2′	26°03.3	7.0′	61.0′
21	133°23.7	·· 09.7	325°38.1	2.2′	25°56.3	7.1′	61.0′
22	148°23.7	09.1	339°59.3	2.3′	25°49.2	7.4′	61.0′
23	163°23.8	08.5	354°20.6	2.4′	25°41.8	7.5′	61.0′
	SD = 15.7′	d = -0.6′		SD = 16.5′			

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	178°23.8	N18°07.8	8°42.0	2.4′	S25°34.3	7.7′	61.0′
1	193°23.8	07.2	23°03.4	2.5′	25°26.6	8.0′	61.0′
2	208°23.9	06.6	37°24.9	2.6′	25°18.6	8.1′	61.1′
3	223°23.9	·· 06.0	51°46.5	2.6′	25°10.5	8.3′	61.1′
4	238°24.0	05.3	66°08.1	2.7′	25°02.2	8.5′	61.1′
5	253°24.0	04.7	80°29.8	2.8′	24°53.7	8.7′	61.1′
6	268°24.0	N18°04.1	94°51.6	2.9′	S24°45.0	8.9′	61.1′
7	283°24.1	03.5	109°13.5	2.9′	24°36.1	9.1′	61.1′
8	298°24.1	02.8	123°35.4	3.0′	24°27.0	9.2′	61.2′
9	313°24.1	·· 02.2	137°57.4	3.1′	24°17.8	9.5′	61.2′
10	328°24.2	01.6	152°19.5	3.2′	24°08.3	9.6′	61.2′
11	343°24.2	00.9	166°41.7	3.3′	23°58.7	9.8′	61.2′
12	358°24.3	N18°00.3	181°04.0	3.4′	S23°48.9	9.9′	61.2′
13	13°24.3	17°59.7	195°26.3	3.4′	23°39.0	10.2′	61.2′
14	28°24.3	59.1	209°48.8	3.5′	23°28.8	10.3′	61.2′
15	43°24.4	·· 58.4	224°11.3	3.6′	23°18.5	10.5′	61.2′
16	58°24.4	57.8	238°34.0	3.7′	23°08.0	10.7′	61.2′
17	73°24.5	57.2	252°56.7	3.8′	22°57.3	10.8′	61.2′
18	88°24.5	N17°56.5	267°19.5	3.9′	S22°46.5	11.0′	61.2′
19	103°24.5	55.9	281°42.4	4.0′	22°35.5	11.2′	61.3′
20	118°24.6	55.3	296°05.4	4.1′	22°24.3	11.3′	61.3′
21	133°24.6	·· 54.6	310°28.6	4.2′	22°13.0	11.5′	61.3′
22	148°24.7	54.0	324°51.8	4.3′	22°01.5	11.6′	61.3′
23	163°24.7	53.4	339°15.1	4.4′	21°49.9	11.8′	61.3′
	SD = 15.7′	d = -0.6′		SD = 16.6′			

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

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

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 13-15 89-99%
30	06:30	06:29	12:06	22:18	09:45	
31	06:28	06:26	12:06	23:24	10:51	
01	06:25	06:23	12:06	–:–	11:56	

August 02, 03, 04 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	310°20.0	163°24.9	N07°14.4	144°51.1	N07°11.5	268°37.6	N14°48.7	332°14.0	S11°03.0
1	325°22.4	178°28.5	14.2	159°52.1	10.9	283°39.8	48.7	347°16.6	03.1
2	340°24.9	193°32.0	14.1	174°53.1	10.3	298°42.0	48.8	2°19.2	03.2
3	355°27.3	208°35.6	·· 13.9	189°54.2	·· 09.6	313°44.2	·· 48.9	17°21.8	·· 03.2
4	10°29.8	223°39.2	13.7	204°55.2	09.0	328°46.4	48.9	32°24.5	03.3
5	25°32.3	238°42.8	13.5	219°56.2	08.4	343°48.6	49.0	47°27.1	03.4
6	40°34.7	253°46.3	N07°13.3	234°57.2	N07°07.8	358°50.8	N14°49.1	62°29.7	S11°03.4
7	55°37.2	268°49.9	13.1	249°58.2	07.2	13°53.0	49.2	77°32.3	03.5
8	70°39.7	283°53.5	13.0	264°59.3	06.5	28°55.2	49.2	92°34.9	03.5
9	85°42.1	298°57.1	·· 12.8	280°00.3	·· 05.9	43°57.4	·· 49.3	107°37.5	·· 03.6
10	100°44.6	314°00.7	12.6	295°01.3	05.3	58°59.7	49.4	122°40.1	03.7
11	115°47.1	329°04.3	12.5	310°02.3	04.7	74°01.9	49.4	137°42.7	03.7
12	130°49.5	344°07.9	N07°12.3	325°03.4	N07°04.0	89°04.1	N14°49.5	152°45.4	S11°03.8
13	145°52.0	359°11.5	12.1	340°04.4	03.4	104°06.3	49.6	167°48.0	03.9
14	160°54.4	14°15.1	12.0	355°05.4	02.8	119°08.5	49.6	182°50.6	03.9
15	175°56.9	29°18.7	·· 11.8	10°06.4	·· 02.2	134°10.7	·· 49.7	197°53.2	·· 04.0
16	190°59.4	44°22.3	11.6	25°07.5	01.6	149°12.9	49.8	212°55.8	04.1
17	206°01.8	59°26.0	11.5	40°08.5	00.9	164°15.1	49.8	227°58.4	04.1
18	221°04.3	74°29.6	N07°11.3	55°09.5	N07°00.3	179°17.3	N14°49.9	243°01.0	S11°04.2
19	236°06.8	89°33.2	11.1	70°10.5	06°59.7	194°19.6	50.0	258°03.7	04.3
20	251°09.2	104°36.8	11.0	85°11.6	59.1	209°21.8	50.0	273°06.3	04.3
21	266°11.7	119°40.5	·· 10.8	100°12.6	·· 58.5	224°24.0	·· 50.1	288°08.9	·· 04.4
22	281°14.2	134°44.1	10.7	115°13.6	57.8	239°26.2	50.2	303°11.5	04.5
23	296°16.6	149°47.7	10.5	130°14.6	57.2	254°28.4	50.2	318°14.1	04.5
Mer.pass. 03:18		ν 3.6′ d -0.2′ m -4.31		ν 1.0′ d -0.6′ m 1.79		ν 2.2′ d 0.1′ m -2.37		ν 2.6′ d -0.1′ m 0.57	

Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	311°19.1	164°51.4	N07°10.4	145°15.7	N06°56.6	269°30.6	N14°50.3	333°16.7	S11°04.6
1	326°21.6	179°55.0	10.2	160°16.7	56.0	284°32.8	50.4	348°19.3	04.7
2	341°24.0	194°58.7	10.1	175°17.7	55.3	299°35.0	50.4	3°22.0	04.7
3	356°26.5	210°02.3	·· 09.9	190°18.7	·· 54.7	314°37.3	·· 50.5	18°24.6	·· 04.8
4	11°28.9	225°06.0	09.8	205°19.8	54.1	329°39.5	50.6	33°27.2	04.8
5	26°31.4	240°09.6	09.7	220°20.8	53.5	344°41.7	50.6	48°29.8	04.9
6	41°33.9	255°13.3	N07°09.5	235°21.8	N06°52.8	359°43.9	N14°50.7	63°32.4	S11°05.0
7	56°36.3	270°16.9	09.4	250°22.8	52.2	14°46.1	50.8	78°35.0	05.0
8	71°38.8	285°20.6	09.2	265°23.9	51.6	29°48.3	50.8	93°37.6	05.1
9	86°41.3	300°24.3	·· 09.1	280°24.9	·· 51.0	44°50.6	·· 50.9	108°40.3	·· 05.2
10	101°43.7	315°27.9	09.0	295°25.9	50.4	59°52.8	51.0	123°42.9	05.2
11	116°46.2	330°31.6	08.8	310°26.9	49.7	74°55.0	51.0	138°45.5	05.3
12	131°48.7	345°35.3	N07°08.7	325°28.0	N06°49.1	89°57.2	N14°51.1	153°48.1	S11°05.4
13	146°51.1	0°39.0	08.6	340°29.0	48.5	104°59.4	51.2	168°50.7	05.4
14	161°53.6	15°42.7	08.4	355°30.0	47.9	120°01.6	51.2	183°53.3	05.5
15	176°56.1	30°46.3	·· 08.3	10°31.0	·· 47.2	135°03.9	·· 51.3	198°55.9	·· 05.6
16	191°58.5	45°50.0	08.2	25°32.1	46.6	150°06.1	51.4	213°58.6	05.6
17	207°01.0	60°53.7	08.1	40°33.1	46.0	165°08.3	51.4	229°01.2	05.7
18	222°03.4	75°57.4	N07°08.0	55°34.1	N06°45.4	180°10.5	N14°51.5	244°03.8	S11°05.8
19	237°05.9	91°01.1	07.8	70°35.1	44.7	195°12.7	51.6	259°06.4	05.8
20	252°08.4	106°04.8	07.7	85°36.2	44.1	210°15.0	51.6	274°09.0	05.9
21	267°10.8	121°08.5	·· 07.6	100°37.2	·· 43.5	225°17.2	·· 51.7	289°11.6	·· 06.0
22	282°13.3	136°12.2	07.5	115°38.2	42.9	240°19.4	51.8	304°14.3	06.0
23	297°15.8	151°15.9	07.4	130°39.2	42.2	255°21.6	51.8	319°16.9	06.1
Mer.pass. 03:14		ν 3.6′ d -0.1′ m -4.26		ν 1.0′ d -0.6′ m 1.79		ν 2.2′ d 0.1′ m -2.38		ν 2.6′ d -0.1′ m 0.56	

Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	312°18.2	166°19.6	N07°07.3	145°40.3	N06°41.6	270°23.8	N14°51.9	334°19.5	S11°06.2
1	327°20.7	181°23.4	07.1	160°41.3	41.0	285°26.1	52.0	349°22.1	06.2
2	342°23.2	196°27.1	07.0	175°42.3	40.4	300°28.3	52.0	4°24.7	06.3
3	357°25.6	211°30.8	·· 06.9	190°43.3	·· 39.7	315°30.5	·· 52.1	19°27.3	·· 06.4
4	12°28.1	226°34.5	06.8	205°44.4	39.1	330°32.7	52.2	34°30.0	06.4
5	27°30.5	241°38.3	06.7	220°45.4	38.5	345°34.9	52.2	49°32.6	06.5
6	42°33.0	256°42.0	N07°06.6	235°46.4	N06°37.9	0°37.2	N14°52.3	64°35.2	S11°06.6
7	57°35.5	271°45.7	06.5	250°47.4	37.2	15°39.4	52.3	79°37.8	06.6
8	72°37.9	286°49.4	06.4	265°48.5	36.6	30°41.6	52.4	94°40.4	06.7
9	87°40.4	301°53.2	·· 06.3	280°49.5	·· 36.0	45°43.8	·· 52.5	109°43.0	·· 06.8
10	102°42.9	316°56.9	06.2	295°50.5	35.4	60°46.1	52.5	124°45.7	06.8
11	117°45.3	332°00.7	06.1	310°51.5	34.7	75°48.3	52.6	139°48.3	06.9
12	132°47.8	347°04.4	N07°06.0	325°52.6	N06°34.1	90°50.5	N14°52.7	154°50.9	S11°07.0
13	147°50.3	2°08.2	06.0	340°53.6	33.5	105°52.7	52.7	169°53.5	07.0
14	162°52.7	17°11.9	05.9	355°54.6	32.9	120°54.9	52.8	184°56.1	07.1
15	177°55.2	32°15.7	·· 05.8	10°55.6	·· 32.2	135°57.2	·· 52.9	199°58.7	·· 07.2
16	192°57.7	47°19.4	05.7	25°56.7	31.6	150°59.4	52.9	215°01.4	07.2
17	208°00.1	62°23.2	05.6	40°57.7	31.0	166°01.6	53.0	230°04.0	07.3
18	223°02.6	77°26.9	N07°05.5	55°58.7	N06°30.4	181°03.8	N14°53.1	245°06.6	S11°07.4
19	238°05.0	92°30.7	05.4	70°59.7	29.7	196°06.1	53.1	260°09.2	07.4
20	253°07.5	107°34.5	05.4	86°00.8	29.1	211°08.3	53.2	275°11.8	07.5
21	268°10.0	122°38.3	·· 05.3	101°01.8	·· 28.5	226°10.5	·· 53.2	290°14.4	·· 07.6
22	283°12.4	137°42.0	05.2	116°02.8	27.9	241°12.8	53.3	305°17.1	07.6
23	298°14.9	152°45.8	05.1	131°03.8	27.2	256°15.0	53.4	320°19.7	07.7
Mer.pass. 03:10		ν 3.7′ d -0.1′ m -4.20		ν 1.0′ d -0.6′ m 1.79		ν 2.2′ d 0.1′ m -2.39		ν 2.6′ d -0.1′ m 0.56	

Stars

	SHA	**Dec**
Alpheratz	357°35.8	29°13.1
Ankaa	353°08.1	-42°10.5
Schedar	349°32.1	56°39.8
Diphda	348°48.3	-17°51.3
Achernar	335°20.9	-57°06.7
Hamal	327°52.5	23°34.4
Polaris	314°40.0	89°21.5
Acamar	315°12.7	-40°12.3
Menkar	314°07.4	4°11.0
Mirfak	308°30.1	49°56.5
Aldebaran	290°41.1	16°33.4
Rigel	281°05.2	-8°10.3
Capella	280°23.9	46°01.2
Bellatrix	278°24.4	6°22.3
Elnath	278°03.6	28°37.6
Alnilam	275°39.2	-1°11.1
Betelgeuse	270°53.6	7°24.8
Canopus	263°53.4	-52°42.2
Sirius	258°27.6	-16°44.7
Adhara	255°07.1	-29°00.1
Procyon	244°52.4	5°10.0
Pollux	243°19.1	27°58.2
Avior	234°15.9	-59°35.0
Suhail	222°47.6	-43°31.6
Miaplacidus	221°39.5	-69°48.8
Alphard	217°49.2	-8°45.5
Regulus	207°36.0	11°51.3
Dubhe	193°43.0	61°37.7
Denebola	182°26.4	14°26.6
Gienah	175°45.0	-17°40.3
Acrux	173°01.8	-63°14.0
Gacrux	171°53.3	-57°14.9
Alioth	166°14.2	55°50.2
Spica	158°23.6	-11°17.0
Alkaid	152°53.0	49°12.0
Hadar	148°37.8	-60°29.4
Menkent	147°59.1	-36°29.2
Arcturus	145°49.0	19°03.8
Rigil Kent.	139°41.9	-60°56.2
Kochab	137°19.7	74°03.8
Zuben'ubi	136°57.3	-16°08.4
Alphecca	126°04.6	26°38.3
Antares	112°17.1	-26°29.1
Atria	107°12.1	-69°04.4
Sabik	102°03.9	-15°45.2
Shaula	96°11.7	-37°07.3
Rasalhague	95°59.4	12°32.7
Eltanin	90°42.3	51°29.3
Kaus Aust.	83°33.7	-34°22.4
Vega	80°33.7	38°48.4
Nunki	75°48.9	-26°16.0
Altair	62°00.8	8°55.9
Peacock	53°07.0	-56°39.5
Deneb	49°26.1	45°21.9
Enif	33°39.6	9°59.0
Al Na'ir	27°33.9	-46°50.7
Fomalhaut	15°15.5	-29°29.7
Scheat	13°46.1	28°12.6
Markab	13°30.8	15°19.9

Aug 02 Wed	**SHA**	**Mer.pass**
Venus	213°05.0	13:03
Mars	194°31.1	14:20
Jupiter	318°17.6	06:05
Saturn	21°54.1	01:51

Aug 03 Thu	**SHA**	**Mer.pass**
Venus	213°32.3	12:57
Mars	193°56.6	14:18
Jupiter	318°11.5	06:01
Saturn	21°57.6	01:47

Aug 04 Fri	**SHA**	**Mer.pass**
Venus	214°01.4	12:51
Mars	193°22.0	14:16
Jupiter	318°05.6	05:58
Saturn	22°01.3	01:42

Horizontal parallax	
Venus:	0.5
Mars:	0.1

h	Sun		Moon				
Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°24.8	N17°52.7	353°38.5	4.5′	S21°38.1	11.9′	61.3′
1	193°24.8	52.1	8°02.0	4.6′	21°26.2	12.1′	61.3′
2	208°24.8	51.5	22°25.7	4.7′	21°14.1	12.3′	61.3′
3	223°24.9	·· 50.8	36°49.4	4.8′	21°01.8	12.4′	61.3′
4	238°24.9	50.2	51°13.2	4.9′	20°49.4	12.5′	61.3′
5	253°25.0	49.5	65°37.2	5.0′	20°36.9	12.7′	61.3′
6	268°25.0	N17°48.9	80°01.2	5.2′	S20°24.2	12.8′	61.3′
7	283°25.1	48.3	94°25.4	5.3′	20°11.4	12.9′	61.3′
8	298°25.1	47.6	108°49.6	5.4′	19°58.5	13.1′	61.3′
9	313°25.1	·· 47.0	123°14.0	5.5′	19°45.4	13.3′	61.3′
10	328°25.2	46.4	137°38.5	5.6′	19°32.1	13.3′	61.3′
11	343°25.2	45.7	152°03.1	5.7′	19°18.8	13.5′	61.3′
12	358°25.3	N17°45.1	166°27.8	5.8′	S19°05.3	13.6′	61.3′
13	13°25.3	44.4	180°52.6	5.9′	18°51.7	13.8′	61.3′
14	28°25.4	43.8	195°17.5	6.0′	18°37.9	13.8′	61.3′
15	43°25.4	·· 43.1	209°42.5	6.1′	18°24.1	14.0′	61.3′
16	58°25.5	42.5	224°07.6	6.2′	18°10.1	14.1′	61.3′
17	73°25.5	41.9	238°32.9	6.3′	17°56.0	14.2′	61.3′
18	88°25.6	N17°41.2	252°58.2	6.5′	S17°41.8	14.3′	61.2′
19	103°25.6	40.6	267°23.6	6.6′	17°27.5	14.4′	61.2′
20	118°25.7	39.9	281°49.2	6.7′	17°13.1	14.6′	61.2′
21	133°25.7	·· 39.3	296°14.9	6.8′	16°58.5	14.6′	61.2′
22	148°25.7	38.6	310°40.6	6.9′	16°43.9	14.8′	61.2′
23	163°25.8	38.0	325°06.5	7.0′	16°29.1	14.8′	61.2′
	SD = 15.8′	d = -0.6′	SD = 16.7′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°25.8	N17°37.3	339°32.5	7.1′	S16°14.3	15.0′	61.2′
1	193°25.9	36.7	353°58.6	7.2′	15°59.3	15.0′	61.2′
2	208°25.9	36.0	8°24.8	7.3′	15°44.3	15.2′	61.2′
3	223°26.0	·· 35.4	22°51.1	7.4′	15°29.1	15.2′	61.2′
4	238°26.0	34.7	37°17.5	7.5′	15°13.9	15.3′	61.2′
5	253°26.1	34.1	51°44.0	7.6′	14°58.6	15.4′	61.1′
6	268°26.1	N17°33.4	66°10.6	7.7′	S14°43.2	15.5′	61.1′
7	283°26.2	32.8	80°37.3	7.8′	14°27.7	15.6′	61.1′
8	298°26.2	32.1	95°04.1	7.9′	14°12.1	15.6′	61.1′
9	313°26.3	·· 31.5	109°31.1	8.0′	13°56.5	15.7′	61.1′
10	328°26.3	30.8	123°58.1	8.1′	13°40.8	15.8′	61.1′
11	343°26.4	30.2	138°25.2	8.2′	13°25.0	15.9′	61.1′
12	358°26.5	N17°29.5	152°52.4	8.3′	S13°09.1	16.0′	61.0′
13	13°26.5	28.9	167°19.7	8.4′	12°53.1	16.0′	61.0′
14	28°26.6	28.2	181°47.1	8.5′	12°37.1	16.1′	61.0′
15	43°26.6	·· 27.6	196°14.6	8.6′	12°21.0	16.1′	61.0′
16	58°26.7	26.9	210°42.2	8.7′	12°04.9	16.2′	61.0′
17	73°26.7	26.3	225°09.9	8.8′	11°48.7	16.3′	60.9′
18	88°26.8	N17°25.6	239°37.7	8.9′	S11°32.4	16.3′	60.9′
19	103°26.8	25.0	254°05.6	9.0′	11°16.1	16.4′	60.9′
20	118°26.9	24.3	268°33.5	9.1′	10°59.7	16.4′	60.9′
21	133°26.9	·· 23.6	283°01.6	9.1′	10°43.3	16.5′	60.9′
22	148°27.0	23.0	297°29.7	9.2′	10°26.8	16.5′	60.8′
23	163°27.0	22.3	311°57.9	9.3′	10°10.3	16.6′	60.8′
	SD = 15.8′	d = -0.6′	SD = 16.7′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°27.1	N17°21.7	326°26.3	9.4′	S09°53.7	16.6′	60.8′
1	193°27.1	21.0	340°54.7	9.5′	09°37.1	16.7′	60.8′
2	208°27.2	20.3	355°23.1	9.6′	09°20.4	16.7′	60.8′
3	223°27.3	·· 19.7	9°51.7	9.6′	09°03.7	16.8′	60.7′
4	238°27.3	19.0	24°20.3	9.7′	08°46.9	16.7′	60.7′
5	253°27.4	18.4	38°49.1	9.8′	08°30.2	16.9′	60.7′
6	268°27.4	N17°17.7	53°17.9	9.9′	S08°13.3	16.8′	60.7′
7	283°27.5	17.0	67°46.8	10.0′	07°56.5	16.9′	60.6′
8	298°27.5	16.4	82°15.7	10.0′	07°39.6	16.9′	60.6′
9	313°27.6	·· 15.7	96°44.7	10.1′	07°22.7	16.9′	60.6′
10	328°27.7	15.0	111°13.8	10.2′	07°05.8	17.0′	60.6′
11	343°27.7	14.4	125°43.0	10.2′	06°48.8	16.9′	60.5′
12	358°27.8	N17°13.7	140°12.3	10.3′	S06°31.9	17.0′	60.5′
13	13°27.8	13.1	154°41.6	10.4′	06°14.9	17.1′	60.5′
14	28°27.9	12.4	169°11.0	10.5′	05°57.8	17.0′	60.5′
15	43°27.9	·· 11.7	183°40.4	10.5′	05°40.8	17.0′	60.4′
16	58°28.0	11.1	198°10.0	10.6′	05°23.8	17.1′	60.4′
17	73°28.1	10.4	212°39.5	10.6′	05°06.7	17.1′	60.4′
18	88°28.1	N17°09.7	227°09.2	10.7′	S04°49.6	17.0′	60.3′
19	103°28.2	09.1	241°38.9	10.8′	04°32.6	17.1′	60.3′
20	118°28.2	08.4	256°08.7	10.8′	04°15.5	17.1′	60.3′
21	133°28.3	·· 07.7	270°38.5	10.9′	03°58.4	17.1′	60.2′
22	148°28.4	07.0	285°08.4	10.9′	03°41.3	17.1′	60.2′
23	163°28.4	06.4	299°38.3	11.0′	03°24.2	17.1′	60.2′
	SD = 15.8′	d = -0.7′	SD = 16.6′				

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

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

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 16-18 100-92%
02	06:21	06:19	12:06	00:27	12:56	○
03	06:17	06:14	12:06	01:25	13:53	
04	06:12	06:09	12:06	02:19	14:45	

August 05, 06, 07 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	313°17.4	167°49.6	N07°05.1	146°04.8	N06°26.6	271°17.2	N14°53.4	335°22.3	S11°07.8
1	328°19.8	182°53.4	05.0	161°05.9	26.0	286°19.4	53.5	350°24.9	07.8
2	343°22.3	197°57.1	04.9	176°06.9	25.4	301°21.7	53.6	5°27.5	07.9
3	358°24.8	213°00.9	·· 04.9	191°07.9	·· 24.7	316°23.9	·· 53.6	20°30.2	·· 08.0
4	13°27.2	228°04.7	04.8	206°08.9	24.1	331°26.1	53.7	35°32.8	08.0
5	28°29.7	243°08.5	04.7	221°10.0	23.5	346°28.3	53.7	50°35.4	08.1
6	43°32.1	258°12.3	N07°04.7	236°11.0	N06°22.8	1°30.6	N14°53.8	65°38.0	S11°08.2
7	58°34.6	273°16.1	04.6	251°12.0	22.2	16°32.8	53.9	80°40.6	08.2
8	73°37.1	288°19.9	04.5	266°13.0	21.6	31°35.0	53.9	95°43.3	08.3
9	88°39.5	303°23.7	·· 04.5	281°14.1	·· 21.0	46°37.3	·· 54.0	110°45.9	·· 08.4
10	103°42.0	318°27.5	04.4	296°15.1	20.3	61°39.5	54.1	125°48.5	08.4
11	118°44.5	333°31.3	04.4	311°16.1	19.7	76°41.7	54.1	140°51.1	08.5
12	133°46.9	348°35.1	N07°04.3	326°17.1	N06°19.1	91°44.0	N14°54.2	155°53.7	S11°08.6
13	148°49.4	3°38.9	04.3	341°18.2	18.5	106°46.2	54.2	170°56.3	08.6
14	163°51.9	18°42.7	04.2	356°19.2	17.8	121°48.4	54.3	185°59.0	08.7
15	178°54.3	33°46.6	·· 04.2	11°20.2	·· 17.2	136°50.6	·· 54.4	201°01.6	·· 08.8
16	193°56.8	48°50.4	04.1	26°21.2	16.6	151°52.9	54.4	216°04.2	08.8
17	208°59.3	63°54.2	04.1	41°22.3	15.9	166°55.1	54.5	231°06.8	08.9
18	224°01.7	78°58.0	N07°04.0	56°23.3	N06°15.3	181°57.3	N14°54.5	246°09.4	S11°09.0
19	239°04.2	94°01.8	04.0	71°24.3	14.7	196°59.6	54.6	261°12.1	09.0
20	254°06.6	109°05.7	03.9	86°25.3	14.1	212°01.8	54.7	276°14.7	09.1
21	269°09.1	124°09.5	·· 03.9	101°26.4	·· 13.4	227°04.0	·· 54.7	291°17.3	·· 09.2
22	284°11.6	139°13.3	03.9	116°27.4	12.8	242°06.3	54.8	306°19.9	09.2
23	299°14.0	154°17.2	03.8	131°28.4	12.2	257°08.5	54.9	321°22.5	09.3
Mer.pass. 03:06		ν 3.8′ d -0.1′ m -4.14		ν 1.0′ d -0.6′ m 1.79		ν 2.2′ d 0.1′ m -2.39		ν 2.6′ d -0.1′ m 0.55	

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	314°16.5	169°21.0	N07°03.8	146°29.4	N06°11.5	272°10.7	N14°54.9	336°25.2	S11°09.4
1	329°19.0	184°24.9	03.8	161°30.5	10.9	287°13.0	55.0	351°27.8	09.4
2	344°21.4	199°28.7	03.7	176°31.5	10.3	302°15.2	55.0	6°30.4	09.5
3	359°23.9	214°32.5	·· 03.7	191°32.5	·· 09.7	317°17.4	·· 55.1	21°33.0	·· 09.6
4	14°26.4	229°36.4	03.7	206°33.5	09.0	332°19.7	55.2	36°35.6	09.6
5	29°28.8	244°40.2	03.6	221°34.6	08.4	347°21.9	55.2	51°38.3	09.7
6	44°31.3	259°44.1	N07°03.6	236°35.6	N06°07.8	2°24.1	N14°55.3	66°40.9	S11°09.8
7	59°33.8	274°47.9	03.6	251°36.6	07.1	17°26.4	55.3	81°43.5	09.8
8	74°36.2	289°51.8	03.6	266°37.6	06.5	32°28.6	55.4	96°46.1	09.9
9	89°38.7	304°55.7	·· 03.5	281°38.6	·· 05.9	47°30.9	·· 55.5	111°48.8	·· 10.0
10	104°41.1	319°59.5	03.5	296°39.7	05.3	62°33.1	55.5	126°51.4	10.0
11	119°43.6	335°03.4	03.5	311°40.7	04.6	77°35.3	55.6	141°54.0	10.1
12	134°46.1	350°07.2	N07°03.5	326°41.7	N06°04.0	92°37.6	N14°55.6	156°56.6	S11°10.2
13	149°48.5	5°11.1	03.5	341°42.7	03.4	107°39.8	55.7	171°59.2	10.2
14	164°51.0	20°15.0	03.5	356°43.8	02.7	122°42.0	55.8	187°01.9	10.3
15	179°53.5	35°18.9	·· 03.5	11°44.8	·· 02.1	137°44.3	·· 55.8	202°04.5	·· 10.4
16	194°55.9	50°22.7	03.4	26°45.8	01.5	152°46.5	55.9	217°07.1	10.4
17	209°58.4	65°26.6	03.4	41°46.8	00.8	167°48.8	55.9	232°09.7	10.5
18	225°00.9	80°30.5	N07°03.4	56°47.9	N06°00.2	182°51.0	N14°56.0	247°12.3	S11°10.6
19	240°03.3	95°34.4	03.4	71°48.9	05°59.6	197°53.2	56.0	262°15.0	10.6
20	255°05.8	110°38.2	03.4	86°49.9	59.0	212°55.5	56.1	277°17.6	10.7
21	270°08.2	125°42.1	·· 03.4	101°50.9	·· 58.3	227°57.7	·· 56.2	292°20.2	·· 10.8
22	285°10.7	140°46.0	03.4	116°52.0	57.7	243°00.0	56.2	307°22.8	10.8
23	300°13.2	155°49.9	03.4	131°53.0	57.1	258°02.2	56.3	322°25.5	10.9
Mer.pass. 03:02		ν 3.8′ d -0.0′ m -4.07		ν 1.0′ d -0.6′ m 1.79		ν 2.2′ d 0.1′ m -2.40		ν 2.6′ d -0.1′ m 0.55	

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	315°15.6	170°53.8	N07°03.4	146°54.0	N05°56.4	273°04.4	N14°56.3	337°28.1	S11°11.0
1	330°18.1	185°57.7	03.4	161°55.0	55.8	288°06.7	56.4	352°30.7	11.0
2	345°20.6	201°01.6	03.4	176°56.1	55.2	303°08.9	56.5	7°33.3	11.1
3	0°23.0	216°05.5	·· 03.4	191°57.1	·· 54.5	318°11.2	·· 56.5	22°35.9	·· 11.2
4	15°25.5	231°09.4	03.5	206°58.1	53.9	333°13.4	56.6	37°38.6	11.2
5	30°28.0	246°13.3	03.5	221°59.1	53.3	348°15.6	56.6	52°41.2	11.3
6	45°30.4	261°17.2	N07°03.5	237°00.1	N05°52.6	3°17.9	N14°56.7	67°43.8	S11°11.4
7	60°32.9	276°21.1	03.5	252°01.2	52.0	18°20.1	56.7	82°46.4	11.5
8	75°35.4	291°25.0	03.5	267°02.2	51.4	33°22.4	56.8	97°49.1	11.5
9	90°37.8	306°28.9	·· 03.5	282°03.2	·· 50.8	48°24.6	·· 56.9	112°51.7	·· 11.6
10	105°40.3	321°32.8	03.5	297°04.2	50.1	63°26.9	56.9	127°54.3	11.7
11	120°42.7	336°36.7	03.6	312°05.3	49.5	78°29.1	57.0	142°56.9	11.7
12	135°45.2	351°40.6	N07°03.6	327°06.3	N05°48.9	93°31.3	N14°57.0	157°59.5	S11°11.8
13	150°47.7	6°44.5	03.6	342°07.3	48.2	108°33.6	57.1	173°02.2	11.9
14	165°50.1	21°48.5	03.6	357°08.3	47.6	123°35.8	57.1	188°04.8	11.9
15	180°52.6	36°52.4	·· 03.7	12°09.4	·· 47.0	138°38.1	·· 57.2	203°07.4	·· 12.0
16	195°55.1	51°56.3	03.7	27°10.4	46.3	153°40.3	57.3	218°10.0	12.1
17	210°57.5	67°00.2	03.7	42°11.4	45.7	168°42.6	57.3	233°12.7	12.1
18	226°00.0	82°04.2	N07°03.8	57°12.4	N05°45.1	183°44.8	N14°57.4	248°15.3	S11°12.2
19	241°02.5	97°08.1	03.8	72°13.4	44.4	198°47.1	57.4	263°17.9	12.3
20	256°04.9	112°12.0	03.8	87°14.5	43.8	213°49.3	57.5	278°20.5	12.3
21	271°07.4	127°15.9	·· 03.9	102°15.5	·· 43.2	228°51.6	·· 57.5	293°23.2	·· 12.4
22	286°09.9	142°19.9	03.9	117°16.5	42.5	243°53.8	57.6	308°25.8	12.5
23	301°12.3	157°23.8	03.9	132°17.5	41.9	258°56.0	57.7	323°28.4	12.5
Mer.pass. 02:58		ν 3.9′ d 0.0′ m -4.01		ν 1.0′ d -0.6′ m 1.79		ν 2.2′ d 0.1′ m -2.41		ν 2.6′ d -0.1′ m 0.54	

Stars

	SHA	Dec
Alpheratz	357°35.8	29°13.2
Ankaa	353°08.0	-42°10.5
Schedar	349°32.1	56°39.8
Diphda	348°48.3	-17°51.3
Achernar	335°20.9	-57°06.7
Hamal	327°52.5	23°34.4
Polaris	314°38.6	89°21.5
Acamar	315°12.7	-40°12.3
Menkar	314°07.4	4°11.0
Mirfak	308°30.0	49°56.5
Aldebaran	290°41.1	16°33.4
Rigel	281°05.2	-8°10.3
Capella	280°23.9	46°01.2
Bellatrix	278°24.4	6°22.3
Elnath	278°03.6	28°37.6
Alnilam	275°39.1	-1°11.1
Betelgeuse	270°53.6	7°24.8
Canopus	263°53.4	-52°42.2
Sirius	258°27.6	-16°44.7
Adhara	255°07.1	-29°00.0
Procyon	244°52.4	5°10.0
Pollux	243°19.1	27°58.2
Avior	234°15.9	-59°34.9
Suhail	222°47.6	-43°31.6
Miaplacidus	221°39.5	-69°48.8
Alphard	217°49.2	-8°45.5
Regulus	207°36.0	11°51.3
Dubhe	193°43.0	61°37.7
Denebola	182°26.4	14°26.6
Gienah	175°45.0	-17°40.3
Acrux	173°01.9	-63°13.9
Gacrux	171°53.3	-57°14.9
Alioth	166°14.3	55°50.2
Spica	158°23.7	-11°17.0
Alkaid	152°53.0	49°12.0
Hadar	148°37.8	-60°29.4
Menkent	147°59.1	-36°29.2
Arcturus	145°49.0	19°03.8
Rigil Kent.	139°42.0	-60°56.2
Kochab	137°19.7	74°03.8
Zuben'ubi	136°57.3	-16°08.4
Alphecca	126°04.7	26°38.3
Antares	112°17.1	-26°29.1
Atria	107°12.1	-69°04.4
Sabik	102°03.9	-15°45.2
Shaula	96°11.7	-37°07.3
Rasalhague	95°59.4	12°32.7
Eltanin	90°42.3	51°29.3
Kaus Aust.	83°33.7	-34°22.4
Vega	80°33.7	38°48.5
Nunki	75°48.9	-26°16.0
Altair	62°00.8	8°55.9
Peacock	53°07.0	-56°39.5
Deneb	49°26.1	45°21.9
Enif	33°39.6	9°59.0
Al Na'ir	27°33.9	-46°50.7
Fomalhaut	15°15.5	-29°29.7
Scheat	13°46.0	28°12.6
Markab	13°30.8	15°19.9

Aug 05 Sat	SHA	Mer.pass
Venus	214°32.2	12:45
Mars	192°47.5	14:15
Jupiter	317°59.8	05:54
Saturn	22°04.9	01:38

Aug 06 Sun	SHA	Mer.pass
Venus	215°04.5	12:39
Mars	192°12.9	14:13
Jupiter	317°54.2	05:50
Saturn	22°08.7	01:34

Aug 07 Mon	SHA	Mer.pass
Venus	215°38.2	12:33
Mars	191°38.4	14:11
Jupiter	317°48.8	05:47
Saturn	22°12.4	01:30

Horizontal parallax	
Venus:	0.5
Mars:	0.1

h — Sun — Moon

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	178°28.5	N17°05.7	314°08.3	11.0′	S03°07.1	17.1′	60.2′
1	193°28.5	05.0	328°38.4	11.1′	02°50.0	17.1′	60.1′
2	208°28.6	04.4	343°08.5	11.2′	02°32.9	17.1′	60.1′
3	223°28.7	·· 03.7	357°38.6	11.2′	02°15.8	17.0′	60.1′
4	238°28.7	03.0	12°08.8	11.2′	01°58.8	17.1′	60.0′
5	253°28.8	02.3	26°39.1	11.3′	01°41.7	17.1′	60.0′
6	268°28.9	N17°01.7	41°09.4	11.3′	S01°24.6	17.0′	60.0′
7	283°28.9	01.0	55°39.7	11.4′	01°07.6	17.0′	59.9′
8	298°29.0	17°00.3	70°10.1	11.4′	00°50.6	17.1′	59.9′
9	313°29.0	16°59.6	84°40.5	11.5′	00°33.5	17.0′	59.9′
10	328°29.1	59.0	99°11.0	11.5′	S00°16.5	16.9′	59.8′
11	343°29.2	58.3	113°41.5	11.5′	N00°00.4	17.0′	59.8′
12	358°29.2	N16°57.6	128°12.0	11.6′	N00°17.4	16.9′	59.8′
13	13°29.3	56.9	142°42.6	11.6′	00°34.3	16.9′	59.7′
14	28°29.4	56.3	157°13.2	11.7′	00°51.2	16.9′	59.7′
15	43°29.4	·· 55.6	171°43.9	11.7′	01°08.1	16.9′	59.7′
16	58°29.5	54.9	186°14.6	11.7′	01°25.0	16.8′	59.6′
17	73°29.6	54.2	200°45.3	11.8′	01°41.8	16.8′	59.6′
18	88°29.6	N16°53.6	215°16.1	11.8′	N01°58.6	16.8′	59.6′
19	103°29.7	52.9	229°46.8	11.8′	02°15.4	16.8′	59.5′
20	118°29.8	52.2	244°17.6	11.8′	02°32.2	16.7′	59.5′
21	133°29.8	·· 51.5	258°48.5	11.9′	02°48.9	16.6′	59.4′
22	148°29.9	50.8	273°19.3	11.9′	03°05.5	16.7′	59.4′
23	163°30.0	50.2	287°50.2	11.9′	03°22.2	16.6′	59.4′
	SD = 15.8′	d = -0.7′		SD = 16.4′			

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	178°30.0	N16°49.5	302°21.1	11.9′	N03°38.8	16.5′	59.3′
1	193°30.1	48.8	316°52.1	11.9′	03°55.3	16.6′	59.3′
2	208°30.2	48.1	331°23.0	12.0′	04°11.9	16.4′	59.3′
3	223°30.2	·· 47.4	345°54.0	12.0′	04°28.3	16.5′	59.2′
4	238°30.3	46.7	0°24.9	12.0′	04°44.8	16.4′	59.2′
5	253°30.4	46.1	14°55.9	12.0′	05°01.2	16.3′	59.2′
6	268°30.4	N16°45.4	29°27.0	12.0′	N05°17.5	16.3′	59.1′
7	283°30.5	44.7	43°58.0	12.0′	05°33.8	16.2′	59.1′
8	298°30.6	44.0	58°29.0	12.0′	05°50.0	16.2′	59.0′
9	313°30.6	·· 43.3	73°00.1	12.1′	06°06.2	16.2′	59.0′
10	328°30.7	42.6	87°31.1	12.1′	06°22.4	16.1′	59.0′
11	343°30.8	41.9	102°02.2	12.1′	06°38.5	16.0′	58.9′
12	358°30.8	N16°41.2	116°33.3	12.1′	N06°54.5	16.0′	58.9′
13	13°30.9	40.6	131°04.4	12.1′	07°10.5	15.9′	58.9′
14	28°31.0	39.9	145°35.4	12.1′	07°26.4	15.9′	58.8′
15	43°31.1	·· 39.2	160°06.5	12.1′	07°42.3	15.8′	58.8′
16	58°31.1	38.5	174°37.6	12.1′	07°58.1	15.7′	58.8′
17	73°31.2	37.8	189°08.7	12.1′	08°13.8	15.7′	58.7′
18	88°31.3	N16°37.1	203°39.8	12.1′	N08°29.5	15.7′	58.7′
19	103°31.3	36.4	218°10.9	12.1′	08°45.2	15.5′	58.6′
20	118°31.4	35.7	232°42.0	12.1′	09°00.7	15.5′	58.6′
21	133°31.5	·· 35.0	247°13.1	12.1′	09°16.2	15.4′	58.6′
22	148°31.6	34.3	261°44.2	12.1′	09°31.6	15.4′	58.5′
23	163°31.6	33.7	276°15.3	12.1′	09°47.0	15.3′	58.5′
	SD = 15.8′	d = -0.7′		SD = 16.2′			

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	178°31.7	N16°33.0	290°46.3	12.1′	N10°02.3	15.2′	58.4′
1	193°31.8	32.3	305°17.4	12.1′	10°17.5	15.2′	58.4′
2	208°31.9	31.6	319°48.5	12.0′	10°32.7	15.1′	58.4′
3	223°31.9	·· 30.9	334°19.5	12.0′	10°47.8	15.0′	58.3′
4	238°32.0	30.2	348°50.5	12.0′	11°02.8	14.9′	58.3′
5	253°32.1	29.5	3°21.6	12.0′	11°17.7	14.9′	58.3′
6	268°32.1	N16°28.8	17°52.6	12.0′	N11°32.6	14.8′	58.2′
7	283°32.2	28.1	32°23.6	12.0′	11°47.4	14.7′	58.2′
8	298°32.3	27.4	46°54.6	12.0′	12°02.1	14.6′	58.1′
9	313°32.4	·· 26.7	61°25.5	12.0′	12°16.7	14.6′	58.1′
10	328°32.4	26.0	75°56.5	11.9′	12°31.3	14.4′	58.1′
11	343°32.5	25.3	90°27.4	11.9′	12°45.7	14.4′	58.0′
12	358°32.6	N16°24.6	104°58.3	11.9′	N13°00.1	14.3′	58.0′
13	13°32.7	23.9	119°29.2	11.9′	13°14.4	14.2′	58.0′
14	28°32.8	23.2	134°00.1	11.9′	13°28.6	14.2′	57.9′
15	43°32.8	·· 22.5	148°31.0	11.8′	13°42.8	14.0′	57.9′
16	58°32.9	21.8	163°01.8	11.8′	13°56.8	14.0′	57.8′
17	73°33.0	21.1	177°32.6	11.8′	14°10.8	13.9′	57.8′
18	88°33.1	N16°20.4	192°03.4	11.8′	N14°24.7	13.8′	57.8′
19	103°33.1	19.7	206°34.2	11.7′	14°38.5	13.7′	57.7′
20	118°33.2	19.0	221°04.9	11.7′	14°52.2	13.6′	57.7′
21	133°33.3	·· 18.3	235°35.6	11.7′	15°05.8	13.5′	57.7′
22	148°33.4	17.6	250°06.3	11.7′	15°19.3	13.4′	57.6′
23	163°33.5	16.9	264°37.0	11.6′	15°32.7	13.4′	57.6′
	SD = 15.8′	d = -0.7′		SD = 15.9′			

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

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

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 19-21 85-65%
05	06:06	06:03	12:06	03:10	15:34	
06	06:00	05:57	12:06	03:58	16:22	
07	05:53	05:50	12:06	04:46	17:10	

August 08, 09, 10 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	316°14.8	172°27.7	N07°04.0	147°18.6	N05°41.3	273°58.3	N14°57.7	338°31.0	S11°12.6
1	331°17.2	187°31.7	04.0	162°19.6	40.6	289°00.5	57.8	353°33.7	12.7
2	346°19.7	202°35.6	04.1	177°20.6	40.0	304°02.8	57.8	8°36.3	12.7
3	1°22.2	217°39.6	·· 04.1	192°21.6	·· 39.4	319°05.0	·· 57.9	23°38.9	·· 12.8
4	16°24.6	232°43.5	04.1	207°22.7	38.7	334°07.3	57.9	38°41.5	12.9
5	31°27.1	247°47.4	04.2	222°23.7	38.1	349°09.5	58.0	53°44.2	13.0
6	46°29.6	262°51.4	N07°04.2	237°24.7	N05°37.5	4°11.8	N14°58.1	68°46.8	S11°13.0
7	61°32.0	277°55.3	04.3	252°25.7	36.8	19°14.0	58.1	83°49.4	13.1
8	76°34.5	292°59.3	04.3	267°26.8	36.2	34°16.3	58.2	98°52.0	13.2
9	91°37.0	308°03.2	·· 04.4	282°27.8	·· 35.6	49°18.5	·· 58.2	113°54.7	·· 13.2
10	106°39.4	323°07.2	04.5	297°28.8	34.9	64°20.8	58.3	128°57.3	13.3
11	121°41.9	338°11.1	04.5	312°29.8	34.3	79°23.0	58.3	143°59.9	13.4
12	136°44.3	353°15.1	N07°04.6	327°30.8	N05°33.7	94°25.3	N14°58.4	159°02.5	S11°13.4
13	151°46.8	8°19.0	04.6	342°31.9	33.0	109°27.5	58.4	174°05.2	13.5
14	166°49.3	23°23.0	04.7	357°32.9	32.4	124°29.8	58.5	189°07.8	13.6
15	181°51.7	38°27.0	·· 04.8	12°33.9	·· 31.8	139°32.0	·· 58.6	204°10.4	·· 13.6
16	196°54.2	53°30.9	04.8	27°34.9	31.1	154°34.3	58.6	219°13.0	13.7
17	211°56.7	68°34.9	04.9	42°36.0	30.5	169°36.5	58.7	234°15.7	13.8
18	226°59.1	83°38.8	N07°05.0	57°37.0	N05°29.9	184°38.8	N14°58.7	249°18.3	S11°13.8
19	242°01.6	98°42.8	05.0	72°38.0	29.2	199°41.0	58.8	264°20.9	13.9
20	257°04.1	113°46.8	05.1	87°39.0	28.6	214°43.3	58.8	279°23.5	14.0
21	272°06.5	128°50.7	·· 05.2	102°40.0	·· 28.0	229°45.6	·· 58.9	294°26.2	·· 14.0
22	287°09.0	143°54.7	05.2	117°41.1	27.3	244°47.8	58.9	309°28.8	14.1
23	302°11.5	158°58.7	05.3	132°42.1	26.7	259°50.1	59.0	324°31.4	14.2
Mer.pass. 02:55		ν 3.9′	d 0.0′	m -3.99	ν 1.0′	d -0.6′	m 1.78	ν 2.2′	d 0.1′ m -2.41	ν 2.6′ d -0.1′ m 0.54

Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	317°13.9	174°02.6	N07°05.4	147°43.1	N05°26.1	274°52.3	N14°59.0	339°34.0	S11°14.3
1	332°16.4	189°06.6	05.5	162°44.1	25.4	289°54.6	59.1	354°36.7	14.3
2	347°18.8	204°10.6	05.6	177°45.2	24.8	304°56.8	59.1	9°39.3	14.4
3	2°21.3	219°14.6	·· 05.6	192°46.2	·· 24.2	319°59.1	·· 59.2	24°41.9	·· 14.5
4	17°23.8	234°18.5	05.7	207°47.2	23.5	335°01.3	59.3	39°44.5	14.5
5	32°26.2	249°22.5	05.8	222°48.2	22.9	350°03.6	59.3	54°47.2	14.6
6	47°28.7	264°26.5	N07°05.9	237°49.3	N05°22.3	5°05.9	N14°59.4	69°49.8	S11°14.7
7	62°31.2	279°30.5	06.0	252°50.3	21.6	20°08.1	59.4	84°52.4	14.7
8	77°33.6	294°34.5	06.1	267°51.3	21.0	35°10.4	59.5	99°55.0	14.8
9	92°36.1	309°38.4	·· 06.1	282°52.3	·· 20.4	50°12.6	·· 59.5	114°57.7	·· 14.9
10	107°38.6	324°42.4	06.2	297°53.3	19.7	65°14.9	59.6	130°00.3	14.9
11	122°41.0	339°46.4	06.3	312°54.4	19.1	80°17.1	59.6	145°02.9	15.0
12	137°43.5	354°50.4	N07°06.4	327°55.4	N05°18.4	95°19.4	N14°59.7	160°05.5	S11°15.1
13	152°46.0	9°54.4	06.5	342°56.4	17.8	110°21.7	59.7	175°08.2	15.2
14	167°48.4	24°58.4	06.6	357°57.4	17.2	125°23.9	59.8	190°10.8	15.2
15	182°50.9	40°02.4	·· 06.7	12°58.5	·· 16.5	140°26.2	·· 59.8	205°13.4	·· 15.3
16	197°53.3	55°06.4	06.8	27°59.5	15.9	155°28.4	59.9	220°16.1	15.4
17	212°55.8	70°10.4	06.9	43°00.5	15.3	170°30.7	14°59.9	235°18.7	15.4
18	227°58.3	85°14.3	N07°07.0	58°01.5	N05°14.6	185°32.9	N15°00.0	250°21.3	S11°15.5
19	243°00.7	100°18.3	07.1	73°02.5	14.0	200°35.2	00.1	265°23.9	15.6
20	258°03.2	115°22.3	07.2	88°03.6	13.4	215°37.5	00.1	280°26.6	15.6
21	273°05.7	130°26.3	·· 07.3	103°04.6	·· 12.7	230°39.7	·· 00.2	295°29.2	·· 15.7
22	288°08.1	145°30.3	07.4	118°05.6	12.1	245°42.0	00.2	310°31.8	15.8
23	303°10.6	160°34.3	07.6	133°06.6	11.5	260°44.3	00.3	325°34.4	15.8
Mer.pass. 02:51		ν 4.0′	d 0.1′	m -4.08	ν 1.0′	d -0.6′	m 1.78	ν 2.3′	d 0.1′ m -2.42	ν 2.6′ d -0.1′ m 0.53

Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	318°13.1	175°38.3	N07°07.7	148°07.7	N05°10.8	275°46.5	N15°00.3	340°37.1	S11°15.9
1	333°15.5	190°42.3	07.8	163°08.7	10.2	290°48.8	00.4	355°39.7	16.0
2	348°18.0	205°46.3	07.9	178°09.7	09.5	305°51.0	00.4	10°42.3	16.0
3	3°20.4	220°50.3	·· 08.0	193°10.7	·· 08.9	320°53.3	·· 00.5	25°45.0	·· 16.1
4	18°22.9	235°54.3	08.1	208°11.7	08.3	335°55.6	00.5	40°47.6	16.2
5	33°25.4	250°58.3	08.3	223°12.8	07.6	350°57.8	00.6	55°50.2	16.3
6	48°27.8	266°02.3	N07°08.4	238°13.8	N05°07.0	6°00.1	N15°00.6	70°52.8	S11°16.3
7	63°30.3	281°06.3	08.5	253°14.8	06.4	21°02.4	00.7	85°55.5	16.4
8	78°32.8	296°10.4	08.6	268°15.8	05.7	36°04.6	00.7	100°58.1	16.5
9	93°35.2	311°14.4	·· 08.7	283°16.9	·· 05.1	51°06.9	·· 00.8	116°00.7	·· 16.5
10	108°37.7	326°18.4	08.9	298°17.9	04.4	66°09.1	00.8	131°03.4	16.6
11	123°40.2	341°22.4	09.0	313°18.9	03.8	81°11.4	00.9	146°06.0	16.7
12	138°42.6	356°26.4	N07°09.1	328°19.9	N05°03.2	96°13.7	N15°00.9	161°08.6	S11°16.7
13	153°45.1	11°30.4	09.3	343°20.9	02.5	111°15.9	01.0	176°11.2	16.8
14	168°47.6	26°34.4	09.4	358°22.0	01.9	126°18.2	01.0	191°13.9	16.9
15	183°50.0	41°38.4	·· 09.5	13°23.0	·· 01.3	141°20.5	·· 01.1	206°16.5	·· 17.0
16	198°52.5	56°42.4	09.7	28°24.0	00.6	156°22.7	01.1	221°19.1	17.0
17	213°54.9	71°46.4	09.8	43°25.0	05°00.0	171°25.0	01.2	236°21.8	17.1
18	228°57.4	86°50.5	N07°09.9	58°26.1	N04°59.4	186°27.3	N15°01.2	251°24.4	S11°17.2
19	243°59.9	101°54.5	10.1	73°27.1	58.7	201°29.5	01.3	266°27.0	17.2
20	259°02.3	116°58.5	10.2	88°28.1	58.1	216°31.8	01.3	281°29.6	17.3
21	274°04.8	132°02.5	·· 10.3	103°29.1	·· 57.4	231°34.1	·· 01.4	296°32.3	·· 17.4
22	289°07.3	147°06.5	10.5	118°30.1	56.8	246°36.3	01.4	311°34.9	17.4
23	304°09.7	162°10.5	10.6	133°31.2	56.2	261°38.6	01.5	326°37.5	17.5
Mer.pass. 02:47		ν 4.0′	d 0.1′	m -4.13	ν 1.0′	d -0.6′	m 1.78	ν 2.3′	d 0.1′ m -2.43	ν 2.6′ d -0.1′ m 0.53

Stars

	SHA	**Dec**
Alpheratz	357°35.7	29°13.2
Ankaa	353°08.0	-42°10.5
Schedar	349°32.1	56°39.8
Diphda	348°48.3	-17°51.3
Achernar	335°20.8	-57°06.7
Hamal	327°52.4	23°34.4
Polaris	314°37.0	89°21.5
Acamar	315°12.7	-40°12.3
Menkar	314°07.4	4°11.0
Mirfak	308°30.0	49°56.5
Aldebaran	290°41.1	16°33.4
Rigel	281°05.2	-8°10.3
Capella	280°23.9	46°01.2
Bellatrix	278°24.3	6°22.3
Elnath	278°03.6	28°37.6
Alnilam	275°39.1	-1°11.1
Betelgeuse	270°53.6	7°24.8
Canopus	263°53.3	-52°42.2
Sirius	258°27.6	-16°44.7
Adhara	255°07.1	-29°00.0
Procyon	244°52.4	5°10.0
Pollux	243°19.1	27°58.2
Avior	234°15.9	-59°34.9
Suhail	222°47.6	-43°31.5
Miaplacidus	221°39.5	-69°48.7
Alphard	217°49.2	-8°45.5
Regulus	207°36.0	11°51.3
Dubhe	193°43.0	61°37.7
Denebola	182°26.4	14°26.6
Gienah	175°45.0	-17°40.3
Acrux	173°01.9	-63°13.9
Gacrux	171°53.3	-57°14.8
Alioth	166°14.3	55°50.2
Spica	158°23.7	-11°17.0
Alkaid	152°53.1	49°12.0
Hadar	148°37.8	-60°29.4
Menkent	147°59.1	-36°29.2
Arcturus	145°49.0	19°03.8
Rigil Kent.	139°42.0	-60°56.2
Kochab	137°19.8	74°03.8
Zuben'ubi	136°57.3	-16°08.4
Alphecca	126°04.7	26°38.3
Antares	112°17.1	-26°29.1
Atria	107°12.1	-69°04.4
Sabik	102°03.9	-15°45.2
Shaula	96°11.7	-37°07.3
Rasalhague	95°59.4	12°32.7
Eltanin	90°42.4	51°29.3
Kaus Aust.	83°33.8	-34°22.4
Vega	80°33.7	38°48.5
Nunki	75°48.9	-26°16.0
Altair	62°00.8	8°55.9
Peacock	53°07.0	-56°39.6
Deneb	49°26.1	45°21.9
Enif	33°39.6	9°59.0
Al Na'ir	27°33.9	-46°50.7
Fomalhaut	15°15.5	-29°29.7
Scheat	13°46.0	28°12.6
Markab	13°30.8	15°19.9

Aug 08 Tue	**SHA**	**Mer.pass**
Venus	216°13.0	12:27
Mars	191°03.8	14:10
Jupiter	317°43.5	05:43
Saturn	22°16.3	01:26

Aug 09 Wed	**SHA**	**Mer.pass**
Venus	216°48.7	12:21
Mars	190°29.2	14:08
Jupiter	317°38.4	05:40
Saturn	22°20.1	01:21

Aug 10 Thu	**SHA**	**Mer.pass**
Venus	217°25.3	12:14
Mars	189°54.6	14:07
Jupiter	317°33.5	05:36
Saturn	22°24.0	01:17

Horizontal parallax	
Venus:	0.5
Mars:	0.1

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°33.5	N16°16.2	279°07.6	11.6′	N15°46.1	13.2′	57.6′
1	193°33.6	15.5	293°38.2	11.6′	15°59.3	13.2′	57.5′
2	208°33.7	14.8	308°08.8	11.5′	16°12.5	13.0′	57.5′
3	223°33.8	·· 14.1	322°39.4	11.5′	16°25.5	13.0′	57.4′
4	238°33.9	13.4	337°09.9	11.5′	16°38.5	12.8′	57.4′
5	253°33.9	12.7	351°40.4	11.5′	16°51.3	12.8′	57.4′
6	268°34.0	N16°11.9	6°10.8	11.4′	N17°04.1	12.6′	57.3′
7	283°34.1	11.2	20°41.2	11.4′	17°16.7	12.6′	57.3′
8	298°34.2	10.5	35°11.6	11.4′	17°29.3	12.4′	57.3′
9	313°34.3	·· 09.8	49°42.0	11.3′	17°41.7	12.4′	57.2′
10	328°34.3	09.1	64°12.3	11.3′	17°54.1	12.2′	57.2′
11	343°34.4	08.4	78°42.6	11.2′	18°06.3	12.2′	57.2′
12	358°34.5	N16°07.7	93°12.8	11.2′	N18°18.5	12.0′	57.1′
13	13°34.6	07.0	107°43.0	11.2′	18°30.5	12.0′	57.1′
14	28°34.7	06.3	122°13.2	11.1′	18°42.5	11.8′	57.1′
15	43°34.7	·· 05.6	136°43.4	11.1′	18°54.3	11.7′	57.0′
16	58°34.8	04.9	151°13.5	11.1′	19°06.0	11.6′	57.0′
17	73°34.9	04.1	165°43.5	11.0′	19°17.6	11.5′	57.0′
18	88°35.0	N16°03.4	180°13.6	11.0′	N19°29.1	11.4′	56.9′
19	103°35.1	02.7	194°43.5	11.0′	19°40.5	11.3′	56.9′
20	118°35.2	02.0	209°13.5	10.9′	19°51.8	11.2′	56.8′
21	133°35.2	·· 01.3	223°43.4	10.9′	20°03.0	11.0′	56.8′
22	148°35.3	16°00.6	238°13.3	10.8′	20°14.0	11.0′	56.8′
23	163°35.4	15°59.9	252°43.1	10.8′	20°25.0	10.8′	56.7′
	SD = 15.8′	d = -0.7′	SD = 15.7′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°35.5	N15°59.1	267°12.9	10.8′	N20°35.8	10.7′	56.7′
1	193°35.6	58.4	281°42.7	10.7′	20°46.5	10.6′	56.7′
2	208°35.7	57.7	296°12.4	10.7′	20°57.1	10.5′	56.6′
3	223°35.8	·· 57.0	310°42.1	10.6′	21°07.6	10.4′	56.6′
4	238°35.8	56.3	325°11.7	10.6′	21°18.0	10.2′	56.6′
5	253°35.9	55.6	339°41.3	10.6′	21°28.2	10.2′	56.6′
6	268°36.0	N15°54.8	354°10.9	10.5′	N21°38.4	10.0′	56.5′
7	283°36.1	54.1	8°40.4	10.5′	21°48.4	9.9′	56.5′
8	298°36.2	53.4	23°09.9	10.4′	21°58.3	9.7′	56.5′
9	313°36.3	·· 52.7	37°39.3	10.4′	22°08.0	9.7′	56.4′
10	328°36.4	52.0	52°08.7	10.4′	22°17.7	9.5′	56.4′
11	343°36.5	51.2	66°38.1	10.3′	22°27.2	9.4′	56.4′
12	358°36.5	N15°50.5	81°07.4	10.3′	N22°36.6	9.3′	56.3′
13	13°36.6	49.8	95°36.7	10.2′	22°45.9	9.1′	56.3′
14	28°36.7	49.1	110°05.9	10.2′	22°55.0	9.1′	56.3′
15	43°36.8	·· 48.4	124°35.1	10.2′	23°04.1	8.9′	56.2′
16	58°36.9	47.6	139°04.3	10.1′	23°13.0	8.8′	56.2′
17	73°37.0	46.9	153°33.4	10.1′	23°21.8	8.6′	56.2′
18	88°37.1	N15°46.2	168°02.5	10.0′	N23°30.4	8.5′	56.1′
19	103°37.2	45.5	182°31.5	10.0′	23°38.9	8.4′	56.1′
20	118°37.3	44.7	197°00.6	10.0′	23°47.3	8.3′	56.1′
21	133°37.3	·· 44.0	211°29.5	9.9′	23°55.6	8.1′	56.1′
22	148°37.4	43.3	225°58.5	9.9′	24°03.7	8.0′	56.0′
23	163°37.5	42.6	240°27.4	9.9′	24°11.7	7.9′	56.0′
	SD = 15.8′	d = -0.7′	SD = 15.5′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°37.6	N15°41.8	254°56.2	9.8′	N24°19.6	7.8′	56.0′
1	193°37.7	41.1	269°25.0	9.8′	24°27.4	7.6′	55.9′
2	208°37.8	40.4	283°53.8	9.8′	24°35.0	7.5′	55.9′
3	223°37.9	·· 39.7	298°22.6	9.7′	24°42.5	7.3′	55.9′
4	238°38.0	38.9	312°51.3	9.7′	24°49.8	7.2′	55.9′
5	253°38.1	38.2	327°20.0	9.7′	24°57.0	7.1′	55.8′
6	268°38.2	N15°37.5	341°48.6	9.6′	N25°04.1	7.0′	55.8′
7	283°38.3	36.8	356°17.3	9.6′	25°11.1	6.8′	55.8′
8	298°38.3	36.0	10°45.8	9.6′	25°17.9	6.6′	55.7′
9	313°38.4	·· 35.3	25°14.4	9.5′	25°24.5	6.6′	55.7′
10	328°38.5	34.6	39°42.9	9.5′	25°31.1	6.4′	55.7′
11	343°38.6	33.8	54°11.4	9.5′	25°37.5	6.3′	55.7′
12	358°38.7	N15°33.1	68°39.9	9.4′	N25°43.8	6.1′	55.6′
13	13°38.8	32.4	83°08.3	9.4′	25°49.9	6.0′	55.6′
14	28°38.9	31.6	97°36.7	9.4′	25°55.9	5.8′	55.6′
15	43°39.0	·· 30.9	112°05.1	9.4′	26°01.7	5.7′	55.6′
16	58°39.1	30.2	126°33.4	9.3′	26°07.4	5.6′	55.5′
17	73°39.2	29.4	141°01.8	9.3′	26°13.0	5.5′	55.5′
18	88°39.3	N15°28.7	155°30.1	9.3′	N26°18.5	5.3′	55.5′
19	103°39.4	28.0	169°58.3	9.3′	26°23.8	5.1′	55.5′
20	118°39.5	27.2	184°26.6	9.2′	26°28.9	5.0′	55.4′
21	133°39.6	·· 26.5	198°54.8	9.2′	26°33.9	4.9′	55.4′
22	148°39.7	25.8	213°23.0	9.2′	26°38.8	4.7′	55.4′
23	163°39.8	25.0	227°51.2	9.2′	26°43.5	4.6′	55.4′
	SD = 15.8′	d = -0.7′	SD = 15.3′				

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

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

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 22-24 55-34%
08	05:46	05:42	12:06	05:34	17:59	
09	05:38	05:34	12:06	06:24	18:50	
10	05:30	05:25	12:05	07:15	19:42	

August 11, 12, 13 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	319°12.2	177°14.6	N07°10.8	148°32.2	N04°55.5	276°40.9	N15°01.5	341°40.2	S11°17.6
1	334°14.7	192°18.6	10.9	163°33.2	54.9	291°43.1	01.6	356°42.8	17.6
2	349°17.1	207°22.6	11.1	178°34.2	54.2	306°45.4	01.6	11°45.4	17.7
3	4°19.6	222°26.6	·· 11.2	193°35.2	·· 53.6	321°47.7	·· 01.7	26°48.0	·· 17.8
4	19°22.1	237°30.6	11.4	208°36.3	53.0	336°50.0	01.7	41°50.7	17.9
5	34°24.5	252°34.7	11.5	223°37.3	52.3	351°52.2	01.8	56°53.3	17.9
6	49°27.0	267°38.7	N07°11.7	238°38.3	N04°51.7	6°54.5	N15°01.8	71°55.9	S11°18.0
7	64°29.4	282°42.7	11.8	253°39.3	51.1	21°56.8	01.9	86°58.6	18.1
8	79°31.9	297°46.7	12.0	268°40.4	50.4	36°59.0	01.9	102°01.2	18.1
9	94°34.4	312°50.7	·· 12.1	283°41.4	·· 49.8	52°01.3	·· 02.0	117°03.8	·· 18.2
10	109°36.8	327°54.8	12.3	298°42.4	49.1	67°03.6	02.0	132°06.5	18.3
11	124°39.3	342°58.8	12.5	313°43.4	48.5	82°05.9	02.1	147°09.1	18.3
12	139°41.8	358°02.8	N07°12.6	328°44.4	N04°47.9	97°08.1	N15°02.1	162°11.7	S11°18.4
13	154°44.2	13°06.8	12.8	343°45.5	47.2	112°10.4	02.2	177°14.3	18.5
14	169°46.7	28°10.9	13.0	358°46.5	46.6	127°12.7	02.2	192°17.0	18.6
15	184°49.2	43°14.9	·· 13.1	13°47.5	·· 45.9	142°14.9	·· 02.3	207°19.6	·· 18.6
16	199°51.6	58°18.9	13.3	28°48.5	45.3	157°17.2	02.3	222°22.2	18.7
17	214°54.1	73°22.9	13.5	43°49.5	44.7	172°19.5	02.4	237°24.9	18.8
18	229°56.6	88°27.0	N07°13.6	58°50.6	N04°44.0	187°21.8	N15°02.4	252°27.5	S11°18.8
19	244°59.0	103°31.0	13.8	73°51.6	43.4	202°24.0	02.5	267°30.1	18.9
20	260°01.5	118°35.0	14.0	88°52.6	42.7	217°26.3	02.5	282°32.8	19.0
21	275°03.9	133°39.0	·· 14.1	103°53.6	·· 42.1	232°28.6	·· 02.5	297°35.4	·· 19.0
22	290°06.4	148°43.1	14.3	118°54.6	41.5	247°30.9	02.6	312°38.0	19.1
23	305°08.9	163°47.1	14.5	133°55.7	40.8	262°33.1	02.6	327°40.6	19.2
Mer.pass. 02:43		ν 4.0′ d 0.1′ m -4.14		ν 1.0′ d -0.6′ m 1.78		ν 2.3′ d 0.0′ m -2.43		ν 2.6′ d -0.1′ m 0.53	

Sat	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	320°11.3	178°51.1	N07°14.7	148°56.7	N04°40.2	277°35.4	N15°02.7	342°43.3	S11°19.3
1	335°13.8	193°55.1	14.8	163°57.7	39.5	292°37.7	02.7	357°45.9	19.3
2	350°16.3	208°59.2	15.0	178°58.7	38.9	307°40.0	02.8	12°48.5	19.4
3	5°18.7	224°03.2	·· 15.2	193°59.8	·· 38.3	322°42.2	·· 02.8	27°51.2	·· 19.5
4	20°21.2	239°07.2	15.4	209°00.8	37.6	337°44.5	02.9	42°53.8	19.5
5	35°23.7	254°11.3	15.6	224°01.8	37.0	352°46.8	02.9	57°56.4	19.6
6	50°26.1	269°15.3	N07°15.8	239°02.8	N04°36.3	7°49.1	N15°03.0	72°59.1	S11°19.7
7	65°28.6	284°19.3	15.9	254°03.8	35.7	22°51.4	03.0	88°01.7	19.7
8	80°31.1	299°23.3	16.1	269°04.9	35.1	37°53.6	03.1	103°04.3	19.8
9	95°33.5	314°27.4	·· 16.3	284°05.9	·· 34.4	52°55.9	·· 03.1	118°07.0	·· 19.9
10	110°36.0	329°31.4	16.5	299°06.9	33.8	67°58.2	03.2	133°09.6	20.0
11	125°38.4	344°35.4	16.7	314°07.9	33.1	83°00.5	03.2	148°12.2	20.0
12	140°40.9	359°39.5	N07°16.9	329°08.9	N04°32.5	98°02.7	N15°03.3	163°14.9	S11°20.1
13	155°43.4	14°43.5	17.1	344°10.0	31.9	113°05.0	03.3	178°17.5	20.2
14	170°45.8	29°47.5	17.3	359°11.0	31.2	128°07.3	03.3	193°20.1	20.2
15	185°48.3	44°51.5	·· 17.5	14°12.0	·· 30.6	143°09.6	·· 03.4	208°22.7	·· 20.3
16	200°50.8	59°55.6	17.7	29°13.0	29.9	158°11.9	03.4	223°25.4	20.4
17	215°53.2	74°59.6	17.9	44°14.0	29.3	173°14.2	03.5	238°28.0	20.4
18	230°55.7	90°03.6	N07°18.1	59°15.1	N04°28.7	188°16.4	N15°03.5	253°30.6	S11°20.5
19	245°58.2	105°07.7	18.3	74°16.1	28.0	203°18.7	03.6	268°33.3	20.6
20	261°00.6	120°11.7	18.5	89°17.1	27.4	218°21.0	03.6	283°35.9	20.7
21	276°03.1	135°15.7	·· 18.7	104°18.1	·· 26.7	233°23.3	·· 03.7	298°38.5	·· 20.7
22	291°05.5	150°19.7	18.9	119°19.1	26.1	248°25.6	03.7	313°41.2	20.8
23	306°08.0	165°23.8	19.1	134°20.2	25.5	263°27.8	03.8	328°43.8	20.9
Mer.pass. 02:39		ν 4.0′ d 0.2′ m -4.14		ν 1.0′ d -0.6′ m 1.78		ν 2.3′ d 0.0′ m -2.44		ν 2.6′ d -0.1′ m 0.52	

Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	321°10.5	180°27.8	N07°19.3	149°21.2	N04°24.8	278°30.1	N15°03.8	343°46.4	S11°20.9
1	336°12.9	195°31.8	19.5	164°22.2	24.2	293°32.4	03.8	358°49.1	21.0
2	351°15.4	210°35.9	19.7	179°23.2	23.5	308°34.7	03.9	13°51.7	21.1
3	6°17.9	225°39.9	·· 19.9	194°24.2	·· 22.9	323°37.0	·· 03.9	28°54.3	·· 21.2
4	21°20.3	240°43.9	20.2	209°25.3	22.2	338°39.3	04.0	43°57.0	21.2
5	36°22.8	255°47.9	20.4	224°26.3	21.6	353°41.5	04.0	58°59.6	21.3
6	51°25.3	270°52.0	N07°20.6	239°27.3	N04°21.0	8°43.8	N15°04.1	74°02.2	S11°21.4
7	66°27.7	285°56.0	20.8	254°28.3	20.3	23°46.1	04.1	89°04.9	21.4
8	81°30.2	301°00.0	21.0	269°29.3	19.7	38°48.4	04.2	104°07.5	21.5
9	96°32.7	316°04.0	·· 21.2	284°30.4	·· 19.0	53°50.7	·· 04.2	119°10.1	·· 21.6
10	111°35.1	331°08.1	21.5	299°31.4	18.4	68°53.0	04.2	134°12.8	21.6
11	126°37.6	346°12.1	21.7	314°32.4	17.8	83°55.3	04.3	149°15.4	21.7
12	141°40.0	1°16.1	N07°21.9	329°33.4	N04°17.1	98°57.5	N15°04.3	164°18.0	S11°21.8
13	156°42.5	16°20.1	22.1	344°34.4	16.5	113°59.8	04.4	179°20.7	21.9
14	171°45.0	31°24.2	22.4	359°35.5	15.8	129°02.1	04.4	194°23.3	21.9
15	186°47.4	46°28.2	·· 22.6	14°36.5	·· 15.2	144°04.4	·· 04.5	209°25.9	·· 22.0
16	201°49.9	61°32.2	22.8	29°37.5	14.5	159°06.7	04.5	224°28.6	22.1
17	216°52.4	76°36.2	23.0	44°38.5	13.9	174°09.0	04.6	239°31.2	22.1
18	231°54.8	91°40.2	N07°23.3	59°39.5	N04°13.3	189°11.3	N15°04.6	254°33.8	S11°22.2
19	246°57.3	106°44.3	23.5	74°40.6	12.6	204°13.6	04.6	269°36.5	22.3
20	261°59.8	121°48.3	23.7	89°41.6	12.0	219°15.9	04.7	284°39.1	22.4
21	277°02.2	136°52.3	·· 24.0	104°42.6	·· 11.3	234°18.1	·· 04.7	299°41.7	·· 22.4
22	292°04.7	151°56.3	24.2	119°43.6	10.7	249°20.4	04.8	314°44.4	22.5
23	307°07.2	167°00.3	24.4	134°44.6	10.0	264°22.7	04.8	329°47.0	22.6
Mer.pass. 02:35		ν 4.0′ d 0.2′ m -4.14		ν 1.0′ d -0.6′ m 1.78		ν 2.3′ d 0.0′ m -2.45		ν 2.6′ d -0.1′ m 0.52	

Stars

	SHA	**Dec**
Alpheratz	357°35.7	29°13.2
Ankaa	353°08.0	-42°10.5
Schedar	349°32.0	56°39.8
Diphda	348°48.3	-17°51.3
Achernar	335°20.8	-57°06.7
Hamal	327°52.4	23°34.4
Polaris	314°35.2	89°21.5
Acamar	315°12.6	-40°12.3
Menkar	314°07.4	4°11.0
Mirfak	308°30.0	49°56.5
Aldebaran	290°41.1	16°33.4
Rigel	281°05.2	-8°10.3
Capella	280°23.9	46°01.2
Bellatrix	278°24.3	6°22.3
Elnath	278°03.5	28°37.6
Alnilam	275°39.1	-1°11.1
Betelgeuse	270°53.6	7°24.8
Canopus	263°53.3	-52°42.2
Sirius	258°27.5	-16°44.7
Adhara	255°07.1	-29°00.0
Procyon	244°52.4	5°10.0
Pollux	243°19.1	27°58.2
Avior	234°15.9	-59°34.9
Suhail	222°47.6	-43°31.5
Miaplacidus	221°39.5	-69°48.7
Alphard	217°49.2	-8°45.5
Regulus	207°36.0	11°51.3
Dubhe	193°43.0	61°37.7
Denebola	182°26.4	14°26.6
Gienah	175°45.0	-17°40.3
Acrux	173°01.9	-63°13.9
Gacrux	171°53.3	-57°14.8
Alioth	166°14.3	55°50.2
Spica	158°23.7	-11°17.0
Alkaid	152°53.1	49°12.0
Hadar	148°37.9	-60°29.4
Menkent	147°59.1	-36°29.2
Arcturus	145°49.1	19°03.8
Rigil Kent.	139°42.0	-60°56.2
Kochab	137°19.8	74°03.8
Zuben'ubi	136°57.3	-16°08.4
Alphecca	126°04.7	26°38.3
Antares	112°17.1	-26°29.1
Atria	107°12.1	-69°04.4
Sabik	102°03.9	-15°45.2
Shaula	96°11.7	-37°07.3
Rasalhague	95°59.4	12°32.7
Eltanin	90°42.4	51°29.3
Kaus Aust.	83°33.8	-34°22.4
Vega	80°33.7	38°48.5
Nunki	75°48.9	-26°16.0
Altair	62°00.8	8°55.9
Peacock	53°07.0	-56°39.6
Deneb	49°26.1	45°21.9
Enif	33°39.6	9°59.0
Al Na'ir	27°33.9	-46°50.7
Fomalhaut	15°15.5	-29°29.7
Scheat	13°46.0	28°12.6
Markab	13°30.8	15°19.9

Aug 11 Fri	**SHA**	**Mer.pass**
Venus	218°02.4	12:08
Mars	189°20.0	14:05
Jupiter	317°28.7	05:32
Saturn	22°28.0	01:13

Aug 12 Sat	**SHA**	**Mer.pass**
Venus	218°39.8	12:01
Mars	188°45.4	14:03
Jupiter	317°24.1	05:29
Saturn	22°31.9	01:09

Aug 13 Sun	**SHA**	**Mer.pass**
Venus	219°17.3	11:55
Mars	188°10.7	14:02
Jupiter	317°19.6	05:25
Saturn	22°36.0	01:05

Horizontal parallax	
Venus:	0.5
Mars:	0.1

h	Sun		Moon				
Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°39.9	N15°24.3	242°19.4	9.1′	N26°48.1	4.5′	55.3′
1	193°40.0	23.6	256°47.5	9.1′	26°52.6	4.3′	55.3′
2	208°40.1	22.8	271°15.7	9.1′	26°56.9	4.2′	55.3′
3	223°40.2	·· 22.1	285°43.8	9.1′	27°01.1	4.0′	55.3′
4	238°40.3	21.3	300°11.9	9.1′	27°05.1	3.9′	55.2′
5	253°40.4	20.6	314°40.0	9.1′	27°09.0	3.7′	55.2′
6	268°40.4	N15°19.9	329°08.0	9.1′	N27°12.7	3.6′	55.2′
7	283°40.5	19.1	343°36.1	9.0′	27°16.3	3.5′	55.2′
8	298°40.6	18.4	358°04.1	9.0′	27°19.8	3.3′	55.2′
9	313°40.7	·· 17.7	12°32.2	9.0′	27°23.1	3.2′	55.1′
10	328°40.8	16.9	27°00.2	9.0′	27°26.3	3.0′	55.1′
11	343°40.9	16.2	41°28.2	9.0′	27°29.3	2.9′	55.1′
12	358°41.0	N15°15.4	55°56.2	9.0′	N27°32.2	2.7′	55.1′
13	13°41.1	14.7	70°24.2	9.0′	27°34.9	2.6′	55.0′
14	28°41.2	13.9	84°52.3	9.0′	27°37.5	2.4′	55.0′
15	43°41.3	·· 13.2	99°20.3	9.0′	27°39.9	2.4′	55.0′
16	58°41.4	12.5	113°48.3	9.0′	27°42.3	2.1′	55.0′
17	73°41.5	11.7	128°16.3	9.0′	27°44.4	2.0′	55.0′
18	88°41.6	N15°11.0	142°44.3	9.0′	N27°46.4	1.9′	54.9′
19	103°41.7	10.2	157°12.3	9.0′	27°48.3	1.7′	54.9′
20	118°41.8	09.5	171°40.3	9.0′	27°50.0	1.6′	54.9′
21	133°41.9	·· 08.7	186°08.3	9.0′	27°51.6	1.5′	54.9′
22	148°42.0	08.0	200°36.3	9.0′	27°53.1	1.3′	54.9′
23	163°42.2	07.2	215°04.3	9.0′	27°54.4	1.1′	54.8′
	SD = 15.8′	d = -0.7′	SD = 15.1′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°42.3	N15°06.5	229°32.3	9.0′	N27°55.5	1.0′	54.8′
1	193°42.4	05.8	244°00.4	9.1′	27°56.5	0.9′	54.8′
2	208°42.5	05.0	258°28.4	9.1′	27°57.4	0.7′	54.8′
3	223°42.6	·· 04.3	272°56.5	9.1′	27°58.1	0.6′	54.8′
4	238°42.7	03.5	287°24.6	9.1′	27°58.7	0.4′	54.8′
5	253°42.8	02.8	301°52.7	9.1′	27°59.1	0.3′	54.7′
6	268°42.9	N15°02.0	316°20.8	9.1′	N27°59.4	0.2′	54.7′
7	283°43.0	01.3	330°48.9	9.1′	27°59.6	0.0′	54.7′
8	298°43.1	15°00.5	345°17.0	9.2′	27°59.6	0.1′	54.7′
9	313°43.2	14°59.8	359°45.2	9.2′	27°59.5	0.3′	54.7′
10	328°43.3	59.0	14°13.4	9.2′	27°59.2	0.4′	54.6′
11	343°43.4	58.3	28°41.6	9.2′	27°58.8	0.6′	54.6′
12	358°43.5	N14°57.5	43°09.8	9.2′	N27°58.2	0.7′	54.6′
13	13°43.6	56.8	57°38.0	9.3′	27°57.5	0.8′	54.6′
14	28°43.7	56.0	72°06.3	9.3′	27°56.7	1.0′	54.6′
15	43°43.8	·· 55.3	86°34.6	9.3′	27°55.7	1.1′	54.6′
16	58°43.9	54.5	101°03.0	9.4′	27°54.6	1.3′	54.5′
17	73°44.0	53.7	115°31.3	9.4′	27°53.3	1.4′	54.5′
18	88°44.1	N14°53.0	129°59.7	9.4′	N27°51.9	1.5′	54.5′
19	103°44.2	52.2	144°28.1	9.5′	27°50.4	1.7′	54.5′
20	118°44.3	51.5	158°56.6	9.5′	27°48.7	1.8′	54.5′
21	133°44.5	·· 50.7	173°25.1	9.5′	27°46.9	1.9′	54.5′
22	148°44.6	50.0	187°53.6	9.6′	27°45.0	2.1′	54.5′
23	163°44.7	49.2	202°22.1	9.6′	27°42.9	2.3′	54.4′
	SD = 15.8′	d = -0.7′	SD = 15.0′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°44.8	N14°48.5	216°50.7	9.6′	N27°40.6	2.3′	54.4′
1	193°44.9	47.7	231°19.4	9.7′	27°38.3	2.5′	54.4′
2	208°45.0	46.9	245°48.1	9.7′	27°35.8	2.7′	54.4′
3	223°45.1	·· 46.2	260°16.8	9.8′	27°33.1	2.7′	54.4′
4	238°45.2	45.4	274°45.5	9.8′	27°30.4	2.9′	54.4′
5	253°45.3	44.7	289°14.3	9.8′	27°27.5	3.1′	54.4′
6	268°45.4	N14°43.9	303°43.2	9.9′	N27°24.4	3.1′	54.3′
7	283°45.5	43.2	318°12.1	9.9′	27°21.3	3.3′	54.3′
8	298°45.7	42.4	332°41.0	10.0′	27°18.0	3.5′	54.3′
9	313°45.8	·· 41.6	347°10.0	10.0′	27°14.5	3.5′	54.3′
10	328°45.9	40.9	1°39.0	10.1′	27°11.0	3.7′	54.3′
11	343°46.0	40.1	16°08.1	10.1′	27°07.3	3.9′	54.3′
12	358°46.1	N14°39.4	30°37.2	10.2′	N27°03.4	3.9′	54.3′
13	13°46.2	38.6	45°06.4	10.2′	26°59.5	4.1′	54.3′
14	28°46.3	37.8	59°35.6	10.3′	26°55.4	4.2′	54.3′
15	43°46.4	·· 37.1	74°04.9	10.3′	26°51.2	4.4′	54.2′
16	58°46.5	36.3	88°34.2	10.4′	26°46.8	4.4′	54.2′
17	73°46.7	35.5	103°03.6	10.4′	26°42.4	4.6′	54.2′
18	88°46.8	N14°34.8	117°33.1	10.5′	N26°37.8	4.8′	54.2′
19	103°46.9	34.0	132°02.6	10.6′	26°33.0	4.8′	54.2′
20	118°47.0	33.2	146°32.1	10.6′	26°28.2	5.0′	54.2′
21	133°47.1	·· 32.5	161°01.8	10.7′	26°23.2	5.1′	54.2′
22	148°47.2	31.7	175°31.4	10.7′	26°18.1	5.2′	54.2′
23	163°47.3	30.9	190°01.2	10.8′	26°12.9	5.3′	54.2′
	SD = 15.8′	d = -0.8′	SD = 14.8′				

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

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

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 25-10%
11	05:21	05:16	12:05	08:08	20:35	
12	05:11	05:06	12:05	09:01	21:27	
13	05:01	04:56	12:05	09:53	22:19	

August 14, 15, 16 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	322°09.6	182°04.4	N07°24.7	149°45.7	N04°09.4	279°25.0	N15°04.9	344°49.6	S11°22.6
1	337°12.1	197°08.4	24.9	164°46.7	08.8	294°27.3	04.9	359°52.3	22.7
2	352°14.5	212°12.4	25.1	179°47.7	08.1	309°29.6	04.9	14°54.9	22.8
3	7°17.0	227°16.4	·· 25.4	194°48.7	·· 07.5	324°31.9	·· 05.0	29°57.5	·· 22.9
4	22°19.5	242°20.4	25.6	209°49.7	06.8	339°34.2	05.0	45°00.2	22.9
5	37°21.9	257°24.4	25.9	224°50.8	06.2	354°36.5	05.1	60°02.8	23.0
6	52°24.4	272°28.4	N07°26.1	239°51.8	N04°05.5	9°38.8	N15°05.1	75°05.4	S11°23.1
7	67°26.9	287°32.5	26.4	254°52.8	04.9	24°41.1	05.2	90°08.1	23.1
8	82°29.3	302°36.5	26.6	269°53.8	04.3	39°43.3	05.2	105°10.7	23.2
9	97°31.8	317°40.5	·· 26.8	284°54.8	·· 03.6	54°45.6	·· 05.2	120°13.3	·· 23.3
10	112°34.3	332°44.5	27.1	299°55.8	03.0	69°47.9	05.3	135°16.0	23.3
11	127°36.7	347°48.5	27.3	314°56.9	02.3	84°50.2	05.3	150°18.6	23.4
12	142°39.2	2°52.5	N07°27.6	329°57.9	N04°01.7	99°52.5	N15°05.4	165°21.2	S11°23.5
13	157°41.7	17°56.5	27.8	344°58.9	01.0	114°54.8	05.4	180°23.9	23.6
14	172°44.1	33°00.5	28.1	359°59.9	04°00.4	129°57.1	05.4	195°26.5	23.6
15	187°46.6	48°04.5	·· 28.3	15°00.9	03°59.7	144°59.4	·· 05.5	210°29.1	·· 23.7
16	202°49.0	63°08.5	28.6	30°02.0	59.1	160°01.7	05.5	225°31.8	23.8
17	217°51.5	78°12.6	28.9	45°03.0	58.5	175°04.0	05.6	240°34.4	23.8
18	232°54.0	93°16.6	N07°29.1	60°04.0	N03°57.8	190°06.3	N15°05.6	255°37.0	S11°23.9
19	247°56.4	108°20.6	29.4	75°05.0	57.2	205°08.6	05.7	270°39.7	24.0
20	262°58.9	123°24.6	29.6	90°06.0	56.5	220°10.9	05.7	285°42.3	24.1
21	278°01.4	138°28.6	·· 29.9	105°07.1	·· 55.9	235°13.2	·· 05.7	300°44.9	·· 24.1
22	293°03.8	153°32.6	30.2	120°08.1	55.2	250°15.5	05.8	315°47.6	24.2
23	308°06.3	168°36.6	30.4	135°09.1	54.6	265°17.8	05.8	330°50.2	24.3
Mer.pass. 02:31		ν 4.0′ d 0.2′ m -4.14		ν 1.0′ d -0.6′ m 1.78		ν 2.3′ d 0.0′ m -2.46		ν 2.6′ d -0.1′ m 0.51	

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	323°08.8	183°40.6	N07°30.7	150°10.1	N03°53.9	280°20.1	N15°05.9	345°52.8	S11°24.3
1	338°11.2	198°44.6	30.9	165°11.1	53.3	295°22.4	05.9	0°55.5	24.4
2	353°13.7	213°48.6	31.2	180°12.1	52.7	310°24.7	05.9	15°58.1	24.5
3	8°16.1	228°52.6	·· 31.5	195°13.2	·· 52.0	325°27.0	·· 06.0	31°00.8	·· 24.6
4	23°18.6	243°56.6	31.7	210°14.2	51.4	340°29.3	06.0	46°03.4	24.6
5	38°21.1	259°00.6	32.0	225°15.2	50.7	355°31.6	06.1	61°06.0	24.7
6	53°23.5	274°04.5	N07°32.3	240°16.2	N03°50.1	10°33.9	N15°06.1	76°08.7	S11°24.8
7	68°26.0	289°08.5	32.5	255°17.2	49.4	25°36.2	06.1	91°11.3	24.8
8	83°28.5	304°12.5	32.8	270°18.3	48.8	40°38.5	06.2	106°13.9	24.9
9	98°30.9	319°16.5	·· 33.1	285°19.3	·· 48.1	55°40.8	·· 06.2	121°16.6	·· 25.0
10	113°33.4	334°20.5	33.4	300°20.3	47.5	70°43.1	06.3	136°19.2	25.1
11	128°35.9	349°24.5	33.6	315°21.3	46.9	85°45.4	06.3	151°21.8	25.1
12	143°38.3	4°28.5	N07°33.9	330°22.3	N03°46.2	100°47.7	N15°06.3	166°24.5	S11°25.2
13	158°40.8	19°32.5	34.2	345°23.3	45.6	115°50.0	06.4	181°27.1	25.3
14	173°43.3	34°36.4	34.5	0°24.4	44.9	130°52.3	06.4	196°29.7	25.3
15	188°45.7	49°40.4	·· 34.7	15°25.4	·· 44.3	145°54.6	·· 06.5	211°32.4	·· 25.4
16	203°48.2	64°44.4	35.0	30°26.4	43.6	160°56.9	06.5	226°35.0	25.5
17	218°50.6	79°48.4	35.3	45°27.4	43.0	175°59.2	06.5	241°37.7	25.6
18	233°53.1	94°52.4	N07°35.6	60°28.4	N03°42.3	191°01.5	N15°06.6	256°40.3	S11°25.6
19	248°55.6	109°56.3	35.9	75°29.5	41.7	206°03.8	06.6	271°42.9	25.7
20	263°58.0	125°00.3	36.1	90°30.5	41.0	221°06.1	06.6	286°45.6	25.8
21	279°00.5	140°04.3	·· 36.4	105°31.5	·· 40.4	236°08.4	·· 06.7	301°48.2	·· 25.8
22	294°03.0	155°08.3	36.7	120°32.5	39.8	251°10.7	06.7	316°50.8	25.9
23	309°05.4	170°12.2	37.0	135°33.5	39.1	266°13.0	06.8	331°53.5	26.0
Mer.pass. 02:27		ν 4.0′ d 0.3′ m -4.15		ν 1.0′ d -0.6′ m 1.78		ν 2.3′ d 0.0′ m -2.46		ν 2.6′ d -0.1′ m 0.51	

Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	324°07.9	185°16.2	N07°37.3	150°34.5	N03°38.5	281°15.3	N15°06.8	346°56.1	S11°26.1
1	339°10.4	200°20.2	37.6	165°35.6	37.8	296°17.6	06.8	1°58.7	26.1
2	354°12.8	215°24.2	37.9	180°36.6	37.2	311°19.9	06.9	17°01.4	26.2
3	9°15.3	230°28.1	·· 38.2	195°37.6	·· 36.5	326°22.2	·· 06.9	32°04.0	·· 26.3
4	24°17.8	245°32.1	38.4	210°38.6	35.9	341°24.5	07.0	47°06.6	26.3
5	39°20.2	260°36.1	38.7	225°39.6	35.2	356°26.9	07.0	62°09.3	26.4
6	54°22.7	275°40.0	N07°39.0	240°40.7	N03°34.6	11°29.2	N15°07.0	77°11.9	S11°26.5
7	69°25.1	290°44.0	39.3	255°41.7	33.9	26°31.5	07.1	92°14.6	26.6
8	84°27.6	305°47.9	39.6	270°42.7	33.3	41°33.8	07.1	107°17.2	26.6
9	99°30.1	320°51.9	·· 39.9	285°43.7	·· 32.6	56°36.1	·· 07.1	122°19.8	·· 26.7
10	114°32.5	335°55.9	40.2	300°44.7	32.0	71°38.4	07.2	137°22.5	26.8
11	129°35.0	350°59.8	40.5	315°45.7	31.4	86°40.7	07.2	152°25.1	26.8
12	144°37.5	6°03.8	N07°40.8	330°46.8	N03°30.7	101°43.0	N15°07.3	167°27.7	S11°26.9
13	159°39.9	21°07.7	41.1	345°47.8	30.1	116°45.3	07.3	182°30.4	27.0
14	174°42.4	36°11.7	41.4	0°48.8	29.4	131°47.6	07.3	197°33.0	27.1
15	189°44.9	51°15.6	·· 41.7	15°49.8	·· 28.8	146°49.9	·· 07.4	212°35.6	·· 27.1
16	204°47.3	66°19.6	42.0	30°50.8	28.1	161°52.3	07.4	227°38.3	27.2
17	219°49.8	81°23.5	42.3	45°51.8	27.5	176°54.6	07.4	242°40.9	27.3
18	234°52.2	96°27.5	N07°42.6	60°52.9	N03°26.8	191°56.9	N15°07.5	257°43.6	S11°27.3
19	249°54.7	111°31.4	42.9	75°53.9	26.2	206°59.2	07.5	272°46.2	27.4
20	264°57.2	126°35.3	43.2	90°54.9	25.5	222°01.5	07.5	287°48.8	27.5
21	279°59.6	141°39.3	·· 43.5	105°55.9	·· 24.9	237°03.8	·· 07.6	302°51.5	·· 27.6
22	295°02.1	156°43.2	43.8	120°56.9	24.2	252°06.1	07.6	317°54.1	27.6
23	310°04.6	171°47.1	44.1	135°57.9	23.6	267°08.4	07.7	332°56.7	27.7
Mer.pass. 02:23		ν 4.0′ d 0.3′ m -4.15		ν 1.0′ d -0.6′ m 1.78		ν 2.3′ d 0.0′ m -2.47		ν 2.6′ d -0.1′ m 0.50	

Stars

	SHA	**Dec**
Alpheratz	357°35.7	29°13.2
Ankaa	353°08.0	-42°10.5
Schedar	349°32.0	56°39.8
Diphda	348°48.2	-17°51.3
Achernar	335°20.8	-57°06.7
Hamal	327°52.4	23°34.4
Polaris	314°33.6	89°21.5
Acamar	315°12.6	-40°12.3
Menkar	314°07.3	4°11.0
Mirfak	308°29.9	49°56.5
Aldebaran	290°41.1	16°33.4
Rigel	281°05.1	-8°10.3
Capella	280°23.8	46°01.2
Bellatrix	278°24.3	6°22.4
Elnath	278°03.5	28°37.6
Alnilam	275°39.1	-1°11.1
Betelgeuse	270°53.5	7°24.8
Canopus	263°53.3	-52°42.2
Sirius	258°27.5	-16°44.7
Adhara	255°07.1	-29°00.0
Procyon	244°52.3	5°10.0
Pollux	243°19.1	27°58.2
Avior	234°15.8	-59°34.9
Suhail	222°47.6	-43°31.5
Miaplacidus	221°39.5	-69°48.7
Alphard	217°49.2	-8°45.5
Regulus	207°36.0	11°51.3
Dubhe	193°43.0	61°37.6
Denebola	182°26.4	14°26.6
Gienah	175°45.0	-17°40.3
Acrux	173°01.9	-63°13.9
Gacrux	171°53.4	-57°14.8
Alioth	166°14.3	55°50.2
Spica	158°23.7	-11°17.0
Alkaid	152°53.1	49°12.0
Hadar	148°37.9	-60°29.4
Menkent	147°59.1	-36°29.2
Arcturus	145°49.1	19°03.8
Rigil Kent.	139°42.0	-60°56.2
Kochab	137°19.9	74°03.8
Zuben'ubi	136°57.3	-16°08.4
Alphecca	126°04.7	26°38.3
Antares	112°17.1	-26°29.1
Atria	107°12.2	-69°04.4
Sabik	102°03.9	-15°45.2
Shaula	96°11.7	-37°07.3
Rasalhague	95°59.4	12°32.7
Eltanin	90°42.4	51°29.3
Kaus Aust.	83°33.8	-34°22.4
Vega	80°33.7	38°48.5
Nunki	75°48.9	-26°16.0
Altair	62°00.8	8°55.9
Peacock	53°07.0	-56°39.6
Deneb	49°26.1	45°21.9
Enif	33°39.6	9°59.0
Al Na'ir	27°33.9	-46°50.7
Fomalhaut	15°15.4	-29°29.7
Scheat	13°46.0	28°12.6
Markab	13°30.8	15°20.0

Aug 14 Mon	**SHA**	**Mer.pass**
Venus	219°54.7	11:49
Mars	187°36.0	14:00
Jupiter	317°15.4	05:22
Saturn	22°40.0	01:01

Aug 15 Tue	**SHA**	**Mer.pass**
Venus	220°31.8	11:42
Mars	187°01.4	13:58
Jupiter	317°11.3	05:18
Saturn	22°44.1	00:56

Aug 16 Wed	**SHA**	**Mer.pass**
Venus	221°08.3	11:36
Mars	186°26.6	13:57
Jupiter	317°07.4	05:14
Saturn	22°48.2	00:52

Horizontal parallax	
Venus:	0.5
Mars:	0.1

h	Sun		Moon				
Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°47.4	N14°30.2	204°30.9	10.8′	N26°07.6	5.5′	54.1′
1	193°47.6	29.4	219°00.8	10.9′	26°02.1	5.6′	54.1′
2	208°47.7	28.6	233°30.7	11.0′	25°56.5	5.7′	54.1′
3	223°47.8	·· 27.9	248°00.7	11.0′	25°50.8	5.8′	54.1′
4	238°47.9	27.1	262°30.7	11.1′	25°45.0	5.9′	54.1′
5	253°48.0	26.3	277°00.8	11.2′	25°39.1	6.1′	54.1′
6	268°48.1	N14°25.6	291°31.0	11.2′	N25°33.0	6.2′	54.1′
7	283°48.2	24.8	306°01.2	11.3′	25°26.8	6.3′	54.1′
8	298°48.4	24.0	320°31.5	11.3′	25°20.5	6.4′	54.1′
9	313°48.5	·· 23.3	335°01.8	11.4′	25°14.1	6.5′	54.1′
10	328°48.6	22.5	349°32.2	11.5′	25°07.6	6.6′	54.1′
11	343°48.7	21.7	4°02.7	11.5′	25°01.0	6.8′	54.0′
12	358°48.8	N14°21.0	18°33.3	11.6′	N24°54.2	6.8′	54.0′
13	13°48.9	20.2	33°03.9	11.7′	24°47.4	7.0′	54.0′
14	28°49.1	19.4	47°34.5	11.7′	24°40.4	7.1′	54.0′
15	43°49.2	·· 18.6	62°05.3	11.8′	24°33.3	7.2′	54.0′
16	58°49.3	17.9	76°36.1	11.9′	24°26.1	7.3′	54.0′
17	73°49.4	17.1	91°07.0	11.9′	24°18.8	7.4′	54.0′
18	88°49.5	N14°16.3	105°37.9	12.0′	N24°11.4	7.5′	54.0′
19	103°49.6	15.5	120°08.9	12.1′	24°03.9	7.6′	54.0′
20	118°49.8	14.8	134°40.0	12.1′	23°56.3	7.7′	54.0′
21	133°49.9	·· 14.0	149°11.2	12.2′	23°48.6	7.8′	54.0′
22	148°50.0	13.2	163°42.4	12.3′	23°40.8	8.0′	54.0′
23	163°50.1	12.4	178°13.7	12.4′	23°32.8	8.0′	54.0′
	SD = 15.8′	d = -0.8′	SD = 14.8′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°50.2	N14°11.7	192°45.0	12.4′	N23°24.8	8.1′	54.0′
1	193°50.4	10.9	207°16.4	12.5′	23°16.7	8.2′	54.0′
2	208°50.5	10.1	221°47.9	12.6′	23°08.5	8.4′	53.9′
3	223°50.6	·· 09.3	236°19.5	12.6′	23°00.1	8.4′	53.9′
4	238°50.7	08.6	250°51.1	12.7′	22°51.7	8.5′	53.9′
5	253°50.8	07.8	265°22.8	12.8′	22°43.2	8.7′	53.9′
6	268°51.0	N14°07.0	279°54.6	12.8′	N22°34.5	8.7′	53.9′
7	283°51.1	06.2	294°26.4	12.9′	22°25.8	8.8′	53.9′
8	298°51.2	05.5	308°58.3	13.0′	22°17.0	8.9′	53.9′
9	313°51.3	·· 04.7	323°30.3	13.0′	22°08.1	9.0′	53.9′
10	328°51.4	03.9	338°02.3	13.1′	21°59.1	9.1′	53.9′
11	343°51.6	03.1	352°34.4	13.2′	21°50.0	9.2′	53.9′
12	358°51.7	N14°02.3	7°06.6	13.2′	N21°40.8	9.3′	53.9′
13	13°51.8	01.6	21°38.9	13.3′	21°31.5	9.4′	53.9′
14	28°51.9	00.8	36°11.2	13.4′	21°22.1	9.4′	53.9′
15	43°52.1	14°00.0	50°43.5	13.4′	21°12.7	9.6′	53.9′
16	58°52.2	13°59.2	65°16.0	13.5′	21°03.1	9.6′	53.9′
17	73°52.3	58.4	79°48.5	13.6′	20°53.5	9.7′	53.9′
18	88°52.4	N13°57.6	94°21.1	13.6′	N20°43.8	9.8′	53.9′
19	103°52.6	56.9	108°53.7	13.7′	20°34.0	9.9′	53.9′
20	118°52.7	56.1	123°26.5	13.8′	20°24.1	10.0′	53.9′
21	133°52.8	·· 55.3	137°59.2	13.8′	20°14.1	10.0′	53.9′
22	148°52.9	54.5	152°32.1	13.9′	20°04.1	10.2′	53.9′
23	163°53.0	53.7	167°05.0	14.0′	19°53.9	10.2′	53.9′
	SD = 15.8′	d = -0.8′	SD = 14.7′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°53.2	N13°52.9	181°38.0	14.0′	N19°43.7	10.3′	53.9′
1	193°53.3	52.2	196°11.0	14.1′	19°33.4	10.4′	53.9′
2	208°53.4	51.4	210°44.1	14.2′	19°23.0	10.4′	53.9′
3	223°53.5	·· 50.6	225°17.3	14.2′	19°12.6	10.6′	53.9′
4	238°53.7	49.8	239°50.5	14.3′	19°02.0	10.6′	53.9′
5	253°53.8	49.0	254°23.8	14.4′	18°51.4	10.7′	53.9′
6	268°53.9	N13°48.2	268°57.2	14.4′	N18°40.7	10.7′	53.9′
7	283°54.1	47.4	283°30.6	14.5′	18°30.0	10.9′	53.9′
8	298°54.2	46.6	298°04.1	14.5′	18°19.1	10.9′	53.9′
9	313°54.3	·· 45.9	312°37.6	14.6′	18°08.2	10.9′	53.9′
10	328°54.4	45.1	327°11.2	14.7′	17°57.3	11.1′	53.9′
11	343°54.6	44.3	341°44.9	14.7′	17°46.2	11.1′	53.9′
12	358°54.7	N13°43.5	356°18.6	14.8′	N17°35.1	11.2′	53.9′
13	13°54.8	42.7	10°52.4	14.8′	17°23.9	11.3′	53.9′
14	28°54.9	41.9	25°26.3	14.9′	17°12.6	11.3′	53.9′
15	43°55.1	·· 41.1	40°00.2	15.0′	17°01.3	11.4′	53.9′
16	58°55.2	40.3	54°34.1	15.0′	16°49.9	11.4′	53.9′
17	73°55.3	39.5	69°08.2	15.1′	16°38.5	11.6′	53.9′
18	88°55.5	N13°38.7	83°42.2	15.1′	N16°26.9	11.5′	53.9′
19	103°55.6	38.0	98°16.4	15.2′	16°15.4	11.7′	53.9′
20	118°55.7	37.2	112°50.5	15.2′	16°03.7	11.7′	53.9′
21	133°55.8	·· 36.4	127°24.8	15.3′	15°52.0	11.8′	53.9′
22	148°56.0	35.6	141°59.1	15.3′	15°40.2	11.8′	53.9′
23	163°56.1	34.8	156°33.4	15.4′	15°28.4	11.9′	53.9′
	SD = 15.8′	d = -0.8′	SD = 14.7′				

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

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 5-0%
14	04:50	04:45	12:05	10:43	23:07	
15	04:39	04:33	12:05	11:31	23:53	
16	04:27	04:21	12:04	12:15	–:–	

August 17, 18, 19 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	325°07.0	186°51.1	N07°44.5	150°59.0	N03°22.9	282°10.7	N15°07.7	347°59.4	S11°27.8
1	340°09.5	201°55.0	44.8	166°00.0	22.3	297°13.1	07.7	3°02.0	27.8
2	355°12.0	216°58.9	45.1	181°01.0	21.6	312°15.4	07.8	18°04.7	27.9
3	10°14.4	232°02.9	·· 45.4	196°02.0	·· 21.0	327°17.7	·· 07.8	33°07.3	·· 28.0
4	25°16.9	247°06.8	45.7	211°03.0	20.4	342°20.0	07.8	48°09.9	28.1
5	40°19.4	262°10.7	46.0	226°04.0	19.7	357°22.3	07.9	63°12.6	28.1
6	55°21.8	277°14.7	N07°46.3	241°05.1	N03°19.1	12°24.6	N15°07.9	78°15.2	S11°28.2
7	70°24.3	292°18.6	46.6	256°06.1	18.4	27°26.9	07.9	93°17.8	28.3
8	85°26.7	307°22.5	47.0	271°07.1	17.8	42°29.3	08.0	108°20.5	28.3
9	100°29.2	322°26.4	·· 47.3	286°08.1	·· 17.1	57°31.6	·· 08.0	123°23.1	·· 28.4
10	115°31.7	337°30.3	47.6	301°09.1	16.5	72°33.9	08.0	138°25.8	28.5
11	130°34.1	352°34.2	47.9	316°10.1	15.8	87°36.2	08.1	153°28.4	28.6
12	145°36.6	7°38.2	N07°48.2	331°11.2	N03°15.2	102°38.5	N15°08.1	168°31.0	S11°28.6
13	160°39.1	22°42.1	48.5	346°12.2	14.5	117°40.8	08.1	183°33.7	28.7
14	175°41.5	37°46.0	48.9	1°13.2	13.9	132°43.2	08.2	198°36.3	28.8
15	190°44.0	52°49.9	·· 49.2	16°14.2	·· 13.2	147°45.5	·· 08.2	213°38.9	·· 28.8
16	205°46.5	67°53.8	49.5	31°15.2	12.6	162°47.8	08.3	228°41.6	28.9
17	220°48.9	82°57.7	49.8	46°16.2	11.9	177°50.1	08.3	243°44.2	29.0
18	235°51.4	98°01.6	N07°50.1	61°17.3	N03°11.3	192°52.4	N15°08.3	258°46.9	S11°29.1
19	250°53.9	113°05.5	50.5	76°18.3	10.6	207°54.8	08.4	273°49.5	29.1
20	265°56.3	128°09.4	50.8	91°19.3	10.0	222°57.1	08.4	288°52.1	29.2
21	280°58.8	143°13.3	·· 51.1	106°20.3	·· 09.3	237°59.4	·· 08.4	303°54.8	·· 29.3
22	296°01.2	158°17.2	51.5	121°21.3	08.7	253°01.7	08.5	318°57.4	29.3
23	311°03.7	173°21.1	51.8	136°22.3	08.0	268°04.0	08.5	334°00.0	29.4
Mer.pass. 02:19		ν 3.9′ d 0.3′ m -4.13		ν 1.0′ d -0.6′ m 1.78		ν 2.3′ d 0.0′ m -2.48		ν 2.6′ d -0.1′ m 0.50	

Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	326°06.2	188°25.0	N07°52.1	151°23.3	N03°07.4	283°06.4	N15°08.5	349°02.7	S11°29.5
1	341°08.6	203°28.8	52.4	166°24.4	06.7	298°08.7	08.6	4°05.3	29.6
2	356°11.1	218°32.7	52.8	181°25.4	06.1	313°11.0	08.6	19°08.0	29.6
3	11°13.6	233°36.6	·· 53.1	196°26.4	·· 05.4	328°13.3	·· 08.6	34°10.6	·· 29.7
4	26°16.0	248°40.5	53.4	211°27.4	04.8	343°15.6	08.7	49°13.2	29.8
5	41°18.5	263°44.4	53.8	226°28.4	04.1	358°18.0	08.7	64°15.9	29.9
6	56°21.0	278°48.2	N07°54.1	241°29.4	N03°03.5	13°20.3	N15°08.7	79°18.5	S11°29.9
7	71°23.4	293°52.1	54.4	256°30.5	02.8	28°22.6	08.8	94°21.2	30.0
8	86°25.9	308°56.0	54.8	271°31.5	02.2	43°24.9	08.8	109°23.8	30.1
9	101°28.3	323°59.9	·· 55.1	286°32.5	·· 01.5	58°27.3	·· 08.8	124°26.4	·· 30.1
10	116°30.8	339°03.7	55.4	301°33.5	00.9	73°29.6	08.9	139°29.1	30.2
11	131°33.3	354°07.6	55.8	316°34.5	03°00.3	88°31.9	08.9	154°31.7	30.3
12	146°35.7	9°11.5	N07°56.1	331°35.5	N02°59.6	103°34.2	N15°08.9	169°34.3	S11°30.4
13	161°38.2	24°15.3	56.4	346°36.6	59.0	118°36.6	09.0	184°37.0	30.4
14	176°40.7	39°19.2	56.8	1°37.6	58.3	133°38.9	09.0	199°39.6	30.5
15	191°43.1	54°23.0	·· 57.1	16°38.6	·· 57.7	148°41.2	·· 09.0	214°42.3	·· 30.6
16	206°45.6	69°26.9	57.5	31°39.6	57.0	163°43.5	09.0	229°44.9	30.6
17	221°48.1	84°30.7	57.8	46°40.6	56.4	178°45.9	09.1	244°47.5	30.7
18	236°50.5	99°34.6	N07°58.1	61°41.6	N02°55.7	193°48.2	N15°09.1	259°50.2	S11°30.8
19	251°53.0	114°38.4	58.5	76°42.6	55.1	208°50.5	09.1	274°52.8	30.9
20	266°55.5	129°42.3	58.8	91°43.7	54.4	223°52.8	09.2	289°55.5	30.9
21	281°57.9	144°46.1	·· 59.2	106°44.7	·· 53.8	238°55.2	·· 09.2	304°58.1	·· 31.0
22	297°00.4	159°50.0	59.5	121°45.7	53.1	253°57.5	09.2	320°00.7	31.1
23	312°02.8	174°53.8	59.8	136°46.7	52.5	268°59.8	09.3	335°03.4	31.1
Mer.pass. 02:15		ν 3.9′ d 0.3′ m -4.07		ν 1.0′ d -0.6′ m 1.78		ν 2.3′ d 0.0′ m -2.49		ν 2.6′ d -0.1′ m 0.49	

Sat	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	327°05.3	189°57.6	N08°00.2	151°47.7	N02°51.8	284°02.1	N15°09.3	350°06.0	S11°31.2
1	342°07.8	205°01.5	00.5	166°48.7	51.2	299°04.5	09.3	5°08.7	31.3
2	357°10.2	220°05.3	00.9	181°49.7	50.5	314°06.8	09.4	20°11.3	31.4
3	12°12.7	235°09.1	·· 01.2	196°50.8	·· 49.9	329°09.1	·· 09.4	35°13.9	·· 31.4
4	27°15.2	250°12.9	01.6	211°51.8	49.2	344°11.5	09.4	50°16.6	31.5
5	42°17.6	265°16.8	01.9	226°52.8	48.6	359°13.8	09.5	65°19.2	31.6
6	57°20.1	280°20.6	N08°02.3	241°53.8	N02°47.9	14°16.1	N15°09.5	80°21.8	S11°31.7
7	72°22.6	295°24.4	02.6	256°54.8	47.3	29°18.5	09.5	95°24.5	31.7
8	87°25.0	310°28.2	03.0	271°55.8	46.6	44°20.8	09.5	110°27.1	31.8
9	102°27.5	325°32.0	·· 03.3	286°56.8	·· 46.0	59°23.1	·· 09.6	125°29.8	·· 31.9
10	117°29.9	340°35.8	03.7	301°57.9	45.3	74°25.4	09.6	140°32.4	31.9
11	132°32.4	355°39.7	04.0	316°58.9	44.7	89°27.8	09.6	155°35.0	32.0
12	147°34.9	10°43.5	N08°04.4	331°59.9	N02°44.0	104°30.1	N15°09.7	170°37.7	S11°32.1
13	162°37.3	25°47.3	04.7	347°00.9	43.4	119°32.4	09.7	185°40.3	32.2
14	177°39.8	40°51.1	05.1	2°01.9	42.7	134°34.8	09.7	200°43.0	32.2
15	192°42.3	55°54.9	·· 05.4	17°02.9	·· 42.1	149°37.1	·· 09.8	215°45.6	·· 32.3
16	207°44.7	70°58.7	05.8	32°03.9	41.4	164°39.4	09.8	230°48.2	32.4
17	222°47.2	86°02.5	06.2	47°05.0	40.7	179°41.8	09.8	245°50.9	32.4
18	237°49.7	101°06.2	N08°06.5	62°06.0	N02°40.1	194°44.1	N15°09.8	260°53.5	S11°32.5
19	252°52.1	116°10.0	06.9	77°07.0	39.4	209°46.4	09.9	275°56.2	32.6
20	267°54.6	131°13.8	07.2	92°08.0	38.8	224°48.8	09.9	290°58.8	32.7
21	282°57.1	146°17.6	·· 07.6	107°09.0	·· 38.1	239°51.1	·· 09.9	306°01.4	·· 32.7
22	297°59.5	161°21.4	07.9	122°10.0	37.5	254°53.5	10.0	321°04.1	32.8
23	313°02.0	176°25.2	08.3	137°11.0	36.8	269°55.8	10.0	336°06.7	32.9
Mer.pass. 02:11		ν 3.8′ d 0.3′ m -3.98		ν 1.0′ d -0.6′ m 1.78		ν 2.3′ d 0.0′ m -2.49		ν 2.6′ d -0.1′ m 0.49	

Stars

	SHA	**Dec**
Alpheratz	357°35.7	29°13.2
Ankaa	353°08.0	-42°10.5
Schedar	349°32.0	56°39.8
Diphda	348°48.2	-17°51.3
Achernar	335°20.7	-57°06.7
Hamal	327°52.4	23°34.4
Polaris	314°32.2	89°21.5
Acamar	315°12.6	-40°12.3
Menkar	314°07.3	4°11.0
Mirfak	308°29.9	49°56.5
Aldebaran	290°41.0	16°33.4
Rigel	281°05.1	-8°10.3
Capella	280°23.8	46°01.2
Bellatrix	278°24.3	6°22.4
Elnath	278°03.5	28°37.6
Alnilam	275°39.1	-1°11.1
Betelgeuse	270°53.5	7°24.8
Canopus	263°53.3	-52°42.2
Sirius	258°27.5	-16°44.7
Adhara	255°07.1	-29°00.0
Procyon	244°52.3	5°10.0
Pollux	243°19.0	27°58.2
Avior	234°15.8	-59°34.9
Suhail	222°47.6	-43°31.5
Miaplacidus	221°39.5	-69°48.7
Alphard	217°49.2	-8°45.5
Regulus	207°36.0	11°51.3
Dubhe	193°43.0	61°37.6
Denebola	182°26.4	14°26.6
Gienah	175°45.0	-17°40.3
Acrux	173°01.9	-63°13.9
Gacrux	171°53.4	-57°14.8
Alioth	166°14.3	55°50.2
Spica	158°23.7	-11°17.0
Alkaid	152°53.1	49°12.0
Hadar	148°37.9	-60°29.4
Menkent	147°59.1	-36°29.2
Arcturus	145°49.1	19°03.8
Rigil Kent.	139°42.1	-60°56.2
Kochab	137°19.9	74°03.8
Zuben'ubi	136°57.4	-16°08.4
Alphecca	126°04.7	26°38.3
Antares	112°17.2	-26°29.1
Atria	107°12.2	-69°04.4
Sabik	102°04.0	-15°45.2
Shaula	96°11.7	-37°07.3
Rasalhague	95°59.4	12°32.7
Eltanin	90°42.4	51°29.3
Kaus Aust.	83°33.8	-34°22.5
Vega	80°33.7	38°48.5
Nunki	75°48.9	-26°16.1
Altair	62°00.8	8°55.9
Peacock	53°07.0	-56°39.6
Deneb	49°26.1	45°21.9
Enif	33°39.6	9°59.0
Al Na'ir	27°33.9	-46°50.7
Fomalhaut	15°15.4	-29°29.7
Scheat	13°46.0	28°12.6
Markab	13°30.7	15°20.0

Aug 17 Thu	**SHA**	**Mer.pass**
Venus	221°44.0	11:30
Mars	185°51.9	13:55
Jupiter	317°03.7	05:10
Saturn	22°52.3	00:48

Aug 18 Fri	**SHA**	**Mer.pass**
Venus	222°18.8	11:23
Mars	185°17.2	13:54
Jupiter	317°00.2	05:07
Saturn	22°56.5	00:44

Aug 19 Sat	**SHA**	**Mer.pass**
Venus	222°52.3	11:17
Mars	184°42.4	13:52
Jupiter	316°56.8	05:03
Saturn	23°00.7	00:39

Horizontal parallax	
Venus:	0.5
Mars:	0.1

h	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°56.2	N13°34.0	171°07.8	15.5′	N15°16.5	12.0′	53.9′
1	193°56.4	33.2	185°42.3	15.5′	15°04.5	12.0′	53.9′
2	208°56.5	32.4	200°16.8	15.6′	14°52.5	12.1′	53.9′
3	223°56.6	·· 31.6	214°51.3	15.6′	14°40.4	12.1′	53.9′
4	238°56.8	30.8	229°25.9	15.7′	14°28.3	12.2′	53.9′
5	253°56.9	30.0	244°00.6	15.7′	14°16.1	12.2′	53.9′
6	268°57.0	N13°29.2	258°35.3	15.7′	N14°03.9	12.3′	53.9′
7	283°57.2	28.4	273°10.0	15.8′	13°51.6	12.3′	53.9′
8	298°57.3	27.6	287°44.8	15.8′	13°39.3	12.4′	53.9′
9	313°57.4	·· 26.8	302°19.7	15.9′	13°26.9	12.5′	53.9′
10	328°57.6	26.0	316°54.5	15.9′	13°14.4	12.5′	53.9′
11	343°57.7	25.2	331°29.5	16.0′	13°01.9	12.5′	53.9′
12	358°57.8	N13°24.4	346°04.4	16.0′	N12°49.4	12.6′	53.9′
13	13°58.0	23.6	0°39.5	16.1′	12°36.8	12.7′	53.9′
14	28°58.1	22.8	15°14.5	16.1′	12°24.1	12.7′	53.9′
15	43°58.2	·· 22.0	29°49.6	16.1′	12°11.4	12.7′	53.9′
16	58°58.4	21.2	44°24.8	16.2′	11°58.7	12.8′	53.9′
17	73°58.5	20.4	58°59.9	16.2′	11°45.9	12.9′	53.9′
18	88°58.6	N13°19.6	73°35.2	16.3′	N11°33.0	12.8′	53.9′
19	103°58.8	18.8	88°10.4	16.3′	11°20.2	13.0′	53.9′
20	118°58.9	18.0	102°45.7	16.3′	11°07.2	12.9′	53.9′
21	133°59.0	·· 17.2	117°21.0	16.4′	10°54.3	13.0′	53.9′
22	148°59.2	16.4	131°56.4	16.4′	10°41.3	13.1′	53.9′
23	163°59.3	15.6	146°31.8	16.4′	10°28.2	13.1′	54.0′
	SD = 15.8′	d = -0.8′	SD = 14.7′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°59.4	N13°14.8	161°07.3	16.5′	N10°15.1	13.1′	54.0′
1	193°59.6	14.0	175°42.7	16.5′	10°02.0	13.2′	54.0′
2	208°59.7	13.2	190°18.2	16.5′	09°48.8	13.2′	54.0′
3	223°59.8	·· 12.4	204°53.8	16.6′	09°35.6	13.2′	54.0′
4	239°00.0	11.6	219°29.3	16.6′	09°22.4	13.3′	54.0′
5	254°00.1	10.8	234°04.9	16.6′	09°09.1	13.3′	54.0′
6	269°00.2	N13°10.0	248°40.5	16.6′	N08°55.8	13.3′	54.0′
7	284°00.4	09.2	263°16.2	16.7′	08°42.5	13.4′	54.0′
8	299°00.5	08.4	277°51.9	16.7′	08°29.1	13.4′	54.0′
9	314°00.7	·· 07.6	292°27.6	16.7′	08°15.7	13.5′	54.0′
10	329°00.8	06.8	307°03.3	16.7′	08°02.2	13.5′	54.0′
11	344°00.9	06.0	321°39.0	16.8′	07°48.7	13.5′	54.0′
12	359°01.1	N13°05.1	336°14.8	16.8′	N07°35.2	13.5′	54.0′
13	14°01.2	04.3	350°50.6	16.8′	07°21.7	13.6′	54.0′
14	29°01.4	03.5	5°26.4	16.8′	07°08.1	13.6′	54.1′
15	44°01.5	·· 02.7	20°02.2	16.9′	06°54.5	13.6′	54.1′
16	59°01.6	01.9	34°38.1	16.9′	06°40.9	13.7′	54.1′
17	74°01.8	01.1	49°14.0	16.9′	06°27.2	13.7′	54.1′
18	89°01.9	N13°00.3	63°49.9	16.9′	N06°13.5	13.7′	54.1′
19	104°02.0	12°59.5	78°25.8	16.9′	05°59.8	13.7′	54.1′
20	119°02.2	58.7	93°01.7	16.9′	05°46.1	13.8′	54.1′
21	134°02.3	·· 57.9	107°37.6	17.0′	05°32.3	13.8′	54.1′
22	149°02.5	57.1	122°13.6	17.0′	05°18.5	13.8′	54.1′
23	164°02.6	56.2	136°49.5	17.0′	05°04.7	13.8′	54.1′
	SD = 15.8′	d = -0.8′	SD = 14.7′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°02.8	N12°55.4	151°25.5	17.0′	N04°50.9	13.9′	54.1′
1	194°02.9	54.6	166°01.5	17.0′	04°37.0	13.8′	54.2′
2	209°03.0	53.8	180°37.5	17.0′	04°23.2	13.9′	54.2′
3	224°03.2	·· 53.0	195°13.5	17.0′	04°09.3	13.9′	54.2′
4	239°03.3	52.2	209°49.5	17.0′	03°55.4	14.0′	54.2′
5	254°03.5	51.4	224°25.5	17.0′	03°41.4	13.9′	54.2′
6	269°03.6	N12°50.6	239°01.5	17.0′	N03°27.5	14.0′	54.2′
7	284°03.7	49.7	253°37.6	17.0′	03°13.5	14.0′	54.2′
8	299°03.9	48.9	268°13.6	17.0′	02°59.5	14.0′	54.2′
9	314°04.0	·· 48.1	282°49.6	17.0′	02°45.5	14.0′	54.2′
10	329°04.2	47.3	297°25.7	17.0′	02°31.5	14.0′	54.3′
11	344°04.3	46.5	312°01.7	17.0′	02°17.5	14.0′	54.3′
12	359°04.5	N12°45.7	326°37.7	17.0′	N02°03.5	14.1′	54.3′
13	14°04.6	44.9	341°13.8	17.0′	01°49.4	14.1′	54.3′
14	29°04.7	44.0	355°49.8	17.0′	01°35.3	14.0′	54.3′
15	44°04.9	·· 43.2	10°25.8	17.0′	01°21.3	14.1′	54.3′
16	59°05.0	42.4	25°01.8	17.0′	01°07.2	14.1′	54.3′
17	74°05.2	41.6	39°37.8	17.0′	00°53.1	14.1′	54.3′
18	89°05.3	N12°40.8	54°13.9	17.0′	N00°39.0	14.1′	54.4′
19	104°05.5	39.9	68°49.9	17.0′	00°24.9	14.2′	54.4′
20	119°05.6	39.1	83°25.8	17.0′	N00°10.7	14.1′	54.4′
21	134°05.8	·· 38.3	98°01.8	17.0′	S00°03.4	14.1′	54.4′
22	149°05.9	37.5	112°37.8	17.0′	00°17.5	14.2′	54.4′
23	164°06.1	36.7	127°13.7	16.9′	00°31.7	14.1′	54.4′
	SD = 15.8′	d = -0.8′	SD = 14.8′				

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

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

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 1-3 0-6%
17	04:15	04:09	12:04	12:57	00:37	
18	04:02	03:56	12:04	13:38	01:18	
19	03:49	03:42	12:04	14:17	01:57	

August 20, 21, 22 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	328°04.4	191°28.9	N08°08.7	152°12.1	N02°36.2	284°58.1	N15°10.0	351°09.4	S11°32.9
1	343°06.9	206°32.7	09.0	167°13.1	35.5	300°00.5	10.1	6°12.0	33.0
2	358°09.4	221°36.5	09.4	182°14.1	34.9	315°02.8	10.1	21°14.6	33.1
3	13°11.8	236°40.2	·· 09.7	197°15.1	·· 34.2	330°05.1	·· 10.1	36°17.3	·· 33.2
4	28°14.3	251°44.0	10.1	212°16.1	33.6	345°07.5	10.1	51°19.9	33.2
5	43°16.8	266°47.8	10.5	227°17.1	32.9	0°09.8	10.2	66°22.6	33.3
6	58°19.2	281°51.5	N08°10.8	242°18.1	N02°32.3	15°12.1	N15°10.2	81°25.2	S11°33.4
7	73°21.7	296°55.3	11.2	257°19.2	31.6	30°14.5	10.2	96°27.8	33.5
8	88°24.2	311°59.0	11.6	272°20.2	31.0	45°16.8	10.3	111°30.5	33.5
9	103°26.6	327°02.8	·· 11.9	287°21.2	·· 30.3	60°19.2	·· 10.3	126°33.1	·· 33.6
10	118°29.1	342°06.5	12.3	302°22.2	29.7	75°21.5	10.3	141°35.8	33.7
11	133°31.6	357°10.3	12.6	317°23.2	29.0	90°23.8	10.3	156°38.4	33.7
12	148°34.0	12°14.0	N08°13.0	332°24.2	N02°28.4	105°26.2	N15°10.4	171°41.0	S11°33.8
13	163°36.5	27°17.7	13.4	347°25.2	27.7	120°28.5	10.4	186°43.7	33.9
14	178°38.9	42°21.5	13.7	2°26.2	27.1	135°30.9	10.4	201°46.3	34.0
15	193°41.4	57°25.2	·· 14.1	17°27.3	·· 26.4	150°33.2	·· 10.4	216°49.0	·· 34.0
16	208°43.9	72°28.9	14.5	32°28.3	25.8	165°35.5	10.5	231°51.6	34.1
17	223°46.3	87°32.7	14.8	47°29.3	25.1	180°37.9	10.5	246°54.2	34.2
18	238°48.8	102°36.4	N08°15.2	62°30.3	N02°24.5	195°40.2	N15°10.5	261°56.9	S11°34.2
19	253°51.3	117°40.1	15.6	77°31.3	23.8	210°42.6	10.6	276°59.5	34.3
20	268°53.7	132°43.8	16.0	92°32.3	23.2	225°44.9	10.6	292°02.2	34.4
21	283°56.2	147°47.5	·· 16.3	107°33.3	·· 22.5	240°47.3	·· 10.6	307°04.8	·· 34.5
22	298°58.7	162°51.3	16.7	122°34.3	21.9	255°49.6	10.6	322°07.4	34.5
23	314°01.1	177°55.0	17.1	137°35.4	21.2	270°51.9	10.7	337°10.1	34.6
Mer.pass. 02:07		ν 3.8′	d 0.4′ m -4.04	ν 1.0′	d -0.7′ m 1.77	ν 2.3′	d 0.0′ m -2.50	ν 2.6′	d -0.1′ m 0.48

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	329°03.6	192°58.7	N08°17.4	152°36.4	N02°20.5	285°54.3	N15°10.7	352°12.7	S11°34.7
1	344°06.0	208°02.4	17.8	167°37.4	19.9	300°56.6	10.7	7°15.4	34.8
2	359°08.5	223°06.1	18.2	182°38.4	19.2	315°59.0	10.7	22°18.0	34.8
3	14°11.0	238°09.8	·· 18.5	197°39.4	·· 18.6	331°01.3	·· 10.8	37°20.7	·· 34.9
4	29°13.4	253°13.5	18.9	212°40.4	17.9	346°03.7	10.8	52°23.3	35.0
5	44°15.9	268°17.2	19.3	227°41.4	17.3	1°06.0	10.8	67°25.9	35.0
6	59°18.4	283°20.8	N08°19.7	242°42.4	N02°16.6	16°08.4	N15°10.8	82°28.6	S11°35.1
7	74°20.8	298°24.5	20.0	257°43.5	16.0	31°10.7	10.9	97°31.2	35.2
8	89°23.3	313°28.2	20.4	272°44.5	15.3	46°13.0	10.9	112°33.9	35.3
9	104°25.8	328°31.9	·· 20.8	287°45.5	·· 14.7	61°15.4	·· 10.9	127°36.5	·· 35.3
10	119°28.2	343°35.6	21.2	302°46.5	14.0	76°17.7	10.9	142°39.1	35.4
11	134°30.7	358°39.2	21.5	317°47.5	13.4	91°20.1	11.0	157°41.8	35.5
12	149°33.2	13°42.9	N08°21.9	332°48.5	N02°12.7	106°22.4	N15°11.0	172°44.4	S11°35.5
13	164°35.6	28°46.6	22.3	347°49.5	12.1	121°24.8	11.0	187°47.1	35.6
14	179°38.1	43°50.2	22.7	2°50.5	11.4	136°27.1	11.1	202°49.7	35.7
15	194°40.5	58°53.9	·· 23.1	17°51.6	·· 10.8	151°29.5	·· 11.1	217°52.3	·· 35.8
16	209°43.0	73°57.6	23.4	32°52.6	10.1	166°31.8	11.1	232°55.0	35.8
17	224°45.5	89°01.2	23.8	47°53.6	09.5	181°34.2	11.1	247°57.6	35.9
18	239°47.9	104°04.9	N08°24.2	62°54.6	N02°08.8	196°36.5	N15°11.2	263°00.3	S11°36.0
19	254°50.4	119°08.5	24.6	77°55.6	08.1	211°38.9	11.2	278°02.9	36.0
20	269°52.9	134°12.1	24.9	92°56.6	07.5	226°41.2	11.2	293°05.5	36.1
21	284°55.3	149°15.8	·· 25.3	107°57.6	·· 06.8	241°43.6	·· 11.2	308°08.2	·· 36.2
22	299°57.8	164°19.4	25.7	122°58.6	06.2	256°45.9	11.3	323°10.8	36.3
23	315°00.3	179°23.1	26.1	137°59.7	05.5	271°48.3	11.3	338°13.5	36.3
Mer.pass. 02:03		ν 3.7′	d 0.4′ m -4.11	ν 1.0′	d -0.7′ m 1.77	ν 2.3′	d 0.0′ m -2.51	ν 2.6′	d -0.1′ m 0.48

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	330°02.7	194°26.7	N08°26.5	153°00.7	N02°04.9	286°50.6	N15°11.3	353°16.1	S11°36.4
1	345°05.2	209°30.3	26.8	168°01.7	04.2	301°53.0	11.3	8°18.8	36.5
2	0°07.6	224°33.9	27.2	183°02.7	03.6	316°55.3	11.3	23°21.4	36.6
3	15°10.1	239°37.6	·· 27.6	198°03.7	·· 02.9	331°57.7	·· 11.4	38°24.0	·· 36.6
4	30°12.6	254°41.2	28.0	213°04.7	02.3	347°00.0	11.4	53°26.7	36.7
5	45°15.0	269°44.8	28.4	228°05.7	01.6	2°02.4	11.4	68°29.3	36.8
6	60°17.5	284°48.4	N08°28.8	243°06.7	N02°01.0	17°04.8	N15°11.4	83°32.0	S11°36.8
7	75°20.0	299°52.0	29.1	258°07.7	02°00.3	32°07.1	11.5	98°34.6	36.9
8	90°22.4	314°55.6	29.5	273°08.8	01°59.7	47°09.5	11.5	113°37.2	37.0
9	105°24.9	329°59.2	·· 29.9	288°09.8	·· 59.0	62°11.8	·· 11.5	128°39.9	·· 37.1
10	120°27.4	345°02.8	30.3	303°10.8	58.3	77°14.2	11.5	143°42.5	37.1
11	135°29.8	0°06.4	30.7	318°11.8	57.7	92°16.5	11.6	158°45.2	37.2
12	150°32.3	15°10.0	N08°31.1	333°12.8	N01°57.0	107°18.9	N15°11.6	173°47.8	S11°37.3
13	165°34.8	30°13.6	31.4	348°13.8	56.4	122°21.2	11.6	188°50.5	37.3
14	180°37.2	45°17.2	31.8	3°14.8	55.7	137°23.6	11.6	203°53.1	37.4
15	195°39.7	60°20.8	·· 32.2	18°15.8	·· 55.1	152°25.9	·· 11.7	218°55.7	·· 37.5
16	210°42.1	75°24.4	32.6	33°16.8	54.4	167°28.3	11.7	233°58.4	37.6
17	225°44.6	90°27.9	33.0	48°17.8	53.8	182°30.7	11.7	249°01.0	37.6
18	240°47.1	105°31.5	N08°33.4	63°18.9	N01°53.1	197°33.0	N15°11.7	264°03.7	S11°37.7
19	255°49.5	120°35.1	33.8	78°19.9	52.5	212°35.4	11.7	279°06.3	37.8
20	270°52.0	135°38.6	34.1	93°20.9	51.8	227°37.7	11.8	294°08.9	37.9
21	285°54.5	150°42.2	·· 34.5	108°21.9	·· 51.2	242°40.1	·· 11.8	309°11.6	·· 37.9
22	300°56.9	165°45.8	34.9	123°22.9	50.5	257°42.5	11.8	324°14.2	38.0
23	315°59.4	180°49.3	35.3	138°23.9	49.8	272°44.8	11.8	339°16.9	38.1
Mer.pass. 01:59		ν 3.6′	d 0.4′ m -4.17	ν 1.0′	d -0.7′ m 1.77	ν 2.4′	d 0.0′ m -2.52	ν 2.6′	d -0.1′ m 0.47

Stars

	SHA	**Dec**
Alpheratz	357°35.7	29°13.2
Ankaa	353°07.9	-42°10.5
Schedar	349°32.0	56°39.9
Diphda	348°48.2	-17°51.3
Achernar	335°20.7	-57°06.7
Hamal	327°52.4	23°34.4
Polaris	314°30.7	89°21.5
Acamar	315°12.6	-40°12.3
Menkar	314°07.3	4°11.0
Mirfak	308°29.9	49°56.5
Aldebaran	290°41.0	16°33.4
Rigel	281°05.1	-8°10.3
Capella	280°23.8	46°01.2
Bellatrix	278°24.3	6°22.4
Elnath	278°03.5	28°37.6
Alnilam	275°39.0	-1°11.1
Betelgeuse	270°53.5	7°24.8
Canopus	263°53.2	-52°42.2
Sirius	258°27.5	-16°44.7
Adhara	255°07.0	-29°00.0
Procyon	244°52.3	5°10.0
Pollux	243°19.0	27°58.2
Avior	234°15.8	-59°34.9
Suhail	222°47.6	-43°31.5
Miaplacidus	221°39.5	-69°48.7
Alphard	217°49.2	-8°45.5
Regulus	207°36.0	11°51.3
Dubhe	193°43.0	61°37.6
Denebola	182°26.4	14°26.6
Gienah	175°45.0	-17°40.3
Acrux	173°02.0	-63°13.9
Gacrux	171°53.4	-57°14.8
Alioth	166°14.3	55°50.2
Spica	158°23.7	-11°17.0
Alkaid	152°53.1	49°12.0
Hadar	148°37.9	-60°29.4
Menkent	147°59.2	-36°29.2
Arcturus	145°49.1	19°03.8
Rigil Kent.	139°42.1	-60°56.1
Kochab	137°20.0	74°03.8
Zuben'ubi	136°57.4	-16°08.4
Alphecca	126°04.7	26°38.3
Antares	112°17.2	-26°29.1
Atria	107°12.3	-69°04.4
Sabik	102°04.0	-15°45.2
Shaula	96°11.7	-37°07.3
Rasalhague	95°59.5	12°32.7
Eltanin	90°42.4	51°29.4
Kaus Aust.	83°33.8	-34°22.5
Vega	80°33.7	38°48.5
Nunki	75°48.9	-26°16.1
Altair	62°00.8	8°55.9
Peacock	53°07.0	-56°39.6
Deneb	49°26.2	45°21.9
Enif	33°39.6	9°59.1
Al Na'ir	27°33.9	-46°50.7
Fomalhaut	15°15.4	-29°29.7
Scheat	13°46.0	28°12.7
Markab	13°30.7	15°20.0

Aug 20 Sun	**SHA**	**Mer.pass**
Venus	223°24.5	11:11
Mars	184°07.6	13:50
Jupiter	316°53.7	04:59
Saturn	23°04.9	00:35

Aug 21 Mon	**SHA**	**Mer.pass**
Venus	223°55.1	11:05
Mars	183°32.8	13:49
Jupiter	316°50.7	04:56
Saturn	23°09.1	00:31

Aug 22 Tue	**SHA**	**Mer.pass**
Venus	224°24.0	11:00
Mars	182°57.9	13:47
Jupiter	316°47.9	04:52
Saturn	23°13.4	00:27

Horizontal parallax	
Venus:	0.5
Mars:	0.1

h	Sun		Moon				
Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°06.2	N12°35.8	141°49.7	16.9′	S00°45.8	14.1′	54.4′
1	194°06.3	35.0	156°25.6	16.9′	00°59.9	14.2′	54.4′
2	209°06.5	34.2	171°01.5	16.9′	01°14.1	14.1′	54.5′
3	224°06.6	·· 33.4	185°37.4	16.9′	01°28.2	14.2′	54.5′
4	239°06.8	32.6	200°13.3	16.9′	01°42.4	14.2′	54.5′
5	254°06.9	31.7	214°49.2	16.8′	01°56.6	14.1′	54.5′
6	269°07.1	N12°30.9	229°25.0	16.8′	S02°10.7	14.2′	54.5′
7	284°07.2	30.1	244°00.8	16.8′	02°24.9	14.1′	54.5′
8	299°07.4	29.3	258°36.6	16.8′	02°39.0	14.2′	54.6′
9	314°07.5	·· 28.5	273°12.4	16.7′	02°53.2	14.1′	54.6′
10	329°07.7	27.6	287°48.1	16.7′	03°07.3	14.2′	54.6′
11	344°07.8	26.8	302°23.8	16.7′	03°21.5	14.1′	54.6′
12	359°08.0	N12°26.0	316°59.5	16.7′	S03°35.6	14.1′	54.6′
13	14°08.1	25.2	331°35.2	16.6′	03°49.7	14.2′	54.6′
14	29°08.3	24.3	346°10.8	16.6′	04°03.9	14.1′	54.7′
15	44°08.4	·· 23.5	0°46.5	16.6′	04°18.0	14.1′	54.7′
16	59°08.6	22.7	15°22.0	16.5′	04°32.1	14.1′	54.7′
17	74°08.7	21.9	29°57.6	16.5′	04°46.2	14.1′	54.7′
18	89°08.9	N12°21.0	44°33.1	16.5′	S05°00.3	14.1′	54.7′
19	104°09.0	20.2	59°08.6	16.4′	05°14.4	14.1′	54.7′
20	119°09.2	19.4	73°44.0	16.4′	05°28.5	14.0′	54.8′
21	134°09.3	·· 18.5	88°19.4	16.4′	05°42.5	14.1′	54.8′
22	149°09.5	17.7	102°54.8	16.3′	05°56.6	14.0′	54.8′
23	164°09.6	16.9	117°30.1	16.3′	06°10.6	14.0′	54.8′
	SD = 15.8′	d = -0.8′	SD = 14.8′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°09.8	N12°16.1	132°05.4	16.2′	S06°24.6	14.1′	54.8′
1	194°09.9	15.2	146°40.6	16.2′	06°38.7	13.9′	54.9′
2	209°10.1	14.4	161°15.8	16.2′	06°52.6	14.0′	54.9′
3	224°10.2	·· 13.6	175°51.0	16.1′	07°06.6	14.0′	54.9′
4	239°10.4	12.7	190°26.1	16.1′	07°20.6	13.9′	54.9′
5	254°10.5	11.9	205°01.1	16.0′	07°34.5	13.9′	54.9′
6	269°10.7	N12°11.1	219°36.2	16.0′	S07°48.4	13.9′	55.0′
7	284°10.8	10.3	234°11.1	15.9′	08°02.3	13.9′	55.0′
8	299°11.0	09.4	248°46.0	15.9′	08°16.2	13.9′	55.0′
9	314°11.1	·· 08.6	263°20.9	15.8′	08°30.1	13.8′	55.0′
10	329°11.3	07.8	277°55.7	15.8′	08°43.9	13.8′	55.0′
11	344°11.4	06.9	292°30.5	15.7′	08°57.7	13.8′	55.1′
12	359°11.6	N12°06.1	307°05.2	15.7′	S09°11.5	13.8′	55.1′
13	14°11.8	05.3	321°39.9	15.6′	09°25.3	13.7′	55.1′
14	29°11.9	04.4	336°14.4	15.5′	09°39.0	13.7′	55.1′
15	44°12.1	·· 03.6	350°49.0	15.5′	09°52.7	13.7′	55.1′
16	59°12.2	02.8	5°23.5	15.4′	10°06.4	13.7′	55.2′
17	74°12.4	01.9	19°57.9	15.4′	10°20.1	13.6′	55.2′
18	89°12.5	N12°01.1	34°32.2	15.3′	S10°33.7	13.6′	55.2′
19	104°12.7	12°00.3	49°06.5	15.2′	10°47.3	13.5′	55.2′
20	119°12.8	11°59.4	63°40.8	15.2′	11°00.8	13.5′	55.3′
21	134°13.0	·· 58.6	78°14.9	15.1′	11°14.3	13.5′	55.3′
22	149°13.1	57.8	92°49.0	15.0′	11°27.8	13.5′	55.3′
23	164°13.3	56.9	107°23.0	15.0′	11°41.3	13.4′	55.3′
	SD = 15.8′	d = -0.8′	SD = 15.0′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°13.5	N11°56.1	121°57.0	14.9′	S11°54.7	13.4′	55.4′
1	194°13.6	55.3	136°30.9	14.8′	12°08.1	13.3′	55.4′
2	209°13.8	54.4	151°04.7	14.7′	12°21.4	13.4′	55.4′
3	224°13.9	·· 53.6	165°38.5	14.7′	12°34.8	13.2′	55.4′
4	239°14.1	52.7	180°12.1	14.6′	12°48.0	13.2′	55.5′
5	254°14.2	51.9	194°45.7	14.5′	13°01.2	13.2′	55.5′
6	269°14.4	N11°51.1	209°19.3	14.4′	S13°14.4	13.2′	55.5′
7	284°14.6	50.2	223°52.7	14.4′	13°27.6	13.1′	55.5′
8	299°14.7	49.4	238°26.1	14.3′	13°40.7	13.0′	55.6′
9	314°14.9	·· 48.5	252°59.4	14.2′	13°53.7	13.0′	55.6′
10	329°15.0	47.7	267°32.6	14.1′	14°06.7	13.0′	55.6′
11	344°15.2	46.9	282°05.7	14.0′	14°19.7	12.9′	55.6′
12	359°15.3	N11°46.0	296°38.7	14.0′	S14°32.6	12.9′	55.7′
13	14°15.5	45.2	311°11.7	13.9′	14°45.5	12.8′	55.7′
14	29°15.7	44.3	325°44.6	13.8′	14°58.3	12.7′	55.7′
15	44°15.8	·· 43.5	340°17.4	13.7′	15°11.0	12.7′	55.7′
16	59°16.0	42.7	354°50.1	13.6′	15°23.7	12.7′	55.8′
17	74°16.1	41.8	9°22.7	13.5′	15°36.4	12.6′	55.8′
18	89°16.3	N11°41.0	23°55.2	13.4′	S15°49.0	12.5′	55.8′
19	104°16.5	40.1	38°27.6	13.3′	16°01.5	12.5′	55.9′
20	119°16.6	39.3	53°00.0	13.2′	16°14.0	12.4′	55.9′
21	134°16.8	·· 38.5	67°32.2	13.2′	16°26.4	12.4′	55.9′
22	149°16.9	37.6	82°04.4	13.1′	16°38.8	12.3′	55.9′
23	164°17.1	36.8	96°36.4	13.0′	16°51.1	12.2′	56.0′
	SD = 15.8′	d = -0.8′	SD = 15.1′				

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

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

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 4-6 11-26%
20	03:35	03:28	12:03	14:57	02:37	
21	03:21	03:14	12:03	15:38	03:17	
22	03:06	02:59	12:03	16:21	03:59	

August 23, 24, 25 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	331°01.9	195°52.9	N08°35.7	153°24.9	N01°49.2	287°47.2	N15°11.9	354°19.5	S11°38.1
1	346°04.3	210°56.4	36.1	168°25.9	48.5	302°49.5	11.9	9°22.2	38.2
2	1°06.8	226°00.0	36.5	183°26.9	47.9	317°51.9	11.9	24°24.8	38.3
3	16°09.3	241°03.5	·· 36.9	198°28.0	·· 47.2	332°54.3	·· 11.9	39°27.4	·· 38.4
4	31°11.7	256°07.0	37.2	213°29.0	46.6	347°56.6	11.9	54°30.1	38.4
5	46°14.2	271°10.6	37.6	228°30.0	45.9	2°59.0	12.0	69°32.7	38.5
6	61°16.6	286°14.1	N08°38.0	243°31.0	N01°45.3	18°01.3	N15°12.0	84°35.4	S11°38.6
7	76°19.1	301°17.6	38.4	258°32.0	44.6	33°03.7	12.0	99°38.0	38.6
8	91°21.6	316°21.1	38.8	273°33.0	44.0	48°06.1	12.0	114°40.6	38.7
9	106°24.0	331°24.7	·· 39.2	288°34.0	·· 43.3	63°08.4	·· 12.0	129°43.3	·· 38.8
10	121°26.5	346°28.2	39.6	303°35.0	42.6	78°10.8	12.1	144°45.9	38.9
11	136°29.0	1°31.7	40.0	318°36.0	42.0	93°13.1	12.1	159°48.6	38.9
12	151°31.4	16°35.2	N08°40.4	333°37.0	N01°41.3	108°15.5	N15°12.1	174°51.2	S11°39.0
13	166°33.9	31°38.7	40.7	348°38.1	40.7	123°17.9	12.1	189°53.9	39.1
14	181°36.4	46°42.2	41.1	3°39.1	40.0	138°20.2	12.2	204°56.5	39.2
15	196°38.8	61°45.7	·· 41.5	18°40.1	·· 39.4	153°22.6	·· 12.2	219°59.1	·· 39.2
16	211°41.3	76°49.2	41.9	33°41.1	38.7	168°25.0	12.2	235°01.8	39.3
17	226°43.7	91°52.7	42.3	48°42.1	38.1	183°27.3	12.2	250°04.4	39.4
18	241°46.2	106°56.2	N08°42.7	63°43.1	N01°37.4	198°29.7	N15°12.2	265°07.1	S11°39.4
19	256°48.7	121°59.7	43.1	78°44.1	36.7	213°32.1	12.3	280°09.7	39.5
20	271°51.1	137°03.2	43.5	93°45.1	36.1	228°34.4	12.3	295°12.3	39.6
21	286°53.6	152°06.6	·· 43.9	108°46.1	·· 35.4	243°36.8	·· 12.3	310°15.0	·· 39.7
22	301°56.1	167°10.1	44.3	123°47.1	34.8	258°39.2	12.3	325°17.6	39.7
23	316°58.5	182°13.6	44.7	138°48.1	34.1	273°41.5	12.3	340°20.3	39.8
Mer.pass. 01:56		ν 3.5′ d 0.4′ m -4.24		ν 1.0′ d -0.7′ m 1.77		ν 2.4′ d 0.0′ m -2.52		ν 2.6′ d -0.1′ m 0.46	

Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	332°01.0	197°17.0	N08°45.1	153°49.2	N01°33.5	288°43.9	N15°12.4	355°22.9	S11°39.9
1	347°03.5	212°20.5	45.4	168°50.2	32.8	303°46.3	12.4	10°25.6	39.9
2	2°05.9	227°24.0	45.8	183°51.2	32.2	318°48.6	12.4	25°28.2	40.0
3	17°08.4	242°27.4	·· 46.2	198°52.2	·· 31.5	333°51.0	·· 12.4	40°30.8	·· 40.1
4	32°10.9	257°30.9	46.6	213°53.2	30.8	348°53.4	12.4	55°33.5	40.2
5	47°13.3	272°34.3	47.0	228°54.2	30.2	3°55.7	12.4	70°36.1	40.2
6	62°15.8	287°37.8	N08°47.4	243°55.2	N01°29.5	18°58.1	N15°12.5	85°38.8	S11°40.3
7	77°18.2	302°41.2	47.8	258°56.2	28.9	34°00.5	12.5	100°41.4	40.4
8	92°20.7	317°44.6	48.2	273°57.2	28.2	49°02.9	12.5	115°44.1	40.4
9	107°23.2	332°48.1	·· 48.6	288°58.2	·· 27.6	64°05.2	·· 12.5	130°46.7	·· 40.5
10	122°25.6	347°51.5	49.0	303°59.2	26.9	79°07.6	12.5	145°49.3	40.6
11	137°28.1	2°54.9	49.4	319°00.2	26.3	94°10.0	12.6	160°52.0	40.7
12	152°30.6	17°58.4	N08°49.8	334°01.3	N01°25.6	109°12.3	N15°12.6	175°54.6	S11°40.7
13	167°33.0	33°01.8	50.2	349°02.3	24.9	124°14.7	12.6	190°57.3	40.8
14	182°35.5	48°05.2	50.6	4°03.3	24.3	139°17.1	12.6	205°59.9	40.9
15	197°38.0	63°08.6	·· 51.0	19°04.3	·· 23.6	154°19.5	·· 12.6	221°02.6	·· 41.0
16	212°40.4	78°12.0	51.3	34°05.3	23.0	169°21.8	12.7	236°05.2	41.0
17	227°42.9	93°15.4	51.7	49°06.3	22.3	184°24.2	12.7	251°07.8	41.1
18	242°45.4	108°18.8	N08°52.1	64°07.3	N01°21.7	199°26.6	N15°12.7	266°10.5	S11°41.2
19	257°47.8	123°22.2	52.5	79°08.3	21.0	214°28.9	12.7	281°13.1	41.2
20	272°50.3	138°25.6	52.9	94°09.3	20.4	229°31.3	12.7	296°15.8	41.3
21	287°52.7	153°29.0	·· 53.3	109°10.3	·· 19.7	244°33.7	·· 12.7	311°18.4	·· 41.4
22	302°55.2	168°32.4	53.7	124°11.3	19.0	259°36.1	12.8	326°21.1	41.5
23	317°57.7	183°35.8	54.1	139°12.3	18.4	274°38.4	12.8	341°23.7	41.5
Mer.pass. 01:52		ν 3.5′ d 0.4′ m -4.30		ν 1.0′ d -0.7′ m 1.77		ν 2.4′ d 0.0′ m -2.53		ν 2.6′ d -0.1′ m 0.45	

Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	333°00.1	198°39.1	N08°54.5	154°13.4	N01°17.7	289°40.8	N15°12.8	356°26.3	S11°41.6
1	348°02.6	213°42.5	54.9	169°14.4	17.1	304°43.2	12.8	11°29.0	41.7
2	3°05.1	228°45.9	55.3	184°15.4	16.4	319°45.6	12.8	26°31.6	41.7
3	18°07.5	243°49.2	·· 55.7	199°16.4	·· 15.8	334°47.9	·· 12.8	41°34.3	·· 41.8
4	33°10.0	258°52.6	56.1	214°17.4	15.1	349°50.3	12.9	56°36.9	41.9
5	48°12.5	273°56.0	56.5	229°18.4	14.5	4°52.7	12.9	71°39.5	42.0
6	63°14.9	288°59.3	N08°56.9	244°19.4	N01°13.8	19°55.1	N15°12.9	86°42.2	S11°42.0
7	78°17.4	304°02.7	57.3	259°20.4	13.1	34°57.5	12.9	101°44.8	42.1
8	93°19.9	319°06.0	57.7	274°21.4	12.5	49°59.8	12.9	116°47.5	42.2
9	108°22.3	334°09.3	·· 58.1	289°22.4	·· 11.8	65°02.2	·· 12.9	131°50.1	·· 42.2
10	123°24.8	349°12.7	58.5	304°23.4	11.2	80°04.6	13.0	146°52.8	42.3
11	138°27.2	4°16.0	58.9	319°24.4	10.5	95°07.0	13.0	161°55.4	42.4
12	153°29.7	19°19.4	N08°59.2	334°25.4	N01°09.9	110°09.3	N15°13.0	176°58.0	S11°42.5
13	168°32.2	34°22.7	08°59.6	349°26.4	09.2	125°11.7	13.0	192°00.7	42.5
14	183°34.6	49°26.0	09°00.0	4°27.5	08.5	140°14.1	13.0	207°03.3	42.6
15	198°37.1	64°29.3	·· 00.4	19°28.5	·· 07.9	155°16.5	·· 13.0	222°06.0	·· 42.7
16	213°39.6	79°32.6	00.8	34°29.5	07.2	170°18.9	13.1	237°08.6	42.8
17	228°42.0	94°35.9	01.2	49°30.5	06.6	185°21.2	13.1	252°11.3	42.8
18	243°44.5	109°39.3	N09°01.6	64°31.5	N01°05.9	200°23.6	N15°13.1	267°13.9	S11°42.9
19	258°47.0	124°42.6	02.0	79°32.5	05.3	215°26.0	13.1	282°16.5	43.0
20	273°49.4	139°45.9	02.4	94°33.5	04.6	230°28.4	13.1	297°19.2	43.0
21	288°51.9	154°49.2	·· 02.8	109°34.5	·· 03.9	245°30.8	·· 13.1	312°21.8	·· 43.1
22	303°54.3	169°52.4	03.2	124°35.5	03.3	260°33.2	13.2	327°24.5	43.2
23	318°56.8	184°55.7	03.6	139°36.5	02.6	275°35.5	13.2	342°27.1	43.3
Mer.pass. 01:48		ν 3.4′ d 0.4′ m -4.35		ν 1.0′ d -0.7′ m 1.77		ν 2.4′ d 0.0′ m -2.54		ν 2.6′ d -0.1′ m 0.45	

Stars

	SHA	**Dec**
Alpheratz	357°35.7	29°13.2
Ankaa	353°07.9	-42°10.5
Schedar	349°31.9	56°39.9
Diphda	348°48.2	-17°51.3
Achernar	335°20.7	-57°06.7
Hamal	327°52.3	23°34.4
Polaris	314°29.1	89°21.5
Acamar	315°12.5	-40°12.3
Menkar	314°07.3	4°11.0
Mirfak	308°29.8	49°56.5
Aldebaran	290°41.0	16°33.4
Rigel	281°05.1	-8°10.3
Capella	280°23.7	46°01.2
Bellatrix	278°24.2	6°22.4
Elnath	278°03.5	28°37.6
Alnilam	275°39.0	-1°11.1
Betelgeuse	270°53.5	7°24.8
Canopus	263°53.2	-52°42.1
Sirius	258°27.5	-16°44.7
Adhara	255°07.0	-29°00.0
Procyon	244°52.3	5°10.0
Pollux	243°19.0	27°58.2
Avior	234°15.8	-59°34.9
Suhail	222°47.6	-43°31.5
Miaplacidus	221°39.5	-69°48.7
Alphard	217°49.2	-8°45.5
Regulus	207°36.0	11°51.3
Dubhe	193°43.0	61°37.6
Denebola	182°26.4	14°26.6
Gienah	175°45.0	-17°40.3
Acrux	173°02.0	-63°13.9
Gacrux	171°53.4	-57°14.8
Alioth	166°14.4	55°50.2
Spica	158°23.7	-11°17.0
Alkaid	152°53.1	49°12.0
Hadar	148°38.0	-60°29.4
Menkent	147°59.2	-36°29.2
Arcturus	145°49.1	19°03.8
Rigil Kent.	139°42.1	-60°56.1
Kochab	137°20.1	74°03.8
Zuben'ubi	136°57.4	-16°08.4
Alphecca	126°04.7	26°38.3
Antares	112°17.2	-26°29.1
Atria	107°12.3	-69°04.4
Sabik	102°04.0	-15°45.2
Shaula	96°11.8	-37°07.3
Rasalhague	95°59.5	12°32.7
Eltanin	90°42.5	51°29.4
Kaus Aust.	83°33.8	-34°22.5
Vega	80°33.7	38°48.5
Nunki	75°48.9	-26°16.1
Altair	62°00.8	8°55.9
Peacock	53°07.0	-56°39.6
Deneb	49°26.2	45°22.0
Enif	33°39.6	9°59.1
Al Na'ir	27°33.9	-46°50.7
Fomalhaut	15°15.4	-29°29.7
Scheat	13°46.0	28°12.7
Markab	13°30.7	15°20.0

Aug 23 Wed	**SHA**	**Mer.pass**
Venus	224°51.0	10:54
Mars	182°23.1	13:45
Jupiter	316°45.3	04:48
Saturn	23°17.7	00:23

Aug 24 Thu	**SHA**	**Mer.pass**
Venus	225°16.0	10:48
Mars	181°48.2	13:44
Jupiter	316°42.9	04:44
Saturn	23°21.9	00:18

Aug 25 Fri	**SHA**	**Mer.pass**
Venus	225°39.0	10:43
Mars	181°13.2	13:42
Jupiter	316°40.7	04:41
Saturn	23°26.2	00:14

Horizontal parallax	
Venus:	0.5
Mars:	0.1

h	Sun		Moon				
Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°17.3	N11°35.9	111°08.4	12.9′	S17°03.3	12.2′	56.0′
1	194°17.4	35.1	125°40.3	12.8′	17°15.5	12.1′	56.0′
2	209°17.6	34.2	140°12.0	12.7′	17°27.6	12.1′	56.1′
3	224°17.8	·· 33.4	154°43.7	12.6′	17°39.7	11.9′	56.1′
4	239°17.9	32.5	169°15.3	12.5′	17°51.6	11.9′	56.1′
5	254°18.1	31.7	183°46.7	12.4′	18°03.5	11.9′	56.1′
6	269°18.2	N11°30.9	198°18.1	12.3′	S18°15.4	11.7′	56.2′
7	284°18.4	30.0	212°49.4	12.2′	18°27.1	11.7′	56.2′
8	299°18.6	29.2	227°20.5	12.1′	18°38.8	11.6′	56.2′
9	314°18.7	·· 28.3	241°51.6	11.9′	18°50.4	11.6′	56.3′
10	329°18.9	27.5	256°22.5	11.8′	19°02.0	11.5′	56.3′
11	344°19.1	26.6	270°53.3	11.7′	19°13.5	11.3′	56.3′
12	359°19.2	N11°25.8	285°24.1	11.6′	S19°24.8	11.4′	56.4′
13	14°19.4	24.9	299°54.7	11.5′	19°36.2	11.2′	56.4′
14	29°19.5	24.1	314°25.2	11.4′	19°47.4	11.1′	56.4′
15	44°19.7	·· 23.2	328°55.6	11.3′	19°58.5	11.1′	56.5′
16	59°19.9	22.4	343°25.9	11.2′	20°09.6	11.0′	56.5′
17	74°20.0	21.5	357°56.1	11.1′	20°20.6	10.8′	56.5′
18	89°20.2	N11°20.7	12°26.2	11.0′	S20°31.4	10.8′	56.6′
19	104°20.4	19.8	26°56.1	10.8′	20°42.2	10.8′	56.6′
20	119°20.5	19.0	41°25.9	10.7′	20°53.0	10.6′	56.6′
21	134°20.7	·· 18.1	55°55.7	10.6′	21°03.6	10.5′	56.7′
22	149°20.9	17.3	70°25.3	10.5′	21°14.1	10.4′	56.7′
23	164°21.0	16.4	84°54.8	10.4′	21°24.5	10.4′	56.7′
	SD = 15.8′	d = -0.8′	SD = 15.3′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°21.2	N11°15.6	99°24.1	10.3′	S21°34.9	10.2′	56.8′
1	194°21.4	14.7	113°53.4	10.1′	21°45.1	10.2′	56.8′
2	209°21.5	13.9	128°22.5	10.0′	21°55.3	10.0′	56.8′
3	224°21.7	·· 13.0	142°51.6	9.9′	22°05.3	9.9′	56.9′
4	239°21.9	12.2	157°20.5	9.8′	22°15.2	9.9′	56.9′
5	254°22.0	11.3	171°49.2	9.7′	22°25.1	9.7′	56.9′
6	269°22.2	N11°10.5	186°17.9	9.5′	S22°34.8	9.6′	57.0′
7	284°22.4	09.6	200°46.4	9.4′	22°44.4	9.5′	57.0′
8	299°22.5	08.8	215°14.9	9.3′	22°53.9	9.4′	57.0′
9	314°22.7	·· 07.9	229°43.2	9.2′	23°03.3	9.3′	57.1′
10	329°22.9	07.1	244°11.4	9.1′	23°12.6	9.2′	57.1′
11	344°23.0	06.2	258°39.4	8.9′	23°21.8	9.1′	57.1′
12	359°23.2	N11°05.3	273°07.3	8.8′	S23°30.9	8.9′	57.2′
13	14°23.4	04.5	287°35.2	8.7′	23°39.8	8.9′	57.2′
14	29°23.5	03.6	302°02.8	8.6′	23°48.7	8.7′	57.2′
15	44°23.7	·· 02.8	316°30.4	8.4′	23°57.4	8.6′	57.3′
16	59°23.9	01.9	330°57.9	8.3′	24°06.0	8.5′	57.3′
17	74°24.0	01.1	345°25.2	8.2′	24°14.5	8.3′	57.4′
18	89°24.2	N11°00.2	359°52.4	8.1′	S24°22.8	8.2′	57.4′
19	104°24.4	10°59.3	14°19.5	8.0′	24°31.0	8.1′	57.4′
20	119°24.5	58.5	28°46.4	7.8′	24°39.1	8.0′	57.5′
21	134°24.7	·· 57.6	43°13.3	7.7′	24°47.1	7.8′	57.5′
22	149°24.9	56.8	57°40.0	7.6′	24°54.9	7.7′	57.5′
23	164°25.1	55.9	72°06.6	7.5′	25°02.6	7.6′	57.6′
	SD = 15.8′	d = -0.9′	SD = 15.5′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°25.2	N10°55.1	86°33.0	7.4′	S25°10.2	7.4′	57.6′
1	194°25.4	54.2	100°59.4	7.2′	25°17.6	7.3′	57.6′
2	209°25.6	53.3	115°25.6	7.1′	25°24.9	7.2′	57.7′
3	224°25.7	·· 52.5	129°51.7	7.0′	25°32.1	7.0′	57.7′
4	239°25.9	51.6	144°17.7	6.9′	25°39.1	6.8′	57.8′
5	254°26.1	50.8	158°43.6	6.8′	25°45.9	6.8′	57.8′
6	269°26.3	N10°49.9	173°09.3	6.6′	S25°52.7	6.6′	57.8′
7	284°26.4	49.0	187°35.0	6.5′	25°59.3	6.4′	57.9′
8	299°26.6	48.2	202°00.5	6.4′	26°05.7	6.3′	57.9′
9	314°26.8	·· 47.3	216°25.9	6.3′	26°12.0	6.1′	57.9′
10	329°26.9	46.5	230°51.2	6.2′	26°18.1	6.0′	58.0′
11	344°27.1	45.6	245°16.4	6.1′	26°24.1	5.8′	58.0′
12	359°27.3	N10°44.7	259°41.4	5.9′	S26°29.9	5.7′	58.1′
13	14°27.5	43.9	274°06.4	5.8′	26°35.6	5.5′	58.1′
14	29°27.6	43.0	288°31.2	5.7′	26°41.1	5.4′	58.1′
15	44°27.8	·· 42.1	302°55.9	5.6′	26°46.5	5.2′	58.2′
16	59°28.0	41.3	317°20.5	5.5′	26°51.7	5.0′	58.2′
17	74°28.2	40.4	331°45.0	5.4′	26°56.7	4.9′	58.2′
18	89°28.3	N10°39.6	346°09.4	5.3′	S27°01.6	4.7′	58.3′
19	104°28.5	38.7	0°33.7	5.2′	27°06.3	4.5′	58.3′
20	119°28.7	37.8	14°57.9	5.1′	27°10.8	4.4′	58.4′
21	134°28.9	·· 37.0	29°22.0	5.0′	27°15.2	4.2′	58.4′
22	149°29.0	36.1	43°46.0	4.9′	27°19.4	4.0′	58.4′
23	164°29.2	35.2	58°09.9	4.8′	27°23.4	3.9′	58.5′
	SD = 15.8′	d = -0.9′	SD = 15.7′				

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

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

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 36-56%
23	02:51	02:43	12:03	17:09	04:44	
24	02:35	02:27	12:02	18:01	05:34	
25	02:19	02:11	12:02	18:58	06:28	

August 26, 27, 28 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	333°59.3	199°59.0	N09°04.0	154°37.5	N01°02.0	290°37.9	N15°13.2	357°29.8	S11°43.3
1	349°01.7	215°02.3	04.4	169°38.5	01.3	305°40.3	13.2	12°32.4	43.4
2	4°04.2	230°05.6	04.8	184°39.5	00.7	320°42.7	13.2	27°35.0	43.5
3	19°06.7	245°08.8	·· 05.2	199°40.5	01°00.0	335°45.1	·· 13.2	42°37.7	·· 43.5
4	34°09.1	260°12.1	05.6	214°41.5	00°59.3	350°47.5	13.2	57°40.3	43.6
5	49°11.6	275°15.4	06.0	229°42.6	58.7	5°49.8	13.3	72°43.0	43.7
6	64°14.1	290°18.6	N09°06.4	244°43.6	N00°58.0	20°52.2	N15°13.3	87°45.6	S11°43.8
7	79°16.5	305°21.9	06.7	259°44.6	57.4	35°54.6	13.3	102°48.3	43.8
8	94°19.0	320°25.1	07.1	274°45.6	56.7	50°57.0	13.3	117°50.9	43.9
9	109°21.5	335°28.4	·· 07.5	289°46.6	·· 56.1	65°59.4	·· 13.3	132°53.5	·· 44.0
10	124°23.9	350°31.6	07.9	304°47.6	55.4	81°01.8	13.3	147°56.2	44.0
11	139°26.4	5°34.9	08.3	319°48.6	54.7	96°04.2	13.3	162°58.8	44.1
12	154°28.8	20°38.1	N09°08.7	334°49.6	N00°54.1	111°06.6	N15°13.4	178°01.5	S11°44.2
13	169°31.3	35°41.4	09.1	349°50.6	53.4	126°08.9	13.4	193°04.1	44.3
14	184°33.8	50°44.6	09.5	4°51.6	52.8	141°11.3	13.4	208°06.8	44.3
15	199°36.2	65°47.8	·· 09.9	19°52.6	·· 52.1	156°13.7	·· 13.4	223°09.4	·· 44.4
16	214°38.7	80°51.0	10.3	34°53.6	51.5	171°16.1	13.4	238°12.0	44.5
17	229°41.2	95°54.2	10.7	49°54.6	50.8	186°18.5	13.4	253°14.7	44.5
18	244°43.6	110°57.5	N09°11.1	64°55.6	N00°50.1	201°20.9	N15°13.4	268°17.3	S11°44.6
19	259°46.1	126°00.7	11.5	79°56.6	49.5	216°23.3	13.5	283°20.0	44.7
20	274°48.6	141°03.9	11.9	94°57.6	48.8	231°25.7	13.5	298°22.6	44.8
21	289°51.0	156°07.1	·· 12.3	109°58.6	·· 48.2	246°28.1	·· 13.5	313°25.3	·· 44.8
22	304°53.5	171°10.3	12.7	124°59.6	47.5	261°30.4	13.5	328°27.9	44.9
23	319°56.0	186°13.5	13.1	140°00.7	46.9	276°32.8	13.5	343°30.5	45.0
Mer.pass. 01:44		ν 3.3′ d 0.4′ m -4.41		ν 1.0′ d -0.7′ m 1.76		ν 2.4′ d 0.0′ m -2.55		ν 2.6′ d -0.1′ m 0.44	

Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	334°58.4	201°16.6	N09°13.4	155°01.7	N00°46.2	291°35.2	N15°13.5	358°33.2	S11°45.1
1	350°00.9	216°19.8	13.8	170°02.7	45.5	306°37.6	13.5	13°35.8	45.1
2	5°03.3	231°23.0	14.2	185°03.7	44.9	321°40.0	13.5	28°38.5	45.2
3	20°05.8	246°26.2	·· 14.6	200°04.7	·· 44.2	336°42.4	·· 13.6	43°41.1	·· 45.3
4	35°08.3	261°29.4	15.0	215°05.7	43.6	351°44.8	13.6	58°43.8	45.3
5	50°10.7	276°32.5	15.4	230°06.7	42.9	6°47.2	13.6	73°46.4	45.4
6	65°13.2	291°35.7	N09°15.8	245°07.7	N00°42.3	21°49.6	N15°13.6	88°49.0	S11°45.5
7	80°15.7	306°38.8	16.2	260°08.7	41.6	36°52.0	13.6	103°51.7	45.6
8	95°18.1	321°42.0	16.6	275°09.7	40.9	51°54.4	13.6	118°54.3	45.6
9	110°20.6	336°45.1	·· 17.0	290°10.7	·· 40.3	66°56.8	·· 13.6	133°57.0	·· 45.7
10	125°23.1	351°48.3	17.4	305°11.7	39.6	81°59.2	13.6	148°59.6	45.8
11	140°25.5	6°51.4	17.8	320°12.7	39.0	97°01.6	13.6	164°02.3	45.8
12	155°28.0	21°54.6	N09°18.2	335°13.7	N00°38.3	112°04.0	N15°13.7	179°04.9	S11°45.9
13	170°30.5	36°57.7	18.5	350°14.7	37.6	127°06.3	13.7	194°07.5	46.0
14	185°32.9	52°00.8	18.9	5°15.7	37.0	142°08.7	13.7	209°10.2	46.1
15	200°35.4	67°04.0	·· 19.3	20°16.7	·· 36.3	157°11.1	·· 13.7	224°12.8	·· 46.1
16	215°37.8	82°07.1	19.7	35°17.7	35.7	172°13.5	13.7	239°15.5	46.2
17	230°40.3	97°10.2	20.1	50°18.7	35.0	187°15.9	13.7	254°18.1	46.3
18	245°42.8	112°13.3	N09°20.5	65°19.7	N00°34.4	202°18.3	N15°13.7	269°20.8	S11°46.3
19	260°45.2	127°16.4	20.9	80°20.7	33.7	217°20.7	13.7	284°23.4	46.4
20	275°47.7	142°19.5	21.3	95°21.7	33.0	232°23.1	13.7	299°26.1	46.5
21	290°50.2	157°22.6	·· 21.7	110°22.7	·· 32.4	247°25.5	·· 13.8	314°28.7	·· 46.6
22	305°52.6	172°25.7	22.1	125°23.7	31.7	262°27.9	13.8	329°31.3	46.6
23	320°55.1	187°28.8	22.4	140°24.8	31.1	277°30.3	13.8	344°34.0	46.7
Mer.pass. 01:40		ν 3.2′ d 0.4′ m -4.45		ν 1.0′ d -0.7′ m 1.76		ν 2.4′ d 0.0′ m -2.55		ν 2.6′ d -0.1′ m 0.43	

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	335°57.6	202°31.9	N09°22.8	155°25.8	N00°30.4	292°32.7	N15°13.8	359°36.6	S11°46.8
1	351°00.0	217°35.0	23.2	170°26.8	29.7	307°35.1	13.8	14°39.3	46.8
2	6°02.5	232°38.1	23.6	185°27.8	29.1	322°37.5	13.8	29°41.9	46.9
3	21°05.0	247°41.2	·· 24.0	200°28.8	·· 28.4	337°39.9	·· 13.8	44°44.6	·· 47.0
4	36°07.4	262°44.2	24.4	215°29.8	27.8	352°42.3	13.8	59°47.2	47.1
5	51°09.9	277°47.3	24.8	230°30.8	27.1	7°44.7	13.8	74°49.8	47.1
6	66°12.3	292°50.4	N09°25.2	245°31.8	N00°26.5	22°47.1	N15°13.9	89°52.5	S11°47.2
7	81°14.8	307°53.4	25.6	260°32.8	25.8	37°49.5	13.9	104°55.1	47.3
8	96°17.3	322°56.5	25.9	275°33.8	25.1	52°51.9	13.9	119°57.8	47.3
9	111°19.7	337°59.5	·· 26.3	290°34.8	·· 24.5	67°54.3	·· 13.9	135°00.4	·· 47.4
10	126°22.2	353°02.6	26.7	305°35.8	23.8	82°56.7	13.9	150°03.1	47.5
11	141°24.7	8°05.6	27.1	320°36.8	23.2	97°59.1	13.9	165°05.7	47.6
12	156°27.1	23°08.7	N09°27.5	335°37.8	N00°22.5	113°01.5	N15°13.9	180°08.3	S11°47.6
13	171°29.6	38°11.7	27.9	350°38.8	21.8	128°03.9	13.9	195°11.0	47.7
14	186°32.1	53°14.7	28.3	5°39.8	21.2	143°06.3	13.9	210°13.6	47.8
15	201°34.5	68°17.8	·· 28.7	20°40.8	·· 20.5	158°08.8	·· 13.9	225°16.3	·· 47.8
16	216°37.0	83°20.8	29.0	35°41.8	19.9	173°11.2	13.9	240°18.9	47.9
17	231°39.5	98°23.8	29.4	50°42.8	19.2	188°13.6	14.0	255°21.6	48.0
18	246°41.9	113°26.8	N09°29.8	65°43.8	N00°18.5	203°16.0	N15°14.0	270°24.2	S11°48.1
19	261°44.4	128°29.8	30.2	80°44.8	17.9	218°18.4	14.0	285°26.8	48.1
20	276°46.8	143°32.8	30.6	95°45.8	17.2	233°20.8	14.0	300°29.5	48.2
21	291°49.3	158°35.8	·· 31.0	110°46.8	·· 16.6	248°23.2	·· 14.0	315°32.1	·· 48.3
22	306°51.8	173°38.8	31.3	125°47.8	15.9	263°25.6	14.0	330°34.8	48.3
23	321°54.2	188°41.8	31.7	140°48.8	15.3	278°28.0	14.0	345°37.4	48.4
Mer.pass. 01:36		ν 3.1′ d 0.4′ m -4.50		ν 1.0′ d -0.7′ m 1.76		ν 2.4′ d 0.0′ m -2.56		ν 2.6′ d -0.1′ m 0.43	

Stars

	SHA	**Dec**
Alpheratz	357°35.6	29°13.2
Ankaa	353°07.9	-42°10.5
Schedar	349°31.9	56°39.9
Diphda	348°48.2	-17°51.3
Achernar	335°20.7	-57°06.7
Hamal	327°52.3	23°34.4
Polaris	314°27.3	89°21.5
Acamar	315°12.5	-40°12.3
Menkar	314°07.2	4°11.0
Mirfak	308°29.8	49°56.5
Aldebaran	290°41.0	16°33.4
Rigel	281°05.1	-8°10.3
Capella	280°23.7	46°01.2
Bellatrix	278°24.2	6°22.4
Elnath	278°03.4	28°37.6
Alnilam	275°39.0	-1°11.1
Betelgeuse	270°53.5	7°24.8
Canopus	263°53.2	-52°42.1
Sirius	258°27.4	-16°44.7
Adhara	255°07.0	-29°00.0
Procyon	244°52.3	5°10.0
Pollux	243°19.0	27°58.2
Avior	234°15.8	-59°34.8
Suhail	222°47.6	-43°31.5
Miaplacidus	221°39.4	-69°48.7
Alphard	217°49.2	-8°45.5
Regulus	207°36.0	11°51.3
Dubhe	193°43.0	61°37.6
Denebola	182°26.4	14°26.6
Gienah	175°45.0	-17°40.3
Acrux	173°02.0	-63°13.9
Gacrux	171°53.4	-57°14.8
Alioth	166°14.4	55°50.2
Spica	158°23.7	-11°17.0
Alkaid	152°53.2	49°12.0
Hadar	148°38.0	-60°29.4
Menkent	147°59.2	-36°29.2
Arcturus	145°49.1	19°03.8
Rigil Kent.	139°42.2	-60°56.1
Kochab	137°20.1	74°03.8
Zuben'ubi	136°57.4	-16°08.3
Alphecca	126°04.7	26°38.3
Antares	112°17.2	-26°29.1
Atria	107°12.3	-69°04.4
Sabik	102°04.0	-15°45.2
Shaula	96°11.8	-37°07.3
Rasalhague	95°59.5	12°32.7
Eltanin	90°42.5	51°29.4
Kaus Aust.	83°33.8	-34°22.5
Vega	80°33.7	38°48.5
Nunki	75°48.9	-26°16.1
Altair	62°00.8	8°55.9
Peacock	53°07.0	-56°39.6
Deneb	49°26.2	45°22.0
Enif	33°39.6	9°59.1
Al Na'ir	27°33.9	-46°50.7
Fomalhaut	15°15.4	-29°29.7
Scheat	13°46.0	28°12.7
Markab	13°30.7	15°20.0

Aug 26 Sat	**SHA**	**Mer.pass**
Venus	225°59.7	10:38
Mars	180°38.2	13:41
Jupiter	316°38.6	04:37
Saturn	23°30.5	00:10

Aug 27 Sun	**SHA**	**Mer.pass**
Venus	226°18.2	10:33
Mars	180°03.2	13:39
Jupiter	316°36.8	04:33
Saturn	23°34.8	00:06

Aug 28 Mon	**SHA**	**Mer.pass**
Venus	226°34.4	10:28
Mars	179°28.2	13:37
Jupiter	316°35.2	04:29
Saturn	23°39.1	00:02

Horizontal parallax	
Venus:	0.5
Mars:	0.1

h	Sun		Moon				
Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°29.4	N10°34.4	72°33.7	4.7′	S27°27.3	3.7′	58.5′
1	194°29.5	33.5	86°57.4	4.6′	27°31.0	3.5′	58.6′
2	209°29.7	32.6	101°21.0	4.5′	27°34.5	3.3′	58.6′
3	224°29.9	·· 31.8	115°44.5	4.4′	27°37.8	3.2′	58.6′
4	239°30.1	30.9	130°07.9	4.3′	27°41.0	3.0′	58.7′
5	254°30.3	30.0	144°31.2	4.2′	27°44.0	2.8′	58.7′
6	269°30.4	N10°29.2	158°54.4	4.2′	S27°46.8	2.6′	58.7′
7	284°30.6	28.3	173°17.6	4.1′	27°49.4	2.4′	58.8′
8	299°30.8	27.4	187°40.6	4.0′	27°51.8	2.3′	58.8′
9	314°31.0	·· 26.6	202°03.6	3.9′	27°54.1	2.0′	58.9′
10	329°31.1	25.7	216°26.5	3.8′	27°56.1	1.9′	58.9′
11	344°31.3	24.8	230°49.4	3.8′	27°58.0	1.7′	58.9′
12	359°31.5	N10°24.0	245°12.1	3.7′	S27°59.7	1.5′	59.0′
13	14°31.7	23.1	259°34.8	3.6′	28°01.2	1.3′	59.0′
14	29°31.8	22.2	273°57.4	3.5′	28°02.5	1.2′	59.0′
15	44°32.0	·· 21.3	288°20.0	3.5′	28°03.7	0.9′	59.1′
16	59°32.2	20.5	302°42.4	3.4′	28°04.6	0.7′	59.1′
17	74°32.4	19.6	317°04.8	3.4′	28°05.3	0.6′	59.2′
18	89°32.6	N10°18.7	331°27.2	3.3′	S28°05.9	0.3′	59.2′
19	104°32.7	17.9	345°49.5	3.2′	28°06.2	0.2′	59.2′
20	119°32.9	17.0	0°11.7	3.2′	28°06.4	0.0′	59.3′
21	134°33.1	·· 16.1	14°33.9	3.1′	28°06.4	0.3′	59.3′
22	149°33.3	15.3	28°56.1	3.1′	28°06.1	0.4′	59.3′
23	164°33.4	14.4	43°18.1	3.0′	28°05.7	0.6′	59.4′
	SD = 15.8′	d = -0.9′	SD = 16.0′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°33.6	N10°13.5	57°40.2	3.0′	S28°05.1	0.9′	59.4′
1	194°33.8	12.6	72°02.2	3.0′	28°04.2	1.0′	59.5′
2	209°34.0	11.8	86°24.1	2.9′	28°03.2	1.2′	59.5′
3	224°34.2	·· 10.9	100°46.1	2.9′	28°02.0	1.5′	59.5′
4	239°34.3	10.0	115°08.0	2.9′	28°00.5	1.6′	59.6′
5	254°34.5	09.1	129°29.8	2.8′	27°58.9	1.8′	59.6′
6	269°34.7	N10°08.3	143°51.6	2.8′	S27°57.1	2.1′	59.6′
7	284°34.9	07.4	158°13.4	2.8′	27°55.0	2.2′	59.7′
8	299°35.1	06.5	172°35.2	2.8′	27°52.8	2.4′	59.7′
9	314°35.2	·· 05.6	186°57.0	2.7′	27°50.4	2.7′	59.7′
10	329°35.4	04.8	201°18.7	2.7′	27°47.7	2.8′	59.8′
11	344°35.6	03.9	215°40.4	2.7′	27°44.9	3.1′	59.8′
12	359°35.8	N10°03.0	230°02.1	2.7′	S27°41.8	3.2′	59.8′
13	14°36.0	02.1	244°23.8	2.7′	27°38.6	3.5′	59.9′
14	29°36.1	01.3	258°45.5	2.7′	27°35.1	3.6′	59.9′
15	44°36.3	10°00.4	273°07.2	2.7′	27°31.5	3.9′	59.9′
16	59°36.5	09°59.5	287°28.9	2.7′	27°27.6	4.0′	60.0′
17	74°36.7	58.6	301°50.6	2.7′	27°23.6	4.3′	60.0′
18	89°36.9	N09°57.8	316°12.3	2.7′	S27°19.3	4.4′	60.0′
19	104°37.1	56.9	330°34.0	2.7′	27°14.9	4.7′	60.1′
20	119°37.2	56.0	344°55.7	2.7′	27°10.2	4.9′	60.1′
21	134°37.4	·· 55.1	359°17.4	2.7′	27°05.3	5.1′	60.1′
22	149°37.6	54.2	13°39.1	2.7′	27°00.2	5.2′	60.2′
23	164°37.8	53.4	28°00.9	2.8′	26°55.0	5.5′	60.2′
	SD = 15.8′	d = -0.9′	SD = 16.2′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°38.0	N09°52.5	42°22.6	2.8′	S26°49.5	5.7′	60.2′
1	194°38.2	51.6	56°44.4	2.8′	26°43.8	5.8′	60.3′
2	209°38.3	50.7	71°06.2	2.8′	26°38.0	6.1′	60.3′
3	224°38.5	·· 49.9	85°28.1	2.9′	26°31.9	6.3′	60.3′
4	239°38.7	49.0	99°50.0	2.9′	26°25.6	6.5′	60.3′
5	254°38.9	48.1	114°11.9	2.9′	26°19.1	6.6′	60.4′
6	269°39.1	N09°47.2	128°33.8	3.0′	S26°12.5	6.9′	60.4′
7	284°39.3	46.3	142°55.8	3.0′	26°05.6	7.0′	60.4′
8	299°39.4	45.4	157°17.8	3.1′	25°58.6	7.3′	60.5′
9	314°39.6	·· 44.6	171°39.9	3.1′	25°51.3	7.4′	60.5′
10	329°39.8	43.7	186°02.0	3.1′	25°43.9	7.7′	60.5′
11	344°40.0	42.8	200°24.1	3.2′	25°36.2	7.8′	60.5′
12	359°40.2	N09°41.9	214°46.3	3.2′	S25°28.4	8.0′	60.6′
13	14°40.4	41.0	229°08.6	3.3′	25°20.4	8.2′	60.6′
14	29°40.6	40.2	243°30.9	3.4′	25°12.2	8.4′	60.6′
15	44°40.7	·· 39.3	257°53.2	3.4′	25°03.8	8.6′	60.7′
16	59°40.9	38.4	272°15.6	3.5′	24°55.2	8.8′	60.7′
17	74°41.1	37.5	286°38.1	3.5′	24°46.4	8.9′	60.7′
18	89°41.3	N09°36.6	301°00.6	3.6′	S24°37.5	9.2′	60.7′
19	104°41.5	35.7	315°23.2	3.7′	24°28.3	9.3′	60.7′
20	119°41.7	34.9	329°45.9	3.7′	24°19.0	9.5′	60.8′
21	134°41.9	·· 34.0	344°08.6	3.8′	24°09.5	9.7′	60.8′
22	149°42.0	33.1	358°31.4	3.9′	23°59.8	9.8′	60.8′
23	164°42.2	32.2	12°54.2	3.9′	23°50.0	10.1′	60.8′
	SD = 15.8′	d = -0.9′	SD = 16.4′				

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

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

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 67-86%
26	02:03	01:54	12:02	19:59	07:28	
27	01:46	01:37	12:02	21:03	08:31	
28	01:28	01:19	12:01	22:06	09:35	

August 29, 30, 31 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	336°56.7	203°44.8	N09°32.1	155°49.8	N00°14.6	293°30.4	N15°14.0	0°40.1	S11°48.5
1	351°59.2	218°47.8	32.5	170°50.8	13.9	308°32.8	14.0	15°42.7	48.6
2	7°01.6	233°50.8	32.9	185°51.8	13.3	323°35.2	14.0	30°45.3	48.6
3	22°04.1	248°53.8	·· 33.3	200°52.8	·· 12.6	338°37.6	·· 14.0	45°48.0	·· 48.7
4	37°06.6	263°56.7	33.6	215°53.8	12.0	353°40.0	14.0	60°50.6	48.8
5	52°09.0	278°59.7	34.0	230°54.8	11.3	8°42.5	14.1	75°53.3	48.8
6	67°11.5	294°02.7	N09°34.4	245°55.8	N00°10.6	23°44.9	N15°14.1	90°55.9	S11°48.9
7	82°13.9	309°05.6	34.8	260°56.8	10.0	38°47.3	14.1	105°58.6	49.0
8	97°16.4	324°08.6	35.2	275°57.8	09.3	53°49.7	14.1	121°01.2	49.1
9	112°18.9	339°11.5	·· 35.6	290°58.8	·· 08.7	68°52.1	·· 14.1	136°03.8	·· 49.1
10	127°21.3	354°14.5	35.9	305°59.8	08.0	83°54.5	14.1	151°06.5	49.2
11	142°23.8	9°17.4	36.3	321°00.8	07.3	98°56.9	14.1	166°09.1	49.3
12	157°26.3	24°20.4	N09°36.7	336°01.8	N00°06.7	113°59.3	N15°14.1	181°11.8	S11°49.3
13	172°28.7	39°23.3	37.1	351°02.8	06.0	129°01.7	14.1	196°14.4	49.4
14	187°31.2	54°26.2	37.5	6°03.8	05.4	144°04.1	14.1	211°17.1	49.5
15	202°33.7	69°29.2	·· 37.8	21°04.8	·· 04.7	159°06.6	·· 14.1	226°19.7	·· 49.6
16	217°36.1	84°32.1	38.2	36°05.8	04.0	174°09.0	14.1	241°22.3	49.6
17	232°38.6	99°35.0	38.6	51°06.8	03.4	189°11.4	14.1	256°25.0	49.7
18	247°41.1	114°37.9	N09°39.0	66°07.8	N00°02.7	204°13.8	N15°14.1	271°27.6	S11°49.8
19	262°43.5	129°40.8	39.3	81°08.8	02.1	219°16.2	14.1	286°30.3	49.8
20	277°46.0	144°43.7	39.7	96°09.8	01.4	234°18.6	14.2	301°32.9	49.9
21	292°48.4	159°46.6	·· 40.1	111°10.8	·· 00.8	249°21.0	·· 14.2	316°35.6	·· 50.0
22	307°50.9	174°49.5	40.5	126°11.8	N00°00.1	264°23.5	14.2	331°38.2	50.0
23	322°53.4	189°52.4	40.9	141°12.8	S00°00.6	279°25.9	14.2	346°40.8	50.1
Mer.pass. 01:32		ν 3.0′ d 0.4′ m -4.54		ν 1.0′ d -0.7′ m 1.76		ν 2.4′ d 0.0′ m -2.57		ν 2.6′ d -0.1′ m 0.43	

Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	337°55.8	204°55.3	N09°41.2	156°13.8	S00°01.2	294°28.3	N15°14.2	1°43.5	S11°50.2
1	352°58.3	219°58.2	41.6	171°14.8	01.9	309°30.7	14.2	16°46.1	50.3
2	8°00.8	235°01.1	42.0	186°15.8	02.5	324°33.1	14.2	31°48.8	50.3
3	23°03.2	250°03.9	·· 42.4	201°16.8	·· 03.2	339°35.5	·· 14.2	46°51.4	·· 50.4
4	38°05.7	265°06.8	42.7	216°17.8	03.9	354°38.0	14.2	61°54.1	50.5
5	53°08.2	280°09.7	43.1	231°18.8	04.5	9°40.4	14.2	76°56.7	50.5
6	68°10.6	295°12.5	N09°43.5	246°19.8	S00°05.2	24°42.8	N15°14.2	91°59.3	S11°50.6
7	83°13.1	310°15.4	43.9	261°20.8	05.8	39°45.2	14.2	107°02.0	50.7
8	98°15.6	325°18.3	44.2	276°21.8	06.5	54°47.6	14.2	122°04.6	50.8
9	113°18.0	340°21.1	·· 44.6	291°22.8	·· 07.2	69°50.0	·· 14.2	137°07.3	·· 50.8
10	128°20.5	355°23.9	45.0	306°23.8	07.8	84°52.5	14.2	152°09.9	50.9
11	143°22.9	10°26.8	45.3	321°24.8	08.5	99°54.9	14.2	167°12.6	51.0
12	158°25.4	25°29.6	N09°45.7	336°25.8	S00°09.1	114°57.3	N15°14.2	182°15.2	S11°51.0
13	173°27.9	40°32.5	46.1	351°26.8	09.8	129°59.7	14.2	197°17.8	51.1
14	188°30.3	55°35.3	46.5	6°27.8	10.5	145°02.1	14.2	212°20.5	51.2
15	203°32.8	70°38.1	·· 46.8	21°28.8	·· 11.1	160°04.6	·· 14.3	227°23.1	·· 51.3
16	218°35.3	85°40.9	47.2	36°29.8	11.8	175°07.0	14.3	242°25.8	51.3
17	233°37.7	100°43.7	47.6	51°30.8	12.4	190°09.4	14.3	257°28.4	51.4
18	248°40.2	115°46.6	N09°47.9	66°31.8	S00°13.1	205°11.8	N15°14.3	272°31.1	S11°51.5
19	263°42.7	130°49.4	48.3	81°32.8	13.8	220°14.3	14.3	287°33.7	51.5
20	278°45.1	145°52.2	48.7	96°33.8	14.4	235°16.7	14.3	302°36.3	51.6
21	293°47.6	160°55.0	·· 49.0	111°34.8	·· 15.1	250°19.1	·· 14.3	317°39.0	·· 51.7
22	308°50.0	175°57.8	49.4	126°35.8	15.7	265°21.5	14.3	332°41.6	51.8
23	323°52.5	191°00.6	49.8	141°36.8	16.4	280°23.9	14.3	347°44.3	51.8
Mer.pass. 01:28		ν 2.9′ d 0.4′ m -4.58		ν 1.0′ d -0.7′ m 1.76		ν 2.4′ d 0.0′ m -2.58		ν 2.6′ d -0.1′ m 0.44	

Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	338°55.0	206°03.3	N09°50.1	156°37.8	S00°17.1	295°26.4	N15°14.3	2°46.9	S11°51.9
1	353°57.4	221°06.1	50.5	171°38.8	17.7	310°28.8	14.3	17°49.6	52.0
2	8°59.9	236°08.9	50.9	186°39.8	18.4	325°31.2	14.3	32°52.2	52.0
3	24°02.4	251°11.7	·· 51.2	201°40.8	·· 19.0	340°33.6	·· 14.3	47°54.8	·· 52.1
4	39°04.8	266°14.4	51.6	216°41.8	19.7	355°36.1	14.3	62°57.5	52.2
5	54°07.3	281°17.2	52.0	231°42.8	20.4	10°38.5	14.3	78°00.1	52.2
6	69°09.8	296°20.0	N09°52.3	246°43.8	S00°21.0	25°40.9	N15°14.3	93°02.8	S11°52.3
7	84°12.2	311°22.7	52.7	261°44.8	21.7	40°43.3	14.3	108°05.4	52.4
8	99°14.7	326°25.5	53.1	276°45.8	22.3	55°45.8	14.3	123°08.1	52.5
9	114°17.2	341°28.2	·· 53.4	291°46.8	·· 23.0	70°48.2	·· 14.3	138°10.7	·· 52.5
10	129°19.6	356°31.0	53.8	306°47.8	23.7	85°50.6	14.3	153°13.3	52.6
11	144°22.1	11°33.7	54.2	321°48.8	24.3	100°53.1	14.3	168°16.0	52.7
12	159°24.5	26°36.4	N09°54.5	336°49.8	S00°25.0	115°55.5	N15°14.3	183°18.6	S11°52.7
13	174°27.0	41°39.2	54.9	351°50.8	25.6	130°57.9	14.3	198°21.3	52.8
14	189°29.5	56°41.9	55.2	6°51.8	26.3	146°00.3	14.3	213°23.9	52.9
15	204°31.9	71°44.6	·· 55.6	21°52.8	·· 27.0	161°02.8	·· 14.3	228°26.6	·· 53.0
16	219°34.4	86°47.3	56.0	36°53.8	27.6	176°05.2	14.3	243°29.2	53.0
17	234°36.9	101°50.0	56.3	51°54.8	28.3	191°07.6	14.3	258°31.8	53.1
18	249°39.3	116°52.8	N09°56.7	66°55.8	S00°28.9	206°10.1	N15°14.3	273°34.5	S11°53.2
19	264°41.8	131°55.5	57.0	81°56.8	29.6	221°12.5	14.3	288°37.1	53.2
20	279°44.3	146°58.2	57.4	96°57.8	30.3	236°14.9	14.3	303°39.8	53.3
21	294°46.7	162°00.9	·· 57.8	111°58.8	·· 30.9	251°17.3	·· 14.3	318°42.4	·· 53.4
22	309°49.2	177°03.5	58.1	126°59.8	31.6	266°19.8	14.3	333°45.0	53.4
23	324°51.6	192°06.2	58.5	142°00.8	32.2	281°22.2	14.3	348°47.7	53.5
Mer.pass. 01:24		ν 2.8′ d 0.4′ m -4.61		ν 1.0′ d -0.7′ m 1.75		ν 2.4′ d 0.0′ m -2.58		ν 2.6′ d -0.1′ m 0.45	

Stars

	SHA	**Dec**
Alpheratz	357°35.6	29°13.3
Ankaa	353°07.9	-42°10.5
Schedar	349°31.9	56°39.9
Diphda	348°48.1	-17°51.3
Achernar	335°20.6	-57°06.7
Hamal	327°52.3	23°34.4
Polaris	314°25.8	89°21.5
Acamar	315°12.5	-40°12.3
Menkar	314°07.2	4°11.0
Mirfak	308°29.8	49°56.5
Aldebaran	290°40.9	16°33.4
Rigel	281°05.0	-8°10.3
Capella	280°23.7	46°01.2
Bellatrix	278°24.2	6°22.4
Elnath	278°03.4	28°37.6
Alnilam	275°39.0	-1°11.1
Betelgeuse	270°53.4	7°24.8
Canopus	263°53.2	-52°42.1
Sirius	258°27.4	-16°44.7
Adhara	255°07.0	-29°00.0
Procyon	244°52.3	5°10.0
Pollux	243°19.0	27°58.2
Avior	234°15.8	-59°34.8
Suhail	222°47.6	-43°31.5
Miaplacidus	221°39.4	-69°48.6
Alphard	217°49.2	-8°45.5
Regulus	207°36.0	11°51.3
Dubhe	193°43.0	61°37.6
Denebola	182°26.4	14°26.6
Gienah	175°45.0	-17°40.3
Acrux	173°02.0	-63°13.9
Gacrux	171°53.4	-57°14.8
Alioth	166°14.4	55°50.1
Spica	158°23.7	-11°17.0
Alkaid	152°53.2	49°12.0
Hadar	148°38.0	-60°29.4
Menkent	147°59.2	-36°29.2
Arcturus	145°49.1	19°03.8
Rigil Kent.	139°42.2	-60°56.1
Kochab	137°20.2	74°03.8
Zuben'ubi	136°57.4	-16°08.4
Alphecca	126°04.8	26°38.3
Antares	112°17.2	-26°29.1
Atria	107°12.3	-69°04.4
Sabik	102°04.0	-15°45.2
Shaula	96°11.8	-37°07.3
Rasalhague	95°59.5	12°32.7
Eltanin	90°42.5	51°29.4
Kaus Aust.	83°33.8	-34°22.5
Vega	80°33.8	38°48.5
Nunki	75°48.9	-26°16.1
Altair	62°00.8	8°55.9
Peacock	53°07.0	-56°39.6
Deneb	49°26.2	45°22.0
Enif	33°39.6	9°59.1
Al Na'ir	27°33.8	-46°50.8
Fomalhaut	15°15.4	-29°29.7
Scheat	13°45.9	28°12.7
Markab	13°30.7	15°20.0

Aug 29 Tue	**SHA**	**Mer.pass**
Venus	226°48.1	10:23
Mars	178°53.1	13:36
Jupiter	316°33.7	04:25
Saturn	23°43.4	23:53

Aug 30 Wed	**SHA**	**Mer.pass**
Venus	226°59.5	10:18
Mars	178°18.0	13:34
Jupiter	316°32.5	04:21
Saturn	23°47.6	23:49

Aug 31 Thu	**SHA**	**Mer.pass**
Venus	227°08.4	10:14
Mars	177°42.8	13:33
Jupiter	316°31.4	04:18
Saturn	23°51.9	23:45

Horizontal parallax	
Venus:	0.4
Mars:	0.1

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°42.4	N09°31.3	27°17.2	4.0′	S23°39.9	10.2′	60.9′
1	194°42.6	30.4	41°40.2	4.1′	23°29.7	10.4′	60.9′
2	209°42.8	29.5	56°03.3	4.1′	23°19.3	10.5′	60.9′
3	224°43.0	·· 28.7	70°26.4	4.2′	23°08.8	10.7′	60.9′
4	239°43.2	27.8	84°49.6	4.3′	22°58.1	10.9′	60.9′
5	254°43.4	26.9	99°12.9	4.4′	22°47.2	11.1′	61.0′
6	269°43.5	N09°26.0	113°36.3	4.5′	S22°36.1	11.2′	61.0′
7	284°43.7	25.1	127°59.8	4.5′	22°24.9	11.4′	61.0′
8	299°43.9	24.2	142°23.3	4.6′	22°13.5	11.6′	61.0′
9	314°44.1	·· 23.3	156°46.9	4.7′	22°01.9	11.7′	61.0′
10	329°44.3	22.5	171°10.6	4.8′	21°50.2	11.8′	61.1′
11	344°44.5	21.6	185°34.4	4.9′	21°38.4	12.1′	61.1′
12	359°44.7	N09°20.7	199°58.3	5.0′	S21°26.3	12.2′	61.1′
13	14°44.9	19.8	214°22.2	5.0′	21°14.1	12.3′	61.1′
14	29°45.1	18.9	228°46.3	5.1′	21°01.8	12.5′	61.1′
15	44°45.2	·· 18.0	243°10.4	5.2′	20°49.3	12.6′	61.1′
16	59°45.4	17.1	257°34.6	5.3′	20°36.7	12.8′	61.1′
17	74°45.6	16.2	271°58.9	5.4′	20°23.9	12.9′	61.2′
18	89°45.8	N09°15.3	286°23.3	5.5′	S20°11.0	13.1′	61.2′
19	104°46.0	14.4	300°47.8	5.6′	19°57.9	13.2′	61.2′
20	119°46.2	13.6	315°12.4	5.7′	19°44.7	13.3′	61.2′
21	134°46.4	·· 12.7	329°37.0	5.7′	19°31.4	13.5′	61.2′
22	149°46.6	11.8	344°01.8	5.8′	19°17.9	13.6′	61.2′
23	164°46.8	10.9	358°26.6	5.9′	19°04.3	13.7′	61.2′
	SD = 15.8′	d = -0.9′	SD = 16.6′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°47.0	N09°10.0	12°51.6	6.0′	S18°50.6	13.9′	61.2′
1	194°47.1	09.1	27°16.6	6.1′	18°36.7	14.0′	61.2′
2	209°47.3	08.2	41°41.7	6.2′	18°22.7	14.1′	61.3′
3	224°47.5	·· 07.3	56°06.9	6.3′	18°08.6	14.3′	61.3′
4	239°47.7	06.4	70°32.2	6.4′	17°54.3	14.4′	61.3′
5	254°47.9	05.5	84°57.6	6.5′	17°39.9	14.4′	61.3′
6	269°48.1	N09°04.6	99°23.0	6.6′	S17°25.5	14.6′	61.3′
7	284°48.3	03.7	113°48.6	6.7′	17°10.9	14.8′	61.3′
8	299°48.5	02.9	128°14.3	6.7′	16°56.1	14.8′	61.3′
9	314°48.7	·· 02.0	142°40.0	6.8′	16°41.3	15.0′	61.3′
10	329°48.9	01.1	157°05.8	6.9′	16°26.3	15.0′	61.3′
11	344°49.1	09°00.2	171°31.8	7.0′	16°11.3	15.2′	61.3′
12	359°49.3	N08°59.3	185°57.8	7.1′	S15°56.1	15.2′	61.3′
13	14°49.5	58.4	200°23.9	7.2′	15°40.9	15.4′	61.3′
14	29°49.6	57.5	214°50.1	7.3′	15°25.5	15.5′	61.3′
15	44°49.8	·· 56.6	229°16.3	7.4′	15°10.0	15.5′	61.3′
16	59°50.0	55.7	243°42.7	7.5′	14°54.5	15.7′	61.3′
17	74°50.2	54.8	258°09.1	7.5′	14°38.8	15.7′	61.3′
18	89°50.4	N08°53.9	272°35.7	7.6′	S14°23.1	15.8′	61.3′
19	104°50.6	53.0	287°02.3	7.7′	14°07.3	16.0′	61.3′
20	119°50.8	52.1	301°29.0	7.8′	13°51.3	16.0′	61.3′
21	134°51.0	·· 51.2	315°55.8	7.9′	13°35.3	16.1′	61.3′
22	149°51.2	50.3	330°22.7	8.0′	13°19.2	16.1′	61.3′
23	164°51.4	49.4	344°49.6	8.0′	13°03.1	16.3′	61.3′
	SD = 15.8′	d = -0.9′	SD = 16.7′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°51.6	N08°48.5	359°16.7	8.1′	S12°46.8	16.3′	61.3′
1	194°51.8	47.6	13°43.8	8.2′	12°30.5	16.4′	61.3′
2	209°52.0	46.7	28°11.0	8.3′	12°14.1	16.5′	61.3′
3	224°52.2	·· 45.8	42°38.3	8.4′	11°57.6	16.5′	61.3′
4	239°52.4	44.9	57°05.7	8.4′	11°41.1	16.7′	61.3′
5	254°52.6	44.0	71°33.1	8.5′	11°24.4	16.6′	61.3′
6	269°52.7	N08°43.1	86°00.6	8.6′	S11°07.8	16.8′	61.3′
7	284°52.9	42.2	100°28.2	8.7′	10°51.0	16.8′	61.2′
8	299°53.1	41.3	114°55.9	8.7′	10°34.2	16.8′	61.2′
9	314°53.3	·· 40.4	129°23.6	8.8′	10°17.4	16.9′	61.2′
10	329°53.5	39.5	143°51.4	8.9′	10°00.5	17.0′	61.2′
11	344°53.7	38.6	158°19.3	9.0′	09°43.5	17.0′	61.2′
12	359°53.9	N08°37.7	172°47.3	9.0′	S09°26.5	17.1′	61.2′
13	14°54.1	36.8	187°15.3	9.1′	09°09.4	17.1′	61.2′
14	29°54.3	35.9	201°43.4	9.2′	08°52.3	17.2′	61.2′
15	44°54.5	·· 35.0	216°11.6	9.2′	08°35.1	17.2′	61.2′
16	59°54.7	34.1	230°39.9	9.3′	08°17.9	17.2′	61.1′
17	74°54.9	33.2	245°08.2	9.4′	08°00.7	17.3′	61.1′
18	89°55.1	N08°32.3	259°36.5	9.4′	S07°43.4	17.3′	61.1′
19	104°55.3	31.4	274°05.0	9.5′	07°26.1	17.4′	61.1′
20	119°55.5	30.5	288°33.5	9.6′	07°08.7	17.4′	61.1′
21	134°55.7	·· 29.6	303°02.0	9.6′	06°51.3	17.4′	61.1′
22	149°55.9	28.7	317°30.6	9.7′	06°33.9	17.4′	61.1′
23	164°56.1	27.8	331°59.3	9.7′	06°16.5	17.5′	61.0′
	SD = 15.8′	d = -0.9′	SD = 16.7′				

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

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

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 13-15 93-100%
29	01:10	01:01	12:01	23:06	10:37	
30	00:52	00:43	12:01	–:–	11:35	
31	00:34	00:24	12:00	00:03	12:30	

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

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	339°54.1	207°08.9	N09°58.8	157°01.8	S00°32.9	296°24.6	N15°14.3	3°50.3	S11°53.6
1	354°56.6	222°11.6	59.2	172°02.8	33.6	311°27.1	14.3	18°53.0	53.7
2	9°59.0	237°14.3	59.5	187°03.8	34.2	326°29.5	14.3	33°55.6	53.7
3	25°01.5	252°16.9	09°59.9	202°04.8	·· 34.9	341°31.9	·· 14.3	48°58.3	·· 53.8
4	40°04.0	267°19.6	10°00.2	217°05.8	35.5	356°34.4	14.3	64°00.9	53.9
5	55°06.4	282°22.3	00.6	232°06.7	36.2	11°36.8	14.3	79°03.5	53.9
6	70°08.9	297°24.9	N10°00.9	247°07.7	S00°36.9	26°39.2	N15°14.3	94°06.2	S11°54.0
7	85°11.4	312°27.6	01.3	262°08.7	37.5	41°41.7	14.3	109°08.8	54.1
8	100°13.8	327°30.2	01.7	277°09.7	38.2	56°44.1	14.3	124°11.5	54.2
9	115°16.3	342°32.9	·· 02.0	292°10.7	·· 38.8	71°46.5	·· 14.3	139°14.1	·· 54.2
10	130°18.8	357°35.5	02.4	307°11.7	39.5	86°49.0	14.3	154°16.8	54.3
11	145°21.2	12°38.2	02.7	322°12.7	40.2	101°51.4	14.3	169°19.4	54.4
12	160°23.7	27°40.8	N10°03.1	337°13.7	S00°40.8	116°53.9	N15°14.3	184°22.0	S11°54.4
13	175°26.1	42°43.4	03.4	352°14.7	41.5	131°56.3	14.3	199°24.7	54.5
14	190°28.6	57°46.0	03.8	7°15.7	42.2	146°58.7	14.3	214°27.3	54.6
15	205°31.1	72°48.7	·· 04.1	22°16.7	·· 42.8	162°01.2	·· 14.3	229°30.0	·· 54.6
16	220°33.5	87°51.3	04.5	37°17.7	43.5	177°03.6	14.3	244°32.6	54.7
17	235°36.0	102°53.9	04.8	52°18.7	44.1	192°06.0	14.3	259°35.3	54.8
18	250°38.5	117°56.5	N10°05.2	67°19.7	S00°44.8	207°08.5	N15°14.3	274°37.9	S11°54.9
19	265°40.9	132°59.1	05.5	82°20.7	45.5	222°10.9	14.3	289°40.5	54.9
20	280°43.4	148°01.7	05.8	97°21.7	46.1	237°13.4	14.3	304°43.2	55.0
21	295°45.9	163°04.3	·· 06.2	112°22.7	·· 46.8	252°15.8	·· 14.3	319°45.8	·· 55.1
22	310°48.3	178°06.9	06.5	127°23.7	47.4	267°18.2	14.3	334°48.5	55.1
23	325°50.8	193°09.5	06.9	142°24.7	48.1	282°20.7	14.3	349°51.1	55.2
Mer.pass. 01:20		ν 2.7′	d 0.4′	ν 1.0′	d -0.7′	ν 2.4′	d 0.0′	ν 2.6′	d -0.1′
			m -4.64		m 1.75		m -2.59		m 0.46

Sat	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	340°53.3	208°12.1	N10°07.2	157°25.7	S00°48.8	297°23.1	N15°14.3	4°53.7	S11°55.3
1	355°55.7	223°14.6	07.6	172°26.7	49.4	312°25.6	14.3	19°56.4	55.3
2	10°58.2	238°17.2	07.9	187°27.7	50.1	327°28.0	14.3	34°59.0	55.4
3	26°00.6	253°19.8	·· 08.3	202°28.6	·· 50.7	342°30.4	·· 14.3	50°01.7	·· 55.5
4	41°03.1	268°22.3	08.6	217°29.6	51.4	357°32.9	14.3	65°04.3	55.6
5	56°05.6	283°24.9	08.9	232°30.6	52.1	12°35.3	14.3	80°07.0	55.6
6	71°08.0	298°27.5	N10°09.3	247°31.6	S00°52.7	27°37.8	N15°14.3	95°09.6	S11°55.7
7	86°10.5	313°30.0	09.6	262°32.6	53.4	42°40.2	14.3	110°12.2	55.8
8	101°13.0	328°32.6	10.0	277°33.6	54.0	57°42.6	14.3	125°14.9	55.8
9	116°15.4	343°35.1	·· 10.3	292°34.6	·· 54.7	72°45.1	·· 14.3	140°17.5	·· 55.9
10	131°17.9	358°37.6	10.6	307°35.6	55.4	87°47.5	14.3	155°20.2	56.0
11	146°20.4	13°40.2	11.0	322°36.6	56.0	102°50.0	14.3	170°22.8	56.0
12	161°22.8	28°42.7	N10°11.3	337°37.6	S00°56.7	117°52.4	N15°14.3	185°25.5	S11°56.1
13	176°25.3	43°45.2	11.6	352°38.6	57.3	132°54.9	14.3	200°28.1	56.2
14	191°27.7	58°47.8	12.0	7°39.6	58.0	147°57.3	14.3	215°30.7	56.3
15	206°30.2	73°50.3	·· 12.3	22°40.6	·· 58.7	162°59.8	·· 14.3	230°33.4	·· 56.3
16	221°32.7	88°52.8	12.7	37°41.6	00°59.3	178°02.2	14.3	245°36.0	56.4
17	236°35.1	103°55.3	13.0	52°42.6	01°00.0	193°04.6	14.3	260°38.7	56.5
18	251°37.6	118°57.8	N10°13.3	67°43.6	S01°00.7	208°07.1	N15°14.3	275°41.3	S11°56.5
19	266°40.1	134°00.3	13.7	82°44.5	01.3	223°09.5	14.3	290°43.9	56.6
20	281°42.5	149°02.8	14.0	97°45.5	02.0	238°12.0	14.3	305°46.6	56.7
21	296°45.0	164°05.3	·· 14.3	112°46.5	·· 02.6	253°14.4	·· 14.3	320°49.2	·· 56.7
22	311°47.5	179°07.8	14.7	127°47.5	03.3	268°16.9	14.3	335°51.9	56.8
23	326°49.9	194°10.3	15.0	142°48.5	04.0	283°19.3	14.3	350°54.5	56.9
Mer.pass. 01:16		ν 2.6′	d 0.3′	ν 1.0′	d -0.7′	ν 2.4′	d -0.0′	ν 2.6′	d -0.1′
			m -4.67		m 1.75		m -2.60		m 0.46

Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	341°52.4	209°12.8	N10°15.3	157°49.5	S01°04.6	298°21.8	N15°14.3	5°57.2	S11°57.0
1	356°54.9	224°15.2	15.6	172°50.5	05.3	313°24.2	14.3	20°59.8	57.0
2	11°57.3	239°17.7	16.0	187°51.5	05.9	328°26.7	14.3	36°02.4	57.1
3	26°59.8	254°20.2	·· 16.3	202°52.5	·· 06.6	343°29.1	·· 14.3	51°05.1	·· 57.2
4	42°02.2	269°22.6	16.6	217°53.5	07.3	358°31.6	14.3	66°07.7	57.2
5	57°04.7	284°25.1	17.0	232°54.5	07.9	13°34.0	14.2	81°10.4	57.3
6	72°07.2	299°27.6	N10°17.3	247°55.5	S01°08.6	28°36.5	N15°14.2	96°13.0	S11°57.4
7	87°09.6	314°30.0	17.6	262°56.5	09.2	43°38.9	14.2	111°15.6	57.4
8	102°12.1	329°32.5	17.9	277°57.4	09.9	58°41.4	14.2	126°18.3	57.5
9	117°14.6	344°34.9	·· 18.3	292°58.4	·· 10.6	73°43.8	·· 14.2	141°20.9	·· 57.6
10	132°17.0	359°37.3	18.6	307°59.4	11.2	88°46.3	14.2	156°23.6	57.6
11	147°19.5	14°39.8	18.9	323°00.4	11.9	103°48.7	14.2	171°26.2	57.7
12	162°22.0	29°42.2	N10°19.2	338°01.4	S01°12.6	118°51.2	N15°14.2	186°28.8	S11°57.8
13	177°24.4	44°44.6	19.6	353°02.4	13.2	133°53.6	14.2	201°31.5	57.9
14	192°26.9	59°47.1	19.9	8°03.4	13.9	148°56.1	14.2	216°34.1	57.9
15	207°29.3	74°49.5	·· 20.2	23°04.4	·· 14.5	163°58.5	·· 14.2	231°36.8	·· 58.0
16	222°31.8	89°51.9	20.5	38°05.4	15.2	179°01.0	14.2	246°39.4	58.1
17	237°34.3	104°54.3	20.8	53°06.4	15.9	194°03.5	14.2	261°42.1	58.1
18	252°36.7	119°56.7	N10°21.2	68°07.4	S01°16.5	209°05.9	N15°14.2	276°44.7	S11°58.2
19	267°39.2	134°59.1	21.5	83°08.4	17.2	224°08.4	14.2	291°47.3	58.3
20	282°41.7	150°01.5	21.8	98°09.3	17.8	239°10.8	14.2	306°50.0	58.3
21	297°44.1	165°03.9	·· 22.1	113°10.3	·· 18.5	254°13.3	·· 14.2	321°52.6	·· 58.4
22	312°46.6	180°06.3	22.4	128°11.3	19.2	269°15.7	14.2	336°55.3	58.5
23	327°49.1	195°08.7	22.8	143°12.3	19.8	284°18.2	14.2	351°57.9	58.6
Mer.pass. 01:12		ν 2.5′	d 0.3′	ν 1.0′	d -0.7′	ν 2.4′	d -0.0′	ν 2.6′	d -0.1′
			m -4.69		m 1.75		m -2.61		m 0.47

Stars

	SHA	**Dec**
Alpheratz	357°35.6	29°13.3
Ankaa	353°07.9	-42°10.5
Schedar	349°31.9	56°39.9
Diphda	348°48.1	-17°51.3
Achernar	335°20.6	-57°06.8
Hamal	327°52.3	23°34.4
Polaris	314°24.6	89°21.5
Acamar	315°12.4	-40°12.3
Menkar	314°07.2	4°11.0
Mirfak	308°29.7	49°56.5
Aldebaran	290°40.9	16°33.4
Rigel	281°05.0	-8°10.3
Capella	280°23.6	46°01.2
Bellatrix	278°24.2	6°22.4
Elnath	278°03.4	28°37.6
Alnilam	275°39.0	-1°11.0
Betelgeuse	270°53.4	7°24.8
Canopus	263°53.1	-52°42.1
Sirius	258°27.4	-16°44.7
Adhara	255°07.0	-29°00.0
Procyon	244°52.2	5°10.0
Pollux	243°18.9	27°58.2
Avior	234°15.7	-59°34.8
Suhail	222°47.6	-43°31.4
Miaplacidus	221°39.4	-69°48.6
Alphard	217°49.2	-8°45.5
Regulus	207°36.0	11°51.3
Dubhe	193°43.0	61°37.6
Denebola	182°26.4	14°26.6
Gienah	175°45.0	-17°40.3
Acrux	173°02.0	-63°13.8
Gacrux	171°53.4	-57°14.8
Alioth	166°14.4	55°50.1
Spica	158°23.7	-11°17.0
Alkaid	152°53.2	49°12.0
Hadar	148°38.0	-60°29.3
Menkent	147°59.2	-36°29.2
Arcturus	145°49.1	19°03.8
Rigil Kent.	139°42.2	-60°56.1
Kochab	137°20.2	74°03.8
Zuben'ubi	136°57.4	-16°08.3
Alphecca	126°04.8	26°38.3
Antares	112°17.2	-26°29.1
Atria	107°12.4	-69°04.4
Sabik	102°04.0	-15°45.2
Shaula	96°11.8	-37°07.3
Rasalhague	95°59.5	12°32.7
Eltanin	90°42.5	51°29.4
Kaus Aust.	83°33.8	-34°22.5
Vega	80°33.8	38°48.5
Nunki	75°48.9	-26°16.1
Altair	62°00.8	8°56.0
Peacock	53°07.0	-56°39.6
Deneb	49°26.2	45°22.0
Enif	33°39.6	9°59.1
Al Na'ir	27°33.8	-46°50.8
Fomalhaut	15°15.4	-29°29.7
Scheat	13°45.9	28°12.7
Markab	13°30.7	15°20.0

Sep 01 Fri	**SHA**	**Mer.pass**
Venus	227°14.8	10:10
Mars	177°07.7	13:31
Jupiter	316°30.5	04:14
Saturn	23°56.2	23:40

Sep 02 Sat	**SHA**	**Mer.pass**
Venus	227°18.8	10:05
Mars	176°32.4	13:29
Jupiter	316°29.9	04:10
Saturn	24°00.5	23:36

Sep 03 Sun	**SHA**	**Mer.pass**
Venus	227°20.4	10:02
Mars	175°57.1	13:28
Jupiter	316°29.4	04:06
Saturn	24°04.8	23:32

Horizontal parallax	
Venus:	0.4
Mars:	0.1

h	Sun		Moon				
Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°56.3	N08°26.9	346°28.1	9.8′	S05°59.0	17.5′	61.0′
1	194°56.5	26.0	0°56.9	9.9′	05°41.5	17.5′	61.0′
2	209°56.7	25.1	15°25.7	9.9′	05°24.0	17.6′	61.0′
3	224°56.9	·· 24.2	29°54.6	10.0′	05°06.4	17.5′	61.0′
4	239°57.1	23.3	44°23.6	10.0′	04°48.9	17.6′	60.9′
5	254°57.3	22.4	58°52.6	10.1′	04°31.3	17.6′	60.9′
6	269°57.5	N08°21.5	73°21.6	10.1′	S04°13.7	17.5′	60.9′
7	284°57.7	20.6	87°50.8	10.2′	03°56.2	17.6′	60.9′
8	299°57.9	19.7	102°19.9	10.2′	03°38.6	17.7′	60.9′
9	314°58.1	·· 18.8	116°49.1	10.3′	03°20.9	17.6′	60.8′
10	329°58.3	17.9	131°18.4	10.3′	03°03.3	17.6′	60.8′
11	344°58.5	17.0	145°47.7	10.3′	02°45.7	17.6′	60.8′
12	359°58.7	N08°16.1	160°17.0	10.4′	S02°28.1	17.6′	60.8′
13	14°58.9	15.2	174°46.4	10.4′	02°10.5	17.6′	60.7′
14	29°59.1	14.3	189°15.8	10.5′	01°52.9	17.6′	60.7′
15	44°59.3	·· 13.4	203°45.3	10.5′	01°35.3	17.7′	60.7′
16	59°59.5	12.4	218°14.8	10.5′	01°17.6	17.5′	60.7′
17	74°59.7	11.5	232°44.4	10.6′	01°00.1	17.6′	60.6′
18	89°59.9	N08°10.6	247°13.9	10.6′	S00°42.5	17.6′	60.6′
19	105°00.1	09.7	261°43.5	10.6′	00°24.9	17.6′	60.6′
20	120°00.3	08.8	276°13.2	10.7′	S00°07.3	17.5′	60.6′
21	135°00.5	·· 07.9	290°42.9	10.7′	N00°10.2	17.5′	60.5′
22	150°00.7	07.0	305°12.6	10.7′	00°27.7	17.5′	60.5′
23	165°00.9	06.1	319°42.3	10.8′	00°45.2	17.5′	60.5′
	SD = 15.8′	d = -0.9′	SD = 16.6′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°01.1	N08°05.2	334°12.1	10.8′	N01°02.7	17.5′	60.4′
1	195°01.3	04.3	348°41.9	10.8′	01°20.2	17.4′	60.4′
2	210°01.5	03.4	3°11.7	10.8′	01°37.6	17.4′	60.4′
3	225°01.7	·· 02.5	17°41.6	10.9′	01°55.0	17.4′	60.4′
4	240°01.9	01.5	32°11.4	10.9′	02°12.4	17.3′	60.3′
5	255°02.1	08°00.6	46°41.3	10.9′	02°29.7	17.4′	60.3′
6	270°02.3	N07°59.7	61°11.3	10.9′	N02°47.1	17.3′	60.3′
7	285°02.5	58.8	75°41.2	11.0′	03°04.4	17.2′	60.2′
8	300°02.7	57.9	90°11.1	11.0′	03°21.6	17.2′	60.2′
9	315°02.9	·· 57.0	104°41.1	11.0′	03°38.8	17.2′	60.2′
10	330°03.1	56.1	119°11.1	11.0′	03°56.0	17.1′	60.1′
11	345°03.3	55.2	133°41.1	11.0′	04°13.1	17.1′	60.1′
12	0°03.5	N07°54.3	148°11.1	11.0′	N04°30.2	17.0′	60.1′
13	15°03.7	53.4	162°41.2	11.0′	04°47.2	17.0′	60.0′
14	30°03.9	52.4	177°11.2	11.1′	05°04.2	17.0′	60.0′
15	45°04.1	·· 51.5	191°41.3	11.1′	05°21.2	16.9′	60.0′
16	60°04.3	50.6	206°11.3	11.1′	05°38.1	16.9′	59.9′
17	75°04.5	49.7	220°41.4	11.1′	05°55.0	16.8′	59.9′
18	90°04.7	N07°48.8	235°11.5	11.1′	N06°11.8	16.7′	59.9′
19	105°04.9	47.9	249°41.6	11.1′	06°28.5	16.7′	59.8′
20	120°05.1	47.0	264°11.7	11.1′	06°45.2	16.6′	59.8′
21	135°05.3	·· 46.1	278°41.7	11.1′	07°01.8	16.6′	59.8′
22	150°05.5	45.1	293°11.8	11.1′	07°18.4	16.5′	59.7′
23	165°05.7	44.2	307°41.9	11.1′	07°34.9	16.5′	59.7′
	SD = 15.8′	d = -0.9′	SD = 16.5′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°05.9	N07°43.3	322°12.0	11.1′	N07°51.4	16.4′	59.6′
1	195°06.1	42.4	336°42.1	11.1′	08°07.8	16.3′	59.6′
2	210°06.3	41.5	351°12.2	11.1′	08°24.1	16.3′	59.6′
3	225°06.5	·· 40.6	5°42.3	11.1′	08°40.4	16.2′	59.5′
4	240°06.7	39.7	20°12.4	11.1′	08°56.6	16.1′	59.5′
5	255°06.9	38.7	34°42.5	11.1′	09°12.7	16.1′	59.5′
6	270°07.1	N07°37.8	49°12.6	11.1′	N09°28.8	16.0′	59.4′
7	285°07.3	36.9	63°42.7	11.1′	09°44.8	15.9′	59.4′
8	300°07.5	36.0	78°12.7	11.1′	10°00.7	15.9′	59.3′
9	315°07.7	·· 35.1	92°42.8	11.0′	10°16.6	15.7′	59.3′
10	330°08.0	34.2	107°12.8	11.0′	10°32.3	15.7′	59.3′
11	345°08.2	33.2	121°42.9	11.0′	10°48.0	15.6′	59.2′
12	0°08.4	N07°32.3	136°12.9	11.0′	N11°03.6	15.6′	59.2′
13	15°08.6	31.4	150°42.9	11.0′	11°19.2	15.4′	59.2′
14	30°08.8	30.5	165°12.9	11.0′	11°34.6	15.4′	59.1′
15	45°09.0	·· 29.6	179°42.9	11.0′	11°50.0	15.3′	59.1′
16	60°09.2	28.7	194°12.9	11.0′	12°05.3	15.2′	59.0′
17	75°09.4	27.7	208°42.8	10.9′	12°20.5	15.2′	59.0′
18	90°09.6	N07°26.8	223°12.7	10.9′	N12°35.7	15.0′	59.0′
19	105°09.8	25.9	237°42.7	10.9′	12°50.7	14.9′	58.9′
20	120°10.0	25.0	252°12.6	10.9′	13°05.6	14.9′	58.9′
21	135°10.2	·· 24.1	266°42.4	10.9′	13°20.5	14.8′	58.8′
22	150°10.4	23.2	281°12.3	10.8′	13°35.3	14.7′	58.8′
23	165°10.6	22.2	295°42.1	10.8′	13°50.0	14.5′	58.8′
	SD = 15.8′	d = -0.9′	SD = 16.3′				

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

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

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 16-18 99-88%
01	00:15	00:05	12:00	00:56	13:22	
02	00:04	00:14	12:00	01:47	14:12	
03	00:24	00:33	11:59	02:36	15:01	

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

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	342°51.5	210°11.1	N10°23.1	158°13.3	S01°20.5	299°20.6	N15°14.1	7°00.5	S11°58.6
1	357°54.0	225°13.4	23.4	173°14.3	21.2	314°23.1	14.1	22°03.2	58.7
2	12°56.5	240°15.8	23.7	188°15.3	21.8	329°25.6	14.1	37°05.8	58.8
3	27°58.9	255°18.2	·· 24.0	203°16.3	·· 22.5	344°28.0	·· 14.1	52°08.5	·· 58.8
4	43°01.4	270°20.5	24.3	218°17.3	23.1	359°30.5	14.1	67°11.1	58.9
5	58°03.8	285°22.9	24.6	233°18.3	23.8	14°32.9	14.1	82°13.7	59.0
6	73°06.3	300°25.3	N10°25.0	248°19.3	S01°24.5	29°35.4	N15°14.1	97°16.4	S11°59.0
7	88°08.8	315°27.6	25.3	263°20.2	25.1	44°37.8	14.1	112°19.0	59.1
8	103°11.2	330°30.0	25.6	278°21.2	25.8	59°40.3	14.1	127°21.7	59.2
9	118°13.7	345°32.3	·· 25.9	293°22.2	·· 26.4	74°42.8	·· 14.1	142°24.3	·· 59.2
10	133°16.2	0°34.6	26.2	308°23.2	27.1	89°45.2	14.1	157°27.0	59.3
11	148°18.6	15°37.0	26.5	323°24.2	27.8	104°47.7	14.1	172°29.6	59.4
12	163°21.1	30°39.3	N10°26.8	338°25.2	S01°28.4	119°50.1	N15°14.1	187°32.2	S11°59.4
13	178°23.6	45°41.6	27.1	353°26.2	29.1	134°52.6	14.1	202°34.9	59.5
14	193°26.0	60°44.0	27.4	8°27.2	29.7	149°55.1	14.1	217°37.5	59.6
15	208°28.5	75°46.3	·· 27.7	23°28.2	·· 30.4	164°57.5	·· 14.0	232°40.2	·· 59.7
16	223°31.0	90°48.6	28.0	38°29.2	31.1	180°00.0	14.0	247°42.8	59.7
17	238°33.4	105°50.9	28.3	53°30.1	31.7	195°02.5	14.0	262°45.4	59.8
18	253°35.9	120°53.2	N10°28.6	68°31.1	S01°32.4	210°04.9	N15°14.0	277°48.1	S11°59.9
19	268°38.3	135°55.5	29.0	83°32.1	33.1	225°07.4	14.0	292°50.7	11°59.9
20	283°40.8	150°57.8	29.3	98°33.1	33.7	240°09.8	14.0	307°53.4	12°00.0
21	298°43.3	166°00.1	·· 29.6	113°34.1	·· 34.4	255°12.3	·· 14.0	322°56.0	·· 00.1
22	313°45.7	181°02.4	29.9	128°35.1	35.0	270°14.8	14.0	337°58.6	00.1
23	328°48.2	196°04.7	30.2	143°36.1	35.7	285°17.2	14.0	353°01.3	00.2
Mer.pass. 01:08		ν 2.4′	d 0.3′	m -4.71	ν 1.0′	d -0.7′	m 1.74	ν 2.5′	d -0.0′ m -2.61	ν 2.6′	d -0.1′ m 0.47

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	343°50.7	211°07.0	N10°30.5	158°37.1	S01°36.4	300°19.7	N15°14.0	8°03.9	S12°00.3
1	358°53.1	226°09.3	30.8	173°38.0	37.0	315°22.2	14.0	23°06.6	00.3
2	13°55.6	241°11.5	31.1	188°39.0	37.7	330°24.6	14.0	38°09.2	00.4
3	28°58.1	256°13.8	·· 31.4	203°40.0	·· 38.3	345°27.1	·· 13.9	53°11.8	·· 00.5
4	44°00.5	271°16.1	31.7	218°41.0	39.0	0°29.6	13.9	68°14.5	00.6
5	59°03.0	286°18.3	31.9	233°42.0	39.7	15°32.0	13.9	83°17.1	00.6
6	74°05.4	301°20.6	N10°32.2	248°43.0	S01°40.3	30°34.5	N15°13.9	98°19.8	S12°00.7
7	89°07.9	316°22.8	32.5	263°44.0	41.0	45°37.0	13.9	113°22.4	00.8
8	104°10.4	331°25.1	32.8	278°45.0	41.7	60°39.4	13.9	128°25.0	00.8
9	119°12.8	346°27.3	·· 33.1	293°46.0	·· 42.3	75°41.9	·· 13.9	143°27.7	·· 00.9
10	134°15.3	1°29.6	33.4	308°46.9	43.0	90°44.4	13.9	158°30.3	01.0
11	149°17.8	16°31.8	33.7	323°47.9	43.6	105°46.8	13.9	173°33.0	01.0
12	164°20.2	31°34.1	N10°34.0	338°48.9	S01°44.3	120°49.3	N15°13.9	188°35.6	S12°01.1
13	179°22.7	46°36.3	34.3	353°49.9	45.0	135°51.8	13.9	203°38.2	01.2
14	194°25.2	61°38.5	34.6	8°50.9	45.6	150°54.3	13.8	218°40.9	01.2
15	209°27.6	76°40.7	·· 34.9	23°51.9	·· 46.3	165°56.7	·· 13.8	233°43.5	·· 01.3
16	224°30.1	91°43.0	35.2	38°52.9	47.0	180°59.2	13.8	248°46.2	01.4
17	239°32.6	106°45.2	35.5	53°53.9	47.6	196°01.7	13.8	263°48.8	01.4
18	254°35.0	121°47.4	N10°35.7	68°54.8	S01°48.3	211°04.1	N15°13.8	278°51.4	S12°01.5
19	269°37.5	136°49.6	36.0	83°55.8	48.9	226°06.6	13.8	293°54.1	01.6
20	284°39.9	151°51.8	36.3	98°56.8	49.6	241°09.1	13.8	308°56.7	01.6
21	299°42.4	166°54.0	·· 36.6	113°57.8	·· 50.3	256°11.6	·· 13.8	323°59.4	·· 01.7
22	314°44.9	181°56.2	36.9	128°58.8	50.9	271°14.0	13.8	339°02.0	01.8
23	329°47.3	196°58.4	37.2	143°59.8	51.6	286°16.5	13.7	354°04.6	01.9
Mer.pass. 01:04		ν 2.3′	d 0.3′	m -4.73	ν 1.0′	d -0.7′	m 1.74	ν 2.5′	d -0.0′ m -2.62	ν 2.6′	d -0.1′ m 0.48

Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	344°49.8	212°00.6	N10°37.5	159°00.8	S01°52.2	301°19.0	N15°13.7	9°07.3	S12°01.9
1	359°52.3	227°02.7	37.7	174°01.7	52.9	316°21.4	13.7	24°09.9	02.0
2	14°54.7	242°04.9	38.0	189°02.7	53.6	331°23.9	13.7	39°12.6	02.1
3	29°57.2	257°07.1	·· 38.3	204°03.7	·· 54.2	346°26.4	·· 13.7	54°15.2	·· 02.1
4	44°59.7	272°09.3	38.6	219°04.7	54.9	1°28.9	13.7	69°17.8	02.2
5	60°02.1	287°11.4	38.9	234°05.7	55.6	16°31.3	13.7	84°20.5	02.3
6	75°04.6	302°13.6	N10°39.1	249°06.7	S01°56.2	31°33.8	N15°13.7	99°23.1	S12°02.3
7	90°07.1	317°15.8	39.4	264°07.7	56.9	46°36.3	13.7	114°25.8	02.4
8	105°09.5	332°17.9	39.7	279°08.6	57.5	61°38.8	13.6	129°28.4	02.5
9	120°12.0	347°20.1	·· 40.0	294°09.6	·· 58.2	76°41.2	·· 13.6	144°31.0	·· 02.5
10	135°14.4	2°22.2	40.3	309°10.6	58.9	91°43.7	13.6	159°33.7	02.6
11	150°16.9	17°24.4	40.5	324°11.6	01°59.5	106°46.2	13.6	174°36.3	02.7
12	165°19.4	32°26.5	N10°40.8	339°12.6	S02°00.2	121°48.7	N15°13.6	189°39.0	S12°02.7
13	180°21.8	47°28.6	41.1	354°13.6	00.8	136°51.2	13.6	204°41.6	02.8
14	195°24.3	62°30.8	41.4	9°14.6	01.5	151°53.6	13.6	219°44.2	02.9
15	210°26.8	77°32.9	·· 41.6	24°15.5	·· 02.2	166°56.1	·· 13.6	234°46.9	·· 02.9
16	225°29.2	92°35.0	41.9	39°16.5	02.8	181°58.6	13.6	249°49.5	03.0
17	240°31.7	107°37.1	42.2	54°17.5	03.5	197°01.1	13.5	264°52.1	03.1
18	255°34.2	122°39.3	N10°42.4	69°18.5	S02°04.2	212°03.5	N15°13.5	279°54.8	S12°03.1
19	270°36.6	137°41.4	42.7	84°19.5	04.8	227°06.0	13.5	294°57.4	03.2
20	285°39.1	152°43.5	43.0	99°20.5	05.5	242°08.5	13.5	310°00.1	03.3
21	300°41.5	167°45.6	·· 43.2	114°21.4	·· 06.1	257°11.0	·· 13.5	325°02.7	·· 03.3
22	315°44.0	182°47.7	43.5	129°22.4	06.8	272°13.5	13.5	340°05.3	03.4
23	330°46.5	197°49.8	43.8	144°23.4	07.5	287°16.0	13.5	355°08.0	03.5
Mer.pass. 01:01		ν 2.2′	d 0.3′	m -4.74	ν 1.0′	d -0.7′	m 1.74	ν 2.5′	d -0.0′ m -2.63	ν 2.6′	d -0.1′ m 0.48

Stars

	SHA	**Dec**
Alpheratz	357°35.6	29°13.3
Ankaa	353°07.8	-42°10.5
Schedar	349°31.8	56°39.9
Diphda	348°48.1	-17°51.3
Achernar	335°20.6	-57°06.8
Hamal	327°52.3	23°34.5
Polaris	314°23.1	89°21.5
Acamar	315°12.4	-40°12.3
Menkar	314°07.2	4°11.1
Mirfak	308°29.7	49°56.5
Aldebaran	290°40.9	16°33.4
Rigel	281°05.0	-8°10.3
Capella	280°23.6	46°01.2
Bellatrix	278°24.1	6°22.4
Elnath	278°03.4	28°37.6
Alnilam	275°38.9	-1°11.0
Betelgeuse	270°53.4	7°24.8
Canopus	263°53.1	-52°42.1
Sirius	258°27.4	-16°44.7
Adhara	255°06.9	-29°00.0
Procyon	244°52.2	5°10.0
Pollux	243°18.9	27°58.2
Avior	234°15.7	-59°34.8
Suhail	222°47.5	-43°31.4
Miaplacidus	221°39.4	-69°48.6
Alphard	217°49.2	-8°45.5
Regulus	207°36.0	11°51.3
Dubhe	193°43.0	61°37.5
Denebola	182°26.4	14°26.6
Gienah	175°45.1	-17°40.3
Acrux	173°02.0	-63°13.8
Gacrux	171°53.5	-57°14.7
Alioth	166°14.4	55°50.1
Spica	158°23.7	-11°17.0
Alkaid	152°53.2	49°12.0
Hadar	148°38.0	-60°29.3
Menkent	147°59.2	-36°29.2
Arcturus	145°49.1	19°03.8
Rigil Kent.	139°42.2	-60°56.1
Kochab	137°20.3	74°03.8
Zuben'ubi	136°57.4	-16°08.3
Alphecca	126°04.8	26°38.3
Antares	112°17.2	-26°29.1
Atria	107°12.4	-69°04.4
Sabik	102°04.0	-15°45.2
Shaula	96°11.8	-37°07.3
Rasalhague	95°59.5	12°32.7
Eltanin	90°42.5	51°29.4
Kaus Aust.	83°33.8	-34°22.5
Vega	80°33.8	38°48.5
Nunki	75°49.0	-26°16.1
Altair	62°00.8	8°56.0
Peacock	53°07.0	-56°39.6
Deneb	49°26.2	45°22.0
Enif	33°39.6	9°59.1
Al Na'ir	27°33.8	-46°50.8
Fomalhaut	15°15.4	-29°29.7
Scheat	13°45.9	28°12.7
Markab	13°30.7	15°20.0

Sep 04 Mon	**SHA**	**Mer.pass**
Venus	227°19.5	09:58
Mars	175°21.8	13:26
Jupiter	316°29.1	04:02
Saturn	24°09.0	23:28

Sep 05 Tue	**SHA**	**Mer.pass**
Venus	227°16.3	09:54
Mars	174°46.4	13:25
Jupiter	316°29.0	03:58
Saturn	24°13.3	23:24

Sep 06 Wed	**SHA**	**Mer.pass**
Venus	227°10.8	09:51
Mars	174°11.0	13:23
Jupiter	316°29.2	03:54
Saturn	24°17.5	23:19

Horizontal parallax	
Venus:	0.4
Mars:	0.1

h	Sun		Moon				
Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°10.8	N07°21.3	310°12.0	10.8′	N14°04.5	14.5′	58.7′
1	195°11.0	20.4	324°41.8	10.8′	14°19.0	14.4′	58.7′
2	210°11.2	19.5	339°11.5	10.7′	14°33.4	14.3′	58.6′
3	225°11.4	·· 18.6	353°41.3	10.7′	14°47.7	14.2′	58.6′
4	240°11.7	17.6	8°11.0	10.7′	15°01.9	14.1′	58.6′
5	255°11.9	16.7	22°40.7	10.7′	15°16.0	14.0′	58.5′
6	270°12.1	N07°15.8	37°10.4	10.6′	N15°30.0	14.0′	58.5′
7	285°12.3	14.9	51°40.0	10.6′	15°44.0	13.8′	58.4′
8	300°12.5	14.0	66°09.6	10.6′	15°57.8	13.7′	58.4′
9	315°12.7	·· 13.0	80°39.2	10.6′	16°11.5	13.6′	58.4′
10	330°12.9	12.1	95°08.8	10.5′	16°25.1	13.4′	58.3′
11	345°13.1	11.2	109°38.3	10.5′	16°38.5	13.4′	58.3′
12	0°13.3	N07°10.3	124°07.8	10.5′	N16°51.9	13.3′	58.2′
13	15°13.5	09.3	138°37.3	10.4′	17°05.2	13.2′	58.2′
14	30°13.7	08.4	153°06.8	10.4′	17°18.4	13.0′	58.2′
15	45°13.9	·· 07.5	167°36.2	10.4′	17°31.4	13.0′	58.1′
16	60°14.1	06.6	182°05.6	10.4′	17°44.4	12.8′	58.1′
17	75°14.3	05.7	196°34.9	10.3′	17°57.2	12.8′	58.0′
18	90°14.5	N07°04.7	211°04.3	10.3′	N18°10.0	12.6′	58.0′
19	105°14.8	03.8	225°33.5	10.3′	18°22.6	12.5′	58.0′
20	120°15.0	02.9	240°02.8	10.2′	18°35.1	12.4′	57.9′
21	135°15.2	·· 02.0	254°32.0	10.2′	18°47.5	12.2′	57.9′
22	150°15.4	01.0	269°01.2	10.2′	18°59.7	12.2′	57.8′
23	165°15.6	00.1	283°30.4	10.1′	19°11.9	12.0′	57.8′
	SD = 15.8′	d = -0.9′	SD = 16.0′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°15.8	N06°59.2	297°59.5	10.1′	N19°23.9	12.0′	57.8′
1	195°16.0	58.3	312°28.6	10.1′	19°35.9	11.8′	57.7′
2	210°16.2	57.3	326°57.6	10.0′	19°47.7	11.6′	57.7′
3	225°16.4	·· 56.4	341°26.7	10.0′	19°59.3	11.6′	57.6′
4	240°16.6	55.5	355°55.7	10.0′	20°10.9	11.4′	57.6′
5	255°16.8	54.6	10°24.6	9.9′	20°22.3	11.3′	57.6′
6	270°17.1	N06°53.6	24°53.5	9.9′	N20°33.6	11.2′	57.5′
7	285°17.3	52.7	39°22.4	9.9′	20°44.8	11.1′	57.5′
8	300°17.5	51.8	53°51.3	9.8′	20°55.9	10.9′	57.4′
9	315°17.7	·· 50.9	68°20.1	9.8′	21°06.8	10.9′	57.4′
10	330°17.9	49.9	82°48.9	9.7′	21°17.7	10.6′	57.4′
11	345°18.1	49.0	97°17.6	9.7′	21°28.3	10.6′	57.3′
12	0°18.3	N06°48.1	111°46.3	9.7′	N21°38.9	10.4′	57.3′
13	15°18.5	47.2	126°15.0	9.6′	21°49.3	10.3′	57.2′
14	30°18.7	46.2	140°43.6	9.6′	21°59.6	10.2′	57.2′
15	45°18.9	·· 45.3	155°12.2	9.6′	22°09.8	10.0′	57.2′
16	60°19.1	44.4	169°40.8	9.5′	22°19.8	10.0′	57.1′
17	75°19.4	43.5	184°09.4	9.5′	22°29.8	9.7′	57.1′
18	90°19.6	N06°42.5	198°37.9	9.5′	N22°39.5	9.7′	57.1′
19	105°19.8	41.6	213°06.3	9.4′	22°49.2	9.5′	57.0′
20	120°20.0	40.7	227°34.8	9.4′	22°58.7	9.4′	57.0′
21	135°20.2	·· 39.7	242°03.2	9.4′	23°08.1	9.2′	56.9′
22	150°20.4	38.8	256°31.5	9.3′	23°17.3	9.1′	56.9′
23	165°20.6	37.9	270°59.9	9.3′	23°26.4	9.0′	56.9′
	SD = 15.9′	d = -0.9′	SD = 15.8′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°20.8	N06°37.0	285°28.2	9.3′	N23°35.4	8.8′	56.8′
1	195°21.0	36.0	299°56.5	9.2′	23°44.2	8.7′	56.8′
2	210°21.2	35.1	314°24.7	9.2′	23°52.9	8.6′	56.8′
3	225°21.5	·· 34.2	328°52.9	9.2′	24°01.5	8.4′	56.7′
4	240°21.7	33.2	343°21.1	9.2′	24°09.9	8.3′	56.7′
5	255°21.9	32.3	357°49.3	9.1′	24°18.2	8.2′	56.6′
6	270°22.1	N06°31.4	12°17.4	9.1′	N24°26.4	8.0′	56.6′
7	285°22.3	30.5	26°45.5	9.1′	24°34.4	7.8′	56.6′
8	300°22.5	29.5	41°13.5	9.0′	24°42.2	7.8′	56.5′
9	315°22.7	·· 28.6	55°41.6	9.0′	24°50.0	7.5′	56.5′
10	330°22.9	27.7	70°09.6	9.0′	24°57.5	7.5′	56.5′
11	345°23.1	26.7	84°37.6	9.0′	25°05.0	7.3′	56.4′
12	0°23.4	N06°25.8	99°05.5	8.9′	N25°12.3	7.2′	56.4′
13	15°23.6	24.9	113°33.5	8.9′	25°19.5	7.0′	56.4′
14	30°23.8	23.9	128°01.4	8.9′	25°26.5	6.8′	56.3′
15	45°24.0	·· 23.0	142°29.3	8.9′	25°33.3	6.8′	56.3′
16	60°24.2	22.1	156°57.1	8.8′	25°40.1	6.6′	56.3′
17	75°24.4	21.1	171°25.0	8.8′	25°46.7	6.4′	56.2′
18	90°24.6	N06°20.2	185°52.8	8.8′	N25°53.1	6.3′	56.2′
19	105°24.8	19.3	200°20.6	8.8′	25°59.4	6.1′	56.2′
20	120°25.1	18.3	214°48.3	8.8′	26°05.5	6.0′	56.1′
21	135°25.3	·· 17.4	229°16.1	8.7′	26°11.5	5.9′	56.1′
22	150°25.5	16.5	243°43.8	8.7′	26°17.4	5.7′	56.1′
23	165°25.7	15.5	258°11.6	8.7′	26°23.1	5.6′	56.0′
	SD = 15.9′	d = -0.9′	SD = 15.5′				

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

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

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 19-21 79-60%
04	00:43	00:53	11:59	03:26	15:51	
05	01:03	01:13	11:59	04:17	16:43	
06	01:23	01:33	11:58	05:09	17:36	

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

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	345°48.9	212°51.9	N10°44.0	159°24.4	S02°08.1	302°18.4	N15°13.4	10°10.6	S12°03.6
1	0°51.4	227°54.0	44.3	174°25.4	08.8	317°20.9	13.4	25°13.3	03.6
2	15°53.9	242°56.0	44.6	189°26.4	09.5	332°23.4	13.4	40°15.9	03.7
3	30°56.3	257°58.1	·· 44.8	204°27.4	·· 10.1	347°25.9	·· 13.4	55°18.5	·· 03.8
4	45°58.8	273°00.2	45.1	219°28.3	10.8	2°28.4	13.4	70°21.2	03.8
5	61°01.3	288°02.3	45.4	234°29.3	11.4	17°30.8	13.4	85°23.8	03.9
6	76°03.7	303°04.3	N10°45.6	249°30.3	S02°12.1	32°33.3	N15°13.4	100°26.5	S12°04.0
7	91°06.2	318°06.4	45.9	264°31.3	12.8	47°35.8	13.4	115°29.1	04.0
8	106°08.7	333°08.5	46.2	279°32.3	13.4	62°38.3	13.3	130°31.7	04.1
9	121°11.1	348°10.5	·· 46.4	294°33.3	·· 14.1	77°40.8	·· 13.3	145°34.4	·· 04.2
10	136°13.6	3°12.6	46.7	309°34.2	14.7	92°43.3	13.3	160°37.0	04.2
11	151°16.0	18°14.6	46.9	324°35.2	15.4	107°45.8	13.3	175°39.6	04.3
12	166°18.5	33°16.7	N10°47.2	339°36.2	S02°16.1	122°48.2	N15°13.3	190°42.3	S12°04.4
13	181°21.0	48°18.7	47.4	354°37.2	16.7	137°50.7	13.3	205°44.9	04.4
14	196°23.4	63°20.8	47.7	9°38.2	17.4	152°53.2	13.3	220°47.6	04.5
15	211°25.9	78°22.8	·· 48.0	24°39.1	·· 18.1	167°55.7	·· 13.2	235°50.2	·· 04.6
16	226°28.4	93°24.8	48.2	39°40.1	18.7	182°58.2	13.2	250°52.8	04.6
17	241°30.8	108°26.9	48.5	54°41.1	19.4	198°00.7	13.2	265°55.5	04.7
18	256°33.3	123°28.9	N10°48.7	69°42.1	S02°20.0	213°03.2	N15°13.2	280°58.1	S12°04.8
19	271°35.8	138°30.9	49.0	84°43.1	20.7	228°05.6	13.2	296°00.8	04.8
20	286°38.2	153°32.9	49.2	99°44.1	21.4	243°08.1	13.2	311°03.4	04.9
21	301°40.7	168°34.9	·· 49.5	114°45.0	·· 22.0	258°10.6	·· 13.1	326°06.0	·· 05.0
22	316°43.2	183°36.9	49.7	129°46.0	22.7	273°13.1	13.1	341°08.7	05.0
23	331°45.6	198°38.9	50.0	144°47.0	23.4	288°15.6	13.1	356°11.3	05.1
Mer.pass. 00:57		ν 2.1′ d 0.3′ m -4.76		ν 1.0′ d -0.7′ m 1.74		ν 2.5′ d -0.0′ m -2.64		ν 2.6′ d -0.1′ m 0.49	

Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	346°48.1	213°40.9	N10°50.2	159°48.0	S02°24.0	303°18.1	N15°13.1	11°13.9	S12°05.2
1	1°50.5	228°42.9	50.5	174°49.0	24.7	318°20.6	13.1	26°16.6	05.2
2	16°53.0	243°44.9	50.7	189°50.0	25.3	333°23.1	13.1	41°19.2	05.3
3	31°55.5	258°46.9	·· 50.9	204°50.9	·· 26.0	348°25.6	·· 13.1	56°21.9	·· 05.4
4	46°57.9	273°48.9	51.2	219°51.9	26.7	3°28.1	13.0	71°24.5	05.4
5	62°00.4	288°50.9	51.4	234°52.9	27.3	18°30.6	13.0	86°27.1	05.5
6	77°02.9	303°52.9	N10°51.7	249°53.9	S02°28.0	33°33.0	N15°13.0	101°29.8	S12°05.6
7	92°05.3	318°54.8	51.9	264°54.9	28.6	48°35.5	13.0	116°32.4	05.6
8	107°07.8	333°56.8	52.2	279°55.8	29.3	63°38.0	13.0	131°35.0	05.7
9	122°10.3	348°58.8	·· 52.4	294°56.8	·· 30.0	78°40.5	·· 13.0	146°37.7	·· 05.8
10	137°12.7	4°00.7	52.6	309°57.8	30.6	93°43.0	12.9	161°40.3	05.8
11	152°15.2	19°02.7	52.9	324°58.8	31.3	108°45.5	12.9	176°43.0	05.9
12	167°17.7	34°04.7	N10°53.1	339°59.8	S02°32.0	123°48.0	N15°12.9	191°45.6	S12°06.0
13	182°20.1	49°06.6	53.4	355°00.7	32.6	138°50.5	12.9	206°48.2	06.0
14	197°22.6	64°08.6	53.6	10°01.7	33.3	153°53.0	12.9	221°50.9	06.1
15	212°25.0	79°10.5	·· 53.8	25°02.7	·· 33.9	168°55.5	·· 12.9	236°53.5	·· 06.2
16	227°27.5	94°12.4	54.1	40°03.7	34.6	183°58.0	12.8	251°56.1	06.2
17	242°30.0	109°14.4	54.3	55°04.7	35.3	199°00.5	12.8	266°58.8	06.3
18	257°32.4	124°16.3	N10°54.5	70°05.6	S02°35.9	214°03.0	N15°12.8	282°01.4	S12°06.4
19	272°34.9	139°18.2	54.8	85°06.6	36.6	229°05.5	12.8	297°04.1	06.4
20	287°37.4	154°20.2	55.0	100°07.6	37.2	244°08.0	12.8	312°06.7	06.5
21	302°39.8	169°22.1	·· 55.2	115°08.6	·· 37.9	259°10.5	·· 12.8	327°09.3	·· 06.6
22	317°42.3	184°24.0	55.5	130°09.6	38.6	274°13.0	12.7	342°12.0	06.6
23	332°44.8	199°25.9	55.7	145°10.5	39.2	289°15.5	12.7	357°14.6	06.7
Mer.pass. 00:53		ν 2.0′ d 0.2′ m -4.77		ν 1.0′ d -0.7′ m 1.73		ν 2.5′ d -0.0′ m -2.65		ν 2.6′ d -0.1′ m 0.49	

Sat	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	347°47.2	214°27.8	N10°55.9	160°11.5	S02°39.9	304°18.0	N15°12.7	12°17.2	S12°06.8
1	2°49.7	229°29.7	56.2	175°12.5	40.6	319°20.5	12.7	27°19.9	06.8
2	17°52.1	244°31.6	56.4	190°13.5	41.2	334°23.0	12.7	42°22.5	06.9
3	32°54.6	259°33.5	·· 56.6	205°14.5	·· 41.9	349°25.5	·· 12.6	57°25.1	·· 07.0
4	47°57.1	274°35.4	56.8	220°15.4	42.5	4°28.0	12.6	72°27.8	07.0
5	62°59.5	289°37.3	57.1	235°16.4	43.2	19°30.5	12.6	87°30.4	07.1
6	78°02.0	304°39.2	N10°57.3	250°17.4	S02°43.9	34°33.0	N15°12.6	102°33.1	S12°07.2
7	93°04.5	319°41.1	57.5	265°18.4	44.5	49°35.5	12.6	117°35.7	07.2
8	108°06.9	334°43.0	57.7	280°19.3	45.2	64°38.0	12.6	132°38.3	07.3
9	123°09.4	349°44.9	·· 58.0	295°20.3	·· 45.9	79°40.5	·· 12.5	147°41.0	·· 07.4
10	138°11.9	4°46.7	58.2	310°21.3	46.5	94°43.0	12.5	162°43.6	07.4
11	153°14.3	19°48.6	58.4	325°22.3	47.2	109°45.5	12.5	177°46.2	07.5
12	168°16.8	34°50.5	N10°58.6	340°23.3	S02°47.8	124°48.0	N15°12.5	192°48.9	S12°07.6
13	183°19.3	49°52.3	58.8	355°24.2	48.5	139°50.5	12.5	207°51.5	07.6
14	198°21.7	64°54.2	59.0	10°25.2	49.2	154°53.0	12.4	222°54.1	07.7
15	213°24.2	79°56.1	·· 59.3	25°26.2	·· 49.8	169°55.5	·· 12.4	237°56.8	·· 07.8
16	228°26.6	94°57.9	59.5	40°27.2	50.5	184°58.0	12.4	252°59.4	07.8
17	243°29.1	109°59.8	59.7	55°28.1	51.1	200°00.5	12.4	268°02.1	07.9
18	258°31.6	125°01.6	N10°59.9	70°29.1	S02°51.8	215°03.0	N15°12.4	283°04.7	S12°08.0
19	273°34.0	140°03.4	11°00.1	85°30.1	52.5	230°05.5	12.3	298°07.3	08.0
20	288°36.5	155°05.3	00.3	100°31.1	53.1	245°08.0	12.3	313°10.0	08.1
21	303°39.0	170°07.1	·· 00.5	115°32.1	·· 53.8	260°10.5	·· 12.3	328°12.6	·· 08.2
22	318°41.4	185°09.0	00.8	130°33.0	54.5	275°13.0	12.3	343°15.2	08.2
23	333°43.9	200°10.8	01.0	145°34.0	55.1	290°15.5	12.3	358°17.9	08.3
Mer.pass. 00:49		ν 1.9′ d 0.2′ m -4.78		ν 1.0′ d -0.7′ m 1.73		ν 2.5′ d -0.0′ m -2.65		ν 2.6′ d -0.1′ m 0.50	

Stars

	SHA	**Dec**
Alpheratz	357°35.6	29°13.3
Ankaa	353°07.8	-42°10.5
Schedar	349°31.8	56°39.9
Diphda	348°48.1	-17°51.3
Achernar	335°20.5	-57°06.8
Hamal	327°52.2	23°34.5
Polaris	314°21.4	89°21.5
Acamar	315°12.4	-40°12.3
Menkar	314°07.2	4°11.1
Mirfak	308°29.7	49°56.6
Aldebaran	290°40.9	16°33.5
Rigel	281°05.0	-8°10.3
Capella	280°23.6	46°01.2
Bellatrix	278°24.1	6°22.4
Elnath	278°03.3	28°37.6
Alnilam	275°38.9	-1°11.0
Betelgeuse	270°53.4	7°24.8
Canopus	263°53.1	-52°42.1
Sirius	258°27.4	-16°44.7
Adhara	255°06.9	-28°59.9
Procyon	244°52.2	5°10.0
Pollux	243°18.9	27°58.2
Avior	234°15.7	-59°34.8
Suhail	222°47.5	-43°31.4
Miaplacidus	221°39.4	-69°48.6
Alphard	217°49.1	-8°45.5
Regulus	207°35.9	11°51.3
Dubhe	193°43.0	61°37.5
Denebola	182°26.4	14°26.6
Gienah	175°45.1	-17°40.3
Acrux	173°02.0	-63°13.8
Gacrux	171°53.5	-57°14.7
Alioth	166°14.4	55°50.1
Spica	158°23.7	-11°17.0
Alkaid	152°53.2	49°12.0
Hadar	148°38.1	-60°29.3
Menkent	147°59.2	-36°29.2
Arcturus	145°49.1	19°03.8
Rigil Kent.	139°42.2	-60°56.1
Kochab	137°20.3	74°03.7
Zuben'ubi	136°57.4	-16°08.3
Alphecca	126°04.8	26°38.3
Antares	112°17.2	-26°29.1
Atria	107°12.5	-69°04.4
Sabik	102°04.0	-15°45.2
Shaula	96°11.8	-37°07.3
Rasalhague	95°59.5	12°32.7
Eltanin	90°42.6	51°29.4
Kaus Aust.	83°33.8	-34°22.5
Vega	80°33.8	38°48.6
Nunki	75°49.0	-26°16.1
Altair	62°00.8	8°56.0
Peacock	53°07.0	-56°39.6
Deneb	49°26.2	45°22.0
Enif	33°39.6	9°59.1
Al Na'ir	27°33.8	-46°50.8
Fomalhaut	15°15.4	-29°29.7
Scheat	13°45.9	28°12.7
Markab	13°30.7	15°20.0

Sep 07 Thu	**SHA**	**Mer.pass**
Venus	227°02.9	09:47
Mars	173°35.5	13:21
Jupiter	316°29.5	03:50
Saturn	24°21.7	23:15

Sep 08 Fri	**SHA**	**Mer.pass**
Venus	226°52.9	09:44
Mars	172°59.9	13:20
Jupiter	316°30.0	03:46
Saturn	24°25.9	23:11

Sep 09 Sat	**SHA**	**Mer.pass**
Venus	226°40.6	09:41
Mars	172°24.3	13:18
Jupiter	316°30.7	03:42
Saturn	24°30.0	23:07

Horizontal parallax	
Venus:	0.4
Mars:	0.1

h	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°25.9	N06°14.6	272°39.3	8.7′	N26°28.7	5.4′	56.0′
1	195°26.1	13.7	287°07.0	8.7′	26°34.1	5.3′	56.0′
2	210°26.3	12.7	301°34.6	8.7′	26°39.4	5.1′	55.9′
3	225°26.5	·· 11.8	316°02.3	8.6′	26°44.5	5.0′	55.9′
4	240°26.8	10.9	330°29.9	8.6′	26°49.5	4.8′	55.9′
5	255°27.0	09.9	344°57.6	8.6′	26°54.3	4.7′	55.8′
6	270°27.2	N06°09.0	359°25.2	8.6′	N26°59.0	4.5′	55.8′
7	285°27.4	08.1	13°52.8	8.6′	27°03.5	4.4′	55.8′
8	300°27.6	07.1	28°20.4	8.6′	27°07.9	4.3′	55.7′
9	315°27.8	·· 06.2	42°48.0	8.6′	27°12.2	4.0′	55.7′
10	330°28.0	05.3	57°15.6	8.6′	27°16.2	4.0′	55.7′
11	345°28.2	04.3	71°43.2	8.6′	27°20.2	3.8′	55.7′
12	0°28.5	N06°03.4	86°10.8	8.6′	N27°24.0	3.6′	55.6′
13	15°28.7	02.5	100°38.4	8.6′	27°27.6	3.5′	55.6′
14	30°28.9	01.5	115°06.0	8.6′	27°31.1	3.4′	55.6′
15	45°29.1	06°00.6	129°33.5	8.6′	27°34.5	3.2′	55.5′
16	60°29.3	05°59.7	144°01.1	8.6′	27°37.7	3.0′	55.5′
17	75°29.5	58.7	158°28.7	8.6′	27°40.7	2.9′	55.5′
18	90°29.7	N05°57.8	172°56.3	8.6′	N27°43.6	2.8′	55.5′
19	105°30.0	56.8	187°23.9	8.6′	27°46.4	2.6′	55.4′
20	120°30.2	55.9	201°51.5	8.6′	27°49.0	2.4′	55.4′
21	135°30.4	·· 55.0	216°19.1	8.6′	27°51.4	2.4′	55.4′
22	150°30.6	54.0	230°46.7	8.6′	27°53.8	2.1′	55.3′
23	165°30.8	53.1	245°14.3	8.6′	27°55.9	2.0′	55.3′
	SD = 15.9′	d = -0.9′	SD = 15.3′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°31.0	N05°52.2	259°41.9	8.6′	N27°57.9	1.9′	55.3′
1	195°31.2	51.2	274°09.6	8.6′	27°59.8	1.7′	55.3′
2	210°31.5	50.3	288°37.2	8.7′	28°01.5	1.6′	55.2′
3	225°31.7	·· 49.3	303°04.9	8.7′	28°03.1	1.4′	55.2′
4	240°31.9	48.4	317°32.6	8.7′	28°04.5	1.3′	55.2′
5	255°32.1	47.5	332°00.3	8.7′	28°05.8	1.1′	55.2′
6	270°32.3	N05°46.5	346°28.0	8.7′	N28°06.9	1.0′	55.1′
7	285°32.5	45.6	0°55.7	8.7′	28°07.9	0.8′	55.1′
8	300°32.7	44.7	15°23.4	8.8′	28°08.7	0.7′	55.1′
9	315°33.0	·· 43.7	29°51.2	8.8′	28°09.4	0.5′	55.1′
10	330°33.2	42.8	44°19.0	8.8′	28°09.9	0.4′	55.0′
11	345°33.4	41.8	58°46.8	8.8′	28°10.3	0.3′	55.0′
12	0°33.6	N05°40.9	73°14.7	8.9′	N28°10.6	0.1′	55.0′
13	15°33.8	40.0	87°42.5	8.9′	28°10.7	0.0′	55.0′
14	30°34.0	39.0	102°10.4	8.9′	28°10.7	0.2′	55.0′
15	45°34.3	·· 38.1	116°38.3	8.9′	28°10.5	0.4′	54.9′
16	60°34.5	37.1	131°06.3	9.0′	28°10.1	0.4′	54.9′
17	75°34.7	36.2	145°34.3	9.0′	28°09.7	0.7′	54.9′
18	90°34.9	N05°35.3	160°02.3	9.0′	N28°09.0	0.7′	54.9′
19	105°35.1	34.3	174°30.3	9.1′	28°08.3	0.9′	54.8′
20	120°35.3	33.4	188°58.4	9.1′	28°07.4	1.1′	54.8′
21	135°35.5	·· 32.4	203°26.5	9.1′	28°06.3	1.1′	54.8′
22	150°35.8	31.5	217°54.7	9.2′	28°05.2	1.4′	54.8′
23	165°36.0	30.6	232°22.8	9.2′	28°03.8	1.4′	54.8′
	SD = 15.9′	d = -0.9′	SD = 15.1′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°36.2	N05°29.6	246°51.1	9.3′	N28°02.4	1.7′	54.7′
1	195°36.4	28.7	261°19.3	9.3′	28°00.7	1.7′	54.7′
2	210°36.6	27.7	275°47.6	9.3′	27°59.0	1.9′	54.7′
3	225°36.8	·· 26.8	290°16.0	9.4′	27°57.1	2.0′	54.7′
4	240°37.1	25.8	304°44.4	9.4′	27°55.1	2.2′	54.7′
5	255°37.3	24.9	319°12.8	9.5′	27°52.9	2.3′	54.6′
6	270°37.5	N05°24.0	333°41.3	9.5′	N27°50.6	2.4′	54.6′
7	285°37.7	23.0	348°09.8	9.6′	27°48.2	2.6′	54.6′
8	300°37.9	22.1	2°38.4	9.6′	27°45.6	2.7′	54.6′
9	315°38.1	·· 21.1	17°07.0	9.7′	27°42.9	2.9′	54.6′
10	330°38.4	20.2	31°35.6	9.7′	27°40.0	3.0′	54.5′
11	345°38.6	19.2	46°04.3	9.8′	27°37.0	3.1′	54.5′
12	0°38.8	N05°18.3	60°33.1	9.8′	N27°33.9	3.2′	54.5′
13	15°39.0	17.4	75°01.9	9.9′	27°30.7	3.4′	54.5′
14	30°39.2	16.4	89°30.8	9.9′	27°27.3	3.5′	54.5′
15	45°39.4	·· 15.5	103°59.7	10.0′	27°23.8	3.7′	54.5′
16	60°39.7	14.5	118°28.7	10.0′	27°20.1	3.8′	54.4′
17	75°39.9	13.6	132°57.7	10.1′	27°16.3	3.9′	54.4′
18	90°40.1	N05°12.6	147°26.8	10.1′	N27°12.4	4.0′	54.4′
19	105°40.3	11.7	161°55.9	10.2′	27°08.4	4.2′	54.4′
20	120°40.5	10.7	176°25.1	10.3′	27°04.2	4.3′	54.4′
21	135°40.7	·· 09.8	190°54.4	10.3′	26°59.9	4.4′	54.4′
22	150°41.0	08.9	205°23.7	10.4′	26°55.5	4.6′	54.4′
23	165°41.2	07.9	219°53.0	10.4′	26°50.9	4.7′	54.3′
	SD = 15.9′	d = -0.9′	SD = 14.9′				

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

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

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 22-24 49-30%
07	01:44	01:54	11:58	06:02	18:29	
08	02:04	02:14	11:58	06:56	19:23	
09	02:25	02:35	11:57	07:49	20:15	

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

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	348°46.4	215°12.6	N11°01.2	160°35.0	S02°55.8	305°18.0	N15°12.2	13°20.5	S12°08.4
1	3°48.8	230°14.4	01.4	175°36.0	56.4	320°20.5	12.2	28°23.1	08.4
2	18°51.3	245°16.2	01.6	190°36.9	57.1	335°23.0	12.2	43°25.8	08.5
3	33°53.8	260°18.1	·· 01.8	205°37.9	·· 57.8	350°25.5	·· 12.2	58°28.4	·· 08.6
4	48°56.2	275°19.9	02.0	220°38.9	58.4	5°28.1	12.2	73°31.1	08.6
5	63°58.7	290°21.7	02.2	235°39.9	59.1	20°30.6	12.1	88°33.7	08.7
6	79°01.1	305°23.5	N11°02.4	250°40.8	S02°59.7	35°33.1	N15°12.1	103°36.3	S12°08.8
7	94°03.6	320°25.3	02.6	265°41.8	03°00.4	50°35.6	12.1	118°39.0	08.8
8	109°06.1	335°27.1	02.8	280°42.8	01.1	65°38.1	12.1	133°41.6	08.9
9	124°08.5	350°28.9	·· 03.0	295°43.8	·· 01.7	80°40.6	·· 12.1	148°44.2	·· 09.0
10	139°11.0	5°30.7	03.2	310°44.7	02.4	95°43.1	12.0	163°46.9	09.0
11	154°13.5	20°32.4	03.4	325°45.7	03.1	110°45.6	12.0	178°49.5	09.1
12	169°15.9	35°34.2	N11°03.6	340°46.7	S03°03.7	125°48.1	N15°12.0	193°52.1	S12°09.2
13	184°18.4	50°36.0	03.8	355°47.7	04.4	140°50.6	12.0	208°54.8	09.2
14	199°20.9	65°37.8	04.0	10°48.6	05.0	155°53.2	11.9	223°57.4	09.3
15	214°23.3	80°39.5	·· 04.2	25°49.6	·· 05.7	170°55.7	·· 11.9	239°00.0	·· 09.4
16	229°25.8	95°41.3	04.4	40°50.6	06.4	185°58.2	11.9	254°02.7	09.4
17	244°28.3	110°43.1	04.6	55°51.6	07.0	201°00.7	11.9	269°05.3	09.5
18	259°30.7	125°44.8	N11°04.8	70°52.5	S03°07.7	216°03.2	N15°11.9	284°07.9	S12°09.5
19	274°33.2	140°46.6	05.0	85°53.5	08.4	231°05.7	11.8	299°10.6	09.6
20	289°35.6	155°48.3	05.2	100°54.5	09.0	246°08.2	11.8	314°13.2	09.7
21	304°38.1	170°50.1	·· 05.4	115°55.5	·· 09.7	261°10.7	·· 11.8	329°15.8	·· 09.7
22	319°40.6	185°51.8	05.6	130°56.4	10.3	276°13.3	11.8	344°18.5	09.8
23	334°43.0	200°53.6	05.8	145°57.4	11.0	291°15.8	11.7	359°21.1	09.9
Mer.pass. 00:45		ν 1.8′	d 0.2′	m -4.79	ν 1.0′	d -0.7′	m 1.73	ν 2.5′	d -0.0′ m -2.66
								ν 2.6′	d -0.1′ m 0.50

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	349°45.5	215°55.3	N11°06.0	160°58.4	S03°11.7	306°18.3	N15°11.7	14°23.8	S12°09.9
1	4°48.0	230°57.1	06.1	175°59.4	12.3	321°20.8	11.7	29°26.4	10.0
2	19°50.4	245°58.8	06.3	191°00.3	13.0	336°23.3	11.7	44°29.0	10.1
3	34°52.9	261°00.5	·· 06.5	206°01.3	·· 13.6	351°25.8	·· 11.7	59°31.7	·· 10.1
4	49°55.4	276°02.3	06.7	221°02.3	14.3	6°28.4	11.6	74°34.3	10.2
5	64°57.8	291°04.0	06.9	236°03.3	15.0	21°30.9	11.6	89°36.9	10.3
6	80°00.3	306°05.7	N11°07.1	251°04.2	S03°15.6	36°33.4	N15°11.6	104°39.6	S12°10.3
7	95°02.7	321°07.4	07.3	266°05.2	16.3	51°35.9	11.6	119°42.2	10.4
8	110°05.2	336°09.1	07.4	281°06.2	16.9	66°38.4	11.5	134°44.8	10.5
9	125°07.7	351°10.8	·· 07.6	296°07.2	·· 17.6	81°40.9	·· 11.5	149°47.5	·· 10.5
10	140°10.1	6°12.5	07.8	311°08.1	18.3	96°43.5	11.5	164°50.1	10.6
11	155°12.6	21°14.2	08.0	326°09.1	18.9	111°46.0	11.5	179°52.7	10.7
12	170°15.1	36°15.9	N11°08.2	341°10.1	S03°19.6	126°48.5	N15°11.4	194°55.4	S12°10.7
13	185°17.5	51°17.6	08.3	356°11.0	20.3	141°51.0	11.4	209°58.0	10.8
14	200°20.0	66°19.3	08.5	11°12.0	20.9	156°53.5	11.4	225°00.6	10.9
15	215°22.5	81°21.0	·· 08.7	26°13.0	·· 21.6	171°56.1	·· 11.4	240°03.3	·· 10.9
16	230°24.9	96°22.7	08.9	41°14.0	22.2	186°58.6	11.3	255°05.9	11.0
17	245°27.4	111°24.4	09.1	56°14.9	22.9	202°01.1	11.3	270°08.5	11.0
18	260°29.9	126°26.1	N11°09.2	71°15.9	S03°23.6	217°03.6	N15°11.3	285°11.2	S12°11.1
19	275°32.3	141°27.7	09.4	86°16.9	24.2	232°06.1	11.3	300°13.8	11.2
20	290°34.8	156°29.4	09.6	101°17.8	24.9	247°08.7	11.3	315°16.4	11.2
21	305°37.2	171°31.1	·· 09.7	116°18.8	·· 25.5	262°11.2	·· 11.2	330°19.1	·· 11.3
22	320°39.7	186°32.7	09.9	131°19.8	26.2	277°13.7	11.2	345°21.7	11.4
23	335°42.2	201°34.4	10.1	146°20.8	26.9	292°16.2	11.2	0°24.3	11.4
Mer.pass. 00:41		ν 1.7′	d 0.2′	m -4.79	ν 1.0′	d -0.7′	m 1.72	ν 2.5′	d -0.0′ m -2.67
								ν 2.6′	d -0.1′ m 0.50

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	350°44.6	216°36.1	N11°10.3	161°21.7	S03°27.5	307°18.8	N15°11.2	15°27.0	S12°11.5
1	5°47.1	231°37.7	10.4	176°22.7	28.2	322°21.3	11.1	30°29.6	11.6
2	20°49.6	246°39.4	10.6	191°23.7	28.9	337°23.8	11.1	45°32.2	11.6
3	35°52.0	261°41.0	·· 10.8	206°24.6	·· 29.5	352°26.3	·· 11.1	60°34.9	·· 11.7
4	50°54.5	276°42.7	10.9	221°25.6	30.2	7°28.9	11.1	75°37.5	11.8
5	65°57.0	291°44.3	11.1	236°26.6	30.8	22°31.4	11.0	90°40.1	11.8
6	80°59.4	306°45.9	N11°11.2	251°27.6	S03°31.5	37°33.9	N15°11.0	105°42.8	S12°11.9
7	96°01.9	321°47.6	11.4	266°28.5	32.2	52°36.4	11.0	120°45.4	12.0
8	111°04.4	336°49.2	11.6	281°29.5	32.8	67°39.0	10.9	135°48.0	12.0
9	126°06.8	351°50.8	·· 11.7	296°30.5	·· 33.5	82°41.5	·· 10.9	150°50.7	·· 12.1
10	141°09.3	6°52.5	11.9	311°31.4	34.1	97°44.0	10.9	165°53.3	12.1
11	156°11.7	21°54.1	12.1	326°32.4	34.8	112°46.5	10.9	180°55.9	12.2
12	171°14.2	36°55.7	N11°12.2	341°33.4	S03°35.5	127°49.1	N15°10.8	195°58.6	S12°12.3
13	186°16.7	51°57.3	12.4	356°34.4	36.1	142°51.6	10.8	211°01.2	12.3
14	201°19.1	66°58.9	12.5	11°35.3	36.8	157°54.1	10.8	226°03.8	12.4
15	216°21.6	82°00.5	·· 12.7	26°36.3	·· 37.4	172°56.7	·· 10.8	241°06.5	·· 12.5
16	231°24.1	97°02.1	12.8	41°37.3	38.1	187°59.2	10.7	256°09.1	12.5
17	246°26.5	112°03.7	13.0	56°38.2	38.8	203°01.7	10.7	271°11.7	12.6
18	261°29.0	127°05.3	N11°13.1	71°39.2	S03°39.4	218°04.2	N15°10.7	286°14.4	S12°12.7
19	276°31.5	142°06.9	13.3	86°40.2	40.1	233°06.8	10.7	301°17.0	12.7
20	291°33.9	157°08.5	13.4	101°41.1	40.8	248°09.3	10.6	316°19.6	12.8
21	306°36.4	172°10.1	·· 13.6	116°42.1	·· 41.4	263°11.8	·· 10.6	331°22.2	·· 12.8
22	321°38.8	187°11.7	13.7	131°43.1	42.1	278°14.4	10.6	346°24.9	12.9
23	336°41.3	202°13.3	13.9	146°44.0	42.7	293°16.9	10.5	1°27.5	13.0
Mer.pass. 00:37		ν 1.7′	d 0.2′	m -4.80	ν 1.0′	d -0.7′	m 1.72	ν 2.5′	d -0.0′ m -2.68
								ν 2.6′	d -0.1′ m 0.51

Stars

	SHA	**Dec**
Alpheratz	357°35.6	29°13.3
Ankaa	353°07.8	-42°10.5
Schedar	349°31.8	56°40.0
Diphda	348°48.1	-17°51.3
Achernar	335°20.5	-57°06.8
Hamal	327°52.2	23°34.5
Polaris	314°19.9	89°21.6
Acamar	315°12.4	-40°12.3
Menkar	314°07.1	4°11.1
Mirfak	308°29.6	49°56.6
Aldebaran	290°40.8	16°33.5
Rigel	281°04.9	-8°10.3
Capella	280°23.5	46°01.2
Bellatrix	278°24.1	6°22.4
Elnath	278°03.3	28°37.6
Alnilam	275°38.9	-1°11.0
Betelgeuse	270°53.3	7°24.8
Canopus	263°53.1	-52°42.1
Sirius	258°27.3	-16°44.7
Adhara	255°06.9	-28°59.9
Procyon	244°52.2	5°10.0
Pollux	243°18.9	27°58.2
Avior	234°15.7	-59°34.8
Suhail	222°47.5	-43°31.4
Miaplacidus	221°39.3	-69°48.6
Alphard	217°49.1	-8°45.5
Regulus	207°35.9	11°51.3
Dubhe	193°43.0	61°37.5
Denebola	182°26.4	14°26.6
Gienah	175°45.0	-17°40.3
Acrux	173°02.0	-63°13.8
Gacrux	171°53.5	-57°14.7
Alioth	166°14.4	55°50.1
Spica	158°23.7	-11°17.0
Alkaid	152°53.2	49°12.0
Hadar	148°38.1	-60°29.3
Menkent	147°59.2	-36°29.2
Arcturus	145°49.1	19°03.8
Rigil Kent.	139°42.3	-60°56.1
Kochab	137°20.4	74°03.7
Zuben'ubi	136°57.4	-16°08.3
Alphecca	126°04.8	26°38.3
Antares	112°17.3	-26°29.1
Atria	107°12.5	-69°04.4
Sabik	102°04.0	-15°45.2
Shaula	96°11.8	-37°07.3
Rasalhague	95°59.5	12°32.7
Eltanin	90°42.6	51°29.4
Kaus Aust.	83°33.9	-34°22.5
Vega	80°33.8	38°48.6
Nunki	75°49.0	-26°16.1
Altair	62°00.8	8°56.0
Peacock	53°07.0	-56°39.7
Deneb	49°26.2	45°22.0
Enif	33°39.6	9°59.1
Al Na'ir	27°33.8	-46°50.8
Fomalhaut	15°15.4	-29°29.7
Scheat	13°45.9	28°12.7
Markab	13°30.7	15°20.0

Sep 10 Sun	**SHA**	**Mer.pass**
Venus	226°26.2	09:38
Mars	171°48.6	13:17
Jupiter	316°31.7	03:38
Saturn	24°34.1	23:03

Sep 11 Mon	**SHA**	**Mer.pass**
Venus	226°09.8	09:35
Mars	171°12.9	13:15
Jupiter	316°32.8	03:34
Saturn	24°38.3	22:58

Sep 12 Tue	**SHA**	**Mer.pass**
Venus	225°51.4	09:33
Mars	170°37.1	13:14
Jupiter	316°34.1	03:30
Saturn	24°42.3	22:54

Horizontal parallax	
Venus:	0.4
Mars:	0.1

h	Sun		Moon				
Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°41.4	N05°07.0	234°22.5	10.5′	N26°46.2	4.8′	54.3′
1	195°41.6	06.0	248°52.0	10.5′	26°41.4	4.9′	54.3′
2	210°41.8	05.1	263°21.5	10.6′	26°36.5	5.0′	54.3′
3	225°42.1	·· 04.1	277°51.1	10.7′	26°31.5	5.2′	54.3′
4	240°42.3	03.2	292°20.8	10.7′	26°26.3	5.3′	54.3′
5	255°42.5	02.2	306°50.5	10.8′	26°21.0	5.4′	54.3′
6	270°42.7	N05°01.3	321°20.3	10.9′	N26°15.6	5.6′	54.2′
7	285°42.9	05°00.3	335°50.2	10.9′	26°10.0	5.6′	54.2′
8	300°43.1	04°59.4	350°20.1	11.0′	26°04.4	5.8′	54.2′
9	315°43.4	·· 58.4	4°50.1	11.1′	25°58.6	5.9′	54.2′
10	330°43.6	57.5	19°20.2	11.1′	25°52.7	6.1′	54.2′
11	345°43.8	56.6	33°50.3	11.2′	25°46.6	6.1′	54.2′
12	0°44.0	N04°55.6	48°20.5	11.3′	N25°40.5	6.2′	54.2′
13	15°44.2	54.7	62°50.7	11.3′	25°34.3	6.4′	54.2′
14	30°44.4	53.7	77°21.1	11.4′	25°27.9	6.5′	54.2′
15	45°44.7	·· 52.8	91°51.4	11.5′	25°21.4	6.6′	54.1′
16	60°44.9	51.8	106°21.9	11.5′	25°14.8	6.7′	54.1′
17	75°45.1	50.9	120°52.4	11.6′	25°08.1	6.8′	54.1′
18	90°45.3	N04°49.9	135°23.0	11.7′	N25°01.3	7.0′	54.1′
19	105°45.5	49.0	149°53.7	11.7′	24°54.3	7.0′	54.1′
20	120°45.8	48.0	164°24.4	11.8′	24°47.3	7.2′	54.1′
21	135°46.0	·· 47.1	178°55.2	11.9′	24°40.1	7.2′	54.1′
22	150°46.2	46.1	193°26.0	11.9′	24°32.9	7.4′	54.1′
23	165°46.4	45.2	207°57.0	12.0′	24°25.5	7.5′	54.1′
	SD = 15.9′	d = -0.9′	SD = 14.8′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°46.6	N04°44.2	222°28.0	12.1′	N24°18.0	7.5′	54.1′
1	195°46.9	43.3	236°59.0	12.1′	24°10.5	7.7′	54.1′
2	210°47.1	42.3	251°30.2	12.2′	24°02.8	7.8′	54.0′
3	225°47.3	·· 41.4	266°01.4	12.3′	23°55.0	7.9′	54.0′
4	240°47.5	40.4	280°32.7	12.3′	23°47.1	8.0′	54.0′
5	255°47.7	39.5	295°04.0	12.4′	23°39.1	8.1′	54.0′
6	270°47.9	N04°38.5	309°35.4	12.5′	N23°31.0	8.2′	54.0′
7	285°48.2	37.6	324°06.9	12.6′	23°22.8	8.3′	54.0′
8	300°48.4	36.6	338°38.5	12.6′	23°14.5	8.4′	54.0′
9	315°48.6	·· 35.7	353°10.1	12.7′	23°06.1	8.6′	54.0′
10	330°48.8	34.7	7°41.8	12.8′	22°57.5	8.6′	54.0′
11	345°49.0	33.8	22°13.6	12.8′	22°48.9	8.6′	54.0′
12	0°49.3	N04°32.8	36°45.4	12.9′	N22°40.3	8.8′	54.0′
13	15°49.5	31.9	51°17.3	13.0′	22°31.5	8.9′	54.0′
14	30°49.7	30.9	65°49.3	13.0′	22°22.6	9.0′	54.0′
15	45°49.9	·· 30.0	80°21.3	13.1′	22°13.6	9.1′	54.0′
16	60°50.1	29.0	94°53.4	13.2′	22°04.5	9.2′	54.0′
17	75°50.4	28.1	109°25.6	13.2′	21°55.3	9.2′	54.0′
18	90°50.6	N04°27.1	123°57.8	13.3′	N21°46.1	9.4′	54.0′
19	105°50.8	26.2	138°30.1	13.4′	21°36.7	9.4′	53.9′
20	120°51.0	25.2	153°02.5	13.4′	21°27.3	9.5′	53.9′
21	135°51.2	·· 24.3	167°34.9	13.5′	21°17.8	9.7′	53.9′
22	150°51.5	23.3	182°07.4	13.6′	21°08.1	9.7′	53.9′
23	165°51.7	22.4	196°40.0	13.6′	20°58.4	9.8′	53.9′
	SD = 15.9′	d = -0.9′	SD = 14.7′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°51.9	N04°21.4	211°12.7	13.7′	N20°48.6	9.8′	53.9′
1	195°52.1	20.5	225°45.4	13.8′	20°38.8	10.0′	53.9′
2	210°52.3	19.5	240°18.1	13.8′	20°28.8	10.1′	53.9′
3	225°52.6	·· 18.6	254°51.0	13.9′	20°18.7	10.1′	53.9′
4	240°52.8	17.6	269°23.9	14.0′	20°08.6	10.2′	53.9′
5	255°53.0	16.7	283°56.8	14.0′	19°58.4	10.3′	53.9′
6	270°53.2	N04°15.7	298°29.9	14.1′	N19°48.1	10.4′	53.9′
7	285°53.4	14.7	313°03.0	14.2′	19°37.7	10.4′	53.9′
8	300°53.7	13.8	327°36.1	14.2′	19°27.3	10.5′	53.9′
9	315°53.9	·· 12.8	342°09.3	14.3′	19°16.8	10.7′	53.9′
10	330°54.1	11.9	356°42.6	14.3′	19°06.1	10.6′	53.9′
11	345°54.3	10.9	11°16.0	14.4′	18°55.5	10.8′	53.9′
12	0°54.5	N04°10.0	25°49.4	14.5′	N18°44.7	10.8′	53.9′
13	15°54.8	09.0	40°22.8	14.5′	18°33.9	11.0′	53.9′
14	30°55.0	08.1	54°56.4	14.6′	18°22.9	10.9′	53.9′
15	45°55.2	·· 07.1	69°30.0	14.6′	18°12.0	11.1′	53.9′
16	60°55.4	06.2	84°03.6	14.7′	18°00.9	11.1′	53.9′
17	75°55.6	05.2	98°37.3	14.8′	17°49.8	11.2′	53.9′
18	90°55.9	N04°04.3	113°11.1	14.8′	N17°38.6	11.3′	53.9′
19	105°56.1	03.3	127°44.9	14.9′	17°27.3	11.4′	53.9′
20	120°56.3	02.3	142°18.8	14.9′	17°15.9	11.4′	53.9′
21	135°56.5	·· 01.4	156°52.7	15.0′	17°04.5	11.4′	53.9′
22	150°56.7	04°00.4	171°26.7	15.0′	16°53.1	11.6′	53.9′
23	165°57.0	03°59.5	186°00.7	15.1′	16°41.5	11.6′	53.9′
	SD = 15.9′	d = -1.0′	SD = 14.7′				

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

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

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 25-27 22-8%
10	02:46	02:56	11:57	08:40	21:04	
11	03:07	03:17	11:57	09:28	21:51	
12	03:28	03:38	11:56	10:14	22:35	

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

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	351°43.8	217°14.9	N11°14.0	161°45.0	S03°43.4	308°19.4	N15°10.5	16°30.1	S12°13.0
1	6°46.2	232°16.4	14.2	176°46.0	44.1	323°22.0	10.5	31°32.8	13.1
2	21°48.7	247°18.0	14.3	191°47.0	44.7	338°24.5	10.5	46°35.4	13.2
3	36°51.2	262°19.6	·· 14.5	206°47.9	·· 45.4	353°27.0	·· 10.4	61°38.0	·· 13.2
4	51°53.6	277°21.2	14.6	221°48.9	46.0	8°29.6	10.4	76°40.7	13.3
5	66°56.1	292°22.7	14.8	236°49.9	46.7	23°32.1	10.4	91°43.3	13.4
6	81°58.6	307°24.3	N11°14.9	251°50.8	S03°47.4	38°34.6	N15°10.4	106°45.9	S12°13.4
7	97°01.0	322°25.8	15.1	266°51.8	48.0	53°37.2	10.3	121°48.6	13.5
8	112°03.5	337°27.4	15.2	281°52.8	48.7	68°39.7	10.3	136°51.2	13.6
9	127°06.0	352°28.9	·· 15.3	296°53.7	·· 49.3	83°42.2	·· 10.3	151°53.8	·· 13.6
10	142°08.4	7°30.5	15.5	311°54.7	50.0	98°44.8	10.2	166°56.5	13.7
11	157°10.9	22°32.0	15.6	326°55.7	50.7	113°47.3	10.2	181°59.1	13.7
12	172°13.3	37°33.6	N11°15.8	341°56.6	S03°51.3	128°49.8	N15°10.2	197°01.7	S12°13.8
13	187°15.8	52°35.1	15.9	356°57.6	52.0	143°52.4	10.2	212°04.4	13.9
14	202°18.3	67°36.6	16.0	11°58.6	52.6	158°54.9	10.1	227°07.0	13.9
15	217°20.7	82°38.2	·· 16.2	26°59.5	·· 53.3	173°57.4	·· 10.1	242°09.6	·· 14.0
16	232°23.2	97°39.7	16.3	42°00.5	54.0	189°00.0	10.1	257°12.2	14.1
17	247°25.7	112°41.2	16.4	57°01.5	54.6	204°02.5	10.0	272°14.9	14.1
18	262°28.1	127°42.7	N11°16.6	72°02.4	S03°55.3	219°05.1	N15°10.0	287°17.5	S12°14.2
19	277°30.6	142°44.3	16.7	87°03.4	55.9	234°07.6	10.0	302°20.1	14.2
20	292°33.1	157°45.8	16.8	102°04.4	56.6	249°10.1	10.0	317°22.8	14.3
21	307°35.5	172°47.3	·· 17.0	117°05.3	·· 57.3	264°12.7	·· 09.9	332°25.4	·· 14.4
22	322°38.0	187°48.8	17.1	132°06.3	57.9	279°15.2	09.9	347°28.0	14.4
23	337°40.4	202°50.3	17.2	147°07.3	58.6	294°17.7	09.9	2°30.7	14.5
Mer.pass. 00:33		ν 1.6′	d 0.1′ m -4.80	ν 1.0′	d -0.7′ m 1.72	ν 2.5′	d -0.0′ m -2.68	ν 2.6′	d -0.1′ m 0.51

Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	352°42.9	217°51.8	N11°17.3	162°08.2	S03°59.3	309°20.3	N15°09.8	17°33.3	S12°14.6
1	7°45.4	232°53.3	17.5	177°09.2	03°59.9	324°22.8	09.8	32°35.9	14.6
2	22°47.8	247°54.8	17.6	192°10.2	04°00.6	339°25.4	09.8	47°38.6	14.7
3	37°50.3	262°56.3	·· 17.7	207°11.1	·· 01.2	354°27.9	·· 09.7	62°41.2	·· 14.8
4	52°52.8	277°57.8	17.8	222°12.1	01.9	9°30.5	09.7	77°43.8	14.8
5	67°55.2	292°59.3	18.0	237°13.1	02.6	24°33.0	09.7	92°46.4	14.9
6	82°57.7	308°00.8	N11°18.1	252°14.0	S04°03.2	39°35.5	N15°09.7	107°49.1	S12°14.9
7	98°00.2	323°02.2	18.2	267°15.0	03.9	54°38.1	09.6	122°51.7	15.0
8	113°02.6	338°03.7	18.3	282°16.0	04.5	69°40.6	09.6	137°54.3	15.1
9	128°05.1	353°05.2	·· 18.4	297°16.9	·· 05.2	84°43.2	·· 09.6	152°57.0	·· 15.1
10	143°07.6	8°06.7	18.6	312°17.9	05.9	99°45.7	09.5	167°59.6	15.2
11	158°10.0	23°08.1	18.7	327°18.8	06.5	114°48.3	09.5	183°02.2	15.3
12	173°12.5	38°09.6	N11°18.8	342°19.8	S04°07.2	129°50.8	N15°09.5	198°04.8	S12°15.3
13	188°14.9	53°11.1	18.9	357°20.8	07.8	144°53.3	09.4	213°07.5	15.4
14	203°17.4	68°12.5	19.0	12°21.7	08.5	159°55.9	09.4	228°10.1	15.4
15	218°19.9	83°14.0	·· 19.1	27°22.7	·· 09.2	174°58.4	·· 09.4	243°12.7	·· 15.5
16	233°22.3	98°15.4	19.2	42°23.7	09.8	190°01.0	09.3	258°15.4	15.6
17	248°24.8	113°16.9	19.4	57°24.6	10.5	205°03.5	09.3	273°18.0	15.6
18	263°27.3	128°18.3	N11°19.5	72°25.6	S04°11.1	220°06.1	N15°09.3	288°20.6	S12°15.7
19	278°29.7	143°19.8	19.6	87°26.6	11.8	235°08.6	09.3	303°23.3	15.8
20	293°32.2	158°21.2	19.7	102°27.5	12.5	250°11.2	09.2	318°25.9	15.8
21	308°34.7	173°22.7	·· 19.8	117°28.5	·· 13.1	265°13.7	·· 09.2	333°28.5	·· 15.9
22	323°37.1	188°24.1	19.9	132°29.5	13.8	280°16.3	09.2	348°31.1	15.9
23	338°39.6	203°25.5	20.0	147°30.4	14.4	295°18.8	09.1	3°33.8	16.0
Mer.pass. 00:29		ν 1.5′	d 0.1′ m -4.80	ν 1.0′	d -0.7′ m 1.72	ν 2.5′	d -0.0′ m -2.69	ν 2.6′	d -0.1′ m 0.52

Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	353°42.1	218°27.0	N11°20.1	162°31.4	S04°15.1	310°21.4	N15°09.1	18°36.4	S12°16.1
1	8°44.5	233°28.4	20.2	177°32.3	15.8	325°23.9	09.1	33°39.0	16.1
2	23°47.0	248°29.8	20.3	192°33.3	16.4	340°26.5	09.0	48°41.7	16.2
3	38°49.4	263°31.2	·· 20.4	207°34.3	·· 17.1	355°29.0	·· 09.0	63°44.3	·· 16.3
4	53°51.9	278°32.6	20.5	222°35.2	17.7	10°31.5	09.0	78°46.9	16.3
5	68°54.4	293°34.1	20.6	237°36.2	18.4	25°34.1	08.9	93°49.5	16.4
6	83°56.8	308°35.5	N11°20.7	252°37.2	S04°19.1	40°36.7	N15°08.9	108°52.2	S12°16.4
7	98°59.3	323°36.9	20.8	267°38.1	19.7	55°39.2	08.9	123°54.8	16.5
8	114°01.8	338°38.3	20.9	282°39.1	20.4	70°41.8	08.8	138°57.4	16.6
9	129°04.2	353°39.7	·· 21.0	297°40.0	·· 21.0	85°44.3	·· 08.8	154°00.1	·· 16.6
10	144°06.7	8°41.1	21.1	312°41.0	21.7	100°46.9	08.8	169°02.7	16.7
11	159°09.2	23°42.5	21.2	327°42.0	22.4	115°49.4	08.7	184°05.3	16.8
12	174°11.6	38°43.9	N11°21.3	342°42.9	S04°23.0	130°52.0	N15°08.7	199°07.9	S12°16.8
13	189°14.1	53°45.3	21.4	357°43.9	23.7	145°54.5	08.7	214°10.6	16.9
14	204°16.5	68°46.7	21.5	12°44.8	24.3	160°57.1	08.6	229°13.2	16.9
15	219°19.0	83°48.0	·· 21.6	27°45.8	·· 25.0	175°59.6	·· 08.6	244°15.8	·· 17.0
16	234°21.5	98°49.4	21.7	42°46.8	25.7	191°02.2	08.6	259°18.4	17.1
17	249°23.9	113°50.8	21.8	57°47.7	26.3	206°04.7	08.5	274°21.1	17.1
18	264°26.4	128°52.2	N11°21.8	72°48.7	S04°27.0	221°07.3	N15°08.5	289°23.7	S12°17.2
19	279°28.9	143°53.6	21.9	87°49.7	27.6	236°09.8	08.5	304°26.3	17.2
20	294°31.3	158°54.9	22.0	102°50.6	28.3	251°12.4	08.4	319°29.0	17.3
21	309°33.8	173°56.3	·· 22.1	117°51.6	·· 28.9	266°14.9	·· 08.4	334°31.6	·· 17.4
22	324°36.3	188°57.7	22.2	132°52.5	29.6	281°17.5	08.4	349°34.2	17.4
23	339°38.7	203°59.0	22.3	147°53.5	30.3	296°20.1	08.3	4°36.8	17.5
Mer.pass. 00:25		ν 1.4′	d 0.1′ m -4.81	ν 1.0′	d -0.7′ m 1.71	ν 2.5′	d -0.0′ m -2.70	ν 2.6′	d -0.1′ m 0.52

Stars

	SHA	**Dec**
Alpheratz	357°35.6	29°13.3
Ankaa	353°07.8	-42°10.5
Schedar	349°31.8	56°40.0
Diphda	348°48.1	-17°51.3
Achernar	335°20.5	-57°06.8
Hamal	327°52.2	23°34.5
Polaris	314°18.7	89°21.6
Acamar	315°12.4	-40°12.3
Menkar	314°07.1	4°11.1
Mirfak	308°29.6	49°56.6
Aldebaran	290°40.8	16°33.5
Rigel	281°04.9	-8°10.2
Capella	280°23.5	46°01.2
Bellatrix	278°24.1	6°22.4
Elnath	278°03.3	28°37.6
Alnilam	275°38.9	-1°11.0
Betelgeuse	270°53.3	7°24.8
Canopus	263°53.0	-52°42.1
Sirius	258°27.3	-16°44.7
Adhara	255°06.9	-28°59.9
Procyon	244°52.2	5°10.0
Pollux	243°18.9	27°58.2
Avior	234°15.6	-59°34.8
Suhail	222°47.5	-43°31.4
Miaplacidus	221°39.3	-69°48.6
Alphard	217°49.1	-8°45.5
Regulus	207°35.9	11°51.2
Dubhe	193°43.0	61°37.5
Denebola	182°26.4	14°26.6
Gienah	175°45.0	-17°40.3
Acrux	173°02.1	-63°13.8
Gacrux	171°53.5	-57°14.7
Alioth	166°14.4	55°50.1
Spica	158°23.7	-11°17.0
Alkaid	152°53.2	49°11.9
Hadar	148°38.1	-60°29.3
Menkent	147°59.2	-36°29.2
Arcturus	145°49.2	19°03.7
Rigil Kent.	139°42.3	-60°56.1
Kochab	137°20.4	74°03.7
Zuben'ubi	136°57.4	-16°08.3
Alphecca	126°04.8	26°38.3
Antares	112°17.3	-26°29.1
Atria	107°12.5	-69°04.4
Sabik	102°04.1	-15°45.2
Shaula	96°11.8	-37°07.3
Rasalhague	95°59.6	12°32.7
Eltanin	90°42.6	51°29.4
Kaus Aust.	83°33.9	-34°22.5
Vega	80°33.8	38°48.6
Nunki	75°49.0	-26°16.1
Altair	62°00.8	8°56.0
Peacock	53°07.0	-56°39.7
Deneb	49°26.2	45°22.1
Enif	33°39.6	9°59.1
Al Na'ir	27°33.8	-46°50.8
Fomalhaut	15°15.4	-29°29.8
Scheat	13°45.9	28°12.8
Markab	13°30.7	15°20.0

Sep 13 Wed	**SHA**	**Mer.pass**
Venus	225°31.1	09:30
Mars	170°01.2	13:12
Jupiter	316°35.6	03:26
Saturn	24°46.4	22:50

Sep 14 Thu	**SHA**	**Mer.pass**
Venus	225°08.9	09:28
Mars	169°25.3	13:11
Jupiter	316°37.4	03:22
Saturn	24°50.4	22:46

Sep 15 Fri	**SHA**	**Mer.pass**
Venus	224°44.9	09:25
Mars	168°49.3	13:09
Jupiter	316°39.3	03:18
Saturn	24°54.3	22:42

Horizontal parallax	
Venus:	0.4
Mars:	0.1

h	Sun		Moon				
Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°57.2	N03°58.5	200°34.8	15.1′	N16°29.9	11.7′	53.9′
1	195°57.4	57.6	215°09.0	15.2′	16°18.2	11.7′	53.9′
2	210°57.6	56.6	229°43.2	15.3′	16°06.5	11.8′	53.9′
3	225°57.9	·· 55.7	244°17.4	15.3′	15°54.7	11.9′	53.9′
4	240°58.1	54.7	258°51.7	15.4′	15°42.8	11.9′	53.9′
5	255°58.3	53.7	273°26.1	15.4′	15°30.9	12.0′	53.9′
6	270°58.5	N03°52.8	288°00.5	15.5′	N15°18.9	12.1′	53.9′
7	285°58.7	51.8	302°34.9	15.5′	15°06.8	12.1′	53.9′
8	300°59.0	50.9	317°09.4	15.6′	14°54.7	12.1′	53.9′
9	315°59.2	·· 49.9	331°44.0	15.6′	14°42.6	12.3′	53.9′
10	330°59.4	49.0	346°18.6	15.6′	14°30.3	12.3′	53.9′
11	345°59.6	48.0	0°53.2	15.7′	14°18.0	12.3′	53.9′
12	0°59.8	N03°47.0	15°27.9	15.7′	N14°05.7	12.4′	53.9′
13	16°00.1	46.1	30°02.7	15.8′	13°53.3	12.4′	53.9′
14	31°00.3	45.1	44°37.5	15.8′	13°40.9	12.5′	53.9′
15	46°00.5	·· 44.2	59°12.3	15.9′	13°28.4	12.6′	54.0′
16	61°00.7	43.2	73°47.2	15.9′	13°15.8	12.6′	54.0′
17	76°00.9	42.3	88°22.1	16.0′	13°03.2	12.7′	54.0′
18	91°01.2	N03°41.3	102°57.0	16.0′	N12°50.5	12.7′	54.0′
19	106°01.4	40.3	117°32.0	16.0′	12°37.8	12.7′	54.0′
20	121°01.6	39.4	132°07.0	16.1′	12°25.1	12.9′	54.0′
21	136°01.8	·· 38.4	146°42.1	16.1′	12°12.2	12.8′	54.0′
22	151°02.1	37.5	161°17.2	16.1′	11°59.4	12.9′	54.0′
23	166°02.3	36.5	175°52.4	16.2′	11°46.5	13.0′	54.0′
	SD = 15.9′	d = -1.0′	SD = 14.7′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	181°02.5	N03°35.6	190°27.6	16.2′	N11°33.5	13.0′	54.0′
1	196°02.7	34.6	205°02.8	16.3′	11°20.5	13.0′	54.0′
2	211°02.9	33.6	219°38.0	16.3′	11°07.5	13.1′	54.0′
3	226°03.2	·· 32.7	234°13.3	16.3′	10°54.4	13.1′	54.0′
4	241°03.4	31.7	248°48.7	16.4′	10°41.3	13.2′	54.0′
5	256°03.6	30.8	263°24.0	16.4′	10°28.1	13.2′	54.0′
6	271°03.8	N03°29.8	277°59.4	16.4′	N10°14.9	13.3′	54.0′
7	286°04.0	28.8	292°34.8	16.4′	10°01.6	13.3′	54.0′
8	301°04.3	27.9	307°10.3	16.5′	09°48.3	13.3′	54.0′
9	316°04.5	·· 26.9	321°45.7	16.5′	09°35.0	13.4′	54.0′
10	331°04.7	26.0	336°21.2	16.5′	09°21.6	13.4′	54.1′
11	346°04.9	25.0	350°56.8	16.6′	09°08.2	13.4′	54.1′
12	1°05.2	N03°24.1	5°32.3	16.6′	N08°54.8	13.5′	54.1′
13	16°05.4	23.1	20°07.9	16.6′	08°41.3	13.5′	54.1′
14	31°05.6	22.1	34°43.5	16.6′	08°27.8	13.6′	54.1′
15	46°05.8	·· 21.2	49°19.2	16.7′	08°14.2	13.6′	54.1′
16	61°06.0	20.2	63°54.8	16.7′	08°00.6	13.6′	54.1′
17	76°06.3	19.3	78°30.5	16.7′	07°47.0	13.6′	54.1′
18	91°06.5	N03°18.3	93°06.2	16.7′	N07°33.4	13.7′	54.1′
19	106°06.7	17.3	107°41.9	16.7′	07°19.7	13.7′	54.1′
20	121°06.9	16.4	122°17.6	16.8′	07°06.0	13.8′	54.1′
21	136°07.2	·· 15.4	136°53.4	16.8′	06°52.2	13.8′	54.1′
22	151°07.4	14.5	151°29.2	16.8′	06°38.4	13.8′	54.1′
23	166°07.6	13.5	166°05.0	16.8′	06°24.6	13.8′	54.2′
	SD = 15.9′	d = -1.0′	SD = 14.7′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	181°07.8	N03°12.5	180°40.8	16.8′	N06°10.8	13.9′	54.2′
1	196°08.0	11.6	195°16.6	16.8′	05°56.9	13.9′	54.2′
2	211°08.3	10.6	209°52.4	16.8′	05°43.0	13.9′	54.2′
3	226°08.5	·· 09.6	224°28.3	16.9′	05°29.1	13.9′	54.2′
4	241°08.7	08.7	239°04.1	16.9′	05°15.2	14.0′	54.2′
5	256°08.9	07.7	253°40.0	16.9′	05°01.2	13.9′	54.2′
6	271°09.2	N03°06.8	268°15.9	16.9′	N04°47.3	14.0′	54.2′
7	286°09.4	05.8	282°51.7	16.9′	04°33.3	14.1′	54.2′
8	301°09.6	04.8	297°27.6	16.9′	04°19.2	14.0′	54.2′
9	316°09.8	·· 03.9	312°03.5	16.9′	04°05.2	14.1′	54.3′
10	331°10.0	02.9	326°39.4	16.9′	03°51.1	14.1′	54.3′
11	346°10.3	02.0	341°15.4	16.9′	03°37.0	14.1′	54.3′
12	1°10.5	N03°01.0	355°51.3	16.9′	N03°22.9	14.1′	54.3′
13	16°10.7	03°00.0	10°27.2	16.9′	03°08.8	14.1′	54.3′
14	31°10.9	02°59.1	25°03.1	16.9′	02°54.7	14.2′	54.3′
15	46°11.2	·· 58.1	39°39.0	16.9′	02°40.5	14.2′	54.3′
16	61°11.4	57.1	54°15.0	16.9′	02°26.3	14.1′	54.3′
17	76°11.6	56.2	68°50.9	16.9′	02°12.2	14.2′	54.3′
18	91°11.8	N02°55.2	83°26.8	16.9′	N01°58.0	14.2′	54.3′
19	106°12.0	54.3	98°02.7	16.9′	01°43.8	14.3′	54.4′
20	121°12.3	53.3	112°38.6	16.9′	01°29.5	14.2′	54.4′
21	136°12.5	·· 52.3	127°14.5	16.9′	01°15.3	14.2′	54.4′
22	151°12.7	51.4	141°50.4	16.9′	01°01.1	14.3′	54.4′
23	166°12.9	50.4	156°26.3	16.9′	00°46.8	14.3′	54.4′
	SD = 15.9′	d = -1.0′	SD = 14.8′				

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

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

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 28-0 4-0%
13	03:49	03:59	11:56	10:56	23:17	
14	04:10	04:21	11:56	11:37	23:57	
15	04:31	04:42	11:55	12:17	–:–	

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

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	354°41.2	219°00.4	N11°22.4	162°54.5	S04°30.9	311°22.6	N15°08.3	19°39.5	S12°17.6
1	9°43.7	234°01.7	22.4	177°55.4	31.6	326°25.2	08.3	34°42.1	17.6
2	24°46.1	249°03.1	22.5	192°56.4	32.2	341°27.7	08.2	49°44.7	17.7
3	39°48.6	264°04.4	·· 22.6	207°57.3	·· 32.9	356°30.3	·· 08.2	64°47.3	·· 17.7
4	54°51.0	279°05.8	22.7	222°58.3	33.6	11°32.8	08.2	79°50.0	17.8
5	69°53.5	294°07.1	22.8	237°59.3	34.2	26°35.4	08.1	94°52.6	17.9
6	84°56.0	309°08.5	N11°22.8	253°00.2	S04°34.9	41°38.0	N15°08.1	109°55.2	S12°17.9
7	99°58.4	324°09.8	22.9	268°01.2	35.5	56°40.5	08.0	124°57.9	18.0
8	115°00.9	339°11.1	23.0	283°02.1	36.2	71°43.1	08.0	140°00.5	18.0
9	130°03.4	354°12.5	·· 23.1	298°03.1	·· 36.9	86°45.6	·· 08.0	155°03.1	·· 18.1
10	145°05.8	9°13.8	23.1	313°04.1	37.5	101°48.2	07.9	170°05.7	18.2
11	160°08.3	24°15.1	23.2	328°05.0	38.2	116°50.8	07.9	185°08.4	18.2
12	175°10.8	39°16.5	N11°23.3	343°06.0	S04°38.8	131°53.3	N15°07.9	200°11.0	S12°18.3
13	190°13.2	54°17.8	23.4	358°06.9	39.5	146°55.9	07.8	215°13.6	18.4
14	205°15.7	69°19.1	23.4	13°07.9	40.2	161°58.4	07.8	230°16.2	18.4
15	220°18.1	84°20.4	·· 23.5	28°08.8	·· 40.8	177°01.0	·· 07.8	245°18.9	·· 18.5
16	235°20.6	99°21.7	23.6	43°09.8	41.5	192°03.6	07.7	260°21.5	18.5
17	250°23.1	114°23.0	23.6	58°10.8	42.1	207°06.1	07.7	275°24.1	18.6
18	265°25.5	129°24.3	N11°23.7	73°11.7	S04°42.8	222°08.7	N15°07.7	290°26.7	S12°18.7
19	280°28.0	144°25.6	23.8	88°12.7	43.4	237°11.3	07.6	305°29.4	18.7
20	295°30.5	159°26.9	23.8	103°13.6	44.1	252°13.8	07.6	320°32.0	18.8
21	310°32.9	174°28.2	·· 23.9	118°14.6	·· 44.8	267°16.4	·· 07.5	335°34.6	·· 18.8
22	325°35.4	189°29.5	24.0	133°15.5	45.4	282°18.9	07.5	350°37.2	18.9
23	340°37.9	204°30.8	24.0	148°16.5	46.1	297°21.5	07.5	5°39.9	19.0
Mer.pass. 00:21		ν 1.4′	d 0.1′	m -4.80	ν 1.0′	d -0.7′	m 1.71	ν 2.6′	d -0.0′ m -2.71 ν 2.6′ d -0.1′ m 0.52

Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	355°40.3	219°32.1	N11°24.1	163°17.5	S04°46.7	312°24.1	N15°07.4	20°42.5	S12°19.0
1	10°42.8	234°33.4	24.1	178°18.4	47.4	327°26.6	07.4	35°45.1	19.1
2	25°45.3	249°34.7	24.2	193°19.4	48.1	342°29.2	07.4	50°47.7	19.1
3	40°47.7	264°36.0	·· 24.3	208°20.3	·· 48.7	357°31.8	·· 07.3	65°50.4	·· 19.2
4	55°50.2	279°37.3	24.3	223°21.3	49.4	12°34.3	07.3	80°53.0	19.3
5	70°52.6	294°38.5	24.4	238°22.2	50.0	27°36.9	07.3	95°55.6	19.3
6	85°55.1	309°39.8	N11°24.4	253°23.2	S04°50.7	42°39.5	N15°07.2	110°58.2	S12°19.4
7	100°57.6	324°41.1	24.5	268°24.2	51.4	57°42.0	07.2	126°00.9	19.4
8	116°00.0	339°42.3	24.5	283°25.1	52.0	72°44.6	07.1	141°03.5	19.5
9	131°02.5	354°43.6	·· 24.6	298°26.1	·· 52.7	87°47.2	·· 07.1	156°06.1	·· 19.6
10	146°05.0	9°44.9	24.6	313°27.0	53.3	102°49.7	07.1	171°08.7	19.6
11	161°07.4	24°46.1	24.7	328°28.0	54.0	117°52.3	07.0	186°11.4	19.7
12	176°09.9	39°47.4	N11°24.8	343°28.9	S04°54.6	132°54.9	N15°07.0	201°14.0	S12°19.7
13	191°12.4	54°48.6	24.8	358°29.9	55.3	147°57.4	07.0	216°16.6	19.8
14	206°14.8	69°49.9	24.8	13°30.9	56.0	163°00.0	06.9	231°19.2	19.9
15	221°17.3	84°51.1	·· 24.9	28°31.8	·· 56.6	178°02.6	·· 06.9	246°21.9	·· 19.9
16	236°19.7	99°52.4	24.9	43°32.8	57.3	193°05.2	06.8	261°24.5	20.0
17	251°22.2	114°53.6	25.0	58°33.7	57.9	208°07.7	06.8	276°27.1	20.0
18	266°24.7	129°54.9	N11°25.0	73°34.7	S04°58.6	223°10.3	N15°06.8	291°29.7	S12°20.1
19	281°27.1	144°56.1	25.1	88°35.6	59.3	238°12.9	06.7	306°32.4	20.2
20	296°29.6	159°57.4	25.1	103°36.6	04°59.9	253°15.4	06.7	321°35.0	20.2
21	311°32.1	174°58.6	·· 25.2	118°37.5	05°00.6	268°18.0	·· 06.6	336°37.6	·· 20.3
22	326°34.5	189°59.8	25.2	133°38.5	01.2	283°20.6	06.6	351°40.2	20.3
23	341°37.0	205°01.0	25.2	148°39.4	01.9	298°23.2	06.6	6°42.9	20.4
Mer.pass. 00:17		ν 1.3′	d 0.1′	m -4.80	ν 1.0′	d -0.7′	m 1.70	ν 2.6′	d -0.0′ m -2.71 ν 2.6′ d -0.1′ m 0.53

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	356°39.5	220°02.3	N11°25.3	163°40.4	S05°02.5	313°25.7	N15°06.5	21°45.5	S12°20.5
1	11°41.9	235°03.5	25.3	178°41.4	03.2	328°28.3	06.5	36°48.1	20.5
2	26°44.4	250°04.7	25.4	193°42.3	03.9	343°30.9	06.5	51°50.7	20.6
3	41°46.9	265°05.9	·· 25.4	208°43.3	·· 04.5	358°33.4	·· 06.4	66°53.4	·· 20.6
4	56°49.3	280°07.1	25.4	223°44.2	05.2	13°36.0	06.4	81°56.0	20.7
5	71°51.8	295°08.4	25.5	238°45.2	05.8	28°38.6	06.3	96°58.6	20.8
6	86°54.2	310°09.6	N11°25.5	253°46.1	S05°06.5	43°41.2	N15°06.3	112°01.2	S12°20.8
7	101°56.7	325°10.8	25.5	268°47.1	07.1	58°43.7	06.3	127°03.8	20.9
8	116°59.2	340°12.0	25.6	283°48.0	07.8	73°46.3	06.2	142°06.5	20.9
9	132°01.6	355°13.2	·· 25.6	298°49.0	·· 08.5	88°48.9	·· 06.2	157°09.1	·· 21.0
10	147°04.1	10°14.4	25.6	313°49.9	09.1	103°51.5	06.1	172°11.7	21.1
11	162°06.6	25°15.6	25.6	328°50.9	09.8	118°54.1	06.1	187°14.3	21.1
12	177°09.0	40°16.8	N11°25.7	343°51.8	S05°10.4	133°56.6	N15°06.1	202°17.0	S12°21.2
13	192°11.5	55°17.9	25.7	358°52.8	11.1	148°59.2	06.0	217°19.6	21.2
14	207°14.0	70°19.1	25.7	13°53.7	11.8	164°01.8	06.0	232°22.2	21.3
15	222°16.4	85°20.3	·· 25.8	28°54.7	·· 12.4	179°04.4	·· 05.9	247°24.8	·· 21.4
16	237°18.9	100°21.5	25.8	43°55.7	13.1	194°06.9	05.9	262°27.4	21.4
17	252°21.3	115°22.7	25.8	58°56.6	13.7	209°09.5	05.9	277°30.1	21.5
18	267°23.8	130°23.9	N11°25.8	73°57.6	S05°14.4	224°12.1	N15°05.8	292°32.7	S12°21.5
19	282°26.3	145°25.0	25.8	88°58.5	15.0	239°14.7	05.8	307°35.3	21.6
20	297°28.7	160°26.2	25.9	103°59.5	15.7	254°17.3	05.7	322°37.9	21.7
21	312°31.2	175°27.4	·· 25.9	119°00.4	·· 16.4	269°19.8	·· 05.7	337°40.6	·· 21.7
22	327°33.7	190°28.5	25.9	134°01.4	17.0	284°22.4	05.6	352°43.2	21.8
23	342°36.1	205°29.7	25.9	149°02.3	17.7	299°25.0	05.6	7°45.8	21.8
Mer.pass. 00:13		ν 1.2′	d 0.0′	m -4.80	ν 1.0′	d -0.7′	m 1.70	ν 2.6′	d -0.0′ m -2.72 ν 2.6′ d -0.1′ m 0.53

Stars

	SHA	**Dec**
Alpheratz	357°35.6	29°13.3
Ankaa	353°07.8	-42°10.5
Schedar	349°31.8	56°40.0
Diphda	348°48.1	-17°51.3
Achernar	335°20.5	-57°06.8
Hamal	327°52.2	23°34.5
Polaris	314°17.5	89°21.6
Acamar	315°12.3	-40°12.3
Menkar	314°07.1	4°11.1
Mirfak	308°29.6	49°56.6
Aldebaran	290°40.8	16°33.5
Rigel	281°04.9	-8°10.2
Capella	280°23.5	46°01.2
Bellatrix	278°24.0	6°22.4
Elnath	278°03.2	28°37.6
Alnilam	275°38.8	-1°11.0
Betelgeuse	270°53.3	7°24.8
Canopus	263°53.0	-52°42.1
Sirius	258°27.3	-16°44.6
Adhara	255°06.9	-28°59.9
Procyon	244°52.1	5°10.0
Pollux	243°18.8	27°58.2
Avior	234°15.6	-59°34.8
Suhail	222°47.5	-43°31.4
Miaplacidus	221°39.3	-69°48.6
Alphard	217°49.1	-8°45.5
Regulus	207°35.9	11°51.2
Dubhe	193°43.0	61°37.5
Denebola	182°26.4	14°26.6
Gienah	175°45.1	-17°40.3
Acrux	173°02.1	-63°13.8
Gacrux	171°53.5	-57°14.7
Alioth	166°14.4	55°50.1
Spica	158°23.8	-11°17.0
Alkaid	152°53.3	49°11.9
Hadar	148°38.1	-60°29.3
Menkent	147°59.2	-36°29.2
Arcturus	145°49.2	19°03.7
Rigil Kent.	139°42.3	-60°56.1
Kochab	137°20.5	74°03.7
Zuben'ubi	136°57.5	-16°08.3
Alphecca	126°04.8	26°38.3
Antares	112°17.3	-26°29.1
Atria	107°12.6	-69°04.4
Sabik	102°04.1	-15°45.2
Shaula	96°11.9	-37°07.3
Rasalhague	95°59.6	12°32.7
Eltanin	90°42.6	51°29.4
Kaus Aust.	83°33.9	-34°22.5
Vega	80°33.9	38°48.6
Nunki	75°49.0	-26°16.1
Altair	62°00.9	8°56.0
Peacock	53°07.0	-56°39.7
Deneb	49°26.2	45°22.1
Enif	33°39.6	9°59.1
Al Na'ir	27°33.8	-46°50.8
Fomalhaut	15°15.4	-29°29.8
Scheat	13°45.9	28°12.8
Markab	13°30.7	15°20.1

Sep 16 Sat	**SHA**	**Mer.pass**
Venus	224°19.2	09:23
Mars	168°13.3	13:08
Jupiter	316°41.4	03:14
Saturn	24°58.3	22:37

Sep 17 Sun	**SHA**	**Mer.pass**
Venus	223°51.8	09:21
Mars	167°37.1	13:06
Jupiter	316°43.8	03:10
Saturn	25°02.2	22:33

Sep 18 Mon	**SHA**	**Mer.pass**
Venus	223°22.8	09:19
Mars	167°00.9	13:04
Jupiter	316°46.3	03:06
Saturn	25°06.0	22:29

Horizontal parallax	
Venus:	0.3
Mars:	0.1

h	Sun		Moon				
Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	181°13.2	N02°49.4	171°02.2	16.9′	N00°32.5	14.2′	54.4′
1	196°13.4	48.5	185°38.1	16.9′	00°18.3	14.3′	54.4′
2	211°13.6	47.5	200°14.0	16.9′	N00°04.0	14.3′	54.4′
3	226°13.8	·· 46.6	214°49.8	16.8′	S00°10.3	14.3′	54.5′
4	241°14.1	45.6	229°25.7	16.8′	00°24.6	14.3′	54.5′
5	256°14.3	44.6	244°01.5	16.8′	00°38.9	14.3′	54.5′
6	271°14.5	N02°43.7	258°37.3	16.8′	S00°53.2	14.3′	54.5′
7	286°14.7	42.7	273°13.1	16.8′	01°07.5	14.3′	54.5′
8	301°14.9	41.7	287°48.9	16.8′	01°21.8	14.3′	54.5′
9	316°15.2	·· 40.8	302°24.7	16.8′	01°36.1	14.3′	54.5′
10	331°15.4	39.8	317°00.4	16.7′	01°50.4	14.3′	54.5′
11	346°15.6	38.8	331°36.2	16.7′	02°04.7	14.3′	54.6′
12	1°15.8	N02°37.9	346°11.9	16.7′	S02°19.0	14.3′	54.6′
13	16°16.1	36.9	0°47.6	16.7′	02°33.3	14.3′	54.6′
14	31°16.3	35.9	15°23.3	16.6′	02°47.6	14.3′	54.6′
15	46°16.5	·· 35.0	29°58.9	16.6′	03°01.9	14.3′	54.6′
16	61°16.7	34.0	44°34.5	16.6′	03°16.2	14.3′	54.6′
17	76°16.9	33.1	59°10.1	16.6′	03°30.5	14.3′	54.6′
18	91°17.2	N02°32.1	73°45.7	16.5′	S03°44.8	14.3′	54.7′
19	106°17.4	31.1	88°21.3	16.5′	03°59.1	14.2′	54.7′
20	121°17.6	30.2	102°56.8	16.5′	04°13.3	14.3′	54.7′
21	136°17.8	·· 29.2	117°32.3	16.5′	04°27.6	14.2′	54.7′
22	151°18.1	28.2	132°07.7	16.4′	04°41.8	14.3′	54.7′
23	166°18.3	27.3	146°43.1	16.4′	04°56.1	14.2′	54.7′
	SD = 15.9′	d = -1.0′	SD = 14.8′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	181°18.5	N02°26.3	161°18.5	16.4′	S05°10.3	14.2′	54.7′
1	196°18.7	25.3	175°53.9	16.3′	05°24.5	14.2′	54.8′
2	211°19.0	24.4	190°29.2	16.3′	05°38.7	14.2′	54.8′
3	226°19.2	·· 23.4	205°04.5	16.3′	05°52.9	14.2′	54.8′
4	241°19.4	22.4	219°39.8	16.2′	06°07.1	14.2′	54.8′
5	256°19.6	21.5	234°15.0	16.2′	06°21.3	14.1′	54.8′
6	271°19.8	N02°20.5	248°50.2	16.1′	S06°35.4	14.1′	54.8′
7	286°20.1	19.5	263°25.3	16.1′	06°49.5	14.2′	54.9′
8	301°20.3	18.6	278°00.4	16.1′	07°03.7	14.0′	54.9′
9	316°20.5	·· 17.6	292°35.4	16.0′	07°17.7	14.1′	54.9′
10	331°20.7	16.6	307°10.5	16.0′	07°31.8	14.1′	54.9′
11	346°21.0	15.7	321°45.4	15.9′	07°45.9	14.0′	54.9′
12	1°21.2	N02°14.7	336°20.3	15.9′	S07°59.9	14.0′	54.9′
13	16°21.4	13.7	350°55.2	15.8′	08°13.9	14.0′	54.9′
14	31°21.6	12.8	5°30.0	15.8′	08°27.9	13.9′	55.0′
15	46°21.8	·· 11.8	20°04.8	15.7′	08°41.8	14.0′	55.0′
16	61°22.1	10.8	34°39.6	15.7′	08°55.8	13.9′	55.0′
17	76°22.3	09.9	49°14.2	15.6′	09°09.7	13.9′	55.0′
18	91°22.5	N02°08.9	63°48.9	15.6′	S09°23.6	13.8′	55.0′
19	106°22.7	07.9	78°23.4	15.5′	09°37.4	13.8′	55.1′
20	121°23.0	07.0	92°58.0	15.5′	09°51.2	13.8′	55.1′
21	136°23.2	·· 06.0	107°32.4	15.4′	10°05.0	13.8′	55.1′
22	151°23.4	05.0	122°06.8	15.4′	10°18.8	13.7′	55.1′
23	166°23.6	04.1	136°41.2	15.3′	10°32.5	13.7′	55.1′
	SD = 15.9′	d = -1.0′	SD = 14.9′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	181°23.9	N02°03.1	151°15.5	15.2′	S10°46.2	13.7′	55.1′
1	196°24.1	02.1	165°49.7	15.2′	10°59.9	13.6′	55.2′
2	211°24.3	01.2	180°23.9	15.1′	11°13.5	13.6′	55.2′
3	226°24.5	02°00.2	194°58.0	15.1′	11°27.1	13.5′	55.2′
4	241°24.7	01°59.2	209°32.1	15.0′	11°40.6	13.5′	55.2′
5	256°25.0	58.3	224°06.0	14.9′	11°54.1	13.5′	55.2′
6	271°25.2	N01°57.3	238°40.0	14.9′	S12°07.6	13.4′	55.3′
7	286°25.4	56.3	253°13.8	14.8′	12°21.0	13.4′	55.3′
8	301°25.6	55.4	267°47.6	14.7′	12°34.4	13.4′	55.3′
9	316°25.9	·· 54.4	282°21.3	14.7′	12°47.8	13.3′	55.3′
10	331°26.1	53.4	296°55.0	14.6′	13°01.1	13.2′	55.3′
11	346°26.3	52.5	311°28.6	14.5′	13°14.3	13.2′	55.3′
12	1°26.5	N01°51.5	326°02.1	14.4′	S13°27.5	13.2′	55.4′
13	16°26.8	50.5	340°35.6	14.4′	13°40.7	13.1′	55.4′
14	31°27.0	49.6	355°08.9	14.3′	13°53.8	13.1′	55.4′
15	46°27.2	·· 48.6	9°42.2	14.2′	14°06.9	13.0′	55.4′
16	61°27.4	47.6	24°15.4	14.1′	14°19.9	13.0′	55.4′
17	76°27.6	46.7	38°48.6	14.1′	14°32.9	12.9′	55.5′
18	91°27.9	N01°45.7	53°21.7	14.0′	S14°45.8	12.9′	55.5′
19	106°28.1	44.7	67°54.7	13.9′	14°58.7	12.8′	55.5′
20	121°28.3	43.8	82°27.6	13.8′	15°11.5	12.7′	55.5′
21	136°28.5	·· 42.8	97°00.4	13.8′	15°24.2	12.7′	55.6′
22	151°28.8	41.8	111°33.2	13.7′	15°36.9	12.7′	55.6′
23	166°29.0	40.8	126°05.9	13.6′	15°49.6	12.5′	55.6′
	SD = 15.9′	d = -1.0′	SD = 15.0′				

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

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

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 1-8%
16	04:53	05:03	11:55	12:57	00:37	
17	05:14	05:25	11:55	13:37	01:17	
18	05:35	05:46	11:54	14:20	01:58	

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

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	357°38.6	220°30.9	N11°25.9	164°03.3	S05°18.3	314°27.6	N15°05.6	22°48.4	S12°21.9
1	12°41.1	235°32.0	25.9	179°04.2	19.0	329°30.2	05.5	37°51.0	21.9
2	27°43.5	250°33.2	26.0	194°05.2	19.6	344°32.7	05.5	52°53.7	22.0
3	42°46.0	265°34.3	·· 26.0	209°06.1	·· 20.3	359°35.3	·· 05.4	67°56.3	·· 22.1
4	57°48.5	280°35.5	26.0	224°07.1	21.0	14°37.9	05.4	82°58.9	22.1
5	72°50.9	295°36.6	26.0	239°08.0	21.6	29°40.5	05.4	98°01.5	22.2
6	87°53.4	310°37.8	N11°26.0	254°09.0	S05°22.3	44°43.1	N15°05.3	113°04.1	S12°22.2
7	102°55.8	325°38.9	26.0	269°09.9	22.9	59°45.7	05.3	128°06.8	22.3
8	117°58.3	340°40.1	26.0	284°10.9	23.6	74°48.2	05.2	143°09.4	22.4
9	133°00.8	355°41.2	·· 26.0	299°11.8	·· 24.2	89°50.8	·· 05.2	158°12.0	·· 22.4
10	148°03.2	10°42.3	26.0	314°12.8	24.9	104°53.4	05.1	173°14.6	22.5
11	163°05.7	25°43.5	26.1	329°13.7	25.6	119°56.0	05.1	188°17.3	22.5
12	178°08.2	40°44.6	N11°26.1	344°14.7	S05°26.2	134°58.6	N15°05.1	203°19.9	S12°22.6
13	193°10.6	55°45.7	26.1	359°15.6	26.9	150°01.2	05.0	218°22.5	22.6
14	208°13.1	70°46.9	26.1	14°16.6	27.5	165°03.7	05.0	233°25.1	22.7
15	223°15.6	85°48.0	·· 26.1	29°17.5	·· 28.2	180°06.3	·· 04.9	248°27.7	·· 22.8
16	238°18.0	100°49.1	26.1	44°18.5	28.8	195°08.9	04.9	263°30.4	22.8
17	253°20.5	115°50.2	26.1	59°19.4	29.5	210°11.5	04.8	278°33.0	22.9
18	268°23.0	130°51.3	N11°26.1	74°20.4	S05°30.1	225°14.1	N15°04.8	293°35.6	S12°22.9
19	283°25.4	145°52.5	26.1	89°21.3	30.8	240°16.7	04.8	308°38.2	23.0
20	298°27.9	160°53.6	26.1	104°22.3	31.5	255°19.3	04.7	323°40.8	23.1
21	313°30.3	175°54.7	·· 26.1	119°23.2	·· 32.1	270°21.9	·· 04.7	338°43.5	·· 23.1
22	328°32.8	190°55.8	26.1	134°24.2	32.8	285°24.4	04.6	353°46.1	23.2
23	343°35.3	205°56.9	26.1	149°25.1	33.4	300°27.0	04.6	8°48.7	23.2
Mer.pass. 00:09		ν 1.2′	d 0.0′	m -4.80	ν 1.0′	d -0.7′	m 1.70	ν 2.6′	d -0.0′ m -2.73	ν 2.6′	d -0.1′ m 0.53

Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	358°37.7	220°58.0	N11°26.0	164°26.1	S05°34.1	315°29.6	N15°04.5	23°51.3	S12°23.3
1	13°40.2	235°59.1	26.0	179°27.0	34.7	330°32.2	04.5	38°53.9	23.3
2	28°42.7	251°00.2	26.0	194°28.0	35.4	345°34.8	04.5	53°56.6	23.4
3	43°45.1	266°01.3	·· 26.0	209°28.9	·· 36.1	0°37.4	·· 04.4	68°59.2	·· 23.5
4	58°47.6	281°02.4	26.0	224°29.8	36.7	15°40.0	04.4	84°01.8	23.5
5	73°50.1	296°03.5	26.0	239°30.8	37.4	30°42.6	04.3	99°04.4	23.6
6	88°52.5	311°04.5	N11°26.0	254°31.7	S05°38.0	45°45.2	N15°04.3	114°07.0	S12°23.6
7	103°55.0	326°05.6	26.0	269°32.7	38.7	60°47.8	04.2	129°09.6	23.7
8	118°57.4	341°06.7	26.0	284°33.6	39.3	75°50.3	04.2	144°12.3	23.7
9	133°59.9	356°07.8	·· 25.9	299°34.6	·· 40.0	90°52.9	·· 04.2	159°14.9	·· 23.8
10	149°02.4	11°08.9	25.9	314°35.5	40.6	105°55.5	04.1	174°17.5	23.9
11	164°04.8	26°09.9	25.9	329°36.5	41.3	120°58.1	04.1	189°20.1	23.9
12	179°07.3	41°11.0	N11°25.9	344°37.4	S05°42.0	136°00.7	N15°04.0	204°22.7	S12°24.0
13	194°09.8	56°12.1	25.9	359°38.4	42.6	151°03.3	04.0	219°25.4	24.0
14	209°12.2	71°13.1	25.9	14°39.3	43.3	166°05.9	03.9	234°28.0	24.1
15	224°14.7	86°14.2	·· 25.8	29°40.3	·· 43.9	181°08.5	·· 03.9	249°30.6	·· 24.1
16	239°17.2	101°15.3	25.8	44°41.2	44.6	196°11.1	03.8	264°33.2	24.2
17	254°19.6	116°16.3	25.8	59°42.2	45.2	211°13.7	03.8	279°35.8	24.3
18	269°22.1	131°17.4	N11°25.8	74°43.1	S05°45.9	226°16.3	N15°03.7	294°38.4	S12°24.3
19	284°24.6	146°18.4	25.7	89°44.0	46.5	241°18.9	03.7	309°41.1	24.4
20	299°27.0	161°19.5	25.7	104°45.0	47.2	256°21.5	03.7	324°43.7	24.4
21	314°29.5	176°20.5	·· 25.7	119°45.9	·· 47.9	271°24.1	·· 03.6	339°46.3	·· 24.5
22	329°31.9	191°21.6	25.7	134°46.9	48.5	286°26.7	03.6	354°48.9	24.5
23	344°34.4	206°22.6	25.6	149°47.8	49.2	301°29.3	03.5	9°51.5	24.6
Mer.pass. 00:05		ν 1.1′	d -0.0′	m -4.80	ν 0.9′	d -0.7′	m 1.69	ν 2.6′	d -0.0′ m -2.74	ν 2.6′	d -0.1′ m 0.54

Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	359°36.9	221°23.7	N11°25.6	164°48.8	S05°49.8	316°31.9	N15°03.5	24°54.2	S12°24.7
1	14°39.3	236°24.7	25.6	179°49.7	50.5	331°34.4	03.4	39°56.8	24.7
2	29°41.8	251°25.8	25.6	194°50.7	51.1	346°37.0	03.4	54°59.4	24.8
3	44°44.3	266°26.8	·· 25.5	209°51.6	·· 51.8	1°39.6	·· 03.3	70°02.0	·· 24.8
4	59°46.7	281°27.8	25.5	224°52.5	52.4	16°42.2	03.3	85°04.6	24.9
5	74°49.2	296°28.9	25.5	239°53.5	53.1	31°44.8	03.2	100°07.2	24.9
6	89°51.7	311°29.9	N11°25.4	254°54.4	S05°53.8	46°47.4	N15°03.2	115°09.9	S12°25.0
7	104°54.1	326°30.9	25.4	269°55.4	54.4	61°50.0	03.2	130°12.5	25.1
8	119°56.6	341°31.9	25.3	284°56.3	55.1	76°52.6	03.1	145°15.1	25.1
9	134°59.1	356°33.0	·· 25.3	299°57.3	·· 55.7	91°55.2	·· 03.1	160°17.7	·· 25.2
10	150°01.5	11°34.0	25.3	314°58.2	56.4	106°57.8	03.0	175°20.3	25.2
11	165°04.0	26°35.0	25.2	329°59.2	57.0	122°00.4	03.0	190°22.9	25.3
12	180°06.4	41°36.0	N11°25.2	345°00.1	S05°57.7	137°03.0	N15°02.9	205°25.6	S12°25.3
13	195°08.9	56°37.0	25.2	0°01.0	58.3	152°05.6	02.9	220°28.2	25.4
14	210°11.4	71°38.0	25.1	15°02.0	59.0	167°08.2	02.8	235°30.8	25.5
15	225°13.8	86°39.0	·· 25.1	30°02.9	05°59.6	182°10.8	·· 02.8	250°33.4	·· 25.5
16	240°16.3	101°40.0	25.0	45°03.9	06°00.3	197°13.4	02.7	265°36.0	25.6
17	255°18.8	116°41.0	25.0	60°04.8	01.0	212°16.0	02.7	280°38.6	25.6
18	270°21.2	131°42.0	N11°24.9	75°05.8	S06°01.6	227°18.7	N15°02.6	295°41.3	S12°25.7
19	285°23.7	146°43.0	24.9	90°06.7	02.3	242°21.3	02.6	310°43.9	25.7
20	300°26.2	161°44.0	24.8	105°07.6	02.9	257°23.9	02.5	325°46.5	25.8
21	315°28.6	176°45.0	·· 24.8	120°08.6	·· 03.6	272°26.5	·· 02.5	340°49.1	·· 25.8
22	330°31.1	191°46.0	24.7	135°09.5	04.2	287°29.1	02.4	355°51.7	25.9
23	345°33.6	206°47.0	24.7	150°10.5	04.9	302°31.7	02.4	10°54.3	26.0
Mer.pass. 23:58		ν 1.0′	d -0.0′	m -4.79	ν 0.9′	d -0.7′	m 1.69	ν 2.6′	d -0.0′ m -2.74	ν 2.6′	d -0.1′ m 0.54

Stars

	SHA	**Dec**
Alpheratz	357°35.6	29°13.3
Ankaa	353°07.8	-42°10.5
Schedar	349°31.8	56°40.0
Diphda	348°48.1	-17°51.3
Achernar	335°20.5	-57°06.8
Hamal	327°52.2	23°34.5
Polaris	314°16.2	89°21.6
Acamar	315°12.3	-40°12.3
Menkar	314°07.1	4°11.1
Mirfak	308°29.6	49°56.6
Aldebaran	290°40.8	16°33.5
Rigel	281°04.9	-8°10.2
Capella	280°23.5	46°01.2
Bellatrix	278°24.0	6°22.4
Elnath	278°03.2	28°37.6
Alnilam	275°38.8	-1°11.0
Betelgeuse	270°53.3	7°24.8
Canopus	263°53.0	-52°42.1
Sirius	258°27.3	-16°44.6
Adhara	255°06.8	-28°59.9
Procyon	244°52.1	5°10.0
Pollux	243°18.8	27°58.2
Avior	234°15.6	-59°34.8
Suhail	222°47.5	-43°31.4
Miaplacidus	221°39.3	-69°48.5
Alphard	217°49.1	-8°45.5
Regulus	207°35.9	11°51.2
Dubhe	193°43.0	61°37.5
Denebola	182°26.4	14°26.6
Gienah	175°45.1	-17°40.2
Acrux	173°02.1	-63°13.8
Gacrux	171°53.5	-57°14.7
Alioth	166°14.4	55°50.1
Spica	158°23.8	-11°17.0
Alkaid	152°53.3	49°11.9
Hadar	148°38.1	-60°29.3
Menkent	147°59.3	-36°29.2
Arcturus	145°49.2	19°03.7
Rigil Kent.	139°42.3	-60°56.1
Kochab	137°20.5	74°03.7
Zuben'ubi	136°57.5	-16°08.3
Alphecca	126°04.9	26°38.3
Antares	112°17.3	-26°29.1
Atria	107°12.6	-69°04.4
Sabik	102°04.1	-15°45.2
Shaula	96°11.9	-37°07.3
Rasalhague	95°59.6	12°32.7
Eltanin	90°42.7	51°29.4
Kaus Aust.	83°33.9	-34°22.5
Vega	80°33.9	38°48.6
Nunki	75°49.0	-26°16.1
Altair	62°00.9	8°56.0
Peacock	53°07.1	-56°39.7
Deneb	49°26.3	45°22.1
Enif	33°39.6	9°59.1
Al Na'ir	27°33.8	-46°50.8
Fomalhaut	15°15.4	-29°29.8
Scheat	13°45.9	28°12.8
Markab	13°30.7	15°20.1

Sep 19 Tue	**SHA**	**Mer.pass**
Venus	222°52.3	09:17
Mars	166°24.7	13:03
Jupiter	316°49.0	03:02
Saturn	25°09.8	22:25

Sep 20 Wed	**SHA**	**Mer.pass**
Venus	222°20.2	09:15
Mars	165°48.3	13:01
Jupiter	316°51.9	02:58
Saturn	25°13.6	22:21

Sep 21 Thu	**SHA**	**Mer.pass**
Venus	221°46.8	09:14
Mars	165°11.9	13:00
Jupiter	316°55.0	02:53
Saturn	25°17.3	22:17

Horizontal parallax	
Venus:	0.3
Mars:	0.1

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	181°29.2	N01°39.9	140°38.4	13.5′	S16°02.1	12.6′	55.6′
1	196°29.4	38.9	155°11.0	13.4′	16°14.7	12.4′	55.6′
2	211°29.6	37.9	169°43.4	13.3′	16°27.1	12.4′	55.7′
3	226°29.9	·· 37.0	184°15.7	13.3′	16°39.5	12.3′	55.7′
4	241°30.1	36.0	198°48.0	13.2′	16°51.8	12.3′	55.7′
5	256°30.3	35.0	213°20.1	13.1′	17°04.1	12.2′	55.7′
6	271°30.5	N01°34.1	227°52.2	13.0′	S17°16.3	12.1′	55.7′
7	286°30.8	33.1	242°24.2	12.9′	17°28.4	12.1′	55.8′
8	301°31.0	32.1	256°56.1	12.8′	17°40.5	12.0′	55.8′
9	316°31.2	·· 31.2	271°27.9	12.7′	17°52.5	11.9′	55.8′
10	331°31.4	30.2	285°59.6	12.6′	18°04.4	11.9′	55.8′
11	346°31.6	29.2	300°31.3	12.5′	18°16.3	11.7′	55.9′
12	1°31.9	N01°28.2	315°02.8	12.4′	S18°28.0	11.7′	55.9′
13	16°32.1	27.3	329°34.3	12.3′	18°39.7	11.7′	55.9′
14	31°32.3	26.3	344°05.6	12.3′	18°51.4	11.5′	55.9′
15	46°32.5	·· 25.3	358°36.9	12.2′	19°02.9	11.5′	56.0′
16	61°32.8	24.4	13°08.0	12.1′	19°14.4	11.4′	56.0′
17	76°33.0	23.4	27°39.1	12.0′	19°25.8	11.3′	56.0′
18	91°33.2	N01°22.4	42°10.0	11.9′	S19°37.1	11.2′	56.0′
19	106°33.4	21.5	56°40.9	11.8′	19°48.3	11.1′	56.0′
20	121°33.7	20.5	71°11.7	11.7′	19°59.4	11.1′	56.1′
21	136°33.9	·· 19.5	85°42.3	11.6′	20°10.5	11.0′	56.1′
22	151°34.1	18.5	100°12.9	11.5′	20°21.5	10.8′	56.1′
23	166°34.3	17.6	114°43.4	11.4′	20°32.3	10.8′	56.1′
	SD = 15.9′	d = -1.0′	SD = 15.2′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	181°34.5	N01°16.6	129°13.7	11.3′	S20°43.1	10.7′	56.2′
1	196°34.8	15.6	143°44.0	11.2′	20°53.8	10.6′	56.2′
2	211°35.0	14.7	158°14.1	11.1′	21°04.4	10.6′	56.2′
3	226°35.2	·· 13.7	172°44.2	11.0′	21°15.0	10.4′	56.2′
4	241°35.4	12.7	187°14.2	10.9′	21°25.4	10.3′	56.3′
5	256°35.7	11.8	201°44.0	10.7′	21°35.7	10.2′	56.3′
6	271°35.9	N01°10.8	216°13.8	10.6′	S21°45.9	10.2′	56.3′
7	286°36.1	09.8	230°43.4	10.5′	21°56.1	10.0′	56.3′
8	301°36.3	08.8	245°12.9	10.4′	22°06.1	9.9′	56.4′
9	316°36.5	·· 07.9	259°42.4	10.3′	22°16.0	9.8′	56.4′
10	331°36.8	06.9	274°11.7	10.2′	22°25.8	9.7′	56.4′
11	346°37.0	05.9	288°40.9	10.1′	22°35.5	9.6′	56.4′
12	1°37.2	N01°05.0	303°10.0	10.0′	S22°45.1	9.5′	56.5′
13	16°37.4	04.0	317°39.0	9.9′	22°54.6	9.4′	56.5′
14	31°37.7	03.0	332°07.9	9.8′	23°04.0	9.3′	56.5′
15	46°37.9	·· 02.0	346°36.7	9.7′	23°13.3	9.2′	56.6′
16	61°38.1	01.1	1°05.4	9.6′	23°22.5	9.1′	56.6′
17	76°38.3	01°00.1	15°34.0	9.5′	23°31.6	8.9′	56.6′
18	91°38.5	N00°59.1	30°02.5	9.4′	S23°40.5	8.8′	56.6′
19	106°38.8	58.2	44°30.8	9.3′	23°49.3	8.7′	56.7′
20	121°39.0	57.2	58°59.1	9.1′	23°58.0	8.6′	56.7′
21	136°39.2	·· 56.2	73°27.2	9.0′	24°06.6	8.5′	56.7′
22	151°39.4	55.3	87°55.3	8.9′	24°15.1	8.4′	56.7′
23	166°39.7	54.3	102°23.2	8.8′	24°23.5	8.2′	56.8′
	SD = 15.9′	d = -1.0′	SD = 15.3′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	181°39.9	N00°53.3	116°51.0	8.7′	S24°31.7	8.1′	56.8′
1	196°40.1	52.3	131°18.7	8.6′	24°39.8	8.0′	56.8′
2	211°40.3	51.4	145°46.3	8.5′	24°47.8	7.8′	56.9′
3	226°40.5	·· 50.4	160°13.9	8.4′	24°55.6	7.7′	56.9′
4	241°40.8	49.4	174°41.2	8.3′	25°03.3	7.6′	56.9′
5	256°41.0	48.5	189°08.5	8.2′	25°10.9	7.5′	56.9′
6	271°41.2	N00°47.5	203°35.7	8.1′	S25°18.4	7.3′	57.0′
7	286°41.4	46.5	218°02.8	8.0′	25°25.7	7.2′	57.0′
8	301°41.6	45.5	232°29.8	7.9′	25°32.9	7.0′	57.0′
9	316°41.9	·· 44.6	246°56.7	7.8′	25°39.9	7.0′	57.1′
10	331°42.1	43.6	261°23.4	7.7′	25°46.9	6.7′	57.1′
11	346°42.3	42.6	275°50.1	7.6′	25°53.6	6.7′	57.1′
12	1°42.5	N00°41.7	290°16.7	7.5′	S26°00.3	6.5′	57.1′
13	16°42.8	40.7	304°43.1	7.4′	26°06.8	6.3′	57.2′
14	31°43.0	39.7	319°09.5	7.3′	26°13.1	6.2′	57.2′
15	46°43.2	·· 38.7	333°35.7	7.2′	26°19.3	6.1′	57.2′
16	61°43.4	37.8	348°01.9	7.1′	26°25.4	5.9′	57.3′
17	76°43.6	36.8	2°28.0	7.0′	26°31.3	5.8′	57.3′
18	91°43.9	N00°35.8	16°53.9	6.9′	S26°37.1	5.6′	57.3′
19	106°44.1	34.8	31°19.8	6.8′	26°42.7	5.4′	57.3′
20	121°44.3	33.9	45°45.5	6.7′	26°48.1	5.4′	57.4′
21	136°44.5	·· 32.9	60°11.2	6.6′	26°53.5	5.1′	57.4′
22	151°44.7	31.9	74°36.8	6.5′	26°58.6	5.0′	57.4′
23	166°45.0	31.0	89°02.3	6.4′	27°03.6	4.9′	57.5′
	SD = 15.9′	d = -1.0′	SD = 15.5′				

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

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

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 4-6 14-31%
19	05:57	06:07	11:54	15:06	02:42	
20	06:18	06:29	11:54	15:55	03:30	
21	06:39	06:50	11:53	16:50	04:22	

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

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	0°36.0	221°48.0	N11°24.6	165°11.4	S06°05.5	317°34.3	N15°02.4	25°56.9	S12°26.0
1	15°38.5	236°49.0	24.6	180°12.3	06.2	332°36.9	02.3	40°59.6	26.1
2	30°40.9	251°50.0	24.5	195°13.3	06.8	347°39.5	02.3	56°02.2	26.1
3	45°43.4	266°50.9	·· 24.5	210°14.2	·· 07.5	2°42.1	·· 02.2	71°04.8	·· 26.2
4	60°45.9	281°51.9	24.4	225°15.2	08.2	17°44.7	02.2	86°07.4	26.2
5	75°48.3	296°52.9	24.4	240°16.1	08.8	32°47.3	02.1	101°10.0	26.3
6	90°50.8	311°53.9	N11°24.3	255°17.1	S06°09.5	47°49.9	N15°02.1	116°12.6	S12°26.3
7	105°53.3	326°54.8	24.2	270°18.0	10.1	62°52.5	02.0	131°15.2	26.4
8	120°55.7	341°55.8	24.2	285°18.9	10.8	77°55.1	02.0	146°17.9	26.5
9	135°58.2	356°56.8	·· 24.1	300°19.9	·· 11.4	92°57.7	·· 01.9	161°20.5	·· 26.5
10	151°00.7	11°57.7	24.1	315°20.8	12.1	108°00.3	01.9	176°23.1	26.6
11	166°03.1	26°58.7	24.0	330°21.8	12.7	123°02.9	01.8	191°25.7	26.6
12	181°05.6	41°59.7	N11°23.9	345°22.7	S06°13.4	138°05.6	N15°01.8	206°28.3	S12°26.7
13	196°08.0	57°00.6	23.9	0°23.6	14.0	153°08.2	01.7	221°30.9	26.7
14	211°10.5	72°01.6	23.8	15°24.6	14.7	168°10.8	01.7	236°33.5	26.8
15	226°13.0	87°02.5	·· 23.7	30°25.5	·· 15.3	183°13.4	·· 01.6	251°36.2	·· 26.8
16	241°15.4	102°03.5	23.7	45°26.5	16.0	198°16.0	01.6	266°38.8	26.9
17	256°17.9	117°04.4	23.6	60°27.4	16.7	213°18.6	01.5	281°41.4	27.0
18	271°20.4	132°05.4	N11°23.5	75°28.3	S06°17.3	228°21.2	N15°01.5	296°44.0	S12°27.0
19	286°22.8	147°06.3	23.5	90°29.3	18.0	243°23.8	01.4	311°46.6	27.1
20	301°25.3	162°07.3	23.4	105°30.2	18.6	258°26.4	01.4	326°49.2	27.1
21	316°27.8	177°08.2	·· 23.3	120°31.2	·· 19.3	273°29.0	·· 01.3	341°51.8	·· 27.2
22	331°30.2	192°09.1	23.3	135°32.1	19.9	288°31.7	01.3	356°54.5	27.2
23	346°32.7	207°10.1	23.2	150°33.0	20.6	303°34.3	01.2	11°57.1	27.3
Mer.pass. 23:54		ν 1.0′ d -0.1′ m -4.79		ν 0.9′ d -0.7′ m 1.69		ν 2.6′ d -0.0′ m -2.75		ν 2.6′ d -0.1′ m 0.55	

Sat	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	1°35.2	222°11.0	N11°23.1	165°34.0	S06°21.2	318°36.9	N15°01.2	26°59.7	S12°27.3
1	16°37.6	237°11.9	23.0	180°34.9	21.9	333°39.5	01.1	42°02.3	27.4
2	31°40.1	252°12.9	23.0	195°35.8	22.5	348°42.1	01.1	57°04.9	27.4
3	46°42.5	267°13.8	·· 22.9	210°36.8	·· 23.2	3°44.7	·· 01.0	72°07.5	·· 27.5
4	61°45.0	282°14.7	22.8	225°37.7	23.8	18°47.3	01.0	87°10.1	27.6
5	76°47.5	297°15.6	22.7	240°38.7	24.5	33°49.9	00.9	102°12.7	27.6
6	91°49.9	312°16.6	N11°22.6	255°39.6	S06°25.1	48°52.6	N15°00.9	117°15.4	S12°27.7
7	106°52.4	327°17.5	22.6	270°40.5	25.8	63°55.2	00.8	132°18.0	27.7
8	121°54.9	342°18.4	22.5	285°41.5	26.4	78°57.8	00.8	147°20.6	27.8
9	136°57.3	357°19.3	·· 22.4	300°42.4	·· 27.1	94°00.4	·· 00.7	162°23.2	·· 27.8
10	151°59.8	12°20.2	22.3	315°43.3	27.8	109°03.0	00.7	177°25.8	27.9
11	167°02.3	27°21.1	22.2	330°44.3	28.4	124°05.6	00.6	192°28.4	27.9
12	182°04.7	42°22.0	N11°22.1	345°45.2	S06°29.1	139°08.3	N15°00.6	207°31.0	S12°28.0
13	197°07.2	57°22.9	22.0	0°46.2	29.7	154°10.9	00.5	222°33.6	28.0
14	212°09.7	72°23.8	22.0	15°47.1	30.4	169°13.5	00.5	237°36.2	28.1
15	227°12.1	87°24.7	·· 21.9	30°48.0	·· 31.0	184°16.1	·· 00.4	252°38.9	·· 28.2
16	242°14.6	102°25.6	21.8	45°49.0	31.7	199°18.7	00.4	267°41.5	28.2
17	257°17.0	117°26.5	21.7	60°49.9	32.3	214°21.3	00.3	282°44.1	28.3
18	272°19.5	132°27.4	N11°21.6	75°50.8	S06°33.0	229°24.0	N15°00.3	297°46.7	S12°28.3
19	287°22.0	147°28.3	21.5	90°51.8	33.6	244°26.6	00.2	312°49.3	28.4
20	302°24.4	162°29.2	21.4	105°52.7	34.3	259°29.2	00.2	327°51.9	28.4
21	317°26.9	177°30.1	·· 21.3	120°53.6	·· 34.9	274°31.8	·· 00.1	342°54.5	·· 28.5
22	332°29.4	192°31.0	21.2	135°54.6	35.6	289°34.4	00.1	357°57.1	28.5
23	347°31.8	207°31.9	21.1	150°55.5	36.2	304°37.1	00.0	12°59.7	28.6
Mer.pass. 23:50		ν 0.9′ d -0.1′ m -4.78		ν 0.9′ d -0.7′ m 1.68		ν 2.6′ d -0.1′ m -2.76		ν 2.6′ d -0.1′ m 0.55	

Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	2°34.3	222°32.7	N11°21.0	165°56.4	S06°36.9	319°39.7	N14°59.9	28°02.4	S12°28.6
1	17°36.8	237°33.6	20.9	180°57.4	37.5	334°42.3	59.9	43°05.0	28.7
2	32°39.2	252°34.5	20.8	195°58.3	38.2	349°44.9	59.8	58°07.6	28.7
3	47°41.7	267°35.4	·· 20.7	210°59.3	·· 38.8	4°47.5	·· 59.8	73°10.2	·· 28.8
4	62°44.2	282°36.3	20.6	226°00.2	39.5	19°50.2	59.7	88°12.8	28.9
5	77°46.6	297°37.1	20.5	241°01.1	40.1	34°52.8	59.7	103°15.4	28.9
6	92°49.1	312°38.0	N11°20.4	256°02.1	S06°40.8	49°55.4	N14°59.6	118°18.0	S12°29.0
7	107°51.5	327°38.9	20.3	271°03.0	41.4	64°58.0	59.6	133°20.6	29.0
8	122°54.0	342°39.7	20.2	286°03.9	42.1	80°00.6	59.5	148°23.2	29.1
9	137°56.5	357°40.6	·· 20.1	301°04.9	·· 42.8	95°03.3	·· 59.5	163°25.8	·· 29.1
10	152°58.9	12°41.4	20.0	316°05.8	43.4	110°05.9	59.4	178°28.5	29.2
11	168°01.4	27°42.3	19.9	331°06.7	44.1	125°08.5	59.4	193°31.1	29.2
12	183°03.9	42°43.2	N11°19.8	346°07.7	S06°44.7	140°11.1	N14°59.3	208°33.7	S12°29.3
13	198°06.3	57°44.0	19.7	1°08.6	45.4	155°13.8	59.3	223°36.3	29.3
14	213°08.8	72°44.9	19.6	16°09.5	46.0	170°16.4	59.2	238°38.9	29.4
15	228°11.3	87°45.7	·· 19.4	31°10.5	·· 46.7	185°19.0	·· 59.2	253°41.5	·· 29.4
16	243°13.7	102°46.6	19.3	46°11.4	47.3	200°21.6	59.1	268°44.1	29.5
17	258°16.2	117°47.4	19.2	61°12.3	48.0	215°24.3	59.0	283°46.7	29.5
18	273°18.7	132°48.3	N11°19.1	76°13.3	S06°48.6	230°26.9	N14°59.0	298°49.3	S12°29.6
19	288°21.1	147°49.1	19.0	91°14.2	49.3	245°29.5	58.9	313°51.9	29.6
20	303°23.6	162°49.9	18.9	106°15.1	49.9	260°32.1	58.9	328°54.5	29.7
21	318°26.0	177°50.8	·· 18.8	121°16.0	·· 50.6	275°34.8	·· 58.8	343°57.2	·· 29.8
22	333°28.5	192°51.6	18.6	136°17.0	51.2	290°37.4	58.8	358°59.8	29.8
23	348°31.0	207°52.5	18.5	151°17.9	51.9	305°40.0	58.7	14°02.4	29.9
Mer.pass. 23:46		ν 0.9′ d -0.1′ m -4.77		ν 0.9′ d -0.7′ m 1.68		ν 2.6′ d -0.1′ m -2.76		ν 2.6′ d -0.1′ m 0.55	

Stars

	SHA	**Dec**
Alpheratz	357°35.6	29°13.3
Ankaa	353°07.8	-42°10.5
Schedar	349°31.8	56°40.0
Diphda	348°48.1	-17°51.3
Achernar	335°20.4	-57°06.8
Hamal	327°52.1	23°34.5
Polaris	314°14.7	89°21.6
Acamar	315°12.3	-40°12.3
Menkar	314°07.1	4°11.1
Mirfak	308°29.5	49°56.6
Aldebaran	290°40.8	16°33.5
Rigel	281°04.9	-8°10.2
Capella	280°23.4	46°01.2
Bellatrix	278°24.0	6°22.4
Elnath	278°03.2	28°37.6
Alnilam	275°38.8	-1°11.0
Betelgeuse	270°53.3	7°24.8
Canopus	263°52.9	-52°42.1
Sirius	258°27.3	-16°44.6
Adhara	255°06.8	-28°59.9
Procyon	244°52.1	5°10.0
Pollux	243°18.8	27°58.2
Avior	234°15.6	-59°34.7
Suhail	222°47.4	-43°31.4
Miaplacidus	221°39.2	-69°48.5
Alphard	217°49.1	-8°45.5
Regulus	207°35.9	11°51.2
Dubhe	193°42.9	61°37.4
Denebola	182°26.4	14°26.5
Gienah	175°45.0	-17°40.2
Acrux	173°02.1	-63°13.8
Gacrux	171°53.5	-57°14.7
Alioth	166°14.4	55°50.0
Spica	158°23.8	-11°17.0
Alkaid	152°53.3	49°11.9
Hadar	148°38.1	-60°29.3
Menkent	147°59.3	-36°29.2
Arcturus	145°49.2	19°03.7
Rigil Kent.	139°42.3	-60°56.1
Kochab	137°20.6	74°03.7
Zuben'ubi	136°57.5	-16°08.3
Alphecca	126°04.9	26°38.3
Antares	112°17.3	-26°29.1
Atria	107°12.7	-69°04.4
Sabik	102°04.1	-15°45.2
Shaula	96°11.9	-37°07.3
Rasalhague	95°59.6	12°32.7
Eltanin	90°42.7	51°29.4
Kaus Aust.	83°33.9	-34°22.5
Vega	80°33.9	38°48.6
Nunki	75°49.0	-26°16.1
Altair	62°00.9	8°56.0
Peacock	53°07.1	-56°39.7
Deneb	49°26.3	45°22.1
Enif	33°39.6	9°59.1
Al Na'ir	27°33.9	-46°50.8
Fomalhaut	15°15.4	-29°29.8
Scheat	13°45.9	28°12.8
Markab	13°30.7	15°20.1

Sep 22 Fri	**SHA**	**Mer.pass**
Venus	221°12.0	09:12
Mars	164°35.4	12:58
Jupiter	316°58.3	02:49
Saturn	25°20.9	22:12

Sep 23 Sat	**SHA**	**Mer.pass**
Venus	220°35.8	09:11
Mars	163°58.8	12:57
Jupiter	317°01.7	02:45
Saturn	25°24.5	22:08

Sep 24 Sun	**SHA**	**Mer.pass**
Venus	219°58.5	09:09
Mars	163°22.2	12:55
Jupiter	317°05.4	02:41
Saturn	25°28.1	22:04

Horizontal parallax	
Venus:	0.3
Mars:	0.1

h	Sun		Moon				
Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	181°45.2	N00°30.0	103°27.7	6.3′	S27°08.5	4.6′	57.5′
1	196°45.4	29.0	117°53.0	6.2′	27°13.1	4.6′	57.5′
2	211°45.6	28.0	132°18.2	6.1′	27°17.7	4.3′	57.6′
3	226°45.9	·· 27.1	146°43.3	6.0′	27°22.0	4.3′	57.6′
4	241°46.1	26.1	161°08.4	6.0′	27°26.3	4.0′	57.6′
5	256°46.3	25.1	175°33.3	5.9′	27°30.3	3.9′	57.6′
6	271°46.5	N00°24.2	189°58.2	5.8′	S27°34.2	3.7′	57.7′
7	286°46.7	23.2	204°23.0	5.7′	27°37.9	3.5′	57.7′
8	301°47.0	22.2	218°47.7	5.6′	27°41.4	3.4′	57.7′
9	316°47.2	·· 21.2	233°12.3	5.5′	27°44.8	3.2′	57.8′
10	331°47.4	20.3	247°36.8	5.5′	27°48.0	3.1′	57.8′
11	346°47.6	19.3	262°01.3	5.4′	27°51.1	2.9′	57.8′
12	1°47.8	N00°18.3	276°25.7	5.3′	S27°54.0	2.7′	57.9′
13	16°48.1	17.3	290°50.0	5.3′	27°56.7	2.5′	57.9′
14	31°48.3	16.4	305°14.3	5.2′	27°59.2	2.3′	57.9′
15	46°48.5	·· 15.4	319°38.5	5.1′	28°01.5	2.2′	58.0′
16	61°48.7	14.4	334°02.6	5.0′	28°03.7	2.0′	58.0′
17	76°48.9	13.5	348°26.6	5.0′	28°05.7	1.9′	58.0′
18	91°49.2	N00°12.5	2°50.6	4.9′	S28°07.6	1.6′	58.0′
19	106°49.4	11.5	17°14.5	4.9′	28°09.2	1.5′	58.1′
20	121°49.6	10.5	31°38.4	4.8′	28°10.7	1.3′	58.1′
21	136°49.8	·· 09.6	46°02.2	4.7′	28°12.0	1.1′	58.1′
22	151°50.1	08.6	60°25.9	4.7′	28°13.1	0.9′	58.2′
23	166°50.3	07.6	74°49.6	4.6′	28°14.0	0.8′	58.2′
	SD = 15.9′	d = -1.0′	SD = 15.7′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	181°50.5	N00°06.6	89°13.3	4.6′	S28°14.8	0.5′	58.2′
1	196°50.7	05.7	103°36.9	4.5′	28°15.3	0.4′	58.3′
2	211°50.9	04.7	118°00.4	4.5′	28°15.7	0.2′	58.3′
3	226°51.2	·· 03.7	132°23.9	4.5′	28°15.9	0.1′	58.3′
4	241°51.4	02.8	146°47.4	4.4′	28°16.0	0.2′	58.4′
5	256°51.6	01.8	161°10.8	4.4′	28°15.8	0.4′	58.4′
6	271°51.8	N00°00.8	175°34.1	4.3′	S28°15.4	0.5′	58.4′
7	286°52.0	S00°00.2	189°57.5	4.3′	28°14.9	0.7′	58.5′
8	301°52.3	01.1	204°20.8	4.3′	28°14.2	0.9′	58.5′
9	316°52.5	·· 02.1	218°44.0	4.2′	28°13.3	1.1′	58.5′
10	331°52.7	03.1	233°07.3	4.2′	28°12.2	1.3′	58.6′
11	346°52.9	04.1	247°30.5	4.2′	28°10.9	1.5′	58.6′
12	1°53.1	S00°05.0	261°53.7	4.2′	S28°09.4	1.7′	58.6′
13	16°53.4	06.0	276°16.8	4.1′	28°07.7	1.8′	58.6′
14	31°53.6	07.0	290°39.9	4.1′	28°05.9	2.1′	58.7′
15	46°53.8	·· 07.9	305°03.1	4.1′	28°03.8	2.2′	58.7′
16	61°54.0	08.9	319°26.2	4.1′	28°01.6	2.4′	58.7′
17	76°54.2	09.9	333°49.2	4.1′	27°59.2	2.6′	58.8′
18	91°54.4	S00°10.9	348°12.3	4.1′	S27°56.6	2.8′	58.8′
19	106°54.7	11.8	2°35.4	4.1′	27°53.8	3.0′	58.8′
20	121°54.9	12.8	16°58.4	4.0′	27°50.8	3.2′	58.9′
21	136°55.1	·· 13.8	31°21.5	4.0′	27°47.6	3.4′	58.9′
22	151°55.3	14.8	45°44.5	4.0′	27°44.2	3.5′	58.9′
23	166°55.5	15.7	60°07.6	4.0′	27°40.7	3.8′	59.0′
	SD = 15.9′	d = -1.0′	SD = 15.9′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	181°55.8	S00°16.7	74°30.6	4.0′	S27°36.9	3.9′	59.0′
1	196°56.0	17.7	88°53.7	4.1′	27°33.0	4.2′	59.0′
2	211°56.2	18.7	103°16.7	4.1′	27°28.8	4.3′	59.0′
3	226°56.4	·· 19.6	117°39.8	4.1′	27°24.5	4.5′	59.1′
4	241°56.6	20.6	132°02.8	4.1′	27°20.0	4.7′	59.1′
5	256°56.9	21.6	146°25.9	4.1′	27°15.3	4.9′	59.1′
6	271°57.1	S00°22.5	160°49.0	4.1′	S27°10.4	5.1′	59.2′
7	286°57.3	23.5	175°12.1	4.1′	27°05.3	5.2′	59.2′
8	301°57.5	24.5	189°35.3	4.2′	27°00.1	5.5′	59.2′
9	316°57.7	·· 25.5	203°58.4	4.2′	26°54.6	5.6′	59.3′
10	331°58.0	26.4	218°21.6	4.2′	26°49.0	5.8′	59.3′
11	346°58.2	27.4	232°44.8	4.2′	26°43.2	6.1′	59.3′
12	1°58.4	S00°28.4	247°08.0	4.3′	S26°37.1	6.2′	59.4′
13	16°58.6	29.4	261°31.3	4.3′	26°30.9	6.3′	59.4′
14	31°58.8	30.3	275°54.6	4.3′	26°24.6	6.6′	59.4′
15	46°59.0	·· 31.3	290°17.9	4.4′	26°18.0	6.8′	59.4′
16	61°59.3	32.3	304°41.3	4.4′	26°11.2	6.9′	59.5′
17	76°59.5	33.3	319°04.7	4.4′	26°04.3	7.1′	59.5′
18	91°59.7	S00°34.2	333°28.1	4.5′	S25°57.2	7.3′	59.5′
19	106°59.9	35.2	347°51.6	4.5′	25°49.9	7.5′	59.6′
20	122°00.1	36.2	2°15.1	4.6′	25°42.4	7.6′	59.6′
21	137°00.4	·· 37.1	16°38.6	4.6′	25°34.8	7.9′	59.6′
22	152°00.6	38.1	31°02.2	4.6′	25°26.9	8.0′	59.6′
23	167°00.8	39.1	45°25.9	4.7′	25°18.9	8.2′	59.7′
	SD = 15.9′	d = -1.0′	SD = 16.1′				

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

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

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 7-9 41-63%
22	07:01	07:11	11:53	17:48	05:19	
23	07:22	07:33	11:52	18:49	06:18	
24	07:43	07:54	11:52	19:51	07:20	

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

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	3°33.4	222°53.3	N11°18.4	166°18.8	S06°52.5	320°42.7	N14°58.7	29°05.0	S12°29.9
1	18°35.9	237°54.1	18.3	181°19.8	53.2	335°45.3	58.6	44°07.6	30.0
2	33°38.4	252°54.9	18.1	196°20.7	53.8	350°47.9	58.6	59°10.2	30.0
3	48°40.8	267°55.8	·· 18.0	211°21.6	·· 54.5	5°50.5	·· 58.5	74°12.8	·· 30.1
4	63°43.3	282°56.6	17.9	226°22.6	55.1	20°53.2	58.4	89°15.4	30.1
5	78°45.8	297°57.4	17.8	241°23.5	55.8	35°55.8	58.4	104°18.0	30.2
6	93°48.2	312°58.2	N11°17.6	256°24.4	S06°56.4	50°58.4	N14°58.3	119°20.6	S12°30.2
7	108°50.7	327°59.1	17.5	271°25.4	57.1	66°01.1	58.3	134°23.2	30.3
8	123°53.1	342°59.9	17.4	286°26.3	57.7	81°03.7	58.2	149°25.8	30.3
9	138°55.6	358°00.7	·· 17.3	301°27.2	·· 58.4	96°06.3	·· 58.2	164°28.4	·· 30.4
10	153°58.1	13°01.5	17.1	316°28.2	59.0	111°08.9	58.1	179°31.1	30.4
11	169°00.5	28°02.3	17.0	331°29.1	06°59.7	126°11.6	58.1	194°33.7	30.5
12	184°03.0	43°03.1	N11°16.9	346°30.0	S07°00.3	141°14.2	N14°58.0	209°36.3	S12°30.5
13	199°05.5	58°03.9	16.7	1°30.9	01.0	156°16.8	58.0	224°38.9	30.6
14	214°07.9	73°04.7	16.6	16°31.9	01.6	171°19.5	57.9	239°41.5	30.6
15	229°10.4	88°05.5	·· 16.5	31°32.8	·· 02.3	186°22.1	·· 57.8	254°44.1	·· 30.7
16	244°12.9	103°06.3	16.3	46°33.7	02.9	201°24.7	57.8	269°46.7	30.7
17	259°15.3	118°07.1	16.2	61°34.7	03.6	216°27.4	57.7	284°49.3	30.8
18	274°17.8	133°07.9	N11°16.1	76°35.6	S07°04.2	231°30.0	N14°57.7	299°51.9	S12°30.9
19	289°20.3	148°08.7	15.9	91°36.5	04.9	246°32.6	57.6	314°54.5	30.9
20	304°22.7	163°09.5	15.8	106°37.4	05.5	261°35.3	57.6	329°57.1	31.0
21	319°25.2	178°10.3	·· 15.6	121°38.4	·· 06.2	276°37.9	·· 57.5	344°59.7	·· 31.0
22	334°27.6	193°11.1	15.5	136°39.3	06.8	291°40.5	57.4	0°02.3	31.1
23	349°30.1	208°11.9	15.4	151°40.2	07.5	306°43.2	57.4	15°04.9	31.1
Mer.pass. 23:42		ν 0.8′ d -0.1′ m -4.77		ν 0.9′ d -0.7′ m 1.67		ν 2.6′ d -0.1′ m -2.77		ν 2.6′ d -0.1′ m 0.56	

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	4°32.6	223°12.7	N11°15.2	166°41.2	S07°08.1	321°45.8	N14°57.3	30°07.5	S12°31.2
1	19°35.0	238°13.4	15.1	181°42.1	08.8	336°48.4	57.3	45°10.2	31.2
2	34°37.5	253°14.2	14.9	196°43.0	09.4	351°51.1	57.2	60°12.8	31.3
3	49°40.0	268°15.0	·· 14.8	211°43.9	·· 10.1	6°53.7	·· 57.2	75°15.4	·· 31.3
4	64°42.4	283°15.8	14.6	226°44.9	10.7	21°56.4	57.1	90°18.0	31.4
5	79°44.9	298°16.6	14.5	241°45.8	11.4	36°59.0	57.1	105°20.6	31.4
6	94°47.4	313°17.3	N11°14.3	256°46.7	S07°12.0	52°01.6	N14°57.0	120°23.2	S12°31.5
7	109°49.8	328°18.1	14.2	271°47.7	12.7	67°04.3	56.9	135°25.8	31.5
8	124°52.3	343°18.9	14.0	286°48.6	13.3	82°06.9	56.9	150°28.4	31.6
9	139°54.8	358°19.6	·· 13.9	301°49.5	·· 14.0	97°09.5	·· 56.8	165°31.0	·· 31.6
10	154°57.2	13°20.4	13.7	316°50.4	14.6	112°12.2	56.8	180°33.6	31.7
11	169°59.7	28°21.2	13.6	331°51.4	15.2	127°14.8	56.7	195°36.2	31.7
12	185°02.1	43°21.9	N11°13.4	346°52.3	S07°15.9	142°17.5	N14°56.7	210°38.8	S12°31.8
13	200°04.6	58°22.7	13.3	1°53.2	16.5	157°20.1	56.6	225°41.4	31.8
14	215°07.1	73°23.4	13.1	16°54.1	17.2	172°22.7	56.5	240°44.0	31.9
15	230°09.5	88°24.2	·· 12.9	31°55.1	·· 17.8	187°25.4	·· 56.5	255°46.6	·· 31.9
16	245°12.0	103°25.0	12.8	46°56.0	18.5	202°28.0	56.4	270°49.2	32.0
17	260°14.5	118°25.7	12.6	61°56.9	19.1	217°30.7	56.4	285°51.8	32.0
18	275°16.9	133°26.5	N11°12.5	76°57.8	S07°19.8	232°33.3	N14°56.3	300°54.4	S12°32.1
19	290°19.4	148°27.2	12.3	91°58.8	20.4	247°35.9	56.2	315°57.0	32.1
20	305°21.9	163°27.9	12.1	106°59.7	21.1	262°38.6	56.2	330°59.6	32.2
21	320°24.3	178°28.7	·· 12.0	122°00.6	·· 21.7	277°41.2	·· 56.1	346°02.2	·· 32.2
22	335°26.8	193°29.4	11.8	137°01.5	22.4	292°43.9	56.1	1°04.8	32.3
23	350°29.2	208°30.2	11.6	152°02.5	23.0	307°46.5	56.0	16°07.4	32.3
Mer.pass. 23:38		ν 0.8′ d -0.1′ m -4.76		ν 0.9′ d -0.6′ m 1.67		ν 2.6′ d -0.1′ m -2.78		ν 2.6′ d -0.1′ m 0.56	

Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	5°31.7	223°30.9	N11°11.5	167°03.4	S07°23.7	322°49.1	N14°56.0	31°10.0	S12°32.4
1	20°34.2	238°31.7	11.3	182°04.3	24.3	337°51.8	55.9	46°12.7	32.4
2	35°36.6	253°32.4	11.1	197°05.2	25.0	352°54.4	55.8	61°15.3	32.5
3	50°39.1	268°33.1	·· 11.0	212°06.2	·· 25.6	7°57.1	·· 55.8	76°17.9	·· 32.5
4	65°41.6	283°33.9	10.8	227°07.1	26.3	22°59.7	55.7	91°20.5	32.6
5	80°44.0	298°34.6	10.6	242°08.0	26.9	38°02.4	55.7	106°23.1	32.6
6	95°46.5	313°35.3	N11°10.4	257°08.9	S07°27.6	53°05.0	N14°55.6	121°25.7	S12°32.7
7	110°49.0	328°36.0	10.3	272°09.9	28.2	68°07.7	55.5	136°28.3	32.7
8	125°51.4	343°36.8	10.1	287°10.8	28.9	83°10.3	55.5	151°30.9	32.8
9	140°53.9	358°37.5	·· 09.9	302°11.7	·· 29.5	98°12.9	·· 55.4	166°33.5	·· 32.8
10	155°56.4	13°38.2	09.7	317°12.6	30.1	113°15.6	55.4	181°36.1	32.9
11	170°58.8	28°38.9	09.6	332°13.6	30.8	128°18.2	55.3	196°38.7	32.9
12	186°01.3	43°39.6	N11°09.4	347°14.5	S07°31.4	143°20.9	N14°55.2	211°41.3	S12°33.0
13	201°03.7	58°40.4	09.2	2°15.4	32.1	158°23.5	55.2	226°43.9	33.0
14	216°06.2	73°41.1	09.0	17°16.3	32.7	173°26.2	55.1	241°46.5	33.1
15	231°08.7	88°41.8	·· 08.8	32°17.2	·· 33.4	188°28.8	·· 55.1	256°49.1	·· 33.1
16	246°11.1	103°42.5	08.7	47°18.2	34.0	203°31.5	55.0	271°51.7	33.2
17	261°13.6	118°43.2	08.5	62°19.1	34.7	218°34.1	54.9	286°54.3	33.2
18	276°16.1	133°43.9	N11°08.3	77°20.0	S07°35.3	233°36.8	N14°54.9	301°56.9	S12°33.3
19	291°18.5	148°44.6	08.1	92°20.9	36.0	248°39.4	54.8	316°59.5	33.3
20	306°21.0	163°45.3	07.9	107°21.8	36.6	263°42.1	54.8	332°02.1	33.4
21	321°23.5	178°46.0	·· 07.7	122°22.8	·· 37.3	278°44.7	·· 54.7	347°04.7	·· 33.4
22	336°25.9	193°46.7	07.6	137°23.7	37.9	293°47.4	54.6	2°07.3	33.5
23	351°28.4	208°47.4	07.4	152°24.6	38.6	308°50.0	54.6	17°09.9	33.5
Mer.pass. 23:34		ν 0.7′ d -0.2′ m -4.75		ν 0.9′ d -0.6′ m 1.67		ν 2.6′ d -0.1′ m -2.78		ν 2.6′ d -0.1′ m 0.57	

Stars

	SHA	**Dec**
Alpheratz	357°35.5	29°13.4
Ankaa	353°07.8	-42°10.5
Schedar	349°31.7	56°40.0
Diphda	348°48.0	-17°51.3
Achernar	335°20.4	-57°06.8
Hamal	327°52.1	23°34.5
Polaris	314°13.4	89°21.6
Acamar	315°12.3	-40°12.3
Menkar	314°07.0	4°11.1
Mirfak	308°29.5	49°56.6
Aldebaran	290°40.7	16°33.5
Rigel	281°04.8	-8°10.2
Capella	280°23.4	46°01.2
Bellatrix	278°24.0	6°22.4
Elnath	278°03.2	28°37.6
Alnilam	275°38.8	-1°11.0
Betelgeuse	270°53.2	7°24.8
Canopus	263°52.9	-52°42.1
Sirius	258°27.2	-16°44.6
Adhara	255°06.8	-28°59.9
Procyon	244°52.1	5°10.0
Pollux	243°18.8	27°58.2
Avior	234°15.5	-59°34.7
Suhail	222°47.4	-43°31.4
Miaplacidus	221°39.2	-69°48.5
Alphard	217°49.1	-8°45.5
Regulus	207°35.9	11°51.2
Dubhe	193°42.9	61°37.4
Denebola	182°26.4	14°26.5
Gienah	175°45.0	-17°40.2
Acrux	173°02.1	-63°13.7
Gacrux	171°53.5	-57°14.7
Alioth	166°14.4	55°50.0
Spica	158°23.7	-11°17.0
Alkaid	152°53.3	49°11.9
Hadar	148°38.1	-60°29.3
Menkent	147°59.3	-36°29.2
Arcturus	145°49.2	19°03.7
Rigil Kent.	139°42.4	-60°56.1
Kochab	137°20.6	74°03.7
Zuben'ubi	136°57.5	-16°08.3
Alphecca	126°04.9	26°38.3
Antares	112°17.3	-26°29.1
Atria	107°12.7	-69°04.4
Sabik	102°04.1	-15°45.2
Shaula	96°11.9	-37°07.3
Rasalhague	95°59.6	12°32.7
Eltanin	90°42.7	51°29.4
Kaus Aust.	83°33.9	-34°22.5
Vega	80°33.9	38°48.6
Nunki	75°49.0	-26°16.1
Altair	62°00.9	8°56.0
Peacock	53°07.1	-56°39.7
Deneb	49°26.3	45°22.1
Enif	33°39.6	9°59.1
Al Na'ir	27°33.9	-46°50.8
Fomalhaut	15°15.4	-29°29.8
Scheat	13°45.9	28°12.8
Markab	13°30.7	15°20.1

Sep 25 Mon	**SHA**	**Mer.pass**
Venus	219°19.8	09:08
Mars	162°45.4	12:54
Jupiter	317°09.2	02:37
Saturn	25°31.5	22:00

Sep 26 Tue	**SHA**	**Mer.pass**
Venus	218°40.1	09:07
Mars	162°08.6	12:52
Jupiter	317°13.2	02:32
Saturn	25°35.0	21:56

Sep 27 Wed	**SHA**	**Mer.pass**
Venus	217°59.2	09:05
Mars	161°31.7	12:51
Jupiter	317°17.4	02:28
Saturn	25°38.3	21:52

Horizontal parallax	
Venus:	0.3
Mars:	0.1

h	Sun		Moon				
Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°01.0	S00°40.1	59°49.6	4.7′	S25°10.7	8.4′	59.7′
1	197°01.2	41.0	74°13.3	4.8′	25°02.3	8.5′	59.7′
2	212°01.4	42.0	88°37.1	4.8′	24°53.8	8.7′	59.7′
3	227°01.7	·· 43.0	103°01.0	4.9′	24°45.1	8.9′	59.8′
4	242°01.9	44.0	117°24.9	5.0′	24°36.2	9.1′	59.8′
5	257°02.1	44.9	131°48.8	5.0′	24°27.1	9.2′	59.8′
6	272°02.3	S00°45.9	146°12.8	5.1′	S24°17.9	9.4′	59.9′
7	287°02.5	46.9	160°36.9	5.1′	24°08.5	9.6′	59.9′
8	302°02.8	47.9	175°01.0	5.2′	23°58.9	9.8′	59.9′
9	317°03.0	·· 48.8	189°25.2	5.3′	23°49.1	9.9′	59.9′
10	332°03.2	49.8	203°49.5	5.3′	23°39.2	10.0′	60.0′
11	347°03.4	50.8	218°13.8	5.4′	23°29.2	10.3′	60.0′
12	2°03.6	S00°51.7	232°38.2	5.4′	S23°18.9	10.4′	60.0′
13	17°03.8	52.7	247°02.6	5.5′	23°08.5	10.5′	60.0′
14	32°04.1	53.7	261°27.1	5.6′	22°58.0	10.8′	60.1′
15	47°04.3	·· 54.7	275°51.7	5.6′	22°47.2	10.8′	60.1′
16	62°04.5	55.6	290°16.4	5.7′	22°36.4	11.1′	60.1′
17	77°04.7	56.6	304°41.1	5.8′	22°25.3	11.2′	60.1′
18	92°04.9	S00°57.6	319°05.8	5.8′	S22°14.1	11.3′	60.2′
19	107°05.1	58.6	333°30.7	5.9′	22°02.8	11.5′	60.2′
20	122°05.4	00°59.5	347°55.6	6.0′	21°51.3	11.7′	60.2′
21	137°05.6	01°00.5	2°20.6	6.1′	21°39.6	11.8′	60.2′
22	152°05.8	01.5	16°45.7	6.1′	21°27.8	11.9′	60.2′
23	167°06.0	02.5	31°10.8	6.2′	21°15.9	12.1′	60.3′
	SD = 15.9′	d = -1.0′	SD = 16.3′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°06.2	S01°03.4	45°36.0	6.3′	S21°03.8	12.2′	60.3′
1	197°06.4	04.4	60°01.3	6.4′	20°51.6	12.4′	60.3′
2	212°06.7	05.4	74°26.6	6.4′	20°39.2	12.5′	60.3′
3	227°06.9	·· 06.3	88°52.0	6.5′	20°26.7	12.7′	60.3′
4	242°07.1	07.3	103°17.5	6.6′	20°14.0	12.8′	60.4′
5	257°07.3	08.3	117°43.1	6.6′	20°01.2	12.9′	60.4′
6	272°07.5	S01°09.3	132°08.8	6.7′	S19°48.3	13.1′	60.4′
7	287°07.7	10.2	146°34.5	6.8′	19°35.2	13.2′	60.4′
8	302°07.9	11.2	161°00.3	6.9′	19°22.0	13.3′	60.4′
9	317°08.2	·· 12.2	175°26.1	6.9′	19°08.7	13.5′	60.5′
10	332°08.4	13.2	189°52.1	7.0′	18°55.2	13.6′	60.5′
11	347°08.6	14.1	204°18.1	7.1′	18°41.6	13.7′	60.5′
12	2°08.8	S01°15.1	218°44.2	7.2′	S18°27.9	13.9′	60.5′
13	17°09.0	16.1	233°10.4	7.2′	18°14.0	13.9′	60.5′
14	32°09.2	17.1	247°36.6	7.3′	18°00.1	14.1′	60.5′
15	47°09.5	·· 18.0	262°02.9	7.4′	17°46.0	14.2′	60.6′
16	62°09.7	19.0	276°29.3	7.5′	17°31.8	14.3′	60.6′
17	77°09.9	20.0	290°55.8	7.5′	17°17.5	14.5′	60.6′
18	92°10.1	S01°20.9	305°22.3	7.6′	S17°03.0	14.5′	60.6′
19	107°10.3	21.9	319°48.9	7.7′	16°48.5	14.7′	60.6′
20	122°10.5	22.9	334°15.6	7.8′	16°33.8	14.8′	60.6′
21	137°10.7	·· 23.9	348°42.4	7.8′	16°19.0	14.8′	60.7′
22	152°11.0	24.8	3°09.2	7.9′	16°04.2	15.0′	60.7′
23	167°11.2	25.8	17°36.1	8.0′	15°49.2	15.1′	60.7′
	SD = 15.9′	d = -1.0′	SD = 16.4′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°11.4	S01°26.8	32°03.1	8.0′	S15°34.1	15.2′	60.7′
1	197°11.6	27.8	46°30.1	8.1′	15°18.9	15.3′	60.7′
2	212°11.8	28.7	60°57.2	8.2′	15°03.6	15.4′	60.7′
3	227°12.0	·· 29.7	75°24.4	8.3′	14°48.2	15.5′	60.7′
4	242°12.2	30.7	89°51.6	8.3′	14°32.7	15.5′	60.7′
5	257°12.5	31.6	104°19.0	8.4′	14°17.2	15.7′	60.7′
6	272°12.7	S01°32.6	118°46.3	8.5′	S14°01.5	15.8′	60.8′
7	287°12.9	33.6	133°13.8	8.5′	13°45.7	15.8′	60.8′
8	302°13.1	34.6	147°41.3	8.6′	13°29.9	15.9′	60.8′
9	317°13.3	·· 35.5	162°08.9	8.7′	13°14.0	16.0′	60.8′
10	332°13.5	36.5	176°36.6	8.7′	12°58.0	16.1′	60.8′
11	347°13.7	37.5	191°04.3	8.8′	12°41.9	16.2′	60.8′
12	2°14.0	S01°38.5	205°32.0	8.8′	S12°25.7	16.3′	60.8′
13	17°14.2	39.4	219°59.9	8.9′	12°09.4	16.3′	60.8′
14	32°14.4	40.4	234°27.8	9.0′	11°53.1	16.4′	60.8′
15	47°14.6	·· 41.4	248°55.8	9.0′	11°36.7	16.5′	60.8′
16	62°14.8	42.3	263°23.8	9.1′	11°20.2	16.5′	60.8′
17	77°15.0	43.3	277°51.9	9.1′	11°03.7	16.6′	60.8′
18	92°15.2	S01°44.3	292°20.0	9.2′	S10°47.1	16.7′	60.8′
19	107°15.5	45.3	306°48.2	9.3′	10°30.4	16.8′	60.8′
20	122°15.7	46.2	321°16.5	9.3′	10°13.6	16.8′	60.8′
21	137°15.9	·· 47.2	335°44.8	9.4′	09°56.8	16.8′	60.8′
22	152°16.1	48.2	350°13.2	9.4′	09°40.0	17.0′	60.8′
23	167°16.3	49.2	4°41.6	9.5′	09°23.0	16.9′	60.8′
	SD = 15.9′	d = -1.0′	SD = 16.6′				

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

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

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 74-91%
25	08:04	08:14	11:52	20:50	08:21	
26	08:25	08:35	11:51	21:47	09:19	
27	08:46	08:56	11:51	22:41	10:14	

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

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	6°30.9	223°48.1	N11°07.2	167°25.5	S07°39.2	323°52.7	N14°54.5	32°12.5	S12°33.6
1	21°33.3	238°48.8	07.0	182°26.5	39.8	338°55.3	54.5	47°15.1	33.6
2	36°35.8	253°49.5	06.8	197°27.4	40.5	353°58.0	54.4	62°17.7	33.7
3	51°38.2	268°50.2	·· 06.6	212°28.3	·· 41.1	9°00.6	·· 54.3	77°20.3	·· 33.7
4	66°40.7	283°50.9	06.4	227°29.2	41.8	24°03.3	54.3	92°22.9	33.8
5	81°43.2	298°51.6	06.2	242°30.1	42.4	39°05.9	54.2	107°25.5	33.8
6	96°45.6	313°52.2	N11°06.0	257°31.1	S07°43.1	54°08.6	N14°54.2	122°28.1	S12°33.9
7	111°48.1	328°52.9	05.8	272°32.0	43.7	69°11.2	54.1	137°30.7	33.9
8	126°50.6	343°53.6	05.6	287°32.9	44.4	84°13.9	54.0	152°33.3	34.0
9	141°53.0	358°54.3	·· 05.4	302°33.8	·· 45.0	99°16.5	·· 54.0	167°35.9	·· 34.0
10	156°55.5	13°55.0	05.2	317°34.7	45.7	114°19.2	53.9	182°38.5	34.1
11	171°58.0	28°55.6	05.0	332°35.7	46.3	129°21.8	53.9	197°41.1	34.1
12	187°00.4	43°56.3	N11°04.8	347°36.6	S07°46.9	144°24.5	N14°53.8	212°43.7	S12°34.2
13	202°02.9	58°57.0	04.6	2°37.5	47.6	159°27.1	53.7	227°46.3	34.2
14	217°05.3	73°57.7	04.4	17°38.4	48.2	174°29.8	53.7	242°48.9	34.3
15	232°07.8	88°58.3	·· 04.2	32°39.3	·· 48.9	189°32.4	·· 53.6	257°51.5	·· 34.3
16	247°10.3	103°59.0	04.0	47°40.2	49.5	204°35.1	53.5	272°54.1	34.4
17	262°12.7	118°59.7	03.8	62°41.2	50.2	219°37.8	53.5	287°56.7	34.4
18	277°15.2	134°00.3	N11°03.6	77°42.1	S07°50.8	234°40.4	N14°53.4	302°59.3	S12°34.5
19	292°17.7	149°01.0	03.4	92°43.0	51.5	249°43.1	53.4	318°01.9	34.5
20	307°20.1	164°01.6	03.2	107°43.9	52.1	264°45.7	53.3	333°04.5	34.6
21	322°22.6	179°02.3	·· 03.0	122°44.8	·· 52.8	279°48.4	·· 53.2	348°07.1	·· 34.6
22	337°25.1	194°03.0	02.7	137°45.8	53.4	294°51.0	53.2	3°09.7	34.7
23	352°27.5	209°03.6	02.5	152°46.7	54.0	309°53.7	53.1	18°12.3	34.7
Mer.pass. 23:30		ν 0.7′ d -0.2′ m -4.75		ν 0.9′ d -0.6′ m 1.66		ν 2.7′ d -0.1′ m -2.79		ν 2.6′ d -0.0′ m 0.57	

Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	7°30.0	224°04.3	N11°02.3	167°47.6	S07°54.7	324°56.3	N14°53.0	33°14.9	S12°34.7
1	22°32.5	239°04.9	02.1	182°48.5	55.3	339°59.0	53.0	48°17.5	34.8
2	37°34.9	254°05.6	01.9	197°49.4	56.0	355°01.7	52.9	63°20.1	34.8
3	52°37.4	269°06.2	·· 01.7	212°50.3	·· 56.6	10°04.3	·· 52.9	78°22.7	·· 34.9
4	67°39.8	284°06.9	01.5	227°51.3	57.3	25°07.0	52.8	93°25.3	34.9
5	82°42.3	299°07.5	01.2	242°52.2	57.9	40°09.6	52.7	108°27.9	35.0
6	97°44.8	314°08.2	N11°01.0	257°53.1	S07°58.6	55°12.3	N14°52.7	123°30.4	S12°35.0
7	112°47.2	329°08.8	00.8	272°54.0	59.2	70°15.0	52.6	138°33.0	35.1
8	127°49.7	344°09.4	00.6	287°54.9	07°59.8	85°17.6	52.5	153°35.6	35.1
9	142°52.2	359°10.1	·· 00.4	302°55.8	08°00.5	100°20.3	·· 52.5	168°38.2	·· 35.2
10	157°54.6	14°10.7	11°00.1	317°56.8	01.1	115°22.9	52.4	183°40.8	35.2
11	172°57.1	29°11.3	10°59.9	332°57.7	01.8	130°25.6	52.4	198°43.4	35.3
12	187°59.6	44°12.0	N10°59.7	347°58.6	S08°02.4	145°28.3	N14°52.3	213°46.0	S12°35.3
13	203°02.0	59°12.6	59.5	2°59.5	03.1	160°30.9	52.2	228°48.6	35.4
14	218°04.5	74°13.2	59.2	18°00.4	03.7	175°33.6	52.2	243°51.2	35.4
15	233°06.9	89°13.9	·· 59.0	33°01.3	·· 04.3	190°36.2	·· 52.1	258°53.8	·· 35.5
16	248°09.4	104°14.5	58.8	48°02.2	05.0	205°38.9	52.0	273°56.4	35.5
17	263°11.9	119°15.1	58.5	63°03.2	05.6	220°41.6	52.0	288°59.0	35.6
18	278°14.3	134°15.7	N10°58.3	78°04.1	S08°06.3	235°44.2	N14°51.9	304°01.6	S12°35.6
19	293°16.8	149°16.4	58.1	93°05.0	06.9	250°46.9	51.8	319°04.2	35.7
20	308°19.3	164°17.0	57.9	108°05.9	07.6	265°49.6	51.8	334°06.8	35.7
21	323°21.7	179°17.6	·· 57.6	123°06.8	·· 08.2	280°52.2	·· 51.7	349°09.4	·· 35.7
22	338°24.2	194°18.2	57.4	138°07.7	08.8	295°54.9	51.6	4°12.0	35.8
23	353°26.7	209°18.8	57.2	153°08.6	09.5	310°57.5	51.6	19°14.6	35.8
Mer.pass. 23:26		ν 0.7′ d -0.2′ m -4.74		ν 0.9′ d -0.6′ m 1.66		ν 2.7′ d -0.1′ m -2.80		ν 2.6′ d -0.0′ m 0.58	

Sat	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	8°29.1	224°19.5	N10°56.9	168°09.6	S08°10.1	326°00.2	N14°51.5	34°17.2	S12°35.9
1	23°31.6	239°20.1	56.7	183°10.5	10.8	341°02.9	51.5	49°19.8	35.9
2	38°34.1	254°20.7	56.4	198°11.4	11.4	356°05.5	51.4	64°22.4	36.0
3	53°36.5	269°21.3	·· 56.2	213°12.3	·· 12.1	11°08.2	·· 51.3	79°25.0	·· 36.0
4	68°39.0	284°21.9	56.0	228°13.2	12.7	26°10.9	51.3	94°27.6	36.1
5	83°41.4	299°22.5	55.7	243°14.1	13.3	41°13.5	51.2	109°30.2	36.1
6	98°43.9	314°23.1	N10°55.5	258°15.0	S08°14.0	56°16.2	N14°51.1	124°32.7	S12°36.2
7	113°46.4	329°23.7	55.2	273°15.9	14.6	71°18.9	51.1	139°35.3	36.2
8	128°48.8	344°24.3	55.0	288°16.9	15.3	86°21.5	51.0	154°37.9	36.3
9	143°51.3	359°24.9	·· 54.7	303°17.8	·· 15.9	101°24.2	·· 50.9	169°40.5	·· 36.3
10	158°53.8	14°25.5	54.5	318°18.7	16.6	116°26.9	50.9	184°43.1	36.4
11	173°56.2	29°26.1	54.3	333°19.6	17.2	131°29.5	50.8	199°45.7	36.4
12	188°58.7	44°26.7	N10°54.0	348°20.5	S08°17.8	146°32.2	N14°50.7	214°48.3	S12°36.4
13	204°01.2	59°27.3	53.8	3°21.4	18.5	161°34.9	50.7	229°50.9	36.5
14	219°03.6	74°27.9	53.5	18°22.3	19.1	176°37.5	50.6	244°53.5	36.5
15	234°06.1	89°28.5	·· 53.3	33°23.2	·· 19.8	191°40.2	·· 50.5	259°56.1	·· 36.6
16	249°08.5	104°29.1	53.0	48°24.1	20.4	206°42.9	50.5	274°58.7	36.6
17	264°11.0	119°29.6	52.7	63°25.1	21.0	221°45.5	50.4	290°01.3	36.7
18	279°13.5	134°30.2	N10°52.5	78°26.0	S08°21.7	236°48.2	N14°50.3	305°03.9	S12°36.7
19	294°15.9	149°30.8	52.2	93°26.9	22.3	251°50.9	50.3	320°06.5	36.8
20	309°18.4	164°31.4	52.0	108°27.8	23.0	266°53.5	50.2	335°09.1	36.8
21	324°20.9	179°32.0	·· 51.7	123°28.7	·· 23.6	281°56.2	·· 50.1	350°11.6	·· 36.9
22	339°23.3	194°32.5	51.5	138°29.6	24.3	296°58.9	50.1	5°14.2	36.9
23	354°25.8	209°33.1	51.2	153°30.5	24.9	312°01.6	50.0	20°16.8	36.9
Mer.pass. 23:22		ν 0.6′ d -0.2′ m -4.73		ν 0.9′ d -0.6′ m 1.65		ν 2.7′ d -0.1′ m -2.80		ν 2.6′ d -0.0′ m 0.58	

Stars

	SHA	**Dec**
Alpheratz	357°35.5	29°13.4
Ankaa	353°07.8	-42°10.6
Schedar	349°31.7	56°40.1
Diphda	348°48.0	-17°51.3
Achernar	335°20.4	-57°06.8
Hamal	327°52.1	23°34.5
Polaris	314°12.5	89°21.6
Acamar	315°12.3	-40°12.3
Menkar	314°07.0	4°11.1
Mirfak	308°29.5	49°56.6
Aldebaran	290°40.7	16°33.5
Rigel	281°04.8	-8°10.2
Capella	280°23.4	46°01.2
Bellatrix	278°24.0	6°22.4
Elnath	278°03.1	28°37.6
Alnilam	275°38.8	-1°11.0
Betelgeuse	270°53.2	7°24.8
Canopus	263°52.9	-52°42.1
Sirius	258°27.2	-16°44.6
Adhara	255°06.8	-28°59.9
Procyon	244°52.1	5°10.0
Pollux	243°18.7	27°58.2
Avior	234°15.5	-59°34.7
Suhail	222°47.4	-43°31.4
Miaplacidus	221°39.2	-69°48.5
Alphard	217°49.0	-8°45.5
Regulus	207°35.9	11°51.2
Dubhe	193°42.9	61°37.4
Denebola	182°26.4	14°26.5
Gienah	175°45.0	-17°40.2
Acrux	173°02.1	-63°13.7
Gacrux	171°53.5	-57°14.7
Alioth	166°14.4	55°50.0
Spica	158°23.8	-11°17.0
Alkaid	152°53.3	49°11.9
Hadar	148°38.2	-60°29.3
Menkent	147°59.3	-36°29.1
Arcturus	145°49.2	19°03.7
Rigil Kent.	139°42.4	-60°56.0
Kochab	137°20.6	74°03.7
Zuben'ubi	136°57.5	-16°08.3
Alphecca	126°04.9	26°38.3
Antares	112°17.3	-26°29.1
Atria	107°12.7	-69°04.4
Sabik	102°04.1	-15°45.2
Shaula	96°11.9	-37°07.3
Rasalhague	95°59.6	12°32.7
Eltanin	90°42.7	51°29.4
Kaus Aust.	83°33.9	-34°22.5
Vega	80°33.9	38°48.6
Nunki	75°49.0	-26°16.1
Altair	62°00.9	8°56.0
Peacock	53°07.1	-56°39.7
Deneb	49°26.3	45°22.1
Enif	33°39.6	9°59.1
Al Na'ir	27°33.9	-46°50.9
Fomalhaut	15°15.4	-29°29.8
Scheat	13°45.9	28°12.8
Markab	13°30.7	15°20.1

Sep 28 Thu	**SHA**	**Mer.pass**
Venus	217°17.3	09:04
Mars	160°54.7	12:50
Jupiter	317°21.8	02:24
Saturn	25°41.6	21:47

Sep 29 Fri	**SHA**	**Mer.pass**
Venus	216°34.3	09:03
Mars	160°17.6	12:48
Jupiter	317°26.4	02:20
Saturn	25°44.9	21:43

Sep 30 Sat	**SHA**	**Mer.pass**
Venus	215°50.3	09:02
Mars	159°40.4	12:47
Jupiter	317°31.1	02:16
Saturn	25°48.1	21:39

Horizontal parallax	
Venus:	0.3
Mars:	0.1

h	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°16.5	S01°50.1	19°10.1	9.5′	S09°06.1	17.1′	60.8′
1	197°16.7	51.1	33°38.6	9.6′	08°49.0	17.0′	60.8′
2	212°16.9	52.1	48°07.2	9.6′	08°32.0	17.2′	60.8′
3	227°17.2	·· 53.0	62°35.8	9.7′	08°14.8	17.2′	60.8′
4	242°17.4	54.0	77°04.5	9.7′	07°57.6	17.2′	60.8′
5	257°17.6	55.0	91°33.2	9.8′	07°40.4	17.3′	60.8′
6	272°17.8	S01°56.0	106°02.0	9.8′	S07°23.1	17.3′	60.8′
7	287°18.0	56.9	120°30.8	9.9′	07°05.8	17.3′	60.8′
8	302°18.2	57.9	134°59.6	9.9′	06°48.5	17.4′	60.8′
9	317°18.4	·· 58.9	149°28.5	9.9′	06°31.1	17.4′	60.8′
10	332°18.6	01°59.8	163°57.5	10.0′	06°13.7	17.5′	60.8′
11	347°18.8	02°00.8	178°26.5	10.0′	05°56.2	17.5′	60.8′
12	2°19.1	S02°01.8	192°55.5	10.1′	S05°38.7	17.5′	60.8′
13	17°19.3	02.8	207°24.6	10.1′	05°21.2	17.5′	60.8′
14	32°19.5	03.7	221°53.7	10.1′	05°03.7	17.6′	60.8′
15	47°19.7	·· 04.7	236°22.8	10.2′	04°46.1	17.6′	60.8′
16	62°19.9	05.7	250°52.0	10.2′	04°28.5	17.6′	60.8′
17	77°20.1	06.7	265°21.2	10.2′	04°10.9	17.6′	60.8′
18	92°20.3	S02°07.6	279°50.4	10.3′	S03°53.3	17.7′	60.8′
19	107°20.5	08.6	294°19.7	10.3′	03°35.6	17.6′	60.8′
20	122°20.7	09.6	308°49.0	10.3′	03°18.0	17.7′	60.8′
21	137°21.0	·· 10.5	323°18.4	10.4′	03°00.3	17.7′	60.7′
22	152°21.2	11.5	337°47.7	10.4′	02°42.6	17.7′	60.7′
23	167°21.4	12.5	352°17.1	10.4′	02°24.9	17.7′	60.7′
	SD = 16.0′	d = -1.0′	SD = 16.6′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°21.6	S02°13.5	6°46.5	10.4′	S02°07.2	17.7′	60.7′
1	197°21.8	14.4	21°16.0	10.5′	01°49.5	17.7′	60.7′
2	212°22.0	15.4	35°45.4	10.5′	01°31.8	17.8′	60.7′
3	227°22.2	·· 16.4	50°14.9	10.5′	01°14.0	17.7′	60.7′
4	242°22.4	17.3	64°44.4	10.5′	00°56.3	17.7′	60.7′
5	257°22.6	18.3	79°14.0	10.5′	00°38.6	17.7′	60.6′
6	272°22.8	S02°19.3	93°43.5	10.6′	S00°20.9	17.7′	60.6′
7	287°23.1	20.3	108°13.1	10.6′	S00°03.2	17.7′	60.6′
8	302°23.3	21.2	122°42.7	10.6′	N00°14.5	17.7′	60.6′
9	317°23.5	·· 22.2	137°12.3	10.6′	00°32.2	17.6′	60.6′
10	332°23.7	23.2	151°41.9	10.6′	00°49.8	17.7′	60.6′
11	347°23.9	24.1	166°11.5	10.6′	01°07.5	17.6′	60.6′
12	2°24.1	S02°25.1	180°41.2	10.7′	N01°25.1	17.7′	60.5′
13	17°24.3	26.1	195°10.8	10.7′	01°42.8	17.6′	60.5′
14	32°24.5	27.1	209°40.5	10.7′	02°00.4	17.5′	60.5′
15	47°24.7	·· 28.0	224°10.1	10.7′	02°17.9	17.6′	60.5′
16	62°24.9	29.0	238°39.8	10.7′	02°35.5	17.5′	60.5′
17	77°25.1	30.0	253°09.5	10.7′	02°53.0	17.5′	60.4′
18	92°25.3	S02°30.9	267°39.2	10.7′	N03°10.5	17.5′	60.4′
19	107°25.6	31.9	282°08.9	10.7′	03°28.0	17.4′	60.4′
20	122°25.8	32.9	296°38.6	10.7′	03°45.4	17.5′	60.4′
21	137°26.0	·· 33.9	311°08.3	10.7′	04°02.9	17.3′	60.4′
22	152°26.2	34.8	325°38.0	10.7′	04°20.2	17.4′	60.3′
23	167°26.4	35.8	340°07.7	10.7′	04°37.6	17.3′	60.3′
	SD = 16.0′	d = -1.0′	SD = 16.6′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°26.6	S02°36.8	354°37.4	10.7′	N04°54.9	17.2′	60.3′
1	197°26.8	37.7	9°07.0	10.7′	05°12.1	17.3′	60.3′
2	212°27.0	38.7	23°36.7	10.7′	05°29.4	17.1′	60.2′
3	227°27.2	·· 39.7	38°06.4	10.7′	05°46.5	17.2′	60.2′
4	242°27.4	40.6	52°36.1	10.7′	06°03.7	17.1′	60.2′
5	257°27.6	41.6	67°05.8	10.7′	06°20.8	17.0′	60.2′
6	272°27.8	S02°42.6	81°35.4	10.7′	N06°37.8	17.0′	60.1′
7	287°28.0	43.6	96°05.1	10.6′	06°54.8	16.9′	60.1′
8	302°28.3	44.5	110°34.7	10.6′	07°11.7	16.9′	60.1′
9	317°28.5	·· 45.5	125°04.4	10.6′	07°28.6	16.8′	60.1′
10	332°28.7	46.5	139°34.0	10.6′	07°45.4	16.8′	60.0′
11	347°28.9	47.4	154°03.6	10.6′	08°02.2	16.7′	60.0′
12	2°29.1	S02°48.4	168°33.2	10.6′	N08°18.9	16.6′	60.0′
13	17°29.3	49.4	183°02.8	10.6′	08°35.5	16.6′	60.0′
14	32°29.5	50.4	197°32.3	10.5′	08°52.1	16.5′	59.9′
15	47°29.7	·· 51.3	212°01.9	10.5′	09°08.6	16.5′	59.9′
16	62°29.9	52.3	226°31.4	10.5′	09°25.1	16.4′	59.9′
17	77°30.1	53.3	241°00.9	10.5′	09°41.5	16.3′	59.8′
18	92°30.3	S02°54.2	255°30.4	10.5′	N09°57.8	16.2′	59.8′
19	107°30.5	55.2	269°59.9	10.4′	10°14.0	16.2′	59.8′
20	122°30.7	56.2	284°29.3	10.4′	10°30.2	16.1′	59.8′
21	137°30.9	·· 57.1	298°58.7	10.4′	10°46.3	16.0′	59.7′
22	152°31.1	58.1	313°28.1	10.4′	11°02.3	16.0′	59.7′
23	167°31.3	59.1	327°57.5	10.4′	11°18.3	15.8′	59.7′
	SD = 16.0′	d = -1.0′	SD = 16.4′				

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

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

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 97-99%
28	09:06	09:16	11:51	23:32	11:06	
29	09:26	09:36	11:50	–:–	11:57	
30	09:46	09:56	11:50	00:22	12:47	

October 01, 02, 03 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	9°28.3	224°33.7	N10°51.0	168°31.4	S08°25.5	327°04.2	N14°49.9	35°19.4	S12°37.0
1	24°30.7	239°34.3	50.7	183°32.3	26.2	342°06.9	49.9	50°22.0	37.0
2	39°33.2	254°34.8	50.4	198°33.2	26.8	357°09.6	49.8	65°24.6	37.1
3	54°35.7	269°35.4	·· 50.2	213°34.2	·· 27.5	12°12.2	·· 49.7	80°27.2	·· 37.1
4	69°38.1	284°36.0	49.9	228°35.1	28.1	27°14.9	49.7	95°29.8	37.2
5	84°40.6	299°36.6	49.6	243°36.0	28.7	42°17.6	49.6	110°32.4	37.2
6	99°43.0	314°37.1	N10°49.4	258°36.9	S08°29.4	57°20.3	N14°49.5	125°35.0	S12°37.3
7	114°45.5	329°37.7	49.1	273°37.8	30.0	72°22.9	49.5	140°37.6	37.3
8	129°48.0	344°38.2	48.8	288°38.7	30.7	87°25.6	49.4	155°40.2	37.4
9	144°50.4	359°38.8	·· 48.6	303°39.6	·· 31.3	102°28.3	·· 49.3	170°42.7	·· 37.4
10	159°52.9	14°39.4	48.3	318°40.5	31.9	117°31.0	49.3	185°45.3	37.4
11	174°55.4	29°39.9	48.0	333°41.4	32.6	132°33.6	49.2	200°47.9	37.5
12	189°57.8	44°40.5	N10°47.8	348°42.3	S08°33.2	147°36.3	N14°49.1	215°50.5	S12°37.5
13	205°00.3	59°41.0	47.5	3°43.2	33.9	162°39.0	49.1	230°53.1	37.6
14	220°02.8	74°41.6	47.2	18°44.1	34.5	177°41.7	49.0	245°55.7	37.6
15	235°05.2	89°42.1	·· 46.9	33°45.0	·· 35.1	192°44.3	·· 48.9	260°58.3	·· 37.7
16	250°07.7	104°42.7	46.7	48°46.0	35.8	207°47.0	48.9	276°00.9	37.7
17	265°10.2	119°43.2	46.4	63°46.9	36.4	222°49.7	48.8	291°03.5	37.8
18	280°12.6	134°43.8	N10°46.1	78°47.8	S08°37.1	237°52.4	N14°48.7	306°06.1	S12°37.8
19	295°15.1	149°44.3	45.8	93°48.7	37.7	252°55.0	48.7	321°08.7	37.9
20	310°17.5	164°44.9	45.6	108°49.6	38.3	267°57.7	48.6	336°11.2	37.9
21	325°20.0	179°45.4	·· 45.3	123°50.5	·· 39.0	283°00.4	·· 48.5	351°13.8	·· 37.9
22	340°22.5	194°46.0	45.0	138°51.4	39.6	298°03.1	48.5	6°16.4	38.0
23	355°24.9	209°46.5	44.7	153°52.3	40.3	313°05.7	48.4	21°19.0	38.0
Mer.pass. 23:18		ν 0.6′ d -0.3′ m -4.72		ν 0.9′ d -0.6′ m 1.65		ν 2.7′ d -0.1′ m -2.81		ν 2.6′ d -0.0′ m 0.59	

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	10°27.4	224°47.0	N10°44.4	168°53.2	S08°40.9	328°08.4	N14°48.3	36°21.6	S12°38.1
1	25°29.9	239°47.6	44.2	183°54.1	41.5	343°11.1	48.2	51°24.2	38.1
2	40°32.3	254°48.1	43.9	198°55.0	42.2	358°13.8	48.2	66°26.8	38.2
3	55°34.8	269°48.7	·· 43.6	213°55.9	·· 42.8	13°16.5	·· 48.1	81°29.4	·· 38.2
4	70°37.3	284°49.2	43.3	228°56.8	43.5	28°19.1	48.0	96°32.0	38.3
5	85°39.7	299°49.7	43.0	243°57.7	44.1	43°21.8	48.0	111°34.5	38.3
6	100°42.2	314°50.2	N10°42.7	258°58.6	S08°44.7	58°24.5	N14°47.9	126°37.1	S12°38.3
7	115°44.6	329°50.8	42.4	273°59.5	45.4	73°27.2	47.8	141°39.7	38.4
8	130°47.1	344°51.3	42.1	289°00.4	46.0	88°29.9	47.8	156°42.3	38.4
9	145°49.6	359°51.8	·· 41.9	304°01.3	·· 46.7	103°32.5	·· 47.7	171°44.9	·· 38.5
10	160°52.0	14°52.4	41.6	319°02.2	47.3	118°35.2	47.6	186°47.5	38.5
11	175°54.5	29°52.9	41.3	334°03.1	47.9	133°37.9	47.6	201°50.1	38.6
12	190°57.0	44°53.4	N10°41.0	349°04.0	S08°48.6	148°40.6	N14°47.5	216°52.7	S12°38.6
13	205°59.4	59°53.9	40.7	4°05.0	49.2	163°43.3	47.4	231°55.2	38.6
14	221°01.9	74°54.4	40.4	19°05.9	49.8	178°45.9	47.3	246°57.8	38.7
15	236°04.4	89°54.9	·· 40.1	34°06.8	·· 50.5	193°48.6	·· 47.3	262°00.4	·· 38.7
16	251°06.8	104°55.5	39.8	49°07.7	51.1	208°51.3	47.2	277°03.0	38.8
17	266°09.3	119°56.0	39.5	64°08.6	51.8	223°54.0	47.1	292°05.6	38.8
18	281°11.8	134°56.5	N10°39.2	79°09.5	S08°52.4	238°56.7	N14°47.1	307°08.2	S12°38.9
19	296°14.2	149°57.0	38.9	94°10.4	53.0	253°59.4	47.0	322°10.8	38.9
20	311°16.7	164°57.5	38.6	109°11.3	53.7	269°02.0	46.9	337°13.4	39.0
21	326°19.1	179°58.0	·· 38.3	124°12.2	·· 54.3	284°04.7	·· 46.9	352°15.9	·· 39.0
22	341°21.6	194°58.5	38.0	139°13.1	54.9	299°07.4	46.8	7°18.5	39.0
23	356°24.1	209°59.0	37.7	154°14.0	55.6	314°10.1	46.7	22°21.1	39.1
Mer.pass. 23:14		ν 0.5′ d -0.3′ m -4.71		ν 0.9′ d -0.6′ m 1.64		ν 2.7′ d -0.1′ m -2.82		ν 2.6′ d -0.0′ m 0.59	

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	11°26.5	224°59.5	N10°37.4	169°14.9	S08°56.2	329°12.8	N14°46.6	37°23.7	S12°39.1
1	26°29.0	240°00.0	37.1	184°15.8	56.9	344°15.5	46.6	52°26.3	39.2
2	41°31.5	255°00.5	36.8	199°16.7	57.5	359°18.1	46.5	67°28.9	39.2
3	56°33.9	270°01.0	·· 36.5	214°17.6	·· 58.1	14°20.8	·· 46.4	82°31.5	·· 39.3
4	71°36.4	285°01.5	36.1	229°18.5	58.8	29°23.5	46.4	97°34.0	39.3
5	86°38.9	300°02.0	35.8	244°19.4	08°59.4	44°26.2	46.3	112°36.6	39.3
6	101°41.3	315°02.5	N10°35.5	259°20.3	S09°00.0	59°28.9	N14°46.2	127°39.2	S12°39.4
7	116°43.8	330°03.0	35.2	274°21.2	00.7	74°31.6	46.2	142°41.8	39.4
8	131°46.3	345°03.5	34.9	289°22.1	01.3	89°34.3	46.1	157°44.4	39.5
9	146°48.7	0°04.0	·· 34.6	304°23.0	·· 02.0	104°37.0	·· 46.0	172°47.0	·· 39.5
10	161°51.2	15°04.5	34.3	319°23.9	02.6	119°39.6	45.9	187°49.6	39.6
11	176°53.6	30°05.0	34.0	334°24.8	03.2	134°42.3	45.9	202°52.1	39.6
12	191°56.1	45°05.5	N10°33.6	349°25.7	S09°03.9	149°45.0	N14°45.8	217°54.7	S12°39.6
13	206°58.6	60°06.0	33.3	4°26.6	04.5	164°47.7	45.7	232°57.3	39.7
14	222°01.0	75°06.4	33.0	19°27.5	05.1	179°50.4	45.7	247°59.9	39.7
15	237°03.5	90°06.9	·· 32.7	34°28.4	·· 05.8	194°53.1	·· 45.6	263°02.5	·· 39.8
16	252°06.0	105°07.4	32.4	49°29.3	06.4	209°55.8	45.5	278°05.1	39.8
17	267°08.4	120°07.9	32.0	64°30.2	07.0	224°58.5	45.4	293°07.7	39.9
18	282°10.9	135°08.4	N10°31.7	79°31.1	S09°07.7	240°01.1	N14°45.4	308°10.2	S12°39.9
19	297°13.4	150°08.8	31.4	94°32.0	08.3	255°03.8	45.3	323°12.8	39.9
20	312°15.8	165°09.3	31.1	109°32.9	09.0	270°06.5	45.2	338°15.4	40.0
21	327°18.3	180°09.8	·· 30.8	124°33.8	·· 09.6	285°09.2	·· 45.1	353°18.0	·· 40.0
22	342°20.7	195°10.3	30.4	139°34.7	10.2	300°11.9	45.1	8°20.6	40.1
23	357°23.2	210°10.7	30.1	154°35.6	10.9	315°14.6	45.0	23°23.2	40.1
Mer.pass. 23:10		ν 0.5′ d -0.3′ m -4.70		ν 0.9′ d -0.6′ m 1.64		ν 2.7′ d -0.1′ m -2.82		ν 2.6′ d -0.0′ m 0.59	

Stars

	SHA	**Dec**
Alpheratz	357°35.5	29°13.4
Ankaa	353°07.8	-42°10.6
Schedar	349°31.7	56°40.1
Diphda	348°48.0	-17°51.3
Achernar	335°20.4	-57°06.9
Hamal	327°52.1	23°34.5
Polaris	314°11.3	89°21.7
Acamar	315°12.2	-40°12.3
Menkar	314°07.0	4°11.1
Mirfak	308°29.4	49°56.6
Aldebaran	290°40.7	16°33.5
Rigel	281°04.8	-8°10.2
Capella	280°23.3	46°01.2
Bellatrix	278°23.9	6°22.4
Elnath	278°03.1	28°37.6
Alnilam	275°38.7	-1°11.0
Betelgeuse	270°53.2	7°24.8
Canopus	263°52.8	-52°42.1
Sirius	258°27.2	-16°44.6
Adhara	255°06.7	-28°59.9
Procyon	244°52.0	5°10.0
Pollux	243°18.7	27°58.1
Avior	234°15.5	-59°34.7
Suhail	222°47.4	-43°31.4
Miaplacidus	221°39.1	-69°48.5
Alphard	217°49.0	-8°45.5
Regulus	207°35.8	11°51.2
Dubhe	193°42.9	61°37.4
Denebola	182°26.4	14°26.5
Gienah	175°45.0	-17°40.2
Acrux	173°02.1	-63°13.7
Gacrux	171°53.5	-57°14.6
Alioth	166°14.4	55°50.0
Spica	158°23.8	-11°17.0
Alkaid	152°53.3	49°11.9
Hadar	148°38.2	-60°29.2
Menkent	147°59.3	-36°29.1
Arcturus	145°49.2	19°03.7
Rigil Kent.	139°42.4	-60°56.0
Kochab	137°20.7	74°03.6
Zuben'ubi	136°57.5	-16°08.3
Alphecca	126°04.9	26°38.3
Antares	112°17.3	-26°29.1
Atria	107°12.8	-69°04.4
Sabik	102°04.1	-15°45.2
Shaula	96°11.9	-37°07.3
Rasalhague	95°59.6	12°32.7
Eltanin	90°42.8	51°29.4
Kaus Aust.	83°34.0	-34°22.5
Vega	80°34.0	38°48.6
Nunki	75°49.1	-26°16.1
Altair	62°00.9	8°56.0
Peacock	53°07.1	-56°39.7
Deneb	49°26.3	45°22.1
Enif	33°39.6	9°59.1
Al Na'ir	27°33.9	-46°50.9
Fomalhaut	15°15.4	-29°29.8
Scheat	13°45.9	28°12.8
Markab	13°30.7	15°20.1

Oct 01 Sun	**SHA**	**Mer.pass**
Venus	215°05.4	09:01
Mars	159°03.2	12:45
Jupiter	317°36.0	02:11
Saturn	25°51.2	21:35

Oct 02 Mon	**SHA**	**Mer.pass**
Venus	214°19.6	09:01
Mars	158°25.8	12:44
Jupiter	317°41.0	02:07
Saturn	25°54.2	21:31

Oct 03 Tue	**SHA**	**Mer.pass**
Venus	213°33.0	09:00
Mars	157°48.3	12:42
Jupiter	317°46.2	02:03
Saturn	25°57.2	21:27

Horizontal parallax	
Venus:	0.3
Mars:	0.1

h Sun Moon

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	182°31.5	S03°00.0	342°26.9	10.3′	N11°34.1	15.8′	59.6′
1	197°31.7	01.0	356°56.2	10.3′	11°49.9	15.7′	59.6′
2	212°32.0	02.0	11°25.5	10.3′	12°05.6	15.7′	59.6′
3	227°32.2	·· 03.0	25°54.8	10.2′	12°21.3	15.5′	59.5′
4	242°32.4	03.9	40°24.0	10.2′	12°36.8	15.5′	59.5′
5	257°32.6	04.9	54°53.2	10.2′	12°52.3	15.3′	59.5′
6	272°32.8	S03°05.9	69°22.4	10.2′	N13°07.6	15.3′	59.4′
7	287°33.0	06.8	83°51.6	10.1′	13°22.9	15.2′	59.4′
8	302°33.2	07.8	98°20.7	10.1′	13°38.1	15.1′	59.4′
9	317°33.4	·· 08.8	112°49.8	10.1′	13°53.2	15.0′	59.3′
10	332°33.6	09.7	127°18.9	10.0′	14°08.2	14.9′	59.3′
11	347°33.8	10.7	141°47.9	10.0′	14°23.1	14.8′	59.3′
12	2°34.0	S03°11.7	156°16.9	10.0′	N14°37.9	14.7′	59.2′
13	17°34.2	12.6	170°45.9	9.9′	14°52.6	14.6′	59.2′
14	32°34.4	13.6	185°14.8	9.9′	15°07.2	14.5′	59.2′
15	47°34.6	·· 14.6	199°43.7	9.9′	15°21.7	14.4′	59.1′
16	62°34.8	15.6	214°12.6	9.8′	15°36.1	14.3′	59.1′
17	77°35.0	16.5	228°41.4	9.8′	15°50.4	14.2′	59.1′
18	92°35.2	S03°17.5	243°10.2	9.8′	N16°04.6	14.1′	59.0′
19	107°35.4	18.5	257°38.9	9.7′	16°18.7	14.0′	59.0′
20	122°35.6	19.4	272°07.7	9.7′	16°32.7	13.9′	58.9′
21	137°35.8	·· 20.4	286°36.3	9.6′	16°46.6	13.7′	58.9′
22	152°36.0	21.4	301°05.0	9.6′	17°00.3	13.7′	58.9′
23	167°36.2	22.3	315°33.6	9.6′	17°14.0	13.5′	58.8′
	SD = 16.0′	d = -1.0′	SD = 16.3′				

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	182°36.4	S03°23.3	330°02.2	9.5′	N17°27.5	13.5′	58.8′
1	197°36.6	24.3	344°30.7	9.5′	17°41.0	13.3′	58.8′
2	212°36.8	25.2	358°59.2	9.4′	17°54.3	13.2′	58.7′
3	227°37.0	·· 26.2	13°27.6	9.4′	18°07.5	13.1′	58.7′
4	242°37.2	27.2	27°56.0	9.4′	18°20.6	12.9′	58.7′
5	257°37.4	28.1	42°24.4	9.3′	18°33.5	12.9′	58.6′
6	272°37.6	S03°29.1	56°52.7	9.3′	N18°46.4	12.7′	58.6′
7	287°37.8	30.1	71°21.0	9.3′	18°59.1	12.6′	58.5′
8	302°38.0	31.0	85°49.3	9.2′	19°11.7	12.5′	58.5′
9	317°38.2	·· 32.0	100°17.5	9.2′	19°24.2	12.3′	58.5′
10	332°38.4	33.0	114°45.7	9.1′	19°36.5	12.3′	58.4′
11	347°38.6	33.9	129°13.8	9.1′	19°48.8	12.1′	58.4′
12	2°38.8	S03°34.9	143°41.9	9.1′	N20°00.9	11.9′	58.3′
13	17°39.0	35.9	158°09.9	9.0′	20°12.8	11.9′	58.3′
14	32°39.2	36.9	172°37.9	9.0′	20°24.7	11.7′	58.3′
15	47°39.4	·· 37.8	187°05.9	8.9′	20°36.4	11.6′	58.2′
16	62°39.6	38.8	201°33.9	8.9′	20°48.0	11.5′	58.2′
17	77°39.8	39.8	216°01.7	8.9′	20°59.5	11.3′	58.2′
18	92°40.0	S03°40.7	230°29.6	8.8′	N21°10.8	11.2′	58.1′
19	107°40.2	41.7	244°57.4	8.8′	21°22.0	11.0′	58.1′
20	122°40.4	42.7	259°25.2	8.7′	21°33.0	10.9′	58.0′
21	137°40.6	·· 43.6	273°52.9	8.7′	21°43.9	10.8′	58.0′
22	152°40.8	44.6	288°20.6	8.7′	21°54.7	10.7′	58.0′
23	167°41.0	45.6	302°48.3	8.6′	22°05.4	10.5′	57.9′
	SD = 16.0′	d = -1.0′	SD = 16.0′				

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	182°41.2	S03°46.5	317°15.9	8.6′	N22°15.9	10.4′	57.9′
1	197°41.4	47.5	331°43.5	8.5′	22°26.3	10.2′	57.8′
2	212°41.6	48.5	346°11.1	8.5′	22°36.5	10.1′	57.8′
3	227°41.8	·· 49.4	0°38.6	8.5′	22°46.6	9.9′	57.8′
4	242°42.0	50.4	15°06.0	8.4′	22°56.5	9.9′	57.7′
5	257°42.2	51.4	29°33.5	8.4′	23°06.4	9.6′	57.7′
6	272°42.4	S03°52.3	44°00.9	8.4′	N23°16.0	9.5′	57.7′
7	287°42.6	53.3	58°28.3	8.3′	23°25.5	9.4′	57.6′
8	302°42.8	54.3	72°55.6	8.3′	23°34.9	9.3′	57.6′
9	317°43.0	·· 55.2	87°22.9	8.3′	23°44.2	9.0′	57.5′
10	332°43.2	56.2	101°50.2	8.2′	23°53.2	9.0′	57.5′
11	347°43.4	57.1	116°17.4	8.2′	24°02.2	8.8′	57.5′
12	2°43.6	S03°58.1	130°44.6	8.2′	N24°11.0	8.6′	57.4′
13	17°43.8	03°59.1	145°11.8	8.1′	24°19.6	8.5′	57.4′
14	32°44.0	04°00.0	159°39.0	8.1′	24°28.1	8.4′	57.3′
15	47°44.2	·· 01.0	174°06.1	8.1′	24°36.5	8.2′	57.3′
16	62°44.4	02.0	188°33.2	8.1′	24°44.7	8.0′	57.3′
17	77°44.6	02.9	203°00.2	8.0′	24°52.7	7.9′	57.2′
18	92°44.8	S04°03.9	217°27.3	8.0′	N25°00.6	7.8′	57.2′
19	107°45.0	04.9	231°54.3	8.0′	25°08.4	7.6′	57.2′
20	122°45.2	05.8	246°21.3	8.0′	25°16.0	7.4′	57.1′
21	137°45.3	·· 06.8	260°48.2	7.9′	25°23.4	7.3′	57.1′
22	152°45.5	07.8	275°15.2	7.9′	25°30.7	7.2′	57.0′
23	167°45.7	08.7	289°42.1	7.9′	25°37.9	7.0′	57.0′
	SD = 16.0′	d = -1.0′	SD = 15.8′				

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

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

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 96-84%
01	10:06	10:16	11:50	01:13	13:38	
02	10:26	10:35	11:49	02:04	14:31	
03	10:45	10:54	11:49	02:57	15:24	

October 04, 05, 06 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	12°25.7	225°11.2	N10°29.8	169°36.5	S09°11.5	330°17.3	N14°44.9	38°25.7	S12°40.1
1	27°28.1	240°11.7	29.4	184°37.4	12.1	345°20.0	44.9	53°28.3	40.2
2	42°30.6	255°12.1	29.1	199°38.2	12.8	0°22.7	44.8	68°30.9	40.2
3	57°33.1	270°12.6	·· 28.8	214°39.1	·· 13.4	15°25.4	·· 44.7	83°33.5	·· 40.3
4	72°35.5	285°13.1	28.4	229°40.0	14.0	30°28.1	44.6	98°36.1	40.3
5	87°38.0	300°13.5	28.1	244°40.9	14.7	45°30.8	44.6	113°38.7	40.4
6	102°40.5	315°14.0	N10°27.8	259°41.8	S09°15.3	60°33.4	N14°44.5	128°41.2	S12°40.4
7	117°42.9	330°14.5	27.4	274°42.7	15.9	75°36.1	44.4	143°43.8	40.4
8	132°45.4	345°14.9	27.1	289°43.6	16.6	90°38.8	44.3	158°46.4	40.5
9	147°47.9	0°15.4	·· 26.8	304°44.5	·· 17.2	105°41.5	·· 44.3	173°49.0	·· 40.5
10	162°50.3	15°15.8	26.4	319°45.4	17.8	120°44.2	44.2	188°51.6	40.6
11	177°52.8	30°16.3	26.1	334°46.3	18.5	135°46.9	44.1	203°54.1	40.6
12	192°55.2	45°16.7	N10°25.8	349°47.2	S09°19.1	150°49.6	N14°44.1	218°56.7	S12°40.6
13	207°57.7	60°17.2	25.4	4°48.1	19.7	165°52.3	44.0	233°59.3	40.7
14	223°00.2	75°17.6	25.1	19°49.0	20.4	180°55.0	43.9	249°01.9	40.7
15	238°02.6	90°18.1	·· 24.7	34°49.9	·· 21.0	195°57.7	·· 43.8	264°04.5	·· 40.8
16	253°05.1	105°18.5	24.4	49°50.8	21.6	211°00.4	43.8	279°07.1	40.8
17	268°07.6	120°19.0	24.1	64°51.7	22.3	226°03.1	43.7	294°09.6	40.8
18	283°10.0	135°19.4	N10°23.7	79°52.6	S09°22.9	241°05.8	N14°43.6	309°12.2	S12°40.9
19	298°12.5	150°19.9	23.4	94°53.5	23.5	256°08.5	43.5	324°14.8	40.9
20	313°15.0	165°20.3	23.0	109°54.4	24.2	271°11.2	43.5	339°17.4	41.0
21	328°17.4	180°20.8	·· 22.7	124°55.3	·· 24.8	286°13.9	·· 43.4	354°20.0	·· 41.0
22	343°19.9	195°21.2	22.3	139°56.1	25.4	301°16.6	43.3	9°22.5	41.1
23	358°22.4	210°21.7	22.0	154°57.0	26.1	316°19.3	43.2	24°25.1	41.1
Mer.pass. 23:06		ν 0.5′ d -0.3′ m -4.70		ν 0.9′ d -0.6′ m 1.63		ν 2.7′ d -0.1′ m -2.83		ν 2.6′ d -0.0′ m 0.60	

Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	13°24.8	225°22.1	N10°21.6	169°57.9	S09°26.7	331°22.0	N14°43.2	39°27.7	S12°41.1
1	28°27.3	240°22.5	21.3	184°58.8	27.3	346°24.7	43.1	54°30.3	41.2
2	43°29.7	255°23.0	20.9	199°59.7	28.0	1°27.4	43.0	69°32.9	41.2
3	58°32.2	270°23.4	·· 20.6	215°00.6	·· 28.6	16°30.1	·· 42.9	84°35.4	·· 41.3
4	73°34.7	285°23.8	20.2	230°01.5	29.2	31°32.8	42.9	99°38.0	41.3
5	88°37.1	300°24.3	19.9	245°02.4	29.9	46°35.5	42.8	114°40.6	41.3
6	103°39.6	315°24.7	N10°19.5	260°03.3	S09°30.5	61°38.2	N14°42.7	129°43.2	S12°41.4
7	118°42.1	330°25.1	19.1	275°04.2	31.1	76°40.9	42.7	144°45.8	41.4
8	133°44.5	345°25.6	18.8	290°05.1	31.8	91°43.6	42.6	159°48.3	41.5
9	148°47.0	0°26.0	·· 18.4	305°06.0	·· 32.4	106°46.3	·· 42.5	174°50.9	·· 41.5
10	163°49.5	15°26.4	18.1	320°06.9	33.0	121°49.0	42.4	189°53.5	41.5
11	178°51.9	30°26.8	17.7	335°07.7	33.7	136°51.7	42.4	204°56.1	41.6
12	193°54.4	45°27.3	N10°17.3	350°08.6	S09°34.3	151°54.4	N14°42.3	219°58.7	S12°41.6
13	208°56.9	60°27.7	17.0	5°09.5	34.9	166°57.1	42.2	235°01.2	41.7
14	223°59.3	75°28.1	16.6	20°10.4	35.6	181°59.8	42.1	250°03.8	41.7
15	239°01.8	90°28.5	·· 16.3	35°11.3	·· 36.2	197°02.5	·· 42.1	265°06.4	·· 41.7
16	254°04.2	105°28.9	15.9	50°12.2	36.8	212°05.2	42.0	280°09.0	41.8
17	269°06.7	120°29.4	15.5	65°13.1	37.5	227°07.9	41.9	295°11.5	41.8
18	284°09.2	135°29.8	N10°15.2	80°14.0	S09°38.1	242°10.6	N14°41.8	310°14.1	S12°41.9
19	299°11.6	150°30.2	14.8	95°14.9	38.7	257°13.3	41.7	325°16.7	41.9
20	314°14.1	165°30.6	14.4	110°15.8	39.4	272°16.0	41.7	340°19.3	41.9
21	329°16.6	180°31.0	·· 14.0	125°16.6	·· 40.0	287°18.7	·· 41.6	355°21.9	·· 42.0
22	344°19.0	195°31.4	13.7	140°17.5	40.6	302°21.4	41.5	10°24.4	42.0
23	359°21.5	210°31.8	13.3	155°18.4	41.3	317°24.1	41.4	25°27.0	42.1
Mer.pass. 23:03		ν 0.4′ d -0.4′ m -4.69		ν 0.9′ d -0.6′ m 1.63		ν 2.7′ d -0.1′ m -2.83		ν 2.6′ d -0.0′ m 0.60	

Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	14°24.0	225°32.2	N10°12.9	170°19.3	S09°41.9	332°26.8	N14°41.4	40°29.6	S12°42.1
1	29°26.4	240°32.6	12.6	185°20.2	42.5	347°29.5	41.3	55°32.2	42.1
2	44°28.9	255°33.0	12.2	200°21.1	43.2	2°32.2	41.2	70°34.7	42.2
3	59°31.4	270°33.5	·· 11.8	215°22.0	·· 43.8	17°34.9	·· 41.1	85°37.3	·· 42.2
4	74°33.8	285°33.9	11.4	230°22.9	44.4	32°37.6	41.1	100°39.9	42.2
5	89°36.3	300°34.3	11.1	245°23.7	45.0	47°40.3	41.0	115°42.5	42.3
6	104°38.7	315°34.7	N10°10.7	260°24.6	S09°45.7	62°43.0	N14°40.9	130°45.0	S12°42.3
7	119°41.2	330°35.1	10.3	275°25.5	46.3	77°45.7	40.8	145°47.6	42.4
8	134°43.7	345°35.5	09.9	290°26.4	46.9	92°48.4	40.8	160°50.2	42.4
9	149°46.1	0°35.9	·· 09.5	305°27.3	·· 47.6	107°51.1	·· 40.7	175°52.8	·· 42.4
10	164°48.6	15°36.3	09.2	320°28.2	48.2	122°53.8	40.6	190°55.4	42.5
11	179°51.1	30°36.6	08.8	335°29.1	48.8	137°56.6	40.5	205°57.9	42.5
12	194°53.5	45°37.0	N10°08.4	350°30.0	S09°49.5	152°59.3	N14°40.5	221°00.5	S12°42.6
13	209°56.0	60°37.4	08.0	5°30.8	50.1	168°02.0	40.4	236°03.1	42.6
14	224°58.5	75°37.8	07.6	20°31.7	50.7	183°04.7	40.3	251°05.7	42.6
15	240°00.9	90°38.2	·· 07.2	35°32.6	·· 51.3	198°07.4	·· 40.2	266°08.2	·· 42.7
16	255°03.4	105°38.6	06.8	50°33.5	52.0	213°10.1	40.1	281°10.8	42.7
17	270°05.8	120°39.0	06.5	65°34.4	52.6	228°12.8	40.1	296°13.4	42.8
18	285°08.3	135°39.4	N10°06.1	80°35.3	S09°53.2	243°15.5	N14°40.0	311°16.0	S12°42.8
19	300°10.8	150°39.8	05.7	95°36.2	53.9	258°18.2	39.9	326°18.5	42.8
20	315°13.2	165°40.1	05.3	110°37.0	54.5	273°20.9	39.8	341°21.1	42.9
21	330°15.7	180°40.5	·· 04.9	125°37.9	·· 55.1	288°23.6	·· 39.8	356°23.7	·· 42.9
22	345°18.2	195°40.9	04.5	140°38.8	55.8	303°26.3	39.7	11°26.2	42.9
23	0°20.6	210°41.3	04.1	155°39.7	56.4	318°29.1	39.6	26°28.8	43.0
Mer.pass. 22:59		ν 0.4′ d -0.4′ m -4.68		ν 0.9′ d -0.6′ m 1.62		ν 2.7′ d -0.1′ m -2.84		ν 2.6′ d -0.0′ m 0.61	

Stars

	SHA	**Dec**
Alpheratz	357°35.5	29°13.4
Ankaa	353°07.8	-42°10.6
Schedar	349°31.7	56°40.1
Diphda	348°48.0	-17°51.3
Achernar	335°20.4	-57°06.9
Hamal	327°52.1	23°34.5
Polaris	314°10.0	89°21.7
Acamar	315°12.2	-40°12.4
Menkar	314°07.0	4°11.1
Mirfak	308°29.4	49°56.6
Aldebaran	290°40.7	16°33.5
Rigel	281°04.8	-8°10.3
Capella	280°23.3	46°01.2
Bellatrix	278°23.9	6°22.4
Elnath	278°03.1	28°37.6
Alnilam	275°38.7	-1°11.0
Betelgeuse	270°53.2	7°24.8
Canopus	263°52.8	-52°42.1
Sirius	258°27.2	-16°44.7
Adhara	255°06.7	-28°59.9
Procyon	244°52.0	5°10.0
Pollux	243°18.7	27°58.1
Avior	234°15.4	-59°34.7
Suhail	222°47.4	-43°31.4
Miaplacidus	221°39.1	-69°48.5
Alphard	217°49.0	-8°45.5
Regulus	207°35.8	11°51.2
Dubhe	193°42.9	61°37.4
Denebola	182°26.3	14°26.5
Gienah	175°45.0	-17°40.2
Acrux	173°02.0	-63°13.7
Gacrux	171°53.5	-57°14.6
Alioth	166°14.4	55°50.0
Spica	158°23.8	-11°17.0
Alkaid	152°53.3	49°11.8
Hadar	148°38.2	-60°29.2
Menkent	147°59.3	-36°29.1
Arcturus	145°49.2	19°03.7
Rigil Kent.	139°42.4	-60°56.0
Kochab	137°20.7	74°03.6
Zuben'ubi	136°57.5	-16°08.3
Alphecca	126°04.9	26°38.3
Antares	112°17.4	-26°29.1
Atria	107°12.8	-69°04.4
Sabik	102°04.1	-15°45.2
Shaula	96°11.9	-37°07.3
Rasalhague	95°59.6	12°32.7
Eltanin	90°42.8	51°29.4
Kaus Aust.	83°34.0	-34°22.5
Vega	80°34.0	38°48.6
Nunki	75°49.1	-26°16.1
Altair	62°00.9	8°56.0
Peacock	53°07.2	-56°39.7
Deneb	49°26.3	45°22.1
Enif	33°39.6	9°59.1
Al Na'ir	27°33.9	-46°50.9
Fomalhaut	15°15.4	-29°29.8
Scheat	13°45.9	28°12.8
Markab	13°30.7	15°20.1

Oct 04 Wed	**SHA**	**Mer.pass**
Venus	212°45.5	08:59
Mars	157°10.8	12:41
Jupiter	317°51.6	01:58
Saturn	26°00.1	21:23

Oct 05 Thu	**SHA**	**Mer.pass**
Venus	211°57.3	08:58
Mars	156°33.1	12:39
Jupiter	317°57.1	01:54
Saturn	26°02.9	21:18

Oct 06 Fri	**SHA**	**Mer.pass**
Venus	211°08.3	08:58
Mars	155°55.3	12:38
Jupiter	318°02.8	01:50
Saturn	26°05.6	21:14

Horizontal parallax	
Venus:	0.3
Mars:	0.1

h Sun Moon

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	182°45.9	S04°09.7	304°09.0	7.9′	N25°44.9	6.8′	57.0′
1	197°46.1	10.7	318°35.9	7.9′	25°51.7	6.7′	56.9′
2	212°46.3	11.6	333°02.7	7.8′	25°58.4	6.5′	56.9′
3	227°46.5	·· 12.6	347°29.6	7.8′	26°04.9	6.4′	56.9′
4	242°46.7	13.6	1°56.4	7.8′	26°11.3	6.2′	56.8′
5	257°46.9	14.5	16°23.2	7.8′	26°17.5	6.1′	56.8′
6	272°47.1	S04°15.5	30°50.0	7.8′	N26°23.6	5.9′	56.7′
7	287°47.3	16.4	45°16.8	7.8′	26°29.5	5.7′	56.7′
8	302°47.5	17.4	59°43.5	7.8′	26°35.2	5.6′	56.7′
9	317°47.7	·· 18.4	74°10.3	7.7′	26°40.8	5.5′	56.6′
10	332°47.9	19.3	88°37.0	7.7′	26°46.3	5.3′	56.6′
11	347°48.1	20.3	103°03.8	7.7′	26°51.6	5.1′	56.6′
12	2°48.3	S04°21.3	117°30.5	7.7′	N26°56.7	5.0′	56.5′
13	17°48.4	22.2	131°57.2	7.7′	27°01.7	4.8′	56.5′
14	32°48.6	23.2	146°24.0	7.7′	27°06.5	4.6′	56.5′
15	47°48.8	·· 24.2	160°50.7	7.7′	27°11.1	4.5′	56.4′
16	62°49.0	25.1	175°17.4	7.7′	27°15.6	4.4′	56.4′
17	77°49.2	26.1	189°44.1	7.7′	27°20.0	4.2′	56.4′
18	92°49.4	S04°27.0	204°10.8	7.7′	N27°24.2	4.0′	56.3′
19	107°49.6	28.0	218°37.5	7.7′	27°28.2	3.9′	56.3′
20	122°49.8	29.0	233°04.2	7.7′	27°32.1	3.7′	56.3′
21	137°50.0	·· 29.9	247°31.0	7.7′	27°35.8	3.5′	56.2′
22	152°50.2	30.9	261°57.7	7.7′	27°39.3	3.4′	56.2′
23	167°50.4	31.9	276°24.4	7.7′	27°42.7	3.3′	56.2′
	SD = 16.0′	d = -1.0′	SD = 15.5′				

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	182°50.6	S04°32.8	290°51.2	7.8′	N27°46.0	3.1′	56.1′
1	197°50.7	33.8	305°17.9	7.8′	27°49.1	2.9′	56.1′
2	212°50.9	34.8	319°44.7	7.8′	27°52.0	2.8′	56.1′
3	227°51.1	·· 35.7	334°11.5	7.8′	27°54.8	2.6′	56.0′
4	242°51.3	36.7	348°38.2	7.8′	27°57.4	2.5′	56.0′
5	257°51.5	37.6	3°05.0	7.8′	27°59.9	2.3′	56.0′
6	272°51.7	S04°38.6	17°31.9	7.8′	N28°02.2	2.1′	55.9′
7	287°51.9	39.6	31°58.7	7.9′	28°04.3	2.0′	55.9′
8	302°52.1	40.5	46°25.6	7.9′	28°06.3	1.8′	55.9′
9	317°52.3	·· 41.5	60°52.4	7.9′	28°08.1	1.7′	55.8′
10	332°52.5	42.4	75°19.3	7.9′	28°09.8	1.5′	55.8′
11	347°52.6	43.4	89°46.3	7.9′	28°11.3	1.4′	55.8′
12	2°52.8	S04°44.4	104°13.2	8.0′	N28°12.7	1.2′	55.7′
13	17°53.0	45.3	118°40.2	8.0′	28°13.9	1.1′	55.7′
14	32°53.2	46.3	133°07.2	8.0′	28°15.0	0.9′	55.7′
15	47°53.4	·· 47.3	147°34.2	8.1′	28°15.9	0.8′	55.6′
16	62°53.6	48.2	162°01.3	8.1′	28°16.7	0.6′	55.6′
17	77°53.8	49.2	176°28.3	8.1′	28°17.3	0.4′	55.6′
18	92°54.0	S04°50.1	190°55.5	8.2′	N28°17.7	0.3′	55.6′
19	107°54.2	51.1	205°22.6	8.2′	28°18.0	0.2′	55.5′
20	122°54.3	52.1	219°49.8	8.2′	28°18.2	0.0′	55.5′
21	137°54.5	·· 53.0	234°17.0	8.3′	28°18.2	0.2′	55.5′
22	152°54.7	54.0	248°44.3	8.3′	28°18.0	0.3′	55.4′
23	167°54.9	54.9	263°11.6	8.3′	28°17.7	0.4′	55.4′
	SD = 16.0′	d = -1.0′	SD = 15.3′				

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	182°55.1	S04°55.9	277°39.0	8.4′	N28°17.3	0.6′	55.4′
1	197°55.3	56.9	292°06.3	8.4′	28°16.7	0.8′	55.4′
2	212°55.5	57.8	306°33.8	8.5′	28°15.9	0.9′	55.3′
3	227°55.7	·· 58.8	321°01.2	8.5′	28°15.0	1.0′	55.3′
4	242°55.8	04°59.7	335°28.8	8.6′	28°14.0	1.2′	55.3′
5	257°56.0	05°00.7	349°56.3	8.6′	28°12.8	1.3′	55.2′
6	272°56.2	S05°01.7	4°23.9	8.7′	N28°11.5	1.5′	55.2′
7	287°56.4	02.6	18°51.6	8.7′	28°10.0	1.6′	55.2′
8	302°56.6	03.6	33°19.3	8.8′	28°08.4	1.8′	55.2′
9	317°56.8	·· 04.5	47°47.1	8.8′	28°06.6	1.9′	55.1′
10	332°57.0	05.5	62°14.9	8.9′	28°04.7	2.1′	55.1′
11	347°57.1	06.5	76°42.8	8.9′	28°02.6	2.2′	55.1′
12	2°57.3	S05°07.4	91°10.7	9.0′	N28°00.4	2.3′	55.1′
13	17°57.5	08.4	105°38.7	9.0′	27°58.1	2.5′	55.0′
14	32°57.7	09.3	120°06.7	9.1′	27°55.6	2.6′	55.0′
15	47°57.9	·· 10.3	134°34.8	9.1′	27°53.0	2.8′	55.0′
16	62°58.1	11.3	149°02.9	9.2′	27°50.2	2.9′	55.0′
17	77°58.2	12.2	163°31.1	9.3′	27°47.3	3.0′	55.0′
18	92°58.4	S05°13.2	177°59.4	9.3′	N27°44.3	3.2′	54.9′
19	107°58.6	14.1	192°27.7	9.4′	27°41.1	3.3′	54.9′
20	122°58.8	15.1	206°56.1	9.4′	27°37.8	3.5′	54.9′
21	137°59.0	·· 16.0	221°24.5	9.5′	27°34.3	3.6′	54.9′
22	152°59.2	17.0	235°53.1	9.6′	27°30.7	3.7′	54.8′
23	167°59.3	18.0	250°21.6	9.6′	27°27.0	3.8′	54.8′
	SD = 16.0′	d = -1.0′	SD = 15.1′				

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

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

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 19-21 75-56%
04	11:04	11:13	11:49	03:52	16:20	
05	11:22	11:31	11:48	04:47	17:15	
06	11:40	11:49	11:48	05:42	18:08	

October 07, 08, 09 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	15°23.1	225°41.7	N10°03.7	170°40.6	S09°57.0	333°31.8	N14°39.5	41°31.4	S12°43.0
1	30°25.6	240°42.1	03.3	185°41.5	57.6	348°34.5	39.4	56°34.0	43.1
2	45°28.0	255°42.4	02.9	200°42.3	58.3	3°37.2	39.4	71°36.5	43.1
3	60°30.5	270°42.8	·· 02.5	215°43.2	·· 58.9	18°39.9	·· 39.3	86°39.1	·· 43.1
4	75°33.0	285°43.2	02.1	230°44.1	09°59.5	33°42.6	39.2	101°41.7	43.2
5	90°35.4	300°43.6	01.7	245°45.0	10°00.2	48°45.3	39.1	116°44.3	43.2
6	105°37.9	315°43.9	N10°01.3	260°45.9	S10°00.8	63°48.0	N14°39.1	131°46.8	S12°43.2
7	120°40.3	330°44.3	00.9	275°46.8	01.4	78°50.7	39.0	146°49.4	43.3
8	135°42.8	345°44.7	00.5	290°47.6	02.0	93°53.5	38.9	161°52.0	43.3
9	150°45.3	0°45.0	10°00.1	305°48.5	·· 02.7	108°56.2	·· 38.8	176°54.6	·· 43.4
10	165°47.7	15°45.4	09°59.7	320°49.4	03.3	123°58.9	38.7	191°57.1	43.4
11	180°50.2	30°45.8	59.3	335°50.3	03.9	139°01.6	38.7	206°59.7	43.4
12	195°52.7	45°46.1	N09°58.9	350°51.2	S10°04.6	154°04.3	N14°38.6	222°02.3	S12°43.5
13	210°55.1	60°46.5	58.5	5°52.1	05.2	169°07.0	38.5	237°04.8	43.5
14	225°57.6	75°46.9	58.1	20°52.9	05.8	184°09.7	38.4	252°07.4	43.5
15	241°00.1	90°47.2	·· 57.7	35°53.8	·· 06.4	199°12.5	·· 38.3	267°10.0	·· 43.6
16	256°02.5	105°47.6	57.3	50°54.7	07.1	214°15.2	38.3	282°12.6	43.6
17	271°05.0	120°47.9	56.9	65°55.6	07.7	229°17.9	38.2	297°15.1	43.7
18	286°07.5	135°48.3	N09°56.4	80°56.5	S10°08.3	244°20.6	N14°38.1	312°17.7	S12°43.7
19	301°09.9	150°48.7	56.0	95°57.3	08.9	259°23.3	38.0	327°20.3	43.7
20	316°12.4	165°49.0	55.6	110°58.2	09.6	274°26.0	38.0	342°22.8	43.8
21	331°14.8	180°49.4	·· 55.2	125°59.1	·· 10.2	289°28.7	·· 37.9	357°25.4	·· 43.8
22	346°17.3	195°49.7	54.8	141°00.0	10.8	304°31.5	37.8	12°28.0	43.8
23	1°19.8	210°50.1	54.4	156°00.9	11.5	319°34.2	37.7	27°30.6	43.9
Mer.pass. 22:55		ν 0.4′ d -0.4′ m -4.67		ν 0.9′ d -0.6′ m 1.62		ν 2.7′ d -0.1′ m -2.84		ν 2.6′ d -0.0′ m 0.61	

Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	16°22.2	225°50.4	N09°54.0	171°01.7	S10°12.1	334°36.9	N14°37.6	42°33.1	S12°43.9
1	31°24.7	240°50.8	53.5	186°02.6	12.7	349°39.6	37.6	57°35.7	43.9
2	46°27.2	255°51.1	53.1	201°03.5	13.3	4°42.3	37.5	72°38.3	44.0
3	61°29.6	270°51.5	·· 52.7	216°04.4	·· 14.0	19°45.0	·· 37.4	87°40.8	·· 44.0
4	76°32.1	285°51.8	52.3	231°05.3	14.6	34°47.8	37.3	102°43.4	44.1
5	91°34.6	300°52.2	51.9	246°06.1	15.2	49°50.5	37.2	117°46.0	44.1
6	106°37.0	315°52.5	N09°51.4	261°07.0	S10°15.8	64°53.2	N14°37.2	132°48.6	S12°44.1
7	121°39.5	330°52.9	51.0	276°07.9	16.5	79°55.9	37.1	147°51.1	44.2
8	136°41.9	345°53.2	50.6	291°08.8	17.1	94°58.6	37.0	162°53.7	44.2
9	151°44.4	0°53.6	·· 50.2	306°09.6	·· 17.7	110°01.3	·· 36.9	177°56.3	·· 44.2
10	166°46.9	15°53.9	49.7	321°10.5	18.3	125°04.1	36.8	192°58.8	44.3
11	181°49.3	30°54.2	49.3	336°11.4	19.0	140°06.8	36.8	208°01.4	44.3
12	196°51.8	45°54.6	N09°48.9	351°12.3	S10°19.6	155°09.5	N14°36.7	223°04.0	S12°44.3
13	211°54.3	60°54.9	48.5	6°13.2	20.2	170°12.2	36.6	238°06.5	44.4
14	226°56.7	75°55.3	48.0	21°14.0	20.8	185°14.9	36.5	253°09.1	44.4
15	241°59.2	90°55.6	·· 47.6	36°14.9	·· 21.5	200°17.7	·· 36.4	268°11.7	·· 44.5
16	257°01.7	105°55.9	47.2	51°15.8	22.1	215°20.4	36.4	283°14.2	44.5
17	272°04.1	120°56.3	46.7	66°16.7	22.7	230°23.1	36.3	298°16.8	44.5
18	287°06.6	135°56.6	N09°46.3	81°17.5	S10°23.3	245°25.8	N14°36.2	313°19.4	S12°44.6
19	302°09.1	150°56.9	45.9	96°18.4	24.0	260°28.5	36.1	328°21.9	44.6
20	317°11.5	165°57.2	45.4	111°19.3	24.6	275°31.3	36.0	343°24.5	44.6
21	332°14.0	180°57.6	·· 45.0	126°20.2	·· 25.2	290°34.0	·· 35.9	358°27.1	·· 44.7
22	347°16.4	195°57.9	44.6	141°21.0	25.8	305°36.7	35.9	13°29.6	44.7
23	2°18.9	210°58.2	44.1	156°21.9	26.5	320°39.4	35.8	28°32.2	44.7
Mer.pass. 22:51		ν 0.4′ d -0.4′ m -4.66		ν 0.9′ d -0.6′ m 1.61		ν 2.7′ d -0.1′ m -2.85		ν 2.6′ d -0.0′ m 0.62	

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	17°21.4	225°58.6	N09°43.7	171°22.8	S10°27.1	335°42.2	N14°35.7	43°34.8	S12°44.8
1	32°23.8	240°58.9	43.2	186°23.7	27.7	350°44.9	35.6	58°37.4	44.8
2	47°26.3	255°59.2	42.8	201°24.5	28.3	5°47.6	35.5	73°39.9	44.8
3	62°28.8	270°59.5	·· 42.4	216°25.4	·· 29.0	20°50.3	·· 35.5	88°42.5	·· 44.9
4	77°31.2	285°59.9	41.9	231°26.3	29.6	35°53.0	35.4	103°45.1	44.9
5	92°33.7	301°00.2	41.5	246°27.2	30.2	50°55.8	35.3	118°47.6	44.9
6	107°36.2	316°00.5	N09°41.0	261°28.0	S10°30.8	65°58.5	N14°35.2	133°50.2	S12°45.0
7	122°38.6	331°00.8	40.6	276°28.9	31.5	81°01.2	35.1	148°52.8	45.0
8	137°41.1	346°01.1	40.2	291°29.8	32.1	96°03.9	35.1	163°55.3	45.1
9	152°43.6	1°01.4	·· 39.7	306°30.7	·· 32.7	111°06.7	·· 35.0	178°57.9	·· 45.1
10	167°46.0	16°01.8	39.3	321°31.5	33.3	126°09.4	34.9	194°00.4	45.1
11	182°48.5	31°02.1	38.8	336°32.4	33.9	141°12.1	34.8	209°03.0	45.2
12	197°50.9	46°02.4	N09°38.4	351°33.3	S10°34.6	156°14.8	N14°34.7	224°05.6	S12°45.2
13	212°53.4	61°02.7	37.9	6°34.2	35.2	171°17.6	34.6	239°08.1	45.2
14	227°55.9	76°03.0	37.5	21°35.0	35.8	186°20.3	34.6	254°10.7	45.3
15	242°58.3	91°03.3	·· 37.0	36°35.9	·· 36.4	201°23.0	·· 34.5	269°13.3	·· 45.3
16	258°00.8	106°03.6	36.6	51°36.8	37.1	216°25.7	34.4	284°15.8	45.3
17	273°03.3	121°03.9	36.1	66°37.6	37.7	231°28.5	34.3	299°18.4	45.4
18	288°05.7	136°04.3	N09°35.6	81°38.5	S10°38.3	246°31.2	N14°34.2	314°21.0	S12°45.4
19	303°08.2	151°04.6	35.2	96°39.4	38.9	261°33.9	34.2	329°23.5	45.4
20	318°10.7	166°04.9	34.7	111°40.3	39.6	276°36.6	34.1	344°26.1	45.5
21	333°13.1	181°05.2	·· 34.3	126°41.1	·· 40.2	291°39.4	·· 34.0	359°28.7	·· 45.5
22	348°15.6	196°05.5	33.8	141°42.0	40.8	306°42.1	33.9	14°31.2	45.5
23	3°18.0	211°05.8	33.4	156°42.9	41.4	321°44.8	33.8	29°33.8	45.6
Mer.pass. 22:47		ν 0.3′ d -0.4′ m -4.65		ν 0.9′ d -0.6′ m 1.61		ν 2.7′ d -0.1′ m -2.85		ν 2.6′ d -0.0′ m 0.62	

Stars

	SHA	**Dec**
Alpheratz	357°35.5	29°13.4
Ankaa	353°07.7	-42°10.6
Schedar	349°31.7	56°40.1
Diphda	348°48.0	-17°51.3
Achernar	335°20.4	-57°06.9
Hamal	327°52.1	23°34.5
Polaris	314°08.9	89°21.7
Acamar	315°12.2	-40°12.4
Menkar	314°07.0	4°11.1
Mirfak	308°29.4	49°56.7
Aldebaran	290°40.6	16°33.5
Rigel	281°04.7	-8°10.3
Capella	280°23.3	46°01.2
Bellatrix	278°23.9	6°22.4
Elnath	278°03.1	28°37.6
Alnilam	275°38.7	-1°11.0
Betelgeuse	270°53.1	7°24.8
Canopus	263°52.8	-52°42.1
Sirius	258°27.1	-16°44.7
Adhara	255°06.7	-28°59.9
Procyon	244°52.0	5°10.0
Pollux	243°18.7	27°58.1
Avior	234°15.4	-59°34.7
Suhail	222°47.3	-43°31.3
Miaplacidus	221°39.0	-69°48.5
Alphard	217°49.0	-8°45.5
Regulus	207°35.8	11°51.2
Dubhe	193°42.8	61°37.3
Denebola	182°26.3	14°26.5
Gienah	175°45.0	-17°40.2
Acrux	173°02.0	-63°13.7
Gacrux	171°53.4	-57°14.6
Alioth	166°14.4	55°49.9
Spica	158°23.7	-11°17.0
Alkaid	152°53.3	49°11.8
Hadar	148°38.2	-60°29.2
Menkent	147°59.3	-36°29.1
Arcturus	145°49.2	19°03.7
Rigil Kent.	139°42.4	-60°56.0
Kochab	137°20.7	74°03.6
Zuben'ubi	136°57.5	-16°08.3
Alphecca	126°04.9	26°38.3
Antares	112°17.4	-26°29.1
Atria	107°12.8	-69°04.4
Sabik	102°04.2	-15°45.2
Shaula	96°12.0	-37°07.3
Rasalhague	95°59.7	12°32.7
Eltanin	90°42.8	51°29.4
Kaus Aust.	83°34.0	-34°22.5
Vega	80°34.0	38°48.6
Nunki	75°49.1	-26°16.1
Altair	62°00.9	8°56.0
Peacock	53°07.2	-56°39.7
Deneb	49°26.4	45°22.1
Enif	33°39.6	9°59.1
Al Na'ir	27°33.9	-46°50.9
Fomalhaut	15°15.4	-29°29.8
Scheat	13°45.9	28°12.8
Markab	13°30.7	15°20.1

Oct 07 Sat	**SHA**	**Mer.pass**
Venus	210°18.6	08:57
Mars	155°17.5	12:37
Jupiter	318°08.7	01:46
Saturn	26°08.3	21:10

Oct 08 Sun	**SHA**	**Mer.pass**
Venus	209°28.2	08:56
Mars	154°39.5	12:35
Jupiter	318°14.7	01:41
Saturn	26°10.9	21:06

Oct 09 Mon	**SHA**	**Mer.pass**
Venus	208°37.2	08:56
Mars	154°01.4	12:34
Jupiter	318°20.8	01:37
Saturn	26°13.4	21:02

Horizontal parallax	
Venus:	0.3
Mars:	0.1

h	Sun		Moon				
Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°59.5	S05°18.9	264°50.3	9.7′	N27°23.2	4.0′	54.8′
1	197°59.7	19.9	279°19.0	9.8′	27°19.2	4.1′	54.8′
2	212°59.9	20.8	293°47.8	9.8′	27°15.1	4.3′	54.8′
3	228°00.1	·· 21.8	308°16.6	9.9′	27°10.8	4.4′	54.7′
4	243°00.3	22.8	322°45.5	10.0′	27°06.4	4.5′	54.7′
5	258°00.4	23.7	337°14.5	10.0′	27°01.9	4.6′	54.7′
6	273°00.6	S05°24.7	351°43.5	10.1′	N26°57.3	4.8′	54.7′
7	288°00.8	25.6	6°12.6	10.2′	26°52.5	4.9′	54.7′
8	303°01.0	26.6	20°41.8	10.3′	26°47.6	5.0′	54.6′
9	318°01.2	·· 27.5	35°11.1	10.3′	26°42.6	5.1′	54.6′
10	333°01.3	28.5	49°40.4	10.4′	26°37.5	5.3′	54.6′
11	348°01.5	29.5	64°09.8	10.5′	26°32.2	5.4′	54.6′
12	3°01.7	S05°30.4	78°39.2	10.5′	N26°26.8	5.5′	54.6′
13	18°01.9	31.4	93°08.8	10.6′	26°21.3	5.6′	54.5′
14	33°02.1	32.3	107°38.4	10.7′	26°15.7	5.8′	54.5′
15	48°02.2	·· 33.3	122°08.1	10.8′	26°09.9	5.9′	54.5′
16	63°02.4	34.2	136°37.8	10.8′	26°04.0	5.9′	54.5′
17	78°02.6	35.2	151°07.7	10.9′	25°58.1	6.2′	54.5′
18	93°02.8	S05°36.1	165°37.6	11.0′	N25°51.9	6.2′	54.5′
19	108°03.0	37.1	180°07.6	11.1′	25°45.7	6.3′	54.5′
20	123°03.1	38.1	194°37.6	11.1′	25°39.4	6.5′	54.4′
21	138°03.3	·· 39.0	209°07.7	11.2′	25°32.9	6.6′	54.4′
22	153°03.5	40.0	223°37.9	11.3′	25°26.3	6.7′	54.4′
23	168°03.7	40.9	238°08.2	11.4′	25°19.6	6.8′	54.4′
	SD = 16.0′	d = -1.0′	SD = 14.9′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°03.9	S05°41.9	252°38.6	11.4′	N25°12.8	6.9′	54.4′
1	198°04.0	42.8	267°09.0	11.5′	25°05.9	7.0′	54.4′
2	213°04.2	43.8	281°39.5	11.6′	24°58.9	7.2′	54.3′
3	228°04.4	·· 44.7	296°10.1	11.7′	24°51.7	7.2′	54.3′
4	243°04.6	45.7	310°40.7	11.7′	24°44.5	7.4′	54.3′
5	258°04.7	46.6	325°11.5	11.8′	24°37.1	7.4′	54.3′
6	273°04.9	S05°47.6	339°42.3	11.9′	N24°29.7	7.6′	54.3′
7	288°05.1	48.6	354°13.2	12.0′	24°22.1	7.7′	54.3′
8	303°05.3	49.5	8°44.1	12.0′	24°14.4	7.8′	54.3′
9	318°05.5	·· 50.5	23°15.2	12.1′	24°06.6	7.8′	54.3′
10	333°05.6	51.4	37°46.3	12.2′	23°58.8	8.0′	54.3′
11	348°05.8	52.4	52°17.5	12.3′	23°50.8	8.1′	54.2′
12	3°06.0	S05°53.3	66°48.7	12.3′	N23°42.7	8.2′	54.2′
13	18°06.2	54.3	81°20.1	12.4′	23°34.5	8.3′	54.2′
14	33°06.3	55.2	95°51.5	12.5′	23°26.2	8.4′	54.2′
15	48°06.5	·· 56.2	110°23.0	12.6′	23°17.8	8.5′	54.2′
16	63°06.7	57.1	124°54.5	12.6′	23°09.3	8.6′	54.2′
17	78°06.9	58.1	139°26.2	12.7′	23°00.7	8.7′	54.2′
18	93°07.0	S05°59.0	153°57.9	12.8′	N22°52.0	8.8′	54.2′
19	108°07.2	06°00.0	168°29.6	12.9′	22°43.2	8.8′	54.2′
20	123°07.4	00.9	183°01.5	12.9′	22°34.4	9.0′	54.2′
21	138°07.6	·· 01.9	197°33.4	13.0′	22°25.4	9.1′	54.1′
22	153°07.7	02.9	212°05.4	13.1′	22°16.3	9.1′	54.1′
23	168°07.9	03.8	226°37.5	13.1′	22°07.2	9.3′	54.1′
	SD = 16.0′	d = -1.0′	SD = 14.8′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°08.1	S06°04.8	241°09.7	13.2′	N21°57.9	9.3′	54.1′
1	198°08.3	05.7	255°41.9	13.3′	21°48.6	9.4′	54.1′
2	213°08.4	06.7	270°14.2	13.4′	21°39.2	9.6′	54.1′
3	228°08.6	·· 07.6	284°46.5	13.4′	21°29.6	9.6′	54.1′
4	243°08.8	08.6	299°19.0	13.5′	21°20.0	9.7′	54.1′
5	258°08.9	09.5	313°51.5	13.6′	21°10.3	9.7′	54.1′
6	273°09.1	S06°10.5	328°24.1	13.6′	N21°00.6	9.9′	54.1′
7	288°09.3	11.4	342°56.7	13.7′	20°50.7	10.0′	54.1′
8	303°09.5	12.4	357°29.4	13.8′	20°40.7	10.0′	54.1′
9	318°09.6	·· 13.3	12°02.2	13.8′	20°30.7	10.1′	54.1′
10	333°09.8	14.3	26°35.0	13.9′	20°20.6	10.2′	54.1′
11	348°10.0	15.2	41°08.0	14.0′	20°10.4	10.3′	54.1′
12	3°10.1	S06°16.2	55°40.9	14.1′	N20°00.1	10.3′	54.1′
13	18°10.3	17.1	70°14.0	14.1′	19°49.8	10.5′	54.0′
14	33°10.5	18.1	84°47.1	14.2′	19°39.3	10.5′	54.0′
15	48°10.7	·· 19.0	99°20.3	14.2′	19°28.8	10.6′	54.0′
16	63°10.8	20.0	113°53.5	14.3′	19°18.2	10.7′	54.0′
17	78°11.0	20.9	128°26.8	14.4′	19°07.5	10.7′	54.0′
18	93°11.2	S06°21.9	143°00.2	14.4′	N18°56.8	10.8′	54.0′
19	108°11.3	22.8	157°33.7	14.5′	18°46.0	10.9′	54.0′
20	123°11.5	23.8	172°07.2	14.6′	18°35.1	11.0′	54.0′
21	138°11.7	·· 24.7	186°40.7	14.6′	18°24.1	11.1′	54.0′
22	153°11.8	25.7	201°14.3	14.7′	18°13.0	11.1′	54.0′
23	168°12.0	26.6	215°48.0	14.7′	18°01.9	11.2′	54.0′
	SD = 16.0′	d = -1.0′	SD = 14.8′				

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

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

October 10, 11, 12 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	18°20.5	226°06.1	N09°32.9	171°43.7	S10°42.0	336°47.6	N14°33.7	44°36.4	S12°45.6
1	33°23.0	241°06.4	32.4	186°44.6	42.7	351°50.3	33.7	59°38.9	45.6
2	48°25.4	256°06.7	32.0	201°45.5	43.3	6°53.0	33.6	74°41.5	45.7
3	63°27.9	271°07.0	·· 31.5	216°46.3	·· 43.9	21°55.7	·· 33.5	89°44.0	·· 45.7
4	78°30.4	286°07.3	31.1	231°47.2	44.5	36°58.5	33.4	104°46.6	45.7
5	93°32.8	301°07.6	30.6	246°48.1	45.1	52°01.2	33.3	119°49.2	45.8
6	108°35.3	316°07.9	N09°30.1	261°49.0	S10°45.8	67°03.9	N14°33.2	134°51.7	S12°45.8
7	123°37.8	331°08.2	29.7	276°49.8	46.4	82°06.7	33.2	149°54.3	45.8
8	138°40.2	346°08.4	29.2	291°50.7	47.0	97°09.4	33.1	164°56.9	45.9
9	153°42.7	1°08.7	·· 28.7	306°51.6	·· 47.6	112°12.1	·· 33.0	179°59.4	·· 45.9
10	168°45.2	16°09.0	28.3	321°52.4	48.3	127°14.8	32.9	195°02.0	45.9
11	183°47.6	31°09.3	27.8	336°53.3	48.9	142°17.6	32.8	210°04.6	46.0
12	198°50.1	46°09.6	N09°27.3	351°54.2	S10°49.5	157°20.3	N14°32.7	225°07.1	S12°46.0
13	213°52.5	61°09.9	26.8	6°55.0	50.1	172°23.0	32.7	240°09.7	46.0
14	228°55.0	76°10.2	26.4	21°55.9	50.7	187°25.8	32.6	255°12.2	46.1
15	243°57.5	91°10.5	·· 25.9	36°56.8	·· 51.4	202°28.5	·· 32.5	270°14.8	·· 46.1
16	258°59.9	106°10.8	25.4	51°57.6	52.0	217°31.2	32.4	285°17.4	46.1
17	274°02.4	121°11.0	25.0	66°58.5	52.6	232°34.0	32.3	300°19.9	46.2
18	289°04.9	136°11.3	N09°24.5	81°59.4	S10°53.2	247°36.7	N14°32.2	315°22.5	S12°46.2
19	304°07.3	151°11.6	24.0	97°00.2	53.8	262°39.4	32.2	330°25.0	46.2
20	319°09.8	166°11.9	23.5	112°01.1	54.5	277°42.2	32.1	345°27.6	46.3
21	334°12.3	181°12.2	·· 23.0	127°02.0	·· 55.1	292°44.9	·· 32.0	0°30.2	·· 46.3
22	349°14.7	196°12.4	22.6	142°02.8	55.7	307°47.6	31.9	15°32.7	46.3
23	4°17.2	211°12.7	22.1	157°03.7	56.3	322°50.4	31.8	30°35.3	46.4
Mer.pass. 22:43		ν 0.3′	d -0.5′ m -4.64	ν 0.9′	d -0.6′ m 1.60	ν 2.7′	d -0.1′ m -2.86	ν 2.6′	d -0.0′ m 0.63

Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	19°19.7	226°13.0	N09°21.6	172°04.6	S10°56.9	337°53.1	N14°31.7	45°37.8	S12°46.4
1	34°22.1	241°13.3	21.1	187°05.4	57.5	352°55.8	31.6	60°40.4	46.4
2	49°24.6	256°13.6	20.6	202°06.3	58.2	7°58.6	31.6	75°43.0	46.5
3	64°27.0	271°13.8	·· 20.2	217°07.2	·· 58.8	23°01.3	·· 31.5	90°45.5	·· 46.5
4	79°29.5	286°14.1	19.7	232°08.0	10°59.4	38°04.0	31.4	105°48.1	46.5
5	94°32.0	301°14.4	19.2	247°08.9	11°00.0	53°06.8	31.3	120°50.6	46.6
6	109°34.4	316°14.7	N09°18.7	262°09.8	S11°00.6	68°09.5	N14°31.2	135°53.2	S12°46.6
7	124°36.9	331°14.9	18.2	277°10.6	01.3	83°12.2	31.1	150°55.8	46.6
8	139°39.4	346°15.2	17.7	292°11.5	01.9	98°15.0	31.1	165°58.3	46.7
9	154°41.8	1°15.5	·· 17.2	307°12.4	·· 02.5	113°17.7	·· 31.0	181°00.9	·· 46.7
10	169°44.3	16°15.7	16.8	322°13.2	03.1	128°20.4	30.9	196°03.4	46.7
11	184°46.8	31°16.0	16.3	337°14.1	03.7	143°23.2	30.8	211°06.0	46.8
12	199°49.2	46°16.3	N09°15.8	352°14.9	S11°04.4	158°25.9	N14°30.7	226°08.6	S12°46.8
13	214°51.7	61°16.5	15.3	7°15.8	05.0	173°28.6	30.6	241°11.1	46.8
14	229°54.1	76°16.8	14.8	22°16.7	05.6	188°31.4	30.5	256°13.7	46.8
15	244°56.6	91°17.1	·· 14.3	37°17.5	·· 06.2	203°34.1	·· 30.5	271°16.2	·· 46.9
16	259°59.1	106°17.3	13.8	52°18.4	06.8	218°36.9	30.4	286°18.8	46.9
17	275°01.5	121°17.6	13.3	67°19.3	07.4	233°39.6	30.3	301°21.4	46.9
18	290°04.0	136°17.8	N09°12.8	82°20.1	S11°08.1	248°42.3	N14°30.2	316°23.9	S12°47.0
19	305°06.5	151°18.1	12.3	97°21.0	08.7	263°45.1	30.1	331°26.5	47.0
20	320°08.9	166°18.4	11.8	112°21.9	09.3	278°47.8	30.0	346°29.0	47.0
21	335°11.4	181°18.6	·· 11.3	127°22.7	·· 09.9	293°50.5	·· 29.9	1°31.6	·· 47.1
22	350°13.9	196°18.9	10.8	142°23.6	10.5	308°53.3	29.9	16°34.1	47.1
23	5°16.3	211°19.1	10.3	157°24.4	11.1	323°56.0	29.8	31°36.7	47.1
Mer.pass. 22:39		ν 0.3′	d -0.5′ m -4.63	ν 0.9′	d -0.6′ m 1.60	ν 2.7′	d -0.1′ m -2.86	ν 2.6′	d -0.0′ m 0.63

Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	20°18.8	226°19.4	N09°09.8	172°25.3	S11°11.8	338°58.8	N14°29.7	46°39.3	S12°47.2
1	35°21.3	241°19.6	09.3	187°26.2	12.4	354°01.5	29.6	61°41.8	47.2
2	50°23.7	256°19.9	08.8	202°27.0	13.0	9°04.2	29.5	76°44.4	47.2
3	65°26.2	271°20.1	·· 08.3	217°27.9	·· 13.6	24°07.0	·· 29.4	91°46.9	·· 47.3
4	80°28.6	286°20.4	07.8	232°28.7	14.2	39°09.7	29.3	106°49.5	47.3
5	95°31.1	301°20.6	07.3	247°29.6	14.8	54°12.5	29.3	121°52.0	47.3
6	110°33.6	316°20.9	N09°06.8	262°30.5	S11°15.5	69°15.2	N14°29.2	136°54.6	S12°47.3
7	125°36.0	331°21.1	06.3	277°31.3	16.1	84°17.9	29.1	151°57.2	47.4
8	140°38.5	346°21.4	05.8	292°32.2	16.7	99°20.7	29.0	166°59.7	47.4
9	155°41.0	1°21.6	·· 05.3	307°33.0	·· 17.3	114°23.4	·· 28.9	182°02.3	·· 47.4
10	170°43.4	16°21.9	04.8	322°33.9	17.9	129°26.2	28.8	197°04.8	47.5
11	185°45.9	31°22.1	04.2	337°34.8	18.5	144°28.9	28.7	212°07.4	47.5
12	200°48.4	46°22.4	N09°03.7	352°35.6	S11°19.1	159°31.6	N14°28.6	227°09.9	S12°47.5
13	215°50.8	61°22.6	03.2	7°36.5	19.8	174°34.4	28.6	242°12.5	47.6
14	230°53.3	76°22.9	02.7	22°37.3	20.4	189°37.1	28.5	257°15.0	47.6
15	245°55.7	91°23.1	·· 02.2	37°38.2	·· 21.0	204°39.9	·· 28.4	272°17.6	·· 47.6
16	260°58.2	106°23.3	01.7	52°39.0	21.6	219°42.6	28.3	287°20.2	47.7
17	276°00.7	121°23.6	01.2	67°39.9	22.2	234°45.4	28.2	302°22.7	47.7
18	291°03.1	136°23.8	N09°00.6	82°40.8	S11°22.8	249°48.1	N14°28.1	317°25.3	S12°47.7
19	306°05.6	151°24.1	09°00.1	97°41.6	23.4	264°50.8	28.0	332°27.8	47.7
20	321°08.1	166°24.3	08°59.6	112°42.5	24.1	279°53.6	28.0	347°30.4	47.8
21	336°10.5	181°24.5	·· 59.1	127°43.3	·· 24.7	294°56.3	·· 27.9	2°32.9	·· 47.8
22	351°13.0	196°24.8	58.6	142°44.2	25.3	309°59.1	27.8	17°35.5	47.8
23	6°15.5	211°25.0	58.0	157°45.0	25.9	325°01.8	27.7	32°38.0	47.9
Mer.pass. 22:35		ν 0.3′	d -0.5′ m -4.62	ν 0.9′	d -0.6′ m 1.59	ν 2.7′	d -0.1′ m -2.87	ν 2.6′	d -0.0′ m 0.64

Stars

	SHA	**Dec**
Alpheratz	357°35.5	29°13.4
Ankaa	353°07.7	-42°10.6
Schedar	349°31.7	56°40.1
Diphda	348°48.0	-17°51.3
Achernar	335°20.4	-57°06.9
Hamal	327°52.1	23°34.5
Polaris	314°08.0	89°21.7
Acamar	315°12.2	-40°12.4
Menkar	314°07.0	4°11.1
Mirfak	308°29.4	49°56.7
Aldebaran	290°40.6	16°33.5
Rigel	281°04.7	-8°10.3
Capella	280°23.2	46°01.2
Bellatrix	278°23.9	6°22.4
Elnath	278°03.0	28°37.6
Alnilam	275°38.7	-1°11.0
Betelgeuse	270°53.1	7°24.8
Canopus	263°52.7	-52°42.1
Sirius	258°27.1	-16°44.7
Adhara	255°06.7	-28°59.9
Procyon	244°52.0	5°10.0
Pollux	243°18.6	27°58.1
Avior	234°15.4	-59°34.7
Suhail	222°47.3	-43°31.3
Miaplacidus	221°39.0	-69°48.5
Alphard	217°49.0	-8°45.5
Regulus	207°35.8	11°51.2
Dubhe	193°42.8	61°37.3
Denebola	182°26.3	14°26.5
Gienah	175°45.0	-17°40.2
Acrux	173°02.0	-63°13.7
Gacrux	171°53.4	-57°14.6
Alioth	166°14.4	55°49.9
Spica	158°23.7	-11°17.0
Alkaid	152°53.3	49°11.8
Hadar	148°38.2	-60°29.2
Menkent	147°59.3	-36°29.1
Arcturus	145°49.2	19°03.7
Rigil Kent.	139°42.4	-60°56.0
Kochab	137°20.8	74°03.6
Zuben'ubi	136°57.5	-16°08.3
Alphecca	126°04.9	26°38.3
Antares	112°17.4	-26°29.1
Atria	107°12.9	-69°04.4
Sabik	102°04.2	-15°45.2
Shaula	96°12.0	-37°07.3
Rasalhague	95°59.7	12°32.7
Eltanin	90°42.8	51°29.4
Kaus Aust.	83°34.0	-34°22.5
Vega	80°34.0	38°48.6
Nunki	75°49.1	-26°16.1
Altair	62°00.9	8°56.0
Peacock	53°07.2	-56°39.7
Deneb	49°26.4	45°22.1
Enif	33°39.6	9°59.1
Al Na'ir	27°33.9	-46°50.9
Fomalhaut	15°15.4	-29°29.8
Scheat	13°45.9	28°12.8
Markab	13°30.7	15°20.1

Oct 10 Tue	**SHA**	**Mer.pass**
Venus	207°45.6	08:55
Mars	153°23.2	12:32
Jupiter	318°27.0	01:33
Saturn	26°15.8	20:58

Oct 11 Wed	**SHA**	**Mer.pass**
Venus	206°53.4	08:55
Mars	152°44.9	12:31
Jupiter	318°33.4	01:28
Saturn	26°18.2	20:54

Oct 12 Thu	**SHA**	**Mer.pass**
Venus	206°00.6	08:55
Mars	152°06.5	12:30
Jupiter	318°40.0	01:24
Saturn	26°20.5	20:50

Horizontal parallax	
Venus:	0.2
Mars:	0.1

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°12.2	S06°27.6	230°21.8	14.8′	N17°50.7	11.2′	54.0′
1	198°12.4	28.5	244°55.6	14.9′	17°39.5	11.4′	54.0′
2	213°12.5	29.5	259°29.4	14.9′	17°28.1	11.4′	54.0′
3	228°12.7	·· 30.4	274°03.3	15.0′	17°16.7	11.4′	54.0′
4	243°12.9	31.4	288°37.3	15.0′	17°05.3	11.6′	54.0′
5	258°13.0	32.3	303°11.3	15.1′	16°53.7	11.6′	54.0′
6	273°13.2	S06°33.2	317°45.4	15.1′	N16°42.1	11.6′	54.0′
7	288°13.4	34.2	332°19.5	15.2′	16°30.5	11.8′	54.0′
8	303°13.5	35.1	346°53.7	15.2′	16°18.7	11.8′	54.0′
9	318°13.7	·· 36.1	1°28.0	15.3′	16°06.9	11.8′	54.0′
10	333°13.9	37.0	16°02.3	15.3′	15°55.1	11.9′	54.0′
11	348°14.0	38.0	30°36.6	15.4′	15°43.2	12.0′	54.0′
12	3°14.2	S06°38.9	45°11.0	15.4′	N15°31.2	12.1′	54.0′
13	18°14.4	39.9	59°45.5	15.5′	15°19.1	12.1′	54.0′
14	33°14.5	40.8	74°20.0	15.5′	15°07.0	12.1′	54.0′
15	48°14.7	·· 41.8	88°54.5	15.6′	14°54.9	12.3′	54.0′
16	63°14.9	42.7	103°29.1	15.6′	14°42.6	12.2′	54.0′
17	78°15.0	43.7	118°03.7	15.7′	14°30.4	12.4′	54.0′
18	93°15.2	S06°44.6	132°38.4	15.7′	N14°18.0	12.4′	54.0′
19	108°15.4	45.6	147°13.2	15.8′	14°05.6	12.4′	54.0′
20	123°15.5	46.5	161°47.9	15.8′	13°53.2	12.5′	54.1′
21	138°15.7	·· 47.4	176°22.7	15.9′	13°40.7	12.6′	54.1′
22	153°15.9	48.4	190°57.6	15.9′	13°28.1	12.6′	54.1′
23	168°16.0	49.3	205°32.5	15.9′	13°15.5	12.7′	54.1′
	SD = 16.0′	d = -0.9′	SD = 14.7′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°16.2	S06°50.3	220°07.4	16.0′	N13°02.8	12.7′	54.1′
1	198°16.3	51.2	234°42.4	16.0′	12°50.1	12.8′	54.1′
2	213°16.5	52.2	249°17.4	16.1′	12°37.3	12.8′	54.1′
3	228°16.7	·· 53.1	263°52.5	16.1′	12°24.5	12.8′	54.1′
4	243°16.8	54.1	278°27.6	16.1′	12°11.7	13.0′	54.1′
5	258°17.0	55.0	293°02.7	16.2′	11°58.7	12.9′	54.1′
6	273°17.2	S06°55.9	307°37.9	16.2′	N11°45.8	13.0′	54.1′
7	288°17.3	56.9	322°13.1	16.2′	11°32.8	13.1′	54.1′
8	303°17.5	57.8	336°48.3	16.3′	11°19.7	13.1′	54.1′
9	318°17.6	·· 58.8	351°23.6	16.3′	11°06.6	13.1′	54.1′
10	333°17.8	06°59.7	5°58.9	16.3′	10°53.5	13.2′	54.1′
11	348°18.0	07°00.7	20°34.2	16.4′	10°40.3	13.3′	54.1′
12	3°18.1	S07°01.6	35°09.6	16.4′	N10°27.0	13.2′	54.1′
13	18°18.3	02.5	49°45.0	16.4′	10°13.8	13.4′	54.1′
14	33°18.5	03.5	64°20.4	16.4′	10°00.4	13.3′	54.2′
15	48°18.6	·· 04.4	78°55.9	16.5′	09°47.1	13.4′	54.2′
16	63°18.8	05.4	93°31.3	16.5′	09°33.7	13.5′	54.2′
17	78°18.9	06.3	108°06.8	16.5′	09°20.2	13.4′	54.2′
18	93°19.1	S07°07.3	122°42.4	16.5′	N09°06.8	13.6′	54.2′
19	108°19.3	08.2	137°17.9	16.6′	08°53.2	13.5′	54.2′
20	123°19.4	09.1	151°53.5	16.6′	08°39.7	13.6′	54.2′
21	138°19.6	·· 10.1	166°29.1	16.6′	08°26.1	13.6′	54.2′
22	153°19.7	11.0	181°04.7	16.6′	08°12.5	13.7′	54.2′
23	168°19.9	12.0	195°40.3	16.6′	07°58.8	13.7′	54.2′
	SD = 16.0′	d = -0.9′	SD = 14.7′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°20.1	S07°12.9	210°15.9	16.7′	N07°45.1	13.7′	54.2′
1	198°20.2	13.9	224°51.6	16.7′	07°31.4	13.8′	54.2′
2	213°20.4	14.8	239°27.3	16.7′	07°17.6	13.8′	54.3′
3	228°20.5	·· 15.7	254°03.0	16.7′	07°03.8	13.8′	54.3′
4	243°20.7	16.7	268°38.7	16.7′	06°50.0	13.9′	54.3′
5	258°20.8	17.6	283°14.4	16.7′	06°36.1	13.9′	54.3′
6	273°21.0	S07°18.6	297°50.2	16.8′	N06°22.2	13.9′	54.3′
7	288°21.2	19.5	312°25.9	16.8′	06°08.3	14.0′	54.3′
8	303°21.3	20.4	327°01.7	16.8′	05°54.3	13.9′	54.3′
9	318°21.5	·· 21.4	341°37.5	16.8′	05°40.4	14.0′	54.3′
10	333°21.6	22.3	356°13.2	16.8′	05°26.4	14.1′	54.3′
11	348°21.8	23.2	10°49.0	16.8′	05°12.3	14.0′	54.4′
12	3°21.9	S07°24.2	25°24.8	16.8′	N04°58.3	14.1′	54.4′
13	18°22.1	25.1	40°00.6	16.8′	04°44.2	14.1′	54.4′
14	33°22.3	26.1	54°36.4	16.8′	04°30.1	14.1′	54.4′
15	48°22.4	·· 27.0	69°12.3	16.8′	04°16.0	14.2′	54.4′
16	63°22.6	27.9	83°48.1	16.8′	04°01.8	14.2′	54.4′
17	78°22.7	28.9	98°23.9	16.8′	03°47.6	14.2′	54.4′
18	93°22.9	S07°29.8	112°59.7	16.8′	N03°33.4	14.2′	54.4′
19	108°23.0	30.8	127°35.5	16.8′	03°19.2	14.2′	54.4′
20	123°23.2	31.7	142°11.3	16.8′	03°05.0	14.3′	54.5′
21	138°23.3	·· 32.6	156°47.2	16.8′	02°50.7	14.2′	54.5′
22	153°23.5	33.6	171°23.0	16.8′	02°36.5	14.3′	54.5′
23	168°23.6	34.5	185°58.8	16.8′	02°22.2	14.3′	54.5′
	SD = 16.0′	d = -0.9′	SD = 14.8′				

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

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

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 25-27 20-7%
10	12:49	12:57	11:47	08:54	21:15	
11	13:05	13:13	11:47	09:35	21:56	
12	13:20	13:28	11:47	10:16	22:35	

October 13, 14, 15 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	21°17.9	226°25.2	N08°57.5	172°45.9	S11°26.5	340°04.6	N14°27.6	47°40.6	S12°47.9
1	36°20.4	241°25.5	57.0	187°46.8	27.1	355°07.3	27.5	62°43.1	47.9
2	51°22.9	256°25.7	56.5	202°47.6	27.7	10°10.0	27.4	77°45.7	48.0
3	66°25.3	271°25.9	·· 56.0	217°48.5	·· 28.4	25°12.8	·· 27.3	92°48.2	·· 48.0
4	81°27.8	286°26.2	55.4	232°49.3	29.0	40°15.5	27.3	107°50.8	48.0
5	96°30.2	301°26.4	54.9	247°50.2	29.6	55°18.3	27.2	122°53.3	48.0
6	111°32.7	316°26.6	N08°54.4	262°51.0	S11°30.2	70°21.0	N14°27.1	137°55.9	S12°48.1
7	126°35.2	331°26.9	53.8	277°51.9	30.8	85°23.8	27.0	152°58.5	48.1
8	141°37.6	346°27.1	53.3	292°52.7	31.4	100°26.5	26.9	168°01.0	48.1
9	156°40.1	1°27.3	·· 52.8	307°53.6	·· 32.0	115°29.3	·· 26.8	183°03.6	·· 48.2
10	171°42.6	16°27.5	52.3	322°54.5	32.6	130°32.0	26.7	198°06.1	48.2
11	186°45.0	31°27.8	51.7	337°55.3	33.3	145°34.7	26.6	213°08.7	48.2
12	201°47.5	46°28.0	N08°51.2	352°56.2	S11°33.9	160°37.5	N14°26.6	228°11.2	S12°48.2
13	216°50.0	61°28.2	50.7	7°57.0	34.5	175°40.2	26.5	243°13.8	48.3
14	231°52.4	76°28.4	50.1	22°57.9	35.1	190°43.0	26.4	258°16.3	48.3
15	246°54.9	91°28.6	·· 49.6	37°58.7	·· 35.7	205°45.7	·· 26.3	273°18.9	·· 48.3
16	261°57.3	106°28.9	49.1	52°59.6	36.3	220°48.5	26.2	288°21.4	48.4
17	276°59.8	121°29.1	48.5	68°00.4	36.9	235°51.2	26.1	303°24.0	48.4
18	292°02.3	136°29.3	N08°48.0	83°01.3	S11°37.5	250°54.0	N14°26.0	318°26.5	S12°48.4
19	307°04.7	151°29.5	47.4	98°02.1	38.2	265°56.7	25.9	333°29.1	48.4
20	322°07.2	166°29.7	46.9	113°03.0	38.8	280°59.5	25.8	348°31.6	48.5
21	337°09.7	181°30.0	·· 46.4	128°03.8	·· 39.4	296°02.2	·· 25.8	3°34.2	·· 48.5
22	352°12.1	196°30.2	45.8	143°04.7	40.0	311°05.0	25.7	18°36.7	48.5
23	7°14.6	211°30.4	45.3	158°05.5	40.6	326°07.7	25.6	33°39.3	48.6
Mer.pass. 22:31		ν 0.2′	d -0.5′	m -4.61	ν 0.9′	d -0.6′	m 1.59	ν 2.7′	d -0.1′	m -2.87	ν 2.6′	d -0.0′	m 0.64

Sat	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	22°17.1	226°30.6	N08°44.7	173°06.4	S11°41.2	341°10.5	N14°25.5	48°41.8	S12°48.6
1	37°19.5	241°30.8	44.2	188°07.2	41.8	356°13.2	25.4	63°44.4	48.6
2	52°22.0	256°31.0	43.7	203°08.1	42.4	11°16.0	25.3	78°46.9	48.6
3	67°24.5	271°31.2	·· 43.1	218°09.0	·· 43.0	26°18.7	·· 25.2	93°49.5	·· 48.7
4	82°26.9	286°31.4	42.6	233°09.8	43.6	41°21.5	25.1	108°52.0	48.7
5	97°29.4	301°31.7	42.0	248°10.7	44.3	56°24.2	25.0	123°54.6	48.7
6	112°31.8	316°31.9	N08°41.5	263°11.5	S11°44.9	71°27.0	N14°25.0	138°57.1	S12°48.8
7	127°34.3	331°32.1	40.9	278°12.4	45.5	86°29.7	24.9	153°59.7	48.8
8	142°36.8	346°32.3	40.4	293°13.2	46.1	101°32.5	24.8	169°02.2	48.8
9	157°39.2	1°32.5	·· 39.8	308°14.1	·· 46.7	116°35.2	·· 24.7	184°04.8	·· 48.8
10	172°41.7	16°32.7	39.3	323°14.9	47.3	131°38.0	24.6	199°07.3	48.9
11	187°44.2	31°32.9	38.7	338°15.8	47.9	146°40.7	24.5	214°09.9	48.9
12	202°46.6	46°33.1	N08°38.2	353°16.6	S11°48.5	161°43.5	N14°24.4	229°12.4	S12°48.9
13	217°49.1	61°33.3	37.6	8°17.4	49.1	176°46.2	24.3	244°15.0	48.9
14	232°51.6	76°33.5	37.1	23°18.3	49.7	191°49.0	24.2	259°17.5	49.0
15	247°54.0	91°33.7	·· 36.5	38°19.1	·· 50.4	206°51.7	·· 24.1	274°20.1	·· 49.0
16	262°56.5	106°33.9	36.0	53°20.0	51.0	221°54.5	24.1	289°22.6	49.0
17	277°59.0	121°34.1	35.4	68°20.8	51.6	236°57.2	24.0	304°25.1	49.1
18	293°01.4	136°34.3	N08°34.9	83°21.7	S11°52.2	252°00.0	N14°23.9	319°27.7	S12°49.1
19	308°03.9	151°34.5	34.3	98°22.5	52.8	267°02.7	23.8	334°30.2	49.1
20	323°06.3	166°34.7	33.7	113°23.4	53.4	282°05.5	23.7	349°32.8	49.1
21	338°08.8	181°34.9	·· 33.2	128°24.2	·· 54.0	297°08.2	·· 23.6	4°35.3	·· 49.2
22	353°11.3	196°35.1	32.6	143°25.1	54.6	312°11.0	23.5	19°37.9	49.2
23	8°13.7	211°35.3	32.1	158°25.9	55.2	327°13.7	23.4	34°40.4	49.2
Mer.pass. 22:27		ν 0.2′	d -0.5′	m -4.60	ν 0.9′	d -0.6′	m 1.58	ν 2.7′	d -0.1′	m -2.88	ν 2.5′	d -0.0′	m 0.64

Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	23°16.2	226°35.5	N08°31.5	173°26.8	S11°55.8	342°16.5	N14°23.3	49°43.0	S12°49.2
1	38°18.7	241°35.7	30.9	188°27.6	56.4	357°19.2	23.2	64°45.5	49.3
2	53°21.1	256°35.9	30.4	203°28.5	57.0	12°22.0	23.2	79°48.1	49.3
3	68°23.6	271°36.1	·· 29.8	218°29.3	·· 57.7	27°24.8	·· 23.1	94°50.6	·· 49.3
4	83°26.1	286°36.3	29.2	233°30.2	58.3	42°27.5	23.0	109°53.2	49.4
5	98°28.5	301°36.4	28.7	248°31.0	58.9	57°30.3	22.9	124°55.7	49.4
6	113°31.0	316°36.6	N08°28.1	263°31.9	S11°59.5	72°33.0	N14°22.8	139°58.2	S12°49.4
7	128°33.4	331°36.8	27.5	278°32.7	12°00.1	87°35.8	22.7	155°00.8	49.4
8	143°35.9	346°37.0	27.0	293°33.5	00.7	102°38.5	22.6	170°03.3	49.5
9	158°38.4	1°37.2	·· 26.4	308°34.4	·· 01.3	117°41.3	·· 22.5	185°05.9	·· 49.5
10	173°40.8	16°37.4	25.8	323°35.2	01.9	132°44.0	22.4	200°08.4	49.5
11	188°43.3	31°37.6	25.3	338°36.1	02.5	147°46.8	22.3	215°11.0	49.5
12	203°45.8	46°37.8	N08°24.7	353°36.9	S12°03.1	162°49.5	N14°22.3	230°13.5	S12°49.6
13	218°48.2	61°37.9	24.1	8°37.8	03.7	177°52.3	22.2	245°16.1	49.6
14	233°50.7	76°38.1	23.5	23°38.6	04.3	192°55.1	22.1	260°18.6	49.6
15	248°53.2	91°38.3	·· 23.0	38°39.5	·· 04.9	207°57.8	·· 22.0	275°21.1	·· 49.6
16	263°55.6	106°38.5	22.4	53°40.3	05.5	223°00.6	21.9	290°23.7	49.7
17	278°58.1	121°38.7	21.8	68°41.1	06.1	238°03.3	21.8	305°26.2	49.7
18	294°00.6	136°38.9	N08°21.2	83°42.0	S12°06.7	253°06.1	N14°21.7	320°28.8	S12°49.7
19	309°03.0	151°39.0	20.7	98°42.8	07.4	268°08.8	21.6	335°31.3	49.7
20	324°05.5	166°39.2	20.1	113°43.7	08.0	283°11.6	21.5	350°33.9	49.8
21	339°07.9	181°39.4	·· 19.5	128°44.5	·· 08.6	298°14.4	·· 21.4	5°36.4	·· 49.8
22	354°10.4	196°39.6	18.9	143°45.4	09.2	313°17.1	21.3	20°39.0	49.8
23	9°12.9	211°39.7	18.3	158°46.2	09.8	328°19.9	21.2	35°41.5	49.8
Mer.pass. 22:23		ν 0.2′	d -0.6′	m -4.59	ν 0.8′	d -0.6′	m 1.58	ν 2.8′	d -0.1′	m -2.88	ν 2.5′	d -0.0′	m 0.65

Stars

	SHA	**Dec**
Alpheratz	357°35.5	29°13.4
Ankaa	353°07.8	-42°10.6
Schedar	349°31.7	56°40.1
Diphda	348°48.0	-17°51.3
Achernar	335°20.4	-57°06.9
Hamal	327°52.1	23°34.6
Polaris	314°07.3	89°21.7
Acamar	315°12.2	-40°12.4
Menkar	314°07.0	4°11.1
Mirfak	308°29.3	49°56.7
Aldebaran	290°40.6	16°33.5
Rigel	281°04.7	-8°10.3
Capella	280°23.2	46°01.2
Bellatrix	278°23.8	6°22.4
Elnath	278°03.0	28°37.6
Alnilam	275°38.7	-1°11.0
Betelgeuse	270°53.1	7°24.8
Canopus	263°52.7	-52°42.1
Sirius	258°27.1	-16°44.7
Adhara	255°06.7	-28°59.9
Procyon	244°52.0	5°10.0
Pollux	243°18.6	27°58.1
Avior	234°15.3	-59°34.7
Suhail	222°47.3	-43°31.3
Miaplacidus	221°38.9	-69°48.5
Alphard	217°49.0	-8°45.5
Regulus	207°35.8	11°51.2
Dubhe	193°42.8	61°37.3
Denebola	182°26.3	14°26.5
Gienah	175°45.0	-17°40.2
Acrux	173°02.0	-63°13.7
Gacrux	171°53.4	-57°14.6
Alioth	166°14.4	55°49.9
Spica	158°23.7	-11°17.0
Alkaid	152°53.3	49°11.8
Hadar	148°38.2	-60°29.2
Menkent	147°59.3	-36°29.1
Arcturus	145°49.2	19°03.7
Rigil Kent.	139°42.4	-60°56.0
Kochab	137°20.8	74°03.6
Zuben'ubi	136°57.5	-16°08.3
Alphecca	126°04.9	26°38.3
Antares	112°17.4	-26°29.1
Atria	107°12.9	-69°04.4
Sabik	102°04.2	-15°45.2
Shaula	96°12.0	-37°07.3
Rasalhague	95°59.7	12°32.7
Eltanin	90°42.9	51°29.4
Kaus Aust.	83°34.0	-34°22.5
Vega	80°34.0	38°48.6
Nunki	75°49.1	-26°16.1
Altair	62°01.0	8°56.0
Peacock	53°07.2	-56°39.7
Deneb	49°26.4	45°22.1
Enif	33°39.7	9°59.1
Al Na'ir	27°33.9	-46°50.9
Fomalhaut	15°15.4	-29°29.8
Scheat	13°45.9	28°12.8
Markab	13°30.7	15°20.1

Oct 13 Fri	**SHA**	**Mer.pass**
Venus	205°07.3	08:54
Mars	151°28.0	12:28
Jupiter	318°46.6	01:19
Saturn	26°22.7	20:46

Oct 14 Sat	**SHA**	**Mer.pass**
Venus	204°13.5	08:54
Mars	150°49.3	12:27
Jupiter	318°53.4	01:15
Saturn	26°24.8	20:42

Oct 15 Sun	**SHA**	**Mer.pass**
Venus	203°19.3	08:54
Mars	150°10.6	12:26
Jupiter	319°00.3	01:11
Saturn	26°26.8	20:38

Horizontal parallax	
Venus:	0.2
Mars:	0.1

h

Fri	Sun GHA	Sun Dec	Moon GHA	ν	Moon Dec	d	HP
0	183°23.8	S07°35.4	200°34.6	16.8′	N02°07.9	14.3′	54.5′
1	198°23.9	36.4	215°10.4	16.8′	01°53.6	14.4′	54.5′
2	213°24.1	37.3	229°46.2	16.8′	01°39.2	14.3′	54.5′
3	228°24.3	·· 38.3	244°22.0	16.8′	01°24.9	14.4′	54.6′
4	243°24.4	39.2	258°57.7	16.8′	01°10.5	14.3′	54.6′
5	258°24.6	40.1	273°33.5	16.8′	00°56.2	14.4′	54.6′
6	273°24.7	S07°41.1	288°09.2	16.7′	N00°41.8	14.4′	54.6′
7	288°24.9	42.0	302°45.0	16.7′	00°27.4	14.4′	54.6′
8	303°25.0	42.9	317°20.7	16.7′	N00°13.0	14.4′	54.6′
9	318°25.2	·· 43.9	331°56.4	16.7′	S00°01.4	14.4′	54.6′
10	333°25.3	44.8	346°32.1	16.7′	00°15.8	14.5′	54.6′
11	348°25.5	45.7	1°07.8	16.7′	00°30.3	14.4′	54.7′
12	3°25.6	S07°46.7	15°43.5	16.6′	S00°44.7	14.5′	54.7′
13	18°25.8	47.6	30°19.1	16.6′	00°59.2	14.4′	54.7′
14	33°25.9	48.5	44°54.7	16.6′	01°13.6	14.4′	54.7′
15	48°26.1	·· 49.5	59°30.3	16.6′	01°28.0	14.5′	54.7′
16	63°26.2	50.4	74°05.9	16.6′	01°42.5	14.4′	54.7′
17	78°26.4	51.3	88°41.5	16.5′	01°56.9	14.5′	54.8′
18	93°26.5	S07°52.3	103°17.0	16.5′	S02°11.4	14.5′	54.8′
19	108°26.7	53.2	117°52.5	16.5′	02°25.9	14.4′	54.8′
20	123°26.8	54.1	132°28.0	16.5′	02°40.3	14.5′	54.8′
21	138°27.0	·· 55.1	147°03.5	16.4′	02°54.8	14.4′	54.8′
22	153°27.1	56.0	161°38.9	16.4′	03°09.2	14.5′	54.8′
23	168°27.3	56.9	176°14.3	16.4′	03°23.7	14.4′	54.8′
	SD = 16.0′	d = -0.9′	SD = 14.9′				

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	183°27.4	S07°57.9	190°49.7	16.3′	S03°38.1	14.5′	54.9′
1	198°27.6	58.8	205°25.0	16.3′	03°52.6	14.4′	54.9′
2	213°27.7	07°59.7	220°00.3	16.3′	04°07.0	14.4′	54.9′
3	228°27.9	08°00.7	234°35.6	16.2′	04°21.4	14.4′	54.9′
4	243°28.0	01.6	249°10.9	16.2′	04°35.8	14.5′	54.9′
5	258°28.1	02.5	263°46.1	16.2′	04°50.3	14.4′	54.9′
6	273°28.3	S08°03.5	278°21.2	16.1′	S05°04.7	14.3′	55.0′
7	288°28.4	04.4	292°56.4	16.1′	05°19.0	14.4′	55.0′
8	303°28.6	05.3	307°31.5	16.1′	05°33.4	14.4′	55.0′
9	318°28.7	·· 06.3	322°06.5	16.0′	05°47.8	14.4′	55.0′
10	333°28.9	07.2	336°41.5	16.0′	06°02.2	14.3′	55.0′
11	348°29.0	08.1	351°16.5	15.9′	06°16.5	14.3′	55.0′
12	3°29.2	S08°09.0	5°51.5	15.9′	S06°30.8	14.3′	55.1′
13	18°29.3	10.0	20°26.3	15.8′	06°45.1	14.3′	55.1′
14	33°29.5	10.9	35°01.2	15.8′	06°59.4	14.3′	55.1′
15	48°29.6	·· 11.8	49°36.0	15.8′	07°13.7	14.3′	55.1′
16	63°29.7	12.8	64°10.7	15.7′	07°28.0	14.2′	55.1′
17	78°29.9	13.7	78°45.5	15.7′	07°42.2	14.2′	55.1′
18	93°30.0	S08°14.6	93°20.1	15.6′	S07°56.4	14.2′	55.2′
19	108°30.2	15.5	107°54.7	15.6′	08°10.6	14.2′	55.2′
20	123°30.3	16.5	122°29.3	15.5′	08°24.8	14.1′	55.2′
21	138°30.5	·· 17.4	137°03.8	15.5′	08°38.9	14.2′	55.2′
22	153°30.6	18.3	151°38.2	15.4′	08°53.1	14.1′	55.2′
23	168°30.7	19.3	166°12.6	15.3′	09°07.2	14.0′	55.2′
	SD = 16.0′	d = -0.9′	SD = 15.0′				

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	183°30.9	S08°20.2	180°47.0	15.3′	S09°21.2	14.1′	55.3′
1	198°31.0	21.1	195°21.3	15.2′	09°35.3	14.0′	55.3′
2	213°31.2	22.0	209°55.5	15.2′	09°49.3	14.0′	55.3′
3	228°31.3	·· 23.0	224°29.7	15.1′	10°03.3	13.9′	55.3′
4	243°31.5	23.9	239°03.8	15.1′	10°17.2	14.0′	55.3′
5	258°31.6	24.8	253°37.8	15.0′	10°31.2	13.9′	55.4′
6	273°31.7	S08°25.7	268°11.8	14.9′	S10°45.1	13.8′	55.4′
7	288°31.9	26.7	282°45.8	14.9′	10°58.9	13.8′	55.4′
8	303°32.0	27.6	297°19.6	14.8′	11°12.7	13.8′	55.4′
9	318°32.2	·· 28.5	311°53.4	14.7′	11°26.5	13.8′	55.4′
10	333°32.3	29.5	326°27.2	14.7′	11°40.3	13.7′	55.4′
11	348°32.4	30.4	341°00.8	14.6′	11°54.0	13.6′	55.5′
12	3°32.6	S08°31.3	355°34.4	14.5′	S12°07.6	13.6′	55.5′
13	18°32.7	32.2	10°08.0	14.5′	12°21.2	13.6′	55.5′
14	33°32.9	33.2	24°41.4	14.4′	12°34.8	13.6′	55.5′
15	48°33.0	·· 34.1	39°14.8	14.3′	12°48.4	13.5′	55.5′
16	63°33.1	35.0	53°48.2	14.3′	13°01.9	13.4′	55.6′
17	78°33.3	35.9	68°21.4	14.2′	13°15.3	13.4′	55.6′
18	93°33.4	S08°36.9	82°54.6	14.1′	S13°28.7	13.4′	55.6′
19	108°33.6	37.8	97°27.7	14.0′	13°42.1	13.3′	55.6′
20	123°33.7	38.7	112°00.8	14.0′	13°55.4	13.2′	55.6′
21	138°33.8	·· 39.6	126°33.7	13.9′	14°08.6	13.2′	55.7′
22	153°34.0	40.5	141°06.6	13.8′	14°21.8	13.2′	55.7′
23	168°34.1	41.5	155°39.4	13.7′	14°35.0	13.1′	55.7′
	SD = 16.0′	d = -0.9′	SD = 15.1′				

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

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

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 28-1 3-0%
13	13:35	13:42	11:46	10:55	23:15	
14	13:50	13:57	11:46	11:36	23:57	
15	14:04	14:10	11:46	12:18	–:–	

October 16, 17, 18 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	24°15.3	226°39.9	N08°17.8	173°47.0	S12°10.4	343°22.6	N14°21.2	50°44.0	S12°49.9
1	39°17.8	241°40.1	17.2	188°47.9	11.0	358°25.4	21.1	65°46.6	49.9
2	54°20.3	256°40.3	16.6	203°48.7	11.6	13°28.1	21.0	80°49.1	49.9
3	69°22.7	271°40.4	·· 16.0	218°49.6	·· 12.2	28°30.9	·· 20.9	95°51.7	·· 49.9
4	84°25.2	286°40.6	15.4	233°50.4	12.8	43°33.7	20.8	110°54.2	50.0
5	99°27.7	301°40.8	14.8	248°51.2	13.4	58°36.4	20.7	125°56.7	50.0
6	114°30.1	316°41.0	N08°14.3	263°52.1	S12°14.0	73°39.2	N14°20.6	140°59.3	S12°50.0
7	129°32.6	331°41.1	13.7	278°52.9	14.6	88°41.9	20.5	156°01.8	50.0
8	144°35.0	346°41.3	13.1	293°53.8	15.2	103°44.7	20.4	171°04.4	50.1
9	159°37.5	1°41.5	·· 12.5	308°54.6	·· 15.8	118°47.5	·· 20.3	186°06.9	·· 50.1
10	174°40.0	16°41.6	11.9	323°55.4	16.4	133°50.2	20.2	201°09.5	50.1
11	189°42.4	31°41.8	11.3	338°56.3	17.0	148°53.0	20.1	216°12.0	50.1
12	204°44.9	46°42.0	N08°10.7	353°57.1	S12°17.6	163°55.7	N14°20.1	231°14.5	S12°50.2
13	219°47.4	61°42.1	10.1	8°58.0	18.2	178°58.5	20.0	246°17.1	50.2
14	234°49.8	76°42.3	09.5	23°58.8	18.8	194°01.3	19.9	261°19.6	50.2
15	249°52.3	91°42.5	·· 09.0	38°59.6	·· 19.4	209°04.0	·· 19.8	276°22.2	·· 50.2
16	264°54.8	106°42.6	08.4	54°00.5	20.0	224°06.8	19.7	291°24.7	50.3
17	279°57.2	121°42.8	07.8	69°01.3	20.6	239°09.5	19.6	306°27.2	50.3
18	294°59.7	136°43.0	N08°07.2	84°02.2	S12°21.2	254°12.3	N14°19.5	321°29.8	S12°50.3
19	310°02.2	151°43.1	06.6	99°03.0	21.8	269°15.1	19.4	336°32.3	50.3
20	325°04.6	166°43.3	06.0	114°03.8	22.4	284°17.8	19.3	351°34.9	50.4
21	340°07.1	181°43.4	·· 05.4	129°04.7	·· 23.0	299°20.6	·· 19.2	6°37.4	·· 50.4
22	355°09.5	196°43.6	04.8	144°05.5	23.6	314°23.3	19.1	21°39.9	50.4
23	10°12.0	211°43.8	04.2	159°06.3	24.2	329°26.1	19.0	36°42.5	50.4
Mer.pass. 22:19		ν 0.2′ d -0.6′ m -4.58		ν 0.8′ d -0.6′ m 1.57		ν 2.8′ d -0.1′ m -2.88		ν 2.5′ d -0.0′ m 0.65	

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	25°14.5	226°43.9	N08°03.6	174°07.2	S12°24.8	344°28.9	N14°18.9	51°45.0	S12°50.5
1	40°16.9	241°44.1	03.0	189°08.0	25.5	359°31.6	18.9	66°47.6	50.5
2	55°19.4	256°44.2	02.4	204°08.8	26.1	14°34.4	18.8	81°50.1	50.5
3	70°21.9	271°44.4	·· 01.8	219°09.7	·· 26.7	29°37.2	·· 18.7	96°52.6	·· 50.5
4	85°24.3	286°44.5	01.2	234°10.5	27.3	44°39.9	18.6	111°55.2	50.6
5	100°26.8	301°44.7	00.6	249°11.4	27.9	59°42.7	18.5	126°57.7	50.6
6	115°29.3	316°44.9	N08°00.0	264°12.2	S12°28.5	74°45.4	N14°18.4	142°00.2	S12°50.6
7	130°31.7	331°45.0	07°59.4	279°13.0	29.1	89°48.2	18.3	157°02.8	50.6
8	145°34.2	346°45.2	58.7	294°13.9	29.7	104°51.0	18.2	172°05.3	50.6
9	160°36.7	1°45.3	·· 58.1	309°14.7	·· 30.3	119°53.7	·· 18.1	187°07.9	·· 50.7
10	175°39.1	16°45.5	57.5	324°15.5	30.9	134°56.5	18.0	202°10.4	50.7
11	190°41.6	31°45.6	56.9	339°16.4	31.5	149°59.3	17.9	217°12.9	50.7
12	205°44.0	46°45.8	N07°56.3	354°17.2	S12°32.1	165°02.0	N14°17.8	232°15.5	S12°50.7
13	220°46.5	61°45.9	55.7	9°18.0	32.7	180°04.8	17.7	247°18.0	50.8
14	235°49.0	76°46.1	55.1	24°18.9	33.3	195°07.6	17.6	262°20.5	50.8
15	250°51.4	91°46.2	·· 54.5	39°19.7	·· 33.9	210°10.3	·· 17.6	277°23.1	·· 50.8
16	265°53.9	106°46.4	53.9	54°20.5	34.5	225°13.1	17.5	292°25.6	50.8
17	280°56.4	121°46.5	53.2	69°21.4	35.1	240°15.9	17.4	307°28.1	50.9
18	295°58.8	136°46.7	N07°52.6	84°22.2	S12°35.7	255°18.6	N14°17.3	322°30.7	S12°50.9
19	311°01.3	151°46.8	52.0	99°23.0	36.3	270°21.4	17.2	337°33.2	50.9
20	326°03.8	166°46.9	51.4	114°23.9	36.9	285°24.1	17.1	352°35.8	50.9
21	341°06.2	181°47.1	·· 50.8	129°24.7	·· 37.5	300°26.9	·· 17.0	7°38.3	·· 50.9
22	356°08.7	196°47.2	50.2	144°25.5	38.0	315°29.7	16.9	22°40.8	51.0
23	11°11.1	211°47.4	49.6	159°26.4	38.6	330°32.4	16.8	37°43.4	51.0
Mer.pass. 22:15		ν 0.2′ d -0.6′ m -4.57		ν 0.8′ d -0.6′ m 1.57		ν 2.8′ d -0.1′ m -2.89		ν 2.5′ d -0.0′ m 0.66	

Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	26°13.6	226°47.5	N07°48.9	174°27.2	S12°39.2	345°35.2	N14°16.7	52°45.9	S12°51.0
1	41°16.1	241°47.7	48.3	189°28.0	39.8	0°38.0	16.6	67°48.4	51.0
2	56°18.5	256°47.8	47.7	204°28.9	40.4	15°40.7	16.5	82°51.0	51.1
3	71°21.0	271°47.9	·· 47.1	219°29.7	·· 41.0	30°43.5	·· 16.4	97°53.5	·· 51.1
4	86°23.5	286°48.1	46.4	234°30.5	41.6	45°46.3	16.3	112°56.0	51.1
5	101°25.9	301°48.2	45.8	249°31.4	42.2	60°49.0	16.2	127°58.6	51.1
6	116°28.4	316°48.4	N07°45.2	264°32.2	S12°42.8	75°51.8	N14°16.1	143°01.1	S12°51.1
7	131°30.9	331°48.5	44.6	279°33.0	43.4	90°54.6	16.1	158°03.6	51.2
8	146°33.3	346°48.6	44.0	294°33.8	44.0	105°57.3	16.0	173°06.2	51.2
9	161°35.8	1°48.8	·· 43.3	309°34.7	·· 44.6	121°00.1	·· 15.9	188°08.7	·· 51.2
10	176°38.3	16°48.9	42.7	324°35.5	45.2	136°02.9	15.8	203°11.2	51.2
11	191°40.7	31°49.0	42.1	339°36.3	45.8	151°05.6	15.7	218°13.8	51.2
12	206°43.2	46°49.2	N07°41.4	354°37.2	S12°46.4	166°08.4	N14°15.6	233°16.3	S12°51.3
13	221°45.6	61°49.3	40.8	9°38.0	47.0	181°11.2	15.5	248°18.8	51.3
14	236°48.1	76°49.4	40.2	24°38.8	47.6	196°14.0	15.4	263°21.4	51.3
15	251°50.6	91°49.6	·· 39.6	39°39.6	·· 48.2	211°16.7	·· 15.3	278°23.9	·· 51.3
16	266°53.0	106°49.7	38.9	54°40.5	48.8	226°19.5	15.2	293°26.4	51.4
17	281°55.5	121°49.8	38.3	69°41.3	49.4	241°22.3	15.1	308°29.0	51.4
18	296°58.0	136°50.0	N07°37.7	84°42.1	S12°50.0	256°25.0	N14°15.0	323°31.5	S12°51.4
19	312°00.4	151°50.1	37.0	99°43.0	50.6	271°27.8	14.9	338°34.0	51.4
20	327°02.9	166°50.2	36.4	114°43.8	51.2	286°30.6	14.8	353°36.6	51.4
21	342°05.4	181°50.3	·· 35.8	129°44.6	·· 51.8	301°33.3	·· 14.7	8°39.1	·· 51.5
22	357°07.8	196°50.5	35.1	144°45.4	52.4	316°36.1	14.6	23°41.6	51.5
23	12°10.3	211°50.6	34.5	159°46.3	53.0	331°38.9	14.5	38°44.2	51.5
Mer.pass. 22:11		ν 0.1′ d -0.6′ m -4.56		ν 0.8′ d -0.6′ m 1.56		ν 2.8′ d -0.1′ m -2.89		ν 2.5′ d -0.0′ m 0.66	

Stars

	SHA	**Dec**
Alpheratz	357°35.5	29°13.4
Ankaa	353°07.8	-42°10.6
Schedar	349°31.7	56°40.2
Diphda	348°48.0	-17°51.3
Achernar	335°20.4	-57°06.9
Hamal	327°52.0	23°34.6
Polaris	314°06.4	89°21.7
Acamar	315°12.2	-40°12.4
Menkar	314°07.0	4°11.1
Mirfak	308°29.3	49°56.7
Aldebaran	290°40.6	16°33.5
Rigel	281°04.7	-8°10.3
Capella	280°23.2	46°01.2
Bellatrix	278°23.8	6°22.4
Elnath	278°03.0	28°37.6
Alnilam	275°38.6	-1°11.0
Betelgeuse	270°53.1	7°24.8
Canopus	263°52.7	-52°42.1
Sirius	258°27.1	-16°44.7
Adhara	255°06.6	-28°59.9
Procyon	244°51.9	5°10.0
Pollux	243°18.6	27°58.1
Avior	234°15.3	-59°34.7
Suhail	222°47.3	-43°31.3
Miaplacidus	221°38.9	-69°48.5
Alphard	217°48.9	-8°45.5
Regulus	207°35.8	11°51.2
Dubhe	193°42.8	61°37.3
Denebola	182°26.3	14°26.5
Gienah	175°45.0	-17°40.2
Acrux	173°02.0	-63°13.7
Gacrux	171°53.4	-57°14.6
Alioth	166°14.4	55°49.9
Spica	158°23.7	-11°17.0
Alkaid	152°53.3	49°11.8
Hadar	148°38.2	-60°29.2
Menkent	147°59.3	-36°29.1
Arcturus	145°49.2	19°03.7
Rigil Kent.	139°42.4	-60°56.0
Kochab	137°20.8	74°03.6
Zuben'ubi	136°57.5	-16°08.3
Alphecca	126°04.9	26°38.2
Antares	112°17.4	-26°29.1
Atria	107°12.9	-69°04.4
Sabik	102°04.2	-15°45.2
Shaula	96°12.0	-37°07.3
Rasalhague	95°59.7	12°32.7
Eltanin	90°42.9	51°29.4
Kaus Aust.	83°34.0	-34°22.5
Vega	80°34.1	38°48.6
Nunki	75°49.1	-26°16.1
Altair	62°01.0	8°56.0
Peacock	53°07.2	-56°39.7
Deneb	49°26.4	45°22.1
Enif	33°39.7	9°59.1
Al Na'ir	27°33.9	-46°50.9
Fomalhaut	15°15.4	-29°29.8
Scheat	13°46.0	28°12.9
Markab	13°30.7	15°20.1

Oct 16 Mon	**SHA**	**Mer.pass**
Venus	202°24.6	08:53
Mars	149°31.7	12:24
Jupiter	319°07.3	01:06
Saturn	26°28.7	20:34

Oct 17 Tue	**SHA**	**Mer.pass**
Venus	201°29.4	08:53
Mars	148°52.7	12:23
Jupiter	319°14.4	01:02
Saturn	26°30.5	20:30

Oct 18 Wed	**SHA**	**Mer.pass**
Venus	200°33.9	08:53
Mars	148°13.6	12:22
Jupiter	319°21.6	00:57
Saturn	26°32.3	20:25

Horizontal parallax	
Venus:	0.2
Mars:	0.1

h Sun Moon

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	183°34.2	S08°42.4	170°12.1	13.6′	S14°48.1	13.0′	55.7′
1	198°34.4	43.3	184°44.8	13.6′	15°01.1	13.0′	55.7′
2	213°34.5	44.2	199°17.3	13.5′	15°14.1	12.9′	55.8′
3	228°34.6	·· 45.2	213°49.8	13.4′	15°27.0	12.9′	55.8′
4	243°34.8	46.1	228°22.2	13.3′	15°39.9	12.8′	55.8′
5	258°34.9	47.0	242°54.6	13.2′	15°52.7	12.8′	55.8′
6	273°35.0	S08°47.9	257°26.8	13.2′	S16°05.5	12.6′	55.8′
7	288°35.2	48.8	271°59.0	13.1′	16°18.1	12.7′	55.8′
8	303°35.3	49.8	286°31.0	13.0′	16°30.8	12.5′	55.9′
9	318°35.5	·· 50.7	301°03.0	12.9′	16°43.3	12.5′	55.9′
10	333°35.6	51.6	315°34.9	12.8′	16°55.8	12.4′	55.9′
11	348°35.7	52.5	330°06.7	12.7′	17°08.2	12.4′	55.9′
12	3°35.9	S08°53.4	344°38.4	12.6′	S17°20.6	12.3′	55.9′
13	18°36.0	54.4	359°10.1	12.5′	17°32.9	12.2′	56.0′
14	33°36.1	55.3	13°41.6	12.5′	17°45.1	12.1′	56.0′
15	48°36.3	·· 56.2	28°13.1	12.4′	17°57.2	12.1′	56.0′
16	63°36.4	57.1	42°44.4	12.3′	18°09.3	12.0′	56.0′
17	78°36.5	58.0	57°15.7	12.2′	18°21.3	11.9′	56.0′
18	93°36.7	S08°59.0	71°46.9	12.1′	S18°33.2	11.8′	56.1′
19	108°36.8	08°59.9	86°18.0	12.0′	18°45.0	11.8′	56.1′
20	123°36.9	09°00.8	100°48.9	11.9′	18°56.8	11.6′	56.1′
21	138°37.0	·· 01.7	115°19.8	11.8′	19°08.4	11.6′	56.1′
22	153°37.2	02.6	129°50.6	11.7′	19°20.0	11.5′	56.1′
23	168°37.3	03.5	144°21.4	11.6′	19°31.5	11.4′	56.2′
	SD = 16.0′	d = -0.9′	SD = 15.2′				

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	183°37.4	S09°04.5	158°52.0	11.5′	S19°42.9	11.4′	56.2′
1	198°37.6	05.4	173°22.5	11.4′	19°54.3	11.2′	56.2′
2	213°37.7	06.3	187°52.9	11.3′	20°05.5	11.2′	56.2′
3	228°37.8	·· 07.2	202°23.2	11.2′	20°16.7	11.0′	56.2′
4	243°38.0	08.1	216°53.4	11.1′	20°27.7	11.0′	56.3′
5	258°38.1	09.1	231°23.6	11.0′	20°38.7	10.9′	56.3′
6	273°38.2	S09°10.0	245°53.6	10.9′	S20°49.6	10.8′	56.3′
7	288°38.3	10.9	260°23.5	10.8′	21°00.4	10.6′	56.3′
8	303°38.5	11.8	274°53.3	10.7′	21°11.0	10.6′	56.3′
9	318°38.6	·· 12.7	289°23.1	10.6′	21°21.6	10.5′	56.4′
10	333°38.7	13.6	303°52.7	10.5′	21°32.1	10.4′	56.4′
11	348°38.9	14.5	318°22.2	10.4′	21°42.5	10.3′	56.4′
12	3°39.0	S09°15.5	332°51.6	10.3′	S21°52.8	10.2′	56.4′
13	18°39.1	16.4	347°21.0	10.2′	22°03.0	10.1′	56.5′
14	33°39.2	17.3	1°50.2	10.1′	22°13.1	9.9′	56.5′
15	48°39.4	·· 18.2	16°19.3	10.0′	22°23.0	9.9′	56.5′
16	63°39.5	19.1	30°48.3	9.9′	22°32.9	9.8′	56.5′
17	78°39.6	20.0	45°17.2	9.8′	22°42.7	9.6′	56.5′
18	93°39.7	S09°20.9	59°46.1	9.7′	S22°52.3	9.5′	56.6′
19	108°39.9	21.9	74°14.8	9.6′	23°01.8	9.5′	56.6′
20	123°40.0	22.8	88°43.4	9.5′	23°11.3	9.3′	56.6′
21	138°40.1	·· 23.7	103°11.9	9.4′	23°20.6	9.2′	56.6′
22	153°40.2	24.6	117°40.3	9.3′	23°29.8	9.0′	56.6′
23	168°40.4	25.5	132°08.6	9.2′	23°38.8	9.0′	56.7′
	SD = 16.0′	d = -0.9′	SD = 15.3′				

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	183°40.5	S09°26.4	146°36.8	9.1′	S23°47.8	8.8′	56.7′
1	198°40.6	27.3	161°05.0	9.0′	23°56.6	8.7′	56.7′
2	213°40.7	28.2	175°33.0	8.9′	24°05.3	8.6′	56.7′
3	228°40.9	·· 29.1	190°00.9	8.8′	24°13.9	8.5′	56.7′
4	243°41.0	30.1	204°28.7	8.7′	24°22.4	8.3′	56.8′
5	258°41.1	31.0	218°56.4	8.6′	24°30.7	8.2′	56.8′
6	273°41.2	S09°31.9	233°24.0	8.5′	S24°38.9	8.1′	56.8′
7	288°41.4	32.8	247°51.5	8.4′	24°47.0	7.9′	56.8′
8	303°41.5	33.7	262°18.9	8.3′	24°54.9	7.9′	56.8′
9	318°41.6	·· 34.6	276°46.2	8.2′	25°02.8	7.6′	56.9′
10	333°41.7	35.5	291°13.5	8.1′	25°10.4	7.6′	56.9′
11	348°41.8	36.4	305°40.6	8.0′	25°18.0	7.4′	56.9′
12	3°42.0	S09°37.3	320°07.6	7.9′	S25°25.4	7.3′	56.9′
13	18°42.1	38.2	334°34.5	7.8′	25°32.7	7.1′	57.0′
14	33°42.2	39.2	349°01.4	7.7′	25°39.8	7.0′	57.0′
15	48°42.3	·· 40.1	3°28.1	7.6′	25°46.8	6.9′	57.0′
16	63°42.5	41.0	17°54.8	7.6′	25°53.7	6.7′	57.0′
17	78°42.6	41.9	32°21.3	7.5′	26°00.4	6.6′	57.0′
18	93°42.7	S09°42.8	46°47.8	7.4′	S26°07.0	6.4′	57.1′
19	108°42.8	43.7	61°14.2	7.3′	26°13.4	6.3′	57.1′
20	123°42.9	44.6	75°40.4	7.2′	26°19.7	6.1′	57.1′
21	138°43.1	·· 45.5	90°06.6	7.1′	26°25.8	6.0′	57.1′
22	153°43.2	46.4	104°32.7	7.0′	26°31.8	5.8′	57.1′
23	168°43.3	47.3	118°58.8	6.9′	26°37.6	5.7′	57.2′
	SD = 16.0′	d = -0.9′	SD = 15.5′				

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

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

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 2-4 2-11%
16	14:17	14:23	11:46	13:03	00:40	
17	14:30	14:36	11:45	13:52	01:27	
18	14:42	14:48	11:45	14:46	02:18	

October 19, 20, 21 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	27°12.8	226°50.7	N07°33.8	174°47.1	S12°53.6	346°41.6	N14°14.4	53°46.7	S12°51.5
1	42°15.2	241°50.8	33.2	189°47.9	54.2	1°44.4	14.3	68°49.2	51.5
2	57°17.7	256°51.0	32.6	204°48.8	54.8	16°47.2	14.3	83°51.8	51.6
3	72°20.1	271°51.1	·· 31.9	219°49.6	·· 55.3	31°50.0	·· 14.2	98°54.3	·· 51.6
4	87°22.6	286°51.2	31.3	234°50.4	55.9	46°52.7	14.1	113°56.8	51.6
5	102°25.1	301°51.3	30.6	249°51.2	56.5	61°55.5	14.0	128°59.3	51.6
6	117°27.5	316°51.5	N07°30.0	264°52.1	S12°57.1	76°58.3	N14°13.9	144°01.9	S12°51.6
7	132°30.0	331°51.6	29.4	279°52.9	57.7	92°01.0	13.8	159°04.4	51.7
8	147°32.5	346°51.7	28.7	294°53.7	58.3	107°03.8	13.7	174°06.9	51.7
9	162°34.9	1°51.8	·· 28.1	309°54.5	·· 58.9	122°06.6	·· 13.6	189°09.5	·· 51.7
10	177°37.4	16°51.9	27.4	324°55.4	12°59.5	137°09.3	13.5	204°12.0	51.7
11	192°39.9	31°52.1	26.8	339°56.2	13°00.1	152°12.1	13.4	219°14.5	51.7
12	207°42.3	46°52.2	N07°26.1	354°57.0	S13°00.7	167°14.9	N14°13.3	234°17.1	S12°51.8
13	222°44.8	61°52.3	25.5	9°57.8	01.3	182°17.7	13.2	249°19.6	51.8
14	237°47.3	76°52.4	24.8	24°58.7	01.9	197°20.4	13.1	264°22.1	51.8
15	252°49.7	91°52.5	·· 24.2	39°59.5	·· 02.5	212°23.2	·· 13.0	279°24.6	·· 51.8
16	267°52.2	106°52.6	23.5	55°00.3	03.1	227°26.0	12.9	294°27.2	51.8
17	282°54.6	121°52.8	22.9	70°01.1	03.7	242°28.8	12.8	309°29.7	51.9
18	297°57.1	136°52.9	N07°22.2	85°01.9	S13°04.2	257°31.5	N14°12.7	324°32.2	S12°51.9
19	312°59.6	151°53.0	21.6	100°02.8	04.8	272°34.3	12.6	339°34.8	51.9
20	328°02.0	166°53.1	20.9	115°03.6	05.4	287°37.1	12.5	354°37.3	51.9
21	343°04.5	181°53.2	·· 20.3	130°04.4	·· 06.0	302°39.8	·· 12.4	9°39.8	·· 51.9
22	358°07.0	196°53.3	19.6	145°05.2	06.6	317°42.6	12.3	24°42.3	52.0
23	13°09.4	211°53.4	19.0	160°06.1	07.2	332°45.4	12.2	39°44.9	52.0
Mer.pass. 22:08		ν 0.1′ d -0.6′ m -4.55		ν 0.8′ d -0.6′ m 1.55		ν 2.8′ d -0.1′ m -2.89		ν 2.5′ d -0.0′ m 0.67	

Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	28°11.9	226°53.5	N07°18.3	175°06.9	S13°07.8	347°48.2	N14°12.2	54°47.4	S12°52.0
1	43°14.4	241°53.7	17.7	190°07.7	08.4	2°50.9	12.1	69°49.9	52.0
2	58°16.8	256°53.8	17.0	205°08.5	09.0	17°53.7	12.0	84°52.4	52.0
3	73°19.3	271°53.9	·· 16.3	220°09.3	·· 09.6	32°56.5	·· 11.9	99°55.0	·· 52.1
4	88°21.8	286°54.0	15.7	235°10.2	10.2	47°59.3	11.8	114°57.5	52.1
5	103°24.2	301°54.1	15.0	250°11.0	10.8	63°02.0	11.7	130°00.0	52.1
6	118°26.7	316°54.2	N07°14.4	265°11.8	S13°11.3	78°04.8	N14°11.6	145°02.6	S12°52.1
7	133°29.1	331°54.3	13.7	280°12.6	11.9	93°07.6	11.5	160°05.1	52.1
8	148°31.6	346°54.4	13.0	295°13.4	12.5	108°10.4	11.4	175°07.6	52.2
9	163°34.1	1°54.5	·· 12.4	310°14.3	·· 13.1	123°13.1	·· 11.3	190°10.1	·· 52.2
10	178°36.5	16°54.6	11.7	325°15.1	13.7	138°15.9	11.2	205°12.7	52.2
11	193°39.0	31°54.7	11.1	340°15.9	14.3	153°18.7	11.1	220°15.2	52.2
12	208°41.5	46°54.8	N07°10.4	355°16.7	S13°14.9	168°21.5	N14°11.0	235°17.7	S12°52.2
13	223°43.9	61°54.9	09.7	10°17.5	15.5	183°24.2	10.9	250°20.2	52.2
14	238°46.4	76°55.0	09.1	25°18.4	16.1	198°27.0	10.8	265°22.8	52.3
15	253°48.9	91°55.1	·· 08.4	40°19.2	·· 16.6	213°29.8	·· 10.7	280°25.3	·· 52.3
16	268°51.3	106°55.2	07.7	55°20.0	17.2	228°32.6	10.6	295°27.8	52.3
17	283°53.8	121°55.3	07.1	70°20.8	17.8	243°35.3	10.5	310°30.3	52.3
18	298°56.2	136°55.4	N07°06.4	85°21.6	S13°18.4	258°38.1	N14°10.4	325°32.9	S12°52.3
19	313°58.7	151°55.5	05.7	100°22.4	19.0	273°40.9	10.3	340°35.4	52.4
20	329°01.2	166°55.6	05.0	115°23.3	19.6	288°43.7	10.2	355°37.9	52.4
21	344°03.6	181°55.7	·· 04.4	130°24.1	·· 20.2	303°46.4	·· 10.1	10°40.4	·· 52.4
22	359°06.1	196°55.8	03.7	145°24.9	20.8	318°49.2	10.0	25°43.0	52.4
23	14°08.6	211°55.9	03.0	160°25.7	21.4	333°52.0	09.9	40°45.5	52.4
Mer.pass. 22:04		ν 0.1′ d -0.7′ m -4.54		ν 0.8′ d -0.6′ m 1.55		ν 2.8′ d -0.1′ m -2.90		ν 2.5′ d -0.0′ m 0.67	

Sat	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	29°11.0	226°56.0	N07°02.4	175°26.5	S13°21.9	348°54.8	N14°09.8	55°48.0	S12°52.4
1	44°13.5	241°56.1	01.7	190°27.4	22.5	3°57.5	09.7	70°50.5	52.5
2	59°16.0	256°56.2	01.0	205°28.2	23.1	19°00.3	09.6	85°53.0	52.5
3	74°18.4	271°56.3	07°00.3	220°29.0	·· 23.7	34°03.1	·· 09.6	100°55.6	·· 52.5
4	89°20.9	286°56.4	06°59.7	235°29.8	24.3	49°05.9	09.5	115°58.1	52.5
5	104°23.4	301°56.5	59.0	250°30.6	24.9	64°08.7	09.4	131°00.6	52.5
6	119°25.8	316°56.6	N06°58.3	265°31.4	S13°25.5	79°11.4	N14°09.3	146°03.1	S12°52.6
7	134°28.3	331°56.7	57.6	280°32.2	26.1	94°14.2	09.2	161°05.7	52.6
8	149°30.7	346°56.8	56.9	295°33.1	26.6	109°17.0	09.1	176°08.2	52.6
9	164°33.2	1°56.9	·· 56.3	310°33.9	·· 27.2	124°19.8	·· 09.0	191°10.7	·· 52.6
10	179°35.7	16°57.0	55.6	325°34.7	27.8	139°22.5	08.9	206°13.2	52.6
11	194°38.1	31°57.0	54.9	340°35.5	28.4	154°25.3	08.8	221°15.7	52.6
12	209°40.6	46°57.1	N06°54.2	355°36.3	S13°29.0	169°28.1	N14°08.7	236°18.3	S12°52.7
13	224°43.1	61°57.2	53.5	10°37.1	29.6	184°30.9	08.6	251°20.8	52.7
14	239°45.5	76°57.3	52.9	25°37.9	30.2	199°33.7	08.5	266°23.3	52.7
15	254°48.0	91°57.4	·· 52.2	40°38.8	·· 30.7	214°36.4	·· 08.4	281°25.8	·· 52.7
16	269°50.5	106°57.5	51.5	55°39.6	31.3	229°39.2	08.3	296°28.4	52.7
17	284°52.9	121°57.6	50.8	70°40.4	31.9	244°42.0	08.2	311°30.9	52.7
18	299°55.4	136°57.7	N06°50.1	85°41.2	S13°32.5	259°44.8	N14°08.1	326°33.4	S12°52.8
19	314°57.9	151°57.7	49.4	100°42.0	33.1	274°47.5	08.0	341°35.9	52.8
20	330°00.3	166°57.8	48.7	115°42.8	33.7	289°50.3	07.9	356°38.4	52.8
21	345°02.8	181°57.9	·· 48.1	130°43.6	·· 34.3	304°53.1	·· 07.8	11°41.0	·· 52.8
22	0°05.2	196°58.0	47.4	145°44.4	34.8	319°55.9	07.7	26°43.5	52.8
23	15°07.7	211°58.1	46.7	160°45.3	35.4	334°58.7	07.6	41°46.0	52.8
Mer.pass. 22:00		ν 0.1′ d -0.7′ m -4.53		ν 0.8′ d -0.6′ m 1.54		ν 2.8′ d -0.1′ m -2.90		ν 2.5′ d -0.0′ m 0.68	

Stars

	SHA	**Dec**
Alpheratz	357°35.5	29°13.4
Ankaa	353°07.8	-42°10.6
Schedar	349°31.7	56°40.2
Diphda	348°48.0	-17°51.3
Achernar	335°20.4	-57°06.9
Hamal	327°52.0	23°34.6
Polaris	314°05.4	89°21.8
Acamar	315°12.2	-40°12.4
Menkar	314°06.9	4°11.1
Mirfak	308°29.3	49°56.7
Aldebaran	290°40.6	16°33.5
Rigel	281°04.7	-8°10.3
Capella	280°23.1	46°01.2
Bellatrix	278°23.8	6°22.4
Elnath	278°03.0	28°37.6
Alnilam	275°38.6	-1°11.1
Betelgeuse	270°53.1	7°24.8
Canopus	263°52.7	-52°42.1
Sirius	258°27.1	-16°44.7
Adhara	255°06.6	-28°59.9
Procyon	244°51.9	5°10.0
Pollux	243°18.6	27°58.1
Avior	234°15.3	-59°34.7
Suhail	222°47.2	-43°31.3
Miaplacidus	221°38.8	-69°48.5
Alphard	217°48.9	-8°45.5
Regulus	207°35.7	11°51.2
Dubhe	193°42.7	61°37.3
Denebola	182°26.3	14°26.5
Gienah	175°45.0	-17°40.2
Acrux	173°02.0	-63°13.6
Gacrux	171°53.4	-57°14.6
Alioth	166°14.4	55°49.9
Spica	158°23.7	-11°17.0
Alkaid	152°53.3	49°11.8
Hadar	148°38.2	-60°29.2
Menkent	147°59.3	-36°29.1
Arcturus	145°49.2	19°03.7
Rigil Kent.	139°42.4	-60°56.0
Kochab	137°20.9	74°03.5
Zuben'ubi	136°57.5	-16°08.3
Alphecca	126°04.9	26°38.2
Antares	112°17.4	-26°29.1
Atria	107°12.9	-69°04.4
Sabik	102°04.2	-15°45.2
Shaula	96°12.0	-37°07.3
Rasalhague	95°59.7	12°32.7
Eltanin	90°42.9	51°29.4
Kaus Aust.	83°34.0	-34°22.5
Vega	80°34.1	38°48.6
Nunki	75°49.1	-26°16.1
Altair	62°01.0	8°56.0
Peacock	53°07.3	-56°39.7
Deneb	49°26.4	45°22.1
Enif	33°39.7	9°59.2
Al Na'ir	27°33.9	-46°50.9
Fomalhaut	15°15.4	-29°29.8
Scheat	13°46.0	28°12.9
Markab	13°30.7	15°20.1

Oct 19 Thu	**SHA**	**Mer.pass**
Venus	199°38.0	08:53
Mars	147°34.3	12:20
Jupiter	319°28.9	00:53
Saturn	26°33.9	20:21

Oct 20 Fri	**SHA**	**Mer.pass**
Venus	198°41.7	08:52
Mars	146°55.0	12:19
Jupiter	319°36.3	00:49
Saturn	26°35.5	20:17

Oct 21 Sat	**SHA**	**Mer.pass**
Venus	197°45.0	08:52
Mars	146°15.5	12:18
Jupiter	319°43.7	00:44
Saturn	26°37.0	20:13

Horizontal parallax	
Venus:	0.2
Mars:	0.1

h	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°43.4	S09°48.2	133°24.7	6.8′	S26°43.3	5.5′	57.2′
1	198°43.5	49.1	147°50.5	6.8′	26°48.8	5.4′	57.2′
2	213°43.6	50.0	162°16.3	6.7′	26°54.2	5.2′	57.2′
3	228°43.8	·· 50.9	176°42.0	6.6′	26°59.4	5.1′	57.2′
4	243°43.9	51.8	191°07.6	6.5′	27°04.5	4.9′	57.3′
5	258°44.0	52.8	205°33.1	6.4′	27°09.4	4.7′	57.3′
6	273°44.1	S09°53.7	219°58.6	6.4′	S27°14.1	4.6′	57.3′
7	288°44.2	54.6	234°23.9	6.3′	27°18.7	4.4′	57.3′
8	303°44.3	55.5	248°49.2	6.2′	27°23.1	4.3′	57.4′
9	318°44.5	·· 56.4	263°14.4	6.1′	27°27.4	4.1′	57.4′
10	333°44.6	57.3	277°39.6	6.1′	27°31.5	4.0′	57.4′
11	348°44.7	58.2	292°04.7	6.0′	27°35.5	3.7′	57.4′
12	3°44.8	S09°59.1	306°29.7	5.9′	S27°39.2	3.6′	57.4′
13	18°44.9	10°00.0	320°54.6	5.9′	27°42.8	3.5′	57.5′
14	33°45.0	00.9	335°19.5	5.8′	27°46.3	3.3′	57.5′
15	48°45.1	·· 01.8	349°44.3	5.7′	27°49.6	3.1′	57.5′
16	63°45.3	02.7	4°09.0	5.7′	27°52.7	2.9′	57.5′
17	78°45.4	03.6	18°33.7	5.6′	27°55.6	2.8′	57.6′
18	93°45.5	S10°04.5	32°58.4	5.6′	S27°58.4	2.6′	57.6′
19	108°45.6	05.4	47°22.9	5.5′	28°01.0	2.4′	57.6′
20	123°45.7	06.3	61°47.4	5.5′	28°03.4	2.3′	57.6′
21	138°45.8	·· 07.2	76°11.9	5.4′	28°05.7	2.0′	57.6′
22	153°45.9	08.1	90°36.3	5.4′	28°07.7	1.9′	57.7′
23	168°46.1	09.0	105°00.7	5.3′	28°09.6	1.8′	57.7′
	SD = 16.0′	d = -0.9′	SD = 15.6′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°46.2	S10°09.9	119°25.0	5.3′	S28°11.4	1.5′	57.7′
1	198°46.3	10.8	133°49.2	5.2′	28°12.9	1.4′	57.7′
2	213°46.4	11.7	148°13.5	5.2′	28°14.3	1.2′	57.7′
3	228°46.5	·· 12.6	162°37.6	5.1′	28°15.5	1.0′	57.8′
4	243°46.6	13.5	177°01.8	5.1′	28°16.5	0.9′	57.8′
5	258°46.7	14.4	191°25.9	5.1′	28°17.4	0.7′	57.8′
6	273°46.8	S10°15.3	205°49.9	5.0′	S28°18.1	0.5′	57.8′
7	288°46.9	16.2	220°14.0	5.0′	28°18.6	0.3′	57.9′
8	303°47.0	17.1	234°38.0	5.0′	28°18.9	0.1′	57.9′
9	318°47.2	·· 18.0	249°01.9	4.9′	28°19.0	0.1′	57.9′
10	333°47.3	18.9	263°25.9	4.9′	28°18.9	0.2′	57.9′
11	348°47.4	19.8	277°49.8	4.9′	28°18.7	0.4′	57.9′
12	3°47.5	S10°20.7	292°13.7	4.9′	S28°18.3	0.6′	58.0′
13	18°47.6	21.6	306°37.6	4.9′	28°17.7	0.7′	58.0′
14	33°47.7	22.5	321°01.4	4.8′	28°17.0	1.0′	58.0′
15	48°47.8	·· 23.4	335°25.3	4.8′	28°16.0	1.1′	58.0′
16	63°47.9	24.3	349°49.1	4.8′	28°14.9	1.4′	58.0′
17	78°48.0	25.1	4°12.9	4.8′	28°13.5	1.5′	58.1′
18	93°48.1	S10°26.0	18°36.7	4.8′	S28°12.0	1.6′	58.1′
19	108°48.2	26.9	33°00.5	4.8′	28°10.4	1.9′	58.1′
20	123°48.3	27.8	47°24.3	4.8′	28°08.5	2.0′	58.1′
21	138°48.5	·· 28.7	61°48.1	4.8′	28°06.5	2.3′	58.2′
22	153°48.6	29.6	76°11.9	4.8′	28°04.2	2.4′	58.2′
23	168°48.7	30.5	90°35.7	4.8′	28°01.8	2.6′	58.2′
	SD = 16.1′	d = -0.9′	SD = 15.7′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°48.8	S10°31.4	104°59.4	4.8′	S27°59.2	2.8′	58.2′
1	198°48.9	32.3	119°23.2	4.8′	27°56.4	2.9′	58.2′
2	213°49.0	33.2	133°47.0	4.8′	27°53.5	3.1′	58.3′
3	228°49.1	·· 34.1	148°10.8	4.8′	27°50.4	3.4′	58.3′
4	243°49.2	35.0	162°34.7	4.8′	27°47.0	3.5′	58.3′
5	258°49.3	35.9	176°58.5	4.8′	27°43.5	3.7′	58.3′
6	273°49.4	S10°36.8	191°22.3	4.9′	S27°39.8	3.8′	58.4′
7	288°49.5	37.7	205°46.2	4.9′	27°36.0	4.1′	58.4′
8	303°49.6	38.5	220°10.1	4.9′	27°31.9	4.2′	58.4′
9	318°49.7	·· 39.4	234°34.0	4.9′	27°27.7	4.4′	58.4′
10	333°49.8	40.3	248°57.9	5.0′	27°23.3	4.6′	58.4′
11	348°49.9	41.2	263°21.9	5.0′	27°18.7	4.7′	58.5′
12	3°50.0	S10°42.1	277°45.8	5.0′	S27°14.0	5.0′	58.5′
13	18°50.1	43.0	292°09.9	5.0′	27°09.0	5.1′	58.5′
14	33°50.2	43.9	306°33.9	5.1′	27°03.9	5.3′	58.5′
15	48°50.3	·· 44.8	320°58.0	5.1′	26°58.6	5.5′	58.5′
16	63°50.4	45.7	335°22.1	5.1′	26°53.1	5.6′	58.6′
17	78°50.5	46.6	349°46.2	5.2′	26°47.5	5.9′	58.6′
18	93°50.6	S10°47.4	4°10.4	5.2′	S26°41.6	6.0′	58.6′
19	108°50.7	48.3	18°34.6	5.3′	26°35.6	6.1′	58.6′
20	123°50.8	49.2	32°58.9	5.3′	26°29.5	6.4′	58.7′
21	138°50.9	·· 50.1	47°23.2	5.3′	26°23.1	6.5′	58.7′
22	153°51.0	51.0	61°47.5	5.4′	26°16.6	6.7′	58.7′
23	168°51.1	51.9	76°11.9	5.4′	26°09.9	6.9′	58.7′
	SD = 16.1′	d = -0.9′	SD = 15.9′				

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

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

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 18-37%
19	14:54	14:59	11:45	15:43	03:14	
20	15:05	15:10	11:45	16:42	04:12	
21	15:15	15:20	11:45	17:43	05:13	

October 22, 23, 24 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	30°10.2	226°58.2	N06°46.0	175°46.1	S13°36.0	350°01.4	N14°07.5	56°48.5	S12°52.9
1	45°12.6	241°58.2	45.3	190°46.9	36.6	5°04.2	07.4	71°51.0	52.9
2	60°15.1	256°58.3	44.6	205°47.7	37.2	20°07.0	07.3	86°53.6	52.9
3	75°17.6	271°58.4	·· 43.9	220°48.5	·· 37.8	35°09.8	·· 07.2	101°56.1	·· 52.9
4	90°20.0	286°58.5	43.2	235°49.3	38.3	50°12.6	07.1	116°58.6	52.9
5	105°22.5	301°58.6	42.5	250°50.1	38.9	65°15.3	07.0	132°01.1	52.9
6	120°25.0	316°58.6	N06°41.8	265°50.9	S13°39.5	80°18.1	N14°06.9	147°03.6	S12°52.9
7	135°27.4	331°58.7	41.1	280°51.7	40.1	95°20.9	06.8	162°06.1	53.0
8	150°29.9	346°58.8	40.4	295°52.6	40.7	110°23.7	06.7	177°08.7	53.0
9	165°32.4	1°58.9	·· 39.7	310°53.4	·· 41.3	125°26.5	·· 06.6	192°11.2	·· 53.0
10	180°34.8	16°59.0	39.0	325°54.2	41.8	140°29.3	06.5	207°13.7	53.0
11	195°37.3	31°59.0	38.3	340°55.0	42.4	155°32.0	06.4	222°16.2	53.0
12	210°39.7	46°59.1	N06°37.6	355°55.8	S13°43.0	170°34.8	N14°06.3	237°18.7	S12°53.0
13	225°42.2	61°59.2	36.9	10°56.6	43.6	185°37.6	06.2	252°21.3	53.1
14	240°44.7	76°59.3	36.2	25°57.4	44.2	200°40.4	06.1	267°23.8	53.1
15	255°47.1	91°59.3	·· 35.5	40°58.2	·· 44.8	215°43.2	·· 06.0	282°26.3	·· 53.1
16	270°49.6	106°59.4	34.8	55°59.0	45.3	230°45.9	05.9	297°28.8	53.1
17	285°52.1	121°59.5	34.1	70°59.8	45.9	245°48.7	05.8	312°31.3	53.1
18	300°54.5	136°59.5	N06°33.4	86°00.6	S13°46.5	260°51.5	N14°05.7	327°33.8	S12°53.1
19	315°57.0	151°59.6	32.7	101°01.4	47.1	275°54.3	05.6	342°36.4	53.1
20	330°59.5	166°59.7	32.0	116°02.3	47.7	290°57.1	05.5	357°38.9	53.2
21	346°01.9	181°59.8	·· 31.3	131°03.1	·· 48.2	305°59.8	·· 05.4	12°41.4	·· 53.2
22	1°04.4	196°59.8	30.6	146°03.9	48.8	321°02.6	05.3	27°43.9	53.2
23	16°06.9	211°59.9	29.9	161°04.7	49.4	336°05.4	05.3	42°46.4	53.2
Mer.pass. 21:56		ν 0.1′	d -0.7′	m -4.52	ν 0.8′	d -0.6′	m 1.54	ν 2.8′	d -0.1′ m -2.90	ν 2.5′ d -0.0′ m 0.68

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	31°09.3	227°00.0	N06°29.2	176°05.5	S13°50.0	351°08.2	N14°05.2	57°48.9	S12°53.2
1	46°11.8	242°00.0	28.5	191°06.3	50.6	6°11.0	05.1	72°51.5	53.2
2	61°14.2	257°00.1	27.8	206°07.1	51.1	21°13.8	05.0	87°54.0	53.3
3	76°16.7	272°00.2	·· 27.1	221°07.9	·· 51.7	36°16.5	·· 04.9	102°56.5	·· 53.3
4	91°19.2	287°00.2	26.4	236°08.7	52.3	51°19.3	04.8	117°59.0	53.3
5	106°21.6	302°00.3	25.7	251°09.5	52.9	66°22.1	04.7	133°01.5	53.3
6	121°24.1	317°00.4	N06°24.9	266°10.3	S13°53.5	81°24.9	N14°04.6	148°04.0	S12°53.3
7	136°26.6	332°00.4	24.2	281°11.1	54.0	96°27.7	04.5	163°06.5	53.3
8	151°29.0	347°00.5	23.5	296°11.9	54.6	111°30.5	04.4	178°09.1	53.3
9	166°31.5	2°00.6	·· 22.8	311°12.7	·· 55.2	126°33.2	·· 04.3	193°11.6	·· 53.4
10	181°34.0	17°00.6	22.1	326°13.5	55.8	141°36.0	04.2	208°14.1	53.4
11	196°36.4	32°00.7	21.4	341°14.3	56.4	156°38.8	04.1	223°16.6	53.4
12	211°38.9	47°00.7	N06°20.7	356°15.1	S13°56.9	171°41.6	N14°04.0	238°19.1	S12°53.4
13	226°41.3	62°00.8	19.9	11°15.9	57.5	186°44.4	03.9	253°21.6	53.4
14	241°43.8	77°00.9	19.2	26°16.7	58.1	201°47.2	03.8	268°24.1	53.4
15	256°46.3	92°00.9	·· 18.5	41°17.5	·· 58.7	216°49.9	·· 03.7	283°26.7	·· 53.4
16	271°48.7	107°01.0	17.8	56°18.3	59.2	231°52.7	03.6	298°29.2	53.5
17	286°51.2	122°01.1	17.1	71°19.1	13°59.8	246°55.5	03.5	313°31.7	53.5
18	301°53.7	137°01.1	N06°16.3	86°20.0	S14°00.4	261°58.3	N14°03.4	328°34.2	S12°53.5
19	316°56.1	152°01.2	15.6	101°20.8	01.0	277°01.1	03.3	343°36.7	53.5
20	331°58.6	167°01.2	14.9	116°21.6	01.6	292°03.9	03.2	358°39.2	53.5
21	347°01.1	182°01.3	·· 14.2	131°22.4	·· 02.1	307°06.7	·· 03.1	13°41.7	·· 53.5
22	2°03.5	197°01.3	13.5	146°23.2	02.7	322°09.4	03.0	28°44.2	53.5
23	17°06.0	212°01.4	12.7	161°24.0	03.3	337°12.2	02.9	43°46.8	53.5
Mer.pass. 21:52		ν 0.1′	d -0.7′	m -4.51	ν 0.8′	d -0.6′	m 1.53	ν 2.8′	d -0.1′ m -2.90	ν 2.5′ d -0.0′ m 0.69

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	32°08.5	227°01.5	N06°12.0	176°24.8	S14°03.9	352°15.0	N14°02.8	58°49.3	S12°53.6
1	47°10.9	242°01.5	11.3	191°25.6	04.4	7°17.8	02.7	73°51.8	53.6
2	62°13.4	257°01.6	10.6	206°26.4	05.0	22°20.6	02.6	88°54.3	53.6
3	77°15.8	272°01.6	·· 09.8	221°27.2	·· 05.6	37°23.4	·· 02.5	103°56.8	·· 53.6
4	92°18.3	287°01.7	09.1	236°28.0	06.2	52°26.2	02.4	118°59.3	53.6
5	107°20.8	302°01.7	08.4	251°28.8	06.7	67°28.9	02.3	134°01.8	53.6
6	122°23.2	317°01.8	N06°07.7	266°29.6	S14°07.3	82°31.7	N14°02.2	149°04.3	S12°53.6
7	137°25.7	332°01.8	06.9	281°30.4	07.9	97°34.5	02.1	164°06.8	53.6
8	152°28.2	347°01.9	06.2	296°31.2	08.5	112°37.3	02.0	179°09.4	53.7
9	167°30.6	2°01.9	·· 05.5	311°32.0	·· 09.0	127°40.1	·· 01.9	194°11.9	·· 53.7
10	182°33.1	17°02.0	04.7	326°32.8	09.6	142°42.9	01.8	209°14.4	53.7
11	197°35.6	32°02.0	04.0	341°33.6	10.2	157°45.7	01.7	224°16.9	53.7
12	212°38.0	47°02.1	N06°03.3	356°34.4	S14°10.8	172°48.4	N14°01.6	239°19.4	S12°53.7
13	227°40.5	62°02.1	02.5	11°35.2	11.3	187°51.2	01.5	254°21.9	53.7
14	242°43.0	77°02.2	01.8	26°35.9	11.9	202°54.0	01.4	269°24.4	53.7
15	257°45.4	92°02.2	·· 01.1	41°36.7	·· 12.5	217°56.8	·· 01.3	284°26.9	·· 53.7
16	272°47.9	107°02.3	06°00.3	56°37.5	13.1	232°59.6	01.2	299°29.4	53.8
17	287°50.3	122°02.3	05°59.6	71°38.3	13.6	248°02.4	01.1	314°31.9	53.8
18	302°52.8	137°02.4	N05°58.9	86°39.1	S14°14.2	263°05.2	N14°01.0	329°34.4	S12°53.8
19	317°55.3	152°02.4	58.1	101°39.9	14.8	278°07.9	00.9	344°37.0	53.8
20	332°57.7	167°02.5	57.4	116°40.7	15.4	293°10.7	00.8	359°39.5	53.8
21	348°00.2	182°02.5	·· 56.7	131°41.5	·· 15.9	308°13.5	·· 00.7	14°42.0	·· 53.8
22	3°02.7	197°02.6	55.9	146°42.3	16.5	323°16.3	00.6	29°44.5	53.8
23	18°05.1	212°02.6	55.2	161°43.1	17.1	338°19.1	00.5	44°47.0	53.8
Mer.pass. 21:48		ν 0.1′	d -0.7′	m -4.50	ν 0.8′	d -0.6′	m 1.52	ν 2.8′	d -0.1′ m -2.91	ν 2.5′ d -0.0′ m 0.69

Stars

	SHA	**Dec**
Alpheratz	357°35.5	29°13.4
Ankaa	353°07.8	-42°10.6
Schedar	349°31.7	56°40.2
Diphda	348°48.0	-17°51.3
Achernar	335°20.3	-57°06.9
Hamal	327°52.0	23°34.6
Polaris	314°04.6	89°21.8
Acamar	315°12.1	-40°12.4
Menkar	314°06.9	4°11.1
Mirfak	308°29.3	49°56.7
Aldebaran	290°40.5	16°33.5
Rigel	281°04.6	-8°10.3
Capella	280°23.1	46°01.2
Bellatrix	278°23.8	6°22.4
Elnath	278°02.9	28°37.6
Alnilam	275°38.6	-1°11.1
Betelgeuse	270°53.0	7°24.8
Canopus	263°52.6	-52°42.1
Sirius	258°27.0	-16°44.7
Adhara	255°06.6	-28°59.9
Procyon	244°51.9	5°10.0
Pollux	243°18.5	27°58.1
Avior	234°15.2	-59°34.7
Suhail	222°47.2	-43°31.3
Miaplacidus	221°38.8	-69°48.5
Alphard	217°48.9	-8°45.5
Regulus	207°35.7	11°51.2
Dubhe	193°42.7	61°37.3
Denebola	182°26.3	14°26.5
Gienah	175°45.0	-17°40.2
Acrux	173°02.0	-63°13.6
Gacrux	171°53.4	-57°14.6
Alioth	166°14.4	55°49.9
Spica	158°23.7	-11°17.0
Alkaid	152°53.3	49°11.7
Hadar	148°38.2	-60°29.2
Menkent	147°59.3	-36°29.1
Arcturus	145°49.2	19°03.6
Rigil Kent.	139°42.4	-60°56.0
Kochab	137°20.9	74°03.5
Zuben'ubi	136°57.5	-16°08.3
Alphecca	126°04.9	26°38.2
Antares	112°17.4	-26°29.1
Atria	107°13.0	-69°04.3
Sabik	102°04.2	-15°45.2
Shaula	96°12.0	-37°07.3
Rasalhague	95°59.7	12°32.7
Eltanin	90°42.9	51°29.4
Kaus Aust.	83°34.0	-34°22.5
Vega	80°34.1	38°48.6
Nunki	75°49.1	-26°16.1
Altair	62°01.0	8°56.0
Peacock	53°07.3	-56°39.7
Deneb	49°26.4	45°22.1
Enif	33°39.7	9°59.2
Al Na'ir	27°33.9	-46°50.9
Fomalhaut	15°15.4	-29°29.8
Scheat	13°46.0	28°12.9
Markab	13°30.7	15°20.1

Oct 22 Sun	**SHA**	**Mer.pass**
Venus	196°48.0	08:52
Mars	145°35.9	12:16
Jupiter	319°51.3	00:40
Saturn	26°38.3	20:09

Oct 23 Mon	**SHA**	**Mer.pass**
Venus	195°50.6	08:52
Mars	144°56.2	12:15
Jupiter	319°58.9	00:35
Saturn	26°39.6	20:05

Oct 24 Tue	**SHA**	**Mer.pass**
Venus	194°53.0	08:52
Mars	144°16.3	12:14
Jupiter	320°06.6	00:31
Saturn	26°40.8	20:01

Horizontal parallax	
Venus:	0.2
Mars:	0.1

h	Sun		Moon				
Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°51.2	S10°52.8	90°36.3	5.5′	S26°03.0	7.0′	58.7′
1	198°51.3	53.7	105°00.8	5.5′	25°56.0	7.2′	58.8′
2	213°51.4	54.5	119°25.4	5.6′	25°48.8	7.4′	58.8′
3	228°51.5	·· 55.4	133°49.9	5.6′	25°41.4	7.5′	58.8′
4	243°51.6	56.3	148°14.6	5.7′	25°33.9	7.8′	58.8′
5	258°51.7	57.2	162°39.3	5.7′	25°26.1	7.8′	58.8′
6	273°51.8	S10°58.1	177°04.0	5.8′	S25°18.3	8.1′	58.9′
7	288°51.9	59.0	191°28.8	5.9′	25°10.2	8.2′	58.9′
8	303°52.0	10°59.8	205°53.7	5.9′	25°02.0	8.4′	58.9′
9	318°52.1	11°00.7	220°18.6	6.0′	24°53.6	8.5′	58.9′
10	333°52.2	01.6	234°43.6	6.0′	24°45.1	8.7′	58.9′
11	348°52.3	02.5	249°08.6	6.1′	24°36.4	8.8′	59.0′
12	3°52.4	S11°03.4	263°33.7	6.2′	S24°27.6	9.0′	59.0′
13	18°52.5	04.3	277°58.9	6.2′	24°18.6	9.2′	59.0′
14	33°52.6	05.2	292°24.1	6.3′	24°09.4	9.3′	59.0′
15	48°52.7	·· 06.0	306°49.4	6.4′	24°00.1	9.5′	59.0′
16	63°52.8	06.9	321°14.8	6.4′	23°50.6	9.7′	59.1′
17	78°52.8	07.8	335°40.2	6.5′	23°40.9	9.7′	59.1′
18	93°52.9	S11°08.7	350°05.7	6.6′	S23°31.2	10.0′	59.1′
19	108°53.0	09.6	4°31.3	6.6′	23°21.2	10.1′	59.1′
20	123°53.1	10.4	18°56.9	6.7′	23°11.1	10.2′	59.1′
21	138°53.2	·· 11.3	33°22.6	6.8′	23°00.9	10.4′	59.2′
22	153°53.3	12.2	47°48.4	6.8′	22°50.5	10.6′	59.2′
23	168°53.4	13.1	62°14.2	6.9′	22°39.9	10.6′	59.2′
	SD = 16.1′	d = -0.9′	SD = 16.0′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°53.5	S11°14.0	76°40.1	7.0′	S22°29.3	10.9′	59.2′
1	198°53.6	14.8	91°06.1	7.0′	22°18.4	10.9′	59.2′
2	213°53.7	15.7	105°32.1	7.1′	22°07.5	11.1′	59.2′
3	228°53.8	·· 16.6	119°58.3	7.2′	21°56.4	11.3′	59.3′
4	243°53.9	17.5	134°24.4	7.3′	21°45.1	11.4′	59.3′
5	258°54.0	18.4	148°50.7	7.3′	21°33.7	11.5′	59.3′
6	273°54.0	S11°19.2	163°17.0	7.4′	S21°22.2	11.7′	59.3′
7	288°54.1	20.1	177°43.5	7.5′	21°10.5	11.8′	59.3′
8	303°54.2	21.0	192°09.9	7.6′	20°58.7	11.9′	59.4′
9	318°54.3	·· 21.9	206°36.5	7.6′	20°46.8	12.1′	59.4′
10	333°54.4	22.7	221°03.1	7.7′	20°34.7	12.1′	59.4′
11	348°54.5	23.6	235°29.8	7.8′	20°22.6	12.4′	59.4′
12	3°54.6	S11°24.5	249°56.6	7.8′	S20°10.2	12.4′	59.4′
13	18°54.7	25.4	264°23.4	7.9′	19°57.8	12.6′	59.4′
14	33°54.8	26.2	278°50.3	8.0′	19°45.2	12.7′	59.5′
15	48°54.8	·· 27.1	293°17.3	8.1′	19°32.5	12.8′	59.5′
16	63°54.9	28.0	307°44.4	8.1′	19°19.7	12.9′	59.5′
17	78°55.0	28.9	322°11.5	8.2′	19°06.8	13.1′	59.5′
18	93°55.1	S11°29.7	336°38.7	8.3′	S18°53.7	13.2′	59.5′
19	108°55.2	30.6	351°06.0	8.3′	18°40.5	13.3′	59.5′
20	123°55.3	31.5	5°33.4	8.4′	18°27.2	13.4′	59.5′
21	138°55.4	·· 32.4	20°00.8	8.5′	18°13.8	13.5′	59.6′
22	153°55.4	33.2	34°28.3	8.6′	18°00.3	13.7′	59.6′
23	168°55.5	34.1	48°55.8	8.6′	17°46.6	13.7′	59.6′
	SD = 16.1′	d = -0.9′	SD = 16.1′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°55.6	S11°35.0	63°23.4	8.7′	S17°32.9	13.9′	59.6′
1	198°55.7	35.9	77°51.1	8.8′	17°19.0	13.9′	59.6′
2	213°55.8	36.7	92°18.9	8.8′	17°05.1	14.1′	59.6′
3	228°55.9	·· 37.6	106°46.7	8.9′	16°51.0	14.2′	59.7′
4	243°56.0	38.5	121°14.7	9.0′	16°36.8	14.2′	59.7′
5	258°56.0	39.3	135°42.6	9.0′	16°22.6	14.4′	59.7′
6	273°56.1	S11°40.2	150°10.7	9.1′	S16°08.2	14.5′	59.7′
7	288°56.2	41.1	164°38.8	9.2′	15°53.7	14.6′	59.7′
8	303°56.3	42.0	179°06.9	9.2′	15°39.1	14.6′	59.7′
9	318°56.4	·· 42.8	193°35.2	9.3′	15°24.5	14.8′	59.7′
10	333°56.4	43.7	208°03.5	9.4′	15°09.7	14.8′	59.7′
11	348°56.5	44.6	222°31.8	9.4′	14°54.9	15.0′	59.8′
12	3°56.6	S11°45.4	237°00.2	9.5′	S14°39.9	15.0′	59.8′
13	18°56.7	46.3	251°28.7	9.5′	14°24.9	15.2′	59.8′
14	33°56.8	47.2	265°57.3	9.6′	14°09.7	15.2′	59.8′
15	48°56.9	·· 48.0	280°25.9	9.7′	13°54.5	15.3′	59.8′
16	63°56.9	48.9	294°54.6	9.7′	13°39.2	15.3′	59.8′
17	78°57.0	49.8	309°23.3	9.8′	13°23.9	15.5′	59.8′
18	93°57.1	S11°50.6	323°52.1	9.8′	S13°08.4	15.5′	59.8′
19	108°57.2	51.5	338°20.9	9.9′	12°52.9	15.6′	59.8′
20	123°57.3	52.4	352°49.8	10.0′	12°37.3	15.7′	59.9′
21	138°57.3	·· 53.2	7°18.7	10.0′	12°21.6	15.8′	59.9′
22	153°57.4	54.1	21°47.7	10.1′	12°05.8	15.8′	59.9′
23	168°57.5	55.0	36°16.8	10.1′	11°50.0	15.9′	59.9′
	SD = 16.1′	d = -0.9′	SD = 16.3′				

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

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

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 8-10 48-71%
22	15:25	15:30	11:45	18:41	06:12	
23	15:34	15:38	11:44	19:37	07:09	
24	15:42	15:46	11:44	20:30	08:04	

October 25, 26, 27 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	33°07.6	227°02.6	N05°54.4	176°43.9	S14°17.6	353°21.9	N14°00.4	59°49.5	S12°53.9
1	48°10.1	242°02.7	53.7	191°44.7	18.2	8°24.7	00.3	74°52.0	53.9
2	63°12.5	257°02.7	53.0	206°45.5	18.8	23°27.5	00.2	89°54.5	53.9
3	78°15.0	272°02.8	·· 52.2	221°46.3	·· 19.4	38°30.2	·· 00.1	104°57.0	·· 53.9
4	93°17.4	287°02.8	51.5	236°47.1	19.9	53°33.0	14°00.0	119°59.5	53.9
5	108°19.9	302°02.9	50.7	251°47.9	20.5	68°35.8	13°59.9	135°02.0	53.9
6	123°22.4	317°02.9	N05°50.0	266°48.7	S14°21.1	83°38.6	N13°59.8	150°04.5	S12°53.9
7	138°24.8	332°02.9	49.2	281°49.5	21.6	98°41.4	59.7	165°07.0	53.9
8	153°27.3	347°03.0	48.5	296°50.3	22.2	113°44.2	59.6	180°09.6	53.9
9	168°29.8	2°03.0	·· 47.7	311°51.1	·· 22.8	128°47.0	·· 59.5	195°12.1	·· 54.0
10	183°32.2	17°03.1	47.0	326°51.9	23.4	143°49.8	59.4	210°14.6	54.0
11	198°34.7	32°03.1	46.3	341°52.7	23.9	158°52.6	59.3	225°17.1	54.0
12	213°37.2	47°03.1	N05°45.5	356°53.4	S14°24.5	173°55.3	N13°59.2	240°19.6	S12°54.0
13	228°39.6	62°03.2	44.8	11°54.2	25.1	188°58.1	59.1	255°22.1	54.0
14	243°42.1	77°03.2	44.0	26°55.0	25.6	204°00.9	59.0	270°24.6	54.0
15	258°44.6	92°03.2	·· 43.3	41°55.8	·· 26.2	219°03.7	·· 58.9	285°27.1	·· 54.0
16	273°47.0	107°03.3	42.5	56°56.6	26.8	234°06.5	58.8	300°29.6	54.0
17	288°49.5	122°03.3	41.8	71°57.4	27.3	249°09.3	58.7	315°32.1	54.0
18	303°51.9	137°03.3	N05°41.0	86°58.2	S14°27.9	264°12.1	N13°58.6	330°34.6	S12°54.1
19	318°54.4	152°03.4	40.2	101°59.0	28.5	279°14.9	58.5	345°37.1	54.1
20	333°56.9	167°03.4	39.5	116°59.8	29.1	294°17.7	58.4	0°39.6	54.1
21	348°59.3	182°03.4	·· 38.7	132°00.6	·· 29.6	309°20.4	·· 58.3	15°42.1	·· 54.1
22	4°01.8	197°03.5	38.0	147°01.4	30.2	324°23.2	58.2	30°44.6	54.1
23	19°04.3	212°03.5	37.2	162°02.2	30.8	339°26.0	58.1	45°47.1	54.1
Mer.pass. 21:44		ν 0.0′	d -0.7′	m -4.49	ν 0.8′	d -0.6′	m 1.52	ν 2.8′	d -0.1′ m -2.91
								ν 2.5′	d -0.0′ m 0.70

Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	34°06.7	227°03.5	N05°36.5	177°02.9	S14°31.3	354°28.8	N13°58.0	60°49.6	S12°54.1
1	49°09.2	242°03.6	35.7	192°03.7	31.9	9°31.6	57.9	75°52.1	54.1
2	64°11.7	257°03.6	35.0	207°04.5	32.5	24°34.4	57.8	90°54.6	54.1
3	79°14.1	272°03.6	·· 34.2	222°05.3	·· 33.0	39°37.2	·· 57.7	105°57.1	·· 54.1
4	94°16.6	287°03.7	33.4	237°06.1	33.6	54°40.0	57.6	120°59.6	54.2
5	109°19.0	302°03.7	32.7	252°06.9	34.2	69°42.8	57.5	136°02.1	54.2
6	124°21.5	317°03.7	N05°31.9	267°07.7	S14°34.7	84°45.5	N13°57.4	151°04.7	S12°54.2
7	139°24.0	332°03.7	31.2	282°08.5	35.3	99°48.3	57.3	166°07.2	54.2
8	154°26.4	347°03.8	30.4	297°09.3	35.9	114°51.1	57.2	181°09.7	54.2
9	169°28.9	2°03.8	·· 29.6	312°10.0	·· 36.4	129°53.9	·· 57.1	196°12.2	·· 54.2
10	184°31.4	17°03.8	28.9	327°10.8	37.0	144°56.7	57.0	211°14.7	54.2
11	199°33.8	32°03.9	28.1	342°11.6	37.6	159°59.5	56.9	226°17.2	54.2
12	214°36.3	47°03.9	N05°27.4	357°12.4	S14°38.1	175°02.3	N13°56.8	241°19.7	S12°54.2
13	229°38.8	62°03.9	26.6	12°13.2	38.7	190°05.1	56.7	256°22.2	54.2
14	244°41.2	77°03.9	25.8	27°14.0	39.3	205°07.9	56.6	271°24.7	54.3
15	259°43.7	92°04.0	·· 25.1	42°14.8	·· 39.8	220°10.7	·· 56.5	286°27.2	·· 54.3
16	274°46.2	107°04.0	24.3	57°15.6	40.4	235°13.5	56.4	301°29.7	54.3
17	289°48.6	122°04.0	23.5	72°16.3	41.0	250°16.2	56.3	316°32.2	54.3
18	304°51.1	137°04.0	N05°22.8	87°17.1	S14°41.5	265°19.0	N13°56.2	331°34.7	S12°54.3
19	319°53.5	152°04.0	22.0	102°17.9	42.1	280°21.8	56.1	346°37.2	54.3
20	334°56.0	167°04.1	21.2	117°18.7	42.7	295°24.6	56.0	1°39.7	54.3
21	349°58.5	182°04.1	·· 20.4	132°19.5	·· 43.2	310°27.4	·· 55.9	16°42.2	·· 54.3
22	5°00.9	197°04.1	19.7	147°20.3	43.8	325°30.2	55.8	31°44.7	54.3
23	20°03.4	212°04.1	18.9	162°21.1	44.4	340°33.0	55.7	46°47.2	54.3
Mer.pass. 21:40		ν 0.0′	d -0.8′	m -4.48	ν 0.8′	d -0.6′	m 1.51	ν 2.8′	d -0.1′ m -2.91
								ν 2.5′	d -0.0′ m 0.70

Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	35°05.9	227°04.2	N05°18.1	177°21.8	S14°44.9	355°35.8	N13°55.6	61°49.7	S12°54.3
1	50°08.3	242°04.2	17.4	192°22.6	45.5	10°38.6	55.5	76°52.2	54.3
2	65°10.8	257°04.2	16.6	207°23.4	46.0	25°41.4	55.4	91°54.7	54.4
3	80°13.3	272°04.2	·· 15.8	222°24.2	·· 46.6	40°44.2	·· 55.3	106°57.2	·· 54.4
4	95°15.7	287°04.2	15.0	237°25.0	47.2	55°46.9	55.2	121°59.7	54.4
5	110°18.2	302°04.2	14.3	252°25.8	47.7	70°49.7	55.1	137°02.2	54.4
6	125°20.7	317°04.3	N05°13.5	267°26.5	S14°48.3	85°52.5	N13°55.0	152°04.7	S12°54.4
7	140°23.1	332°04.3	12.7	282°27.3	48.9	100°55.3	54.9	167°07.2	54.4
8	155°25.6	347°04.3	11.9	297°28.1	49.4	115°58.1	54.8	182°09.7	54.4
9	170°28.0	2°04.3	·· 11.2	312°28.9	·· 50.0	131°00.9	·· 54.7	197°12.2	·· 54.4
10	185°30.5	17°04.3	10.4	327°29.7	50.5	146°03.7	54.6	212°14.7	54.4
11	200°33.0	32°04.3	09.6	342°30.5	51.1	161°06.5	54.5	227°17.2	54.4
12	215°35.4	47°04.4	N05°08.8	357°31.2	S14°51.7	176°09.3	N13°54.4	242°19.7	S12°54.4
13	230°37.9	62°04.4	08.0	12°32.0	52.2	191°12.1	54.3	257°22.2	54.4
14	245°40.4	77°04.4	07.3	27°32.8	52.8	206°14.9	54.2	272°24.7	54.5
15	260°42.8	92°04.4	·· 06.5	42°33.6	·· 53.4	221°17.7	·· 54.0	287°27.1	·· 54.5
16	275°45.3	107°04.4	05.7	57°34.4	53.9	236°20.5	53.9	302°29.6	54.5
17	290°47.8	122°04.4	04.9	72°35.1	54.5	251°23.2	53.8	317°32.1	54.5
18	305°50.2	137°04.4	N05°04.1	87°35.9	S14°55.0	266°26.0	N13°53.7	332°34.6	S12°54.5
19	320°52.7	152°04.4	03.4	102°36.7	55.6	281°28.8	53.6	347°37.1	54.5
20	335°55.1	167°04.5	02.6	117°37.5	56.2	296°31.6	53.5	2°39.6	54.5
21	350°57.6	182°04.5	·· 01.8	132°38.3	·· 56.7	311°34.4	·· 53.4	17°42.1	·· 54.5
22	6°00.1	197°04.5	01.0	147°39.0	57.3	326°37.2	53.3	32°44.6	54.5
23	21°02.5	212°04.5	00.2	162°39.8	57.8	341°40.0	53.2	47°47.1	54.5
Mer.pass. 21:36		ν 0.0′	d -0.8′	m -4.47	ν 0.8′	d -0.6′	m 1.51	ν 2.8′	d -0.1′ m -2.91
								ν 2.5′	d -0.0′ m 0.71

Stars

	SHA	**Dec**
Alpheratz	357°35.5	29°13.4
Ankaa	353°07.8	-42°10.7
Schedar	349°31.7	56°40.2
Diphda	348°48.0	-17°51.3
Achernar	335°20.3	-57°07.0
Hamal	327°52.0	23°34.6
Polaris	314°04.1	89°21.8
Acamar	315°12.1	-40°12.4
Menkar	314°06.9	4°11.1
Mirfak	308°29.3	49°56.7
Aldebaran	290°40.5	16°33.5
Rigel	281°04.6	-8°10.3
Capella	280°23.1	46°01.2
Bellatrix	278°23.8	6°22.4
Elnath	278°02.9	28°37.6
Alnilam	275°38.6	-1°11.1
Betelgeuse	270°53.0	7°24.8
Canopus	263°52.6	-52°42.1
Sirius	258°27.0	-16°44.7
Adhara	255°06.6	-29°00.0
Procyon	244°51.9	5°10.0
Pollux	243°18.5	27°58.1
Avior	234°15.2	-59°34.7
Suhail	222°47.2	-43°31.3
Miaplacidus	221°38.8	-69°48.5
Alphard	217°48.9	-8°45.5
Regulus	207°35.7	11°51.2
Dubhe	193°42.7	61°37.3
Denebola	182°26.3	14°26.5
Gienah	175°44.9	-17°40.2
Acrux	173°01.9	-63°13.6
Gacrux	171°53.4	-57°14.6
Alioth	166°14.4	55°49.8
Spica	158°23.7	-11°17.0
Alkaid	152°53.3	49°11.7
Hadar	148°38.2	-60°29.2
Menkent	147°59.3	-36°29.1
Arcturus	145°49.2	19°03.6
Rigil Kent.	139°42.4	-60°55.9
Kochab	137°20.9	74°03.5
Zuben'ubi	136°57.5	-16°08.3
Alphecca	126°05.0	26°38.2
Antares	112°17.4	-26°29.1
Atria	107°13.0	-69°04.3
Sabik	102°04.2	-15°45.2
Shaula	96°12.0	-37°07.3
Rasalhague	95°59.7	12°32.7
Eltanin	90°43.0	51°29.3
Kaus Aust.	83°34.1	-34°22.5
Vega	80°34.1	38°48.5
Nunki	75°49.2	-26°16.1
Altair	62°01.0	8°56.0
Peacock	53°07.3	-56°39.7
Deneb	49°26.5	45°22.1
Enif	33°39.7	9°59.2
Al Na'ir	27°34.0	-46°50.9
Fomalhaut	15°15.4	-29°29.8
Scheat	13°46.0	28°12.9
Markab	13°30.7	15°20.1

Oct 25 Wed	**SHA**	**Mer.pass**
Venus	193°55.1	08:52
Mars	143°36.3	12:12
Jupiter	320°14.3	00:26
Saturn	26°41.9	19:57

Oct 26 Thu	**SHA**	**Mer.pass**
Venus	192°56.8	08:52
Mars	142°56.2	12:11
Jupiter	320°22.1	00:22
Saturn	26°42.9	19:53

Oct 27 Fri	**SHA**	**Mer.pass**
Venus	191°58.3	08:52
Mars	142°16.0	12:10
Jupiter	320°29.9	00:18
Saturn	26°43.8	19:49

Horizontal parallax	
Venus:	0.2
Mars:	0.1

h	Sun		Moon				
Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°57.6	S11°55.8	50°45.9	10.2′	S11°34.1	16.0′	59.9′
1	198°57.6	56.7	65°15.1	10.2′	11°18.1	16.1′	59.9′
2	213°57.7	57.6	79°44.3	10.3′	11°02.0	16.1′	59.9′
3	228°57.8	·· 58.4	94°13.5	10.3′	10°45.9	16.1′	59.9′
4	243°57.9	11°59.3	108°42.9	10.4′	10°29.8	16.3′	59.9′
5	258°57.9	12°00.1	123°12.2	10.4′	10°13.5	16.3′	59.9′
6	273°58.0	S12°01.0	137°41.6	10.4′	S09°57.2	16.3′	59.9′
7	288°58.1	01.9	152°11.1	10.5′	09°40.9	16.5′	59.9′
8	303°58.2	02.7	166°40.5	10.5′	09°24.4	16.4′	60.0′
9	318°58.2	·· 03.6	181°10.1	10.6′	09°08.0	16.6′	60.0′
10	333°58.3	04.5	195°39.7	10.6′	08°51.4	16.5′	60.0′
11	348°58.4	05.3	210°09.3	10.7′	08°34.9	16.7′	60.0′
12	3°58.5	S12°06.2	224°38.9	10.7′	S08°18.2	16.6′	60.0′
13	18°58.5	07.0	239°08.6	10.7′	08°01.6	16.8′	60.0′
14	33°58.6	07.9	253°38.3	10.8′	07°44.8	16.7′	60.0′
15	48°58.7	·· 08.8	268°08.1	10.8′	07°28.1	16.8′	60.0′
16	63°58.8	09.6	282°37.9	10.8′	07°11.3	16.9′	60.0′
17	78°58.8	10.5	297°07.8	10.9′	06°54.4	16.9′	60.0′
18	93°58.9	S12°11.3	311°37.6	10.9′	S06°37.5	16.9′	60.0′
19	108°59.0	12.2	326°07.5	10.9′	06°20.6	17.0′	60.0′
20	123°59.1	13.1	340°37.4	11.0′	06°03.6	17.0′	60.0′
21	138°59.1	·· 13.9	355°07.4	11.0′	05°46.6	17.0′	60.0′
22	153°59.2	14.8	9°37.4	11.0′	05°29.6	17.1′	60.0′
23	168°59.3	15.6	24°07.4	11.0′	05°12.5	17.1′	60.0′
	SD = 16.1′	d = -0.9′	SD = 16.3′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°59.3	S12°16.5	38°37.4	11.1′	S04°55.4	17.1′	60.0′
1	198°59.4	17.3	53°07.5	11.1′	04°38.3	17.2′	60.0′
2	213°59.5	18.2	67°37.6	11.1′	04°21.1	17.1′	60.0′
3	228°59.5	·· 19.1	82°07.7	11.1′	04°04.0	17.2′	60.0′
4	243°59.6	19.9	96°37.8	11.1′	03°46.8	17.2′	60.0′
5	258°59.7	20.8	111°08.0	11.2′	03°29.6	17.3′	60.0′
6	273°59.8	S12°21.6	125°38.1	11.2′	S03°12.3	17.2′	60.0′
7	288°59.8	22.5	140°08.3	11.2′	02°55.1	17.3′	60.0′
8	303°59.9	23.3	154°38.5	11.2′	02°37.8	17.3′	60.0′
9	319°00.0	·· 24.2	169°08.7	11.2′	02°20.5	17.3′	60.0′
10	334°00.0	25.0	183°39.0	11.2′	02°03.2	17.3′	60.0′
11	349°00.1	25.9	198°09.2	11.3′	01°45.9	17.3′	60.0′
12	4°00.2	S12°26.8	212°39.5	11.3′	S01°28.6	17.3′	60.0′
13	19°00.2	27.6	227°09.7	11.3′	01°11.3	17.4′	60.0′
14	34°00.3	28.5	241°40.0	11.3′	00°53.9	17.3′	60.0′
15	49°00.4	·· 29.3	256°10.3	11.3′	00°36.6	17.3′	60.0′
16	64°00.4	30.2	270°40.5	11.3′	00°19.3	17.4′	60.0′
17	79°00.5	31.0	285°10.8	11.3′	S00°01.9	17.3′	60.0′
18	94°00.6	S12°31.9	299°41.1	11.3′	N00°15.4	17.3′	60.0′
19	109°00.6	32.7	314°11.4	11.3′	00°32.7	17.4′	60.0′
20	124°00.7	33.6	328°41.7	11.3′	00°50.1	17.3′	60.0′
21	139°00.7	·· 34.4	343°12.0	11.3′	01°07.4	17.3′	60.0′
22	154°00.8	35.3	357°42.3	11.3′	01°24.7	17.3′	60.0′
23	169°00.9	36.1	12°12.6	11.3′	01°42.0	17.3′	59.9′
	SD = 16.1′	d = -0.9′	SD = 16.4′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	184°00.9	S12°37.0	26°42.9	11.3′	N01°59.3	17.2′	59.9′
1	199°01.0	37.8	41°13.1	11.3′	02°16.5	17.3′	59.9′
2	214°01.1	38.7	55°43.4	11.3′	02°33.8	17.2′	59.9′
3	229°01.1	·· 39.5	70°13.7	11.3′	02°51.0	17.3′	59.9′
4	244°01.2	40.4	84°44.0	11.3′	03°08.3	17.2′	59.9′
5	259°01.2	41.2	99°14.2	11.2′	03°25.5	17.1′	59.9′
6	274°01.3	S12°42.0	113°44.4	11.2′	N03°42.6	17.2′	59.9′
7	289°01.4	42.9	128°14.7	11.2′	03°59.8	17.1′	59.9′
8	304°01.4	43.7	142°44.9	11.2′	04°16.9	17.1′	59.9′
9	319°01.5	·· 44.6	157°15.1	11.2′	04°34.0	17.1′	59.9′
10	334°01.5	45.4	171°45.3	11.2′	04°51.1	17.0′	59.8′
11	349°01.6	46.3	186°15.4	11.2′	05°08.1	17.0′	59.8′
12	4°01.7	S12°47.1	200°45.6	11.1′	N05°25.1	17.0′	59.8′
13	19°01.7	48.0	215°15.7	11.1′	05°42.1	16.9′	59.8′
14	34°01.8	48.8	229°45.9	11.1′	05°59.0	16.9′	59.8′
15	49°01.8	·· 49.7	244°15.9	11.1′	06°15.9	16.8′	59.8′
16	64°01.9	50.5	258°46.0	11.0′	06°32.7	16.9′	59.8′
17	79°02.0	51.3	273°16.1	11.0′	06°49.6	16.7′	59.8′
18	94°02.0	S12°52.2	287°46.1	11.0′	N07°06.3	16.7′	59.7′
19	109°02.1	53.0	302°16.1	11.0′	07°23.0	16.7′	59.7′
20	124°02.1	53.9	316°46.1	10.9′	07°39.7	16.7′	59.7′
21	139°02.2	·· 54.7	331°16.0	10.9′	07°56.4	16.5′	59.7′
22	154°02.2	55.6	345°45.9	10.9′	08°12.9	16.6′	59.7′
23	169°02.3	56.4	0°15.8	10.9′	08°29.5	16.4′	59.7′
	SD = 16.1′	d = -0.8′	SD = 16.3′				

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

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

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 11-13 81-95%
25	15:50	15:54	11:44	21:20	08:55	
26	15:57	16:01	11:44	22:09	09:45	
27	16:04	16:07	11:44	22:59	10:34	

October 28, 29, 30 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	36°05.0	227°04.5	N04°59.4	177°40.6	S14°58.4	356°42.8	N13°53.1	62°49.6	S12°54.5
1	51°07.5	242°04.5	58.6	192°41.4	59.0	11°45.6	53.0	77°52.1	54.5
2	66°09.9	257°04.5	57.9	207°42.2	14°59.5	26°48.4	52.9	92°54.6	54.5
3	81°12.4	272°04.5	·· 57.1	222°42.9	15°00.1	41°51.2	·· 52.8	107°57.1	·· 54.5
4	96°14.9	287°04.5	56.3	237°43.7	00.6	56°54.0	52.7	122°59.6	54.6
5	111°17.3	302°04.5	55.5	252°44.5	01.2	71°56.8	52.6	138°02.1	54.6
6	126°19.8	317°04.5	N04°54.7	267°45.3	S15°01.8	86°59.6	N13°52.5	153°04.6	S12°54.6
7	141°22.3	332°04.5	53.9	282°46.1	02.3	102°02.3	52.4	168°07.1	54.6
8	156°24.7	347°04.5	53.1	297°46.8	02.9	117°05.1	52.3	183°09.6	54.6
9	171°27.2	2°04.6	·· 52.3	312°47.6	·· 03.4	132°07.9	·· 52.2	198°12.1	·· 54.6
10	186°29.6	17°04.6	51.5	327°48.4	04.0	147°10.7	52.1	213°14.6	54.6
11	201°32.1	32°04.6	50.7	342°49.2	04.5	162°13.5	52.0	228°17.1	54.6
12	216°34.6	47°04.6	N04°49.9	357°49.9	S15°05.1	177°16.3	N13°51.9	243°19.6	S12°54.6
13	231°37.0	62°04.6	49.2	12°50.7	05.7	192°19.1	51.8	258°22.0	54.6
14	246°39.5	77°04.6	48.4	27°51.5	06.2	207°21.9	51.7	273°24.5	54.6
15	261°42.0	92°04.6	·· 47.6	42°52.3	·· 06.8	222°24.7	·· 51.6	288°27.0	·· 54.6
16	276°44.4	107°04.6	46.8	57°53.0	07.3	237°27.5	51.5	303°29.5	54.6
17	291°46.9	122°04.6	46.0	72°53.8	07.9	252°30.3	51.4	318°32.0	54.6
18	306°49.4	137°04.6	N04°45.2	87°54.6	S15°08.4	267°33.1	N13°51.3	333°34.5	S12°54.6
19	321°51.8	152°04.6	44.4	102°55.4	09.0	282°35.9	51.2	348°37.0	54.6
20	336°54.3	167°04.6	43.6	117°56.1	09.6	297°38.7	51.1	3°39.5	54.7
21	351°56.7	182°04.6	·· 42.8	132°56.9	·· 10.1	312°41.5	·· 51.0	18°42.0	·· 54.7
22	6°59.2	197°04.6	42.0	147°57.7	10.7	327°44.3	50.9	33°44.5	54.7
23	22°01.7	212°04.6	41.2	162°58.5	11.2	342°47.1	50.8	48°47.0	54.7
Mer.pass. 21:32		ν 0.0′	d -0.8′	m -4.46	ν 0.8′	d -0.6′	m 1.50	ν 2.8′	d -0.1′ m -2.91	ν 2.5′	d -0.0′ m 0.71

Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	37°04.1	227°04.6	N04°40.4	177°59.2	S15°11.8	357°49.8	N13°50.7	63°49.5	S12°54.7
1	52°06.6	242°04.6	39.6	193°00.0	12.3	12°52.6	50.6	78°52.0	54.7
2	67°09.1	257°04.6	38.8	208°00.8	12.9	27°55.4	50.5	93°54.4	54.7
3	82°11.5	272°04.6	·· 38.0	223°01.6	·· 13.5	42°58.2	·· 50.4	108°56.9	·· 54.7
4	97°14.0	287°04.6	37.2	238°02.3	14.0	58°01.0	50.3	123°59.4	54.7
5	112°16.5	302°04.6	36.4	253°03.1	14.6	73°03.8	50.2	139°01.9	54.7
6	127°18.9	317°04.5	N04°35.6	268°03.9	S15°15.1	88°06.6	N13°50.1	154°04.4	S12°54.7
7	142°21.4	332°04.5	34.7	283°04.6	15.7	103°09.4	50.0	169°06.9	54.7
8	157°23.9	347°04.5	33.9	298°05.4	16.2	118°12.2	49.9	184°09.4	54.7
9	172°26.3	2°04.5	·· 33.1	313°06.2	·· 16.8	133°15.0	·· 49.8	199°11.9	·· 54.7
10	187°28.8	17°04.5	32.3	328°07.0	17.3	148°17.8	49.7	214°14.4	54.7
11	202°31.2	32°04.5	31.5	343°07.7	17.9	163°20.6	49.6	229°16.9	54.7
12	217°33.7	47°04.5	N04°30.7	358°08.5	S15°18.4	178°23.4	N13°49.5	244°19.4	S12°54.7
13	232°36.2	62°04.5	29.9	13°09.3	19.0	193°26.2	49.4	259°21.8	54.7
14	247°38.6	77°04.5	29.1	28°10.0	19.5	208°29.0	49.3	274°24.3	54.7
15	262°41.1	92°04.5	·· 28.3	43°10.8	·· 20.1	223°31.8	·· 49.2	289°26.8	·· 54.7
16	277°43.6	107°04.5	27.5	58°11.6	20.6	238°34.6	49.1	304°29.3	54.8
17	292°46.0	122°04.5	26.7	73°12.4	21.2	253°37.4	49.0	319°31.8	54.8
18	307°48.5	137°04.5	N04°25.8	88°13.1	S15°21.8	268°40.2	N13°48.9	334°34.3	S12°54.8
19	322°51.0	152°04.4	25.0	103°13.9	22.3	283°42.9	48.8	349°36.8	54.8
20	337°53.4	167°04.4	24.2	118°14.7	22.9	298°45.7	48.7	4°39.3	54.8
21	352°55.9	182°04.4	·· 23.4	133°15.4	·· 23.4	313°48.5	·· 48.6	19°41.8	·· 54.8
22	7°58.4	197°04.4	22.6	148°16.2	24.0	328°51.3	48.5	34°44.2	54.8
23	23°00.8	212°04.4	21.8	163°17.0	24.5	343°54.1	48.4	49°46.7	54.8
Mer.pass. 21:28		ν -0.0′	d -0.8′	m -4.46	ν 0.8′	d -0.6′	m 1.49	ν 2.8′	d -0.1′ m -2.91	ν 2.5′	d -0.0′ m 0.72

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	38°03.3	227°04.4	N04°21.0	178°17.7	S15°25.1	358°56.9	N13°48.3	64°49.2	S12°54.8
1	53°05.7	242°04.4	20.1	193°18.5	25.6	13°59.7	48.1	79°51.7	54.8
2	68°08.2	257°04.4	19.3	208°19.3	26.2	29°02.5	48.0	94°54.2	54.8
3	83°10.7	272°04.3	·· 18.5	223°20.0	·· 26.7	44°05.3	·· 47.9	109°56.7	·· 54.8
4	98°13.1	287°04.3	17.7	238°20.8	27.3	59°08.1	47.8	124°59.2	54.8
5	113°15.6	302°04.3	16.9	253°21.6	27.8	74°10.9	47.7	140°01.7	54.8
6	128°18.1	317°04.3	N04°16.1	268°22.3	S15°28.4	89°13.7	N13°47.6	155°04.1	S12°54.8
7	143°20.5	332°04.3	15.2	283°23.1	28.9	104°16.5	47.5	170°06.6	54.8
8	158°23.0	347°04.3	14.4	298°23.9	29.5	119°19.3	47.4	185°09.1	54.8
9	173°25.5	2°04.3	·· 13.6	313°24.6	·· 30.0	134°22.1	·· 47.3	200°11.6	·· 54.8
10	188°27.9	17°04.2	12.8	328°25.4	30.6	149°24.9	47.2	215°14.1	54.8
11	203°30.4	32°04.2	12.0	343°26.2	31.1	164°27.7	47.1	230°16.6	54.8
12	218°32.8	47°04.2	N04°11.1	358°26.9	S15°31.7	179°30.5	N13°47.0	245°19.1	S12°54.8
13	233°35.3	62°04.2	10.3	13°27.7	32.2	194°33.3	46.9	260°21.5	54.8
14	248°37.8	77°04.2	09.5	28°28.5	32.8	209°36.1	46.8	275°24.0	54.8
15	263°40.2	92°04.1	·· 08.7	43°29.2	·· 33.3	224°38.9	·· 46.7	290°26.5	·· 54.8
16	278°42.7	107°04.1	07.8	58°30.0	33.9	239°41.7	46.6	305°29.0	54.8
17	293°45.2	122°04.1	07.0	73°30.8	34.4	254°44.5	46.5	320°31.5	54.8
18	308°47.6	137°04.1	N04°06.2	88°31.5	S15°34.9	269°47.2	N13°46.4	335°34.0	S12°54.8
19	323°50.1	152°04.1	05.4	103°32.3	35.5	284°50.0	46.3	350°36.4	54.8
20	338°52.6	167°04.0	04.5	118°33.0	36.0	299°52.8	46.2	5°38.9	54.8
21	353°55.0	182°04.0	·· 03.7	133°33.8	·· 36.6	314°55.6	·· 46.1	20°41.4	·· 54.9
22	8°57.5	197°04.0	02.9	148°34.6	37.1	329°58.4	46.0	35°43.9	54.9
23	24°00.0	212°04.0	02.1	163°35.3	37.7	345°01.2	45.9	50°46.4	54.9
Mer.pass. 21:24		ν -0.0′	d -0.8′	m -4.45	ν 0.8′	d -0.6′	m 1.49	ν 2.8′	d -0.1′ m -2.91	ν 2.5′	d -0.0′ m 0.72

Stars	SHA	Dec
Alpheratz	357°35.5	29°13.5
Ankaa	353°07.8	-42°10.7
Schedar	349°31.7	56°40.2
Diphda	348°48.0	-17°51.3
Achernar	335°20.3	-57°07.0
Hamal	327°52.0	23°34.6
Polaris	314°03.6	89°21.8
Acamar	315°12.1	-40°12.4
Menkar	314°06.9	4°11.1
Mirfak	308°29.2	49°56.7
Aldebaran	290°40.5	16°33.5
Rigel	281°04.6	-8°10.3
Capella	280°23.1	46°01.2
Bellatrix	278°23.7	6°22.4
Elnath	278°02.9	28°37.6
Alnilam	275°38.5	-1°11.1
Betelgeuse	270°53.0	7°24.8
Canopus	263°52.6	-52°42.1
Sirius	258°27.0	-16°44.7
Adhara	255°06.5	-29°00.0
Procyon	244°51.8	5°10.0
Pollux	243°18.5	27°58.1
Avior	234°15.2	-59°34.7
Suhail	222°47.2	-43°31.3
Miaplacidus	221°38.7	-69°48.5
Alphard	217°48.8	-8°45.5
Regulus	207°35.7	11°51.2
Dubhe	193°42.7	61°37.2
Denebola	182°26.2	14°26.4
Gienah	175°44.9	-17°40.2
Acrux	173°01.9	-63°13.6
Gacrux	171°53.3	-57°14.5
Alioth	166°14.4	55°49.8
Spica	158°23.7	-11°17.0
Alkaid	152°53.3	49°11.7
Hadar	148°38.2	-60°29.1
Menkent	147°59.2	-36°29.1
Arcturus	145°49.2	19°03.6
Rigil Kent.	139°42.4	-60°55.9
Kochab	137°20.9	74°03.5
Zuben'ubi	136°57.5	-16°08.3
Alphecca	126°05.0	26°38.2
Antares	112°17.4	-26°29.1
Atria	107°13.0	-69°04.3
Sabik	102°04.2	-15°45.2
Shaula	96°12.0	-37°07.3
Rasalhague	95°59.7	12°32.7
Eltanin	90°43.0	51°29.3
Kaus Aust.	83°34.1	-34°22.5
Vega	80°34.1	38°48.5
Nunki	75°49.2	-26°16.1
Altair	62°01.0	8°56.0
Peacock	53°07.3	-56°39.7
Deneb	49°26.5	45°22.1
Enif	33°39.7	9°59.1
Al Na'ir	27°34.0	-46°50.9
Fomalhaut	15°15.4	-29°29.9
Scheat	13°46.0	28°12.9
Markab	13°30.7	15°20.1

Oct 28 Sat	**SHA**	**Mer.pass**
Venus	190°59.5	08:52
Mars	141°35.6	12:09
Jupiter	320°37.8	00:13
Saturn	26°44.6	19:45

Oct 29 Sun	**SHA**	**Mer.pass**
Venus	190°00.4	08:52
Mars	140°55.1	12:07
Jupiter	320°45.7	00:09
Saturn	26°45.3	19:41

Oct 30 Mon	**SHA**	**Mer.pass**
Venus	189°01.1	08:52
Mars	140°14.5	12:06
Jupiter	320°53.6	00:04
Saturn	26°45.9	19:37

Horizontal parallax	
Venus:	0.2
Mars:	0.1

h	Sun		Moon				
Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	184°02.3	S12°57.2	14°45.7	10.8′	N08°45.9	16.4′	59.6′
1	199°02.4	58.1	29°15.5	10.8′	09°02.3	16.4′	59.6′
2	214°02.5	58.9	43°45.3	10.8′	09°18.7	16.3′	59.6′
3	229°02.5	12°59.8	58°15.1	10.7′	09°35.0	16.2′	59.6′
4	244°02.6	13°00.6	72°44.8	10.7′	09°51.2	16.2′	59.6′
5	259°02.6	01.4	87°14.5	10.7′	10°07.4	16.1′	59.6′
6	274°02.7	S13°02.3	101°44.2	10.6′	N10°23.5	16.1′	59.5′
7	289°02.7	03.1	116°13.8	10.6′	10°39.6	16.0′	59.5′
8	304°02.8	04.0	130°43.4	10.6′	10°55.6	15.9′	59.5′
9	319°02.8	·· 04.8	145°12.9	10.5′	11°11.5	15.8′	59.5′
10	334°02.9	05.6	159°42.4	10.5′	11°27.3	15.8′	59.5′
11	349°02.9	06.5	174°11.9	10.4′	11°43.1	15.7′	59.4′
12	4°03.0	S13°07.3	188°41.4	10.4′	N11°58.8	15.6′	59.4′
13	19°03.0	08.1	203°10.7	10.3′	12°14.4	15.5′	59.4′
14	34°03.1	09.0	217°40.1	10.3′	12°29.9	15.5′	59.4′
15	49°03.1	·· 09.8	232°09.4	10.3′	12°45.4	15.4′	59.4′
16	64°03.2	10.6	246°38.7	10.2′	13°00.8	15.3′	59.3′
17	79°03.2	11.5	261°07.9	10.2′	13°16.1	15.2′	59.3′
18	94°03.3	S13°12.3	275°37.0	10.1′	N13°31.3	15.1′	59.3′
19	109°03.3	13.1	290°06.2	10.1′	13°46.4	15.1′	59.3′
20	124°03.4	14.0	304°35.3	10.0′	14°01.5	15.0′	59.2′
21	139°03.4	·· 14.8	319°04.3	10.0′	14°16.5	14.8′	59.2′
22	154°03.5	15.6	333°33.3	9.9′	14°31.3	14.8′	59.2′
23	169°03.5	16.5	348°02.2	9.9′	14°46.1	14.7′	59.2′
	SD = 16.1′	d = -0.8′	SD = 16.3′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	184°03.6	S13°17.3	2°31.1	9.8′	N15°00.8	14.6′	59.2′
1	199°03.6	18.1	17°00.0	9.8′	15°15.4	14.5′	59.1′
2	214°03.7	19.0	31°28.7	9.7′	15°29.9	14.4′	59.1′
3	229°03.7	·· 19.8	45°57.5	9.7′	15°44.3	14.3′	59.1′
4	244°03.8	20.6	60°26.2	9.6′	15°58.6	14.2′	59.1′
5	259°03.8	21.5	74°54.8	9.6′	16°12.8	14.1′	59.0′
6	274°03.9	S13°22.3	89°23.4	9.5′	N16°26.9	14.0′	59.0′
7	289°03.9	23.1	103°52.0	9.5′	16°40.9	13.8′	59.0′
8	304°03.9	24.0	118°20.5	9.4′	16°54.7	13.8′	58.9′
9	319°04.0	·· 24.8	132°48.9	9.4′	17°08.5	13.7′	58.9′
10	334°04.0	25.6	147°17.3	9.3′	17°22.2	13.6′	58.9′
11	349°04.1	26.4	161°45.6	9.3′	17°35.8	13.4′	58.9′
12	4°04.1	S13°27.3	176°13.9	9.2′	N17°49.2	13.4′	58.8′
13	19°04.2	28.1	190°42.1	9.2′	18°02.6	13.2′	58.8′
14	34°04.2	28.9	205°10.3	9.1′	18°15.8	13.1′	58.8′
15	49°04.2	·· 29.8	219°38.4	9.1′	18°28.9	13.0′	58.8′
16	64°04.3	30.6	234°06.5	9.0′	18°41.9	12.9′	58.7′
17	79°04.3	31.4	248°34.5	9.0′	18°54.8	12.7′	58.7′
18	94°04.4	S13°32.2	263°02.5	8.9′	N19°07.5	12.7′	58.7′
19	109°04.4	33.1	277°30.4	8.9′	19°20.2	12.5′	58.6′
20	124°04.5	33.9	291°58.2	8.8′	19°32.7	12.4′	58.6′
21	139°04.5	·· 34.7	306°26.0	8.7′	19°45.1	12.3′	58.6′
22	154°04.5	35.5	320°53.8	8.7′	19°57.4	12.1′	58.5′
23	169°04.6	36.4	335°21.5	8.6′	20°09.5	12.0′	58.5′
	SD = 16.1′	d = -0.8′	SD = 16.1′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	184°04.6	S13°37.2	349°49.1	8.6′	N20°21.5	11.9′	58.5′
1	199°04.7	38.0	4°16.7	8.5′	20°33.4	11.8′	58.5′
2	214°04.7	38.8	18°44.2	8.5′	20°45.2	11.6′	58.4′
3	229°04.7	·· 39.6	33°11.7	8.4′	20°56.8	11.5′	58.4′
4	244°04.8	40.5	47°39.2	8.4′	21°08.3	11.4′	58.4′
5	259°04.8	41.3	62°06.6	8.3′	21°19.7	11.2′	58.3′
6	274°04.8	S13°42.1	76°33.9	8.3′	N21°30.9	11.1′	58.3′
7	289°04.9	42.9	91°01.2	8.2′	21°42.0	10.9′	58.3′
8	304°04.9	43.8	105°28.4	8.2′	21°52.9	10.9′	58.2′
9	319°05.0	·· 44.6	119°55.6	8.1′	22°03.8	10.6′	58.2′
10	334°05.0	45.4	134°22.7	8.1′	22°14.4	10.6′	58.2′
11	349°05.0	46.2	148°49.8	8.0′	22°25.0	10.4′	58.1′
12	4°05.1	S13°47.0	163°16.8	8.0′	N22°35.4	10.3′	58.1′
13	19°05.1	47.8	177°43.8	7.9′	22°45.7	10.1′	58.1′
14	34°05.1	48.7	192°10.8	7.9′	22°55.8	9.9′	58.1′
15	49°05.2	·· 49.5	206°37.7	7.8′	23°05.7	9.9′	58.0′
16	64°05.2	50.3	221°04.5	7.8′	23°15.6	9.7′	58.0′
17	79°05.2	51.1	235°31.3	7.8′	23°25.3	9.5′	58.0′
18	94°05.3	S13°51.9	249°58.1	7.7′	N23°34.8	9.4′	57.9′
19	109°05.3	52.8	264°24.8	7.7′	23°44.2	9.2′	57.9′
20	124°05.3	53.6	278°51.5	7.6′	23°53.4	9.1′	57.9′
21	139°05.4	·· 54.4	293°18.1	7.6′	24°02.5	9.0′	57.8′
22	154°05.4	55.2	307°44.7	7.6′	24°11.5	8.8′	57.8′
23	169°05.4	56.0	322°11.2	7.5′	24°20.3	8.6′	57.8′
	SD = 16.1′	d = -0.8′	SD = 16.0′				

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

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

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 14-16 99-98%
28	16:09	16:12	11:44	23:50	11:24	
29	16:14	16:16	11:44	–:–	12:16	
30	16:18	16:20	11:44	00:42	13:09	

October 31, 01, 02 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	39°02.4	227°04.0	N04°01.2	178°36.1	S15°38.2	0°04.0	N13°45.8	65°48.9	S12°54.9
1	54°04.9	242°03.9	04°00.4	193°36.9	38.8	15°06.8	45.7	80°51.4	54.9
2	69°07.3	257°03.9	03°59.6	208°37.6	39.3	30°09.6	45.6	95°53.8	54.9
3	84°09.8	272°03.9	·· 58.7	223°38.4	·· 39.9	45°12.4	·· 45.5	110°56.3	·· 54.9
4	99°12.3	287°03.9	57.9	238°39.1	40.4	60°15.2	45.4	125°58.8	54.9
5	114°14.7	302°03.8	57.1	253°39.9	41.0	75°18.0	45.3	141°01.3	54.9
6	129°17.2	317°03.8	N03°56.2	268°40.7	S15°41.5	90°20.8	N13°45.2	156°03.8	S12°54.9
7	144°19.7	332°03.8	55.4	283°41.4	42.1	105°23.6	45.1	171°06.2	54.9
8	159°22.1	347°03.8	54.6	298°42.2	42.6	120°26.4	45.0	186°08.7	54.9
9	174°24.6	2°03.7	·· 53.7	313°42.9	·· 43.1	135°29.2	·· 44.9	201°11.2	·· 54.9
10	189°27.1	17°03.7	52.9	328°43.7	43.7	150°32.0	44.8	216°13.7	54.9
11	204°29.5	32°03.7	52.1	343°44.5	44.2	165°34.8	44.7	231°16.2	54.9
12	219°32.0	47°03.6	N03°51.2	358°45.2	S15°44.8	180°37.6	N13°44.6	246°18.7	S12°54.9
13	234°34.5	62°03.6	50.4	13°46.0	45.3	195°40.4	44.5	261°21.1	54.9
14	249°36.9	77°03.6	49.6	28°46.7	45.9	210°43.2	44.4	276°23.6	54.9
15	264°39.4	92°03.6	·· 48.7	43°47.5	·· 46.4	225°46.0	·· 44.3	291°26.1	·· 54.9
16	279°41.8	107°03.5	47.9	58°48.3	46.9	240°48.8	44.2	306°28.6	54.9
17	294°44.3	122°03.5	47.0	73°49.0	47.5	255°51.6	44.1	321°31.1	54.9
18	309°46.8	137°03.5	N03°46.2	88°49.8	S15°48.0	270°54.4	N13°44.0	336°33.5	S12°54.9
19	324°49.2	152°03.4	45.4	103°50.5	48.6	285°57.2	43.9	351°36.0	54.9
20	339°51.7	167°03.4	44.5	118°51.3	49.1	301°00.0	43.8	6°38.5	54.9
21	354°54.2	182°03.4	·· 43.7	133°52.0	·· 49.7	316°02.8	·· 43.6	21°41.0	·· 54.9
22	9°56.6	197°03.3	42.8	148°52.8	50.2	331°05.6	43.5	36°43.5	54.9
23	24°59.1	212°03.3	42.0	163°53.6	50.7	346°08.4	43.4	51°45.9	54.9
Mer.pass. 21:20		ν -0.0′	d -0.8′	m -4.44	ν 0.8′	d -0.5′	m 1.48	ν 2.8′	d -0.1′ m -2.91
								ν 2.5′	d -0.0′ m 0.73

Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	40°01.6	227°03.3	N03°41.2	178°54.3	S15°51.3	1°11.1	N13°43.3	66°48.4	S12°54.9
1	55°04.0	242°03.2	40.3	193°55.1	51.8	16°13.9	43.2	81°50.9	54.9
2	70°06.5	257°03.2	39.5	208°55.8	52.4	31°16.7	43.1	96°53.4	54.9
3	85°09.0	272°03.2	·· 38.6	223°56.6	·· 52.9	46°19.5	·· 43.0	111°55.9	·· 54.9
4	100°11.4	287°03.1	37.8	238°57.3	53.5	61°22.3	42.9	126°58.3	54.9
5	115°13.9	302°03.1	36.9	253°58.1	54.0	76°25.1	42.8	142°00.8	54.9
6	130°16.3	317°03.1	N03°36.1	268°58.9	S15°54.5	91°27.9	N13°42.7	157°03.3	S12°54.9
7	145°18.8	332°03.0	35.2	283°59.6	55.1	106°30.7	42.6	172°05.8	54.9
8	160°21.3	347°03.0	34.4	299°00.4	55.6	121°33.5	42.5	187°08.3	54.9
9	175°23.7	2°03.0	·· 33.5	314°01.1	·· 56.2	136°36.3	·· 42.4	202°10.7	·· 54.9
10	190°26.2	17°02.9	32.7	329°01.9	56.7	151°39.1	42.3	217°13.2	54.9
11	205°28.7	32°02.9	31.8	344°02.6	57.2	166°41.9	42.2	232°15.7	54.9
12	220°31.1	47°02.8	N03°31.0	359°03.4	S15°57.8	181°44.7	N13°42.1	247°18.2	S12°54.9
13	235°33.6	62°02.8	30.2	14°04.1	58.3	196°47.5	42.0	262°20.6	54.9
14	250°36.1	77°02.8	29.3	29°04.9	58.9	211°50.3	41.9	277°23.1	54.9
15	265°38.5	92°02.7	·· 28.4	44°05.6	·· 59.4	226°53.1	·· 41.8	292°25.6	·· 54.9
16	280°41.0	107°02.7	27.6	59°06.4	15°59.9	241°55.9	41.7	307°28.1	54.9
17	295°43.5	122°02.7	26.7	74°07.1	16°00.5	256°58.7	41.6	322°30.6	54.9
18	310°45.9	137°02.6	N03°25.9	89°07.9	S16°01.0	272°01.5	N13°41.5	337°33.0	S12°54.9
19	325°48.4	152°02.6	25.0	104°08.6	01.5	287°04.3	41.4	352°35.5	54.9
20	340°50.8	167°02.5	24.2	119°09.4	02.1	302°07.1	41.3	7°38.0	54.9
21	355°53.3	182°02.5	·· 23.3	134°10.2	·· 02.6	317°09.9	·· 41.2	22°40.5	·· 54.9
22	10°55.8	197°02.4	22.5	149°10.9	03.2	332°12.7	41.1	37°42.9	54.9
23	25°58.2	212°02.4	21.6	164°11.7	03.7	347°15.5	41.0	52°45.4	54.9
Mer.pass. 21:16		ν -0.0′	d -0.8′	m -4.43	ν 0.8′	d -0.5′	m 1.47	ν 2.8′	d -0.1′ m -2.91
								ν 2.5′	d -0.0′ m 0.73

Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	41°00.7	227°02.4	N03°20.8	179°12.4	S16°04.2	2°18.3	N13°40.9	67°47.9	S12°54.9
1	56°03.2	242°02.3	19.9	194°13.2	04.8	17°21.1	40.8	82°50.4	54.9
2	71°05.6	257°02.3	19.1	209°13.9	05.3	32°23.9	40.7	97°52.8	54.9
3	86°08.1	272°02.2	·· 18.2	224°14.7	·· 05.8	47°26.7	·· 40.6	112°55.3	·· 54.9
4	101°10.6	287°02.2	17.3	239°15.4	06.4	62°29.5	40.5	127°57.8	54.9
5	116°13.0	302°02.1	16.5	254°16.2	06.9	77°32.3	40.4	143°00.3	54.9
6	131°15.5	317°02.1	N03°15.6	269°16.9	S16°07.5	92°35.1	N13°40.3	158°02.7	S12°54.9
7	146°17.9	332°02.1	14.8	284°17.7	08.0	107°37.9	40.2	173°05.2	54.9
8	161°20.4	347°02.0	13.9	299°18.4	08.5	122°40.7	40.1	188°07.7	54.9
9	176°22.9	2°02.0	·· 13.0	314°19.2	·· 09.1	137°43.5	·· 40.0	203°10.2	·· 54.9
10	191°25.3	17°01.9	12.2	329°19.9	09.6	152°46.3	39.9	218°12.6	54.9
11	206°27.8	32°01.9	11.3	344°20.6	10.1	167°49.1	39.8	233°15.1	54.9
12	221°30.3	47°01.8	N03°10.5	359°21.4	S16°10.7	182°51.9	N13°39.7	248°17.6	S12°54.9
13	236°32.7	62°01.8	09.6	14°22.1	11.2	197°54.6	39.5	263°20.0	54.9
14	251°35.2	77°01.7	08.7	29°22.9	11.7	212°57.4	39.4	278°22.5	54.9
15	266°37.7	92°01.7	·· 07.9	44°23.6	·· 12.3	228°00.2	·· 39.3	293°25.0	·· 54.9
16	281°40.1	107°01.6	07.0	59°24.4	12.8	243°03.0	39.2	308°27.5	54.9
17	296°42.6	122°01.6	06.1	74°25.1	13.3	258°05.8	39.1	323°29.9	54.9
18	311°45.1	137°01.5	N03°05.3	89°25.9	S16°13.9	273°08.6	N13°39.0	338°32.4	S12°54.9
19	326°47.5	152°01.5	04.4	104°26.6	14.4	288°11.4	38.9	353°34.9	54.9
20	341°50.0	167°01.4	03.6	119°27.4	14.9	303°14.2	38.8	8°37.4	54.9
21	356°52.4	182°01.4	·· 02.7	134°28.1	·· 15.5	318°17.0	·· 38.7	23°39.8	·· 54.9
22	11°54.9	197°01.3	01.8	149°28.9	16.0	333°19.8	38.6	38°42.3	54.9
23	26°57.4	212°01.3	01.0	164°29.6	16.5	348°22.6	38.5	53°44.8	54.9
Mer.pass. 21:12		ν -0.0′	d -0.9′	m -4.42	ν 0.8′	d -0.5′	m 1.47	ν 2.8′	d -0.1′ m -2.91
								ν 2.5′	d 0.0′ m 0.74

Stars

	SHA	**Dec**
Alpheratz	357°35.5	29°13.5
Ankaa	353°07.8	-42°10.7
Schedar	349°31.7	56°40.2
Diphda	348°48.0	-17°51.3
Achernar	335°20.3	-57°07.0
Hamal	327°52.0	23°34.6
Polaris	314°02.8	89°21.8
Acamar	315°12.1	-40°12.5
Menkar	314°06.9	4°11.1
Mirfak	308°29.2	49°56.7
Aldebaran	290°40.5	16°33.5
Rigel	281°04.6	-8°10.3
Capella	280°23.0	46°01.2
Bellatrix	278°23.7	6°22.4
Elnath	278°02.9	28°37.6
Alnilam	275°38.5	-1°11.1
Betelgeuse	270°53.0	7°24.8
Canopus	263°52.5	-52°42.1
Sirius	258°27.0	-16°44.7
Adhara	255°06.5	-29°00.0
Procyon	244°51.8	5°10.0
Pollux	243°18.5	27°58.1
Avior	234°15.1	-59°34.7
Suhail	222°47.1	-43°31.3
Miaplacidus	221°38.6	-69°48.5
Alphard	217°48.8	-8°45.5
Regulus	207°35.6	11°51.1
Dubhe	193°42.6	61°37.2
Denebola	182°26.2	14°26.4
Gienah	175°44.9	-17°40.2
Acrux	173°01.9	-63°13.6
Gacrux	171°53.3	-57°14.5
Alioth	166°14.4	55°49.8
Spica	158°23.7	-11°17.0
Alkaid	152°53.3	49°11.7
Hadar	148°38.1	-60°29.1
Menkent	147°59.2	-36°29.1
Arcturus	145°49.2	19°03.6
Rigil Kent.	139°42.4	-60°55.9
Kochab	137°20.9	74°03.5
Zuben'ubi	136°57.5	-16°08.3
Alphecca	126°05.0	26°38.2
Antares	112°17.4	-26°29.0
Atria	107°13.0	-69°04.3
Sabik	102°04.2	-15°45.2
Shaula	96°12.1	-37°07.3
Rasalhague	95°59.7	12°32.7
Eltanin	90°43.0	51°29.3
Kaus Aust.	83°34.1	-34°22.5
Vega	80°34.1	38°48.5
Nunki	75°49.2	-26°16.1
Altair	62°01.0	8°56.0
Peacock	53°07.4	-56°39.7
Deneb	49°26.5	45°22.2
Enif	33°39.7	9°59.2
Al Na'ir	27°34.0	-46°50.9
Fomalhaut	15°15.4	-29°29.9
Scheat	13°46.0	28°12.9
Markab	13°30.7	15°20.1

Oct 31 Tue	**SHA**	**Mer.pass**
Venus	188°01.5	08:52
Mars	139°33.7	12:05
Jupiter	321°01.6	23:55
Saturn	26°46.4	19:34

Nov 01 Wed	**SHA**	**Mer.pass**
Venus	187°01.7	08:52
Mars	138°52.8	12:04
Jupiter	321°09.6	23:51
Saturn	26°46.9	19:30

Nov 02 Thu	**SHA**	**Mer.pass**
Venus	186°01.7	08:52
Mars	138°11.7	12:03
Jupiter	321°17.6	23:46
Saturn	26°47.2	19:26

Horizontal parallax	
Venus:	0.2
Mars:	0.1

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	184°05.5	**S**13°56.8	336°37.8	7.5′	**N**24°28.9	8.5′	57.7′
1	199°05.5	57.6	351°04.2	7.4′	24°37.4	8.3′	57.7′
2	214°05.5	58.5	5°30.7	7.4′	24°45.7	8.2′	57.7′
3	229°05.5	13°59.3	19°57.1	7.4′	24°53.9	8.0′	57.6′
4	244°05.6	14°00.1	34°23.4	7.3′	25°01.9	7.9′	57.6′
5	259°05.6	00.9	48°49.8	7.3′	25°09.8	7.7′	57.6′
6	274°05.6	**S**14°01.7	63°16.1	7.3′	**N**25°17.5	7.6′	57.5′
7	289°05.7	02.5	77°42.4	7.2′	25°25.1	7.4′	57.5′
8	304°05.7	03.3	92°08.6	7.2′	25°32.5	7.2′	57.5′
9	319°05.7	·· 04.1	106°34.8	7.2′	25°39.7	7.1′	57.4′
10	334°05.8	05.0	121°01.0	7.2′	25°46.8	6.9′	57.4′
11	349°05.8	05.8	135°27.2	7.1′	25°53.7	6.8′	57.4′
12	4°05.8	**S**14°06.6	149°53.3	7.1′	**N**26°00.5	6.6′	57.3′
13	19°05.8	07.4	164°19.4	7.1′	26°07.1	6.4′	57.3′
14	34°05.9	08.2	178°45.5	7.1′	26°13.5	6.3′	57.3′
15	49°05.9	·· 09.0	193°11.6	7.1′	26°19.8	6.1′	57.2′
16	64°05.9	09.8	207°37.6	7.0′	26°25.9	6.0′	57.2′
17	79°05.9	10.6	222°03.7	7.0′	26°31.9	5.8′	57.2′
18	94°06.0	**S**14°11.4	236°29.7	7.0′	**N**26°37.7	5.6′	57.1′
19	109°06.0	12.2	250°55.7	7.0′	26°43.3	5.5′	57.1′
20	124°06.0	13.0	265°21.7	7.0′	26°48.8	5.3′	57.1′
21	139°06.0	·· 13.8	279°47.6	7.0′	26°54.1	5.2′	57.0′
22	154°06.1	14.6	294°13.6	7.0′	26°59.3	5.0′	57.0′
23	169°06.1	15.5	308°39.6	6.9′	27°04.3	4.8′	57.0′
	SD = 16.1′	d = -0.8′	SD = 15.7′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	184°06.1	**S**14°16.3	323°05.5	6.9′	**N**27°09.1	4.6′	56.9′
1	199°06.1	17.1	337°31.4	6.9′	27°13.7	4.5′	56.9′
2	214°06.1	17.9	351°57.4	6.9′	27°18.2	4.4′	56.8′
3	229°06.2	·· 18.7	6°23.3	6.9′	27°22.6	4.1′	56.8′
4	244°06.2	19.5	20°49.3	6.9′	27°26.7	4.0′	56.8′
5	259°06.2	20.3	35°15.2	6.9′	27°30.7	3.9′	56.7′
6	274°06.2	**S**14°21.1	49°41.1	6.9′	**N**27°34.6	3.7′	56.7′
7	289°06.3	21.9	64°07.1	6.9′	27°38.3	3.5′	56.7′
8	304°06.3	22.7	78°33.0	7.0′	27°41.8	3.3′	56.7′
9	319°06.3	·· 23.5	92°59.0	7.0′	27°45.1	3.2′	56.6′
10	334°06.3	24.3	107°24.9	7.0′	27°48.3	3.0′	56.6′
11	349°06.3	25.1	121°50.9	7.0′	27°51.3	2.9′	56.6′
12	4°06.3	**S**14°25.9	136°16.9	7.0′	**N**27°54.2	2.7′	56.5′
13	19°06.4	26.7	150°42.9	7.0′	27°56.9	2.5′	56.5′
14	34°06.4	27.5	165°08.9	7.0′	27°59.4	2.4′	56.5′
15	49°06.4	·· 28.3	179°35.0	7.1′	28°01.8	2.2′	56.4′
16	64°06.4	29.1	194°01.0	7.1′	28°04.0	2.0′	56.4′
17	79°06.4	29.9	208°27.1	7.1′	28°06.0	1.9′	56.4′
18	94°06.5	**S**14°30.7	222°53.2	7.1′	**N**28°07.9	1.7′	56.3′
19	109°06.5	31.5	237°19.3	7.1′	28°09.6	1.6′	56.3′
20	124°06.5	32.3	251°45.5	7.2′	28°11.2	1.4′	56.3′
21	139°06.5	·· 33.1	266°11.6	7.2′	28°12.6	1.2′	56.2′
22	154°06.5	33.9	280°37.8	7.2′	28°13.8	1.1′	56.2′
23	169°06.5	34.7	295°04.1	7.3′	28°14.9	0.9′	56.2′
	SD = 16.1′	d = -0.8′	SD = 15.5′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	184°06.5	**S**14°35.5	309°30.3	7.3′	**N**28°15.8	0.7′	56.1′
1	199°06.6	36.3	323°56.6	7.3′	28°16.5	0.6′	56.1′
2	214°06.6	37.1	338°23.0	7.4′	28°17.1	0.5′	56.1′
3	229°06.6	·· 37.8	352°49.3	7.4′	28°17.6	0.2′	56.0′
4	244°06.6	38.6	7°15.7	7.4′	28°17.8	0.1′	56.0′
5	259°06.6	39.4	21°42.2	7.5′	28°17.9	0.0′	56.0′
6	274°06.6	**S**14°40.2	36°08.7	7.5′	**N**28°17.9	0.2′	56.0′
7	289°06.6	41.0	50°35.2	7.6′	28°17.7	0.3′	55.9′
8	304°06.6	41.8	65°01.8	7.6′	28°17.4	0.6′	55.9′
9	319°06.7	·· 42.6	79°28.4	7.7′	28°16.8	0.6′	55.9′
10	334°06.7	43.4	93°55.1	7.7′	28°16.2	0.8′	55.8′
11	349°06.7	44.2	108°21.8	7.8′	28°15.4	1.0′	55.8′
12	4°06.7	**S**14°45.0	122°48.6	7.8′	**N**28°14.4	1.1′	55.8′
13	19°06.7	45.8	137°15.4	7.9′	28°13.3	1.3′	55.7′
14	34°06.7	46.6	151°42.3	7.9′	28°12.0	1.5′	55.7′
15	49°06.7	·· 47.4	166°09.2	8.0′	28°10.5	1.5′	55.7′
16	64°06.7	48.1	180°36.2	8.0′	28°09.0	1.8′	55.7′
17	79°06.7	48.9	195°03.2	8.1′	28°07.2	1.8′	55.6′
18	94°06.7	**S**14°49.7	209°30.3	8.2′	**N**28°05.4	2.1′	55.6′
19	109°06.8	50.5	223°57.5	8.2′	28°03.3	2.2′	55.6′
20	124°06.8	51.3	238°24.7	8.3′	28°01.1	2.3′	55.5′
21	139°06.8	·· 52.1	252°52.0	8.3′	27°58.8	2.5′	55.5′
22	154°06.8	52.9	267°19.4	8.4′	27°56.3	2.6′	55.5′
23	169°06.8	53.7	281°46.8	8.5′	27°53.7	2.7′	55.5′
	SD = 16.1′	d = -0.8′	SD = 15.3′				

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

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

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 17-19 94-81%
31	16:22	16:23	11:44	01:37	14:05	
01	16:24	16:25	11:44	02:33	15:02	
02	16:26	16:27	11:44	03:30	15:57	

November 03, 04, 05 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	41°59.8	227°01.2	N03°00.1	179°30.3	S16°17.1	3°25.4	N13°38.4	68°47.2	S12°54.9
1	57°02.3	242°01.2	02°59.2	194°31.1	17.6	18°28.2	38.3	83°49.7	54.9
2	72°04.8	257°01.1	58.3	209°31.8	18.1	33°31.0	38.2	98°52.2	54.8
3	87°07.2	272°01.1	·· 57.5	224°32.6	·· 18.7	48°33.8	·· 38.1	113°54.7	·· 54.8
4	102°09.7	287°01.0	56.6	239°33.3	19.2	63°36.6	38.0	128°57.1	54.8
5	117°12.2	302°01.0	55.7	254°34.1	19.7	78°39.4	37.9	143°59.6	54.8
6	132°14.6	317°00.9	N02°54.9	269°34.8	S16°20.3	93°42.2	N13°37.8	159°02.1	S12°54.8
7	147°17.1	332°00.8	54.0	284°35.6	20.8	108°45.0	37.7	174°04.5	54.8
8	162°19.6	347°00.8	53.1	299°36.3	21.3	123°47.8	37.6	189°07.0	54.8
9	177°22.0	2°00.7	·· 52.2	314°37.0	·· 21.8	138°50.6	·· 37.5	204°09.5	·· 54.8
10	192°24.5	17°00.7	51.4	329°37.8	22.4	153°53.4	37.4	219°11.9	54.8
11	207°26.9	32°00.6	50.5	344°38.5	22.9	168°56.2	37.3	234°14.4	54.8
12	222°29.4	47°00.6	N02°49.6	359°39.3	S16°23.4	183°59.0	N13°37.2	249°16.9	S12°54.8
13	237°31.9	62°00.5	48.8	14°40.0	24.0	199°01.8	37.1	264°19.4	54.8
14	252°34.3	77°00.5	47.9	29°40.8	24.5	214°04.6	37.0	279°21.8	54.8
15	267°36.8	92°00.4	·· 47.0	44°41.5	·· 25.0	229°07.4	·· 36.9	294°24.3	·· 54.8
16	282°39.3	107°00.3	46.1	59°42.2	25.6	244°10.2	36.8	309°26.8	54.8
17	297°41.7	122°00.3	45.3	74°43.0	26.1	259°13.0	36.7	324°29.2	54.8
18	312°44.2	137°00.2	N02°44.4	89°43.7	S16°26.6	274°15.8	N13°36.6	339°31.7	S12°54.8
19	327°46.7	152°00.2	43.5	104°44.5	27.1	289°18.6	36.5	354°34.2	54.8
20	342°49.1	167°00.1	42.6	119°45.2	27.7	304°21.4	36.4	9°36.6	54.8
21	357°51.6	182°00.0	·· 41.7	134°45.9	·· 28.2	319°24.2	·· 36.3	24°39.1	·· 54.8
22	12°54.1	197°00.0	40.9	149°46.7	28.7	334°27.0	36.2	39°41.6	54.8
23	27°56.5	211°59.9	40.0	164°47.4	29.3	349°29.8	36.1	54°44.0	54.8
Mer.pass. 21:09		ν -0.1′ d -0.9′ m -4.41		ν 0.7′ d -0.5′ m 1.46		ν 2.8′ d -0.1′ m -2.91		ν 2.5′ d 0.0′ m 0.74	

Sat	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	42°59.0	226°59.9	N02°39.1	179°48.2	S16°29.8	4°32.6	N13°36.0	69°46.5	S12°54.8
1	58°01.4	241°59.8	38.2	194°48.9	30.3	19°35.4	35.9	84°49.0	54.8
2	73°03.9	256°59.7	37.3	209°49.6	30.8	34°38.2	35.8	99°51.4	54.8
3	88°06.4	271°59.7	·· 36.5	224°50.4	·· 31.4	49°41.0	·· 35.7	114°53.9	·· 54.8
4	103°08.8	286°59.6	35.6	239°51.1	31.9	64°43.8	35.6	129°56.4	54.8
5	118°11.3	301°59.5	34.7	254°51.8	32.4	79°46.5	35.5	144°58.8	54.8
6	133°13.8	316°59.5	N02°33.8	269°52.6	S16°32.9	94°49.3	N13°35.3	160°01.3	S12°54.8
7	148°16.2	331°59.4	32.9	284°53.3	33.5	109°52.1	35.2	175°03.8	54.7
8	163°18.7	346°59.4	32.0	299°54.1	34.0	124°54.9	35.1	190°06.2	54.7
9	178°21.2	1°59.3	·· 31.2	314°54.8	·· 34.5	139°57.7	·· 35.0	205°08.7	·· 54.7
10	193°23.6	16°59.2	30.3	329°55.5	35.0	155°00.5	34.9	220°11.2	54.7
11	208°26.1	31°59.2	29.4	344°56.3	35.6	170°03.3	34.8	235°13.6	54.7
12	223°28.6	46°59.1	N02°28.5	359°57.0	S16°36.1	185°06.1	N13°34.7	250°16.1	S12°54.7
13	238°31.0	61°59.0	27.6	14°57.7	36.6	200°08.9	34.6	265°18.6	54.7
14	253°33.5	76°59.0	26.7	29°58.5	37.1	215°11.7	34.5	280°21.0	54.7
15	268°35.9	91°58.9	·· 25.8	44°59.2	·· 37.7	230°14.5	·· 34.4	295°23.5	·· 54.7
16	283°38.4	106°58.8	25.0	59°59.9	38.2	245°17.3	34.3	310°26.0	54.7
17	298°40.9	121°58.8	24.1	75°00.7	38.7	260°20.1	34.2	325°28.4	54.7
18	313°43.3	136°58.7	N02°23.2	90°01.4	S16°39.2	275°22.9	N13°34.1	340°30.9	S12°54.7
19	328°45.8	151°58.6	22.3	105°02.1	39.8	290°25.7	34.0	355°33.3	54.7
20	343°48.3	166°58.6	21.4	120°02.9	40.3	305°28.5	33.9	10°35.8	54.7
21	358°50.7	181°58.5	·· 20.5	135°03.6	·· 40.8	320°31.3	·· 33.8	25°38.3	·· 54.7
22	13°53.2	196°58.4	19.6	150°04.3	41.3	335°34.1	33.7	40°40.7	54.7
23	28°55.7	211°58.3	18.7	165°05.1	41.9	350°36.9	33.6	55°43.2	54.7
Mer.pass. 21:05		ν -0.1′ d -0.9′ m -4.40		ν 0.7′ d -0.5′ m 1.45		ν 2.8′ d -0.1′ m -2.91		ν 2.5′ d 0.0′ m 0.74	

Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	43°58.1	226°58.3	N02°17.8	180°05.8	S16°42.4	5°39.7	N13°33.5	70°45.7	S12°54.7
1	59°00.6	241°58.2	17.0	195°06.5	42.9	20°42.5	33.4	85°48.1	54.7
2	74°03.0	256°58.1	16.1	210°07.3	43.4	35°45.3	33.3	100°50.6	54.7
3	89°05.5	271°58.1	·· 15.2	225°08.0	·· 43.9	50°48.1	·· 33.2	115°53.0	·· 54.6
4	104°08.0	286°58.0	14.3	240°08.7	44.5	65°50.9	33.1	130°55.5	54.6
5	119°10.4	301°57.9	13.4	255°09.5	45.0	80°53.7	33.0	145°58.0	54.6
6	134°12.9	316°57.8	N02°12.5	270°10.2	S16°45.5	95°56.5	N13°32.9	161°00.4	S12°54.6
7	149°15.4	331°57.8	11.6	285°10.9	46.0	110°59.3	32.8	176°02.9	54.6
8	164°17.8	346°57.7	10.7	300°11.7	46.5	126°02.1	32.7	191°05.4	54.6
9	179°20.3	1°57.6	·· 09.8	315°12.4	·· 47.1	141°04.9	·· 32.6	206°07.8	·· 54.6
10	194°22.8	16°57.6	08.9	330°13.1	47.6	156°07.7	32.5	221°10.3	54.6
11	209°25.2	31°57.5	08.0	345°13.9	48.1	171°10.5	32.4	236°12.7	54.6
12	224°27.7	46°57.4	N02°07.1	0°14.6	S16°48.6	186°13.3	N13°32.3	251°15.2	S12°54.6
13	239°30.2	61°57.3	06.2	15°15.3	49.1	201°16.1	32.2	266°17.7	54.6
14	254°32.6	76°57.3	05.3	30°16.1	49.7	216°18.9	32.1	281°20.1	54.6
15	269°35.1	91°57.2	·· 04.4	45°16.8	·· 50.2	231°21.6	·· 32.0	296°22.6	·· 54.6
16	284°37.5	106°57.1	03.5	60°17.5	50.7	246°24.4	31.9	311°25.0	54.6
17	299°40.0	121°57.0	02.6	75°18.2	51.2	261°27.2	31.8	326°27.5	54.6
18	314°42.5	136°56.9	N02°01.7	90°19.0	S16°51.7	276°30.0	N13°31.7	341°30.0	S12°54.6
19	329°44.9	151°56.9	02°00.8	105°19.7	52.3	291°32.8	31.6	356°32.4	54.6
20	344°47.4	166°56.8	01°59.9	120°20.4	52.8	306°35.6	31.5	11°34.9	54.5
21	359°49.9	181°56.7	·· 59.0	135°21.2	·· 53.3	321°38.4	·· 31.4	26°37.3	·· 54.5
22	14°52.3	196°56.6	58.1	150°21.9	53.8	336°41.2	31.3	41°39.8	54.5
23	29°54.8	211°56.6	57.2	165°22.6	54.3	351°44.0	31.2	56°42.3	54.5
Mer.pass. 21:01		ν -0.1′ d -0.9′ m -4.39		ν 0.7′ d -0.5′ m 1.45		ν 2.8′ d -0.1′ m -2.91		ν 2.5′ d 0.0′ m 0.75	

Stars

	SHA	**Dec**
Alpheratz	357°35.5	29°13.5
Ankaa	353°07.8	-42°10.7
Schedar	349°31.7	56°40.2
Diphda	348°48.0	-17°51.4
Achernar	335°20.3	-57°07.0
Hamal	327°52.0	23°34.6
Polaris	314°02.2	89°21.8
Acamar	315°12.1	-40°12.5
Menkar	314°06.9	4°11.1
Mirfak	308°29.2	49°56.8
Aldebaran	290°40.5	16°33.5
Rigel	281°04.6	-8°10.3
Capella	280°23.0	46°01.2
Bellatrix	278°23.7	6°22.4
Elnath	278°02.8	28°37.6
Alnilam	275°38.5	-1°11.1
Betelgeuse	270°52.9	7°24.8
Canopus	263°52.5	-52°42.2
Sirius	258°26.9	-16°44.7
Adhara	255°06.5	-29°00.0
Procyon	244°51.8	5°09.9
Pollux	243°18.4	27°58.1
Avior	234°15.1	-59°34.7
Suhail	222°47.1	-43°31.4
Miaplacidus	221°38.6	-69°48.5
Alphard	217°48.8	-8°45.5
Regulus	207°35.6	11°51.1
Dubhe	193°42.6	61°37.2
Denebola	182°26.2	14°26.4
Gienah	175°44.9	-17°40.2
Acrux	173°01.8	-63°13.6
Gacrux	171°53.3	-57°14.5
Alioth	166°14.3	55°49.8
Spica	158°23.7	-11°17.0
Alkaid	152°53.3	49°11.7
Hadar	148°38.1	-60°29.1
Menkent	147°59.2	-36°29.1
Arcturus	145°49.2	19°03.6
Rigil Kent.	139°42.4	-60°55.9
Kochab	137°20.9	74°03.4
Zuben'ubi	136°57.5	-16°08.3
Alphecca	126°05.0	26°38.2
Antares	112°17.4	-26°29.0
Atria	107°13.0	-69°04.3
Sabik	102°04.2	-15°45.2
Shaula	96°12.1	-37°07.3
Rasalhague	95°59.7	12°32.7
Eltanin	90°43.0	51°29.3
Kaus Aust.	83°34.1	-34°22.5
Vega	80°34.1	38°48.5
Nunki	75°49.2	-26°16.1
Altair	62°01.0	8°56.0
Peacock	53°07.4	-56°39.7
Deneb	49°26.5	45°22.2
Enif	33°39.7	9°59.2
Al Na'ir	27°34.0	-46°50.9
Fomalhaut	15°15.4	-29°29.9
Scheat	13°46.0	28°12.9
Markab	13°30.7	15°20.1

Nov 03 Fri	**SHA**	**Mer.pass**
Venus	185°01.4	08:52
Mars	137°30.5	12:01
Jupiter	321°25.6	23:42
Saturn	26°47.4	19:22

Nov 04 Sat	**SHA**	**Mer.pass**
Venus	184°00.9	08:52
Mars	136°49.2	12:00
Jupiter	321°33.6	23:37
Saturn	26°47.5	19:18

Nov 05 Sun	**SHA**	**Mer.pass**
Venus	183°00.2	08:52
Mars	136°07.7	11:59
Jupiter	321°41.6	23:33
Saturn	26°47.5	19:14

Horizontal parallax	
Venus:	0.2
Mars:	0.1

h

Fri	Sun GHA	Sun Dec	Moon GHA	ν	Moon Dec	d	HP
0	184°06.8	S14°54.4	296°14.2	8.5′	N27°51.0	2.9′	55.4′
1	199°06.8	55.2	310°41.8	8.6′	27°48.1	3.1′	55.4′
2	214°06.8	56.0	325°09.4	8.7′	27°45.0	3.2′	55.4′
3	229°06.8	·· 56.8	339°37.1	8.7′	27°41.8	3.3′	55.4′
4	244°06.8	57.6	354°04.8	8.8′	27°38.5	3.5′	55.3′
5	259°06.8	58.4	8°32.7	8.9′	27°35.0	3.6′	55.3′
6	274°06.8	S14°59.1	23°00.5	9.0′	N27°31.4	3.7′	55.3′
7	289°06.8	14°59.9	37°28.5	9.0′	27°27.7	3.9′	55.3′
8	304°06.8	15°00.7	51°56.5	9.1′	27°23.8	4.1′	55.2′
9	319°06.8	·· 01.5	66°24.7	9.2′	27°19.7	4.1′	55.2′
10	334°06.8	02.3	80°52.8	9.3′	27°15.6	4.3′	55.2′
11	349°06.8	03.1	95°21.1	9.3′	27°11.3	4.5′	55.2′
12	4°06.8	S15°03.8	109°49.4	9.4′	N27°06.8	4.5′	55.1′
13	19°06.8	04.6	124°17.9	9.5′	27°02.3	4.7′	55.1′
14	34°06.8	05.4	138°46.4	9.6′	26°57.6	4.8′	55.1′
15	49°06.8	·· 06.2	153°14.9	9.7′	26°52.8	5.0′	55.1′
16	64°06.8	07.0	167°43.6	9.7′	26°47.8	5.1′	55.0′
17	79°06.8	07.7	182°12.3	9.8′	26°42.7	5.2′	55.0′
18	94°06.8	S15°08.5	196°41.1	9.9′	N26°37.5	5.3′	55.0′
19	109°06.8	09.3	211°10.0	10.0′	26°32.2	5.5′	55.0′
20	124°06.8	10.1	225°39.0	10.1′	26°26.7	5.6′	55.0′
21	139°06.8	·· 10.8	240°08.0	10.1′	26°21.1	5.7′	54.9′
22	154°06.8	11.6	254°37.2	10.2′	26°15.4	5.9′	54.9′
23	169°06.8	12.4	269°06.4	10.3′	26°09.5	5.9′	54.9′
	SD = 16.1′	d = -0.8′	SD = 15.1′				

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	184°06.8	S15°13.2	283°35.7	10.4′	N26°03.6	6.1′	54.9′
1	199°06.8	13.9	298°05.1	10.5′	25°57.5	6.2′	54.8′
2	214°06.8	14.7	312°34.5	10.6′	25°51.3	6.3′	54.8′
3	229°06.8	·· 15.5	327°04.1	10.6′	25°45.0	6.5′	54.8′
4	244°06.8	16.3	341°33.7	10.7′	25°38.5	6.5′	54.8′
5	259°06.8	17.0	356°03.5	10.8′	25°32.0	6.7′	54.8′
6	274°06.8	S15°17.8	10°33.3	10.9′	N25°25.3	6.8′	54.7′
7	289°06.8	18.6	25°03.2	11.0′	25°18.5	6.9′	54.7′
8	304°06.8	19.4	39°33.1	11.1′	25°11.6	7.0′	54.7′
9	319°06.8	·· 20.1	54°03.2	11.1′	25°04.6	7.1′	54.7′
10	334°06.8	20.9	68°33.3	11.2′	24°57.5	7.3′	54.7′
11	349°06.8	21.7	83°03.6	11.3′	24°50.2	7.3′	54.7′
12	4°06.8	S15°22.4	97°33.9	11.4′	N24°42.9	7.5′	54.6′
13	19°06.8	23.2	112°04.3	11.5′	24°35.4	7.5′	54.6′
14	34°06.7	24.0	126°34.8	11.6′	24°27.9	7.7′	54.6′
15	49°06.7	·· 24.7	141°05.3	11.7′	24°20.2	7.8′	54.6′
16	64°06.7	25.5	155°36.0	11.7′	24°12.4	7.9′	54.6′
17	79°06.7	26.3	170°06.7	11.8′	24°04.5	8.0′	54.6′
18	94°06.7	S15°27.1	184°37.5	11.9′	N23°56.5	8.1′	54.5′
19	109°06.7	27.8	199°08.5	12.0′	23°48.4	8.2′	54.5′
20	124°06.7	28.6	213°39.4	12.1′	23°40.2	8.2′	54.5′
21	139°06.7	·· 29.4	228°10.5	12.2′	23°32.0	8.4′	54.5′
22	154°06.7	30.1	242°41.7	12.2′	23°23.6	8.5′	54.5′
23	169°06.7	30.9	257°12.9	12.3′	23°15.1	8.6′	54.5′
	SD = 16.1′	d = -0.8′	SD = 15.0′				

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	184°06.6	S15°31.7	271°44.3	12.4′	N23°06.5	8.7′	54.5′
1	199°06.6	32.4	286°15.7	12.5′	22°57.8	8.8′	54.4′
2	214°06.6	33.2	300°47.2	12.6′	22°49.0	8.9′	54.4′
3	229°06.6	·· 33.9	315°18.7	12.7′	22°40.1	8.9′	54.4′
4	244°06.6	34.7	329°50.4	12.7′	22°31.2	9.1′	54.4′
5	259°06.6	35.5	344°22.1	12.8′	22°22.1	9.2′	54.4′
6	274°06.6	S15°36.2	358°53.9	12.9′	N22°12.9	9.2′	54.4′
7	289°06.6	37.0	13°25.8	13.0′	22°03.7	9.4′	54.4′
8	304°06.5	37.8	27°57.8	13.1′	21°54.3	9.4′	54.4′
9	319°06.5	·· 38.5	42°29.9	13.1′	21°44.9	9.5′	54.3′
10	334°06.5	39.3	57°02.0	13.2′	21°35.4	9.6′	54.3′
11	349°06.5	40.0	71°34.2	13.3′	21°25.8	9.7′	54.3′
12	4°06.5	S15°40.8	86°06.5	13.4′	N21°16.1	9.8′	54.3′
13	19°06.5	41.6	100°38.9	13.4′	21°06.3	9.8′	54.3′
14	34°06.4	42.3	115°11.4	13.5′	20°56.5	10.0′	54.3′
15	49°06.4	·· 43.1	129°43.9	13.6′	20°46.5	10.0′	54.3′
16	64°06.4	43.8	144°16.5	13.7′	20°36.5	10.1′	54.3′
17	79°06.4	44.6	158°49.2	13.8′	20°26.4	10.2′	54.3′
18	94°06.4	S15°45.3	173°21.9	13.8′	N20°16.2	10.3′	54.3′
19	109°06.4	46.1	187°54.7	13.9′	20°05.9	10.3′	54.2′
20	124°06.3	46.9	202°27.6	14.0′	19°55.6	10.5′	54.2′
21	139°06.3	·· 47.6	217°00.6	14.0′	19°45.1	10.5′	54.2′
22	154°06.3	48.4	231°33.7	14.1′	19°34.6	10.6′	54.2′
23	169°06.3	49.1	246°06.8	14.2′	19°24.0	10.6′	54.2′
	SD = 16.1′	d = -0.8′	SD = 14.9′				

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

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

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 72-53%
03	16:27	16:27	11:44	04:25	16:51	
04	16:27	16:27	11:44	05:16	17:41	
05	16:27	16:26	11:44	06:05	18:27	

November 06, 07, 08 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	44°57.3	226°56.5	N01°56.3	180°23.3	S16°54.8	6°46.8	N13°31.1	71°44.7	S12°54.5
1	59°59.7	241°56.4	55.4	195°24.1	55.4	21°49.6	31.0	86°47.2	54.5
2	75°02.2	256°56.3	54.5	210°24.8	55.9	36°52.4	30.9	101°49.6	54.5
3	90°04.7	271°56.2	·· 53.6	225°25.5	·· 56.4	51°55.2	·· 30.8	116°52.1	·· 54.5
4	105°07.1	286°56.2	52.7	240°26.2	56.9	66°58.0	30.7	131°54.6	54.5
5	120°09.6	301°56.1	51.8	255°27.0	57.4	82°00.8	30.5	146°57.0	54.5
6	135°12.0	316°56.0	N01°50.9	270°27.7	S16°57.9	97°03.6	N13°30.4	161°59.5	S12°54.5
7	150°14.5	331°55.9	50.0	285°28.4	58.5	112°06.4	30.3	177°01.9	54.5
8	165°17.0	346°55.8	49.1	300°29.1	59.0	127°09.2	30.2	192°04.4	54.5
9	180°19.4	1°55.8	·· 48.2	315°29.9	16°59.5	142°12.0	·· 30.1	207°06.8	·· 54.5
10	195°21.9	16°55.7	47.3	330°30.6	17°00.0	157°14.8	30.0	222°09.3	54.4
11	210°24.4	31°55.6	46.4	345°31.3	00.5	172°17.6	29.9	237°11.8	54.4
12	225°26.8	46°55.5	N01°45.5	0°32.0	S17°01.0	187°20.4	N13°29.8	252°14.2	S12°54.4
13	240°29.3	61°55.4	44.6	15°32.8	01.5	202°23.2	29.7	267°16.7	54.4
14	255°31.8	76°55.3	43.6	30°33.5	02.1	217°26.0	29.6	282°19.1	54.4
15	270°34.2	91°55.3	·· 42.7	45°34.2	·· 02.6	232°28.8	·· 29.5	297°21.6	·· 54.4
16	285°36.7	106°55.2	41.8	60°34.9	03.1	247°31.6	29.4	312°24.0	54.4
17	300°39.1	121°55.1	40.9	75°35.7	03.6	262°34.4	29.3	327°26.5	54.4
18	315°41.6	136°55.0	N01°40.0	90°36.4	S17°04.1	277°37.1	N13°29.2	342°29.0	S12°54.4
19	330°44.1	151°54.9	39.1	105°37.1	04.6	292°39.9	29.1	357°31.4	54.4
20	345°46.5	166°54.8	38.2	120°37.8	05.1	307°42.7	29.0	12°33.9	54.4
21	0°49.0	181°54.7	·· 37.3	135°38.5	·· 05.7	322°45.5	·· 28.9	27°36.3	·· 54.4
22	15°51.5	196°54.7	36.4	150°39.3	06.2	337°48.3	28.8	42°38.8	54.3
23	30°53.9	211°54.6	35.4	165°40.0	06.7	352°51.1	28.7	57°41.2	54.3
Mer.pass. 20:57		ν -0.1′	d -0.9′	m -4.38	ν 0.7′	d -0.5′	m 1.44	ν 2.8′	d -0.1′ m -2.91
								ν 2.5′	d 0.0′ m 0.75

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	45°56.4	226°54.5	N01°34.5	180°40.7	S17°07.2	7°53.9	N13°28.6	72°43.7	S12°54.3
1	60°58.9	241°54.4	33.6	195°41.4	07.7	22°56.7	28.5	87°46.1	54.3
2	76°01.3	256°54.3	32.7	210°42.2	08.2	37°59.5	28.4	102°48.6	54.3
3	91°03.8	271°54.2	·· 31.8	225°42.9	·· 08.7	53°02.3	·· 28.3	117°51.0	·· 54.3
4	106°06.3	286°54.1	30.9	240°43.6	09.2	68°05.1	28.2	132°53.5	54.3
5	121°08.7	301°54.0	30.0	255°44.3	09.7	83°07.9	28.1	147°56.0	54.3
6	136°11.2	316°53.9	N01°29.1	270°45.0	S17°10.3	98°10.7	N13°28.0	162°58.4	S12°54.3
7	151°13.6	331°53.9	28.1	285°45.8	10.8	113°13.5	27.9	178°00.9	54.3
8	166°16.1	346°53.8	27.2	300°46.5	11.3	128°16.3	27.8	193°03.3	54.3
9	181°18.6	1°53.7	·· 26.3	315°47.2	·· 11.8	143°19.1	·· 27.7	208°05.8	·· 54.2
10	196°21.0	16°53.6	25.4	330°47.9	12.3	158°21.9	27.6	223°08.2	54.2
11	211°23.5	31°53.5	24.5	345°48.6	12.8	173°24.7	27.5	238°10.7	54.2
12	226°26.0	46°53.4	N01°23.6	0°49.3	S17°13.3	188°27.5	N13°27.4	253°13.1	S12°54.2
13	241°28.4	61°53.3	22.6	15°50.1	13.8	203°30.3	27.3	268°15.6	54.2
14	256°30.9	76°53.2	21.7	30°50.8	14.3	218°33.1	27.2	283°18.0	54.2
15	271°33.4	91°53.1	·· 20.8	45°51.5	·· 14.8	233°35.8	·· 27.1	298°20.5	·· 54.2
16	286°35.8	106°53.0	19.9	60°52.2	15.3	248°38.6	27.0	313°22.9	54.2
17	301°38.3	121°52.9	19.0	75°52.9	15.9	263°41.4	26.9	328°25.4	54.2
18	316°40.8	136°52.8	N01°18.0	90°53.6	S17°16.4	278°44.2	N13°26.8	343°27.8	S12°54.2
19	331°43.2	151°52.7	17.1	105°54.4	16.9	293°47.0	26.7	358°30.3	54.2
20	346°45.7	166°52.7	16.2	120°55.1	17.4	308°49.8	26.6	13°32.7	54.1
21	1°48.1	181°52.6	·· 15.3	135°55.8	·· 17.9	323°52.6	·· 26.5	28°35.2	·· 54.1
22	16°50.6	196°52.5	14.4	150°56.5	18.4	338°55.4	26.4	43°37.6	54.1
23	31°53.1	211°52.4	13.4	165°57.2	18.9	353°58.2	26.3	58°40.1	54.1
Mer.pass. 20:53		ν -0.1′	d -0.9′	m -4.37	ν 0.7′	d -0.5′	m 1.43	ν 2.8′	d -0.1′ m -2.91
								ν 2.5′	d 0.0′ m 0.76

Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	46°55.5	226°52.3	N01°12.5	180°57.9	S17°19.4	9°01.0	N13°26.2	73°42.5	S12°54.1
1	61°58.0	241°52.2	11.6	195°58.7	19.9	24°03.8	26.1	88°45.0	54.1
2	77°00.5	256°52.1	10.7	210°59.4	20.4	39°06.6	26.0	103°47.4	54.1
3	92°02.9	271°52.0	·· 09.7	226°00.1	·· 20.9	54°09.4	·· 25.9	118°49.9	·· 54.1
4	107°05.4	286°51.9	08.8	241°00.8	21.4	69°12.2	25.8	133°52.3	54.1
5	122°07.9	301°51.8	07.9	256°01.5	21.9	84°15.0	25.7	148°54.8	54.1
6	137°10.3	316°51.7	N01°07.0	271°02.2	S17°22.4	99°17.8	N13°25.6	163°57.2	S12°54.0
7	152°12.8	331°51.6	06.0	286°02.9	22.9	114°20.6	25.5	178°59.7	54.0
8	167°15.2	346°51.5	05.1	301°03.7	23.4	129°23.4	25.4	194°02.1	54.0
9	182°17.7	1°51.4	·· 04.2	316°04.4	·· 24.0	144°26.1	·· 25.3	209°04.6	·· 54.0
10	197°20.2	16°51.3	03.3	331°05.1	24.5	159°28.9	25.2	224°07.0	54.0
11	212°22.6	31°51.2	02.3	346°05.8	25.0	174°31.7	25.1	239°09.5	54.0
12	227°25.1	46°51.1	N01°01.4	1°06.5	S17°25.5	189°34.5	N13°25.0	254°11.9	S12°54.0
13	242°27.6	61°51.0	01°00.5	16°07.2	26.0	204°37.3	24.9	269°14.4	54.0
14	257°30.0	76°50.9	00°59.6	31°07.9	26.5	219°40.1	24.8	284°16.8	54.0
15	272°32.5	91°50.8	·· 58.6	46°08.6	·· 27.0	234°42.9	·· 24.7	299°19.3	·· 53.9
16	287°35.0	106°50.7	57.7	61°09.4	27.5	249°45.7	24.6	314°21.7	53.9
17	302°37.4	121°50.6	56.8	76°10.1	28.0	264°48.5	24.5	329°24.2	53.9
18	317°39.9	136°50.5	N00°55.8	91°10.8	S17°28.5	279°51.3	N13°24.4	344°26.6	S12°53.9
19	332°42.4	151°50.4	54.9	106°11.5	29.0	294°54.1	24.3	359°29.1	53.9
20	347°44.8	166°50.3	54.0	121°12.2	29.5	309°56.9	24.2	14°31.5	53.9
21	2°47.3	181°50.2	·· 53.0	136°12.9	·· 30.0	324°59.7	·· 24.1	29°34.0	·· 53.9
22	17°49.7	196°50.1	52.1	151°13.6	30.5	340°02.5	24.0	44°36.4	53.9
23	32°52.2	211°50.0	51.2	166°14.3	31.0	355°05.3	23.9	59°38.9	53.9
Mer.pass. 20:49		ν -0.1′	d -0.9′	m -4.37	ν 0.7′	d -0.5′	m 1.43	ν 2.8′	d -0.1′ m -2.91
								ν 2.5′	d 0.0′ m 0.76

Stars

	SHA	**Dec**
Alpheratz	357°35.6	29°13.5
Ankaa	353°07.8	-42°10.7
Schedar	349°31.7	56°40.3
Diphda	348°48.0	-17°51.4
Achernar	335°20.3	-57°07.0
Hamal	327°52.0	23°34.6
Polaris	314°01.9	89°21.9
Acamar	315°12.1	-40°12.5
Menkar	314°06.9	4°11.1
Mirfak	308°29.2	49°56.8
Aldebaran	290°40.5	16°33.5
Rigel	281°04.5	-8°10.3
Capella	280°23.0	46°01.2
Bellatrix	278°23.7	6°22.4
Elnath	278°02.8	28°37.6
Alnilam	275°38.5	-1°11.1
Betelgeuse	270°52.9	7°24.8
Canopus	263°52.5	-52°42.2
Sirius	258°26.9	-16°44.7
Adhara	255°06.5	-29°00.0
Procyon	244°51.8	5°09.9
Pollux	243°18.4	27°58.1
Avior	234°15.0	-59°34.7
Suhail	222°47.1	-43°31.4
Miaplacidus	221°38.5	-69°48.5
Alphard	217°48.8	-8°45.5
Regulus	207°35.6	11°51.1
Dubhe	193°42.5	61°37.2
Denebola	182°26.2	14°26.4
Gienah	175°44.9	-17°40.2
Acrux	173°01.8	-63°13.6
Gacrux	171°53.3	-57°14.5
Alioth	166°14.3	55°49.8
Spica	158°23.7	-11°17.0
Alkaid	152°53.3	49°11.7
Hadar	148°38.1	-60°29.1
Menkent	147°59.2	-36°29.1
Arcturus	145°49.2	19°03.6
Rigil Kent.	139°42.4	-60°55.9
Kochab	137°20.9	74°03.4
Zuben'ubi	136°57.5	-16°08.3
Alphecca	126°05.0	26°38.2
Antares	112°17.4	-26°29.0
Atria	107°13.0	-69°04.3
Sabik	102°04.2	-15°45.2
Shaula	96°12.1	-37°07.3
Rasalhague	95°59.7	12°32.7
Eltanin	90°43.0	51°29.3
Kaus Aust.	83°34.1	-34°22.5
Vega	80°34.2	38°48.5
Nunki	75°49.2	-26°16.1
Altair	62°01.0	8°56.0
Peacock	53°07.4	-56°39.7
Deneb	49°26.5	45°22.1
Enif	33°39.7	9°59.1
Al Na'ir	27°34.0	-46°50.9
Fomalhaut	15°15.4	-29°29.9
Scheat	13°46.0	28°12.9
Markab	13°30.7	15°20.1

Nov 06 Mon	**SHA**	**Mer.pass**
Venus	181°59.2	08:52
Mars	135°26.1	11:58
Jupiter	321°49.6	23:29
Saturn	26°47.5	19:10

Nov 07 Tue	**SHA**	**Mer.pass**
Venus	180°58.1	08:52
Mars	134°44.3	11:57
Jupiter	321°57.5	23:24
Saturn	26°47.3	19:06

Nov 08 Wed	**SHA**	**Mer.pass**
Venus	179°56.7	08:53
Mars	134°02.4	11:56
Jupiter	322°05.5	23:20
Saturn	26°47.0	19:02

Horizontal parallax	
Venus:	0.2
Mars:	0.1

h	Sun		Moon				
Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	184°06.3	S15°49.9	260°40.0	14.3′	N19°13.4	10.8′	54.2′
1	199°06.2	50.6	275°13.2	14.3′	19°02.6	10.8′	54.2′
2	214°06.2	51.4	289°46.5	14.4′	18°51.8	10.9′	54.2′
3	229°06.2	·· 52.1	304°19.9	14.5′	18°40.9	10.9′	54.2′
4	244°06.2	52.9	318°53.4	14.5′	18°30.0	11.0′	54.2′
5	259°06.2	53.6	333°26.9	14.6′	18°19.0	11.1′	54.2′
6	274°06.1	S15°54.4	348°00.5	14.7′	N18°07.9	11.2′	54.2′
7	289°06.1	55.2	2°34.2	14.7′	17°56.7	11.2′	54.2′
8	304°06.1	55.9	17°07.9	14.8′	17°45.5	11.3′	54.2′
9	319°06.1	·· 56.7	31°41.7	14.9′	17°34.2	11.4′	54.2′
10	334°06.0	57.4	46°15.5	14.9′	17°22.8	11.5′	54.2′
11	349°06.0	58.2	60°49.5	15.0′	17°11.3	11.5′	54.2′
12	4°06.0	S15°58.9	75°23.4	15.0′	N16°59.8	11.5′	54.2′
13	19°06.0	15°59.6	89°57.5	15.1′	16°48.3	11.7′	54.1′
14	34°05.9	16°00.4	104°31.6	15.2′	16°36.6	11.7′	54.1′
15	49°05.9	·· 01.1	119°05.7	15.2′	16°24.9	11.7′	54.1′
16	64°05.9	01.9	133°39.9	15.3′	16°13.2	11.8′	54.1′
17	79°05.9	02.6	148°14.2	15.3′	16°01.4	11.9′	54.1′
18	94°05.8	S16°03.4	162°48.5	15.4′	N15°49.5	12.0′	54.1′
19	109°05.8	04.1	177°22.9	15.4′	15°37.5	12.0′	54.1′
20	124°05.8	04.9	191°57.3	15.5′	15°25.5	12.0′	54.1′
21	139°05.7	·· 05.6	206°31.8	15.5′	15°13.5	12.1′	54.1′
22	154°05.7	06.4	221°06.3	15.6′	15°01.4	12.2′	54.1′
23	169°05.7	07.1	235°40.9	15.6′	14°49.2	12.3′	54.1′
	SD = 16.1′	d = -0.8′	SD = 14.8′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	184°05.7	S16°07.9	250°15.6	15.7′	N14°36.9	12.2′	54.1′
1	199°05.6	08.6	264°50.3	15.7′	14°24.7	12.4′	54.1′
2	214°05.6	09.3	279°25.0	15.8′	14°12.3	12.4′	54.1′
3	229°05.6	·· 10.1	293°59.8	15.8′	13°59.9	12.4′	54.1′
4	244°05.5	10.8	308°34.6	15.9′	13°47.5	12.5′	54.1′
5	259°05.5	11.6	323°09.5	15.9′	13°35.0	12.6′	54.1′
6	274°05.5	S16°12.3	337°44.4	16.0′	N13°22.4	12.6′	54.1′
7	289°05.4	13.0	352°19.4	16.0′	13°09.8	12.7′	54.1′
8	304°05.4	13.8	6°54.4	16.1′	12°57.1	12.7′	54.2′
9	319°05.4	·· 14.5	21°29.4	16.1′	12°44.4	12.7′	54.2′
10	334°05.3	15.3	36°04.5	16.1′	12°31.7	12.8′	54.2′
11	349°05.3	16.0	50°39.7	16.2′	12°18.9	12.9′	54.2′
12	4°05.3	S16°16.7	65°14.8	16.2′	N12°06.0	12.9′	54.2′
13	19°05.2	17.5	79°50.0	16.2′	11°53.1	12.9′	54.2′
14	34°05.2	18.2	94°25.3	16.3′	11°40.2	13.0′	54.2′
15	49°05.2	·· 18.9	109°00.6	16.3′	11°27.2	13.1′	54.2′
16	64°05.1	19.7	123°35.9	16.4′	11°14.1	13.1′	54.2′
17	79°05.1	20.4	138°11.2	16.4′	11°01.0	13.1′	54.2′
18	94°05.1	S16°21.2	152°46.6	16.4′	N10°47.9	13.2′	54.2′
19	109°05.0	21.9	167°22.0	16.4′	10°34.7	13.2′	54.2′
20	124°05.0	22.6	181°57.5	16.5′	10°21.5	13.2′	54.2′
21	139°05.0	·· 23.4	196°33.0	16.5′	10°08.3	13.3′	54.2′
22	154°04.9	24.1	211°08.5	16.5′	09°55.0	13.4′	54.2′
23	169°04.9	24.8	225°44.0	16.6′	09°41.6	13.3′	54.2′
	SD = 16.1′	d = -0.7′	SD = 14.8′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	184°04.8	S16°25.6	240°19.6	16.6′	N09°28.3	13.4′	54.2′
1	199°04.8	26.3	254°55.1	16.6′	09°14.9	13.5′	54.2′
2	214°04.8	27.0	269°30.7	16.6′	09°01.4	13.5′	54.2′
3	229°04.7	·· 27.7	284°06.4	16.7′	08°47.9	13.5′	54.3′
4	244°04.7	28.5	298°42.0	16.7′	08°34.4	13.6′	54.3′
5	259°04.7	29.2	313°17.7	16.7′	08°20.8	13.6′	54.3′
6	274°04.6	S16°29.9	327°53.4	16.7′	N08°07.2	13.6′	54.3′
7	289°04.6	30.7	342°29.1	16.7′	07°53.6	13.6′	54.3′
8	304°04.5	31.4	357°04.8	16.7′	07°40.0	13.7′	54.3′
9	319°04.5	·· 32.1	11°40.6	16.8′	07°26.3	13.8′	54.3′
10	334°04.4	32.8	26°16.4	16.8′	07°12.5	13.7′	54.3′
11	349°04.4	33.6	40°52.1	16.8′	06°58.8	13.8′	54.3′
12	4°04.4	S16°34.3	55°27.9	16.8′	N06°45.0	13.9′	54.3′
13	19°04.3	35.0	70°03.7	16.8′	06°31.1	13.8′	54.4′
14	34°04.3	35.8	84°39.6	16.8′	06°17.3	13.9′	54.4′
15	49°04.2	·· 36.5	99°15.4	16.8′	06°03.4	13.9′	54.4′
16	64°04.2	37.2	113°51.2	16.8′	05°49.5	13.9′	54.4′
17	79°04.1	37.9	128°27.1	16.9′	05°35.6	14.0′	54.4′
18	94°04.1	S16°38.6	143°02.9	16.9′	N05°21.6	14.0′	54.4′
19	109°04.1	39.4	157°38.8	16.9′	05°07.6	14.0′	54.4′
20	124°04.0	40.1	172°14.7	16.9′	04°53.6	14.1′	54.4′
21	139°04.0	·· 40.8	186°50.5	16.9′	04°39.5	14.0′	54.4′
22	154°03.9	41.5	201°26.4	16.9′	04°25.5	14.1′	54.5′
23	169°03.9	42.3	216°02.3	16.9′	04°11.4	14.1′	54.5′
	SD = 16.1′	d = -0.7′	SD = 14.8′				

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

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

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 23-25 44-26%
06	16:25	16:24	11:44	06:49	19:11	
07	16:23	16:21	11:44	07:32	19:52	
08	16:19	16:17	11:44	08:12	20:32	

November 09, 10, 11 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	47°54.7	226°49.9	N00°50.2	181°15.0	S17°31.5	10°08.0	N13°23.8	74°41.3	S12°53.8
1	62°57.1	241°49.8	49.3	196°15.7	32.0	25°10.8	23.7	89°43.7	53.8
2	77°59.6	256°49.6	48.4	211°16.4	32.5	40°13.6	23.6	104°46.2	53.8
3	93°02.1	271°49.5	·· 47.5	226°17.2	·· 33.0	55°16.4	·· 23.5	119°48.6	·· 53.8
4	108°04.5	286°49.4	46.5	241°17.9	33.5	70°19.2	23.4	134°51.1	53.8
5	123°07.0	301°49.3	45.6	256°18.6	34.0	85°22.0	23.3	149°53.5	53.8
6	138°09.5	316°49.2	N00°44.6	271°19.3	S17°34.5	100°24.8	N13°23.2	164°56.0	S12°53.8
7	153°11.9	331°49.1	43.7	286°20.0	35.0	115°27.6	23.1	179°58.4	53.8
8	168°14.4	346°49.0	42.8	301°20.7	35.5	130°30.4	23.0	195°00.9	53.7
9	183°16.8	1°48.9	·· 41.8	316°21.4	·· 36.0	145°33.2	·· 22.9	210°03.3	·· 53.7
10	198°19.3	16°48.8	40.9	331°22.1	36.5	160°36.0	22.8	225°05.8	53.7
11	213°21.8	31°48.7	40.0	346°22.8	37.0	175°38.8	22.7	240°08.2	53.7
12	228°24.2	46°48.6	N00°39.0	1°23.5	S17°37.5	190°41.6	N13°22.6	255°10.6	S12°53.7
13	243°26.7	61°48.5	38.1	16°24.2	38.0	205°44.4	22.5	270°13.1	53.7
14	258°29.2	76°48.4	37.2	31°24.9	38.5	220°47.1	22.4	285°15.5	53.7
15	273°31.6	91°48.3	·· 36.2	46°25.6	·· 39.0	235°49.9	·· 22.3	300°18.0	·· 53.7
16	288°34.1	106°48.1	35.3	61°26.3	39.5	250°52.7	22.2	315°20.4	53.6
17	303°36.6	121°48.0	34.3	76°27.0	40.0	265°55.5	22.1	330°22.9	53.6
18	318°39.0	136°47.9	N00°33.4	91°27.7	S17°40.5	280°58.3	N13°22.0	345°25.3	S12°53.6
19	333°41.5	151°47.8	32.5	106°28.5	41.0	296°01.1	21.9	0°27.8	53.6
20	348°44.0	166°47.7	31.5	121°29.2	41.5	311°03.9	21.8	15°30.2	53.6
21	3°46.4	181°47.6	·· 30.6	136°29.9	·· 42.0	326°06.7	·· 21.7	30°32.6	·· 53.6
22	18°48.9	196°47.5	29.7	151°30.6	42.4	341°09.5	21.6	45°35.1	53.6
23	33°51.3	211°47.4	28.7	166°31.3	42.9	356°12.3	21.5	60°37.5	53.6
Mer.pass. 20:45		ν -0.1′ d -0.9′ m -4.36		ν 0.7′ d -0.5′ m 1.42		ν 2.8′ d -0.1′ m -2.91		ν 2.4′ d 0.0′ m 0.77	

Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	48°53.8	226°47.3	N00°27.8	181°32.0	S17°43.4	11°15.1	N13°21.4	75°40.0	S12°53.5
1	63°56.3	241°47.1	26.8	196°32.7	43.9	26°17.9	21.3	90°42.4	53.5
2	78°58.7	256°47.0	25.9	211°33.4	44.4	41°20.6	21.2	105°44.8	53.5
3	94°01.2	271°46.9	·· 24.9	226°34.1	·· 44.9	56°23.4	·· 21.1	120°47.3	·· 53.5
4	109°03.7	286°46.8	24.0	241°34.8	45.4	71°26.2	21.0	135°49.7	53.5
5	124°06.1	301°46.7	23.1	256°35.5	45.9	86°29.0	20.9	150°52.2	53.5
6	139°08.6	316°46.6	N00°22.1	271°36.2	S17°46.4	101°31.8	N13°20.8	165°54.6	S12°53.5
7	154°11.1	331°46.5	21.2	286°36.9	46.9	116°34.6	20.7	180°57.1	53.4
8	169°13.5	346°46.3	20.2	301°37.6	47.4	131°37.4	20.6	195°59.5	53.4
9	184°16.0	1°46.2	·· 19.3	316°38.3	·· 47.9	146°40.2	·· 20.5	211°01.9	·· 53.4
10	199°18.5	16°46.1	18.3	331°39.0	48.4	161°43.0	20.4	226°04.4	53.4
11	214°20.9	31°46.0	17.4	346°39.7	48.9	176°45.8	20.3	241°06.8	53.4
12	229°23.4	46°45.9	N00°16.5	1°40.4	S17°49.4	191°48.5	N13°20.2	256°09.3	S12°53.4
13	244°25.8	61°45.8	15.5	16°41.1	49.9	206°51.3	20.1	271°11.7	53.4
14	259°28.3	76°45.6	14.6	31°41.8	50.3	221°54.1	20.0	286°14.1	53.3
15	274°30.8	91°45.5	·· 13.6	46°42.5	·· 50.8	236°56.9	·· 19.9	301°16.6	·· 53.3
16	289°33.2	106°45.4	12.7	61°43.2	51.3	251°59.7	19.8	316°19.0	53.3
17	304°35.7	121°45.3	11.7	76°43.9	51.8	267°02.5	19.7	331°21.5	53.3
18	319°38.2	136°45.2	N00°10.8	91°44.6	S17°52.3	282°05.3	N13°19.6	346°23.9	S12°53.3
19	334°40.6	151°45.0	09.8	106°45.3	52.8	297°08.1	19.5	1°26.3	53.3
20	349°43.1	166°44.9	08.9	121°46.0	53.3	312°10.9	19.4	16°28.8	53.3
21	4°45.6	181°44.8	·· 07.9	136°46.7	·· 53.8	327°13.7	·· 19.3	31°31.2	·· 53.2
22	19°48.0	196°44.7	07.0	151°47.4	54.3	342°16.4	19.2	46°33.6	53.2
23	34°50.5	211°44.6	06.0	166°48.1	54.8	357°19.2	19.1	61°36.1	53.2
Mer.pass. 20:41		ν -0.1′ d -0.9′ m -4.35		ν 0.7′ d -0.5′ m 1.41		ν 2.8′ d -0.1′ m -2.91		ν 2.4′ d 0.0′ m 0.77	

Sat	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	49°52.9	226°44.4	N00°05.1	181°48.8	S17°55.3	12°22.0	N13°19.0	76°38.5	S12°53.2
1	64°55.4	241°44.3	04.1	196°49.5	55.7	27°24.8	18.9	91°41.0	53.2
2	79°57.9	256°44.2	03.2	211°50.2	56.2	42°27.6	18.8	106°43.4	53.2
3	95°00.3	271°44.1	·· 02.2	226°50.9	·· 56.7	57°30.4	·· 18.7	121°45.8	·· 53.2
4	110°02.8	286°44.0	01.3	241°51.6	57.2	72°33.2	18.6	136°48.3	53.1
5	125°05.3	301°43.8	N00°00.3	256°52.2	57.7	87°36.0	18.5	151°50.7	53.1
6	140°07.7	316°43.7	S00°00.6	271°52.9	S17°58.2	102°38.8	N13°18.4	166°53.2	S12°53.1
7	155°10.2	331°43.6	01.6	286°53.6	58.7	117°41.5	18.3	181°55.6	53.1
8	170°12.7	346°43.5	02.5	301°54.3	59.2	132°44.3	18.2	196°58.0	53.1
9	185°15.1	1°43.3	·· 03.5	316°55.0	17°59.7	147°47.1	·· 18.1	212°00.5	·· 53.1
10	200°17.6	16°43.2	04.4	331°55.7	18°00.1	162°49.9	18.0	227°02.9	53.1
11	215°20.1	31°43.1	05.4	346°56.4	00.6	177°52.7	17.9	242°05.3	53.0
12	230°22.5	46°43.0	S00°06.3	1°57.1	S18°01.1	192°55.5	N13°17.8	257°07.8	S12°53.0
13	245°25.0	61°42.8	07.3	16°57.8	01.6	207°58.3	17.7	272°10.2	53.0
14	260°27.4	76°42.7	08.2	31°58.5	02.1	223°01.1	17.6	287°12.6	53.0
15	275°29.9	91°42.6	·· 09.2	46°59.2	·· 02.6	238°03.9	·· 17.5	302°15.1	·· 53.0
16	290°32.4	106°42.5	10.1	61°59.9	03.1	253°06.6	17.4	317°17.5	53.0
17	305°34.8	121°42.3	11.1	77°00.6	03.5	268°09.4	17.3	332°19.9	52.9
18	320°37.3	136°42.2	S00°12.1	92°01.3	S18°04.0	283°12.2	N13°17.2	347°22.4	S12°52.9
19	335°39.8	151°42.1	13.0	107°02.0	04.5	298°15.0	17.1	2°24.8	52.9
20	350°42.2	166°42.0	14.0	122°02.7	05.0	313°17.8	17.0	17°27.3	52.9
21	5°44.7	181°41.8	·· 14.9	137°03.3	·· 05.5	328°20.6	·· 16.9	32°29.7	·· 52.9
22	20°47.2	196°41.7	15.9	152°04.0	06.0	343°23.4	16.8	47°32.1	52.9
23	35°49.6	211°41.6	16.8	167°04.7	06.4	358°26.2	16.7	62°34.6	52.8
Mer.pass. 20:37		ν -0.1′ d -0.9′ m -4.34		ν 0.7′ d -0.5′ m 1.40		ν 2.8′ d -0.1′ m -2.90		ν 2.4′ d 0.0′ m 0.78	

Stars

	SHA	**Dec**
Alpheratz	357°35.6	29°13.5
Ankaa	353°07.8	-42°10.7
Schedar	349°31.7	56°40.3
Diphda	348°48.0	-17°51.4
Achernar	335°20.4	-57°07.0
Hamal	327°52.0	23°34.6
Polaris	314°01.8	89°21.9
Acamar	315°12.1	-40°12.5
Menkar	314°06.9	4°11.1
Mirfak	308°29.2	49°56.8
Aldebaran	290°40.4	16°33.5
Rigel	281°04.5	-8°10.3
Capella	280°23.0	46°01.3
Bellatrix	278°23.7	6°22.4
Elnath	278°02.8	28°37.6
Alnilam	275°38.5	-1°11.1
Betelgeuse	270°52.9	7°24.8
Canopus	263°52.5	-52°42.2
Sirius	258°26.9	-16°44.7
Adhara	255°06.4	-29°00.0
Procyon	244°51.7	5°09.9
Pollux	243°18.4	27°58.1
Avior	234°15.0	-59°34.7
Suhail	222°47.0	-43°31.4
Miaplacidus	221°38.5	-69°48.5
Alphard	217°48.8	-8°45.5
Regulus	207°35.6	11°51.1
Dubhe	193°42.5	61°37.2
Denebola	182°26.2	14°26.4
Gienah	175°44.9	-17°40.3
Acrux	173°01.8	-63°13.6
Gacrux	171°53.2	-57°14.5
Alioth	166°14.3	55°49.7
Spica	158°23.7	-11°17.0
Alkaid	152°53.2	49°11.6
Hadar	148°38.1	-60°29.1
Menkent	147°59.2	-36°29.1
Arcturus	145°49.2	19°03.6
Rigil Kent.	139°42.4	-60°55.9
Kochab	137°20.9	74°03.4
Zuben'ubi	136°57.5	-16°08.3
Alphecca	126°05.0	26°38.1
Antares	112°17.4	-26°29.0
Atria	107°13.1	-69°04.3
Sabik	102°04.2	-15°45.2
Shaula	96°12.1	-37°07.3
Rasalhague	95°59.8	12°32.7
Eltanin	90°43.1	51°29.3
Kaus Aust.	83°34.1	-34°22.5
Vega	80°34.2	38°48.5
Nunki	75°49.2	-26°16.1
Altair	62°01.1	8°56.0
Peacock	53°07.4	-56°39.7
Deneb	49°26.6	45°22.1
Enif	33°39.7	9°59.1
Al Na'ir	27°34.0	-46°51.0
Fomalhaut	15°15.5	-29°29.9
Scheat	13°46.0	28°12.9
Markab	13°30.7	15°20.1

Nov 09 Thu	**SHA**	**Mer.pass**
Venus	178°55.2	08:53
Mars	133°20.4	11:54
Jupiter	322°13.4	23:15
Saturn	26°46.6	18:58

Nov 10 Fri	**SHA**	**Mer.pass**
Venus	177°53.4	08:53
Mars	132°38.2	11:53
Jupiter	322°21.2	23:11
Saturn	26°46.2	18:54

Nov 11 Sat	**SHA**	**Mer.pass**
Venus	176°51.5	08:53
Mars	131°55.8	11:52
Jupiter	322°29.1	23:06
Saturn	26°45.6	18:50

Horizontal parallax	
Venus:	0.2
Mars:	0.1

h	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	184°03.8	S16°43.0	230°38.2	16.9′	N03°57.3	14.2′	54.5′
1	199°03.8	43.7	245°14.0	16.9′	03°43.1	14.1′	54.5′
2	214°03.7	44.4	259°49.9	16.9′	03°29.0	14.2′	54.5′
3	229°03.7	·· 45.1	274°25.8	16.9′	03°14.8	14.2′	54.5′
4	244°03.6	45.9	289°01.7	16.9′	03°00.6	14.2′	54.5′
5	259°03.6	46.6	303°37.5	16.9′	02°46.4	14.3′	54.6′
6	274°03.5	S16°47.3	318°13.4	16.9′	N02°32.1	14.2′	54.6′
7	289°03.5	48.0	332°49.2	16.8′	02°17.9	14.3′	54.6′
8	304°03.4	48.7	347°25.1	16.8′	02°03.6	14.3′	54.6′
9	319°03.4	·· 49.4	2°00.9	16.8′	01°49.3	14.3′	54.6′
10	334°03.3	50.2	16°36.7	16.8′	01°35.0	14.3′	54.6′
11	349°03.3	50.9	31°12.5	16.8′	01°20.7	14.3′	54.6′
12	4°03.2	S16°51.6	45°48.3	16.8′	N01°06.4	14.4′	54.7′
13	19°03.2	52.3	60°24.1	16.8′	00°52.0	14.3′	54.7′
14	34°03.1	53.0	74°59.9	16.8′	00°37.7	14.4′	54.7′
15	49°03.1	·· 53.7	89°35.7	16.7′	00°23.3	14.4′	54.7′
16	64°03.0	54.4	104°11.4	16.7′	N00°08.9	14.4′	54.7′
17	79°03.0	55.2	118°47.1	16.7′	S00°05.5	14.4′	54.7′
18	94°02.9	S16°55.9	133°22.8	16.7′	S00°19.9	14.4′	54.8′
19	109°02.9	56.6	147°58.5	16.7′	00°34.3	14.4′	54.8′
20	124°02.8	57.3	162°34.2	16.6′	00°48.7	14.4′	54.8′
21	139°02.7	·· 58.0	177°09.8	16.6′	01°03.1	14.5′	54.8′
22	154°02.7	58.7	191°45.4	16.6′	01°17.6	14.4′	54.8′
23	169°02.6	59.4	206°21.0	16.6′	01°32.0	14.4′	54.8′
	SD = 16.1′	d = -0.7′	SD = 14.9′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	184°02.6	S17°00.1	220°56.6	16.5′	S01°46.4	14.5′	54.9′
1	199°02.5	00.8	235°32.1	16.5′	02°00.9	14.4′	54.9′
2	214°02.5	01.5	250°07.6	16.5′	02°15.3	14.5′	54.9′
3	229°02.4	·· 02.2	264°43.1	16.4′	02°29.8	14.4′	54.9′
4	244°02.4	03.0	279°18.6	16.4′	02°44.2	14.5′	54.9′
5	259°02.3	03.7	293°54.0	16.4′	02°58.7	14.4′	55.0′
6	274°02.2	S17°04.4	308°29.4	16.4′	S03°13.1	14.5′	55.0′
7	289°02.2	05.1	323°04.7	16.3′	03°27.6	14.5′	55.0′
8	304°02.1	05.8	337°40.0	16.3′	03°42.1	14.4′	55.0′
9	319°02.1	·· 06.5	352°15.3	16.2′	03°56.5	14.5′	55.0′
10	334°02.0	07.2	6°50.5	16.2′	04°11.0	14.4′	55.0′
11	349°01.9	07.9	21°25.7	16.2′	04°25.4	14.4′	55.1′
12	4°01.9	S17°08.6	36°00.9	16.1′	S04°39.8	14.5′	55.1′
13	19°01.8	09.3	50°36.0	16.1′	04°54.3	14.4′	55.1′
14	34°01.8	10.0	65°11.1	16.0′	05°08.7	14.4′	55.1′
15	49°01.7	·· 10.7	79°46.1	16.0′	05°23.1	14.4′	55.1′
16	64°01.6	11.4	94°21.1	15.9′	05°37.5	14.4′	55.2′
17	79°01.6	12.1	108°56.1	15.9′	05°51.9	14.4′	55.2′
18	94°01.5	S17°12.8	123°31.0	15.9′	S06°06.3	14.4′	55.2′
19	109°01.4	13.5	138°05.8	15.8′	06°20.7	14.3′	55.2′
20	124°01.4	14.2	152°40.7	15.8′	06°35.0	14.4′	55.2′
21	139°01.3	·· 14.9	167°15.4	15.7′	06°49.4	14.3′	55.3′
22	154°01.3	15.6	181°50.1	15.7′	07°03.7	14.3′	55.3′
23	169°01.2	16.3	196°24.8	15.6′	07°18.0	14.3′	55.3′
	SD = 16.1′	d = -0.7′	SD = 15.0′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	184°01.1	S17°17.0	210°59.4	15.5′	S07°32.3	14.3′	55.3′
1	199°01.1	17.7	225°33.9	15.5′	07°46.6	14.3′	55.4′
2	214°01.0	18.4	240°08.4	15.4′	08°00.9	14.2′	55.4′
3	229°00.9	·· 19.1	254°42.8	15.4′	08°15.1	14.2′	55.4′
4	244°00.9	19.8	269°17.2	15.3′	08°29.3	14.2′	55.4′
5	259°00.8	20.5	283°51.5	15.3′	08°43.5	14.2′	55.4′
6	274°00.7	S17°21.2	298°25.8	15.2′	S08°57.7	14.2′	55.5′
7	289°00.7	21.8	313°00.0	15.1′	09°11.9	14.1′	55.5′
8	304°00.6	22.5	327°34.1	15.1′	09°26.0	14.1′	55.5′
9	319°00.5	·· 23.2	342°08.2	15.0′	09°40.1	14.1′	55.5′
10	334°00.5	23.9	356°42.2	14.9′	09°54.2	14.1′	55.6′
11	349°00.4	24.6	11°16.1	14.9′	10°08.3	14.0′	55.6′
12	4°00.3	S17°25.3	25°50.0	14.8′	S10°22.3	14.0′	55.6′
13	19°00.2	26.0	40°23.8	14.7′	10°36.3	13.9′	55.6′
14	34°00.2	26.7	54°57.6	14.7′	10°50.2	14.0′	55.6′
15	49°00.1	·· 27.4	69°31.2	14.6′	11°04.2	13.9′	55.7′
16	64°00.0	28.1	84°04.8	14.5′	11°18.1	13.8′	55.7′
17	79°00.0	28.7	98°38.4	14.5′	11°31.9	13.8′	55.7′
18	93°59.9	S17°29.4	113°11.8	14.4′	S11°45.7	13.8′	55.7′
19	108°59.8	30.1	127°45.2	14.3′	11°59.5	13.8′	55.8′
20	123°59.7	30.8	142°18.5	14.2′	12°13.3	13.7′	55.8′
21	138°59.7	·· 31.5	156°51.7	14.2′	12°27.0	13.7′	55.8′
22	153°59.6	32.2	171°24.9	14.1′	12°40.7	13.6′	55.8′
23	168°59.5	32.9	185°57.9	14.0′	12°54.3	13.6′	55.8′
	SD = 16.1′	d = -0.7′	SD = 15.1′				

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

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

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 26-28 18-6%
09	16:15	16:13	11:44	08:52	21:12	
10	16:10	16:08	11:44	09:32	21:52	
11	16:05	16:01	11:44	10:14	22:35	

November 12, 13, 14 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	50°52.1	226°41.4	S00°17.8	182°05.4	S18°06.9	13°28.9	N13°16.6	77°37.0	S12°52.8
1	65°54.6	241°41.3	18.8	197°06.1	07.4	28°31.7	16.5	92°39.4	52.8
2	80°57.0	256°41.2	19.7	212°06.8	07.9	43°34.5	16.4	107°41.9	52.8
3	95°59.5	271°41.1	·· 20.7	227°07.5	·· 08.4	58°37.3	·· 16.3	122°44.3	·· 52.8
4	111°01.9	286°40.9	21.6	242°08.2	08.9	73°40.1	16.2	137°46.7	52.8
5	126°04.4	301°40.8	22.6	257°08.9	09.3	88°42.9	16.1	152°49.2	52.7
6	141°06.9	316°40.7	S00°23.5	272°09.6	S18°09.8	103°45.7	N13°16.0	167°51.6	S12°52.7
7	156°09.3	331°40.5	24.5	287°10.2	10.3	118°48.4	15.9	182°54.0	52.7
8	171°11.8	346°40.4	25.5	302°10.9	10.8	133°51.2	15.8	197°56.5	52.7
9	186°14.3	1°40.3	·· 26.4	317°11.6	·· 11.3	148°54.0	·· 15.7	212°58.9	·· 52.7
10	201°16.7	16°40.1	27.4	332°12.3	11.8	163°56.8	15.6	228°01.3	52.7
11	216°19.2	31°40.0	28.3	347°13.0	12.2	178°59.6	15.5	243°03.7	52.6
12	231°21.7	46°39.9	S00°29.3	2°13.7	S18°12.7	194°02.4	N13°15.4	258°06.2	S12°52.6
13	246°24.1	61°39.7	30.3	17°14.4	13.2	209°05.2	15.3	273°08.6	52.6
14	261°26.6	76°39.6	31.2	32°15.1	13.7	224°08.0	15.2	288°11.0	52.6
15	276°29.0	91°39.5	·· 32.2	47°15.8	·· 14.2	239°10.7	·· 15.1	303°13.5	·· 52.6
16	291°31.5	106°39.3	33.2	62°16.4	14.6	254°13.5	15.0	318°15.9	52.6
17	306°34.0	121°39.2	34.1	77°17.1	15.1	269°16.3	14.9	333°18.3	52.5
18	321°36.4	136°39.1	S00°35.1	92°17.8	S18°15.6	284°19.1	N13°14.8	348°20.8	S12°52.5
19	336°38.9	151°38.9	36.0	107°18.5	16.1	299°21.9	14.7	3°23.2	52.5
20	351°41.4	166°38.8	37.0	122°19.2	16.6	314°24.7	14.6	18°25.6	52.5
21	6°43.8	181°38.7	·· 38.0	137°19.9	·· 17.0	329°27.4	·· 14.5	33°28.1	·· 52.5
22	21°46.3	196°38.5	38.9	152°20.6	17.5	344°30.2	14.4	48°30.5	52.5
23	36°48.8	211°38.4	39.9	167°21.2	18.0	359°33.0	14.3	63°32.9	52.4
Mer.pass. 20:33		ν -0.1′ d -1.0′ m -4.33		ν 0.7′ d -0.5′ m 1.40		ν 2.8′ d -0.1′ m -2.90		ν 2.4′ d 0.0′ m 0.78	

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	51°51.2	226°38.3	S00°40.9	182°21.9	S18°18.5	14°35.8	N13°14.2	78°35.3	S12°52.4
1	66°53.7	241°38.1	41.8	197°22.6	18.9	29°38.6	14.1	93°37.8	52.4
2	81°56.2	256°38.0	42.8	212°23.3	19.4	44°41.4	14.0	108°40.2	52.4
3	96°58.6	271°37.8	·· 43.8	227°24.0	·· 19.9	59°44.2	·· 13.9	123°42.6	·· 52.4
4	112°01.1	286°37.7	44.7	242°24.7	20.4	74°46.9	13.8	138°45.1	52.3
5	127°03.5	301°37.6	45.7	257°25.3	20.9	89°49.7	13.7	153°47.5	52.3
6	142°06.0	316°37.4	S00°46.7	272°26.0	S18°21.3	104°52.5	N13°13.6	168°49.9	S12°52.3
7	157°08.5	331°37.3	47.6	287°26.7	21.8	119°55.3	13.5	183°52.4	52.3
8	172°10.9	346°37.1	48.6	302°27.4	22.3	134°58.1	13.4	198°54.8	52.3
9	187°13.4	1°37.0	·· 49.6	317°28.1	·· 22.8	150°00.9	·· 13.3	213°57.2	·· 52.3
10	202°15.9	16°36.9	50.5	332°28.8	23.2	165°03.6	13.3	228°59.6	52.2
11	217°18.3	31°36.7	51.5	347°29.4	23.7	180°06.4	13.2	244°02.1	52.2
12	232°20.8	46°36.6	S00°52.5	2°30.1	S18°24.2	195°09.2	N13°13.1	259°04.5	S12°52.2
13	247°23.3	61°36.4	53.4	17°30.8	24.7	210°12.0	13.0	274°06.9	52.2
14	262°25.7	76°36.3	54.4	32°31.5	25.1	225°14.8	12.9	289°09.3	52.2
15	277°28.2	91°36.2	·· 55.4	47°32.2	·· 25.6	240°17.6	·· 12.8	304°11.8	·· 52.1
16	292°30.7	106°36.0	56.3	62°32.8	26.1	255°20.3	12.7	319°14.2	52.1
17	307°33.1	121°35.9	57.3	77°33.5	26.5	270°23.1	12.6	334°16.6	52.1
18	322°35.6	136°35.7	S00°58.3	92°34.2	S18°27.0	285°25.9	N13°12.5	349°19.1	S12°52.1
19	337°38.0	151°35.6	00°59.2	107°34.9	27.5	300°28.7	12.4	4°21.5	52.1
20	352°40.5	166°35.4	01°00.2	122°35.6	28.0	315°31.5	12.3	19°23.9	52.0
21	7°43.0	181°35.3	·· 01.2	137°36.2	·· 28.4	330°34.3	·· 12.2	34°26.3	·· 52.0
22	22°45.4	196°35.2	02.2	152°36.9	28.9	345°37.0	12.1	49°28.8	52.0
23	37°47.9	211°35.0	03.1	167°37.6	29.4	0°39.8	12.0	64°31.2	52.0
Mer.pass. 20:29		ν -0.1′ d -1.0′ m -4.32		ν 0.7′ d -0.5′ m 1.39		ν 2.8′ d -0.1′ m -2.90		ν 2.4′ d 0.0′ m 0.79	

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	52°50.4	226°34.9	S01°04.1	182°38.3	S18°29.9	15°42.6	N13°11.9	79°33.6	S12°52.0
1	67°52.8	241°34.7	05.1	197°39.0	30.3	30°45.4	11.8	94°36.0	51.9
2	82°55.3	256°34.6	06.0	212°39.6	30.8	45°48.2	11.7	109°38.5	51.9
3	97°57.8	271°34.4	·· 07.0	227°40.3	·· 31.3	60°50.9	·· 11.6	124°40.9	·· 51.9
4	113°00.2	286°34.3	08.0	242°41.0	31.7	75°53.7	11.5	139°43.3	51.9
5	128°02.7	301°34.1	09.0	257°41.7	32.2	90°56.5	11.4	154°45.7	51.9
6	143°05.1	316°34.0	S01°09.9	272°42.3	S18°32.7	105°59.3	N13°11.3	169°48.2	S12°51.8
7	158°07.6	331°33.8	10.9	287°43.0	33.2	121°02.1	11.2	184°50.6	51.8
8	173°10.1	346°33.7	11.9	302°43.7	33.6	136°04.9	11.1	199°53.0	51.8
9	188°12.5	1°33.5	·· 12.8	317°44.4	·· 34.1	151°07.6	·· 11.0	214°55.4	·· 51.8
10	203°15.0	16°33.4	13.8	332°45.1	34.6	166°10.4	10.9	229°57.9	51.8
11	218°17.5	31°33.3	14.8	347°45.7	35.0	181°13.2	10.8	245°00.3	51.7
12	233°19.9	46°33.1	S01°15.8	2°46.4	S18°35.5	196°16.0	N13°10.7	260°02.7	S12°51.7
13	248°22.4	61°33.0	16.7	17°47.1	36.0	211°18.8	10.6	275°05.1	51.7
14	263°24.9	76°32.8	17.7	32°47.8	36.4	226°21.5	10.5	290°07.5	51.7
15	278°27.3	91°32.7	·· 18.7	47°48.4	·· 36.9	241°24.3	·· 10.4	305°10.0	·· 51.7
16	293°29.8	106°32.5	19.7	62°49.1	37.4	256°27.1	10.3	320°12.4	51.6
17	308°32.3	121°32.4	20.6	77°49.8	37.8	271°29.9	10.3	335°14.8	51.6
18	323°34.7	136°32.2	S01°21.6	92°50.5	S18°38.3	286°32.7	N13°10.2	350°17.2	S12°51.6
19	338°37.2	151°32.0	22.6	107°51.1	38.8	301°35.4	10.1	5°19.7	51.6
20	353°39.6	166°31.9	23.6	122°51.8	39.2	316°38.2	10.0	20°22.1	51.6
21	8°42.1	181°31.7	·· 24.6	137°52.5	·· 39.7	331°41.0	·· 09.9	35°24.5	·· 51.5
22	23°44.6	196°31.6	25.5	152°53.2	40.2	346°43.8	09.8	50°26.9	51.5
23	38°47.0	211°31.4	26.5	167°53.8	40.6	1°46.6	09.7	65°29.3	51.5
Mer.pass. 20:25		ν -0.1′ d -1.0′ m -4.32		ν 0.7′ d -0.5′ m 1.38		ν 2.8′ d -0.1′ m -2.90		ν 2.4′ d 0.0′ m 0.79	

Stars

	SHA	**Dec**
Alpheratz	357°35.6	29°13.5
Ankaa	353°07.8	-42°10.7
Schedar	349°31.8	56°40.3
Diphda	348°48.0	-17°51.4
Achernar	335°20.4	-57°07.1
Hamal	327°52.0	23°34.6
Polaris	314°01.5	89°21.9
Acamar	315°12.1	-40°12.5
Menkar	314°06.9	4°11.1
Mirfak	308°29.2	49°56.8
Aldebaran	290°40.4	16°33.5
Rigel	281°04.5	-8°10.3
Capella	280°22.9	46°01.3
Bellatrix	278°23.7	6°22.4
Elnath	278°02.8	28°37.6
Alnilam	275°38.5	-1°11.1
Betelgeuse	270°52.9	7°24.8
Canopus	263°52.4	-52°42.2
Sirius	258°26.9	-16°44.7
Adhara	255°06.4	-29°00.0
Procyon	244°51.7	5°09.9
Pollux	243°18.4	27°58.1
Avior	234°15.0	-59°34.7
Suhail	222°47.0	-43°31.4
Miaplacidus	221°38.4	-69°48.5
Alphard	217°48.7	-8°45.5
Regulus	207°35.6	11°51.1
Dubhe	193°42.5	61°37.2
Denebola	182°26.2	14°26.4
Gienah	175°44.8	-17°40.3
Acrux	173°01.8	-63°13.6
Gacrux	171°53.2	-57°14.5
Alioth	166°14.3	55°49.7
Spica	158°23.6	-11°17.0
Alkaid	152°53.2	49°11.6
Hadar	148°38.1	-60°29.1
Menkent	147°59.2	-36°29.1
Arcturus	145°49.2	19°03.6
Rigil Kent.	139°42.4	-60°55.9
Kochab	137°20.9	74°03.4
Zuben'ubi	136°57.5	-16°08.3
Alphecca	126°05.0	26°38.1
Antares	112°17.4	-26°29.0
Atria	107°13.1	-69°04.3
Sabik	102°04.2	-15°45.2
Shaula	96°12.1	-37°07.3
Rasalhague	95°59.8	12°32.7
Eltanin	90°43.1	51°29.3
Kaus Aust.	83°34.1	-34°22.5
Vega	80°34.2	38°48.5
Nunki	75°49.2	-26°16.1
Altair	62°01.1	8°56.0
Peacock	53°07.4	-56°39.7
Deneb	49°26.6	45°22.1
Enif	33°39.8	9°59.1
Al Na'ir	27°34.1	-46°51.0
Fomalhaut	15°15.5	-29°29.9
Scheat	13°46.0	28°12.9
Markab	13°30.8	15°20.1

Nov 12 Sun	**SHA**	**Mer.pass**
Venus	175°49.4	08:53
Mars	131°13.3	11:51
Jupiter	322°36.9	23:02
Saturn	26°44.9	18:46

Nov 13 Mon	**SHA**	**Mer.pass**
Venus	174°47.0	08:54
Mars	130°30.7	11:50
Jupiter	322°44.6	22:57
Saturn	26°44.1	18:43

Nov 14 Tue	**SHA**	**Mer.pass**
Venus	173°44.5	08:54
Mars	129°47.9	11:49
Jupiter	322°52.2	22:53
Saturn	26°43.2	18:39

Horizontal parallax	
Venus:	0.2
Mars:	0.1

h	Sun		Moon				
Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°59.5	S17°33.5	200°30.9	13.9′	S13°07.9	13.5′	55.9′
1	198°59.4	34.2	215°03.8	13.8′	13°21.4	13.5′	55.9′
2	213°59.3	34.9	229°36.7	13.7′	13°34.9	13.4′	55.9′
3	228°59.2	·· 35.6	244°09.4	13.7′	13°48.3	13.4′	55.9′
4	243°59.2	36.3	258°42.1	13.6′	14°01.7	13.4′	56.0′
5	258°59.1	37.0	273°14.7	13.5′	14°15.1	13.3′	56.0′
6	273°59.0	S17°37.6	287°47.2	13.4′	S14°28.4	13.2′	56.0′
7	288°58.9	38.3	302°19.6	13.3′	14°41.6	13.2′	56.0′
8	303°58.9	39.0	316°51.9	13.2′	14°54.8	13.2′	56.1′
9	318°58.8	·· 39.7	331°24.1	13.1′	15°08.0	13.1′	56.1′
10	333°58.7	40.4	345°56.3	13.1′	15°21.1	13.0′	56.1′
11	348°58.6	41.0	0°28.3	13.0′	15°34.1	12.9′	56.1′
12	3°58.5	S17°41.7	15°00.3	12.9′	S15°47.0	13.0′	56.1′
13	18°58.5	42.4	29°32.2	12.8′	16°00.0	12.8′	56.2′
14	33°58.4	43.1	44°04.0	12.7′	16°12.8	12.8′	56.2′
15	48°58.3	·· 43.7	58°35.7	12.6′	16°25.6	12.7′	56.2′
16	63°58.2	44.4	73°07.3	12.5′	16°38.3	12.7′	56.2′
17	78°58.1	45.1	87°38.8	12.4′	16°51.0	12.5′	56.3′
18	93°58.1	S17°45.8	102°10.2	12.3′	S17°03.5	12.6′	56.3′
19	108°58.0	46.4	116°41.5	12.2′	17°16.1	12.4′	56.3′
20	123°57.9	47.1	131°12.7	12.1′	17°28.5	12.4′	56.3′
21	138°57.8	·· 47.8	145°43.8	12.0′	17°40.9	12.3′	56.4′
22	153°57.7	48.5	160°14.8	11.9′	17°53.2	12.2′	56.4′
23	168°57.7	49.1	174°45.7	11.8′	18°05.4	12.2′	56.4′
	SD = 16.1′	d = -0.7′	SD = 15.2′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°57.6	S17°49.8	189°16.5	11.7′	S18°17.6	12.1′	56.4′
1	198°57.5	50.5	203°47.2	11.6′	18°29.7	11.9′	56.5′
2	213°57.4	51.1	218°17.9	11.5′	18°41.6	12.0′	56.5′
3	228°57.3	·· 51.8	232°48.4	11.4′	18°53.6	11.8′	56.5′
4	243°57.2	52.5	247°18.8	11.3′	19°05.4	11.8′	56.5′
5	258°57.2	53.2	261°49.1	11.2′	19°17.2	11.6′	56.5′
6	273°57.1	S17°53.8	276°19.3	11.1′	S19°28.8	11.6′	56.6′
7	288°57.0	54.5	290°49.4	11.0′	19°40.4	11.5′	56.6′
8	303°56.9	55.2	305°19.4	10.9′	19°51.9	11.4′	56.6′
9	318°56.8	·· 55.8	319°49.3	10.8′	20°03.3	11.3′	56.6′
10	333°56.7	56.5	334°19.0	10.7′	20°14.6	11.3′	56.7′
11	348°56.6	57.2	348°48.7	10.6′	20°25.9	11.1′	56.7′
12	3°56.5	S17°57.8	3°18.3	10.5′	S20°37.0	11.0′	56.7′
13	18°56.5	58.5	17°47.7	10.4′	20°48.0	11.0′	56.7′
14	33°56.4	59.1	32°17.1	10.2′	20°59.0	10.8′	56.8′
15	48°56.3	17°59.8	46°46.4	10.1′	21°09.8	10.7′	56.8′
16	63°56.2	18°00.5	61°15.5	10.0′	21°20.5	10.7′	56.8′
17	78°56.1	01.1	75°44.5	9.9′	21°31.2	10.5′	56.8′
18	93°56.0	S18°01.8	90°13.5	9.8′	S21°41.7	10.4′	56.8′
19	108°55.9	02.5	104°42.3	9.7′	21°52.1	10.4′	56.9′
20	123°55.8	03.1	119°11.0	9.6′	22°02.5	10.2′	56.9′
21	138°55.7	·· 03.8	133°39.6	9.5′	22°12.7	10.1′	56.9′
22	153°55.7	04.4	148°08.1	9.4′	22°22.8	10.0′	56.9′
23	168°55.6	05.1	162°36.5	9.3′	22°32.8	9.9′	57.0′
	SD = 16.2′	d = -0.7′	SD = 15.4′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°55.5	S18°05.8	177°04.7	9.2′	S22°42.7	9.7′	57.0′
1	198°55.4	06.4	191°32.9	9.1′	22°52.4	9.7′	57.0′
2	213°55.3	07.1	206°01.0	9.0′	23°02.1	9.5′	57.0′
3	228°55.2	·· 07.7	220°28.9	8.8′	23°11.6	9.4′	57.0′
4	243°55.1	08.4	234°56.8	8.7′	23°21.0	9.3′	57.1′
5	258°55.0	09.0	249°24.5	8.6′	23°30.3	9.2′	57.1′
6	273°54.9	S18°09.7	263°52.1	8.5′	S23°39.5	9.1′	57.1′
7	288°54.8	10.3	278°19.6	8.4′	23°48.6	8.9′	57.1′
8	303°54.7	11.0	292°47.1	8.3′	23°57.5	8.8′	57.2′
9	318°54.6	·· 11.7	307°14.4	8.2′	24°06.3	8.7′	57.2′
10	333°54.5	12.3	321°41.6	8.1′	24°15.0	8.5′	57.2′
11	348°54.4	13.0	336°08.7	8.0′	24°23.5	8.4′	57.2′
12	3°54.3	S18°13.6	350°35.7	7.9′	S24°31.9	8.3′	57.2′
13	18°54.2	14.3	5°02.6	7.8′	24°40.2	8.1′	57.3′
14	33°54.2	14.9	19°29.3	7.7′	24°48.3	8.0′	57.3′
15	48°54.1	·· 15.6	33°56.0	7.6′	24°56.3	7.9′	57.3′
16	63°54.0	16.2	48°22.6	7.5′	25°04.2	7.7′	57.3′
17	78°53.9	16.9	62°49.1	7.4′	25°11.9	7.6′	57.4′
18	93°53.8	S18°17.5	77°15.5	7.3′	S25°19.5	7.5′	57.4′
19	108°53.7	18.2	91°41.8	7.2′	25°27.0	7.3′	57.4′
20	123°53.6	18.8	106°07.9	7.1′	25°34.3	7.1′	57.4′
21	138°53.5	·· 19.4	120°34.0	7.0′	25°41.4	7.0′	57.4′
22	153°53.4	20.1	135°00.0	6.9′	25°48.4	6.9′	57.5′
23	168°53.3	20.7	149°25.9	6.8′	25°55.3	6.7′	57.5′
	SD = 16.2′	d = -0.7′	SD = 15.5′				

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

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

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 29-1 2-0%
12	15:58	15:54	11:44	10:58	23:22	
13	15:50	15:46	11:44	11:46	–:–	
14	15:42	15:37	11:44	12:39	00:12	

November 15, 16, 17 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	53°49.5	226°31.3	S01°27.5	182°54.5	S18°41.1	16°49.3	N13°09.6	80°31.8	S12°51.5
1	68°52.0	241°31.1	28.5	197°55.2	41.6	31°52.1	09.5	95°34.2	51.5
2	83°54.4	256°31.0	29.4	212°55.8	42.0	46°54.9	09.4	110°36.6	51.4
3	98°56.9	271°30.8	·· 30.4	227°56.5	·· 42.5	61°57.7	·· 09.3	125°39.0	·· 51.4
4	113°59.4	286°30.7	31.4	242°57.2	43.0	77°00.4	09.2	140°41.5	51.4
5	129°01.8	301°30.5	32.4	257°57.9	43.4	92°03.2	09.1	155°43.9	51.4
6	144°04.3	316°30.4	S01°33.4	272°58.5	S18°43.9	107°06.0	N13°09.0	170°46.3	S12°51.3
7	159°06.8	331°30.2	34.3	287°59.2	44.4	122°08.8	08.9	185°48.7	51.3
8	174°09.2	346°30.1	35.3	302°59.9	44.8	137°11.6	08.8	200°51.1	51.3
9	189°11.7	1°29.9	·· 36.3	318°00.5	·· 45.3	152°14.3	·· 08.7	215°53.6	·· 51.3
10	204°14.1	16°29.7	37.3	333°01.2	45.7	167°17.1	08.6	230°56.0	51.3
11	219°16.6	31°29.6	38.3	348°01.9	46.2	182°19.9	08.5	245°58.4	51.2
12	234°19.1	46°29.4	S01°39.2	3°02.5	S18°46.7	197°22.7	N13°08.4	261°00.8	S12°51.2
13	249°21.5	61°29.3	40.2	18°03.2	47.1	212°25.4	08.3	276°03.2	51.2
14	264°24.0	76°29.1	41.2	33°03.9	47.6	227°28.2	08.2	291°05.6	51.2
15	279°26.5	91°29.0	·· 42.2	48°04.6	·· 48.1	242°31.0	·· 08.2	306°08.1	·· 51.2
16	294°28.9	106°28.8	43.2	63°05.2	48.5	257°33.8	08.1	321°10.5	51.1
17	309°31.4	121°28.6	44.1	78°05.9	49.0	272°36.6	08.0	336°12.9	51.1
18	324°33.9	136°28.5	S01°45.1	93°06.6	S18°49.4	287°39.3	N13°07.9	351°15.3	S12°51.1
19	339°36.3	151°28.3	46.1	108°07.2	49.9	302°42.1	07.8	6°17.7	51.1
20	354°38.8	166°28.2	47.1	123°07.9	50.4	317°44.9	07.7	21°20.2	51.0
21	9°41.3	181°28.0	·· 48.1	138°08.6	·· 50.8	332°47.7	·· 07.6	36°22.6	·· 51.0
22	24°43.7	196°27.8	49.1	153°09.2	51.3	347°50.4	07.5	51°25.0	51.0
23	39°46.2	211°27.7	50.0	168°09.9	51.7	2°53.2	07.4	66°27.4	51.0
Mer.pass. 20:21		ν -0.2′	d -1.0′ m -4.31	ν 0.7′	d -0.5′ m 1.37	ν 2.8′	d -0.1′ m -2.90	ν 2.4′	d 0.0′ m 0.79

Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	54°48.6	226°27.5	S01°51.0	183°10.6	S18°52.2	17°56.0	N13°07.3	81°29.8	S12°51.0
1	69°51.1	241°27.4	52.0	198°11.2	52.7	32°58.8	07.2	96°32.2	50.9
2	84°53.6	256°27.2	53.0	213°11.9	53.1	48°01.5	07.1	111°34.7	50.9
3	99°56.0	271°27.0	·· 54.0	228°12.6	·· 53.6	63°04.3	·· 07.0	126°37.1	·· 50.9
4	114°58.5	286°26.9	55.0	243°13.2	54.0	78°07.1	06.9	141°39.5	50.9
5	130°01.0	301°26.7	55.9	258°13.9	54.5	93°09.9	06.8	156°41.9	50.8
6	145°03.4	316°26.5	S01°56.9	273°14.6	S18°54.9	108°12.6	N13°06.7	171°44.3	S12°50.8
7	160°05.9	331°26.4	57.9	288°15.2	55.4	123°15.4	06.6	186°46.7	50.8
8	175°08.4	346°26.2	58.9	303°15.9	55.9	138°18.2	06.5	201°49.2	50.8
9	190°10.8	1°26.1	01°59.9	318°16.6	·· 56.3	153°21.0	·· 06.4	216°51.6	·· 50.7
10	205°13.3	16°25.9	02°00.9	333°17.2	56.8	168°23.7	06.4	231°54.0	50.7
11	220°15.8	31°25.7	01.9	348°17.9	57.2	183°26.5	06.3	246°56.4	50.7
12	235°18.2	46°25.6	S02°02.8	3°18.5	S18°57.7	198°29.3	N13°06.2	261°58.8	S12°50.7
13	250°20.7	61°25.4	03.8	18°19.2	58.1	213°32.1	06.1	277°01.2	50.7
14	265°23.1	76°25.2	04.8	33°19.9	58.6	228°34.8	06.0	292°03.7	50.6
15	280°25.6	91°25.1	·· 05.8	48°20.5	·· 59.1	243°37.6	·· 05.9	307°06.1	·· 50.6
16	295°28.1	106°24.9	06.8	63°21.2	18°59.5	258°40.4	05.8	322°08.5	50.6
17	310°30.5	121°24.7	07.8	78°21.9	19°00.0	273°43.2	05.7	337°10.9	50.6
18	325°33.0	136°24.6	S02°08.8	93°22.5	S19°00.4	288°45.9	N13°05.6	352°13.3	S12°50.5
19	340°35.5	151°24.4	09.7	108°23.2	00.9	303°48.7	05.5	7°15.7	50.5
20	355°37.9	166°24.2	10.7	123°23.8	01.3	318°51.5	05.4	22°18.1	50.5
21	10°40.4	181°24.1	·· 11.7	138°24.5	·· 01.8	333°54.2	·· 05.3	37°20.6	·· 50.5
22	25°42.9	196°23.9	12.7	153°25.2	02.2	348°57.0	05.2	52°23.0	50.4
23	40°45.3	211°23.7	13.7	168°25.8	02.7	3°59.8	05.1	67°25.4	50.4
Mer.pass. 20:17		ν -0.2′	d -1.0′ m -4.30	ν 0.7′	d -0.5′ m 1.37	ν 2.8′	d -0.1′ m -2.89	ν 2.4′	d 0.0′ m 0.80

Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	55°47.8	226°23.6	S02°14.7	183°26.5	S19°03.1	19°02.6	N13°05.0	82°27.8	S12°50.4
1	70°50.3	241°23.4	15.7	198°27.1	03.6	34°05.3	05.0	97°30.2	50.4
2	85°52.7	256°23.2	16.7	213°27.8	04.0	49°08.1	04.9	112°32.6	50.3
3	100°55.2	271°23.0	·· 17.7	228°28.5	·· 04.5	64°10.9	·· 04.8	127°35.0	·· 50.3
4	115°57.6	286°22.9	18.6	243°29.1	05.0	79°13.7	04.7	142°37.4	50.3
5	131°00.1	301°22.7	19.6	258°29.8	05.4	94°16.4	04.6	157°39.9	50.3
6	146°02.6	316°22.5	S02°20.6	273°30.4	S19°05.9	109°19.2	N13°04.5	172°42.3	S12°50.2
7	161°05.0	331°22.4	21.6	288°31.1	06.3	124°22.0	04.4	187°44.7	50.2
8	176°07.5	346°22.2	22.6	303°31.8	06.8	139°24.7	04.3	202°47.1	50.2
9	191°10.0	1°22.0	·· 23.6	318°32.4	·· 07.2	154°27.5	·· 04.2	217°49.5	·· 50.2
10	206°12.4	16°21.8	24.6	333°33.1	07.7	169°30.3	04.1	232°51.9	50.1
11	221°14.9	31°21.7	25.6	348°33.7	08.1	184°33.0	04.0	247°54.3	50.1
12	236°17.4	46°21.5	S02°26.6	3°34.4	S19°08.6	199°35.8	N13°03.9	262°56.7	S12°50.1
13	251°19.8	61°21.3	27.6	18°35.0	09.0	214°38.6	03.8	277°59.1	50.1
14	266°22.3	76°21.2	28.5	33°35.7	09.5	229°41.4	03.7	293°01.6	50.0
15	281°24.8	91°21.0	·· 29.5	48°36.4	·· 09.9	244°44.1	·· 03.6	308°04.0	·· 50.0
16	296°27.2	106°20.8	30.5	63°37.0	10.4	259°46.9	03.6	323°06.4	50.0
17	311°29.7	121°20.6	31.5	78°37.7	10.8	274°49.7	03.5	338°08.8	50.0
18	326°32.1	136°20.5	S02°32.5	93°38.3	S19°11.3	289°52.4	N13°03.4	353°11.2	S12°49.9
19	341°34.6	151°20.3	33.5	108°39.0	11.7	304°55.2	03.3	8°13.6	49.9
20	356°37.1	166°20.1	34.5	123°39.6	12.2	319°58.0	03.2	23°16.0	49.9
21	11°39.5	181°19.9	·· 35.5	138°40.3	·· 12.6	335°00.7	·· 03.1	38°18.4	·· 49.9
22	26°42.0	196°19.8	36.5	153°41.0	13.1	350°03.5	03.0	53°20.8	49.8
23	41°44.5	211°19.6	37.5	168°41.6	13.5	5°06.3	02.9	68°23.2	49.8
Mer.pass. 20:13		ν -0.2′	d -1.0′ m -4.29	ν 0.7′	d -0.5′ m 1.36	ν 2.8′	d -0.1′ m -2.89	ν 2.4′	d 0.0′ m 0.80

Stars

	SHA	**Dec**
Alpheratz	357°35.6	29°13.5
Ankaa	353°07.8	-42°10.7
Schedar	349°31.8	56°40.3
Diphda	348°48.0	-17°51.4
Achernar	335°20.4	-57°07.1
Hamal	327°52.0	23°34.6
Polaris	314°01.1	89°21.9
Acamar	315°12.1	-40°12.5
Menkar	314°06.8	4°11.1
Mirfak	308°29.2	49°56.8
Aldebaran	290°40.4	16°33.5
Rigel	281°04.5	-8°10.3
Capella	280°22.9	46°01.3
Bellatrix	278°23.6	6°22.4
Elnath	278°02.8	28°37.6
Alnilam	275°38.4	-1°11.1
Betelgeuse	270°52.9	7°24.8
Canopus	263°52.4	-52°42.2
Sirius	258°26.9	-16°44.7
Adhara	255°06.4	-29°00.0
Procyon	244°51.7	5°09.9
Pollux	243°18.3	27°58.1
Avior	234°14.9	-59°34.8
Suhail	222°47.0	-43°31.4
Miaplacidus	221°38.4	-69°48.5
Alphard	217°48.7	-8°45.5
Regulus	207°35.5	11°51.1
Dubhe	193°42.4	61°37.2
Denebola	182°26.1	14°26.4
Gienah	175°44.8	-17°40.3
Acrux	173°01.7	-63°13.6
Gacrux	171°53.2	-57°14.5
Alioth	166°14.3	55°49.7
Spica	158°23.6	-11°17.0
Alkaid	152°53.2	49°11.6
Hadar	148°38.0	-60°29.1
Menkent	147°59.2	-36°29.1
Arcturus	145°49.1	19°03.5
Rigil Kent.	139°42.3	-60°55.9
Kochab	137°20.9	74°03.4
Zuben'ubi	136°57.5	-16°08.3
Alphecca	126°04.9	26°38.1
Antares	112°17.4	-26°29.0
Atria	107°13.1	-69°04.2
Sabik	102°04.2	-15°45.2
Shaula	96°12.1	-37°07.3
Rasalhague	95°59.8	12°32.6
Eltanin	90°43.1	51°29.3
Kaus Aust.	83°34.1	-34°22.5
Vega	80°34.2	38°48.5
Nunki	75°49.2	-26°16.1
Altair	62°01.1	8°56.0
Peacock	53°07.5	-56°39.7
Deneb	49°26.6	45°22.1
Enif	33°39.8	9°59.1
Al Na'ir	27°34.1	-46°51.0
Fomalhaut	15°15.5	-29°29.9
Scheat	13°46.0	28°12.9
Markab	13°30.8	15°20.1

Nov 15 Wed	**SHA**	**Mer.pass**
Venus	172°41.8	08:54
Mars	129°05.0	11:48
Jupiter	322°59.8	22:48
Saturn	26°42.3	18:35

Nov 16 Thu	**SHA**	**Mer.pass**
Venus	171°38.9	08:54
Mars	128°21.9	11:47
Jupiter	323°07.3	22:44
Saturn	26°41.2	18:31

Nov 17 Fri	**SHA**	**Mer.pass**
Venus	170°35.8	08:55
Mars	127°38.7	11:46
Jupiter	323°14.8	22:40
Saturn	26°40.0	18:27

Horizontal parallax	
Venus:	0.2
Mars:	0.1

h	Sun		Moon				
Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°53.2	S18°21.4	163°51.7	6.7′	S26°02.0	6.6′	57.5′
1	198°53.1	22.0	178°17.4	6.6′	26°08.6	6.4′	57.5′
2	213°53.0	22.7	192°43.0	6.5′	26°15.0	6.3′	57.5′
3	228°52.9	·· 23.3	207°08.5	6.4′	26°21.3	6.1′	57.6′
4	243°52.8	24.0	221°34.0	6.3′	26°27.4	5.9′	57.6′
5	258°52.7	24.6	235°59.3	6.3′	26°33.3	5.8′	57.6′
6	273°52.6	S18°25.2	250°24.6	6.2′	S26°39.1	5.6′	57.6′
7	288°52.4	25.9	264°49.8	6.1′	26°44.7	5.5′	57.6′
8	303°52.3	26.5	279°14.8	6.0′	26°50.2	5.3′	57.7′
9	318°52.2	·· 27.2	293°39.9	5.9′	26°55.5	5.2′	57.7′
10	333°52.1	27.8	308°04.8	5.8′	27°00.7	5.0′	57.7′
11	348°52.0	28.4	322°29.6	5.8′	27°05.7	4.8′	57.7′
12	3°51.9	S18°29.1	336°54.4	5.7′	S27°10.5	4.6′	57.7′
13	18°51.8	29.7	351°19.1	5.6′	27°15.1	4.5′	57.7′
14	33°51.7	30.4	5°43.7	5.5′	27°19.6	4.4′	57.8′
15	48°51.6	·· 31.0	20°08.2	5.5′	27°24.0	4.1′	57.8′
16	63°51.5	31.6	34°32.7	5.4′	27°28.1	4.0′	57.8′
17	78°51.4	32.3	48°57.1	5.3′	27°32.1	3.8′	57.8′
18	93°51.3	S18°32.9	63°21.5	5.3′	S27°35.9	3.7′	57.8′
19	108°51.2	33.5	77°45.7	5.2′	27°39.6	3.4′	57.9′
20	123°51.1	34.2	92°10.0	5.2′	27°43.0	3.3′	57.9′
21	138°51.0	·· 34.8	106°34.1	5.1′	27°46.3	3.1′	57.9′
22	153°50.9	35.4	120°58.2	5.0′	27°49.4	3.0′	57.9′
23	168°50.8	36.1	135°22.2	5.0′	27°52.4	2.7′	57.9′
	SD = 16.2′	d = -0.6′	SD = 15.7′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°50.6	S18°36.7	149°46.2	4.9′	S27°55.1	2.6′	57.9′
1	198°50.5	37.3	164°10.1	4.9′	27°57.7	2.4′	58.0′
2	213°50.4	38.0	178°34.0	4.8′	28°00.1	2.3′	58.0′
3	228°50.3	·· 38.6	192°57.9	4.8′	28°02.4	2.0′	58.0′
4	243°50.2	39.2	207°21.6	4.7′	28°04.4	1.9′	58.0′
5	258°50.1	39.8	221°45.4	4.7′	28°06.3	1.7′	58.0′
6	273°50.0	S18°40.5	236°09.1	4.7′	S28°08.0	1.5′	58.1′
7	288°49.9	41.1	250°32.8	4.6′	28°09.5	1.3′	58.1′
8	303°49.8	41.7	264°56.4	4.6′	28°10.8	1.2′	58.1′
9	318°49.6	·· 42.4	279°20.0	4.6′	28°12.0	1.0′	58.1′
10	333°49.5	43.0	293°43.5	4.5′	28°13.0	0.7′	58.1′
11	348°49.4	43.6	308°07.1	4.5′	28°13.7	0.6′	58.1′
12	3°49.3	S18°44.2	322°30.6	4.5′	S28°14.3	0.5′	58.1′
13	18°49.2	44.9	336°54.0	4.5′	28°14.8	0.2′	58.2′
14	33°49.1	45.5	351°17.5	4.4′	28°15.0	0.0′	58.2′
15	48°49.0	·· 46.1	5°40.9	4.4′	28°15.0	0.1′	58.2′
16	63°48.8	46.7	20°04.3	4.4′	28°14.9	0.3′	58.2′
17	78°48.7	47.3	34°27.8	4.4′	28°14.6	0.6′	58.2′
18	93°48.6	S18°48.0	48°51.1	4.4′	S28°14.0	0.6′	58.2′
19	108°48.5	48.6	63°14.5	4.4′	28°13.4	0.9′	58.3′
20	123°48.4	49.2	77°37.9	4.4′	28°12.5	1.1′	58.3′
21	138°48.3	·· 49.8	92°01.3	4.4′	28°11.4	1.3′	58.3′
22	153°48.2	50.4	106°24.6	4.4′	28°10.1	1.4′	58.3′
23	168°48.0	51.1	120°48.0	4.4′	28°08.7	1.6′	58.3′
	SD = 16.2′	d = -0.6′	SD = 15.8′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°47.9	S18°51.7	135°11.4	4.4′	S28°07.1	1.8′	58.3′
1	198°47.8	52.3	149°34.7	4.4′	28°05.3	2.0′	58.3′
2	213°47.7	52.9	163°58.1	4.4′	28°03.3	2.2′	58.4′
3	228°47.6	·· 53.5	178°21.5	4.4′	28°01.1	2.4′	58.4′
4	243°47.4	54.1	192°44.9	4.4′	27°58.7	2.5′	58.4′
5	258°47.3	54.8	207°08.3	4.4′	27°56.2	2.8′	58.4′
6	273°47.2	S18°55.4	221°31.7	4.4′	S27°53.4	2.9′	58.4′
7	288°47.1	56.0	235°55.2	4.5′	27°50.5	3.1′	58.4′
8	303°47.0	56.6	250°18.7	4.5′	27°47.4	3.3′	58.4′
9	318°46.8	·· 57.2	264°42.2	4.5′	27°44.1	3.5′	58.5′
10	333°46.7	57.8	279°05.7	4.5′	27°40.6	3.6′	58.5′
11	348°46.6	58.4	293°29.2	4.6′	27°37.0	3.9′	58.5′
12	3°46.5	S18°59.0	307°52.8	4.6′	S27°33.1	4.0′	58.5′
13	18°46.4	18°59.6	322°16.4	4.6′	27°29.1	4.2′	58.5′
14	33°46.2	19°00.3	336°40.0	4.7′	27°24.9	4.4′	58.5′
15	48°46.1	·· 00.9	351°03.7	4.7′	27°20.5	4.5′	58.5′
16	63°46.0	01.5	5°27.4	4.8′	27°16.0	4.8′	58.6′
17	78°45.9	02.1	19°51.2	4.8′	27°11.2	4.9′	58.6′
18	93°45.7	S19°02.7	34°15.0	4.8′	S27°06.3	5.1′	58.6′
19	108°45.6	03.3	48°38.8	4.9′	27°01.2	5.3′	58.6′
20	123°45.5	03.9	63°02.7	4.9′	26°55.9	5.4′	58.6′
21	138°45.4	·· 04.5	77°26.6	5.0′	26°50.5	5.6′	58.6′
22	153°45.2	05.1	91°50.6	5.0′	26°44.9	5.8′	58.6′
23	168°45.1	05.7	106°14.7	5.1′	26°39.1	6.0′	58.6′
	SD = 16.2′	d = -0.6′	SD = 15.9′				

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

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

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 2-4 3-15%
15	15:33	15:28	11:45	13:36	01:07	
16	15:23	15:17	11:45	14:36	02:06	
17	15:12	15:06	11:45	15:37	03:07	

November 18, 19, 20 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	56°46.9	226°19.4	S02°38.5	183°42.3	S19°14.0	20°09.1	N13°02.8	83°25.7	S12°49.8
1	71°49.4	241°19.2	39.5	198°42.9	14.4	35°11.8	02.7	98°28.1	49.8
2	86°51.9	256°19.0	40.5	213°43.6	14.9	50°14.6	02.6	113°30.5	49.7
3	101°54.3	271°18.9	·· 41.5	228°44.2	·· 15.3	65°17.4	·· 02.5	128°32.9	·· 49.7
4	116°56.8	286°18.7	42.4	243°44.9	15.7	80°20.1	02.5	143°35.3	49.7
5	131°59.2	301°18.5	43.4	258°45.6	16.2	95°22.9	02.4	158°37.7	49.7
6	147°01.7	316°18.3	S02°44.4	273°46.2	S19°16.6	110°25.7	N13°02.3	173°40.1	S12°49.6
7	162°04.2	331°18.2	45.4	288°46.9	17.1	125°28.4	02.2	188°42.5	49.6
8	177°06.6	346°18.0	46.4	303°47.5	17.5	140°31.2	02.1	203°44.9	49.6
9	192°09.1	1°17.8	·· 47.4	318°48.2	·· 18.0	155°34.0	·· 02.0	218°47.3	·· 49.6
10	207°11.6	16°17.6	48.4	333°48.8	18.4	170°36.7	01.9	233°49.7	49.5
11	222°14.0	31°17.4	49.4	348°49.5	18.8	185°39.5	01.8	248°52.1	49.5
12	237°16.5	46°17.2	S02°50.4	3°50.1	S19°19.3	200°42.3	N13°01.7	263°54.5	S12°49.5
13	252°19.0	61°17.1	51.4	18°50.8	19.7	215°45.0	01.6	278°57.0	49.4
14	267°21.4	76°16.9	52.4	33°51.4	20.2	230°47.8	01.5	293°59.4	49.4
15	282°23.9	91°16.7	·· 53.4	48°52.1	·· 20.6	245°50.6	·· 01.4	309°01.8	·· 49.4
16	297°26.4	106°16.5	54.4	63°52.7	21.0	260°53.3	01.4	324°04.2	49.4
17	312°28.8	121°16.3	55.4	78°53.4	21.5	275°56.1	01.3	339°06.6	49.3
18	327°31.3	136°16.2	S02°56.4	93°54.0	S19°21.9	290°58.9	N13°01.2	354°09.0	S12°49.3
19	342°33.7	151°16.0	57.4	108°54.7	22.4	306°01.6	01.1	9°11.4	49.3
20	357°36.2	166°15.8	58.4	123°55.3	22.8	321°04.4	01.0	24°13.8	49.3
21	12°38.7	181°15.6	02°59.4	138°56.0	·· 23.2	336°07.2	·· 00.9	39°16.2	·· 49.2
22	27°41.1	196°15.4	03°00.4	153°56.6	23.7	351°09.9	00.8	54°18.6	49.2
23	42°43.6	211°15.2	01.4	168°57.3	24.1	6°12.7	00.7	69°21.0	49.2
Mer.pass. 20:10		ν -0.2′ d -1.0′ m -4.28		ν 0.7′ d -0.4′ m 1.36		ν 2.8′ d -0.1′ m -2.89		ν 2.4′ d 0.0′ m 0.81	

Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	57°46.1	226°15.0	S03°02.4	183°57.9	S19°24.6	21°15.5	N13°00.6	84°23.4	S12°49.2
1	72°48.5	241°14.9	03.4	198°58.6	25.0	36°18.2	00.5	99°25.8	49.1
2	87°51.0	256°14.7	04.4	213°59.2	25.4	51°21.0	00.4	114°28.2	49.1
3	102°53.5	271°14.5	·· 05.4	228°59.9	·· 25.9	66°23.7	·· 00.4	129°30.6	·· 49.1
4	117°55.9	286°14.3	06.4	244°00.5	26.3	81°26.5	00.3	144°33.0	49.0
5	132°58.4	301°14.1	07.4	259°01.2	26.7	96°29.3	00.2	159°35.4	49.0
6	148°00.9	316°13.9	S03°08.4	274°01.8	S19°27.2	111°32.0	N13°00.1	174°37.8	S12°49.0
7	163°03.3	331°13.7	09.3	289°02.5	27.6	126°34.8	13°00.0	189°40.2	49.0
8	178°05.8	346°13.6	10.3	304°03.1	28.1	141°37.6	12°59.9	204°42.6	48.9
9	193°08.2	1°13.4	·· 11.3	319°03.8	·· 28.5	156°40.3	·· 59.8	219°45.1	·· 48.9
10	208°10.7	16°13.2	12.3	334°04.4	28.9	171°43.1	59.7	234°47.5	48.9
11	223°13.2	31°13.0	13.3	349°05.0	29.4	186°45.9	59.6	249°49.9	48.8
12	238°15.6	46°12.8	S03°14.3	4°05.7	S19°29.8	201°48.6	N12°59.5	264°52.3	S12°48.8
13	253°18.1	61°12.6	15.3	19°06.3	30.2	216°51.4	59.5	279°54.7	48.8
14	268°20.6	76°12.4	16.3	34°07.0	30.7	231°54.1	59.4	294°57.1	48.8
15	283°23.0	91°12.2	·· 17.3	49°07.6	·· 31.1	246°56.9	·· 59.3	309°59.5	·· 48.7
16	298°25.5	106°12.0	18.3	64°08.3	31.6	261°59.7	59.2	325°01.9	48.7
17	313°28.0	121°11.8	19.3	79°08.9	32.0	277°02.4	59.1	340°04.3	48.7
18	328°30.4	136°11.7	S03°20.3	94°09.6	S19°32.4	292°05.2	N12°59.0	355°06.7	S12°48.7
19	343°32.9	151°11.5	21.3	109°10.2	32.9	307°07.9	58.9	10°09.1	48.6
20	358°35.4	166°11.3	22.3	124°10.8	33.3	322°10.7	58.8	25°11.5	48.6
21	13°37.8	181°11.1	·· 23.3	139°11.5	·· 33.7	337°13.5	·· 58.7	40°13.9	·· 48.6
22	28°40.3	196°10.9	24.3	154°12.1	34.2	352°16.2	58.6	55°16.3	48.5
23	43°42.7	211°10.7	25.3	169°12.8	34.6	7°19.0	58.6	70°18.7	48.5
Mer.pass. 20:06		ν -0.2′ d -1.0′ m -4.28		ν 0.6′ d -0.4′ m 1.36		ν 2.8′ d -0.1′ m -2.88		ν 2.4′ d 0.0′ m 0.81	

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	58°45.2	226°10.5	S03°26.3	184°13.4	S19°35.0	22°21.8	N12°58.5	85°21.1	S12°48.5
1	73°47.7	241°10.3	27.3	199°14.1	35.5	37°24.5	58.4	100°23.5	48.5
2	88°50.1	256°10.1	28.4	214°14.7	35.9	52°27.3	58.3	115°25.9	48.4
3	103°52.6	271°09.9	·· 29.4	229°15.3	·· 36.3	67°30.0	·· 58.2	130°28.3	·· 48.4
4	118°55.1	286°09.7	30.4	244°16.0	36.8	82°32.8	58.1	145°30.7	48.4
5	133°57.5	301°09.5	31.4	259°16.6	37.2	97°35.6	58.0	160°33.1	48.3
6	149°00.0	316°09.3	S03°32.4	274°17.3	S19°37.6	112°38.3	N12°57.9	175°35.5	S12°48.3
7	164°02.5	331°09.1	33.4	289°17.9	38.0	127°41.1	57.8	190°37.9	48.3
8	179°04.9	346°08.9	34.4	304°18.5	38.5	142°43.8	57.8	205°40.3	48.2
9	194°07.4	1°08.7	·· 35.4	319°19.2	·· 38.9	157°46.6	·· 57.7	220°42.7	·· 48.2
10	209°09.8	16°08.5	36.4	334°19.8	39.3	172°49.3	57.6	235°45.1	48.2
11	224°12.3	31°08.3	37.4	349°20.5	39.8	187°52.1	57.5	250°47.5	48.2
12	239°14.8	46°08.1	S03°38.4	4°21.1	S19°40.2	202°54.9	N12°57.4	265°49.9	S12°48.1
13	254°17.2	61°08.0	39.4	19°21.7	40.6	217°57.6	57.3	280°52.3	48.1
14	269°19.7	76°07.8	40.4	34°22.4	41.1	233°00.4	57.2	295°54.7	48.1
15	284°22.2	91°07.6	·· 41.4	49°23.0	·· 41.5	248°03.1	·· 57.1	310°57.1	·· 48.0
16	299°24.6	106°07.4	42.4	64°23.7	41.9	263°05.9	57.0	325°59.5	48.0
17	314°27.1	121°07.2	43.4	79°24.3	42.3	278°08.7	57.0	341°01.9	48.0
18	329°29.6	136°07.0	S03°44.4	94°24.9	S19°42.8	293°11.4	N12°56.9	356°04.3	S12°48.0
19	344°32.0	151°06.8	45.4	109°25.6	43.2	308°14.2	56.8	11°06.7	47.9
20	359°34.5	166°06.6	46.4	124°26.2	43.6	323°16.9	56.7	26°09.1	47.9
21	14°37.0	181°06.4	·· 47.4	139°26.9	·· 44.0	338°19.7	·· 56.6	41°11.5	·· 47.9
22	29°39.4	196°06.2	48.4	154°27.5	44.5	353°22.4	56.5	56°13.9	47.8
23	44°41.9	211°05.9	49.4	169°28.1	44.9	8°25.2	56.4	71°16.2	47.8
Mer.pass. 20:02		ν -0.2′ d -1.0′ m -4.27		ν 0.6′ d -0.4′ m 1.36		ν 2.8′ d -0.1′ m -2.88		ν 2.4′ d 0.0′ m 0.82	

Stars

	SHA	**Dec**
Alpheratz	357°35.6	29°13.5
Ankaa	353°07.8	-42°10.7
Schedar	349°31.8	56°40.3
Diphda	348°48.0	-17°51.4
Achernar	335°20.4	-57°07.1
Hamal	327°52.0	23°34.6
Polaris	314°01.0	89°21.9
Acamar	315°12.1	-40°12.5
Menkar	314°06.8	4°11.1
Mirfak	308°29.1	49°56.8
Aldebaran	290°40.4	16°33.5
Rigel	281°04.5	-8°10.3
Capella	280°22.9	46°01.3
Bellatrix	278°23.6	6°22.4
Elnath	278°02.7	28°37.7
Alnilam	275°38.4	-1°11.1
Betelgeuse	270°52.8	7°24.8
Canopus	263°52.4	-52°42.2
Sirius	258°26.8	-16°44.8
Adhara	255°06.4	-29°00.0
Procyon	244°51.7	5°09.9
Pollux	243°18.3	27°58.1
Avior	234°14.9	-59°34.8
Suhail	222°46.9	-43°31.4
Miaplacidus	221°38.3	-69°48.5
Alphard	217°48.7	-8°45.5
Regulus	207°35.5	11°51.1
Dubhe	193°42.4	61°37.1
Denebola	182°26.1	14°26.4
Gienah	175°44.8	-17°40.3
Acrux	173°01.7	-63°13.6
Gacrux	171°53.1	-57°14.5
Alioth	166°14.2	55°49.7
Spica	158°23.6	-11°17.0
Alkaid	152°53.2	49°11.6
Hadar	148°38.0	-60°29.1
Menkent	147°59.2	-36°29.1
Arcturus	145°49.1	19°03.5
Rigil Kent.	139°42.3	-60°55.9
Kochab	137°20.9	74°03.3
Zuben'ubi	136°57.4	-16°08.3
Alphecca	126°04.9	26°38.1
Antares	112°17.4	-26°29.0
Atria	107°13.1	-69°04.2
Sabik	102°04.2	-15°45.2
Shaula	96°12.1	-37°07.3
Rasalhague	95°59.8	12°32.6
Eltanin	90°43.1	51°29.3
Kaus Aust.	83°34.1	-34°22.5
Vega	80°34.2	38°48.5
Nunki	75°49.2	-26°16.1
Altair	62°01.1	8°56.0
Peacock	53°07.5	-56°39.7
Deneb	49°26.6	45°22.1
Enif	33°39.8	9°59.1
Al Na'ir	27°34.1	-46°51.0
Fomalhaut	15°15.5	-29°29.9
Scheat	13°46.0	28°12.9
Markab	13°30.8	15°20.1

Nov 18 Sat	**SHA**	**Mer.pass**
Venus	169°32.5	08:55
Mars	126°55.3	11:45
Jupiter	323°22.1	22:35
Saturn	26°38.7	18:23

Nov 19 Sun	**SHA**	**Mer.pass**
Venus	168°29.0	08:55
Mars	126°11.9	11:44
Jupiter	323°29.4	22:31
Saturn	26°37.3	18:20

Nov 20 Mon	**SHA**	**Mer.pass**
Venus	167°25.3	08:55
Mars	125°28.2	11:43
Jupiter	323°36.5	22:26
Saturn	26°35.9	18:16

Horizontal parallax	
Venus:	0.2
Mars:	0.1

h	Sun		Moon				
Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°45.0	S19°06.3	120°38.8	5.1′	S26°33.1	6.2′	58.6′
1	198°44.9	06.9	135°02.9	5.2′	26°26.9	6.3′	58.7′
2	213°44.7	07.5	149°27.1	5.3′	26°20.6	6.5′	58.7′
3	228°44.6	·· 08.1	163°51.4	5.3′	26°14.1	6.7′	58.7′
4	243°44.5	08.7	178°15.7	5.4′	26°07.4	6.8′	58.7′
5	258°44.3	09.3	192°40.1	5.4′	26°00.6	7.0′	58.7′
6	273°44.2	S19°09.9	207°04.5	5.5′	S25°53.6	7.2′	58.7′
7	288°44.1	10.5	221°29.0	5.6′	25°46.4	7.3′	58.7′
8	303°44.0	11.1	235°53.6	5.6′	25°39.1	7.5′	58.7′
9	318°43.8	·· 11.7	250°18.3	5.7′	25°31.6	7.7′	58.7′
10	333°43.7	12.3	264°43.0	5.8′	25°23.9	7.8′	58.8′
11	348°43.6	12.9	279°07.7	5.9′	25°16.1	8.0′	58.8′
12	3°43.4	S19°13.5	293°32.6	5.9′	S25°08.1	8.1′	58.8′
13	18°43.3	14.1	307°57.5	6.0′	25°00.0	8.3′	58.8′
14	33°43.2	14.7	322°22.5	6.1′	24°51.7	8.5′	58.8′
15	48°43.0	·· 15.3	336°47.6	6.1′	24°43.2	8.6′	58.8′
16	63°42.9	15.9	351°12.7	6.2′	24°34.6	8.8′	58.8′
17	78°42.8	16.5	5°38.0	6.3′	24°25.8	8.9′	58.8′
18	93°42.6	S19°17.1	20°03.3	6.4′	S24°16.9	9.1′	58.8′
19	108°42.5	17.7	34°28.6	6.5′	24°07.8	9.2′	58.8′
20	123°42.4	18.3	48°54.1	6.5′	23°58.6	9.4′	58.9′
21	138°42.2	·· 18.9	63°19.6	6.6′	23°49.2	9.6′	58.9′
22	153°42.1	19.4	77°45.2	6.7′	23°39.6	9.6′	58.9′
23	168°42.0	20.0	92°10.9	6.8′	23°30.0	9.9′	58.9′
	SD = 16.2′	d = -0.6′	SD = 16.0′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°41.8	S19°20.6	106°36.7	6.9′	S23°20.1	10.0′	58.9′
1	198°41.7	21.2	121°02.6	6.9′	23°10.1	10.1′	58.9′
2	213°41.6	21.8	135°28.5	7.0′	23°00.0	10.2′	58.9′
3	228°41.4	·· 22.4	149°54.5	7.1′	22°49.8	10.4′	58.9′
4	243°41.3	23.0	164°20.6	7.2′	22°39.4	10.6′	58.9′
5	258°41.2	23.6	178°46.8	7.3′	22°28.8	10.6′	58.9′
6	273°41.0	S19°24.1	193°13.1	7.4′	S22°18.2	10.8′	58.9′
7	288°40.9	24.7	207°39.5	7.4′	22°07.4	11.0′	59.0′
8	303°40.8	25.3	222°05.9	7.5′	21°56.4	11.1′	59.0′
9	318°40.6	·· 25.9	236°32.4	7.6′	21°45.3	11.2′	59.0′
10	333°40.5	26.5	250°59.1	7.7′	21°34.1	11.3′	59.0′
11	348°40.3	27.1	265°25.8	7.8′	21°22.8	11.5′	59.0′
12	3°40.2	S19°27.6	279°52.5	7.9′	S21°11.3	11.6′	59.0′
13	18°40.1	28.2	294°19.4	8.0′	20°59.7	11.7′	59.0′
14	33°39.9	28.8	308°46.4	8.0′	20°48.0	11.9′	59.0′
15	48°39.8	·· 29.4	323°13.4	8.1′	20°36.1	11.9′	59.0′
16	63°39.6	30.0	337°40.5	8.2′	20°24.2	12.1′	59.0′
17	78°39.5	30.5	352°07.7	8.3′	20°12.1	12.2′	59.0′
18	93°39.4	S19°31.1	6°35.0	8.4′	S19°59.9	12.4′	59.0′
19	108°39.2	31.7	21°02.4	8.5′	19°47.5	12.4′	59.0′
20	123°39.1	32.3	35°29.9	8.5′	19°35.1	12.6′	59.0′
21	138°38.9	·· 32.8	49°57.4	8.6′	19°22.5	12.6′	59.1′
22	153°38.8	33.4	64°25.0	8.7′	19°09.9	12.8′	59.1′
23	168°38.6	34.0	78°52.7	8.8′	18°57.1	12.9′	59.1′
	SD = 16.2′	d = -0.6′	SD = 16.1′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°38.5	S19°34.6	93°20.5	8.9′	S18°44.2	13.0′	59.1′
1	198°38.4	35.1	107°48.4	9.0′	18°31.2	13.1′	59.1′
2	213°38.2	35.7	122°16.3	9.0′	18°18.1	13.2′	59.1′
3	228°38.1	·· 36.3	136°44.4	9.1′	18°04.9	13.3′	59.1′
4	243°37.9	36.9	151°12.5	9.2′	17°51.6	13.5′	59.1′
5	258°37.8	37.4	165°40.7	9.3′	17°38.1	13.5′	59.1′
6	273°37.6	S19°38.0	180°09.0	9.4′	S17°24.6	13.6′	59.1′
7	288°37.5	38.6	194°37.3	9.4′	17°11.0	13.7′	59.1′
8	303°37.3	39.1	209°05.8	9.5′	16°57.3	13.8′	59.1′
9	318°37.2	·· 39.7	223°34.3	9.6′	16°43.5	13.9′	59.1′
10	333°37.1	40.3	238°02.8	9.7′	16°29.6	14.0′	59.1′
11	348°36.9	40.8	252°31.5	9.7′	16°15.6	14.1′	59.1′
12	3°36.8	S19°41.4	267°00.2	9.8′	S16°01.5	14.2′	59.1′
13	18°36.6	42.0	281°29.1	9.9′	15°47.3	14.3′	59.1′
14	33°36.5	42.5	295°57.9	10.0′	15°33.0	14.4′	59.1′
15	48°36.3	·· 43.1	310°26.9	10.0′	15°18.6	14.4′	59.1′
16	63°36.2	43.7	324°55.9	10.1′	15°04.2	14.5′	59.2′
17	78°36.0	44.2	339°25.0	10.2′	14°49.7	14.6′	59.2′
18	93°35.9	S19°44.8	353°54.2	10.2′	S14°35.1	14.7′	59.2′
19	108°35.7	45.4	8°23.4	10.3′	14°20.4	14.8′	59.2′
20	123°35.6	45.9	22°52.7	10.4′	14°05.6	14.8′	59.2′
21	138°35.4	·· 46.5	37°22.1	10.4′	13°50.8	15.0′	59.2′
22	153°35.3	47.1	51°51.6	10.5′	13°35.8	14.9′	59.2′
23	168°35.1	47.6	66°21.1	10.6′	13°20.9	15.1′	59.2′
	SD = 16.2′	d = -0.6′	SD = 16.1′				

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

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

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 5-7 24-45%
18	15:00	14:54	11:45	16:37	04:07	
19	14:47	14:41	11:45	17:33	05:05	
20	14:34	14:27	11:46	18:25	05:59	

November 21, 22, 23 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	59°44.3	226°05.7	S03°50.4	184°28.8	S19°45.3	23°28.0	N12°56.3	86°18.6	S12°47.8
1	74°46.8	241°05.5	51.4	199°29.4	45.8	38°30.7	56.3	101°21.0	47.7
2	89°49.3	256°05.3	52.4	214°30.0	46.2	53°33.5	56.2	116°23.4	47.7
3	104°51.7	271°05.1	·· 53.4	229°30.7	·· 46.6	68°36.2	·· 56.1	131°25.8	·· 47.7
4	119°54.2	286°04.9	54.4	244°31.3	47.0	83°39.0	56.0	146°28.2	47.7
5	134°56.7	301°04.7	55.4	259°31.9	47.5	98°41.7	55.9	161°30.6	47.6
6	149°59.1	316°04.5	S03°56.4	274°32.6	S19°47.9	113°44.5	N12°55.8	176°33.0	S12°47.6
7	165°01.6	331°04.3	57.4	289°33.2	48.3	128°47.2	55.7	191°35.4	47.6
8	180°04.1	346°04.1	58.5	304°33.8	48.7	143°50.0	55.6	206°37.8	47.5
9	195°06.5	1°03.9	03°59.5	319°34.5	·· 49.1	158°52.7	·· 55.6	221°40.2	·· 47.5
10	210°09.0	16°03.7	04°00.5	334°35.1	49.6	173°55.5	55.5	236°42.6	47.5
11	225°11.5	31°03.5	01.5	349°35.8	50.0	188°58.3	55.4	251°45.0	47.4
12	240°13.9	46°03.3	S04°02.5	4°36.4	S19°50.4	204°01.0	N12°55.3	266°47.4	S12°47.4
13	255°16.4	61°03.1	03.5	19°37.0	50.8	219°03.8	55.2	281°49.8	47.4
14	270°18.8	76°02.9	04.5	34°37.7	51.3	234°06.5	55.1	296°52.2	47.3
15	285°21.3	91°02.7	·· 05.5	49°38.3	·· 51.7	249°09.3	·· 55.0	311°54.6	·· 47.3
16	300°23.8	106°02.5	06.5	64°38.9	52.1	264°12.0	54.9	326°57.0	47.3
17	315°26.2	121°02.3	07.5	79°39.5	52.5	279°14.8	54.9	341°59.4	47.2
18	330°28.7	136°02.1	S04°08.5	94°40.2	S19°52.9	294°17.5	N12°54.8	357°01.8	S12°47.2
19	345°31.2	151°01.8	09.5	109°40.8	53.4	309°20.3	54.7	12°04.2	47.2
20	0°33.6	166°01.6	10.5	124°41.4	53.8	324°23.0	54.6	27°06.5	47.2
21	15°36.1	181°01.4	·· 11.5	139°42.1	·· 54.2	339°25.8	·· 54.5	42°08.9	·· 47.1
22	30°38.6	196°01.2	12.5	154°42.7	54.6	354°28.5	54.4	57°11.3	47.1
23	45°41.0	211°01.0	13.5	169°43.3	55.0	9°31.3	54.3	72°13.7	47.1
Mer.pass. 19:58		ν -0.2′	d -1.0′ m -4.26	ν 0.6′	d -0.4′ m 1.36	ν 2.8′	d -0.1′ m -2.87	ν 2.4′	d 0.0′ m 0.82

Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	60°43.5	226°00.8	S04°14.5	184°44.0	S19°55.5	24°34.0	N12°54.3	87°16.1	S12°47.0
1	75°45.9	241°00.6	15.6	199°44.6	55.9	39°36.8	54.2	102°18.5	47.0
2	90°48.4	256°00.4	16.6	214°45.2	56.3	54°39.5	54.1	117°20.9	47.0
3	105°50.9	271°00.2	·· 17.6	229°45.9	·· 56.7	69°42.3	·· 54.0	132°23.3	·· 46.9
4	120°53.3	285°59.9	18.6	244°46.5	57.1	84°45.0	53.9	147°25.7	46.9
5	135°55.8	300°59.7	19.6	259°47.1	57.6	99°47.8	53.8	162°28.1	46.9
6	150°58.3	315°59.5	S04°20.6	274°47.7	S19°58.0	114°50.5	N12°53.7	177°30.5	S12°46.8
7	166°00.7	330°59.3	21.6	289°48.4	58.4	129°53.3	53.7	192°32.9	46.8
8	181°03.2	345°59.1	22.6	304°49.0	58.8	144°56.0	53.6	207°35.2	46.8
9	196°05.7	0°58.9	·· 23.6	319°49.6	·· 59.2	159°58.8	·· 53.5	222°37.6	·· 46.7
10	211°08.1	15°58.7	24.6	334°50.3	19°59.6	175°01.5	53.4	237°40.0	46.7
11	226°10.6	30°58.5	25.6	349°50.9	20°00.1	190°04.3	53.3	252°42.4	46.7
12	241°13.1	45°58.2	S04°26.6	4°51.5	S20°00.5	205°07.0	N12°53.2	267°44.8	S12°46.6
13	256°15.5	60°58.0	27.6	19°52.1	00.9	220°09.8	53.1	282°47.2	46.6
14	271°18.0	75°57.8	28.7	34°52.8	01.3	235°12.5	53.1	297°49.6	46.6
15	286°20.4	90°57.6	·· 29.7	49°53.4	·· 01.7	250°15.3	·· 53.0	312°52.0	·· 46.5
16	301°22.9	105°57.4	30.7	64°54.0	02.1	265°18.0	52.9	327°54.4	46.5
17	316°25.4	120°57.2	31.7	79°54.7	02.5	280°20.8	52.8	342°56.8	46.5
18	331°27.8	135°56.9	S04°32.7	94°55.3	S20°03.0	295°23.5	N12°52.7	357°59.2	S12°46.4
19	346°30.3	150°56.7	33.7	109°55.9	03.4	310°26.3	52.6	13°01.5	46.4
20	1°32.8	165°56.5	34.7	124°56.5	03.8	325°29.0	52.5	28°03.9	46.4
21	16°35.2	180°56.3	·· 35.7	139°57.2	·· 04.2	340°31.8	·· 52.5	43°06.3	·· 46.3
22	31°37.7	195°56.1	36.7	154°57.8	04.6	355°34.5	52.4	58°08.7	46.3
23	46°40.2	210°55.8	37.7	169°58.4	05.0	10°37.3	52.3	73°11.1	46.3
Mer.pass. 19:54		ν -0.2′	d -1.0′ m -4.25	ν 0.6′	d -0.4′ m 1.36	ν 2.8′	d -0.1′ m -2.87	ν 2.4′	d 0.0′ m 0.82

Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	61°42.6	225°55.6	S04°38.7	184°59.0	S20°05.4	25°40.0	N12°52.2	88°13.5	S12°46.2
1	76°45.1	240°55.4	39.8	199°59.7	05.8	40°42.8	52.1	103°15.9	46.2
2	91°47.6	255°55.2	40.8	215°00.3	06.3	55°45.5	52.0	118°18.3	46.2
3	106°50.0	270°55.0	·· 41.8	230°00.9	·· 06.7	70°48.3	·· 52.0	133°20.7	·· 46.1
4	121°52.5	285°54.7	42.8	245°01.5	07.1	85°51.0	51.9	148°23.0	46.1
5	136°54.9	300°54.5	43.8	260°02.2	07.5	100°53.8	51.8	163°25.4	46.1
6	151°57.4	315°54.3	S04°44.8	275°02.8	S20°07.9	115°56.5	N12°51.7	178°27.8	S12°46.0
7	166°59.9	330°54.1	45.8	290°03.4	08.3	130°59.2	51.6	193°30.2	46.0
8	182°02.3	345°53.9	46.8	305°04.0	08.7	146°02.0	51.5	208°32.6	46.0
9	197°04.8	0°53.6	·· 47.8	320°04.6	·· 09.1	161°04.7	·· 51.5	223°35.0	·· 45.9
10	212°07.3	15°53.4	48.8	335°05.3	09.5	176°07.5	51.4	238°37.4	45.9
11	227°09.7	30°53.2	49.8	350°05.9	09.9	191°10.2	51.3	253°39.8	45.9
12	242°12.2	45°53.0	S04°50.9	5°06.5	S20°10.4	206°13.0	N12°51.2	268°42.1	S12°45.8
13	257°14.7	60°52.7	51.9	20°07.1	10.8	221°15.7	51.1	283°44.5	45.8
14	272°17.1	75°52.5	52.9	35°07.8	11.2	236°18.5	51.0	298°46.9	45.8
15	287°19.6	90°52.3	·· 53.9	50°08.4	·· 11.6	251°21.2	·· 50.9	313°49.3	·· 45.7
16	302°22.0	105°52.1	54.9	65°09.0	12.0	266°23.9	50.9	328°51.7	45.7
17	317°24.5	120°51.8	55.9	80°09.6	12.4	281°26.7	50.8	343°54.1	45.7
18	332°27.0	135°51.6	S04°56.9	95°10.2	S20°12.8	296°29.4	N12°50.7	358°56.5	S12°45.6
19	347°29.4	150°51.4	57.9	110°10.9	13.2	311°32.2	50.6	13°58.8	45.6
20	2°31.9	165°51.2	58.9	125°11.5	13.6	326°34.9	50.5	29°01.2	45.6
21	17°34.4	180°50.9	04°59.9	140°12.1	·· 14.0	341°37.7	·· 50.4	44°03.6	·· 45.5
22	32°36.8	195°50.7	05°01.0	155°12.7	14.4	356°40.4	50.4	59°06.0	45.5
23	47°39.3	210°50.5	02.0	170°13.3	14.8	11°43.1	50.3	74°08.4	45.5
Mer.pass. 19:50		ν -0.2′	d -1.0′ m -4.25	ν 0.6′	d -0.4′ m 1.36	ν 2.7′	d -0.1′ m -2.87	ν 2.4′	d 0.0′ m 0.83

Stars

	SHA	**Dec**
Alpheratz	357°35.6	29°13.5
Ankaa	353°07.8	-42°10.7
Schedar	349°31.8	56°40.3
Diphda	348°48.0	-17°51.4
Achernar	335°20.4	-57°07.1
Hamal	327°52.0	23°34.6
Polaris	314°01.2	89°22.0
Acamar	315°12.1	-40°12.5
Menkar	314°06.8	4°11.1
Mirfak	308°29.1	49°56.8
Aldebaran	290°40.4	16°33.5
Rigel	281°04.5	-8°10.3
Capella	280°22.9	46°01.3
Bellatrix	278°23.6	6°22.3
Elnath	278°02.7	28°37.7
Alnilam	275°38.4	-1°11.1
Betelgeuse	270°52.8	7°24.8
Canopus	263°52.4	-52°42.2
Sirius	258°26.8	-16°44.8
Adhara	255°06.3	-29°00.0
Procyon	244°51.6	5°09.9
Pollux	243°18.3	27°58.1
Avior	234°14.9	-59°34.8
Suhail	222°46.9	-43°31.4
Miaplacidus	221°38.3	-69°48.5
Alphard	217°48.7	-8°45.6
Regulus	207°35.5	11°51.1
Dubhe	193°42.3	61°37.1
Denebola	182°26.1	14°26.4
Gienah	175°44.8	-17°40.3
Acrux	173°01.6	-63°13.6
Gacrux	171°53.1	-57°14.5
Alioth	166°14.2	55°49.7
Spica	158°23.6	-11°17.0
Alkaid	152°53.2	49°11.6
Hadar	148°38.0	-60°29.1
Menkent	147°59.1	-36°29.1
Arcturus	145°49.1	19°03.5
Rigil Kent.	139°42.3	-60°55.8
Kochab	137°20.9	74°03.3
Zuben'ubi	136°57.4	-16°08.3
Alphecca	126°04.9	26°38.1
Antares	112°17.4	-26°29.0
Atria	107°13.1	-69°04.2
Sabik	102°04.2	-15°45.2
Shaula	96°12.1	-37°07.3
Rasalhague	95°59.8	12°32.6
Eltanin	90°43.1	51°29.2
Kaus Aust.	83°34.1	-34°22.5
Vega	80°34.2	38°48.5
Nunki	75°49.2	-26°16.1
Altair	62°01.1	8°55.9
Peacock	53°07.5	-56°39.7
Deneb	49°26.6	45°22.1
Enif	33°39.8	9°59.1
Al Na'ir	27°34.1	-46°51.0
Fomalhaut	15°15.5	-29°29.9
Scheat	13°46.1	28°12.9
Markab	13°30.8	15°20.1

Nov 21 Tue	**SHA**	**Mer.pass**
Venus	166°21.4	08:56
Mars	124°44.4	11:42
Jupiter	323°43.6	22:22
Saturn	26°34.3	18:12

Nov 22 Wed	**SHA**	**Mer.pass**
Venus	165°17.3	08:56
Mars	124°00.5	11:41
Jupiter	323°50.6	22:18
Saturn	26°32.6	18:08

Nov 23 Thu	**SHA**	**Mer.pass**
Venus	164°13.0	08:56
Mars	123°16.4	11:40
Jupiter	323°57.4	22:13
Saturn	26°30.9	18:04

Horizontal parallax	
Venus:	0.2
Mars:	0.1

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°35.0	S19°48.2	80°50.6	10.6′	S13°05.8	15.2′	59.2′
1	198°34.8	48.7	95°20.3	10.7′	12°50.6	15.2′	59.2′
2	213°34.7	49.3	109°50.0	10.8′	12°35.4	15.2′	59.2′
3	228°34.5	·· 49.8	124°19.7	10.8′	12°20.2	15.4′	59.2′
4	243°34.4	50.4	138°49.5	10.9′	12°04.8	15.4′	59.2′
5	258°34.2	51.0	153°19.4	10.9′	11°49.4	15.5′	59.2′
6	273°34.1	S19°51.5	167°49.3	11.0′	S11°33.9	15.5′	59.2′
7	288°33.9	52.1	182°19.3	11.0′	11°18.4	15.6′	59.2′
8	303°33.7	52.6	196°49.4	11.1′	11°02.8	15.6′	59.2′
9	318°33.6	·· 53.2	211°19.5	11.2′	10°47.2	15.7′	59.2′
10	333°33.4	53.7	225°49.6	11.2′	10°31.5	15.8′	59.2′
11	348°33.3	54.3	240°19.8	11.3′	10°15.7	15.8′	59.2′
12	3°33.1	S19°54.8	254°50.1	11.3′	S09°59.9	15.9′	59.2′
13	18°33.0	55.4	269°20.4	11.4′	09°44.0	15.9′	59.2′
14	33°32.8	55.9	283°50.7	11.4′	09°28.1	16.0′	59.2′
15	48°32.7	·· 56.5	298°21.1	11.4′	09°12.1	16.0′	59.2′
16	63°32.5	57.0	312°51.6	11.5′	08°56.1	16.1′	59.2′
17	78°32.3	57.6	327°22.1	11.5′	08°40.0	16.1′	59.2′
18	93°32.2	S19°58.1	341°52.6	11.6′	S08°23.9	16.2′	59.2′
19	108°32.0	58.7	356°23.2	11.6′	08°07.7	16.2′	59.2′
20	123°31.9	59.2	10°53.8	11.7′	07°51.5	16.2′	59.2′
21	138°31.7	19°59.8	25°24.5	11.7′	07°35.3	16.3′	59.2′
22	153°31.6	20°00.3	39°55.2	11.7′	07°19.0	16.3′	59.2′
23	168°31.4	00.9	54°25.9	11.8′	07°02.7	16.4′	59.2′
	SD = 16.2′	d = -0.6′	SD = 16.1′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°31.2	S20°01.4	68°56.7	11.8′	S06°46.3	16.3′	59.2′
1	198°31.1	01.9	83°27.5	11.8′	06°30.0	16.5′	59.2′
2	213°30.9	02.5	97°58.3	11.9′	06°13.5	16.4′	59.2′
3	228°30.8	·· 03.0	112°29.2	11.9′	05°57.1	16.5′	59.2′
4	243°30.6	03.6	127°00.1	11.9′	05°40.6	16.5′	59.2′
5	258°30.4	04.1	141°31.0	12.0′	05°24.1	16.6′	59.2′
6	273°30.3	S20°04.7	156°02.0	12.0′	S05°07.5	16.5′	59.2′
7	288°30.1	05.2	170°33.0	12.0′	04°51.0	16.6′	59.2′
8	303°29.9	05.7	185°04.0	12.0′	04°34.4	16.6′	59.2′
9	318°29.8	·· 06.3	199°35.0	12.1′	04°17.8	16.6′	59.2′
10	333°29.6	06.8	214°06.1	12.1′	04°01.2	16.7′	59.2′
11	348°29.5	07.3	228°37.1	12.1′	03°44.5	16.7′	59.2′
12	3°29.3	S20°07.9	243°08.2	12.1′	S03°27.8	16.7′	59.2′
13	18°29.1	08.4	257°39.4	12.1′	03°11.1	16.7′	59.2′
14	33°29.0	09.0	272°10.5	12.2′	02°54.4	16.7′	59.2′
15	48°28.8	·· 09.5	286°41.6	12.2′	02°37.7	16.7′	59.2′
16	63°28.6	10.0	301°12.8	12.2′	02°21.0	16.7′	59.2′
17	78°28.5	10.6	315°44.0	12.2′	02°04.3	16.8′	59.2′
18	93°28.3	S20°11.1	330°15.2	12.2′	S01°47.5	16.8′	59.2′
19	108°28.1	11.6	344°46.4	12.2′	01°30.7	16.7′	59.2′
20	123°28.0	12.2	359°17.6	12.2′	01°14.0	16.8′	59.2′
21	138°27.8	·· 12.7	13°48.8	12.2′	00°57.2	16.8′	59.2′
22	153°27.6	13.2	28°20.1	12.2′	00°40.4	16.7′	59.2′
23	168°27.5	13.7	42°51.3	12.2′	00°23.7	16.8′	59.2′
	SD = 16.2′	d = -0.5′	SD = 16.1′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°27.3	S20°14.3	57°22.5	12.2′	S00°06.9	16.8′	59.2′
1	198°27.1	14.8	71°53.8	12.2′	N00°09.9	16.7′	59.1′
2	213°27.0	15.3	86°25.0	12.2′	00°26.6	16.8′	59.1′
3	228°26.8	·· 15.9	100°56.3	12.2′	00°43.4	16.8′	59.1′
4	243°26.6	16.4	115°27.5	12.2′	01°00.2	16.7′	59.1′
5	258°26.5	16.9	129°58.8	12.2′	01°16.9	16.8′	59.1′
6	273°26.3	S20°17.4	144°30.0	12.2′	N01°33.7	16.7′	59.1′
7	288°26.1	18.0	159°01.2	12.2′	01°50.4	16.7′	59.1′
8	303°26.0	18.5	173°32.5	12.2′	02°07.1	16.7′	59.1′
9	318°25.8	·· 19.0	188°03.7	12.2′	02°23.8	16.7′	59.1′
10	333°25.6	19.5	202°34.9	12.2′	02°40.5	16.7′	59.1′
11	348°25.4	20.0	217°06.1	12.2′	02°57.2	16.7′	59.1′
12	3°25.3	S20°20.6	231°37.3	12.2′	N03°13.9	16.6′	59.1′
13	18°25.1	21.1	246°08.5	12.2′	03°30.5	16.7′	59.1′
14	33°24.9	21.6	260°39.7	12.2′	03°47.2	16.6′	59.1′
15	48°24.8	·· 22.1	275°10.8	12.1′	04°03.8	16.5′	59.1′
16	63°24.6	22.6	289°42.0	12.1′	04°20.3	16.6′	59.1′
17	78°24.4	23.2	304°13.1	12.1′	04°36.9	16.5′	59.0′
18	93°24.2	S20°23.7	318°44.2	12.1′	N04°53.4	16.5′	59.0′
19	108°24.1	24.2	333°15.3	12.1′	05°09.9	16.5′	59.0′
20	123°23.9	24.7	347°46.3	12.0′	05°26.4	16.4′	59.0′
21	138°23.7	·· 25.2	2°17.4	12.0′	05°42.8	16.5′	59.0′
22	153°23.5	25.7	16°48.4	12.0′	05°59.3	16.3′	59.0′
23	168°23.4	26.3	31°19.4	12.0′	06°15.6	16.4′	59.0′
	SD = 16.2′	d = -0.5′	SD = 16.1′				

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

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

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 56-78%
21	14:20	14:13	11:46	19:15	06:50	
22	14:05	13:57	11:46	20:03	07:39	
23	13:49	13:41	11:46	20:51	08:27	

November 24, 25, 26 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	62°41.8	225°50.3	S05°03.0	185°14.0	S20°15.2	26°45.9	N12°50.2	89°10.8	S12°45.4
1	77°44.2	240°50.0	04.0	200°14.6	15.6	41°48.6	50.1	104°13.1	45.4
2	92°46.7	255°49.8	05.0	215°15.2	16.0	56°51.4	50.0	119°15.5	45.4
3	107°49.2	270°49.6	·· 06.0	230°15.8	·· 16.4	71°54.1	·· 50.0	134°17.9	·· 45.3
4	122°51.6	285°49.3	07.0	245°16.4	16.8	86°56.8	49.9	149°20.3	45.3
5	137°54.1	300°49.1	08.0	260°17.0	17.3	101°59.6	49.8	164°22.7	45.3
6	152°56.5	315°48.9	S05°09.0	275°17.7	S20°17.7	117°02.3	N12°49.7	179°25.1	S12°45.2
7	167°59.0	330°48.6	10.1	290°18.3	18.1	132°05.1	49.6	194°27.5	45.2
8	183°01.5	345°48.4	11.1	305°18.9	18.5	147°07.8	49.5	209°29.8	45.2
9	198°03.9	0°48.2	·· 12.1	320°19.5	·· 18.9	162°10.5	·· 49.5	224°32.2	·· 45.1
10	213°06.4	15°47.9	13.1	335°20.1	19.3	177°13.3	49.4	239°34.6	45.1
11	228°08.9	30°47.7	14.1	350°20.7	19.7	192°16.0	49.3	254°37.0	45.0
12	243°11.3	45°47.5	S05°15.1	5°21.4	S20°20.1	207°18.8	N12°49.2	269°39.4	S12°45.0
13	258°13.8	60°47.3	16.1	20°22.0	20.5	222°21.5	49.1	284°41.7	45.0
14	273°16.3	75°47.0	17.1	35°22.6	20.9	237°24.2	49.0	299°44.1	44.9
15	288°18.7	90°46.8	·· 18.1	50°23.2	·· 21.3	252°27.0	·· 49.0	314°46.5	·· 44.9
16	303°21.2	105°46.5	19.2	65°23.8	21.7	267°29.7	48.9	329°48.9	44.9
17	318°23.7	120°46.3	20.2	80°24.4	22.1	282°32.5	48.8	344°51.3	44.8
18	333°26.1	135°46.1	S05°21.2	95°25.1	S20°22.5	297°35.2	N12°48.7	359°53.7	S12°44.8
19	348°28.6	150°45.8	22.2	110°25.7	22.9	312°37.9	48.6	14°56.0	44.8
20	3°31.0	165°45.6	23.2	125°26.3	23.3	327°40.7	48.6	29°58.4	44.7
21	18°33.5	180°45.4	·· 24.2	140°26.9	·· 23.7	342°43.4	·· 48.5	45°00.8	·· 44.7
22	33°36.0	195°45.1	25.2	155°27.5	24.1	357°46.1	48.4	60°03.2	44.7
23	48°38.4	210°44.9	26.2	170°28.1	24.5	12°48.9	48.3	75°05.6	44.6
Mer.pass. 19:46		ν -0.2′	d -1.0′	m -4.24	ν 0.6′	d -0.4′	m 1.37	ν 2.7′	d -0.1′ m -2.86
								ν 2.4′	d 0.0′ m 0.83

Sat	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	63°40.9	225°44.7	S05°27.2	185°28.7	S20°24.9	27°51.6	N12°48.2	90°07.9	S12°44.6
1	78°43.4	240°44.4	28.3	200°29.3	25.3	42°54.4	48.2	105°10.3	44.5
2	93°45.8	255°44.2	29.3	215°30.0	25.7	57°57.1	48.1	120°12.7	44.5
3	108°48.3	270°43.9	·· 30.3	230°30.6	·· 26.0	72°59.8	·· 48.0	135°15.1	·· 44.5
4	123°50.8	285°43.7	31.3	245°31.2	26.4	88°02.6	47.9	150°17.5	44.4
5	138°53.2	300°43.5	32.3	260°31.8	26.8	103°05.3	47.8	165°19.8	44.4
6	153°55.7	315°43.2	S05°33.3	275°32.4	S20°27.2	118°08.0	N12°47.7	180°22.2	S12°44.4
7	168°58.1	330°43.0	34.3	290°33.0	27.6	133°10.8	47.7	195°24.6	44.3
8	184°00.6	345°42.7	35.3	305°33.6	28.0	148°13.5	47.6	210°27.0	44.3
9	199°03.1	0°42.5	·· 36.4	320°34.2	·· 28.4	163°16.2	·· 47.5	225°29.4	·· 44.3
10	214°05.5	15°42.3	37.4	335°34.8	28.8	178°19.0	47.4	240°31.7	44.2
11	229°08.0	30°42.0	38.4	350°35.5	29.2	193°21.7	47.3	255°34.1	44.2
12	244°10.5	45°41.8	S05°39.4	5°36.1	S20°29.6	208°24.4	N12°47.3	270°36.5	S12°44.1
13	259°12.9	60°41.5	40.4	20°36.7	30.0	223°27.2	47.2	285°38.9	44.1
14	274°15.4	75°41.3	41.4	35°37.3	30.4	238°29.9	47.1	300°41.3	44.1
15	289°17.9	90°41.1	·· 42.4	50°37.9	·· 30.8	253°32.6	·· 47.0	315°43.6	·· 44.0
16	304°20.3	105°40.8	43.4	65°38.5	31.2	268°35.4	46.9	330°46.0	44.0
17	319°22.8	120°40.6	44.5	80°39.1	31.6	283°38.1	46.9	345°48.4	44.0
18	334°25.3	135°40.3	S05°45.5	95°39.7	S20°32.0	298°40.8	N12°46.8	0°50.8	S12°43.9
19	349°27.7	150°40.1	46.5	110°40.3	32.4	313°43.6	46.7	15°53.1	43.9
20	4°30.2	165°39.8	47.5	125°40.9	32.7	328°46.3	46.6	30°55.5	43.8
21	19°32.6	180°39.6	·· 48.5	140°41.5	·· 33.1	343°49.0	·· 46.5	45°57.9	·· 43.8
22	34°35.1	195°39.3	49.5	155°42.2	33.5	358°51.8	46.5	61°00.3	43.8
23	49°37.6	210°39.1	50.5	170°42.8	33.9	13°54.5	46.4	76°02.7	43.7
Mer.pass. 19:42		ν -0.2′	d -1.0′	m -4.23	ν 0.6′	d -0.4′	m 1.37	ν 2.7′	d -0.1′ m -2.86
								ν 2.4′	d 0.0′ m 0.84

Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	64°40.0	225°38.8	S05°51.5	185°43.4	S20°34.3	28°57.2	N12°46.3	91°05.0	S12°43.7
1	79°42.5	240°38.6	52.6	200°44.0	34.7	44°00.0	46.2	106°07.4	43.7
2	94°45.0	255°38.4	53.6	215°44.6	35.1	59°02.7	46.2	121°09.8	43.6
3	109°47.4	270°38.1	·· 54.6	230°45.2	·· 35.5	74°05.4	·· 46.1	136°12.2	·· 43.6
4	124°49.9	285°37.9	55.6	245°45.8	35.9	89°08.2	46.0	151°14.5	43.5
5	139°52.4	300°37.6	56.6	260°46.4	36.3	104°10.9	45.9	166°16.9	43.5
6	154°54.8	315°37.4	S05°57.6	275°47.0	S20°36.6	119°13.6	N12°45.8	181°19.3	S12°43.5
7	169°57.3	330°37.1	58.6	290°47.6	37.0	134°16.3	45.8	196°21.7	43.4
8	184°59.8	345°36.9	05°59.6	305°48.2	37.4	149°19.1	45.7	211°24.0	43.4
9	200°02.2	0°36.6	06°00.6	320°48.8	·· 37.8	164°21.8	·· 45.6	226°26.4	·· 43.4
10	215°04.7	15°36.4	01.7	335°49.4	38.2	179°24.5	45.5	241°28.8	43.3
11	230°07.1	30°36.1	02.7	350°50.0	38.6	194°27.3	45.4	256°31.2	43.3
12	245°09.6	45°35.9	S06°03.7	5°50.6	S20°39.0	209°30.0	N12°45.4	271°33.5	S12°43.2
13	260°12.1	60°35.6	04.7	20°51.2	39.4	224°32.7	45.3	286°35.9	43.2
14	275°14.5	75°35.4	05.7	35°51.8	39.7	239°35.5	45.2	301°38.3	43.2
15	290°17.0	90°35.1	·· 06.7	50°52.4	·· 40.1	254°38.2	·· 45.1	316°40.7	·· 43.1
16	305°19.5	105°34.8	07.7	65°53.0	40.5	269°40.9	45.1	331°43.0	43.1
17	320°21.9	120°34.6	08.7	80°53.7	40.9	284°43.6	45.0	346°45.4	43.0
18	335°24.4	135°34.3	S06°09.8	95°54.3	S20°41.3	299°46.4	N12°44.9	1°47.8	S12°43.0
19	350°26.9	150°34.1	10.8	110°54.9	41.7	314°49.1	44.8	16°50.2	43.0
20	5°29.3	165°33.8	11.8	125°55.5	42.0	329°51.8	44.7	31°52.5	42.9
21	20°31.8	180°33.6	·· 12.8	140°56.1	·· 42.4	344°54.5	·· 44.7	46°54.9	·· 42.9
22	35°34.2	195°33.3	13.8	155°56.7	42.8	359°57.3	44.6	61°57.3	42.8
23	50°36.7	210°33.1	14.8	170°57.3	43.2	15°00.0	44.5	76°59.6	42.8
Mer.pass. 19:38		ν -0.2′	d -1.0′	m -4.22	ν 0.6′	d -0.4′	m 1.37	ν 2.7′	d -0.1′ m -2.85
								ν 2.4′	d 0.0′ m 0.84

Stars

	SHA	**Dec**
Alpheratz	357°35.6	29°13.5
Ankaa	353°07.8	-42°10.8
Schedar	349°31.8	56°40.3
Diphda	348°48.0	-17°51.4
Achernar	335°20.4	-57°07.1
Hamal	327°52.0	23°34.6
Polaris	314°01.3	89°22.0
Acamar	315°12.1	-40°12.6
Menkar	314°06.8	4°11.1
Mirfak	308°29.1	49°56.8
Aldebaran	290°40.4	16°33.5
Rigel	281°04.5	-8°10.3
Capella	280°22.8	46°01.3
Bellatrix	278°23.6	6°22.3
Elnath	278°02.7	28°37.7
Alnilam	275°38.4	-1°11.1
Betelgeuse	270°52.8	7°24.8
Canopus	263°52.3	-52°42.3
Sirius	258°26.8	-16°44.8
Adhara	255°06.3	-29°00.1
Procyon	244°51.6	5°09.9
Pollux	243°18.2	27°58.1
Avior	234°14.8	-59°34.8
Suhail	222°46.9	-43°31.4
Miaplacidus	221°38.2	-69°48.5
Alphard	217°48.6	-8°45.6
Regulus	207°35.5	11°51.1
Dubhe	193°42.3	61°37.1
Denebola	182°26.1	14°26.3
Gienah	175°44.8	-17°40.3
Acrux	173°01.6	-63°13.6
Gacrux	171°53.1	-57°14.5
Alioth	166°14.2	55°49.7
Spica	158°23.6	-11°17.0
Alkaid	152°53.2	49°11.5
Hadar	148°38.0	-60°29.1
Menkent	147°59.1	-36°29.1
Arcturus	145°49.1	19°03.5
Rigil Kent.	139°42.3	-60°55.8
Kochab	137°20.9	74°03.3
Zuben'ubi	136°57.4	-16°08.3
Alphecca	126°04.9	26°38.1
Antares	112°17.4	-26°29.0
Atria	107°13.1	-69°04.2
Sabik	102°04.2	-15°45.2
Shaula	96°12.1	-37°07.3
Rasalhague	95°59.8	12°32.6
Eltanin	90°43.1	51°29.2
Kaus Aust.	83°34.1	-34°22.4
Vega	80°34.2	38°48.5
Nunki	75°49.2	-26°16.1
Altair	62°01.1	8°55.9
Peacock	53°07.5	-56°39.7
Deneb	49°26.7	45°22.1
Enif	33°39.8	9°59.1
Al Na'ir	27°34.1	-46°51.0
Fomalhaut	15°15.5	-29°29.9
Scheat	13°46.1	28°12.9
Markab	13°30.8	15°20.1

Nov 24 Fri	**SHA**	**Mer.pass**
Venus	163°08.5	08:57
Mars	122°32.2	11:39
Jupiter	324°04.1	22:09
Saturn	26°29.0	18:00

Nov 25 Sat	**SHA**	**Mer.pass**
Venus	162°03.8	08:57
Mars	121°47.8	11:38
Jupiter	324°10.7	22:05
Saturn	26°27.0	17:57

Nov 26 Sun	**SHA**	**Mer.pass**
Venus	160°58.8	08:58
Mars	121°03.3	11:37
Jupiter	324°17.2	22:00
Saturn	26°25.0	17:53

Horizontal parallax	
Venus:	0.2
Mars:	0.1

h

Fri	Sun GHA	Sun Dec	Moon GHA	ν	Moon Dec	d	HP
0	183°23.2	S20°26.8	45°50.3	11.9′	N06°32.0	16.3′	59.0′
1	198°23.0	27.3	60°21.3	11.9′	06°48.3	16.2′	59.0′
2	213°22.8	27.8	74°52.2	11.9′	07°04.5	16.3′	59.0′
3	228°22.7	·· 28.3	89°23.1	11.9′	07°20.8	16.1′	59.0′
4	243°22.5	28.8	103°53.9	11.8′	07°36.9	16.2′	58.9′
5	258°22.3	29.3	118°24.7	11.8′	07°53.1	16.1′	58.9′
6	273°22.1	S20°29.8	132°55.5	11.8′	N08°09.2	16.0′	58.9′
7	288°21.9	30.3	147°26.3	11.7′	08°25.2	16.0′	58.9′
8	303°21.8	30.8	161°57.0	11.7′	08°41.2	16.0′	58.9′
9	318°21.6	·· 31.4	176°27.7	11.6′	08°57.2	15.9′	58.9′
10	333°21.4	31.9	190°58.3	11.6′	09°13.1	15.9′	58.9′
11	348°21.2	32.4	205°28.9	11.6′	09°29.0	15.8′	58.9′
12	3°21.1	S20°32.9	219°59.5	11.5′	N09°44.8	15.7′	58.9′
13	18°20.9	33.4	234°30.0	11.5′	10°00.5	15.7′	58.8′
14	33°20.7	33.9	249°00.5	11.4′	10°16.2	15.6′	58.8′
15	48°20.5	·· 34.4	263°31.0	11.4′	10°31.8	15.6′	58.8′
16	63°20.3	34.9	278°01.4	11.4′	10°47.4	15.5′	58.8′
17	78°20.2	35.4	292°31.7	11.3′	11°02.9	15.4′	58.8′
18	93°20.0	S20°35.9	307°02.0	11.3′	N11°18.3	15.4′	58.8′
19	108°19.8	36.4	321°32.3	11.2′	11°33.7	15.3′	58.8′
20	123°19.6	36.9	336°02.5	11.2′	11°49.0	15.3′	58.8′
21	138°19.4	·· 37.4	350°32.7	11.1′	12°04.3	15.2′	58.7′
22	153°19.2	37.9	5°02.8	11.1′	12°19.5	15.1′	58.7′
23	168°19.1	38.4	19°32.9	11.0′	12°34.6	15.0′	58.7′
	SD = 16.2′	d = -0.5′	SD = 16.1′				

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	183°18.9	S20°38.9	34°03.0	11.0′	N12°49.6	15.0′	58.7′
1	198°18.7	39.4	48°32.9	10.9′	13°04.6	14.9′	58.7′
2	213°18.5	39.9	63°02.9	10.9′	13°19.5	14.8′	58.7′
3	228°18.3	·· 40.4	77°32.7	10.8′	13°34.3	14.8′	58.7′
4	243°18.1	40.9	92°02.6	10.8′	13°49.1	14.6′	58.6′
5	258°18.0	41.4	106°32.3	10.7′	14°03.7	14.6′	58.6′
6	273°17.8	S20°41.8	121°02.0	10.7′	N14°18.3	14.5′	58.6′
7	288°17.6	42.3	135°31.7	10.6′	14°32.8	14.4′	58.6′
8	303°17.4	42.8	150°01.3	10.5′	14°47.2	14.3′	58.6′
9	318°17.2	·· 43.3	164°30.8	10.5′	15°01.5	14.3′	58.6′
10	333°17.0	43.8	179°00.3	10.4′	15°15.8	14.1′	58.5′
11	348°16.8	44.3	193°29.8	10.4′	15°29.9	14.1′	58.5′
12	3°16.6	S20°44.8	207°59.1	10.3′	N15°44.0	14.0′	58.5′
13	18°16.5	45.3	222°28.4	10.3′	15°58.0	13.9′	58.5′
14	33°16.3	45.8	236°57.7	10.2′	16°11.9	13.8′	58.5′
15	48°16.1	·· 46.3	251°26.9	10.1′	16°25.7	13.7′	58.5′
16	63°15.9	46.7	265°56.0	10.1′	16°39.4	13.6′	58.4′
17	78°15.7	47.2	280°25.1	10.0′	16°53.0	13.5′	58.4′
18	93°15.5	S20°47.7	294°54.1	9.9′	N17°06.5	13.4′	58.4′
19	108°15.3	48.2	309°23.0	9.9′	17°19.9	13.3′	58.4′
20	123°15.1	48.7	323°51.9	9.8′	17°33.2	13.2′	58.4′
21	138°14.9	·· 49.2	338°20.8	9.8′	17°46.4	13.0′	58.4′
22	153°14.8	49.6	352°49.5	9.7′	17°59.4	13.0′	58.3′
23	168°14.6	50.1	7°18.2	9.6′	18°12.4	12.9′	58.3′
	SD = 16.2′	d = -0.5′	SD = 16.0′				

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	183°14.4	S20°50.6	21°46.9	9.6′	N18°25.3	12.8′	58.3′
1	198°14.2	51.1	36°15.4	9.5′	18°38.1	12.6′	58.3′
2	213°14.0	51.6	50°43.9	9.4′	18°50.7	12.6′	58.3′
3	228°13.8	·· 52.0	65°12.4	9.4′	19°03.3	12.4′	58.2′
4	243°13.6	52.5	79°40.8	9.3′	19°15.7	12.4′	58.2′
5	258°13.4	53.0	94°09.1	9.3′	19°28.1	12.2′	58.2′
6	273°13.2	S20°53.5	108°37.3	9.2′	N19°40.3	12.1′	58.2′
7	288°13.0	54.0	123°05.5	9.1′	19°52.4	11.9′	58.2′
8	303°12.8	54.4	137°33.7	9.1′	20°04.3	11.9′	58.1′
9	318°12.6	·· 54.9	152°01.7	9.0′	20°16.2	11.7′	58.1′
10	333°12.4	55.4	166°29.7	8.9′	20°27.9	11.7′	58.1′
11	348°12.3	55.9	180°57.7	8.9′	20°39.6	11.4′	58.1′
12	3°12.1	S20°56.3	195°25.5	8.8′	N20°51.0	11.4′	58.1′
13	18°11.9	56.8	209°53.3	8.7′	21°02.4	11.3′	58.0′
14	33°11.7	57.3	224°21.1	8.7′	21°13.7	11.1′	58.0′
15	48°11.5	·· 57.7	238°48.8	8.6′	21°24.8	11.0′	58.0′
16	63°11.3	58.2	253°16.4	8.6′	21°35.8	10.8′	58.0′
17	78°11.1	58.7	267°43.9	8.5′	21°46.6	10.7′	57.9′
18	93°10.9	S20°59.2	282°11.4	8.4′	N21°57.3	10.6′	57.9′
19	108°10.7	20°59.6	296°38.9	8.4′	22°07.9	10.5′	57.9′
20	123°10.5	21°00.1	311°06.3	8.3′	22°18.4	10.3′	57.9′
21	138°10.3	·· 00.6	325°33.6	8.3′	22°28.7	10.2′	57.9′
22	153°10.1	01.0	340°00.8	8.2′	22°38.9	10.1′	57.8′
23	168°09.9	01.5	354°28.0	8.1′	22°49.0	9.9′	57.8′
	SD = 16.2′	d = -0.5′	SD = 15.9′				

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

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

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 86-98%
24	13:33	13:24	11:47	21:39	09:15	
25	13:15	13:07	11:47	22:30	10:04	
26	12:57	12:48	11:47	23:23	10:56	

November 27, 28, 29 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	65°39.2	225°32.8	S06°15.8	185°57.9	S20°43.6	30°02.7	N12°44.4	92°02.0	S12°42.8
1	80°41.6	240°32.6	16.8	200°58.5	44.0	45°05.4	44.4	107°04.4	42.7
2	95°44.1	255°32.3	17.9	215°59.1	44.3	60°08.2	44.3	122°06.8	42.7
3	110°46.6	270°32.0	·· 18.9	230°59.7	·· 44.7	75°10.9	·· 44.2	137°09.1	·· 42.7
4	125°49.0	285°31.8	19.9	246°00.3	45.1	90°13.6	44.1	152°11.5	42.6
5	140°51.5	300°31.5	20.9	261°00.9	45.5	105°16.3	44.0	167°13.9	42.6
6	155°54.0	315°31.3	S06°21.9	276°01.5	S20°45.9	120°19.1	N12°44.0	182°16.3	S12°42.5
7	170°56.4	330°31.0	22.9	291°02.1	46.3	135°21.8	43.9	197°18.6	42.5
8	185°58.9	345°30.7	23.9	306°02.7	46.6	150°24.5	43.8	212°21.0	42.5
9	201°01.4	0°30.5	·· 24.9	321°03.3	·· 47.0	165°27.2	·· 43.7	227°23.4	·· 42.4
10	216°03.8	15°30.2	26.0	336°03.9	47.4	180°30.0	43.7	242°25.7	42.4
11	231°06.3	30°30.0	27.0	351°04.5	47.8	195°32.7	43.6	257°28.1	42.3
12	246°08.7	45°29.7	S06°28.0	6°05.1	S20°48.1	210°35.4	N12°43.5	272°30.5	S12°42.3
13	261°11.2	60°29.4	29.0	21°05.7	48.5	225°38.1	43.4	287°32.9	42.3
14	276°13.7	75°29.2	30.0	36°06.3	48.9	240°40.9	43.4	302°35.2	42.2
15	291°16.1	90°28.9	·· 31.0	51°06.9	·· 49.3	255°43.6	·· 43.3	317°37.6	·· 42.2
16	306°18.6	105°28.7	32.0	66°07.4	49.7	270°46.3	43.2	332°40.0	42.1
17	321°21.1	120°28.4	33.0	81°08.0	50.0	285°49.0	43.1	347°42.3	42.1
18	336°23.5	135°28.1	S06°34.1	96°08.6	S20°50.4	300°51.7	N12°43.1	2°44.7	S12°42.1
19	351°26.0	150°27.9	35.1	111°09.2	50.8	315°54.5	43.0	17°47.1	42.0
20	6°28.5	165°27.6	36.1	126°09.8	51.2	330°57.2	42.9	32°49.4	42.0
21	21°30.9	180°27.3	·· 37.1	141°10.4	·· 51.5	345°59.9	·· 42.8	47°51.8	·· 41.9
22	36°33.4	195°27.1	38.1	156°11.0	51.9	1°02.6	42.8	62°54.2	41.9
23	51°35.9	210°26.8	39.1	171°11.6	52.3	16°05.3	42.7	77°56.6	41.9
Mer.pass. 19:34		ν -0.3′	d -1.0′	m -4.22	ν 0.6′	d -0.4′	m 1.37	ν 2.7′	d -0.1′ m -2.85	ν 2.4′ d 0.0′ m 0.84

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	66°38.3	225°26.5	S06°40.1	186°12.2	S20°52.7	31°08.1	N12°42.6	92°58.9	S12°41.8
1	81°40.8	240°26.3	41.1	201°12.8	53.0	46°10.8	42.5	108°01.3	41.8
2	96°43.2	255°26.0	42.2	216°13.4	53.4	61°13.5	42.5	123°03.7	41.7
3	111°45.7	270°25.7	·· 43.2	231°14.0	·· 53.8	76°16.2	·· 42.4	138°06.0	·· 41.7
4	126°48.2	285°25.5	44.2	246°14.6	54.2	91°18.9	42.3	153°08.4	41.6
5	141°50.6	300°25.2	45.2	261°15.2	54.5	106°21.7	42.2	168°10.8	41.6
6	156°53.1	315°24.9	S06°46.2	276°15.8	S20°54.9	121°24.4	N12°42.2	183°13.1	S12°41.6
7	171°55.6	330°24.7	47.2	291°16.4	55.3	136°27.1	42.1	198°15.5	41.5
8	186°58.0	345°24.4	48.2	306°17.0	55.7	151°29.8	42.0	213°17.9	41.5
9	202°00.5	0°24.1	·· 49.2	321°17.6	·· 56.0	166°32.5	·· 41.9	228°20.2	·· 41.4
10	217°03.0	15°23.9	50.2	336°18.2	56.4	181°35.3	41.9	243°22.6	41.4
11	232°05.4	30°23.6	51.3	351°18.7	56.8	196°38.0	41.8	258°25.0	41.4
12	247°07.9	45°23.3	S06°52.3	6°19.3	S20°57.1	211°40.7	N12°41.7	273°27.3	S12°41.3
13	262°10.4	60°23.0	53.3	21°19.9	57.5	226°43.4	41.6	288°29.7	41.3
14	277°12.8	75°22.8	54.3	36°20.5	57.9	241°46.1	41.6	303°32.1	41.2
15	292°15.3	90°22.5	·· 55.3	51°21.1	·· 58.3	256°48.8	·· 41.5	318°34.4	·· 41.2
16	307°17.7	105°22.2	56.3	66°21.7	58.6	271°51.6	41.4	333°36.8	41.2
17	322°20.2	120°22.0	57.3	81°22.3	59.0	286°54.3	41.3	348°39.2	41.1
18	337°22.7	135°21.7	S06°58.3	96°22.9	S20°59.4	301°57.0	N12°41.3	3°41.5	S12°41.1
19	352°25.1	150°21.4	06°59.3	111°23.5	20°59.7	316°59.7	41.2	18°43.9	41.0
20	7°27.6	165°21.1	07°00.4	126°24.1	21°00.1	332°02.4	41.1	33°46.3	41.0
21	22°30.1	180°20.9	·· 01.4	141°24.7	·· 00.5	347°05.1	·· 41.0	48°48.6	·· 40.9
22	37°32.5	195°20.6	02.4	156°25.2	00.8	2°07.9	41.0	63°51.0	40.9
23	52°35.0	210°20.3	03.4	171°25.8	01.2	17°10.6	40.9	78°53.4	40.9
Mer.pass. 19:30		ν -0.3′	d -1.0′	m -4.21	ν 0.6′	d -0.4′	m 1.37	ν 2.7′	d -0.1′ m -2.84	ν 2.4′ d 0.0′ m 0.85

Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	67°37.5	225°20.0	S07°04.4	186°26.4	S21°01.6	32°13.3	N12°40.8	93°55.7	S12°40.8
1	82°39.9	240°19.8	05.4	201°27.0	01.9	47°16.0	40.7	108°58.1	40.8
2	97°42.4	255°19.5	06.4	216°27.6	02.3	62°18.7	40.7	124°00.5	40.7
3	112°44.9	270°19.2	·· 07.4	231°28.2	·· 02.7	77°21.4	·· 40.6	139°02.8	·· 40.7
4	127°47.3	285°18.9	08.4	246°28.8	03.0	92°24.1	40.5	154°05.2	40.7
5	142°49.8	300°18.7	09.5	261°29.4	03.4	107°26.9	40.5	169°07.5	40.6
6	157°52.2	315°18.4	S07°10.5	276°30.0	S21°03.8	122°29.6	N12°40.4	184°09.9	S12°40.6
7	172°54.7	330°18.1	11.5	291°30.5	04.1	137°32.3	40.3	199°12.3	40.5
8	187°57.2	345°17.8	12.5	306°31.1	04.5	152°35.0	40.2	214°14.6	40.5
9	202°59.6	0°17.5	·· 13.5	321°31.7	·· 04.9	167°37.7	·· 40.2	229°17.0	·· 40.4
10	218°02.1	15°17.3	14.5	336°32.3	05.2	182°40.4	40.1	244°19.4	40.4
11	233°04.6	30°17.0	15.5	351°32.9	05.6	197°43.1	40.0	259°21.7	40.4
12	248°07.0	45°16.7	S07°16.5	6°33.5	S21°06.0	212°45.8	N12°39.9	274°24.1	S12°40.3
13	263°09.5	60°16.4	17.5	21°34.1	06.3	227°48.5	39.9	289°26.5	40.3
14	278°12.0	75°16.1	18.6	36°34.7	06.7	242°51.3	39.8	304°28.8	40.2
15	293°14.4	90°15.9	·· 19.6	51°35.2	·· 07.1	257°54.0	·· 39.7	319°31.2	·· 40.2
16	308°16.9	105°15.6	20.6	66°35.8	07.4	272°56.7	39.7	334°33.5	40.1
17	323°19.4	120°15.3	21.6	81°36.4	07.8	287°59.4	39.6	349°35.9	40.1
18	338°21.8	135°15.0	S07°22.6	96°37.0	S21°08.1	303°02.1	N12°39.5	4°38.3	S12°40.1
19	353°24.3	150°14.7	23.6	111°37.6	08.5	318°04.8	39.4	19°40.6	40.0
20	8°26.7	165°14.4	24.6	126°38.2	08.9	333°07.5	39.4	34°43.0	40.0
21	23°29.2	180°14.2	·· 25.6	141°38.7	·· 09.2	348°10.2	·· 39.3	49°45.3	·· 39.9
22	38°31.7	195°13.9	26.6	156°39.3	09.6	3°12.9	39.2	64°47.7	39.9
23	53°34.1	210°13.6	27.6	171°39.9	09.9	18°15.6	39.2	79°50.1	39.8
Mer.pass. 19:26		ν -0.3′	d -1.0′	m -4.20	ν 0.6′	d -0.4′	m 1.37	ν 2.7′	d -0.1′ m -2.83	ν 2.4′ d 0.0′ m 0.85

Stars

	SHA	**Dec**
Alpheratz	357°35.6	29°13.5
Ankaa	353°07.9	-42°10.8
Schedar	349°31.8	56°40.3
Diphda	348°48.1	-17°51.4
Achernar	335°20.4	-57°07.1
Hamal	327°52.0	23°34.6
Polaris	314°01.2	89°22.0
Acamar	315°12.1	-40°12.6
Menkar	314°06.8	4°11.1
Mirfak	308°29.1	49°56.8
Aldebaran	290°40.4	16°33.5
Rigel	281°04.4	-8°10.4
Capella	280°22.8	46°01.3
Bellatrix	278°23.6	6°22.3
Elnath	278°02.7	28°37.7
Alnilam	275°38.4	-1°11.1
Betelgeuse	270°52.8	7°24.7
Canopus	263°52.3	-52°42.3
Sirius	258°26.8	-16°44.8
Adhara	255°06.3	-29°00.1
Procyon	244°51.6	5°09.9
Pollux	243°18.2	27°58.1
Avior	234°14.8	-59°34.8
Suhail	222°46.9	-43°31.4
Miaplacidus	221°38.2	-69°48.5
Alphard	217°48.6	-8°45.6
Regulus	207°35.4	11°51.1
Dubhe	193°42.3	61°37.1
Denebola	182°26.0	14°26.3
Gienah	175°44.7	-17°40.3
Acrux	173°01.6	-63°13.6
Gacrux	171°53.0	-57°14.5
Alioth	166°14.2	55°49.6
Spica	158°23.6	-11°17.0
Alkaid	152°53.1	49°11.5
Hadar	148°37.9	-60°29.0
Menkent	147°59.1	-36°29.0
Arcturus	145°49.1	19°03.5
Rigil Kent.	139°42.2	-60°55.8
Kochab	137°20.9	74°03.3
Zuben'ubi	136°57.4	-16°08.3
Alphecca	126°04.9	26°38.1
Antares	112°17.4	-26°29.0
Atria	107°13.0	-69°04.2
Sabik	102°04.2	-15°45.2
Shaula	96°12.1	-37°07.3
Rasalhague	95°59.8	12°32.6
Eltanin	90°43.1	51°29.2
Kaus Aust.	83°34.1	-34°22.4
Vega	80°34.2	38°48.4
Nunki	75°49.2	-26°16.1
Altair	62°01.1	8°55.9
Peacock	53°07.5	-56°39.7
Deneb	49°26.7	45°22.1
Enif	33°39.8	9°59.1
Al Na'ir	27°34.1	-46°51.0
Fomalhaut	15°15.5	-29°29.9
Scheat	13°46.1	28°12.9
Markab	13°30.8	15°20.1

Nov 27 Mon	**SHA**	**Mer.pass**
Venus	159°53.6	08:58
Mars	120°18.7	11:36
Jupiter	324°23.5	21:56
Saturn	26°22.8	17:49

Nov 28 Tue	**SHA**	**Mer.pass**
Venus	158°48.2	08:58
Mars	119°33.9	11:35
Jupiter	324°29.8	21:52
Saturn	26°20.6	17:45

Nov 29 Wed	**SHA**	**Mer.pass**
Venus	157°42.6	08:59
Mars	118°49.0	11:34
Jupiter	324°35.8	21:47
Saturn	26°18.3	17:41

Horizontal parallax	
Venus:	0.2
Mars:	0.1

h	Sun		Moon				
Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°09.7	**S**21°02.0	8°55.2	8.1′	**N**22°58.9	9.8′	57.8′
1	198°09.5	02.4	23°22.3	8.0′	23°08.7	9.6′	57.8′
2	213°09.3	02.9	37°49.3	8.0′	23°18.3	9.5′	57.7′
3	228°09.1	·· 03.3	52°16.2	7.9′	23°27.8	9.3′	57.7′
4	243°08.9	03.8	66°43.2	7.9′	23°37.1	9.3′	57.7′
5	258°08.7	04.3	81°10.0	7.8′	23°46.4	9.0′	57.7′
6	273°08.5	**S**21°04.7	95°36.8	7.8′	**N**23°55.4	8.9′	57.6′
7	288°08.3	05.2	110°03.6	7.7′	24°04.3	8.8′	57.6′
8	303°08.1	05.6	124°30.3	7.6′	24°13.1	8.6′	57.6′
9	318°07.9	·· 06.1	138°56.9	7.6′	24°21.7	8.5′	57.6′
10	333°07.7	06.6	153°23.5	7.5′	24°30.2	8.4′	57.5′
11	348°07.5	07.0	167°50.1	7.5′	24°38.6	8.1′	57.5′
12	3°07.3	**S**21°07.5	182°16.6	7.5′	**N**24°46.7	8.1′	57.5′
13	18°07.1	07.9	196°43.0	7.4′	24°54.8	7.9′	57.5′
14	33°06.9	08.4	211°09.4	7.4′	25°02.7	7.7′	57.4′
15	48°06.7	·· 08.8	225°35.8	7.3′	25°10.4	7.6′	57.4′
16	63°06.5	09.3	240°02.1	7.3′	25°18.0	7.4′	57.4′
17	78°06.3	09.8	254°28.4	7.2′	25°25.4	7.2′	57.4′
18	93°06.1	**S**21°10.2	268°54.6	7.2′	**N**25°32.6	7.1′	57.3′
19	108°05.9	10.7	283°20.8	7.2′	25°39.7	7.0′	57.3′
20	123°05.6	11.1	297°47.0	7.1′	25°46.7	6.8′	57.3′
21	138°05.4	·· 11.6	312°13.1	7.1′	25°53.5	6.6′	57.3′
22	153°05.2	12.0	326°39.2	7.1′	26°00.1	6.5′	57.2′
23	168°05.0	12.5	341°05.3	7.0′	26°06.6	6.3′	57.2′
	SD = 16.2′	d = -0.5′	SD = 15.8′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°04.8	**S**21°12.9	355°31.3	7.0′	**N**26°12.9	6.2′	57.2′
1	198°04.6	13.4	9°57.3	7.0′	26°19.1	6.0′	57.2′
2	213°04.4	13.8	24°23.2	6.9′	26°25.1	5.8′	57.1′
3	228°04.2	·· 14.2	38°49.2	6.9′	26°30.9	5.7′	57.1′
4	243°04.0	14.7	53°15.1	6.9′	26°36.6	5.5′	57.1′
5	258°03.8	15.1	67°40.9	6.9′	26°42.1	5.4′	57.1′
6	273°03.6	**S**21°15.6	82°06.8	6.8′	**N**26°47.5	5.2′	57.0′
7	288°03.4	16.0	96°32.6	6.8′	26°52.7	5.0′	57.0′
8	303°03.2	16.5	110°58.5	6.8′	26°57.7	4.9′	57.0′
9	318°03.0	·· 16.9	125°24.3	6.8′	27°02.6	4.7′	56.9′
10	333°02.7	17.3	139°50.0	6.8′	27°07.3	4.5′	56.9′
11	348°02.5	17.8	154°15.8	6.8′	27°11.8	4.4′	56.9′
12	3°02.3	**S**21°18.2	168°41.6	6.7′	**N**27°16.2	4.2′	56.9′
13	18°02.1	18.7	183°07.3	6.7′	27°20.4	4.1′	56.8′
14	33°01.9	19.1	197°33.0	6.7′	27°24.5	3.9′	56.8′
15	48°01.7	·· 19.5	211°58.8	6.7′	27°28.4	3.7′	56.8′
16	63°01.5	20.0	226°24.5	6.7′	27°32.1	3.6′	56.8′
17	78°01.3	20.4	240°50.2	6.7′	27°35.7	3.3′	56.7′
18	93°01.1	**S**21°20.9	255°15.9	6.7′	**N**27°39.0	3.3′	56.7′
19	108°00.8	21.3	269°41.6	6.7′	27°42.3	3.0′	56.7′
20	123°00.6	21.7	284°07.3	6.7′	27°45.3	2.9′	56.6′
21	138°00.4	·· 22.2	298°33.0	6.7′	27°48.2	2.7′	56.6′
22	153°00.2	22.6	312°58.8	6.7′	27°50.9	2.6′	56.6′
23	168°00.0	23.0	327°24.5	6.7′	27°53.5	2.4′	56.6′
	SD = 16.2′	d = -0.4′	SD = 15.6′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°59.8	**S**21°23.5	341°50.2	6.8′	**N**27°55.9	2.2′	56.5′
1	197°59.6	23.9	356°16.0	6.8′	27°58.1	2.1′	56.5′
2	212°59.4	24.3	10°41.8	6.8′	28°00.2	1.9′	56.5′
3	227°59.1	·· 24.7	25°07.5	6.8′	28°02.1	1.8′	56.5′
4	242°58.9	25.2	39°33.3	6.8′	28°03.9	1.5′	56.4′
5	257°58.7	25.6	53°59.1	6.8′	28°05.4	1.4′	56.4′
6	272°58.5	**S**21°26.0	68°25.0	6.9′	**N**28°06.8	1.3′	56.4′
7	287°58.3	26.5	82°50.8	6.9′	28°08.1	1.1′	56.4′
8	302°58.1	26.9	97°16.7	6.9′	28°09.2	0.9′	56.3′
9	317°57.8	·· 27.3	111°42.6	6.9′	28°10.1	0.8′	56.3′
10	332°57.6	27.7	126°08.5	7.0′	28°10.9	0.6′	56.3′
11	347°57.4	28.2	140°34.5	7.0′	28°11.5	0.4′	56.2′
12	2°57.2	**S**21°28.6	155°00.5	7.0′	**N**28°11.9	0.3′	56.2′
13	17°57.0	29.0	169°26.5	7.1′	28°12.2	0.1′	56.2′
14	32°56.8	29.4	183°52.6	7.1′	28°12.3	0.1′	56.2′
15	47°56.5	·· 29.8	198°18.7	7.1′	28°12.2	0.2′	56.1′
16	62°56.3	30.3	212°44.8	7.2′	28°12.0	0.4′	56.1′
17	77°56.1	30.7	227°11.0	7.2′	28°11.6	0.5′	56.1′
18	92°55.9	**S**21°31.1	241°37.2	7.3′	**N**28°11.1	0.7′	56.1′
19	107°55.7	31.5	256°03.5	7.3′	28°10.4	0.8′	56.0′
20	122°55.4	31.9	270°29.8	7.4′	28°09.6	1.0′	56.0′
21	137°55.2	·· 32.4	284°56.1	7.4′	28°08.6	1.2′	56.0′
22	152°55.0	32.8	299°22.5	7.5′	28°07.4	1.3′	56.0′
23	167°54.8	33.2	313°49.0	7.5′	28°06.1	1.5′	55.9′
	SD = 16.2′	d = -0.4′	SD = 15.4′				

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

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

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 14-16 100-97%
27	12:39	12:29	11:48	–:–	11:51	○
28	12:19	12:09	11:48	00:19	12:47	
29	11:59	11:49	11:48	01:16	13:44	

November 30, 01, 02 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	68°36.6	225°13.3	S07°28.6	186°40.5	S21°10.3	33°18.4	N12°39.1	94°52.4	S12°39.8
1	83°39.1	240°13.0	29.7	201°41.1	10.7	48°21.1	39.0	109°54.8	39.8
2	98°41.5	255°12.7	30.7	216°41.7	11.0	63°23.8	38.9	124°57.2	39.7
3	113°44.0	270°12.4	·· 31.7	231°42.2	·· 11.4	78°26.5	·· 38.9	139°59.5	·· 39.7
4	128°46.5	285°12.2	32.7	246°42.8	11.7	93°29.2	38.8	155°01.9	39.6
5	143°48.9	300°11.9	33.7	261°43.4	12.1	108°31.9	38.7	170°04.2	39.6
6	158°51.4	315°11.6	S07°34.7	276°44.0	S21°12.5	123°34.6	N12°38.7	185°06.6	S12°39.5
7	173°53.9	330°11.3	35.7	291°44.6	12.8	138°37.3	38.6	200°09.0	39.5
8	188°56.3	345°11.0	36.7	306°45.2	13.2	153°40.0	38.5	215°11.3	39.4
9	203°58.8	0°10.7	·· 37.7	321°45.7	·· 13.5	168°42.7	·· 38.5	230°13.7	·· 39.4
10	219°01.2	15°10.4	38.7	336°46.3	13.9	183°45.4	38.4	245°16.0	39.4
11	234°03.7	30°10.1	39.7	351°46.9	14.2	198°48.1	38.3	260°18.4	39.3
12	249°06.2	45°09.8	S07°40.8	6°47.5	S21°14.6	213°50.8	N12°38.2	275°20.8	S12°39.3
13	264°08.6	60°09.5	41.8	21°48.1	15.0	228°53.5	38.2	290°23.1	39.2
14	279°11.1	75°09.3	42.8	36°48.6	15.3	243°56.2	38.1	305°25.5	39.2
15	294°13.6	90°09.0	·· 43.8	51°49.2	·· 15.7	258°58.9	·· 38.0	320°27.8	·· 39.1
16	309°16.0	105°08.7	44.8	66°49.8	16.0	274°01.7	38.0	335°30.2	39.1
17	324°18.5	120°08.4	45.8	81°50.4	16.4	289°04.4	37.9	350°32.5	39.0
18	339°21.0	135°08.1	S07°46.8	96°51.0	S21°16.7	304°07.1	N12°37.8	5°34.9	S12°39.0
19	354°23.4	150°07.8	47.8	111°51.5	17.1	319°09.8	37.8	20°37.3	39.0
20	9°25.9	165°07.5	48.8	126°52.1	17.4	334°12.5	37.7	35°39.6	38.9
21	24°28.3	180°07.2	·· 49.8	141°52.7	·· 17.8	349°15.2	·· 37.6	50°42.0	·· 38.9
22	39°30.8	195°06.9	50.8	156°53.3	18.1	4°17.9	37.5	65°44.3	38.8
23	54°33.3	210°06.6	51.8	171°53.8	18.5	19°20.6	37.5	80°46.7	38.8
Mer.pass. 19:22		ν -0.3′ d -1.0′ m -4.20		ν 0.6′ d -0.4′ m 1.37		ν 2.7′ d -0.1′ m -2.83		ν 2.4′ d 0.0′ m 0.86	

Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	69°35.7	225°06.3	S07°52.8	186°54.4	S21°18.8	34°23.3	N12°37.4	95°49.1	S12°38.7
1	84°38.2	240°06.0	53.9	201°55.0	19.2	49°26.0	37.3	110°51.4	38.7
2	99°40.7	255°05.7	54.9	216°55.6	19.5	64°28.7	37.3	125°53.8	38.6
3	114°43.1	270°05.4	·· 55.9	231°56.2	·· 19.9	79°31.4	·· 37.2	140°56.1	·· 38.6
4	129°45.6	285°05.1	56.9	246°56.7	20.2	94°34.1	37.1	155°58.5	38.6
5	144°48.1	300°04.8	57.9	261°57.3	20.6	109°36.8	37.1	171°00.8	38.5
6	159°50.5	315°04.5	S07°58.9	276°57.9	S21°20.9	124°39.5	N12°37.0	186°03.2	S12°38.5
7	174°53.0	330°04.2	07°59.9	291°58.5	21.3	139°42.2	36.9	201°05.5	38.4
8	189°55.5	345°03.9	08°00.9	306°59.0	21.6	154°44.9	36.9	216°07.9	38.4
9	204°57.9	0°03.6	·· 01.9	321°59.6	·· 22.0	169°47.6	·· 36.8	231°10.3	·· 38.3
10	220°00.4	15°03.3	02.9	337°00.2	22.3	184°50.3	36.7	246°12.6	38.3
11	235°02.8	30°03.0	03.9	352°00.8	22.7	199°53.0	36.7	261°15.0	38.2
12	250°05.3	45°02.7	S08°04.9	7°01.3	S21°23.0	214°55.7	N12°36.6	276°17.3	S12°38.2
13	265°07.8	60°02.4	05.9	22°01.9	23.4	229°58.4	36.5	291°19.7	38.1
14	280°10.2	75°02.1	06.9	37°02.5	23.7	245°01.1	36.4	306°22.0	38.1
15	295°12.7	90°01.8	·· 07.9	52°03.1	·· 24.1	260°03.8	·· 36.4	321°24.4	·· 38.1
16	310°15.2	105°01.5	08.9	67°03.6	24.4	275°06.5	36.3	336°26.7	38.0
17	325°17.6	120°01.2	10.0	82°04.2	24.8	290°09.2	36.2	351°29.1	38.0
18	340°20.1	135°00.9	S08°11.0	97°04.8	S21°25.1	305°11.9	N12°36.2	6°31.5	S12°37.9
19	355°22.6	150°00.6	12.0	112°05.4	25.5	320°14.6	36.1	21°33.8	37.9
20	10°25.0	165°00.3	13.0	127°05.9	25.8	335°17.3	36.0	36°36.2	37.8
21	25°27.5	180°00.0	·· 14.0	142°06.5	·· 26.2	350°20.0	·· 36.0	51°38.5	·· 37.8
22	40°30.0	194°59.7	15.0	157°07.1	26.5	5°22.7	35.9	66°40.9	37.7
23	55°32.4	209°59.4	16.0	172°07.6	26.8	20°25.4	35.8	81°43.2	37.7
Mer.pass. 19:18		ν -0.3′ d -1.0′ m -4.19		ν 0.6′ d -0.4′ m 1.37		ν 2.7′ d -0.1′ m -2.82		ν 2.4′ d 0.0′ m 0.86	

Sat	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	70°34.9	224°59.1	S08°17.0	187°08.2	S21°27.2	35°28.1	N12°35.8	96°45.6	S12°37.6
1	85°37.3	239°58.8	18.0	202°08.8	27.5	50°30.7	35.7	111°47.9	37.6
2	100°39.8	254°58.5	19.0	217°09.4	27.9	65°33.4	35.6	126°50.3	37.5
3	115°42.3	269°58.2	·· 20.0	232°09.9	·· 28.2	80°36.1	·· 35.6	141°52.6	·· 37.5
4	130°44.7	284°57.9	21.0	247°10.5	28.6	95°38.8	35.5	156°55.0	37.5
5	145°47.2	299°57.5	22.0	262°11.1	28.9	110°41.5	35.4	171°57.3	37.4
6	160°49.7	314°57.2	S08°23.0	277°11.6	S21°29.2	125°44.2	N12°35.4	186°59.7	S12°37.4
7	175°52.1	329°56.9	24.0	292°12.2	29.6	140°46.9	35.3	202°02.0	37.3
8	190°54.6	344°56.6	25.0	307°12.8	29.9	155°49.6	35.2	217°04.4	37.3
9	205°57.1	359°56.3	·· 26.0	322°13.4	·· 30.3	170°52.3	·· 35.2	232°06.8	·· 37.2
10	220°59.5	14°56.0	27.0	337°13.9	30.6	185°55.0	35.1	247°09.1	37.2
11	236°02.0	29°55.7	28.0	352°14.5	30.9	200°57.7	35.0	262°11.5	37.1
12	251°04.5	44°55.4	S08°29.0	7°15.1	S21°31.3	216°00.4	N12°35.0	277°13.8	S12°37.1
13	266°06.9	59°55.1	30.0	22°15.6	31.6	231°03.1	34.9	292°16.2	37.0
14	281°09.4	74°54.8	31.0	37°16.2	32.0	246°05.8	34.8	307°18.5	37.0
15	296°11.8	89°54.4	·· 32.0	52°16.8	·· 32.3	261°08.5	·· 34.8	322°20.9	·· 36.9
16	311°14.3	104°54.1	33.0	67°17.3	32.6	276°11.1	34.7	337°23.2	36.9
17	326°16.8	119°53.8	34.0	82°17.9	33.0	291°13.8	34.7	352°25.6	36.8
18	341°19.2	134°53.5	S08°35.0	97°18.5	S21°33.3	306°16.5	N12°34.6	7°27.9	S12°36.8
19	356°21.7	149°53.2	36.0	112°19.0	33.7	321°19.2	34.5	22°30.3	36.8
20	11°24.2	164°52.9	37.0	127°19.6	34.0	336°21.9	34.5	37°32.6	36.7
21	26°26.6	179°52.6	·· 38.1	142°20.2	·· 34.3	351°24.6	·· 34.4	52°35.0	·· 36.7
22	41°29.1	194°52.2	39.1	157°20.7	34.7	6°27.3	34.3	67°37.3	36.6
23	56°31.6	209°51.9	40.1	172°21.3	35.0	21°30.0	34.3	82°39.7	36.6
Mer.pass. 19:15		ν -0.3′ d -1.0′ m -4.18		ν 0.6′ d -0.3′ m 1.37		ν 2.7′ d -0.1′ m -2.82		ν 2.4′ d 0.0′ m 0.86	

Stars

	SHA	**Dec**
Alpheratz	357°35.6	29°13.5
Ankaa	353°07.9	-42°10.8
Schedar	349°31.8	56°40.3
Diphda	348°48.1	-17°51.4
Achernar	335°20.4	-57°07.1
Hamal	327°52.0	23°34.6
Polaris	314°01.3	89°22.0
Acamar	315°12.1	-40°12.6
Menkar	314°06.8	4°11.0
Mirfak	308°29.1	49°56.8
Aldebaran	290°40.3	16°33.5
Rigel	281°04.4	-8°10.4
Capella	280°22.8	46°01.3
Bellatrix	278°23.6	6°22.3
Elnath	278°02.7	28°37.7
Alnilam	275°38.4	-1°11.1
Betelgeuse	270°52.8	7°24.7
Canopus	263°52.3	-52°42.3
Sirius	258°26.8	-16°44.8
Adhara	255°06.3	-29°00.1
Procyon	244°51.6	5°09.9
Pollux	243°18.2	27°58.1
Avior	234°14.7	-59°34.8
Suhail	222°46.8	-43°31.4
Miaplacidus	221°38.1	-69°48.5
Alphard	217°48.6	-8°45.6
Regulus	207°35.4	11°51.0
Dubhe	193°42.2	61°37.1
Denebola	182°26.0	14°26.3
Gienah	175°44.7	-17°40.3
Acrux	173°01.5	-63°13.6
Gacrux	171°53.0	-57°14.5
Alioth	166°14.1	55°49.6
Spica	158°23.5	-11°17.0
Alkaid	152°53.1	49°11.5
Hadar	148°37.9	-60°29.0
Menkent	147°59.1	-36°29.1
Arcturus	145°49.1	19°03.5
Rigil Kent.	139°42.2	-60°55.8
Kochab	137°20.9	74°03.3
Zuben'ubi	136°57.4	-16°08.4
Alphecca	126°04.9	26°38.0
Antares	112°17.4	-26°29.0
Atria	107°13.0	-69°04.2
Sabik	102°04.2	-15°45.2
Shaula	96°12.1	-37°07.3
Rasalhague	95°59.8	12°32.6
Eltanin	90°43.1	51°29.2
Kaus Aust.	83°34.1	-34°22.4
Vega	80°34.2	38°48.4
Nunki	75°49.2	-26°16.1
Altair	62°01.1	8°55.9
Peacock	53°07.5	-56°39.7
Deneb	49°26.7	45°22.1
Enif	33°39.8	9°59.1
Al Na'ir	27°34.2	-46°51.0
Fomalhaut	15°15.5	-29°29.9
Scheat	13°46.1	28°12.9
Markab	13°30.8	15°20.1

Nov 30 Thu	**SHA**	**Mer.pass**
Venus	156°36.7	08:59
Mars	118°03.9	11:33
Jupiter	324°41.8	21:43
Saturn	26°15.8	17:38

Dec 01 Fri	**SHA**	**Mer.pass**
Venus	155°30.6	09:00
Mars	117°18.7	11:32
Jupiter	324°47.5	21:39
Saturn	26°13.3	17:34

Dec 02 Sat	**SHA**	**Mer.pass**
Venus	154°24.2	09:00
Mars	116°33.3	11:31
Jupiter	324°53.2	21:34
Saturn	26°10.7	17:30

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°54.6	S21°33.6	328°15.5	7.6′	N28°04.6	1.6′	55.9′
1	197°54.3	34.0	342°42.1	7.6′	28°03.0	1.8′	55.9′
2	212°54.1	34.4	357°08.7	7.7′	28°01.2	1.9′	55.9′
3	227°53.9	·· 34.8	11°35.3	7.7′	27°59.3	2.1′	55.8′
4	242°53.7	35.3	26°02.1	7.8′	27°57.2	2.2′	55.8′
5	257°53.4	35.7	40°28.9	7.8′	27°55.0	2.4′	55.8′
6	272°53.2	S21°36.1	54°55.7	7.9′	N27°52.6	2.6′	55.7′
7	287°53.0	36.5	69°22.6	8.0′	27°50.0	2.6′	55.7′
8	302°52.8	36.9	83°49.6	8.0′	27°47.4	2.9′	55.7′
9	317°52.6	·· 37.3	98°16.6	8.1′	27°44.5	3.0′	55.7′
10	332°52.3	37.7	112°43.7	8.2′	27°41.5	3.1′	55.6′
11	347°52.1	38.1	127°10.9	8.2′	27°38.4	3.3′	55.6′
12	2°51.9	S21°38.5	141°38.2	8.3′	N27°35.1	3.4′	55.6′
13	17°51.7	38.9	156°05.5	8.4′	27°31.7	3.5′	55.6′
14	32°51.4	39.3	170°32.9	8.5′	27°28.2	3.8′	55.5′
15	47°51.2	·· 39.7	185°00.3	8.5′	27°24.4	3.8′	55.5′
16	62°51.0	40.1	199°27.9	8.6′	27°20.6	4.0′	55.5′
17	77°50.8	40.5	213°55.5	8.7′	27°16.6	4.1′	55.5′
18	92°50.5	S21°40.9	228°23.1	8.8′	N27°12.5	4.3′	55.5′
19	107°50.3	41.3	242°50.9	8.8′	27°08.2	4.4′	55.4′
20	122°50.1	41.7	257°18.7	8.9′	27°03.8	4.5′	55.4′
21	137°49.8	·· 42.1	271°46.6	9.0′	26°59.3	4.7′	55.4′
22	152°49.6	42.5	286°14.6	9.1′	26°54.6	4.8′	55.4′
23	167°49.4	42.9	300°42.7	9.2′	26°49.8	5.0′	55.3′
	SD = 16.2′	d = -0.4′	SD = 15.2′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°49.2	S21°43.3	315°10.9	9.2′	N26°44.8	5.1′	55.3′
1	197°48.9	43.7	329°39.1	9.3′	26°39.7	5.2′	55.3′
2	212°48.7	44.1	344°07.4	9.4′	26°34.5	5.3′	55.3′
3	227°48.5	·· 44.5	358°35.8	9.5′	26°29.2	5.5′	55.2′
4	242°48.3	44.9	13°04.3	9.6′	26°23.7	5.6′	55.2′
5	257°48.0	45.3	27°32.9	9.7′	26°18.1	5.7′	55.2′
6	272°47.8	S21°45.7	42°01.5	9.7′	N26°12.4	5.9′	55.2′
7	287°47.6	46.1	56°30.3	9.8′	26°06.5	6.0′	55.2′
8	302°47.3	46.5	70°59.1	9.9′	26°00.5	6.1′	55.1′
9	317°47.1	·· 46.9	85°28.0	10.0′	25°54.4	6.2′	55.1′
10	332°46.9	47.3	99°57.0	10.1′	25°48.2	6.4′	55.1′
11	347°46.6	47.7	114°26.1	10.2′	25°41.8	6.4′	55.1′
12	2°46.4	S21°48.1	128°55.3	10.3′	N25°35.4	6.6′	55.0′
13	17°46.2	48.4	143°24.6	10.4′	25°28.8	6.7′	55.0′
14	32°45.9	48.8	157°53.9	10.4′	25°22.1	6.9′	55.0′
15	47°45.7	·· 49.2	172°23.4	10.5′	25°15.2	6.9′	55.0′
16	62°45.5	49.6	186°52.9	10.6′	25°08.3	7.1′	55.0′
17	77°45.2	50.0	201°22.6	10.7′	25°01.2	7.2′	54.9′
18	92°45.0	S21°50.4	215°52.3	10.8′	N24°54.0	7.2′	54.9′
19	107°44.8	50.8	230°22.1	10.9′	24°46.8	7.4′	54.9′
20	122°44.5	51.1	244°52.0	11.0′	24°39.4	7.6′	54.9′
21	137°44.3	·· 51.5	259°22.0	11.1′	24°31.8	7.6′	54.9′
22	152°44.1	51.9	273°52.1	11.2′	24°24.2	7.7′	54.8′
23	167°43.8	52.3	288°22.2	11.3′	24°16.5	7.8′	54.8′
	SD = 16.2′	d = -0.4′	SD = 15.1′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°43.6	S21°52.7	302°52.5	11.4′	N24°08.7	8.0′	54.8′
1	197°43.4	53.0	317°22.8	11.4′	24°00.7	8.0′	54.8′
2	212°43.1	53.4	331°53.3	11.5′	23°52.7	8.2′	54.8′
3	227°42.9	·· 53.8	346°23.8	11.6′	23°44.5	8.2′	54.8′
4	242°42.7	54.2	0°54.4	11.7′	23°36.3	8.4′	54.7′
5	257°42.4	54.6	15°25.1	11.8′	23°27.9	8.5′	54.7′
6	272°42.2	S21°54.9	29°56.0	11.9′	N23°19.4	8.5′	54.7′
7	287°42.0	55.3	44°26.8	12.0′	23°10.9	8.7′	54.7′
8	302°41.7	55.7	58°57.8	12.1′	23°02.2	8.7′	54.7′
9	317°41.5	·· 56.1	73°28.9	12.2′	22°53.5	8.9′	54.7′
10	332°41.2	56.4	88°00.1	12.2′	22°44.6	8.9′	54.6′
11	347°41.0	56.8	102°31.3	12.3′	22°35.7	9.1′	54.6′
12	2°40.8	S21°57.2	117°02.6	12.4′	N22°26.6	9.1′	54.6′
13	17°40.5	57.5	131°34.1	12.5′	22°17.5	9.3′	54.6′
14	32°40.3	57.9	146°05.6	12.6′	22°08.2	9.3′	54.6′
15	47°40.0	·· 58.3	160°37.2	12.7′	21°58.9	9.4′	54.6′
16	62°39.8	58.7	175°08.9	12.8′	21°49.5	9.5′	54.5′
17	77°39.6	59.0	189°40.7	12.9′	21°40.0	9.6′	54.5′
18	92°39.3	S21°59.4	204°12.5	12.9′	N21°30.4	9.7′	54.5′
19	107°39.1	21°59.8	218°44.5	13.0′	21°20.7	9.7′	54.5′
20	122°38.8	22°00.1	233°16.5	13.1′	21°11.0	9.9′	54.5′
21	137°38.6	·· 00.5	247°48.6	13.2′	21°01.1	9.9′	54.5′
22	152°38.4	00.8	262°20.8	13.3′	20°51.2	10.0′	54.5′
23	167°38.1	01.2	276°53.1	13.4′	20°41.2	10.1′	54.5′
	SD = 16.2′	d = -0.4′	SD = 14.9′				

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

Lat.	**Moonrise** Thu	Fri	Sat	**Moonset** Thu	Fri	Sat
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	▭	▭	17:11	▭	▭	15:44
66°	▭	▭	18:18	▭	▭	14:36
64°	▭	16:44	18:53	▭	14:29	14:00
62°	15:38	17:33	19:18	13:45	13:39	13:34
60°	16:32	18:04	19:38	12:51	13:07	13:14
N 58°	17:04	18:27	19:54	12:19	12:44	12:57
56°	17:28	18:46	20:08	11:55	12:25	12:42
54°	17:47	19:02	20:20	11:36	12:08	12:30
52°	18:03	19:15	20:30	11:19	11:55	12:19
50°	18:17	19:27	20:39	11:05	11:42	12:09
45°	18:45	19:52	20:59	10:36	11:17	11:49
N 40°	19:08	20:11	21:15	10:13	10:57	11:32
35°	19:26	20:27	21:28	09:55	10:40	11:18
30°	19:42	20:41	21:39	09:38	10:25	11:05
20°	20:09	21:05	21:59	09:11	10:00	10:44
N 10°	20:32	21:25	22:16	08:47	09:39	10:25
0°	20:53	21:44	22:32	08:25	09:18	10:08
S 10°	21:14	22:03	22:48	08:03	08:58	09:50
20°	21:37	22:24	23:05	07:39	08:36	09:31
30°	22:04	22:47	23:24	07:11	08:10	09:10
35°	22:19	23:01	23:35	06:55	07:55	08:57
40°	22:38	23:16	23:48	06:36	07:38	08:42
45°	22:59	23:35	·· ··	06:12	07:17	08:24
S 50°	23:27	23:58	·· ··	05:42	06:50	08:02
52°	23:40	·· ··	00:10	05:27	06:37	07:51
54°	23:56	·· ··	00:22	05:10	06:21	07:39
56°	·· ··	00:14	00:37	04:49	06:03	07:25
58°	00:03	00:36	00:53	04:23	05:42	07:09
S 60°	00:41	01:05	01:14	03:45	05:13	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 17-19 92-79%
30	11:38	11:28	11:49	02:12	14:39	
01	11:17	11:06	11:49	03:06	15:32	
02	10:54	10:43	11:49	03:56	16:20	

December 03, 04, 05 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	71°34.0	224°51.6	S08°41.1	187°21.9	S21°35.3	36°32.7	N12°34.2	97°42.0	S12°36.5
1	86°36.5	239°51.3	42.1	202°22.4	35.7	51°35.4	34.1	112°44.4	36.5
2	101°39.0	254°51.0	43.1	217°23.0	36.0	66°38.1	34.1	127°46.7	36.4
3	116°41.4	269°50.7	·· 44.1	232°23.6	·· 36.3	81°40.7	·· 34.0	142°49.1	·· 36.4
4	131°43.9	284°50.3	45.1	247°24.1	36.7	96°43.4	33.9	157°51.4	36.3
5	146°46.3	299°50.0	46.1	262°24.7	37.0	111°46.1	33.9	172°53.8	36.3
6	161°48.8	314°49.7	S08°47.1	277°25.3	S21°37.3	126°48.8	N12°33.8	187°56.1	S12°36.2
7	176°51.3	329°49.4	48.1	292°25.8	37.7	141°51.5	33.7	202°58.5	36.2
8	191°53.7	344°49.1	49.1	307°26.4	38.0	156°54.2	33.7	218°00.8	36.1
9	206°56.2	359°48.7	·· 50.1	322°27.0	·· 38.3	171°56.9	·· 33.6	233°03.2	·· 36.1
10	221°58.7	14°48.4	51.1	337°27.5	38.7	186°59.6	33.6	248°05.5	36.0
11	237°01.1	29°48.1	52.1	352°28.1	39.0	202°02.2	33.5	263°07.8	36.0
12	252°03.6	44°47.8	S08°53.1	7°28.6	S21°39.3	217°04.9	N12°33.4	278°10.2	S12°35.9
13	267°06.1	59°47.4	54.1	22°29.2	39.7	232°07.6	33.4	293°12.5	35.9
14	282°08.5	74°47.1	55.1	37°29.8	40.0	247°10.3	33.3	308°14.9	35.8
15	297°11.0	89°46.8	·· 56.1	52°30.3	·· 40.3	262°13.0	·· 33.2	323°17.2	·· 35.8
16	312°13.4	104°46.5	57.1	67°30.9	40.7	277°15.7	33.2	338°19.6	35.7
17	327°15.9	119°46.2	58.1	82°31.5	41.0	292°18.4	33.1	353°21.9	35.7
18	342°18.4	134°45.8	S08°59.1	97°32.0	S21°41.3	307°21.0	N12°33.0	8°24.3	S12°35.6
19	357°20.8	149°45.5	09°00.1	112°32.6	41.7	322°23.7	33.0	23°26.6	35.6
20	12°23.3	164°45.2	01.0	127°33.1	42.0	337°26.4	32.9	38°29.0	35.5
21	27°25.8	179°44.9	·· 02.0	142°33.7	·· 42.3	352°29.1	·· 32.9	53°31.3	·· 35.5
22	42°28.2	194°44.5	03.0	157°34.3	42.6	7°31.8	32.8	68°33.7	35.5
23	57°30.7	209°44.2	04.0	172°34.8	43.0	22°34.5	32.7	83°36.0	35.4
Mer.pass. 19:11		ν -0.3′ d -1.0′ m -4.18		ν 0.6′ d -0.3′ m 1.37		ν 2.7′ d -0.1′ m -2.81		ν 2.3′ d 0.0′ m 0.87	

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	72°33.2	224°43.9	S09°05.0	187°35.4	S21°43.3	37°37.1	N12°32.7	98°38.4	S12°35.4
1	87°35.6	239°43.5	06.0	202°35.9	43.6	52°39.8	32.6	113°40.7	35.3
2	102°38.1	254°43.2	07.0	217°36.5	44.0	67°42.5	32.5	128°43.0	35.3
3	117°40.6	269°42.9	·· 08.0	232°37.1	·· 44.3	82°45.2	·· 32.5	143°45.4	·· 35.2
4	132°43.0	284°42.6	09.0	247°37.6	44.6	97°47.9	32.4	158°47.7	35.2
5	147°45.5	299°42.2	10.0	262°38.2	44.9	112°50.5	32.4	173°50.1	35.1
6	162°47.9	314°41.9	S09°11.0	277°38.7	S21°45.3	127°53.2	N12°32.3	188°52.4	S12°35.1
7	177°50.4	329°41.6	12.0	292°39.3	45.6	142°55.9	32.2	203°54.8	35.0
8	192°52.9	344°41.2	13.0	307°39.9	45.9	157°58.6	32.2	218°57.1	35.0
9	207°55.3	359°40.9	·· 14.0	322°40.4	·· 46.2	173°01.3	·· 32.1	233°59.5	·· 34.9
10	222°57.8	14°40.6	15.0	337°41.0	46.6	188°04.0	32.1	249°01.8	34.9
11	238°00.3	29°40.2	16.0	352°41.5	46.9	203°06.6	32.0	264°04.2	34.8
12	253°02.7	44°39.9	S09°17.0	7°42.1	S21°47.2	218°09.3	N12°31.9	279°06.5	S12°34.8
13	268°05.2	59°39.6	18.0	22°42.6	47.5	233°12.0	31.9	294°08.8	34.7
14	283°07.7	74°39.2	19.0	37°43.2	47.8	248°14.7	31.8	309°11.2	34.7
15	298°10.1	89°38.9	·· 20.0	52°43.8	·· 48.2	263°17.3	·· 31.7	324°13.5	·· 34.6
16	313°12.6	104°38.6	21.0	67°44.3	48.5	278°20.0	31.7	339°15.9	34.6
17	328°15.1	119°38.2	22.0	82°44.9	48.8	293°22.7	31.6	354°18.2	34.5
18	343°17.5	134°37.9	S09°23.0	97°45.4	S21°49.1	308°25.4	N12°31.6	9°20.6	S12°34.5
19	358°20.0	149°37.6	24.0	112°46.0	49.5	323°28.1	31.5	24°22.9	34.4
20	13°22.4	164°37.2	25.0	127°46.5	49.8	338°30.7	31.4	39°25.2	34.4
21	28°24.9	179°36.9	·· 25.9	142°47.1	·· 50.1	353°33.4	·· 31.4	54°27.6	·· 34.3
22	43°27.4	194°36.6	26.9	157°47.6	50.4	8°36.1	31.3	69°29.9	34.3
23	58°29.8	209°36.2	27.9	172°48.2	50.7	23°38.8	31.3	84°32.3	34.2
Mer.pass. 19:07		ν -0.3′ d -1.0′ m -4.17		ν 0.6′ d -0.3′ m 1.37		ν 2.7′ d -0.1′ m -2.80		ν 2.3′ d 0.0′ m 0.87	

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	73°32.3	224°35.9	S09°28.9	187°48.8	S21°51.1	38°41.4	N12°31.2	99°34.6	S12°34.2
1	88°34.8	239°35.5	29.9	202°49.3	51.4	53°44.1	31.1	114°37.0	34.1
2	103°37.2	254°35.2	30.9	217°49.9	51.7	68°46.8	31.1	129°39.3	34.1
3	118°39.7	269°34.9	·· 31.9	232°50.4	·· 52.0	83°49.5	·· 31.0	144°41.6	·· 34.0
4	133°42.2	284°34.5	32.9	247°51.0	52.3	98°52.1	31.0	159°44.0	34.0
5	148°44.6	299°34.2	33.9	262°51.5	52.7	113°54.8	30.9	174°46.3	33.9
6	163°47.1	314°33.8	S09°34.9	277°52.1	S21°53.0	128°57.5	N12°30.8	189°48.7	S12°33.9
7	178°49.5	329°33.5	35.9	292°52.6	53.3	144°00.2	30.8	204°51.0	33.8
8	193°52.0	344°33.2	36.9	307°53.2	53.6	159°02.8	30.7	219°53.3	33.8
9	208°54.5	359°32.8	·· 37.9	322°53.7	·· 53.9	174°05.5	·· 30.7	234°55.7	·· 33.7
10	223°56.9	14°32.5	38.8	337°54.3	54.2	189°08.2	30.6	249°58.0	33.7
11	238°59.4	29°32.1	39.8	352°54.8	54.5	204°10.9	30.6	265°00.4	33.6
12	254°01.9	44°31.8	S09°40.8	7°55.4	S21°54.9	219°13.5	N12°30.5	280°02.7	S12°33.5
13	269°04.3	59°31.4	41.8	22°55.9	55.2	234°16.2	30.4	295°05.0	33.5
14	284°06.8	74°31.1	42.8	37°56.5	55.5	249°18.9	30.4	310°07.4	33.4
15	299°09.3	89°30.7	·· 43.8	52°57.0	·· 55.8	264°21.5	·· 30.3	325°09.7	·· 33.4
16	314°11.7	104°30.4	44.8	67°57.6	56.1	279°24.2	30.3	340°12.1	33.3
17	329°14.2	119°30.1	45.8	82°58.1	56.4	294°26.9	30.2	355°14.4	33.3
18	344°16.7	134°29.7	S09°46.8	97°58.7	S21°56.7	309°29.6	N12°30.1	10°16.7	S12°33.2
19	359°19.1	149°29.4	47.8	112°59.2	57.1	324°32.2	30.1	25°19.1	33.2
20	14°21.6	164°29.0	48.7	127°59.8	57.4	339°34.9	30.0	40°21.4	33.1
21	29°24.0	179°28.7	·· 49.7	143°00.3	·· 57.7	354°37.6	·· 30.0	55°23.8	·· 33.1
22	44°26.5	194°28.3	50.7	158°00.9	58.0	9°40.2	29.9	70°26.1	33.0
23	59°29.0	209°28.0	51.7	173°01.4	58.3	24°42.9	29.9	85°28.4	33.0
Mer.pass. 19:03		ν -0.3′ d -1.0′ m -4.16		ν 0.6′ d -0.3′ m 1.37		ν 2.7′ d -0.1′ m -2.80		ν 2.3′ d 0.1′ m 0.88	

Stars	SHA	Dec
Alpheratz	357°35.6	29°13.5
Ankaa	353°07.9	-42°10.8
Schedar	349°31.8	56°40.3
Diphda	348°48.1	-17°51.4
Achernar	335°20.5	-57°07.1
Hamal	327°52.0	23°34.6
Polaris	314°01.7	89°22.0
Acamar	315°12.1	-40°12.6
Menkar	314°06.8	4°11.0
Mirfak	308°29.1	49°56.9
Aldebaran	290°40.3	16°33.5
Rigel	281°04.4	-8°10.4
Capella	280°22.8	46°01.3
Bellatrix	278°23.5	6°22.3
Elnath	278°02.7	28°37.7
Alnilam	275°38.3	-1°11.1
Betelgeuse	270°52.8	7°24.7
Canopus	263°52.3	-52°42.3
Sirius	258°26.7	-16°44.8
Adhara	255°06.3	-29°00.1
Procyon	244°51.6	5°09.9
Pollux	243°18.2	27°58.1
Avior	234°14.7	-59°34.8
Suhail	222°46.8	-43°31.4
Miaplacidus	221°38.1	-69°48.5
Alphard	217°48.6	-8°45.6
Regulus	207°35.4	11°51.0
Dubhe	193°42.2	61°37.1
Denebola	182°26.0	14°26.3
Gienah	175°44.7	-17°40.3
Acrux	173°01.5	-63°13.6
Gacrux	171°53.0	-57°14.5
Alioth	166°14.1	55°49.6
Spica	158°23.5	-11°17.0
Alkaid	152°53.1	49°11.5
Hadar	148°37.9	-60°29.0
Menkent	147°59.0	-36°29.1
Arcturus	145°49.0	19°03.5
Rigil Kent.	139°42.2	-60°55.8
Kochab	137°20.8	74°03.2
Zuben'ubi	136°57.4	-16°08.4
Alphecca	126°04.9	26°38.0
Antares	112°17.4	-26°29.0
Atria	107°13.0	-69°04.2
Sabik	102°04.2	-15°45.2
Shaula	96°12.1	-37°07.3
Rasalhague	95°59.8	12°32.6
Eltanin	90°43.1	51°29.2
Kaus Aust.	83°34.1	-34°22.4
Vega	80°34.2	38°48.4
Nunki	75°49.2	-26°16.1
Altair	62°01.1	8°55.9
Peacock	53°07.5	-56°39.7
Deneb	49°26.7	45°22.1
Enif	33°39.8	9°59.1
Al Na'ir	27°34.2	-46°51.0
Fomalhaut	15°15.5	-29°29.9
Scheat	13°46.1	28°12.9
Markab	13°30.8	15°20.1

Dec 03 Sun	**SHA**	**Mer.pass**
Venus	153°17.6	09:01
Mars	115°47.8	11:30
Jupiter	324°58.6	21:30
Saturn	26°08.0	17:26

Dec 04 Mon	**SHA**	**Mer.pass**
Venus	152°10.7	09:01
Mars	115°02.2	11:29
Jupiter	325°04.0	21:26
Saturn	26°05.2	17:23

Dec 05 Tue	**SHA**	**Mer.pass**
Venus	151°03.6	09:02
Mars	114°16.5	11:28
Jupiter	325°09.1	21:21
Saturn	26°02.3	17:19

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°37.9	S22°01.6	291°25.5	13.4′	N20°31.1	10.2′	54.4′
1	197°37.6	01.9	305°57.9	13.5′	20°20.9	10.2′	54.4′
2	212°37.4	02.3	320°30.4	13.6′	20°10.7	10.4′	54.4′
3	227°37.2	·· 02.7	335°03.1	13.7′	20°00.3	10.4′	54.4′
4	242°36.9	03.0	349°35.7	13.8′	19°49.9	10.5′	54.4′
5	257°36.7	03.4	4°08.5	13.9′	19°39.4	10.5′	54.4′
6	272°36.4	S22°03.7	18°41.4	13.9′	N19°28.9	10.7′	54.4′
7	287°36.2	04.1	33°14.3	14.0′	19°18.2	10.7′	54.4′
8	302°35.9	04.5	47°47.3	14.1′	19°07.5	10.8′	54.3′
9	317°35.7	·· 04.8	62°20.4	14.2′	18°56.7	10.9′	54.3′
10	332°35.5	05.2	76°53.5	14.2′	18°45.8	10.9′	54.3′
11	347°35.2	05.5	91°26.8	14.3′	18°34.9	11.0′	54.3′
12	2°35.0	S22°05.9	106°00.1	14.4′	N18°23.9	11.1′	54.3′
13	17°34.7	06.2	120°33.5	14.5′	18°12.8	11.1′	54.3′
14	32°34.5	06.6	135°06.9	14.5′	18°01.7	11.2′	54.3′
15	47°34.2	·· 06.9	149°40.5	14.6′	17°50.5	11.3′	54.3′
16	62°34.0	07.3	164°14.1	14.7′	17°39.2	11.3′	54.3′
17	77°33.7	07.6	178°47.7	14.7′	17°27.9	11.5′	54.3′
18	92°33.5	S22°08.0	193°21.5	14.8′	N17°16.4	11.4′	54.3′
19	107°33.2	08.3	207°55.3	14.9′	17°05.0	11.6′	54.3′
20	122°33.0	08.7	222°29.1	14.9′	16°53.4	11.6′	54.2′
21	137°32.7	·· 09.0	237°03.1	15.0′	16°41.8	11.6′	54.2′
22	152°32.5	09.4	251°37.1	15.1′	16°30.2	11.7′	54.2′
23	167°32.3	09.7	266°11.2	15.1′	16°18.5	11.8′	54.2′
	SD = 16.2′	d = -0.4′	SD = 14.8′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°32.0	S22°10.1	280°45.3	15.2′	N16°06.7	11.9′	54.2′
1	197°31.8	10.4	295°19.5	15.3′	15°54.8	11.9′	54.2′
2	212°31.5	10.7	309°53.8	15.3′	15°42.9	11.9′	54.2′
3	227°31.3	·· 11.1	324°28.1	15.4′	15°31.0	12.0′	54.2′
4	242°31.0	11.4	339°02.5	15.4′	15°19.0	12.1′	54.2′
5	257°30.8	11.8	353°36.9	15.5′	15°06.9	12.1′	54.2′
6	272°30.5	S22°12.1	8°11.4	15.6′	N14°54.8	12.2′	54.2′
7	287°30.3	12.5	22°46.0	15.6′	14°42.6	12.2′	54.2′
8	302°30.0	12.8	37°20.6	15.7′	14°30.4	12.3′	54.2′
9	317°29.8	·· 13.1	51°55.3	15.7′	14°18.1	12.4′	54.2′
10	332°29.5	13.5	66°30.0	15.8′	14°05.7	12.4′	54.2′
11	347°29.3	13.8	81°04.8	15.8′	13°53.3	12.4′	54.2′
12	2°29.0	S22°14.1	95°39.6	15.9′	N13°40.9	12.5′	54.2′
13	17°28.8	14.5	110°14.5	15.9′	13°28.4	12.5′	54.2′
14	32°28.5	14.8	124°49.5	16.0′	13°15.9	12.6′	54.2′
15	47°28.2	·· 15.1	139°24.4	16.0′	13°03.3	12.6′	54.2′
16	62°28.0	15.5	153°59.5	16.1′	12°50.7	12.7′	54.2′
17	77°27.7	15.8	168°34.6	16.1′	12°38.0	12.7′	54.2′
18	92°27.5	S22°16.1	183°09.7	16.2′	N12°25.3	12.8′	54.2′
19	107°27.2	16.5	197°44.9	16.2′	12°12.5	12.8′	54.2′
20	122°27.0	16.8	212°20.1	16.3′	11°59.7	12.9′	54.2′
21	137°26.7	·· 17.1	226°55.3	16.3′	11°46.8	12.9′	54.2′
22	152°26.5	17.5	241°30.6	16.3′	11°33.9	12.9′	54.2′
23	167°26.2	17.8	256°06.0	16.4′	11°21.0	13.0′	54.2′
	SD = 16.2′	d = -0.3′	SD = 14.8′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°26.0	S22°18.1	270°41.4	16.4′	N11°08.0	13.1′	54.2′
1	197°25.7	18.4	285°16.8	16.5′	10°54.9	13.0′	54.2′
2	212°25.5	18.8	299°52.3	16.5′	10°41.9	13.1′	54.2′
3	227°25.2	·· 19.1	314°27.8	16.5′	10°28.8	13.2′	54.2′
4	242°24.9	19.4	329°03.3	16.6′	10°15.6	13.2′	54.2′
5	257°24.7	19.7	343°38.9	16.6′	10°02.4	13.2′	54.2′
6	272°24.4	S22°20.1	358°14.5	16.6′	N09°49.2	13.2′	54.2′
7	287°24.2	20.4	12°50.1	16.7′	09°36.0	13.3′	54.2′
8	302°23.9	20.7	27°25.8	16.7′	09°22.7	13.4′	54.2′
9	317°23.7	·· 21.0	42°01.4	16.7′	09°09.3	13.3′	54.2′
10	332°23.4	21.3	56°37.2	16.8′	08°56.0	13.4′	54.2′
11	347°23.2	21.7	71°12.9	16.8′	08°42.6	13.5′	54.2′
12	2°22.9	S22°22.0	85°48.7	16.8′	N08°29.1	13.4′	54.2′
13	17°22.6	22.3	100°24.5	16.8′	08°15.7	13.5′	54.2′
14	32°22.4	22.6	115°00.3	16.9′	08°02.2	13.6′	54.2′
15	47°22.1	·· 22.9	129°36.2	16.9′	07°48.6	13.5′	54.2′
16	62°21.9	23.3	144°12.1	16.9′	07°35.1	13.6′	54.2′
17	77°21.6	23.6	158°48.0	16.9′	07°21.5	13.7′	54.2′
18	92°21.3	S22°23.9	173°23.9	16.9′	N07°07.8	13.6′	54.3′
19	107°21.1	24.2	187°59.8	17.0′	06°54.2	13.7′	54.3′
20	122°20.8	24.5	202°35.8	17.0′	06°40.5	13.7′	54.3′
21	137°20.6	·· 24.8	217°11.7	17.0′	06°26.8	13.7′	54.3′
22	152°20.3	25.1	231°47.7	17.0′	06°13.1	13.8′	54.3′
23	167°20.1	25.4	246°23.7	17.0′	05°59.3	13.8′	54.3′
	SD = 16.2′	d = -0.3′	SD = 14.8′				

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

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

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 20-22 71-52%
03	10:32	10:20	11:50	04:43	17:05	
04	10:08	09:56	11:50	05:26	17:47	
05	09:44	09:32	11:50	06:07	18:27	

December 06, 07, 08 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	74°31.4	224°27.6	S09°52.7	188°02.0	S21°58.6	39°45.6	N12°29.8	100°30.8	S12°32.9
1	89°33.9	239°27.3	53.7	203°02.5	58.9	54°48.3	29.7	115°33.1	32.9
2	104°36.4	254°26.9	54.7	218°03.1	59.2	69°50.9	29.7	130°35.5	32.8
3	119°38.8	269°26.6	·· 55.7	233°03.6	·· 59.5	84°53.6	·· 29.6	145°37.8	·· 32.8
4	134°41.3	284°26.2	56.6	248°04.2	21°59.9	99°56.3	29.6	160°40.1	32.7
5	149°43.8	299°25.9	57.6	263°04.7	22°00.2	114°58.9	29.5	175°42.5	32.7
6	164°46.2	314°25.5	S09°58.6	278°05.3	S22°00.5	130°01.6	N12°29.4	190°44.8	S12°32.6
7	179°48.7	329°25.2	09°59.6	293°05.8	00.8	145°04.3	29.4	205°47.1	32.6
8	194°51.2	344°24.8	10°00.6	308°06.4	01.1	160°06.9	29.3	220°49.5	32.5
9	209°53.6	359°24.5	·· 01.6	323°06.9	·· 01.4	175°09.6	·· 29.3	235°51.8	·· 32.5
10	224°56.1	14°24.1	02.6	338°07.5	01.7	190°12.3	29.2	250°54.2	32.4
11	239°58.5	29°23.7	03.5	353°08.0	02.0	205°14.9	29.2	265°56.5	32.4
12	255°01.0	44°23.4	S10°04.5	8°08.6	S22°02.3	220°17.6	N12°29.1	280°58.8	S12°32.3
13	270°03.5	59°23.0	05.5	23°09.1	02.6	235°20.3	29.1	296°01.2	32.3
14	285°05.9	74°22.7	06.5	38°09.7	02.9	250°22.9	29.0	311°03.5	32.2
15	300°08.4	89°22.3	·· 07.5	53°10.2	·· 03.2	265°25.6	·· 28.9	326°05.8	·· 32.1
16	315°10.9	104°22.0	08.5	68°10.7	03.5	280°28.2	28.9	341°08.2	32.1
17	330°13.3	119°21.6	09.5	83°11.3	03.9	295°30.9	28.8	356°10.5	32.0
18	345°15.8	134°21.3	S10°10.4	98°11.8	S22°04.2	310°33.6	N12°28.8	11°12.8	S12°32.0
19	0°18.3	149°20.9	11.4	113°12.4	04.5	325°36.2	28.7	26°15.2	31.9
20	15°20.7	164°20.5	12.4	128°12.9	04.8	340°38.9	28.7	41°17.5	31.9
21	30°23.2	179°20.2	·· 13.4	143°13.5	·· 05.1	355°41.6	·· 28.6	56°19.8	·· 31.8
22	45°25.6	194°19.8	14.4	158°14.0	05.4	10°44.2	28.6	71°22.2	31.8
23	60°28.1	209°19.5	15.4	173°14.6	05.7	25°46.9	28.5	86°24.5	31.7
Mer.pass. 18:59		ν -0.3′ d -1.0′ m -4.16		ν 0.5′ d -0.3′ m 1.37		ν 2.7′ d -0.1′ m -2.79		ν 2.3′ d 0.1′ m 0.88	

Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	75°30.6	224°19.1	S10°16.3	188°15.1	S22°06.0	40°49.6	N12°28.4	101°26.9	S12°31.7
1	90°33.0	239°18.7	17.3	203°15.6	06.3	55°52.2	28.4	116°29.2	31.6
2	105°35.5	254°18.4	18.3	218°16.2	06.6	70°54.9	28.3	131°31.5	31.6
3	120°38.0	269°18.0	·· 19.3	233°16.7	·· 06.9	85°57.5	·· 28.3	146°33.9	·· 31.5
4	135°40.4	284°17.7	20.3	248°17.3	07.2	101°00.2	28.2	161°36.2	31.5
5	150°42.9	299°17.3	21.2	263°17.8	07.5	116°02.9	28.2	176°38.5	31.4
6	165°45.4	314°16.9	S10°22.2	278°18.4	S22°07.8	131°05.5	N12°28.1	191°40.9	S12°31.4
7	180°47.8	329°16.6	23.2	293°18.9	08.1	146°08.2	28.1	206°43.2	31.3
8	195°50.3	344°16.2	24.2	308°19.4	08.4	161°10.8	28.0	221°45.5	31.2
9	210°52.8	359°15.8	·· 25.2	323°20.0	·· 08.7	176°13.5	·· 27.9	236°47.9	·· 31.2
10	225°55.2	14°15.5	26.1	338°20.5	09.0	191°16.2	27.9	251°50.2	31.1
11	240°57.7	29°15.1	27.1	353°21.1	09.3	206°18.8	27.8	266°52.5	31.1
12	256°00.1	44°14.7	S10°28.1	8°21.6	S22°09.6	221°21.5	N12°27.8	281°54.9	S12°31.0
13	271°02.6	59°14.4	29.1	23°22.1	09.9	236°24.1	27.7	296°57.2	31.0
14	286°05.1	74°14.0	30.1	38°22.7	10.2	251°26.8	27.7	311°59.5	30.9
15	301°07.5	89°13.6	·· 31.0	53°23.2	·· 10.5	266°29.5	·· 27.6	327°01.9	·· 30.9
16	316°10.0	104°13.3	32.0	68°23.8	10.8	281°32.1	27.6	342°04.2	30.8
17	331°12.5	119°12.9	33.0	83°24.3	11.1	296°34.8	27.5	357°06.5	30.8
18	346°14.9	134°12.5	S10°34.0	98°24.8	S22°11.4	311°37.4	N12°27.5	12°08.8	S12°30.7
19	1°17.4	149°12.2	35.0	113°25.4	11.7	326°40.1	27.4	27°11.2	30.7
20	16°19.9	164°11.8	35.9	128°25.9	12.0	341°42.7	27.4	42°13.5	30.6
21	31°22.3	179°11.4	·· 36.9	143°26.5	·· 12.2	356°45.4	·· 27.3	57°15.8	·· 30.5
22	46°24.8	194°11.1	37.9	158°27.0	12.5	11°48.0	27.3	72°18.2	30.5
23	61°27.3	209°10.7	38.9	173°27.5	12.8	26°50.7	27.2	87°20.5	30.4
Mer.pass. 18:55		ν -0.4′ d -1.0′ m -4.15		ν 0.5′ d -0.3′ m 1.37		ν 2.7′ d -0.1′ m -2.78		ν 2.3′ d 0.1′ m 0.88	

Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	76°29.7	224°10.3	S10°39.8	188°28.1	S22°13.1	41°53.4	N12°27.1	102°22.8	S12°30.4
1	91°32.2	239°09.9	40.8	203°28.6	13.4	56°56.0	27.1	117°25.2	30.3
2	106°34.6	254°09.6	41.8	218°29.2	13.7	71°58.7	27.0	132°27.5	30.3
3	121°37.1	269°09.2	·· 42.8	233°29.7	·· 14.0	87°01.3	·· 27.0	147°29.8	·· 30.2
4	136°39.6	284°08.8	43.7	248°30.2	14.3	102°04.0	26.9	162°32.2	30.2
5	151°42.0	299°08.4	44.7	263°30.8	14.6	117°06.6	26.9	177°34.5	30.1
6	166°44.5	314°08.1	S10°45.7	278°31.3	S22°14.9	132°09.3	N12°26.8	192°36.8	S12°30.1
7	181°47.0	329°07.7	46.7	293°31.8	15.2	147°11.9	26.8	207°39.2	30.0
8	196°49.4	344°07.3	47.6	308°32.4	15.5	162°14.6	26.7	222°41.5	29.9
9	211°51.9	359°06.9	·· 48.6	323°32.9	·· 15.8	177°17.2	·· 26.7	237°43.8	·· 29.9
10	226°54.4	14°06.6	49.6	338°33.4	16.0	192°19.9	26.6	252°46.1	29.8
11	241°56.8	29°06.2	50.6	353°34.0	16.3	207°22.5	26.6	267°48.5	29.8
12	256°59.3	44°05.8	S10°51.5	8°34.5	S22°16.6	222°25.2	N12°26.5	282°50.8	S12°29.7
13	272°01.7	59°05.4	52.5	23°35.0	16.9	237°27.8	26.5	297°53.1	29.7
14	287°04.2	74°05.1	53.5	38°35.6	17.2	252°30.5	26.4	312°55.5	29.6
15	302°06.7	89°04.7	·· 54.5	53°36.1	·· 17.5	267°33.1	·· 26.4	327°57.8	·· 29.6
16	317°09.1	104°04.3	55.4	68°36.7	17.8	282°35.8	26.3	343°00.1	29.5
17	332°11.6	119°03.9	56.4	83°37.2	18.1	297°38.4	26.3	358°02.4	29.4
18	347°14.1	134°03.5	S10°57.4	98°37.7	S22°18.4	312°41.1	N12°26.2	13°04.8	S12°29.4
19	2°16.5	149°03.2	58.3	113°38.3	18.6	327°43.7	26.2	28°07.1	29.3
20	17°19.0	164°02.8	10°59.3	128°38.8	18.9	342°46.4	26.1	43°09.4	29.3
21	32°21.5	179°02.4	11°00.3	143°39.3	·· 19.2	357°49.0	·· 26.1	58°11.8	·· 29.2
22	47°23.9	194°02.0	01.3	158°39.9	19.5	12°51.7	26.0	73°14.1	29.2
23	62°26.4	209°01.6	02.2	173°40.4	19.8	27°54.3	26.0	88°16.4	29.1
Mer.pass. 18:51		ν -0.4′ d -1.0′ m -4.14		ν 0.5′ d -0.3′ m 1.37		ν 2.7′ d -0.1′ m -2.78		ν 2.3′ d 0.1′ m 0.89	

Stars

	SHA	**Dec**
Alpheratz	357°35.6	29°13.5
Ankaa	353°07.9	-42°10.8
Schedar	349°31.9	56°40.4
Diphda	348°48.1	-17°51.4
Achernar	335°20.5	-57°07.1
Hamal	327°52.0	23°34.6
Polaris	314°02.3	89°22.0
Acamar	315°12.1	-40°12.6
Menkar	314°06.8	4°11.0
Mirfak	308°29.1	49°56.9
Aldebaran	290°40.3	16°33.5
Rigel	281°04.4	-8°10.4
Capella	280°22.8	46°01.3
Bellatrix	278°23.5	6°22.3
Elnath	278°02.7	28°37.7
Alnilam	275°38.3	-1°11.1
Betelgeuse	270°52.8	7°24.7
Canopus	263°52.3	-52°42.3
Sirius	258°26.7	-16°44.8
Adhara	255°06.3	-29°00.1
Procyon	244°51.5	5°09.9
Pollux	243°18.1	27°58.1
Avior	234°14.7	-59°34.8
Suhail	222°46.8	-43°31.4
Miaplacidus	221°38.0	-69°48.5
Alphard	217°48.5	-8°45.6
Regulus	207°35.3	11°51.0
Dubhe	193°42.1	61°37.1
Denebola	182°26.0	14°26.3
Gienah	175°44.7	-17°40.3
Acrux	173°01.4	-63°13.6
Gacrux	171°52.9	-57°14.5
Alioth	166°14.1	55°49.6
Spica	158°23.5	-11°17.0
Alkaid	152°53.1	49°11.5
Hadar	148°37.8	-60°29.0
Menkent	147°59.0	-36°29.1
Arcturus	145°49.0	19°03.4
Rigil Kent.	139°42.2	-60°55.8
Kochab	137°20.8	74°03.2
Zuben'ubi	136°57.3	-16°08.4
Alphecca	126°04.9	26°38.0
Antares	112°17.4	-26°29.0
Atria	107°13.0	-69°04.2
Sabik	102°04.2	-15°45.2
Shaula	96°12.1	-37°07.3
Rasalhague	95°59.8	12°32.6
Eltanin	90°43.1	51°29.2
Kaus Aust.	83°34.1	-34°22.4
Vega	80°34.3	38°48.4
Nunki	75°49.2	-26°16.1
Altair	62°01.1	8°55.9
Peacock	53°07.6	-56°39.7
Deneb	49°26.7	45°22.1
Enif	33°39.8	9°59.1
Al Na'ir	27°34.2	-46°51.0
Fomalhaut	15°15.5	-29°29.9
Scheat	13°46.1	28°12.9
Markab	13°30.8	15°20.1

Dec 06 Wed	**SHA**	**Mer.pass**
Venus	149°56.2	09:02
Mars	113°30.6	11:27
Jupiter	325°14.1	21:17
Saturn	25°59.3	17:15

Dec 07 Thu	**SHA**	**Mer.pass**
Venus	148°48.5	09:03
Mars	112°44.5	11:27
Jupiter	325°19.0	21:13
Saturn	25°56.3	17:12

Dec 08 Fri	**SHA**	**Mer.pass**
Venus	147°40.6	09:04
Mars	111°58.4	11:26
Jupiter	325°23.6	21:09
Saturn	25°53.1	17:08

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h — Sun — Moon

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	182°19.8	S22°25.7	260°59.7	17.0′	N05°45.5	13.8′	54.3′
1	197°19.5	26.1	275°35.7	17.0′	05°31.7	13.8′	54.3′
2	212°19.3	26.4	290°11.8	17.0′	05°17.9	13.9′	54.3′
3	227°19.0	·· 26.7	304°47.8	17.1′	05°04.0	13.9′	54.3′
4	242°18.7	27.0	319°23.9	17.1′	04°50.1	13.9′	54.3′
5	257°18.5	27.3	333°59.9	17.1′	04°36.2	13.9′	54.3′
6	272°18.2	S22°27.6	348°36.0	17.1′	N04°22.3	14.0′	54.4′
7	287°18.0	27.9	3°12.1	17.1′	04°08.3	13.9′	54.4′
8	302°17.7	28.2	17°48.2	17.1′	03°54.4	14.0′	54.4′
9	317°17.4	·· 28.5	32°24.2	17.1′	03°40.4	14.0′	54.4′
10	332°17.2	28.8	47°00.3	17.1′	03°26.4	14.1′	54.4′
11	347°16.9	29.1	61°36.4	17.1′	03°12.3	14.0′	54.4′
12	2°16.6	S22°29.4	76°12.5	17.1′	N02°58.3	14.1′	54.4′
13	17°16.4	29.7	90°48.5	17.1′	02°44.2	14.0′	54.4′
14	32°16.1	30.0	105°24.6	17.1′	02°30.2	14.1′	54.5′
15	47°15.9	·· 30.3	120°00.7	17.1′	02°16.1	14.2′	54.5′
16	62°15.6	30.6	134°36.7	17.1′	02°01.9	14.1′	54.5′
17	77°15.3	30.9	149°12.8	17.0′	01°47.8	14.1′	54.5′
18	92°15.1	S22°31.2	163°48.8	17.0′	N01°33.7	14.2′	54.5′
19	107°14.8	31.5	178°24.9	17.0′	01°19.5	14.2′	54.5′
20	122°14.5	31.8	193°00.9	17.0′	01°05.3	14.1′	54.5′
21	137°14.3	·· 32.1	207°36.9	17.0′	00°51.2	14.2′	54.6′
22	152°14.0	32.4	222°12.9	17.0′	00°37.0	14.2′	54.6′
23	167°13.7	32.6	236°48.9	17.0′	00°22.8	14.2′	54.6′
	SD = 16.2′	d = -0.3′		SD = 14.8′			

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	182°13.5	S22°32.9	251°24.9	17.0′	N00°08.6	14.3′	54.6′
1	197°13.2	33.2	266°00.9	16.9′	S00°05.7	14.2′	54.6′
2	212°12.9	33.5	280°36.8	16.9′	00°19.9	14.2′	54.6′
3	227°12.7	·· 33.8	295°12.7	16.9′	00°34.1	14.3′	54.6′
4	242°12.4	34.1	309°48.6	16.9′	00°48.4	14.2′	54.7′
5	257°12.1	34.4	324°24.5	16.9′	01°02.6	14.3′	54.7′
6	272°11.9	S22°34.7	339°00.4	16.8′	S01°16.9	14.3′	54.7′
7	287°11.6	34.9	353°36.2	16.8′	01°31.2	14.2′	54.7′
8	302°11.3	35.2	8°12.0	16.8′	01°45.4	14.3′	54.7′
9	317°11.1	·· 35.5	22°47.8	16.8′	01°59.7	14.3′	54.8′
10	332°10.8	35.8	37°23.5	16.7′	02°14.0	14.3′	54.8′
11	347°10.5	36.1	51°59.3	16.7′	02°28.3	14.2′	54.8′
12	2°10.3	S22°36.4	66°35.0	16.7′	S02°42.5	14.3′	54.8′
13	17°10.0	36.6	81°10.6	16.6′	02°56.8	14.3′	54.8′
14	32°09.7	36.9	95°46.3	16.6′	03°11.1	14.3′	54.8′
15	47°09.5	·· 37.2	110°21.9	16.6′	03°25.4	14.3′	54.9′
16	62°09.2	37.5	124°57.4	16.5′	03°39.7	14.2′	54.9′
17	77°08.9	37.8	139°32.9	16.5′	03°53.9	14.3′	54.9′
18	92°08.6	S22°38.0	154°08.4	16.5′	S04°08.2	14.3′	54.9′
19	107°08.4	38.3	168°43.9	16.4′	04°22.5	14.3′	54.9′
20	122°08.1	38.6	183°19.3	16.4′	04°36.8	14.2′	55.0′
21	137°07.8	·· 38.9	197°54.7	16.3′	04°51.0	14.3′	55.0′
22	152°07.6	39.1	212°30.0	16.3′	05°05.3	14.2′	55.0′
23	167°07.3	39.4	227°05.3	16.2′	05°19.5	14.3′	55.0′
	SD = 16.2′	d = -0.3′		SD = 14.9′			

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	182°07.0	S22°39.7	241°40.5	16.2′	S05°33.8	14.2′	55.1′
1	197°06.7	40.0	256°15.7	16.1′	05°48.0	14.2′	55.1′
2	212°06.5	40.2	270°50.9	16.1′	06°02.2	14.2′	55.1′
3	227°06.2	·· 40.5	285°26.0	16.0′	06°16.4	14.2′	55.1′
4	242°05.9	40.8	300°01.0	16.0′	06°30.6	14.2′	55.1′
5	257°05.7	41.0	314°36.0	15.9′	06°44.8	14.2′	55.2′
6	272°05.4	S22°41.3	329°11.0	15.9′	S06°59.0	14.2′	55.2′
7	287°05.1	41.6	343°45.9	15.8′	07°13.2	14.1′	55.2′
8	302°04.8	41.8	358°20.7	15.8′	07°27.3	14.2′	55.2′
9	317°04.6	·· 42.1	12°55.5	15.7′	07°41.5	14.1′	55.3′
10	332°04.3	42.4	27°30.2	15.7′	07°55.6	14.1′	55.3′
11	347°04.0	42.6	42°04.9	15.6′	08°09.7	14.1′	55.3′
12	2°03.7	S22°42.9	56°39.5	15.5′	S08°23.8	14.0′	55.3′
13	17°03.5	43.2	71°14.0	15.5′	08°37.8	14.1′	55.4′
14	32°03.2	43.4	85°48.5	15.4′	08°51.9	14.0′	55.4′
15	47°02.9	·· 43.7	100°22.9	15.4′	09°05.9	14.0′	55.4′
16	62°02.6	43.9	114°57.3	15.3′	09°19.9	14.0′	55.4′
17	77°02.4	44.2	129°31.6	15.2′	09°33.9	13.9′	55.5′
18	92°02.1	S22°44.5	144°05.8	15.2′	S09°47.8	13.9′	55.5′
19	107°01.8	44.7	158°40.0	15.1′	10°01.7	13.9′	55.5′
20	122°01.5	45.0	173°14.0	15.0′	10°15.6	13.9′	55.5′
21	137°01.3	·· 45.2	187°48.1	14.9′	10°29.5	13.9′	55.6′
22	152°01.0	45.5	202°22.0	14.9′	10°43.4	13.8′	55.6′
23	167°00.7	45.7	216°55.9	14.8′	10°57.2	13.8′	55.6′
	SD = 16.2′	d = -0.3′		SD = 15.0′			

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

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

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 23-25 43-25%
06	09:19	09:07	11:51	06:47	19:07	
07	08:54	08:41	11:51	07:26	19:46	
08	08:28	08:15	11:52	08:07	20:28	

December 09, 10, 11 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	77°28.9	224°01.2	S11°03.2	188°40.9	S22°20.1	42°57.0	N12°25.9	103°18.7	S12°29.1
1	92°31.3	239°00.9	04.2	203°41.5	20.4	57°59.6	25.9	118°21.1	29.0
2	107°33.8	254°00.5	05.1	218°42.0	20.6	73°02.3	25.8	133°23.4	28.9
3	122°36.2	269°00.1	·· 06.1	233°42.5	·· 20.9	88°04.9	·· 25.8	148°25.7	·· 28.9
4	137°38.7	283°59.7	07.1	248°43.0	21.2	103°07.6	25.7	163°28.0	28.8
5	152°41.2	298°59.3	08.0	263°43.6	21.5	118°10.2	25.7	178°30.4	28.8
6	167°43.6	313°58.9	S11°09.0	278°44.1	S22°21.8	133°12.9	N12°25.6	193°32.7	S12°28.7
7	182°46.1	328°58.6	10.0	293°44.6	22.1	148°15.5	25.6	208°35.0	28.7
8	197°48.6	343°58.2	10.9	308°45.2	22.3	163°18.2	25.5	223°37.4	28.6
9	212°51.0	358°57.8	·· 11.9	323°45.7	·· 22.6	178°20.8	·· 25.5	238°39.7	·· 28.6
10	227°53.5	13°57.4	12.9	338°46.2	22.9	193°23.4	25.4	253°42.0	28.5
11	242°56.0	28°57.0	13.8	353°46.8	23.2	208°26.1	25.4	268°44.3	28.4
12	257°58.4	43°56.6	S11°14.8	8°47.3	S22°23.5	223°28.7	N12°25.3	283°46.7	S12°28.4
13	273°00.9	58°56.2	15.8	23°47.8	23.7	238°31.4	25.3	298°49.0	28.3
14	288°03.4	73°55.8	16.7	38°48.4	24.0	253°34.0	25.2	313°51.3	28.3
15	303°05.8	88°55.4	·· 17.7	53°48.9	·· 24.3	268°36.7	·· 25.2	328°53.6	·· 28.2
16	318°08.3	103°55.1	18.7	68°49.4	24.6	283°39.3	25.1	343°56.0	28.2
17	333°10.7	118°54.7	19.6	83°49.9	24.9	298°42.0	25.1	358°58.3	28.1
18	348°13.2	133°54.3	S11°20.6	98°50.5	S22°25.1	313°44.6	N12°25.0	14°00.6	S12°28.0
19	3°15.7	148°53.9	21.6	113°51.0	25.4	328°47.2	25.0	29°02.9	28.0
20	18°18.1	163°53.5	22.5	128°51.5	25.7	343°49.9	24.9	44°05.3	27.9
21	33°20.6	178°53.1	·· 23.5	143°52.1	·· 26.0	358°52.5	·· 24.9	59°07.6	·· 27.9
22	48°23.1	193°52.7	24.4	158°52.6	26.3	13°55.2	24.8	74°09.9	27.8
23	63°25.5	208°52.3	25.4	173°53.1	26.5	28°57.8	24.8	89°12.2	27.8
Mer.pass. 18:47		ν -0.4′	d -1.0′	m -4.14	ν 0.5′	d -0.3′	m 1.37	ν 2.6′	d -0.1′ m -2.77
								ν 2.3′	d 0.1′ m 0.89

Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	78°28.0	223°51.9	S11°26.4	188°53.6	S22°26.8	44°00.4	N12°24.7	104°14.6	S12°27.7
1	93°30.5	238°51.5	27.3	203°54.2	27.1	59°03.1	24.7	119°16.9	27.6
2	108°32.9	253°51.1	28.3	218°54.7	27.4	74°05.7	24.6	134°19.2	27.6
3	123°35.4	268°50.7	·· 29.3	233°55.2	·· 27.6	89°08.4	·· 24.6	149°21.5	·· 27.5
4	138°37.8	283°50.3	30.2	248°55.7	27.9	104°11.0	24.6	164°23.8	27.5
5	153°40.3	298°49.9	31.2	263°56.3	28.2	119°13.6	24.5	179°26.2	27.4
6	168°42.8	313°49.5	S11°32.1	278°56.8	S22°28.5	134°16.3	N12°24.5	194°28.5	S12°27.4
7	183°45.2	328°49.1	33.1	293°57.3	28.7	149°18.9	24.4	209°30.8	27.3
8	198°47.7	343°48.7	34.1	308°57.8	29.0	164°21.6	24.4	224°33.1	27.2
9	213°50.2	358°48.3	·· 35.0	323°58.4	·· 29.3	179°24.2	·· 24.3	239°35.5	·· 27.2
10	228°52.6	13°47.9	36.0	338°58.9	29.5	194°26.8	24.3	254°37.8	27.1
11	243°55.1	28°47.5	36.9	353°59.4	29.8	209°29.5	24.2	269°40.1	27.1
12	258°57.6	43°47.1	S11°37.9	8°59.9	S22°30.1	224°32.1	N12°24.2	284°42.4	S12°27.0
13	274°00.0	58°46.7	38.9	24°00.5	30.4	239°34.7	24.1	299°44.7	26.9
14	289°02.5	73°46.3	39.8	39°01.0	30.6	254°37.4	24.1	314°47.1	26.9
15	304°05.0	88°45.9	·· 40.8	54°01.5	·· 30.9	269°40.0	·· 24.0	329°49.4	·· 26.8
16	319°07.4	103°45.5	41.7	69°02.0	31.2	284°42.6	24.0	344°51.7	26.8
17	334°09.9	118°45.1	42.7	84°02.6	31.4	299°45.3	23.9	359°54.0	26.7
18	349°12.3	133°44.7	S11°43.6	99°03.1	S22°31.7	314°47.9	N12°23.9	14°56.4	S12°26.7
19	4°14.8	148°44.3	44.6	114°03.6	32.0	329°50.5	23.9	29°58.7	26.6
20	19°17.3	163°43.9	45.6	129°04.1	32.3	344°53.2	23.8	45°01.0	26.5
21	34°19.7	178°43.5	·· 46.5	144°04.7	·· 32.5	359°55.8	·· 23.8	60°03.3	·· 26.5
22	49°22.2	193°43.1	47.5	159°05.2	32.8	14°58.4	23.7	75°05.6	26.4
23	64°24.7	208°42.7	48.4	174°05.7	33.1	30°01.1	23.7	90°08.0	26.4
Mer.pass. 18:43		ν -0.4′	d -1.0′	m -4.13	ν 0.5′	d -0.3′	m 1.37	ν 2.6′	d -0.0′ m -2.76
								ν 2.3′	d 0.1′ m 0.89

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	79°27.1	223°42.3	S11°49.4	189°06.2	S22°33.3	45°03.7	N12°23.6	105°10.3	S12°26.3
1	94°29.6	238°41.9	50.3	204°06.7	33.6	60°06.3	23.6	120°12.6	26.2
2	109°32.1	253°41.5	51.3	219°07.3	33.9	75°09.0	23.5	135°14.9	26.2
3	124°34.5	268°41.1	·· 52.2	234°07.8	·· 34.1	90°11.6	·· 23.5	150°17.2	·· 26.1
4	139°37.0	283°40.7	53.2	249°08.3	34.4	105°14.2	23.5	165°19.6	26.1
5	154°39.5	298°40.3	54.1	264°08.8	34.7	120°16.9	23.4	180°21.9	26.0
6	169°41.9	313°39.8	S11°55.1	279°09.3	S22°34.9	135°19.5	N12°23.4	195°24.2	S12°26.0
7	184°44.4	328°39.4	56.0	294°09.9	35.2	150°22.1	23.3	210°26.5	25.9
8	199°46.8	343°39.0	57.0	309°10.4	35.5	165°24.8	23.3	225°28.8	25.8
9	214°49.3	358°38.6	·· 57.9	324°10.9	·· 35.7	180°27.4	·· 23.2	240°31.2	·· 25.8
10	229°51.8	13°38.2	58.9	339°11.4	36.0	195°30.0	23.2	255°33.5	25.7
11	244°54.2	28°37.8	11°59.8	354°11.9	36.2	210°32.7	23.1	270°35.8	25.7
12	259°56.7	43°37.4	S12°00.8	9°12.5	S22°36.5	225°35.3	N12°23.1	285°38.1	S12°25.6
13	274°59.2	58°37.0	01.7	24°13.0	36.8	240°37.9	23.1	300°40.4	25.5
14	290°01.6	73°36.6	02.7	39°13.5	37.0	255°40.5	23.0	315°42.7	25.5
15	305°04.1	88°36.1	·· 03.6	54°14.0	·· 37.3	270°43.2	·· 23.0	330°45.1	·· 25.4
16	320°06.6	103°35.7	04.6	69°14.5	37.6	285°45.8	22.9	345°47.4	25.4
17	335°09.0	118°35.3	05.5	84°15.1	37.8	300°48.4	22.9	0°49.7	25.3
18	350°11.5	133°34.9	S12°06.5	99°15.6	S22°38.1	315°51.1	N12°22.8	15°52.0	S12°25.2
19	5°14.0	148°34.5	07.4	114°16.1	38.3	330°53.7	22.8	30°54.3	25.2
20	20°16.4	163°34.1	08.4	129°16.6	38.6	345°56.3	22.8	45°56.7	25.1
21	35°18.9	178°33.6	·· 09.3	144°17.1	·· 38.9	0°58.9	·· 22.7	60°59.0	·· 25.1
22	50°21.3	193°33.2	10.3	159°17.7	39.1	16°01.6	22.7	76°01.3	25.0
23	65°23.8	208°32.8	11.2	174°18.2	39.4	31°04.2	22.6	91°03.6	24.9
Mer.pass. 18:39		ν -0.4′	d -1.0′	m -4.13	ν 0.5′	d -0.3′	m 1.38	ν 2.6′	d -0.0′ m -2.76
								ν 2.3′	d 0.1′ m 0.90

Stars

	SHA	**Dec**
Alpheratz	357°35.6	29°13.5
Ankaa	353°07.9	-42°10.8
Schedar	349°31.9	56°40.4
Diphda	348°48.1	-17°51.4
Achernar	335°20.5	-57°07.2
Hamal	327°52.0	23°34.6
Polaris	314°02.8	89°22.1
Acamar	315°12.1	-40°12.6
Menkar	314°06.8	4°11.0
Mirfak	308°29.1	49°56.9
Aldebaran	290°40.3	16°33.5
Rigel	281°04.4	-8°10.4
Capella	280°22.8	46°01.3
Bellatrix	278°23.5	6°22.3
Elnath	278°02.6	28°37.7
Alnilam	275°38.3	-1°11.2
Betelgeuse	270°52.7	7°24.7
Canopus	263°52.3	-52°42.3
Sirius	258°26.7	-16°44.8
Adhara	255°06.2	-29°00.1
Procyon	244°51.5	5°09.9
Pollux	243°18.1	27°58.1
Avior	234°14.7	-59°34.9
Suhail	222°46.8	-43°31.5
Miaplacidus	221°38.0	-69°48.5
Alphard	217°48.5	-8°45.6
Regulus	207°35.3	11°51.0
Dubhe	193°42.1	61°37.1
Denebola	182°25.9	14°26.3
Gienah	175°44.6	-17°40.3
Acrux	173°01.4	-63°13.6
Gacrux	171°52.9	-57°14.5
Alioth	166°14.0	55°49.6
Spica	158°23.5	-11°17.1
Alkaid	152°53.1	49°11.5
Hadar	148°37.8	-60°29.0
Menkent	147°59.0	-36°29.1
Arcturus	145°49.0	19°03.4
Rigil Kent.	139°42.1	-60°55.8
Kochab	137°20.8	74°03.2
Zuben'ubi	136°57.3	-16°08.4
Alphecca	126°04.9	26°38.0
Antares	112°17.3	-26°29.0
Atria	107°13.0	-69°04.1
Sabik	102°04.2	-15°45.2
Shaula	96°12.0	-37°07.3
Rasalhague	95°59.8	12°32.6
Eltanin	90°43.2	51°29.1
Kaus Aust.	83°34.1	-34°22.4
Vega	80°34.3	38°48.4
Nunki	75°49.2	-26°16.1
Altair	62°01.1	8°55.9
Peacock	53°07.6	-56°39.7
Deneb	49°26.7	45°22.1
Enif	33°39.8	9°59.1
Al Na'ir	27°34.2	-46°51.0
Fomalhaut	15°15.6	-29°29.9
Scheat	13°46.1	28°12.9
Markab	13°30.8	15°20.1

Dec 09 Sat	**SHA**	**Mer.pass**
Venus	146°32.4	09:04
Mars	111°12.1	11:25
Jupiter	325°28.1	21:04
Saturn	25°49.9	17:04

Dec 10 Sun	**SHA**	**Mer.pass**
Venus	145°23.9	09:05
Mars	110°25.6	11:24
Jupiter	325°32.4	21:00
Saturn	25°46.6	17:00

Dec 11 Mon	**SHA**	**Mer.pass**
Venus	144°15.2	09:05
Mars	109°39.1	11:23
Jupiter	325°36.6	20:56
Saturn	25°43.1	16:57

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°00.4	S22°46.0	231°29.7	14.7′	S11°11.0	13.7′	55.6′
1	197°00.2	46.2	246°03.4	14.6′	11°24.7	13.7′	55.7′
2	211°59.9	46.5	260°37.0	14.6′	11°38.4	13.7′	55.7′
3	226°59.6	·· 46.7	275°10.6	14.5′	11°52.1	13.7′	55.7′
4	241°59.3	47.0	289°44.1	14.4′	12°05.8	13.6′	55.8′
5	256°59.1	47.2	304°17.5	14.3′	12°19.4	13.6′	55.8′
6	271°58.8	S22°47.5	318°50.8	14.2′	S12°33.0	13.5′	55.8′
7	286°58.5	47.7	333°24.0	14.2′	12°46.5	13.5′	55.8′
8	301°58.2	48.0	347°57.2	14.1′	13°00.0	13.5′	55.9′
9	316°57.9	·· 48.2	2°30.3	14.0′	13°13.5	13.4′	55.9′
10	331°57.7	48.5	17°03.3	13.9′	13°26.9	13.4′	55.9′
11	346°57.4	48.7	31°36.2	13.8′	13°40.3	13.3′	55.9′
12	1°57.1	S22°49.0	46°09.0	13.7′	S13°53.6	13.3′	56.0′
13	16°56.8	49.2	60°41.7	13.6′	14°06.9	13.2′	56.0′
14	31°56.5	49.5	75°14.3	13.5′	14°20.1	13.2′	56.0′
15	46°56.3	·· 49.7	89°46.8	13.4′	14°33.3	13.2′	56.1′
16	61°56.0	49.9	104°19.3	13.3′	14°46.5	13.1′	56.1′
17	76°55.7	50.2	118°51.6	13.3′	14°59.6	13.0′	56.1′
18	91°55.4	S22°50.4	133°23.9	13.2′	S15°12.6	13.0′	56.1′
19	106°55.2	50.7	147°56.0	13.1′	15°25.6	12.9′	56.2′
20	121°54.9	50.9	162°28.1	13.0′	15°38.5	12.9′	56.2′
21	136°54.6	·· 51.1	177°00.1	12.9′	15°51.4	12.8′	56.2′
22	151°54.3	51.4	191°31.9	12.8′	16°04.2	12.8′	56.3′
23	166°54.0	51.6	206°03.7	12.7′	16°17.0	12.7′	56.3′
	SD = 16.2′	d = -0.3′	SD = 15.2′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	181°53.7	S22°51.8	220°35.4	12.6′	S16°29.7	12.6′	56.3′
1	196°53.5	52.1	235°06.9	12.5′	16°42.3	12.6′	56.4′
2	211°53.2	52.3	249°38.4	12.4′	16°54.9	12.5′	56.4′
3	226°52.9	·· 52.6	264°09.7	12.2′	17°07.4	12.5′	56.4′
4	241°52.6	52.8	278°41.0	12.1′	17°19.9	12.4′	56.4′
5	256°52.3	53.0	293°12.1	12.0′	17°32.3	12.3′	56.5′
6	271°52.1	S22°53.2	307°43.1	11.9′	S17°44.6	12.2′	56.5′
7	286°51.8	53.5	322°14.1	11.8′	17°56.8	12.2′	56.5′
8	301°51.5	53.7	336°44.9	11.7′	18°09.0	12.1′	56.6′
9	316°51.2	·· 53.9	351°15.6	11.6′	18°21.1	12.0′	56.6′
10	331°50.9	54.2	5°46.2	11.5′	18°33.1	12.0′	56.6′
11	346°50.6	54.4	20°16.6	11.4′	18°45.1	11.8′	56.6′
12	1°50.4	S22°54.6	34°47.0	11.3′	S18°56.9	11.8′	56.7′
13	16°50.1	54.8	49°17.3	11.1′	19°08.7	11.7′	56.7′
14	31°49.8	55.1	63°47.4	11.0′	19°20.4	11.7′	56.7′
15	46°49.5	·· 55.3	78°17.5	10.9′	19°32.1	11.5′	56.8′
16	61°49.2	55.5	92°47.4	10.8′	19°43.6	11.5′	56.8′
17	76°48.9	55.7	107°17.2	10.7′	19°55.1	11.3′	56.8′
18	91°48.6	S22°55.9	121°46.9	10.6′	S20°06.4	11.3′	56.9′
19	106°48.4	56.2	136°16.4	10.5′	20°17.7	11.2′	56.9′
20	121°48.1	56.4	150°45.9	10.3′	20°28.9	11.1′	56.9′
21	136°47.8	·· 56.6	165°15.2	10.2′	20°40.0	11.0′	57.0′
22	151°47.5	56.8	179°44.4	10.1′	20°51.0	10.9′	57.0′
23	166°47.2	57.0	194°13.5	10.0′	21°01.9	10.9′	57.0′
	SD = 16.2′	d = -0.2′	SD = 15.4′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	181°46.9	S22°57.3	208°42.5	9.9′	S21°12.8	10.7′	57.0′
1	196°46.7	57.5	223°11.4	9.7′	21°23.5	10.6′	57.1′
2	211°46.4	57.7	237°40.1	9.6′	21°34.1	10.5′	57.1′
3	226°46.1	·· 57.9	252°08.7	9.5′	21°44.6	10.4′	57.1′
4	241°45.8	58.1	266°37.2	9.4′	21°55.0	10.3′	57.2′
5	256°45.5	58.3	281°05.6	9.3′	22°05.3	10.2′	57.2′
6	271°45.2	S22°58.5	295°33.8	9.1′	S22°15.5	10.1′	57.2′
7	286°44.9	58.8	310°02.0	9.0′	22°25.6	10.0′	57.3′
8	301°44.6	59.0	324°30.0	8.9′	22°35.6	9.8′	57.3′
9	316°44.4	·· 59.2	338°57.9	8.8′	22°45.4	9.8′	57.3′
10	331°44.1	59.4	353°25.7	8.7′	22°55.2	9.6′	57.3′
11	346°43.8	59.6	7°53.3	8.5′	23°04.8	9.5′	57.4′
12	1°43.5	S22°59.8	22°20.9	8.4′	S23°14.3	9.4′	57.4′
13	16°43.2	23°00.0	36°48.3	8.3′	23°23.7	9.3′	57.4′
14	31°42.9	00.2	51°15.6	8.2′	23°33.0	9.2′	57.5′
15	46°42.6	·· 00.4	65°42.7	8.1′	23°42.2	9.0′	57.5′
16	61°42.3	00.6	80°09.8	7.9′	23°51.2	8.9′	57.5′
17	76°42.1	00.8	94°36.7	7.8′	24°00.1	8.8′	57.5′
18	91°41.8	S23°01.0	109°03.5	7.7′	S24°08.9	8.6′	57.6′
19	106°41.5	01.2	123°30.2	7.6′	24°17.5	8.5′	57.6′
20	121°41.2	01.4	137°56.8	7.5′	24°26.0	8.4′	57.6′
21	136°40.9	·· 01.6	152°23.2	7.3′	24°34.4	8.3′	57.7′
22	151°40.6	01.8	166°49.6	7.2′	24°42.7	8.1′	57.7′
23	166°40.3	02.0	181°15.8	7.1′	24°50.8	8.0′	57.7′
	SD = 16.2′	d = -0.2′	SD = 15.6′				

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

Lat.	**Moonrise** Sat	Sun	Mon	**Moonset** Sat	Sun	Mon
N 72°	05:37	▬	▬	11:36	▬	▬
N 70°	05:13	07:52	▬	12:02	10:59	▬
68°	04:55	07:07	▬	12:22	11:46	▬
66°	04:40	06:38	09:11	12:39	12:17	11:29
64°	04:28	06:16	08:20	12:52	12:40	12:21
62°	04:18	05:58	07:49	13:03	12:58	12:53
60°	04:10	05:44	07:26	13:13	13:14	13:17
N 58°	04:02	05:32	07:07	13:21	13:27	13:36
56°	03:56	05:21	06:51	13:29	13:38	13:53
54°	03:50	05:12	06:38	13:36	13:48	14:06
52°	03:45	05:04	06:27	13:42	13:57	14:19
50°	03:40	04:56	06:16	13:47	14:05	14:29
45°	03:30	04:41	05:55	13:59	14:22	14:52
N 40°	03:21	04:28	05:38	14:09	14:36	15:10
35°	03:14	04:17	05:23	14:18	14:48	15:26
30°	03:08	04:08	05:11	14:25	14:59	15:39
20°	02:57	03:52	04:50	14:38	15:17	16:02
N 10°	02:48	03:38	04:32	14:50	15:33	16:22
0°	02:39	03:25	04:15	15:00	15:48	16:40
S 10°	02:30	03:12	03:58	15:11	16:03	16:59
20°	02:21	02:58	03:40	15:23	16:19	17:19
30°	02:11	02:43	03:19	15:36	16:38	17:42
35°	02:05	02:34	03:07	15:44	16:48	17:56
40°	01:58	02:23	02:54	15:53	17:01	18:12
45°	01:50	02:12	02:38	16:03	17:16	18:31
S 50°	01:41	01:57	02:18	16:16	17:34	18:55
52°	01:37	01:51	02:09	16:22	17:43	19:06
54°	01:32	01:43	01:59	16:29	17:52	19:19
56°	01:27	01:35	01:47	16:36	18:03	19:35
58°	01:21	01:26	01:33	16:44	18:16	19:53
S 60°	01:15	01:15	01:18	16:54	18:31	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 26-28 17-5%
09	08:02	07:48	11:52	08:50	21:12	
10	07:35	07:21	11:53	09:36	22:01	
11	07:08	06:54	11:53	10:27	22:55	

December 12, 13, 14 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	80°26.3	223°32.4	S12°12.2	189°18.7	S22°39.6	46°06.8	N12°22.6	106°05.9	S12°24.9
1	95°28.7	238°32.0	13.1	204°19.2	39.9	61°09.4	22.5	121°08.2	24.8
2	110°31.2	253°31.6	14.1	219°19.7	40.2	76°12.1	22.5	136°10.6	24.8
3	125°33.7	268°31.1	·· 15.0	234°20.2	·· 40.4	91°14.7	·· 22.5	151°12.9	·· 24.7
4	140°36.1	283°30.7	16.0	249°20.7	40.7	106°17.3	22.4	166°15.2	24.6
5	155°38.6	298°30.3	16.9	264°21.3	40.9	121°19.9	22.4	181°17.5	24.6
6	170°41.1	313°29.9	S12°17.8	279°21.8	S22°41.2	136°22.6	N12°22.3	196°19.8	S12°24.5
7	185°43.5	328°29.5	18.8	294°22.3	41.4	151°25.2	22.3	211°22.1	24.5
8	200°46.0	343°29.0	19.7	309°22.8	41.7	166°27.8	22.2	226°24.5	24.4
9	215°48.4	358°28.6	·· 20.7	324°23.3	·· 41.9	181°30.4	·· 22.2	241°26.8	·· 24.3
10	230°50.9	13°28.2	21.6	339°23.8	42.2	196°33.0	22.2	256°29.1	24.3
11	245°53.4	28°27.8	22.6	354°24.4	42.5	211°35.7	22.1	271°31.4	24.2
12	260°55.8	43°27.3	S12°23.5	9°24.9	S22°42.7	226°38.3	N12°22.1	286°33.7	S12°24.2
13	275°58.3	58°26.9	24.4	24°25.4	43.0	241°40.9	22.0	301°36.0	24.1
14	291°00.8	73°26.5	25.4	39°25.9	43.2	256°43.5	22.0	316°38.3	24.0
15	306°03.2	88°26.1	·· 26.3	54°26.4	·· 43.5	271°46.1	·· 22.0	331°40.7	·· 24.0
16	321°05.7	103°25.6	27.3	69°26.9	43.7	286°48.8	21.9	346°43.0	23.9
17	336°08.2	118°25.2	28.2	84°27.4	44.0	301°51.4	21.9	1°45.3	23.9
18	351°10.6	133°24.8	S12°29.1	99°28.0	S22°44.2	316°54.0	N12°21.8	16°47.6	S12°23.8
19	6°13.1	148°24.4	30.1	114°28.5	44.5	331°56.6	21.8	31°49.9	23.7
20	21°15.6	163°23.9	31.0	129°29.0	44.7	346°59.2	21.8	46°52.2	23.7
21	36°18.0	178°23.5	·· 32.0	144°29.5	·· 45.0	2°01.9	·· 21.7	61°54.5	·· 23.6
22	51°20.5	193°23.1	32.9	159°30.0	45.2	17°04.5	21.7	76°56.9	23.6
23	66°22.9	208°22.6	33.8	174°30.5	45.5	32°07.1	21.6	91°59.2	23.5
Mer.pass. 18:35		ν -0.4′	d -0.9′	m -4.12	ν 0.5′	d -0.3′	m 1.38	ν 2.6′	d -0.0′ m -2.75
								ν 2.3′	d 0.1′ m 0.90

Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	81°25.4	223°22.2	S12°34.8	189°31.0	S22°45.7	47°09.7	N12°21.6	107°01.5	S12°23.4
1	96°27.9	238°21.8	35.7	204°31.5	46.0	62°12.3	21.6	122°03.8	23.4
2	111°30.3	253°21.4	36.6	219°32.0	46.2	77°14.9	21.5	137°06.1	23.3
3	126°32.8	268°20.9	·· 37.6	234°32.6	·· 46.5	92°17.6	·· 21.5	152°08.4	·· 23.2
4	141°35.3	283°20.5	38.5	249°33.1	46.7	107°20.2	21.4	167°10.7	23.2
5	156°37.7	298°20.1	39.4	264°33.6	47.0	122°22.8	21.4	182°13.0	23.1
6	171°40.2	313°19.6	S12°40.4	279°34.1	S22°47.2	137°25.4	N12°21.4	197°15.4	S12°23.1
7	186°42.7	328°19.2	41.3	294°34.6	47.5	152°28.0	21.3	212°17.7	23.0
8	201°45.1	343°18.8	42.2	309°35.1	47.7	167°30.6	21.3	227°20.0	22.9
9	216°47.6	358°18.3	·· 43.2	324°35.6	·· 48.0	182°33.3	·· 21.3	242°22.3	·· 22.9
10	231°50.1	13°17.9	44.1	339°36.1	48.2	197°35.9	21.2	257°24.6	22.8
11	246°52.5	28°17.5	45.0	354°36.6	48.4	212°38.5	21.2	272°26.9	22.8
12	261°55.0	43°17.0	S12°46.0	9°37.2	S22°48.7	227°41.1	N12°21.1	287°29.2	S12°22.7
13	276°57.4	58°16.6	46.9	24°37.7	48.9	242°43.7	21.1	302°31.5	22.6
14	291°59.9	73°16.1	47.8	39°38.2	49.2	257°46.3	21.1	317°33.9	22.6
15	307°02.4	88°15.7	·· 48.8	54°38.7	·· 49.4	272°48.9	·· 21.0	332°36.2	·· 22.5
16	322°04.8	103°15.3	49.7	69°39.2	49.7	287°51.5	21.0	347°38.5	22.4
17	337°07.3	118°14.8	50.6	84°39.7	49.9	302°54.2	20.9	2°40.8	22.4
18	352°09.8	133°14.4	S12°51.6	99°40.2	S22°50.2	317°56.8	N12°20.9	17°43.1	S12°22.3
19	7°12.2	148°14.0	52.5	114°40.7	50.4	332°59.4	20.9	32°45.4	22.3
20	22°14.7	163°13.5	53.4	129°41.2	50.6	348°02.0	20.8	47°47.7	22.2
21	37°17.2	178°13.1	·· 54.3	144°41.7	·· 50.9	3°04.6	·· 20.8	62°50.0	·· 22.1
22	52°19.6	193°12.6	55.3	159°42.2	51.1	18°07.2	20.8	77°52.3	22.1
23	67°22.1	208°12.2	56.2	174°42.7	51.4	33°09.8	20.7	92°54.6	22.0
Mer.pass. 18:31		ν -0.4′	d -0.9′	m -4.11	ν 0.5′	d -0.2′	m 1.38	ν 2.6′	d -0.0′ m -2.74
								ν 2.3′	d 0.1′ m 0.90

Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	82°24.6	223°11.7	S12°57.1	189°43.2	S22°51.6	48°12.4	N12°20.7	107°57.0	S12°21.9
1	97°27.0	238°11.3	58.1	204°43.8	51.8	63°15.0	20.7	122°59.3	21.9
2	112°29.5	253°10.9	59.0	219°44.3	52.1	78°17.7	20.6	138°01.6	21.8
3	127°31.9	268°10.4	12°59.9	234°44.8	·· 52.3	93°20.3	·· 20.6	153°03.9	·· 21.8
4	142°34.4	283°10.0	13°00.8	249°45.3	52.6	108°22.9	20.5	168°06.2	21.7
5	157°36.9	298°09.5	01.8	264°45.8	52.8	123°25.5	20.5	183°08.5	21.6
6	172°39.3	313°09.1	S13°02.7	279°46.3	S22°53.0	138°28.1	N12°20.5	198°10.8	S12°21.6
7	187°41.8	328°08.6	03.6	294°46.8	53.3	153°30.7	20.4	213°13.1	21.5
8	202°44.3	343°08.2	04.5	309°47.3	53.5	168°33.3	20.4	228°15.4	21.4
9	217°46.7	358°07.7	·· 05.5	324°47.8	·· 53.7	183°35.9	·· 20.4	243°17.7	·· 21.4
10	232°49.2	13°07.3	06.4	339°48.3	54.0	198°38.5	20.3	258°20.0	21.3
11	247°51.7	28°06.9	07.3	354°48.8	54.2	213°41.1	20.3	273°22.4	21.3
12	262°54.1	43°06.4	S13°08.2	9°49.3	S22°54.5	228°43.7	N12°20.3	288°24.7	S12°21.2
13	277°56.6	58°06.0	09.1	24°49.8	54.7	243°46.3	20.2	303°27.0	21.1
14	292°59.1	73°05.5	10.1	39°50.3	54.9	258°48.9	20.2	318°29.3	21.1
15	308°01.5	88°05.1	·· 11.0	54°50.8	·· 55.2	273°51.5	·· 20.1	333°31.6	·· 21.0
16	323°04.0	103°04.6	11.9	69°51.3	55.4	288°54.1	20.1	348°33.9	20.9
17	338°06.4	118°04.2	12.8	84°51.8	55.6	303°56.7	20.1	3°36.2	20.9
18	353°08.9	133°03.7	S13°13.8	99°52.3	S22°55.9	318°59.4	N12°20.0	18°38.5	S12°20.8
19	8°11.4	148°03.3	14.7	114°52.8	56.1	334°02.0	20.0	33°40.8	20.8
20	23°13.8	163°02.8	15.6	129°53.3	56.3	349°04.6	20.0	48°43.1	20.7
21	38°16.3	178°02.3	·· 16.5	144°53.8	·· 56.6	4°07.2	·· 19.9	63°45.4	·· 20.6
22	53°18.8	193°01.9	17.4	159°54.3	56.8	19°09.8	19.9	78°47.7	20.6
23	68°21.2	208°01.4	18.3	174°54.8	57.0	34°12.4	19.9	93°50.0	20.5
Mer.pass. 18:27		ν -0.4′	d -0.9′	m -4.11	ν 0.5′	d -0.2′	m 1.38	ν 2.6′	d -0.0′ m -2.73
								ν 2.3′	d 0.1′ m 0.91

Stars

	SHA	**Dec**
Alpheratz	357°35.6	29°13.5
Ankaa	353°07.9	-42°10.8
Schedar	349°31.9	56°40.4
Diphda	348°48.1	-17°51.4
Achernar	335°20.5	-57°07.2
Hamal	327°52.0	23°34.6
Polaris	314°03.1	89°22.1
Acamar	315°12.1	-40°12.6
Menkar	314°06.8	4°11.0
Mirfak	308°29.1	49°56.9
Aldebaran	290°40.3	16°33.5
Rigel	281°04.4	-8°10.4
Capella	280°22.7	46°01.3
Bellatrix	278°23.5	6°22.3
Elnath	278°02.6	28°37.7
Alnilam	275°38.3	-1°11.2
Betelgeuse	270°52.7	7°24.7
Canopus	263°52.3	-52°42.4
Sirius	258°26.7	-16°44.9
Adhara	255°06.2	-29°00.1
Procyon	244°51.5	5°09.8
Pollux	243°18.1	27°58.0
Avior	234°14.6	-59°34.9
Suhail	222°46.7	-43°31.5
Miaplacidus	221°37.9	-69°48.6
Alphard	217°48.5	-8°45.6
Regulus	207°35.3	11°51.0
Dubhe	193°42.0	61°37.1
Denebola	182°25.9	14°26.3
Gienah	175°44.6	-17°40.3
Acrux	173°01.3	-63°13.6
Gacrux	171°52.9	-57°14.5
Alioth	166°14.0	55°49.6
Spica	158°23.4	-11°17.1
Alkaid	152°53.0	49°11.4
Hadar	148°37.8	-60°29.0
Menkent	147°59.0	-36°29.1
Arcturus	145°49.0	19°03.4
Rigil Kent.	139°42.1	-60°55.8
Kochab	137°20.7	74°03.2
Zuben'ubi	136°57.3	-16°08.4
Alphecca	126°04.9	26°38.0
Antares	112°17.3	-26°29.0
Atria	107°13.0	-69°04.1
Sabik	102°04.2	-15°45.2
Shaula	96°12.0	-37°07.2
Rasalhague	95°59.7	12°32.6
Eltanin	90°43.2	51°29.1
Kaus Aust.	83°34.1	-34°22.4
Vega	80°34.3	38°48.4
Nunki	75°49.2	-26°16.1
Altair	62°01.1	8°55.9
Peacock	53°07.6	-56°39.7
Deneb	49°26.7	45°22.1
Enif	33°39.8	9°59.1
Al Na'ir	27°34.2	-46°51.0
Fomalhaut	15°15.6	-29°29.9
Scheat	13°46.1	28°12.9
Markab	13°30.8	15°20.1

Dec 12 Tue	**SHA**	**Mer.pass**
Venus	143°06.1	09:06
Mars	108°52.4	11:22
Jupiter	325°40.5	20:52
Saturn	25°39.7	16:53

Dec 13 Wed	**SHA**	**Mer.pass**
Venus	141°56.8	09:07
Mars	108°05.6	11:22
Jupiter	325°44.3	20:48
Saturn	25°36.1	16:49

Dec 14 Thu	**SHA**	**Mer.pass**
Venus	140°47.2	09:07
Mars	107°18.7	11:21
Jupiter	325°47.9	20:44
Saturn	25°32.4	16:46

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	181°40.0	S23°02.2	195°41.9	7.0′	S24°58.8	7.8′	57.7′
1	196°39.7	02.4	210°07.9	6.9′	25°06.6	7.7′	57.8′
2	211°39.4	02.6	224°33.8	6.8′	25°14.3	7.5′	57.8′
3	226°39.2	·· 02.8	238°59.5	6.7′	25°21.8	7.4′	57.8′
4	241°38.9	03.0	253°25.2	6.5′	25°29.2	7.3′	57.9′
5	256°38.6	03.2	267°50.7	6.4′	25°36.5	7.1′	57.9′
6	271°38.3	S23°03.4	282°16.2	6.3′	S25°43.6	7.0′	57.9′
7	286°38.0	03.6	296°41.5	6.2′	25°50.6	6.8′	57.9′
8	301°37.7	03.8	311°06.7	6.1′	25°57.4	6.6′	58.0′
9	316°37.4	·· 04.0	325°31.8	6.0′	26°04.0	6.5′	58.0′
10	331°37.1	04.1	339°56.8	5.9′	26°10.5	6.3′	58.0′
11	346°36.8	04.3	354°21.7	5.8′	26°16.8	6.2′	58.1′
12	1°36.5	S23°04.5	8°46.5	5.7′	S26°23.0	6.1′	58.1′
13	16°36.2	04.7	23°11.1	5.6′	26°29.1	5.8′	58.1′
14	31°36.0	04.9	37°35.7	5.5′	26°34.9	5.7′	58.1′
15	46°35.7	·· 05.1	52°00.2	5.4′	26°40.6	5.6′	58.2′
16	61°35.4	05.3	66°24.6	5.3′	26°46.2	5.3′	58.2′
17	76°35.1	05.4	80°48.9	5.2′	26°51.5	5.2′	58.2′
18	91°34.8	S23°05.6	95°13.1	5.1′	S26°56.7	5.1′	58.2′
19	106°34.5	05.8	109°37.2	5.0′	27°01.8	4.8′	58.3′
20	121°34.2	06.0	124°01.2	4.9′	27°06.6	4.7′	58.3′
21	136°33.9	·· 06.2	138°25.2	4.8′	27°11.3	4.5′	58.3′
22	151°33.6	06.4	152°49.0	4.8′	27°15.8	4.4′	58.3′
23	166°33.3	06.5	167°12.8	4.7′	27°20.2	4.2′	58.4′
	SD = 16.2′	d = -0.2′	SD = 15.8′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	181°33.0	S23°06.7	181°36.4	4.6′	S27°24.4	4.0′	58.4′
1	196°32.7	06.9	196°00.0	4.5′	27°28.4	3.8′	58.4′
2	211°32.4	07.1	210°23.6	4.4′	27°32.2	3.6′	58.4′
3	226°32.1	·· 07.2	224°47.0	4.4′	27°35.8	3.5′	58.5′
4	241°31.8	07.4	239°10.4	4.3′	27°39.3	3.3′	58.5′
5	256°31.6	07.6	253°33.7	4.2′	27°42.6	3.1′	58.5′
6	271°31.3	S23°07.8	267°56.9	4.2′	S27°45.7	2.9′	58.5′
7	286°31.0	07.9	282°20.0	4.1′	27°48.6	2.7′	58.6′
8	301°30.7	08.1	296°43.1	4.0′	27°51.3	2.6′	58.6′
9	316°30.4	·· 08.3	311°06.2	4.0′	27°53.9	2.3′	58.6′
10	331°30.1	08.4	325°29.1	3.9′	27°56.2	2.2′	58.6′
11	346°29.8	08.6	339°52.1	3.9′	27°58.4	2.0′	58.6′
12	1°29.5	S23°08.8	354°14.9	3.8′	S28°00.4	1.8′	58.7′
13	16°29.2	09.0	8°37.7	3.8′	28°02.2	1.6′	58.7′
14	31°28.9	09.1	23°00.5	3.7′	28°03.8	1.4′	58.7′
15	46°28.6	·· 09.3	37°23.2	3.7′	28°05.2	1.2′	58.7′
16	61°28.3	09.5	51°45.9	3.6′	28°06.4	1.1′	58.8′
17	76°28.0	09.6	66°08.5	3.6′	28°07.5	0.8′	58.8′
18	91°27.7	S23°09.8	80°31.1	3.6′	S28°08.3	0.7′	58.8′
19	106°27.4	09.9	94°53.7	3.5′	28°09.0	0.4′	58.8′
20	121°27.1	10.1	109°16.2	3.5′	28°09.4	0.3′	58.8′
21	136°26.8	·· 10.3	123°38.7	3.5′	28°09.7	0.1′	58.9′
22	151°26.5	10.4	138°01.1	3.4′	28°09.8	0.1′	58.9′
23	166°26.2	10.6	152°23.6	3.4′	28°09.7	0.4′	58.9′
	SD = 16.2′	d = -0.2′	SD = 15.9′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	181°25.9	S23°10.7	166°46.0	3.4′	S28°09.3	0.5′	58.9′
1	196°25.6	10.9	181°08.4	3.4′	28°08.8	0.7′	58.9′
2	211°25.3	11.1	195°30.8	3.4′	28°08.1	0.9′	58.9′
3	226°25.0	·· 11.2	209°53.1	3.4′	28°07.2	1.1′	59.0′
4	241°24.7	11.4	224°15.5	3.4′	28°06.1	1.3′	59.0′
5	256°24.4	11.5	238°37.9	3.3′	28°04.8	1.4′	59.0′
6	271°24.1	S23°11.7	253°00.2	3.3′	S28°03.4	1.7′	59.0′
7	286°23.8	11.8	267°22.6	3.3′	28°01.7	1.9′	59.0′
8	301°23.6	12.0	281°44.9	3.4′	27°59.8	2.1′	59.0′
9	316°23.3	·· 12.1	296°07.3	3.4′	27°57.7	2.3′	59.1′
10	331°23.0	12.3	310°29.6	3.4′	27°55.4	2.4′	59.1′
11	346°22.7	12.4	324°52.0	3.4′	27°53.0	2.7′	59.1′
12	1°22.4	S23°12.6	339°14.4	3.4′	S27°50.3	2.8′	59.1′
13	16°22.1	12.7	353°36.8	3.4′	27°47.5	3.1′	59.1′
14	31°21.8	12.9	7°59.2	3.4′	27°44.4	3.2′	59.1′
15	46°21.5	·· 13.0	22°21.6	3.5′	27°41.2	3.5′	59.2′
16	61°21.2	13.2	36°44.1	3.5′	27°37.7	3.6′	59.2′
17	76°20.9	13.3	51°06.5	3.5′	27°34.1	3.8′	59.2′
18	91°20.6	S23°13.5	65°29.1	3.5′	S27°30.3	4.0′	59.2′
19	106°20.3	13.6	79°51.6	3.6′	27°26.3	4.2′	59.2′
20	121°20.0	13.8	94°14.2	3.6′	27°22.1	4.4′	59.2′
21	136°19.7	·· 13.9	108°36.8	3.7′	27°17.7	4.6′	59.2′
22	151°19.4	14.0	122°59.4	3.7′	27°13.1	4.8′	59.3′
23	166°19.1	14.2	137°22.1	3.7′	27°08.3	4.9′	59.3′
	SD = 16.2′	d = -0.2′	SD = 16.1′				

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

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

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 0-2 1-2%
12	06:40	06:26	11:54	11:23	23:53	
13	06:12	05:58	11:54	12:24	–:–	
14	05:44	05:29	11:55	13:27	00:55	

December 15, 16, 17 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	83°23.7	223°01.0	S13°19.3	189°55.4	S22°57.3	49°15.0	N12°19.8	108°52.3	S12°20.4
1	98°26.2	238°00.5	20.2	204°55.9	57.5	64°17.6	19.8	123°54.7	20.4
2	113°28.6	253°00.1	21.1	219°56.4	57.7	79°20.2	19.8	138°57.0	20.3
3	128°31.1	267°59.6	·· 22.0	234°56.9	·· 57.9	94°22.8	·· 19.7	153°59.3	·· 20.2
4	143°33.6	282°59.2	22.9	249°57.4	58.2	109°25.4	19.7	169°01.6	20.2
5	158°36.0	297°58.7	23.8	264°57.9	58.4	124°28.0	19.7	184°03.9	20.1
6	173°38.5	312°58.3	S13°24.8	279°58.4	S22°58.6	139°30.6	N12°19.6	199°06.2	S12°20.1
7	188°40.9	327°57.8	25.7	294°58.9	58.9	154°33.2	19.6	214°08.5	20.0
8	203°43.4	342°57.3	26.6	309°59.4	59.1	169°35.8	19.6	229°10.8	19.9
9	218°45.9	357°56.9	·· 27.5	324°59.9	·· 59.3	184°38.4	·· 19.5	244°13.1	·· 19.9
10	233°48.3	12°56.4	28.4	340°00.4	59.5	199°41.0	19.5	259°15.4	19.8
11	248°50.8	27°56.0	29.3	355°00.9	22°59.8	214°43.6	19.5	274°17.7	19.7
12	263°53.3	42°55.5	S13°30.2	10°01.4	S23°00.0	229°46.2	N12°19.4	289°20.0	S12°19.7
13	278°55.7	57°55.0	31.1	25°01.9	00.2	244°48.8	19.4	304°22.3	19.6
14	293°58.2	72°54.6	32.1	40°02.4	00.4	259°51.4	19.4	319°24.6	19.5
15	309°00.7	87°54.1	·· 33.0	55°02.9	·· 00.7	274°54.0	·· 19.3	334°26.9	·· 19.5
16	324°03.1	102°53.7	33.9	70°03.4	00.9	289°56.5	19.3	349°29.2	19.4
17	339°05.6	117°53.2	34.8	85°03.9	01.1	304°59.1	19.3	4°31.5	19.3
18	354°08.1	132°52.7	S13°35.7	100°04.4	S23°01.3	320°01.7	N12°19.2	19°33.8	S12°19.3
19	9°10.5	147°52.3	36.6	115°04.9	01.6	335°04.3	19.2	34°36.1	19.2
20	24°13.0	162°51.8	37.5	130°05.4	01.8	350°06.9	19.2	49°38.4	19.1
21	39°15.4	177°51.3	·· 38.4	145°05.8	·· 02.0	5°09.5	·· 19.1	64°40.7	·· 19.1
22	54°17.9	192°50.9	39.3	160°06.3	02.2	20°12.1	19.1	79°43.0	19.0
23	69°20.4	207°50.4	40.2	175°06.8	02.5	35°14.7	19.1	94°45.4	19.0
Mer.pass. 18:23		ν -0.5′ d -0.9′ m -4.10		ν 0.5′ d -0.2′ m 1.38		ν 2.6′ d -0.0′ m -2.73		ν 2.3′ d 0.1′ m 0.91	

Sat	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	84°22.8	222°49.9	S13°41.1	190°07.3	S23°02.7	50°17.3	N12°19.1	109°47.7	S12°18.9
1	99°25.3	237°49.5	42.0	205°07.8	02.9	65°19.9	19.0	124°50.0	18.8
2	114°27.8	252°49.0	43.0	220°08.3	03.1	80°22.5	19.0	139°52.3	18.8
3	129°30.2	267°48.5	·· 43.9	235°08.8	·· 03.3	95°25.1	·· 19.0	154°54.6	·· 18.7
4	144°32.7	282°48.1	44.8	250°09.3	03.6	110°27.7	18.9	169°56.9	18.6
5	159°35.2	297°47.6	45.7	265°09.8	03.8	125°30.3	18.9	184°59.2	18.6
6	174°37.6	312°47.1	S13°46.6	280°10.3	S23°04.0	140°32.9	N12°18.9	200°01.5	S12°18.5
7	189°40.1	327°46.7	47.5	295°10.8	04.2	155°35.5	18.8	215°03.8	18.4
8	204°42.6	342°46.2	48.4	310°11.3	04.4	170°38.0	18.8	230°06.1	18.4
9	219°45.0	357°45.7	·· 49.3	325°11.8	·· 04.7	185°40.6	·· 18.8	245°08.4	·· 18.3
10	234°47.5	12°45.3	50.2	340°12.3	04.9	200°43.2	18.7	260°10.7	18.2
11	249°49.9	27°44.8	51.1	355°12.8	05.1	215°45.8	18.7	275°13.0	18.2
12	264°52.4	42°44.3	S13°52.0	10°13.3	S23°05.3	230°48.4	N12°18.7	290°15.3	S12°18.1
13	279°54.9	57°43.8	52.9	25°13.8	05.5	245°51.0	18.7	305°17.6	18.0
14	294°57.3	72°43.4	53.8	40°14.3	05.7	260°53.6	18.6	320°19.9	18.0
15	309°59.8	87°42.9	·· 54.7	55°14.8	·· 06.0	275°56.2	·· 18.6	335°22.2	·· 17.9
16	325°02.3	102°42.4	55.6	70°15.3	06.2	290°58.8	18.6	350°24.5	17.8
17	340°04.7	117°41.9	56.5	85°15.8	06.4	306°01.4	18.5	5°26.8	17.8
18	355°07.2	132°41.5	S13°57.4	100°16.3	S23°06.6	321°03.9	N12°18.5	20°29.1	S12°17.7
19	10°09.7	147°41.0	58.3	115°16.8	06.8	336°06.5	18.5	35°31.4	17.6
20	25°12.1	162°40.5	13°59.2	130°17.2	07.0	351°09.1	18.5	50°33.7	17.6
21	40°14.6	177°40.0	14°00.1	145°17.7	·· 07.2	6°11.7	·· 18.4	65°36.0	·· 17.5
22	55°17.1	192°39.6	01.0	160°18.2	07.5	21°14.3	18.4	80°38.3	17.4
23	70°19.5	207°39.1	01.9	175°18.7	07.7	36°16.9	18.4	95°40.6	17.4
Mer.pass. 18:19		ν -0.5′ d -0.9′ m -4.10		ν 0.5′ d -0.2′ m 1.38		ν 2.6′ d -0.0′ m -2.72		ν 2.3′ d 0.1′ m 0.91	

Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	85°22.0	222°38.6	S14°02.8	190°19.2	S23°07.9	51°19.5	N12°18.3	110°42.9	S12°17.3
1	100°24.4	237°38.1	03.6	205°19.7	08.1	66°22.0	18.3	125°45.2	17.2
2	115°26.9	252°37.6	04.5	220°20.2	08.3	81°24.6	18.3	140°47.5	17.2
3	130°29.4	267°37.2	·· 05.4	235°20.7	·· 08.5	96°27.2	·· 18.3	155°49.8	·· 17.1
4	145°31.8	282°36.7	06.3	250°21.2	08.7	111°29.8	18.2	170°52.1	17.0
5	160°34.3	297°36.2	07.2	265°21.7	08.9	126°32.4	18.2	185°54.4	17.0
6	175°36.8	312°35.7	S14°08.1	280°22.2	S23°09.2	141°35.0	N12°18.2	200°56.7	S12°16.9
7	190°39.2	327°35.2	09.0	295°22.7	09.4	156°37.5	18.1	215°59.0	16.8
8	205°41.7	342°34.8	09.9	310°23.2	09.6	171°40.1	18.1	231°01.3	16.8
9	220°44.2	357°34.3	·· 10.8	325°23.6	·· 09.8	186°42.7	·· 18.1	246°03.6	·· 16.7
10	235°46.6	12°33.8	11.7	340°24.1	10.0	201°45.3	18.1	261°05.9	16.6
11	250°49.1	27°33.3	12.6	355°24.6	10.2	216°47.9	18.0	276°08.2	16.6
12	265°51.5	42°32.8	S14°13.5	10°25.1	S23°10.4	231°50.5	N12°18.0	291°10.5	S12°16.5
13	280°54.0	57°32.3	14.3	25°25.6	10.6	246°53.0	18.0	306°12.8	16.4
14	295°56.5	72°31.8	15.2	40°26.1	10.8	261°55.6	18.0	321°15.1	16.4
15	310°58.9	87°31.4	·· 16.1	55°26.6	·· 11.0	276°58.2	·· 17.9	336°17.4	·· 16.3
16	326°01.4	102°30.9	17.0	70°27.1	11.2	292°00.8	17.9	351°19.7	16.2
17	341°03.9	117°30.4	17.9	85°27.6	11.4	307°03.4	17.9	6°22.0	16.2
18	356°06.3	132°29.9	S14°18.8	100°28.1	S23°11.6	322°05.9	N12°17.8	21°24.3	S12°16.1
19	11°08.8	147°29.4	19.7	115°28.5	11.8	337°08.5	17.8	36°26.6	16.0
20	26°11.3	162°28.9	20.5	130°29.0	12.0	352°11.1	17.8	51°28.8	16.0
21	41°13.7	177°28.4	·· 21.4	145°29.5	·· 12.3	7°13.7	·· 17.8	66°31.1	·· 15.9
22	56°16.2	192°27.9	22.3	160°30.0	12.5	22°16.3	17.7	81°33.4	15.8
23	71°18.7	207°27.5	23.2	175°30.5	12.7	37°18.8	17.7	96°35.7	15.8
Mer.pass. 18:16		ν -0.5′ d -0.9′ m -4.09		ν 0.5′ d -0.2′ m 1.37		ν 2.6′ d -0.0′ m -2.71		ν 2.3′ d 0.1′ m 0.91	

Stars

	SHA	**Dec**
Alpheratz	357°35.6	29°13.5
Ankaa	353°07.9	-42°10.8
Schedar	349°31.9	56°40.4
Diphda	348°48.1	-17°51.4
Achernar	335°20.5	-57°07.2
Hamal	327°52.0	23°34.6
Polaris	314°03.6	89°22.1
Acamar	315°12.1	-40°12.7
Menkar	314°06.8	4°11.0
Mirfak	308°29.1	49°56.9
Aldebaran	290°40.3	16°33.5
Rigel	281°04.4	-8°10.4
Capella	280°22.7	46°01.3
Bellatrix	278°23.5	6°22.3
Elnath	278°02.6	28°37.7
Alnilam	275°38.3	-1°11.2
Betelgeuse	270°52.7	7°24.7
Canopus	263°52.2	-52°42.4
Sirius	258°26.7	-16°44.9
Adhara	255°06.2	-29°00.2
Procyon	244°51.5	5°09.8
Pollux	243°18.1	27°58.0
Avior	234°14.6	-59°34.9
Suhail	222°46.7	-43°31.5
Miaplacidus	221°37.9	-69°48.6
Alphard	217°48.5	-8°45.6
Regulus	207°35.3	11°51.0
Dubhe	193°42.0	61°37.1
Denebola	182°25.9	14°26.3
Gienah	175°44.6	-17°40.3
Acrux	173°01.3	-63°13.6
Gacrux	171°52.8	-57°14.5
Alioth	166°14.0	55°49.6
Spica	158°23.4	-11°17.1
Alkaid	152°53.0	49°11.4
Hadar	148°37.7	-60°29.0
Menkent	147°58.9	-36°29.1
Arcturus	145°49.0	19°03.4
Rigil Kent.	139°42.0	-60°55.8
Kochab	137°20.7	74°03.2
Zuben'ubi	136°57.3	-16°08.4
Alphecca	126°04.8	26°38.0
Antares	112°17.3	-26°29.0
Atria	107°12.9	-69°04.1
Sabik	102°04.2	-15°45.2
Shaula	96°12.0	-37°07.2
Rasalhague	95°59.7	12°32.5
Eltanin	90°43.1	51°29.1
Kaus Aust.	83°34.1	-34°22.4
Vega	80°34.3	38°48.4
Nunki	75°49.2	-26°16.1
Altair	62°01.1	8°55.9
Peacock	53°07.6	-56°39.7
Deneb	49°26.8	45°22.1
Enif	33°39.8	9°59.1
Al Na'ir	27°34.2	-46°51.0
Fomalhaut	15°15.6	-29°29.9
Scheat	13°46.1	28°12.9
Markab	13°30.8	15°20.1

Dec 15 Fri	**SHA**	**Mer.pass**
Venus	139°37.3	09:08
Mars	106°31.7	11:20
Jupiter	325°51.3	20:39
Saturn	25°28.6	16:42

Dec 16 Sat	**SHA**	**Mer.pass**
Venus	138°27.1	09:09
Mars	105°44.5	11:19
Jupiter	325°54.5	20:35
Saturn	25°24.8	16:38

Dec 17 Sun	**SHA**	**Mer.pass**
Venus	137°16.6	09:10
Mars	104°57.2	11:18
Jupiter	325°57.5	20:31
Saturn	25°20.9	16:35

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	181°18.8	S23°14.3	151°44.9	3.8′	S27°03.4	5.2′	59.3′
1	196°18.5	14.5	166°07.7	3.8′	26°58.2	5.3′	59.3′
2	211°18.2	14.6	180°30.5	3.9′	26°52.9	5.6′	59.3′
3	226°17.9	·· 14.7	194°53.4	3.9′	26°47.3	5.7′	59.3′
4	241°17.6	14.9	209°16.3	4.0′	26°41.6	5.9′	59.3′
5	256°17.3	15.0	223°39.3	4.0′	26°35.7	6.0′	59.3′
6	271°17.0	S23°15.1	238°02.3	4.1′	S26°29.7	6.3′	59.3′
7	286°16.7	15.3	252°25.5	4.2′	26°23.4	6.4′	59.4′
8	301°16.4	15.4	266°48.6	4.2′	26°17.0	6.7′	59.4′
9	316°16.1	·· 15.5	281°11.9	4.3′	26°10.3	6.8′	59.4′
10	331°15.8	15.7	295°35.2	4.4′	26°03.5	6.9′	59.4′
11	346°15.5	15.8	309°58.5	4.4′	25°56.6	7.2′	59.4′
12	1°15.2	S23°15.9	324°22.0	4.5′	S25°49.4	7.3′	59.4′
13	16°14.9	16.1	338°45.5	4.6′	25°42.1	7.5′	59.4′
14	31°14.6	16.2	353°09.1	4.7′	25°34.6	7.7′	59.4′
15	46°14.3	·· 16.3	7°32.7	4.7′	25°26.9	7.8′	59.4′
16	61°14.0	16.5	21°56.4	4.8′	25°19.1	8.1′	59.4′
17	76°13.6	16.6	36°20.3	4.9′	25°11.0	8.1′	59.4′
18	91°13.3	S23°16.7	50°44.1	5.0′	S25°02.9	8.4′	59.4′
19	106°13.0	16.8	65°08.1	5.1′	24°54.5	8.5′	59.4′
20	121°12.7	17.0	79°32.2	5.1′	24°46.0	8.7′	59.5′
21	136°12.4	·· 17.1	93°56.3	5.2′	24°37.3	8.8′	59.5′
22	151°12.1	17.2	108°20.5	5.3′	24°28.5	9.1′	59.5′
23	166°11.8	17.3	122°44.8	5.4′	24°19.4	9.1′	59.5′
	SD = 16.2′	d = -0.1′	SD = 16.2′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	181°11.5	S23°17.4	137°09.2	5.5′	S24°10.3	9.3′	59.5′
1	196°11.2	17.6	151°33.7	5.6′	24°01.0	9.5′	59.5′
2	211°10.9	17.7	165°58.3	5.7′	23°51.5	9.7′	59.5′
3	226°10.6	·· 17.8	180°23.0	5.8′	23°41.8	9.8′	59.5′
4	241°10.3	17.9	194°47.7	5.8′	23°32.0	9.9′	59.5′
5	256°10.0	18.0	209°12.6	5.9′	23°22.1	10.1′	59.5′
6	271°09.7	S23°18.1	223°37.5	6.0′	S23°12.0	10.2′	59.5′
7	286°09.4	18.3	238°02.5	6.1′	23°01.8	10.4′	59.5′
8	301°09.1	18.4	252°27.7	6.2′	22°51.4	10.6′	59.5′
9	316°08.8	·· 18.5	266°52.9	6.3′	22°40.8	10.6′	59.5′
10	331°08.5	18.6	281°18.2	6.4′	22°30.2	10.9′	59.5′
11	346°08.2	18.7	295°43.6	6.5′	22°19.3	10.9′	59.5′
12	1°07.9	S23°18.8	310°09.1	6.6′	S22°08.4	11.1′	59.5′
13	16°07.6	18.9	324°34.7	6.7′	21°57.3	11.2′	59.5′
14	31°07.3	19.0	339°00.4	6.8′	21°46.1	11.4′	59.5′
15	46°07.0	·· 19.2	353°26.2	6.9′	21°34.7	11.5′	59.5′
16	61°06.7	19.3	7°52.1	7.0′	21°23.2	11.7′	59.5′
17	76°06.4	19.4	22°18.1	7.1′	21°11.5	11.7′	59.5′
18	91°06.1	S23°19.5	36°44.2	7.2′	S20°59.8	11.9′	59.5′
19	106°05.8	19.6	51°10.4	7.3′	20°47.9	12.0′	59.5′
20	121°05.5	19.7	65°36.7	7.4′	20°35.9	12.2′	59.5′
21	136°05.2	·· 19.8	80°03.1	7.5′	20°23.7	12.2′	59.5′
22	151°04.9	19.9	94°29.6	7.6′	20°11.5	12.4′	59.5′
23	166°04.5	20.0	108°56.2	7.7′	19°59.1	12.5′	59.5′
	SD = 16.2′	d = -0.1′	SD = 16.2′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	181°04.2	S23°20.1	123°22.9	7.8′	S19°46.6	12.6′	59.5′
1	196°03.9	20.2	137°49.7	7.9′	19°34.0	12.8′	59.5′
2	211°03.6	20.3	152°16.6	8.0′	19°21.2	12.8′	59.5′
3	226°03.3	·· 20.4	166°43.6	8.1′	19°08.4	13.0′	59.5′
4	241°03.0	20.5	181°10.6	8.2′	18°55.4	13.1′	59.5′
5	256°02.7	20.6	195°37.8	8.3′	18°42.3	13.1′	59.5′
6	271°02.4	S23°20.7	210°05.1	8.4′	S18°29.2	13.3′	59.5′
7	286°02.1	20.8	224°32.5	8.5′	18°15.9	13.4′	59.5′
8	301°01.8	20.9	238°59.9	8.6′	18°02.5	13.5′	59.5′
9	316°01.5	·· 21.0	253°27.5	8.7′	17°49.0	13.6′	59.5′
10	331°01.2	21.1	267°55.2	8.7′	17°35.4	13.7′	59.5′
11	346°00.9	21.1	282°22.9	8.8′	17°21.7	13.8′	59.5′
12	1°00.6	S23°21.2	296°50.7	8.9′	S17°07.9	13.8′	59.5′
13	16°00.3	21.3	311°18.7	9.0′	16°54.1	14.0′	59.5′
14	31°00.0	21.4	325°46.7	9.1′	16°40.1	14.1′	59.5′
15	45°59.7	·· 21.5	340°14.8	9.2′	16°26.0	14.2′	59.5′
16	60°59.4	21.6	354°43.0	9.3′	16°11.8	14.2′	59.5′
17	75°59.1	21.7	9°11.3	9.4′	15°57.6	14.3′	59.5′
18	90°58.7	S23°21.8	23°39.7	9.5′	S15°43.3	14.4′	59.5′
19	105°58.4	21.9	38°08.2	9.6′	15°28.9	14.5′	59.5′
20	120°58.1	21.9	52°36.8	9.7′	15°14.4	14.6′	59.4′
21	135°57.8	·· 22.0	67°05.4	9.7′	14°59.8	14.7′	59.4′
22	150°57.5	22.1	81°34.2	9.8′	14°45.1	14.7′	59.4′
23	165°57.2	22.2	96°03.0	9.9′	14°30.4	14.8′	59.4′
	SD = 16.2′	d = -0.1′	SD = 16.2′				

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

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

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 3-5 5-20%
15	05:15	05:01	11:55	14:29	01:58	
16	04:46	04:32	11:55	15:27	02:58	
17	04:17	04:02	11:56	16:22	03:55	

December 18, 19, 20 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	86°21.1	222°27.0	S14°24.1	190°31.0	S23°12.9	52°21.4	N12°17.7	111°38.0	S12°15.7
1	101°23.6	237°26.5	25.0	205°31.5	13.1	67°24.0	17.7	126°40.3	15.6
2	116°26.0	252°26.0	25.9	220°32.0	13.3	82°26.6	17.6	141°42.6	15.6
3	131°28.5	267°25.5	·· 26.7	235°32.5	·· 13.5	97°29.1	·· 17.6	156°44.9	·· 15.5
4	146°31.0	282°25.0	27.6	250°32.9	13.7	112°31.7	17.6	171°47.2	15.4
5	161°33.4	297°24.5	28.5	265°33.4	13.9	127°34.3	17.6	186°49.5	15.4
6	176°35.9	312°24.0	S14°29.4	280°33.9	S23°14.1	142°36.9	N12°17.5	201°51.8	S12°15.3
7	191°38.4	327°23.5	30.3	295°34.4	14.3	157°39.4	17.5	216°54.1	15.2
8	206°40.8	342°23.0	31.1	310°34.9	14.5	172°42.0	17.5	231°56.4	15.2
9	221°43.3	357°22.5	·· 32.0	325°35.4	·· 14.7	187°44.6	·· 17.5	246°58.7	·· 15.1
10	236°45.8	12°22.0	32.9	340°35.9	14.9	202°47.2	17.4	262°01.0	15.0
11	251°48.2	27°21.5	33.8	355°36.4	15.1	217°49.7	17.4	277°03.3	15.0
12	266°50.7	42°21.0	S14°34.6	10°36.8	S23°15.3	232°52.3	N12°17.4	292°05.6	S12°14.9
13	281°53.2	57°20.5	35.5	25°37.3	15.5	247°54.9	17.4	307°07.9	14.8
14	296°55.6	72°20.0	36.4	40°37.8	15.7	262°57.5	17.3	322°10.2	14.8
15	311°58.1	87°19.5	·· 37.3	55°38.3	·· 15.9	278°00.0	·· 17.3	337°12.5	·· 14.7
16	327°00.5	102°19.0	38.1	70°38.8	16.1	293°02.6	17.3	352°14.8	14.6
17	342°03.0	117°18.5	39.0	85°39.3	16.2	308°05.2	17.3	7°17.1	14.6
18	357°05.5	132°18.0	S14°39.9	100°39.8	S23°16.4	323°07.8	N12°17.2	22°19.3	S12°14.5
19	12°07.9	147°17.5	40.8	115°40.2	16.6	338°10.3	17.2	37°21.6	14.4
20	27°10.4	162°17.0	41.6	130°40.7	16.8	353°12.9	17.2	52°23.9	14.4
21	42°12.9	177°16.5	·· 42.5	145°41.2	·· 17.0	8°15.5	·· 17.2	67°26.2	·· 14.3
22	57°15.3	192°16.0	43.4	160°41.7	17.2	23°18.0	17.2	82°28.5	14.2
23	72°17.8	207°15.5	44.3	175°42.2	17.4	38°20.6	17.1	97°30.8	14.1
Mer.pass. 18:12		ν -0.5′ d -0.9′ m -4.09		ν 0.5′ d -0.2′ m 1.37		ν 2.6′ d -0.0′ m -2.70		ν 2.3′ d 0.1′ m 0.92	

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	87°20.3	222°15.0	S14°45.1	190°42.7	S23°17.6	53°23.2	N12°17.1	112°33.1	S12°14.1
1	102°22.7	237°14.5	46.0	205°43.1	17.8	68°25.7	17.1	127°35.4	14.0
2	117°25.2	252°14.0	46.9	220°43.6	18.0	83°28.3	17.1	142°37.7	13.9
3	132°27.6	267°13.5	·· 47.7	235°44.1	·· 18.2	98°30.9	·· 17.0	157°40.0	·· 13.9
4	147°30.1	282°13.0	48.6	250°44.6	18.4	113°33.4	17.0	172°42.3	13.8
5	162°32.6	297°12.5	49.5	265°45.1	18.6	128°36.0	17.0	187°44.6	13.7
6	177°35.0	312°12.0	S14°50.3	280°45.6	S23°18.8	143°38.6	N12°17.0	202°46.9	S12°13.7
7	192°37.5	327°11.5	51.2	295°46.0	18.9	158°41.1	17.0	217°49.2	13.6
8	207°40.0	342°11.0	52.1	310°46.5	19.1	173°43.7	16.9	232°51.4	13.5
9	222°42.4	357°10.5	·· 52.9	325°47.0	·· 19.3	188°46.3	·· 16.9	247°53.7	·· 13.5
10	237°44.9	12°10.0	53.8	340°47.5	19.5	203°48.8	16.9	262°56.0	13.4
11	252°47.4	27°09.5	54.7	355°48.0	19.7	218°51.4	16.9	277°58.3	13.3
12	267°49.8	42°08.9	S14°55.5	10°48.5	S23°19.9	233°54.0	N12°16.8	293°00.6	S12°13.3
13	282°52.3	57°08.4	56.4	25°48.9	20.1	248°56.5	16.8	308°02.9	13.2
14	297°54.8	72°07.9	57.3	40°49.4	20.3	263°59.1	16.8	323°05.2	13.1
15	312°57.2	87°07.4	·· 58.1	55°49.9	·· 20.5	279°01.7	·· 16.8	338°07.5	·· 13.0
16	327°59.7	102°06.9	59.0	70°50.4	20.6	294°04.2	16.8	353°09.8	13.0
17	343°02.1	117°06.4	14°59.8	85°50.9	20.8	309°06.8	16.7	8°12.1	12.9
18	358°04.6	132°05.9	S15°00.7	100°51.3	S23°21.0	324°09.4	N12°16.7	23°14.4	S12°12.8
19	13°07.1	147°05.4	01.6	115°51.8	21.2	339°11.9	16.7	38°16.7	12.8
20	28°09.5	162°04.8	02.4	130°52.3	21.4	354°14.5	16.7	53°18.9	12.7
21	43°12.0	177°04.3	·· 03.3	145°52.8	·· 21.6	9°17.1	·· 16.7	68°21.2	·· 12.6
22	58°14.5	192°03.8	04.1	160°53.3	21.8	24°19.6	16.6	83°23.5	12.6
23	73°16.9	207°03.3	05.0	175°53.7	21.9	39°22.2	16.6	98°25.8	12.5
Mer.pass. 18:08		ν -0.5′ d -0.9′ m -4.08		ν 0.5′ d -0.2′ m 1.37		ν 2.6′ d -0.0′ m -2.70		ν 2.3′ d 0.1′ m 0.92	

Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	88°19.4	222°02.8	S15°05.9	190°54.2	S23°22.1	54°24.7	N12°16.6	113°28.1	S12°12.4
1	103°21.9	237°02.3	06.7	205°54.7	22.3	69°27.3	16.6	128°30.4	12.3
2	118°24.3	252°01.8	07.6	220°55.2	22.5	84°29.9	16.6	143°32.7	12.3
3	133°26.8	267°01.2	·· 08.4	235°55.7	·· 22.7	99°32.4	·· 16.5	158°35.0	·· 12.2
4	148°29.3	282°00.7	09.3	250°56.1	22.9	114°35.0	16.5	173°37.3	12.1
5	163°31.7	297°00.2	10.1	265°56.6	23.0	129°37.5	16.5	188°39.5	12.1
6	178°34.2	311°59.7	S15°11.0	280°57.1	S23°23.2	144°40.1	N12°16.5	203°41.8	S12°12.0
7	193°36.6	326°59.2	11.8	295°57.6	23.4	159°42.7	16.5	218°44.1	11.9
8	208°39.1	341°58.6	12.7	310°58.1	23.6	174°45.2	16.4	233°46.4	11.9
9	223°41.6	356°58.1	·· 13.6	325°58.5	·· 23.8	189°47.8	·· 16.4	248°48.7	·· 11.8
10	238°44.0	11°57.6	14.4	340°59.0	23.9	204°50.3	16.4	263°51.0	11.7
11	253°46.5	26°57.1	15.3	355°59.5	24.1	219°52.9	16.4	278°53.3	11.6
12	268°49.0	41°56.6	S15°16.1	11°00.0	S23°24.3	234°55.4	N12°16.4	293°55.6	S12°11.6
13	283°51.4	56°56.0	17.0	26°00.4	24.5	249°58.0	16.3	308°57.9	11.5
14	298°53.9	71°55.5	17.8	41°00.9	24.6	265°00.6	16.3	324°00.1	11.4
15	313°56.4	86°55.0	·· 18.7	56°01.4	·· 24.8	280°03.1	·· 16.3	339°02.4	·· 11.4
16	328°58.8	101°54.5	19.5	71°01.9	25.0	295°05.7	16.3	354°04.7	11.3
17	344°01.3	116°53.9	20.4	86°02.3	25.2	310°08.2	16.3	9°07.0	11.2
18	359°03.7	131°53.4	S15°21.2	101°02.8	S23°25.4	325°10.8	N12°16.3	24°09.3	S12°11.2
19	14°06.2	146°52.9	22.0	116°03.3	25.5	340°13.3	16.2	39°11.6	11.1
20	29°08.7	161°52.4	22.9	131°03.8	25.7	355°15.9	16.2	54°13.9	11.0
21	44°11.1	176°51.8	·· 23.7	146°04.3	·· 25.9	10°18.4	·· 16.2	69°16.2	·· 10.9
22	59°13.6	191°51.3	24.6	161°04.7	26.1	25°21.0	16.2	84°18.4	10.9
23	74°16.1	206°50.8	25.4	176°05.2	26.2	40°23.5	16.2	99°20.7	10.8
Mer.pass. 18:04		ν -0.5′ d -0.9′ m -4.08		ν 0.5′ d -0.2′ m 1.37		ν 2.6′ d -0.0′ m -2.69		ν 2.3′ d 0.1′ m 0.92	

Stars

	SHA	**Dec**
Alpheratz	357°35.7	29°13.5
Ankaa	353°07.9	-42°10.8
Schedar	349°31.9	56°40.4
Diphda	348°48.1	-17°51.4
Achernar	335°20.5	-57°07.2
Hamal	327°52.0	23°34.6
Polaris	314°04.5	89°22.1
Acamar	315°12.1	-40°12.7
Menkar	314°06.8	4°11.0
Mirfak	308°29.1	49°56.9
Aldebaran	290°40.3	16°33.5
Rigel	281°04.4	-8°10.4
Capella	280°22.7	46°01.3
Bellatrix	278°23.5	6°22.3
Elnath	278°02.6	28°37.7
Alnilam	275°38.3	-1°11.2
Betelgeuse	270°52.7	7°24.7
Canopus	263°52.2	-52°42.4
Sirius	258°26.7	-16°44.9
Adhara	255°06.2	-29°00.2
Procyon	244°51.5	5°09.8
Pollux	243°18.1	27°58.0
Avior	234°14.6	-59°34.9
Suhail	222°46.7	-43°31.5
Miaplacidus	221°37.9	-69°48.6
Alphard	217°48.4	-8°45.6
Regulus	207°35.2	11°51.0
Dubhe	193°41.9	61°37.1
Denebola	182°25.9	14°26.2
Gienah	175°44.6	-17°40.3
Acrux	173°01.3	-63°13.6
Gacrux	171°52.8	-57°14.5
Alioth	166°13.9	55°49.5
Spica	158°23.4	-11°17.1
Alkaid	152°53.0	49°11.4
Hadar	148°37.7	-60°29.0
Menkent	147°58.9	-36°29.1
Arcturus	145°48.9	19°03.4
Rigil Kent.	139°42.0	-60°55.8
Kochab	137°20.6	74°03.2
Zuben'ubi	136°57.3	-16°08.4
Alphecca	126°04.8	26°38.0
Antares	112°17.3	-26°29.0
Atria	107°12.9	-69°04.1
Sabik	102°04.2	-15°45.3
Shaula	96°12.0	-37°07.2
Rasalhague	95°59.7	12°32.5
Eltanin	90°43.1	51°29.1
Kaus Aust.	83°34.1	-34°22.4
Vega	80°34.3	38°48.3
Nunki	75°49.2	-26°16.1
Altair	62°01.1	8°55.9
Peacock	53°07.6	-56°39.7
Deneb	49°26.8	45°22.1
Enif	33°39.8	9°59.1
Al Na'ir	27°34.2	-46°51.0
Fomalhaut	15°15.6	-29°29.9
Scheat	13°46.1	28°12.9
Markab	13°30.9	15°20.1

Dec 18 Mon	**SHA**	**Mer.pass**
Venus	136°05.8	09:11
Mars	104°09.9	11:18
Jupiter	326°00.3	20:27
Saturn	25°16.9	16:31

Dec 19 Tue	**SHA**	**Mer.pass**
Venus	134°54.8	09:11
Mars	103°22.4	11:17
Jupiter	326°02.9	20:23
Saturn	25°12.8	16:27

Dec 20 Wed	**SHA**	**Mer.pass**
Venus	133°43.4	09:12
Mars	102°34.8	11:16
Jupiter	326°05.3	20:19
Saturn	25°08.7	16:24

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°56.9	S23°22.3	110°31.9	10.0′	S14°15.6	14.9′	59.4′
1	195°56.6	22.3	125°00.9	10.1′	14°00.7	15.0′	59.4′
2	210°56.3	22.4	139°29.9	10.2′	13°45.7	15.0′	59.4′
3	225°56.0	·· 22.5	153°59.1	10.2′	13°30.7	15.1′	59.4′
4	240°55.7	22.6	168°28.3	10.3′	13°15.6	15.2′	59.4′
5	255°55.4	22.7	182°57.6	10.4′	13°00.4	15.2′	59.4′
6	270°55.1	S23°22.7	197°27.0	10.5′	S12°45.2	15.3′	59.4′
7	285°54.8	22.8	211°56.5	10.5′	12°29.9	15.4′	59.4′
8	300°54.5	22.9	226°26.0	10.6′	12°14.5	15.4′	59.4′
9	315°54.1	·· 23.0	240°55.6	10.7′	11°59.1	15.5′	59.4′
10	330°53.8	23.0	255°25.3	10.8′	11°43.6	15.5′	59.4′
11	345°53.5	23.1	269°55.1	10.8′	11°28.1	15.6′	59.3′
12	0°53.2	S23°23.2	284°24.9	10.9′	S11°12.5	15.7′	59.3′
13	15°52.9	23.3	298°54.8	11.0′	10°56.8	15.7′	59.3′
14	30°52.6	23.3	313°24.8	11.0′	10°41.1	15.7′	59.3′
15	45°52.3	·· 23.4	327°54.8	11.1′	10°25.4	15.8′	59.3′
16	60°52.0	23.5	342°24.9	11.2′	10°09.6	15.8′	59.3′
17	75°51.7	23.5	356°55.1	11.2′	09°53.8	15.9′	59.3′
18	90°51.4	S23°23.6	11°25.3	11.3′	S09°37.9	16.0′	59.3′
19	105°51.1	23.7	25°55.6	11.3′	09°21.9	16.0′	59.3′
20	120°50.8	23.7	40°25.9	11.4′	09°05.9	16.0′	59.3′
21	135°50.5	·· 23.8	54°56.3	11.5′	08°49.9	16.0′	59.3′
22	150°50.1	23.9	69°26.8	11.5′	08°33.9	16.1′	59.2′
23	165°49.8	23.9	83°57.3	11.6′	08°17.8	16.2′	59.2′
	SD = 16.2′	d = -0.1′	SD = 16.2′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°49.5	S23°24.0	98°27.9	11.6′	S08°01.6	16.1′	59.2′
1	195°49.2	24.0	112°58.5	11.7′	07°45.5	16.2′	59.2′
2	210°48.9	24.1	127°29.2	11.7′	07°29.3	16.3′	59.2′
3	225°48.6	·· 24.2	142°00.0	11.8′	07°13.0	16.2′	59.2′
4	240°48.3	24.2	156°30.7	11.8′	06°56.8	16.3′	59.2′
5	255°48.0	24.3	171°01.6	11.9′	06°40.5	16.3′	59.2′
6	270°47.7	S23°24.3	185°32.5	11.9′	S06°24.2	16.4′	59.2′
7	285°47.4	24.4	200°03.4	12.0′	06°07.8	16.4′	59.1′
8	300°47.1	24.4	214°34.4	12.0′	05°51.4	16.3′	59.1′
9	315°46.8	·· 24.5	229°05.4	12.1′	05°35.1	16.5′	59.1′
10	330°46.4	24.6	243°36.4	12.1′	05°18.6	16.4′	59.1′
11	345°46.1	24.6	258°07.5	12.1′	05°02.2	16.4′	59.1′
12	0°45.8	S23°24.7	272°38.7	12.2′	S04°45.8	16.5′	59.1′
13	15°45.5	24.7	287°09.8	12.2′	04°29.3	16.5′	59.1′
14	30°45.2	24.8	301°41.1	12.2′	04°12.8	16.5′	59.1′
15	45°44.9	·· 24.8	316°12.3	12.3′	03°56.3	16.5′	59.1′
16	60°44.6	24.9	330°43.6	12.3′	03°39.8	16.5′	59.0′
17	75°44.3	24.9	345°14.9	12.3′	03°23.3	16.6′	59.0′
18	90°44.0	S23°25.0	359°46.2	12.4′	S03°06.7	16.5′	59.0′
19	105°43.7	25.0	14°17.6	12.4′	02°50.2	16.6′	59.0′
20	120°43.4	25.0	28°49.0	12.4′	02°33.6	16.5′	59.0′
21	135°43.1	·· 25.1	43°20.4	12.5′	02°17.1	16.6′	59.0′
22	150°42.7	25.1	57°51.9	12.5′	02°00.5	16.5′	59.0′
23	165°42.4	25.2	72°23.4	12.5′	01°44.0	16.6′	59.0′
	SD = 16.2′	d = -0.1′	SD = 16.2′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°42.1	S23°25.2	86°54.9	12.5′	S01°27.4	16.5′	58.9′
1	195°41.8	25.3	101°26.4	12.5′	01°10.9	16.6′	58.9′
2	210°41.5	25.3	115°57.9	12.6′	00°54.3	16.6′	58.9′
3	225°41.2	·· 25.3	130°29.5	12.6′	00°37.7	16.5′	58.9′
4	240°40.9	25.4	145°01.1	12.6′	00°21.2	16.6′	58.9′
5	255°40.6	25.4	159°32.6	12.6′	S00°04.6	16.5′	58.9′
6	270°40.3	S23°25.5	174°04.3	12.6′	N00°11.9	16.5′	58.9′
7	285°40.0	25.5	188°35.9	12.6′	00°28.4	16.5′	58.8′
8	300°39.7	25.5	203°07.5	12.6′	00°44.9	16.6′	58.8′
9	315°39.3	·· 25.6	217°39.1	12.6′	01°01.5	16.5′	58.8′
10	330°39.0	25.6	232°10.8	12.7′	01°18.0	16.4′	58.8′
11	345°38.7	25.6	246°42.4	12.7′	01°34.4	16.5′	58.8′
12	0°38.4	S23°25.7	261°14.1	12.7′	N01°50.9	16.5′	58.8′
13	15°38.1	25.7	275°45.7	12.7′	02°07.4	16.4′	58.8′
14	30°37.8	25.7	290°17.4	12.7′	02°23.8	16.4′	58.8′
15	45°37.5	·· 25.8	304°49.1	12.7′	02°40.2	16.4′	58.7′
16	60°37.2	25.8	319°20.7	12.7′	02°56.6	16.4′	58.7′
17	75°36.9	25.8	333°52.4	12.7′	03°13.0	16.3′	58.7′
18	90°36.6	S23°25.8	348°24.1	12.7′	N03°29.3	16.4′	58.7′
19	105°36.2	25.9	2°55.7	12.7′	03°45.7	16.3′	58.7′
20	120°35.9	25.9	17°27.4	12.6′	04°02.0	16.2′	58.7′
21	135°35.6	·· 25.9	31°59.0	12.6′	04°18.2	16.3′	58.7′
22	150°35.3	25.9	46°30.7	12.6′	04°34.5	16.2′	58.6′
23	165°35.0	26.0	61°02.3	12.6′	04°50.7	16.2′	58.6′
	SD = 16.2′	d = -0.0′	SD = 16.1′				

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

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

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 6-8 30-53%
18	03:48	03:33	11:56	17:13	04:48	
19	03:18	03:03	11:57	18:01	05:37	
20	02:49	02:34	11:57	18:48	06:24	

December 21, 22, 23 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	89°18.5	221°50.2	S15°26.3	191°05.7	S23°26.4	55°26.1	N12°16.2	114°23.0	S12°10.7
1	104°21.0	236°49.7	27.1	206°06.2	26.6	70°28.7	16.1	129°25.3	10.7
2	119°23.5	251°49.2	28.0	221°06.6	26.8	85°31.2	16.1	144°27.6	10.6
3	134°25.9	266°48.7	·· 28.8	236°07.1	·· 26.9	100°33.8	·· 16.1	159°29.9	·· 10.5
4	149°28.4	281°48.1	29.6	251°07.6	27.1	115°36.3	16.1	174°32.2	10.4
5	164°30.9	296°47.6	30.5	266°08.1	27.3	130°38.9	16.1	189°34.5	10.4
6	179°33.3	311°47.1	S15°31.3	281°08.5	S23°27.4	145°41.4	N12°16.1	204°36.7	S12°10.3
7	194°35.8	326°46.5	32.2	296°09.0	27.6	160°44.0	16.0	219°39.0	10.2
8	209°38.2	341°46.0	33.0	311°09.5	27.8	175°46.5	16.0	234°41.3	10.2
9	224°40.7	356°45.5	·· 33.8	326°10.0	·· 27.9	190°49.1	·· 16.0	249°43.6	·· 10.1
10	239°43.2	11°44.9	34.7	341°10.4	28.1	205°51.6	16.0	264°45.9	10.0
11	254°45.6	26°44.4	35.5	356°10.9	28.3	220°54.2	16.0	279°48.2	09.9
12	269°48.1	41°43.9	S15°36.4	11°11.4	S23°28.5	235°56.7	N12°16.0	294°50.5	S12°09.9
13	284°50.6	56°43.3	37.2	26°11.8	28.6	250°59.3	15.9	309°52.7	09.8
14	299°53.0	71°42.8	38.0	41°12.3	28.8	266°01.8	15.9	324°55.0	09.7
15	314°55.5	86°42.3	·· 38.9	56°12.8	·· 29.0	281°04.4	·· 15.9	339°57.3	·· 09.7
16	329°58.0	101°41.7	39.7	71°13.3	29.1	296°06.9	15.9	354°59.6	09.6
17	345°00.4	116°41.2	40.5	86°13.7	29.3	311°09.4	15.9	10°01.9	09.5
18	0°02.9	131°40.6	S15°41.4	101°14.2	S23°29.5	326°12.0	N12°15.9	25°04.2	S12°09.4
19	15°05.4	146°40.1	42.2	116°14.7	29.6	341°14.5	15.9	40°06.4	09.4
20	30°07.8	161°39.6	43.0	131°15.2	29.8	356°17.1	15.8	55°08.7	09.3
21	45°10.3	176°39.0	·· 43.9	146°15.6	·· 30.0	11°19.6	·· 15.8	70°11.0	·· 09.2
22	60°12.7	191°38.5	44.7	161°16.1	30.1	26°22.2	15.8	85°13.3	09.2
23	75°15.2	206°37.9	45.5	176°16.6	30.3	41°24.7	15.8	100°15.6	09.1
Mer.pass. 18:00		ν -0.5′ d -0.8′ m -4.07		ν 0.5′ d -0.2′ m 1.37		ν 2.6′ d -0.0′ m -2.68		ν 2.3′ d 0.1′ m 0.93	

Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	90°17.7	221°37.4	S15°46.4	191°17.0	S23°30.5	56°27.3	N12°15.8	115°17.9	S12°09.0
1	105°20.1	236°36.9	47.2	206°17.5	30.6	71°29.8	15.8	130°20.1	08.9
2	120°22.6	251°36.3	48.0	221°18.0	30.8	86°32.4	15.8	145°22.4	08.9
3	135°25.1	266°35.8	·· 48.8	236°18.5	·· 30.9	101°34.9	·· 15.7	160°24.7	·· 08.8
4	150°27.5	281°35.2	49.7	251°18.9	31.1	116°37.4	15.7	175°27.0	08.7
5	165°30.0	296°34.7	50.5	266°19.4	31.3	131°40.0	15.7	190°29.3	08.6
6	180°32.5	311°34.1	S15°51.3	281°19.9	S23°31.4	146°42.5	N12°15.7	205°31.6	S12°08.6
7	195°34.9	326°33.6	52.2	296°20.3	31.6	161°45.1	15.7	220°33.8	08.5
8	210°37.4	341°33.1	53.0	311°20.8	31.7	176°47.6	15.7	235°36.1	08.4
9	225°39.8	356°32.5	·· 53.8	326°21.3	·· 31.9	191°50.2	·· 15.7	250°38.4	·· 08.4
10	240°42.3	11°32.0	54.6	341°21.8	32.1	206°52.7	15.6	265°40.7	08.3
11	255°44.8	26°31.4	55.5	356°22.2	32.2	221°55.2	15.6	280°43.0	08.2
12	270°47.2	41°30.9	S15°56.3	11°22.7	S23°32.4	236°57.8	N12°15.6	295°45.3	S12°08.1
13	285°49.7	56°30.3	57.1	26°23.2	32.5	252°00.3	15.6	310°47.5	08.1
14	300°52.2	71°29.8	57.9	41°23.6	32.7	267°02.9	15.6	325°49.8	08.0
15	315°54.6	86°29.2	·· 58.7	56°24.1	·· 32.9	282°05.4	·· 15.6	340°52.1	·· 07.9
16	330°57.1	101°28.7	15°59.6	71°24.6	33.0	297°07.9	15.6	355°54.4	07.8
17	345°59.6	116°28.1	16°00.4	86°25.0	33.2	312°10.5	15.6	10°56.7	07.8
18	1°02.0	131°27.6	S16°01.2	101°25.5	S23°33.3	327°13.0	N12°15.5	25°58.9	S12°07.7
19	16°04.5	146°27.0	02.0	116°26.0	33.5	342°15.6	15.5	41°01.2	07.6
20	31°07.0	161°26.5	02.8	131°26.4	33.6	357°18.1	15.5	56°03.5	07.6
21	46°09.4	176°25.9	·· 03.7	146°26.9	·· 33.8	12°20.6	·· 15.5	71°05.8	·· 07.5
22	61°11.9	191°25.4	04.5	161°27.4	34.0	27°23.2	15.5	86°08.1	07.4
23	76°14.3	206°24.8	05.3	176°27.8	34.1	42°25.7	15.5	101°10.4	07.3
Mer.pass. 17:56		ν -0.5′ d -0.8′ m -4.06		ν 0.5′ d -0.2′ m 1.37		ν 2.5′ d -0.0′ m -2.67		ν 2.3′ d 0.1′ m 0.93	

Sat	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	91°16.8	221°24.3	S16°06.1	191°28.3	S23°34.3	57°28.2	N12°15.5	116°12.6	S12°07.3
1	106°19.3	236°23.7	06.9	206°28.8	34.4	72°30.8	15.5	131°14.9	07.2
2	121°21.7	251°23.1	07.7	221°29.2	34.6	87°33.3	15.5	146°17.2	07.1
3	136°24.2	266°22.6	·· 08.5	236°29.7	·· 34.7	102°35.8	·· 15.4	161°19.5	·· 07.0
4	151°26.7	281°22.0	09.4	251°30.2	34.9	117°38.4	15.4	176°21.8	07.0
5	166°29.1	296°21.5	10.2	266°30.6	35.0	132°40.9	15.4	191°24.0	06.9
6	181°31.6	311°20.9	S16°11.0	281°31.1	S23°35.2	147°43.4	N12°15.4	206°26.3	S12°06.8
7	196°34.1	326°20.4	11.8	296°31.6	35.3	162°46.0	15.4	221°28.6	06.7
8	211°36.5	341°19.8	12.6	311°32.0	35.5	177°48.5	15.4	236°30.9	06.7
9	226°39.0	356°19.2	·· 13.4	326°32.5	·· 35.6	192°51.0	·· 15.4	251°33.2	·· 06.6
10	241°41.5	11°18.7	14.2	341°33.0	35.8	207°53.6	15.4	266°35.4	06.5
11	256°43.9	26°18.1	15.0	356°33.4	35.9	222°56.1	15.4	281°37.7	06.5
12	271°46.4	41°17.6	S16°15.8	11°33.9	S23°36.1	237°58.6	N12°15.3	296°40.0	S12°06.4
13	286°48.8	56°17.0	16.6	26°34.4	36.2	253°01.2	15.3	311°42.3	06.3
14	301°51.3	71°16.4	17.5	41°34.8	36.4	268°03.7	15.3	326°44.5	06.2
15	316°53.8	86°15.9	·· 18.3	56°35.3	·· 36.5	283°06.2	·· 15.3	341°46.8	·· 06.2
16	331°56.2	101°15.3	19.1	71°35.8	36.7	298°08.8	15.3	356°49.1	06.1
17	346°58.7	116°14.8	19.9	86°36.2	36.8	313°11.3	15.3	11°51.4	06.0
18	2°01.2	131°14.2	S16°20.7	101°36.7	S23°37.0	328°13.8	N12°15.3	26°53.7	S12°05.9
19	17°03.6	146°13.6	21.5	116°37.2	37.1	343°16.4	15.3	41°55.9	05.9
20	32°06.1	161°13.1	22.3	131°37.6	37.3	358°18.9	15.3	56°58.2	05.8
21	47°08.6	176°12.5	·· 23.1	146°38.1	·· 37.4	13°21.4	·· 15.3	72°00.5	·· 05.7
22	62°11.0	191°11.9	23.9	161°38.6	37.5	28°23.9	15.3	87°02.8	05.6
23	77°13.5	206°11.4	24.7	176°39.0	37.7	43°26.5	15.2	102°05.0	05.6
Mer.pass. 17:52		ν -0.6′ d -0.8′ m -4.06		ν 0.5′ d -0.2′ m 1.37		ν 2.5′ d -0.0′ m -2.66		ν 2.3′ d 0.1′ m 0.93	

Stars

	SHA	**Dec**
Alpheratz	357°35.7	29°13.5
Ankaa	353°08.0	-42°10.8
Schedar	349°31.9	56°40.4
Diphda	348°48.1	-17°51.4
Achernar	335°20.6	-57°07.2
Hamal	327°52.0	23°34.6
Polaris	314°05.4	89°22.1
Acamar	315°12.1	-40°12.7
Menkar	314°06.8	4°11.0
Mirfak	308°29.1	49°56.9
Aldebaran	290°40.3	16°33.5
Rigel	281°04.4	-8°10.4
Capella	280°22.7	46°01.4
Bellatrix	278°23.5	6°22.3
Elnath	278°02.6	28°37.7
Alnilam	275°38.3	-1°11.2
Betelgeuse	270°52.7	7°24.7
Canopus	263°52.2	-52°42.4
Sirius	258°26.7	-16°44.9
Adhara	255°06.2	-29°00.2
Procyon	244°51.4	5°09.8
Pollux	243°18.0	27°58.0
Avior	234°14.6	-59°34.9
Suhail	222°46.6	-43°31.5
Miaplacidus	221°37.8	-69°48.6
Alphard	217°48.4	-8°45.7
Regulus	207°35.2	11°51.0
Dubhe	193°41.9	61°37.1
Denebola	182°25.8	14°26.2
Gienah	175°44.5	-17°40.4
Acrux	173°01.2	-63°13.6
Gacrux	171°52.7	-57°14.5
Alioth	166°13.9	55°49.5
Spica	158°23.4	-11°17.1
Alkaid	152°52.9	49°11.4
Hadar	148°37.6	-60°29.0
Menkent	147°58.9	-36°29.1
Arcturus	145°48.9	19°03.4
Rigil Kent.	139°42.0	-60°55.8
Kochab	137°20.6	74°03.1
Zuben'ubi	136°57.2	-16°08.4
Alphecca	126°04.8	26°37.9
Antares	112°17.3	-26°29.0
Atria	107°12.9	-69°04.1
Sabik	102°04.1	-15°45.3
Shaula	96°12.0	-37°07.2
Rasalhague	95°59.7	12°32.5
Eltanin	90°43.1	51°29.1
Kaus Aust.	83°34.1	-34°22.4
Vega	80°34.3	38°48.3
Nunki	75°49.2	-26°16.1
Altair	62°01.1	8°55.9
Peacock	53°07.6	-56°39.7
Deneb	49°26.8	45°22.0
Enif	33°39.9	9°59.1
Al Na'ir	27°34.2	-46°51.0
Fomalhaut	15°15.6	-29°29.9
Scheat	13°46.2	28°12.9
Markab	13°30.9	15°20.1

Dec 21 Thu	**SHA**	**Mer.pass**
Venus	132°31.7	09:13
Mars	101°47.1	11:15
Jupiter	326°07.6	20:15
Saturn	25°04.5	16:20

Dec 22 Fri	**SHA**	**Mer.pass**
Venus	131°19.7	09:14
Mars	100°59.4	11:15
Jupiter	326°09.6	20:11
Saturn	25°00.2	16:16

Dec 23 Sat	**SHA**	**Mer.pass**
Venus	130°07.4	09:15
Mars	100°11.5	11:14
Jupiter	326°11.4	20:07
Saturn	24°55.8	16:13

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h Sun Moon

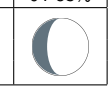
Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	180°34.7	S23°26.0	75°33.9	12.6′	N05°06.9	16.1′	58.6′
1	195°34.4	26.0	90°05.5	12.6′	05°23.0	16.2′	58.6′
2	210°34.1	26.0	104°37.1	12.6′	05°39.2	16.0′	58.6′
3	225°33.8	·· 26.1	119°08.7	12.6′	05°55.2	16.1′	58.6′
4	240°33.5	26.1	133°40.3	12.6′	06°11.3	16.0′	58.5′
5	255°33.2	26.1	148°11.8	12.5′	06°27.3	16.0′	58.5′
6	270°32.8	S23°26.1	162°43.4	12.5′	N06°43.3	15.9′	58.5′
7	285°32.5	26.1	177°14.9	12.5′	06°59.2	15.9′	58.5′
8	300°32.2	26.1	191°46.4	12.5′	07°15.1	15.8′	58.5′
9	315°31.9	·· 26.2	206°17.9	12.4′	07°30.9	15.9′	58.5′
10	330°31.6	26.2	220°49.3	12.4′	07°46.8	15.7′	58.5′
11	345°31.3	26.2	235°20.7	12.4′	08°02.5	15.7′	58.4′
12	0°31.0	S23°26.2	249°52.1	12.4′	N08°18.2	15.7′	58.4′
13	15°30.7	26.2	264°23.5	12.3′	08°33.9	15.6′	58.4′
14	30°30.4	26.2	278°54.8	12.3′	08°49.5	15.6′	58.4′
15	45°30.1	·· 26.2	293°26.2	12.3′	09°05.1	15.5′	58.4′
16	60°29.7	26.2	307°57.4	12.3′	09°20.6	15.4′	58.4′
17	75°29.4	26.3	322°28.7	12.2′	09°36.0	15.4′	58.3′
18	90°29.1	S23°26.3	336°59.9	12.2′	N09°51.4	15.4′	58.3′
19	105°28.8	26.3	351°31.1	12.2′	10°06.8	15.3′	58.3′
20	120°28.5	26.3	6°02.3	12.1′	10°22.1	15.2′	58.3′
21	135°28.2	·· 26.3	20°33.4	12.1′	10°37.3	15.2′	58.3′
22	150°27.9	26.3	35°04.5	12.0′	10°52.5	15.1′	58.3′
23	165°27.6	26.3	49°35.5	12.0′	11°07.6	15.1′	58.2′
	SD = 16.3′	d = -0.0′	SD = 16.0′				

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	180°27.3	S23°26.3	64°06.5	12.0′	N11°22.7	15.0′	58.2′
1	195°26.9	26.3	78°37.5	11.9′	11°37.7	14.9′	58.2′
2	210°26.6	26.3	93°08.4	11.9′	11°52.6	14.8′	58.2′
3	225°26.3	·· 26.3	107°39.3	11.8′	12°07.4	14.8′	58.2′
4	240°26.0	26.3	122°10.1	11.8′	12°22.2	14.7′	58.2′
5	255°25.7	26.3	136°40.9	11.8′	12°36.9	14.7′	58.1′
6	270°25.4	S23°26.3	151°11.7	11.7′	N12°51.6	14.6′	58.1′
7	285°25.1	26.3	165°42.4	11.7′	13°06.2	14.5′	58.1′
8	300°24.8	26.3	180°13.1	11.6′	13°20.7	14.4′	58.1′
9	315°24.5	·· 26.3	194°43.7	11.6′	13°35.1	14.4′	58.1′
10	330°24.2	26.3	209°14.2	11.5′	13°49.5	14.3′	58.1′
11	345°23.8	26.3	223°44.7	11.5′	14°03.8	14.2′	58.0′
12	0°23.5	S23°26.3	238°15.2	11.4′	N14°18.0	14.1′	58.0′
13	15°23.2	26.3	252°45.6	11.4′	14°32.1	14.0′	58.0′
14	30°22.9	26.3	267°16.0	11.3′	14°46.1	14.0′	58.0′
15	45°22.6	·· 26.2	281°46.3	11.3′	15°00.1	13.9′	58.0′
16	60°22.3	26.2	296°16.6	11.2′	15°14.0	13.8′	58.0′
17	75°22.0	26.2	310°46.8	11.1′	15°27.8	13.7′	57.9′
18	90°21.7	S23°26.2	325°16.9	11.1′	N15°41.5	13.6′	57.9′
19	105°21.4	26.2	339°47.0	11.0′	15°55.1	13.6′	57.9′
20	120°21.1	26.2	354°17.0	11.0′	16°08.7	13.4′	57.9′
21	135°20.7	·· 26.2	8°47.0	10.9′	16°22.1	13.4′	57.9′
22	150°20.4	26.2	23°16.9	10.9′	16°35.5	13.2′	57.9′
23	165°20.1	26.1	37°46.8	10.8′	16°48.7	13.2′	57.8′
	SD = 16.3′	d = -0.0′	SD = 15.9′				

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	180°19.8	S23°26.1	52°16.6	10.7′	N17°01.9	13.1′	57.8′
1	195°19.5	26.1	66°46.4	10.7′	17°15.0	13.0′	57.8′
2	210°19.2	26.1	81°16.0	10.6′	17°28.0	12.9′	57.8′
3	225°18.9	·· 26.1	95°45.7	10.6′	17°40.9	12.8′	57.8′
4	240°18.6	26.0	110°15.2	10.5′	17°53.7	12.6′	57.7′
5	255°18.3	26.0	124°44.7	10.4′	18°06.3	12.6′	57.7′
6	270°18.0	S23°26.0	139°14.2	10.4′	N18°18.9	12.5′	57.7′
7	285°17.6	26.0	153°43.6	10.3′	18°31.4	12.4′	57.7′
8	300°17.3	26.0	168°12.9	10.3′	18°43.8	12.3′	57.7′
9	315°17.0	·· 25.9	182°42.2	10.2′	18°56.1	12.2′	57.7′
10	330°16.7	25.9	197°11.4	10.1′	19°08.3	12.0′	57.6′
11	345°16.4	25.9	211°40.5	10.1′	19°20.3	12.0′	57.6′
12	0°16.1	S23°25.9	226°09.6	10.0′	N19°32.3	11.8′	57.6′
13	15°15.8	25.8	240°38.6	9.9′	19°44.1	11.8′	57.6′
14	30°15.5	25.8	255°07.5	9.9′	19°55.9	11.6′	57.6′
15	45°15.2	·· 25.8	269°36.4	9.8′	20°07.5	11.5′	57.5′
16	60°14.9	25.7	284°05.2	9.7′	20°19.0	11.4′	57.5′
17	75°14.5	25.7	298°33.9	9.7′	20°30.4	11.3′	57.5′
18	90°14.2	S23°25.7	313°02.6	9.6′	N20°41.7	11.2′	57.5′
19	105°13.9	25.7	327°31.2	9.6′	20°52.9	11.0′	57.5′
20	120°13.6	25.6	341°59.8	9.5′	21°03.9	10.9′	57.5′
21	135°13.3	·· 25.6	356°28.3	9.4′	21°14.8	10.8′	57.4′
22	150°13.0	25.6	10°56.7	9.4′	21°25.6	10.7′	57.4′
23	165°12.7	25.5	25°25.1	9.3′	21°36.3	10.6′	57.4′
	SD = 16.3′	d = 0.0′	SD = 15.8′				

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

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 64-83%
21	02:19	02:04	11:58	19:35	07:11	
22	01:49	01:34	11:58	20:24	07:59	
23	01:19	01:04	11:59	21:15	08:49	

December 24, 25, 26 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	92°16.0	221°10.8	S16°25.5	191°39.5	S23°37.8	58°29.0	N12°15.2	117°07.3	S12°05.5
1	107°18.4	236°10.2	26.3	206°39.9	38.0	73°31.5	15.2	132°09.6	05.4
2	122°20.9	251°09.7	27.1	221°40.4	38.1	88°34.1	15.2	147°11.9	05.3
3	137°23.3	266°09.1	·· 27.9	236°40.9	·· 38.3	103°36.6	·· 15.2	162°14.2	·· 05.3
4	152°25.8	281°08.5	28.7	251°41.3	38.4	118°39.1	15.2	177°16.4	05.2
5	167°28.3	296°08.0	29.5	266°41.8	38.5	133°41.6	15.2	192°18.7	05.1
6	182°30.7	311°07.4	S16°30.3	281°42.3	S23°38.7	148°44.2	N12°15.2	207°21.0	S12°05.0
7	197°33.2	326°06.8	31.1	296°42.7	38.8	163°46.7	15.2	222°23.3	05.0
8	212°35.7	341°06.2	31.9	311°43.2	39.0	178°49.2	15.2	237°25.5	04.9
9	227°38.1	356°05.7	·· 32.7	326°43.7	·· 39.1	193°51.7	·· 15.2	252°27.8	·· 04.8
10	242°40.6	11°05.1	33.5	341°44.1	39.3	208°54.3	15.2	267°30.1	04.7
11	257°43.1	26°04.5	34.2	356°44.6	39.4	223°56.8	15.2	282°32.4	04.7
12	272°45.5	41°04.0	S16°35.0	11°45.0	S23°39.5	238°59.3	N12°15.1	297°34.6	S12°04.6
13	287°48.0	56°03.4	35.8	26°45.5	39.7	254°01.8	15.1	312°36.9	04.5
14	302°50.4	71°02.8	36.6	41°46.0	39.8	269°04.4	15.1	327°39.2	04.4
15	317°52.9	86°02.2	·· 37.4	56°46.4	·· 39.9	284°06.9	·· 15.1	342°41.5	·· 04.4
16	332°55.4	101°01.7	38.2	71°46.9	40.1	299°09.4	15.1	357°43.8	04.3
17	347°57.8	116°01.1	39.0	86°47.3	40.2	314°11.9	15.1	12°46.0	04.2
18	3°00.3	131°00.5	S16°39.8	101°47.8	S23°40.4	329°14.5	N12°15.1	27°48.3	S12°04.1
19	18°02.8	145°59.9	40.6	116°48.3	40.5	344°17.0	15.1	42°50.6	04.1
20	33°05.2	160°59.3	41.4	131°48.7	40.6	359°19.5	15.1	57°52.9	04.0
21	48°07.7	175°58.8	·· 42.1	146°49.2	·· 40.8	14°22.0	·· 15.1	72°55.1	·· 03.9
22	63°10.2	190°58.2	42.9	161°49.6	40.9	29°24.5	15.1	87°57.4	03.8
23	78°12.6	205°57.6	43.7	176°50.1	41.0	44°27.1	15.1	102°59.7	03.8
Mer.pass. 17:48		ν -0.6′ d -0.8′ m -4.05		ν 0.5′ d -0.1′ m 1.37		ν 2.5′ d -0.0′ m -2.66		ν 2.3′ d 0.1′ m 0.93	

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	93°15.1	220°57.0	S16°44.5	191°50.6	S23°41.2	59°29.6	N12°15.1	118°02.0	S12°03.7
1	108°17.6	235°56.4	45.3	206°51.0	41.3	74°32.1	15.1	133°04.2	03.6
2	123°20.0	250°55.9	46.1	221°51.5	41.4	89°34.6	15.1	148°06.5	03.5
3	138°22.5	265°55.3	·· 46.8	236°51.9	·· 41.6	104°37.1	·· 15.1	163°08.8	·· 03.5
4	153°24.9	280°54.7	47.6	251°52.4	41.7	119°39.6	15.0	178°11.0	03.4
5	168°27.4	295°54.1	48.4	266°52.9	41.8	134°42.2	15.0	193°13.3	03.3
6	183°29.9	310°53.5	S16°49.2	281°53.3	S23°42.0	149°44.7	N12°15.0	208°15.6	S12°03.2
7	198°32.3	325°53.0	50.0	296°53.8	42.1	164°47.2	15.0	223°17.9	03.2
8	213°34.8	340°52.4	50.7	311°54.2	42.2	179°49.7	15.0	238°20.1	03.1
9	228°37.3	355°51.8	·· 51.5	326°54.7	·· 42.4	194°52.2	·· 15.0	253°22.4	·· 03.0
10	243°39.7	10°51.2	52.3	341°55.2	42.5	209°54.8	15.0	268°24.7	02.9
11	258°42.2	25°50.6	53.1	356°55.6	42.6	224°57.3	15.0	283°27.0	02.8
12	273°44.7	40°50.0	S16°53.9	11°56.1	S23°42.7	239°59.8	N12°15.0	298°29.2	S12°02.8
13	288°47.1	55°49.4	54.6	26°56.5	42.9	255°02.3	15.0	313°31.5	02.7
14	303°49.6	70°48.9	55.4	41°57.0	43.0	270°04.8	15.0	328°33.8	02.6
15	318°52.1	85°48.3	·· 56.2	56°57.4	·· 43.1	285°07.3	·· 15.0	343°36.1	·· 02.5
16	333°54.5	100°47.7	57.0	71°57.9	43.3	300°09.8	15.0	358°38.3	02.5
17	348°57.0	115°47.1	57.7	86°58.4	43.4	315°12.4	15.0	13°40.6	02.4
18	3°59.4	130°46.5	S16°58.5	101°58.8	S23°43.5	330°14.9	N12°15.0	28°42.9	S12°02.3
19	19°01.9	145°45.9	16°59.3	116°59.3	43.6	345°17.4	15.0	43°45.1	02.2
20	34°04.4	160°45.3	17°00.0	131°59.7	43.8	0°19.9	15.0	58°47.4	02.2
21	49°06.8	175°44.7	·· 00.8	147°00.2	·· 43.9	15°22.4	·· 15.0	73°49.7	·· 02.1
22	64°09.3	190°44.1	01.6	162°00.6	44.0	30°24.9	15.0	88°52.0	02.0
23	79°11.8	205°43.5	02.4	177°01.1	44.1	45°27.4	15.0	103°54.2	01.9
Mer.pass. 17:44		ν -0.6′ d -0.8′ m -4.05		ν 0.5′ d -0.1′ m 1.37		ν 2.5′ d -0.0′ m -2.65		ν 2.3′ d 0.1′ m 0.94	

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	94°14.2	220°43.0	S17°03.1	192°01.6	S23°44.3	60°29.9	N12°15.0	118°56.5	S12°01.9
1	109°16.7	235°42.4	03.9	207°02.0	44.4	75°32.5	15.0	133°58.8	01.8
2	124°19.2	250°41.8	04.7	222°02.5	44.5	90°35.0	15.0	149°01.0	01.7
3	139°21.6	265°41.2	·· 05.4	237°02.9	·· 44.6	105°37.5	·· 15.0	164°03.3	·· 01.6
4	154°24.1	280°40.6	06.2	252°03.4	44.8	120°40.0	15.0	179°05.6	01.5
5	169°26.6	295°40.0	07.0	267°03.8	44.9	135°42.5	15.0	194°07.9	01.5
6	184°29.0	310°39.4	S17°07.7	282°04.3	S23°45.0	150°45.0	N12°15.0	209°10.1	S12°01.4
7	199°31.5	325°38.8	08.5	297°04.7	45.1	165°47.5	15.0	224°12.4	01.3
8	214°33.9	340°38.2	09.2	312°05.2	45.2	180°50.0	15.0	239°14.7	01.2
9	229°36.4	355°37.6	·· 10.0	327°05.7	·· 45.4	195°52.5	·· 15.0	254°16.9	·· 01.2
10	244°38.9	10°37.0	10.8	342°06.1	45.5	210°55.0	15.0	269°19.2	01.1
11	259°41.3	25°36.4	11.5	357°06.6	45.6	225°57.5	14.9	284°21.5	01.0
12	274°43.8	40°35.8	S17°12.3	12°07.0	S23°45.7	241°00.1	N12°14.9	299°23.8	S12°00.9
13	289°46.3	55°35.2	13.1	27°07.5	45.8	256°02.6	14.9	314°26.0	00.9
14	304°48.7	70°34.6	13.8	42°07.9	46.0	271°05.1	14.9	329°28.3	00.8
15	319°51.2	85°34.0	·· 14.6	57°08.4	·· 46.1	286°07.6	·· 14.9	344°30.6	·· 00.7
16	334°53.7	100°33.4	15.3	72°08.8	46.2	301°10.1	14.9	359°32.8	00.6
17	349°56.1	115°32.8	16.1	87°09.3	46.3	316°12.6	14.9	14°35.1	00.5
18	4°58.6	130°32.2	S17°16.8	102°09.7	S23°46.4	331°15.1	N12°14.9	29°37.4	S12°00.5
19	20°01.1	145°31.6	17.6	117°10.2	46.5	346°17.6	14.9	44°39.6	00.4
20	35°03.5	160°31.0	18.3	132°10.7	46.7	1°20.1	14.9	59°41.9	00.3
21	50°06.0	175°30.4	·· 19.1	147°11.1	·· 46.8	16°22.6	·· 14.9	74°44.2	·· 00.2
22	65°08.4	190°29.8	19.9	162°11.6	46.9	31°25.1	14.9	89°46.4	00.2
23	80°10.9	205°29.2	20.6	177°12.0	47.0	46°27.6	14.9	104°48.7	00.1
Mer.pass. 17:40		ν -0.6′ d -0.8′ m -4.05		ν 0.5′ d -0.1′ m 1.37		ν 2.5′ d -0.0′ m -2.64		ν 2.3′ d 0.1′ m 0.94	

Stars

	SHA	**Dec**
Alpheratz	357°35.7	29°13.5
Ankaa	353°08.0	-42°10.8
Schedar	349°32.0	56°40.4
Diphda	348°48.1	-17°51.4
Achernar	335°20.6	-57°07.2
Hamal	327°52.0	23°34.6
Polaris	314°06.0	89°22.1
Acamar	315°12.1	-40°12.7
Menkar	314°06.8	4°11.0
Mirfak	308°29.1	49°56.9
Aldebaran	290°40.3	16°33.5
Rigel	281°04.4	-8°10.4
Capella	280°22.7	46°01.4
Bellatrix	278°23.5	6°22.3
Elnath	278°02.6	28°37.7
Alnilam	275°38.3	-1°11.2
Betelgeuse	270°52.7	7°24.7
Canopus	263°52.2	-52°42.4
Sirius	258°26.7	-16°44.9
Adhara	255°06.2	-29°00.2
Procyon	244°51.4	5°09.8
Pollux	243°18.0	27°58.0
Avior	234°14.5	-59°34.9
Suhail	222°46.6	-43°31.5
Miaplacidus	221°37.8	-69°48.6
Alphard	217°48.4	-8°45.7
Regulus	207°35.2	11°51.0
Dubhe	193°41.9	61°37.0
Denebola	182°25.8	14°26.2
Gienah	175°44.5	-17°40.4
Acrux	173°01.2	-63°13.6
Gacrux	171°52.7	-57°14.5
Alioth	166°13.8	55°49.5
Spica	158°23.3	-11°17.1
Alkaid	152°52.9	49°11.4
Hadar	148°37.6	-60°29.0
Menkent	147°58.9	-36°29.1
Arcturus	145°48.9	19°03.4
Rigil Kent.	139°41.9	-60°55.8
Kochab	137°20.6	74°03.1
Zuben'ubi	136°57.2	-16°08.4
Alphecca	126°04.8	26°37.9
Antares	112°17.3	-26°29.0
Atria	107°12.8	-69°04.1
Sabik	102°04.1	-15°45.3
Shaula	96°12.0	-37°07.2
Rasalhague	95°59.7	12°32.5
Eltanin	90°43.1	51°29.1
Kaus Aust.	83°34.1	-34°22.4
Vega	80°34.3	38°48.3
Nunki	75°49.2	-26°16.1
Altair	62°01.1	8°55.9
Peacock	53°07.6	-56°39.7
Deneb	49°26.8	45°22.0
Enif	33°39.9	9°59.1
Al Na'ir	27°34.3	-46°50.9
Fomalhaut	15°15.6	-29°29.9
Scheat	13°46.2	28°12.9
Markab	13°30.9	15°20.1

Dec 24 Sun	**SHA**	**Mer.pass**
Venus	128°54.8	09:16
Mars	99°23.5	11:13
Jupiter	326°13.1	20:03
Saturn	24°51.4	16:09

Dec 25 Mon	**SHA**	**Mer.pass**
Venus	127°41.9	09:17
Mars	98°35.5	11:12
Jupiter	326°14.5	19:59
Saturn	24°46.9	16:05

Dec 26 Tue	**SHA**	**Mer.pass**
Venus	126°28.7	09:18
Mars	97°47.3	11:12
Jupiter	326°15.7	19:55
Saturn	24°42.3	16:02

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°12.4	S23°25.5	39°53.4	9.2′	N21°46.9	10.4′	57.4′
1	195°12.1	25.4	54°21.6	9.2′	21°57.3	10.4′	57.4′
2	210°11.8	25.4	68°49.8	9.1′	22°07.7	10.1′	57.3′
3	225°11.4	·· 25.4	83°17.9	9.0′	22°17.8	10.1′	57.3′
4	240°11.1	25.3	97°46.0	9.0′	22°27.9	9.9′	57.3′
5	255°10.8	25.3	112°14.0	8.9′	22°37.8	9.9′	57.3′
6	270°10.5	S23°25.2	126°41.9	8.9′	N22°47.7	9.6′	57.3′
7	285°10.2	25.2	141°09.7	8.8′	22°57.3	9.6′	57.2′
8	300°09.9	25.2	155°37.5	8.7′	23°06.9	9.4′	57.2′
9	315°09.6	·· 25.1	170°05.3	8.7′	23°16.3	9.3′	57.2′
10	330°09.3	25.1	184°33.0	8.6′	23°25.6	9.1′	57.2′
11	345°09.0	25.0	199°00.6	8.6′	23°34.7	9.0′	57.2′
12	0°08.7	S23°25.0	213°28.1	8.5′	N23°43.7	8.9′	57.1′
13	15°08.3	24.9	227°55.6	8.4′	23°52.6	8.7′	57.1′
14	30°08.0	24.9	242°23.1	8.4′	24°01.3	8.6′	57.1′
15	45°07.7	·· 24.8	256°50.5	8.3′	24°09.9	8.5′	57.1′
16	60°07.4	24.8	271°17.8	8.3′	24°18.4	8.3′	57.1′
17	75°07.1	24.7	285°45.1	8.2′	24°26.7	8.2′	57.0′
18	90°06.8	S23°24.7	300°12.3	8.2′	N24°34.9	8.0′	57.0′
19	105°06.5	24.6	314°39.5	8.1′	24°42.9	7.9′	57.0′
20	120°06.2	24.6	329°06.6	8.1′	24°50.8	7.7′	57.0′
21	135°05.9	·· 24.5	343°33.7	8.0′	24°58.5	7.6′	57.0′
22	150°05.6	24.5	358°00.7	8.0′	25°06.1	7.5′	56.9′
23	165°05.2	24.4	12°27.6	7.9′	25°13.6	7.3′	56.9′
	SD = 16.3′	d = 0.0′	SD = 15.6′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°04.9	S23°24.4	26°54.5	7.9′	N25°20.9	7.1′	56.9′
1	195°04.6	24.3	41°21.4	7.8′	25°28.0	7.0′	56.9′
2	210°04.3	24.3	55°48.2	7.8′	25°35.0	6.9′	56.9′
3	225°04.0	·· 24.2	70°15.0	7.7′	25°41.9	6.7′	56.8′
4	240°03.7	24.1	84°41.7	7.7′	25°48.6	6.6′	56.8′
5	255°03.4	24.1	99°08.4	7.6′	25°55.2	6.4′	56.8′
6	270°03.1	S23°24.0	113°35.0	7.6′	N26°01.6	6.2′	56.8′
7	285°02.8	24.0	128°01.6	7.6′	26°07.8	6.2′	56.8′
8	300°02.5	23.9	142°28.2	7.5′	26°14.0	5.9′	56.7′
9	315°02.2	·· 23.8	156°54.7	7.5′	26°19.9	5.8′	56.7′
10	330°01.8	23.8	171°21.2	7.5′	26°25.7	5.6′	56.7′
11	345°01.5	23.7	185°47.7	7.4′	26°31.3	5.5′	56.7′
12	0°01.2	S23°23.6	200°14.1	7.4′	N26°36.8	5.4′	56.7′
13	15°00.9	23.6	214°40.5	7.4′	26°42.2	5.1′	56.6′
14	30°00.6	23.5	229°06.8	7.3′	26°47.3	5.1′	56.6′
15	45°00.3	·· 23.4	243°33.1	7.3′	26°52.4	4.8′	56.6′
16	60°00.0	23.4	257°59.4	7.3′	26°57.2	4.7′	56.6′
17	74°59.7	23.3	272°25.7	7.2′	27°01.9	4.6′	56.6′
18	89°59.4	S23°23.2	286°52.0	7.2′	N27°06.5	4.4′	56.5′
19	104°59.1	23.2	301°18.2	7.2′	27°10.9	4.2′	56.5′
20	119°58.8	23.1	315°44.4	7.2′	27°15.1	4.1′	56.5′
21	134°58.4	·· 23.0	330°10.6	7.2′	27°19.2	3.9′	56.5′
22	149°58.1	22.9	344°36.7	7.1′	27°23.1	3.7′	56.5′
23	164°57.8	22.9	359°02.9	7.1′	27°26.8	3.6′	56.4′
	SD = 16.3′	d = 0.1′	SD = 15.5′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°57.5	S23°22.8	13°29.0	7.1′	N27°30.4	3.4′	56.4′
1	194°57.2	22.7	27°55.1	7.1′	27°33.8	3.3′	56.4′
2	209°56.9	22.6	42°21.2	7.1′	27°37.1	3.1′	56.4′
3	224°56.6	·· 22.6	56°47.3	7.1′	27°40.2	3.0′	56.4′
4	239°56.3	22.5	71°13.4	7.1′	27°43.2	2.8′	56.3′
5	254°56.0	22.4	85°39.5	7.1′	27°46.0	2.6′	56.3′
6	269°55.7	S23°22.3	100°05.6	7.1′	N27°48.6	2.5′	56.3′
7	284°55.4	22.2	114°31.6	7.1′	27°51.1	2.3′	56.3′
8	299°55.1	22.2	128°57.7	7.1′	27°53.4	2.1′	56.2′
9	314°54.7	·· 22.1	143°23.8	7.1′	27°55.5	2.0′	56.2′
10	329°54.4	22.0	157°49.9	7.1′	27°57.5	1.8′	56.2′
11	344°54.1	21.9	172°16.0	7.1′	27°59.3	1.7′	56.2′
12	359°53.8	S23°21.8	186°42.1	7.1′	N28°01.0	1.5′	56.2′
13	14°53.5	21.7	201°08.2	7.1′	28°02.5	1.3′	56.1′
14	29°53.2	21.7	215°34.3	7.1′	28°03.8	1.2′	56.1′
15	44°52.9	·· 21.6	230°00.4	7.1′	28°05.0	1.0′	56.1′
16	59°52.6	21.5	244°26.5	7.2′	28°06.0	0.9′	56.1′
17	74°52.3	21.4	258°52.7	7.2′	28°06.9	0.6′	56.1′
18	89°52.0	S23°21.3	273°18.9	7.2′	N28°07.5	0.6′	56.0′
19	104°51.7	21.2	287°45.0	7.2′	28°08.1	0.4′	56.0′
20	119°51.4	21.1	302°11.3	7.2′	28°08.5	0.2′	56.0′
21	134°51.1	·· 21.0	316°37.5	7.3′	28°08.7	0.0′	56.0′
22	149°50.7	20.9	331°03.8	7.3′	28°08.7	0.1′	56.0′
23	164°50.4	20.8	345°30.0	7.3′	28°08.6	0.2′	55.9′
	SD = 16.3′	d = 0.1′	SD = 15.4′				

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

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

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 12-14 90-99%
24	00:49	00:35	11:59	22:08	09:41	
25	00:20	00:05	12:00	23:04	10:36	
26	00:10	00:25	12:00	–:–	11:32	

December 27, 28, 29 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	95°13.4	220°28.6	S17°21.4	192°12.5	S23°47.1	61°30.1	N12°14.9	119°51.0	S12°00.0
1	110°15.8	235°28.0	22.1	207°12.9	47.2	76°32.6	14.9	134°53.3	11°59.9
2	125°18.3	250°27.4	22.9	222°13.4	47.3	91°35.1	14.9	149°55.5	59.8
3	140°20.8	265°26.7	·· 23.6	237°13.8	·· 47.4	106°37.6	·· 14.9	164°57.8	·· 59.8
4	155°23.2	280°26.1	24.4	252°14.3	47.6	121°40.1	14.9	180°00.1	59.7
5	170°25.7	295°25.5	25.1	267°14.7	47.7	136°42.6	14.9	195°02.3	59.6
6	185°28.2	310°24.9	S17°25.9	282°15.2	S23°47.8	151°45.1	N12°14.9	210°04.6	S11°59.5
7	200°30.6	325°24.3	26.6	297°15.6	47.9	166°47.6	14.9	225°06.9	59.5
8	215°33.1	340°23.7	27.3	312°16.1	48.0	181°50.1	14.9	240°09.1	59.4
9	230°35.6	355°23.1	·· 28.1	327°16.5	·· 48.1	196°52.6	·· 14.9	255°11.4	·· 59.3
10	245°38.0	10°22.5	28.8	342°17.0	48.2	211°55.1	15.0	270°13.7	59.2
11	260°40.5	25°21.9	29.6	357°17.4	48.3	226°57.6	15.0	285°15.9	59.1
12	275°42.9	40°21.3	S17°30.3	12°17.9	S23°48.4	242°00.1	N12°15.0	300°18.2	S11°59.1
13	290°45.4	55°20.6	31.1	27°18.3	48.6	257°02.6	15.0	315°20.5	59.0
14	305°47.9	70°20.0	31.8	42°18.8	48.7	272°05.1	15.0	330°22.7	58.9
15	320°50.3	85°19.4	·· 32.6	57°19.2	·· 48.8	287°07.6	·· 15.0	345°25.0	·· 58.8
16	335°52.8	100°18.8	33.3	72°19.7	48.9	302°10.1	15.0	0°27.3	58.7
17	350°55.3	115°18.2	34.0	87°20.1	49.0	317°12.6	15.0	15°29.5	58.7
18	5°57.7	130°17.6	S17°34.8	102°20.6	S23°49.1	332°15.1	N12°15.0	30°31.8	S11°58.6
19	21°00.2	145°17.0	35.5	117°21.0	49.2	347°17.6	15.0	45°34.1	58.5
20	36°02.7	160°16.3	36.2	132°21.5	49.3	2°20.1	15.0	60°36.3	58.4
21	51°05.1	175°15.7	·· 37.0	147°21.9	·· 49.4	17°22.6	·· 15.0	75°38.6	·· 58.4
22	66°07.6	190°15.1	37.7	162°22.4	49.5	32°25.1	15.0	90°40.9	58.3
23	81°10.1	205°14.5	38.5	177°22.8	49.6	47°27.6	15.0	105°43.1	58.2
Mer.pass. 17:36		ν -0.6′ d -0.8′ m -4.04		ν 0.5′ d -0.1′ m 1.37		ν 2.5′ d 0.0′ m -2.63		ν 2.3′ d 0.1′ m 0.94	

Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	96°12.5	220°13.9	S17°39.2	192°23.3	S23°49.7	62°30.1	N12°15.0	120°45.4	S11°58.1
1	111°15.0	235°13.3	39.9	207°23.7	49.8	77°32.6	15.0	135°47.7	58.0
2	126°17.4	250°12.6	40.7	222°24.2	49.9	92°35.1	15.0	150°49.9	58.0
3	141°19.9	265°12.0	·· 41.4	237°24.6	·· 50.0	107°37.6	·· 15.0	165°52.2	·· 57.9
4	156°22.4	280°11.4	42.1	252°25.1	50.1	122°40.1	15.0	180°54.5	57.8
5	171°24.8	295°10.8	42.8	267°25.5	50.2	137°42.5	15.0	195°56.7	57.7
6	186°27.3	310°10.2	S17°43.6	282°26.0	S23°50.3	152°45.0	N12°15.0	210°59.0	S11°57.6
7	201°29.8	325°09.5	44.3	297°26.4	50.4	167°47.5	15.0	226°01.3	57.6
8	216°32.2	340°08.9	45.0	312°26.9	50.5	182°50.0	15.0	241°03.5	57.5
9	231°34.7	355°08.3	·· 45.8	327°27.3	·· 50.6	197°52.5	·· 15.0	256°05.8	·· 57.4
10	246°37.2	10°07.7	46.5	342°27.8	50.7	212°55.0	15.0	271°08.1	57.3
11	261°39.6	25°07.0	47.2	357°28.2	50.8	227°57.5	15.0	286°10.3	57.2
12	276°42.1	40°06.4	S17°47.9	12°28.7	S23°50.9	243°00.0	N12°15.0	301°12.6	S11°57.2
13	291°44.6	55°05.8	48.7	27°29.1	51.0	258°02.5	15.0	316°14.8	57.1
14	306°47.0	70°05.2	49.4	42°29.6	51.1	273°05.0	15.0	331°17.1	57.0
15	321°49.5	85°04.5	·· 50.1	57°30.0	·· 51.2	288°07.5	·· 15.0	346°19.4	·· 56.9
16	336°51.9	100°03.9	50.8	72°30.5	51.3	303°09.9	15.0	1°21.6	56.9
17	351°54.4	115°03.3	51.6	87°30.9	51.4	318°12.4	15.1	16°23.9	56.8
18	6°56.9	130°02.6	S17°52.3	102°31.4	S23°51.5	333°14.9	N12°15.1	31°26.2	S11°56.7
19	21°59.3	145°02.0	53.0	117°31.8	51.6	348°17.4	15.1	46°28.4	56.6
20	37°01.8	160°01.4	53.7	132°32.2	51.7	3°19.9	15.1	61°30.7	56.5
21	52°04.3	175°00.8	·· 54.4	147°32.7	·· 51.8	18°22.4	·· 15.1	76°33.0	·· 56.5
22	67°06.7	190°00.1	55.2	162°33.1	51.9	33°24.9	15.1	91°35.2	56.4
23	82°09.2	204°59.5	55.9	177°33.6	52.0	48°27.4	15.1	106°37.5	56.3
Mer.pass. 17:32		ν -0.6′ d -0.7′ m -4.04		ν 0.4′ d -0.1′ m 1.37		ν 2.5′ d 0.0′ m -2.62		ν 2.3′ d 0.1′ m 0.94	

Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	97°11.7	219°58.9	S17°56.6	192°34.0	S23°52.1	63°29.8	N12°15.1	121°39.7	S11°56.2
1	112°14.1	234°58.2	57.3	207°34.5	52.2	78°32.3	15.1	136°42.0	56.1
2	127°16.6	249°57.6	58.0	222°34.9	52.3	93°34.8	15.1	151°44.3	56.1
3	142°19.0	264°57.0	·· 58.7	237°35.4	·· 52.4	108°37.3	·· 15.1	166°46.5	·· 56.0
4	157°21.5	279°56.3	17°59.5	252°35.8	52.4	123°39.8	15.1	181°48.8	55.9
5	172°24.0	294°55.7	18°00.2	267°36.3	52.5	138°42.3	15.1	196°51.1	55.8
6	187°26.4	309°55.1	S18°00.9	282°36.7	S23°52.6	153°44.8	N12°15.1	211°53.3	S11°55.7
7	202°28.9	324°54.4	01.6	297°37.2	52.7	168°47.2	15.1	226°55.6	55.7
8	217°31.4	339°53.8	02.3	312°37.6	52.8	183°49.7	15.1	241°57.8	55.6
9	232°33.8	354°53.2	·· 03.0	327°38.0	·· 52.9	198°52.2	·· 15.2	257°00.1	·· 55.5
10	247°36.3	9°52.5	03.7	342°38.5	53.0	213°54.7	15.2	272°02.4	55.4
11	262°38.8	24°51.9	04.4	357°38.9	53.1	228°57.2	15.2	287°04.6	55.3
12	277°41.2	39°51.3	S18°05.1	12°39.4	S23°53.2	243°59.7	N12°15.2	302°06.9	S11°55.3
13	292°43.7	54°50.6	05.8	27°39.8	53.3	259°02.1	15.2	317°09.2	55.2
14	307°46.2	69°50.0	06.5	42°40.3	53.3	274°04.6	15.2	332°11.4	55.1
15	322°48.6	84°49.3	·· 07.3	57°40.7	·· 53.4	289°07.1	·· 15.2	347°13.7	·· 55.0
16	337°51.1	99°48.7	08.0	72°41.2	53.5	304°09.6	15.2	2°15.9	54.9
17	352°53.5	114°48.1	08.7	87°41.6	53.6	319°12.1	15.2	17°18.2	54.8
18	7°56.0	129°47.4	S18°09.4	102°42.0	S23°53.7	334°14.5	N12°15.2	32°20.5	S11°54.8
19	22°58.5	144°46.8	10.1	117°42.5	53.8	349°17.0	15.2	47°22.7	54.7
20	38°00.9	159°46.1	10.8	132°42.9	53.9	4°19.5	15.2	62°25.0	54.6
21	53°03.4	174°45.5	·· 11.5	147°43.4	·· 53.9	19°22.0	·· 15.2	77°27.2	·· 54.5
22	68°05.9	189°44.9	12.2	162°43.8	54.0	34°24.5	15.3	92°29.5	54.4
23	83°08.3	204°44.2	12.9	177°44.3	54.1	49°26.9	15.3	107°31.8	54.4
Mer.pass. 17:28		ν -0.6′ d -0.7′ m -4.03		ν 0.4′ d -0.1′ m 1.37		ν 2.5′ d 0.0′ m -2.62		ν 2.3′ d 0.1′ m 0.95	

Stars	SHA	Dec
Alpheratz	357°35.7	29°13.5
Ankaa	353°08.0	-42°10.8
Schedar	349°32.0	56°40.4
Diphda	348°48.1	-17°51.5
Achernar	335°20.6	-57°07.2
Hamal	327°52.0	23°34.6
Polaris	314°06.7	89°22.2
Acamar	315°12.1	-40°12.7
Menkar	314°06.8	4°11.0
Mirfak	308°29.1	49°56.9
Aldebaran	290°40.3	16°33.5
Rigel	281°04.4	-8°10.4
Capella	280°22.7	46°01.4
Bellatrix	278°23.5	6°22.3
Elnath	278°02.6	28°37.7
Alnilam	275°38.3	-1°11.2
Betelgeuse	270°52.7	7°24.7
Canopus	263°52.2	-52°42.4
Sirius	258°26.6	-16°44.9
Adhara	255°06.2	-29°00.2
Procyon	244°51.4	5°09.8
Pollux	243°18.0	27°58.0
Avior	234°14.5	-59°35.0
Suhail	222°46.6	-43°31.6
Miaplacidus	221°37.7	-69°48.6
Alphard	217°48.4	-8°45.7
Regulus	207°35.2	11°51.0
Dubhe	193°41.8	61°37.0
Denebola	182°25.8	14°26.2
Gienah	175°44.5	-17°40.4
Acrux	173°01.1	-63°13.6
Gacrux	171°52.7	-57°14.5
Alioth	166°13.8	55°49.5
Spica	158°23.3	-11°17.1
Alkaid	152°52.9	49°11.4
Hadar	148°37.6	-60°29.0
Menkent	147°58.8	-36°29.1
Arcturus	145°48.9	19°03.4
Rigil Kent.	139°41.9	-60°55.8
Kochab	137°20.5	74°03.1
Zuben'ubi	136°57.2	-16°08.4
Alphecca	126°04.8	26°37.9
Antares	112°17.2	-26°29.0
Atria	107°12.8	-69°04.1
Sabik	102°04.1	-15°45.3
Shaula	96°12.0	-37°07.2
Rasalhague	95°59.7	12°32.5
Eltanin	90°43.1	51°29.0
Kaus Aust.	83°34.1	-34°22.4
Vega	80°34.2	38°48.3
Nunki	75°49.2	-26°16.1
Altair	62°01.1	8°55.9
Peacock	53°07.6	-56°39.6
Deneb	49°26.8	45°22.0
Enif	33°39.9	9°59.1
Al Na'ir	27°34.3	-46°50.9
Fomalhaut	15°15.6	-29°29.9
Scheat	13°46.2	28°12.9
Markab	13°30.9	15°20.1

Dec 27 Wed	**SHA**	**Mer.pass**
Venus	125°15.2	09:18
Mars	96°59.1	11:11
Jupiter	326°16.7	19:51
Saturn	24°37.6	15:58

Dec 28 Thu	**SHA**	**Mer.pass**
Venus	124°01.4	09:19
Mars	96°10.8	11:10
Jupiter	326°17.6	19:47
Saturn	24°32.9	15:55

Dec 29 Fri	**SHA**	**Mer.pass**
Venus	122°47.2	09:20
Mars	95°22.4	11:09
Jupiter	326°18.2	19:43
Saturn	24°28.1	15:51

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°50.1	S23°20.7	359°56.4	7.3′	N28°08.4	0.5′	55.9′
1	194°49.8	20.6	14°22.7	7.4′	28°07.9	0.5′	55.9′
2	209°49.5	20.6	28°49.1	7.4′	28°07.4	0.8′	55.9′
3	224°49.2	·· 20.5	43°15.5	7.5′	28°06.6	0.9′	55.8′
4	239°48.9	20.4	57°42.0	7.5′	28°05.7	1.0′	55.8′
5	254°48.6	20.3	72°08.5	7.5′	28°04.7	1.2′	55.8′
6	269°48.3	S23°20.2	86°35.0	7.6′	N28°03.5	1.4′	55.8′
7	284°48.0	20.1	101°01.6	7.6′	28°02.1	1.5′	55.8′
8	299°47.7	20.0	115°28.2	7.7′	28°00.6	1.7′	55.7′
9	314°47.4	·· 19.9	129°54.8	7.7′	27°58.9	1.8′	55.7′
10	329°47.1	19.8	144°21.5	7.8′	27°57.1	1.9′	55.7′
11	344°46.8	19.6	158°48.3	7.8′	27°55.2	2.2′	55.7′
12	359°46.4	S23°19.5	173°15.1	7.9′	N27°53.0	2.3′	55.7′
13	14°46.1	19.4	187°41.9	7.9′	27°50.7	2.4′	55.6′
14	29°45.8	19.3	202°08.9	8.0′	27°48.3	2.6′	55.6′
15	44°45.5	·· 19.2	216°35.8	8.0′	27°45.7	2.7′	55.6′
16	59°45.2	19.1	231°02.8	8.1′	27°43.0	2.9′	55.6′
17	74°44.9	19.0	245°29.9	8.1′	27°40.1	3.0′	55.6′
18	89°44.6	S23°18.9	259°57.0	8.2′	N27°37.1	3.2′	55.5′
19	104°44.3	18.8	274°24.2	8.3′	27°33.9	3.3′	55.5′
20	119°44.0	18.7	288°51.5	8.3′	27°30.6	3.4′	55.5′
21	134°43.7	·· 18.6	303°18.8	8.4′	27°27.2	3.6′	55.5′
22	149°43.4	18.5	317°46.2	8.4′	27°23.6	3.8′	55.5′
23	164°43.1	18.3	332°13.6	8.5′	27°19.8	3.9′	55.4′
	SD = 16.3′	d = 0.1′	SD = 15.2′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°42.8	S23°18.2	346°41.1	8.6′	N27°15.9	4.0′	55.4′
1	194°42.5	18.1	1°08.7	8.6′	27°11.9	4.2′	55.4′
2	209°42.2	18.0	15°36.4	8.7′	27°07.7	4.3′	55.4′
3	224°41.9	·· 17.9	30°04.1	8.8′	27°03.4	4.5′	55.4′
4	239°41.6	17.8	44°31.9	8.9′	26°58.9	4.6′	55.3′
5	254°41.2	17.6	58°59.7	8.9′	26°54.3	4.7′	55.3′
6	269°40.9	S23°17.5	73°27.7	9.0′	N26°49.6	4.9′	55.3′
7	284°40.6	17.4	87°55.7	9.1′	26°44.7	5.0′	55.3′
8	299°40.3	17.3	102°23.8	9.2′	26°39.7	5.1′	55.3′
9	314°40.0	·· 17.2	116°51.9	9.2′	26°34.6	5.3′	55.2′
10	329°39.7	17.0	131°20.2	9.3′	26°29.3	5.4′	55.2′
11	344°39.4	16.9	145°48.5	9.4′	26°23.9	5.5′	55.2′
12	359°39.1	S23°16.8	160°16.9	9.5′	N26°18.4	5.7′	55.2′
13	14°38.8	16.7	174°45.3	9.6′	26°12.7	5.8′	55.2′
14	29°38.5	16.5	189°13.9	9.6′	26°06.9	5.9′	55.2′
15	44°38.2	·· 16.4	203°42.5	9.7′	26°01.0	6.0′	55.1′
16	59°37.9	16.3	218°11.3	9.8′	25°55.0	6.2′	55.1′
17	74°37.6	16.2	232°40.1	9.9′	25°48.8	6.3′	55.1′
18	89°37.3	S23°16.0	247°09.0	10.0′	N25°42.5	6.4′	55.1′
19	104°37.0	15.9	261°37.9	10.1′	25°36.1	6.6′	55.1′
20	119°36.7	15.8	276°07.0	10.1′	25°29.5	6.6′	55.0′
21	134°36.4	·· 15.6	290°36.1	10.2′	25°22.9	6.8′	55.0′
22	149°36.1	15.5	305°05.4	10.3′	25°16.1	6.9′	55.0′
23	164°35.8	15.4	319°34.7	10.4′	25°09.2	7.1′	55.0′
	SD = 16.3′	d = 0.1′	SD = 15.1′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°35.5	S23°15.2	334°04.1	10.5′	N25°02.1	7.1′	55.0′
1	194°35.2	15.1	348°33.6	10.6′	24°55.0	7.3′	55.0′
2	209°34.8	15.0	3°03.1	10.7′	24°47.7	7.3′	54.9′
3	224°34.5	·· 14.8	17°32.8	10.8′	24°40.4	7.5′	54.9′
4	239°34.2	14.7	32°02.5	10.8′	24°32.9	7.6′	54.9′
5	254°33.9	14.6	46°32.4	10.9′	24°25.3	7.7′	54.9′
6	269°33.6	S23°14.4	61°02.3	11.0′	N24°17.6	7.8′	54.9′
7	284°33.3	14.3	75°32.3	11.1′	24°09.8	8.0′	54.8′
8	299°33.0	14.1	90°02.4	11.2′	24°01.8	8.0′	54.8′
9	314°32.7	·· 14.0	104°32.6	11.3′	23°53.8	8.2′	54.8′
10	329°32.4	13.9	119°02.9	11.4′	23°45.6	8.2′	54.8′
11	344°32.1	13.7	133°33.3	11.5′	23°37.4	8.4′	54.8′
12	359°31.8	S23°13.6	148°03.7	11.6′	N23°29.0	8.4′	54.8′
13	14°31.5	13.4	162°34.3	11.6′	23°20.6	8.6′	54.7′
14	29°31.2	13.3	177°04.9	11.7′	23°12.0	8.6′	54.7′
15	44°30.9	·· 13.1	191°35.7	11.8′	23°03.4	8.8′	54.7′
16	59°30.6	13.0	206°06.5	11.9′	22°54.6	8.8′	54.7′
17	74°30.3	12.8	220°37.4	12.0′	22°45.8	9.0′	54.7′
18	89°30.0	S23°12.7	235°08.4	12.1′	N22°36.8	9.1′	54.7′
19	104°29.7	12.6	249°39.5	12.2′	22°27.7	9.1′	54.7′
20	119°29.4	12.4	264°10.7	12.3′	22°18.6	9.2′	54.6′
21	134°29.1	·· 12.3	278°41.9	12.4′	22°09.4	9.4′	54.6′
22	149°28.8	12.1	293°13.3	12.4′	22°00.0	9.4′	54.6′
23	164°28.5	11.9	307°44.7	12.5′	21°50.6	9.5′	54.6′
	SD = 16.3′	d = 0.1′	SD = 15.0′				

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

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

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 15-17 100-96%
27	00:39	00:54	12:01	00:00	12:28	○
28	01:09	01:24	12:01	00:55	13:22	
29	01:38	01:53	12:02	01:47	14:12	

December 30, 31, 01 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	98°10.8	219°43.6	S18°13.6	192°44.7	S23°54.2	64°29.4	N12°15.3	122°34.0	S11°54.3
1	113°13.3	234°42.9	14.3	207°45.1	54.3	79°31.9	15.3	137°36.3	54.2
2	128°15.7	249°42.3	15.0	222°45.6	54.4	94°34.4	15.3	152°38.5	54.1
3	143°18.2	264°41.6	·· 15.7	237°46.0	·· 54.4	109°36.8	·· 15.3	167°40.8	·· 54.0
4	158°20.7	279°41.0	16.4	252°46.5	54.5	124°39.3	15.3	182°43.1	54.0
5	173°23.1	294°40.3	17.0	267°46.9	54.6	139°41.8	15.3	197°45.3	53.9
6	188°25.6	309°39.7	S18°17.7	282°47.4	S23°54.7	154°44.3	N12°15.3	212°47.6	S11°53.8
7	203°28.0	324°39.0	18.4	297°47.8	54.8	169°46.7	15.3	227°49.8	53.7
8	218°30.5	339°38.4	19.1	312°48.2	54.8	184°49.2	15.3	242°52.1	53.6
9	233°33.0	354°37.7	·· 19.8	327°48.7	·· 54.9	199°51.7	·· 15.4	257°54.4	·· 53.6
10	248°35.4	9°37.1	20.5	342°49.1	55.0	214°54.2	15.4	272°56.6	53.5
11	263°37.9	24°36.4	21.2	357°49.6	55.1	229°56.6	15.4	287°58.9	53.4
12	278°40.4	39°35.8	S18°21.9	12°50.0	S23°55.2	244°59.1	N12°15.4	303°01.1	S11°53.3
13	293°42.8	54°35.1	22.6	27°50.4	55.2	260°01.6	15.4	318°03.4	53.2
14	308°45.3	69°34.5	23.3	42°50.9	55.3	275°04.1	15.4	333°05.7	53.1
15	323°47.8	84°33.8	·· 23.9	57°51.3	·· 55.4	290°06.5	·· 15.4	348°07.9	·· 53.1
16	338°50.2	99°33.2	24.6	72°51.8	55.5	305°09.0	15.4	3°10.2	53.0
17	353°52.7	114°32.5	25.3	87°52.2	55.5	320°11.5	15.4	18°12.4	52.9
18	8°55.2	129°31.9	S18°26.0	102°52.6	S23°55.6	335°14.0	N12°15.5	33°14.7	S11°52.8
19	23°57.6	144°31.2	26.7	117°53.1	55.7	350°16.4	15.5	48°16.9	52.7
20	39°00.1	159°30.6	27.4	132°53.5	55.8	5°18.9	15.5	63°19.2	52.7
21	54°02.5	174°29.9	·· 28.0	147°54.0	·· 55.8	20°21.4	·· 15.5	78°21.5	·· 52.6
22	69°05.0	189°29.3	28.7	162°54.4	55.9	35°23.8	15.5	93°23.7	52.5
23	84°07.5	204°28.6	29.4	177°54.9	56.0	50°26.3	15.5	108°26.0	52.4
Mer.pass. 17:24		ν -0.6′ d -0.7′ m -4.03		ν 0.4′ d -0.1′ m 1.37		ν 2.5′ d 0.0′ m -2.61		ν 2.3′ d 0.1′ m 0.95	

Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	99°09.9	219°28.0	S18°30.1	192°55.3	S23°56.1	65°28.8	N12°15.5	123°28.2	S11°52.3
1	114°12.4	234°27.3	30.8	207°55.7	56.1	80°31.2	15.5	138°30.5	52.2
2	129°14.9	249°26.6	31.4	222°56.2	56.2	95°33.7	15.5	153°32.7	52.2
3	144°17.3	264°26.0	·· 32.1	237°56.6	·· 56.3	110°36.2	·· 15.6	168°35.0	·· 52.1
4	159°19.8	279°25.3	32.8	252°57.0	56.4	125°38.7	15.6	183°37.3	52.0
5	174°22.3	294°24.7	33.5	267°57.5	56.4	140°41.1	15.6	198°39.5	51.9
6	189°24.7	309°24.0	S18°34.2	282°57.9	S23°56.5	155°43.6	N12°15.6	213°41.8	S11°51.8
7	204°27.2	324°23.3	34.8	297°58.4	56.6	170°46.1	15.6	228°44.0	51.8
8	219°29.6	339°22.7	35.5	312°58.8	56.6	185°48.5	15.6	243°46.3	51.7
9	234°32.1	354°22.0	·· 36.2	327°59.2	·· 56.7	200°51.0	·· 15.6	258°48.5	·· 51.6
10	249°34.6	9°21.4	36.8	342°59.7	56.8	215°53.5	15.6	273°50.8	51.5
11	264°37.0	24°20.7	37.5	358°00.1	56.8	230°55.9	15.7	288°53.1	51.4
12	279°39.5	39°20.0	S18°38.2	13°00.6	S23°56.9	245°58.4	N12°15.7	303°55.3	S11°51.3
13	294°42.0	54°19.4	38.9	28°01.0	57.0	261°00.9	15.7	318°57.6	51.3
14	309°44.4	69°18.7	39.5	43°01.4	57.0	276°03.3	15.7	333°59.8	51.2
15	324°46.9	84°18.0	·· 40.2	58°01.9	·· 57.1	291°05.8	·· 15.7	349°02.1	·· 51.1
16	339°49.4	99°17.4	40.9	73°02.3	57.2	306°08.2	15.7	4°04.3	51.0
17	354°51.8	114°16.7	41.5	88°02.7	57.2	321°10.7	15.7	19°06.6	50.9
18	9°54.3	129°16.0	S18°42.2	103°03.2	S23°57.3	336°13.2	N12°15.8	34°08.8	S11°50.8
19	24°56.8	144°15.4	42.8	118°03.6	57.4	351°15.6	15.8	49°11.1	50.8
20	39°59.2	159°14.7	43.5	133°04.1	57.4	6°18.1	15.8	64°13.4	50.7
21	55°01.7	174°14.0	·· 44.2	148°04.5	·· 57.5	21°20.6	·· 15.8	79°15.6	·· 50.6
22	70°04.1	189°13.4	44.8	163°04.9	57.6	36°23.0	15.8	94°17.9	50.5
23	85°06.6	204°12.7	45.5	178°05.4	57.6	51°25.5	15.8	109°20.1	50.4
Mer.pass. 17:20		ν -0.7′ d -0.7′ m -4.02		ν 0.4′ d -0.1′ m 1.37		ν 2.5′ d 0.0′ m -2.60		ν 2.3′ d 0.1′ m 0.95	

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	100°09.1	219°12.0	S18°46.2	193°05.8	S23°57.7	66°27.9	N12°15.8	124°22.4	S11°50.3
1	115°11.5	234°11.4	46.8	208°06.2	57.7	81°30.4	15.9	139°24.6	50.3
2	130°14.0	249°10.7	47.5	223°06.7	57.8	96°32.9	15.9	154°26.9	50.2
3	145°16.5	264°10.0	·· 48.1	238°07.1	·· 57.9	111°35.3	·· 15.9	169°29.1	·· 50.1
4	160°18.9	279°09.4	48.8	253°07.6	57.9	126°37.8	15.9	184°31.4	50.0
5	175°21.4	294°08.7	49.4	268°08.0	58.0	141°40.2	15.9	199°33.6	49.9
6	190°23.9	309°08.0	S18°50.1	283°08.4	S23°58.0	156°42.7	N12°15.9	214°35.9	S11°49.8
7	205°26.3	324°07.3	50.8	298°08.9	58.1	171°45.2	15.9	229°38.2	49.8
8	220°28.8	339°06.7	51.4	313°09.3	58.2	186°47.6	16.0	244°40.4	49.7
9	235°31.3	354°06.0	·· 52.1	328°09.7	·· 58.2	201°50.1	·· 16.0	259°42.7	·· 49.6
10	250°33.7	9°05.3	52.7	343°10.2	58.3	216°52.5	16.0	274°44.9	49.5
11	265°36.2	24°04.6	53.4	358°10.6	58.3	231°55.0	16.0	289°47.2	49.4
12	280°38.6	39°04.0	S18°54.0	13°11.0	S23°58.4	246°57.5	N12°16.0	304°49.4	S11°49.3
13	295°41.1	54°03.3	54.7	28°11.5	58.5	261°59.9	16.0	319°51.7	49.3
14	310°43.6	69°02.6	55.3	43°11.9	58.5	277°02.4	16.1	334°53.9	49.2
15	325°46.0	84°01.9	·· 56.0	58°12.3	·· 58.6	292°04.8	·· 16.1	349°56.2	·· 49.1
16	340°48.5	99°01.3	56.6	73°12.8	58.6	307°07.3	16.1	4°58.4	49.0
17	355°51.0	114°00.6	57.3	88°13.2	58.7	322°09.7	16.1	20°00.7	48.9
18	10°53.4	128°59.9	S18°57.9	103°13.7	S23°58.7	337°12.2	N12°16.1	35°02.9	S11°48.8
19	25°55.9	143°59.2	58.5	118°14.1	58.8	352°14.6	16.1	50°05.2	48.8
20	40°58.4	158°58.6	59.2	133°14.5	58.8	7°17.1	16.2	65°07.4	48.7
21	56°00.8	173°57.9	18°59.8	148°15.0	·· 58.9	22°19.5	·· 16.2	80°09.7	·· 48.6
22	71°03.3	188°57.2	19°00.5	163°15.4	58.9	37°22.0	16.2	95°12.0	48.5
23	86°05.7	203°56.5	01.1	178°15.8	59.0	52°24.5	16.2	110°14.2	48.4
Mer.pass. 17:17		ν -0.7′ d -0.7′ m -4.02		ν 0.4′ d -0.1′ m 1.37		ν 2.5′ d 0.0′ m -2.59		ν 2.3′ d 0.1′ m 0.95	

Stars

	SHA	**Dec**
Alpheratz	357°35.7	29°13.5
Ankaa	353°08.0	-42°10.8
Schedar	349°32.0	56°40.4
Diphda	348°48.1	-17°51.5
Achernar	335°20.6	-57°07.2
Hamal	327°52.0	23°34.6
Polaris	314°07.8	89°22.2
Acamar	315°12.1	-40°12.7
Menkar	314°06.8	4°11.0
Mirfak	308°29.1	49°56.9
Aldebaran	290°40.3	16°33.5
Rigel	281°04.4	-8°10.5
Capella	280°22.7	46°01.4
Bellatrix	278°23.5	6°22.3
Elnath	278°02.6	28°37.7
Alnilam	275°38.3	-1°11.2
Betelgeuse	270°52.7	7°24.7
Canopus	263°52.2	-52°42.5
Sirius	258°26.6	-16°44.9
Adhara	255°06.1	-29°00.2
Procyon	244°51.4	5°09.8
Pollux	243°18.0	27°58.0
Avior	234°14.5	-59°35.0
Suhail	222°46.6	-43°31.6
Miaplacidus	221°37.7	-69°48.7
Alphard	217°48.3	-8°45.7
Regulus	207°35.1	11°51.0
Dubhe	193°41.8	61°37.0
Denebola	182°25.8	14°26.2
Gienah	175°44.4	-17°40.4
Acrux	173°01.1	-63°13.6
Gacrux	171°52.6	-57°14.5
Alioth	166°13.8	55°49.5
Spica	158°23.3	-11°17.1
Alkaid	152°52.8	49°11.4
Hadar	148°37.5	-60°29.0
Menkent	147°58.8	-36°29.1
Arcturus	145°48.8	19°03.3
Rigil Kent.	139°41.8	-60°55.8
Kochab	137°20.5	74°03.1
Zuben'ubi	136°57.2	-16°08.4
Alphecca	126°04.7	26°37.9
Antares	112°17.2	-26°29.0
Atria	107°12.7	-69°04.1
Sabik	102°04.1	-15°45.3
Shaula	96°11.9	-37°07.2
Rasalhague	95°59.7	12°32.5
Eltanin	90°43.1	51°29.0
Kaus Aust.	83°34.1	-34°22.4
Vega	80°34.2	38°48.3
Nunki	75°49.2	-26°16.1
Altair	62°01.1	8°55.9
Peacock	53°07.6	-56°39.6
Deneb	49°26.8	45°22.0
Enif	33°39.9	9°59.1
Al Na'ir	27°34.3	-46°50.9
Fomalhaut	15°15.6	-29°29.9
Scheat	13°46.2	28°12.9
Markab	13°30.9	15°20.1

Dec 30 Sat	**SHA**	**Mer.pass**
Venus	121°32.8	09:21
Mars	94°33.9	11:09
Jupiter	326°18.6	19:39
Saturn	24°23.2	15:47

Dec 31 Sun	**SHA**	**Mer.pass**
Venus	120°18.0	09:23
Mars	93°45.4	11:08
Jupiter	326°18.8	19:35
Saturn	24°18.3	15:44

Jan 01 Mon	**SHA**	**Mer.pass**
Venus	119°03.0	09:24
Mars	92°56.7	11:07
Jupiter	326°18.9	19:31
Saturn	24°13.3	15:40

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°28.2	S23°11.8	322°16.2	12.6′	N21°41.1	9.6′	54.6′
1	194°27.9	11.6	336°47.9	12.7′	21°31.5	9.7′	54.6′
2	209°27.6	11.5	351°19.6	12.8′	21°21.8	9.8′	54.6′
3	224°27.3	·· 11.3	5°51.4	12.9′	21°12.0	9.9′	54.5′
4	239°27.0	11.2	20°23.2	13.0′	21°02.1	9.9′	54.5′
5	254°26.7	11.0	34°55.2	13.0′	20°52.2	10.1′	54.5′
6	269°26.4	S23°10.9	49°27.2	13.1′	N20°42.1	10.1′	54.5′
7	284°26.1	10.7	63°59.4	13.2′	20°32.0	10.2′	54.5′
8	299°25.8	10.5	78°31.6	13.3′	20°21.8	10.3′	54.5′
9	314°25.5	·· 10.4	93°03.9	13.4′	20°11.5	10.4′	54.5′
10	329°25.2	10.2	107°36.3	13.5′	20°01.1	10.4′	54.4′
11	344°24.9	10.1	122°08.7	13.5′	19°50.7	10.5′	54.4′
12	359°24.6	S23°09.9	136°41.3	13.6′	N19°40.2	10.6′	54.4′
13	14°24.3	09.7	151°13.9	13.7′	19°29.6	10.7′	54.4′
14	29°24.0	09.6	165°46.6	13.8′	19°18.9	10.8′	54.4′
15	44°23.7	·· 09.4	180°19.4	13.9′	19°08.1	10.8′	54.4′
16	59°23.4	09.2	194°52.3	14.0′	18°57.3	10.9′	54.4′
17	74°23.1	09.1	209°25.2	14.0′	18°46.4	11.0′	54.4′
18	89°22.8	S23°08.9	223°58.3	14.1′	N18°35.4	11.0′	54.4′
19	104°22.5	08.7	238°31.4	14.2′	18°24.4	11.1′	54.3′
20	119°22.2	08.6	253°04.6	14.3′	18°13.3	11.2′	54.3′
21	134°21.9	·· 08.4	267°37.8	14.3′	18°02.1	11.3′	54.3′
22	149°21.6	08.2	282°11.2	14.4′	17°50.8	11.3′	54.3′
23	164°21.3	08.1	296°44.6	14.5′	17°39.5	11.4′	54.3′
	SD = 16.3′	d = 0.2′	SD = 14.9′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°21.0	S23°07.9	311°18.1	14.6′	N17°28.1	11.4′	54.3′
1	194°20.7	07.7	325°51.6	14.6′	17°16.7	11.5′	54.3′
2	209°20.4	07.5	340°25.3	14.7′	17°05.2	11.6′	54.3′
3	224°20.1	·· 07.4	354°59.0	14.8′	16°53.6	11.6′	54.3′
4	239°19.8	07.2	9°32.8	14.8′	16°42.0	11.7′	54.3′
5	254°19.5	07.0	24°06.6	14.9′	16°30.3	11.8′	54.2′
6	269°19.2	S23°06.8	38°40.5	15.0′	N16°18.5	11.8′	54.2′
7	284°18.9	06.7	53°14.5	15.1′	16°06.7	11.9′	54.2′
8	299°18.6	06.5	67°48.6	15.1′	15°54.8	11.9′	54.2′
9	314°18.3	·· 06.3	82°22.7	15.2′	15°42.9	12.0′	54.2′
10	329°18.0	06.1	96°56.9	15.3′	15°30.9	12.0′	54.2′
11	344°17.7	05.9	111°31.1	15.3′	15°18.9	12.1′	54.2′
12	359°17.4	S23°05.8	126°05.5	15.4′	N15°06.8	12.2′	54.2′
13	14°17.1	05.6	140°39.8	15.4′	14°54.6	12.2′	54.2′
14	29°16.8	05.4	155°14.3	15.5′	14°42.4	12.2′	54.2′
15	44°16.5	·· 05.2	169°48.8	15.6′	14°30.2	12.3′	54.2′
16	59°16.2	05.0	184°23.4	15.6′	14°17.9	12.4′	54.2′
17	74°15.9	04.8	198°58.0	15.7′	14°05.5	12.4′	54.2′
18	89°15.6	S23°04.6	213°32.7	15.7′	N13°53.1	12.5′	54.2′
19	104°15.3	04.5	228°07.4	15.8′	13°40.6	12.5′	54.1′
20	119°15.0	04.3	242°42.2	15.9′	13°28.1	12.5′	54.1′
21	134°14.7	·· 04.1	257°17.1	15.9′	13°15.6	12.6′	54.1′
22	149°14.4	03.9	271°52.0	16.0′	13°03.0	12.7′	54.1′
23	164°14.1	03.7	286°26.9	16.0′	12°50.3	12.6′	54.1′
	SD = 16.3′	d = 0.2′	SD = 14.8′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°13.8	S23°03.5	301°02.0	16.1′	N12°37.7	12.8′	54.1′
1	194°13.5	03.3	315°37.0	16.1′	12°24.9	12.8′	54.1′
2	209°13.2	03.1	330°12.2	16.2′	12°12.1	12.8′	54.1′
3	224°12.9	·· 02.9	344°47.3	16.2′	11°59.3	12.8′	54.1′
4	239°12.6	02.7	359°22.6	16.3′	11°46.5	12.9′	54.1′
5	254°12.3	02.5	13°57.8	16.3′	11°33.6	13.0′	54.1′
6	269°12.0	S23°02.3	28°33.1	16.4′	N11°20.6	13.0′	54.1′
7	284°11.7	02.1	43°08.5	16.4′	11°07.6	13.0′	54.1′
8	299°11.4	01.9	57°43.9	16.5′	10°54.6	13.0′	54.1′
9	314°11.2	·· 01.7	72°19.4	16.5′	10°41.6	13.1′	54.1′
10	329°10.9	01.5	86°54.9	16.5′	10°28.5	13.1′	54.1′
11	344°10.6	01.3	101°30.4	16.6′	10°15.4	13.2′	54.1′
12	359°10.3	S23°01.1	116°06.0	16.6′	N10°02.2	13.2′	54.1′
13	14°10.0	00.9	130°41.6	16.7′	09°49.0	13.2′	54.1′
14	29°09.7	00.7	145°17.2	16.7′	09°35.8	13.3′	54.1′
15	44°09.4	·· 00.5	159°52.9	16.7′	09°22.5	13.3′	54.1′
16	59°09.1	00.3	174°28.7	16.8′	09°09.2	13.3′	54.1′
17	74°08.8	23°00.1	189°04.4	16.8′	08°55.9	13.4′	54.1′
18	89°08.5	S22°59.9	203°40.2	16.8′	N08°42.5	13.4′	54.1′
19	104°08.2	59.7	218°16.1	16.9′	08°29.1	13.4′	54.1′
20	119°07.9	59.5	232°51.9	16.9′	08°15.7	13.5′	54.1′
21	134°07.6	·· 59.3	247°27.8	16.9′	08°02.2	13.4′	54.1′
22	149°07.3	59.1	262°03.7	17.0′	07°48.8	13.5′	54.1′
23	164°07.0	58.9	276°39.7	17.0′	07°35.3	13.6′	54.1′
	SD = 16.3′	d = 0.2′	SD = 14.8′				

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

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

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 18-20 91-78%
30	02:07	02:22	12:02	02:36	14:59	
31	02:36	02:50	12:03	03:21	15:42	
01	03:05	03:19	12:03	04:03	16:23	

Conversion of Arc to Time

0° - 59°			60° - 119°			120° - 179°			180° - 239°			240° - 299°			300° - 360°		
°	h	m	°	h	m	°	h	m	°	h	m	°	h	m	°	h	m
0	0	00	**60**	4	00	**120**	8	00	**180**	12	00	**240**	16	00	**300**	20	00
1	0	04	**61**	4	04	**121**	8	04	**181**	12	04	**241**	16	04	**301**	20	04
2	0	08	**62**	4	08	**122**	8	08	**182**	12	08	**242**	16	08	**302**	20	08
3	0	12	**63**	4	12	**123**	8	12	**183**	12	12	**243**	16	12	**303**	20	12
4	0	16	**64**	4	16	**124**	8	16	**184**	12	16	**244**	16	16	**304**	20	16
5	0	20	**65**	4	20	**125**	8	20	**185**	12	20	**245**	16	20	**305**	20	20
6	0	24	**66**	4	24	**126**	8	24	**186**	12	24	**246**	16	24	**306**	20	24
7	0	28	**67**	4	28	**127**	8	28	**187**	12	28	**247**	16	28	**307**	20	28
8	0	32	**68**	4	32	**128**	8	32	**188**	12	32	**248**	16	32	**308**	20	32
9	0	36	**69**	4	36	**129**	8	36	**189**	12	36	**249**	16	36	**309**	20	36
10	0	40	**70**	4	40	**130**	8	40	**190**	12	40	**250**	16	40	**310**	20	40
11	0	44	**71**	4	44	**131**	8	44	**191**	12	44	**251**	16	44	**311**	20	44
12	0	48	**72**	4	48	**132**	8	48	**192**	12	48	**252**	16	48	**312**	20	48
13	0	52	**73**	4	52	**133**	8	52	**193**	12	52	**253**	16	52	**313**	20	52
14	0	56	**74**	4	56	**134**	8	56	**194**	12	56	**254**	16	56	**314**	20	56
15	1	00	**75**	5	00	**135**	9	00	**195**	13	00	**255**	17	00	**315**	21	00
16	1	04	**76**	5	04	**136**	9	04	**196**	13	04	**256**	17	04	**316**	21	04
17	1	08	**77**	5	08	**137**	9	08	**197**	13	08	**257**	17	08	**317**	21	08
18	1	12	**78**	5	12	**138**	9	12	**198**	13	12	**258**	17	12	**318**	21	12
19	1	16	**79**	5	16	**139**	9	16	**199**	13	16	**259**	17	16	**319**	21	16
20	1	20	**80**	5	20	**140**	9	20	**200**	13	20	**260**	17	20	**320**	21	20
21	1	24	**81**	5	24	**141**	9	24	**201**	13	24	**261**	17	24	**321**	21	24
22	1	28	**82**	5	28	**142**	9	28	**202**	13	28	**262**	17	28	**322**	21	28
23	1	32	**83**	5	32	**143**	9	32	**203**	13	32	**263**	17	32	**323**	21	32
24	1	36	**84**	5	36	**144**	9	36	**204**	13	36	**264**	17	36	**324**	21	36
25	1	40	**85**	5	40	**145**	9	40	**205**	13	40	**265**	17	40	**325**	21	40
26	1	44	**86**	5	44	**146**	9	44	**206**	13	44	**266**	17	44	**326**	21	44
27	1	48	**87**	5	48	**147**	9	48	**207**	13	48	**267**	17	48	**327**	21	48
28	1	52	**88**	5	52	**148**	9	52	**208**	13	52	**268**	17	52	**328**	21	52
29	1	56	**89**	5	56	**149**	9	56	**209**	13	56	**269**	17	56	**329**	21	56
30	2	00	**90**	6	00	**150**	10	00	**210**	14	00	**270**	18	00	**330**	22	00
31	2	04	**91**	6	04	**151**	10	04	**211**	14	04	**271**	18	04	**331**	22	04
32	2	08	**92**	6	08	**152**	10	08	**212**	14	08	**272**	18	08	**332**	22	08
33	2	12	**93**	6	12	**153**	10	12	**213**	14	12	**273**	18	12	**333**	22	12
34	2	16	**94**	6	16	**154**	10	16	**214**	14	16	**274**	18	16	**334**	22	16
35	2	20	**95**	6	20	**155**	10	20	**215**	14	20	**275**	18	20	**335**	22	20
36	2	24	**96**	6	24	**156**	10	24	**216**	14	24	**276**	18	24	**336**	22	24
37	2	28	**97**	6	28	**157**	10	28	**217**	14	28	**277**	18	28	**337**	22	28
38	2	32	**98**	6	32	**158**	10	32	**218**	14	32	**278**	18	32	**338**	22	32
39	2	36	**99**	6	36	**159**	10	36	**219**	14	36	**279**	18	36	**339**	22	36
40	2	40	**100**	6	40	**160**	10	40	**220**	14	40	**280**	18	40	**340**	22	40
41	2	44	**101**	6	44	**161**	10	44	**221**	14	44	**281**	18	44	**341**	22	44
42	2	48	**102**	6	48	**162**	10	48	**222**	14	48	**282**	18	48	**342**	22	48
43	2	52	**103**	6	52	**163**	10	52	**223**	14	52	**283**	18	52	**343**	22	52
44	2	56	**104**	6	56	**164**	10	56	**224**	14	56	**284**	18	56	**344**	22	56
45	3	00	**105**	7	00	**165**	11	00	**225**	15	00	**285**	19	00	**345**	23	00
46	3	04	**106**	7	04	**166**	11	04	**226**	15	04	**286**	19	04	**346**	23	04
47	3	08	**107**	7	08	**167**	11	08	**227**	15	08	**287**	19	08	**347**	23	08
48	3	12	**108**	7	12	**168**	11	12	**228**	15	12	**288**	19	12	**348**	23	12
49	3	16	**109**	7	16	**169**	11	16	**229**	15	16	**289**	19	16	**349**	23	16
50	3	20	**110**	7	20	**170**	11	20	**230**	15	20	**290**	19	20	**350**	23	20
51	3	24	**111**	7	24	**171**	11	24	**231**	15	24	**291**	19	24	**351**	23	24
52	3	28	**112**	7	28	**172**	11	28	**232**	15	28	**292**	19	28	**352**	23	28
53	3	32	**113**	7	32	**173**	11	32	**233**	15	32	**293**	19	32	**353**	23	32
54	3	36	**114**	7	36	**174**	11	36	**234**	15	36	**294**	19	36	**354**	23	36
55	3	40	**115**	7	40	**175**	11	40	**235**	15	40	**295**	19	40	**355**	23	40
56	3	44	**116**	7	44	**176**	11	44	**236**	15	44	**296**	19	44	**356**	23	44
57	3	48	**117**	7	48	**177**	11	48	**237**	15	48	**297**	19	48	**357**	23	48
58	3	52	**118**	7	52	**178**	11	52	**238**	15	52	**298**	19	52	**358**	23	52
59	3	56	**119**	7	56	**179**	11	56	**239**	15	56	**299**	19	56	**359**	23	56
60	4	00	**120**	8	00	**180**	12	00	**240**	16	00	**300**	20	00	**360**	24	00

0′ - 59′			0″ - 59″	
′	m	s	″	s
0	0	00	**0**	0.00
1	0	04	**1**	0.07
2	0	08	**2**	0.13
3	0	12	**3**	0.20
4	0	16	**4**	0.27
5	0	20	**5**	0.33
6	0	24	**6**	0.40
7	0	28	**7**	0.47
8	0	32	**8**	0.53
9	0	36	**9**	0.60
10	0	40	**10**	0.67
11	0	44	**11**	0.73
12	0	48	**12**	0.80
13	0	52	**13**	0.87
14	0	56	**14**	0.93
15	1	00	**15**	1.00
16	1	04	**16**	1.07
17	1	08	**17**	1.13
18	1	12	**18**	1.20
19	1	16	**19**	1.27
20	1	20	**20**	1.33
21	1	24	**21**	1.40
22	1	28	**22**	1.47
23	1	32	**23**	1.53
24	1	36	**24**	1.60
25	1	40	**25**	1.67
26	1	44	**26**	1.73
27	1	48	**27**	1.80
28	1	52	**28**	1.87
29	1	56	**29**	1.93
30	2	00	**30**	2.00
31	2	04	**31**	2.07
32	2	08	**32**	2.13
33	2	12	**33**	2.20
34	2	16	**34**	2.27
35	2	20	**35**	2.33
36	2	24	**36**	2.40
37	2	28	**37**	2.47
38	2	32	**38**	2.53
39	2	36	**39**	2.60
40	2	40	**40**	2.67
41	2	44	**41**	2.73
42	2	48	**42**	2.80
43	2	52	**43**	2.87
44	2	56	**44**	2.93
45	3	00	**45**	3.00
46	3	04	**46**	3.07
47	3	08	**47**	3.13
48	3	12	**48**	3.20
49	3	16	**49**	3.27
50	3	20	**50**	3.33
51	3	24	**51**	3.40
52	3	28	**52**	3.47
53	3	32	**53**	3.53
54	3	36	**54**	3.60
55	3	40	**55**	3.67
56	3	44	**56**	3.73
57	3	48	**57**	3.80
58	3	52	**58**	3.87
59	3	56	**59**	3.93
60	4	00	**60**	4.00

h= hours of time **m**= minutes of time **s** = seconds of time **'** = minutes of arc **"** = seconds of arc

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 18	Sun Plan.	Aries	Moon	v and d corr		
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 19	Sun Plan.	Aries	Moon	v and d corr		
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 20	Sun Plan.	Aries	Moon	v and d corr		
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 57	Sun Plan.	Aries	Moon	v and d corr		
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 58	Sun Plan.	Aries	Moon	v and d corr		
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 59	Sun Plan.	Aries	Moon	v and d corr		
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

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 subtracted from 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		
18.4	**– 7.6**	60.5	130	**– 11.1**
18.8	**– 7.7**	62.1	135	**– 11.3**
19.3	**– 7.8**	63.8	140	**– 11.5**
19.8	**– 7.9**	65.4	145	**– 11.7**
20.4	**– 8.0**	67.1	150	**– 11.9**
20.9	**– 8.1**	68.8	155	**– 12.1**
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.
	Corr^n		Corr^n		Corr^n		Corr^n		Corr^n		Corr^n		Corr^n		Corr^n		Corr^n		Corr^n		Corr^n		
'	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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Penumbral Lunar Eclipse of 2023 May 05

Ecliptic Conjunction = 17:35:12.7 TD (= 17:33:59.2 UT)
Greatest Eclipse = 17:24:05.1 TD (= 17:22:51.7 UT)

Penumbral Magnitude = 0.9636 P. Radius = 1.2375° Gamma = -1.0349
Umbral Magnitude = -0.0457 U. Radius = 0.7089° Axis = 0.9947°

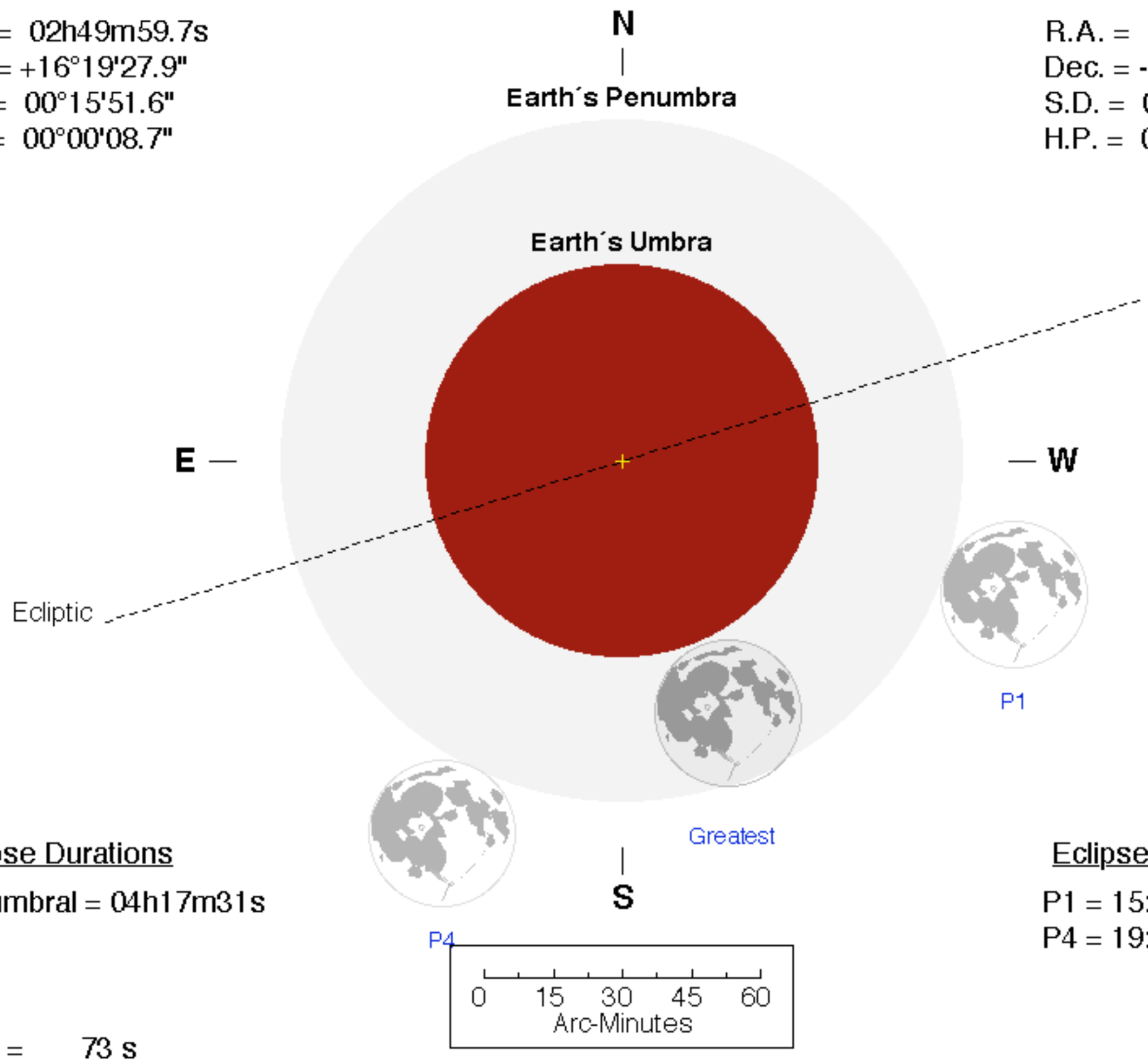
Saros Series = 141 Member = 24 of 73

Sun at Greatest Eclipse
(Geocentric Coordinates)

R.A. = 02h49m59.7s
Dec. = +16°19'27.9"
S.D. = 00°15'51.6"
H.P. = 00°00'08.7"

Moon at Greatest Eclipse
(Geocentric Coordinates)

R.A. = 14h48m23.5s
Dec. = -17°14'31.9"
S.D. = 00°15'42.8"
H.P. = 00°57'40.1"



Eclipse Durations

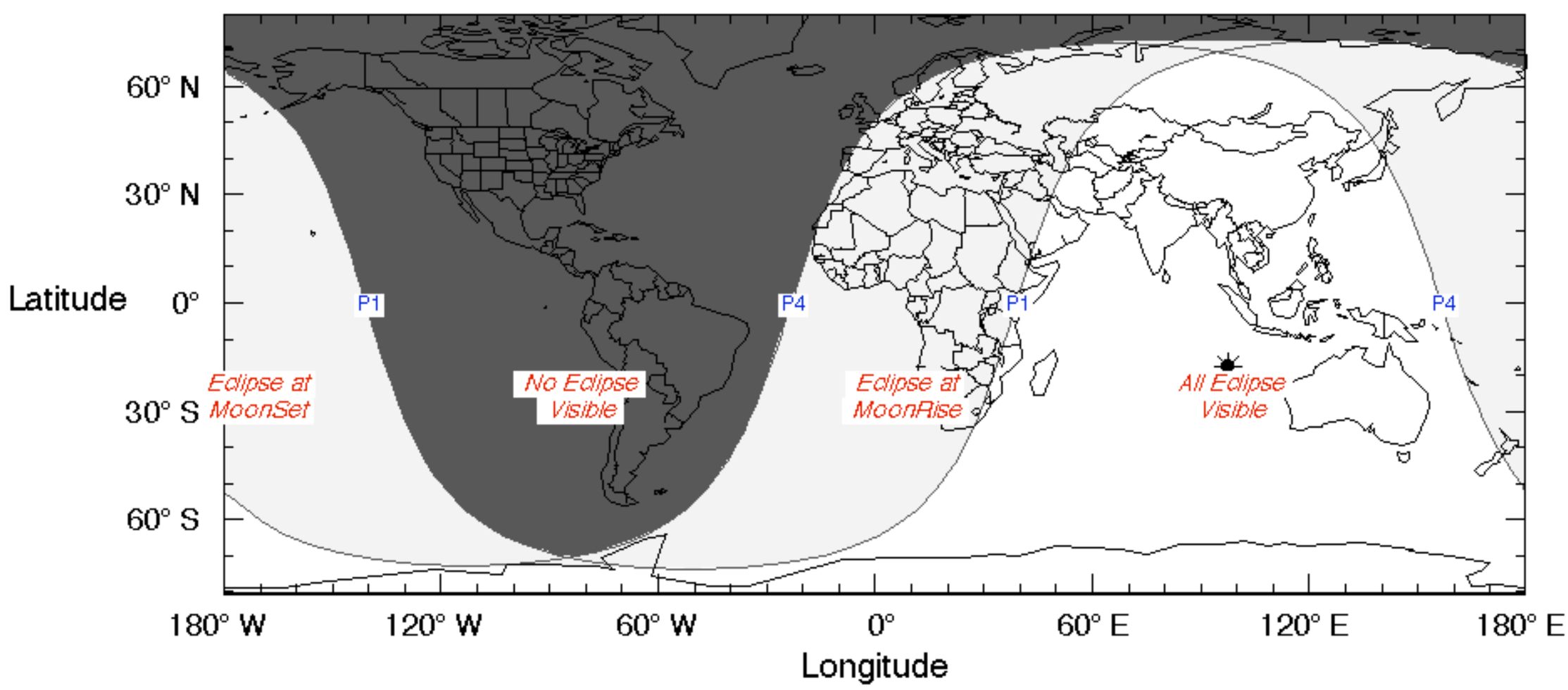
Penumbral = 04h17m31s

Eclipse Contacts

P1 = 15:14:10 UT
P4 = 19:31:41 UT

ΔT = 73 s
Rule = CdT (Danjon)
Eph. = VSOP87/ELP2000-85

F. Espenak, NASA's GSFC
eclipse.gsfc.nasa.gov/eclipse.html



2009 Apr 29

Partial Lunar Eclipse of 2023 Oct 28

Ecliptic Conjunction = 20:25:12.2 TD (= 20:23:58.5 UT)
Greatest Eclipse = 20:15:17.6 TD (= 20:14:03.9 UT)

Penumbral Magnitude = 1.1181 P. Radius = 1.2692° Gamma = 0.9471
Umbral Magnitude = 0.1220 U. Radius = 0.7326° Axis = 0.9363°

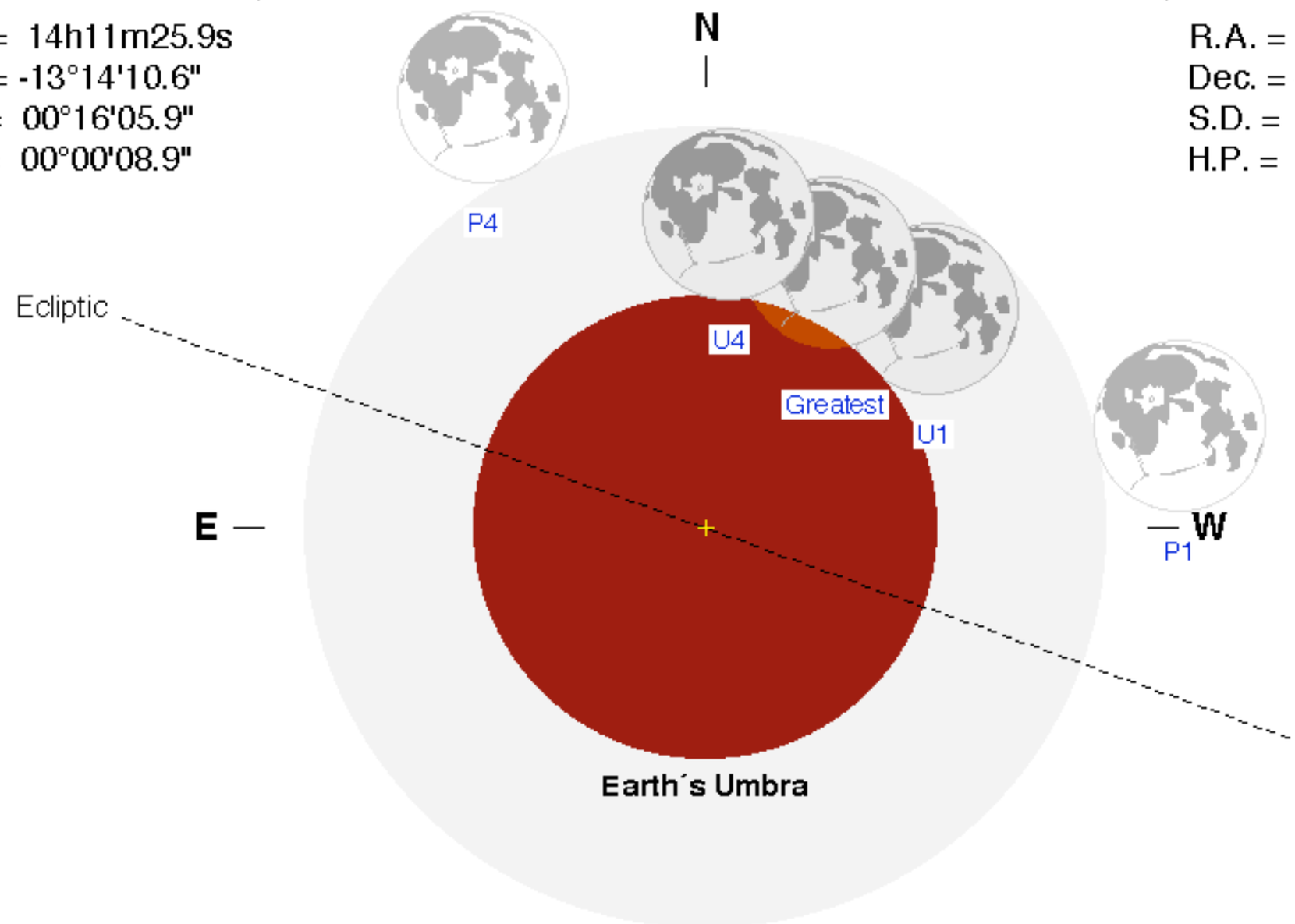
Saros Series = 146 Member = 11 of 72

Sun at Greatest Eclipse
(Geocentric Coordinates)

R.A. = 14h11m25.9s
Dec. = -13°14'10.6"
S.D. = 00°16'05.9"
H.P. = 00°00'08.9"

Moon at Greatest Eclipse
(Geocentric Coordinates)

R.A. = 02h09m47.6s
Dec. = +14°05'01.8"
S.D. = 00°16'09.7"
H.P. = 00°59'18.9"



Eclipse Durations

Penumbral = 04h24m34s
Umbral = 01h17m21s

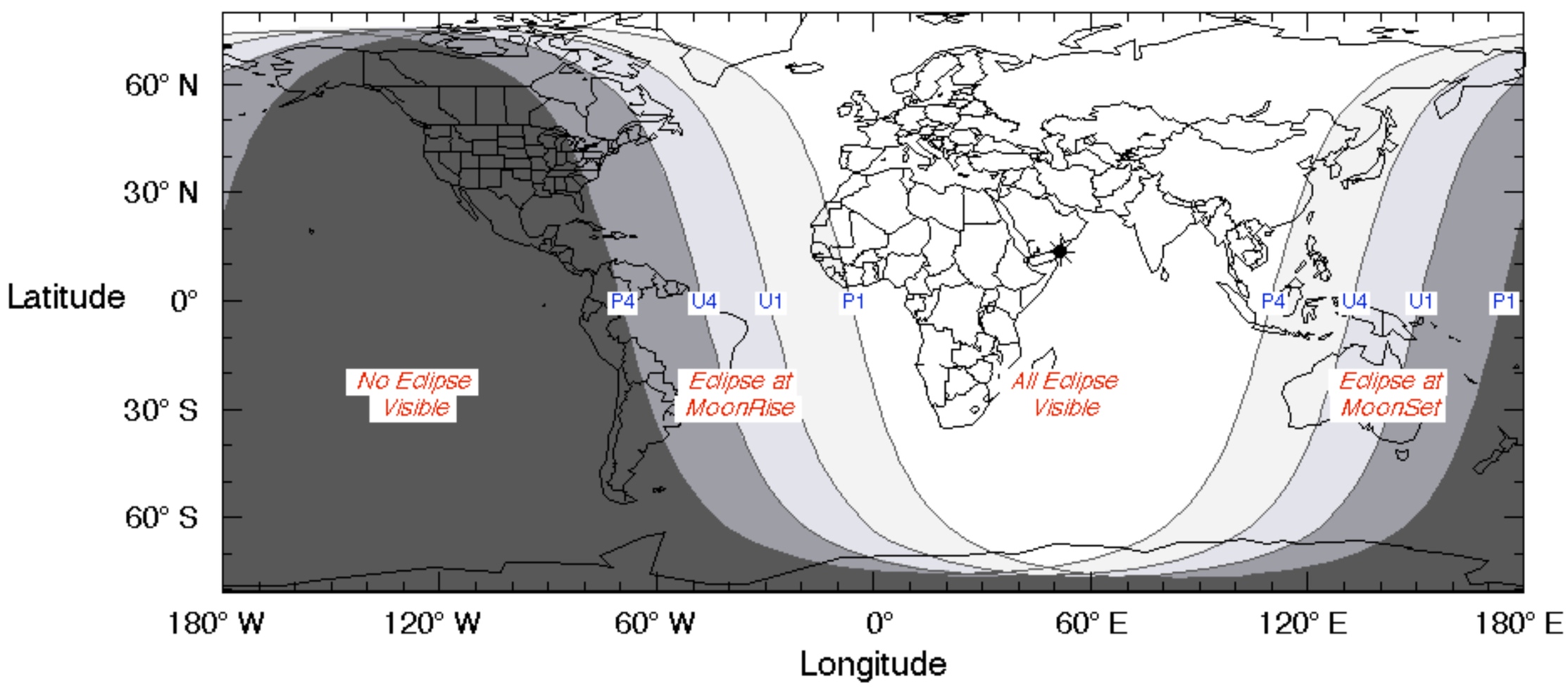
Eclipse Contacts

P1 = 18:01:47 UT
U1 = 19:35:18 UT
U4 = 20:52:39 UT
P4 = 22:26:20 UT

0 15 30 45 60
Arc-Minutes

ΔT = 74 s
Rule = CdT (Danjon)
Eph. = VSOP87/ELP2000-85

F. Espenak, NASA's GSFC
eclipse.gsfc.nasa.gov/eclipse.html



2009 Apr 29

Hybrid Solar Eclipse of 2023 Apr 20

Geocentric Conjunction = 03:55:26.5 UT J.D. = 2460054.663502
Greatest Eclipse = 04:16:37.5 UT J.D. = 2460054.678212

Eclipse Magnitude = 1.0132 Gamma = -0.3951

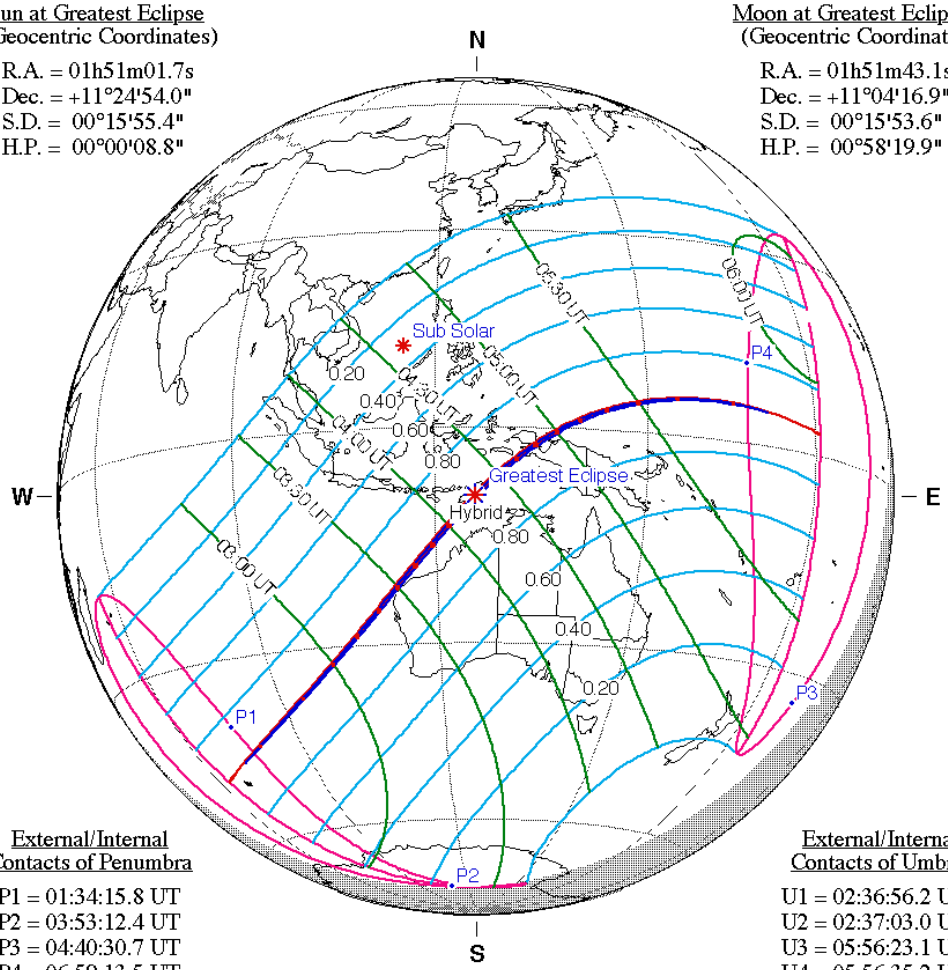
Saros Series = 129 Member = 52 of 80

Sun at Greatest Eclipse
(Geocentric Coordinates)

R.A. = 01h51m01.7s
Dec. = +11°24'54.0"
S.D. = 00°15'55.4"
H.P. = 00°00'08.8"

Moon at Greatest Eclipse
(Geocentric Coordinates)

R.A. = 01h51m43.1s
Dec. = +11°04'16.9"
S.D. = 00°15'53.6"
H.P. = 00°58'19.9"



External/Internal Contacts of Penumbra

P1 = 01:34:15.8 UT
P2 = 03:53:12.4 UT
P3 = 04:40:30.7 UT
P4 = 06:59:13.5 UT

External/Internal Contacts of Umbra

U1 = 02:36:56.2 UT
U2 = 02:37:03.0 UT
U3 = 05:56:23.1 UT
U4 = 05:56:35.2 UT

Local Circumstances at Greatest Eclipse

Lat. = 09°35.4'S Sun Alt. = 66.7°
Long. = 125°48.4'E Sun Azm. = 334.0°
Path Width = 49.0 km Duration = 01m16.1s

Ephemeris & Constants

Eph. = Newcomb/ILE
ΔT = 80.2 s
k1 = 0.2724880
k2 = 0.2722810
Δb = 0.0" Δl = 0.0"

Geocentric Libration
(Optical + Physical)

l = 4.67°
b = 0.46°
c = -19.05°
Brown Lun. No. = 1241

0 1000 2000 3000 4000 5000
Kilometers

F. Espenak, NASA's GSFC - Fri, Jul 2,
sunearth.gsfc.nasa.gov/eclipse/eclipse.html

Annular Solar Eclipse of 2023 Oct 14

Geocentric Conjunction = 17:36:28.8 UT J.D. = 2460232.233667
Greatest Eclipse = 17:59:21.0 UT J.D. = 2460232.249549

Eclipse Magnitude = 0.9520 Gamma = 0.3752

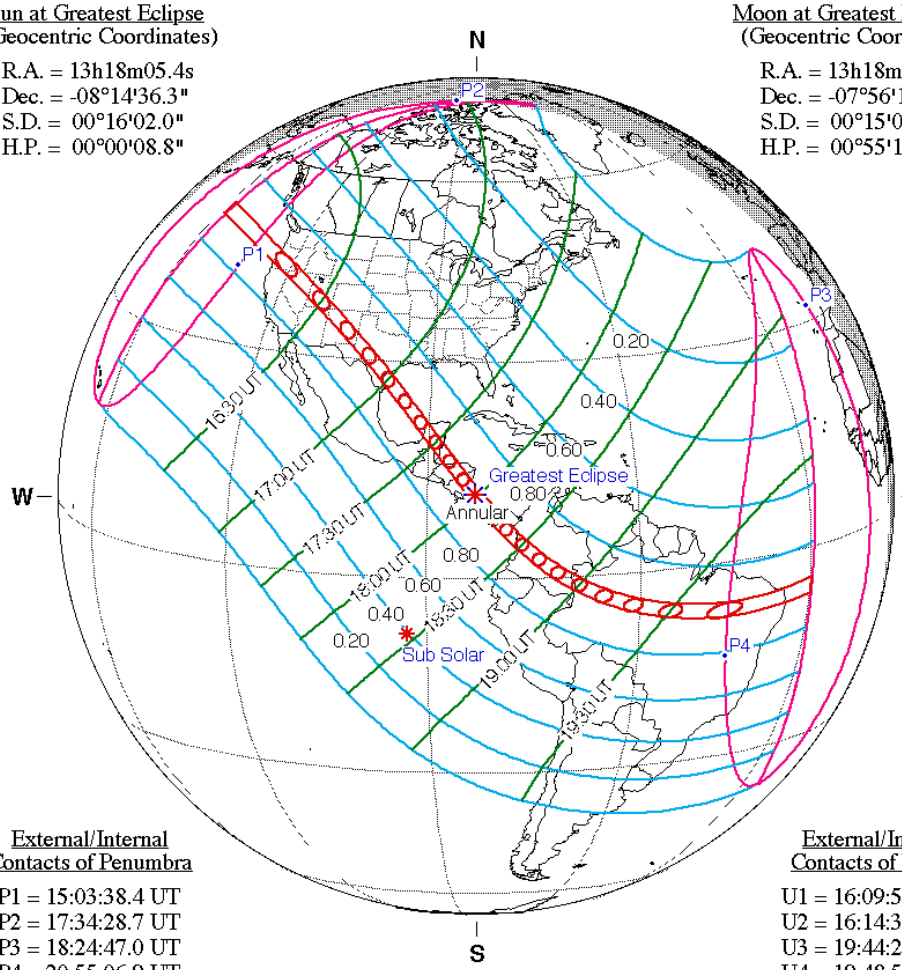
Saros Series = 134 Member = 44 of 71

Sun at Greatest Eclipse
(Geocentric Coordinates)

R.A. = 13h18m05.4s
Dec. = -08°14'36.3"
S.D. = 00°16'02.0"
H.P. = 00°00'08.8"

Moon at Greatest Eclipse
(Geocentric Coordinates)

R.A. = 13h18m44.3s
Dec. = -07°56'18.8"
S.D. = 00°15'02.9"
H.P. = 00°55'13.8"



External/Internal Contacts of Penumbra

P1 = 15:03:38.4 UT
P2 = 17:34:28.7 UT
P3 = 18:24:47.0 UT
P4 = 20:55:06.9 UT

External/Internal Contacts of Umbra

U1 = 16:09:59.1 UT
U2 = 16:14:32.6 UT
U3 = 19:44:25.5 UT
U4 = 19:48:53.5 UT

Local Circumstances at Greatest Eclipse

Lat. = 11°21.7'N Sun Alt. = 67.9°
Long. = 083°04.3'W Sun Azm. = 208.0°
Path Width = 187.4 km Duration = 05m17.2s

Ephemeris & Constants

Eph. = Newcomb/ILE
ΔT = 80.7 s
k1 = 0.2724880
k2 = 0.2722810
Δb = 0.0" Δl = 0.0"

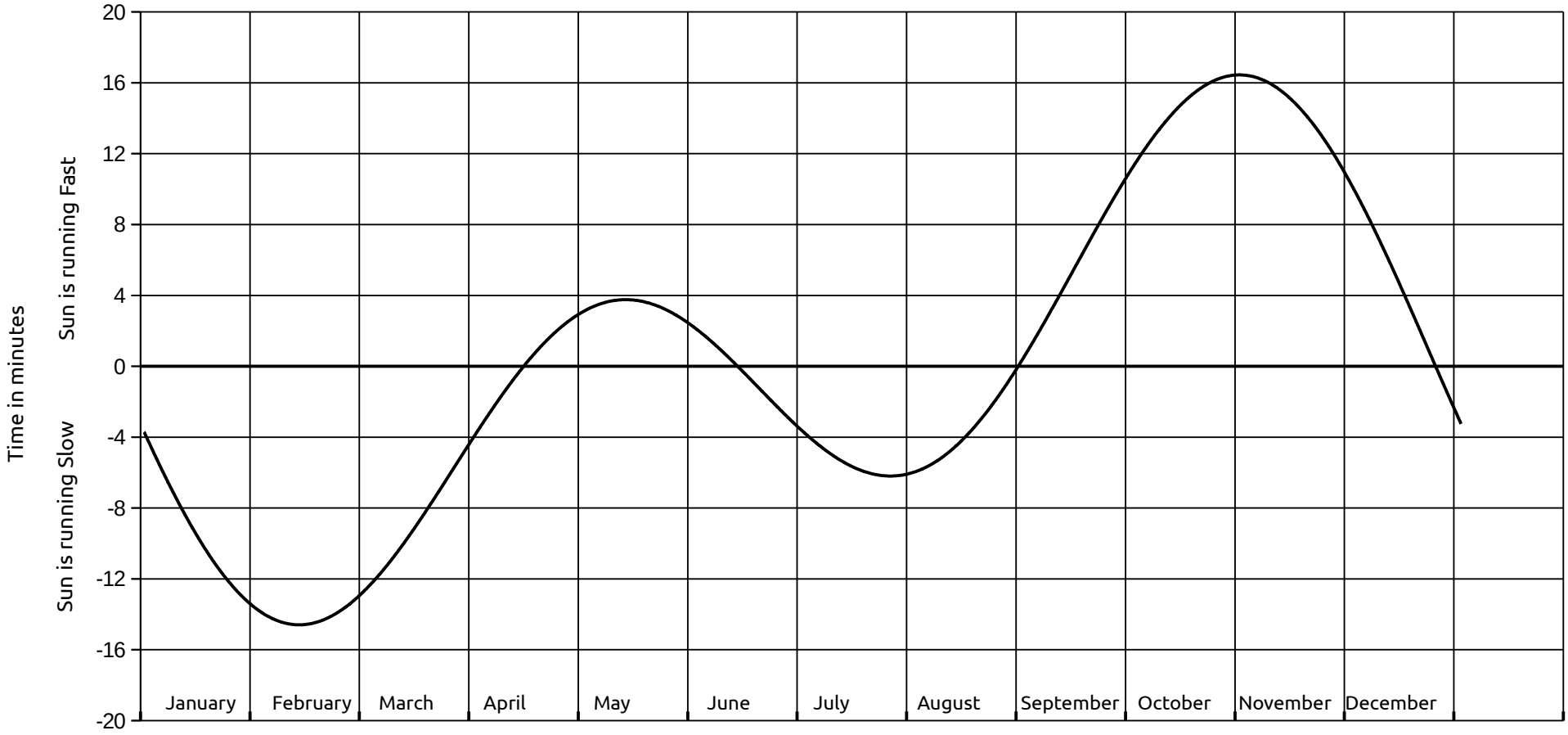
Geocentric Libration
(Optical + Physical)

l = -3.80°
b = -0.48°
c = 20.45°
Brown Lun. No. = 1247

0 1000 2000 3000 4000 5000
Kilometers

F. Espenak, NASA's GSFC - Fri, Jul 2,
sunearth.gsfc.nasa.gov/eclipse/eclipse.html

Equation of Time
for the Sun



Equation_of_Time_Curve.odt

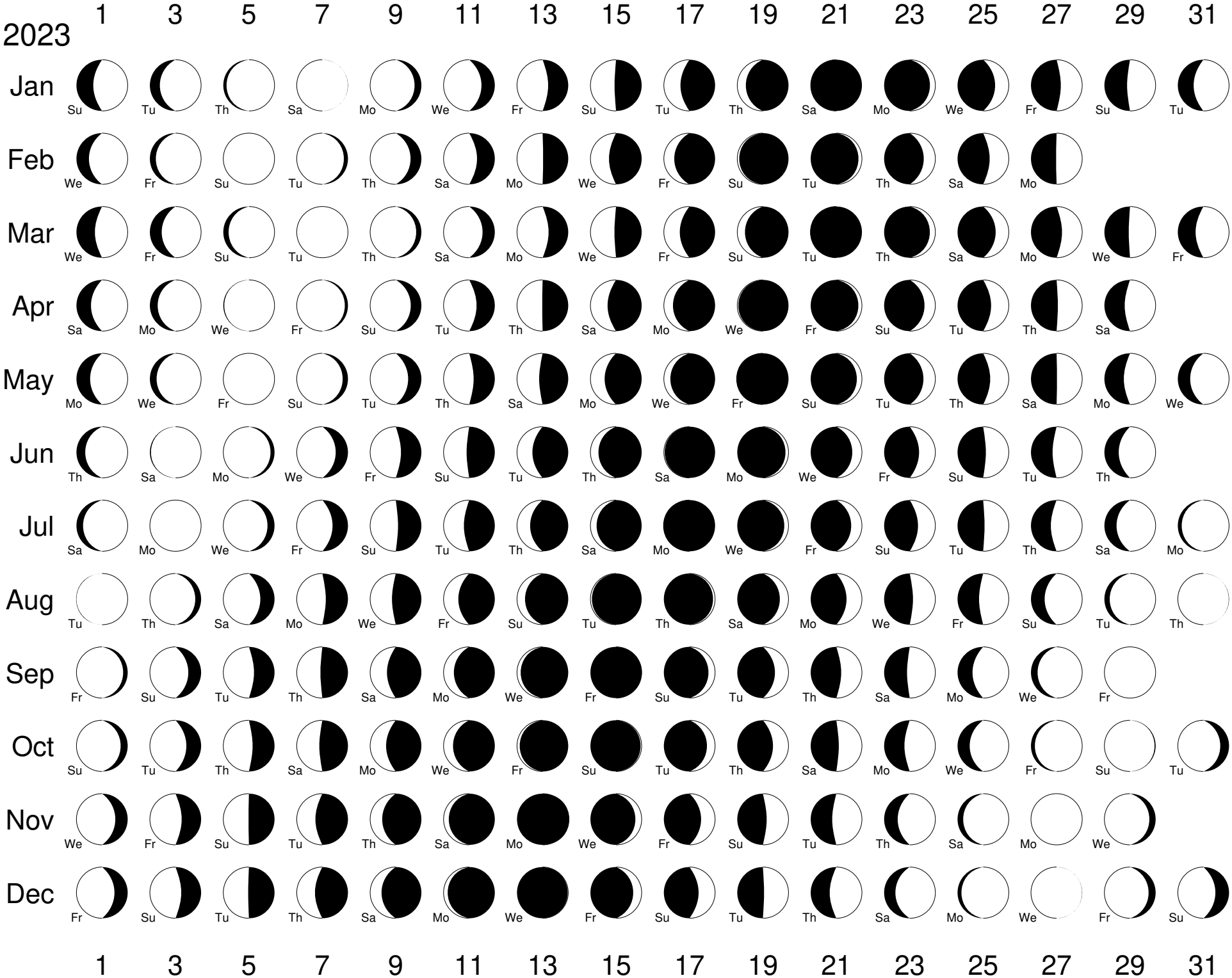
2023 Moon Phases

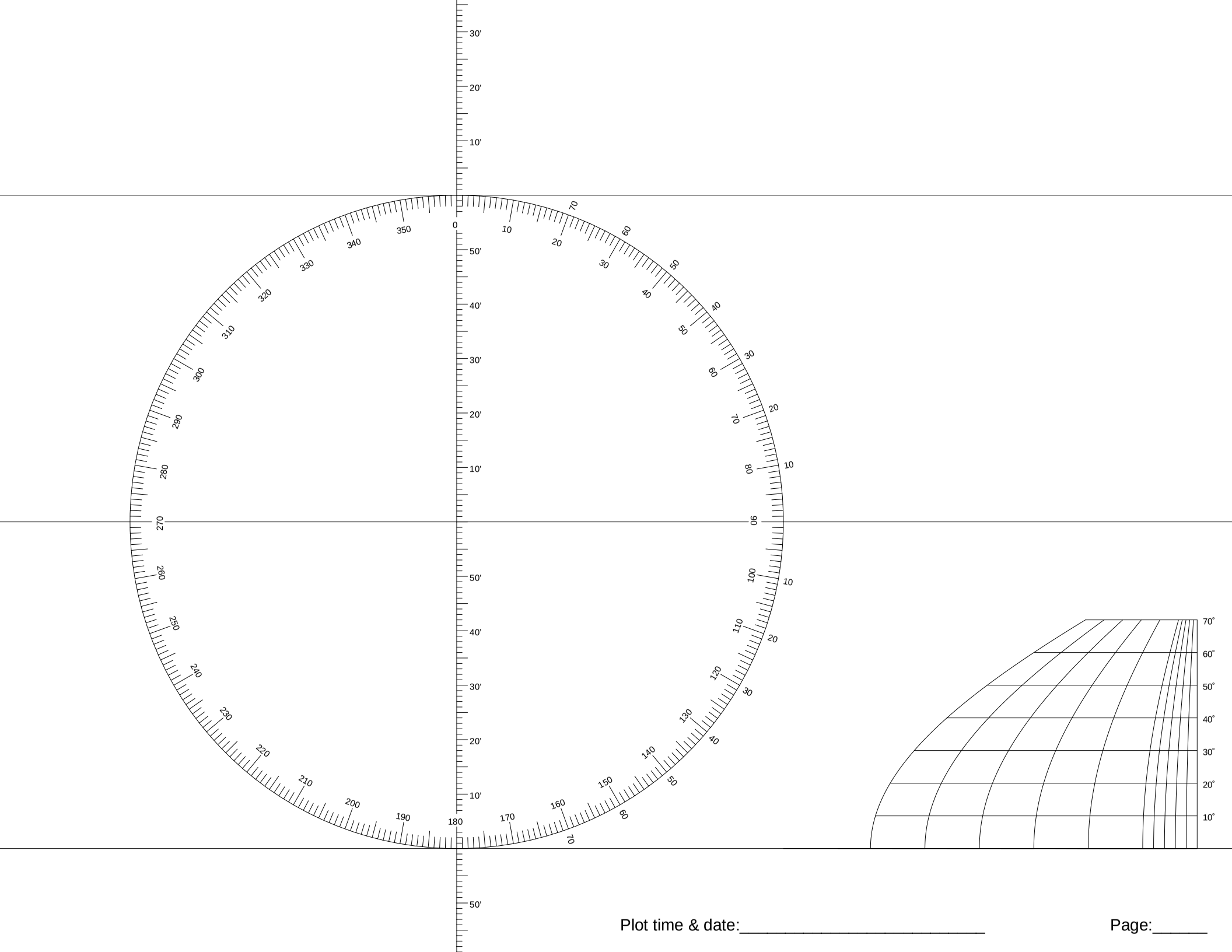
Date and Time (GMT/Universal Time)

New Moon	First Quarter	Full Moon	Last Quarter
--	--	January 06 23:08	January 15 02:10
January 21 20:53	January 28 15:19	February 05 18:28	February 13 16:01
February 20 07:06	February 27 08:06	March 07 12:40	March 15 02:08
March 21 17:23	March 29 02:32	April 06 04:34	April 13 09:11
April 20 04:12	April 27 21:20	May 05 17:34	May 12 14:28
May 19 15:53	May 27 15:22	June 04 03:42	June 10 19:31
June 18 04:37	June 26 07:50	July 03 11:39	July 10 01:48
July 17 18:32	July 25 22:07	August 01 18:32	August 08 10:28
August 16 09:38	August 24 09:57	August 31 01:35	September 06 22:21
September 15 01:40	September 22 19:32	September 29 09:57	October 06 13:48
October 14 17:55	October 22 03:29	October 28 20:24	November 05 08:37
November 13 09:27	November 20 10:50	November 27 09:16	December 05 05:49
December 12 23:32	December 19 18:39	December 27 00:33	

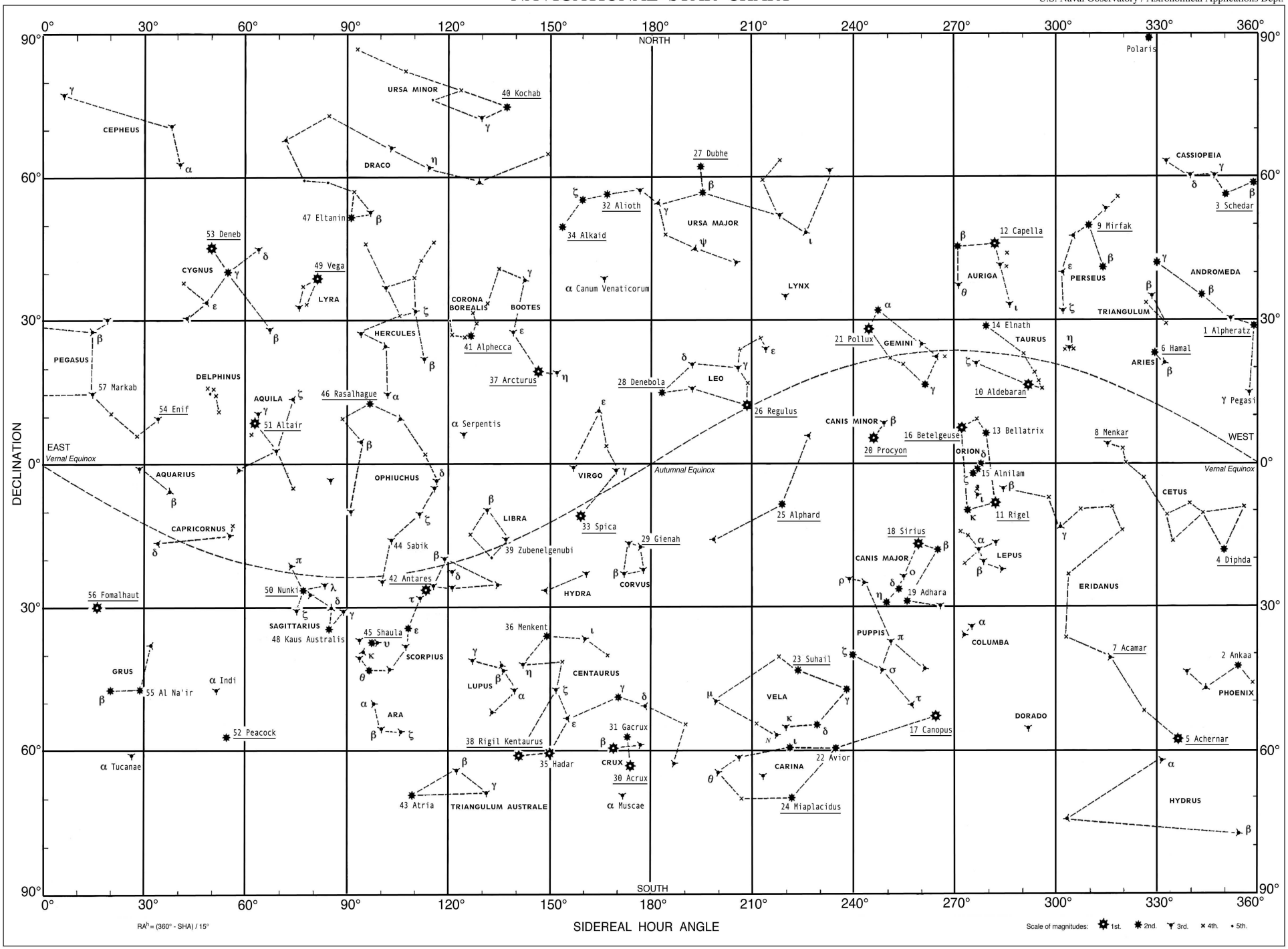
Add or subtract your time difference from Greenwich to determine local time and date of Moon phase.

2023


1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
Jan Su Tu Th Sa Mo We Fr Su Tu Th Sa Mo We Fr Su Tu
Feb We Fr Su Tu Th Sa Mo We Fr Su Tu Th Sa Mo
Mar We Fr Su Tu Th Sa Mo We Fr Su Tu Th Sa Mo We Fr
Apr Sa Mo We Fr Su Tu Th Sa Mo We Fr Su Tu Th Sa
May Mo We Fr Su Tu Th Sa Mo We Fr Su Tu Th Sa Mo We
Jun Th Sa Mo We Fr Su Tu Th Sa Mo We Fr Su Tu Th
Jul Sa Mo We Fr Su Tu Th Sa Mo We Fr Su Tu Th Sa Mo
Aug Tu Th Sa Mo We Fr Su Tu Th Sa Mo We Fr Su Tu Th
Sep Fr Su Tu Th Sa Mo We Fr Su Tu Th Sa Mo We Fr
Oct Su Tu Th Sa Mo We Fr Su Tu Th Sa Mo We Fr Su Tu
Nov We Fr Su Tu Th Sa Mo We Fr Su Tu Th Sa Mo We
Dec Fr Su Tu Th Sa Mo We Fr Su Tu Th Sa Mo We Fr Su
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31



Plot time & date:_____ Page:_____

NAVIGATIONAL STAR CHART

U.S. Naval Observatory / Astronomical Applications Dept.