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# The Nautical Almanac 2022

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# The Nautical Almanac

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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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# 2022

## January

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

## February

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

## March

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

## April

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

## May

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

## June

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

## July

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

## August

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

## September

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

## October

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

## November

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

## December

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

# 2022

Day of Month	1			2			3			4			5			6			
	January		Days remaining	February		Days remaining	March		Days remaining	April		Days remaining	May		Days remaining	June			
	Day of Week	Day of Year	Week number	Day of Week	Day of Year	Week number	Day of Week	Day of Year	Week number	Day of Week	Day of Year	Week number	Day of Week	Day of Year	Week number	Day of Week	Day of Year	Week number	
1 Sat	1	364		1 Tue	32	333	5	1 Tue	60	305	9	1 Fri	91	274	13	1 Sun	121	244	17
2 Sun	2	363	1	2 Wed	33	332		2 Wed	61	304		2 Sat	92	273		2 Mon	122	243	
3 Mon	3	362		3 Thu	34	331		3 Thu	62	303		3 Sun	93	272	14	3 Tue	123	242	
4 Tue	4	361		4 Fri	35	330		4 Fri	63	302		4 Mon	94	271		4 Wed	124	241	
5 Wed	5	360		5 Sat	36	329		5 Sat	64	301		5 Tue	95	270		5 Thu	125	240	
6 Thu	6	359		6 Sun	37	328	6	6 Sun	65	300	10	6 Wed	96	269		6 Fri	126	239	
7 Fri	7	358		7 Mon	38	327		7 Mon	66	299		7 Thu	97	268		7 Sat	127	238	
8 Sat	8	357		8 Tue	39	326		8 Tue	67	298		8 Fri	98	267		8 Sun	128	237	19
9 Sun	9	356	2	9 Wed	40	325		9 Wed	68	297		9 Sat	99	266		9 Mon	129	236	
10 Mon	10	355		10 Thu	41	324		10 Thu	69	296		10 Sun	100	265	15	10 Tue	130	235	
11 Tue	11	354		11 Fri	42	323		11 Fri	70	295		11 Mon	101	264		11 Wed	131	234	
12 Wed	12	353		12 Sat	43	322		12 Sat	71	294		12 Tue	102	263		12 Thu	132	233	
13 Thu	13	352		13 Sun	44	321	7	13 Sun	72	293	11	13 Wed	103	262		13 Fri	133	232	
14 Fri	14	351		14 Mon	45	320		14 Mon	73	292		14 Thu	104	261		14 Sat	134	231	
15 Sat	15	350		15 Tue	46	319		15 Tue	74	291		15 Fri	105	260		15 Sun	135	230	20
16 Sun	16	349	3	16 Wed	47	318		16 Wed	75	290		16 Sat	106	259		16 Mon	136	229	
17 Mon	17	348		17 Thu	48	317		17 Thu	76	289		17 Sun	107	258	16	17 Tue	137	228	
18 Tue	18	347		18 Fri	49	316		18 Fri	77	288		18 Mon	108	257		18 Wed	138	227	
19 Wed	19	346		19 Sat	50	315		19 Sat	78	287		19 Tue	109	256		19 Thu	139	226	
20 Thu	20	345		20 Sun	51	314	8	20 Sun	79	286	12	20 Wed	110	255		20 Fri	140	225	
21 Fri	21	344		21 Mon	52	313		21 Mon	80	285		21 Thu	111	254		21 Sat	141	224	
22 Sat	22	343		22 Tue	53	312		22 Tue	81	284		22 Fri	112	253		22 Sun	142	223	21
23 Sun	23	342	4	23 Wed	54	311		23 Wed	82	283		23 Sat	113	252		23 Mon	143	222	
24 Mon	24	341		24 Thu	55	310		24 Thu	83	282		24 Sun	114	251	17	24 Tue	144	221	
25 Tue	25	340		25 Fri	56	309		25 Fri	84	281		25 Mon	115	250		25 Wed	145	220	
26 Wed	26	339		26 Sat	57	308		26 Sat	85	280		26 Tue	116	249		26 Thu	146	219	
27 Thu	27	338		27 Sun	58	307	9	27 Sun	86	279	13	27 Wed	117	248		27 Fri	147	218	
28 Fri	28	337		28 Mon	59	306		28 Mon	87	278		28 Thu	118	247		28 Sat	148	217	
29 Sat	29	336		29 Tue	88	277		29 Tue	119	246		29 Fri	119	246		29 Sun	149	216	22
30 Sun	30	335	5	30 Wed	89	276		30 Wed	120	245		30 Sat	150	215		30 Mon	151	214	
31 Mon	31	334		31 Thu	90	275		31 Thu	90	275		31 Tue	151	214					

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

Day of Month	7			8			9			10			11			12			
	July		Days remaining	August		Days remaining	September		Days remaining	October		Days remaining	November		Days remaining	December			
	Day of Week	Day of Year	Week number	Day of Week	Day of Year	Days remaining	Day of Week	Day of Year	Week number	Day of Week	Day of Year	Days remaining	Day of Week	Day of Year	Week number	Day of Week	Day of Year	Week number	
1 Fri	182	183	26	1 Mon	213	152	31	1 Thu	244	121	35	1 Sat	274	91	39	1 Tue	305	60	44
2 Sat	183	182		2 Tue	214	151		2 Tue	245	120		2 Sun	275	90	40	2 Wed	306	59	
3 Sun	184	181	27	3 Wed	215	150		3 Sat	246	119		3 Mon	276	89		3 Thu	307	58	
4 Mon	185	180		4 Thu	216	149		4 Sun	247	118	36	4 Tue	277	88		4 Fri	308	57	
5 Tue	186	179		5 Fri	217	148		5 Mon	248	117		5 Wed	278	87		5 Sat	309	56	
6 Wed	187	178		6 Sat	218	147		6 Tue	249	116		6 Thu	279	86		6 Sun	310	55	45
7 Thu	188	177		7 Sun	219	146	32	7 Wed	250	115		7 Fri	280	85		7 Mon	311	54	
8 Fri	189	176		8 Mon	220	145		8 Thu	251	114		8 Sat	281	84	41	8 Tue	312	53	
9 Sat	190	175		9 Tue	221	144		9 Fri	252	113		9 Sun	282	83		9 Wed	313	52	
10 Sun	191	174	28	10 Wed	222	143		10 Sat	253	112		10 Mon	283	82		10 Thu	314	51	
11 Mon	192	173		11 Thu	223	142		11 Sun	254	111	37	11 Tue	284	81		11 Fri	315	50	
12 Tue	193	172		12 Fri	224	141		12 Mon	255	110		12 Wed	285	80		12 Sat	316	49	
13 Wed	194	171		13 Sat	225	140		13 Tue	256	109		13 Thu	286	79		13 Sun	317	48	46
14 Thu	195	170		14 Sun	226	139	33	14 Wed	257	108		14 Fri	287	78		14 Mon	318	47	
15 Fri	196	169		15 Mon	227	138		15 Thu	258	107		15 Sat	288	77		15 Tue	319	46	
16 Sat	197	168		16 Tue	228	137		16 Fri	259	106		16 Sun	289	76	42	16 Wed	320	45	
17 Sun	198	167	29	17 Wed	229	136		17 Sat	260	105	38	17 Mon	290	75		17 Thu	321	44	
18 Mon	199	166		18 Thu	230	135		18 Sun	261	104		18 Tue	291	74		18 Fri	322	43	
19 Tue	200	165		19 Fri	231	134		19 Mon	262	103		19 Wed	292	73		19 Sat	323	42	
20 Wed	201	164		20 Sat	232	133		20 Tue	263	102		20 Thu	293	72		20 Sun	324	41	47
21 Thu	202	163		21 Sun	233	132	34	21 Wed	264	101		21 Fri	294	71		21 Mon	325	40	
22 Fri	203	162		22 Mon	234	131		22 Thu	265	100		22 Sat	295	70		22 Tue	326	39	
23 Sat	204	161		23 Tue	235	130		23 Fri	266	99		23 Sun	296	69	43	23 Wed	327	38	
24 Sun	205	160	30	24 Wed	236	129		24 Sat	267	98		24 Mon	297	68		24 Thu	328	37	
25 Mon	206	159		25 Thu	237	128		25 Sun	268	97	39	25 Tue	298	67		25 Fri	329	36	
26 Tue	207	158		26 Fri	238	127		26 Mon	269	96		26 Wed	299	66		26 Sat	330	35	
27 Wed	208	157		27 Sat	239	126		27 Tue	270	95		27 Thu	300	65		27 Sun	331	34	48
28 Thu	209	156		28 Sun	240	125	35	28 Wed	271	94		28 Fri	301	64		28 Mon	332	33	
29 Fri	210	155		29 Mon	241	124		29 Thu	272	93		29 Sat	302	63		29 Tue	333	32	
30 Sat	211	154		30 Tue	242	123		30 Fri	273	92		30 Sun	303	62	44	30 Wed	334	31	
31 Sun	212	153	31	31 Wed	243	122		31 Mon	304	61		31 Tue	305	60		31 Sat	365	0	

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    *2017- The American Practical Navigator*

[https://TheNauticalAlmanac.com/2017\\_Bowditch\\_American\\_Practical\\_Navigator.html](https://TheNauticalAlmanac.com/2017_Bowditch_American_Practical_Navigator.html)

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

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

<https://TheNauticalAlmanac.com/TerrestrialAlmanac.html>

### Pub. No. 249 Download individual Latitudes or Volumes

[https://TheNauticalAlmanac.com/Pub.\\_No.\\_249.html](https://TheNauticalAlmanac.com/Pub._No._249.html)

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

[https://TheNauticalAlmanac.com/Pub.\\_No.\\_229.html](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

$$Hc = \text{asin}[\sin(\text{Declination}) * \sin(\text{Latitude}) + \cos(\text{Latitude}) * \cos(\text{Declination}) * \cos(\text{LHA})]$$

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

$$\text{Sin}^{-1}(\text{Sin}(\text{Ap Latitude}) * \text{Sin}(\text{Declination}) + \text{Cos}(\text{Ap Latitude}) * \text{Cos}(\text{Declination}) * \text{Cos}(\text{LHA}))$$

**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** is the Latitude 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.

#### In Western Longitudes

**LHA** is the Local Hour Angle which is derived from subtracting your whole number value of Longitude (Assumed or otherwise) from the whole number value of **GHA** (Greenwich Hour Angle).

#### In Eastern Longitudes

**LHA, in Eastern Longitudes**, is determined by rounding up the GHA figure to the next highest whole degree figure then adding the DR. Longitude to GHA to obtain LHA. Only add the whole degree DR. Longitude figure to the rounded up whole degree GHA figure. If the resulting LHA figure is greater than  $360^\circ$  then subtract  $360^\circ$  from the figure to obtain the 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

$$Z = \text{acos}[(\sin(\text{Declination}) - \sin(\text{Ap Latitude}) \times \sin(\text{Hc})) \div (\cos(\text{Ap Latitude}) \times \cos(\text{Hc}))]$$

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

$$\text{Cos}^{-1}((\text{Sin}(\text{Declination}) - \text{Sin}(\text{AP Latitude}) \times \text{Sin}(\text{Hc})) \div (\text{Cos}(\text{AP Latitude}) \times \text{Cos}(\text{Hc}))$$

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

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

"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

$$Z = \tan^{-1}((\sin(\text{LHA}) \div (\cos(\text{AP latitude}) \times \tan(\text{declination}) - (\sin(\text{AP latitude}) \times \cos(\text{LHA})))$$

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  $180^\circ$ , it is treated as a negative quantity. If the azimuth angle as calculated is negative, add  $180^\circ$  to obtain the desired value.

**To obtain Zn apply the following rules**

<b>In Northern Latitudes</b>	<b>In Southern Latitudes</b>
LHA greater than $180^\circ$ ....Zn=Z	LHA greater than $180^\circ$ ....Zn= $180^\circ - Z$
LHA less than $180^\circ$ .....Zn= $360^\circ - Z$	LHA less than $180^\circ$ .....Zn= $180^\circ + Z$

**Determine Refraction**  $0.96 \div \text{Tan of } (\text{Ha})$

Gives good results down to about  $8^\circ$  from the horizon but not less.

**Refraction** (good overall formula from  $90^\circ$  to below  $8^\circ$  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...

$$1 \div \tan((H_a + (7.31 \div (H_a + 4.4)))$$

Both refraction formulas use the standard pressure and temperature of;

1010 mb    10°C  
29.83 in    53°F

**Determine Dip using feet**                     $0.97 \times (\text{Square Root of } H_e \text{ (Height of Eye) in feet})$

**Determine Dip using meters**                     $1.76 \times (\text{Square Root of } H_e \text{ (Height of eye) in meters})$

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

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

$$\text{Latitude} = (90^\circ - H_o) + \text{declination}$$

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

$$\text{Latitude} = \text{Declination} - (90^\circ - H_o)$$

**3-** Latitude and declination *Contrary name*:

$$\text{Latitude} = (90^\circ - H_o) - \text{Declination}$$

## 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  $\lambda$  figure will be used when plotting the LOP on the UPS.

### In Eastern longitudes

In Eastern longitudes the Ap  $\lambda$  is determined as follows;

$$\text{DR longitude} + (0^\circ 60' \text{ minus GHA minutes of arc})$$

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



*fair winds...clear skies and following seas*  
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## Explanation of The Nautical Almanac Daily Pages

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

10	<b>d</b> - the daily average change, per hour, in the Sun's declination in minutes of arc.
11	<b>SD</b> - 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	<b>HP</b> - 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. <i>Source- starpath.com</i>
13	<b>Sun- Eqn. of Time</b> - 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 <sup>h</sup> and 12 <sup>h</sup> . 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 <b>Example</b> - Meridian Passage on May 30, 2020 equals 12:00 – EoT of 2 minutes 21 seconds MP= 11:57:39 <i>Local Apparent Noon</i> <b>Example</b> - Meridian Passage on August 25, 2020 equals 12:00 + EoT of 1 minute 59 seconds MP= 12:01:59 <i>Local Apparent Noon</i>
14	<b>Sun- Mer. Pass</b> just to the right of the <b>Eqn. of Time</b> is the approximate GMT/UT when the Sun crosses The Prime Meridian (at Greenwich) for that specific date.
15	<b>Moon- Mer. Pass</b> - is the approximate GMT/UT when the Moon crosses The Prime Meridian (at Greenwich) or the 180° line of longitude. <b>Upper</b> means the GMT/UT when the Moon crosses The Prime Meridian (Greenwich). <b>Lower</b> means the GMT/UT when the Moon crosses the 180° line of longitude.
16	<b>Moon- Age</b> - 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 1/2 of the Moon is illuminated. A 3 day range percentage is provided but only one graphic for the phase.
17* see notes at bottom	<b>(morning) Twilight- Naut.</b> - 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 <b>Lat.</b> column and then follow across horizontally to the right to find the time.
17* see notes at bottom	<b>(morning) Twilight- Civil</b> - 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 <b>Lat.</b> column and then follow across horizontally to the right to find the time.
17* see notes at bottom	<b>Sunrise</b> - the approximate GMT/UT when the Sun is 0° 50' (semi-diameter plus refraction) below the horizon. First locate your approximate Latitude in the <b>Lat.</b> column and then follow across horizontally to the right to find the time.

17* see notes at bottom	<b>Sunset</b> - the approximate GMT/UT when the Sun is $0^\circ 50'$ (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	<b>(evening) Twilight- Civil</b> - the approximate GMT/UT of evening civil twilight that ends when the geometric center of the sun is $6^\circ$ below the horizon. First locate your approximate Latitude in the <b>Lat.</b> column and then follow across horizontally to the right to find the time.
17* see notes at bottom	<b>(evening) Twilight- Naut.</b> - the approximate GMT/UT of when evening Nautical Twilight ends. Nautical twilight is the time when the center of the sun is $12^\circ$ 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	<b>Moonrise</b> - the approximate GMT/UT when the Moon is about $0^\circ 05'$ to $0^\circ 10'$ 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	<b>Moonset</b> - the approximate GMT/UT when the Moon is about $0^\circ 05'$ to $0^\circ 10'$ 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  $0^\circ$  (Greenwich) and can be considered 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			Stars		
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	100°32.5	181°58.1	\$23°38.5	318°04.0	N18°45.1	131°37.2	\$13°36.5	275°29.9	N00°18.5	Alpheratz	357°46.2	29°09.0					
1	115°35.0	196°57.1	38.4	333°06.8	45.4	146°39.2	36.4	290°32.3	18.5	Ankaa	353°18.1	-42°15.2					
2	130°37.4	211°56.1	38.3	348°09.6	45.6	161°41.2	36.2	305°34.7	18.5	Schedar	349°43.6	56°35.9					
3	145°39.9	226°55.1	.. 38.2	3°12.4	.. 45.8	176°43.2	.. 36.0	320°37.1	.. 18.5	Diphda	348°58.3	-17°55.9					
4	160°42.4	241°54.2	38.1	18°15.2	46.0	191°45.1	35.8	335°39.5	18.5	Achernar	335°28.3	-57°11.3					
5	175°44.8	256°53.2	38.0	33°18.1	46.2	206°47.1	35.7	350°41.9	18.5	Hamal	328°03.5	23°30.8					
6	190°47.3	271°52.2	\$23°37.9	48°20.9	N18°46.5	221°49.1	\$13°35.5	5°44.3	N00°18.5	Polaris	318°47.1	89°18.8					
7	205°49.8	286°51.3	37.8	63°23.7	46.7	236°51.1	35.3	20°46.7	18.5	Akamar	315°19.9	-40°16.0					
8	220°52.2	301°50.3	37.7	78°26.5	46.9	251°53.0	35.1	35°49.2	18.5	Menkar	314°17.5	4°07.8					
9	235°54.7	316°49.3	.. 37.6	93°29.4	.. 47.1	266°55.0	.. 35.0	50°51.6	.. 18.4	Mirfak	308°43.7	49°54.0					
10	250°57.2	331°48.4	37.5	108°32.2	47.3	281°57.0	34.8	65°54.0	18.4	Aldebaran	290°52.0	16°31.9					
11	265°59.6	346°47.4	37.4	123°35.0	47.6	296°59.0	34.6	80°56.4	18.4	Rigel	281°14.1	-8°11.4					
12	281°02.1	1°46.4	\$23°37.3	138°37.9	N18°47.8	312°00.9	\$13°34.4	95°58.8	N00°18.4	Capella	280°37.8	46°00.6					
13	296°04.5	16°45.5	37.2	153°40.7	48.0	327°02.9	34.3	111°01.2	18.4	Bellatrix	278°34.4	6°21.5					
14	311°07.0	31°44.5	37.1	168°43.5	48.2	342°04.9	34.1	126°03.6	18.4	Elnath	278°15.5	28°37.0					
15	326°09.5	46°43.5	.. 37.0	183°46.4	.. 48.5	357°06.8	.. 33.9	141°06.0	.. 18.4	Alnilam	275°48.6	-1°11.7					
16	341°11.9	61°42.6	36.9	198°49.2	48.7	12°08.8	33.7	156°08.4	18.4	Betelgeuse	271°03.7	7°24.5					
17	356°14.4	76°41.6	36.8	213°52.0	48.9	27°10.8	33.6	171°10.8	18.4	Canopus	263°56.7	-52°42.1					
18	11°16.9	91°40.6	\$23°36.7	228°54.9	N18°49.1	42°12.8	\$13°33.4	186°13.2	N00°18.3	Sirius	258°35.5	-16°43.6					
19	26°19.3	106°39.6	36.5	243°57.7	49.4	57°14.7	33.2	201°15.7	18.3	Adara	255°14.1	-28°59.2					
20	41°21.8	121°38.7	36.4	259°00.6	49.6	72°16.7	33.0	216°18.1	18.3	Procyon	245°01.9	5°12.0					
21	56°24.3	136°37.7	.. 36.3	274°03.4	.. 49.8	87°18.7	.. 32.9	231°20.5	.. 18.3	Pollux	243°30.3	28°00.0					
22	71°26.7	151°36.7	36.2	289°06.3	50.0	102°20.7	32.7	246°22.9	18.3	Avior	234°18.6	-59°32.4					
23	86°29.2	166°35.8	36.1	304°09.1	50.3	117°22.6	32.5	261°25.3	18.3	Suhail	222°54.0	-43°28.3					
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			Miaplacidus				
Sat			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	101°31.7	181°34.8	\$23°36.0	319°12.0	N18°50.5	132°24.6	\$13°32.3	276°27.7	N00°18.3	Denebola	182°36.0	14°30.8					
1	116°34.1	196°33.8	35.8	334°14.8	50.7	147°26.6	32.2	291°30.1	18.3	Gienah	175°54.9	-17°35.9					
2	131°36.6	211°32.9	35.7	349°17.7	51.0	162°28.6	32.0	306°32.5	18.3	Acrux	173°12.3	-63°09.1					
3	146°39.0	226°31.9	.. 35.6	4°20.5	.. 51.2	177°30.5	.. 31.8	321°34.9	.. 18.3	Gacrux	172°03.9	-57°10.0					
4	161°41.5	241°30.9	35.5	19°23.4	51.4	192°32.5	31.6	336°37.3	18.2	Alioth	166°22.8	55°53.9					
5	176°44.0	256°30.0	35.3	34°26.2	51.6	207°34.5	31.5	351°39.8	18.2	Spica	158°34.0	-11°12.9					
6	191°46.4	271°29.0	\$23°35.2	49°29.1	N18°51.9	222°36.4	\$13°31.3	6°42.2	N00°18.2	Alcaid	153°00.9	49°15.4					
7	206°48.9	286°28.0	35.1	64°31.9	52.1	237°38.4	31.1	21°44.6	18.2	Hadar	148°51.9	-60°25.1					
8	221°51.4	301°27.1	34.9	79°34.8	52.3	252°40.4	30.9	36°47.0	18.2	Menkent	148°10.8	-36°25.1					
9	236°53.8	316°26.1	.. 34.8	94°37.7	.. 52.6	267°42.4	.. 30.8	51°49.4	.. 18.2	Arcturus	145°58.0	19°07.9					
10	251°56.3	331°25.1	34.7	109°40.5	52.8	282°44.3	30.6	66°51.8	18.2	Rigel Kent	139°55.6	-60°52.4					
11	266°58.8	346°24.2	34.5	124°43.4	53.0	297°46.3	30.4	81°54.2	18.2	Zubenelgaf	137°08.4	-16°05.0					
12	282°01.2	1°23.2	\$23°34.4	139°46.3	N18°53.3	312°48.3	\$13°30.2	96°56.6	N00°18.2	Kochab	137°20.2	74°06.5					
13	297°03.7	16°22.2	34.3	154°49.1	53.5	327°50.2	30.1	111°59.1	18.2	Alphecca	126°13.4	26°40.7					
14	312°06.1	31°21.3	34.1	169°52.0	53.7	342°52.2	29.9	127°01.5	18.2	Antares	112°29.7	-26°27.2					
15	327°08.6	46°20.3	.. 34.0	184°54.9	.. 54.0	357°54.2	.. 29.7	142°03.9	.. 18.1	Atria	107°34.4	-69°02.6					
16	342°11.1	61°19.3	33.8	199°57.7	54.2	12°56.2	29.5	157°06.3	18.1	Sabik	102°15.8	-15°44.3					
17	357°13.5	76°18.4	33.7	215°00.6	54.4	27°58.1	29.3	172°08.7	18.1	Shaula	96°25.8	-37°06.6					
18	12°16.0	91°17.4	\$23°33.6	230°03.5	N18°54.7	43°00.1	\$13°29.2	187°11.1	N00°18.1	Rasalhague	96°09.1	12°33.1					
19	27°18.5	106°16.5	33.4	245°06.4	54.9	58°02.1	29.0	202°13.5	18.1	Eltanin	90°47.8	51°29.2					
20	42°20.9	121°15.5	33.3	260°09.3	55.1	73°04.0	28.8	217°16.0	18.1	Kaus Aust.	83°47.5	-34°22.8					
21	57°23.4	136°14.5	.. 33.1	275°12.1	.. 55.4	88°06.0	.. 28.6	232°18.4	.. 18.1	Vega	80°41.1	38°47.5					
22	72°25.9	151°13.6	33.0	290°15.0	55.6	103°08.0	28.5	247°20.8	18.1	Nunki	76°01.8	-26°17.1					
23	87°28.3	166°12.6	32.8	305°17.9	55.9	118°09.9	28.3	262°23.2	18.1	Altair	62°11.1	8°53.7					
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			Peacock			Fomalhaut				
Sun			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	102°30.8	181°11.6	\$23°32.7	320°20.8	N18°56.1	133°11.9	\$13°28.1	277°25.6	N00°18.1	Scheat	13°56.1	28°08.4					
1	117°33.3	196°10.7	32.5	335°23.7	56.3	148°13.9	27.9	292°28.0	18.1	Markab	13°41.0	15°15.7					
2	132°35.7	211°09.7	32.4	350°26.6	56.6	163°15.9	27.8	307°30.4	18.1	Jan 01 Fri	81°25.5	11:53					
3	147°38.2	226°08.7	.. 32.2	5°29.4	.. 56.8	178°17.8	.. 27.6	322°32.9	.. 18.0	Venus	80°03.2	11:54					
4	162°40.6	241°07.8	32.0	20°32.3	57.0	193°19.8	27.4	337°35.3	18.0	Mars	217°31.4	02:47					
5	177°43.1	256°06.8	31.9	35°35.2	57.3	208°21.8	27.2	352°37.7	18.0	Jupiter	31°04.7	15:19					
6	192°45.6	271°05.8	\$23°31.7	50°38.1	N18°57.5	223°23.7	\$13°27.0	7°40.1	N00°18.0	Saturn	174°57.4	05:37					
7	207°48.0	286°04.9	31.6	65°41.0	57.8	238°25.7	26.9	22°42.5	18.0	Jan 02 Sat	80°03.2	11:54					
8	222°50.5	301°03.9	31.4	80°43.9	58.0	253°27.7	26.7	37°44.9	18.0	Venus	217°40.3	02:43					
9	237°53.0	316°03.0	.. 31.2	95°46.8	.. 58.2	268°29.6	.. 26.5	52°47.4	.. 18.0	Mars	30°53.0	15:08					
10	252°55.4	331°02.0	31.1	110°49.7	58.5	283°31.6	26.3	67°49.8	18.0	Jupiter	174°56.1	05:33					
11	267°57.9	346°01.0	30.9	125°52.6	58.7	298°33.6	26.2	82°52.2	18.0	Saturn	174°54.8	05:29					
12	283°00.4	1°00.1	\$23°30.7	140°55.5	N18°59.0	313°35.5	\$13°26.0	97°54.6	N00°18.0	Jan 03 Sun	78°40.8	11:56					
13	298°02.8	15°59.1	30.6	155°58.4	59.2	328°37.5	25.8	112°57.0	18.0	Venus	217°50.0	02:38					
14	313°05.3	30°58.1	30.4	171°01.3	59.5	343°39.5	25.6	127°59.4	18.0	Mars	30°41.1	15:05					
15	328°07.8	45°57.2	.. 30.2														

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2020 January 01 to Jan. 03

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h	Sun			Moon			Lat.	Twilight	Sunrise	Sunset	Twilight	
	Wed	GHA	Dec	GHA	v	Dec	d	Civil	Naut.			
0	179° 13.7	S23° 03.5	110° 56.9	15.3°	S09° 58.5	10.7°	54.3°	N 72°	08:23	10:41	■■■	13:27 15:45
1	194° 13.4	03.3	125° 31.3	15.4°	09° 47.8	10.7°	54.3°	N 70°	08:05	09:49	■■■	14:19 16:03
2	209° 13.1	03.1	140° 05.7	15.4°	09° 37.1	10.7°	54.3°	68°	07:50	09:16	■■■	14:52 16:18
3	224° 12.8	.. 03.0	154° 40.1	15.5°	09° 26.3	10.8°	54.3°	66°	07:37	08:53	10:27	13:41 15:15 16:31
4	239° 12.5	02.8	169° 14.6	15.5°	09° 15.5	10.8°	54.3°	64°	07:26	08:34	09:49	14:19 15:34 16:41
5	254° 12.2	02.6	183° 49.1	15.5°	09° 04.7	10.8°	54.2°	62°	07:17	08:18	09:23	14:45 15:49 16:51
6	269° 11.9	S23° 02.4	198° 23.6	15.6°	S08° 53.8	10.9°	54.2°	60°	07:09	08:05	09:02	15:06 16:02 16:59
7	284° 11.6	02.2	212° 58.2	15.6°	08° 42.9	10.9°	54.2°	N 58°	07:02	07:54	08:45	15:23 16:14 17:06
8	299° 11.3	02.0	227° 32.8	15.6°	08° 32.0	10.9°	54.2°	56°	06:56	07:44	08:31	15:37 16:24 17:12
9	314° 11.0	.. 01.8	242° 07.5	15.7°	08° 21.0	11.0°	54.2°	54°	06:50	07:35	08:19	15:49 16:32 17:18
10	329° 10.7	01.6	256° 42.2	15.7°	08° 10.0	11.0°	54.2°	52°	06:44	07:28	08:08	16:00 16:40 17:24
11	344° 10.4	01.4	271° 16.9	15.7°	07° 59.0	11.0°	54.2°	50°	06:39	07:20	07:58	16:09 16:47 17:29
12	359° 10.1	S23° 01.2	285° 51.7	15.8°	S07° 48.0	11.1°	54.2°	45°	06:28	07:05	07:38	16:29 17:03 17:40
13	14° 09.8	01.0	300° 26.4	15.8°	07° 36.9	11.1°	54.2°	N 40°	06:18	06:52	07:22	16:46 17:16 17:50
14	29° 09.5	00.8	315° 01.2	15.8°	07° 25.8	11.1°	54.2°	35°	06:08	06:40	07:08	17:00 17:28 17:59
15	44° 09.2	.. 00.6	329° 36.1	15.9°	07° 14.7	11.1°	54.2°	30°	06:00	06:30	06:56	17:12 17:38 18:08
16	59° 08.9	00.4	344° 10.9	15.9°	07° 03.5	11.2°	54.2°	20°	05:44	06:11	06:35	17:32 17:56 18:24
17	74° 08.6	00.2	358° 45.8	15.9°	06° 52.3	11.2°	54.2°	N 10°	05:28	05:54	06:17	17:50 18:13 18:40
18	89° 08.3	S23° 00.0	13° 20.7	15.9°	S06° 41.1	11.2°	54.2°	0°	05:11	05:38	06:00	18:08 18:30 18:56
19	104° 08.0	22° 59.7	27° 55.7	16.0°	06° 29.9	11.2°	54.2°	S 10°	04:53	05:20	05:43	18:25 18:48 19:15
20	119° 07.7	59.5	42° 30.7	16.0°	06° 18.7	11.3°	54.2°	20°	04:31	05:00	05:24	18:43 19:08 19:37
21	134° 07.5	.. 59.3	57° 05.6	16.0°	06° 07.4	11.3°	54.2°	30°	04:02	04:35	05:03	19:05 19:32 20:05
22	149° 07.2	59.1	71° 40.6	16.0°	05° 56.1	11.3°	54.2°	35°	03:44	04:20	04:50	19:17 19:47 20:23
23	164° 06.9	58.9	86° 15.7	16.0°	05° 44.8	11.3°	54.2°	40°	03:21	04:03	04:35	19:32 20:05 20:46
			SD.=16.3	d=0.2		S.D.=14.8	45°	02:52	03:41	04:18	19:50	20:27

Thu	Sun			Moon			Lat.	Twilight	Sunrise	Sunset	Twilight	
	Thu	GHA	Dec	GHA	v	Dec	d	Civil	Naut.			
0	179° 06.6	S22° 58.7	100° 50.7	16.1°	S05° 33.4	11.3°	54.2°	N 50°	02:08	03:12	03:56	20:11 20:55 21:59
1	194° 06.3	58.5	115° 25.8	16.1°	05° 22.1	11.4°	54.2°	52°	01:42	02:57	03:45	20:22 21:10 22:24
2	209° 06.0	58.3	130° 09.9	16.1°	05° 10.7	11.4°	54.2°	54°	01:02	02:40	03:33	20:34 21:27 23:03
3	224° 05.7	.. 58.1	144° 36.0	16.1°	04° 59.3	11.4°	54.2°	56°	00:59	02:19	03:20	20:47 21:48 22:58
4	239° 05.4	57.9	159° 11.1	16.1°	04° 47.9	11.4°	54.2°	S 50°	01:51	03:03	21:04	22:15
5	254° 05.1	57.6	173° 46.3	16.1°	04° 36.5	11.4°	54.2°	58°	01:08	02:44	21:23	22:58
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	Sun			Moon			Lat.	Moonrise	Thu	Fri	Moonset	
	Fri	GHA	Dec	GHA	v	Dec	d	Wed	Thu	Fri		
0	178° 59.5	S22° 53.4	90° 55.5	16.2°	S00° 56.6	11.7°	54.3°	N 72°	12:37	12:18	12:00	21:58 23:43
1	193° 59.3	53.2	105° 30.8	16.2°	00° 44.9	11.7°	54.3°	N 70°	12:26	12:13	12:02	22:06 23:44
2	208° 59.0	53.0	120° 06.0	16.2°	00° 33.2	11.7°	54.3°	68°	12:17	12:10	12:03	22:14 23:45
3	223° 58.7	.. 52.7	134° 41.3	16.2°	00° 21.5	11.7°	54.3°	66°	12:09	12:07	12:04	22:20 23:46
4	238° 58.4	52.5	149° 16.5	16.2°	S09° 09.9	11.7°	54.3°	64°	12:02	12:04	12:05	22:25 23:47
5	253° 58.1	52.3	163° 51.7	16.2°	S00° 01.8	11.7°	54.3°	62°	11:57	12:02	12:06	22:29 23:48
6	268° 57.8	S22° 52.0	178° 26.9	16.2°	S00° 13.5	11.7°	54.3°	60°	11:52	12:00	12:07	22:33 23:49
7	283° 57.5	51.8	193° 02.1	16.2°	00° 25.2	11.7°	54.3°	N 58°	11:48	11:58	12:08	22:36 23:49
8	298° 57.2	51.6	207° 37.3	16.2°	00° 36.9	11.7°	54.3°	56°	11:44	11:56	12:08	22:39 23:50
9	313° 56.9	.. 51.3	222° 12.5	16.2°	00° 48.6	11.7°	54.3°	54°	11:40	11:55	12:09	22:42 23:50
10	328° 56.6	51.1	236° 47.7	16.2°	01° 00.3	11.7°	54.3°	52°	11:37	11:54	12:10	22:44 23:51
11	343° 56.4	50.8	251° 22.8	16.1°	01° 12.0	11.7°	54.4°	50°	11:34	11:52	12:10	22:46 23:51
12	358° 56.1	S22° 50.6	265° 58.0	16.1°	S01° 23.7	11.7°	54.4°	48°	11:28	11:50	12:11	22:51 23:52
13	13° 55.8	50.4	280° 33.1	16.1°	01° 35.4	11.7°	54.4°	46°	10:49	11:34	12:18	23:19 23:57
14	28° 55.5	50.1	295° 08.2	16.1°	01° 47.1	11.7°	54.4°	44°	10:43	11:31	12:19	23:24 23:57
15	43° 55.2	.. 49.9	309° 43.3	16.1°	01° 58.8	11.7°	54.4°	42°	10:36	11:28	12:20	23:29 23:58
16	58° 54.9	49.6	324° 18.4	16.1°	02° 10.5	11.7°	54.4°	40°	10:32	11:26	12:21	23:31 23:59
17	73° 54.6	49.4	338° 53.4	16.0°	02° 22.2	11.7°	54.4°	38°	10:27	11:25	12:22	23:35 23:59
18	88° 54.3	S22° 49.2	353° 28.4	16.0°	S02° 33.9	11.7°	54.4°	36°	10:21	11:22	12:23	

## 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.<sup>1</sup> 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 January 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.<sup>2</sup>) 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  $\Delta T$  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.

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<sup>1</sup>[https://en.wikipedia.org/wiki/Day\\_length\\_fluctuations](https://en.wikipedia.org/wiki/Day_length_fluctuations)

<sup>2</sup><https://hpiers.obspm.fr/eoppc/bul/bulb/explanatory.html>

## January 01, 02, 03 UT (Sat., Sun., Mon.)

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	100°37.6	166°00.0	\$18°35.0	208°58.0	\$22°30.0	127°39.4	\$12°12.7	146°01.3	\$18°00.6	Alpheratz	357°37.4	29°12.8					
1	115°40.0	181°03.9	34.6	223°58.6	30.2	142°41.4	12.5	161°03.5	00.6	Ankaa	353°09.7	-42°11.5					
2	130°42.5	196°07.7	34.1	238°59.1	30.5	157°43.4	12.3	176°05.7	00.5	Schedar	349°33.8	56°39.7					
3	145°45.0	211°11.6	33.7	253°59.7	30.7	172°45.4	12.1	191°07.9	00.4	Diphda	348°49.8	-17°52.2					
4	160°47.4	226°15.4	33.3	269°00.3	31.0	187°47.3	12.0	206°10.1	00.3	Achernar	335°22.0	-57°07.9					
5	175°49.9	241°19.3	32.8	284°00.8	31.2	202°49.3	11.8	221°12.3	00.3	Hamal	327°53.8	23°34.0					
6	190°52.4	256°23.1	\$18°32.4	299°01.4	\$22°31.5	217°51.3	\$12°11.6	236°14.5	\$18°00.2	Polaris	314°53.0	89°21.6					
7	205°54.8	271°27.0	31.9	314°01.9	31.7	232°53.3	11.4	251°16.6	00.1	Acamar	315°13.4	-40°13.3					
8	220°57.3	286°30.9	31.5	329°02.5	32.0	247°55.3	11.3	266°18.8	00.0	Menkar	314°08.5	4°10.5					
9	235°59.8	301°34.7	31.1	344°03.1	32.2	262°57.3	11.1	281°21.0	18°00.0	Mirfak	308°31.4	49°56.4					
10	251°02.2	316°38.6	30.6	359°03.6	32.5	277°59.3	10.9	296°23.2	17°59.9	Aldebaran	290°42.2	16°33.2					
11	266°04.7	331°42.5	30.2	14°04.2	32.7	293°01.3	10.7	311°25.4	59.8	Rigel	281°05.9	-8°10.7					
12	281°07.2	346°46.3	\$18°29.8	29°04.7	\$22°33.0	308°03.3	\$12°10.5	326°27.6	\$17°59.7	Capella	280°25.1	46°01.2					
13	296°09.6	1°50.2	29.3	44°05.3	33.2	323°05.3	10.4	341°29.8	59.7	Bellatrix	278°25.2	6°22.1					
14	311°12.1	16°54.1	28.9	59°05.8	33.5	338°07.3	10.2	356°32.0	59.6	Elnath	278°04.6	28°37.5					
15	326°14.5	31°58.0	28.5	74°06.4	33.7	353°09.3	10.0	11°34.2	59.5	Alnilam	275°39.9	-1°11.3					
16	341°17.0	47°01.9	28.0	89°07.0	33.9	8°11.3	09.8	26°36.4	59.4	Betelgeuse	270°54.4	7°24.6					
17	356°19.5	62°05.8	27.6	104°07.5	34.2	23°13.3	09.7	41°38.5	59.4	Canopus	263°52.9	-52°42.5					
18	11°21.9	77°09.7	\$18°27.2	119°08.1	\$22°34.4	38°15.3	\$12°09.5	56°40.7	\$17°59.3	Sirius	258°28.1	-16°44.8					
19	26°24.4	92°13.6	26.7	134°08.6	34.7	53°17.3	09.3	71°42.9	59.2	Adhara	255°07.4	-29°00.1					
20	41°26.9	107°17.4	26.3	149°09.2	34.9	68°19.3	09.1	86°45.1	59.1	Procyon	244°53.1	5°10.1					
21	56°29.3	122°21.3	3.3	25.9	164°09.7	35.2	83°21.3	09.0	101°47.3	59.1	Pollux	243°20.0	27°58.3				
22	71°31.8	137°25.3	25.4	179°10.3	35.4	98°23.3	08.8	116°49.5	59.0	Avior	234°15.1	-59°34.6					
23	86°34.3	152°29.2	25.0	194°10.8	35.6	113°25.3	08.6	131°51.7	58.9	Suhail	222°47.7	-43°31.1					
Mer.pass. 17:15			ν 3.8° d 0.4° m -4.17	ν 0.6° d -0.2° m 1.54	ν 2.0° d 0.2° m -2.14	ν 2.2° d 0.1° m 0.77	Mer.pass. 17:11			ν 3.9° d 0.4° m -4.18	ν 0.6° d -0.2° m 1.54	ν 2.0° d 0.2° m -2.13	ν 2.2° d 0.1° m 0.77	Mer.pass. 17:07			
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	101°36.7	167°33.1	\$18°24.6	209°11.4	\$22°35.9	128°27.3	\$12°08.4	146°53.9	\$17°58.8	Denebola	182°27.4	14°26.9					
1	116°39.2	182°37.0	24.1	224°12.0	36.1	143°29.3	08.2	161°56.1	58.8	Gienah	175°46.1	-17°39.7					
2	131°41.7	197°40.9	23.7	239°12.5	36.4	158°31.3	08.1	176°58.3	58.7	Acrux	173°02.7	-63°12.9					
3	146°44.1	212°44.8	33.3	254°13.1	36.6	173°33.2	07.9	192°00.4	58.6	Gacrux	171°54.3	-57°13.8					
4	161°46.6	227°48.7	22.8	269°13.6	36.8	188°35.2	07.7	207°02.6	58.5	Alioth	166°15.3	55°50.2					
5	176°49.0	242°52.6	22.4	284°14.2	37.1	203°37.2	07.5	222°04.8	58.5	Spica	158°25.0	-11°16.4					
6	191°51.5	257°56.6	\$18°22.0	299°14.7	\$22°37.3	218°39.2	\$12°07.4	237°07.0	\$17°58.4	Alkaid	152°54.2	49°12.0					
7	206°54.0	273°00.5	21.6	314°15.3	37.6	233°41.2	07.2	252°09.2	58.3	Hadar	148°39.7	-60°28.4					
8	221°56.4	288°04.4	21.1	329°15.8	37.8	248°43.2	07.0	267°11.4	58.2	Menkent	148°00.7	-36°28.4					
9	236°58.9	303°08.4	20.7	344°16.4	38.0	263°45.2	06.8	282°13.6	58.2	Arcturus	145°50.3	19°04.0					
10	252°01.4	318°12.3	20.3	359°16.9	38.3	278°47.2	06.6	297°15.8	58.1	Rigel Kent	139°44.0	-60°55.2					
11	267°03.8	333°16.2	19.8	14°17.5	38.5	293°49.2	06.5	312°18.0	58.0	Kochab	137°20.5	74°03.7					
12	282°06.3	348°20.2	\$18°19.4	29°18.0	\$22°38.8	308°51.2	\$12°06.3	327°20.1	\$17°57.9	Zuben'ubi	136°58.9	-16°07.8					
13	297°08.8	3°24.1	19.0	44°18.6	39.0	323°53.2	06.1	342°22.3	57.9	Alphecca	126°06.1	26°38.4					
14	312°11.2	18°28.1	18.6	59°19.2	39.2	338°55.2	05.9	357°24.5	57.8	Antares	112°19.2	-26°28.7					
15	327°13.7	33°32.0	3.3	74°19.7	39.5	353°57.2	05.7	12°26.7	57.7	Atria	107°16.2	-69°03.8					
16	342°16.2	48°36.0	17.7	89°20.3	39.7	8°59.2	05.6	27°28.9	57.6	Sabik	102°06.0	-15°45.1					
17	357°18.6	63°39.9	17.3	104°20.8	39.9	24°01.2	05.4	42°31.1	57.6	Shaula	96°14.1	-37°07.1					
18	12°21.1	78°43.9	\$18°16.9	119°21.4	\$22°40.2	39°03.1	\$12°05.2	57°33.3	\$17°57.5	Rasalhague	96°01.2	12°32.6					
19	27°23.5	93°47.8	16.5	134°21.9	40.4	54°05.1	05.0	72°35.5	57.4	Eltanin	90°43.9	51°29.1					
20	42°26.0	108°51.8	16.0	149°22.5	40.6	69°07.1	04.9	87°37.6	57.3	Kaus Aust.	83°36.2	-34°22.4					
21	57°28.5	123°55.7	15.6	164°23.0	40.9	84°09.1	04.7	102°39.8	57.3	Vega	80°35.3	38°48.2					
22	72°30.9	138°59.7	15.2	179°23.6	41.1	99°11.1	04.5	117°42.0	57.2	Nunki	75°51.2	-26°16.2					
23	87°33.4	154°03.7	14.8	194°24.1	41.3	114°13.1	04.3	132°44.2	57.1	Altair	62°02.7	8°55.6					
Mer.pass. 17:11			ν 3.9° d 0.4° m -4.18	ν 0.6° d -0.2° m 1.54	ν 2.0° d 0.2° m -2.13	ν 2.2° d 0.1° m 0.77	Mer.pass. 17:07			ν 4.0° d 0.4° m -4.27	ν 0.6° d -0.2° m 1.53	ν 2.0° d 0.2° m -2.13	ν 2.2° d 0.1° m 0.77	Mer.pass. 17:07			
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	102°35.9	169°07.6	\$18°14.4	209°24.7	\$22°41.6	129°15.1	\$12°04.1	147°46.4	\$17°57.0	Jan 01 Sat	65°22.5	12:53					
1	117°38.3	184°11.6	13.9	224°25.2	41.8	144°17.1	04.0	162°48.6	57.0	Venus	65°56.3	12:46					
2	132°40.8	199°15.6	13.5	239°25.8	42.0	159°19.1	03.8	177°50.8	56.9	Mars	108°20.4	10:04					
3	147°43.3	214°19.6	33.3	254°26.3	42.3	174°21.1	03.6	192°53.0	56.8	Jupiter	27°01.8	15:27					
4	162°45.7	229°23.5	12.7	269°26.9	42.5	189°23.1	03.4	207°55.1	56.7	Saturn	45°23.7	14:14					
5	177°48.2	244°27.5	12.3	284°27.4	42.7	204°25.0	03.2	222°57.3	56.7	Jan 02 Sun	65°56.3	10:03					
6	192°50.7	259°31.5	\$18°11.8	299°28.0	\$22°43.0	219°27.0	\$12°03.1	237°59.5	\$17°56.6	Venus	65°34.7	10:45					
7	207°53.1	274°35.5	11.4	314°28.5	43.2	234°29.0	02.9	253°01.7	56.5	Mars	107°34.2	15:24					
8	222°55.6	289°39.5	11.0	329°29.1	43.4	249°31.0	02.7	268°03.9	56.4	Jupiter	26°50.5	14:10					
9	237°58.0	304°43.5	10.6	344°29.6	43.6	264°33.0	02.5	283°06.1	56.4	Saturn	45°17.2	14:07					
10	253°00.5	319°47.5	10.2	359°30.2	43.9	279°35.0	02.3	298°08.3	56.3	Jan 03 Mon	66°31.8	12:40					
11	268°03.0	334°51.5	09.8	14°30.7	44.1	294°37.0	02.2	313°10.5	56.2	Venus	106°48.8	10:02					
12	283°05.4	349°55.5	\$18°09.4	29°31.3	\$22°44.3	309°39.0	\$12°02.0	328°12.6	\$17°56.1	Mars	26°39.2	15:21					
13	298°07.9	4°59.5	08.9	44°31.8	44.6	324°41.0	01.8</										

DUT1 = UT1-UTC = -0.1105 sec  $\Delta T = TT-UT1 = +69.2945$  sec

2022 January 01 to Jan. 03 UT

h		Sun		Moon				
Sat		GHA	Dec	GHA	$\nu$	Dec	d	HP
0	179°10.5	S23°01.2	206°32.5	2.9'	S23°55.2	-7.3'	61.0'	
1	194°10.2	01.0	220°54.3	2.8'	24°02.5	-7.1'	61.0'	
2	209°09.9	00.8	235°16.1	2.7'	24°09.6	-7.0'	61.0'	
3	224°09.6	.. 00.6	249°37.8	2.6'	24°16.6	-6.8'	61.1'	
4	239°09.3	00.4	263°59.4	2.5'	24°23.4	-6.6'	61.1'	
5	254°09.0	00.2	278°20.9	2.4'	24°30.0	-6.4'	61.1'	
6	269°08.7	S23°00.0	292°42.4	2.3'	S24°36.4	-6.2'	61.1'	
7	284°08.4	22°59.8	307°03.7	2.3'	24°42.6	-6.0'	61.1'	
8	299°08.1	59.6	321°25.0	2.2'	24°48.6	-5.9'	61.1'	
9	314°07.8	.. 59.4	335°46.1	2.1'	24°54.5	-5.7'	61.1'	
10	329°07.5	59.2	350°07.2	2.0'	25°00.2	-5.5'	61.1'	
11	344°07.2	58.9	4°28.3	2.0'	25°05.6	-5.3'	61.1'	
12	359°06.9	S22°58.7	18°49.2	1.9'	S25°10.9	-5.1'	61.1'	
13	14°06.6	58.5	33°10.1	1.8'	25°16.0	-4.9'	61.1'	
14	29°06.3	58.3	47°30.9	1.8'	25°20.9	-4.7'	61.1'	
15	44°06.0	.. 58.1	61°51.7	1.7'	25°25.6	-4.5'	61.2'	
16	59°05.7	57.9	76°12.4	1.6'	25°30.2	-4.3'	61.2'	
17	74°05.5	57.7	90°33.0	1.6'	25°34.5	-4.1'	61.2'	
18	89°05.2	S22°57.5	104°53.6	1.5'	S25°38.6	-3.9'	61.2'	
19	104°04.9	57.2	119°14.1	1.5'	25°42.5	-3.7'	61.2'	
20	119°04.6	57.0	133°34.6	1.4'	25°46.2	-3.5'	61.2'	
21	134°04.3	.. 56.8	147°55.0	1.4'	25°49.7	-3.3'	61.2'	
22	149°04.0	56.6	162°15.4	1.4'	25°53.0	-3.1'	61.2'	
23	164°03.7	56.4	176°35.8	1.3'	25°56.2	-2.9'	61.2'	
		SD = 16.3' $d = 0.2'$		SD = 16.6'				

Sun	GHA	Dec	GHA	$\nu$	Dec	d	HP	
0	179°03.4	S22°56.1	190°56.1	1.3'	S25°59.1	-2.7'	61.2'	
1	194°03.1	55.9	205°16.4	1.2'	26°01.8	-2.5'	61.2'	
2	209°02.8	55.7	219°36.6	1.2'	26°04.3	-2.3'	61.2'	
3	224°02.5	.. 55.5	233°56.9	1.2'	26°06.6	-2.1'	61.2'	
4	239°02.2	55.3	248°17.1	1.2'	26°08.7	-1.9'	61.2'	
5	254°01.9	55.0	262°37.2	1.2'	26°10.5	-1.7'	61.2'	
6	269°01.6	S22°54.8	276°57.4	1.1'	S26°12.2	-1.5'	61.2'	
7	284°01.3	54.6	291°17.5	1.1'	26°13.7	-1.3'	61.1'	
8	299°01.1	54.4	305°37.7	1.1'	26°14.9	-1.1'	61.1'	
9	314°00.8	.. 54.1	319°57.8	1.1'	26°16.0	-0.8'	61.1'	
10	329°00.5	53.9	334°17.9	1.1'	26°16.8	-0.6'	61.1'	
11	344°00.2	53.7	348°38.0	1.1'	26°17.5	-0.4'	61.1'	
12	358°59.9	S22°53.4	2°58.2	1.1'	S26°17.9	-0.2'	61.1'	
13	13°59.6	53.2	17°18.3	1.1'	26°18.1	-0.0'	61.1'	
14	28°59.3	53.0	31°38.4	1.2'	26°18.2	0.2'	61.1'	
15	43°59.0	.. 52.8	45°58.6	1.2'	26°18.0	0.4'	61.1'	
16	58°58.7	52.5	60°18.8	1.2'	26°17.6	0.6'	61.1'	
17	73°58.4	52.3	74°38.9	1.2'	26°17.0	0.8'	61.1'	
18	88°58.1	S22°52.1	88°59.2	1.2'	S26°16.2	1.0'	61.1'	
19	103°57.8	51.8	103°19.4	1.3'	26°15.1	1.2'	61.1'	
20	118°57.6	51.6	117°39.7	1.3'	26°13.9	1.4'	61.0'	
21	133°57.3	.. 51.3	132°00.0	1.3'	26°12.5	1.6'	61.0'	
22	148°57.0	51.1	146°20.3	1.4'	26°10.9	1.8'	61.0'	
23	163°56.7	50.9	160°40.7	1.4'	26°09.0	2.0'	61.0'	
		SD = 16.3' $d = 0.2'$		SD = 16.7'				

Mon	GHA	Dec	GHA	$\nu$	Dec	d	HP	
0	178°56.4	S22°50.6	175°01.1	1.5'	S26°07.0	2.2'	61.0'	
1	193°56.1	50.4	189°21.5	1.5'	26°04.7	2.4'	61.0'	
2	208°55.8	50.2	203°42.0	1.6'	26°02.3	2.6'	61.0'	
3	223°55.5	.. 49.9	218°02.6	1.6'	25°59.7	2.8'	60.9'	
4	238°55.2	49.7	232°23.2	1.7'	25°56.8	3.0'	60.9'	
5	253°54.9	49.4	246°43.9	1.7'	25°53.8	3.2'	60.9'	
6	268°54.7	S22°49.2	261°04.6	1.8'	S25°50.5	3.4'	60.9'	
7	283°54.4	48.9	275°25.4	1.9'	25°47.1	3.6'	60.9'	
8	298°54.1	48.7	289°46.3	1.9'	25°43.5	3.8'	60.9'	
9	313°53.8	.. 48.4	304°07.2	2.0'	25°39.6	4.0'	60.8'	
10	328°53.5	48.2	318°28.2	2.1'	25°35.6	4.2'	60.8'	
11	343°53.2	48.0	332°49.3	2.2'	25°31.4	4.4'	60.8'	
12	358°52.9	S22°47.7	347°10.5	2.2'	S25°27.0	4.6'	60.8'	
13	13°52.6	47.5	1°31.7	2.3'	25°22.4	4.8'	60.8'	
14	28°52.4	47.2	15°53.0	2.4'	25°17.6	5.0'	60.7'	
15	43°52.1	.. 47.0	30°14.5	2.5'	25°12.7	5.2'	60.7'	
16	58°51.8	46.7	44°36.0	2.6'	25°07.5	5.3'	60.7'	
17	73°51.5	46.4	58°57.5	2.7'	25°02.2	5.5'	60.7'	
18	88°51.2	S22°46.2	73°19.2	2.8'	S24°56.7	5.7'	60.6'	
19	103°50.9	45.9	87°41.0	2.9'	24°51.0	5.9'	60.6'	
20	118°50.6	45.7	102°02.9	3.0'	24°45.1	6.1'	60.6'	
21	133°50.3	.. 45.4	116°24.8	3.1'	24°39.0	6.2'	60.6'	
22	148°50.1	45.2	130°46.9	3.2'	24°32.8	6.4'	60.6'	
23	163°49.8	44.9	145°09.1	3.3'	24°26.4	6.6'	60.5'	
		SD = 16.3' $d = 0.2'$		SD = 16.6'				

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

**January 04, 05, 06 UT (Tue., Wed., Thu.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	103°35.0	170°43.6	\$18°04.4	209°37.8	\$22°47.0	130°02.8	\$11°59.8	148°38.9	\$17°55.2					Alpheratz	357°37.4	29°12.8	
1	118°37.5	185°47.6	04.0	224°38.4	47.3	145°04.8	59.6	163°41.1	55.1					Ankaa	353°09.7	-42°11.5	
2	133°39.9	200°51.6	03.6	239°38.9	47.5	160°06.8	59.5	178°43.3	55.1					Schedar	349°33.8	56°39.7	
3	148°42.4	215°55.6	03.2	254°39.5	47.7	175°08.8	59.3	193°45.4	55.0					Diphda	348°49.8	-17°52.2	
4	163°44.9	230°59.7	02.8	269°40.0	47.9	190°10.8	59.1	208°47.6	54.9					Achernar	335°22.0	-57°07.9	
5	178°47.3	246°03.7	02.4	284°40.6	48.2	205°12.8	58.9	223°49.8	54.8					Hamal	327°53.8	23°34.0	
6	193°49.8	261°07.7	\$18°02.0	299°41.1	\$22°48.4	220°14.8	\$11°58.7	238°52.0	\$17°54.8					Polaris	314°54.1	89°21.6	
7	208°52.3	276°11.8	01.6	314°41.7	48.6	235°16.7	58.6	253°54.2	54.7					Acamar	315°13.4	-40°13.3	
8	223°54.7	291°15.8	01.2	329°42.2	48.8	250°18.7	58.4	268°56.4	54.6					Menkar	314°08.5	4°10.5	
9	238°57.2	306°19.8	00.8	344°42.7	49.0	265°20.7	58.2	283°58.6	54.5					Mirfak	308°31.4	49°56.4	
10	253°59.7	321°23.9	00.4	359°43.3	49.3	280°22.7	58.0	299°00.7	54.5					Aldebaran	290°42.1	16°33.2	
11	269°02.1	336°27.9	18°00.0	14°43.8	49.5	295°24.7	57.8	314°02.9	54.4					Rigel	281°05.9	-8°10.7	
12	284°04.6	351°32.0	\$17°59.6	29°44.4	\$22°49.7	310°26.7	\$11°57.6	329°05.1	\$17°54.3					Capella	280°25.1	46°01.2	
13	299°07.0	6°36.0	59.2	44°44.9	49.9	325°28.7	57.5	344°07.3	54.2					Bellatrix	278°25.2	6°22.1	
14	314°09.5	21°40.1	58.8	59°45.5	50.1	340°30.7	57.3	359°09.5	54.1					Elnath	278°04.6	28°37.5	
15	329°12.0	36°44.1	00.4	58.4	74°46.0	00.4	355°32.6	57.1	14°11.7	54.1					Alnilam	275°39.9	-1°11.3
16	344°14.4	51°48.2	58.0	89°46.6	50.6	10°34.6	56.9	29°13.8	54.0					Betelgeuse	270°54.4	7°24.6	
17	359°16.9	66°52.2	57.6	104°47.1	50.8	25°36.6	56.7	44°16.0	53.9					Canopus	263°52.9	-52°42.5	
18	14°19.4	81°56.3	\$17°57.2	119°47.6	\$22°51.0	40°38.6	\$11°56.6	59°18.2	\$17°53.8					Sirius	258°28.1	-16°44.8	
19	29°21.8	97°00.3	56.8	134°48.2	51.2	55°40.6	56.4	74°20.4	53.8					Adhara	255°07.4	-29°00.1	
20	44°24.3	112°04.4	56.4	149°48.7	51.4	70°42.6	56.2	89°22.6	53.7					Procyon	244°53.1	5°10.1	
21	59°26.8	127°08.4	00.4	56.0	164°49.3	00.4	85°44.5	56.0	104°24.8	53.6					Pollux	243°20.0	27°58.3
22	74°29.2	142°12.5	55.6	179°49.8	51.9	100°46.5	55.8	119°27.0	53.5					Avor	234°15.1	-59°34.6	
23	89°31.7	157°16.6	55.2	194°50.4	52.1	115°48.5	55.6	134°29.1	53.5					Suhail	222°47.7	-43°31.1	
Mer.pass. 17:03			ν 4.0' d 0.4' m -4.30	ν 0.5' d -0.2' m 1.53	ν 2.0' d 0.2' m -2.13	ν 2.2' d 0.1' m 0.77											
Wed			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	104°34.1	172°20.6	\$17°54.8	209°50.9	\$22°52.3	130°50.5	\$11°55.5	149°31.3	\$17°53.4					Denebola	182°27.4	14°26.9	
1	119°36.6	187°24.7	54.4	224°51.4	52.5	145°52.5	55.3	164°33.5	53.3					Gienah	175°46.1	-17°39.7	
2	134°39.1	202°28.8	54.0	239°52.0	52.7	160°54.5	55.1	179°35.7	53.2					Acru	173°02.7	-63°12.9	
3	149°41.5	217°32.8	00.4	254°52.5	00.4	175°56.5	54.9	194°37.9	53.2					Gacrux	171°54.3	-57°13.8	
4	164°44.0	232°36.9	53.2	269°53.1	53.2	190°58.4	54.7	209°40.1	53.1					Alioth	166°15.2	55°50.2	
5	179°46.5	247°41.0	52.8	284°53.6	53.4	206°00.4	54.6	224°42.3	53.0					Spica	158°24.9	-11°16.4	
6	194°48.9	262°45.0	\$17°52.4	299°54.2	\$22°53.6	221°02.4	\$11°54.4	239°44.4	\$17°52.9					Alkaid	152°54.1	49°12.0	
7	209°51.4	277°49.1	52.0	314°54.7	53.8	236°04.4	54.2	254°46.6	52.8					Hadar	148°39.7	60°28.4	
8	224°53.9	292°53.2	51.7	329°55.2	54.0	251°06.4	54.0	269°48.8	52.8					Menkent	148°00.6	-36°28.4	
9	239°56.3	307°57.3	00.4	51.3	344°55.8	00.4	266°08.4	53.8	284°51.0	52.7					Arcturus	145°50.3	19°04.0
10	254°58.8	323°01.3	50.9	359°56.3	54.4	281°10.3	53.6	299°53.2	52.6					Rigel Kent	139°43.9	-60°55.2	
11	270°01.3	338°05.4	50.5	14°56.9	54.6	296°12.3	53.5	314°55.4	52.5					Kochab	137°20.5	74°03.6	
12	285°03.7	353°09.5	\$17°50.1	29°57.4	\$22°54.9	311°14.3	\$11°53.3	329°57.5	\$17°52.5					Zuben'ubi	136°58.9	-16°07.9	
13	300°06.2	8°13.6	49.7	44°57.9	55.1	326°16.3	53.1	344°59.7	52.4					Alphecca	126°06.1	26°38.4	
14	315°08.6	23°17.7	49.3	59°58.5	55.3	341°18.3	52.9	0°01.9	52.3					Antares	112°19.2	-26°28.7	
15	330°11.1	38°21.7	00.4	48.9	74°59.0	00.4	356°20.3	52.7	15°04.1	52.2					Atria	107°16.1	-69°03.8
16	345°13.6	53°25.8	48.5	89°59.6	55.7	11°22.2	52.5	30°06.3	52.2					Sabik	102°05.9	-15°45.1	
17	0°16.0	68°29.9	48.2	105°00.1	55.9	26°24.2	52.4	45°08.5	52.1					Shaula	96°14.1	-37°07.1	
18	15°18.5	83°34.0	\$17°47.8	120°00.6	\$22°56.1	41°26.2	\$11°52.2	60°10.6	\$17°52.0					Rasalhague	96°01.2	12°32.6	
19	30°21.0	98°38.1	47.4	135°01.2	56.3	56°28.2	52.0	75°12.8	51.9					Eltanin	90°43.9	51°29.1	
20	45°23.4	113°42.2	47.0	150°01.7	56.5	71°30.2	51.8	90°15.0	51.8					Kaus Aust.	83°36.2	-34°22.4	
21	60°25.9	128°46.3	00.4	46.6	165°02.3	00.4	86°32.1	51.6	105°17.2	51.8					Vega	80°35.3	38°48.2
22	75°28.4	143°50.4	46.2	180°02.8	56.9	101°34.1	51.4	120°19.4	51.7					Nunki	75°51.2	-26°16.2	
23	90°30.8	158°54.5	45.9	195°03.3	57.1	116°36.1	51.3	135°21.6	51.6					Altair	62°02.7	8°55.5	
Mer.pass. 16:59			ν 4.1' d 0.4' m -4.28	ν 0.5' d -0.2' m 1.53	ν 2.0' d 0.2' m -2.12	ν 2.2' d 0.1' m 0.77											
Thu			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	105°33.3	173°58.6	\$17°45.5	210°03.9	\$22°57.3	131°38.1	\$11°51.1	150°23.7	\$17°51.5					Jan 04 Tue	SHA	Mer.pass	
1	120°35.8	189°02.7	45.1	225°04.4	57.6	146°40.1	50.9	165°25.9	51.5					Venus	67°08.6	12:34	
2	135°38.2	204°06.8	44.7	240°05.0	57.8	161°42.1	50.7	180°28.1	51.4					Mars	106°02.8	10:01	
3	150°40.7	219°10.9	00.4	44.3	255°05.5	00.4	176°44.0	50.5	195°30.3	51.3					Jupiter	26°27.8	15:18
4	165°43.1	234°15.0	44.0	270°06.0	58.2	191°46.0	50.3	210°32.5	51.2					Saturn	45°03.9	14:03	
5	180°45.6	249°19.1	43.6	285°06.6	58.4	206°48.0	50.2	225°34.7	51.2					Jan 05 Wed	SHA	Mer.pass	
6	195°48.1	264°23.2	\$17°43.2	300°07.1	\$22°58.6	221°50.0	\$11°50.0	240°36.8	\$17°51.1					Venus	67°46.5	12:27	
7	210°50.5	279°27.3	42.8	315°07.6	58.8	236°52.0	49.8	255°39.0	51.0					Mars	105°16.8	10:00	
8	225°53.0	294°31.4	42.5	330°08.2	59.0	251°53.9	49.6	270°41.2	50.9					Jupiter	26°16.4	15:15	
9	240°55.5	309°35.5	00.4	42.1	345°08.7	00.4	266°55.9	49.4	285°43.4	50.8					Saturn	44°57.2	14:00
10	255°57.9	324°39.6	41.7	40.9	0°09.3	59.4	281°57.9	49.2	300°45.6	50.8					Jan 06 Thu	SHA	Mer.pass
11	271°00.4	339°43.7	41.3	15°09.8	59.6	296°59.9	49.1	315°47.8	50.7					Venus	68°25.3	12:21	
12	286°02.9	354°47.8	\$17°40.9	30°10.3	\$22°59.8	312°01.9	\$11°48.9	330°49.9	\$17°5								

DUT1 = UT1-UTC = -0.1099 sec  $\Delta T = TT-UT1 = +69.2939$  sec

2022 January 04 to Jan. 06 UT

h		Sun		Moon				
Tue		GHA	Dec	GHA	$\nu$	Dec	d	HP
0	178°49.5	S22°44.7	159°31.3	3.4'	S24°19.8	6.7'	60.5'	
1	193°49.2	44.4	173°53.7	3.5'	24°13.1	6.9'	60.5'	
2	208°48.9	44.1	188°16.2	3.6'	24°06.2	7.1'	60.4'	
3	223°48.6	.. 43.9	202°38.8	3.7'	23°59.1	7.2'	60.4'	
4	238°48.3	43.6	217°01.5	3.8'	23°51.9	7.4'	60.4'	
5	253°48.1	43.4	231°24.4	3.9'	23°44.5	7.6'	60.4'	
6	268°47.8	S22°43.1	245°47.3	4.1'	S23°36.9	7.7'	60.3'	
7	283°47.5	42.8	260°10.4	4.2'	23°29.2	7.9'	60.3'	
8	298°47.2	42.6	274°33.5	4.3'	23°21.3	8.0'	60.3'	
9	313°46.9	.. 42.3	288°56.8	4.4'	23°13.2	8.2'	60.2'	
10	328°46.6	42.0	303°20.2	4.5'	23°05.0	8.3'	60.2'	
11	343°46.4	41.8	317°43.8	4.7'	22°56.7	8.5'	60.2'	
12	358°46.1	S22°41.5	332°07.4	4.8'	S22°48.2	8.6'	60.2'	
13	13°45.8	41.2	346°31.2	4.9'	22°39.6	8.8'	60.1'	
14	28°45.5	41.0	0°55.1	5.0'	22°30.8	8.9'	60.1'	
15	43°45.2	.. 40.7	15°19.2	5.2'	22°21.9	9.1'	60.1'	
16	58°44.9	40.4	29°43.3	5.3'	22°12.8	9.2'	60.0'	
17	73°44.7	40.2	44°07.6	5.4'	22°03.6	9.3'	60.0'	
18	88°44.4	S22°39.9	58°32.0	5.5'	S21°54.2	9.5'	60.0'	
19	103°44.1	39.6	72°56.5	5.7'	21°44.8	9.6'	59.9'	
20	118°43.8	39.3	87°21.2	5.8'	21°35.1	9.7'	59.9'	
21	133°43.5	.. 39.1	101°46.0	5.9'	21°25.4	9.9'	59.9'	
22	148°43.2	38.8	116°10.9	6.1'	21°15.5	10.0'	59.8'	
23	163°43.0	38.5	130°36.0	6.2'	21°05.5	10.1'	59.8'	
SD = 16.3'		SD = 16.5'						
Wed								
Wed		GHA	Dec	GHA	$\nu$	Dec	d	HP
0	178°42.7	S22°38.2	145°01.1	6.3'	S20°55.4	10.2'	59.8'	
1	193°42.4	38.0	159°26.5	6.4'	20°45.2	10.4'	59.7'	
2	208°42.1	37.7	173°51.9	6.6'	20°34.8	10.5'	59.7'	
3	223°41.8	.. 37.4	188°17.5	6.7'	20°24.3	10.6'	59.7'	
4	238°41.6	37.1	202°43.2	6.8'	20°13.7	10.7'	59.6'	
5	253°41.3	36.8	217°09.0	7.0'	20°03.0	10.8'	59.6'	
6	268°41.0	S22°36.6	231°35.0	7.1'	S19°52.2	10.9'	59.5'	
7	283°40.7	36.3	246°01.1	7.2'	19°41.3	11.0'	59.5'	
8	298°40.4	36.0	260°27.3	7.4'	19°30.2	11.1'	59.5'	
9	313°40.2	.. 35.7	274°53.7	7.5'	19°19.1	11.2'	59.4'	
10	328°39.9	35.4	289°20.1	7.6'	19°07.8	11.4'	59.4'	
11	343°39.6	35.1	303°46.8	7.7'	18°56.5	11.4'	59.4'	
12	358°39.3	S22°34.9	318°13.5	7.9'	S18°45.0	11.5'	59.3'	
13	13°39.0	34.6	332°40.4	8.0'	18°33.5	11.6'	59.3'	
14	28°38.8	34.3	347°07.4	8.1'	18°21.8	11.7'	59.3'	
15	43°38.5	.. 34.0	1°34.5	8.3'	18°10.1	11.8'	59.2'	
16	58°38.2	33.7	16°01.8	8.4'	17°58.3	11.9'	59.2'	
17	73°37.9	33.4	30°29.1	8.5'	17°46.4	12.0'	59.1'	
18	88°37.7	S22°33.1	44°56.7	8.6'	S17°34.4	12.1'	59.1'	
19	103°37.4	32.8	59°24.3	8.8'	17°22.3	12.2'	59.1'	
20	118°37.1	32.5	73°52.1	8.9'	17°10.1	12.3'	59.0'	
21	133°36.8	.. 32.3	88°19.9	9.0'	16°57.8	12.3'	59.0'	
22	148°36.5	32.0	102°47.9	9.1'	16°45.5	12.4'	58.9'	
23	163°36.3	31.7	117°16.1	9.3'	16°33.1	12.5'	58.9'	
SD = 16.3'		SD = 16.3'						
Thu								
Thu		GHA	Dec	GHA	$\nu$	Dec	d	HP
0	178°36.0	S22°31.4	131°44.3	9.4'	S16°20.6	12.6'	58.9'	
1	193°35.7	31.1	146°12.7	9.5'	16°08.0	12.6'	58.8'	
2	208°35.4	30.8	160°41.2	9.6'	15°55.4	12.7'	58.8'	
3	223°35.2	.. 30.5	175°09.8	9.7'	15°42.7	12.8'	58.7'	
4	238°34.9	30.2	189°38.6	9.9'	15°29.9	12.8'	58.7'	
5	253°34.6	29.9	204°07.4	10.0'	15°17.1	12.9'	58.7'	
6	268°34.3	S22°29.6	218°36.4	10.1'	S15°04.2	13.0'	58.6'	
7	283°34.1	29.3	233°05.5	10.2'	14°51.2	13.0'	58.6'	
8	298°33.8	29.0	247°34.7	10.3'	14°38.2	13.1'	58.5'	
9	313°33.5	.. 28.7	262°04.0	10.4'	14°25.1	13.1'	58.5'	
10	328°33.2	28.4	276°33.4	10.5'	14°12.0	13.2'	58.5'	
11	343°33.0	28.1	291°03.0	10.7'	13°58.7	13.3'	58.4'	
12	358°32.7	S22°27.8	305°32.6	10.8'	S13°45.5	13.3'	58.4'	
13	13°32.4	27.5	320°02.4	10.9'	13°32.2	13.4'	58.3'	
14	28°32.1	27.2	334°32.3	11.0'	13°18.8	13.4'	58.3'	
15	43°31.9	.. 26.8	349°02.2	11.1'	13°05.4	13.5'	58.3'	
16	58°31.6	26.5	3°32.3	11.2'	12°51.9	13.5'	58.2'	
17	73°31.3	26.2	18°02.5	11.3'	12°38.4	13.6'	58.2'	
18	88°31.0	S22°25.9	32°32.8	11.4'	S12°24.9	13.6'	58.1'	
19	103°30.8	25.6	47°03.2	11.5'	12°11.3	13.6'	58.1'	
20	118°30.5	25.3	61°33.7	11.6'	11°57.7	13.7'	58.1'	
21	133°30.2	.. 25.0	76°04.3	11.7'	11°44.0	13.7'	58.0'	
22	148°30.0	24.7	90°35.0	11.8'	11°30.3	13.8'	58.0'	
23	163°29.7	24.4	105°05.8	11.9'	11°16.5	13.8'	57.9'	
SD = 16.3'		SD = 16.1'						

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

**January 07, 08, 09 UT (Fri., Sat., Sun.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	106°32.4	175°37.1	\$17°36.5	210°16.7	\$23°02.2	132°25.6	\$11°46.6	151°16.1	\$17°49.7								
1	121°34.9	190°41.3	36.1	225°17.3	02.4	147°27.6	46.5	166°18.3	49.6								
2	136°37.4	205°45.4	35.8	240°17.8	02.6	162°29.6	46.3	181°20.5	49.5								
3	151°39.8	220°49.5	.. 35.4	255°18.4	.. 02.8	177°31.5	.. 46.1	196°22.7	.. 49.5								
4	166°42.3	235°53.6	35.0	270°18.9	03.0	192°33.5	45.9	211°24.9	49.4								
5	181°44.7	250°57.7	34.7	285°19.4	03.2	207°35.5	45.7	226°27.0	49.3								
6	196°47.2	266°01.8	\$17°34.3	300°20.0	\$23°03.4	222°37.5	\$11°45.5	241°29.2	\$17°49.2								
7	211°49.7	281°06.0	34.0	315°20.5	03.5	237°39.4	45.4	256°31.4	49.1								
8	226°52.1	296°10.1	33.6	330°21.0	03.7	252°41.4	45.2	271°33.6	49.1								
9	241°54.6	311°14.2	.. 33.2	345°21.6	.. 03.9	267°43.4	.. 45.0	286°35.8	.. 49.0								
10	256°57.1	326°18.3	32.9	0°22.1	04.1	282°45.4	44.8	301°37.9	48.9								
11	271°59.5	341°22.5	32.5	15°22.6	04.3	297°47.4	44.6	316°40.1	48.8								
12	287°02.0	356°26.6	\$17°32.1	30°23.2	\$23°04.5	312°49.3	\$11°44.4	331°42.3	\$17°48.8								
13	302°04.5	11°30.7	31.8	45°23.7	04.7	327°51.3	44.2	346°44.5	48.7								
14	317°06.9	26°34.8	31.4	60°24.2	04.9	342°53.3	44.1	1°46.7	48.6								
15	332°09.4	41°38.9	.. 31.1	75°24.8	.. 05.1	357°55.3	.. 43.9	16°48.8	.. 48.5								
16	347°11.9	56°43.1	30.7	90°25.3	05.3	12°57.2	43.7	31°51.0	48.4								
17	2°14.3	71°47.2	30.4	105°25.8	05.5	27°59.2	43.5	46°53.2	48.4								
18	17°16.8	86°51.3	\$17°30.0	120°26.3	\$23°05.7	43°01.2	\$11°43.3	61°55.4	\$17°48.3								
19	32°19.2	101°55.5	29.7	135°26.9	05.8	58°03.2	43.1	76°57.6	48.2								
20	47°21.7	116°59.6	29.3	150°27.4	06.0	73°05.1	42.9	91°59.8	48.1								
21	62°24.2	132°03.7	.. 28.9	165°27.9	.. 06.2	88°07.1	.. 42.7	107°01.9	.. 48.0								
22	77°26.6	147°07.8	28.6	180°28.5	06.4	103°09.1	42.6	122°04.1	48.0								
23	92°29.1	162°12.0	28.2	195°29.0	06.6	118°11.1	42.4	137°06.3	47.9								
Mer.pass. 16:51			ν 4.1' d 0.4' m -4.13	ν 0.5' d -0.2' m 1.52			ν 2.0' d 0.2' m -2.12			ν 2.2' d 0.1' m 0.77							
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	107°31.6	177°16.1	\$17°27.9	210°29.5	\$23°06.8	133°13.0	\$11°42.2	152°08.5	\$17°47.8								
1	122°34.0	192°20.2	27.5	225°30.1	07.0	148°15.0	42.0	167°10.7	47.7								
2	137°36.5	207°24.3	27.2	240°30.6	07.2	163°17.0	41.8	182°12.8	47.7								
3	152°39.0	222°28.5	.. 26.8	255°31.1	.. 07.3	178°19.0	.. 41.6	197°15.0	.. 47.6								
4	167°41.4	237°32.6	26.5	270°31.7	07.5	193°20.9	41.4	212°17.2	47.5								
5	182°43.9	252°36.7	26.1	285°32.2	07.7	208°22.9	41.3	227°19.4	47.4								
6	197°46.4	267°40.8	\$17°25.8	300°32.7	\$23°07.9	223°24.9	\$11°41.1	242°21.6	\$17°47.3								
7	212°48.8	282°45.0	25.4	315°33.2	08.1	238°26.9	40.9	257°23.7	47.3								
8	227°51.3	297°49.1	25.1	330°33.8	08.3	253°28.8	40.7	272°25.9	47.2								
9	242°53.7	312°53.2	.. 24.8	345°34.3	.. 08.5	268°30.8	.. 40.5	287°28.1	.. 47.1								
10	257°56.2	327°57.4	24.4	0°34.8	08.6	283°32.8	40.3	302°30.3	47.0								
11	272°58.7	343°01.5	24.1	15°35.4	08.8	298°34.8	40.1	317°32.5	47.0								
12	288°01.1	358°05.6	\$17°23.7	30°35.9	\$23°09.0	313°36.7	\$11°39.9	332°34.6	\$17°46.9								
13	303°03.6	13°09.7	23.4	45°36.4	09.2	328°38.7	39.8	347°36.8	46.8								
14	318°06.1	28°13.9	23.0	60°36.9	09.4	343°40.7	39.6	2°39.0	46.7								
15	333°08.5	43°18.0	.. 22.7	75°37.5	.. 09.6	358°42.7	.. 39.4	17°41.2	.. 46.6								
16	348°11.0	58°22.1	22.3	90°38.0	09.7	13°44.6	39.2	32°43.4	46.6								
17	3°13.5	73°26.3	22.0	105°38.5	09.9	28°46.6	39.0	47°45.5	46.5								
18	18°15.9	88°30.4	\$17°21.7	120°39.1	\$23°10.1	43°48.6	\$11°38.8	62°47.7	\$17°46.4								
19	33°18.4	103°34.5	21.3	135°39.6	10.3	58°50.5	38.6	77°49.9	46.3								
20	48°20.8	118°38.6	21.0	150°40.1	10.5	73°52.5	38.4	92°52.1	46.2								
21	63°23.3	133°42.8	.. 20.7	165°40.6	.. 10.6	88°54.5	.. 38.3	107°54.3	.. 46.2								
22	78°25.8	148°46.9	20.3	180°41.2	10.8	103°56.5	38.1	122°56.4	46.1								
23	93°28.2	163°51.0	20.0	195°41.7	11.0	118°58.4	37.9	137°58.6	46.0								
Mer.pass. 16:47			ν 4.1' d 0.4' m -4.08	ν 0.5' d -0.2' m 1.51			ν 2.0' d 0.2' m -2.11			ν 2.2' d 0.1' m 0.77							
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	108°30.7	178°55.1	\$17°19.6	210°42.2	\$23°11.2	134°00.4	\$11°37.7	153°00.8	\$17°45.9								
1	123°33.2	193°59.3	19.3	225°42.8	11.4	149°02.4	37.5	168°03.0	45.9								
2	138°35.6	209°03.4	19.0	240°43.3	11.5	164°04.4	37.3	183°05.2	45.8								
3	153°38.1	224°07.5	.. 18.6	255°43.8	.. 11.7	179°06.3	.. 37.1	198°07.3	.. 45.7								
4	168°40.6	239°11.6	18.3	270°44.3	11.9	194°08.3	36.9	213°09.5	45.6								
5	183°43.0	254°15.8	18.0	285°44.9	12.1	209°10.3	36.8	228°11.7	45.5								
6	198°45.5	269°19.9	\$17°17.6	300°45.4	\$23°12.2	224°12.2	\$11°36.6	243°13.9	\$17°45.5								
7	213°48.0	284°24.0	17.3	315°45.9	12.4	239°14.2	36.4	258°16.0	45.4								
8	228°50.4	299°28.1	17.0	330°46.4	12.6	254°16.2	36.2	273°18.2	45.3								
9	243°52.9	314°32.3	.. 16.7	345°47.0	.. 12.8	269°18.2	.. 36.0	288°20.4	.. 45.2								
10	258°55.3	329°36.4	16.3	0°47.5	12.9	284°20.1	35.8	303°22.6	45.1								
11	273°57.8	344°40.5	16.0	15°48.0	13.1	299°22.1	35.6	318°24.8	45.1								
12	289°00.3	359°44.6	\$17°15.7	30°48.5	\$23°13.3	314°24.1	\$11°35.4	333°26.9	\$17°45.0								
13	304°02.7	14°48.7	15.3	45°49.1	13.5	329°26.0	35.2	348°29.1	44.9								
14	319°05.2	29°52.9	15.0	60°49.6	13.6	344°28.0	35.1	3°31.3	44.8								
15	334°07.7	44°57.0	.. 14.7	75°50.1	.. 13.8	359°30.0	.. 34.9	18°33.5	.. 44.8								
16	349°10.1	60°01.1	14.4	90°50.6	14.0	14°31.9	34.7	33°35.7	44.7								
17	4°12.6	75°05.2	14.0	105°51.2	14.2	29°33.9	34.5	48°37.8	44.6								
18	19°15.1	90°09.3	\$17°13.7	120°51.7	\$23°14.3	44°35.9	\$11°34.3	63°40.0	\$17°44.5								
19	34°17.5	105°13.5	13.4	135°52.2	14.5	59°37.9	34.1	78°42.2	44.4								
20	49°20.0	120°17.6	13.1	150°52.7	14.7	74°39.8											

DUT1 = UT1-UTC = -0.1104 sec  $\Delta T = TT-UT1 = +69.2944$  sec

2022 January 07 to Jan. 09 UT

h	Sun			Moon			
Fri	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	178°29.4	S22°24.1	119°36.7	12.0'	S11°02.7	13.8'	57.9'
1	193°29.1	23.7	134°07.7	12.1'	10°48.9	13.9'	57.9'
2	208°28.9	23.4	148°38.8	12.2'	10°35.0	13.9'	57.8'
3	223°28.6	.. 23.1	163°10.0	12.3'	10°21.2	13.9'	57.8'
4	238°28.3	22.8	177°41.2	12.4'	10°07.2	13.9'	57.7'
5	253°28.1	22.5	192°12.6	12.5'	09°53.3	14.0'	57.7'
6	268°27.8	S22°22.2	206°44.1	12.5'	S09°39.3	14.0'	57.7'
7	283°27.5	21.8	221°15.6	12.6'	09°25.3	14.0'	57.6'
8	298°27.2	21.5	235°47.2	12.7'	09°11.3	14.0'	57.6'
9	313°27.0	.. 21.2	250°18.9	12.8'	08°57.3	14.1'	57.5'
10	328°26.7	20.9	264°50.7	12.9'	08°43.2	14.1'	57.5'
11	343°26.4	20.6	279°22.6	13.0'	08°29.1	14.1'	57.5'
12	358°26.2	S22°20.2	293°54.6	13.0'	S08°15.0	14.1'	57.4'
13	13°25.9	19.9	308°26.6	13.1'	08°09.9	14.1'	57.4'
14	28°25.6	19.6	322°58.7	13.2'	07°46.7	14.2'	57.3'
15	43°25.4	.. 19.3	337°30.9	13.3'	07°32.6	14.2'	57.3'
16	58°25.1	18.9	352°03.2	13.3'	07°18.4	14.2'	57.3'
17	73°24.8	18.6	6°35.6	13.4'	07°04.2	14.2'	57.2'
18	88°24.6	S22°18.3	21°08.0	13.5'	S06°50.0	14.2'	57.2'
19	103°24.3	17.9	35°40.5	13.6'	06°35.8	14.2'	57.1'
20	118°24.0	17.6	50°13.0	13.6'	06°21.6	14.2'	57.1'
21	133°23.8	.. 17.3	64°45.7	13.7'	06°07.4	14.2'	57.1'
22	148°23.5	17.0	79°18.4	13.8'	05°53.1	14.2'	57.0'
23	163°23.2	16.6	93°51.2	13.8'	05°38.9	14.2'	57.0'
	SD = 16.3'			SD = 15.8'			

Sat	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	178°23.0	S22°16.3	108°24.0	13.9'	S05°24.6	14.3'	57.0'
1	193°22.7	16.0	122°56.9	14.0'	05°10.4	14.3'	56.9'
2	208°22.4	15.6	137°29.9	14.0'	04°56.1	14.3'	56.9'
3	223°22.2	.. 15.3	152°02.9	14.1'	04°41.9	14.3'	56.8'
4	238°21.9	15.0	166°36.0	14.1'	04°27.6	14.3'	56.8'
5	253°21.6	14.6	181°09.1	14.2'	04°13.4	14.3'	56.8'
6	268°21.4	S22°14.3	195°42.3	14.3'	S03°59.1	14.3'	56.7'
7	283°21.1	13.9	210°15.6	14.3'	03°44.9	14.3'	56.7'
8	298°20.8	13.6	224°48.9	14.4'	03°30.6	14.2'	56.7'
9	313°20.6	.. 13.3	239°22.3	14.4'	03°16.4	14.2'	56.6'
10	328°20.3	12.9	253°55.7	14.5'	03°02.1	14.2'	56.6'
11	343°20.0	12.6	268°29.2	14.5'	02°47.9	14.2'	56.5'
12	358°19.8	S22°12.3	283°02.7	14.6'	S02°33.6	14.2'	56.5'
13	13°19.5	11.9	297°36.3	14.6'	02°19.4	14.2'	56.5'
14	28°19.3	11.6	312°09.9	14.7'	02°05.2	14.2'	56.4'
15	43°19.0	.. 11.2	326°43.6	14.7'	01°51.0	14.2'	56.4'
16	58°18.7	10.9	341°17.3	14.8'	01°36.8	14.2'	56.4'
17	73°18.5	10.5	355°51.0	14.8'	01°22.6	14.2'	56.3'
18	88°18.2	S22°10.2	10°24.8	14.8'	S01°08.5	14.2'	56.3'
19	103°17.9	09.8	24°58.7	14.9'	00°54.3	14.1'	56.3'
20	118°17.7	09.5	39°32.6	14.9'	00°40.2	14.1'	56.2'
21	133°17.4	.. 09.1	54°06.5	15.0'	00°26.0	14.1'	56.2'
22	148°17.2	08.8	68°40.4	15.0'	S00°11.9	14.1'	56.2'
23	163°16.9	08.4	83°14.4	15.0'	N00°02.2	14.1'	56.1'
	SD = 16.3'			SD = 15.5'			

Sun	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	178°16.6	S22°08.1	97°48.5	15.1'	N00°16.2	14.1'	56.1'
1	193°16.4	07.7	112°22.5	15.1'	00°30.3	14.0'	56.1'
2	208°16.1	07.4	126°56.6	15.1'	00°44.3	14.0'	56.0'
3	223°15.9	.. 07.0	141°30.7	15.2'	00°58.4	14.0'	56.0'
4	238°15.6	06.7	156°04.9	15.2'	01°12.3	14.0'	56.0'
5	253°15.3	06.3	170°39.1	15.2'	01°26.3	14.0'	55.9'
6	268°15.1	S22°06.0	185°13.3	15.2'	N01°40.3	13.9'	55.9'
7	283°14.8	05.6	199°47.5	15.3'	01°54.2	13.9'	55.9'
8	298°14.6	05.3	214°21.8	15.3'	02°08.1	13.9'	55.8'
9	313°14.3	.. 04.9	228°56.1	15.3'	02°22.0	13.9'	55.8'
10	328°14.0	04.6	243°30.4	15.3'	02°35.9	13.8'	55.8'
11	343°13.8	04.2	258°04.7	15.4'	02°49.7	13.8'	55.7'
12	358°13.5	S22°03.8	272°39.1	15.4'	N03°03.5	13.8'	55.7'
13	13°13.3	03.5	287°13.4	15.4'	03°17.3	13.8'	55.7'
14	28°13.0	03.1	301°47.8	15.4'	03°31.0	13.7'	55.6'
15	43°12.8	.. 02.8	316°22.2	15.4'	03°44.8	13.7'	55.6'
16	58°12.5	02.4	330°56.6	15.4'	03°58.4	13.7'	55.6'
17	73°12.2	02.0	345°31.1	15.4'	04°12.1	13.6'	55.6'
18	88°12.0	S22°01.7	0°05.5	15.5'	N04°25.7	13.6'	55.5'
19	103°11.7	01.3	14°40.0	15.5'	04°39.3	13.6'	55.5'
20	118°11.5	00.9	29°14.5	15.5'	04°52.9	13.5'	55.5'
21	133°11.2	.. 00.6	43°48.9	15.5'	05°06.4	13.5'	55.4'
22	148°11.0	22°00.2	58°23.4	15.5'	05°19.9	13.5'	55.4'
23	163°10.7	21°59.8	72°57.9	15.5'	05°33.4	13.4'	55.4'
	SD = 16.3'			SD = 15.3'			

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

Day	Sun		Mer.	Moon	
	Eqn.of	Time		Mer.	Age
	00 <sup>h</sup> mm:ss	12 <sup>h</sup> mm:ss	Pass.	Upper hh:mm	Lower hh:mm
07	06:02	06:15	12:06	16:33	04:10
08	06:28	06:41	12:07	17:17	04:55
09	06:53	07:06	12:07	18:00	05:38

**January 10, 11, 12 UT (Mon., Tue., Wed.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	109°29.8	180°34.0	\$17°11.8	210°54.8	\$23°15.4	134°47.7	\$11°33.2	153°53.1	\$17°44.0	Alpheratz	357°37.4	29°12.7					
1	124°32.3	195°38.2	11.5	225°55.4	15.5	149°49.7	33.0	168°55.3	44.0	Ankaa	353°09.7	-42°11.5					
2	139°34.8	210°42.3	11.2	240°55.9	15.7	164°51.6	32.8	183°57.4	43.9	Schedar	349°33.9	56°39.6					
3	154°37.2	225°46.4	.. 10.9	255°56.4	.. 15.9	179°53.6	.. 32.6	198°59.6	.. 43.8	Diphda	348°49.8	-17°52.2					
4	169°39.7	240°50.5	10.5	270°56.9	16.0	194°55.6	32.4	214°01.8	43.7	Achernar	335°22.0	-57°07.9					
5	184°42.2	255°54.6	10.2	285°57.4	16.2	209°57.6	32.2	229°04.0	43.6	Hamal	327°53.9	23°34.0					
6	199°44.6	270°58.7	\$17°09.9	300°58.0	\$23°16.4	224°59.5	\$11°32.0	244°06.2	\$17°43.6	Polaris	314°56.7	89°21.7					
7	214°47.1	286°02.8	09.6	315°58.5	16.5	240°01.5	31.8	259°08.3	43.5	Acamar	315°13.5	-40°13.3					
8	229°49.6	301°06.9	09.3	330°59.0	16.7	255°03.5	31.6	274°10.5	43.4	Menkar	314°08.6	4°10.5					
9	244°52.0	316°11.0	.. 09.0	345°59.5	.. 16.9	270°05.4	.. 31.5	289°12.7	.. 43.3	Mirfak	308°31.5	49°56.5					
10	259°54.5	331°15.1	08.7	1°00.1	17.0	285°07.4	31.3	304°14.9	43.2	Aldebaran	290°42.2	16°33.2					
11	274°56.9	346°19.2	08.3	16°00.6	17.2	300°09.4	31.1	319°17.0	43.2	Rigel	281°05.9	-8°10.7					
12	289°59.4	1°23.3	\$17°08.0	31°01.1	\$23°17.4	315°11.3	\$11°30.9	334°19.2	\$17°43.1	Capella	280°25.1	46°01.2					
13	305°01.9	16°27.4	07.7	46°01.6	17.5	330°13.3	30.7	349°21.4	43.0	Bellatrix	278°25.2	6°22.1					
14	320°04.3	31°31.6	07.4	61°02.1	17.7	345°15.3	30.5	4°23.6	42.9	Elnath	278°04.6	28°37.5					
15	335°06.8	46°35.7	.. 07.1	76°02.7	.. 17.8	0°17.2	.. 30.3	19°25.7	.. 42.9	Alnilam	275°39.9	-1°11.4					
16	350°09.3	61°39.8	06.8	91°03.2	18.0	15°19.2	30.1	34°27.9	42.8	Betelgeuse	270°54.4	7°24.6					
17	5°11.7	76°43.9	06.5	106°03.7	18.2	30°21.2	29.9	49°30.1	42.7	Canopus	263°52.9	-52°42.5					
18	20°14.2	91°47.9	\$17°06.2	121°04.2	\$23°18.3	45°23.1	\$11°29.7	64°32.3	\$17°42.6	Sirius	258°28.0	-16°44.8					
19	35°16.7	106°52.0	05.9	136°04.8	18.5	60°25.1	29.6	79°34.5	42.5	Adhara	255°07.4	-29°00.2					
20	50°19.1	121°56.1	05.6	151°05.3	18.7	75°27.1	29.4	94°36.6	42.5	Procyon	244°53.1	5°10.1					
21	65°21.6	137°00.2	.. 05.3	166°05.8	.. 18.8	90°29.0	.. 29.2	100°38.8	.. 42.4	Pollux	243°19.9	27°58.3					
22	80°24.1	152°04.3	05.0	181°06.3	19.0	105°31.0	29.0	124°41.0	42.3	Avior	234°15.0	-59°34.7					
23	95°26.5	167°08.4	04.7	196°06.8	19.1	120°33.0	28.8	139°43.2	42.2	Suhail	222°47.7	-43°31.1					
Mer.pass. 16:39			ν 4.1' d 0.3' m -4.15	ν 0.5' d -0.2' m 1.51	ν 2.0' d 0.2' m -2.11	ν 2.2' d 0.1' m 0.77	Mer.pass. 16:39			Mer.pass. 16:39			Mer.pass. 16:39				
Tue			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	110°29.0	182°12.5	\$17°04.4	211°07.4	\$23°19.3	135°34.9	\$11°28.6	154°45.3	\$17°42.1	Denebola	182°27.3	14°26.9					
1	125°31.4	197°16.6	04.1	226°07.9	19.5	150°36.9	28.4	169°47.5	42.1	Gienah	175°46.0	-17°39.7					
2	140°33.9	212°20.7	03.8	241°08.4	19.6	165°38.9	28.2	184°49.7	42.0	Acrux	173°02.6	-63°12.9					
3	155°36.4	227°24.8	.. 03.5	256°08.9	.. 19.8	180°40.8	.. 28.0	199°51.9	.. 41.9	Gacrux	171°54.2	-57°13.8					
4	170°38.8	242°28.9	03.2	271°09.4	19.9	195°42.8	27.8	214°54.1	41.8	Alioth	166°15.1	55°50.2					
5	185°41.3	257°33.0	02.9	286°10.0	20.1	210°44.8	27.6	229°56.2	41.7	Spica	158°24.9	-11°16.5					
6	200°43.8	272°37.0	\$17°02.6	301°10.5	\$23°20.3	225°46.7	\$11°27.5	244°58.4	\$17°41.7	Alkaid	152°54.1	49°12.0					
7	215°46.2	287°41.1	02.3	316°11.0	20.4	240°48.7	27.3	260°06.6	41.6	Hadar	148°39.6	-60°28.4					
8	230°48.7	302°45.2	02.0	331°11.5	20.6	255°50.7	27.1	275°02.8	41.5	Menkent	148°00.6	-36°28.4					
9	245°51.2	317°49.3	.. 01.7	346°12.0	.. 20.7	270°52.6	.. 26.9	290°04.9	.. 41.4	Arcturus	145°50.3	19°04.0					
10	260°53.6	332°53.4	01.4	1°12.5	20.9	285°54.6	26.7	305°07.1	41.3	Rigel Kent	139°43.9	-60°55.2					
11	275°56.1	347°57.4	01.1	16°13.1	21.0	300°56.6	26.5	320°09.3	41.3	Kochab	137°20.4	74°03.6					
12	290°58.5	3°01.5	\$17°00.8	31°13.6	\$23°21.2	315°58.5	\$11°26.3	335°11.5	\$17°41.2	Zuben' ubi	136°58.9	-16°07.9					
13	306°01.0	18°05.6	00.5	46°14.1	21.3	331°00.5	26.1	350°13.6	41.1	Alphecca	126°06.1	26°38.3					
14	321°03.5	33°09.7	00.2	61°14.6	21.5	346°02.5	25.9	5°15.8	41.0	Antares	112°19.1	-26°28.7					
15	336°05.9	48°13.7	17°00.0	76°15.1	.. 21.7	1°04.4	.. 25.7	20°18.0	.. 40.9	Atria	107°16.0	-69°03.8					
16	351°08.4	63°17.8	16°59.7	91°15.7	21.8	16°06.4	25.5	35°20.2	40.9	Sabik	102°05.9	-15°45.1					
17	6°10.9	78°21.9	59.4	106°16.2	22.0	31°08.3	25.3	50°22.3	40.8	Shaula	96°14.1	-37°07.1					
18	21°13.3	93°25.9	\$16°59.1	121°16.7	\$23°22.1	46°10.3	\$11°25.2	65°24.5	\$17°40.7	Rasalhague	96°01.1	12°32.6					
19	36°15.8	108°30.0	58.8	136°17.2	22.3	61°12.3	25.0	80°26.7	40.6	Eltanin	90°43.8	51°29.0					
20	51°18.3	123°34.1	58.5	151°17.7	22.4	76°14.2	24.8	95°28.9	40.5	Kaus Aust.	83°36.2	-34°22.4					
21	66°20.7	138°38.1	.. 58.2	166°18.2	.. 22.6	91°16.2	.. 24.6	110°31.1	.. 40.5	Vega	80°35.3	38°48.2					
22	81°23.2	153°42.2	58.0	181°18.8	22.7	106°18.2	24.4	125°33.2	40.4	Nunki	75°51.2	-26°16.2					
23	96°25.7	168°46.2	57.7	196°19.3	22.9	121°20.1	24.2	140°35.4	40.3	Altair	62°02.7	8°55.5					
Mer.pass. 16:35			ν 4.1' d 0.3' m -4.23	ν 0.5' d -0.2' m 1.50	ν 2.0' d 0.2' m -2.10	ν 2.2' d 0.1' m 0.77	Mer.pass. 16:35			Mer.pass. 16:35			Mer.pass. 16:35				
Wed			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	111°28.1	183°50.3	\$16°57.4	211°19.8	\$23°23.0	136°22.1	\$11°24.0	155°37.6	\$17°40.2	Fomalhaut	15°17.5	-29°30.6					
1	126°30.6	198°54.4	57.1	226°20.3	23.2	151°24.1	23.8	170°39.8	40.1	Scheat	13°47.8	28°12.1					
2	141°33.0	213°58.4	56.8	241°20.8	23.3	166°26.0	23.6	185°41.9	40.1	Markab	13°32.5	15°19.4					
3	156°35.5	229°02.5	.. 56.5	256°21.3	.. 23.5	181°28.0	.. 23.4	200°44.1	.. 40.0	Jan 10 Mon	SHA	Mer.pass					
4	171°38.0	244°06.5	56.3	271°21.9	23.6	196°30.0	23.2	215°46.3	39.9	Venus	71°04.2	11:54					
5	186°40.4	259°10.6	56.0	286°22.4	23.8	211°31.9	23.0	230°48.5	39.8	Mars	101°25.0	09:56					
6	201°42.9	274°14.6	\$16°55.7	301°22.9	\$23°23.9	226°33.9	\$11°22.8	245°50.6	\$17°39.7	Jupiter	25°17.9	14:59					
7	216°45.4	289°18.7	55.4	316°23.4	24.1	241°35.8	22.7	260°52.8	39.7	Saturn	44°23.2	13:42					
8	231°47.8	304°22.7	55.2	331°23.9	24.2	256°37.8	22.5	275°55.0	39.6	Jan 11 Tue	SHA	Mer.pass					
9	246°50.3	319°26.7	.. 54.9	346°24.4	.. 24.4	271°39.8	.. 22.3	290°57.2	.. 39.5	Venus	71°43.5	11:48					
10	261°52.8	334°30.8	54.6	1°24.9	24.5	286°41.7	22.1	305°59.3	39.4	Mars	100°38.4	09:55					
11	276°55.2	349°34.8	54.3	16°25.5	24.7	301°43.7	21.9	321°01.5	39.3	Jupiter	25°06.0	14:56					
12	291°57.7	4°38.9	\$16°54.1	31°26.0	\$23°25.7	316°45.7	\$11°21.7	336°03.7	\$17°39.3	Saturn	44°16.4	13:39					
13	307°00.2	19°42.9	53.8	46°26.5	25.0	331°47.6	21.5	351°05.9	39.2	Jan 12							

DUT1 = UT1-UTC = -0.1116 sec  $\Delta T = TT-UT1 = +69.2956$  sec

2022 January 10 to Jan. 12 UT

h		Sun		Moon				
Mon		GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	178°10.5	S21°59.5		87°32.4	15.5'	N05°46.8	13.4'	55.4'
1	193°10.2	59.1	102°06.9	15.5'	06°00.2	13.4'	55.3'	
2	208°10.0	58.7	116°41.5	15.5'	06°13.6	13.3'	55.3'	
3	223°09.7	.. 58.4	131°16.0	15.5'	06°26.9	13.3'	55.3'	
4	238°09.4	58.0	145°50.5	15.5'	06°40.2	13.2'	55.2'	
5	253°09.2	57.6	160°25.0	15.5'	06°53.4	13.2'	55.2'	
6	268°08.9	S21°57.2	174°59.5	15.5'	N07°06.6	13.2'	55.2'	
7	283°08.7	56.9	189°34.1	15.5'	07°19.8	13.1'	55.2'	
8	298°08.4	56.5	204°08.6	15.5'	07°32.9	13.1'	55.1'	
9	313°08.2	.. 56.1	218°43.1	15.5'	07°46.0	13.0'	55.1'	
10	328°07.9	55.7	233°17.6	15.5'	07°59.0	13.0'	55.1'	
11	343°07.7	55.4	247°52.1	15.5'	08°12.0	13.0'	55.1'	
12	358°07.4	S21°55.0	262°26.6	15.5'	N08°25.0	12.9'	55.0'	
13	13°07.2	54.6	277°01.1	15.5'	08°37.9	12.9'	55.0'	
14	28°06.9	54.2	291°35.6	15.5'	08°50.7	12.8'	55.0'	
15	43°06.7	.. 53.9	306°10.1	15.5'	09°03.5	12.8'	55.0'	
16	58°06.4	53.5	320°44.5	15.5'	09°16.3	12.7'	54.9'	
17	73°06.2	53.1	335°19.0	15.4'	09°29.0	12.7'	54.9'	
18	88°05.9	S21°52.7	349°53.4	15.4'	N09°41.7	12.6'	54.9'	
19	103°05.7	52.3	4°27.8	15.4'	09°54.3	12.6'	54.9'	
20	118°05.4	51.9	19°02.2	15.4'	10°06.9	12.5'	54.9'	
21	133°05.2	.. 51.6	33°36.6	15.4'	10°19.5	12.5'	54.8'	
22	148°04.9	51.2	48°11.0	15.4'	10°31.9	12.4'	54.8'	
23	163°04.7	50.8	62°45.4	15.3'	10°44.4	12.4'	54.8'	
		SD = 16.3' $d = 0.4'$		SD = 15.1'				

Tue	GHA	Dec	GHA	$\nu$	Dec	$d$	HP	
0	178°04.4	S21°50.4	77°19.7	15.3'	N10°56.8	12.3'	54.8'	
1	193°04.2	50.0	91°54.1	15.3'	11°09.1	12.3'	54.8'	
2	208°03.9	49.6	106°28.4	15.3'	11°21.4	12.2'	54.7'	
3	223°03.7	.. 49.2	121°02.7	15.3'	11°33.6	12.2'	54.7'	
4	238°03.4	48.9	135°36.9	15.2'	11°45.7	12.1'	54.7'	
5	253°03.2	48.5	150°11.2	15.2'	11°57.9	12.1'	54.7'	
6	268°02.9	S21°48.1	164°45.4	15.2'	N12°09.9	12.0'	54.7'	
7	283°02.7	47.7	179°19.6	15.2'	12°21.9	11.9'	54.6'	
8	298°02.4	47.3	193°53.8	15.1'	12°33.9	11.9'	54.6'	
9	313°02.2	.. 46.9	208°27.9	15.1'	12°45.8	11.8'	54.6'	
10	328°02.0	46.5	223°02.0	15.1'	12°57.6	11.8'	54.6'	
11	343°01.7	46.1	237°36.1	15.1'	13°09.4	11.7'	54.6'	
12	358°01.5	S21°45.7	252°10.2	15.0'	N13°21.1	11.7'	54.5'	
13	13°01.2	45.3	266°44.2	15.0'	13°32.7	11.6'	54.5'	
14	28°01.0	44.9	281°18.2	15.0'	13°44.3	11.5'	54.5'	
15	43°00.7	.. 44.5	295°52.2	14.9'	13°55.9	11.5'	54.5'	
16	58°00.5	44.1	310°26.1	14.9'	14°07.3	11.4'	54.5'	
17	73°00.2	43.7	325°00.0	14.9'	14°18.7	11.3'	54.5'	
18	88°00.0	S21°43.3	339°33.9	14.8'	N14°30.1	11.3'	54.4'	
19	102°59.8	42.9	354°07.7	14.8'	14°41.4	11.2'	54.4'	
20	117°59.5	42.5	8°41.6	14.8'	14°52.6	11.2'	54.4'	
21	132°59.3	.. 42.1	23°15.3	14.7'	15°03.7	11.1'	54.4'	
22	147°59.0	41.7	37°49.1	14.7'	15°14.8	11.0'	54.4'	
23	162°58.8	41.3	52°22.8	14.7'	15°25.8	11.0'	54.4'	
		SD = 16.3' $d = 0.4'$		SD = 14.9'				

Wed	GHA	Dec	GHA	$\nu$	Dec	$d$	HP	
0	177°58.5	S21°40.9	66°56.4	14.6'	N15°36.8	10.9'	54.4'	
1	192°58.3	40.5	81°30.0	14.6'	15°47.7	10.8'	54.3'	
2	207°58.1	40.1	96°03.6	14.5'	15°58.5	10.7'	54.3'	
3	222°57.8	.. 39.7	110°37.2	14.5'	16°09.2	10.7'	54.3'	
4	237°57.6	39.3	125°10.7	14.5'	16°19.9	10.6'	54.3'	
5	252°57.3	38.9	139°44.1	14.4'	16°30.5	10.5'	54.3'	
6	267°57.1	S21°38.5	154°17.6	14.4'	N16°41.1	10.5'	54.3'	
7	282°56.9	38.1	168°50.9	14.3'	16°51.5	10.4'	54.3'	
8	297°56.6	37.7	183°24.3	14.3'	17°01.9	10.3'	54.2'	
9	312°56.4	.. 37.3	197°57.6	14.2'	17°12.2	10.2'	54.2'	
10	327°56.1	36.8	212°30.8	14.2'	17°22.5	10.2'	54.2'	
11	342°55.9	36.4	227°04.0	14.2'	17°32.7	10.1'	54.2'	
12	357°55.7	S21°36.0	241°37.2	14.1'	N17°42.8	10.0'	54.2'	
13	12°55.4	35.6	256°10.3	14.1'	17°52.8	9.9'	54.2'	
14	27°55.2	35.2	270°43.4	14.0'	18°02.7	9.9'	54.2'	
15	42°54.9	.. 34.8	285°16.4	14.0'	18°12.6	9.8'	54.2'	
16	57°54.7	34.4	299°49.4	13.9'	18°22.4	9.7'	54.2'	
17	72°54.5	34.0	314°22.3	13.9'	18°32.1	9.6'	54.2'	
18	87°54.2	S21°33.5	328°55.2	13.8'	N18°41.7	9.5'	54.1'	
19	102°54.0	33.1	343°28.0	13.8'	18°51.3	9.5'	54.1'	
20	117°53.8	32.7	358°00.8	13.7'	19°00.7	9.4'	54.1'	
21	132°53.5	.. 32.3	12°33.5	13.7'	19°10.1	9.3'	54.1'	
22	147°53.3	31.9	27°06.2	13.6'	19°19.4	9.2'	54.1'	
23	162°53.0	31.4	41°38.8	13.6'	19°28.6	9.1'	54.1'	
		SD = 16.3' $d = 0.4'$		SD = 14.8'				

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

**January 13, 14, 15 UT (Thu., Fri., Sat.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	112°27.3	185°27.1	\$16°50.8	211°32.1	\$23°26.5	137°09.2	\$11°19.4	156°29.8	\$17°38.3					Alpheratz	357°37.4	29°12.7	
1	127°29.7	200°31.1	50.6	226°32.7	26.7	152°11.2	19.2	171°32.0	38.2					Ankaa	353°09.7	-42°11.5	
2	142°32.2	215°35.2	50.3	241°33.2	26.8	167°13.1	19.0	186°34.1	38.1					Schedar	349°33.9	56°39.6	
3	157°34.7	230°39.2	.. 50.1	256°33.7	.. 27.0	182°15.1	.. 18.8	201°36.3	.. 38.1					Diphda	348°49.8	-17°52.2	
4	172°37.1	245°43.2	49.8	271°34.2	27.1	197°17.0	18.6	216°38.5	38.0					Achernar	335°22.0	-57°07.9	
5	187°39.6	260°47.2	49.5	286°34.7	27.2	212°19.0	18.4	231°40.7	37.9					Hamal	327°53.9	23°34.0	
6	202°42.0	275°51.2	\$16°49.3	301°35.2	\$23°27.4	227°21.0	\$11°18.2	246°42.8	\$17°37.8					Polaris	314°57.9	89°21.7	
7	217°44.5	290°55.2	49.0	316°35.7	27.5	242°22.9	18.0	261°45.0	37.7					Acamar	315°13.5	-40°13.3	
8	232°47.0	305°59.2	48.8	331°36.2	27.6	257°24.9	17.8	276°47.2	37.6					Menkar	314°08.6	4°10.5	
9	247°49.4	321°03.2	.. 48.5	346°36.8	.. 27.8	272°26.8	.. 17.6	291°49.4	.. 37.6					Mirfak	308°31.5	49°56.5	
10	262°51.9	336°07.2	48.3	1°37.3	27.9	287°28.8	17.4	306°51.5	37.5					Aldebaran	290°42.2	16°33.2	
11	277°54.4	351°11.1	48.0	16°37.8	28.1	302°30.8	17.2	321°53.7	37.4					Rigel	281°05.9	-8°10.7	
12	292°56.8	6°15.1	\$16°47.8	31°38.3	\$23°28.2	317°32.7	\$11°17.0	336°55.9	\$17°37.3					Capella	280°25.1	46°01.2	
13	307°59.3	21°19.1	47.5	46°38.8	28.3	332°34.7	16.8	351°58.1	37.2					Bellatrix	278°25.2	6°22.1	
14	323°01.8	36°23.1	47.2	61°39.3	28.5	347°36.6	16.7	7°00.2	37.2					Elnath	278°04.6	28°37.5	
15	338°04.2	51°27.1	.. 47.0	76°39.8	.. 28.6	2°38.6	.. 16.5	22°02.4	.. 37.1					Alnilam	275°39.9	-1°11.4	
16	353°06.7	66°31.1	46.7	91°40.3	28.7	17°40.6	16.3	37°04.6	37.0					Betelgeuse	270°54.4	7°24.6	
17	8°09.1	81°35.0	46.5	106°40.8	28.9	32°42.5	16.1	52°06.8	36.9					Canopus	263°52.9	-52°42.5	
18	23°11.6	96°39.0	\$16°46.2	121°41.4	\$23°29.0	47°44.5	\$11°15.9	67°08.9	\$17°36.8					Sirius	258°28.0	-16°44.9	
19	38°14.1	111°43.0	46.0	136°41.9	29.1	62°46.4	15.7	82°11.1	36.8					Adhara	255°07.4	-29°00.2	
20	53°16.5	126°46.9	45.8	151°42.4	29.3	77°48.4	15.5	97°13.3	36.7					Procyon	244°53.1	5°10.1	
21	68°19.0	141°50.9	.. 45.5	166°42.9	.. 29.4	92°50.4	.. 15.3	112°15.5	.. 36.6					Pollux	243°19.9	27°58.3	
22	83°21.5	156°54.9	45.3	181°43.4	29.5	107°52.3	15.1	127°17.6	36.5					Avisor	234°15.0	-59°34.7	
23	98°23.9	171°58.8	45.0	196°43.9	29.7	122°54.3	14.9	142°19.8	36.4					Suhail	222°47.7	-43°31.2	
Mer.pass. 16:27			ν 4.0° d 0.3' m -4.30	ν 0.5° d -0.1' m 1.50			ν 2.0' d 0.2' m -2.10			ν 2.2' d 0.1' m 0.77							
Fri			GHA	GHA	Dec	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Dubhe	193°43.7	61°37.7
0	113°26.4	187°02.8	\$16°44.8	211°44.4	\$23°29.8	137°56.2	\$11°14.7	157°22.0	\$17°36.4					Denebola	182°27.3	14°26.9	
1	128°28.9	202°06.7	44.5	226°44.9	29.9	152°58.2	14.5	172°24.2	36.3					Gienah	175°46.0	-17°39.7	
2	143°31.3	217°10.7	44.3	241°45.4	30.1	168°00.1	14.3	187°26.3	36.2					Acru	173°02.6	-63°12.9	
3	158°33.8	232°14.7	.. 44.1	256°46.0	.. 30.2	183°02.1	.. 14.1	202°28.5	.. 36.1					Gacrux	171°54.2	-57°13.8	
4	173°36.3	247°18.6	43.8	271°46.5	30.3	198°04.1	13.9	217°30.7	36.0					Alioth	166°15.1	55°50.2	
5	188°38.7	262°22.6	43.6	286°47.0	30.5	213°06.0	13.7	232°32.8	36.0					Spica	158°24.9	-11°16.5	
6	203°41.2	277°26.5	\$16°43.3	301°47.5	\$23°30.6	228°08.0	\$11°13.5	247°35.0	\$17°35.9					Alkaid	152°54.0	49°12.0	
7	218°43.6	292°30.4	43.1	316°48.0	30.7	243°09.9	13.3	262°37.2	35.8					Hadar	148°39.5	-60°28.4	
8	233°46.1	307°34.4	42.9	331°48.5	30.9	258°11.9	13.1	277°39.4	35.7					Menkent	148°00.6	-36°28.4	
9	248°48.6	322°38.3	.. 42.6	346°49.0	.. 31.0	273°13.9	.. 13.0	292°41.5	.. 35.6					Arcturus	145°50.2	19°04.0	
10	263°51.0	337°42.2	42.4	1°49.5	31.1	288°15.8	12.8	307°43.7	35.5					Rigel Kent.	139°43.8	-60°55.2	
11	278°53.5	352°46.2	42.2	16°50.0	31.2	303°17.8	12.6	322°45.9	35.5					Kochab	137°20.3	74°03.6	
12	293°56.0	7°50.1	\$16°41.9	31°50.5	\$23°31.4	318°19.7	\$11°12.4	337°48.1	\$17°35.4					Zuben'ubi	136°58.8	-16°07.9	
13	308°58.4	22°54.0	41.7	46°51.0	31.5	333°21.7	12.2	352°50.2	35.3					Alphecca	126°06.0	26°38.3	
14	324°00.9	37°58.0	41.5	61°51.5	31.6	348°23.6	12.0	7°52.4	35.2					Antares	112°19.1	-26°28.7	
15	339°03.4	53°01.9	.. 41.2	76°52.1	.. 31.7	3°25.6	.. 11.8	22°54.6	.. 35.1					Atria	107°16.0	-69°03.8	
16	354°05.8	68°05.8	41.0	91°52.6	31.9	18°27.6	11.6	37°56.8	35.1					Sabik	102°05.9	-15°45.1	
17	9°08.3	83°09.7	40.8	106°53.1	32.0	33°29.5	11.4	52°58.9	35.0					Shaula	96°14.1	-37°07.1	
18	24°10.8	98°13.6	\$16°40.5	121°53.6	\$23°32.1	48°31.5	\$11°11.2	68°01.1	\$17°34.9					Rasalhague	96°01.1	12°32.6	
19	39°13.2	113°17.5	40.3	136°54.1	32.2	63°33.4	11.0	83°03.3	34.8					Eltanin	90°43.8	51°29.0	
20	54°15.7	128°21.4	40.1	151°54.6	32.4	78°35.4	10.8	98°05.4	34.7					Kaus Aust.	83°36.2	-34°22.4	
21	69°18.1	143°25.3	.. 39.9	166°55.1	.. 32.5	93°37.3	.. 10.6	113°07.6	.. 34.7					Vega	80°35.3	38°48.1	
22	84°20.6	158°29.2	39.6	181°55.6	32.6	108°39.3	10.4	128°09.8	34.6					Nunki	75°51.2	-26°16.2	
23	99°23.1	173°33.1	39.4	196°56.1	32.7	123°41.2	10.2	143°12.0	34.5					Altair	62°02.7	8°55.5	
Mer.pass. 16:24			ν 4.0° d 0.2' m -4.25	ν 0.5° d -0.1' m 1.49			ν 2.0' d 0.2' m -2.10			ν 2.2' d 0.1' m 0.77							
Sat			GHA	GHA	Dec	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Fomalhaut	15°17.5	-29°30.6
0	114°25.5	188°37.0	\$16°39.2	211°56.6	\$23°32.9	138°43.2	\$11°10.0	158°14.1	\$17°34.4					Scheat	13°47.8	28°12.1	
1	129°28.0	203°40.9	39.0	226°57.1	33.0	153°45.2	09.8	173°16.3	34.3					Markab	13°32.5	15°19.4	
2	144°30.5	218°44.8	38.7	241°57.6	33.1	168°47.1	09.6	188°18.5	34.2					Jan 13 Thu	SHA	Mer.pass	
3	159°32.9	233°48.7	.. 38.5	256°58.1	.. 33.2	183°49.1	.. 09.4	203°20.7	.. 34.2					Venus	72°59.9	11:35	
4	174°35.4	248°52.6	38.3	271°58.6	33.3	198°51.0	09.2	218°22.8	34.1					Mars	99°04.9	09:54	
5	189°37.9	263°56.5	38.1	286°59.2	33.5	213°53.0	09.0	233°25.0	34.0					Jupiter	24°41.9	14:49	
6	204°40.3	279°00.3	\$16°37.9	301°59.7	\$23°33.6	228°54.9	\$11°08.8	248°27.2	\$17°33.9					Saturn	44°02.5	13:32	
7	219°42.8	294°04.2	37.6	317°00.2	33.7	243°56.9	08.6	263°29.3	33.8					Jan 14 Fri	SHA	Mer.pass	
8	234°45.3	309°08.1	37.4	332°00.7	33.8	258°58.8	08.4	278°31.5	33.8					Venus	73°36.4	11:29	
9	249°47.7	324°12.0	.. 37.2	347°01.2	.. 33.9	274°00.8	.. 08.2	293°33.7	.. 33.7					Mars	98°18.0	09:53	
10	264°50.2	339°15.8	37.0	2°01.7	34.1	289°02.8	08.1	308°35.9	33.6					Jupiter	24°29.8	14:46	
11	279°52.6	354°19.7	36.8	17°02.2	34.2	304°04.7	07.9	323°38.0	33.5					Saturn	43°55.6	13:29	
12	294°55.1	9															

DUT1 = UT1-UTC = -0.1119 sec  $\Delta T = TT-UT1 = +69.2959$  sec

2022 January 13 to Jan. 15 UT

h		Sun		Moon				
Thu		GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	177°52.8	S21°31.0	56°11.4	13.5'	N19°37.8	9.1'	54.1'	
1	192°52.6	30.6	70°44.0	13.5'	19°46.8	9.0'	54.1'	
2	207°52.3	30.2	85°16.4	13.4'	19°55.8	8.9'	54.1'	
3	222°52.1	29.8	99°48.9	13.4'	20°04.7	8.8'	54.1'	
4	237°51.9	29.3	114°21.3	13.3'	20°13.5	8.7'	54.1'	
5	252°51.6	28.9	128°53.6	13.3'	20°22.2	8.6'	54.1'	
6	267°51.4	S21°28.5	143°25.9	13.2'	N20°30.8	8.5'	54.0'	
7	282°51.2	28.1	157°58.1	13.2'	20°39.3	8.4'	54.0'	
8	297°50.9	27.6	172°30.3	13.1'	20°47.8	8.4'	54.0'	
9	312°50.7	27.2	187°02.4	13.1'	20°56.1	8.3'	54.0'	
10	327°50.5	26.8	201°34.4	13.0'	21°04.4	8.2'	54.0'	
11	342°50.2	26.3	216°06.5	13.0'	21°12.6	8.1'	54.0'	
12	357°50.0	S21°25.9	230°38.4	12.9'	N21°20.7	8.0'	54.0'	
13	12°49.8	25.5	245°10.3	12.9'	21°28.6	7.9'	54.0'	
14	27°49.5	25.1	259°42.2	12.8'	21°36.5	7.8'	54.0'	
15	42°49.3	24.6	274°14.0	12.7'	21°44.3	7.7'	54.0'	
16	57°49.1	24.2	288°45.7	12.7'	21°52.0	7.6'	54.0'	
17	72°48.8	23.8	303°17.4	12.6'	21°59.7	7.5'	54.0'	
18	87°48.6	S21°23.3	317°49.1	12.6'	N22°07.2	7.4'	54.0'	
19	102°48.4	22.9	332°20.7	12.5'	22°14.6	7.3'	54.0'	
20	117°48.2	22.5	346°52.2	12.5'	22°21.9	7.2'	54.0'	
21	132°47.9	22.0	1°23.7	12.4'	22°29.1	7.1'	54.0'	
22	147°47.7	21.6	15°55.1	12.4'	22°36.2	7.0'	54.0'	
23	162°47.5	21.1	30°26.5	12.3'	22°43.2	6.9'	54.0'	
	SD = 16.3'	d = 0.4'		SD = 14.8'				

Fri		GHA		Dec				
Fri		GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	177°47.2	S21°20.7	44°57.8	12.3'	N22°50.2	6.8'	54.0'	
1	192°47.0	20.3	59°29.1	12.2'	22°57.0	6.7'	54.0'	
2	207°46.8	19.8	74°00.3	12.2'	23°03.7	6.6'	54.0'	
3	222°46.6	19.4	88°31.4	12.1'	23°10.3	6.5'	54.0'	
4	237°46.3	18.9	103°02.6	12.1'	23°16.8	6.4'	54.0'	
5	252°46.1	18.5	117°33.6	12.0'	23°23.2	6.3'	54.0'	
6	267°45.9	S21°18.1	132°04.6	12.0'	N23°29.5	6.2'	54.0'	
7	282°45.6	17.6	146°35.6	11.9'	23°35.7	6.1'	54.0'	
8	297°45.4	17.2	161°06.5	11.9'	23°41.8	6.0'	54.0'	
9	312°45.2	16.7	175°37.3	11.8'	23°47.8	5.9'	54.0'	
10	327°45.0	16.3	190°08.1	11.7'	23°53.7	5.8'	54.0'	
11	342°44.7	15.8	204°38.9	11.7'	23°59.4	5.7'	54.0'	
12	357°44.5	S21°15.4	219°09.6	11.6'	N24°05.1	5.6'	54.0'	
13	12°44.3	14.9	233°40.2	11.6'	24°10.7	5.4'	54.0'	
14	27°44.1	14.5	248°10.8	11.6'	24°16.1	5.3'	54.0'	
15	42°43.8	14.0	262°41.4	11.5'	24°21.4	5.2'	54.0'	
16	57°43.6	13.6	277°11.9	11.5'	24°26.6	5.1'	54.0'	
17	72°43.4	13.1	291°42.3	11.4'	24°31.7	5.0'	54.0'	
18	87°43.2	S21°12.7	306°12.7	11.4'	N24°36.7	4.9'	54.0'	
19	102°42.9	12.2	320°43.1	11.3'	24°41.6	4.8'	54.0'	
20	117°42.7	11.8	335°13.4	11.3'	24°46.4	4.7'	54.0'	
21	132°42.5	11.3	349°43.7	11.2'	24°51.0	4.5'	54.0'	
22	147°42.3	10.9	4°13.9	11.2'	24°55.6	4.4'	54.0'	
23	162°42.1	10.4	18°44.1	11.1'	25°00.0	4.3'	54.0'	
	SD = 16.3'	d = 0.4'		SD = 14.7'				

Sat		GHA		Dec				
Sat		GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	177°41.8	S21°10.0	33°14.2	11.1'	N25°04.3	4.2'	54.0'	
1	192°41.6	09.5	47°44.3	11.0'	25°08.5	4.1'	54.0'	
2	207°41.4	09.1	62°14.3	11.0'	25°12.6	4.0'	54.0'	
3	222°41.2	08.6	76°44.3	11.0'	25°16.5	3.8'	54.0'	
4	237°41.0	08.1	91°14.3	10.9'	25°20.4	3.7'	54.0'	
5	252°40.7	07.7	105°44.2	10.9'	25°24.1	3.6'	54.0'	
6	267°40.5	S21°07.2	120°14.1	10.8'	N25°27.7	3.5'	54.0'	
7	282°40.3	06.8	134°43.9	10.8'	25°31.2	3.4'	54.0'	
8	297°40.1	06.3	149°13.7	10.8'	25°34.5	3.2'	54.0'	
9	312°39.9	05.8	163°43.5	10.7'	25°37.8	3.1'	54.0'	
10	327°39.6	05.4	178°13.2	10.7'	25°40.9	3.0'	54.0'	
11	342°39.4	04.9	192°42.9	10.7'	25°43.9	2.9'	54.0'	
12	357°39.2	S21°04.5	207°12.5	10.6'	N25°46.8	2.8'	54.0'	
13	12°39.0	04.0	221°42.2	10.6'	25°49.5	2.6'	54.0'	
14	27°38.8	03.5	236°11.8	10.6'	25°52.2	2.5'	54.0'	
15	42°38.5	03.1	250°41.3	10.5'	25°54.7	2.4'	54.1'	
16	57°38.3	02.6	265°10.8	10.5'	25°57.1	2.3'	54.1'	
17	72°38.1	02.1	279°40.3	10.5'	25°59.3	2.1'	54.1'	
18	87°37.9	S21°01.7	294°09.8	10.4'	N26°01.5	2.0'	54.1'	
19	102°37.7	01.2	308°39.2	10.4'	26°03.5	1.9'	54.1'	
20	117°37.5	00.7	323°08.6	10.4'	26°05.4	1.8'	54.1'	
21	132°37.2	21°00.3	337°38.0	10.3'	26°07.1	1.6'	54.1'	
22	147°37.0	20°59.8	352°07.3	10.3'	26°08.8	1.5'	54.1'	
23	162°36.8	59.3	6°36.6	10.3'	26°10.3	1.4'	54.1'	
	SD = 16.3'	d = 0.5'		SD = 14.7'				

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

Lat.	Thu	Moonrise		Thu	Moonset	
		Fri	Sat		Fri	Sat
N 72°	■	■	■	■	■	■
N 70°	■	■	■	■	■	■
68°	■	■	■	09:51	06:14	08:36
66°	10:35	09:51	■	■	05:44	07:28
64°	11:06	11:00	10:50	■	05:44	07:28
62°	11:29	11:36	11:52	05:22	06:53	08:19
60°	11:48	12:02	12:26	05:04	06:27	07:45
N 58°	12:04	12:22	12:51	04:49	06:07	07:20
56°	12:17	12:39	13:11	04:36	05:51	07

**January 16, 17, 18 UT (Sun., Mon., Tue.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	115°24.7	190°09.7	\$16°34.1	212°08.7	\$23°35.7	139°30.1	\$11°05.3	159°06.3	\$17°32.5								
1	130°27.1	205°13.5	33.9	227°09.2	35.8	154°32.1	05.1	174°08.5	32.4								
2	145°29.6	220°17.3	33.7	242°09.8	35.9	169°34.0	04.9	189°10.6	32.3								
3	160°32.1	235°21.1	.. 33.5	257°10.3	.. 36.0	184°36.0	.. 04.7	204°12.8	.. 32.2								
4	175°34.5	250°24.9	33.3	272°10.8	36.1	199°37.9	04.5	219°15.0	32.1								
5	190°37.0	265°28.7	33.1	287°11.3	36.2	214°39.9	04.3	234°17.1	32.0								
6	205°39.5	280°32.5	\$16°32.9	302°11.8	\$23°36.3	229°41.8	\$11°04.1	249°19.3	\$17°32.0								
7	220°41.9	295°36.3	32.7	317°12.3	36.5	244°43.8	03.9	264°21.5	31.9								
8	235°44.4	310°40.1	32.5	332°12.8	36.6	259°45.7	03.7	279°23.7	31.8								
9	250°46.9	325°43.9	.. 32.3	347°13.3	.. 36.7	274°47.7	.. 03.5	294°25.8	.. 31.7								
10	265°49.3	340°47.7	32.1	2°13.8	36.8	289°49.6	03.3	309°28.0	31.6								
11	280°51.8	355°51.5	31.9	17°14.3	36.9	304°51.6	03.1	324°30.2	31.6								
12	295°54.2	10°55.3	\$16°31.7	32°14.8	\$23°37.0	319°53.6	\$11°02.9	339°32.3	\$17°31.5								
13	310°56.7	25°59.1	31.5	47°15.3	37.1	334°55.5	02.7	354°34.5	31.4								
14	325°59.2	41°02.9	31.3	62°15.8	37.2	349°57.5	02.5	9°36.7	31.3								
15	341°01.6	56°06.6	.. 31.1	77°16.3	.. 37.3	4°59.4	.. 02.3	24°38.9	.. 31.2								
16	356°04.1	71°10.4	31.0	92°16.8	37.4	20°01.4	02.1	39°41.0	31.1								
17	1°06.6	86°14.2	30.8	107°17.3	37.5	35°03.3	01.9	54°43.2	31.1								
18	26°09.0	101°17.9	\$16°30.6	122°17.8	\$23°37.6	50°05.3	\$11°01.7	69°45.4	\$17°31.0								
19	41°11.5	116°21.7	30.4	137°18.3	37.8	65°07.2	01.5	84°47.5	30.9								
20	56°14.0	131°25.5	30.2	152°18.8	37.9	80°09.2	01.3	99°49.7	30.8								
21	71°16.4	146°29.2	.. 30.0	167°19.3	.. 38.0	95°11.1	.. 01.1	114°51.9	.. 30.7								
22	86°18.9	161°33.0	29.8	182°19.8	38.1	110°13.1	00.9	129°54.1	30.7								
23	101°21.4	176°36.7	29.7	197°20.3	38.2	125°15.0	00.7	144°56.2	30.6								
Mer.pass. 16:16			ν 3.8° d 0.2° m -4.18	ν 0.5° d -0.1° m 1.48	ν 2.0° d 0.2° m -2.09	ν 2.2° d 0.1° m 0.76											
Mon			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec						
0	116°23.8	191°40.5	\$16°29.5	212°20.8	\$23°38.3	140°17.0	\$11°00.5	159°58.4	\$17°30.5								
1	131°26.3	206°44.2	29.3	227°21.3	38.4	155°18.9	00.3	175°00.6	30.4								
2	146°28.7	221°47.9	29.1	242°21.8	38.5	170°20.9	11°00.1	190°02.7	30.3								
3	161°31.2	236°51.7	.. 28.9	257°22.3	.. 38.6	185°22.8	10°59.9	205°04.9	.. 30.2								
4	176°33.7	251°55.4	28.8	272°22.8	38.7	200°24.8	59.7	220°07.1	30.2								
5	191°36.1	266°59.1	28.6	287°23.3	38.8	215°26.7	59.5	235°09.3	30.1								
6	206°38.6	282°02.8	\$16°28.4	302°23.8	\$23°38.9	230°28.7	\$10°59.3	250°11.4	\$17°30.0								
7	221°41.1	297°06.6	28.2	317°24.3	39.0	245°30.6	59.1	265°13.6	29.9								
8	236°43.5	312°10.3	28.1	332°24.8	39.1	260°32.6	58.9	280°15.8	29.8								
9	251°46.0	327°14.0	.. 27.9	347°25.3	.. 39.2	275°34.5	.. 58.7	295°17.9	.. 29.7								
10	266°48.5	342°17.7	27.7	2°25.8	39.3	290°36.5	58.5	310°20.1	29.7								
11	281°50.9	357°21.4	27.5	17°26.3	39.4	305°38.4	58.3	325°22.3	29.6								
12	296°53.4	12°25.1	\$16°27.4	32°26.8	\$23°39.5	320°40.4	\$10°58.1	340°24.5	\$17°29.5								
13	311°55.9	27°28.8	27.2	47°27.3	39.6	335°42.3	57.9	355°26.6	29.4								
14	326°58.3	42°32.5	27.0	62°27.8	39.7	350°44.3	57.7	10°28.8	29.3								
15	342°00.8	57°36.2	.. 26.9	77°28.3	.. 39.8	5°46.2	.. 57.6	25°31.0	.. 29.3								
16	357°03.2	72°39.9	26.7	92°28.8	39.9	20°48.2	57.4	40°33.1	29.2								
17	12°05.7	87°43.6	26.5	107°29.3	40.0	35°50.1	57.2	55°35.3	29.1								
18	27°08.2	102°47.3	\$16°26.4	122°29.8	\$23°40.1	50°52.1	\$10°57.0	70°37.5	\$17°29.0								
19	42°10.6	117°50.9	26.2	137°30.3	40.2	65°54.0	56.8	85°39.6	28.9								
20	57°13.1	132°54.6	26.0	152°30.8	40.3	80°56.0	56.6	100°41.8	28.8								
21	72°15.6	147°58.3	.. 25.9	167°31.3	.. 40.4	95°57.9	.. 56.4	115°44.0	.. 28.8								
22	87°18.0	163°01.9	25.7	182°31.8	40.4	110°59.9	56.2	130°46.2	28.7								
23	102°20.5	178°05.6	25.5	197°32.3	40.5	126°01.8	56.0	145°48.3	28.6								
Mer.pass. 16:12			ν 3.7° d 0.2° m -4.26	ν 0.5° d -0.1° m 1.48	ν 2.0° d 0.2° m -2.09	ν 2.2° d 0.1° m 0.76											
Tue			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec						
0	117°23.0	193°09.3	\$16°25.4	212°32.8	\$23°40.6	141°03.8	\$10°55.8	160°50.5	\$17°28.5								
1	132°25.4	208°12.9	25.2	227°33.3	40.7	156°05.7	55.6	175°52.7	28.4								
2	147°27.9	223°16.6	25.1	242°33.8	40.8	171°07.7	55.4	190°54.8	28.3								
3	162°30.4	238°20.2	.. 24.9	257°34.3	.. 40.9	186°09.6	.. 55.2	205°57.0	.. 28.3								
4	177°32.8	253°23.9	24.7	272°34.8	41.0	201°11.6	55.0	220°59.2	28.2								
5	192°35.3	268°27.5	24.6	287°35.3	41.1	216°13.5	54.8	236°01.4	28.1								
6	207°37.7	283°31.1	\$16°24.4	302°35.8	\$23°41.2	231°15.5	\$10°54.6	251°03.5	\$17°28.0								
7	222°40.2	298°34.8	24.3	317°36.3	41.3	246°17.4	54.4	266°05.7	27.9								
8	237°42.7	313°38.4	24.1	332°36.8	41.4	261°19.4	54.2	281°07.9	27.9								
9	252°45.1	328°42.0	.. 24.0	347°37.2	.. 41.5	276°21.3	.. 54.0	296°10.0	.. 27.8								
10	267°47.6	343°45.6	23.8	2°37.7	41.6	291°23.3	53.8	311°12.2	27.7								
11	282°50.1	358°49.3	23.7	17°38.2	41.6	306°25.2	53.6	326°14.4	27.6								
12	297°52.5	13°52.9	\$16°23.5	32°38.7	\$23°41.7	321°27.1	\$10°53.3	341°16.5	\$17°27.5								
13	312°55.0	28°56.5	23.4	47°39.2	41.8	336°29.1	53.1	356°18.7	27.4								
14	327°57.5	44°00.1	23.2	62°39.7	41.9	351°31.0	52.9	11°20.9	27.4								
15	342°59.9	59°03.7	.. 23.1	77°40.2	.. 42.0	6°33.0	.. 52.7	26°23.1	.. 27.3								
16	358°02.4	74°07.3	22.9	92°40.7	42.1	21°34.9	52.5	41°25.2	27.2								
17	13°04.9	89°10.9	22.8	107°41.2	42.2	36°36.9	52.3	56°27.4	27.1								
18	28°07.3	104°14.5	\$16°22.6	122°41.7	\$23°42.3	51°38.8	\$10°52.1	71°29.6	\$17°27.0								
19	43°09.8	119°18.1	22.5	137°42.2	42.3	66°40.8	51.9	86°31.7	26.9								
20	58°12.2	134°21.6	22.3	152°42.7	42.4	81°42.7	51.7	101°33.9	26.9								
21	73°14.7	149°25.2	.. 22.2	167°43.2	.. 42.5	96°44.7											

DUT1 = UT1-UTC = -0.1106 sec  $\Delta T = TT-UT1 = +69.2946$  sec

2022 January 16 to Jan. 18 UT

h		Sun		Moon			
Sun	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	177°36.6	S20°58.8	21°05.9	10.3'	N26°11.6	1.3'	54.1'
1	192°36.4	58.4	35°35.2	10.3'	26°12.9	1.1'	54.1'
2	207°36.2	57.9	50°04.5	10.2'	26°14.0	1.0'	54.1'
3	222°36.0	57.4	64°33.7	10.2'	26°15.0	0.9'	54.1'
4	237°35.7	56.9	79°02.9	10.2'	26°15.9	0.7'	54.1'
5	252°35.5	56.5	93°32.1	10.2'	26°16.7	0.6'	54.1'
6	267°35.3	S20°56.0	108°01.3	10.2'	N26°17.3	0.5'	54.2'
7	282°35.1	55.5	122°30.4	10.1'	26°17.8	0.4'	54.2'
8	297°34.9	55.0	136°59.5	10.1'	26°18.1	0.2'	54.2'
9	312°34.7	54.6	151°28.7	10.1'	26°18.4	0.1'	54.2'
10	327°34.5	54.1	165°57.8	10.1'	26°18.5	-0.0'	54.2'
11	342°34.3	53.6	180°26.9	10.1'	26°18.4	-0.2'	54.2'
12	357°34.0	S20°53.1	194°56.0	10.1'	N26°18.3	-0.3'	54.2'
13	12°33.8	52.6	209°25.0	10.1'	26°18.0	-0.4'	54.2'
14	27°33.6	52.2	223°54.1	10.1'	26°17.6	-0.5'	54.2'
15	42°33.4	51.7	238°23.2	10.0'	26°17.0	-0.7'	54.2'
16	57°33.2	51.2	252°52.2	10.0'	26°16.4	-0.8'	54.2'
17	72°33.0	50.7	267°21.3	10.0'	26°15.6	-0.9'	54.3'
18	87°32.8	S20°50.2	281°50.3	10.0'	N26°14.6	-1.1'	54.3'
19	102°32.6	49.7	296°19.3	10.0'	26°13.6	-1.2'	54.3'
20	117°32.4	49.3	310°48.4	10.0'	26°12.4	-1.3'	54.3'
21	132°32.2	48.8	325°17.4	10.0'	26°11.1	-1.5'	54.3'
22	147°32.0	48.3	339°46.4	10.0'	26°09.6	-1.6'	54.3'
23	162°31.7	47.8	354°15.5	10.0'	26°08.0	-1.7'	54.3'
		SD = 16.3' d = 0.5'		SD = 14.8'			

Mon	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	177°31.5	S20°47.3	8°44.5	10.0'	N26°06.3	-1.8'	54.3'
1	192°31.3	46.8	23°13.5	10.0'	26°04.5	-2.0'	54.3'
2	207°31.1	46.3	37°42.6	10.0'	26°02.5	-2.1'	54.3'
3	222°30.9	45.8	52°11.6	10.1'	26°00.4	-2.2'	54.4'
4	237°30.7	45.3	66°40.7	10.1'	25°58.2	-2.4'	54.4'
5	252°30.5	44.9	81°09.7	10.1'	25°55.8	-2.5'	54.4'
6	267°30.3	S20°44.4	95°38.8	10.1'	N25°53.3	-2.6'	54.4'
7	282°30.1	43.9	110°07.8	10.1'	25°50.7	-2.7'	54.4'
8	297°29.9	43.4	124°36.9	10.1'	25°48.0	-2.9'	54.4'
9	312°29.7	42.9	139°06.0	10.1'	25°45.1	-3.0'	54.4'
10	327°29.5	42.4	153°35.1	10.1'	25°42.1	-3.1'	54.4'
11	342°29.3	41.9	168°04.3	10.1'	25°39.0	-3.3'	54.4'
12	357°29.1	S20°41.4	182°33.4	10.2'	N25°35.7	-3.4'	54.5'
13	12°28.9	40.9	197°02.6	10.2'	25°32.3	-3.5'	54.5'
14	27°28.7	40.4	211°31.7	10.2'	25°28.8	-3.6'	54.5'
15	42°28.5	39.9	226°00.9	10.2'	25°25.2	-3.8'	54.5'
16	57°28.3	39.4	240°30.1	10.2'	25°21.4	-3.9'	54.5'
17	72°28.1	38.9	254°59.3	10.2'	25°17.5	-4.0'	54.5'
18	87°27.9	S20°38.4	269°28.6	10.3'	N25°13.5	-4.1'	54.5'
19	102°27.7	37.9	283°57.9	10.3'	25°09.4	-4.3'	54.5'
20	117°27.4	37.4	298°27.1	10.3'	25°05.1	-4.4'	54.6'
21	132°27.2	36.9	312°56.5	10.3'	25°00.7	-4.5'	54.6'
22	147°27.0	36.4	327°25.8	10.4'	24°56.2	-4.6'	54.6'
23	162°26.8	35.9	341°55.2	10.4'	24°51.5	-4.8'	54.6'
		SD = 16.3' d = 0.5'		SD = 14.8'			

Tue	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	177°26.6	S20°35.4	356°24.5	10.4'	N24°46.8	-4.9'	54.6'
1	192°26.4	34.9	10°54.0	10.4'	24°41.9	-5.0'	54.6'
2	207°26.2	34.4	25°23.4	10.5'	24°36.9	-5.1'	54.6'
3	222°26.0	33.9	39°52.9	10.5'	24°31.7	-5.3'	54.7'
4	237°25.8	33.4	54°22.4	10.5'	24°26.5	-5.4'	54.7'
5	252°25.7	32.8	68°51.9	10.6'	24°21.1	-5.5'	54.7'
6	267°25.5	S20°32.3	83°21.5	10.6'	N24°15.6	-5.6'	54.7'
7	282°25.3	31.8	97°51.1	10.6'	24°09.9	-5.7'	54.7'
8	297°25.1	31.3	112°20.7	10.7'	24°04.2	-5.9'	54.7'
9	312°24.9	30.8	126°50.4	10.7'	23°58.3	-6.0'	54.7'
10	327°24.7	30.3	141°20.0	10.7'	23°52.3	-6.1'	54.8'
11	342°24.5	29.8	155°49.8	10.8'	23°46.2	-6.2'	54.8'
12	357°24.3	S20°29.3	170°19.5	10.8'	N23°40.0	-6.3'	54.8'
13	12°24.1	28.8	184°49.3	10.8'	23°33.7	-6.5'	54.8'
14	27°23.9	28.2	199°19.2	10.9'	23°27.2	-6.6'	54.8'
15	42°23.7	27.7	213°49.0	10.9'	23°20.6	-6.7'	54.8'
16	57°23.5	27.2	228°18.9	10.9'	23°13.9	-6.8'	54.8'
17	72°23.3	26.7	242°48.9	11.0'	23°07.1	-6.9'	54.9'
18	87°23.1	S20°26.2	257°18.9	11.0'	N23°00.2	-7.0'	54.9'
19	102°22.9	25.7	271°48.9	11.1'	22°53.2	-7.2'	54.9'
20	117°22.7	25.1	286°19.0	11.1'	22°46.0	-7.3'	54.9'
21	132°22.5	24.6	300°49.1	11.1'	22°38.7	-7.4'	54.9'
22	147°22.3	24.1	315°19.2	11.2'	22°31.4	-7.5'	54.9'
23	162°22.1	23.6	329°49.4	11.2'	22°23.9	-7.6'	54.9'
		SD = 16.3' d = 0.5'		SD = 14.9'			

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

**January 19, 20, 21 UT (Wed., Thu., Fri.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	118°22.1	194°35.9	\$16°21.8	212°44.7	\$23°42.8	141°50.5	\$10°50.9	161°42.6	\$17°26.5	Alpheratz	357°37.4	29°12.7					
1	133°24.6	209°39.5	21.6	227°45.2	42.8	156°52.5	50.7	176°44.8	26.4	Ankaa	353°09.7	-42°11.5					
2	148°27.0	224°43.0	21.5	242°45.7	42.9	171°54.4	50.5	191°46.9	26.4	Schedar	349°33.9	56°39.6					
3	163°29.5	239°46.6	21.4	257°46.2	43.0	186°56.4	50.3	206°49.1	26.3	Diphda	348°49.8	-17°52.2					
4	178°32.0	254°50.2	21.2	272°46.7	43.1	201°58.3	50.1	221°51.3	26.2	Achernar	335°22.1	-57°07.9					
5	193°34.4	269°53.7	21.1	287°47.2	43.2	217°00.2	49.9	236°53.4	26.1	Hamal	327°53.9	23°34.0					
6	208°36.9	284°57.2	\$16°20.9	302°47.7	\$23°43.3	232°02.2	\$10°49.7	251°55.6	\$17°26.0	Polaris	315°00.4	89°21.7					
7	223°39.3	300°00.8	20.8	317°48.1	43.3	247°04.1	49.5	266°57.8	26.0	Acamar	315°13.5	-40°13.3					
8	238°41.8	315°04.3	20.7	332°48.6	43.4	262°06.1	49.3	281°59.9	25.9	Menkar	314°08.6	4°10.4					
9	253°44.3	330°07.8	20.5	347°49.1	43.5	277°08.0	49.1	297°02.1	25.8	Mirfak	308°31.5	49°56.5					
10	268°46.7	345°11.4	20.4	2°49.6	43.6	292°10.0	48.9	312°04.3	25.7	Aldebaran	290°42.2	16°33.2					
11	283°49.2	0°14.9	20.3	17°50.1	43.7	307°11.9	48.7	327°06.4	25.6	Rigel	281°05.9	-8°10.7					
12	298°51.7	15°18.4	\$16°20.2	32°50.6	\$23°43.7	322°13.9	\$10°48.5	342°08.6	\$17°25.5	Capella	280°25.1	46°01.2					
13	313°54.1	30°21.9	20.0	47°51.1	43.8	337°15.8	48.3	357°10.8	25.5	Bellatrix	278°25.2	6°22.1					
14	328°56.6	45°25.4	19.9	62°51.6	43.9	352°17.8	48.1	12°13.0	25.4	Elnath	278°04.6	28°37.5					
15	343°59.1	60°28.9	19.8	77°52.1	44.0	7°19.7	47.9	27°15.1	25.3	Alnilam	275°39.9	-1°11.4					
16	359°01.5	75°32.4	19.6	92°52.6	44.1	22°21.6	47.7	42°17.3	25.2	Betelgeuse	270°54.4	7°24.6					
17	14°04.0	90°35.9	19.5	107°53.1	44.1	37°23.6	47.5	57°19.5	25.1	Canopus	263°52.9	-52°42.6					
18	29°06.5	105°39.4	\$16°19.4	122°53.6	\$23°44.2	52°25.5	\$10°47.3	72°21.6	\$17°25.0	Sirius	258°28.0	-16°44.9					
19	44°08.9	120°42.9	19.3	137°54.1	44.3	67°27.5	47.1	87°23.8	25.0	Adhara	255°07.4	-29°00.4					
20	59°11.4	135°46.4	19.1	152°54.6	44.4	82°29.4	46.9	102°26.0	24.9	Procyon	244°53.0	5°10.0					
21	74°13.8	150°49.9	19.0	167°55.1	44.4	97°31.4	46.7	117°28.1	24.8	Pollux	243°19.9	27°58.3					
22	89°16.3	165°53.4	18.9	182°55.5	44.5	112°33.3	46.5	132°30.3	24.7	Avor	234°15.0	-59°34.7					
23	104°18.8	180°56.9	18.8	197°56.0	44.6	127°35.3	46.3	147°32.5	24.6	Suhail	222°47.6	-43°31.2					
Mer.pass. 16:04			ν 3.6° d 0.1' m -4.40	ν 0.5° d -0.1' m 1.47	ν 1.9° d 0.2' m -2.08	ν 2.2° d 0.1' m 0.76	Mer.pass. 16:00			ν 3.5° d 0.1' m -4.46	ν 0.5° d -0.1' m 1.47	ν 1.9° d 0.2' m -2.08	ν 2.2° d 0.1' m 0.76	Mer.pass. 16:00			
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	119°21.2	196°00.3	\$16°18.7	212°56.5	\$23°44.7	142°37.2	\$10°46.1	162°34.6	\$17°24.5	Denebola	182°27.3	14°26.9					
1	134°23.7	211°03.8	18.5	227°57.0	44.7	157°39.1	45.9	177°36.8	24.5	Gienah	175°45.9	-17°39.7					
2	149°26.2	226°07.2	18.4	242°57.5	44.8	172°41.1	45.7	192°39.0	24.4	Acrux	173°02.5	-63°12.9					
3	164°28.6	241°10.7	18.3	257°58.0	44.9	187°43.0	45.5	207°41.2	24.3	Gacrux	171°54.1	-57°13.9					
4	179°31.1	256°14.2	18.2	272°58.5	45.0	202°45.0	45.3	222°43.3	24.2	Alioth	166°15.0	55°50.2					
5	194°33.6	271°17.6	18.1	287°59.0	45.0	217°46.9	45.1	237°45.5	24.1	Spica	158°24.8	-11°16.5					
6	209°36.0	286°21.0	\$16°18.0	302°59.5	\$23°45.1	232°48.9	\$10°44.9	252°47.7	\$17°24.0	Alkaid	152°54.0	49°12.0					
7	224°38.5	301°24.5	17.8	318°00.0	45.2	247°50.8	44.7	267°49.8	24.0	Hadar	148°39.4	60°28.4					
8	239°41.0	316°27.9	17.7	333°00.5	45.2	262°52.8	44.5	282°52.0	23.9	Menkent	148°00.5	-36°28.5					
9	254°43.4	331°31.4	17.6	348°01.0	45.3	277°54.7	44.3	297°54.2	23.8	Arcturus	145°50.2	19°04.0					
10	269°45.9	346°34.8	17.5	3°01.5	45.4	292°56.6	44.1	312°56.3	23.7	Rigel Kent	139°43.7	-60°55.2					
11	284°48.3	1°38.2	17.4	18°01.9	45.5	307°58.6	43.9	327°58.5	23.6	Kochab	137°20.2	74°03.6					
12	299°50.8	16°41.6	\$16°17.3	33°02.4	\$23°45.5	323°00.5	\$10°43.7	343°00.7	\$17°23.5	Zuben'ubi	136°58.8	-16°07.9					
13	314°53.3	31°45.0	17.2	48°02.9	45.6	338°02.5	43.5	358°02.8	23.5	Alphecca	126°06.0	26°38.3					
14	329°55.7	46°48.5	17.1	63°03.4	45.7	353°04.4	43.3	13°05.0	23.4	Antares	112°19.0	-26°28.7					
15	344°58.2	61°51.9	17.0	78°03.9	45.7	8°06.4	43.1	28°07.2	23.3	Atria	107°15.9	-69°03.7					
16	0°00.7	76°55.3	16.9	93°04.4	45.8	23°08.3	42.9	43°09.3	23.2	Sabik	102°05.8	-15°45.1					
17	15°03.1	91°58.7	16.8	108°04.9	45.9	38°10.2	42.7	58°11.5	23.1	Shaula	96°14.0	-37°07.1					
18	30°05.6	107°02.1	\$16°16.7	123°05.4	\$23°45.9	53°12.2	\$10°42.4	73°13.7	\$17°23.0	Rasalhague	96°01.1	12°32.6					
19	45°08.1	122°05.4	16.6	138°05.9	46.0	68°14.1	42.2	88°15.9	23.0	Eltanin	90°43.8	51°29.0					
20	60°10.5	137°08.8	16.4	153°06.4	46.1	83°16.1	42.0	103°18.0	22.9	Kaus Aust.	83°36.1	-34°22.4					
21	75°13.0	152°12.2	16.3	168°06.8	46.1	98°18.0	41.8	118°20.2	22.8	Vega	80°35.3	38°48.1					
22	90°15.5	167°15.6	16.2	183°07.3	46.2	113°19.9	41.6	133°22.4	22.7	Nunki	75°51.1	-26°16.2					
23	105°17.9	182°19.0	16.1	198°07.8	46.3	128°21.9	41.4	148°24.5	22.6	Altair	62°02.7	8°55.5					
Mer.pass. 16:00			ν 3.5° d 0.1' m -4.46	ν 0.5° d -0.1' m 1.47	ν 1.9° d 0.2' m -2.08	ν 2.2° d 0.1' m 0.76	Mer.pass. 16:00			ν 3.4° d 0.1' m -4.51	ν 0.5° d -0.1' m 1.46	ν 1.9° d 0.2' m -2.08	ν 2.2° d 0.1' m 0.76	Mer.pass. 16:00			
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	120°20.4	197°22.3	\$16°16.0	213°08.3	\$23°46.3	143°23.8	\$10°41.2	163°26.7	\$17°22.5	Jan 19 Wed	76°13.8	10:59					
1	135°22.8	212°25.7	15.9	228°08.8	46.4	158°25.8	41.0	178°28.9	22.5	Venus	94°22.6	09:49					
2	150°25.3	227°29.1	15.8	243°09.3	46.5	173°27.7	40.8	193°31.0	22.4	Mars	23°28.4	14:31					
3	165°27.8	242°32.4	15.8	258°09.8	46.5	188°29.7	40.6	208°33.2	22.3	Jupiter	43°20.5	13:11					
4	180°30.2	257°35.8	15.7	273°10.3	46.6	203°31.6	40.4	223°35.4	22.2	Saturn							
5	195°32.7	272°39.1	15.6	288°10.8	46.6	218°33.5	40.2	238°37.5	22.1	Jan 20 Thu	76°39.1	10:53					
6	210°35.2	287°42.4	\$16°15.5	303°11.3	\$23°46.7	233°35.5	\$10°40.0	253°39.7	\$17°22.0	Venus	93°35.3	09:48					
7	225°37.6	302°45.8	15.4	318°11.7	46.8	248°37.4	39.8	268°41.9	22.0	Mars	23°16.0	14:28					
8	240°40.1	317°49.1	15.3	333°12.2	46.8	263°39.4	39.6	283°44.0	21.9	Jupiter	43°13.4	13:08					
9	255°42.6	332°52.5	15.2	348°12.7	46.9	278°41.3	39.4	298°46.2	21.8	Saturn							
10	270°45.0	347°55.8	15.1	3°13.2	47.0	293°43.2	39.2	313°48.4	21.7	Jan 21 Fri	77°02.0	10:48					
11	285°47.5	2°59.1	15.0	18°13.7	47.0	308°45.2	39.0	328°50.5	21.6	Venus	92°47.9	09:47					
12	300°49.9	18°02.4	\$16°14.9	33°14.2	\$23°47.1	323°47.1	\$10°38.8	343°52.7	\$17°21.5	Mars	23°03.5	14:25					
13	315°52.4	33°05.7	14.8	48°14.7	47.1	338°49.1	38.6	358°54.9	21.5	Jupiter	43°06.3	13:04					

h		Sun		Moon				
Wed		GHA	Dec	GHA	$\nu$	Dec	d	HP
0	177°21.9	S20°23.1	344°19.6	11.3'	N22°16.3	-7.7'	55.0'	
1	192°21.7	22.5	358°49.9	11.3'	22°08.6	-7.8'	55.0'	
2	207°21.6	22.0	13°20.2	11.4'	22°00.8	-7.9'	55.0'	
3	222°21.4	.. 21.5	27°50.6	11.4'	21°52.8	-8.0'	55.0'	
4	237°21.2	21.0	42°20.9	11.4'	21°44.8	-8.1'	55.0'	
5	252°21.0	20.4	56°51.4	11.5'	21°36.6	-8.3'	55.0'	
6	267°20.8	S20°19.9	71°21.9	11.5'	N21°28.4	-8.4'	55.1'	
7	282°20.6	19.4	85°52.4	11.6'	21°20.0	-8.5'	55.1'	
8	297°20.4	18.9	100°23.0	11.6'	21°11.6	-8.6'	55.1'	
9	312°20.2	.. 18.3	114°53.6	11.7'	21°03.0	-8.7'	55.1'	
10	327°20.0	17.8	129°24.2	11.7'	20°54.3	-8.8'	55.1'	
11	342°19.8	17.3	143°54.9	11.7'	20°45.6	-8.9'	55.1'	
12	357°19.6	S20°16.8	158°25.7	11.8'	N20°36.7	-9.0'	55.2'	
13	12°19.5	16.2	172°56.5	11.8'	20°27.7	-9.1'	55.2'	
14	27°19.3	15.7	187°27.3	11.9'	20°18.6	-9.2'	55.2'	
15	42°19.1	.. 15.2	201°58.2	11.9'	20°09.4	-9.3'	55.2'	
16	57°18.9	14.6	216°29.1	12.0'	20°00.2	-9.4'	55.2'	
17	72°18.7	14.1	231°00.0	12.0'	19°50.8	-9.5'	55.2'	
18	87°18.5	S20°13.6	245°31.1	12.1'	N19°41.3	-9.6'	55.3'	
19	102°18.3	13.0	260°02.1	12.1'	19°31.7	-9.7'	55.3'	
20	117°18.2	12.5	274°33.2	12.1'	19°22.1	-9.8'	55.3'	
21	132°18.0	.. 12.0	289°04.4	12.2'	19°12.3	-9.9'	55.3'	
22	147°17.8	11.4	303°35.5	12.2'	19°02.5	-10.0'	55.3'	
23	162°17.6	10.9	318°06.8	12.3'	18°52.5	-10.0'	55.3'	
		SD = 16.2'		d = 0.5'		SD = 15.0'		
Thu		GHA	Dec	GHA	$\nu$	Dec	d	HP
0	177°17.4	S20°10.4	332°38.1	12.3'	N18°42.5	-10.1'	55.4'	
1	192°17.2	09.8	347°09.4	12.4'	18°32.3	-10.2'	55.4'	
2	207°17.0	09.3	1°40.7	12.4'	18°22.1	-10.3'	55.4'	
3	222°16.9	.. 08.7	16°12.2	12.5'	18°11.8	-10.4'	55.4'	
4	237°16.7	08.2	30°43.6	12.5'	18°01.4	-10.5'	55.4'	
5	252°16.5	07.7	45°15.1	12.5'	17°50.9	-10.6'	55.5'	
6	267°16.3	S20°07.1	59°46.6	12.6'	N17°40.3	-10.7'	55.5'	
7	282°16.1	06.6	74°18.2	12.6'	17°29.6	-10.8'	55.5'	
8	297°15.9	06.0	88°49.8	12.7'	17°18.9	-10.8'	55.5'	
9	312°15.8	.. 05.5	103°21.5	12.7'	17°08.0	-10.9'	55.5'	
10	327°15.6	05.0	117°53.2	12.7'	16°57.1	-11.0'	55.5'	
11	342°15.4	04.4	132°25.0	12.8'	16°46.1	-11.1'	55.6'	
12	357°15.2	S20°03.9	146°56.8	12.8'	N16°35.0	-11.2'	55.6'	
13	12°15.0	03.3	161°28.6	12.9'	16°23.8	-11.3'	55.6'	
14	27°14.9	02.8	176°00.5	12.9'	16°12.6	-11.3'	55.6'	
15	42°14.7	.. 02.2	190°32.4	13.0'	16°01.2	-11.4'	55.6'	
16	57°14.5	01.7	205°04.3	13.0'	15°49.8	-11.5'	55.7'	
17	72°14.3	01.1	219°36.3	13.0'	15°38.3	-11.6'	55.7'	
18	87°14.1	S20°00.6	234°08.3	13.1'	N15°26.7	-11.6'	55.7'	
19	102°14.0	20°00.0	248°40.4	13.1'	15°15.1	-11.7'	55.7'	
20	117°13.8	19°59.5	263°12.5	13.1'	15°03.4	-11.8'	55.7'	
21	132°13.6	.. 58.9	277°44.7	13.2'	14°51.6	-11.9'	55.8'	
22	147°13.4	58.4	292°16.8	13.2'	14°39.7	-11.9'	55.8'	
23	162°13.2	57.8	306°49.1	13.3'	14°27.7	-12.0'	55.8'	
		SD = 16.2'		d = 0.5'		SD = 15.1'		
Fri		GHA	Dec	GHA	$\nu$	Dec	d	HP
0	177°13.1	S19°57.3	321°21.3	13.3'	N14°15.7	-12.1'	55.8'	
1	192°12.9	56.7	335°53.6	13.3'	14°03.6	-12.2'	55.8'	
2	207°12.7	56.2	350°25.9	13.4'	13°51.5	-12.2'	55.9'	
3	222°12.5	.. 55.6	4°58.3	13.4'	13°39.3	-12.3'	55.9'	
4	237°12.4	55.1	19°30.7	13.4'	13°27.0	-12.4'	55.9'	
5	252°12.2	54.5	34°03.1	13.5'	13°14.6	-12.4'	55.9'	
6	267°12.0	S19°54.0	48°35.5	13.5'	N13°02.2	-12.5'	55.9'	
7	282°11.8	53.4	63°08.0	13.5'	12°49.7	-12.6'	56.0'	
8	297°11.7	52.8	77°40.5	13.5'	12°37.1	-12.6'	56.0'	
9	312°11.5	.. 52.3	92°13.1	13.6'	12°24.5	-12.7'	56.0'	
10	327°11.3	51.7	106°45.6	13.6'	12°11.8	-12.8'	56.0'	
11	342°11.1	51.2	121°18.2	13.6'	11°59.0	-12.8'	56.0'	
12	357°11.0	S19°50.6	135°50.9	13.7'	N11°46.2	-12.9'	56.1'	
13	12°10.8	50.0	150°23.5	13.7'	11°33.4	-12.9'	56.1'	
14	27°10.6	49.5	164°56.2	13.7'	11°20.4	-13.0'	56.1'	
15	42°10.4	.. 48.9	179°28.9	13.7'	11°07.4	-13.0'	56.1'	
16	57°10.3	48.4	194°01.7	13.8'	10°54.4	-13.1'	56.1'	
17	72°10.1	47.8	208°34.4	13.8'	10°41.3	-13.2'	56.2'	
18	87°09.9	S19°47.2	223°07.2	13.8'	N10°28.1	-13.2'	56.2'	
19	102°09.8	46.7	237°40.0	13.8'	10°14.9	-13.3'	56.2'	
20	117°09.6	46.1	252°12.8	13.8'	10°01.6	-13.3'	56.2'	
21	132°09.4	.. 45.5	266°45.7	13.9'	09°48.3	-13.4'	56.3'	
22	147°09.2	45.0	281°18.5	13.9'	09°34.9	-13.4'	56.3'	
23	162°09.1	44.4	295°51.4	13.9'	09°21.5	-13.5'	56.3'	
		SD = 16.2'		d = 0.6'		SD = 15.2'		

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

**January 22, 23, 24 UT (Sat., Sun., Mon.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	121°19.5	198°41.9	\$16°13.9	213°20.0	\$23°47.8	144°10.4	\$10°36.3	164°18.7	\$17°20.5	Alpheratz	357°37.4	29°12.7					
1	136°22.0	213°45.1	13.8	228°20.5	47.8	159°12.4	36.1	179°20.9	20.4	Ankaa	353°09.8	-42°11.5					
2	151°24.4	228°48.4	13.8	243°21.0	47.9	174°14.3	35.9	194°23.1	20.4	Schedar	349°34.0	56°39.6					
3	166°26.9	243°51.6	.. 13.7	258°21.5	.. 47.9	189°16.2	.. 35.7	209°25.2	.. 20.3	Diphda	348°49.9	-17°52.2					
4	181°29.4	258°54.9	13.6	273°22.0	48.0	204°18.2	35.5	224°27.4	20.2	Achernar	335°22.1	-57°07.9					
5	196°31.8	273°58.1	13.5	288°22.5	48.0	219°20.1	35.3	239°29.6	20.1	Hamal	327°53.9	23°34.0					
6	211°34.3	289°01.4	\$16°13.5	303°23.0	\$23°48.1	234°22.1	\$10°35.1	254°31.7	\$17°20.0	Polaris	315°02.0	89°21.7					
7	226°36.8	304°04.6	13.4	318°23.5	48.1	249°24.0	34.9	269°33.9	19.9	Acamar	315°13.5	-40°13.3					
8	241°39.2	319°07.8	13.3	333°23.9	48.2	264°25.9	34.7	284°36.1	19.9	Menkar	314°08.6	4°10.4					
9	256°41.7	334°11.0	.. 13.2	348°24.4	.. 48.2	279°27.9	.. 34.5	299°38.2	.. 19.8	Mirfak	308°31.5	49°56.5					
10	271°44.2	349°14.3	13.2	3°24.9	48.3	294°29.8	34.3	314°40.4	19.7	Aldebaran	290°42.2	16°33.2					
11	286°46.6	4°17.5	13.1	18°25.4	48.3	309°31.8	34.1	329°42.6	19.6	Rigel	281°05.9	-8°10.7					
12	301°49.1	19°20.7	\$16°13.0	33°25.9	\$23°48.4	324°33.7	\$10°33.9	344°44.7	\$17°19.5	Capella	280°25.1	46°01.3					
13	316°51.5	34°23.9	13.0	48°26.4	48.4	339°35.6	33.7	359°46.9	19.4	Bellatrix	278°25.2	6°22.1					
14	331°54.0	49°27.1	12.9	63°26.9	48.5	354°37.6	33.5	14°49.1	19.4	Elnath	278°04.6	28°37.5					
15	346°56.5	64°30.3	.. 12.8	78°27.3	.. 48.5	9°39.5	.. 33.3	29°51.2	.. 19.3	Alnilam	275°39.9	-1°11.4					
16	1°58.9	79°33.5	12.7	93°27.8	48.6	24°41.4	33.1	44°53.4	19.2	Betelgeuse	270°54.4	7°24.6					
17	17°01.4	94°36.7	12.7	108°28.3	48.6	39°43.4	32.8	59°55.6	19.1	Canopus	263°53.0	-52°42.6					
18	32°03.9	109°39.9	\$16°12.6	123°28.8	\$23°48.7	54°45.3	\$10°32.6	74°57.7	\$17°19.0	Sirius	258°28.0	-16°44.9					
19	47°06.3	124°43.0	12.6	138°29.3	48.7	69°47.3	32.4	89°59.9	18.9	Adhara	255°07.4	-29°00.2					
20	62°08.8	139°46.2	12.5	153°29.8	48.8	84°49.2	32.2	105°02.1	18.9	Procyon	244°53.0	5°10.0					
21	77°11.3	154°49.4	.. 12.4	168°30.3	.. 48.8	99°51.1	.. 32.0	120°04.2	.. 18.8	Pollux	243°19.9	27°58.3					
22	92°13.7	169°52.5	12.4	183°30.7	48.9	114°53.1	31.8	135°06.4	18.7	Avor	234°15.0	-59°34.8					
23	107°16.2	184°55.7	12.3	198°31.2	48.9	129°55.0	31.6	150°08.6	18.6	Suhail	222°47.6	-43°31.2					
Mer.pass. 15:52		ν 3.3° d 0.1° m -4.56	ν 0.5° d -0.1° m 1.46	ν 1.9° d 0.2° m -2.08	ν 2.2° d 0.1° m 0.76												
Mer.pass. 15:52		ν 3.3° d 0.1° m -4.56	ν 0.5° d -0.1° m 1.46	ν 1.9° d 0.2° m -2.08	ν 2.2° d 0.1° m 0.76												
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec						
0	122°18.7	199°58.9	\$16°12.2	213°31.7	\$23°49.0	144°57.0	\$10°31.4	165°10.7	\$17°18.5	Denebola	182°27.2	14°26.9					
1	137°21.1	215°02.0	12.2	228°32.2	49.0	159°58.9	31.2	180°12.9	18.4	Gienah	175°45.9	-17°39.8					
2	152°23.6	230°05.2	12.1	243°32.7	49.0	175°00.8	31.0	195°15.1	18.3	Acrux	173°02.4	-63°12.9					
3	167°26.0	245°08.3	.. 12.1	258°33.2	.. 49.1	190°02.8	.. 30.8	210°17.2	.. 18.3	Gacrux	171°54.1	-57°13.9					
4	182°28.5	260°11.4	12.0	273°33.6	49.1	205°04.7	30.6	225°19.4	18.2	Alioth	166°15.0	55°50.2					
5	197°31.0	275°14.6	12.0	288°34.1	49.2	220°06.6	30.4	240°21.6	18.1	Spica	158°24.8	-11°16.5					
6	212°33.4	290°17.7	\$16°11.9	303°34.6	\$23°49.2	235°08.6	\$10°30.2	255°23.7	\$17°18.0	Alkaid	152°53.9	49°12.0					
7	227°35.9	305°20.8	11.8	318°35.1	49.3	250°10.5	30.0	270°25.9	17.9	Hadar	148°39.4	-60°28.4					
8	242°38.4	320°24.0	11.8	333°35.6	49.3	265°12.5	29.8	285°28.1	17.8	Menkent	148°00.5	-36°28.5					
9	257°40.8	335°27.1	.. 11.7	348°36.1	.. 49.3	280°14.4	.. 29.6	300°30.2	.. 17.8	Arcturus	145°50.2	19°04.0					
10	272°43.3	350°30.2	11.7	3°36.6	49.4	295°16.3	29.3	315°32.4	17.7	Rigel Kent	139°43.7	-60°55.2					
11	287°45.8	5°33.3	11.6	18°37.0	49.4	310°18.3	29.1	330°34.6	17.6	Kochab	137°20.1	74°03.6					
12	302°48.2	20°36.4	\$16°11.6	33°37.5	\$23°49.5	325°20.2	\$10°28.9	345°36.7	\$17°17.5	Zuben' ubi	136°58.8	-16°07.9					
13	317°50.7	35°39.5	11.5	48°38.0	49.5	340°22.1	28.7	0°38.9	17.4	Alphecca	126°06.0	26°38.3					
14	332°53.2	50°42.6	11.5	63°38.5	49.5	355°24.1	28.5	15°41.1	17.3	Antares	112°19.0	-26°28.7					
15	347°55.6	65°45.7	.. 11.4	78°39.0	.. 49.6	10°26.0	.. 28.3	30°43.2	.. 17.3	Atria	107°15.8	-69°03.7					
16	2°58.1	80°48.8	11.4	93°39.5	49.6	25°27.9	28.1	45°45.4	17.2	Sabik	102°05.8	-15°45.1					
17	18°00.5	95°51.8	11.3	108°39.9	49.7	40°29.9	27.9	60°47.6	17.1	Shaula	96°14.0	-37°07.1					
18	33°03.0	110°54.9	\$16°11.3	123°40.4	\$23°49.7	55°31.8	\$10°27.7	75°49.7	\$17°17.0	Rasalhague	96°01.1	12°32.5					
19	48°05.5	125°58.0	11.2	138°40.9	49.7	70°33.8	27.5	90°51.9	16.9	Eltanin	90°43.8	51°29.0					
20	63°07.9	141°01.1	11.2	153°41.4	49.8	85°35.7	27.3	105°54.1	16.8	Kaus Aust.	83°36.1	-34°22.4					
21	78°10.4	156°04.1	.. 11.2	168°41.9	.. 49.8	100°37.6	.. 27.1	120°56.2	.. 16.7	Vega	80°35.3	38°48.1					
22	93°12.9	171°07.2	11.1	183°42.4	49.8	115°39.6	26.9	135°58.4	16.7	Nunki	75°51.1	-26°16.2					
23	108°15.3	186°10.2	11.1	198°42.8	49.9	130°41.5	26.7	151°00.6	16.6	Altair	62°02.7	8°55.5					
Mer.pass. 15:48		ν 3.2° d 0.1° m -4.60	ν 0.5° d -0.0° m 1.45	ν 1.9° d 0.2° m -2.07	ν 2.2° d 0.1° m 0.75												
Mer.pass. 15:48		ν 3.0° d 0.0° m -4.64	ν 0.5° d -0.0° m 1.45	ν 1.9° d 0.2° m -2.07	ν 2.2° d 0.1° m 0.75												
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec						
0	123°17.8	201°13.3	\$16°11.0	213°43.3	\$23°49.9	145°43.4	\$10°26.5	166°02.7	\$17°16.5	Jan 22 Sat	77°22.4	10:43					
1	138°20.3	216°16.3	11.0	228°43.8	49.9	160°45.4	26.2	181°04.9	16.4	Venus	92°00.5	09:46					
2	153°22.7	231°19.4	10.9	243°44.3	50.0	175°47.3	26.0	196°07.1	16.3	Mars	22°50.9	14:21					
3	168°25.2	246°22.4	.. 10.9	258°44.8	.. 50.0	190°49.2	.. 25.8	211°09.2	.. 16.2	Jupiter	42°59.2	13:01					
4	183°27.6	261°25.4	10.9	273°45.2	50.0	205°51.2	25.6	226°11.4	16.2	Saturn	42°52.1	12:57					
5	198°30.1	276°28.4	10.8	288°45.7	50.1	220°53.1	25.4	241°13.6	16.1	Jan 23 Sun	77°40.2	10:38					
6	213°32.6	291°31.5	\$16°10.8	303°46.2	\$23°50.1	235°55.0	\$10°25.2	256°15.7	\$17°16.0	Venus	91°13.1	09:46					
7	228°35.0	306°34.5	10.8	318°46.7	50.1	250°57.0	25.0	271°17.9	15.9	Mars	22°38.3	14:18					
8	243°37.5	321°37.5	10.7	333°47.2	50.2	265°58.9	24.8	286°20.1	15.8	Jupiter	42°52.1	12:57					
9	258°40.0	336°40.5	.. 10.7	348°47.7	.. 50.2	281°00.9	.. 24.6	301°22.2	.. 15.7	Saturn	77°55.5	10:33					
10	273°42.4	351°43.5	10.7	3°48.1	50.2	296°02.8	24.4	316°24.4	15.7	Jan 24 Mon	90°25.5	09:45					
11	288°44.9	6°46.5	10.6	18°48.6	50.3	311°04.7	24.2										

DUT1 = UT1-UTC = -0.1083 sec  $\Delta T = TT-UT1 = +69.2923$  sec

2022 January 22 to Jan. 24 UT

h		Sun		Moon				
Sat		GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	177°08.9	S19°43.8	310°24.3	13.9'	N09°08.0	-13.5'	56.3'	
1	192°08.7	43.3	324°57.2	13.9'	08°54.5	-13.6'	56.3'	
2	207°08.6	42.7	339°30.1	13.9'	08°40.9	-13.6'	56.4'	
3	222°08.4	42.1	354°03.1	14.0'	08°27.3	-13.7'	56.4'	
4	237°08.2	41.6	8°36.1	14.0'	08°13.6	-13.7'	56.4'	
5	252°08.1	41.0	23°09.0	14.0'	07°59.9	-13.8'	56.4'	
6	267°07.9	S19°40.4	37°42.0	14.0'	N07°46.2	-13.8'	56.5'	
7	282°07.7	39.8	52°15.0	14.0'	07°32.4	-13.8'	56.5'	
8	297°07.6	39.3	66°48.0	14.0'	07°18.5	-13.9'	56.5'	
9	312°07.4	38.7	81°21.1	14.0'	07°04.6	-13.9'	56.5'	
10	327°07.2	38.1	95°54.1	14.0'	06°50.7	-14.0'	56.5'	
11	342°07.1	37.5	110°27.1	14.0'	06°36.7	-14.0'	56.6'	
12	357°06.9	S19°37.0	125°00.2	14.0'	N06°22.7	-14.0'	56.6'	
13	12°06.7	36.4	139°33.2	14.1'	06°08.7	-14.1'	56.6'	
14	27°06.6	35.8	154°06.3	14.1'	05°54.6	-14.1'	56.6'	
15	42°06.4	35.2	168°39.3	14.1'	05°40.5	-14.2'	56.7'	
16	57°06.2	34.7	183°12.4	14.1'	05°26.3	-14.2'	56.7'	
17	72°06.1	34.1	197°45.4	14.1'	05°12.1	-14.2'	56.7'	
18	87°05.9	S19°33.5	212°18.5	14.1'	N04°57.9	-14.3'	56.7'	
19	102°05.7	32.9	226°51.6	14.1'	04°43.6	-14.3'	56.7'	
20	117°05.6	32.3	241°24.6	14.1'	04°29.4	-14.3'	56.8'	
21	132°05.4	31.8	255°57.7	14.1'	04°15.0	-14.3'	56.8'	
22	147°05.3	31.2	270°30.7	14.0'	04°00.7	-14.4'	56.8'	
23	162°05.1	30.6	285°03.8	14.0'	03°46.3	-14.4'	56.8'	
		SD = 16.2' $d = 0.6'$		SD = 15.4'				
Sun		GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	177°04.9	S19°30.0	299°36.8	14.0'	N03°31.9	-14.4'	56.9'	
1	192°04.8	29.4	314°09.9	14.0'	03°17.5	-14.5'	56.9'	
2	207°04.6	28.8	328°42.9	14.0'	03°03.0	-14.5'	56.9'	
3	222°04.4	28.3	343°15.9	14.0'	02°48.5	-14.5'	56.9'	
4	237°04.3	27.7	357°48.9	14.0'	02°34.0	-14.5'	57.0'	
5	252°04.1	27.1	12°21.9	14.0'	02°19.5	-14.5'	57.0'	
6	267°04.0	S19°26.5	26°54.9	14.0'	N02°05.0	-14.6'	57.0'	
7	282°03.8	25.9	41°27.9	14.0'	01°50.4	-14.6'	57.0'	
8	297°03.7	25.3	56°00.8	13.9'	01°35.8	-14.6'	57.1'	
9	312°03.5	24.7	70°33.8	13.9'	01°21.2	-14.6'	57.1'	
10	327°03.3	24.1	85°06.7	13.9'	01°06.6	-14.6'	57.1'	
11	342°03.2	23.6	99°39.6	13.9'	00°51.9	-14.7'	57.1'	
12	357°03.0	S19°23.0	114°12.5	13.9'	N00°37.3	-14.7'	57.2'	
13	12°02.9	22.4	128°45.3	13.8'	00°22.6	-14.7'	57.2'	
14	27°02.7	21.8	143°18.2	13.8'	N00°07.9	-14.7'	57.2'	
15	42°02.5	21.2	157°51.0	13.8'	S00°06.8	-14.7'	57.2'	
16	57°02.4	20.6	172°23.8	13.8'	00°21.5	-14.7'	57.3'	
17	72°02.2	20.0	186°56.5	13.7'	00°36.2	-14.7'	57.3'	
18	87°02.1	S19°19.4	201°29.3	13.7'	S00°51.0	-14.7'	57.3'	
19	102°01.9	18.8	216°02.0	13.7'	01°05.7	-14.7'	57.3'	
20	117°01.8	18.2	230°34.7	13.7'	01°20.4	-14.8'	57.4'	
21	132°01.6	17.6	245°07.3	13.6'	01°35.2	-14.8'	57.4'	
22	147°01.5	17.0	259°39.9	13.6'	01°50.0	-14.8'	57.4'	
23	162°01.3	16.4	274°12.5	13.6'	02°04.7	-14.8'	57.4'	
		SD = 16.2' $d = 0.6'$		SD = 15.5'				
Mon		GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	177°01.2	S19°15.8	288°45.1	13.5'	S02°19.5	-14.8'	57.5'	
1	192°01.0	15.2	303°17.6	13.5'	02°34.3	-14.8'	57.5'	
2	207°00.8	14.6	317°50.1	13.4'	02°49.0	-14.8'	57.5'	
3	222°00.7	14.0	332°22.5	13.4'	03°03.8	-14.8'	57.5'	
4	237°00.5	13.4	346°54.9	13.4'	03°18.6	-14.8'	57.6'	
5	252°00.4	12.8	1°27.3	13.3'	03°33.3	-14.8'	57.6'	
6	267°00.2	S19°12.2	15°59.6	13.3'	S03°48.1	-14.8'	57.6'	
7	282°00.1	11.6	30°31.9	13.2'	04°02.8	-14.7'	57.6'	
8	296°59.9	11.0	45°04.1	13.2'	04°17.6	-14.7'	57.7'	
9	311°59.8	10.4	59°36.3	13.1'	04°32.3	-14.7'	57.7'	
10	326°59.6	09.8	74°08.5	13.1'	04°47.1	-14.7'	57.7'	
11	341°59.5	09.2	88°40.6	13.0'	05°01.8	-14.7'	57.7'	
12	356°59.3	S19°08.6	103°12.6	13.0'	S05°16.5	-14.7'	57.8'	
13	11°59.2	08.0	117°44.6	12.9'	05°31.2	-14.7'	57.8'	
14	26°59.0	07.4	132°16.5	12.9'	05°45.9	-14.7'	57.8'	
15	41°58.9	06.8	146°48.4	12.8'	06°00.6	-14.7'	57.8'	
16	56°58.7	06.2	161°20.3	12.8'	06°15.2	-14.6'	57.9'	
17	71°58.6	05.6	175°52.0	12.7'	06°29.9	-14.6'	57.9'	
18	86°58.4	S19°05.0	190°23.8	12.7'	S06°44.5	-14.6'	57.9'	
19	101°58.3	04.4	204°55.4	12.6'	06°59.1	-14.6'	58.0'	
20	116°58.1	03.7	219°27.0	12.5'	07°13.7	-14.6'	58.0'	
21	131°58.0	03.1	233°58.6	12.5'	07°28.2	-14.5'	58.0'	
22	146°57.9	02.5	248°30.1	12.4'	07°42.8	-14.5'	58.0'	
23	161°57.7	01.9	263°01.5	12.4'	07°57.3	-14.5'	58.1'	
		SD = 16.2' $d = 0.6'$		SD = 15.7'				

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

**January 25, 26, 27 UT (Tue., Wed., Thu.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	124°16.9	202°25.1	\$16°10.3	213°54.9	\$23°50.6	146°29.9	\$10°21.5	166°54.7	\$17°14.5					Alpheratz	357°37.5	29°12.7	
1	139°19.4	217°28.0	10.2	228°55.4	50.7	161°31.8	21.3	181°56.9	14.4					Ankaa	353°09.8	-42°11.5	
2	154°21.9	232°30.9	10.2	243°58.5	50.7	176°33.7	21.1	196°59.1	14.3					Schedar	349°34.0	56°39.6	
3	169°24.3	247°33.8	.. 10.2	258°56.3	.. 50.7	191°35.7	.. 20.9	212°01.2	.. 14.2					Diphda	348°49.9	-17°52.2	
4	184°26.8	262°36.8	10.2	273°56.8	50.7	206°37.6	20.6	227°03.4	14.1					Achernar	335°22.1	-57°07.9	
5	199°29.2	277°39.7	10.1	288°57.3	50.8	221°39.5	20.4	242°05.6	14.0					Hamal	327°53.9	23°34.0	
6	214°31.7	292°42.6	\$16°10.1	303°57.8	\$23°50.8	236°41.5	\$10°20.2	257°07.7	\$17°14.0					Polaris	315°03.4	89°21.7	
7	229°34.2	307°45.5	10.1	318°58.2	50.8	251°43.4	20.0	272°09.9	13.9					Acamar	315°13.5	-40°13.3	
8	244°36.6	322°48.4	10.1	333°58.7	50.8	266°45.3	19.8	287°12.1	13.8					Menkar	314°08.6	4°10.4	
9	259°39.1	337°51.3	.. 10.1	348°59.2	.. 50.8	281°47.3	.. 19.6	302°14.2	.. 13.7					Mirfak	308°31.5	49°56.5	
10	274°41.6	352°54.2	10.0	3°59.7	50.9	296°49.2	19.4	317°16.4	13.6					Aldebaran	290°42.2	16°33.2	
11	289°44.0	7°57.1	10.0	19°00.2	50.9	311°51.1	19.2	332°18.6	13.5					Rigel	281°06.0	-8°10.7	
12	304°46.5	23°00.0	\$16°10.0	34°00.6	\$23°50.9	326°53.1	\$10°19.0	347°20.7	\$17°13.4					Capella	280°25.1	46°01.3	
13	319°49.0	38°02.8	10.0	49°01.1	50.9	341°55.0	18.8	2°22.9	13.4					Bellatrix	278°25.2	6°22.1	
14	334°51.4	53°05.7	10.0	64°01.6	50.9	356°56.9	18.6	17°25.1	13.3					Elnath	278°04.6	28°37.5	
15	349°53.9	68°08.6	.. 10.0	79°02.1	.. 51.0	11°58.9	.. 18.4	32°27.2	.. 13.2					Alnilam	275°39.9	-1°11.4	
16	4°56.4	83°11.4	10.0	94°02.6	51.0	27°00.8	18.1	47°29.4	13.1					Betelgeuse	270°54.4	7°24.6	
17	19°58.8	98°14.3	09.9	109°03.0	51.0	42°02.7	17.9	62°31.6	13.0					Canopus	263°53.0	-52°42.6	
18	35°01.3	113°17.2	\$16°09.9	124°03.5	\$23°51.0	57°04.7	\$10°17.7	77°33.7	\$17°12.9					Sirius	258°28.0	-16°44.9	
19	50°03.7	128°20.0	09.9	139°04.0	51.0	72°06.6	17.5	92°35.9	12.9					Adhara	255°07.4	-29°00.2	
20	65°06.2	143°22.9	09.9	154°04.5	51.0	87°08.5	17.3	107°38.1	12.8					Procyon	244°53.0	5°10.0	
21	80°08.7	158°25.7	.. 09.9	169°05.0	.. 51.1	102°10.5	.. 17.1	122°40.2	.. 12.7					Pollux	243°19.9	27°58.3	
22	95°11.1	173°28.5	09.9	184°05.4	51.1	117°12.4	16.9	137°42.4	12.6					Avor	234°15.0	-59°34.8	
23	110°13.6	188°31.4	09.9	199°05.9	51.1	132°14.3	16.7	152°44.6	12.5					Suhail	222°47.6	-43°31.2	
Mer.pass. 15:40			ν 2.9' d 0.0' m -4.68	ν 0.5' d -0.0' m 1.45	ν 1.9' d 0.2' m -2.07	ν 2.2' d 0.1' m 0.75								Miaplacidus	221°37.8	-69°48.3	
Mer.pass. 15:40			ν 2.9' d 0.0' m -4.68	ν 0.5' d -0.0' m 1.45	ν 1.9' d 0.2' m -2.07	ν 2.2' d 0.1' m 0.75								Alphard	217°49.8	-8°45.3	
Mer.pass. 15:40			ν 2.8' d 0.0' m -4.71	ν 0.5' d -0.0' m 1.44	ν 1.9' d 0.2' m -2.07	ν 2.2' d 0.1' m 0.74								Regulus	207°36.7	11°51.5	
Mer.pass. 15:40			ν 2.8' d 0.0' m -4.71	ν 0.5' d -0.0' m 1.44	ν 1.9' d 0.2' m -2.07	ν 2.2' d 0.1' m 0.74								Dubhe	193°43.5	61°37.8	
Mer.pass. 15:40			ν 2.8' d 0.0' m -4.71	ν 0.5' d -0.0' m 1.44	ν 1.9' d 0.2' m -2.07	ν 2.2' d 0.1' m 0.74								Denebola	182°27.2	14°26.9	
Mer.pass. 15:40			ν 2.8' d 0.0' m -4.71	ν 0.5' d -0.0' m 1.44	ν 1.9' d 0.2' m -2.07	ν 2.2' d 0.1' m 0.74								Gienah	175°45.9	-17°39.8	
Mer.pass. 15:40			ν 2.8' d 0.0' m -4.71	ν 0.5' d -0.0' m 1.44	ν 1.9' d 0.2' m -2.07	ν 2.2' d 0.1' m 0.74								Acrux	173°02.4	-63°13.0	
Mer.pass. 15:40			ν 2.8' d 0.0' m -4.71	ν 0.5' d -0.0' m 1.44	ν 1.9' d 0.2' m -2.07	ν 2.2' d 0.1' m 0.74								Gacrux	171°54.0	-57°13.9	
Mer.pass. 15:40			ν 2.8' d 0.0' m -4.71	ν 0.5' d -0.0' m 1.44	ν 1.9' d 0.2' m -2.07	ν 2.2' d 0.1' m 0.74								Alioth	166°14.9	55°50.2	
Mer.pass. 15:40			ν 2.8' d 0.0' m -4.71	ν 0.5' d -0.0' m 1.44	ν 1.9' d 0.2' m -2.07	ν 2.2' d 0.1' m 0.74								Spica	158°24.8	-11°16.5	
Mer.pass. 15:40			ν 2.8' d 0.0' m -4.71	ν 0.5' d -0.0' m 1.44	ν 1.9' d 0.2' m -2.07	ν 2.2' d 0.1' m 0.74								Alkaid	152°53.9	49°12.0	
Mer.pass. 15:40			ν 2.8' d 0.0' m -4.71	ν 0.5' d -0.0' m 1.44	ν 1.9' d 0.2' m -2.07	ν 2.2' d 0.1' m 0.74								Hadar	148°39.4	-60°28.4	
Mer.pass. 15:40			ν 2.8' d 0.0' m -4.71	ν 0.5' d -0.0' m 1.44	ν 1.9' d 0.2' m -2.07	ν 2.2' d 0.1' m 0.74								Menkent	148°00.4	-36°28.5	
Mer.pass. 15:40			ν 2.8' d 0.0' m -4.71	ν 0.5' d -0.0' m 1.44	ν 1.9' d 0.2' m -2.07	ν 2.2' d 0.1' m 0.74								Arcturus	145°50.1	19°03.9	
Mer.pass. 15:40			ν 2.8' d 0.0' m -4.71	ν 0.5' d -0.0' m 1.44	ν 1.9' d 0.2' m -2.07	ν 2.2' d 0.1' m 0.74								Rigel	139°43.6	-60°55.2	
Mer.pass. 15:40			ν 2.8' d 0.0' m -4.71	ν 0.5' d -0.0' m 1.44	ν 1.9' d 0.2' m -2.07	ν 2.2' d 0.1' m 0.74								Kochab	137°20.0	74°03.6	
Mer.pass. 15:40			ν 2.8' d 0.0' m -4.71	ν 0.5' d -0.0' m 1.44	ν 1.9' d 0.2' m -2.07	ν 2.2' d 0.1' m 0.74								Zuben'ubi	136°58.7	-16°07.9	
Mer.pass. 15:40			ν 2.8' d 0.0' m -4.71	ν 0.5' d -0.0' m 1.44	ν 1.9' d 0.2' m -2.07	ν 2.2' d 0.1' m 0.74								Alphecca	126°05.9	26°38.3	
Mer.pass. 15:40			ν 2.8' d 0.0' m -4.71	ν 0.5' d -0.0' m 1.44	ν 1.9' d 0.2' m -2.07	ν 2.2' d 0.1' m 0.74								Antares	112°19.0	-26°28.7	
Mer.pass. 15:40			ν 2.8' d 0.0' m -4.71	ν 0.5' d -0.0' m 1.44	ν 1.9' d 0.2' m -2.07	ν 2.2' d 0.1' m 0.74								Atria	107°15.8	-69°03.7	
Mer.pass. 15:40			ν 2.8' d 0.0' m -4.71	ν 0.5' d -0.0' m 1.44	ν 1.9' d 0.2' m -2.07	ν 2.2' d 0.1' m 0.74								Sabik	102°05.8	-15°45.1	
Mer.pass. 15:40			ν 2.8' d 0.0' m -4.71	ν 0.5' d -0.0' m 1.44	ν 1.9' d 0.2' m -2.07	ν 2.2' d 0.1' m 0.74								Shaula	96°14.0	-37°07.1	
Mer.pass. 15:40			ν 2.8' d 0.0' m -4.71	ν 0.5' d -0.0' m 1.44	ν 1.9' d 0.2' m -2.07	ν 2.2' d 0.1' m 0.74								Rasalhague	96°01.1	12°32.5	
Mer.pass. 15:40			ν 2.8' d 0.0' m -4.71	ν 0.5' d -0.0' m 1.44	ν 1.9' d 0.2' m -2.07	ν 2.2' d 0.1' m 0.74								Eltanin	90°43.8	51°28.9	
Mer.pass. 15:40			ν 2.8' d 0.0' m -4.71	ν 0.5' d -0.0' m 1.44	ν 1.9' d 0.2' m -2.07	ν 2.2' d 0.1' m 0.74								Kaus Aust.	83°36.1	-34°22.4	
Mer.pass. 15:40			ν 2.8' d 0.0' m -4.71	ν 0.5' d -0.0' m 1.44	ν 1.9' d 0.2' m -2.07	ν 2.2' d 0.1' m 0.74								Vega	80°35.2	38°48.1	
Mer.pass. 15:40			ν 2.8' d 0.0' m -4.71	ν 0.5' d -0.0' m 1.44	ν 1.9' d 0.2' m -2.07	ν 2.2' d 0.1' m 0.74								Nunki	75°51.1	-26°16.2	
Mer.pass. 15:40			ν 2.8' d 0.0' m -4.71	ν 0.5' d -0.0' m 1.44	ν 1.9' d 0.2' m -2.07	ν 2.2' d 0.1' m 0.74								Altair	62°02.6	8°55.5	
Mer.pass. 15:40			ν 2.8' d 0.0' m -4.71	ν 0.5' d -0.0' m 1.44	ν 1.9' d 0.2' m -2.07	ν 2.2' d 0.1' m 0.74								Peacock	53°10.2	-56°39.9	
Mer.pass. 15:40			ν 2.8' d 0.0' m -4.71	ν 0.5' d -0.0' m 1.44	ν 1.9' d 0.2' m -2.07	ν 2.2' d 0.1' m 0.74								Deneb	49°27.9	45°21.5	
Mer.pass. 15:40			ν 2.8' d 0.0' m -4.71	ν 0.5' d -0.0' m 1.44	ν 1.9' d 0.2' m -2.07	ν 2.2' d 0.1' m 0.74								Enif	33°41.5	9°58.5	
Mer.pass. 15:40			ν 2.8' d 0.0' m -4.71	ν 0.5' d -0.0' m 1.44	ν 1.9' d 0.2' m -2.07	ν 2.2' d 0.1' m 0.74								Al Na'ir	27°36.4	-46°51.5	
Mer.pass. 15:40			ν 2.8' d 0.0' m -4.71	ν 0.5' d -0.0' m 1.44	ν 1.9' d 0.2' m -2.07	ν 2.2' d 0.1' m 0.74								Fomalhaut	15°17.5	-29°30.6	
Mer.pass. 15:40			ν 2.8' d 0.0' m -4.71	ν 0.5' d -0.0' m 1.44	ν												

DUT1 = UT1-UTC = -0.1090 sec  $\Delta T = TT-UT1 = +69.2930$  sec

2022 January 25 to Jan. 27 UT

h		Sun		Moon			
Tue	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	176°57.6	S19°01.3	277°32.9	12.3'	S08°11.8	-14.5'	58.1'
1	191°57.4	00.7	292°04.1	12.2'	08°26.3	-14.4'	58.1'
2	206°57.3	19°00.1	306°35.4	12.2'	08°40.7	-14.4'	58.1'
3	221°57.1	18°59.5	321°06.5	12.1'	08°55.1	-14.4'	58.2'
4	236°57.0	58.8	335°37.6	12.0'	09°09.5	-14.3'	58.2'
5	251°56.8	58.2	350°08.6	11.9'	09°23.8	-14.3'	58.2'
6	266°56.7	S18°57.6	4°39.6	11.9'	S09°38.1	-14.3'	58.2'
7	281°56.6	57.0	19°10.4	11.8'	09°52.4	-14.2'	58.3'
8	296°56.4	56.4	33°41.2	11.7'	10°06.6	-14.2'	58.3'
9	311°56.3	.. 55.8	48°12.0	11.6'	10°20.8	-14.2'	58.3'
10	326°56.1	55.1	62°42.6	11.6'	10°35.0	-14.1'	58.4'
11	341°56.0	54.5	77°13.2	11.5'	10°49.1	-14.1'	58.4'
12	356°55.8	S18°53.9	91°43.7	11.4'	S11°03.2	-14.0'	58.4'
13	11°55.7	53.3	106°14.1	11.3'	11°17.2	-14.0'	58.4'
14	26°55.6	52.7	120°44.4	11.2'	11°31.2	-13.9'	58.5'
15	41°55.4	.. 52.0	135°14.6	11.2'	11°45.2	-13.9'	58.5'
16	56°55.3	51.4	149°44.8	11.1'	11°59.1	-13.8'	58.5'
17	71°55.1	50.8	164°14.9	11.0'	12°12.9	-13.8'	58.5'
18	86°55.0	S18°50.2	178°44.9	10.9'	S12°26.7	-13.7'	58.6'
19	101°54.9	49.5	193°14.8	10.8'	12°40.5	-13.7'	58.6'
20	116°54.7	48.9	207°44.6	10.7'	12°54.2	-13.6'	58.6'
21	131°54.6	.. 48.3	222°14.3	10.6'	13°07.8	-13.6'	58.6'
22	146°54.4	47.7	236°44.0	10.5'	13°21.4	-13.5'	58.7'
23	161°54.3	47.0	251°13.5	10.5'	13°34.9	-13.5'	58.7'
SD = 16.2'		SD = 15.8'					
SD = 16.2' $d = 0.6'$		SD = 15.8'					
Wed	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	176°54.2	S18°46.4	265°42.9	10.4'	S13°48.4	-13.4'	58.7'
1	191°54.0	45.8	280°12.3	10.3'	14°01.8	-13.3'	58.8'
2	206°53.9	45.2	294°41.6	10.2'	14°15.1	-13.3'	58.8'
3	221°53.8	.. 44.5	309°10.7	10.1'	14°28.4	-13.2'	58.8'
4	236°53.6	43.9	323°39.8	10.0'	14°41.6	-13.1'	58.8'
5	251°53.5	43.3	338°08.8	9.9'	14°54.7	-13.1'	58.9'
6	266°53.3	S18°42.6	352°37.6	9.8'	S15°07.8	-13.0'	58.9'
7	281°53.2	42.0	7°06.4	9.7'	15°20.8	-12.9'	58.9'
8	296°53.1	41.4	21°35.1	9.6'	15°33.7	-12.9'	58.9'
9	311°52.9	.. 40.7	36°03.7	9.5'	15°46.6	-12.8'	59.0'
10	326°52.8	40.1	50°32.1	9.4'	15°59.3	-12.7'	59.0'
11	341°52.7	39.5	65°00.5	9.3'	16°12.0	-12.6'	59.0'
12	356°52.5	S18°38.8	79°28.8	9.2'	S16°24.6	-12.5'	59.0'
13	11°52.4	38.2	93°56.9	9.1'	16°37.2	-12.5'	59.1'
14	26°52.3	37.6	108°25.0	8.9'	16°49.6	-12.4'	59.1'
15	41°52.1	.. 36.9	122°52.9	8.8'	17°02.0	-12.3'	59.1'
16	56°52.0	36.3	137°20.8	8.7'	17°14.3	-12.2'	59.1'
17	71°51.9	35.7	151°48.5	8.6'	17°26.5	-12.1'	59.2'
18	86°51.7	S18°35.0	166°16.1	8.5'	S17°38.6	-12.0'	59.2'
19	101°51.6	34.4	180°43.6	8.4'	17°50.6	-11.9'	59.2'
20	116°51.5	33.7	195°11.0	8.3'	18°02.5	-11.8'	59.2'
21	131°51.4	.. 33.1	209°38.3	8.2'	18°14.3	-11.7'	59.3'
22	146°51.2	32.5	224°05.5	8.1'	18°26.1	-11.6'	59.3'
23	161°51.1	31.8	238°32.6	8.0'	18°37.7	-11.5'	59.3'
SD = 16.2' $d = 0.6'$		SD = 16.0'					
Thu	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	176°51.0	S18°31.2	252°59.6	7.9'	S18°49.2	-11.4'	59.3'
1	191°50.8	30.5	267°26.4	7.7'	19°00.6	-11.3'	59.4'
2	206°50.7	29.9	281°53.2	7.6'	19°11.9	-11.2'	59.4'
3	221°50.6	.. 29.3	296°19.8	7.5'	19°23.2	-11.1'	59.4'
4	236°50.4	28.6	310°46.3	7.4'	19°34.3	-11.0'	59.4'
5	251°50.3	28.0	325°12.7	7.3'	19°45.3	-10.9'	59.5'
6	266°50.2	S18°27.3	339°39.0	7.2'	S19°56.1	-10.8'	59.5'
7	281°50.1	26.7	354°05.2	7.1'	20°06.9	-10.7'	59.5'
8	296°49.9	26.0	8°31.2	7.0'	20°17.6	-10.5'	59.5'
9	311°49.8	.. 25.4	22°57.2	6.8'	20°28.1	-10.4'	59.5'
10	326°49.7	24.7	37°23.0	6.7'	20°38.5	-10.3'	59.6'
11	341°49.6	24.1	51°48.8	6.6'	20°48.8	-10.2'	59.6'
12	356°49.4	S18°23.4	66°14.4	6.5'	S20°59.0	-10.1'	59.6'
13	11°49.3	22.8	80°39.9	6.4'	21°09.0	-9.9'	59.6'
14	26°49.2	22.1	95°05.3	6.3'	21°19.0	-9.8'	59.7'
15	41°49.1	.. 21.5	109°30.5	6.2'	21°28.8	-9.7'	59.7'
16	56°48.9	20.8	123°55.7	6.0'	21°38.4	-9.5'	59.7'
17	71°48.8	20.2	138°20.7	5.9'	21°48.0	-9.4'	59.7'
18	86°48.7	S18°19.5	152°45.7	5.8'	S21°57.4	-9.3'	59.7'
19	101°48.6	18.9	167°10.5	5.7'	22°06.6	-9.1'	59.8'
20	116°48.4	18.2	181°35.2	5.6'	22°15.8	-9.0'	59.8'
21	131°48.3	.. 17.6	195°59.8	5.5'	22°24.7	-8.8'	59.8'
22	146°48.2	16.9	210°24.3	5.4'	22°33.6	-8.7'	59.8'
23	161°48.1	16.3	224°48.7	5.3'	22°42.3	-8.6'	59.8'
SD = 16.2' $d = 0.6'$		SD = 16.2'					

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

**January 28, 29, 30 UT (Fri., Sat., Sun.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	127°14.3	205°44.6	\$16°10.3	214°29.3	\$23°51.4	148°48.9	\$10°06.4	169°30.7	\$17°08.3					Alpheratz	357°37.5	29°12.7	
1	142°16.8	220°47.2	10.3	229°29.8	51.4	163°50.8	06.2	184°32.8	08.2					Ankaa	353°09.8	-42°11.5	
2	157°19.3	235°49.8	10.3	244°30.2	51.3	178°52.8	06.0	199°35.0	08.2					Schedar	349°34.0	56°39.6	
3	172°21.7	250°52.4	.. 10.4	259°30.7	.. 51.3	193°54.7	.. 05.7	214°37.2	.. 08.1					Diphda	348°49.9	-17°52.2	
4	187°24.2	265°55.0	10.4	274°31.2	51.3	208°56.6	05.5	229°39.3	08.0					Achernar	335°22.2	-57°07.9	
5	202°26.7	280°57.6	10.4	289°31.7	51.3	223°58.5	05.3	244°41.5	07.9					Hamal	327°53.9	23°34.0	
6	217°29.1	296°00.1	\$16°10.4	304°32.1	\$23°51.3	239°00.5	\$10°05.1	259°43.6	\$17°07.8					Polaris	315°04.6	89°21.7	
7	232°31.6	311°02.7	10.5	319°32.6	51.3	254°02.4	04.9	274°45.8	07.7					Acamar	315°13.6	-40°13.3	
8	247°34.1	326°05.3	10.5	334°33.1	51.3	269°04.3	04.7	289°48.0	07.6					Menkar	314°08.6	4°10.4	
9	262°36.5	341°07.9	.. 10.5	349°33.6	.. 51.3	284°06.3	.. 04.5	304°50.1	.. 07.6					Mirfak	308°31.5	49°56.5	
10	277°39.0	356°10.4	10.6	4°34.0	51.3	299°08.2	04.3	319°52.3	07.5					Aldebaran	290°42.2	16°33.2	
11	292°41.5	11°13.0	10.6	19°34.5	51.3	314°10.1	04.1	334°54.5	07.4					Rigel	281°06.0	-8°10.7	
12	307°43.9	26°15.6	\$16°10.6	34°35.0	\$23°51.3	329°12.0	\$10°03.8	349°56.6	\$17°07.3					Capella	280°25.1	46°01.3	
13	322°46.4	41°18.1	10.6	49°35.4	51.3	344°14.0	03.6	4°58.8	07.2					Bellatrix	278°25.2	6°22.1	
14	337°48.8	56°20.6	10.7	64°35.9	51.3	359°15.9	03.4	20°01.0	07.1					Elnath	278°04.6	28°37.5	
15	352°51.3	71°23.2	.. 10.7	79°36.4	.. 51.2	14°17.8	.. 03.2	35°03.1	.. 07.0					Alnilam	275°39.9	-1°11.4	
16	7°53.8	86°25.7	10.7	94°36.9	51.2	29°19.8	03.0	50°05.3	07.0					Betelgeuse	270°54.4	7°24.6	
17	22°56.2	101°28.3	10.8	109°37.3	51.2	44°21.7	02.8	65°07.5	06.9					Canopus	263°53.0	-52°42.6	
18	37°58.7	116°30.8	\$16°10.8	124°37.8	\$23°51.2	59°23.6	\$10°02.6	80°09.6	\$17°06.8					Sirius	258°28.0	-16°44.9	
19	53°01.2	131°33.3	10.8	139°38.3	51.2	74°25.5	02.4	95°11.8	06.7					Adhara	255°07.4	-29°00.2	
20	68°03.6	146°35.8	10.9	154°38.8	51.2	89°27.5	02.2	110°14.0	06.6					Procyon	244°53.0	5°10.0	
21	83°06.1	161°38.3	.. 10.9	169°39.2	.. 51.2	104°29.4	.. 01.9	125°16.1	.. 06.5					Pollux	243°19.9	27°58.3	
22	98°08.6	176°40.9	10.9	184°39.7	51.2	119°31.3	01.7	140°18.3	06.4					Avisor	234°15.0	-59°34.8	
23	113°11.0	191°43.4	11.0	199°40.2	51.1	134°33.2	01.5	155°20.4	06.4					Suhail	222°47.6	-43°31.3	
Mer.pass. 15:29			ν 2.6° d -0.0' m -4.76	ν 0.5° d 0.0' m 1.43			ν 1.9° d 0.2' m -2.06			ν 2.2° d 0.1' m 0.73			Miaplacidus				
Sat			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Dubhe	193°43.5	61°37.8	
0	128°13.5	206°45.9	\$16°11.0	214°40.7	\$23°51.1	149°35.2	\$10°01.3	170°22.6	\$17°06.3					Denebola	182°27.2	14°26.9	
1	143°16.0	221°48.4	11.1	229°41.1	51.1	164°37.1	01.1	185°24.8	06.2					Gienah	175°45.9	-17°39.8	
2	158°18.4	236°50.9	11.1	244°41.6	51.1	179°39.0	00.9	200°26.9	06.1					Acrux	173°02.4	-63°13.0	
3	173°20.9	251°53.3	.. 11.1	259°42.1	.. 51.1	194°40.9	.. 00.7	215°29.1	.. 06.0					Gacrux	171°54.0	-57°13.9	
4	188°23.3	266°55.8	11.2	274°42.6	51.1	209°42.9	00.5	230°31.3	05.9					Alioth	166°14.9	55°50.2	
5	203°25.8	281°58.3	11.2	289°43.0	51.0	224°44.8	00.2	245°33.4	05.8					Spica	158°24.7	-11°16.5	
6	218°28.3	297°00.8	\$16°11.3	304°43.5	\$23°51.0	239°46.7	\$10°00.0	260°35.6	\$17°05.8					Alkaid	152°53.9	49°12.0	
7	233°30.7	312°03.3	11.3	319°44.0	51.0	254°48.7	00°59.8	275°37.8	05.7					Hadar	148°39.3	-60°28.4	
8	248°33.2	327°05.7	11.3	334°44.4	51.0	269°50.6	59.6	290°39.9	05.6					Menkent	148°00.4	-36°28.5	
9	263°35.7	342°08.2	.. 11.4	349°44.9	.. 51.0	284°52.5	.. 59.4	305°42.1	.. 05.5					Arcturus	145°50.1	19°03.9	
10	278°38.1	357°10.6	11.4	4°45.4	51.0	299°54.4	59.2	320°44.3	05.4					Rigel Kent.	139°43.6	-60°55.2	
11	293°40.6	12°13.1	11.5	19°45.9	50.9	314°56.4	59.0	335°46.4	05.3					Kochab	137°20.0	74°03.6	
12	308°43.1	27°15.5	\$16°11.5	34°46.3	\$23°50.9	329°58.3	\$09°58.8	350°48.6	\$17°05.2					Zuben'ubi	136°58.7	-16°07.9	
13	323°45.5	42°18.0	11.5	49°46.8	50.9	345°00.2	58.5	5°50.8	05.2					Alphecca	126°05.9	26°38.3	
14	338°48.0	57°20.4	11.6	64°47.3	50.9	0°02.1	58.3	20°52.9	05.1					Antares	112°19.0	-26°28.7	
15	353°50.5	72°22.9	.. 11.6	79°47.8	.. 50.9	15°04.1	.. 58.1	35°55.1	.. 05.0					Atria	107°15.7	-69°03.7	
16	8°52.9	87°25.3	11.7	94°48.2	50.8	30°06.0	57.9	50°57.2	04.9					Sabik	102°05.8	-15°45.1	
17	23°55.4	102°27.7	11.7	109°48.7	50.8	45°07.9	57.7	65°59.4	04.8					Shaula	96°13.9	-37°07.1	
18	38°57.8	117°30.1	\$16°11.8	124°49.2	\$23°50.8	60°09.8	\$09°57.5	81°01.6	\$17°04.7					Rasalhague	96°01.0	12°32.5	
19	54°00.3	132°32.6	11.8	139°49.6	50.8	75°11.8	57.3	96°03.7	04.6					Eltanin	90°43.7	51°28.9	
20	69°02.8	147°35.0	11.9	154°50.1	50.7	90°13.7	57.0	111°05.9	04.6					Kaus Aust.	83°36.1	-34°22.4	
21	84°05.2	162°37.4	.. 11.9	169°50.6	.. 50.7	105°15.6	.. 56.8	126°08.1	.. 04.5					Vega	80°35.2	38°48.1	
22	99°07.7	177°39.8	12.0	184°51.1	50.7	120°17.5	56.6	141°10.2	04.4					Nunki	75°51.1	-26°16.2	
23	114°10.2	192°42.2	12.0	199°51.5	50.7	135°19.5	56.4	156°12.4	04.3					Altair	62°02.6	8°55.5	
Mer.pass. 15:25			ν 2.5° d -0.0' m -4.79	ν 0.5° d 0.0' m 1.43			ν 1.9° d 0.2' m -2.06			ν 2.2° d 0.1' m 0.73			Peacock				
Sun			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Fomalhaut	15°17.5	-29°30.6	
0	129°12.6	207°44.6	\$16°12.1	214°52.0	\$23°50.6	150°21.4	\$09°56.2	171°14.6	\$17°04.2					Scheat	13°47.8	28°12.1	
1	144°15.1	222°47.0	12.1	229°52.5	50.6	165°23.3	56.0	186°16.7	04.1					Markab	13°32.5	15°19.3	
2	159°17.6	237°49.4	12.2	244°53.0	50.6	180°25.2	55.8	201°18.9	04.0					Jan 28 Fri	SHA	Mer.pass	
3	174°20.0	252°51.7	.. 12.2	259°53.4	.. 50.6	195°27.2	.. 55.6	216°21.1	.. 04.0					Venus	78°30.2	10:15	
4	189°22.5	267°54.1	12.3	274°53.9	50.5	210°29.1	55.3	231°23.2	03.9					Mars	87°14.9	09:42	
5	204°25.0	282°56.5	12.3	289°54.4	50.5	225°31.0	55.1	246°25.4	03.8					Jupiter	21°34.6	14:03	
6	219°27.4	297°58.9	\$16°12.4	304°54.8	\$23°50.5	240°32.9	\$09°54.9	261°27.5	\$17°03.7					Saturn	42°16.3	12:40	
7	234°29.9	313°01.2	12.4	319°55.3	50.5	255°34.9	54.7	276°29.7	03.6					Jan 29 Sat	SHA	Mer.pass	
8	249°32.3	328°03.6	12.5	334°55.8	50.4	270°36.8	54.5	291°31.9	03.5					Venus	78°32.4	10:11	
9	264°34.8	343°06.0	.. 12.5	349°56.3	.. 50.4	285°38.7	.. 54.3	306°34.0	.. 03.4					Mars	86°27.2	09:41	
10	279°37.3	358°08.3	12.6	4°56.7	50.4	300°40.6	54.1	321°36.2	03.4					Jupiter	21°21.7	14:00	
11	294°39.7	13°10.7	12.6	19°57.2	50.4	315°42.6	53.8	336°38.4	03.3					Saturn	42°09.1	12:37	
12	309°42.2</td																

DUT1 = UT1-UTC = -0.1091 sec  $\Delta T = TT-UT1 = +69.2931$  sec

2022 January 28 to Jan. 30 UT

h		Sun		Moon			
Fri	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	176°48.0	S18°15.6	239°13.0	5.2'	S22°50.9	-8.4'	59.9'
1	191°47.8	15.0	253°37.1	5.1'	22°59.3	-8.3'	59.9'
2	206°47.7	14.3	268°01.2	5.0'	23°07.5	-8.1'	59.9'
3	221°47.6	13.6	282°25.2	4.9'	23°15.6	-8.0'	59.9'
4	236°47.5	13.0	296°49.0	4.8'	23°23.6	-7.8'	59.9'
5	251°47.4	12.3	311°12.8	4.6'	23°31.4	-7.7'	60.0'
6	266°47.2	S18°11.7	325°36.4	4.5'	S23°39.1	-7.5'	60.0'
7	281°47.1	11.0	340°00.0	4.4'	23°46.6	-7.3'	60.0'
8	296°47.0	10.4	354°23.4	4.3'	23°53.9	-7.2'	60.0'
9	311°46.9	09.7	8°46.8	4.2'	24°01.1	-7.0'	60.0'
10	326°46.8	09.0	23°10.0	4.2'	24°08.1	-6.9'	60.0'
11	341°46.6	08.4	37°33.2	4.1'	24°15.0	-6.7'	60.1'
12	356°46.5	S18°07.7	51°56.2	4.0'	S24°21.7	-6.5'	60.1'
13	11°46.4	07.0	66°19.2	3.9'	24°28.2	-6.4'	60.1'
14	26°46.3	06.4	80°42.1	3.8'	24°34.6	-6.2'	60.1'
15	41°46.2	05.7	95°04.8	3.7'	24°40.7	-6.0'	60.1'
16	56°46.1	05.1	109°27.5	3.6'	24°46.8	-5.8'	60.1'
17	71°45.9	04.4	123°50.2	3.5'	24°52.6	-5.7'	60.2'
18	86°45.8	S18°03.7	138°12.7	3.4'	S24°58.3	-5.5'	60.2'
19	101°45.7	03.1	152°35.1	3.4'	25°03.8	-5.3'	60.2'
20	116°45.6	02.4	166°57.5	3.3'	25°09.1	-5.1'	60.2'
21	131°45.5	01.7	181°19.8	3.2'	25°14.2	-5.0'	60.2'
22	146°45.4	01.1	195°42.0	3.1'	25°19.2	-4.8'	60.2'
23	161°45.3	00.4	210°04.1	3.1'	25°24.0	-4.6'	60.2'
		SD = 16.2' $d = 0.7'$		SD = 16.3'			

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

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

Day	Sun		Moon		Age
	Eqn.of	Time	Mer.	Mer. Pass.	
	00 <sup>h</sup>	12 <sup>h</sup>	Pass.	Upper	26-28
mm:ss	mm:ss	hh:mm	hh:mm	hh:mm	24-7%
28	12:48	12:54	12:13	08:23	20:54
29	12:59	13:05	12:13	09:26	21:59
30	13:10	13:15	12:13	10:31	23:04

**January 31, 01, 02 UT (Mon., Tue., Wed.)**

Aries		Venus		Mars		Jupiter		Saturn		Stars	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec
0	130°11.8	208°40.8	\$16°13.4	215°03.3	\$23°49.9	151°07.6	\$09°51.1	172°06.5	\$17°02.2	Alpheratz	357°37.5
1	145°14.2	223°43.1	13.4	230°03.8	49.9	166°09.5	50.9	187°08.7	02.1	Ankaa	353°09.8
2	160°16.7	238°45.4	13.5	245°04.3	49.9	181°11.4	50.6	202°10.8	02.0	Schedar	349°34.0
3	175°19.2	253°47.6	.. 13.6	260°04.7	.. 49.8	196°13.3	.. 50.4	217°13.0	.. 01.9	Diphda	348°49.9
4	190°21.6	268°49.9	13.6	275°05.2	49.8	211°15.3	50.2	232°15.2	01.8	Achernar	335°22.2
5	205°24.1	283°52.2	13.7	290°05.7	49.8	226°17.2	50.0	247°17.3	01.7	Hamal	327°53.9
6	220°26.6	298°54.4	\$16°13.8	305°06.2	\$23°49.7	241°19.1	\$09°49.8	262°19.5	\$17°01.6	Polaris	315°05.9
7	235°29.0	313°56.7	13.8	320°06.6	49.7	256°21.0	49.6	277°21.7	01.5	Acamar	315°13.6
8	250°31.5	328°59.0	13.9	335°07.1	49.6	271°22.9	49.4	292°23.8	01.5	Menkar	314°08.6
9	265°33.9	344°01.2	.. 14.0	350°07.6	.. 49.6	286°24.9	.. 49.1	307°26.0	.. 01.4	Mirfak	308°31.6
10	280°36.4	359°03.5	14.0	5°08.0	49.6	301°26.8	48.9	322°28.1	01.3	Aldebaran	290°42.2
11	295°38.9	14°05.7	14.1	20°08.5	49.5	316°28.7	48.7	337°30.3	01.2	Rigel	281°06.0
12	310°41.3	29°07.9	\$16°14.1	35°09.0	\$23°49.5	331°30.6	\$09°48.5	352°32.5	\$17°01.1	Capella	280°25.1
13	325°43.8	44°10.2	14.2	50°09.4	49.4	346°32.6	48.3	7°34.6	01.0	Bellatrix	278°25.2
14	340°46.3	59°12.4	14.3	65°09.9	49.4	1°34.5	48.1	22°36.8	00.9	Elnath	278°04.6
15	355°48.7	74°14.6	.. 14.3	80°10.4	.. 49.4	16°36.4	.. 47.9	37°39.0	.. 00.9	Alnilam	275°39.9
16	10°51.2	89°16.9	14.4	95°10.9	49.3	31°38.3	47.6	52°41.1	00.8	Betelgeuse	270°54.4
17	25°53.7	104°19.1	14.5	110°11.3	49.3	46°40.3	47.4	67°43.3	00.7	Canopus	263°53.0
18	40°56.1	119°21.3	\$16°14.6	125°11.8	\$23°49.2	61°42.2	\$09°47.2	82°45.5	\$17°00.6	Sirius	258°28.0
19	55°58.6	134°23.5	14.6	140°12.3	49.2	76°44.1	47.0	97°47.6	00.5	Adhara	255°07.4
20	71°01.1	149°25.7	14.7	155°12.7	49.2	91°46.0	46.8	112°49.8	00.4	Procyon	244°53.0
21	86°03.5	164°27.9	.. 14.8	170°13.2	.. 49.1	106°47.9	.. 46.6	127°52.0	.. 00.3	Pollux	243°19.9
22	101°06.0	179°30.1	14.8	185°13.7	49.1	121°49.9	46.3	142°54.1	00.3	Avior	234°15.0
23	116°08.4	194°32.3	14.9	200°14.2	49.0	136°51.8	46.1	157°56.3	00.2	Suhail	222°47.6
Mer.pass. 15:17		ν 2.3° d -0.1° m -4.82	ν 0.5° d 0.0° m 1.42	ν 1.9° d 0.2° m -2.06	ν 2.2° d 0.1° m 0.71	Miaplacidus		221°37.7	69°48.4	Alphard	217°49.8
Mer.pass. 15:17		ν 2.3° d -0.1° m -4.82	ν 0.5° d 0.0° m 1.42	ν 1.9° d 0.2° m -2.06	ν 2.2° d 0.1° m 0.71	Regulus		207°36.7	11°51.5	Dubhe	193°43.4
Mer.pass. 15:17		ν 2.2° d -0.1° m -4.83	ν 0.5° d 0.0° m 1.41	ν 1.9° d 0.2° m -2.06	ν 2.2° d 0.1° m 0.70	Denebola		182°27.2	14°26.8	Gienah	175°45.8
Mer.pass. 15:17		ν 2.2° d -0.1° m -4.83	ν 0.5° d 0.0° m 1.41	ν 1.9° d 0.2° m -2.06	ν 2.2° d 0.1° m 0.70	Gienah		175°45.8	-17°39.8	Acrux	173°02.3
Mer.pass. 15:17		ν 2.2° d -0.1° m -4.83	ν 0.5° d 0.0° m 1.41	ν 1.9° d 0.2° m -2.06	ν 2.2° d 0.1° m 0.70	Gacrux		171°53.9	-57°13.9	Alioth	166°14.9
Mer.pass. 15:17		ν 2.2° d -0.1° m -4.83	ν 0.5° d 0.0° m 1.41	ν 1.9° d 0.2° m -2.06	ν 2.2° d 0.1° m 0.70	Alioth		166°14.9	55°50.2	Spica	158°24.7
Mer.pass. 15:17		ν 2.2° d -0.1° m -4.83	ν 0.5° d 0.0° m 1.41	ν 1.9° d 0.2° m -2.06	ν 2.2° d 0.1° m 0.70	Spica		158°24.7	-11°16.5	Alkaid	152°53.8
Mer.pass. 15:17		ν 2.2° d -0.1° m -4.83	ν 0.5° d 0.0° m 1.41	ν 1.9° d 0.2° m -2.06	ν 2.2° d 0.1° m 0.70	Alkaid		148°39.3	60°28.4	Hadar	148°39.3
Mer.pass. 15:17		ν 2.2° d -0.1° m -4.83	ν 0.5° d 0.0° m 1.41	ν 1.9° d 0.2° m -2.06	ν 2.2° d 0.1° m 0.70	Hadar		148°39.3	-36°28.5	Menkent	148°00.4
Mer.pass. 15:17		ν 2.2° d -0.1° m -4.83	ν 0.5° d 0.0° m 1.41	ν 1.9° d 0.2° m -2.06	ν 2.2° d 0.1° m 0.70	Menkent		148°00.4	19°03.9	Arcturus	145°50.1
Mer.pass. 15:17		ν 2.2° d -0.1° m -4.83	ν 0.5° d 0.0° m 1.41	ν 1.9° d 0.2° m -2.06	ν 2.2° d 0.1° m 0.70	Arcturus		145°50.1	-60°55.2	Rigel Kent	139°43.5
Mer.pass. 15:17		ν 2.2° d -0.1° m -4.83	ν 0.5° d 0.0° m 1.41	ν 1.9° d 0.2° m -2.06	ν 2.2° d 0.1° m 0.70	Rigel Kent		139°43.5	74°03.6	Kochab	137°19.9
Mer.pass. 15:17		ν 2.2° d -0.1° m -4.83	ν 0.5° d 0.0° m 1.41	ν 1.9° d 0.2° m -2.06	ν 2.2° d 0.1° m 0.70	Kochab		136°58.7	-16°07.9	Zuben'ubi	136°58.7
Mer.pass. 15:17		ν 2.2° d -0.1° m -4.83	ν 0.5° d 0.0° m 1.41	ν 1.9° d 0.2° m -2.06	ν 2.2° d 0.1° m 0.70	Zuben'ubi		136°58.7	26°38.2	Alphecca	126°05.9
Mer.pass. 15:17		ν 2.2° d -0.1° m -4.83	ν 0.5° d 0.0° m 1.41	ν 1.9° d 0.2° m -2.06	ν 2.2° d 0.1° m 0.70	Antares		112°18.9	-26°28.7	Antares	112°18.9
Mer.pass. 15:17		ν 2.2° d -0.1° m -4.83	ν 0.5° d 0.0° m 1.41	ν 1.9° d 0.2° m -2.06	ν 2.2° d 0.1° m 0.70	Antares		107°15.6	-69°03.7	Atria	107°15.6
Mer.pass. 15:17		ν 2.2° d -0.1° m -4.83	ν 0.5° d 0.0° m 1.41	ν 1.9° d 0.2° m -2.06	ν 2.2° d 0.1° m 0.70	Atria		102°05.7	-15°45.1	Sabik	102°05.7
Mer.pass. 15:17		ν 2.2° d -0.1° m -4.83	ν 0.5° d 0.0° m 1.41	ν 1.9° d 0.2° m -2.06	ν 2.2° d 0.1° m 0.70	Shaula		96°13.9	-37°07.1	Rasalhague	96°01.0
Mer.pass. 15:17		ν 2.2° d -0.1° m -4.83	ν 0.5° d 0.0° m 1.41	ν 1.9° d 0.2° m -2.06	ν 2.2° d 0.1° m 0.70	Rasalhague		90°43.7	12°32.5	Eltanin	90°43.7
Mer.pass. 15:17		ν 2.2° d -0.1° m -4.83	ν 0.5° d 0.0° m 1.41	ν 1.9° d 0.2° m -2.06	ν 2.2° d 0.1° m 0.70	Eltanin		83°36.0	34°22.4	Kaus Aust.	83°36.0
Mer.pass. 15:17		ν 2.2° d -0.1° m -4.83	ν 0.5° d 0.0° m 1.41	ν 1.9° d 0.2° m -2.06	ν 2.2° d 0.1° m 0.70	Kaus Aust.		80°35.2	38°48.1	Vega	80°35.2
Mer.pass. 15:17		ν 2.2° d -0.1° m -4.83	ν 0.5° d 0.0° m 1.41	ν 1.9° d 0.2° m -2.06	ν 2.2° d 0.1° m 0.70	Vega		75°51.1	-26°16.2	Nunki	75°51.1
Mer.pass. 15:17		ν 2.2° d -0.1° m -4.83	ν 0.5° d 0.0° m 1.41	ν 1.9° d 0.2° m -2.06	ν 2.2° d 0.1° m 0.70	Nunki		62°02.6	8°55.5	Altair	62°02.6
Mer.pass. 15:17		ν 2.2° d -0.1° m -4.83	ν 0.5° d 0.0° m 1.41	ν 1.9° d 0.2° m -2.06	ν 2.2° d 0.1° m 0.70	Altair		53°10.1	-56°39.9	Peacock	53°10.1
Mer.pass. 15:17		ν 2.2° d -0.1° m -4.83	ν 0.5° d 0.0° m 1.41	ν 1.9° d 0.2° m -2.06	ν 2.2° d 0.1° m 0.70	Peacock		49°27.9	45°21.4	Deneb	49°27.9
Mer.pass. 15:17		ν 2.2° d -0.1° m -4.83	ν 0.5° d 0.0° m 1.41	ν 1.9° d 0.2° m -2.06	ν 2.2° d 0.1° m 0.70	Deneb		33°41.5	9°58.4	Enif	33°41.5
Mer.pass. 15:17		ν 2.2° d -0.1° m -4.83	ν 0.5° d 0.0° m 1.41	ν 1.9° d 0.2° m -2.06	ν 2.2° d 0.1° m 0.70	Enif		27°36.4	-46°51.5	Al Na'ir	27°36.4
Mer.pass. 15:17		ν 2.2° d -0.1° m -4.83	ν 0.5° d 0.0° m 1.41	ν 1.9° d 0.2° m -2.06	ν 2.2° d 0.1° m 0.70	Fomalhaut		15°17.5	-29°30.6	Fomalhaut	15°17.5
Mer.pass. 15:17		ν 2.2° d -0.1° m -4.83	ν 0.5° d 0.0° m 1.41	ν 1.9° d 0.2° m -2.06	ν 2.2° d 0.1° m 0.70	Scheat		13°47.8	28°12.1	Scheat	13°47.8
Mer.pass. 15:17		ν 2.2° d -0.1° m -4.83	ν 0.5° d 0.0° m 1.41	ν 1.9° d 0.2° m -2.06	ν 2.2° d 0.1° m 0.70	Markab		13°32.5	15°19.3	Markab	13°32.5
Jan 31 Mon		SHA	Mer.pass			Jan 31 Mon		78°29.0	10:04	Venus	78°29.0
Jan 31 Mon		SHA	Mer.pass			Jan 31 Mon		84°51.6	09:39	Mars	84°51.6
Jan 31 Mon		SHA	Mer.pass			Jan 31 Mon		20°55.8	13:54	Jupiter	20°55.8
Jan 31 Mon		SHA	Mer.pass			Jan 31 Mon		41°54.7	12:30	Saturn	41°54.7
Feb 01 Tue		SHA	Mer.pass			Feb 01 Tue		78°23.6	10:00	Venus	78°23.6
Feb 01 Tue		SHA	Mer.pass			Feb 01 Tue		84°03.7	09:39	Mars	84°03.7
Feb 01 Tue		SHA	Mer.pass			Feb 01 Tue		20°42.8	13:51	Jupiter	20°42.8
Feb 01 Tue		SHA	Mer.pass			Feb 01 Tue		41°47.5	12:26	Saturn	41°47.5
Feb 02 Wed		SHA	Mer.pass			Feb 02 Wed		78°15.8	09:57	Venus	78°15.8
Feb 02 Wed		SHA	Mer.pass			Feb 02 Wed		83°15.8	09:38	Mars	83°15.8
Feb 02 Wed		SHA	Mer.pass			Feb 02 Wed		20°29.8	13:48	Jupiter	20°29.8
Feb 02 Wed		SHA</									

DUT1 = UT1-UTC = -0.1078 sec  $\Delta T = TT-UT1 = +69.2918$  sec

2022 January 31 to Feb. 02 UT

h		Sun		Moon			
Mon	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	176°40.1	S17°27.0	193°31.1	2.8'	S25°22.3	4.9'	60.4'
1	191°40.0	26.3	207°52.9	2.9'	25°17.4	5.1'	60.4'
2	206°39.9	25.6	222°14.8	2.9'	25°12.4	5.3'	60.4'
3	221°39.8	24.9	236°36.8	3.0'	25°07.1	5.4'	60.4'
4	236°39.7	24.2	250°58.8	3.1'	25°01.7	5.6'	60.4'
5	251°39.6	23.5	265°20.9	3.2'	24°56.1	5.8'	60.3'
6	266°39.6	S17°22.8	279°43.0	3.2'	S24°50.3	6.0'	60.3'
7	281°39.5	22.1	294°05.3	3.3'	24°44.3	6.2'	60.3'
8	296°39.4	21.4	308°27.6	3.4'	24°38.1	6.3'	60.3'
9	311°39.3	20.7	322°50.0	3.5'	24°31.8	6.5'	60.3'
10	326°39.2	20.0	337°12.5	3.6'	24°25.3	6.7'	60.3'
11	341°39.1	19.3	351°35.0	3.6'	24°18.6	6.8'	60.3'
12	356°39.0	S17°18.6	5°57.7	3.7'	S24°11.8	7.0'	60.3'
13	11°38.9	17.9	20°20.4	3.8'	24°04.8	7.2'	60.3'
14	26°38.8	17.2	34°43.2	3.9'	23°57.6	7.4'	60.2'
15	41°38.7	16.5	49°06.2	4.0'	23°50.2	7.5'	60.2'
16	56°38.6	15.8	63°29.2	4.1'	23°42.7	7.7'	60.2'
17	71°38.5	15.1	77°52.3	4.2'	23°35.0	7.8'	60.2'
18	86°38.4	S17°14.3	92°15.5	4.3'	S23°27.2	8.0'	60.2'
19	101°38.4	13.6	106°38.8	4.4'	23°19.2	8.2'	60.2'
20	116°38.3	12.9	121°02.2	4.5'	23°11.0	8.3'	60.2'
21	131°38.2	12.2	135°25.7	4.6'	23°02.7	8.5'	60.1'
22	146°38.1	11.5	149°49.3	4.7'	22°54.2	8.6'	60.1'
23	161°38.0	10.8	164°13.0	4.8'	22°45.6	8.8'	60.1'
		SD = 16.2'	d = 0.7'	SD = 16.5'			

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

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

Day	Sun		Moon	
	Eqn.of Time	Mer.	Mer.	Age
	00 <sup>h</sup> mm:ss	12 <sup>h</sup> mm:ss	Pass Upper hh:mm	Pass Lower hh:mm
31	13:20	13:24	12:13	11:35
01	13:28	13:32	12:14	12:35
02	13:36	13:40	12:14	13:31

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

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	133°09.2	211°14.8	\$16°18.8	215°37.1	\$23°46.3	153°25.9	\$09°35.6	174°42.3	\$16°55.9								
1	148°11.7	226°16.7	18.9	230°37.6	46.3	168°27.8	35.3	189°44.5	55.8								
2	163°14.1	241°18.7	19.0	245°38.1	46.2	183°29.7	35.1	204°46.6	55.8								
3	178°16.6	256°20.7	19.0	260°38.5	46.1	198°31.6	34.9	219°48.8	55.7								
4	193°19.0	271°22.7	19.1	275°39.0	46.1	213°33.6	34.7	234°51.0	55.6								
5	208°21.5	286°24.7	19.2	290°39.5	46.0	228°35.5	34.5	249°53.1	55.5								
6	223°24.0	301°26.6	\$16°19.3	305°40.0	\$23°45.9	243°37.4	\$09°34.2	264°55.3	\$16°55.4								
7	238°26.4	316°28.6	19.4	320°40.4	45.9	258°39.3	34.0	279°57.5	55.3								
8	253°28.9	331°30.6	19.5	335°40.9	45.8	273°41.2	33.8	294°59.6	55.2								
9	268°31.4	346°32.5	19.6	350°41.4	45.7	288°43.2	33.6	310°01.8	55.2								
10	283°33.8	1°34.5	19.7	5°41.8	45.7	303°45.1	33.4	325°04.0	55.1								
11	298°36.3	16°36.4	19.8	20°42.3	45.6	318°47.0	33.2	340°06.1	55.0								
12	313°38.8	31°38.4	\$16°19.8	35°42.8	\$23°45.5	333°48.9	\$09°32.9	355°08.3	\$16°54.9								
13	328°41.2	46°40.3	19.9	50°43.2	45.5	348°50.8	32.7	10°10.4	54.8								
14	343°43.7	61°42.2	20.0	65°43.7	45.4	3°52.7	32.5	25°12.6	54.7								
15	358°46.2	76°44.2	20.1	80°44.2	45.3	18°54.7	32.3	40°14.8	54.6								
16	13°48.6	91°46.1	20.2	95°44.6	45.2	33°56.6	32.1	55°16.9	54.5								
17	28°51.1	106°48.0	20.3	110°45.1	45.2	48°58.5	31.9	70°19.1	54.5								
18	43°53.5	121°50.0	\$16°20.4	125°45.6	\$23°45.1	64°00.4	\$09°31.6	85°21.3	\$16°54.4								
19	58°56.0	136°51.9	20.5	140°46.0	45.0	79°02.3	31.4	100°23.4	54.3								
20	73°58.5	151°53.8	20.6	155°46.5	45.0	94°04.2	31.2	115°25.6	54.2								
21	89°00.9	166°55.7	20.7	170°47.0	44.9	109°06.2	31.0	130°27.8	54.1								
22	104°03.4	181°57.6	20.8	185°47.4	44.8	124°08.1	30.8	145°29.9	54.0								
23	119°05.9	196°59.5	20.9	200°47.9	44.7	139°10.0	30.6	160°32.1	53.9								
Mer.pass. 15:05			ν 2.0' d -0.1' m -4.85	ν 0.5' d 0.1' m 1.40	ν 1.9' d 0.2' m -2.05	ν 2.2' d 0.1' m 0.68											
Fri			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	134°08.3	212°01.4	\$16°21.0	215°48.4	\$23°44.7	154°11.9	\$09°30.3	175°34.3	\$16°53.9								
1	149°10.8	227°03.3	21.0	230°48.8	44.6	169°13.8	30.1	190°36.4	53.8								
2	164°13.3	242°05.2	21.1	245°49.3	44.5	184°15.8	29.9	205°38.6	53.7								
3	179°15.7	257°07.1	21.2	260°49.8	44.4	199°17.7	29.7	220°40.7	53.6								
4	194°18.2	272°09.0	21.3	275°50.2	44.4	214°19.6	29.5	235°42.9	53.5								
5	209°20.6	287°10.8	21.4	290°50.7	44.3	229°21.5	29.2	250°45.1	53.4								
6	224°23.1	302°12.7	\$16°21.5	305°51.2	\$23°44.2	244°23.4	\$09°29.0	265°47.2	\$16°53.3								
7	239°25.6	317°14.6	21.6	320°51.6	44.1	259°25.3	28.8	280°49.4	53.2								
8	254°28.0	332°16.5	21.7	335°52.1	44.0	274°27.3	28.6	295°51.6	53.2								
9	269°30.5	347°18.3	21.8	350°52.6	44.0	289°29.2	28.4	310°53.7	53.1								
10	284°33.0	2°20.2	21.9	5°53.1	43.9	304°31.1	28.2	325°55.9	53.0								
11	299°35.4	17°22.0	22.0	20°53.5	43.8	319°33.0	27.9	340°58.1	52.9								
12	314°37.9	32°23.9	\$16°22.1	35°54.0	\$23°43.7	334°34.9	\$09°27.7	356°00.2	\$16°52.8								
13	329°40.4	47°25.7	22.2	50°54.5	43.6	349°36.8	27.5	11°02.4	52.7								
14	344°42.8	62°27.6	22.3	65°54.9	43.6	4°38.8	27.3	26°04.5	52.6								
15	359°45.3	77°29.4	22.4	80°55.4	43.5	19°40.7	27.1	41°06.7	52.6								
16	14°47.8	92°31.3	22.5	95°55.9	43.4	34°42.6	26.8	56°08.9	52.5								
17	29°50.2	107°33.1	22.6	110°56.3	43.3	49°44.5	26.6	71°11.0	52.4								
18	44°52.7	122°34.9	\$16°22.7	125°56.8	\$23°43.2	64°46.4	\$09°26.4	86°13.2	\$16°52.3								
19	59°55.1	137°36.8	22.8	140°57.3	43.2	79°48.3	26.2	101°15.4	52.2								
20	74°57.6	152°38.6	22.9	155°57.7	43.1	94°50.3	26.0	116°17.5	52.1								
21	90°00.1	167°40.4	23.0	170°58.2	43.0	109°52.2	25.8	131°19.7	52.0								
22	105°02.5	182°42.2	23.1	185°58.7	42.9	124°54.1	25.5	146°21.9	51.9								
23	120°05.0	197°44.0	23.2	200°59.1	42.8	139°56.0	25.3	161°24.0	51.9								
Mer.pass. 15:01			ν 1.9' d -0.1' m -4.86	ν 0.5' d 0.1' m 1.40	ν 1.9' d 0.2' m -2.05	ν 2.2' d 0.1' m 0.67											
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	135°07.5	212°45.8	\$16°23.3	215°59.6	\$23°42.7	154°57.9	\$09°25.1	176°26.2	\$16°51.8								
1	150°09.9	227°47.6	23.4	231°00.1	42.6	169°59.8	24.9	191°28.4	51.7								
2	165°12.4	242°49.4	23.5	246°00.5	42.6	185°01.8	24.7	206°30.5	51.6								
3	180°14.9	257°51.2	23.6	261°01.0	42.5	200°03.7	24.4	221°32.7	51.5								
4	195°17.3	272°53.0	23.7	276°01.5	42.4	215°05.6	24.2	236°34.9	51.4								
5	210°19.8	287°54.8	23.8	291°01.9	42.3	230°07.5	24.0	251°37.0	51.3								
6	225°22.2	302°56.6	\$16°23.9	306°02.4	\$23°42.2	245°09.4	\$09°23.8	266°39.2	\$16°51.2								
7	240°24.7	317°58.4	24.0	321°02.9	42.1	260°11.3	23.6	281°41.3	51.2								
8	255°27.2	333°00.1	24.1	336°03.3	42.0	275°13.3	23.4	296°43.5	51.1								
9	270°29.6	348°01.9	24.2	351°03.8	42.0	290°15.2	23.1	311°45.7	51.0								
10	285°32.1	3°03.7	24.3	6°04.3	41.9	305°17.1	22.9	326°47.8	50.9								
11	300°34.6	18°05.5	24.4	21°04.7	41.8	320°19.0	22.7	341°50.0	50.8								
12	315°37.0	33°07.2	\$16°24.5	36°05.2	\$23°41.7	335°20.9	\$09°22.5	356°52.2	\$16°50.7								
13	330°39.5	48°09.0	24.6	51°05.7	41.6	350°22.8	22.3	11°54.3	50.6								
14	345°42.0	63°10.7	24.7	66°06.1	41.5	5°24.8	22.0	26°56.5	50.6								
15	0°44.4	78°12.5	24.8	81°06.6	41.4	20°26.7	21.8	41°58.7	50.5								
16	15°46.9	93°14.2	24.9	96°07.1	41.3	35°28.6	21.6	57°00.8	50.4								
17	30°49.4	108°16.0	25.0	111°07.5	41.2	50°30.5	21.4	72°03.0	50.3								
18	45°51.8	123°17.7	\$16°25.1	126°08.0	\$23°41.1	65°32.4	\$09°21.2	87°05.2	\$16°50.2								
19	60°54.3	138°19.4	25.2	141°08.5	41.0	80°34.3	20.9	102°07.3	50.1								
20	75°56.7	153°21.2	25.3	156°08.9	40.9	95°36.2	20.7	117°09.5	50.0								
21	90°59.2	168°22.9	25.4	171°09.4	40.9	110°38.2	20.5	132°11.6	49.9								
22	106°01.7	183°24.6	25.5	186°09.9	4												

DUT1 = UT1-UTC = -0.1071 sec  $\Delta T = TT-UT1 = +69.2911$  sec

2022 February 03 to Feb. 05 UT

h	Sun			Moon			
Thu	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	176°34.1	S16°35.5	151°52.8	10.3'	S13°16.6	13.8'	58.8'
1	191°34.0	34.8	166°22.1	10.4'	13°02.8	13.8'	58.8'
2	206°34.0	34.0	180°51.5	10.5'	12°49.0	13.9'	58.7'
3	221°33.9	.. 33.3	195°21.0	10.6'	12°35.1	13.9'	58.7'
4	236°33.8	32.6	209°50.6	10.7'	12°21.2	14.0'	58.7'
5	251°33.8	31.8	224°20.3	10.8'	12°07.2	14.0'	58.6'
6	266°33.7	S16°31.1	238°50.1	10.9'	S11°53.2	14.1'	58.6'
7	281°33.6	30.4	253°20.0	11.0'	11°39.1	14.1'	58.6'
8	296°33.6	29.6	267°50.0	11.1'	11°25.0	14.1'	58.5'
9	311°33.5	.. 28.9	282°20.1	11.2'	11°10.9	14.2'	58.5'
10	326°33.4	28.2	296°50.3	11.3'	10°56.7	14.2'	58.5'
11	341°33.4	27.4	311°20.6	11.4'	10°42.5	14.3'	58.4'
12	356°33.3	S16°26.7	325°50.9	11.5'	S10°28.2	14.3'	58.4'
13	11°33.2	25.9	340°21.4	11.5'	10°13.9	14.3'	58.3'
14	26°33.2	25.2	354°51.9	11.6'	09°59.6	14.4'	58.3'
15	41°33.1	.. 24.5	9°22.6	11.7'	09°45.2	14.4'	58.3'
16	56°33.0	23.7	23°53.3	11.8'	09°30.8	14.4'	58.2'
17	71°33.0	23.0	38°24.1	11.9'	09°16.4	14.5'	58.2'
18	86°32.9	S16°22.2	52°55.0	12.0'	S09°01.9	14.5'	58.2'
19	101°32.8	21.5	67°26.0	12.1'	08°47.4	14.5'	58.1'
20	116°32.8	20.7	81°57.0	12.1'	08°32.9	14.5'	58.1'
21	131°32.7	.. 20.0	96°28.2	12.2'	08°18.4	14.6'	58.1'
22	146°32.6	19.3	110°59.4	12.3'	08°03.8	14.6'	58.0'
23	161°32.6	18.5	125°30.7	12.4'	07°49.3	14.6'	58.0'
	SD = 16.2'			SD = 16.0'			

Fri	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	176°32.5	S16°17.8	140°02.1	12.5'	S07°34.7	14.6'	58.0'
1	191°32.5	17.0	154°33.5	12.5'	07°20.1	14.6'	57.9'
2	206°32.4	16.3	169°05.1	12.6'	07°05.5	14.6'	57.9'
3	221°32.3	.. 15.5	183°36.7	12.7'	06°50.8	14.7'	57.8'
4	236°32.3	14.8	198°08.4	12.8'	06°36.2	14.7'	57.8'
5	251°32.2	14.0	212°40.1	12.8'	06°21.5	14.7'	57.8'
6	266°32.2	S16°13.3	227°11.9	12.9'	S06°06.8	14.7'	57.7'
7	281°32.1	12.5	241°43.8	13.0'	05°52.1	14.7'	57.7'
8	296°32.0	11.8	256°15.8	13.0'	05°37.4	14.7'	57.7'
9	311°32.0	.. 11.0	270°47.8	13.1'	05°22.7	14.7'	57.6'
10	326°31.9	10.3	285°19.9	13.2'	05°08.0	14.7'	57.6'
11	341°31.9	09.5	299°52.1	13.2'	04°53.3	14.7'	57.6'
12	356°31.8	S16°08.8	314°24.3	13.3'	S04°38.6	14.7'	57.5'
13	11°31.7	08.0	328°56.6	13.3'	04°23.9	14.7'	57.5'
14	26°31.7	07.3	343°28.9	13.4'	04°09.2	14.7'	57.4'
15	41°31.6	.. 06.5	358°01.3	13.5'	03°54.5	14.7'	57.4'
16	56°31.6	05.8	12°33.8	13.5'	03°39.8	14.7'	57.4'
17	71°31.5	05.0	27°06.3	13.6'	03°25.1	14.7'	57.3'
18	86°31.5	S16°04.3	41°38.8	13.6'	S03°10.3	14.7'	57.3'
19	101°31.4	03.5	56°11.5	13.7'	02°55.6	14.7'	57.3'
20	116°31.4	02.8	70°44.2	13.7'	02°41.0	14.7'	57.2'
21	131°31.3	.. 02.0	85°16.9	13.8'	02°26.3	14.7'	57.2'
22	146°31.2	01.3	99°49.7	13.8'	02°11.6	14.7'	57.1'
23	161°31.2	00.5	114°22.5	13.9'	01°56.9	14.7'	57.1'
	SD = 16.2'			SD = 15.8'			

Sat	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	176°31.1	S15°59.8	128°55.4	13.9'	S01°42.3	14.6'	57.1'
1	191°31.1	59.0	143°28.3	14.0'	01°27.6	14.6'	57.0'
2	206°31.0	58.2	158°01.3	14.0'	01°13.0	14.6'	57.0'
3	221°31.0	.. 57.5	172°34.3	14.1'	00°58.4	14.6'	57.0'
4	236°30.9	56.7	187°07.4	14.1'	00°43.8	14.6'	56.9'
5	251°30.9	56.0	201°40.5	14.2'	00°29.2	14.6'	56.9'
6	266°30.8	S15°55.2	216°13.7	14.2'	S00°14.6	14.6'	56.9'
7	281°30.8	54.4	230°46.9	14.2'	S00°00.1	14.5'	56.8'
8	296°30.7	53.7	245°20.1	14.3'	N00°14.5	14.5'	56.8'
9	311°30.7	.. 52.9	259°53.4	14.3'	00°29.0	14.5'	56.8'
10	326°30.6	52.2	274°26.7	14.3'	00°43.5	14.5'	56.7'
11	341°30.6	51.4	289°00.0	14.4'	00°57.9	14.4'	56.7'
12	356°30.5	S15°50.6	303°33.4	14.4'	N01°12.4	14.4'	56.6'
13	11°30.5	49.9	318°06.8	14.4'	01°26.8	14.4'	56.6'
14	26°30.4	49.1	332°40.2	14.5'	01°41.2	14.4'	56.6'
15	41°30.4	.. 48.3	347°13.7	14.5'	01°55.6	14.3'	56.5'
16	56°30.3	47.6	1°47.2	14.5'	02°09.9	14.3'	56.5'
17	71°30.3	46.8	16°20.7	14.6'	02°24.2	14.3'	56.5'
18	86°30.2	S15°46.1	30°54.3	14.6'	N02°38.5	14.3'	56.4'
19	101°30.2	45.3	45°27.9	14.6'	02°52.8	14.2'	56.4'
20	116°30.1	44.5	60°01.5	14.6'	03°07.0	14.2'	56.3'
21	131°30.1	.. 43.8	74°35.1	14.7'	03°21.2	14.2'	56.3'
22	146°30.1	43.0	89°08.8	14.7'	03°35.4	14.1'	56.3'
23	161°30.0	42.2	103°42.4	14.7'	03°49.5	14.1'	56.3'
	SD = 16.2'			SD = 15.6'			

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

## February 06, 07, 08 UT (Sun., Mon., Tue.)

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	136°06.6	213°28.1	\$16°25.7	216°10.8	\$23°40.6	155°43.9	\$09°19.8	177°18.1	\$16°49.7					Alpheratz	357°37.5	29°12.7	
1	151°09.1	228°29.8	25.8	231°11.3	40.5	170°45.8	19.6	192°20.3	49.6					Ankaa	353°09.8	-42°11.5	
2	166°11.5	243°31.5	25.9	246°11.7	40.4	185°47.7	19.4	207°22.5	49.5					Schedar	349°34.1	56°39.6	
3	181°14.0	258°33.2	26.0	261°12.2	40.3	200°49.6	19.2	222°24.6	49.4					Diphda	348°49.9	-17°52.2	
4	196°16.5	273°34.9	26.1	276°12.7	40.2	215°51.6	19.0	237°26.8	49.3					Achernar	335°22.2	-57°07.9	
5	211°18.9	288°36.6	26.2	291°13.1	40.1	230°53.5	18.7	252°29.0	49.2					Hamal	327°54.0	23°34.0	
6	226°21.4	303°38.3	\$16°26.3	306°13.6	\$23°40.0	245°55.4	\$09°18.5	267°31.1	\$16°49.2					Polaris	315°09.1	89°21.7	
7	241°23.9	318°40.0	26.4	321°14.1	39.9	260°57.3	18.3	282°33.3	49.1					Acamar	315°13.6	-40°13.3	
8	256°26.3	333°41.7	26.5	336°14.5	39.8	275°59.2	18.1	297°35.5	49.0					Menkar	314°08.6	4°10.4	
9	271°28.8	348°43.4	26.6	351°15.0	39.7	291°01.1	17.9	312°37.6	48.9					Mirfak	308°31.6	49°56.5	
10	286°31.2	3°45.0	26.7	6°15.5	39.6	306°03.1	17.7	327°39.8	48.8					Aldebaran	290°42.2	16°33.2	
11	301°33.7	18°46.7	26.8	21°15.9	39.5	321°05.0	17.4	342°41.9	48.7					Rigel	281°06.0	-8°10.7	
12	316°36.2	33°48.4	\$16°26.9	36°16.4	\$23°39.4	336°06.9	\$09°17.2	357°44.1	\$16°48.6					Capella	280°25.2	46°01.3	
13	331°38.6	48°50.1	27.0	51°16.9	39.3	351°08.8	17.0	12°46.3	48.5					Bellatrix	278°25.2	6°22.1	
14	346°41.1	63°51.7	27.1	66°17.3	39.2	6°10.7	16.8	27°48.4	48.5					Elnath	278°04.7	28°37.6	
15	1°43.6	78°53.4	27.2	81°17.8	39.1	21°12.6	16.6	42°50.6	48.4					Alnilam	275°39.9	-1°11.4	
16	16°46.0	93°55.1	27.3	96°18.3	39.0	36°14.5	16.3	57°52.8	48.3					Betelgeuse	270°54.4	7°24.6	
17	31°48.5	108°56.7	27.5	111°18.7	38.9	51°16.5	16.1	72°54.9	48.2					Canopus	263°53.0	-52°42.6	
18	46°51.0	123°58.4	\$16°27.6	126°19.2	\$23°38.8	66°18.4	\$09°15.9	87°57.1	\$16°48.1					Sirius	258°28.1	-16°44.9	
19	61°53.4	139°00.0	27.7	141°19.7	38.7	81°20.3	15.7	102°59.3	48.0					Adhara	255°07.4	-29°00.3	
20	76°55.9	154°01.7	27.8	156°20.1	38.6	96°22.2	15.5	118°01.4	47.9					Procyon	244°53.0	5°10.0	
21	91°58.3	169°03.3	27.9	171°20.6	38.5	111°24.1	15.2	133°03.6	47.9					Pollux	243°19.9	27°58.3	
22	107°00.8	184°04.9	28.0	186°21.1	38.4	126°26.0	15.0	148°05.8	47.8					Arior	234°15.0	-59°34.8	
23	122°03.3	199°06.6	28.1	201°21.5	38.3	141°27.9	14.8	163°07.9	47.7					Suhail	222°47.6	-43°31.3	
Mer.pass. 14:53			ν 1.7° d -0.1° m -4.86	ν 0.5° d 0.1° m 1.39			ν 1.9° d 0.2° m -2.05			ν 2.2° d 0.1° m 0.68							
Mon			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec				
0	137°05.7	214°08.2	\$16°28.2	216°22.0	\$23°38.2	156°29.9	\$09°14.6	178°10.1	\$16°47.6					Denebola	182°27.1	14°26.8	
1	152°08.2	229°09.8	28.3	231°22.5	38.1	171°31.8	14.4	193°12.2	47.5					Gienah	175°45.8	-17°39.8	
2	167°10.7	244°11.5	28.4	246°22.9	38.0	186°33.7	14.1	208°14.4	47.4					Acrux	173°02.3	-63°13.0	
3	182°13.1	259°13.1	28.5	261°23.4	37.8	201°35.6	13.9	223°16.6	47.3					Gacrux	171°53.9	-57°14.0	
4	197°15.6	274°14.7	28.6	276°23.9	37.7	216°37.5	13.7	238°18.7	47.2					Alioth	166°14.8	55°50.2	
5	212°18.1	289°16.3	28.7	291°24.3	37.6	231°39.4	13.5	253°20.9	47.2					Spica	158°24.7	-11°16.6	
6	227°20.5	304°17.9	\$16°28.8	306°24.8	\$23°37.5	246°41.3	\$09°13.3	268°23.1	\$16°47.1					Alkaid	152°53.8	49°11.9	
7	242°23.0	319°19.5	28.9	321°25.3	37.4	261°43.2	13.0	283°25.2	47.0					Hadar	148°39.2	-60°28.4	
8	257°25.5	334°21.1	29.0	336°25.7	37.3	276°45.2	12.8	298°27.4	46.9					Menkent	148°00.3	-36°28.5	
9	272°27.9	349°22.7	29.1	351°26.2	37.2	291°47.1	12.6	313°29.6	46.8					Arcturus	145°50.0	19°03.9	
10	287°30.4	4°24.3	29.2	6°26.7	37.1	306°49.0	12.4	328°31.7	46.7					Rigel Kent.	139°43.5	-60°55.3	
11	302°32.8	19°25.9	29.4	21°27.1	37.0	321°50.9	12.1	343°33.9	46.6					Kochab	137°19.8	74°03.6	
12	317°35.3	34°27.5	\$16°29.5	36°27.6	\$23°36.9	336°52.8	\$09°11.9	358°36.1	\$16°46.5					Zuben'ubi	136°58.6	-16°07.9	
13	332°37.8	49°29.1	29.6	51°28.1	36.8	351°54.7	11.7	13°38.2	46.5					Alphecca	126°05.8	26°38.2	
14	347°40.2	64°30.7	29.7	66°28.5	36.6	6°56.6	11.5	28°40.4	46.4					Antares	112°18.9	-26°28.8	
15	2°42.7	79°32.2	29.8	81°29.0	36.5	21°58.6	11.3	43°42.6	46.3					Atria	107°15.5	-69°03.7	
16	17°45.2	94°33.8	29.9	96°29.5	36.4	37°00.5	11.0	58°44.7	46.2					Sabik	102°05.7	-15°45.1	
17	32°47.6	109°35.4	30.0	111°29.9	36.3	52°02.4	10.8	73°46.9	46.1					Shaula	96°13.9	-37°07.1	
18	47°50.1	124°37.0	\$16°30.1	126°30.4	\$23°36.2	67°04.3	\$09°10.6	88°49.0	\$16°46.0					Rasalhague	96°01.0	12°32.5	
19	62°52.6	139°38.5	30.2	141°30.9	36.1	82°06.2	10.4	103°51.2	45.9					Eltanin	90°43.7	51°28.9	
20	77°55.0	154°40.1	30.3	156°31.4	36.0	97°08.1	10.2	118°53.4	45.8					Kaus Aust.	83°36.0	-34°22.4	
21	92°57.5	169°41.6	30.4	171°31.8	35.9	112°10.0	9.9	133°55.5	45.8					Vega	80°35.2	38°48.0	
22	107°59.9	184°43.2	30.5	186°32.3	35.7	127°11.9	9.7	148°57.7	45.7					Nunki	75°51.0	-26°16.2	
23	123°02.4	199°44.8	30.6	201°32.8	35.6	142°13.9	9.5	163°59.9	45.6					Altair	62°02.6	8°55.5	
Mer.pass. 14:49			ν 1.6° d -0.1° m -4.87	ν 0.5° d 0.1° m 1.38			ν 1.9° d 0.2° m -2.05			ν 2.2° d 0.1° m 0.69							
Tue			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec				
0	138°04.9	214°46.3	\$16°30.7	216°33.2	\$23°35.5	157°15.8	\$09°09.3	179°02.0	\$16°45.5					Fomalhaut	15°17.5	-29°30.6	
1	153°07.3	229°47.8	30.8	231°33.7	35.4	172°17.7	09.1	194°04.2	45.4					Scheat	13°47.8	28°12.1	
2	168°09.8	244°49.4	31.0	246°34.2	35.3	187°19.6	08.8	209°06.4	45.3					Markab	13°32.6	15°19.3	
3	183°12.3	259°50.9	31.1	261°34.6	35.2	202°21.5	08.6	224°08.5	45.2					Feb 06 Sun	77°21.5	09:45	
4	198°14.7	274°52.5	31.2	276°35.1	35.0	217°23.4	08.4	239°10.7	45.1					Venus	77°04.2	09:35	
5	213°17.2	289°54.0	31.3	291°35.6	34.9	232°25.3	08.2	254°12.9	45.1					Mars	80°04.2	13:35	
6	228°19.7	304°55.5	\$16°31.4	306°36.0	\$23°34.8	247°27.3	\$09°08.0	269°15.0	\$16°45.0					Jupiter	19°37.3	13:35	
7	243°22.1	319°57.0	31.5	321°36.5	34.7	262°29.2	07.7	284°17.2	44.9					Saturn	41°11.5	12:09	
8	258°24.6	334°58.6	31.6	336°37.0	34.6	277°31.1	07.5	299°19.4	44.8					Feb 07 Mon	77°02.5	09:42	
9	273°27.1	350°00.1	31.7	351°37.4	34.5	292°33.0	07.3	314°21.5	44.7					Venus	77°02.5	09:42	
10	288°29.5	5°01.6	31.8	6°37.9	34.3	307°34.9	07.1	329°23.7	44.6					Mars	79°16.3	09:34	
11	303°32.0	20°03.1	31.9	21°38.4	34.2	322°36.8	06.8	344°25.8	44.5					Jupiter	19°24.1	13:32	
12	318°34.4	35°04.6	\$16°32.0	36°38.8	\$23°34.1	337°38.7	\$09°06.6	359°28.									

DUT1 = UT1-UTC = -0.1076 sec  $\Delta T = TT-UT1 = +69.2916$  sec

2022 February 06 to Feb. 08 UT

h		Sun		Moon			
Sun	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	176°30.0	S15°41.5	118°16.1	14.7'	N04°03.6	14.1'	56.2'
1	191°29.9	40.7	132°49.9	14.7'	04°17.7	14.0'	56.2'
2	206°29.9	39.9	147°23.6	14.8'	04°31.7	14.0'	56.2'
3	221°29.8	39.1	161°57.4	14.8'	04°45.7	14.0'	56.1'
4	236°29.8	38.4	176°31.1	14.8'	04°59.6	13.9'	56.1'
5	251°29.7	37.6	191°04.9	14.8'	05°13.6	13.9'	56.1'
6	266°29.7	S15°36.8	205°38.7	14.8'	N05°27.4	13.8'	56.0'
7	281°29.7	36.1	220°12.5	14.8'	05°41.3	13.8'	56.0'
8	296°29.6	35.3	234°46.3	14.8'	05°55.1	13.8'	56.0'
9	311°29.6	34.5	249°20.2	14.8'	06°08.9	13.7'	55.9'
10	326°29.5	33.8	263°54.0	14.9'	06°22.6	13.7'	55.9'
11	341°29.5	33.0	278°27.9	14.9'	06°36.2	13.6'	55.9'
12	356°29.4	S15°32.2	293°01.7	14.9'	N06°49.9	13.6'	55.9'
13	11°29.4	31.4	307°35.6	14.9'	07°03.5	13.5'	55.8'
14	26°29.4	30.7	322°09.5	14.9'	07°17.0	13.5'	55.8'
15	41°29.3	29.9	336°43.3	14.9'	07°30.5	13.5'	55.8'
16	56°29.3	29.1	351°17.2	14.9'	07°44.0	13.4'	55.7'
17	71°29.2	28.3	5°51.1	14.9'	07°57.4	13.4'	55.7'
18	86°29.2	S15°27.6	20°25.0	14.9'	N08°10.7	13.3'	55.7'
19	101°29.2	26.8	34°58.9	14.9'	08°24.0	13.3'	55.6'
20	116°29.1	26.0	49°32.7	14.9'	08°37.3	13.2'	55.6'
21	131°29.1	25.2	64°06.6	14.9'	08°50.5	13.2'	55.6'
22	146°29.1	24.4	78°40.5	14.9'	09°03.7	13.1'	55.6'
23	161°29.0	23.7	93°14.4	14.9'	09°16.8	13.1'	55.5'
		SD = 16.2' $d = 0.8'$		SD = 15.3'			

Mon	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	176°29.0	S15°22.9	107°48.2	14.9'	N09°29.8	13.0'	55.5'
1	191°28.9	22.1	122°22.1	14.9'	09°42.9	13.0'	55.5'
2	206°28.9	21.3	136°56.0	14.8'	09°55.8	12.9'	55.4'
3	221°28.9	20.6	151°29.8	14.8'	10°08.7	12.8'	55.4'
4	236°28.8	19.8	166°03.6	14.8'	10°21.6	12.8'	55.4'
5	251°28.8	19.0	180°37.5	14.8'	10°34.3	12.7'	55.4'
6	266°28.8	S15°18.2	195°11.3	14.8'	N10°47.1	12.7'	55.3'
7	281°28.7	17.4	209°45.1	14.8'	10°59.8	12.6'	55.3'
8	296°28.7	16.6	224°18.9	14.8'	11°12.4	12.6'	55.3'
9	311°28.7	15.9	238°52.7	14.8'	11°24.9	12.5'	55.3'
10	326°28.6	15.1	253°26.5	14.8'	11°37.4	12.4'	55.2'
11	341°28.6	14.3	268°00.2	14.7'	11°49.9	12.4'	55.2'
12	356°28.6	S15°13.5	282°34.0	14.7'	N12°02.3	12.3'	55.2'
13	11°28.5	12.7	297°07.7	14.7'	12°14.6	12.3'	55.2'
14	26°28.5	11.9	311°41.4	14.7'	12°26.9	12.2'	55.1'
15	41°28.5	11.2	326°15.1	14.7'	12°39.1	12.1'	55.1'
16	56°28.4	10.4	340°48.7	14.6'	12°51.2	12.1'	55.1'
17	71°28.4	09.6	355°22.4	14.6'	13°03.3	12.0'	55.1'
18	86°28.4	S15°08.8	9°56.0	14.6'	N13°15.3	11.9'	55.0'
19	101°28.4	08.0	24°29.6	14.6'	13°27.2	11.9'	55.0'
20	116°28.3	07.2	39°03.2	14.6'	13°39.1	11.8'	55.0'
21	131°28.3	06.4	53°36.7	14.5'	13°50.9	11.7'	55.0'
22	146°28.3	05.6	68°10.3	14.5'	14°02.7	11.7'	54.9'
23	161°28.2	04.9	82°43.8	14.5'	14°14.3	11.6'	54.9'
		SD = 16.2' $d = 0.8'$		SD = 15.1'			

Tue	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	176°28.2	S15°04.1	97°17.3	14.5'	N14°26.0	11.5'	54.9'
1	191°28.2	03.3	111°50.7	14.4'	14°37.5	11.5'	54.9'
2	206°28.2	02.5	126°24.1	14.4'	14°49.0	11.4'	54.9'
3	221°28.1	01.7	140°57.5	14.4'	15°00.4	11.3'	54.8'
4	236°28.1	00.9	155°30.9	14.3'	15°11.7	11.3'	54.8'
5	251°28.1	15°00.1	170°04.3	14.3'	15°23.0	11.2'	54.8'
6	266°28.1	S14°59.3	184°37.6	14.3'	N15°34.2	11.1'	54.8'
7	281°28.0	58.5	199°10.9	14.2'	15°45.3	11.0'	54.7'
8	296°28.0	57.7	213°44.1	14.2'	15°56.3	11.0'	54.7'
9	311°28.0	56.9	228°17.3	14.2'	16°07.3	10.9'	54.7'
10	326°28.0	56.2	242°50.5	14.2'	16°18.2	10.8'	54.7'
11	341°27.9	55.4	257°23.7	14.1'	16°29.0	10.7'	54.7'
12	356°27.9	S14°54.6	271°56.8	14.1'	N16°39.8	10.7'	54.7'
13	11°27.9	53.8	286°29.8	14.0'	16°50.5	10.6'	54.6'
14	26°27.9	53.0	301°02.9	14.0'	17°01.1	10.5'	54.6'
15	41°27.8	52.2	315°35.9	14.0'	17°11.6	10.4'	54.6'
16	56°27.8	51.4	330°08.9	13.9'	17°22.0	10.4'	54.6'
17	71°27.8	50.6	344°41.8	13.9'	17°32.4	10.3'	54.6'
18	86°27.8	S14°49.8	359°14.7	13.9'	N17°42.7	10.2'	54.5'
19	101°27.7	49.0	13°47.6	13.8'	17°52.9	10.1'	54.5'
20	116°27.7	48.2	28°20.4	13.8'	18°03.0	10.0'	54.5'
21	131°27.7	47.4	42°53.2	13.7'	18°13.0	10.0'	54.5'
22	146°27.7	46.6	57°25.9	13.7'	18°23.0	9.9'	54.5'
23	161°27.7	45.8	71°58.6	13.7'	18°32.9	9.8'	54.5'
		SD = 16.2' $d = 0.8'$		SD = 15.0'			

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

Day	Sun		Mer. Pass.	Moon	
	Eqn. of	Time		Mer.	Pass.
	00 <sup>h</sup>	12 <sup>h</sup>	Upper	Lower	5-7
mm:ss	mm:ss	hh:mm	hh:mm	hh:mm	26-44%
06	14:00	14:02	12:14	16:36	04:14
07	14:04	14:06	12:14	17:19	04:57
08	14:07	14:08	12:14	18:03	05:41

**February 09, 10, 11 UT (Wed., Thu., Fri.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	139°04.0	215°22.4	\$16°33.3	216°44.4	\$23°32.6	158°01.7	\$09°04.0	179°54.0	\$16°43.4								
1	154°06.5	230°23.9	33.4	231°44.9	32.5	173°03.6	03.7	194°56.2	43.3								
2	169°08.9	245°25.3	33.5	246°45.4	32.4	188°05.5	03.5	209°58.3	43.2								
3	184°11.4	260°26.8	.. 33.6	261°45.8	.. 32.2	203°07.4	.. 03.3	225°00.5	.. 43.1								
4	199°13.9	275°28.2	33.8	276°46.3	32.1	218°09.3	03.1	240°02.6	43.1								
5	214°16.3	290°29.7	33.9	291°46.8	32.0	233°11.2	02.9	255°04.8	43.0								
6	229°18.8	305°31.1	\$16°34.0	306°47.2	\$23°31.9	248°13.1	\$09°02.6	270°07.0	\$16°42.9								
7	244°21.3	320°32.6	34.1	321°47.7	31.7	263°15.1	02.4	285°09.1	42.8								
8	259°23.7	335°34.0	34.2	336°48.2	31.6	278°17.0	02.2	300°11.3	42.7								
9	274°26.2	350°35.5	.. 34.3	351°48.6	.. 31.5	293°18.9	.. 02.0	315°13.5	.. 42.6								
10	289°28.7	5°36.9	34.4	6°49.1	31.4	308°20.8	01.7	330°15.6	42.5								
11	304°31.1	20°38.3	34.5	21°49.6	31.2	323°22.7	01.5	345°17.8	42.4								
12	319°33.6	35°39.7	\$16°34.6	36°50.0	\$23°31.1	338°24.6	\$09°01.3	0°20.0	\$16°42.4								
13	334°36.1	50°41.2	34.7	51°50.5	31.0	353°26.5	01.1	15°22.1	42.3								
14	349°38.5	65°42.6	34.8	66°51.0	30.8	8°28.4	00.9	30°24.3	42.2								
15	4°41.0	80°44.0	.. 34.9	81°51.4	.. 30.7	23°30.3	.. 00.6	45°26.5	.. 42.1								
16	19°43.4	95°45.4	35.0	96°51.9	30.6	38°32.3	00.4	60°28.6	42.0								
17	34°45.9	110°46.8	35.1	111°52.4	30.4	53°34.2	00.2	75°30.8	41.9								
18	49°48.4	125°48.2	\$16°35.3	126°52.8	\$23°30.3	68°36.1	\$09°00.0	90°33.0	\$16°41.8								
19	64°50.8	140°49.6	35.4	141°53.3	30.2	83°38.0	08°59.8	105°35.1	41.7								
20	79°53.3	155°51.0	35.5	156°53.8	30.0	98°39.9	59.5	120°37.3	41.7								
21	94°55.8	170°52.4	.. 35.6	171°54.2	.. 29.9	113°41.8	.. 59.3	135°39.5	.. 41.6								
22	109°58.2	185°53.8	35.7	186°54.7	29.8	128°43.7	59.1	150°41.6	41.5								
23	125°00.7	200°55.2	35.8	201°55.2	29.6	143°45.6	58.9	165°43.8	41.4								
Mer.pass. 14:41			ν 1.5° d -0.1° m -4.86	ν 0.5° d 0.1° m 1.37			ν 1.9° d 0.2° m -2.05			ν 2.2° d 0.1° m 0.72							
Thu			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	140°03.2	215°56.6	\$16°35.9	216°55.6	\$23°29.5	158°47.5	\$08°58.6	180°46.0	\$16°41.3								
1	155°05.6	230°58.0	36.0	231°56.1	29.4	173°49.5	58.4	195°48.1	41.2								
2	170°08.1	245°59.4	36.1	246°56.6	29.2	188°51.4	58.2	210°50.3	41.1								
3	185°10.5	261°00.8	.. 36.2	261°57.0	.. 29.1	203°53.3	.. 58.0	225°52.4	.. 41.0								
4	200°13.0	276°02.1	36.3	276°57.5	29.0	218°55.2	57.7	240°54.6	41.0								
5	215°15.5	291°03.5	36.4	291°58.0	28.8	233°57.1	57.5	255°56.8	40.9								
6	230°17.9	306°04.9	\$16°36.5	306°58.4	\$23°28.7	248°59.0	\$08°57.3	270°58.9	\$16°40.8								
7	245°20.4	321°06.2	36.6	321°58.9	28.5	264°00.9	57.1	286°01.1	40.7								
8	260°22.9	336°07.6	36.8	336°59.4	28.4	279°02.8	56.9	301°03.3	40.6								
9	275°25.3	351°09.0	.. 36.9	351°59.8	.. 28.3	294°04.7	.. 56.6	316°05.4	.. 40.5								
10	290°27.8	6°10.3	37.0	7°00.3	28.1	309°06.7	56.4	331°07.6	40.4								
11	305°30.3	21°11.7	37.1	22°00.8	28.0	324°08.6	56.2	346°09.8	40.3								
12	320°32.7	36°13.0	\$16°37.2	37°01.2	\$23°27.8	339°10.5	\$08°56.0	1°11.9	\$16°40.3								
13	335°35.2	51°14.4	37.3	52°01.7	27.7	354°12.4	55.7	16°14.1	40.2								
14	350°37.7	66°15.7	37.4	67°02.2	27.6	9°14.3	55.5	31°16.3	40.1								
15	5°40.1	81°17.0	.. 37.5	82°02.6	.. 27.4	24°16.2	.. 55.3	46°18.4	.. 40.0								
16	20°42.6	96°18.4	37.6	97°03.1	27.3	39°18.1	55.1	61°20.6	39.9								
17	35°45.0	111°19.7	37.7	112°03.6	27.1	54°20.0	54.9	76°22.8	39.8								
18	50°47.5	126°21.0	\$16°37.8	127°04.0	\$23°27.0	69°21.9	\$08°54.6	91°24.9	\$16°39.7								
19	65°50.0	141°22.4	37.9	142°04.5	26.8	84°23.8	54.4	106°27.1	39.6								
20	80°52.4	156°23.7	38.0	157°05.0	26.7	99°25.8	54.2	121°29.3	39.6								
21	95°54.9	171°25.0	.. 38.1	172°05.4	.. 26.6	114°27.7	.. 54.0	136°31.4	.. 39.5								
22	110°57.4	186°26.3	38.2	187°05.9	26.4	129°29.6	53.7	151°33.6	39.4								
23	125°59.8	201°27.7	38.3	202°06.4	26.3	144°31.5	53.5	166°35.8	39.3								
Mer.pass. 14:37			ν 1.4° d -0.1° m -4.86	ν 0.5° d 0.1° m 1.37			ν 1.9° d 0.2° m -2.05			ν 2.2° d 0.1° m 0.73							
Fri			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	141°02.3	216°29.0	\$16°38.4	217°06.8	\$23°26.1	159°33.4	\$08°53.3	181°37.9	\$16°39.2								
1	156°04.8	231°30.3	38.5	232°07.3	26.0	174°35.3	53.1	196°40.1	39.1								
2	171°07.2	246°31.6	38.7	247°07.8	25.8	189°37.2	52.8	211°42.3	39.0								
3	186°09.7	261°32.9	.. 38.8	262°08.2	.. 25.7	204°39.1	.. 52.6	226°44.4	.. 38.9								
4	201°12.2	276°34.2	38.9	277°08.7	25.5	219°41.0	52.4	241°46.6	38.9								
5	216°14.6	291°35.5	39.0	292°09.2	25.4	234°42.9	52.2	256°48.8	38.8								
6	231°17.1	306°36.8	\$16°39.1	307°09.6	\$23°25.2	249°44.9	\$08°52.0	271°50.9	\$16°38.7								
7	246°19.5	321°38.1	39.2	322°10.1	25.1	264°46.8	51.7	286°53.1	38.6								
8	261°22.0	336°39.3	39.3	337°10.6	25.0	279°48.7	51.5	301°55.3	38.5								
9	276°24.5	351°40.6	.. 39.4	352°11.0	.. 24.8	294°50.6	.. 51.3	316°57.4	.. 38.4								
10	291°26.9	6°41.9	39.5	7°11.5	24.7	309°52.5	51.1	331°59.6	38.3								
11	306°29.4	21°43.2	39.6	22°12.0	24.5	324°54.4	50.8	347°01.7	38.2								
12	321°31.9	36°44.5	\$16°39.7	37°12.4	\$23°24.4	339°56.3	\$08°50.6	2°03.9	\$16°38.2								
13	336°34.3	51°45.7	39.8	52°12.9	24.2	354°58.2	50.4	17°06.1	38.1								
14	351°36.8	66°47.0	39.9	67°13.4	24.1	10°00.1	50.2	32°08.2	38.0								
15	6°39.3	81°48.3	.. 40.0	82°13.8	.. 23.9	25°02.0	.. 49.9	47°10.4	.. 37.9								
16	21°41.7	96°49.5	40.1	97°14.3	23.7	40°03.9	49.7	62°12.6	37.8								
17	36°44.2	111°50.8	40.2	112°14.8	23.6	55°05.9	49.5	77°14.7	37.7								
18	51°46.7	126°52.0	\$16°40.3	127°15.2	\$23°23.4	70°07.8	\$08°49.3	92°16.9	\$16°37.6								
19	66°49.1	141°53.3	40.4	142°15.7	23.3	85°09.7	49.1	107°19.1	37.5								
20	81°51.6	156°54.6	40.5	157°16.2	23.1	100°11.6	48.8	122°21.2									

DUT1 = UT1-UTC = -0.1073 sec  $\Delta T = TT-UT1 = +69.2913$  sec

2022 February 09 to Feb. 11 UT

h	Sun			Moon			
Wed	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	176°27.6	S14°45.0	86°31.3	13.6'	N18°42.7	9.7'	54.5'
1	191°27.6	44.2	101°03.9	13.6'	18°52.4	9.6'	54.4'
2	206°27.6	43.4	115°36.5	13.5'	19°02.0	9.5'	54.4'
3	221°27.6	42.6	130°09.0	13.5'	19°11.5	9.5'	54.4'
4	236°27.6	41.8	144°41.5	13.4'	19°21.0	9.4'	54.4'
5	251°27.6	41.0	159°13.9	13.4'	19°30.4	9.3'	54.4'
6	266°27.5	S14°40.2	173°46.3	13.4'	N19°39.6	9.2'	54.4'
7	281°27.5	39.4	188°18.7	13.3'	19°48.8	9.1'	54.4'
8	296°27.5	38.6	202°51.0	13.3'	19°57.9	9.0'	54.3'
9	311°27.5	37.8	217°23.3	13.2'	20°07.0	8.9'	54.3'
10	326°27.5	37.0	231°55.5	13.2'	20°15.9	8.8'	54.3'
11	341°27.5	36.2	246°27.7	13.1'	20°24.7	8.7'	54.3'
12	356°27.4	S14°35.4	260°59.8	13.1'	N20°33.5	8.7'	54.3'
13	11°27.4	34.6	275°31.9	13.0'	20°42.1	8.6'	54.3'
14	26°27.4	33.7	290°03.9	13.0'	20°50.7	8.5'	54.3'
15	41°27.4	32.9	304°35.9	12.9'	20°59.1	8.4'	54.3'
16	56°27.4	32.1	319°07.9	12.9'	21°07.5	8.3'	54.3'
17	71°27.4	31.3	333°39.8	12.9'	21°15.8	8.2'	54.2'
18	86°27.4	S14°30.5	348°11.6	12.8'	N21°24.0	8.1'	54.2'
19	101°27.3	29.7	2°43.4	12.8'	21°32.1	8.0'	54.2'
20	116°27.3	28.9	17°15.2	12.7'	21°40.1	7.9'	54.2'
21	131°27.3	28.1	31°46.9	12.7'	21°48.0	7.8'	54.2'
22	146°27.3	27.3	46°18.6	12.6'	21°55.8	7.7'	54.2'
23	161°27.3	26.5	60°50.2	12.6'	22°03.5	7.6'	54.2'
	SD = 16.2'			SD = 14.9'			

Thu	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	176°27.3	S14°25.7	75°21.8	12.5'	N22°11.1	7.5'	54.2'
1	191°27.3	24.9	89°53.3	12.5'	22°18.6	7.4'	54.2'
2	206°27.3	24.0	104°24.7	12.4'	22°26.0	7.3'	54.2'
3	221°27.2	23.2	118°56.2	12.4'	22°33.3	7.2'	54.2'
4	236°27.2	22.4	133°27.5	12.3'	22°40.5	7.1'	54.2'
5	251°27.2	21.6	147°58.9	12.3'	22°47.6	7.0'	54.1'
6	266°27.2	S14°20.8	162°30.1	12.2'	N22°54.6	6.9'	54.1'
7	281°27.2	20.0	177°01.4	12.2'	23°01.5	6.8'	54.1'
8	296°27.2	19.2	191°32.5	12.1'	23°08.3	6.7'	54.1'
9	311°27.2	18.4	206°03.7	12.1'	23°15.0	6.6'	54.1'
10	326°27.2	17.5	220°34.8	12.0'	23°21.6	6.5'	54.1'
11	341°27.2	16.7	235°05.8	12.0'	23°28.1	6.4'	54.1'
12	356°27.2	S14°15.9	249°36.8	11.9'	N23°34.4	6.3'	54.1'
13	11°27.2	15.1	264°07.7	11.9'	23°40.7	6.2'	54.1'
14	26°27.2	14.3	278°38.6	11.8'	23°46.9	6.1'	54.1'
15	41°27.1	13.5	293°09.5	11.8'	23°52.9	5.9'	54.1'
16	56°27.1	12.7	307°40.3	11.8'	23°58.9	5.8'	54.1'
17	71°27.1	11.8	322°11.0	11.7'	24°04.7	5.7'	54.1'
18	86°27.1	S14°11.0	336°41.7	11.7'	N24°10.4	5.6'	54.1'
19	101°27.1	10.2	351°12.4	11.6'	24°16.0	5.5'	54.1'
20	116°27.1	09.4	5°43.0	11.6'	24°21.5	5.4'	54.1'
21	131°27.1	08.6	20°13.5	11.5'	24°26.9	5.3'	54.1'
22	146°27.1	07.7	34°44.1	11.5'	24°32.2	5.2'	54.1'
23	161°27.1	06.9	49°14.5	11.4'	24°37.4	5.1'	54.1'
	SD = 16.2'			SD = 14.8'			

Fri	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	176°27.1	S14°06.1	63°45.0	11.4'	N24°42.4	4.9'	54.1'
1	191°27.1	05.3	78°15.4	11.3'	24°47.4	4.8'	54.1'
2	206°27.1	04.5	92°45.7	11.3'	24°52.2	4.7'	54.1'
3	221°27.1	03.6	107°16.0	11.3'	24°56.9	4.6'	54.1'
4	236°27.1	02.8	121°46.3	11.2'	25°01.5	4.5'	54.1'
5	251°27.1	02.0	136°16.5	11.2'	25°06.0	4.4'	54.1'
6	266°27.1	S14°01.2	150°46.6	11.1'	N25°10.4	4.3'	54.1'
7	281°27.1	14°00.4	165°16.8	11.1'	25°14.6	4.1'	54.1'
8	296°27.1	13°59.5	179°46.8	11.0'	25°18.8	4.0'	54.1'
9	311°27.1	11.8	194°16.9	11.0'	25°22.8	3.9'	54.1'
10	326°27.1	57.9	208°46.9	11.0'	25°26.7	3.8'	54.1'
11	341°27.1	57.1	223°16.9	10.9'	25°30.5	3.7'	54.1'
12	356°27.1	S13°56.2	237°46.8	10.9'	N25°34.1	3.5'	54.1'
13	11°27.1	55.4	252°16.7	10.9'	25°37.7	3.4'	54.1'
14	26°27.1	54.6	266°46.5	10.8'	25°41.1	3.3'	54.1'
15	41°27.1	53.8	281°16.4	10.8'	25°44.4	3.2'	54.1'
16	56°27.1	52.9	295°46.1	10.7'	25°47.6	3.1'	54.1'
17	71°27.1	52.1	310°15.9	10.7'	25°50.6	2.9'	54.1'
18	86°27.1	S13°51.3	324°45.6	10.7'	N25°53.6	2.8'	54.1'
19	101°27.1	50.5	339°15.2	10.6'	25°56.4	2.7'	54.1'
20	116°27.1	49.6	353°44.9	10.6'	25°59.1	2.6'	54.1'
21	131°27.1	48.8	8°14.5	10.6'	26°01.6	2.4'	54.1'
22	146°27.1	48.0	22°44.1	10.5'	26°04.1	2.3'	54.1'
23	161°27.1	47.1	37°13.6	10.5'	26°06.4	2.2'	54.1'
	SD = 16.2'			SD = 14.8'			

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

Day	Sun		Mer.	Moon	
	Eqn.of Time	00 <sup>h</sup> 00:00 <sup>m</sup>	12 <sup>h</sup> 00:00 <sup>m</sup>	Mer. Pass	Upper
09	14:09	14:10	12:14	18:49	06:26
10	14:11	14:11	12:14	19:36	07:12
11	14:12	14:12	12:14	20:26	08:01

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

Aries		Venus		Mars		Jupiter		Saturn		Stars		
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	142°01.4	216°59.5	\$16°40.9	217°18.0	\$23°22.5	160°19.2	\$08°47.9	182°29.9	\$16°37.1	Alpheratz	357°37.5	
1	157°03.9	232°00.8	41.0	232°18.5	22.4	175°21.1	47.7	197°32.1	37.0	Ankaa	353°09.8	
2	172°06.4	247°02.0	41.1	247°19.0	22.2	190°23.0	47.5	212°34.2	36.9	Schedar	349°34.1	
3	187°08.8	262°03.2	.. 41.2	262°19.4	.. 22.1	205°24.9	.. 47.3	227°36.4	.. 36.9	Diphda	348°49.9	
4	202°11.3	277°04.4	41.3	277°19.9	21.9	220°26.9	47.0	242°38.6	36.8	Achernar	335°22.3	
5	217°13.8	292°05.7	41.4	292°20.4	21.7	235°28.8	46.8	257°40.7	36.7	Hamal	327°54.0	
6	232°16.2	307°06.9	\$16°41.5	307°20.9	\$23°21.6	250°30.7	\$08°46.6	272°42.9	\$16°36.6	Polaris	315°11.8	
7	247°18.7	322°08.1	41.6	322°21.3	21.4	265°32.6	46.4	287°45.1	36.5	Acamar	315°13.6	
8	262°21.1	337°09.3	41.7	337°21.8	21.3	280°34.5	46.1	302°47.2	36.4	Menkar	314°08.7	
9	277°23.6	352°10.5	.. 41.8	352°22.3	.. 21.1	295°36.4	.. 45.9	317°49.4	.. 36.3	Mirfak	308°31.6	
10	292°26.1	7°11.7	41.9	7°22.7	20.9	310°38.3	45.7	332°51.6	36.2	Aldebaran	290°42.2	
11	307°28.5	22°13.0	42.1	22°23.2	20.8	325°40.2	45.5	347°53.7	36.2	Rigel	281°06.0	
12	322°31.0	37°14.2	\$16°42.2	37°23.7	\$23°20.6	340°42.1	\$08°45.2	2°55.9	\$16°36.1	Capella	280°25.2	
13	337°33.5	52°15.4	42.3	52°24.1	20.5	355°44.0	45.0	17°58.1	36.0	Bellatrix	278°25.3	
14	352°35.9	67°16.6	42.4	67°24.6	20.3	10°45.9	44.8	33°00.2	35.9	Elnath	278°04.7	
15	7°38.4	82°17.7	.. 42.5	82°25.1	.. 20.1	25°47.9	.. 44.6	48°02.4	.. 35.8	Alnilam	275°40.0	
16	22°40.9	97°18.9	42.6	97°25.5	20.0	40°49.8	44.4	63°04.6	35.7	Betelgeuse	270°54.5	
17	37°43.3	112°20.1	42.7	112°26.0	19.8	55°51.7	44.1	78°06.7	35.6	Canopus	263°53.1	
18	52°45.8	127°21.3	\$16°42.8	127°26.5	\$23°19.7	70°53.6	\$08°43.9	93°08.9	\$16°35.5	Sirius	258°28.1	
19	67°48.3	142°22.5	42.8	142°26.9	19.5	85°55.5	43.7	108°11.1	35.5	Adhara	255°07.4	
20	82°50.7	157°23.7	42.9	157°27.4	19.3	100°57.4	43.5	123°13.2	35.4	Procyon	244°53.0	
21	97°53.2	172°24.8	.. 43.0	172°27.9	.. 19.2	115°59.3	.. 43.2	138°15.4	.. 35.3	Pollux	243°19.9	
22	112°55.6	187°26.0	43.1	187°28.3	19.0	131°01.2	43.0	153°17.6	35.2	Avior	234°15.1	
23	127°58.1	202°27.2	43.2	202°28.8	18.8	146°03.1	42.8	168°19.7	35.1	Suhail	222°47.6	
Mer.pass. 14:30		ν 1.2' d -0.1' m -4.85	ν 0.5' d 0.2' m 1.36	ν 1.9' d 0.2' m -2.04	ν 2.2' d 0.1' m 0.75	Miaplacidus		221°37.8	69°48.4	Alphard	217°49.8	
Mer.pass. 14:30		ν 1.2' d -0.1' m -4.85	ν 0.5' d 0.2' m 1.36	ν 1.9' d 0.2' m -2.04	ν 2.2' d 0.1' m 0.75	Regulus		207°36.6	11°51.5	Dubhe	193°43.3	
Sun		GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Denebola	182°27.1
0	143°00.6	217°28.4	\$16°43.3	217°29.3	\$23°18.7	161°05.0	\$08°42.6	183°21.9	\$16°35.0	Gienah	175°45.8	
1	158°03.0	232°29.5	43.4	232°29.7	18.5	176°06.9	42.3	198°24.1	34.9	Acrux	173°02.2	
2	173°05.5	247°30.7	43.5	247°30.2	18.3	191°08.8	42.1	213°26.2	34.8	Gacrux	171°53.8	
3	188°08.0	262°31.8	.. 43.6	262°30.7	.. 18.2	206°10.8	.. 41.9	228°28.4	.. 34.8	Alioth	166°14.7	
4	203°10.4	277°33.0	43.7	277°31.1	18.0	221°12.7	41.7	243°30.6	34.7	Spica	158°24.6	
5	218°12.9	292°34.2	43.8	292°31.6	17.8	236°14.6	41.4	258°32.7	34.6	Alkaid	152°53.7	
6	233°15.4	307°35.3	\$16°43.9	307°32.1	\$23°17.7	251°16.5	\$08°41.2	273°34.9	\$16°34.5	Hadar	148°39.1	
7	248°17.8	322°36.5	44.0	322°32.5	17.5	266°18.4	41.0	288°37.1	34.4	Menkent	148°00.3	
8	263°20.3	337°37.6	44.1	337°33.0	17.3	281°20.3	40.8	303°39.2	34.3	Arcturus	145°50.0	
9	278°22.8	352°38.7	.. 44.2	352°33.5	.. 17.2	296°22.2	.. 40.5	318°41.4	.. 34.2	Rigil Kent.	139°43.4	
10	293°25.2	7°39.9	44.3	7°34.0	17.0	311°24.1	40.3	333°43.6	34.1	Kochab	137°19.6	
11	308°27.7	22°41.0	44.4	22°34.4	16.8	326°26.0	40.1	348°45.7	34.1	Zuben'ubi	136°58.6	
12	323°30.1	37°42.2	\$16°44.5	37°34.9	\$23°16.7	341°27.9	\$08°39.9	3°47.9	\$16°34.0	Alphecca	126°05.8	
13	338°32.6	52°43.3	44.6	52°35.4	16.5	356°29.8	39.6	18°50.1	33.9	Antares	112°18.8	
14	353°35.1	67°44.4	44.7	67°35.8	16.3	11°31.7	39.4	33°52.2	33.8	Atria	107°15.4	
15	8°37.5	82°45.5	.. 44.8	82°36.3	.. 16.1	26°33.6	.. 39.2	48°54.4	.. 33.7	Sabik	102°05.7	
16	23°40.0	97°46.7	44.9	97°36.8	16.0	41°35.6	39.0	63°56.6	33.6	Shaula	96°13.8	
17	38°42.5	112°47.8	45.0	112°37.2	15.8	56°37.5	38.7	78°58.7	33.5	Rasalhague	96°00.9	
18	53°44.9	127°48.9	\$16°45.1	127°37.7	\$23°15.6	71°39.4	\$08°38.5	94°00.9	\$16°33.4	Eltanin	90°43.6	
19	68°47.4	142°50.0	45.2	142°38.2	15.5	86°41.3	38.3	109°03.1	33.4	Kaus Aust.	83°35.9	
20	83°49.9	157°51.1	45.3	157°38.6	15.3	101°43.2	38.1	124°05.2	33.3	Vega	80°35.1	
21	98°52.3	172°52.2	.. 45.4	172°39.1	.. 15.1	116°45.1	.. 37.8	139°07.4	.. 33.2	Nunki	75°51.0	
22	113°54.8	187°53.3	45.5	187°39.6	14.9	131°47.0	37.6	154°09.6	33.1	Altair	62°02.6	
23	128°57.3	202°54.4	45.6	202°40.0	14.8	146°48.9	37.4	169°11.7	33.0	Peacock	53°10.1	
Mer.pass. 14:26		ν 1.2' d -0.1' m -4.85	ν 0.5' d 0.2' m 1.35	ν 1.9' d 0.2' m -2.04	ν 2.2' d 0.1' m 0.75	Deneb		49°27.8	45°21.4	Enif	33°41.4	
Mer.pass. 14:26		ν 1.2' d -0.1' m -4.85	ν 0.5' d 0.2' m 1.35	ν 1.9' d 0.2' m -2.04	ν 2.2' d 0.1' m 0.75	Al Na'ir		27°36.4	9°58.4	Fomalhaut	27°36.4	
Mon		GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Scheat	13°47.8
0	143°59.7	217°55.5	\$16°45.6	217°40.5	\$23°14.6	161°50.8	\$08°37.2	184°13.9	\$16°32.9	Markab	13°32.6	
1	159°02.2	232°56.6	45.7	232°41.0	14.4	176°52.7	36.9	199°16.1	32.8	Feb 12 Sat	SHA	Mer.pass
2	174°04.6	247°57.7	45.8	247°41.4	14.2	191°54.6	36.7	214°18.2	32.7	Venus	74°58.1	09:31
3	189°07.1	262°58.8	.. 45.9	262°41.9	.. 14.1	206°56.5	.. 36.5	229°20.4	.. 32.7	Mars	75°16.6	09:31
4	204°09.6	277°59.9	46.0	277°42.4	13.9	221°58.4	36.3	244°22.6	32.6	Jupiter	18°17.8	13:17
5	219°12.0	293°01.0	46.1	292°42.9	13.7	237°00.4	36.0	259°24.7	32.5	Saturn	40°28.5	11:48
6	234°14.5	308°02.1	\$16°46.2	307°43.3	\$23°13.5	252°02.3	\$08°35.8	274°26.9	\$16°32.4	Feb 13 Sun	SHA	Mer.pass
7	249°17.0	323°03.2	46.3	322°43.8	13.3	267°04.2	35.6	289°29.1	32.3	Venus	74°27.8	09:29
8	264°19.4	338°04.2	46.4	337°44.3	13.2	282°06.1	35.4	304°31.2	32.2	Mars	74°28.7	09:30
9	279°21.9	353°05.3	.. 46.5	352°44.7	.. 13.0	297°08.0	.. 35.1	319°33.4	.. 32.1	Jupiter	18°04.5	13:14
10	294°24.4	8°06.4	46.6	7°45.2	12.8	312°09.9	34.9	334°35.6	32.0	Saturn	40°21.3	11:45
11	309°26.8	23°07.4	46.7	22°45.7	12.6	327°11.8	34.7	349°37.7	32.0	Feb 14 Mon	SHA	Mer.pass
12	324°29.3	38°08.5	\$16°46.7	37°46.1	\$23°12.5	342°13.7	\$08°34.5	4°39.9	\$16°31.9	Venus	73°55.8	09:28
13	339°31.7	53°09.6	46.8	52°46.6	12.3	357°15.6	34.2	19°42.1	31.8	Mars	73°40.8	09:29
14	354°34.2	68°10.6	46.9	67°47.1	12.1	12°17.5	34.0	34°44.2	31.7	Jupiter	17°51.1	13:11
15	9°36.7	83°11.7	.. 47.0	82°47.5	.. 11.9	27°19.4	.. 33.8	49°46.4	.. 31.6	Saturn	40°14.2	11:41
16	24°39.1	98°12.8	47.1	97°48.0	11.7	42°21.3	33.6	64°48.6	31.5	Horizontal parallax		
17	39°41.6	113°13.8	47.2	112°48.5	11.5	57°23.2	33.3	79°50.7	31.4	Venus:	0.3	
18	54°44.1	128°14.9	\$16°47.3	127°48.9	\$23°11.4	72°25.1	\$08°33.1	94°52.9	\$16°31.3	Mars:	0.1	
19	69°46.5	143°15.9	47.4	142°49.4	11.2	87°27.1	32.9	109°55.1	31.3			
20	84°49.0	158°17.0	47.5	157°49.9	11.0	102°29.0	32.7	124°57.2	31.2			
21	99°51.5	173°18.0	.. 47.6	172°50.4	.. 10.8	117°30.9	.. 32.4	139°59.4	.. 31.1			
22	114°53.9	188°19.0	47.6	187°50.8	10.6	132°32.8	32.2	155°01.6	31.0			

DUT1 = UT1-UTC = -0.1052 sec  $\Delta T = TT-UT1 = +69.2892$  sec

2022 February 12 to Feb. 14 UT

h	Sun		Moon				
Sat	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	176°27.1	S13°46.3	51°43.1	10.5'	N26°08.6	2.1'	54.1'
1	191°27.1	45.5	66°12.6	10.5'	26°10.7	1.9'	54.2'
2	206°27.1	44.6	80°42.1	10.4'	26°12.6	1.8'	54.2'
3	221°27.2	43.8	95°11.5	10.4'	26°14.4	1.7'	54.2'
4	236°27.2	43.0	109°40.9	10.4'	26°16.1	1.6'	54.2'
5	251°27.2	42.2	124°10.2	10.3'	26°17.7	1.4'	54.2'
6	266°27.2	S13°41.3	138°39.6	10.3'	N26°19.1	1.3'	54.2'
7	281°27.2	40.5	153°08.9	10.3'	26°20.4	1.2'	54.2'
8	296°27.2	39.7	167°38.2	10.3'	26°21.6	1.1'	54.2'
9	311°27.2	38.8	182°07.5	10.3'	26°22.7	0.9'	54.2'
10	326°27.2	38.0	196°36.7	10.2'	26°23.6	0.8'	54.2'
11	341°27.2	37.2	211°06.0	10.2'	26°24.4	0.7'	54.2'
12	356°27.2	S13°36.3	225°35.2	10.2'	N26°25.1	0.5'	54.2'
13	11°27.2	35.5	240°04.4	10.2'	26°25.7	0.4'	54.2'
14	26°27.2	34.7	254°33.5	10.2'	26°26.1	0.3'	54.2'
15	41°27.2	33.8	269°02.7	10.1'	26°26.4	0.2'	54.3'
16	56°27.3	33.0	283°31.8	10.1'	26°26.5	0.0'	54.3'
17	71°27.3	32.2	298°01.0	10.1'	26°26.6	-0.1'	54.3'
18	86°27.3	S13°31.3	312°30.1	10.1'	N26°26.5	-0.2'	54.3'
19	101°27.3	30.5	326°59.2	10.1'	26°26.2	-0.4'	54.3'
20	116°27.3	29.6	341°28.3	10.1'	26°25.9	-0.5'	54.3'
21	131°27.3	28.8	355°57.3	10.1'	26°25.4	-0.6'	54.3'
22	146°27.3	28.0	10°26.4	10.1'	26°24.8	-0.7'	54.3'
23	161°27.3	27.1	24°55.4	10.0'	26°24.0	-0.9'	54.3'
	SD = 16.2'		SD = 14.8'				

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

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

Day	Sun		Mer.	Moon	
	Eqn.of Time	00 <sup>h</sup> 12 <sup>h</sup>		Mer.Pass.	Age
	mm:ss	mm:ss	hh:mm	Upper	Lower
			hh:mm	hh:mm	hh:mm
12	14:11	14:11	12:14	21:17	08:51
13	14:11	14:10	12:14	22:08	09:42
14	14:09	14:08	12:14	22:59	10:34



**February 15, 16, 17 UT (Tue., Wed., Thu.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec			
0	144°58.9	218°21.1	\$16°47.8	217°51.8	\$23°10.3	162°36.6	\$08°31.8	185°05.9	\$16°30.8			Alpheratz	357°37.5	29°12.7		
1	160°01.3	233°22.1	47.9	232°52.2	10.1	177°38.5	31.5	200°08.1	30.7			Ankaa	353°09.8	-42°11.5		
2	175°03.8	248°23.2	48.0	247°52.7	09.9	192°40.4	31.3	215°10.3	30.7			Schedar	349°34.1	56°39.6		
3	190°06.2	263°24.2	.. 48.1	262°53.2	.. 09.7	207°42.3	.. 31.1	230°12.4	.. 30.6			Diphda	348°49.9	-17°52.2		
4	205°08.7	278°25.2	48.2	277°53.6	09.5	222°44.2	30.9	245°14.6	30.5			Achernar	335°22.3	-57°07.8		
5	220°11.2	293°26.2	48.3	292°54.1	09.3	237°46.1	30.6	260°16.8	30.4			Hamal	327°54.0	23°34.0		
6	235°13.6	308°27.3	\$16°48.3	307°54.6	\$23°09.1	252°48.0	\$08°30.4	275°18.9	\$16°30.3			Polaris	315°13.3	89°21.7		
7	250°16.1	323°28.3	48.4	322°55.0	09.0	267°49.9	30.2	290°21.1	30.2			Acamar	315°13.7	-40°13.3		
8	265°18.6	338°29.3	48.5	337°55.5	08.8	282°51.8	30.0	305°23.3	30.1			Menkar	314°08.7	4°10.4		
9	280°21.0	353°30.3	.. 48.6	352°56.0	.. 08.6	297°53.7	.. 29.7	320°25.4	.. 30.0			Mirfak	308°31.7	49°56.5		
10	295°23.5	8°31.3	48.7	7°56.5	08.4	312°55.7	29.5	335°27.6	30.0			Aldebaran	290°42.2	16°33.2		
11	310°26.0	23°32.3	48.8	22°56.9	08.2	327°57.6	29.3	350°29.8	29.9			Rigel	281°06.0	-8°10.7		
12	325°28.4	38°33.3	\$16°48.8	37°57.4	\$23°08.0	342°59.5	\$08°29.1	5°31.9	\$16°29.8			Capella	280°25.2	46°01.3		
13	340°30.9	53°34.3	48.9	52°57.9	07.8	358°01.4	28.8	20°34.1	29.7			Bellatrix	278°25.3	6°22.1		
14	355°33.4	68°35.3	49.0	67°58.3	07.6	13°03.3	28.6	35°36.3	29.6			Elnath	278°04.7	28°37.6		
15	10°35.8	83°36.3	.. 49.1	82°58.8	.. 07.4	28°05.2	.. 28.4	50°38.4	.. 29.5			Alnilam	275°40.0	-1°11.4		
16	25°38.3	98°37.3	49.2	97°59.3	07.2	43°07.1	28.1	65°40.6	29.4			Betelgeuse	270°54.5	7°24.6		
17	40°40.7	113°38.3	49.3	112°59.7	07.1	58°09.0	27.9	80°42.8	29.3			Canopus	263°53.1	-52°42.7		
18	55°43.2	128°39.3	\$16°49.3	128°00.2	\$23°06.9	73°10.9	\$08°27.7	95°44.9	\$16°29.3			Sirius	258°28.1	-16°45.0		
19	70°45.7	143°40.2	49.4	143°00.7	06.7	88°12.8	27.5	110°47.1	29.2			Adhara	255°07.4	-29°00.3		
20	85°48.1	158°41.2	49.5	158°01.2	06.5	103°14.7	27.2	125°49.3	29.1			Procyon	244°53.0	5°10.0		
21	100°50.6	173°42.2	.. 49.6	173°01.6	.. 06.3	118°16.6	.. 27.0	140°51.4	.. 29.0			Pollux	243°19.9	27°58.3		
22	115°53.1	188°43.2	49.7	188°02.1	06.1	133°18.5	26.8	155°53.6	28.9			Avior	234°15.1	-59°34.9		
23	130°55.5	203°44.2	49.8	203°02.6	05.9	148°20.4	26.6	170°55.8	28.8			Suhail	222°47.6	-43°31.4		
Mer.pass. 14:18			ν 1.0' d -0.1' m -4.83	ν 0.5' d 0.2' m 1.34	ν 1.9' d 0.2' m -2.04	ν 2.2' d 0.1' m 0.77										
Wed			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec			
0	145°58.0	218°45.1	\$16°49.8	218°03.0	\$23°05.7	163°22.3	\$08°26.3	185°57.9	\$16°28.7			Denebola	193°43.3	61°37.8		
1	161°00.5	233°46.1	49.9	233°03.5	05.5	178°24.2	26.1	201°00.1	28.6			Gienah	175°45.8	-17°39.8		
2	176°02.9	248°47.1	50.0	248°04.0	05.3	193°26.2	25.9	216°02.3	28.6			Acrux	173°02.2	-63°13.1		
3	191°05.4	263°48.0	.. 50.1	263°04.4	.. 05.1	208°28.1	.. 25.7	231°04.5	.. 28.5			Gacrux	171°53.8	-57°14.0		
4	206°07.9	278°49.0	50.2	278°04.9	04.9	223°30.0	25.4	246°06.6	28.4			Alioth	166°14.7	55°50.2		
5	221°10.3	293°49.9	50.2	293°05.4	04.7	238°31.9	25.2	261°08.8	28.3			Spica	158°24.6	-11°16.6		
6	236°12.8	308°50.9	\$16°50.3	308°05.9	\$23°04.5	253°33.8	\$08°25.0	276°11.0	\$16°28.2			Alkaid	152°53.7	49°11.9		
7	251°15.2	323°51.9	50.4	323°06.3	04.3	268°35.7	24.8	291°13.1	28.1			Hadar	148°39.1	-60°28.5		
8	266°17.7	338°52.8	50.5	338°06.8	04.1	283°37.6	24.5	306°15.3	28.0			Menkent	148°00.2	-36°28.6		
9	281°20.2	353°53.8	.. 50.5	353°07.3	.. 03.9	298°39.5	.. 24.3	321°17.5	.. 27.9			Arcturus	145°50.0	19°03.9		
10	296°22.6	8°54.7	50.6	8°07.7	03.7	313°41.4	24.1	336°19.6	27.9			Rigil Kent	139°43.3	-60°55.3		
11	311°25.1	23°55.6	50.7	23°08.2	03.5	328°43.3	23.9	351°21.8	27.8			Kochab	137°19.6	74°03.6		
12	326°27.6	38°56.6	\$16°50.8	38°08.7	\$23°03.3	343°45.2	\$08°23.6	6°24.0	\$16°27.7			Zuben'ubi	136°58.6	-16°08.0		
13	341°30.0	53°57.5	50.9	53°09.1	03.1	358°47.1	23.4	21°26.1	27.6			Alphecca	126°05.8	26°38.2		
14	356°32.5	68°58.5	50.9	68°09.6	02.9	13°49.0	23.2	36°28.3	27.5			Antares	112°18.8	-26°28.8		
15	11°35.0	83°59.4	.. 51.0	83°10.1	.. 02.7	28°50.9	.. 22.9	51°30.5	.. 27.4			Atria	107°15.4	-69°03.7		
16	26°37.4	99°00.3	51.1	98°10.6	02.5	43°52.8	22.7	66°32.6	27.3			Sabik	102°05.6	-15°45.1		
17	41°39.9	114°01.2	51.2	113°11.0	02.3	58°54.7	22.5	81°34.8	27.2			Shaula	96°13.8	-37°07.1		
18	56°42.3	129°02.2	\$16°51.2	128°11.5	\$23°02.1	73°56.6	\$08°22.3	96°37.0	\$16°27.2			Rasalhague	96°00.9	12°32.5		
19	71°44.8	144°03.1	51.3	143°12.0	01.9	88°58.5	22.0	111°39.1	27.1			Eltanin	90°43.6	51°28.9		
20	86°47.3	159°04.0	51.4	158°12.4	01.7	104°00.5	21.8	126°41.3	27.0			Kaus Aust.	83°35.9	-34°22.4		
21	101°49.7	174°04.9	.. 51.5	173°12.9	.. 01.5	119°02.4	.. 21.6	141°43.5	.. 26.9			Vega	80°35.1	38°48.0		
22	116°52.2	189°05.8	51.5	188°13.4	01.3	134°04.3	21.4	156°45.7	26.8			Nunki	75°51.0	-26°16.2		
23	131°54.7	204°06.8	51.6	203°13.9	01.1	149°06.2	21.1	171°47.8	26.7			Altair	62°02.5	8°55.4		
Mer.pass. 14:14			ν 1.0' d -0.1' m -4.83	ν 0.5' d 0.2' m 1.34	ν 1.9' d 0.2' m -2.04	ν 2.2' d 0.1' m 0.77										
Thu			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec			
0	146°57.1	219°07.7	\$16°51.7	218°14.3	\$23°00.9	164°08.1	\$08°20.9	186°50.0	\$16°26.6			Fomalhaut	15°17.5	-29°30.5		
1	161°59.6	234°08.6	51.7	233°14.8	00.7	179°10.0	20.7	201°52.2	26.6			Scheat	13°47.8	28°12.0		
2	177°02.1	249°09.5	51.8	248°15.3	00.5	194°11.9	20.5	216°54.3	26.5			Markab	13°32.6	15°19.3		
3	192°04.5	264°10.4	.. 51.9	263°15.7	.. 00.3	209°13.8	.. 20.2	231°56.5	.. 26.4			Feb 15 Tue	SHA	Mer.pass		
4	207°07.0	279°11.3	52.0	278°16.2	23°00.1	224°15.7	20.0	246°58.7	26.3			Venus	73°22.2	09:26		
5	222°09.5	294°12.2	52.0	293°16.7	22°59.9	239°17.6	19.8	262°00.8	26.2			Mars	72°52.9	09:28		
6	237°11.9	309°13.1	\$16°52.1	308°17.2	\$22°59.7	254°19.5	\$08°19.5	277°03.0	\$16°26.1			Jupiter	17°37.7	13:08		
7	252°14.4	324°14.0	52.2	323°17.6	59.5	269°21.4	19.3	292°05.2	26.0			Saturn	40°07.1	11:38		
8	267°16.8	339°14.9	52.2	338°18.1	59.3	284°23.3	19.1	307°07.3	25.9			Feb 16 Wed	SHA	Mer.pass		
9	282°19.3	354°15.8	.. 52.3	353°18.6	.. 59.0	299°25.2	.. 18.9	322°09.5	.. 25.9			Venus	72°47.1	09:24		
10	297°21.8	9°16.6	52.4	8°19.0	58.8	314°27.1	18.6	337°11.7	25.8			Mars	72°05.0	09:28		
11	312°24.2	24°17.5	52.4	23°19.5	58.6	329°29.0	18.4	352°13.8	25.7			Jupiter	17°24.3	13:05		
12	327°26.7	39°18.4	\$16°52.5	38°20.0	\$22°58.4	344°30.9	\$08°18.2	7°16.0	\$16°25.6			Saturn	40°00.0	11:34		
13	342°29.2	54°19.3	52.6	53°20.5	58.2	359°32.8	18.0	22°18.2	25.5			Feb 17 Thu	SHA	Mer.pass		
14	357°31.6	69°20.2	52.7	68°20.9	58.0	14°34.7	17.7	37°20.4	25.4			Venus	72°10.5	09:23		
15	12°34.1	84°21.0	.. 52.7	83°21.4	.. 57.8	29°36.7	.. 17.5	52°22.5	.. 25.3			Mars	71°17.2	09:27		
16	27°36.6															

DUT1 = UT1-UTC = -0.1030 sec  $\Delta T = TT-UT1 = +69.2870$  sec

2022 February 15 to Feb. 17 UT

h		Sun		Moon			
Tue	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	176°28.4	S12°45.6	14°47.8	10.8'	N23°09.7	-7.1'	55.1'
1	191°28.4	44.7	29°17.6	10.8'	23°02.7	-7.2'	55.1'
2	206°28.4	43.9	43°47.4	10.9'	22°55.5	-7.3'	55.1'
3	221°28.4	43.0	58°17.2	10.9'	22°48.2	-7.4'	55.1'
4	236°28.5	42.2	72°47.1	10.9'	22°40.7	-7.5'	55.1'
5	251°28.5	41.3	87°17.0	11.0'	22°33.2	-7.7'	55.2'
6	266°28.5	S12°40.5	101°47.0	11.0'	N22°25.5	-7.8'	55.2'
7	281°28.6	39.6	116°17.0	11.0'	22°17.7	-7.9'	55.2'
8	296°28.6	38.7	130°47.0	11.1'	22°09.9	-8.0'	55.2'
9	311°28.6	37.9	145°17.1	11.1'	22°01.8	-8.1'	55.2'
10	326°28.7	37.0	159°47.2	11.1'	21°53.7	-8.2'	55.3'
11	341°28.7	36.2	174°17.3	11.2'	21°45.5	-8.3'	55.3'
12	356°28.7	S12°35.3	188°47.5	11.2'	N21°37.2	-8.4'	55.3'
13	11°28.8	34.4	203°17.7	11.3'	21°28.7	-8.6'	55.3'
14	26°28.8	33.6	217°48.0	11.3'	21°20.2	-8.7'	55.3'
15	41°28.8	32.7	232°18.3	11.3'	21°11.5	-8.8'	55.4'
16	56°28.9	31.9	246°48.6	11.4'	21°02.7	-8.9'	55.4'
17	71°28.9	31.0	261°19.0	11.4'	20°53.8	-9.0'	55.4'
18	86°28.9	S12°30.1	275°49.4	11.5'	N20°44.9	-9.1'	55.4'
19	101°29.0	29.3	290°19.9	11.5'	20°35.8	-9.2'	55.4'
20	116°29.0	28.4	304°50.4	11.5'	20°26.6	-9.3'	55.5'
21	131°29.0	27.5	319°20.9	11.6'	20°17.2	-9.4'	55.5'
22	146°29.1	26.7	333°51.5	11.6'	20°07.8	-9.5'	55.5'
23	161°29.1	25.8	348°22.1	11.7'	19°58.3	-9.6'	55.5'
		SD = 16.2'	d = 0.9'	SD = 15.0'			
		SD	16.2'	SD			
Wed	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	176°29.1	S12°24.9	2°52.8	11.7'	N19°48.7	-9.7'	55.5'
1	191°29.2	24.1	17°23.5	11.7'	19°39.0	-9.8'	55.6'
2	206°29.2	23.2	31°54.2	11.8'	19°29.2	-9.9'	55.6'
3	221°29.2	22.3	46°25.0	11.8'	19°19.3	-10.0'	55.6'
4	236°29.3	21.5	60°55.9	11.9'	19°09.3	-10.1'	55.6'
5	251°29.3	20.6	75°26.7	11.9'	18°59.1	-10.2'	55.6'
6	266°29.4	S12°19.7	89°57.6	11.9'	N18°48.9	-10.3'	55.7'
7	281°29.4	18.9	104°28.6	12.0'	18°38.6	-10.4'	55.7'
8	296°29.4	18.0	118°59.6	12.0'	18°28.2	-10.5'	55.7'
9	311°29.5	17.1	133°30.6	12.1'	18°17.7	-10.6'	55.7'
10	326°29.5	16.3	148°01.6	12.1'	18°07.1	-10.7'	55.7'
11	341°29.6	15.4	162°32.8	12.1'	17°56.4	-10.8'	55.8'
12	356°29.6	S12°14.5	177°03.9	12.2'	N17°45.7	-10.9'	55.8'
13	11°29.6	13.7	191°35.1	12.2'	17°34.8	-11.0'	55.8'
14	26°29.7	12.8	206°06.3	12.3'	17°23.8	-11.0'	55.8'
15	41°29.7	11.9	220°37.6	12.3'	17°12.8	-11.1'	55.8'
16	56°29.8	11.1	235°08.9	12.3'	17°01.7	-11.2'	55.9'
17	71°29.8	10.2	249°40.2	12.4'	16°50.4	-11.3'	55.9'
18	86°29.8	S12°09.3	264°11.6	12.4'	N16°39.1	-11.4'	55.9'
19	101°29.9	08.5	278°43.0	12.5'	16°27.7	-11.5'	55.9'
20	116°29.9	07.6	293°14.5	12.5'	16°16.2	-11.6'	55.9'
21	131°30.0	06.7	307°46.0	12.5'	16°04.7	-11.6'	56.0'
22	146°30.0	05.8	322°17.5	12.6'	15°53.0	-11.7'	56.0'
23	161°30.0	05.0	336°49.1	12.6'	15°41.3	-11.8'	56.0'
		SD = 16.2'	d = 0.9'	SD = 15.1'			
		SD	16.2'	SD			
Thu	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	176°30.1	S12°04.1	351°20.7	12.6'	N15°29.5	-11.9'	56.0'
1	191°30.1	03.2	5°52.3	12.7'	15°17.6	-12.0'	56.1'
2	206°30.2	02.3	20°24.0	12.7'	15°05.6	-12.1'	56.1'
3	221°30.2	01.5	34°55.7	12.8'	14°53.6	-12.1'	56.1'
4	236°30.3	12°06.6	49°27.5	12.8'	14°41.4	-12.2'	56.1'
5	251°30.3	11°59.7	63°59.3	12.8'	14°29.2	-12.3'	56.1'
6	266°30.4	S11°58.8	78°31.1	12.9'	N14°17.0	-12.4'	56.2'
7	281°30.4	58.0	93°03.0	12.9'	14°04.6	-12.4'	56.2'
8	296°30.4	57.1	107°34.8	12.9'	13°52.2	-12.5'	56.2'
9	311°30.5	56.2	122°06.8	13.0'	13°39.7	-12.6'	56.2'
10	326°30.5	55.3	136°38.7	13.0'	13°27.1	-12.6'	56.2'
11	341°30.6	54.5	151°10.7	13.0'	13°14.4	-12.7'	56.3'
12	356°30.6	S11°53.6	165°42.7	13.0'	N13°01.7	-12.8'	56.3'
13	11°30.7	52.7	180°14.8	13.1'	12°49.0	-12.9'	56.3'
14	26°30.7	51.8	194°46.8	13.1'	12°36.1	-12.9'	56.3'
15	41°30.8	51.0	209°18.9	13.1'	12°23.2	-13.0'	56.3'
16	56°30.8	50.1	223°51.1	13.2'	12°10.2	-13.0'	56.4'
17	71°30.9	49.2	238°23.2	13.2'	11°57.2	-13.1'	56.4'
18	86°30.9	S11°48.3	252°55.4	13.2'	N11°44.0	-13.2'	56.4'
19	101°31.0	47.4	267°27.6	13.2'	11°30.9	-13.2'	56.4'
20	116°31.0	46.6	281°59.9	13.3'	11°17.6	-13.3'	56.5'
21	131°31.1	45.7	296°32.2	13.3'	11°04.3	-13.4'	56.5'
22	146°31.1	44.8	311°04.4	13.3'	10°51.0	-13.4'	56.5'
23	161°31.2	43.9	325°36.8	13.3'	10°37.6	-13.5'	56.5'
		SD = 16.2'	d = 0.9'	SD = 15.3'			
		SD	16.2'	SD			

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

Lat.	Tue	Moonrise		Thu	Moonset	
		Wed	Thu		Tue	Wed
N 72°		13:14	16:22		11:31	10:01
N 70°		14:23	16:45		10:20	09:36
68°	12:18	14:59	17:02	10:42	09:43	09:18
66°	13:23	15:24	17:15	09:37	09:16	09:03
64°	13:57	15:44	17:26	09:01	08:55	08:50
62°	14:23	16:00	17:36	08:36	08:39	08:39
60°	14:42	16:13	17:44	08:15	08:24	08:30
N 58°	14:58	16:24	17:51	07:59	08:12	08:22
56°	15:12	16:34	17:57	07:44	08:02	08:15
54°	15:24	16:43	18:03	07:32	07:53	08:08
50°	15:44	16:57	18:12	07:11	07:37	07:57
45°	16:03	17:12				

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

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	147°56.3	219°28.8	\$16°53.3	218°25.6	\$22°55.9	164°53.8	\$08°15.5	187°42.1	\$16°24.5					Alpheratz	357°37.5	29°12.7	
1	162°58.7	234°29.6	53.4	233°26.1	55.7	179°55.7	15.2	202°44.2	24.5					Ankaa	353°09.8	-42°11.4	
2	178°01.2	249°30.5	53.4	248°26.6	55.4	194°57.6	15.0	217°46.4	24.4					Schedar	349°34.1	56°39.6	
3	193°03.7	264°31.3	.. 53.5	263°27.1	.. 55.2	209°59.5	.. 14.8	232°48.6	.. 24.3					Diphda	348°49.9	-17°52.2	
4	208°06.1	279°32.2	53.6	278°27.5	55.0	225°01.4	14.6	247°50.7	24.2					Achernar	335°22.3	-57°07.8	
5	223°08.6	294°33.0	53.6	293°28.0	54.8	240°03.3	14.3	262°52.9	24.1					Hamal	327°54.0	23°33.9	
6	238°11.1	309°33.8	\$16°53.7	308°28.5	\$22°54.6	255°05.2	\$08°14.1	277°55.1	\$16°24.0					Polaris	315°14.9	89°21.7	
7	253°13.5	324°34.7	53.7	323°28.9	54.4	270°07.1	13.9	292°57.2	23.9					Acamar	315°13.7	-40°13.3	
8	268°16.0	339°35.5	53.8	338°29.4	54.1	285°09.0	13.6	307°59.4	23.9					Menkar	314°08.7	4°10.4	
9	283°18.4	354°36.3	.. 53.9	353°29.9	.. 53.9	300°10.9	.. 13.4	323°01.6	.. 23.8					Mirfak	308°31.7	49°56.5	
10	298°20.9	9°37.2	53.9	8°30.4	53.7	315°12.8	13.2	338°03.7	23.7					Aldebaran	290°42.3	16°33.2	
11	313°23.4	24°38.0	54.0	23°30.8	53.5	330°14.7	13.0	353°05.9	23.6					Rigel	281°06.0	-8°10.7	
12	328°25.8	39°38.8	\$16°54.0	38°31.3	\$22°53.3	345°16.7	\$08°12.7	8°08.1	\$16°23.5					Capella	280°25.2	46°01.3	
13	343°28.3	54°39.6	54.1	53°31.8	53.0	0°18.6	12.5	23°10.3	23.4					Bellatrix	278°25.3	6°22.1	
14	358°30.8	69°40.5	54.2	68°32.3	52.8	15°20.5	12.3	38°12.4	23.3					Elnath	278°04.7	28°37.6	
15	13°33.2	84°41.3	.. 54.2	83°32.7	.. 52.6	30°22.4	.. 12.1	53°14.6	.. 23.2					Alnilam	275°40.0	-1°11.4	
16	28°35.7	99°42.1	54.3	98°33.2	52.4	45°24.3	11.8	68°16.8	23.2					Betelgeuse	270°54.5	7°24.6	
17	43°38.2	114°42.9	54.3	113°33.7	52.2	60°26.2	11.6	83°18.9	23.1					Canopus	263°53.1	-52°42.7	
18	58°40.6	129°43.7	\$16°54.4	128°34.1	\$22°51.9	75°28.1	\$08°11.4	98°21.1	\$16°23.0					Sirius	258°28.1	-16°45.0	
19	73°43.1	144°44.5	54.5	143°34.6	51.7	90°30.0	11.1	113°23.3	22.9					Adhara	255°07.4	-29°00.3	
20	88°45.6	159°45.3	54.5	158°35.1	51.5	105°31.9	10.9	128°25.4	22.8					Procyon	244°53.0	5°10.0	
21	103°48.0	174°46.1	.. 54.6	173°35.6	.. 51.3	120°33.8	.. 10.7	143°27.6	.. 22.7					Pollux	243°19.9	27°58.4	
22	118°50.5	189°46.9	54.6	188°36.0	51.0	135°35.7	10.5	158°29.8	22.6					Avisor	234°15.1	-59°34.9	
23	133°52.9	204°47.7	54.7	203°36.5	50.8	150°37.6	10.2	173°32.0	22.5					Suhail	222°47.6	-43°31.4	
Mer.pass. 14:06			ν 0.8° d -0.1° m -4.81	ν 0.5° d 0.2° m 1.32			ν 1.9° d 0.2° m -2.04			ν 2.2° d 0.1° m 0.78							
Sat			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Denebola	193°43.3	61°37.8	
0	148°55.4	219°48.5	\$16°54.7	218°37.0	\$22°50.6	165°39.5	\$08°10.0	188°34.1	\$16°22.5					Regulus	207°36.6	11°51.5	
1	163°57.9	234°49.3	54.8	233°37.5	50.4	180°41.4	09.8	203°36.3	22.4					Dubhe	193°43.3	61°37.8	
2	179°00.3	249°50.1	54.8	248°37.9	50.2	195°43.3	09.5	218°38.5	22.3					Gienah	182°27.1	14°26.8	
3	194°02.8	264°50.9	.. 54.9	263°38.4	.. 49.9	210°45.2	.. 09.3	233°40.6	.. 22.2					Acrux	175°45.7	-17°39.9	
4	209°05.3	279°51.7	54.9	278°38.9	49.7	225°47.1	09.1	248°42.8	22.1					Gacrux	173°02.2	-63°13.1	
5	224°07.7	294°52.5	55.0	293°39.3	49.5	240°49.0	08.9	263°45.0	22.0					Alioth	171°53.8	-57°14.0	
6	239°10.2	309°53.2	\$16°55.0	308°39.8	\$22°49.2	255°50.9	\$08°08.6	278°47.1	\$16°21.9					Spica	166°14.7	55°50.2	
7	254°12.7	324°54.0	55.1	323°40.3	49.0	270°52.8	08.4	293°49.3	21.9					Alkaid	162°53.6	49°11.9	
8	269°15.1	339°54.8	55.2	338°40.8	48.8	285°54.7	08.2	308°51.5	21.8					Hadar	148°39.0	-60°28.5	
9	284°17.6	354°55.6	.. 55.2	353°41.2	.. 48.6	300°56.6	.. 08.0	323°53.7	.. 21.7					Menkent	148°00.2	-36°28.6	
10	299°20.0	9°56.3	55.3	8°41.7	48.3	315°58.5	07.7	338°55.8	21.6					Arcturus	145°49.9	19°03.9	
11	314°22.5	24°57.1	55.3	23°42.2	48.1	331°00.5	07.5	353°58.0	21.5					Rigel Kent.	139°43.3	-60°55.3	
12	329°25.0	39°57.9	\$16°55.4	38°42.7	\$22°47.9	346°02.4	\$08°07.3	9°00.2	\$16°21.4					Kochab	137°19.5	74°03.6	
13	344°27.4	54°58.7	55.4	53°43.1	47.6	1°04.3	07.0	24°02.3	21.3					Zuben'ubi	136°58.5	-16°08.0	
14	359°29.9	69°59.4	55.4	68°43.6	47.4	16°06.2	06.8	39°04.5	21.2					Alphecca	126°05.7	26°38.2	
15	14°32.4	85°00.2	.. 55.5	83°44.1	.. 47.2	31°08.1	.. 06.6	54°06.7	.. 21.2					Antares	112°18.8	-26°28.8	
16	29°34.8	100°00.9	55.5	98°44.6	47.0	46°10.0	06.4	69°08.9	21.1					Atria	107°15.3	-69°03.7	
17	44°37.3	115°01.7	55.6	113°45.0	46.7	61°11.9	06.1	84°11.0	21.0					Sabik	102°05.6	-15°45.1	
18	59°39.8	130°02.4	\$16°55.6	128°45.5	\$22°46.5	76°13.8	\$08°05.9	99°13.2	\$16°20.9					Shaula	96°13.8	-37°07.1	
19	74°42.2	145°03.2	55.7	143°46.0	46.3	91°15.7	05.7	114°15.4	20.8					Rasalhague	96°00.9	12°32.5	
20	89°44.7	160°04.0	55.7	158°46.5	46.0	106°17.6	05.4	129°17.5	20.7					Eltanin	90°43.5	51°28.8	
21	104°47.2	175°04.7	.. 55.8	173°46.9	.. 45.8	121°19.5	.. 05.2	144°19.7	.. 20.6					Kaus Aust.	83°35.9	-34°22.4	
22	119°49.6	190°05.4	55.8	188°47.4	45.6	136°21.4	05.0	159°21.9	20.5					Vega	80°35.1	38°48.0	
23	134°52.1	205°06.2	55.9	203°47.9	45.3	151°23.3	04.8	174°24.1	20.5					Nunki	75°50.9	-26°16.2	
Mer.pass. 14:02			ν 0.8° d -0.1° m -4.80	ν 0.5° d 0.2° m 1.32			ν 1.9° d 0.2° m -2.04			ν 2.2° d 0.1° m 0.78							
Sun			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Feb 18 Fri	SHA	Mer.pass	
0	149°54.5	220°06.9	\$16°55.9	218°48.3	\$22°45.1	166°25.2	\$08°04.5	189°26.2	\$16°20.4					Venus	71°32.5	09:22	
1	164°57.0	235°07.7	56.0	233°48.8	44.9	181°27.1	04.3	204°28.4	20.3					Mars	70°29.4	09:26	
2	179°59.5	250°08.4	56.0	248°49.3	44.6	196°29.0	04.1	219°30.6	20.2					Jupiter	16°57.5	12:59	
3	195°01.9	265°09.1	.. 56.0	263°49.8	.. 44.4	211°30.9	.. 03.9	234°32.7	.. 20.1					Saturn	39°45.8	11:28	
4	210°04.4	280°09.9	56.1	278°50.2	44.2	226°32.8	03.6	249°34.9	20.0					Feb 19 Sat	SHA	Mer.pass	
5	225°06.9	295°10.6	56.1	293°50.7	43.9	241°34.7	03.4	264°37.1	19.9					Venus	70°53.1	09:20	
6	240°09.3	310°11.3	\$16°56.2	308°51.2	\$22°43.7	256°36.6	\$08°03.2	279°39.2	\$16°19.9					Mars	69°41.6	09:25	
7	255°11.8	325°12.1	56.2	323°51.7	43.4	271°38.5	02.9	294°41.4	19.8					Jupiter	16°44.1	12:56	
8	270°14.3	340°12.8	56.2	338°52.1	43.2	286°40.4	02.7	309°43.6	19.7					Saturn	39°38.7	11:24	
9	285°16.7	355°13.5	.. 56.3	353°52.6	.. 43.0	301°42.3	.. 02.5	324°45.8	.. 19.6					Feb 20 Sun	SHA	Mer.pass	
10	300°19.2	10°14.2	56.3	8°53.1	42.7	316°44.2	02.3	339°47.9	19.5					Venus	70°12.4	09:19	
11	315°21.6	25°14.9	56.4	23°53.6	42.5	331°46.1	02.0	354°50.1	19.4					Mars	68°53.8	09:24	
12	330°24.1	40°15.7	\$16°56.4	38°													

DUT1 = UT1-UTC = -0.1023 sec  $\Delta T = TT-UT1 = +69.2863$  sec

2022 February 18 to Feb. 20 UT

h	Sun			Moon			
Fri	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	176°31.2	S11°43.0	340°09.1	13.4'	N10°24.1	-13.5'	56.5'
1	191°31.3	42.2	354°41.5	13.4'	10°10.6	-13.6'	56.6'
2	206°31.3	41.3	9°13.9	13.4'	09°57.0	-13.6'	56.6'
3	221°31.4	40.4	23°46.3	13.4'	09°43.3	-13.7'	56.6'
4	236°31.4	39.5	38°18.7	13.4'	09°29.6	-13.7'	56.6'
5	251°31.5	38.6	52°51.1	13.5'	09°15.9	-13.8'	56.6'
6	266°31.5	S11°37.8	67°23.6	13.5'	N09°02.1	-13.8'	56.7'
7	281°31.6	36.9	81°56.1	13.5'	08°48.3	-13.9'	56.7'
8	296°31.6	36.0	96°28.6	13.5'	08°34.4	-13.9'	56.7'
9	311°31.7	35.1	111°01.1	13.5'	08°20.4	-14.0'	56.7'
10	326°31.7	34.2	125°33.6	13.5'	08°06.4	-14.0'	56.7'
11	341°31.8	33.3	140°06.2	13.6'	07°52.4	-14.1'	56.8'
12	356°31.9	S11°32.5	154°38.7	13.6'	N07°38.3	-14.1'	56.8'
13	11°31.9	31.6	169°11.3	13.6'	07°24.2	-14.2'	56.8'
14	26°32.0	30.7	183°43.9	13.6'	07°10.0	-14.2'	56.8'
15	41°32.0	29.8	198°16.5	13.6'	06°55.8	-14.3'	56.8'
16	56°32.1	28.9	212°49.1	13.6'	06°41.5	-14.3'	56.9'
17	71°32.1	28.0	227°21.7	13.6'	06°27.2	-14.3'	56.9'
18	86°32.2	S11°27.1	241°54.4	13.6'	N06°12.9	-14.4'	56.9'
19	101°32.2	26.3	256°27.0	13.6'	05°58.5	-14.4'	56.9'
20	116°32.3	25.4	270°59.7	13.6'	05°44.1	-14.4'	56.9'
21	131°32.4	24.5	285°32.3	13.7'	05°29.7	-14.5'	57.0'
22	146°32.4	23.6	300°05.0	13.7'	05°15.2	-14.5'	57.0'
23	161°32.5	22.7	314°37.6	13.7'	05°00.7	-14.5'	57.0'
	SD = 16.2'			SD = 15.4'			

Sat	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	176°32.5	S11°21.8	329°10.3	13.7'	N04°46.2	-14.6'	57.0'
1	191°32.6	20.9	343°42.9	13.7'	04°31.6	-14.6'	57.0'
2	206°32.6	20.0	358°15.6	13.7'	04°17.0	-14.6'	57.1'
3	221°32.7	19.1	12°48.3	13.7'	04°02.4	-14.7'	57.1'
4	236°32.8	18.3	27°20.9	13.7'	03°47.7	-14.7'	57.1'
5	251°32.8	17.4	41°53.6	13.7'	03°33.0	-14.7'	57.1'
6	266°32.9	S11°16.5	56°26.3	13.7'	N03°18.3	-14.7'	57.1'
7	281°32.9	15.6	70°58.9	13.7'	03°03.6	-14.8'	57.2'
8	296°33.0	14.7	85°31.6	13.6'	02°48.8	-14.8'	57.2'
9	311°33.1	13.8	100°04.2	13.6'	02°34.0	-14.8'	57.2'
10	326°33.1	12.9	114°36.9	13.6'	02°19.2	-14.8'	57.2'
11	341°33.2	12.0	129°09.5	13.6'	02°04.4	-14.8'	57.2'
12	356°33.2	S11°11.1	143°42.1	13.6'	N01°49.6	-14.9'	57.3'
13	11°33.3	10.2	158°14.7	13.6'	01°34.7	-14.9'	57.3'
14	26°33.4	09.3	172°47.3	13.6'	01°19.8	-14.9'	57.3'
15	41°33.4	08.5	187°19.9	13.6'	01°04.9	-14.9'	57.3'
16	56°33.5	07.6	201°52.5	13.6'	00°50.0	-14.9'	57.3'
17	71°33.5	06.7	216°25.1	13.5'	00°35.1	-14.9'	57.4'
18	86°33.6	S11°05.8	230°57.6	13.5'	N00°20.2	-14.9'	57.4'
19	101°33.7	04.9	245°30.1	13.5'	N00°05.3	-14.9'	57.4'
20	116°33.7	04.0	260°02.7	13.5'	S00°09.7	-15.0'	57.4'
21	131°33.8	03.1	274°35.2	13.5'	00°24.7	-15.0'	57.4'
22	146°33.9	02.2	289°07.6	13.5'	00°39.6	-15.0'	57.5'
23	161°33.9	01.3	303°40.1	13.4'	00°54.6	-15.0'	57.5'
	SD = 16.2'			SD = 15.6'			

Sun	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	176°34.0	S11°00.4	318°12.5	13.4'	S01°09.6	-15.0'	57.5'
1	191°34.1	10°59.5	332°45.0	13.4'	01°24.5	-15.0'	57.5'
2	206°34.1	58.6	347°17.3	13.4'	01°39.5	-15.0'	57.5'
3	221°34.2	57.7	1°49.7	13.3'	01°54.5	-15.0'	57.6'
4	236°34.3	56.8	16°22.1	13.3'	02°09.5	-15.0'	57.6'
5	251°34.3	55.9	30°54.4	13.3'	02°24.5	-15.0'	57.6'
6	266°34.4	S10°55.0	45°26.7	13.3'	S02°39.5	-15.0'	57.6'
7	281°34.4	54.1	59°58.9	13.2'	02°54.4	-15.0'	57.6'
8	296°34.5	53.2	74°31.1	13.2'	03°09.4	-15.0'	57.6'
9	311°34.6	52.3	89°03.3	13.2'	03°24.4	-15.0'	57.7'
10	326°34.7	51.4	103°35.5	13.1'	03°39.3	-15.0'	57.7'
11	341°34.7	50.5	118°07.6	13.1'	03°54.3	-14.9'	57.7'
12	356°34.8	S10°49.6	132°39.7	13.1'	S04°09.2	-14.9'	57.7'
13	11°34.9	48.7	147°11.8	13.0'	04°24.2	-14.9'	57.7'
14	26°34.9	47.8	161°43.8	13.0'	04°39.1	-14.9'	57.8'
15	41°35.0	46.9	176°15.8	12.9'	04°54.0	-14.9'	57.8'
16	56°35.1	46.0	190°47.7	12.9'	05°08.9	-14.9'	57.8'
17	71°35.1	45.1	205°19.6	12.9'	05°23.7	-14.9'	57.8'
18	86°35.2	S10°44.2	219°51.5	12.8'	S05°38.6	-14.8'	57.8'
19	101°35.3	43.3	234°23.3	12.8'	05°53.4	-14.8'	57.8'
20	116°35.3	42.4	248°55.1	12.7'	06°08.3	-14.8'	57.9'
21	131°35.4	41.5	263°26.8	12.7'	06°23.1	-14.8'	57.9'
22	146°35.5	40.6	277°58.5	12.6'	06°37.8	-14.8'	57.9'
23	161°35.5	39.7	292°30.1	12.6'	06°52.6	-14.7'	57.9'
	SD = 16.2'			SD = 15.7'			

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

Day	Sun		Mer. Pass. Upper hh:mm	Moon
	Eqn.of 00h mm:ss	Time 12h mm:ss		
18	13:55	13:53	12:14	01:22 13:45
19	13:50	13:47	12:14	02:07 14:30
20	13:44	13:41	12:14	02:52 15:15

## February 21, 22, 23 UT (Mon., Tue., Wed.)

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	150°53.7	220°24.1	\$16°56.8	218°59.7	\$22°39.4	167°10.9	\$07°59.1	190°18.3	\$16°18.3					Alpheratz	357°37.5	29°12.6	
1	165°56.1	235°24.8	56.9	234°00.2	39.1	182°12.8	58.8	205°20.5	18.2					Ankaa	353°09.8	-42°11.4	
2	180°58.6	250°25.5	56.9	249°00.7	38.9	197°14.7	58.6	220°22.7	18.1					Schedar	349°34.1	56°39.5	
3	196°01.1	265°26.1	.. 56.9	264°01.2	.. 38.6	212°16.6	.. 58.4	235°24.9	.. 18.0					Diphda	348°49.9	-17°52.2	
4	211°03.5	280°26.8	57.0	279°01.6	38.4	227°18.5	58.1	250°27.0	17.9					Achernar	335°22.3	-57°07.8	
5	226°06.0	295°27.5	57.0	294°02.1	38.1	242°20.4	57.9	265°29.2	17.9					Hamal	327°54.0	23°33.9	
6	241°08.5	310°28.2	\$16°57.0	309°02.6	\$22°37.9	257°22.3	\$07°57.7	280°31.4	\$16°17.8					Polaris	315°16.4	89°21.7	
7	256°10.9	325°28.9	57.0	324°03.1	37.6	272°24.2	57.5	295°33.5	17.7					Acamar	315°13.7	-40°13.3	
8	271°13.4	340°29.5	57.1	339°03.5	37.4	287°26.1	57.2	310°35.7	17.6					Menkar	314°08.7	4°10.4	
9	286°15.9	355°30.2	.. 57.1	354°04.0	.. 37.1	302°28.0	.. 57.0	325°37.9	.. 17.5					Mirfak	308°31.7	49°56.5	
10	301°18.3	10°30.9	57.1	9°04.5	36.9	317°29.9	56.8	340°40.1	17.4					Aldebaran	290°42.3	16°33.1	
11	316°20.8	25°31.5	57.2	24°05.0	36.7	332°31.8	56.5	355°42.2	17.3					Rigel	281°06.0	-8°10.8	
12	331°23.2	40°32.2	\$16°57.2	39°05.5	\$22°36.4	347°33.7	\$07°56.3	10°44.4	\$16°17.2					Capella	280°25.2	46°01.3	
13	346°25.7	55°32.9	57.2	54°05.9	36.2	2°35.6	56.1	25°46.6	17.2					Bellatrix	278°25.3	6°22.1	
14	1°28.2	70°33.5	57.2	69°06.4	35.9	17°37.5	55.9	40°48.7	17.1					Elnath	278°04.7	28°37.6	
15	16°30.6	85°34.2	.. 57.3	84°06.9	.. 35.7	32°39.4	.. 55.6	55°50.9	.. 17.0					Alnilam	275°40.0	-1°11.4	
16	31°33.1	100°34.8	57.3	99°07.4	35.4	47°41.3	55.4	70°53.1	16.9					Betelgeuse	270°54.5	7°24.6	
17	46°35.6	115°35.5	57.3	114°07.8	35.2	62°43.2	55.2	85°55.3	16.8					Canopus	263°53.1	-52°42.7	
18	61°38.0	130°36.1	\$16°57.3	129°08.3	\$22°34.9	77°45.1	\$07°54.9	100°57.4	\$16°16.7					Sirius	258°28.1	-16°45.0	
19	76°40.5	145°36.8	57.4	144°08.8	34.7	92°47.0	54.7	115°59.6	16.6					Adhara	255°07.5	-29°00.3	
20	91°43.0	160°37.4	57.4	159°09.3	34.4	107°48.9	54.5	131°01.8	16.6					Procyon	244°53.1	5°10.0	
21	106°45.4	175°38.1	.. 57.4	174°09.7	.. 34.1	122°50.9	.. 54.2	146°04.0	.. 16.5					Pollux	243°19.9	27°58.4	
22	121°47.9	190°38.7	57.4	189°10.2	33.9	137°52.8	54.0	161°06.1	16.4					Avior	234°15.1	-59°34.9	
23	136°50.4	205°39.4	57.4	204°10.7	33.6	152°54.7	53.8	176°08.3	16.3					Suhail	222°47.6	-43°31.4	
Mer.pass. 13:54		ν 0.7' d -0.0' m -4.78	ν 0.5' d 0.2' m 1.31		ν 1.9' d 0.2' m -2.04		ν 2.2' d 0.1' m 0.79										
Tue		GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Stars				
0	151°52.8	220°40.0	\$16°57.5	219°11.2	\$22°33.4	167°56.6	\$07°53.6	191°10.5	\$16°16.2					Denebola	182°27.1	14°26.8	
1	166°55.3	235°40.7	57.5	234°11.6	33.1	182°58.5	53.3	206°12.6	16.1					Gienah	175°45.7	-17°39.9	
2	181°57.7	250°41.3	57.5	249°12.1	32.9	198°00.4	53.1	221°14.8	16.0					Acrux	173°02.1	-63°13.1	
3	197°00.2	265°41.9	.. 57.5	264°12.6	.. 32.6	213°02.3	.. 52.9	236°17.0	.. 15.9					Gacrux	171°53.8	-57°14.0	
4	212°02.7	280°42.6	57.5	279°13.1	32.4	228°04.2	52.6	251°19.2	15.9					Alioth	166°14.7	55°50.2	
5	227°05.1	295°43.2	57.6	294°13.6	32.1	243°06.1	52.4	266°21.3	15.8					Spica	158°24.6	-11°16.6	
6	242°07.6	310°43.8	\$16°57.6	309°14.0	\$22°31.9	258°08.0	\$07°52.2	281°23.5	\$16°15.7					Alkaid	152°53.6	49°12.0	
7	257°10.1	325°44.4	57.6	324°14.5	31.6	273°09.9	52.0	296°25.7	15.6					Hadar	148°39.0	-60°28.5	
8	272°12.5	340°45.1	57.6	339°15.0	31.3	288°11.8	51.7	311°27.9	15.5					Menkent	148°00.2	-36°28.6	
9	287°15.0	355°45.7	.. 57.6	354°15.5	.. 31.1	303°13.7	.. 51.5	326°30.0	.. 15.4					Arcturus	145°49.9	19°03.9	
10	302°17.5	10°46.3	57.6	9°15.9	30.8	318°15.6	51.3	341°32.2	15.3					Rigil Kent.	139°43.3	-60°55.3	
11	317°19.9	25°46.9	57.7	24°16.4	30.6	333°17.5	51.0	356°34.4	15.3					Kochab	137°19.4	74°03.6	
12	332°22.4	40°47.5	\$16°57.7	39°16.9	\$22°30.3	348°19.4	\$07°50.8	11°36.5	\$16°15.2					Zuben'ubi	136°58.5	-16°08.0	
13	347°24.9	55°48.2	57.7	54°17.4	30.1	3°21.3	50.6	26°38.7	15.1					Alphecca	126°05.7	26°38.2	
14	2°27.3	70°48.8	57.7	69°17.9	29.8	18°23.2	50.4	41°40.9	15.0					Antares	112°18.8	-26°28.8	
15	17°29.8	85°49.4	.. 57.7	84°18.3	.. 29.5	33°25.1	.. 50.1	56°43.1	.. 14.9					Atria	107°15.3	-69°03.7	
16	32°32.2	100°50.0	57.7	99°18.8	29.3	48°27.0	49.9	71°45.2	14.8					Sabik	102°05.6	-15°45.1	
17	47°34.7	115°50.6	57.7	114°19.3	29.0	63°28.9	49.7	86°47.4	14.7					Shaula	96°13.7	-37°07.1	
18	62°37.2	130°51.2	\$16°57.8	129°19.8	\$22°28.8	78°30.8	\$07°49.4	101°49.6	\$16°14.6					Rasalhague	96°00.9	12°32.5	
19	77°39.6	145°51.8	57.8	144°20.2	28.5	93°32.7	49.2	116°51.8	14.6					Eltanin	90°43.5	51°28.8	
20	92°42.1	160°52.4	57.8	159°20.7	28.2	108°34.6	49.0	131°53.9	14.5					Kaus Aust.	83°35.9	-34°22.4	
21	107°44.6	175°53.0	.. 57.8	174°21.2	.. 28.0	123°36.5	.. 48.7	146°56.1	.. 14.4					Vega	80°35.1	38°48.0	
22	122°47.0	190°53.6	57.8	189°21.7	27.7	138°38.4	48.5	161°58.3	14.3					Nunki	75°50.9	-26°16.2	
23	137°49.5	205°54.2	57.8	204°22.2	27.5	153°40.3	48.3	177°00.4	14.2					Altair	62°02.5	8°55.4	
Mer.pass. 13:50		ν 0.6' d -0.0' m -4.77	ν 0.5' d 0.3' m 1.30		ν 1.9' d 0.2' m -2.04		ν 2.2' d 0.1' m 0.79										
Wed		GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Stars				
0	152°52.0	220°54.8	\$16°57.8	219°22.6	\$22°27.2	168°42.2	\$07°48.1	192°02.6	\$16°14.1					Fomalhaut	15°17.5	-29°30.5	
1	167°54.4	235°55.4	57.8	234°23.1	26.9	183°44.1	47.8	207°04.8	14.0					Scheat	13°47.8	28°12.0	
2	182°56.9	250°56.0	57.8	249°23.6	26.7	198°46.0	47.6	222°07.0	14.0					Markab	13°32.6	15°19.3	
3	197°59.3	265°56.6	.. 57.8	264°24.1	.. 26.4	213°47.9	.. 47.4	237°09.1	.. 13.9					Feb 21 Mon	SHA	Mer.pass	
4	213°01.8	280°57.1	57.8	279°24.5	26.1	228°49.8	47.1	252°11.3	13.8					Venus	69°30.4	09:18	
5	228°04.3	295°57.7	57.8	294°25.0	25.9	243°51.7	46.9	267°13.5	13.7					Mars	68°06.1	09:24	
6	243°06.7	310°58.3	\$16°57.8	309°25.5	\$22°25.6	258°53.6	\$07°46.7	282°15.7	\$16°13.6					Jupiter	16°17.2	12:50	
7	258°09.2	325°58.9	57.8	324°26.0	25.3	273°55.5	46.5	297°17.8	13.5					Saturn	39°24.7	11:17	
8	273°11.7	340°59.5	57.9	339°26.5	25.1	288°57.4	46.2	312°20.0	13.4					Feb 22 Tue	SHA	Mer.pass	
9	288°14.1	356°00.0	.. 57.9	354°26.9	.. 24.8	303°59.3	.. 46.0	327°22.2	.. 13.3					Venus	68°47.2	09:17	
10	303°16.6	11°00.6	57.9	9°27.4	24.5	319°01.2	45.8	342°24.4	13.3					Mars	67°18.4	09:23	
11	318°19.1	26°01.2	57.9	24°27.9	24.3	334°03.1	45.5	357°26.5	13.2					Jupiter	16°03.7	12	

DUT1 = UT1-UTC = -0.1032 sec  $\Delta T = TT-UT1 = +69.2872$  sec

2022 February 21 to Feb. 23 UT

h	Sun			Moon			
Mon	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	176°35.6	S10°38.8	307°01.7	12.5'	S07°07.3	-14.7'	57.9'
1	191°35.7	37.9	321°33.2	12.5'	07°22.0	-14.7'	58.0'
2	206°35.8	37.0	336°04.7	12.4'	07°36.7	-14.6'	58.0'
3	221°35.8	.. 36.1	350°36.2	12.4'	07°51.3	-14.6'	58.0'
4	236°35.9	35.2	5°07.5	12.3'	08°06.0	-14.6'	58.0'
5	251°36.0	34.3	19°38.9	12.3'	08°20.5	-14.6'	58.0'
6	266°36.1	S10°33.4	34°10.2	12.2'	S08°35.1	-14.5'	58.0'
7	281°36.1	32.5	48°41.4	12.2'	08°49.6	-14.5'	58.1'
8	296°36.2	31.6	63°12.5	12.1'	09°04.1	-14.4'	58.1'
9	311°36.3	.. 30.7	77°43.6	12.0'	09°18.5	-14.4'	58.1'
10	326°36.3	29.8	92°14.7	12.0'	09°32.9	-14.4'	58.1'
11	341°36.4	28.9	106°45.7	11.9'	09°47.3	-14.3'	58.1'
12	356°36.5	S10°28.0	121°16.6	11.9'	S10°01.6	-14.3'	58.1'
13	11°36.6	27.1	135°47.4	11.8'	10°15.9	-14.2'	58.2'
14	26°36.6	26.2	150°18.2	11.7'	10°30.2	-14.2'	58.2'
15	41°36.7	.. 25.2	164°49.0	11.7'	10°44.4	-14.2'	58.2'
16	56°36.8	24.3	179°19.6	11.6'	10°58.5	-14.1'	58.2'
17	71°36.9	23.4	193°50.2	11.5'	11°12.6	-14.1'	58.2'
18	86°36.9	S10°22.5	208°20.8	11.5'	S11°26.7	-14.0'	58.2'
19	101°37.0	21.6	222°51.2	11.4'	11°40.7	-14.0'	58.3'
20	116°37.1	20.7	237°21.6	11.3'	11°54.6	-13.9'	58.3'
21	131°37.2	.. 19.8	251°51.9	11.2'	12°08.5	-13.8'	58.3'
22	146°37.3	18.9	266°22.2	11.2'	12°22.4	-13.8'	58.3'
23	161°37.3	18.0	280°52.3	11.1'	12°36.2	-13.7'	58.3'
	SD = 16.2'			SD = 15.8'			

Tue	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	176°37.4	S10°17.1	295°22.5	11.0'	S12°49.9	-13.7'	58.3'
1	191°37.5	16.2	309°52.5	10.9'	13°03.6	-13.6'	58.4'
2	206°37.6	15.3	324°22.4	10.9'	13°17.2	-13.5'	58.4'
3	221°37.6	.. 14.3	338°52.3	10.8'	13°30.7	-13.5'	58.4'
4	236°37.7	13.4	353°22.1	10.7'	13°44.2	-13.4'	58.4'
5	251°37.8	12.5	7°51.8	10.6'	13°57.6	-13.4'	58.4'
6	266°37.9	S10°11.6	22°21.4	10.6'	S14°11.0	-13.3'	58.4'
7	281°38.0	10.7	36°51.0	10.5'	14°24.3	-13.2'	58.5'
8	296°38.0	09.8	51°20.5	10.4'	14°37.5	-13.1'	58.5'
9	311°38.1	.. 08.9	65°49.9	10.3'	14°50.6	-13.1'	58.5'
10	326°38.2	08.0	80°19.2	10.2'	15°03.7	-13.0'	58.5'
11	341°38.3	07.1	94°48.4	10.1'	15°16.7	-12.9'	58.5'
12	356°38.4	S10°06.1	109°17.6	10.1'	S15°29.6	-12.8'	58.5'
13	11°38.4	05.2	123°46.6	10.0'	15°42.5	-12.8'	58.6'
14	26°38.5	04.3	138°15.6	9.9'	15°55.3	-12.7'	58.6'
15	41°38.6	.. 03.4	152°44.5	9.8'	16°07.9	-12.6'	58.6'
16	56°38.7	02.5	167°13.3	9.7'	16°20.5	-12.5'	58.6'
17	71°38.8	01.6	181°42.0	9.6'	16°33.1	-12.4'	58.6'
18	86°38.8	S10°00.7	196°10.6	9.5'	S16°45.5	-12.4'	58.6'
19	101°38.9	09°59.7	210°39.1	9.4'	16°57.9	-12.3'	58.6'
20	116°39.0	58.8	225°07.5	9.3'	17°10.1	-12.2'	58.7'
21	131°39.1	.. 57.9	239°35.9	9.3'	17°22.3	-12.1'	58.7'
22	146°39.2	57.0	254°04.1	9.2'	17°34.4	-12.0'	58.7'
23	161°39.3	56.1	268°32.3	9.1'	17°46.4	-11.9'	58.7'
	SD = 16.2'			SD = 15.9'			

Wed	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	176°39.3	S09°55.2	283°00.4	9.0'	S17°58.3	-11.8'	58.7'
1	191°39.4	54.3	297°28.4	8.9'	18°10.1	-11.7'	58.7'
2	206°39.5	53.3	311°56.2	8.8'	18°21.8	-11.6'	58.8'
3	221°39.6	.. 52.4	326°24.0	8.7'	18°33.4	-11.5'	58.8'
4	236°39.7	51.5	340°51.7	8.6'	18°44.9	-11.4'	58.8'
5	251°39.8	50.6	355°19.3	8.5'	18°56.3	-11.3'	58.8'
6	266°39.9	S09°49.7	9°46.8	8.4'	S19°07.6	-11.2'	58.8'
7	281°39.9	48.7	24°14.2	8.3'	19°18.8	-11.1'	58.8'
8	296°40.0	47.8	38°41.6	8.2'	19°29.9	-11.0'	58.8'
9	311°40.1	.. 46.9	53°08.8	8.1'	19°40.9	-10.9'	58.9'
10	326°40.2	46.0	67°35.9	8.0'	19°51.7	-10.8'	58.9'
11	341°40.3	45.1	82°02.9	7.9'	20°02.5	-10.6'	58.9'
12	356°40.4	S09°44.2	96°29.9	7.8'	S20°13.1	-10.5'	58.9'
13	11°40.5	43.2	110°56.7	7.7'	20°23.7	-10.4'	58.9'
14	26°40.5	42.3	125°23.4	7.6'	20°34.1	-10.3'	58.9'
15	41°40.6	.. 41.4	139°50.1	7.5'	20°44.4	-10.2'	58.9'
16	56°40.7	40.5	154°16.6	7.4'	20°54.6	-10.1'	58.9'
17	71°40.8	39.6	168°43.1	7.3'	21°04.6	-9.9'	59.0'
18	86°40.9	S09°38.6	183°09.4	7.3'	S21°14.6	-9.8'	59.0'
19	101°41.0	37.7	197°35.7	7.2'	21°24.4	-9.7'	59.0'
20	116°41.1	36.8	212°01.8	7.1'	21°34.0	-9.6'	59.0'
21	131°41.2	.. 35.9	226°27.9	7.0'	21°43.6	-9.4'	59.0'
22	146°41.3	34.9	240°53.8	6.9'	21°53.0	-9.3'	59.0'
23	161°41.3	34.0	255°19.7	6.8'	22°02.3	-9.2'	59.0'
	SD = 16.2'			SD = 16.0'			

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

## February 24, 25, 26 UT (Thu., Fri., Sat.)

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	153°51.1	221°08.5	\$16°57.8	219°34.1	\$22°20.8	169°27.9	\$07°42.5	192°54.8	\$16°12.1	Alpheratz	357°37.5	29°12.6					
1	168°53.6	236°09.0	57.8	234°34.6	20.5	184°29.8	42.3	207°57.0	12.0	Ankaa	353°09.9	-42°11.4					
2	183°56.0	251°09.5	57.8	249°35.1	20.2	199°31.7	42.1	222°59.1	11.9	Schedar	349°34.2	56°39.5					
3	198°58.5	266°10.1	.. 57.8	264°35.6	.. 19.9	214°33.6	.. 41.9	238°01.3	.. 11.8	Diphda	348°49.9	-17°52.2					
4	214°01.0	281°10.6	57.8	279°36.1	19.7	229°35.5	41.6	253°03.5	11.7	Achernar	335°22.4	-57°07.8					
5	229°03.4	296°11.2	57.8	294°36.5	19.4	244°37.4	41.4	268°05.7	11.6	Hamal	327°54.0	23°33.9					
6	244°05.9	311°11.7	\$16°57.8	309°37.0	\$22°19.1	259°39.3	\$07°41.2	283°07.8	\$16°11.5	Polaris	315°17.5	89°21.7					
7	259°08.3	326°12.2	57.8	324°37.5	18.8	274°41.2	40.9	298°10.0	11.4	Acamar	315°13.7	-40°13.3					
8	274°10.8	341°12.8	57.8	339°38.0	18.6	289°43.1	40.7	313°12.2	11.4	Menkar	314°08.7	4°10.4					
9	289°13.3	356°13.3	.. 57.8	354°38.5	.. 18.3	304°45.0	.. 40.5	328°14.4	.. 11.3	Mirfak	308°31.7	49°56.5					
10	304°15.7	11°13.8	57.8	9°38.9	18.0	319°46.9	40.2	343°16.5	11.2	Aldebaran	290°42.3	16°33.1					
11	319°18.2	26°14.4	57.7	24°39.4	17.7	334°48.8	40.0	358°18.7	11.1	Rigel	281°06.0	-8°10.8					
12	334°20.7	41°14.9	\$16°57.7	39°39.9	\$22°17.5	349°50.7	\$07°39.8	13°20.9	\$16°11.0	Capella	280°25.2	46°01.3					
13	349°23.1	56°15.4	57.7	54°40.4	17.2	4°52.6	39.6	28°23.1	10.9	Bellatrix	278°25.3	6°22.1					
14	4°25.6	71°15.9	57.7	69°40.9	16.9	19°54.5	39.3	43°25.2	10.8	Elnath	278°04.7	28°37.6					
15	19°28.1	86°16.5	.. 57.7	84°41.3	.. 16.6	34°56.4	.. 39.1	58°27.4	.. 10.8	Alnilam	275°40.0	-1°11.4					
16	34°30.5	101°17.0	57.7	99°41.8	16.3	49°58.3	38.9	73°29.6	10.7	Betelgeuse	270°54.5	7°24.6					
17	49°33.0	116°17.5	57.7	114°42.3	16.1	65°00.2	38.6	88°31.8	10.6	Canopus	263°53.2	-52°42.7					
18	64°35.5	131°18.0	\$16°57.6	129°42.8	\$22°15.8	80°02.1	\$07°38.4	103°33.9	\$16°10.5	Sirius	258°28.1	-16°45.0					
19	79°37.9	146°18.5	57.6	144°43.3	15.5	95°04.0	38.2	118°36.1	10.4	Adhara	255°07.5	-29°00.3					
20	94°40.4	161°19.0	57.6	159°43.8	15.2	110°05.9	37.9	133°38.3	10.3	Procyon	244°53.1	5°10.0					
21	109°42.8	176°19.5	.. 57.6	174°44.2	.. 14.9	125°07.8	.. 37.7	148°40.5	.. 10.2	Pollux	243°19.9	27°58.4					
22	124°45.3	191°20.0	57.6	189°44.7	14.7	140°09.7	37.5	163°42.6	10.2	Avior	234°15.1	-59°34.9					
23	139°47.8	206°20.6	57.6	204°45.2	14.4	155°11.6	37.3	178°44.8	10.1	Suhail	222°47.6	-43°31.4					
Mer.pass. 13:42			ν 0.5' d 0.0' m -4.75	ν 0.5' d 0.3' m 1.29	ν 1.9' d 0.2' m -2.03	ν 2.2' d 0.1' m 0.80	Miaplacidus			221°37.8	-69°48.5						
Fri			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Dubhe	193°43.3	61°37.9	
0	154°50.2	221°21.1	\$16°57.5	219°45.7	\$22°14.1	170°13.5	\$07°37.0	193°47.0	\$16°10.0	Denebola	182°27.1	14°26.8					
1	169°52.7	236°21.6	57.5	234°46.2	13.8	185°15.4	36.8	208°49.2	09.9	Gienah	175°45.7	-17°39.9					
2	184°55.2	251°22.1	57.5	249°46.6	13.5	200°17.3	36.6	223°51.3	09.8	Acru	173°02.1	-63°13.1					
3	199°57.6	266°22.6	.. 57.5	264°47.1	.. 13.2	215°19.2	.. 36.3	238°53.5	.. 09.7	Gacrux	171°53.7	-57°14.1					
4	215°00.1	281°23.1	57.5	279°47.6	13.0	230°21.1	36.1	253°55.7	09.6	Alioth	166°14.6	55°50.2					
5	230°02.6	296°23.6	57.4	294°48.1	12.7	245°23.0	35.9	268°57.9	09.6	Spica	158°24.6	-11°16.6					
6	245°05.0	311°24.1	\$16°57.4	309°48.6	\$22°12.4	260°24.9	\$07°35.6	284°00.0	\$16°09.5	Alkaid	152°53.6	49°12.0					
7	260°07.5	326°24.5	57.4	324°49.1	12.1	275°26.8	35.4	299°02.2	09.4	Hadar	148°39.0	-60°28.5					
8	275°09.9	341°25.0	57.4	339°49.5	11.8	290°28.7	35.2	314°04.4	09.3	Menkent	148°00.2	-36°28.6					
9	290°12.4	356°25.5	.. 57.3	354°50.0	.. 11.5	305°30.6	.. 34.9	329°06.6	.. 09.2	Arcturus	145°49.9	19°03.9					
10	305°14.9	11°26.0	57.3	9°50.5	11.3	320°32.5	34.7	344°08.8	09.1	Rigel Kent.	139°43.2	-60°55.3					
11	320°17.3	26°26.5	57.3	24°51.0	11.0	335°34.4	34.5	359°10.9	09.0	Kochab	137°19.4	74°03.6					
12	335°19.8	41°27.0	\$16°57.3	39°51.5	\$22°10.7	350°36.3	\$07°34.3	14°13.1	\$16°08.9	Zuben'ubi	136°58.5	-16°08.0					
13	350°22.3	56°27.5	57.2	54°51.9	10.4	5°38.2	34.0	29°15.3	08.9	Alphecca	126°05.7	26°38.2					
14	5°24.7	71°27.9	57.2	69°52.4	10.1	20°40.2	33.8	44°17.5	08.8	Antares	112°18.7	-26°28.8					
15	20°27.2	86°28.4	.. 57.2	84°52.9	.. 09.8	35°42.1	.. 33.6	59°19.6	.. 08.7	Atria	107°15.2	-69°03.7					
16	35°29.7	101°28.9	57.2	99°53.4	09.5	50°44.0	33.3	74°21.8	08.6	Sabik	102°05.6	-15°45.1					
17	50°32.1	116°29.4	57.1	114°53.9	09.2	65°45.9	33.1	89°24.0	08.5	Shaula	96°13.7	-37°07.1					
18	65°34.6	131°29.8	\$16°57.1	129°54.4	\$22°09.0	80°47.8	\$07°32.9	104°26.2	\$16°08.4	Rasalhague	96°00.8	12°32.5					
19	80°37.1	146°30.3	57.1	144°54.8	08.7	95°49.7	32.6	119°28.3	08.3	Eltanin	90°43.5	51°28.8					
20	95°39.5	161°30.8	57.0	159°55.3	08.4	110°51.6	32.4	134°30.5	08.3	Kaus Aust.	83°35.8	-34°22.4					
21	110°42.0	176°31.3	.. 57.0	174°55.8	.. 08.1	125°53.5	.. 32.2	149°32.7	.. 08.2	Vega	80°35.0	38°48.0					
22	125°44.4	191°31.7	57.0	189°56.3	07.8	140°55.4	32.0	164°34.9	08.1	Nunki	75°50.9	-26°16.1					
23	140°46.9	206°32.2	56.9	204°56.8	07.5	155°57.3	31.7	179°37.0	08.0	Altair	62°02.5	8°55.4					
Mer.pass. 13:38			ν 0.5' d 0.0' m -4.74	ν 0.5' d 0.3' m 1.28	ν 1.9' d 0.2' m -2.03	ν 2.2' d 0.1' m 0.80	Peacock			53°10.0	-56°39.8						
Sat			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Fomalhaut	15°17.5	-29°30.4	
0	155°49.4	221°32.6	\$16°56.9	219°57.3	\$22°07.2	170°59.2	\$07°31.5	194°39.2	\$16°07.9	Scheat	13°47.8	28°12.0					
1	170°51.8	236°33.1	56.9	234°57.7	06.9	186°01.1	31.3	209°41.4	07.8	Markab	13°32.6	15°19.3					
2	185°54.3	251°33.6	56.8	249°58.2	06.6	201°03.0	31.0	224°43.6	07.7	Feb 24 Thu			Feb 24 Thu	SHA	Mer.pass		
3	200°56.8	266°34.0	.. 56.8	264°58.7	.. 06.3	216°04.9	.. 30.8	239°45.7	.. 07.7	Venus	67°17.4	09:15					
4	215°59.2	281°34.5	56.8	279°59.2	06.0	231°06.8	30.6	254°47.9	07.6	Mars	65°43.0	09:21					
5	231°01.7	296°34.9	56.7	294°59.7	05.7	246°08.7	30.3	269°50.1	07.5	Jupiter	15°36.8	12:41					
6	246°04.2	311°35.4	\$16°56.7	310°00.2	\$22°05.5	261°10.6	\$07°30.1	284°52.3	\$16°07.4	Saturn	39°03.7	11:07					
7	261°06.6	326°35.8	56.7	325°00.6	05.2	276°12.5	29.9	299°54.5	07.3	Feb 25 Fri			Feb 25 Fri	SHA	Mer.pass		
8	276°09.1	341°36.3	56.6	340°01.1	04.9	291°14.4	29.6	314°56.6	07.2	Venus	66°30.8	09:14					
9	291°11.6	356°36.7	.. 56.6	355°01.6	.. 04.6	306°16.3	.. 29.4	329°58.8	.. 07.1	Mars	64°55.4	09:21					
10	306°14.0	11°37.2	56.5	10°02.1	04.3	321°18.2	29.2	345°01.0	07.1	Jupiter	15°23.3	12:37					
11	321°16.5	26°37.6	56.5	25°02.6	04.0	336°20.1	29.0	0°03.2	07.0	Saturn	38°56.8	11:03					
12	336°18.9	41°38.1	\$16°56.5	40°03.1	\$22°03.7	351°22.0	\$07°28.7	15°05.3	\$16°06.9	Feb 26 Sat			Feb 26 Sat	SHA	Mer.pass		
13	351°21.4	56°38.5	56.4	55°03.6	03.4	6°23.9	28.5	30°07.5	06.8	Venus	65°43.3	09:14					
14	6°23.9	71°39.0	56.4	70°04.0	03.1	21°25.8	28.3	45°09.7	06.7	Mars	64°07.9	09:20					
15	21°26.3	86°39.4	.. 56.3	85°04.5	.. 02.8	36°27.7	28.0	60°11.9	.. 06.6	Jupiter	15°09.8	12:34					
16	36°28.8	101°39.8	56.3	100°05.0	02.5	51°29.6	27.8	75°14.0	06.5	Saturn	38°49.8	11:00					
17	51°31.3	116°40.3	56.2	115°05.5	02.2	66°31.5	27.6	90°16.2	06.5	Horizontal parallax			Horizontal parallax	Venus:	0.3		
18	66°33.7	131°40.7	\$16°56.2	130°06.0	\$22°01.9	81°33.4	\$07°27.3	105°18.4	\$16°06.4	Mars:							

DUT1 = UT1-UTC = -0.1037 sec  $\Delta T = TT-UT1 = +69.2877$  sec

2022 February 24 to Feb. 26 UT

h	Sun			Moon			
Thu	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	176°41.4	S09°33.1	269°45.5	6.7'	S22°11.5	-9.0'	59.0'
1	191°41.5	32.2	284°11.2	6.6'	22°20.5	-8.9'	59.1'
2	206°41.6	31.3	298°36.7	6.5'	22°29.4	-8.8'	59.1'
3	221°41.7	30.3	313°02.2	6.4'	22°38.2	-8.6'	59.1'
4	236°41.8	29.4	327°27.6	6.3'	22°46.8	-8.5'	59.1'
5	251°41.9	28.5	341°52.9	6.2'	22°55.3	-8.3'	59.1'
6	266°42.0	S09°27.6	356°18.1	6.1'	S23°03.6	-8.2'	59.1'
7	281°42.1	26.6	10°43.2	6.0'	23°11.8	-8.1'	59.1'
8	296°42.2	25.7	25°08.3	5.9'	23°19.9	-7.9'	59.1'
9	311°42.3	24.8	39°33.2	5.8'	23°27.8	-7.8'	59.2'
10	326°42.3	23.9	53°58.1	5.8'	23°35.6	-7.6'	59.2'
11	341°42.4	22.9	68°22.8	5.7'	23°43.2	-7.5'	59.2'
12	356°42.5	S09°22.0	82°47.5	5.6'	S23°50.7	-7.3'	59.2'
13	11°42.6	21.1	97°12.1	5.5'	23°58.0	-7.2'	59.2'
14	26°42.7	20.2	111°36.6	5.4'	24°05.1	-7.0'	59.2'
15	41°42.8	19.2	126°01.0	5.3'	24°12.1	-6.9'	59.2'
16	56°42.9	18.3	140°25.3	5.2'	24°19.0	-6.7'	59.2'
17	71°43.0	17.4	154°49.6	5.2'	24°25.7	-6.5'	59.2'
18	86°43.1	S09°16.5	169°13.7	5.1'	S24°32.2	-6.4'	59.3'
19	101°43.2	15.5	183°37.8	5.0'	24°38.6	-6.2'	59.3'
20	116°43.3	14.6	198°01.8	4.9'	24°44.8	-6.1'	59.3'
21	131°43.4	13.7	212°25.8	4.9'	24°50.9	-5.9'	59.3'
22	146°43.5	12.8	226°49.6	4.8'	24°56.8	-5.7'	59.3'
23	161°43.6	11.8	241°13.4	4.7'	25°02.5	-5.6'	59.3'
	SD = 16.2'			SD = 16.1'			
Fri	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	176°43.7	S09°10.9	255°37.1	4.6'	S25°08.1	-5.4'	59.3'
1	191°43.8	10.0	270°00.7	4.6'	25°13.5	-5.2'	59.3'
2	206°43.9	09.0	284°24.3	4.5'	25°18.7	-5.1'	59.3'
3	221°44.0	08.1	298°47.8	4.4'	25°23.8	-4.9'	59.3'
4	236°44.1	07.2	313°11.2	4.4'	25°28.7	-4.7'	59.3'
5	251°44.2	06.3	327°34.6	4.3'	25°33.4	-4.5'	59.4'
6	266°44.2	S09°05.3	341°57.9	4.2'	S25°37.9	-4.4'	59.4'
7	281°44.3	04.4	356°21.1	4.2'	25°42.3	-4.2'	59.4'
8	296°44.4	03.5	10°44.3	4.1'	25°46.5	-4.0'	59.4'
9	311°44.5	02.5	25°07.4	4.1'	25°50.5	-3.9'	59.4'
10	326°44.6	01.6	39°30.5	4.0'	25°54.4	-3.7'	59.4'
11	341°44.7	00°07.7	53°53.5	4.0'	25°58.1	-3.5'	59.4'
12	356°44.8	S08°59.7	68°16.4	3.9'	S26°01.6	-3.3'	59.4'
13	11°44.9	58.8	82°39.3	3.9'	26°04.9	-3.1'	59.4'
14	26°45.0	57.9	97°02.2	3.8'	26°08.0	-3.0'	59.4'
15	41°45.1	56.9	111°25.0	3.8'	26°11.0	-2.8'	59.4'
16	56°45.2	56.0	125°47.8	3.7'	26°13.8	-2.6'	59.4'
17	71°45.3	55.1	140°10.5	3.7'	26°16.4	-2.4'	59.4'
18	86°45.4	S08°54.1	154°33.2	3.7'	S26°18.8	-2.2'	59.5'
19	101°45.5	53.2	168°55.9	3.6'	26°21.0	-2.1'	59.5'
20	116°45.6	52.3	183°18.5	3.6'	26°23.1	-1.9'	59.5'
21	131°45.7	51.3	197°41.1	3.6'	26°24.9	-1.7'	59.5'
22	146°45.8	50.4	212°03.6	3.5'	26°26.6	-1.5'	59.5'
23	161°45.9	49.5	226°26.1	3.5'	26°28.1	-1.3'	59.5'
	SD = 16.2'			SD = 16.2'			
Sat	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	176°46.0	S08°48.5	240°48.6	3.5'	S26°29.4	-1.1'	59.5'
1	191°46.1	47.6	255°11.1	3.5'	26°30.5	-0.9'	59.5'
2	206°46.2	46.7	269°33.6	3.4'	26°31.5	-0.8'	59.5'
3	221°46.3	45.7	283°56.0	3.4'	26°32.2	-0.6'	59.5'
4	236°46.5	44.8	298°18.4	3.4'	26°32.8	-0.4'	59.5'
5	251°46.6	43.9	312°40.8	3.4'	26°33.2	-0.2'	59.5'
6	266°46.7	S08°42.9	327°03.2	3.4'	S26°33.4	-0.0'	59.5'
7	281°46.8	42.0	341°25.6	3.4'	26°33.4	0.2'	59.5'
8	296°46.9	41.1	355°48.0	3.4'	26°33.2	0.4'	59.5'
9	311°47.0	40.1	10°10.3	3.4'	26°32.8	0.6'	59.5'
10	326°47.1	39.2	24°32.7	3.4'	26°32.3	0.7'	59.5'
11	341°47.2	38.3	38°55.1	3.4'	26°31.5	0.9'	59.5'
12	356°47.3	S08°37.3	53°17.5	3.4'	S26°30.6	1.1'	59.5'
13	11°47.4	36.4	67°39.8	3.4'	26°29.5	1.3'	59.5'
14	26°47.5	35.5	82°02.2	3.4'	26°28.2	1.5'	59.5'
15	41°47.6	34.5	96°24.6	3.4'	26°26.7	1.7'	59.5'
16	56°47.7	33.6	110°47.0	3.4'	26°25.0	1.9'	59.5'
17	71°47.8	32.6	125°09.5	3.4'	26°23.2	2.0'	59.5'
18	86°47.9	S08°31.7	139°31.9	3.5'	S26°21.1	2.2'	59.5'
19	101°48.0	30.8	153°54.4	3.5'	26°18.9	2.4'	59.5'
20	116°48.1	29.8	168°16.9	3.5'	26°16.5	2.6'	59.5'
21	131°48.2	28.9	182°39.4	3.5'	26°13.9	2.8'	59.5'
22	146°48.3	27.9	197°01.9	3.6'	26°11.1	3.0'	59.5'
23	161°48.4	27.0	211°24.5	3.6'	26°08.1	3.2'	59.5'
	SD = 16.1'			SD = 16.2'			

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

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

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	156°48.5	221°43.3	\$16°55.9	220°08.9	\$22°00.1	171°44.8	\$07°26.0	195°31.5	\$16°05.9					Alpheratz	357°37.5	29°12.6	
1	171°51.0	236°43.7	55.9	235°09.4	21°59.8	186°46.7	25.7	210°33.6	05.8					Ankaa	353°09.9	-42°11.4	
2	186°53.4	251°44.1	55.8	250°09.9	59.5	201°48.6	25.5	225°35.8	05.7					Schedar	349°34.2	56°39.5	
3	201°55.9	266°44.5	.. 55.8	265°10.4	.. 59.2	216°50.5	.. 25.3	240°38.0	.. 05.6					Diphda	348°49.9	-17°52.2	
4	216°58.4	281°45.0	55.7	280°10.8	58.9	231°52.4	25.0	255°40.2	05.5					Achernar	335°22.4	-57°07.8	
5	232°00.8	296°45.4	55.7	295°11.3	58.6	246°54.3	24.8	270°42.4	05.4					Hamal	327°54.0	23°33.9	
6	247°03.3	311°45.8	\$16°55.6	310°11.8	\$21°58.3	261°56.2	\$07°24.6	285°44.5	\$16°05.3					Polaris	315°18.8	89°21.7	
7	262°05.8	326°46.2	55.6	325°12.3	58.0	276°58.1	24.3	300°46.7	05.3					Acamar	315°13.7	-40°13.3	
8	277°08.2	341°46.6	55.5	340°12.8	57.7	292°00.0	24.1	315°48.9	05.2					Menkar	314°08.7	4°10.4	
9	292°10.7	356°47.0	.. 55.4	355°13.3	.. 57.4	307°01.9	.. 23.9	330°51.1	.. 05.1					Mirfak	308°31.7	49°56.5	
10	307°13.2	11°47.4	55.4	10°13.8	57.1	322°03.8	23.6	345°53.2	05.0					Aldebaran	290°42.3	16°33.1	
11	322°15.6	26°47.8	55.3	25°14.2	56.8	337°05.7	23.4	0°55.4	04.9					Rigel	281°06.1	-8°10.8	
12	337°18.1	41°48.2	\$16°55.3	40°14.7	\$21°56.5	352°07.6	\$07°23.2	15°57.6	\$16°04.8					Capella	280°25.3	46°01.3	
13	352°20.6	56°48.6	55.2	55°15.2	56.1	7°09.5	22.9	30°59.8	04.7					Bellatrix	278°25.3	6°22.1	
14	7°23.0	71°49.0	55.2	70°15.7	55.8	22°11.4	22.7	46°02.0	04.7					Elnath	278°04.7	28°37.6	
15	22°25.5	86°49.4	.. 55.1	85°16.2	.. 55.5	37°13.3	.. 22.5	61°04.1	.. 04.6					Alnilam	275°40.0	-1°11.4	
16	37°27.9	101°49.8	55.0	100°16.7	55.2	52°15.2	22.3	76°06.3	04.5					Betelgeuse	270°54.5	7°24.6	
17	52°30.4	116°50.2	55.0	115°17.2	54.9	67°17.1	22.0	91°08.5	04.4					Canopus	263°53.2	-52°42.7	
18	67°32.9	131°50.6	\$16°54.9	130°17.7	\$21°54.6	82°19.0	\$07°21.8	106°10.7	\$16°04.3					Sirius	258°28.1	-16°45.0	
19	82°35.3	146°51.0	54.9	145°18.1	54.3	97°20.9	21.6	121°12.8	04.2					Adhara	255°07.5	-29°00.3	
20	97°37.8	161°51.4	54.8	160°18.6	54.0	112°22.8	21.3	136°15.0	04.1					Procyon	244°53.1	5°10.0	
21	112°40.3	176°51.8	.. 54.7	175°19.1	.. 53.7	127°24.7	.. 21.1	151°17.2	.. 04.1					Pollux	243°19.9	27°58.4	
22	127°42.7	191°52.2	54.7	190°19.6	53.4	142°26.6	20.9	166°19.4	04.0					Avior	234°15.1	-59°35.0	
23	142°45.2	206°52.6	54.6	205°20.1	53.1	157°28.5	20.6	181°21.6	03.9					Suhail	222°47.6	-43°31.4	
Mer.pass. 13:31			ν 0.4' d 0.0' m -4.71	ν 0.5' d 0.3' m 1.27	ν 1.9' d 0.2' m -2.03	ν 2.2' d 0.1' m 0.80								Alplacidus	221°37.8	-69°48.5	
														Alphard	217°49.7	-8°45.4	
														Regulus	207°36.6	11°51.5	
														Dubhe	193°43.3	61°37.9	
														Denebola	182°27.0	14°26.8	
														Gienah	175°45.7	-17°39.9	
														Acrux	173°02.1	-63°13.1	
														Gacrux	171°53.7	-57°14.1	
														Alioth	166°14.6	55°50.2	
														Spica	158°24.5	-11°16.6	
														Alkaid	152°53.6	49°12.0	
														Hadar	148°38.9	-60°28.5	
														Menkent	148°00.1	-36°28.6	
														Arcturus	145°49.9	19°03.9	
														Rigel Kent	139°43.2	-60°55.3	
														Kochab	137°19.3	74°03.6	
														Zuben'ubि	136°58.5	-16°08.0	
														Alphecca	126°05.7	26°38.2	
														Antares	112°18.7	-26°28.8	
														Atria	107°15.1	-69°03.7	
														Sabik	102°05.5	-15°45.1	
														Shaula	96°13.7	-37°07.1	
														Rasalhague	96°00.8	12°32.5	
														Eltanin	90°43.5	51°28.8	
														Kaus Aust.	83°35.8	-34°22.4	
														Vega	80°35.0	38°48.0	
														Nunki	75°50.9	-26°16.1	
														Altair	62°02.5	8°55.4	
														Peacock	53°09.9	-56°39.8	
														Deneb	49°27.8	45°21.3	
														Enif	33°41.4	9°58.4	
														Al Na'ir	27°36.3	-46°51.4	
														Fomalhaut	15°17.5	-29°30.5	
														Scheat	13°47.8	28°12.0	
														Markab	13°32.5	15°19.3	
Feb 27 Sun																	
														Venus	64°54.8	09:13	
														Mars	63°20.4	09:19	
														Jupiter	14°56.3	12:31	
														Saturn	38°42.9	10:56	
Feb 28 Mon																	
														Venus	64°05.3	09:12	
														Mars	62°32.9	09:18	
														Jupiter	14°42.8	12:28	
														Saturn	38°36.1	10:53	
Mar 01 Tue																	
														Venus	63°15.0	09:12	
														Mars	61°45.5	09:18	
														Jupiter	14°29.3	12:25	
														Saturn	38°29.2	10:49	
Horizontal parallax																	
														Venus:	0.3		
														Mars:	0.1		

DUT1 = UT1-UTC = -0.1026 sec  $\Delta T = TT-UT1 = +69.2866$  sec

2022 February 27 to Mar. 01 UT

h		Sun		Moon			
Sun	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	176°48.6	S08°26.1	225°47.1	3.6'	S26°04.9	3.3'	59.5'
1	191°48.7	25.1	240°09.7	3.7'	26°01.6	3.5'	59.5'
2	206°48.8	24.2	254°32.4	3.7'	25°58.1	3.7'	59.5'
3	221°48.9	23.2	268°55.1	3.8'	25°54.4	3.9'	59.5'
4	236°49.0	22.3	283°17.9	3.8'	25°50.5	4.1'	59.5'
5	251°49.1	21.4	297°40.7	3.8'	25°46.4	4.2'	59.5'
6	266°49.2	S08°20.4	312°03.5	3.9'	S25°42.2	4.4'	59.5'
7	281°49.3	19.5	326°26.4	3.9'	25°37.8	4.6'	59.5'
8	296°49.4	18.5	340°49.4	4.0'	25°33.2	4.8'	59.5'
9	311°49.5	17.6	355°12.4	4.0'	25°28.4	5.0'	59.5'
10	326°49.6	16.7	9°35.4	4.1'	25°23.4	5.1'	59.5'
11	341°49.7	15.7	23°58.5	4.2'	25°18.3	5.3'	59.5'
12	356°49.9	S08°14.8	38°21.7	4.2'	S25°13.0	5.5'	59.5'
13	11°50.0	13.8	52°44.9	4.3'	25°07.5	5.6'	59.5'
14	26°50.1	12.9	67°08.2	4.3'	25°01.9	5.8'	59.5'
15	41°50.2	12.0	81°31.5	4.4'	24°56.1	6.0'	59.5'
16	56°50.3	11.0	95°54.9	4.5'	24°50.1	6.2'	59.5'
17	71°50.4	10.1	110°18.4	4.5'	24°43.9	6.3'	59.5'
18	86°50.5	S08°09.1	124°42.0	4.6'	S24°37.6	6.5'	59.5'
19	101°50.6	08.2	139°05.6	4.7'	24°31.1	6.7'	59.5'
20	116°50.7	07.2	153°29.3	4.8'	24°24.6	6.8'	59.5'
21	131°50.9	06.3	167°53.0	4.8'	24°17.6	7.0'	59.5'
22	146°51.0	05.3	182°16.9	4.9'	24°10.7	7.1'	59.5'
23	161°51.1	04.4	196°40.8	5.0'	24°03.5	7.3'	59.5'
		SD = 16.1'	d = 0.9'	SD = 16.2'			
		SD = 16.2'					
Mon	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	176°51.2	S08°03.5	211°04.8	5.1'	S23°56.2	7.5'	59.5'
1	191°51.3	02.5	225°28.9	5.2'	23°48.8	7.6'	59.5'
2	206°51.4	01.6	239°53.0	5.2'	23°41.1	7.8'	59.4'
3	221°51.5	08°00.6	254°17.3	5.3'	23°33.4	7.9'	59.4'
4	236°51.6	07°59.7	268°41.6	5.4'	23°25.4	8.1'	59.4'
5	251°51.8	58.7	283°06.0	5.5'	23°17.4	8.2'	59.4'
6	266°51.9	S07°57.8	297°30.5	5.6'	S23°09.1	8.4'	59.4'
7	281°52.0	56.8	311°55.1	5.7'	23°00.7	8.5'	59.4'
8	296°52.1	55.9	326°19.7	5.8'	22°52.2	8.7'	59.4'
9	311°52.2	55.0	340°44.5	5.8'	22°43.5	8.8'	59.4'
10	326°52.3	54.0	355°09.3	5.9'	22°34.7	9.0'	59.4'
11	341°52.4	53.1	9°34.3	6.0'	22°25.8	9.1'	59.4'
12	356°52.6	S07°52.1	23°59.3	6.1'	S22°16.6	9.2'	59.4'
13	11°52.7	51.2	38°24.4	6.2'	22°07.4	9.4'	59.3'
14	26°52.8	50.2	52°49.6	6.3'	21°58.0	9.5'	59.3'
15	41°52.9	49.3	67°14.9	6.4'	21°48.5	9.7'	59.3'
16	56°53.0	48.3	81°40.3	6.5'	21°38.8	9.8'	59.3'
17	71°53.1	47.4	96°05.8	6.6'	21°29.0	9.9'	59.3'
18	86°53.3	S07°46.4	110°31.4	6.7'	S21°19.1	10.1'	59.3'
19	101°53.4	45.5	124°57.1	6.8'	21°09.1	10.2'	59.3'
20	116°53.5	44.5	139°22.9	6.9'	20°58.9	10.3'	59.3'
21	131°53.6	43.6	153°48.8	7.0'	20°48.6	10.4'	59.2'
22	146°53.7	42.6	168°14.8	7.1'	20°38.1	10.6'	59.2'
23	161°53.8	41.7	182°40.8	7.2'	20°27.6	10.7'	59.2'
		SD = 16.1'	d = 0.9'	SD = 16.2'			
		SD = 16.2'					
Tue	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	176°54.0	S07°40.7	197°07.0	7.3'	S20°16.9	10.8'	59.2'
1	191°54.1	39.8	211°33.3	7.4'	20°06.1	10.9'	59.2'
2	206°54.2	38.8	225°59.7	7.5'	19°55.2	11.0'	59.2'
3	221°54.3	37.9	240°26.2	7.6'	19°44.1	11.2'	59.2'
4	236°54.4	36.9	254°52.7	7.7'	19°33.0	11.3'	59.2'
5	251°54.6	36.0	269°19.4	7.8'	19°21.7	11.4'	59.1'
6	266°54.7	S07°35.0	283°46.2	7.9'	S19°10.3	11.5'	59.1'
7	281°54.8	34.1	298°13.1	8.0'	18°58.8	11.6'	59.1'
8	296°54.9	33.1	312°40.0	8.1'	18°47.2	11.7'	59.1'
9	311°55.0	32.2	327°07.1	8.2'	18°35.5	11.8'	59.1'
10	326°55.2	31.2	341°34.3	8.3'	18°23.7	11.9'	59.1'
11	341°55.3	30.3	356°01.6	8.4'	18°11.8	12.0'	59.0'
12	356°55.4	S07°29.3	10°28.9	8.5'	S17°59.8	12.1'	59.0'
13	11°55.5	28.4	24°56.4	8.6'	17°47.7	12.2'	59.0'
14	26°55.6	27.4	39°24.0	8.7'	17°35.5	12.3'	59.0'
15	41°55.8	26.5	53°51.6	8.8'	17°23.2	12.4'	59.0'
16	56°55.9	25.5	68°19.4	8.9'	17°10.8	12.5'	58.9'
17	71°56.0	24.6	82°47.3	9.0'	16°58.3	12.6'	58.9'
18	86°56.1	S07°23.6	97°15.2	9.1'	S16°45.8	12.7'	58.9'
19	101°56.3	22.7	111°43.3	9.2'	16°33.1	12.7'	58.9'
20	116°56.4	21.7	126°11.5	9.3'	16°20.4	12.8'	58.9'
21	131°56.5	20.8	140°39.7	9.4'	16°07.5	12.9'	58.9'
22	146°56.6	19.8	155°08.1	9.4'	15°54.6	13.0'	58.8'
23	161°56.7	18.9	169°36.5	9.5'	15°41.6	13.1'	58.8'
		SD = 16.1'	d = 0.9'	SD = 16.1'			
		SD = 16.1'					

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

**March 02, 03, 04 UT (Wed., Thu., Fri.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	159°45.9	222°09.8	\$16°50.7	220°44.1	S21°37.4	174°01.7	S07°09.3	198°08.4	\$15°59.7					Alpheratz	357°37.5	29°12.6	
1	174°48.4	237°10.1	50.6	235°44.6	37.1	189°03.6	09.1	213°10.6	59.6					Ankaa	353°09.9	-42°11.4	
2	189°50.9	252°10.4	50.5	250°45.1	36.8	204°05.5	08.8	228°12.7	59.5					Schedar	349°34.2	56°39.5	
3	204°53.3	267°10.7	.. 50.4	265°45.6	.. 36.4	219°07.4	.. 08.6	243°14.9	.. 59.5					Diphda	348°49.9	-17°52.2	
4	219°55.8	282°11.1	50.3	280°46.1	36.1	234°09.3	08.4	258°17.1	59.4					Achnera	335°22.4	-57°07.8	
5	234°58.3	297°11.4	50.2	295°46.6	35.8	249°11.2	08.1	273°19.3	59.3					Hamal	327°54.0	23°33.9	
6	250°00.7	312°11.7	\$16°50.1	310°47.1	S21°35.4	264°13.1	S07°07.9	288°21.5	\$15°59.2					Polaris	315°20.3	89°21.7	
7	265°03.2	327°12.0	50.0	325°47.5	35.1	279°15.0	07.7	303°23.6	59.1					Acamar	315°13.7	-40°13.3	
8	280°05.6	342°12.3	49.9	340°48.0	34.8	294°16.9	07.4	318°25.8	59.0					Menkar	314°08.7	4°10.4	
9	295°08.1	357°12.6	.. 49.8	355°48.5	.. 34.4	309°18.8	.. 07.2	333°28.0	.. 58.9					Mirfak	308°31.8	49°56.5	
10	310°10.6	12°12.9	49.7	10°49.0	34.1	324°20.7	07.0	348°30.2	58.9					Aldebaran	290°42.3	16°33.1	
11	325°13.0	27°13.2	49.6	25°49.5	33.8	339°22.6	06.7	3°32.4	58.8					Rigel	281°06.1	-8°10.8	
12	340°15.5	42°13.5	\$16°49.5	40°50.0	S21°33.4	354°24.5	S07°06.5	18°34.5	\$15°58.7					Capella	280°25.3	46°01.3	
13	355°18.0	57°13.8	49.4	55°50.5	33.1	9°26.4	06.3	33°36.7	58.6					Bellatrix	278°25.3	6°22.1	
14	10°20.4	72°14.1	49.3	70°51.0	32.8	24°28.3	06.0	48°38.9	58.5					Elnath	278°04.8	28°37.6	
15	25°22.9	87°14.4	.. 49.2	85°51.5	.. 32.4	39°30.2	.. 05.8	63°41.1	.. 58.4					Alnilam	275°40.0	-1°11.4	
16	40°25.4	102°14.7	49.0	100°52.0	32.1	54°32.1	05.6	78°43.3	58.4					Betelgeuse	270°54.5	7°24.6	
17	55°27.8	117°15.0	48.9	115°52.5	31.8	69°34.0	05.3	93°45.5	58.3					Canopus	263°53.2	-52°42.7	
18	70°30.3	132°15.3	\$16°48.8	130°53.0	S21°31.4	84°35.9	S07°05.1	108°47.6	\$15°58.2					Sirius	258°28.1	-16°45.0	
19	85°32.8	147°15.6	48.7	145°53.5	31.1	99°37.8	04.9	123°49.8	58.1					Adhara	255°07.5	-29°00.3	
20	100°35.2	162°15.9	48.6	160°54.0	30.8	114°39.7	04.7	138°52.0	58.0					Procyon	244°53.1	5°10.0	
21	115°37.7	177°16.1	.. 48.5	175°54.5	.. 30.4	129°41.6	.. 04.4	153°54.2	.. 57.9					Pollux	243°19.9	27°58.4	
22	130°40.1	192°16.4	48.4	190°55.0	30.1	144°43.5	04.2	168°56.4	57.8					Avior	234°15.1	-59°35.0	
23	145°42.6	207°16.7	48.3	205°55.5	29.7	159°45.4	04.0	183°58.6	57.8					Suhail	222°47.6	-43°31.4	
Mer.pass. 13:19			ν 0.3° d 0.1' m -4.68	ν 0.5° d 0.3' m 1.25	ν 1.9° d 0.2' m -2.03	ν 2.2° d 0.1' m 0.81											
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	160°45.1	222°17.0	\$16°48.2	220°55.9	S21°29.4	174°47.3	S07°03.7	199°00.7	\$15°57.7					Denebola	182°27.0	14°26.8	
1	175°47.5	237°17.3	48.0	235°56.4	29.1	189°49.2	03.5	214°02.9	57.6					Gienah	175°45.7	-17°39.9	
2	190°50.0	252°17.6	47.9	250°56.9	28.7	204°51.1	03.3	229°05.1	57.5					Acrux	173°02.1	-63°13.2	
3	205°52.5	267°17.9	.. 47.8	265°57.4	.. 28.4	219°53.0	.. 03.0	244°07.3	.. 57.4					Gacrux	171°53.7	-57°14.1	
4	220°54.9	282°18.1	47.7	280°57.9	28.1	234°54.9	02.8	259°09.5	57.3					Alioth	166°14.6	55°50.2	
5	235°57.4	297°18.4	47.6	295°58.4	27.7	249°56.8	02.6	274°11.6	57.3					Spica	158°24.5	-11°16.6	
6	250°59.9	312°18.7	\$16°47.5	310°58.9	S21°27.4	264°58.7	S07°02.3	289°13.8	\$15°57.2					Alkaid	152°53.5	49°12.0	
7	266°02.3	327°19.0	47.3	325°59.4	27.0	280°00.6	02.1	304°16.0	57.1					Hadar	148°38.9	-60°28.6	
8	281°04.8	342°19.2	47.2	340°59.9	26.7	295°02.5	01.9	319°18.2	57.0					Menkent	148°00.1	-36°28.6	
9	296°07.2	357°19.5	.. 47.1	356°00.4	.. 26.4	310°04.4	.. 01.6	334°20.4	.. 56.9					Arcturus	145°49.9	19°03.9	
10	311°09.7	12°19.8	47.0	11°00.9	26.0	325°06.3	01.4	349°22.6	56.8					Rigel Kent.	139°43.2	-60°55.3	
11	326°12.2	27°20.1	46.9	26°01.4	25.7	340°08.2	01.2	4°24.7	56.7					Kochab	137°19.3	74°03.6	
12	341°14.6	42°20.3	\$16°46.7	41°01.9	S21°25.3	355°10.1	S07°00.9	19°26.9	\$15°56.7					Zuben'ubi	136°58.5	-16°08.0	
13	356°17.1	57°20.6	46.6	56°02.4	25.0	10°12.0	00.7	34°29.1	56.6					Alphecca	126°05.6	26°38.2	
14	11°19.6	72°20.9	46.5	71°02.9	24.6	25°13.9	00.5	49°31.3	56.5					Antares	112°18.7	-26°28.8	
15	26°22.0	87°21.1	.. 46.4	86°03.4	.. 24.3	40°15.8	.. 00.2	64°33.5	.. 56.4					Atria	107°15.1	-69°03.7	
16	41°24.5	102°21.4	46.2	101°03.9	24.0	55°17.7	07°00.0	79°35.7	56.3					Sabik	102°05.5	-15°45.1	
17	56°27.0	117°21.7	46.1	116°04.4	23.6	70°19.6	06°59.8	94°37.8	56.2					Shaula	96°13.6	-37°07.1	
18	71°29.4	132°21.9	\$16°46.0	131°04.9	S21°23.3	85°21.5	S06°59.5	109°40.0	\$15°56.2					Rasalhague	96°00.8	12°32.4	
19	86°31.9	147°22.2	45.9	146°05.4	22.9	100°23.4	59.3	124°42.2	56.1					Eltanin	90°43.4	51°28.8	
20	101°34.4	162°22.4	45.7	161°05.9	22.6	115°25.3	59.1	139°44.4	56.0					Kaus Aust.	83°35.8	-34°22.4	
21	116°36.8	177°22.7	.. 45.6	176°06.4	.. 22.2	130°27.2	.. 58.9	154°46.6	.. 55.9					Vega	80°35.0	38°47.9	
22	131°39.3	192°23.0	45.5	191°06.9	21.9	145°29.1	58.6	169°48.8	55.8					Nunki	75°50.9	-26°16.1	
23	146°41.7	207°23.2	45.4	206°07.4	21.5	160°31.0	58.4	184°50.9	55.7					Altair	62°02.5	8°55.4	
Mer.pass. 13:15			ν 0.3° d 0.1' m -4.67	ν 0.5° d 0.3' m 1.25	ν 1.9° d 0.2' m -2.03	ν 2.2° d 0.1' m 0.81									Peacock	53°09.9	-56°39.8
														Deneb	49°27.8	45°21.3	
														Enif	33°41.4	9°58.4	
														Al Na'ir	27°36.3	-46°51.3	
														Fomalhaut	15°17.5	-29°30.5	
														Scheat	13°47.8	28°12.0	
														Markab	13°32.5	15°19.3	
Mar 02	Wed	SHA	Mer.pass														
	Venus	62°23.9	09:11														
	Mars	60°58.2	09:17														
	Jupiter	14°15.8	12:22														
	Saturn	38°22.4	10:46														
Mar 03	Thu	SHA	Mer.pass														
	Venus	61°31.9	09:11														
	Mars	60°10.9	09:16														
	Jupiter	14°02.2	12:19														
	Saturn	38°15.7	10:42														
Mar 04	Fri	SHA	Mer.pass														
	Venus	60°39.3	09:10														
	Mars	59°23.6	09:15														
	Jupiter	13°48.7	12:16														
	Saturn	38°08.9	10:39														
Horizontal parallax															Venus:	0.3	
															Mars:	0.1	

DUT1 = UT1-UTC = -0.1022 sec  $\Delta T = TT-UT1 = +69.2862$  sec

2022 March 02 to Mar. 04 UT

h		Sun		Moon			
Wed	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	176°56.9	S07°17.9	184°05.1	9.6'	S15°28.6	13.2'	58.8'
1	191°57.0	16.9	198°33.7	9.7'	15°15.4	13.2'	58.8'
2	206°57.1	16.0	213°02.4	9.8'	15°02.2	13.3'	58.8'
3	221°57.2	15.0	227°31.2	9.9'	14°48.9	13.4'	58.7'
4	236°57.4	14.1	242°00.2	10.0'	14°35.5	13.4'	58.7'
5	251°57.5	13.1	256°29.2	10.1'	14°22.1	13.5'	58.7'
6	266°57.6	S07°12.2	270°58.3	10.2'	S14°08.5	13.6'	58.7'
7	281°57.7	11.2	285°27.5	10.3'	13°55.0	13.6'	58.6'
8	296°57.9	10.3	299°56.7	10.4'	13°41.3	13.7'	58.6'
9	311°58.0	09.3	314°26.1	10.5'	13°27.6	13.8'	58.6'
10	326°58.1	08.3	328°55.6	10.5'	13°13.8	13.8'	58.6'
11	341°58.2	07.4	343°25.1	10.6'	13°00.0	13.9'	58.6'
12	356°58.4	S07°06.4	357°54.8	10.7'	S12°46.1	13.9'	58.5'
13	11°58.5	05.5	12°24.5	10.8'	12°32.2	14.0'	58.5'
14	26°58.6	04.5	26°54.3	10.9'	12°18.2	14.1'	58.5'
15	41°58.7	03.6	41°24.2	11.0'	12°04.1	14.1'	58.5'
16	56°58.9	02.6	55°54.1	11.1'	11°50.0	14.2'	58.4'
17	71°59.0	01.7	70°24.2	11.1'	11°35.8	14.2'	58.4'
18	86°59.1	S07°00.7	84°54.3	11.2'	S11°21.6	14.3'	58.4'
19	101°59.2	06°59.7	99°24.6	11.3'	11°07.4	14.3'	58.4'
20	116°59.4	58.8	113°54.9	11.4'	10°53.1	14.3'	58.3'
21	131°59.5	57.8	128°25.2	11.5'	10°38.8	14.4'	58.3'
22	146°59.6	56.9	142°55.7	11.5'	10°24.4	14.4'	58.3'
23	161°59.8	55.9	157°26.2	11.6'	10°09.9	14.5'	58.3'
SD = 16.1'		SD = 16.0'					

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

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

Day	Sun		Moon		Age
	Eqn.of	Time	Mer.	Mer. Pass.	
	00 <sup>h</sup>	12 <sup>h</sup>	Pass.	Upper	0-2
	mm:ss	mm:ss	hh:mm	hh:mm	1-2%
02	12:13	12:07	12:12	12:09	—
03	12:00	11:54	12:12	12:57	00:33
04	11:48	11:41	12:12	13:43	01:20

**March 05, 06, 07 UT (Sat., Sun., Mon.)**

Aries		Venus		Mars		Jupiter		Saturn		Stars	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec
0	162°43.3	222°29.2	\$16°41.9	221°19.8	\$21°12.8	176°18.6	\$06°52.6	200°45.5	\$15°53.6	Alpheratz	357°37.5
1	177°45.8	237°29.4	41.7	236°20.3	12.4	191°20.5	52.4	215°47.7	53.5	Ankaa	353°09.9
2	192°48.3	252°29.6	41.6	251°20.8	12.0	206°22.4	52.1	230°49.9	53.5	Schedar	349°34.2
3	207°50.7	267°29.9	.. 41.4	266°21.3	.. 11.7	221°24.3	.. 51.9	245°52.1	.. 53.4	Diphda	348°49.9
4	222°53.2	282°30.1	41.3	281°21.8	11.3	236°26.2	51.7	260°54.3	53.3	Achernar	335°22.4
5	237°55.7	297°30.3	41.1	296°22.3	11.0	251°28.1	51.4	275°56.5	53.2	Hamal	327°54.1
6	252°58.1	312°30.5	\$16°41.0	311°22.8	\$21°10.6	266°30.0	\$06°51.2	290°58.7	\$15°53.1	Polaris	315°21.7
7	268°00.6	327°30.7	40.8	326°23.3	10.3	281°31.9	51.0	306°00.8	53.0	Acamar	315°13.8
8	283°03.1	342°31.0	40.7	341°23.8	09.9	296°33.8	50.7	321°03.0	53.0	Menkar	314°08.7
9	298°05.5	357°31.2	.. 40.5	356°24.3	.. 09.5	311°35.7	.. 50.5	336°05.2	.. 52.9	Mirfak	308°31.8
10	313°08.0	12°31.4	40.4	11°24.8	09.2	326°37.6	50.3	351°07.4	52.8	Aldebaran	290°42.3
11	328°10.5	27°31.6	40.2	26°25.3	08.8	341°39.5	50.0	6°09.6	52.7	Rigel	281°06.1
12	343°12.9	42°31.8	\$16°40.0	41°25.8	\$21°08.5	356°41.4	\$06°49.8	21°11.8	\$15°52.6	Capella	280°25.3
13	358°15.4	57°32.0	39.9	56°26.3	08.1	11°43.3	49.6	36°14.0	52.5	Bellatrix	278°25.3
14	13°17.8	72°32.2	39.7	71°26.8	07.7	26°45.2	49.3	51°16.1	52.4	Elnath	278°04.8
15	28°20.3	87°32.4	.. 39.6	86°27.3	.. 07.4	41°47.1	.. 49.1	66°18.3	.. 52.4	Alnilam	275°40.0
16	43°22.8	102°32.6	39.4	101°27.8	07.0	56°49.0	48.9	81°20.5	52.3	Betelgeuse	270°54.5
17	58°25.2	117°32.9	39.2	116°28.3	06.6	71°50.9	48.6	96°22.7	52.2	Canopus	263°53.2
18	73°27.7	132°33.1	\$16°39.1	131°28.9	\$21°06.3	86°52.8	\$06°48.4	111°24.9	\$15°52.1	Sirius	258°28.2
19	88°30.2	147°33.3	38.9	146°29.4	05.9	101°54.7	48.2	126°27.1	52.0	Adhara	255°07.5
20	103°32.6	162°33.5	38.8	161°29.9	05.6	116°56.6	47.9	141°29.3	51.9	Procyon	244°53.1
21	118°35.1	177°33.7	.. 38.6	176°30.4	.. 05.2	131°58.5	.. 47.7	156°31.4	.. 51.9	Pollux	243°19.9
22	133°37.6	192°33.9	38.4	191°30.9	04.8	147°00.4	47.5	171°33.6	51.8	Arior	234°15.2
23	148°40.0	207°34.1	38.3	206°31.4	04.5	162°02.3	47.2	186°35.8	51.7	Suhail	222°47.6
Mer.pass. 13:07		ν 0.2° d 0.1° m -4.64		ν 0.5° d 0.4° m 1.24		ν 1.9° d 0.2° m -2.03		ν 2.2° d 0.1° m 0.82		Miaplacidus	
Sun		GHA		GHA		Dec		GHA		Dec	
0	163°42.5	222°34.3	\$16°38.1	221°31.9	\$21°04.1	177°04.2	\$06°47.0	201°38.0	\$15°51.6	Denebola	182°27.0
1	178°44.9	237°34.5	37.9	236°32.4	03.7	192°06.1	46.8	216°40.2	51.5	Gienah	175°45.7
2	193°47.4	252°34.7	37.8	251°32.9	03.4	207°08.0	46.5	231°42.4	51.4	Acrux	173°02.0
3	208°49.9	267°34.9	.. 37.6	266°33.4	.. 03.0	222°09.9	.. 46.3	246°44.6	.. 51.4	Gacrux	171°53.7
4	223°52.3	282°35.0	37.4	281°33.9	02.6	237°11.8	46.1	261°46.8	51.3	Alioth	166°14.6
5	238°54.8	297°35.2	37.3	296°34.4	02.3	252°13.7	45.8	276°48.9	51.2	Spica	158°24.5
6	253°57.3	312°35.4	\$16°37.1	311°34.9	\$21°01.9	267°15.6	\$06°45.6	291°51.1	\$15°51.1	Alkaid	152°53.5
7	268°59.7	327°35.6	36.9	326°35.4	01.5	282°17.5	45.4	306°53.3	51.0	Hadar	148°38.9
8	284°02.2	342°35.8	36.7	341°35.9	01.2	297°19.4	45.1	321°55.5	50.9	Menkent	148°00.1
9	299°04.7	357°36.0	.. 36.6	356°36.4	.. 00.8	312°21.3	.. 44.9	336°57.7	.. 50.9	Arcturus	145°49.8
10	314°07.1	12°36.2	36.4	11°36.9	00.4	327°23.2	44.7	351°59.9	50.8	Rigel Kent.	139°43.1
11	329°09.6	27°36.4	36.2	26°37.4	21°00.1	342°25.1	44.4	7°02.1	50.7	Zuben'ubi	136°58.4
12	344°12.1	42°36.6	\$16°36.1	41°37.9	\$20°59.7	357°27.0	\$06°44.2	22°04.2	\$15°50.6	Alphecca	126°05.6
13	359°14.5	57°36.7	35.9	56°38.4	59.3	12°28.9	44.0	37°06.4	50.5	Antares	112°18.7
14	14°17.0	72°36.9	35.7	71°38.9	59.0	27°30.9	43.8	52°08.6	50.4	Atria	107°15.0
15	29°19.4	87°37.1	.. 35.5	86°39.4	.. 58.6	42°32.8	.. 43.5	67°10.8	.. 50.4	Sabik	102°05.5
16	44°21.9	102°37.3	35.3	101°39.9	58.2	57°34.7	43.3	82°13.0	50.3	Shaula	96°13.6
17	59°24.4	117°37.5	35.2	116°40.4	57.8	72°36.6	43.1	97°15.2	50.2	Rasalhague	96°00.8
18	74°26.8	132°37.6	\$16°35.0	131°40.9	\$20°57.5	87°38.5	\$06°42.8	112°17.4	\$15°50.1	Eltanin	90°43.4
19	89°29.3	147°37.8	34.8	146°41.4	57.1	102°40.4	42.6	127°19.6	50.0	Kaus Aust.	83°35.8
20	104°31.8	162°38.0	34.6	161°41.9	56.7	117°42.3	42.4	142°21.7	49.9	Vega	80°35.0
21	119°34.2	177°38.2	.. 34.4	176°42.5	.. 56.4	132°44.2	.. 42.1	157°23.9	.. 49.9	Nunki	75°50.8
22	134°36.7	192°38.3	34.3	191°43.0	56.0	147°46.1	41.9	172°26.1	49.8	Altair	62°02.5
23	149°39.2	207°38.5	34.1	206°43.5	55.6	162°48.0	41.7	187°28.3	49.7	Peacock	53°09.9
Mer.pass. 13:03		ν 0.2° d 0.2° m -4.63		ν 0.5° d 0.4° m 1.23		ν 1.9° d 0.2° m -2.03		ν 2.2° d 0.1° m 0.82		Fomalhaut	
Mon		GHA		GHA		Dec		GHA		Dec	
0	164°41.6	222°38.7	\$16°33.9	221°44.0	\$20°55.2	177°49.9	\$06°41.4	202°30.5	\$15°49.6	Enif	33°41.4
1	179°44.1	237°38.9	33.7	236°44.5	54.9	192°51.8	41.2	217°32.7	49.5	Al Na'ir	27°36.3
2	194°46.5	252°39.0	33.5	251°45.0	54.5	207°53.7	41.0	232°34.9	49.4	Fomalhaut	15°17.5
3	209°49.0	267°39.2	.. 33.3	266°45.5	.. 54.1	222°55.6	.. 40.7	247°37.1	.. 49.4	Scheat	13°47.8
4	224°51.5	282°39.4	33.2	281°46.0	53.7	237°57.5	40.5	262°39.3	49.3	Markab	13°32.5
5	239°53.9	297°39.5	33.0	296°46.5	53.4	252°59.4	40.3	277°41.4	49.2	Mar 05 Sat	15°20.2
6	254°56.4	312°39.7	\$16°32.8	311°47.0	\$20°53.0	268°01.3	\$06°40.0	292°43.6	\$15°49.1	Venus	59°45.9
7	269°58.9	327°39.9	32.6	326°47.5	52.6	283°03.2	39.8	307°45.8	49.0	Mars	58°36.5
8	285°01.3	342°40.0	32.4	341°48.0	52.2	298°05.1	39.6	322°48.0	48.9	Jupiter	13°35.2
9	300°03.8	357°40.2	.. 32.2	356°48.5	.. 51.9	313°07.0	.. 39.3	337°50.2	.. 48.9	Saturn	38°02.2
10	315°06.3	12°40.3	32.0	11°49.0	51.5	328°08.9	39.1	352°52.4	48.8	Mar 06 Sun	10:35
11	330°08.7	27°40.5	31.8	26°49.5	51.1	343°10.8	38.9	7°54.6	48.7	Venus	58°51.8
12	345°11.2	42°40.7	\$16°31.6	41°50.0	\$20°50.7	358°12.7	\$06°38.6	22°56.8	\$15°48.6	Mars	57°49.4
13	0°13.7	57°40.8	31.4	56°50.6	50.3	13°14.6	38.4	37°58.9	48.5	Jupiter	13°21.7
14	15°16.1	72°41.0	31.2	71°51.1	50.0	28°16.5	38.2	53°01.1	48.4	Saturn	37°55.5
15	30°18.6	87°41.1	.. 31.0	86°51.6	.. 49.6	43°18.4	.. 37.9	68°03.3	.. 48.4	Mar 07 Mon	10:28
16	45°21.0	102°41.3	30.9	101°52.1	49.2	58°20.3	37.7	83°05.5	48.3	Venus	57°51.7
17	60°23.5	117°41.4	30.7	116°52.6	48.8	73°22.2	37.5	98°07.7	48.2	Mars	57°02.4
18	75°26.0	132°41.6	\$16°30.5	131°53.1	\$20°48.4	88°24.1	\$06°37.2	113°09.9	\$15°48.1	Jupiter	13°08.2
19	90°28.4	147°41.7	30.3	146°53.6	48.1	103°26.0	37.0	128°12.1	48.0	Saturn	37°48.9
20	105°30.9	162°41.9	30.1	161°54.1	47.7	118°27.9	36.8	143°14.3	47.9	Horizontal parallax	
21	120°33.4	177°42.0	.. 29.9	176°54.6	.. 47.3	133°29.8	.. 36.5	158°16.5	.. 47.9	Venus:	0.3
22	135°35.8	192°42.2	29.7	191°55.1	46.9	148°31.7	36.3	173°18.6	47.8	Mars:	0.1
23	150°38.3	207°42.3	29.5	206°55.6	46.5	163°33.6	36.1	188°20.8	47.7	Mer.pass. 12:59	..
Mer.pass. 12:59		ν 0.2° d 0.2° m -4.62		ν 0.5° d 0.4° m 1.22		ν 1.9° d 0.2° m -2.03		ν 2.2° d 0.1° m 0.82		Mer.pass. 12:59	

DUT1 = UT1-UTC = -0.1032 sec  $\Delta T = TT-UT1 = +69.2872$  sec

2022 March 05 to Mar. 07 UT

h		Sun		Moon				
Sat		GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	177°06.3	S06°08.8		149°36.1	14.1'	N01°56.5	14.7'	56.8'
1	192°06.4	07.8		164°09.2	14.1'	02°11.2	14.6'	56.8'
2	207°06.6	06.8		178°42.3	14.1'	02°25.8	14.6'	56.8'
3	222°06.7	05.9		193°15.5	14.2'	02°40.4	14.6'	56.8'
4	237°06.8	04.9		207°48.6	14.2'	02°55.0	14.6'	56.7'
5	252°07.0	04.0		222°21.8	14.2'	03°09.6	14.5'	56.7'
6	267°07.1	S06°03.0		236°55.0	14.2'	N03°24.1	14.5'	56.7'
7	282°07.3	02.0		251°28.2	14.2'	03°38.6	14.5'	56.6'
8	297°07.4	01.1		266°01.5	14.3'	03°53.1	14.4'	56.6'
9	312°07.5	06°00.1		280°34.7	14.3'	04°07.5	14.4'	56.6'
10	327°07.7	05°59.1		295°08.0	14.3'	04°21.9	14.4'	56.5'
11	342°07.8	58.2		309°41.3	14.3'	04°36.3	14.3'	56.5'
12	357°08.0	S05°57.2		324°14.6	14.3'	N04°50.6	14.3'	56.5'
13	12°08.1	56.2		338°47.9	14.3'	05°04.9	14.3'	56.5'
14	27°08.2	55.2		353°21.2	14.3'	05°19.2	14.2'	56.4'
15	42°08.4	05.3		7°54.5	14.3'	05°33.4	14.2'	56.4'
16	57°08.5	53.3		22°27.9	14.4'	05°47.6	14.1'	56.4'
17	72°08.7	52.3		37°01.2	14.4'	06°01.7	14.1'	56.3'
18	87°08.8	S05°51.4		51°34.6	14.4'	N06°15.8	14.1'	56.3'
19	102°08.9	50.4		66°07.9	14.4'	06°29.9	14.0'	56.3'
20	117°09.1	49.4		80°41.3	14.4'	06°43.9	14.0'	56.2'
21	132°09.2	05.9		95°14.7	14.4'	06°57.9	13.9'	56.2'
22	147°09.4	47.5		109°48.1	14.4'	07°11.8	13.9'	56.2'
23	162°09.5	46.5		124°21.4	14.4'	07°25.7	13.8'	56.2'
		SD = 16.1'		d = 1.0'		SD = 15.5'		

Sun	GHA	Dec	GHA	$\nu$	Dec	$d$	HP	
0	177°09.7	S05°45.6	138°54.8	14.4'	N07°39.5	13.8'	56.1'	
1	192°09.8	44.6	153°28.2	14.4'	07°53.3	13.7'	56.1'	
2	207°09.9	43.6	168°01.6	14.4'	08°07.0	13.7'	56.1'	
3	222°10.1	05.7	182°35.0	14.4'	08°20.7	13.6'	56.0'	
4	237°10.2	41.7	197°08.4	14.4'	08°34.3	13.6'	56.0'	
5	252°10.4	40.7	211°41.7	14.4'	08°47.9	13.5'	56.0'	
6	267°10.5	S05°39.7	226°15.1	14.4'	N09°01.5	13.5'	56.0'	
7	282°10.7	38.8	240°48.5	14.4'	09°14.9	13.4'	55.9'	
8	297°10.8	37.8	255°21.9	14.4'	09°28.4	13.4'	55.9'	
9	312°10.9	05.8	269°55.2	14.4'	09°41.7	13.3'	55.9'	
10	327°11.1	35.9	284°28.6	14.3'	09°55.1	13.3'	55.8'	
11	342°11.2	34.9	299°01.9	14.3'	10°08.3	13.2'	55.8'	
12	357°11.4	S05°33.9	313°35.3	14.3'	N10°21.5	13.1'	55.8'	
13	12°11.5	33.0	328°08.6	14.3'	10°34.7	13.1'	55.8'	
14	27°11.7	32.0	342°41.9	14.3'	10°47.8	13.0'	55.7'	
15	42°11.8	05.0	357°15.2	14.3'	11°00.8	13.0'	55.7'	
16	57°12.0	30.0	11°48.5	14.3'	11°13.8	12.9'	55.7'	
17	72°12.1	29.1	26°21.8	14.3'	11°26.7	12.8'	55.7'	
18	87°12.3	S05°28.1	40°55.1	14.3'	N11°39.5	12.8'	55.6'	
19	102°12.4	27.1	55°28.3	14.2'	11°52.3	12.7'	55.6'	
20	117°12.5	26.2	70°01.6	14.2'	12°05.0	12.7'	55.6'	
21	132°12.7	05.2	84°34.8	14.2'	12°17.7	12.6'	55.6'	
22	147°12.8	24.2	99°08.0	14.2'	12°30.3	12.5'	55.5'	
23	162°13.0	23.2	113°41.2	14.2'	12°42.8	12.5'	55.5'	
		SD = 16.1'		d = 1.0'		SD = 15.3'		

Mon	GHA	Dec	GHA	$\nu$	Dec	$d$	HP	
0	177°13.1	S05°22.3	128°14.4	14.2'	N12°55.3	12.4'	55.5'	
1	192°13.3	21.3	142°47.5	14.1'	13°07.7	12.3'	55.4'	
2	207°13.4	20.3	157°20.6	14.1'	13°20.0	12.3'	55.4'	
3	222°13.6	05.9	171°53.8	14.1'	13°32.3	12.2'	55.4'	
4	237°13.7	18.4	186°26.8	14.1'	13°44.5	12.1'	55.4'	
5	252°13.9	17.4	200°59.9	14.0'	13°56.6	12.1'	55.3'	
6	267°14.0	S05°16.4	215°33.0	14.0'	N14°08.7	12.0'	55.3'	
7	282°14.2	15.5	230°06.0	14.0'	14°20.6	11.9'	55.3'	
8	297°14.3	14.5	244°39.0	14.0'	14°32.6	11.8'	55.3'	
9	312°14.5	05.5	259°11.9	13.9'	14°44.4	11.8'	55.3'	
10	327°14.6	12.5	273°44.9	13.9'	14°56.2	11.7'	55.2'	
11	342°14.8	11.6	288°17.8	13.9'	15°07.9	11.6'	55.2'	
12	357°14.9	S05°10.6	302°50.7	13.9'	N15°19.5	11.5'	55.2'	
13	12°15.1	09.6	317°23.6	13.8'	15°31.0	11.5'	55.2'	
14	27°15.2	08.6	331°56.4	13.8'	15°42.5	11.4'	55.1'	
15	42°15.4	05.7	346°29.2	13.8'	15°53.9	11.3'	55.1'	
16	57°15.5	06.7	1°02.0	13.8'	16°05.2	11.2'	55.1'	
17	72°15.7	05.7	15°34.8	13.7'	16°16.4	11.2'	55.1'	
18	87°15.8	S05°04.8	30°07.5	13.7'	N16°27.6	11.1'	55.0'	
19	102°16.0	03.8	44°40.2	13.7'	16°38.6	11.0'	55.0'	
20	117°16.1	02.8	59°12.8	13.6'	16°49.6	10.9'	55.0'	
21	132°16.3	01.8	73°45.5	13.6'	17°00.6	10.8'	55.0'	
22	147°16.4	05°00.9	88°18.1	13.6'	17°11.4	10.8'	55.0'	
23	162°16.6	04°59.9	102°50.6	13.5'	17°22.1	10.7'	54.9'	
		SD = 16.1'		d = 1.0'		SD = 15.1'		

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

## March 08, 09, 10 UT (Tue., Wed., Thu.)

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	165°40.8	222°42.5	\$16°29.3	221°56.1	\$20°46.2	178°35.5	\$06°35.8	203°23.0	\$15°47.6					Alpheratz	357°37.5	29°12.6	
1	180°43.2	237°42.6	29.1	236°56.7	45.8	193°37.4	35.6	218°25.2	47.5					Ankaa	353°09.9	-42°11.4	
2	195°45.7	252°42.8	28.8	251°57.2	45.4	208°39.3	35.4	233°27.4	47.4					Schedar	349°34.2	56°39.5	
3	210°48.2	267°42.9	.. 28.6	266°57.7	.. 45.0	223°41.2	.. 35.1	248°29.6	.. 47.4					Diphda	348°49.9	-17°52.1	
4	225°50.6	282°43.1	28.4	281°58.2	44.6	238°43.1	34.9	263°31.8	47.3					Achernar	335°22.4	-57°07.8	
5	240°53.1	297°43.2	28.2	296°58.7	44.2	253°45.0	34.7	278°34.0	47.2					Hamal	327°54.1	23°33.9	
6	255°55.5	312°43.3	\$16°28.0	311°59.2	\$20°43.9	268°46.9	\$06°34.4	293°36.2	\$15°47.1					Polaris	315°22.9	89°21.7	
7	270°58.0	327°43.5	27.8	326°59.7	43.5	283°48.8	34.2	308°38.4	47.0					Acamar	315°13.8	-40°13.3	
8	286°00.5	342°43.6	27.6	342°00.2	43.1	298°50.7	34.0	323°40.5	46.9					Menkar	314°08.8	4°10.4	
9	301°02.9	357°43.8	.. 27.4	357°00.7	.. 42.7	313°52.6	.. 33.7	338°42.7	.. 46.9					Mirfak	308°31.8	49°56.4	
10	316°05.4	12°43.9	27.2	12°01.2	42.3	328°54.5	33.5	353°44.9	46.8					Aldebaran	290°42.3	16°33.1	
11	331°07.9	27°44.0	27.0	27°01.7	41.9	343°56.4	33.3	8°47.1	46.7					Rigel	281°06.1	-8°10.8	
12	346°10.3	42°44.2	\$16°26.8	42°02.3	\$20°41.5	358°58.3	\$06°33.0	23°49.3	\$15°46.6					Capella	280°25.3	46°01.3	
13	1°12.8	57°44.3	26.6	57°02.8	41.2	14°00.2	32.8	38°51.5	46.5					Bellatrix	278°25.4	6°22.1	
14	16°15.3	72°44.4	26.3	72°03.3	40.8	29°02.2	32.6	53°53.7	46.4					Elnath	278°04.8	28°37.6	
15	31°17.7	87°44.6	.. 26.1	87°03.8	.. 40.4	44°04.1	.. 32.3	68°55.9	.. 46.4					Alnilam	275°40.1	-1°11.4	
16	46°20.2	102°44.7	25.9	102°04.3	40.0	59°06.0	32.1	83°58.1	46.3					Betelgeuse	270°54.5	7°24.6	
17	61°22.6	117°44.8	25.7	117°04.8	39.6	74°07.9	31.9	99°00.3	46.2					Canopus	263°53.3	-52°42.7	
18	76°25.1	132°45.0	\$16°25.5	132°05.3	\$20°39.2	89°09.8	\$06°31.6	114°02.4	\$15°46.1					Sirius	258°28.2	-16°45.0	
19	91°27.6	147°45.1	25.3	147°05.8	38.8	104°11.7	31.4	129°04.6	46.0					Adhara	255°07.5	-29°00.4	
20	106°30.0	162°45.2	25.1	162°06.3	38.4	119°13.6	31.2	144°06.8	46.0					Procyon	244°53.1	5°10.0	
21	121°32.5	177°45.3	.. 24.8	177°06.9	.. 38.0	134°15.5	.. 30.9	159°09.0	.. 45.9					Pollux	243°19.9	27°58.4	
22	136°35.0	192°45.5	24.6	192°07.4	37.7	149°17.4	30.7	174°11.2	45.8					Avior	234°15.2	-59°35.0	
23	151°37.4	207°45.6	24.4	207°07.9	37.3	164°19.3	30.5	189°13.4	45.7					Suhail	222°47.6	-43°31.5	
Mer.pass. 12:55			ν 0.1' d 0.2' m -4.61	ν 0.5' d 0.4' m 1.22	ν 1.9' d 0.2' m -2.03	ν 2.2' d 0.1' m 0.82								Miaplacidus	221°37.9	-69°48.6	
														Alphard	217°49.8	-8°45.4	
														Regulus	207°36.6	11°51.5	
														Dubhe	193°43.2	61°37.9	
														Denebola	182°27.0	14°26.8	
														Gienah	175°45.7	-17°39.9	
														Acrux	173°02.0	-63°13.2	
														Gacrux	171°53.7	-57°14.1	
														Alioth	166°14.6	55°50.3	
														Spica	158°24.5	-11°16.6	
														Alkaid	152°53.5	49°12.0	
														Hadar	148°38.8	-60°28.6	
														Menkent	148°00.1	-36°28.6	
														Arcturus	145°49.8	19°03.9	
														Rigel Kent.	139°43.1	-60°55.4	
														Kochab	137°19.2	74°03.6	
														Zuben'ubi	136°58.4	-16°08.0	
														Alphecca	126°05.6	26°38.2	
														Antares	112°18.6	-26°28.8	
														Atria	107°15.0	-69°03.7	
														Sabik	102°05.5	-15°45.1	
														Shaula	96°13.6	-37°07.1	
														Rasalhague	96°00.8	12°32.4	
														Eltanin	90°43.4	51°28.8	
														Kaus Aust.	83°35.7	-34°22.4	
														Vega	80°34.9	38°47.9	
														Nunki	75°50.8	-26°16.1	
														Altair	62°02.4	8°55.4	
														Peacock	53°09.9	-56°39.8	
														Deneb	49°27.7	45°21.3	
														Enif	33°41.4	9°58.4	
														Al Na'ir	27°36.3	-46°51.3	
														Fomalhaut	15°17.5	-29°30.5	
														Scheat	13°47.8	28°12.0	
														Markab	13°32.5	15°19.3	
Mar 08 Tue														Mar 08 Tue	SHA	Mer.pass	
														Venus	57°01.7	09:09	
														Mars	56°15.4	09:12	
														Jupiter	12°54.8	12:04	
														Saturn	37°42.3	10:25	
Mar 09 Wed														Mar 09 Wed	SHA	Mer.pass	
														Venus	56°05.8	09:09	
														Mars	55°28.5	09:11	
														Jupiter	12°41.3	12:01	
														Saturn	37°35.7	10:21	
Mar 10 Thu														Mar 10 Thu	SHA	Mer.pass	
														Venus	55°09.4	09:09	
														Mars	54°41.7	09:10	
														Jupiter	12°27.8	11:58	
														Saturn	37°29.2	10:18	
Horizontal parallax																	
Venus: 0.2																	
Mars: 0.1																	

DUT1 = UT1-UTC = -0.1037 sec  $\Delta T = TT-UT1 = +69.2877$  sec

2022 March 08 to Mar. 10 UT

h		Sun		Moon				
Tue		GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	177°16.7	S04°58.9	117°23.1	13.5'	N17°32.8	10.6'	54.9'	
1	192°16.9	57.9	131°55.6	13.5'	17°43.4	10.5'	54.9'	
2	207°17.0	57.0	146°28.1	13.4'	17°53.9	10.4'	54.9'	
3	222°17.2	.. 56.0	161°00.5	13.4'	18°04.3	10.3'	54.9'	
4	237°17.3	55.0	175°32.9	13.4'	18°14.6	10.2'	54.8'	
5	252°17.5	54.0	190°05.3	13.3'	18°24.9	10.2'	54.8'	
6	267°17.6	S04°53.1	204°37.6	13.3'	N18°35.0	10.1'	54.8'	
7	282°17.8	52.1	219°09.9	13.2'	18°45.1	10.0'	54.8'	
8	297°17.9	51.1	233°42.1	13.2'	18°55.1	9.9'	54.8'	
9	312°18.1	.. 50.1	248°14.3	13.2'	19°05.0	9.8'	54.7'	
10	327°18.2	49.2	262°46.5	13.1'	19°14.8	9.7'	54.7'	
11	342°18.4	48.2	277°18.6	13.1'	19°24.5	9.6'	54.7'	
12	357°18.5	S04°47.2	291°50.7	13.1'	N19°34.1	9.5'	54.7'	
13	12°18.7	46.2	306°22.8	13.0'	19°43.7	9.4'	54.7'	
14	27°18.8	45.2	320°54.8	13.0'	19°53.1	9.3'	54.7'	
15	42°19.0	.. 44.3	335°26.7	12.9'	20°02.4	9.3'	54.6'	
16	57°19.2	43.3	349°58.7	12.9'	20°11.7	9.2'	54.6'	
17	72°19.3	42.3	4°30.6	12.9'	20°20.9	9.1'	54.6'	
18	87°19.5	S04°41.3	19°02.4	12.8'	N20°29.9	9.0'	54.6'	
19	102°19.6	40.4	33°34.2	12.8'	20°38.9	8.9'	54.6'	
20	117°19.8	39.4	48°06.0	12.7'	20°47.8	8.8'	54.6'	
21	132°19.9	.. 38.4	62°37.7	12.7'	20°56.5	8.7'	54.5'	
22	147°20.1	37.4	77°09.4	12.6'	21°05.2	8.6'	54.5'	
23	162°20.2	36.5	91°41.1	12.6'	21°13.8	8.5'	54.5'	
SD = 16.1'		SD = 15.0'						

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

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

Day	Sun		Moon		Age
	Eqn. of	Time	Mer.	Mer. Pass.	
	00 <sup>h</sup>	12 <sup>h</sup>	Pass	Upper	6-8
	mm:ss	mm:ss	hh:mm	hh:mm	27-46%
08	10:53	10:46	12:11	16:41	04:18
09	10:38	10:31	12:11	17:29	05:05
10	10:23	10:16	12:10	18:18	05:53



SD = 16.1'	d = 1.0'	SD = 14.8'
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## March 11, 12, 13 UT (Fri., Sat., Sun.)

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	168°38.2	222°50.5	\$16°12.7	222°33.1	\$20°17.7	180°52.5	\$06°19.1	206°00.8	\$15°41.7					Alpheratz	357°37.5	29°12.6	
1	183°40.6	237°50.6	12.4	237°33.6	17.3	195°54.4	18.8	221°03.0	41.6					Ankaa	353°09.9	-42°11.4	
2	198°43.1	252°50.7	12.1	252°34.1	16.9	210°56.3	18.6	236°05.2	41.5					Schedar	349°34.2	56°39.5	
3	213°45.6	267°50.8	.. 11.9	267°34.6	.. 16.5	225°58.2	.. 18.4	251°07.4	.. 41.4					Diphda	348°49.9	-17°52.1	
4	228°48.0	282°50.9	11.6	282°35.2	16.1	241°00.1	18.1	266°09.6	41.3					Achernar	335°22.4	-57°07.7	
5	243°50.5	297°50.9	11.4	297°35.7	15.6	256°02.0	17.9	281°11.8	41.3					Hamal	327°54.1	23°33.9	
6	258°53.0	312°51.0	\$16°11.1	312°36.2	\$20°15.2	271°03.9	\$06°17.7	296°14.0	\$15°41.2					Polaris	315°23.9	89°21.7	
7	273°55.4	327°51.1	10.8	327°36.7	14.8	286°05.8	17.4	311°16.2	41.1					Acamar	315°13.8	-40°13.3	
8	288°57.9	342°51.1	10.6	342°37.2	14.4	301°07.7	17.2	326°18.4	41.0					Menkar	314°08.8	4°10.4	
9	304°00.4	357°51.2	.. 10.3	357°37.8	.. 14.0	316°09.6	.. 17.0	341°20.6	.. 40.9					Mirfak	308°31.8	49°56.4	
10	319°02.8	12°51.3	10.0	12°38.3	13.6	331°11.6	16.7	356°22.8	40.9					Aldebaran	290°42.4	16°33.1	
11	334°05.3	27°51.4	09.8	27°38.8	13.2	346°13.5	16.5	11°25.0	40.8					Rigel	281°06.1	-8°10.8	
12	349°07.7	42°51.4	\$16°09.5	42°39.3	\$20°12.8	1°15.4	\$06°16.3	26°27.2	\$15°40.7					Capella	280°25.3	46°01.3	
13	4°10.2	57°51.5	09.2	57°39.8	12.4	16°17.3	16.0	41°29.4	40.6					Bellatrix	278°25.4	6°22.1	
14	19°12.7	72°51.6	09.0	72°40.4	11.9	31°19.2	15.8	56°31.6	40.5					Elnath	278°04.8	28°37.6	
15	34°15.1	87°51.6	.. 08.7	87°40.9	.. 11.5	46°21.1	.. 15.6	71°33.8	.. 40.5					Alnilam	275°40.1	-1°11.4	
16	49°17.6	102°51.7	08.4	102°41.4	11.1	61°23.0	15.3	86°35.9	40.4					Betelgeuse	270°54.6	7°24.6	
17	64°20.1	117°51.8	08.2	117°41.9	10.7	76°24.9	15.1	101°38.1	40.3					Canopus	263°53.3	-52°42.7	
18	79°22.5	132°51.8	\$16°07.9	132°42.4	\$20°10.3	91°26.8	\$06°14.9	116°40.3	\$15°40.2					Sirius	258°28.2	-16°45.0	
19	94°25.0	147°51.9	07.6	147°43.0	09.9	106°28.7	14.7	131°42.5	40.1					Adhara	255°07.5	-29°00.4	
20	109°27.5	162°52.0	07.3	162°43.5	09.5	121°30.6	14.4	146°44.7	40.0					Procyon	244°53.1	5°10.0	
21	124°29.9	177°52.0	.. 07.1	177°44.0	.. 09.0	136°32.5	.. 14.2	161°46.9	.. 40.0					Pollux	243°19.9	27°58.4	
22	139°32.4	192°52.1	06.8	192°44.5	08.6	151°34.4	14.0	176°49.1	39.9					Avisor	234°15.2	-59°35.0	
23	154°34.9	207°52.1	06.5	207°45.0	08.2	166°36.3	13.7	191°51.3	39.8					Suhail	222°47.6	-43°31.5	
Mer.pass. 12:43		ν 0.1° d 0.3' m -4.57		ν 0.5° d 0.4' m 1.20		ν 1.9° d 0.2' m -2.03		ν 2.2° d 0.1' m 0.82						Miaplacidus	221°37.9	-69°48.6	
Mer.pass. 12:43		ν 0.1° d 0.3' m -4.57		ν 0.5° d 0.4' m 1.20		ν 1.9° d 0.2' m -2.03		ν 2.2° d 0.1' m 0.82						Alphard	217°49.8	-8°45.4	
Mer.pass. 12:43		ν 0.1° d 0.3' m -4.57		ν 0.5° d 0.4' m 1.20		ν 1.9° d 0.2' m -2.03		ν 2.2° d 0.1' m 0.82						Regulus	207°36.6	11°51.5	
Mer.pass. 12:43		ν 0.1° d 0.3' m -4.57		ν 0.5° d 0.4' m 1.20		ν 1.9° d 0.2' m -2.03		ν 2.2° d 0.1' m 0.82						Dubhe	193°43.2	61°37.9	
Mer.pass. 12:43		ν 0.1° d 0.3' m -4.57		ν 0.5° d 0.4' m 1.20		ν 1.9° d 0.2' m -2.03		ν 2.2° d 0.1' m 0.82						Denebola	182°27.0	14°26.8	
Mer.pass. 12:43		ν 0.1° d 0.3' m -4.57		ν 0.5° d 0.4' m 1.20		ν 1.9° d 0.2' m -2.03		ν 2.2° d 0.1' m 0.82						Gienah	175°45.7	-17°39.9	
Mer.pass. 12:43		ν 0.1° d 0.3' m -4.57		ν 0.5° d 0.4' m 1.20		ν 1.9° d 0.2' m -2.03		ν 2.2° d 0.1' m 0.82						Acru	173°02.0	-63°13.2	
Mer.pass. 12:43		ν 0.1° d 0.3' m -4.57		ν 0.5° d 0.4' m 1.20		ν 1.9° d 0.2' m -2.03		ν 2.2° d 0.1' m 0.82						Gacrux	171°53.7	-57°14.1	
Mer.pass. 12:43		ν 0.1° d 0.3' m -4.57		ν 0.5° d 0.4' m 1.20		ν 1.9° d 0.2' m -2.03		ν 2.2° d 0.1' m 0.82						Alioth	166°14.5	55°50.3	
Mer.pass. 12:43		ν 0.1° d 0.3' m -4.57		ν 0.5° d 0.4' m 1.20		ν 1.9° d 0.2' m -2.03		ν 2.2° d 0.1' m 0.82						Spica	158°24.5	-11°16.6	
Mer.pass. 12:43		ν 0.1° d 0.3' m -4.57		ν 0.5° d 0.4' m 1.20		ν 1.9° d 0.2' m -2.03		ν 2.2° d 0.1' m 0.82						Alkaid	152°53.5	49°12.0	
Mer.pass. 12:43		ν 0.1° d 0.3' m -4.57		ν 0.5° d 0.4' m 1.20		ν 1.9° d 0.2' m -2.03		ν 2.2° d 0.1' m 0.82						Hadar	148°38.8	-60°28.6	
Mer.pass. 12:43		ν 0.1° d 0.3' m -4.57		ν 0.5° d 0.4' m 1.20		ν 1.9° d 0.2' m -2.03		ν 2.2° d 0.1' m 0.82						Menkent	148°00.1	-36°28.6	
Mer.pass. 12:43		ν 0.1° d 0.3' m -4.57		ν 0.5° d 0.4' m 1.20		ν 1.9° d 0.2' m -2.03		ν 2.2° d 0.1' m 0.82						Arcturus	145°49.8	19°03.9	
Mer.pass. 12:43		ν 0.1° d 0.3' m -4.57		ν 0.5° d 0.4' m 1.20		ν 1.9° d 0.2' m -2.03		ν 2.2° d 0.1' m 0.82						Rigel Kent.	139°43.0	-60°55.4	
Mer.pass. 12:43		ν 0.1° d 0.3' m -4.57		ν 0.5° d 0.4' m 1.20		ν 1.9° d 0.2' m -2.03		ν 2.2° d 0.1' m 0.82						Kochab	137°19.1	74°03.6	
Mer.pass. 12:43		ν 0.1° d 0.3' m -4.57		ν 0.5° d 0.4' m 1.20		ν 1.9° d 0.2' m -2.03		ν 2.2° d 0.1' m 0.82						Zuben'ubi	136°58.4	-16°08.0	
Mer.pass. 12:43		ν 0.1° d 0.3' m -4.57		ν 0.5° d 0.4' m 1.20		ν 1.9° d 0.2' m -2.03		ν 2.2° d 0.1' m 0.82						Alphecca	126°05.6	26°38.2	
Mer.pass. 12:43		ν 0.1° d 0.3' m -4.57		ν 0.5° d 0.4' m 1.20		ν 1.9° d 0.2' m -2.03		ν 2.2° d 0.1' m 0.82						Antares	112°18.6	-26°28.8	
Mer.pass. 12:43		ν 0.1° d 0.3' m -4.57		ν 0.5° d 0.4' m 1.20		ν 1.9° d 0.2' m -2.03		ν 2.2° d 0.1' m 0.82						Atria	107°14.9	-69°03.7	
Mer.pass. 12:43		ν 0.1° d 0.3' m -4.57		ν 0.5° d 0.4' m 1.20		ν 1.9° d 0.2' m -2.03		ν 2.2° d 0.1' m 0.82						Sabik	102°05.4	-15°45.1	
Mer.pass. 12:43		ν 0.1° d 0.3' m -4.57		ν 0.5° d 0.4' m 1.20		ν 1.9° d 0.2' m -2.03		ν 2.2° d 0.1' m 0.82						Shaula	96°13.6	-37°07.1	
Mer.pass. 12:43		ν 0.1° d 0.3' m -4.57		ν 0.5° d 0.4' m 1.20		ν 1.9° d 0.2' m -2.03		ν 2.2° d 0.1' m 0.82						Rasalhague	96°00.7	12°32.4	
Mer.pass. 12:43		ν 0.1° d 0.3' m -4.57		ν 0.5° d 0.4' m 1.20		ν 1.9° d 0.2' m -2.03		ν 2.2° d 0.1' m 0.82						Eltanin	90°43.3	51°28.8	
Mer.pass. 12:43		ν 0.1° d 0.3' m -4.57		ν 0.5° d 0.4' m 1.20		ν 1.9° d 0.2' m -2.03		ν 2.2° d 0.1' m 0.82						Kaus Aust.	83°35.7	-34°22.4	
Mer.pass. 12:43		ν 0.1° d 0.3' m -4.57		ν 0.5° d 0.4' m 1.20		ν 1.9° d 0.2' m -2.03		ν 2.2° d 0.1' m 0.82						Vega	80°34.9	38°47.9	
Mer.pass. 12:43		ν 0.1° d 0.3' m -4.57		ν 0.5° d 0.4' m 1.20		ν 1.9° d 0.2' m -2.03		ν 2.2° d 0.1' m 0.82						Nunki	75°50.8	-26°16.1	
Mer.pass. 12:43		ν 0.1° d 0.3' m -4.57		ν 0.5° d 0.4' m 1.20		ν 1.9° d 0.2' m -2.03		ν 2.2° d 0.1' m 0.82						Altair	62°02.4	8°55.4	
Mer.pass. 12:43		ν 0.1° d 0.3' m -4.57		ν 0.5° d 0.4' m 1.20		ν 1.9° d 0.2' m -2.03		ν 2.2° d 0.1' m 0.82						Peacock	53°09.8	-56°39.7	
Mer.pass. 12:43		ν 0.1° d 0.3' m -4.57		ν 0.5° d 0.4' m 1.20		ν 1.9° d 0.2' m -2.03		ν 2.2° d 0.1' m 0.82									

DUT1 = UT1-UTC = -0.1023 sec  $\Delta T = TT-UT1 = +69.2863$  sec

2022 March 11 to Mar. 13 UT

h	Sun			Moon			
Fri	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	177°28.0	S03°48.5	82°41.4	10.7'	N26°03.1	3.0'	54.2'
1	192°28.2	47.5	97°11.1	10.7'	26°06.1	2.9'	54.2'
2	207°28.3	46.5	111°40.8	10.6'	26°08.9	2.8'	54.2'
3	222°28.5	45.5	126°10.5	10.6'	26°11.7	2.6'	54.2'
4	237°28.7	44.5	140°40.1	10.6'	26°14.3	2.5'	54.2'
5	252°28.8	43.5	155°09.7	10.6'	26°16.8	2.4'	54.2'
6	267°29.0	S03°42.6	169°39.2	10.5'	N26°19.2	2.3'	54.2'
7	282°29.2	41.6	184°08.8	10.5'	26°21.5	2.1'	54.2'
8	297°29.3	40.6	198°38.3	10.5'	26°23.6	2.0'	54.2'
9	312°29.5	39.6	213°07.8	10.5'	26°25.6	1.9'	54.2'
10	327°29.7	38.6	227°37.2	10.4'	26°27.5	1.8'	54.2'
11	342°29.8	37.7	242°06.7	10.4'	26°29.3	1.6'	54.2'
12	357°30.0	S03°36.7	256°36.1	10.4'	N26°30.9	1.5'	54.2'
13	12°30.1	35.7	271°05.5	10.4'	26°32.4	1.4'	54.2'
14	27°30.3	34.7	285°34.9	10.4'	26°33.8	1.2'	54.2'
15	42°30.5	33.7	300°04.2	10.3'	26°35.0	1.1'	54.2'
16	57°30.6	32.7	314°33.6	10.3'	26°36.1	1.0'	54.2'
17	72°30.8	31.8	329°02.9	10.3'	26°37.1	0.9'	54.2'
18	87°31.0	S03°30.8	343°32.2	10.3'	N26°38.0	0.7'	54.2'
19	102°31.1	29.8	358°01.5	10.3'	26°38.7	0.6'	54.2'
20	117°31.3	28.8	12°30.8	10.3'	26°39.3	0.5'	54.2'
21	132°31.5	27.8	27°00.0	10.2'	26°39.8	0.4'	54.2'
22	147°31.6	26.8	41°29.3	10.2'	26°40.2	0.2'	54.2'
23	162°31.8	25.9	55°58.5	10.2'	26°40.4	0.1'	54.3'
	SD = 16.1'			SD = 14.8'			

Sat	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	177°32.0	S03°24.9	70°27.7	10.2'	N26°40.5	-0.0'	54.3'
1	192°32.1	23.9	84°57.0	10.2'	26°40.5	-0.2'	54.3'
2	207°32.3	22.9	99°26.2	10.2'	26°40.3	-0.3'	54.3'
3	222°32.5	21.9	113°55.4	10.2'	26°40.0	-0.4'	54.3'
4	237°32.6	20.9	128°24.5	10.2'	26°39.6	-0.6'	54.3'
5	252°32.8	20.0	142°53.7	10.2'	26°39.0	-0.7'	54.3'
6	267°33.0	S03°19.0	157°22.9	10.2'	N26°38.3	-0.8'	54.3'
7	282°33.1	18.0	171°52.0	10.2'	26°37.5	-0.9'	54.3'
8	297°33.3	17.0	186°21.2	10.2'	26°36.6	-1.1'	54.3'
9	312°33.5	16.0	200°50.4	10.2'	26°35.5	-1.2'	54.3'
10	327°33.6	15.0	215°19.5	10.1'	26°34.3	-1.3'	54.3'
11	342°33.8	14.1	229°48.7	10.1'	26°33.0	-1.5'	54.4'
12	357°34.0	S03°13.1	244°17.8	10.1'	N26°31.5	-1.6'	54.4'
13	12°34.1	12.1	258°47.0	10.1'	26°29.9	-1.7'	54.4'
14	27°34.3	11.1	273°16.1	10.1'	26°28.2	-1.9'	54.4'
15	42°34.5	10.1	287°45.3	10.2'	26°26.4	-2.0'	54.4'
16	57°34.6	09.1	302°14.4	10.2'	26°24.4	-2.1'	54.4'
17	72°34.8	08.1	316°43.6	10.2'	26°22.3	-2.2'	54.4'
18	87°35.0	S03°07.2	331°12.7	10.2'	N26°20.0	-2.4'	54.4'
19	102°35.1	06.2	345°41.9	10.2'	26°17.7	-2.5'	54.5'
20	117°35.3	05.2	0°11.1	10.2'	26°15.2	-2.6'	54.5'
21	132°35.5	04.2	14°40.2	10.2'	26°12.5	-2.8'	54.5'
22	147°35.6	03.2	29°09.4	10.2'	26°09.8	-2.9'	54.5'
23	162°35.8	02.2	43°38.6	10.2'	26°06.9	-3.0'	54.5'
	SD = 16.1'			SD = 14.8'			

Sun	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	177°36.0	S03°01.3	58°07.8	10.2'	N26°03.9	-3.1'	54.5'
1	192°36.2	03°00.3	72°37.0	10.2'	26°00.7	-3.3'	54.5'
2	207°36.3	02°59.3	87°06.2	10.2'	25°57.5	-3.4'	54.5'
3	222°36.5	05.3	101°35.5	10.2'	25°54.1	-3.5'	54.6'
4	237°36.7	57.3	116°04.7	10.3'	25°50.5	-3.7'	54.6'
5	252°36.8	56.3	130°33.9	10.3'	25°46.9	-3.8'	54.6'
6	267°37.0	S02°55.3	145°03.2	10.3'	N25°43.1	-3.9'	54.6'
7	282°37.2	54.4	159°32.5	10.3'	25°39.2	-4.0'	54.6'
8	297°37.3	53.4	174°01.8	10.3'	25°35.1	-4.2'	54.6'
9	312°37.5	52.4	188°31.1	10.3'	25°30.9	-4.3'	54.7'
10	327°37.7	51.4	203°00.4	10.3'	25°26.6	-4.4'	54.7'
11	342°37.9	50.4	217°29.8	10.4'	25°22.2	-4.6'	54.7'
12	357°38.0	S02°49.4	231°59.2	10.4'	N25°17.7	-4.7'	54.7'
13	12°38.2	48.4	246°28.5	10.4'	25°13.0	-4.8'	54.7'
14	27°38.4	47.5	260°57.9	10.4'	25°08.2	-4.9'	54.7'
15	42°38.5	46.5	275°27.4	10.4'	25°03.2	-5.1'	54.8'
16	57°38.7	45.5	289°56.8	10.5'	24°58.2	-5.2'	54.8'
17	72°38.9	44.5	304°26.3	10.5'	24°53.0	-5.3'	54.8'
18	87°39.0	S02°43.5	318°55.8	10.5'	N24°47.7	-5.4'	54.8'
19	102°39.2	42.5	333°25.3	10.5'	24°42.3	-5.6'	54.8'
20	117°39.4	41.5	347°54.8	10.6'	24°36.7	-5.7'	54.8'
21	132°39.6	40.6	2°24.4	10.6'	24°31.0	-5.8'	54.9'
22	147°39.7	39.6	16°54.0	10.6'	24°25.2	-5.9'	54.9'
23	162°39.9	38.6	31°23.6	10.6'	24°19.3	-6.0'	54.9'
	SD = 16.1'			SD = 14.9'			

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

## March 14, 15, 16 UT (Mon., Tue., Wed.)

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	171°35.6	222°54.1	\$15°52.0	223°10.7	\$19°47.4	183°09.6	\$06°02.3	208°39.0	\$15°35.8	Alpheratz	357°37.5	29°12.6					
1	186°38.1	237°54.2	51.7	238°11.2	47.0	198°11.5	02.1	223°41.2	35.8	Ankaa	353°09.9	-42°11.4					
2	201°40.5	252°54.2	51.3	253°11.8	46.5	213°13.4	01.8	238°43.4	35.7	Schedar	349°34.2	56°39.5					
3	216°43.0	267°54.2	.. 51.0	268°12.3	.. 46.1	228°15.3	.. 01.6	253°45.6	.. 35.6	Diphda	348°49.9	-17°52.1					
4	231°45.5	282°54.2	50.7	283°12.8	45.7	243°17.2	01.4	268°47.8	35.5	Achernar	335°22.4	-57°07.7					
5	246°47.9	297°54.3	50.4	298°13.4	45.2	258°19.1	01.2	283°50.0	35.4	Hamal	327°54.1	23°33.9					
6	261°50.4	312°54.3	\$15°50.1	313°13.9	\$19°44.8	273°21.0	\$06°00.9	298°52.2	\$15°35.4	Polaris	315°25.1	89°21.7					
7	276°52.8	327°54.3	49.7	328°14.4	44.4	288°23.0	00.7	313°54.4	35.3	Acamar	315°13.8	-40°13.3					
8	291°55.3	342°54.3	49.4	343°14.9	43.9	303°24.9	00.5	328°56.6	35.2	Menkar	314°08.8	4°10.4					
9	306°57.8	357°54.3	.. 49.1	358°15.5	.. 43.5	318°26.8	.. 00.2	343°58.8	.. 35.1	Mirfak	308°31.8	49°56.4					
10	322°00.2	12°54.3	48.8	13°16.0	43.0	333°28.7	06°00.0	359°01.0	35.0	Aldebaran	290°42.4	16°33.1					
11	337°02.7	27°54.4	48.5	28°16.5	42.6	348°30.6	05°59.8	14°03.2	35.0	Rigel	281°06.1	-8°10.8					
12	352°05.2	42°54.4	\$15°48.1	43°17.0	\$19°42.2	3°32.5	\$05°59.5	29°05.4	\$15°34.9	Capella	280°25.3	46°01.3					
13	7°07.6	57°54.4	47.8	58°17.6	41.7	18°34.4	59.3	44°07.6	34.8	Bellatrix	278°25.4	6°22.1					
14	22°10.1	72°54.4	47.5	73°18.1	41.3	33°36.3	59.1	59°09.8	34.7	Elnath	278°04.8	28°37.6					
15	37°12.6	87°54.4	.. 47.1	88°18.6	.. 40.9	48°38.2	.. 58.8	74°12.0	.. 34.6	Alnilam	275°40.1	-1°11.4					
16	52°15.0	102°54.4	46.8	103°19.2	40.4	63°40.1	58.6	89°14.2	34.6	Betelgeuse	270°54.6	7°24.6					
17	67°17.5	117°54.4	46.5	118°19.7	40.0	78°42.0	58.4	104°16.4	34.5	Canopus	263°53.3	-52°42.7					
18	82°19.9	132°54.4	\$15°46.2	133°20.2	\$19°39.5	93°43.9	\$05°58.1	119°18.6	\$15°34.4	Sirius	258°28.2	-16°45.0					
19	97°22.4	147°54.4	45.8	148°20.8	39.1	108°45.8	57.9	134°20.8	34.3	Adhara	255°07.6	-29°00.4					
20	112°24.9	162°54.5	45.5	163°21.3	38.7	123°47.7	57.7	149°23.0	34.2	Procyon	244°53.1	5°10.0					
21	127°27.3	177°54.5	.. 45.2	178°21.8	.. 38.2	138°49.6	.. 57.4	164°25.2	.. 34.2	Pollux	243°20.0	27°58.4					
22	142°29.8	192°54.5	44.8	193°22.3	37.8	153°51.5	57.2	179°27.4	34.1	Avior	234°15.2	-59°35.0					
23	157°32.3	207°54.5	44.5	208°22.9	37.3	168°53.4	57.0	194°29.6	34.0	Suhail	222°47.7	-43°31.5					
Mer.pass. 12:32			ν 0.0' d 0.3' m -4.54	ν 0.5' d 0.4' m 1.18	ν 1.9' d 0.2' m -2.03	ν 2.2' d 0.1' m 0.83	Mer.pass. 12:32			Mer.pass. 12:32			Mer.pass. 12:32				
Tue			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	172°34.7	222°54.5	\$15°44.2	223°23.4	\$19°36.9	183°55.3	\$05°56.7	209°31.8	\$15°33.9	Denebola	182°27.0	14°26.8					
1	187°37.2	237°54.5	43.8	238°23.9	36.5	198°57.2	56.5	224°34.0	33.8	Gienah	175°45.6	-17°39.9					
2	202°39.7	252°54.5	43.5	253°24.5	36.0	213°59.2	56.3	239°36.2	33.8	Acrux	173°02.0	-63°13.2					
3	217°42.1	267°54.5	.. 43.1	268°25.0	.. 35.6	229°01.1	.. 56.0	254°38.4	.. 33.7	Gacrux	171°53.6	-57°14.2					
4	232°44.6	282°54.5	42.8	283°25.5	35.1	244°03.0	55.8	269°40.6	33.6	Alioth	166°14.5	55°50.3					
5	247°47.1	297°54.5	42.5	298°26.1	34.7	259°04.9	55.6	284°42.8	33.5	Spica	158°24.5	-11°16.6					
6	262°49.5	312°54.5	\$15°42.1	313°26.6	\$19°34.2	274°06.8	\$05°55.3	299°45.0	\$15°33.4	Alkaid	152°53.5	49°12.0					
7	277°52.0	327°54.5	41.8	328°27.1	33.8	289°08.7	55.1	314°47.2	33.4	Hadar	148°38.8	-60°28.6					
8	292°54.4	342°54.5	41.4	343°27.7	33.4	304°10.6	54.9	329°49.4	33.3	Menkent	148°00.0	-36°28.7					
9	307°56.9	357°54.5	.. 41.1	358°28.2	.. 32.9	319°12.5	.. 54.6	344°51.6	.. 33.2	Arcturus	145°49.8	19°03.9					
10	322°59.4	12°54.5	40.8	13°28.7	32.5	334°14.4	54.4	359°53.8	33.1	Rigel Kent.	139°43.0	-60°55.4					
11	338°01.8	27°54.5	40.4	28°29.2	32.0	349°16.3	54.2	14°56.0	33.0	Kochab	137°19.1	74°03.6					
12	353°04.3	42°54.5	\$15°40.1	43°29.8	\$19°31.6	4°18.2	\$05°53.9	29°58.2	\$15°33.0	Zuben'ubi	136°58.4	-16°08.0					
13	8°06.8	57°54.5	39.7	58°30.3	31.1	19°20.1	53.7	45°00.4	32.9	Alphecca	126°05.5	26°38.2					
14	23°09.2	72°54.5	39.4	73°30.8	30.7	34°22.0	53.5	60°02.6	32.8	Antares	112°18.6	-26°28.8					
15	38°11.7	87°54.5	.. 39.0	88°31.4	.. 30.2	49°23.9	.. 53.2	75°04.8	.. 32.7	Atria	107°14.8	-69°03.7					
16	53°14.2	102°54.5	38.7	103°31.9	29.8	64°25.8	53.0	90°07.0	32.6	Sabik	102°05.4	-15°45.2					
17	68°16.6	117°54.5	38.3	118°32.4	29.3	79°27.7	52.8	105°09.2	32.6	Shaula	96°13.5	-37°07.1					
18	83°19.1	132°54.5	\$15°38.0	133°33.0	\$19°28.9	94°29.6	\$05°52.5	120°11.4	\$15°32.5	Rasalhague	96°00.7	12°32.4					
19	98°21.6	147°54.5	37.6	148°33.5	28.5	109°31.6	52.3	135°13.6	32.4	Eltanin	90°43.3	51°28.8					
20	113°24.0	162°54.5	37.3	163°34.0	28.0	124°33.5	52.1	150°15.8	32.3	Kaus Aust.	83°35.7	-34°22.4					
21	128°26.5	177°54.5	.. 36.9	178°34.6	.. 27.6	139°35.4	.. 51.8	165°18.0	.. 32.2	Vega	80°34.9	38°47.9					
22	143°28.9	192°54.4	36.6	193°35.1	27.1	154°37.3	51.6	180°20.2	32.2	Nunki	75°50.8	-26°16.1					
23	158°31.4	207°54.4	36.2	208°35.6	26.7	169°39.2	51.4	195°22.4	32.1	Altair	62°02.4	8°55.4					
Mer.pass. 12:28			ν 0.0' d 0.3' m -4.52	ν 0.5' d 0.4' m 1.17	ν 1.9' d 0.2' m -2.04	ν 2.2' d 0.1' m 0.83	Mer.pass. 12:28			Mer.pass. 12:28			Mer.pass. 12:28				
Wed			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	173°33.9	222°54.4	\$15°35.9	223°36.2	\$19°26.2	184°41.1	\$05°51.1	210°24.6	\$15°32.0	Mar 14 Mon	51°18.6	09:08					
1	188°36.3	237°54.4	35.5	238°36.7	25.8	199°43.0	50.9	225°26.9	31.9	Venus	51°35.1	09:07					
2	203°38.8	252°54.4	35.2	253°37.2	25.3	214°44.9	50.7	240°29.1	31.8	Mars	11°34.0	11:46					
3	218°41.3	267°54.4	.. 34.8	268°37.8	.. 24.9	229°46.8	.. 50.5	255°31.3	.. 31.8	Jupiter	37°03.4	10:04					
4	233°43.7	282°54.4	34.4	283°38.3	24.4	244°48.7	50.2	270°33.5	31.7	Saturn	36°57.1	10:00					
5	248°46.2	297°54.4	34.1	298°38.8	24.0	259°50.6	50.0	285°35.7	31.6	Mar 15 Tue	50°19.8	09:08					
6	263°48.7	312°54.4	\$15°33.7	313°39.4	\$19°23.5	274°52.5	\$05°49.8	300°37.9	\$15°31.5	Venus	50°48.7	09:06					
7	278°51.1	327°54.3	33.4	328°39.9	23.1	289°54.4	49.5	315°40.1	31.4	Mars	11°20.6	11:43					
8	293°53.6	342°54.3	33.0	343°40.4	22.6	304°56.3	49.3	330°42.3	31.4	Jupiter	36°57.1	10:00					
9	308°56.0	357°54.3	.. 32.6	358°41.0	.. 22.2	319°58.2	.. 49.1	345°44.5	.. 31.3	Saturn	49°20.6	09:08					
10	323°58.5	12°54.3	32.3	13°41.5	21.7	335°00.1	48.8	0°46.7	31.2	Mar 16 Wed	49°02.3	09:05					
11	339°01.0	27°54.3	31.9	28°42.1	21.2	350°02.1	48.6	15°48.9	31.1	Venus	11°07.2	11:40					
12	354°03.4	42°54.3	\$15°31.6	43°42.6	\$19°20.8	5°04.0	\$05°48.4	30°51.1	\$15°31.1	Mars	36°50.8	09:57					
13	9°05.9	57°54.2	31.2	58°43.1	20.3	20°05.9	48.1	45°53.3	31								

DUT1 = UT1-UTC = -0.1004 sec  $\Delta T = TT-UT1 = +69.2844$  sec

2022 March 14 to Mar. 16 UT

h		Sun		Moon				
Mon		GHA	Dec	GHA	$\nu$	Dec	d	HP
0	177°40.1	S02°37.6	45°53.2	10.7'	N24°13.3	-6.2'	54.9'	
1	192°40.3	36.6	60°22.9	10.7'	24°07.1	-6.3'	54.9'	
2	207°40.4	35.6	74°52.6	10.7'	24°00.8	-6.4'	55.0'	
3	222°40.6	34.6	89°22.3	10.7'	23°54.4	-6.5'	55.0'	
4	237°40.8	33.7	103°52.0	10.8'	23°47.8	-6.7'	55.0'	
5	252°40.9	32.7	118°21.8	10.8'	23°41.2	-6.8'	55.0'	
6	267°41.1	S02°31.7	132°51.6	10.8'	N23°34.4	-6.9'	55.0'	
7	282°41.3	30.7	147°21.4	10.9'	23°27.5	-7.0'	55.1'	
8	297°41.5	29.7	161°51.3	10.9'	23°20.5	-7.1'	55.1'	
9	312°41.6	28.7	176°21.2	10.9'	23°13.4	-7.3'	55.1'	
10	327°41.8	27.7	190°51.1	11.0'	23°06.1	-7.4'	55.1'	
11	342°42.0	26.8	205°21.1	11.0'	22°58.7	-7.5'	55.2'	
12	357°42.2	S02°25.8	219°51.1	11.0'	N22°51.3	-7.6'	55.2'	
13	12°42.3	24.8	234°21.1	11.0'	22°43.7	-7.7'	55.2'	
14	27°42.5	23.8	248°51.1	11.1'	22°35.9	-7.8'	55.2'	
15	42°42.7	22.8	263°21.2	11.1'	22°28.1	-7.9'	55.2'	
16	57°42.8	21.8	277°51.3	11.1'	22°20.2	-8.1'	55.3'	
17	72°43.0	20.8	292°21.5	11.2'	22°12.1	-8.2'	55.3'	
18	87°43.2	S02°19.8	306°51.6	11.2'	N22°03.9	-8.3'	55.3'	
19	102°43.4	18.9	321°21.9	11.2'	21°55.6	-8.4'	55.3'	
20	117°43.5	17.9	335°52.1	11.3'	21°47.2	-8.5'	55.4'	
21	132°43.7	16.9	350°22.4	11.3'	21°38.7	-8.6'	55.4'	
22	147°43.9	15.9	4°52.7	11.3'	21°30.1	-8.7'	55.4'	
23	162°44.1	14.9	19°23.0	11.4'	21°21.3	-8.8'	55.4'	
		SD = 16.1'		d = 1.0'		SD = 15.0'		
Tue		GHA	Dec	GHA	$\nu$	Dec	d	HP
0	177°44.2	S02°13.9	33°53.4	11.4'	N21°12.5	-9.0'	55.4'	
1	192°44.4	12.9	48°23.8	11.5'	21°03.5	-9.1'	55.5'	
2	207°44.6	12.0	62°54.3	11.5'	20°54.5	-9.2'	55.5'	
3	222°44.8	11.0	77°24.8	11.5'	20°45.3	-9.3'	55.5'	
4	237°44.9	10.0	91°55.3	11.6'	20°36.0	-9.4'	55.5'	
5	252°45.1	09.0	106°25.9	11.6'	20°26.6	-9.5'	55.6'	
6	267°45.3	S02°08.0	120°56.4	11.6'	N20°17.1	-9.6'	55.6'	
7	282°45.5	07.0	135°27.1	11.7'	20°07.5	-9.7'	55.6'	
8	297°45.6	06.0	149°57.7	11.7'	19°57.8	-9.8'	55.6'	
9	312°45.8	05.0	164°28.4	11.7'	19°48.0	-9.9'	55.7'	
10	327°46.0	04.1	178°59.1	11.8'	19°38.1	-10.0'	55.7'	
11	342°46.2	03.1	193°29.9	11.8'	19°28.1	-10.1'	55.7'	
12	357°46.3	S02°02.1	208°00.7	11.8'	N19°18.0	-10.2'	55.7'	
13	12°46.5	01.1	222°31.5	11.9'	19°07.7	-10.3'	55.8'	
14	27°46.7	02°00.1	237°02.4	11.9'	18°57.4	-10.4'	55.8'	
15	42°46.9	01°59.1	251°33.3	11.9'	18°47.0	-10.5'	55.8'	
16	57°47.1	58.1	266°04.3	12.0'	18°36.5	-10.6'	55.8'	
17	72°47.2	57.1	280°35.2	12.0'	18°25.9	-10.7'	55.9'	
18	87°47.4	S01°56.2	295°06.2	12.0'	N18°15.1	-10.8'	55.9'	
19	102°47.6	55.2	309°37.3	12.1'	18°04.3	-10.9'	55.9'	
20	117°47.8	54.2	324°08.3	12.1'	17°53.4	-11.0'	55.9'	
21	132°47.9	53.2	338°39.4	12.1'	17°42.4	-11.1'	56.0'	
22	147°48.1	52.2	353°10.6	12.2'	17°31.3	-11.2'	56.0'	
23	162°48.3	51.2	7°41.8	12.2'	17°20.1	-11.3'	56.0'	
		SD = 16.1'		d = 1.0'		SD = 15.1'		
Wed		GHA	Dec	GHA	$\nu$	Dec	d	HP
0	177°48.5	S01°50.2	22°13.0	12.2'	N17°08.9	-11.4'	56.1'	
1	192°48.6	49.2	36°44.2	12.3'	16°57.5	-11.5'	56.1'	
2	207°48.8	48.3	51°15.5	12.3'	16°46.0	-11.6'	56.1'	
3	222°49.0	47.3	65°46.8	12.3'	16°34.5	-11.6'	56.1'	
4	237°49.2	46.3	80°18.1	12.4'	16°22.8	-11.7'	56.2'	
5	252°49.4	45.3	94°49.5	12.4'	16°11.1	-11.8'	56.2'	
6	267°49.5	S01°44.3	109°20.8	12.4'	N15°59.3	-11.9'	56.2'	
7	282°49.7	43.3	123°52.3	12.5'	15°47.4	-12.0'	56.2'	
8	297°49.9	42.3	138°23.7	12.5'	15°35.4	-12.1'	56.3'	
9	312°50.1	41.3	152°55.2	12.5'	15°23.3	-12.2'	56.3'	
10	327°50.2	40.4	167°26.7	12.5'	15°11.1	-12.2'	56.3'	
11	342°50.4	39.4	181°58.3	12.6'	14°58.9	-12.3'	56.3'	
12	357°50.6	S01°38.4	196°29.8	12.6'	N14°46.6	-12.4'	56.4'	
13	12°50.8	37.4	211°01.4	12.6'	14°34.2	-12.5'	56.4'	
14	27°51.0	36.4	225°33.0	12.6'	14°21.7	-12.6'	56.4'	
15	42°51.1	35.4	240°04.7	12.7'	14°09.1	-12.6'	56.4'	
16	57°51.3	34.4	254°36.4	12.7'	13°56.5	-12.7'	56.5'	
17	72°51.5	33.4	269°08.1	12.7'	13°43.8	-12.8'	56.5'	
18	87°51.7	S01°32.4	283°39.8	12.8'	N13°31.0	-12.9'	56.5'	
19	102°51.9	31.5	298°11.6	12.8'	13°18.1	-12.9'	56.6'	
20	117°52.0	30.5	312°43.3	12.8'	13°05.1	-13.0'	56.6'	
21	132°52.2	29.5	327°15.1	12.8'	12°52.1	-13.1'	56.6'	
22	147°52.4	28.5	341°46.9	12.8'	12°39.0	-13.2'	56.6'	
23	162°52.6	27.5	356°18.8	12.9'	12°25.9	-13.2'	56.7'	
		SD = 16.1'		d = 1.0'		SD = 15.3'		

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

## March 17, 18, 19 UT (Thu., Fri., Sat.)

Aries				Venus				Mars				Jupiter				Saturn				Stars			
Thu	GHA	GHA	Dec	GHA	GHA	Dec	GHA	GHA	GHA	Dec	GHA	GHA	Dec	GHA	GHA	SHA	Dec						
0	174°33.0	222°54.0	\$15°27.1	223°49.0	\$19°15.3	185°26.8	\$05°45.6	211°17.5	\$15°30.1	Alpheratz	357°37.5	29°12.6											
1	189°35.5	237°54.0	26.7	238°49.6	14.9	200°28.7	45.3	226°19.7	30.0	Ankaa	353°09.9	-42°11.3											
2	204°37.9	252°53.9	26.4	253°50.1	14.4	215°30.7	45.1	241°21.9	29.9	Schedar	349°34.2	56°39.4											
3	219°40.4	267°53.9	26.0	268°50.6	14.0	230°32.6	44.9	256°24.2	29.9	Diphda	348°49.9	-17°52.1											
4	234°42.9	282°53.9	25.6	283°51.2	13.5	245°34.5	44.6	271°26.4	29.8	Achernar	335°22.5	-57°07.7											
5	249°45.3	297°53.9	25.2	298°51.7	13.0	260°36.4	44.4	286°28.6	29.7	Hamal	327°54.1	23°33.9											
6	264°47.8	312°53.8	\$15°24.9	313°52.2	\$19°12.6	275°38.3	\$05°44.2	301°30.8	\$15°29.6	Polaris	315°26.4	89°21.6											
7	279°50.3	327°53.8	24.5	328°52.8	12.1	290°40.2	43.9	316°33.0	29.6	Alcamer	315°13.8	-40°13.2											
8	294°52.7	342°53.8	24.1	343°53.3	11.7	305°42.1	43.7	331°35.2	29.5	Menkar	314°08.8	4°10.4											
9	309°55.2	357°53.8	23.7	358°53.9	11.2	320°44.0	43.5	346°37.4	29.4	Mirfak	308°31.8	49°56.4											
10	324°57.6	12°53.7	23.3	13°54.4	10.7	335°45.9	43.2	1°39.6	29.3	Aldebaran	290°42.4	16°33.1											
11	340°00.1	27°53.7	23.0	28°54.9	10.3	350°47.8	43.0	16°41.8	29.2	Rigel	281°06.1	-8°10.8											
12	355°02.6	42°53.7	\$15°22.6	43°55.5	\$19°09.8	5°49.7	\$05°42.8	31°44.0	\$15°29.2	Capella	280°25.4	46°01.3											
13	10°05.0	57°53.6	22.2	58°56.0	09.4	20°51.6	42.6	46°46.2	29.1	Bellatrix	278°25.4	6°22.1											
14	25°07.5	72°53.6	21.8	73°56.6	08.9	35°53.5	42.3	61°48.4	29.0	Elnath	278°04.8	28°37.6											
15	40°10.0	87°53.6	21.4	88°57.1	08.4	50°55.4	42.1	76°50.6	28.9	Alnilam	275°40.1	-1°11.4											
16	55°12.4	102°53.5	21.0	103°57.6	08.0	65°57.4	41.9	91°52.8	28.8	Betelgeuse	270°54.6	7°24.6											
17	70°14.9	117°53.5	20.6	118°58.2	07.5	80°59.3	41.6	106°55.0	28.8	Canopus	263°53.3	-52°42.7											
18	85°17.4	132°53.5	\$15°20.3	133°58.7	\$19°07.0	96°01.2	\$05°41.4	121°57.2	\$15°28.7	Sirius	258°28.2	-16°45.0											
19	100°19.8	147°53.4	19.9	148°59.3	06.6	111°03.1	41.2	136°59.4	28.6	Adhara	255°07.6	-29°00.4											
20	115°22.3	162°53.4	19.5	163°59.8	06.1	126°05.0	40.9	152°01.7	28.5	Procyon	244°53.1	5°10.0											
21	130°24.8	177°53.3	19.1	179°00.3	05.7	141°06.9	40.7	167°03.9	28.5	Pollux	243°20.0	27°58.4											
22	145°27.2	192°53.3	18.7	194°00.9	05.2	156°08.8	40.5	182°06.1	28.4	Avior	234°15.3	-59°35.0											
23	160°29.7	207°53.3	18.3	209°01.4	04.7	171°10.7	40.2	197°08.3	28.3	Suhail	222°47.7	-43°31.5											
Mer.pass. 12:20				ν -0.0' d 0.4' m -4.50				ν 0.5' d 0.5' m 1.16				ν 1.9' d 0.2' m -2.04				ν 2.2' d 0.1' m 0.83							
Fri				GHA				GHA				GHA				GHA							
0	175°32.1	222°53.2	\$15°17.9	224°02.0	\$19°04.3	186°12.6	\$05°40.0	212°10.5	\$15°28.2	Denebola	182°27.0	14°26.8											
1	190°34.6	237°53.2	17.5	239°02.5	03.8	201°14.5	39.8	227°12.7	28.1	Gienah	175°45.6	-17°39.9											
2	205°37.1	252°53.1	17.1	254°03.0	03.3	216°16.4	39.5	242°14.9	28.1	Acrua	173°02.0	-63°13.2											
3	220°39.5	267°53.1	16.7	269°03.6	02.9	231°18.3	39.3	257°17.1	28.0	Gacrux	171°53.6	-57°14.2											
4	235°42.0	282°53.1	16.3	284°04.1	02.4	246°20.2	39.1	272°19.3	27.9	Alioth	166°14.5	55°50.3											
5	250°44.5	297°53.0	15.9	299°04.7	01.9	261°22.2	38.8	287°21.5	27.8	Spica	158°24.5	-11°16.7											
6	265°46.9	312°53.0	\$15°15.5	314°05.2	\$19°01.5	276°24.1	\$05°38.6	302°23.7	\$15°27.8	Alkaid	152°53.4	49°12.0											
7	280°49.4	327°52.9	15.1	329°05.7	01.0	291°26.0	38.4	317°25.9	27.7	Hadar	148°38.8	-60°28.6											
8	295°51.9	342°52.9	14.7	344°06.3	00.5	306°27.9	38.1	332°28.1	27.6	Menkent	148°00.0	-36°28.7											
9	310°54.3	357°52.9	14.3	359°06.8	19°00.1	321°29.8	37.9	347°30.3	27.5	Arcturus	145°49.8	19°03.9											
10	325°56.8	12°52.8	13.9	14°07.4	18°59.6	336°31.7	37.7	2°32.5	27.4	Rigel Kent	139°43.0	-60°55.4											
11	340°59.2	27°52.8	13.5	29°07.9	59.1	351°33.6	37.4	17°34.8	27.4	Kochab	137°19.0	74°03.6											
12	356°01.7	42°52.7	\$15°13.1	44°08.4	\$18°58.7	6°35.5	\$05°37.2	32°37.0	\$15°27.3	Zuben'ubi	136°58.4	-16°08.0											
13	11°04.2	57°52.7	12.7	59°09.0	58.2	21°37.4	37.0	47°39.2	27.2	Alphecca	126°05.5	26°38.2											
14	26°06.6	72°52.6	12.3	74°09.5	57.7	36°39.3	36.7	62°41.4	27.1	Antares	112°18.6	-26°28.8											
15	41°09.1	87°52.6	11.9	89°10.1	57.2	51°41.2	36.5	77°43.6	27.0	Atria	107°14.8	-69°03.7											
16	56°11.6	102°52.5	11.5	104°10.6	56.8	66°43.1	36.3	92°45.8	27.0	Sabik	102°05.4	-15°45.2											
17	71°14.0	117°52.5	11.1	119°11.2	56.3	81°45.0	36.0	107°48.0	26.9	Shaula	96°13.5	-37°07.1											
18	86°16.5	132°52.4	\$15°10.7	134°11.7	\$18°55.8	96°47.0	\$05°35.8	122°50.2	\$15°26.8	Rasalhague	96°00.7	12°32.4											
19	101°19.0	147°52.4	10.3	149°12.2	55.4	111°48.9	35.6	137°52.4	26.7	Eltanin	90°43.3	51°28.8											
20	116°21.4	162°52.3	09.9	164°12.8	54.9	126°50.8	35.4	152°54.6	26.7	Kaus Aust.	83°35.7	-34°22.4											
21	131°23.9	177°52.3	09.5	179°13.3	54.4	141°52.7	35.1	167°56.8	26.6	Vega	80°34.9	38°47.9											
22	146°26.4	192°52.2	09.0	194°13.9	53.9	156°54.6	34.9	182°59.0	26.5	Nunki	75°50.7	-26°16.1											
23	161°28.8	207°52.2	08.6	209°14.4	53.5	171°56.5	34.7	198°01.3	26.4	Altair	62°02.4	8°55.4											
Mer.pass. 12:16				ν -0.0' d 0.4' m -4.49				ν 0.5' d 0.5' m 1.15				ν 1.9' d 0.2' m -2.04				ν 2.2' d 0.1' m 0.83							
Sat				GHA				GHA				GHA				GHA							
0	176°31.3	222°52.1	\$15°08.2	224°15.0	\$18°53.0	186°58.4	\$05°34.4	213°03.5	\$15°26.3	Mar 17 Thu	SHA	Mer.pass											
1	191°33.7	237°52.1	07.8	239°15.5	52.5	202°00.3	34.2	228°05.7	26.3	Venus	48°21.0	09:08											
2	206°36.2	252°52.0	07.4	254°16.0	52.1	217°02.2	34.0	243°07.9	26.2	Mars	49°16.0	09:04											
3	221°38.7	267°52.0	07.0	269°16.6	51.6	232°04.1	33.7	258°10.1	26.1	Jupiter	10°53.8	11:37											
4	236°41.1	282°51.9	06.6	284°17.1	51.1	247°06.0	33.5	273°12.3	26.0	Saturn	36°44.5	09:53											
5	251°43.6	297°51.9	06.1	299°17.7	50.6	262°08.0	33.3	288°14.5	26.0	Mar 18 Fri	SHA	Mer.pass											
6	266°46.1	312°51.8	\$15°05.7	314°18.2	\$18°50.2	277°09.9	\$05°33.0	303°16.7	\$15°25.9	Venus	47°21.1	09:08											
7	281°48.5	327°51.7	05.3	329°18.8	49.7	292°11.8	32.8	318°18.9	25.8	Mars	48°29.8	09:04											
8	296°51.0	342°51.7	04.9	34																			

DUT1 = UT1-UTC = -0.0994 sec  $\Delta T = TT-UT1 = +69.2834$  sec

2022 March 17 to Mar. 19 UT

h	Sun			Moon			
Thu	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	177°52.7	S01°26.5	10°50.7	12.9'	N12°12.6	-13.3'	56.7'
1	192°52.9	25.5	25°22.5	12.9'	11°59.3	-13.4'	56.7'
2	207°53.1	24.5	39°54.5	12.9'	11°45.9	-13.4'	56.7'
3	222°53.3	23.6	54°26.4	12.9'	11°32.5	-13.5'	56.8'
4	237°53.5	22.6	68°58.3	13.0'	11°19.0	-13.6'	56.8'
5	252°53.6	21.6	83°30.3	13.0'	11°05.4	-13.6'	56.8'
6	267°53.8	S01°20.6	98°02.3	13.0'	N10°51.8	-13.7'	56.9'
7	282°54.0	19.6	112°34.3	13.0'	10°38.1	-13.8'	56.9'
8	297°54.2	18.6	127°06.3	13.0'	10°24.3	-13.8'	56.9'
9	312°54.4	17.6	141°38.3	13.0'	10°10.5	-13.9'	56.9'
10	327°54.5	16.6	156°10.4	13.1'	09°56.6	-13.9'	57.0'
11	342°54.7	15.7	170°42.4	13.1'	09°42.6	-14.0'	57.0'
12	357°54.9	S01°14.7	185°14.5	13.1'	N09°28.6	-14.1'	57.0'
13	12°55.1	13.7	199°46.6	13.1'	09°14.6	-14.1'	57.0'
14	27°55.3	12.7	214°18.7	13.1'	09°00.4	-14.2'	57.1'
15	42°55.5	11.7	228°50.8	13.1'	08°46.3	-14.2'	57.1'
16	57°55.6	10.7	243°22.9	13.1'	08°32.0	-14.3'	57.1'
17	72°55.8	09.7	257°55.0	13.1'	08°17.8	-14.3'	57.1'
18	87°56.0	S01°08.7	272°27.2	13.1'	N08°03.4	-14.4'	57.2'
19	102°56.2	07.7	286°59.3	13.2'	07°49.0	-14.4'	57.2'
20	117°56.4	06.8	301°31.5	13.2'	07°34.6	-14.5'	57.2'
21	132°56.5	05.8	316°03.6	13.2'	07°20.1	-14.5'	57.2'
22	147°56.7	04.8	330°35.8	13.2'	07°05.6	-14.6'	57.3'
23	162°56.9	03.8	345°08.0	13.2'	06°51.0	-14.6'	57.3'
	SD = 16.1'			SD = 15.5'			

Fri	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	177°57.1	S01°02.8	359°40.1	13.2'	N06°36.4	-14.7'	57.3'
1	192°57.3	01.8	14°12.3	13.2'	06°21.7	-14.7'	57.3'
2	207°57.4	01°00.8	28°44.5	13.2'	06°07.0	-14.8'	57.4'
3	222°57.6	00°59.8	43°16.7	13.2'	05°52.3	-14.8'	57.4'
4	237°57.8	58.8	57°48.8	13.2'	05°37.5	-14.8'	57.4'
5	252°58.0	57.9	72°21.0	13.2'	05°22.6	-14.9'	57.4'
6	267°58.2	S00°56.9	86°53.2	13.2'	N05°07.8	-14.9'	57.5'
7	282°58.4	55.9	101°25.4	13.2'	04°52.9	-14.9'	57.5'
8	297°58.5	54.9	115°57.5	13.2'	04°37.9	-15.0'	57.5'
9	312°58.7	53.9	130°29.7	13.2'	04°22.9	-15.0'	57.5'
10	327°58.9	52.9	145°01.9	13.2'	04°07.9	-15.0'	57.6'
11	342°59.1	51.9	159°34.0	13.1'	03°52.9	-15.1'	57.6'
12	357°59.3	S00°50.9	174°06.2	13.1'	N03°37.8	-15.1'	57.6'
13	12°59.4	50.0	188°38.3	13.1'	03°22.7	-15.1'	57.6'
14	27°59.6	49.0	203°10.4	13.1'	03°07.6	-15.2'	57.7'
15	42°59.8	48.0	217°42.6	13.1'	02°52.4	-15.2'	57.7'
16	58°00.0	47.0	232°14.7	13.1'	02°37.2	-15.2'	57.7'
17	73°00.2	46.0	246°46.8	13.1'	02°22.0	-15.2'	57.7'
18	88°00.4	S00°45.0	261°18.9	13.1'	N02°06.8	-15.3'	57.8'
19	103°00.5	44.0	275°50.9	13.1'	01°51.5	-15.3'	57.8'
20	118°00.7	43.0	290°23.0	13.0'	01°36.3	-15.3'	57.8'
21	133°00.9	42.0	304°55.0	13.0'	01°21.0	-15.3'	57.8'
22	148°01.1	41.1	319°27.0	13.0'	01°05.6	-15.3'	57.9'
23	163°01.3	40.1	333°59.0	13.0'	00°50.3	-15.3'	57.9'
	SD = 16.1'			SD = 15.6'			

Sat	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	178°01.5	S00°39.1	348°31.0	13.0'	N00°35.0	-15.4'	57.9'
1	193°01.6	38.1	3°03.0	12.9'	00°19.6	-15.4'	57.9'
2	208°01.8	37.1	17°34.9	12.9'	N00°04.2	-15.4'	57.9'
3	223°02.0	36.1	32°06.9	12.9'	S00°11.2	-15.4'	58.0'
4	238°02.2	35.1	46°38.7	12.9'	00°26.6	-15.4'	58.0'
5	253°02.4	34.1	61°10.6	12.8'	00°42.0	-15.4'	58.0'
6	268°02.6	S00°33.2	75°42.5	12.8'	S00°57.4	-15.4'	58.0'
7	283°02.7	32.2	90°14.3	12.8'	01°12.8	-15.4'	58.1'
8	298°02.9	31.2	104°46.1	12.8'	01°28.2	-15.4'	58.1'
9	313°03.1	30.2	119°17.9	12.7'	01°43.7	-15.4'	58.1'
10	328°03.3	29.2	133°49.6	12.7'	01°59.1	-15.4'	58.1'
11	343°03.5	28.2	148°21.3	12.7'	02°14.5	-15.4'	58.1'
12	358°03.7	S00°27.2	162°53.0	12.6'	S02°30.0	-15.4'	58.2'
13	13°03.8	26.2	177°24.6	12.6'	02°45.4	-15.4'	58.2'
14	28°04.0	25.2	191°56.2	12.6'	03°00.9	-15.4'	58.2'
15	43°04.2	24.3	206°27.8	12.5'	03°16.3	-15.4'	58.2'
16	58°04.4	23.3	220°59.3	12.5'	03°31.7	-15.4'	58.2'
17	73°04.6	22.3	235°30.8	12.5'	03°47.1	-15.4'	58.3'
18	88°04.8	S00°21.3	250°02.3	12.4'	S04°02.5	-15.4'	58.3'
19	103°04.9	20.3	264°33.7	12.4'	04°17.9	-15.4'	58.3'
20	118°05.1	19.3	279°05.1	12.3'	04°33.3	-15.4'	58.3'
21	133°05.3	18.3	293°36.5	12.3'	04°48.7	-15.4'	58.3'
22	148°05.5	17.3	308°07.8	12.3'	05°04.0	-15.3'	58.4'
23	163°05.7	16.4	322°39.0	12.2'	05°19.4	-15.3'	58.4'
	SD = 16.1'			SD = 15.8'			

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

## March 20, 21, 22 UT (Sun., Mon., Tue.)

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	177°30.4	222°50.7	\$14°58.1	224°28.0	\$18°41.6	187°44.2	\$05°28.9	213°56.5	\$15°24.5					Alpheratz	357°37.5	29°12.6	
1	192°32.9	237°50.7	57.6	239°28.6	41.1	202°46.1	28.6	228°58.7	24.4					Ankaa	353°09.9	-42°11.3	
2	207°35.3	252°50.6	57.2	254°29.1	40.6	217°48.0	28.4	244°00.9	24.3					Schedar	349°34.2	56°39.4	
3	222°37.8	267°50.5	· · 56.8	269°29.7	· · 40.1	232°49.9	· · 28.2	259°03.1	· · 24.3					Diphda	348°49.9	-17°52.1	
4	237°40.3	282°50.5	56.3	284°30.2	39.6	247°51.9	27.9	274°05.3	24.2					Achernar	335°22.5	-57°07.7	
5	252°42.7	297°50.4	55.9	299°30.8	39.1	262°53.8	27.7	289°07.5	24.1					Hamal	327°54.1	23°33.9	
6	267°45.2	312°50.3	\$14°55.5	314°31.3	\$18°38.7	277°55.7	\$05°27.5	304°09.8	\$15°24.0					Polaris	315°27.5	89°21.6	
7	282°47.7	327°50.3	55.0	329°31.9	38.2	292°57.6	27.2	319°12.0	23.9					Acamar	315°13.8	-40°13.2	
8	297°50.1	342°50.2	54.6	344°32.4	37.7	307°59.5	27.0	334°14.2	23.9					Menkar	314°08.8	4°10.4	
9	312°52.6	357°50.1	· · 54.1	359°33.0	· · 37.2	323°01.4	· · 26.8	349°16.4	· · 23.8					Mirfak	308°31.9	49°56.4	
10	327°55.1	12°50.0	53.7	14°33.5	36.7	338°03.3	26.5	4°18.6	23.7					Aldebaran	290°42.4	16°33.1	
11	342°57.5	27°50.0	53.3	29°34.1	36.2	353°05.2	26.3	19°20.8	23.6					Rigel	281°06.2	-8°10.8	
12	358°00.0	42°49.9	\$14°52.8	44°34.6	\$18°35.8	8°07.1	\$05°26.1	34°23.0	\$15°23.6					Capella	280°25.4	46°01.3	
13	13°02.5	57°49.8	52.4	59°35.2	35.3	23°09.0	25.8	49°25.2	23.5					Bellatrix	278°25.4	6°22.1	
14	28°04.9	72°49.8	51.9	74°35.7	34.8	38°11.0	25.6	64°27.4	23.4					Elnath	278°04.8	28°37.6	
15	43°07.4	87°49.7	· · 51.5	89°36.3	· · 34.3	53°12.9	· · 25.4	79°29.7	· · 23.3					Alnilam	275°40.1	-1°11.4	
16	58°09.8	102°49.6	51.0	104°36.8	33.8	68°14.8	25.2	94°31.9	23.3					Betelgeuse	270°54.6	7°24.6	
17	73°12.3	117°49.5	50.6	119°37.4	33.3	83°16.7	24.9	109°34.1	23.2					Canopus	263°53.4	-52°42.7	
18	88°14.8	132°49.5	\$14°50.1	134°37.9	\$18°32.9	98°18.6	\$05°24.7	124°36.3	\$15°23.1					Sirius	258°28.2	-16°45.0	
19	103°17.2	147°49.4	49.7	149°38.5	32.4	113°20.5	24.5	139°38.5	23.0					Adhara	255°07.6	-29°00.4	
20	118°19.7	162°49.3	49.2	164°39.0	31.9	128°22.4	24.2	154°40.7	22.9					Procyon	244°53.1	5°10.0	
21	133°22.2	177°49.2	· · 48.8	179°39.6	· · 31.4	143°24.3	· · 24.0	169°42.9	· · 22.9					Pollux	243°20.0	27°58.4	
22	148°24.6	192°49.2	48.3	194°40.1	30.9	158°26.2	23.8	184°45.1	22.8					Avior	234°15.3	-59°35.0	
23	163°27.1	207°49.1	47.9	209°40.7	30.4	173°28.1	23.5	199°47.4	22.7					Suhail	222°47.7	-43°31.5	
Mer.pass. 12:08			ν -0.1° d 0.4° m -4.47	ν 0.5° d 0.5° m 1.14			ν 1.9° d 0.2° m -2.04			ν 2.2° d 0.1° m 0.83							
Mon			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec				
0	178°29.6	222°49.0	\$14°47.4	224°41.2	\$18°29.9	188°30.0	\$05°23.3	214°49.6	\$15°22.6					Denebola	182°27.0	14°26.8	
1	193°32.0	237°48.9	47.0	239°41.8	29.4	203°32.0	23.1	229°51.8	22.6					Gienah	175°45.6	-17°39.9	
2	208°34.5	252°48.9	46.5	254°42.3	29.0	218°33.9	22.8	244°54.0	22.5					Acrux	173°02.0	-63°13.3	
3	223°36.9	267°48.8	· · 46.1	269°42.9	· · 28.5	233°35.8	· · 22.6	259°56.2	· · 22.4					Gacrux	171°53.6	-57°14.2	
4	238°39.4	282°48.7	45.6	284°43.4	28.0	248°37.7	22.4	274°58.4	22.3					Alioth	166°14.5	55°50.3	
5	253°41.9	297°48.6	45.2	299°44.0	27.5	263°39.6	22.1	290°00.6	22.3					Spica	158°24.4	-11°16.7	
6	268°44.3	312°48.6	\$14°44.7	314°44.5	\$18°27.0	278°41.5	\$05°21.9	305°02.8	\$15°22.2					Alkaid	152°53.4	49°12.0	
7	283°46.8	327°48.5	44.3	329°45.1	26.5	293°43.4	21.7	320°05.1	22.1					Hadar	148°38.7	-60°28.6	
8	298°49.3	342°48.4	43.8	344°45.6	26.0	308°45.3	21.4	335°07.3	22.0					Menkent	148°00.0	-36°28.7	
9	313°51.7	357°48.3	· · 43.3	359°46.2	· · 25.5	323°47.2	· · 21.2	350°09.5	· · 22.0					Arcturus	145°49.8	19°03.9	
10	328°54.2	12°48.2	42.9	14°46.7	25.0	338°49.2	21.0	5°11.7	21.9					Rigel Kent.	139°43.0	-60°55.4	
11	343°56.7	27°48.2	42.4	29°47.3	24.5	353°51.1	20.8	20°13.9	21.8					Kochab	137°19.0	74°03.6	
12	358°59.1	42°48.1	\$14°42.0	44°47.8	\$18°24.0	8°53.0	\$05°20.5	35°16.1	\$15°21.7					Zuben'ubi	136°58.3	-16°08.0	
13	14°01.6	57°48.0	41.5	59°48.4	23.6	23°54.9	20.3	50°18.3	21.6					Alphecca	126°05.5	26°38.2	
14	29°04.1	72°47.9	41.0	74°48.9	23.1	38°56.8	20.1	65°20.6	21.6					Antares	112°18.5	-26°28.8	
15	44°06.5	87°47.8	· · 40.6	89°49.5	· · 22.6	53°58.7	· · 19.8	80°22.8	· · 21.5					Atria	107°14.7	-69°03.7	
16	59°09.0	102°47.7	40.1	104°50.0	22.1	69°00.6	19.6	95°25.0	21.4					Sabik	102°05.4	-15°45.2	
17	74°11.4	117°47.7	39.6	119°50.6	21.6	84°02.5	19.4	110°27.2	21.3					Shaula	96°13.5	-37°07.1	
18	89°13.9	132°47.6	\$14°39.2	134°51.1	\$18°21.1	99°04.4	\$05°19.1	125°29.4	\$15°21.3					Rasalhague	96°00.7	12°32.4	
19	104°16.4	147°47.5	38.7	149°51.7	20.6	114°06.3	18.9	140°31.6	21.2					Eltanin	90°43.3	51°28.8	
20	119°18.8	162°47.4	38.2	164°52.3	20.1	129°08.3	18.7	155°33.8	21.1					Kaus Aust.	83°35.6	-34°22.4	
21	134°21.3	177°47.3	· · 37.8	179°52.8	· · 19.6	144°10.2	· · 18.4	170°36.1	· · 21.0					Vega	80°34.9	38°47.9	
22	149°23.8	192°47.2	37.3	194°53.4	19.1	159°12.1	18.2	185°38.3	21.0					Nunki	75°50.7	-26°16.1	
23	164°26.2	207°47.1	36.8	209°53.9	18.6	174°14.0	18.0	200°40.5	20.9					Altair	62°02.4	8°55.4	
Mer.pass. 12:04			ν -0.1° d 0.5° m -4.46	ν 0.6° d 0.5° m 1.14			ν 1.9° d 0.2° m -2.04			ν 2.2° d 0.1° m 0.83							
Tue			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec				
0	179°28.7	222°47.1	\$14°36.4	224°54.5	\$18°18.1	189°15.9	\$05°17.7	215°42.7	\$15°20.8					Peacock	53°09.7	-56°39.7	
1	194°31.2	237°47.0	35.9	239°55.0	17.6	204°17.8	17.5	230°44.9	20.7					Deneb	49°27.7	45°21.2	
2	209°33.6	252°46.9	35.4	254°55.6	17.1	219°19.7	17.3	245°47.1	20.7					Enif	33°41.3	9°58.4	
3	224°36.1	267°46.8	· · 34.9	269°56.1	· · 16.6	234°21.6	· · 17.0	260°49.3	· · 20.6					Almalhaut	27°36.2	-46°51.3	
4	239°38.5	282°46.7	34.5	284°56.7	16.1	249°23.5	16.8	275°51.6	20.5					Scheat	13°47.8	28°12.0	
5	254°41.0	297°46.6	34.0	299°57.2	15.6	264°25.5	16.6	290°53.8	20.4					Markab	13°32.5	15°19.2	
6	269°43.5	312°46.5	\$14°33.5	314°57.8	\$18°15.1	279°27.4	\$05°16.4	305°56.0	\$15°20.4					Mar 20 Sun			
7	284°45.9	327°46.4	33.0	329°58.3	14.6	294°29.3	16.1	320°58.2	20.3					Venus	45°20.3	09:09	
8	299°48.4	342°46.3	32.6	344°58.9	14.1	309°31.2	15.9	336°00.4	20.2					Mars	46°57.6	09:02	
9	314°50.9	357°46.3	· · 32.1	359°59.5	· · 13.6	324°33.1	· · 15.7	351°02.6	· · 20.1					Jupiter	10°13.8	11:28	
10	329°53.3	12°46.2	31.6	15°00.0	13.1	339°35.0	15.4	6°04.8	20.0					Saturn	36°26.1	09:43	
11	344°55.8	27°46.1	31.1	30°00.6	12.6	354°36.9	15.2	21°07.1	20.0								

DUT1 = UT1-UTC = -0.1002 sec  $\Delta T = TT-UT1 = +69.2842$  sec

2022 March 20 to Mar. 22 UT

h		Sun		Moon			
Sun	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	178°05.9	S00°15.4	337°10.3	12.2'	S05°34.7	-15.3'	58.4'
1	193°06.1	14.4	351°41.4	12.1'	05°50.0	-15.3'	58.4'
2	208°06.2	13.4	6°12.6	12.1'	06°05.3	-15.3'	58.4'
3	223°06.4	12.4	20°43.6	12.0'	06°20.6	-15.2'	58.4'
4	238°06.6	11.4	35°14.7	12.0'	06°35.8	-15.2'	58.5'
5	253°06.8	10.4	49°45.7	11.9'	06°51.1	-15.2'	58.5'
6	268°07.0	S00°09.4	64°16.6	11.9'	S07°06.2	-15.2'	58.5'
7	283°07.2	08.5	78°47.5	11.8'	07°21.4	-15.1'	58.5'
8	298°07.4	07.5	93°18.3	11.8'	07°36.6	-15.1'	58.5'
9	313°07.5	06.5	107°49.1	11.7'	07°51.7	-15.1'	58.6'
10	328°07.7	05.5	122°19.8	11.7'	08°06.7	-15.0'	58.6'
11	343°07.9	04.5	136°50.5	11.6'	08°21.8	-15.0'	58.6'
12	358°08.1	S00°03.5	151°21.1	11.6'	S08°36.8	-15.0'	58.6'
13	13°08.3	02.5	165°51.6	11.5'	08°51.8	-14.9'	58.6'
14	28°08.5	01.5	180°22.1	11.4'	09°06.7	-14.9'	58.6'
15	43°08.6	S00°00.5	194°52.5	11.4'	09°21.6	-14.9'	58.6'
16	58°08.8	N00°00.4	209°22.9	11.3'	09°36.5	-14.8'	58.7'
17	73°09.0	01.4	223°53.2	11.3'	09°51.3	-14.8'	58.7'
18	88°09.2	N00°02.4	238°23.5	11.2'	S10°06.0	-14.7'	58.7'
19	103°09.4	03.4	252°53.7	11.1'	10°20.8	-14.7'	58.7'
20	118°09.6	04.4	267°23.8	11.1'	10°35.4	-14.6'	58.7'
21	133°09.8	05.4	281°53.9	11.0'	10°50.1	-14.6'	58.7'
22	148°09.9	06.4	296°23.9	10.9'	11°04.6	-14.5'	58.7'
23	163°10.1	07.4	310°53.8	10.9'	11°19.2	-14.5'	58.8'
		SD = 16.1'		SD = 15.9'			
Mon	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	178°10.3	N00°08.3	325°23.6	10.8'	S11°33.6	-14.4'	58.8'
1	193°10.5	09.3	339°53.4	10.7'	11°48.0	-14.4'	58.8'
2	208°10.7	10.3	354°23.2	10.7'	12°02.4	-14.3'	58.8'
3	223°10.9	11.3	8°52.8	10.6'	12°16.7	-14.2'	58.8'
4	238°11.1	12.3	23°22.4	10.5'	12°31.0	-14.2'	58.8'
5	253°11.2	13.3	37°51.9	10.4'	12°45.1	-14.1'	58.8'
6	268°11.4	N00°14.3	52°21.3	10.4'	S12°59.3	-14.1'	58.9'
7	283°11.6	15.3	66°50.7	10.3'	13°13.3	-14.0'	58.9'
8	298°11.8	16.2	81°20.0	10.2'	13°27.3	-13.9'	58.9'
9	313°12.0	17.2	95°49.2	10.1'	13°41.2	-13.8'	58.9'
10	328°12.2	18.2	110°18.3	10.1'	13°55.1	-13.8'	58.9'
11	343°12.4	19.2	124°47.4	10.0'	14°08.8	-13.7'	58.9'
12	358°12.6	N00°20.2	139°16.4	9.9'	S14°22.5	-13.6'	58.9'
13	13°12.7	21.2	153°45.3	9.8'	14°36.2	-13.6'	58.9'
14	28°12.9	22.2	168°14.1	9.7'	14°49.7	-13.5'	58.9'
15	43°13.1	23.1	182°42.8	9.7'	15°03.2	-13.4'	59.0'
16	58°13.3	24.1	197°11.5	9.6'	15°16.6	-13.3'	59.0'
17	73°13.5	25.1	211°40.1	9.5'	15°29.9	-13.2'	59.0'
18	88°13.7	N00°26.1	226°08.6	9.4'	S15°43.2	-13.2'	59.0'
19	103°13.9	27.1	240°37.0	9.3'	15°56.3	-13.1'	59.0'
20	118°14.0	28.1	255°05.3	9.3'	16°09.4	-13.0'	59.0'
21	133°14.2	29.1	269°33.6	9.2'	16°22.4	-12.9'	59.0'
22	148°14.4	30.1	284°01.8	9.1'	16°35.2	-12.8'	59.0'
23	163°14.6	31.0	298°29.9	9.0'	16°48.0	-12.7'	59.0'
		SD = 16.1'		SD = 16.0'			
Tue	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	178°14.8	N00°32.0	312°57.9	8.9'	S17°00.8	-12.6'	59.0'
1	193°15.0	33.0	327°25.8	8.8'	17°13.4	-12.5'	59.0'
2	208°15.2	34.0	341°53.6	8.7'	17°25.9	-12.4'	59.1'
3	223°15.4	35.0	356°21.4	8.7'	17°38.3	-12.3'	59.1'
4	238°15.5	36.0	10°49.0	8.6'	17°50.6	-12.2'	59.1'
5	253°15.7	37.0	25°16.6	8.5'	18°02.8	-12.1'	59.1'
6	268°15.9	N00°38.0	39°44.1	8.4'	S18°15.0	-12.0'	59.1'
7	283°16.1	38.9	54°11.5	8.3'	18°27.0	-11.9'	59.1'
8	298°16.3	39.9	68°38.8	8.2'	18°38.9	-11.8'	59.1'
9	313°16.5	40.9	83°06.0	8.1'	18°50.7	-11.7'	59.1'
10	328°16.7	41.9	97°33.2	8.1'	19°02.4	-11.6'	59.1'
11	343°16.8	42.9	112°00.2	8.0'	19°14.0	-11.5'	59.1'
12	358°17.0	N00°43.9	126°27.2	7.9'	S19°25.4	-11.4'	59.1'
13	13°17.2	44.9	140°54.1	7.8'	19°36.8	-11.2'	59.1'
14	28°17.4	45.8	155°20.8	7.7'	19°48.0	-11.1'	59.1'
15	43°17.6	46.8	169°47.5	7.6'	19°59.2	-11.0'	59.1'
16	58°17.8	47.8	184°14.1	7.5'	20°10.2	-10.9'	59.1'
17	73°18.0	48.8	198°40.7	7.4'	20°21.1	-10.8'	59.2'
18	88°18.2	N00°49.8	213°07.1	7.3'	S20°31.8	-10.6'	59.2'
19	103°18.3	50.8	227°33.5	7.3'	20°42.5	-10.5'	59.2'
20	118°18.5	51.8	241°59.7	7.2'	20°53.0	-10.4'	59.2'
21	133°18.7	52.7	256°25.9	7.1'	21°03.4	-10.3'	59.2'
22	148°18.9	53.7	270°52.0	7.0'	21°13.6	-10.1'	59.2'
23	163°19.1	54.7	285°18.0	6.9'	21°23.8	-10.0'	59.2'
		SD = 16.0'		SD = 16.1'			

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

## March 23, 24, 25 UT (Wed., Thu., Fri.)

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	180°27.8	222°44.8	\$14°24.8	225°07.8	\$18°06.1	190°01.8	\$05°12.2	216°35.9	\$15°19.0	Alpheratz	357°37.5	29°12.6					
1	195°30.3	237°44.8	24.3	240°08.4	05.6	205°03.7	12.0	231°38.1	18.9	Ankaa	353°09.9	-42°11.3					
2	210°32.8	252°44.7	23.8	255°08.9	05.1	220°05.6	11.7	246°40.3	18.8	Schedar	349°34.2	56°39.4					
3	225°35.2	267°44.6	.. 23.3	270°09.5	.. 04.6	235°07.5	.. 11.5	261°42.5	.. 18.8	Diphda	348°49.9	-17°52.1					
4	240°37.7	282°44.5	22.8	285°10.0	04.1	250°09.4	11.3	276°44.7	18.7	Achernar	335°22.5	-57°07.7					
5	255°40.2	297°44.4	22.3	300°10.6	03.6	265°11.3	11.0	291°47.0	18.6	Hamal	327°54.1	23°33.9					
6	270°42.6	312°44.3	\$14°21.9	315°11.1	\$18°03.1	280°13.2	\$05°10.8	306°49.2	\$15°18.5	Polaris	315°28.2	89°21.6					
7	285°45.1	327°44.2	21.4	330°11.7	02.6	295°15.2	10.6	321°51.4	18.5	Acamar	315°13.8	-40°13.2					
8	300°47.5	342°44.1	20.9	345°12.3	02.1	310°17.1	10.3	336°53.6	18.4	Menkar	314°08.8	4°10.4					
9	315°50.0	357°44.0	.. 20.4	0°12.8	.. 01.6	325°19.0	.. 10.1	351°55.8	.. 18.3	Mirfak	308°31.9	49°56.4					
10	330°52.5	12°43.9	19.9	15°13.4	01.1	340°20.9	09.9	6°58.0	18.2	Aldebaran	290°42.4	16°33.1					
11	345°54.9	27°43.8	19.4	30°13.9	00.6	355°22.8	09.6	22°00.3	18.2	Rigel	281°06.2	-8°10.8					
12	0°57.4	42°43.7	\$14°18.9	45°14.5	\$18°00.1	10°24.7	\$05°09.4	37°02.5	\$15°18.1	Capella	280°25.4	46°01.3					
13	15°59.9	57°43.6	18.4	60°15.1	17°59.6	25°26.6	09.2	52°04.7	18.0	Bellatrix	278°25.4	6°22.1					
14	31°02.3	72°43.5	17.9	75°15.6	59.1	40°28.5	09.0	67°06.9	17.9	Elnath	278°04.9	28°37.6					
15	46°04.8	87°43.3	.. 17.4	90°16.2	.. 58.5	55°30.5	.. 08.7	82°09.1	.. 17.9	Alnilam	275°40.1	-1°11.4					
16	61°07.3	102°43.2	16.9	105°16.7	58.0	70°32.4	08.5	97°11.4	17.8	Betelgeuse	270°54.6	7°24.6					
17	76°09.7	117°43.1	16.4	120°17.3	57.5	85°34.3	08.3	112°13.6	17.7	Canopus	263°53.4	-52°42.7					
18	91°12.2	132°43.0	\$14°15.8	135°17.9	\$17°57.0	100°36.2	\$05°08.0	127°15.8	\$15°17.6	Sirius	258°28.2	-16°45.0					
19	106°14.7	147°42.9	15.3	150°18.4	56.5	115°38.1	07.8	142°18.0	17.6	Adhara	255°07.6	-29°00.4					
20	121°17.1	162°42.8	14.8	165°19.0	56.0	130°40.0	07.6	157°20.2	17.5	Procyon	244°53.1	5°10.0					
21	136°19.6	177°42.7	.. 14.3	180°19.5	.. 55.5	145°41.9	.. 07.3	172°22.4	.. 17.4	Pollux	243°20.0	27°58.4					
22	151°22.0	192°42.6	13.8	195°20.1	55.0	160°43.8	07.1	187°24.7	17.3	Avior	234°15.3	-59°35.1					
23	166°24.5	207°42.5	13.3	210°20.7	54.5	175°45.8	06.9	202°26.9	17.3	Suhail	222°47.7	-43°31.5					
Mer.pass. 11:56			ν -0.1' d 0.5' m -4.44	ν 0.6' d 0.5' m 1.12	ν 1.9' d 0.2' m -2.04	ν 2.2' d 0.1' m 0.83	Mer.pass. 11:56			Mer.pass. 11:56			Mer.pass. 11:56				
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec						
0	181°27.0	222°42.4	\$14°12.8	225°21.2	\$17°54.0	190°47.7	\$05°06.6	217°29.1	\$15°17.2	Denebola	182°27.0	14°26.8					
1	196°29.4	237°42.3	12.3	240°21.8	53.5	205°49.6	06.4	232°31.3	17.1	Gienah	175°45.6	-17°40.0					
2	211°31.9	252°42.2	11.8	255°22.3	52.9	220°51.5	06.2	247°33.5	17.0	Acrux	173°02.0	-63°13.3					
3	226°34.4	267°42.1	.. 11.3	270°22.9	.. 52.4	235°53.4	.. 06.0	262°35.8	.. 17.0	Gacrux	171°53.6	-57°14.2					
4	241°36.8	282°42.0	10.8	285°23.5	51.9	250°55.3	05.7	277°38.0	16.9	Alioth	166°14.5	55°50.3					
5	256°39.3	297°41.9	10.2	300°24.0	51.4	265°57.2	05.5	292°40.2	16.8	Spica	158°24.4	-11°16.7					
6	271°41.8	312°41.8	\$14°09.7	315°24.6	\$17°50.9	280°59.1	\$05°05.3	307°42.4	\$15°16.7	Alkaid	152°53.4	49°12.0					
7	286°44.2	327°41.7	09.2	330°25.1	50.4	296°01.1	05.0	322°44.6	16.7	Hadar	148°38.7	-60°28.6					
8	301°46.7	342°41.5	08.7	345°25.7	49.9	311°03.0	04.8	337°46.9	16.6	Menkent	148°00.0	-36°28.7					
9	316°49.1	357°41.4	.. 08.2	0°26.3	.. 49.4	326°04.9	.. 04.6	352°49.1	.. 16.5	Arcturus	145°49.8	19°03.9					
10	331°51.6	12°41.3	07.7	15°26.8	48.8	341°06.8	04.3	7°51.3	16.4	Rigel Kent.	139°42.9	-60°55.4					
11	346°54.1	27°41.2	07.1	30°27.4	48.3	356°08.7	04.1	22°53.5	16.4	Kochab	137°18.9	74°03.6					
12	1°56.5	42°41.1	\$14°06.6	45°28.0	\$17°47.8	11°10.6	\$05°03.9	37°55.7	\$15°16.3	Zuben'ubi	136°58.3	-16°08.0					
13	16°59.0	57°41.0	06.1	60°28.5	47.3	26°12.5	03.6	52°58.0	16.2	Alphecca	126°05.5	26°38.2					
14	32°01.5	72°40.9	05.6	75°29.1	46.8	41°14.4	03.4	68°00.2	16.1	Antares	112°18.5	-26°28.8					
15	47°03.9	87°40.8	.. 05.1	90°29.6	.. 46.3	56°16.4	.. 03.2	83°02.4	.. 16.1	Atria	107°14.7	-69°03.7					
16	62°06.4	102°40.7	04.5	105°30.2	45.8	71°18.3	03.0	98°04.6	16.0	Sabik	102°05.3	-15°45.2					
17	77°08.9	117°40.5	04.0	120°30.8	45.2	86°20.2	02.7	113°06.8	15.9	Shaula	96°13.4	-37°07.1					
18	92°11.3	132°40.4	\$14°03.5	135°31.3	\$17°44.7	101°22.1	\$05°02.5	128°09.1	\$15°15.8	Rasalhague	96°00.6	12°32.4					
19	107°13.8	147°40.3	03.0	150°31.9	44.2	116°24.0	02.3	143°11.3	15.8	Eltanin	90°43.2	51°28.8					
20	122°16.3	162°40.2	02.4	165°32.5	43.7	131°25.9	02.0	158°13.5	15.7	Kaus Aust.	83°35.6	-34°22.4					
21	137°18.7	177°40.1	.. 01.9	180°33.0	.. 43.2	146°27.8	.. 01.8	173°15.7	.. 15.6	Vega	80°34.8	38°47.9					
22	152°21.2	192°40.0	01.4	195°33.6	42.7	161°29.8	01.6	188°17.9	15.5	Nunki	75°50.7	-26°16.1					
23	167°23.6	207°39.9	00.9	210°34.2	42.1	176°31.7	01.3	203°20.2	15.5	Altair	62°02.3	8°55.4					
Mer.pass. 11:52			ν -0.1' d 0.5' m -4.42	ν 0.6' d 0.5' m 1.12	ν 1.9' d 0.2' m -2.04	ν 2.2' d 0.1' m 0.83	Mer.pass. 11:52			Mer.pass. 11:52			Mer.pass. 11:52				
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec						
0	182°26.1	222°39.8	\$14°00.3	225°34.7	\$17°41.6	191°33.6	\$05°01.1	218°22.4	\$15°15.4	Mar 23 Wed	SHA	Mer.pass					
1	197°28.6	237°39.6	13°59.8	240°35.3	41.1	206°35.5	00.9	233°24.6	15.3	Venus	42°17.0	09:09					
2	212°31.0	252°39.5	59.3	255°35.8	40.6	221°37.4	00.6	248°26.8	15.3	Mars	44°40.0	08:59					
3	227°33.5	267°39.4	.. 58.7	270°36.4	.. 40.1	236°39.3	.. 00.4	263°29.0	.. 15.2	Jupiter	9°33.9	11:18					
4	242°36.0	282°39.3	58.2	285°37.0	39.5	251°41.2	00.2	278°31.3	15.1	Saturn	36°08.0	09:32					
5	257°38.7	297°39.2	57.7	300°37.5	39.0	266°43.2	00.0	293°33.5	15.0	Mar 24 Thu	SHA	Mer.pass					
6	272°40.9	312°39.1	\$13°57.1	315°38.1	\$17°38.5	281°45.1	\$04°59.7	308°35.7	\$15°15.0	Venus	41°15.4	09:09					
7	287°43.4	327°38.9	56.6	330°38.7	38.0	296°47.0	59.5	323°37.9	14.9	Mars	43°54.2	08:58					
8	302°45.8	342°38.8	56.1	345°39.2	37.5	311°48.9	59.3	338°40.1	14.8	Jupiter	9°20.7	11:15					
9	317°48.3	357°38.7	.. 55.5	0°39.8	.. 37.0	326°50.8	.. 59.0	353°42.4	.. 14.7	Saturn	36°02.1	09:29					
10	332°50.8	12°38.6	55.0	15°40.4	36.4	341°52.7	58.8	8°44.6	14.7	Mar 25 Fri	SHA	Mer.pass					
11	347°53.2	27°38.5	54.5	30°40.9	35.9	356°54.6	58.6	23°46.8	14.6	Venus	40°13.6	09:09					
12	2°55.7	42°38.4	\$13°53.9	45°41.5	\$17°35.4	11°56.6	\$04°58.3	38°49.0	\$15°14.5	Mars	43°08.6	08:57					

DUT1 = UT1-UTC = -0.1008 sec  $\Delta T = TT-UT1 = +69.2848$  sec

2022 March 23 to Mar. 25 UT

h	Sun		Moon				
Wed	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	178°19.3	N00°55.7	299°43.9	6.8'	S21°33.8	-9.9'	59.2'
1	193°19.5	56.7	314°09.7	6.7'	21°43.7	-9.7'	59.2'
2	208°19.7	57.7	328°35.4	6.7'	21°53.4	-9.6'	59.2'
3	223°19.8	.. 58.7	343°01.1	6.6'	22°03.0	-9.5'	59.2'
4	238°20.0	00°59.6	357°26.7	6.5'	22°12.5	-9.3'	59.2'
5	253°20.2	01°00.6	11°52.2	6.4'	22°21.8	-9.2'	59.2'
6	268°20.4	N01°01.6	26°17.6	6.3'	S22°31.0	-9.0'	59.2'
7	283°20.6	02.6	40°42.9	6.2'	22°40.0	-8.9'	59.2'
8	298°20.8	03.6	55°08.1	6.2'	22°48.9	-8.8'	59.2'
9	313°21.0	.. 04.6	69°33.3	6.1'	22°57.7	-8.6'	59.2'
10	328°21.2	05.6	83°58.4	6.0'	23°06.3	-8.5'	59.2'
11	343°21.3	06.5	98°23.3	5.9'	23°14.8	-8.3'	59.2'
12	358°21.5	N01°07.5	112°48.3	5.8'	S23°23.1	-8.2'	59.2'
13	13°21.7	08.5	127°13.1	5.8'	23°31.3	-8.0'	59.2'
14	28°21.9	09.5	141°37.9	5.7'	23°39.3	-7.9'	59.2'
15	43°22.1	.. 10.5	156°02.5	5.6'	23°47.1	-7.7'	59.2'
16	58°22.3	11.5	170°27.2	5.5'	23°54.9	-7.6'	59.2'
17	73°22.5	12.5	184°51.7	5.5'	24°02.4	-7.4'	59.2'
18	88°22.7	N01°13.4	199°16.2	5.4'	S24°09.8	-7.2'	59.2'
19	103°22.9	14.4	213°40.5	5.3'	24°17.1	-7.1'	59.2'
20	118°23.0	15.4	228°04.9	5.2'	24°24.2	-6.9'	59.2'
21	133°23.2	.. 16.4	242°29.1	5.2'	24°31.1	-6.8'	59.2'
22	148°23.4	17.4	256°53.3	5.1'	24°37.9	-6.6'	59.2'
23	163°23.6	18.4	271°17.4	5.0'	24°44.5	-6.4'	59.2'
	SD = 16.0'		SD = 16.1'				

Thu	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	178°23.8	N01°19.4	285°41.4	5.0'	S24°50.9	-6.3'	59.2'
1	193°24.0	20.3	300°05.4	4.9'	24°57.2	-6.1'	59.2'
2	208°24.2	21.3	314°29.4	4.9'	25°03.3	-5.9'	59.2'
3	223°24.4	.. 22.3	328°53.2	4.8'	25°09.2	-5.8'	59.2'
4	238°24.5	23.3	343°17.0	4.7'	25°15.0	-5.6'	59.2'
5	253°24.7	24.3	357°40.8	4.7'	25°20.6	-5.4'	59.2'
6	268°24.9	N01°25.3	12°04.4	4.6'	S25°26.1	-5.3'	59.2'
7	283°25.1	26.2	26°28.1	4.6'	25°31.3	-5.1'	59.2'
8	298°25.3	27.2	40°51.6	4.5'	25°36.4	-4.9'	59.2'
9	313°25.5	.. 28.2	55°15.2	4.5'	25°41.4	-4.8'	59.2'
10	328°25.7	29.2	69°38.6	4.4'	25°46.1	-4.6'	59.2'
11	343°25.9	30.2	84°02.1	4.4'	25°50.7	-4.4'	59.2'
12	358°26.0	N01°31.2	98°25.5	4.3'	S25°55.1	-4.2'	59.2'
13	13°26.2	32.2	112°48.8	4.3'	25°59.4	-4.1'	59.2'
14	28°26.4	33.1	127°12.1	4.3'	26°03.4	-3.9'	59.2'
15	43°26.6	.. 34.1	141°35.3	4.2'	26°07.3	-3.7'	59.2'
16	58°26.8	35.1	155°58.6	4.2'	26°11.0	-3.5'	59.2'
17	73°27.0	36.1	170°21.7	4.1'	26°14.5	-3.3'	59.2'
18	88°27.2	N01°37.1	184°44.9	4.1'	S26°17.9	-3.2'	59.2'
19	103°27.4	38.1	199°08.0	4.1'	26°21.0	-3.0'	59.2'
20	118°27.6	39.0	213°31.1	4.1'	26°24.0	-2.8'	59.2'
21	133°27.7	.. 40.0	227°54.1	4.0'	26°26.8	-2.6'	59.2'
22	148°27.9	41.0	242°17.2	4.0'	26°29.5	-2.4'	59.2'
23	163°28.1	42.0	256°40.2	4.0'	26°31.9	-2.3'	59.2'
	SD = 16.0'		SD = 16.2'				

Fri	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	178°28.3	N01°43.0	271°03.1	4.0'	S26°34.2	-2.1'	59.2'
1	193°28.5	44.0	285°26.1	3.9'	26°36.3	-1.9'	59.2'
2	208°28.7	44.9	299°49.0	3.9'	26°38.2	-1.7'	59.2'
3	223°28.9	.. 45.9	314°12.0	3.9'	26°39.9	-1.5'	59.2'
4	238°29.1	46.9	328°34.9	3.9'	26°41.4	-1.4'	59.2'
5	253°29.2	47.9	342°57.8	3.9'	26°42.8	-1.2'	59.2'
6	268°29.4	N01°48.9	357°20.7	3.9'	S26°43.9	-1.0'	59.2'
7	283°29.6	49.9	11°43.5	3.9'	26°44.9	-0.8'	59.2'
8	298°29.8	50.8	26°06.4	3.9'	26°45.7	-0.6'	59.2'
9	313°30.0	.. 51.8	40°29.3	3.9'	26°46.3	-0.4'	59.2'
10	328°30.2	52.8	54°52.2	3.9'	26°46.8	-0.3'	59.1'
11	343°30.4	53.8	69°15.1	3.9'	26°47.0	-0.1'	59.1'
12	358°30.6	N01°54.8	83°37.9	3.9'	S26°47.1	0.1'	59.1'
13	13°30.8	55.7	98°00.8	3.9'	26°47.0	0.3'	59.1'
14	28°30.9	56.7	112°23.7	3.9'	26°46.7	0.5'	59.1'
15	43°31.1	.. 57.7	126°46.7	3.9'	26°46.2	0.7'	59.1'
16	58°31.3	58.7	141°09.6	3.9'	26°45.6	0.8'	59.1'
17	73°31.5	01°59.7	155°32.5	4.0'	26°44.7	1.0'	59.1'
18	88°31.7	N02°00.7	169°55.5	4.0'	S26°43.7	1.2'	59.1'
19	103°31.9	01.6	184°18.5	4.0'	26°42.5	1.4'	59.1'
20	118°32.1	02.6	198°41.5	4.0'	26°41.1	1.6'	59.1'
21	133°32.3	.. 03.6	213°04.5	4.1'	26°39.5	1.8'	59.1'
22	148°32.5	04.6	227°27.5	4.1'	26°37.8	1.9'	59.1'
23	163°32.6	05.6	241°50.6	4.1'	26°35.8	2.1'	59.1'
	SD = 16.0'		SD = 16.1'				

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

## March 26, 27, 28 UT (Sat., Sun., Mon.)

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	183°25.3	222°36.9	\$13°47.4	225°48.3	\$17°29.1	192°19.5	\$04°55.6	219°15.7	\$15°13.6								
1	198°27.7	237°36.8	46.9	240°48.9	28.6	207°21.4	55.3	234°17.9	13.6								
2	213°30.2	252°36.7	46.3	255°49.4	28.1	222°23.4	55.1	249°20.2	13.5								
3	228°32.6	267°36.5	.. 45.8	270°50.0	.. 27.5	237°25.3	.. 54.9	264°22.4	.. 13.4								
4	243°35.1	282°36.4	45.2	285°50.6	27.0	252°27.2	54.7	279°24.6	13.3								
5	258°37.6	297°36.3	44.7	300°51.1	26.5	267°29.1	54.4	294°26.8	13.3								
6	273°40.0	312°36.2	\$13°44.1	315°51.7	\$17°26.0	282°31.0	\$04°54.2	309°29.1	\$15°13.2								
7	288°42.5	327°36.0	43.6	330°52.3	25.4	297°32.9	54.0	324°31.3	13.1								
8	303°45.0	342°35.9	43.0	345°52.8	24.9	312°34.8	53.7	339°33.5	13.0								
9	318°47.4	357°35.8	.. 42.5	0°53.4	.. 24.4	327°36.8	.. 53.5	354°35.7	.. 13.0								
10	333°49.9	12°35.7	41.9	15°54.0	23.8	342°38.7	53.3	9°37.9	12.9								
11	348°52.4	27°35.5	41.3	30°54.6	23.3	357°40.6	53.0	24°40.2	12.8								
12	3°54.8	42°35.4	\$13°40.8	45°55.1	\$17°22.8	12°42.5	\$04°52.8	39°42.4	\$15°12.7								
13	18°57.3	57°35.3	40.2	60°55.7	22.3	27°44.4	52.6	54°44.6	12.7								
14	33°59.8	72°35.2	39.7	75°56.3	21.7	42°46.3	52.4	69°46.8	12.6								
15	49°02.2	87°35.0	.. 39.1	90°56.8	.. 21.2	57°48.3	.. 52.1	84°49.1	.. 12.5								
16	64°04.7	102°34.9	38.5	105°57.4	20.7	72°50.2	51.9	99°51.3	12.5								
17	79°07.1	117°34.8	38.0	120°58.0	20.1	87°52.1	51.7	114°53.5	12.4								
18	94°09.6	132°34.7	\$13°37.4	135°58.5	\$17°19.6	102°54.0	\$04°51.4	129°55.7	\$15°12.3								
19	109°12.1	147°34.5	36.9	150°59.1	19.1	117°55.9	51.2	144°58.0	12.2								
20	124°14.5	162°34.4	36.3	165°59.7	18.6	132°57.8	51.0	160°00.2	12.2								
21	139°17.0	177°34.3	.. 35.7	181°00.3	.. 18.0	147°59.7	.. 50.7	175°02.4	.. 12.1								
22	154°19.5	192°34.1	35.2	196°00.8	17.5	163°01.7	50.5	190°04.6	12.0								
23	169°21.9	207°34.0	34.6	211°01.4	17.0	178°03.6	50.3	205°06.9	11.9								
Mer.pass. 11:44			ν -0.1° d 0.5' m -4.40	ν 0.6° d 0.5' m 1.10	ν 1.9° d 0.2' m -2.04	ν 2.2° d 0.1' m 0.83											
Sun			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec						
0	184°24.4	222°33.9	\$13°34.0	226°02.0	\$17°16.4	193°05.5	\$04°50.1	220°09.1	\$15°11.9								
1	199°26.9	237°33.8	33.5	241°02.5	15.9	208°07.4	49.8	235°11.3	11.8								
2	214°29.3	252°33.6	32.9	256°03.1	15.4	223°09.3	49.6	250°13.5	11.7								
3	229°31.8	267°33.5	.. 32.3	271°03.7	.. 14.8	238°11.2	.. 49.4	265°15.8	.. 11.7								
4	244°34.2	282°33.4	31.8	286°04.3	14.3	253°13.2	49.1	280°18.0	11.6								
5	259°36.7	297°33.2	31.2	301°04.8	13.8	268°15.1	48.9	295°20.2	11.5								
6	274°39.2	312°33.1	\$13°30.6	316°05.4	\$17°13.2	283°17.0	\$04°48.7	310°22.4	\$15°11.4								
7	289°41.6	327°33.0	30.1	331°06.0	12.7	298°18.9	48.4	325°24.7	11.4								
8	304°44.1	342°32.8	29.5	346°06.5	12.2	313°20.8	48.2	340°26.9	11.3								
9	319°46.6	357°32.7	.. 28.9	1°07.1	.. 11.6	328°22.7	.. 48.0	355°29.1	.. 11.2								
10	334°49.0	12°32.6	28.3	16°07.7	11.1	343°24.7	47.8	10°31.4	11.1								
11	349°51.5	27°32.4	27.8	31°08.3	10.6	358°26.6	47.5	25°33.6	11.1								
12	4°54.0	42°32.3	\$13°27.2	46°08.8	\$17°10.0	13°28.5	\$04°47.3	40°35.8	\$15°11.0								
13	19°56.4	57°32.2	26.6	61°09.4	09.5	28°30.4	47.1	55°38.0	10.9								
14	34°58.9	72°32.0	26.0	76°10.0	09.0	43°32.3	46.8	70°40.3	10.9								
15	50°01.4	87°31.9	.. 25.5	91°10.6	.. 08.4	58°34.2	.. 46.6	85°42.5	.. 10.8								
16	65°03.8	102°31.8	24.9	106°11.1	07.9	73°36.2	46.4	100°44.7	10.7								
17	80°06.3	117°31.6	24.3	121°11.7	07.3	88°38.1	46.1	115°46.9	10.6								
18	95°08.7	132°31.5	\$13°23.7	136°12.3	\$17°06.8	103°40.0	\$04°45.9	130°49.2	\$15°10.6								
19	110°11.2	147°31.4	23.1	151°12.8	06.3	118°41.9	45.7	145°51.4	10.5								
20	125°13.7	162°31.2	22.6	166°13.4	05.7	133°43.8	45.5	160°53.6	10.4								
21	140°16.1	177°31.1	.. 22.0	181°14.0	.. 05.2	148°45.7	.. 45.2	175°55.9	.. 10.3								
22	155°18.6	192°31.0	21.4	196°14.6	04.7	163°47.7	45.0	190°58.1	10.3								
23	170°21.1	207°30.8	20.8	211°15.1	04.1	178°49.6	44.8	206°00.3	10.2								
Mer.pass. 11:40			ν -0.1° d 0.6' m -4.39	ν 0.6° d 0.5' m 1.10	ν 1.9° d 0.2' m -2.05	ν 2.2° d 0.1' m 0.83											
Mon			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec						
0	185°23.5	222°30.7	\$13°20.2	226°15.7	\$17°03.6	193°51.5	\$04°44.5	221°02.5	\$15°10.1								
1	200°26.0	237°30.6	19.6	241°16.3	03.0	208°53.4	44.3	236°04.8	10.1								
2	215°28.5	252°30.4	19.1	256°16.9	02.5	223°55.3	44.1	251°07.0	10.0								
3	230°30.9	267°30.3	.. 18.5	271°17.4	.. 02.0	238°57.2	.. 43.9	266°09.2	.. 09.9								
4	245°33.4	282°30.2	17.9	286°18.0	01.4	253°59.2	43.6	281°11.4	09.8								
5	260°35.9	297°30.0	17.3	301°18.6	00.9	269°01.1	43.4	296°13.7	09.8								
6	275°38.3	312°29.9	\$13°16.7	316°19.2	\$17°00.3	284°03.0	\$04°43.2	311°15.9	\$15°09.7								
7	290°40.8	327°29.7	16.1	331°19.8	16°59.8	299°04.9	42.9	326°18.1	09.6								
8	305°43.2	342°29.6	15.5	346°20.3	59.3	314°06.8	42.7	341°20.4	09.6								
9	320°45.7	357°29.5	.. 14.9	1°20.9	.. 58.7	329°08.7	.. 42.5	356°22.6	.. 09.5								
10	335°48.2	12°29.3	14.3	16°21.5	58.2	344°10.7	42.2	11°24.8	09.4								
11	350°50.6	27°29.2	13.7	31°22.1	57.6	359°12.6	42.0	26°27.0	09.3								
12	5°53.1	42°29.1	\$13°13.2	46°22.6	\$16°57.1	14°14.5	\$04°41.8	41°29.3	\$15°09.3								
13	20°55.6	57°28.9	12.6	61°23.2	56.6	29°16.4	41.6	56°31.5	09.2								
14	35°58.0	72°28.8	12.0	76°23.8	56.0	44°18.3	41.3	71°33.7	09.1								
15	51°00.5	87°28.6	.. 11.4	91°24.4	.. 55.5	59°20.3	.. 41.1	86°36.0	.. 09.1								
16	66°03.0	102°28.5	10.8	106°24.9	54.9	74°22.2	40.9	101°38.2	09.0								
17	81°05.4	117°28.4	10.2	121°25.5	54.4	89°24.1	40.6	116°40.4	08.9								
18	96°07.9	132°28.2	\$13°09.6	136°26.1	\$16°53.8	104°26.0	\$04°40.4	131°42.6	\$15°08.8								
19	111°10.3	147°28.1	09.0	151°26.7	53.3	119°27.9	40.2	146°44.9	08.8								
20	126°12.8	162°27.9	08.4	166°27.3	52.8	134°29.8	40.0	161°47.1	08.7								
21	141°15.3	177°27.8	.. 07.8	181°27.8	.. 52.2	149°31.8	..										

DUT1 = UT1-UTC = -0.0997 sec  $\Delta T = TT-UT1 = +69.2837$  sec

2022 March 26 to Mar. 28 UT

h	Sun			Moon			
Sat	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	178°32.8	N02°06.6	256°13.7	4.1'	S26°33.7	2.3'	59.1'
1	193°33.0	07.5	270°36.9	4.2'	26°31.4	2.5'	59.1'
2	208°33.2	08.5	285°00.0	4.2'	26°28.9	2.7'	59.1'
3	223°33.4	09.5	299°23.3	4.3'	26°26.3	2.8'	59.0'
4	238°33.6	10.5	313°46.5	4.3'	26°23.5	3.0'	59.0'
5	253°33.8	11.5	328°09.8	4.3'	26°20.4	3.2'	59.0'
6	268°34.0	N02°12.4	342°33.1	4.4'	S26°17.3	3.4'	59.0'
7	283°34.1	13.4	356°56.5	4.4'	26°13.9	3.5'	59.0'
8	298°34.3	14.4	11°20.0	4.5'	26°10.4	3.7'	59.0'
9	313°34.5	15.4	25°43.4	4.5'	26°06.7	3.9'	59.0'
10	328°34.7	16.4	40°07.0	4.6'	26°02.8	4.1'	59.0'
11	343°34.9	17.3	54°30.6	4.6'	25°58.7	4.2'	59.0'
12	358°35.1	N02°18.3	68°54.2	4.7'	S25°54.5	4.4'	59.0'
13	13°35.3	19.3	83°17.9	4.8'	25°50.1	4.6'	59.0'
14	28°35.5	20.3	97°41.6	4.8'	25°45.5	4.7'	59.0'
15	43°35.7	21.3	112°05.4	4.9'	25°40.8	4.9'	59.0'
16	58°35.8	22.2	126°29.3	4.9'	25°35.9	5.1'	58.9'
17	73°36.0	23.2	140°53.3	5.0'	25°30.8	5.2'	58.9'
18	88°36.2	N02°24.2	155°17.3	5.1'	S25°25.6	5.4'	58.9'
19	103°36.4	25.2	169°41.3	5.1'	25°20.1	5.6'	58.9'
20	118°36.6	26.2	184°05.5	5.2'	25°14.6	5.7'	58.9'
21	133°36.8	27.1	198°29.7	5.3'	25°08.8	5.9'	58.9'
22	148°37.0	28.1	212°53.9	5.3'	25°02.9	6.1'	58.9'
23	163°37.2	29.1	227°18.3	5.4'	24°56.9	6.2'	58.9'
	SD = 16.0' d = 1.0'		SD = 16.1'				

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

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

Day	Sun		Moon	
	Eqn.of Time	Mer.	Mer.	Age
	00 <sup>h</sup>	12 <sup>h</sup>	Pass.	
mm:ss	mm:ss	hh:mm	hh:mm	
26	05:49	05:40	12:06	07:13 19:43
27	05:31	05:22	12:05	08:12 20:41
28	05:13	05:04	12:05	09:09 21:35



## March 29, 30, 31 UT (Tue., Wed., Thu.)

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	186°22.7	222°27.4	\$13°06.0	226°29.6	\$16°50.6	194°37.5	\$04°39.0	221°56.0	\$15°08.4								
1	201°25.1	237°27.2	05.4	241°30.1	50.0	209°39.4	38.8	236°58.3	08.3								
2	216°27.6	252°27.1	04.8	256°30.7	49.5	224°41.3	38.6	252°00.5	08.3								
3	231°30.1	267°26.9	.. 04.2	271°31.3	.. 48.9	239°43.3	.. 38.4	267°02.7	.. 08.2								
4	246°32.5	282°26.8	03.6	286°31.9	48.4	254°45.2	38.1	282°05.0	08.1								
5	261°35.0	297°26.7	03.0	301°32.5	47.8	269°47.1	37.9	297°07.2	08.1								
6	276°37.5	312°26.5	\$13°02.3	316°33.0	\$16°47.3	284°49.0	\$04°37.7	312°09.4	\$15°08.0								
7	291°39.9	327°26.4	01.7	331°33.6	46.8	299°50.9	37.4	327°11.6	07.9								
8	306°42.4	342°26.2	01.1	346°34.2	46.2	314°52.9	37.2	342°13.9	07.8								
9	321°44.8	357°26.1	13°00.5	1°34.8	.. 45.7	329°54.8	.. 37.0	357°16.1	.. 07.8								
10	336°47.3	12°25.9	12°59.9	16°35.4	45.1	344°56.7	36.7	12°18.3	07.7								
11	351°49.8	27°25.8	59.3	31°35.9	44.6	359°58.6	36.5	27°20.6	07.6								
12	6°52.2	42°25.7	\$12°58.7	46°36.5	\$10°44.0	15°00.5	\$04°36.3	42°22.8	\$15°07.6								
13	21°54.7	57°25.5	58.1	61°37.1	43.5	30°02.5	36.1	57°25.0	07.5								
14	36°57.2	72°25.4	57.5	76°37.7	42.9	45°04.4	35.8	72°27.3	07.4								
15	51°59.6	87°25.2	.. 56.8	91°38.3	.. 42.4	60°06.3	.. 35.6	87°29.5	.. 07.3								
16	67°02.1	102°25.1	56.2	106°38.8	41.8	75°08.2	35.4	102°31.7	07.3								
17	82°04.6	117°24.9	55.6	121°39.4	41.3	90°10.1	35.1	117°34.0	07.2								
18	97°07.0	132°24.8	\$12°55.0	136°40.0	\$16°40.7	105°12.0	\$04°34.9	132°36.2	\$15°07.1								
19	112°09.5	147°24.6	54.4	151°40.6	40.2	120°14.0	34.7	147°38.4	07.1								
20	127°12.0	162°24.5	53.8	166°41.2	39.6	135°15.9	34.5	162°40.7	07.0								
21	142°14.4	177°24.4	.. 53.1	181°41.8	.. 39.1	150°17.8	.. 34.2	177°42.9	.. 06.9								
22	157°16.9	192°24.2	52.5	196°42.3	38.5	165°19.7	34.0	192°45.1	06.8								
23	172°19.3	207°24.1	51.9	211°42.9	38.0	180°21.6	33.8	207°47.3	06.8								
Mer.pass. 11:33			ν -0.1° d 0.6° m -4.37	ν 0.6° d 0.5° m 1.08	ν 1.9° d 0.2° m -2.05	ν 2.2° d 0.1° m 0.83											
Wed			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	187°21.8	222°23.9	\$12°51.3	226°43.5	\$16°37.4	195°23.6	\$04°33.5	222°49.6	\$15°06.7								
1	202°24.3	237°23.8	50.7	241°44.1	36.9	210°25.5	33.3	237°51.8	06.6								
2	217°26.7	252°23.6	50.0	256°44.7	36.3	225°27.4	33.1	252°54.0	06.6								
3	232°29.2	267°23.5	.. 49.4	271°45.2	.. 35.8	240°29.3	.. 32.9	267°56.3	.. 06.5								
4	247°31.7	282°23.3	48.8	286°45.8	35.2	255°31.2	32.6	282°58.5	06.4								
5	262°34.1	297°23.2	48.2	301°46.4	34.6	270°33.2	32.4	298°00.7	06.4								
6	277°36.6	312°23.0	\$12°47.6	316°47.0	\$16°34.1	285°35.1	\$04°32.2	313°03.0	\$15°06.3								
7	292°39.1	327°22.9	46.9	331°47.6	33.5	300°37.0	31.9	328°05.2	06.2								
8	307°41.5	342°22.7	46.3	346°48.2	33.0	315°38.9	31.7	343°07.4	06.1								
9	322°44.0	357°22.6	.. 45.7	1°48.7	.. 32.4	330°40.8	.. 31.5	358°09.7	.. 06.1								
10	337°46.4	12°22.4	45.0	16°49.3	31.9	345°42.8	31.3	13°11.9	06.0								
11	352°48.9	27°22.3	44.4	31°49.9	31.3	0°44.7	31.0	28°14.1	05.9								
12	7°51.4	42°22.1	\$12°43.8	46°50.5	\$16°30.8	15°46.6	\$04°30.8	43°16.4	\$15°05.9								
13	22°53.8	57°22.0	43.2	61°51.1	30.2	30°48.5	30.6	58°18.6	05.8								
14	37°56.3	72°21.8	42.5	76°51.7	29.7	45°50.4	30.3	73°20.8	05.7								
15	52°58.8	87°21.7	.. 41.9	91°52.3	.. 29.1	60°52.4	.. 30.1	88°23.1	.. 05.7								
16	68°01.2	102°21.5	41.3	106°52.8	28.5	75°54.3	29.9	103°25.3	05.6								
17	83°03.7	117°21.4	40.6	121°53.4	28.0	90°56.2	29.7	118°27.5	05.5								
18	98°06.2	132°21.2	\$12°40.0	136°54.0	\$16°27.4	105°58.1	\$04°29.4	133°29.8	\$15°05.4								
19	113°08.6	147°21.1	39.4	151°54.6	26.9	121°00.0	29.2	148°32.0	05.4								
20	128°11.1	162°20.9	38.7	166°55.2	26.3	136°02.0	29.0	163°34.3	05.3								
21	143°13.6	177°20.8	.. 38.1	181°55.8	.. 25.8	151°03.9	.. 28.7	178°36.5	.. 05.2								
22	158°16.0	192°20.6	37.5	196°56.3	25.2	166°05.8	28.5	193°38.7	05.2								
23	173°18.5	207°20.5	36.8	211°56.9	24.6	181°07.7	28.3	208°41.0	05.1								
Mer.pass. 11:29			ν -0.1° d 0.6° m -4.36	ν 0.6° d 0.6° m 1.08	ν 1.9° d 0.2° m -2.05	ν 2.2° d 0.1° m 0.83											
Thu			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	188°20.9	222°20.3	\$12°36.2	226°57.5	\$16°24.1	196°09.6	\$04°28.1	223°43.2	\$15°05.0								
1	203°23.4	237°20.2	35.5	241°58.1	23.5	211°11.6	27.8	238°45.4	05.0								
2	218°25.9	252°20.0	34.9	256°58.7	23.0	226°13.5	27.6	253°47.7	04.9								
3	233°28.3	267°19.9	.. 34.3	271°59.3	.. 22.4	241°15.4	.. 27.4	268°49.9	.. 04.8								
4	248°30.8	282°19.7	33.6	286°59.9	21.8	256°17.3	27.2	283°52.1	04.7								
5	263°33.3	297°19.6	33.0	302°00.5	21.3	271°19.3	26.9	298°54.4	04.7								
6	278°35.7	312°19.4	\$12°32.3	317°01.0	\$16°20.7	286°21.2	\$04°26.7	313°56.6	\$15°04.6								
7	293°38.2	327°19.3	31.7	332°01.6	20.2	301°23.1	26.5	328°58.8	04.5								
8	308°40.7	342°19.1	31.0	347°02.2	19.6	316°25.0	26.2	344°01.1	04.5								
9	323°43.1	357°19.0	.. 30.4	2°02.8	.. 19.0	331°26.9	.. 26.0	359°03.3	.. 04.4								
10	338°45.6	12°18.8	29.8	17°03.4	18.5	346°28.9	25.8	14°05.5	04.3								
11	353°48.0	27°18.7	29.1	32°04.0	17.9	1°30.8	25.6	29°07.8	04.3								
12	8°50.5	42°18.5	\$12°28.5	47°04.6	\$16°17.4	16°32.7	\$04°25.3	44°10.0	\$15°04.2								
13	23°53.0	57°18.4	27.8	62°05.2	16.8	31°34.6	25.1	59°12.3	04.1								
14	38°55.4	72°18.2	27.2	77°05.7	16.2	46°36.5	24.9	74°14.5	04.0								
15	53°57.9	87°18.0	.. 26.5	92°06.3	.. 15.7	61°38.5	.. 24.6	89°16.7	.. 04.0								
16	69°00.4	102°17.9	25.9	107°06.9	15.1	76°40.4	24.4	104°19.0	03.9								
17	84°02.8	117°17.7	25.2	122°07.5	14.6	91°42.3	24.2	119°21.2	03.8								
18	99°05.3	132°17.6	\$12°24.6	137°08.1	\$16°14.0	106°44.2	\$04°24.0	134°23.4	\$15°03.8								
19	114°07.8	147°17.4	23.9	152°08.7	13.4	121°46.2	23.7	149°25.7	03.7								
20	129°10.2	162°17.3	23.3	167°09.3	12.9	136°48.1	23.5	164°27.9	03.6								
21	144°12.7	177°17.1	.. 22.6	182°09.9	.. 12.3	151°50.0	.. 2										

DUT1 = UT1-UTC = -0.0990 sec  $\Delta T = TT-UT1 = +69.2830$  sec

2022 March 29 to Mar. 31 UT

h		Sun		Moon				
Tue		GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	178°46.4	N03°17.0	214°57.0	9.8'	S17°10.9	12.3'	58.3'	
1	193°46.6	18.0	229°25.9	9.9'	16°58.6	12.4'	58.3'	
2	208°46.7	19.0	243°54.7	10.0'	16°46.2	12.5'	58.2'	
3	223°46.9	19.9	258°23.7	10.1'	16°33.7	12.6'	58.2'	
4	238°47.1	20.9	272°52.8	10.2'	16°21.1	12.7'	58.2'	
5	253°47.3	21.9	287°22.0	10.2'	16°08.4	12.7'	58.2'	
6	268°47.5	N03°22.9	301°51.2	10.3'	S15°55.7	12.8'	58.2'	
7	283°47.7	23.8	316°20.5	10.4'	15°42.9	12.9'	58.2'	
8	298°47.9	24.8	330°49.9	10.5'	15°30.0	13.0'	58.1'	
9	313°48.1	25.8	345°19.4	10.6'	15°17.0	13.0'	58.1'	
10	328°48.2	26.8	359°49.0	10.7'	15°03.9	13.1'	58.1'	
11	343°48.4	27.7	14°18.7	10.8'	14°50.8	13.2'	58.1'	
12	358°48.6	N03°28.7	28°48.5	10.8'	S14°37.6	13.3'	58.1'	
13	13°48.8	29.7	43°18.3	10.9'	14°24.4	13.3'	58.1'	
14	28°49.0	30.7	57°48.2	11.0'	14°11.0	13.4'	58.0'	
15	43°49.2	31.6	72°18.2	11.1'	13°57.6	13.5'	58.0'	
16	58°49.4	32.6	86°48.3	11.2'	13°44.2	13.5'	58.0'	
17	73°49.5	33.6	101°18.5	11.2'	13°30.7	13.6'	58.0'	
18	88°49.7	N03°34.5	115°48.7	11.3'	S13°17.1	13.6'	58.0'	
19	103°49.9	35.5	130°19.0	11.4'	13°03.4	13.7'	58.0'	
20	118°50.1	36.5	144°49.4	11.5'	12°49.7	13.8'	57.9'	
21	133°50.3	37.5	159°19.9	11.5'	12°36.0	13.8'	57.9'	
22	148°50.5	38.4	173°50.4	11.6'	12°22.1	13.9'	57.9'	
23	163°50.7	39.4	188°21.0	11.7'	12°08.3	13.9'	57.9'	
SD = 16.0'		SD = 15.9'						
SD = 16.0' d = 1.0'		SD = 15.9'						
Wed		GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	178°50.9	N03°40.4	202°51.7	11.8'	S11°54.3	14.0'	57.9'	
1	193°51.0	41.4	217°22.5	11.8'	11°40.4	14.0'	57.8'	
2	208°51.2	42.3	231°53.3	11.9'	11°26.3	14.1'	57.8'	
3	223°51.4	43.3	246°24.3	12.0'	11°12.3	14.1'	57.8'	
4	238°51.6	44.3	260°55.2	12.0'	10°58.2	14.2'	57.8'	
5	253°51.8	45.2	275°26.3	12.1'	10°44.0	14.2'	57.8'	
6	268°52.0	N03°46.2	289°57.4	12.2'	S10°29.8	14.3'	57.7'	
7	283°52.2	47.2	304°28.6	12.3'	10°15.5	14.3'	57.7'	
8	298°52.3	48.2	318°59.8	12.3'	10°01.2	14.3'	57.7'	
9	313°52.5	49.1	333°31.1	12.4'	09°46.9	14.4'	57.7'	
10	328°52.7	50.1	348°02.5	12.4'	09°32.5	14.4'	57.7'	
11	343°52.9	51.1	2°34.0	12.5'	09°18.1	14.4'	57.7'	
12	358°53.1	N03°52.0	17°05.5	12.6'	S09°03.7	14.5'	57.6'	
13	13°53.3	53.0	31°37.0	12.6'	08°49.2	14.5'	57.6'	
14	28°53.5	54.0	46°08.7	12.7'	08°34.7	14.5'	57.6'	
15	43°53.7	55.0	60°40.4	12.7'	08°20.1	14.6'	57.6'	
16	58°53.8	55.9	75°12.1	12.8'	08°05.5	14.6'	57.6'	
17	73°54.0	56.9	89°43.9	12.9'	07°50.9	14.6'	57.5'	
18	88°54.2	N03°57.9	104°15.8	12.9'	S07°36.3	14.7'	57.5'	
19	103°54.4	58.8	118°47.7	13.0'	07°21.7	14.7'	57.5'	
20	118°54.6	03°59.8	133°19.6	13.0'	07°07.0	14.7'	57.5'	
21	133°54.8	04°00.8	147°51.7	13.1'	06°52.3	14.7'	57.4'	
22	148°55.0	01.7	162°23.7	13.1'	06°37.5	14.7'	57.4'	
23	163°55.1	02.7	176°55.9	13.2'	06°22.8	14.8'	57.4'	
SD = 16.0'		SD = 15.8'						
SD = 16.0' d = 1.0'		SD = 15.8'						
Thu		GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	178°55.3	N04°03.7	191°28.0	13.2'	S06°08.0	14.8'	57.4'	
1	193°55.5	04.7	206°00.3	13.3'	05°53.2	14.8'	57.4'	
2	208°55.7	05.6	220°32.5	13.3'	05°38.4	14.8'	57.3'	
3	223°55.9	06.6	235°04.9	13.4'	05°23.6	14.8'	57.3'	
4	238°56.1	07.6	249°37.2	13.4'	05°08.8	14.8'	57.3'	
5	253°56.3	08.5	264°09.6	13.5'	04°53.9	14.9'	57.3'	
6	268°56.4	N04°09.5	278°42.1	13.5'	S04°39.1	14.9'	57.3'	
7	283°56.6	10.5	293°14.6	13.5'	04°24.2	14.9'	57.2'	
8	298°56.8	11.4	307°47.1	13.6'	04°09.3	14.9'	57.2'	
9	313°57.0	12.4	322°19.7	13.6'	03°54.4	14.9'	57.2'	
10	328°57.2	13.4	336°52.3	13.7'	03°39.5	14.9'	57.2'	
11	343°57.4	14.3	351°25.0	13.7'	03°24.6	14.9'	57.1'	
12	358°57.6	N04°15.3	5°57.7	13.7'	S03°09.7	14.9'	57.1'	
13	13°57.7	16.3	20°30.4	13.8'	02°54.8	14.9'	57.1'	
14	28°57.9	17.2	35°03.2	13.8'	02°39.9	14.9'	57.1'	
15	43°58.1	18.2	49°36.0	13.8'	02°25.0	14.9'	57.1'	
16	58°58.3	19.2	64°08.8	13.9'	02°10.1	14.9'	57.0'	
17	73°58.5	20.1	78°41.7	13.9'	01°55.2	14.9'	57.0'	
18	88°58.7	N04°21.1	93°14.6	13.9'	S01°40.3	14.9'	57.0'	
19	103°58.9	22.1	107°47.6	14.0'	01°25.4	14.9'	57.0'	
20	118°59.0	23.0	122°20.5	14.0'	01°10.5	14.9'	56.9'	
21	133°59.2	24.0	136°53.5	14.0'	00°55.6	14.9'	56.9'	
22	148°59.4	25.0	151°26.5	14.0'	00°40.7	14.9'	56.9'	
23	163°59.6	25.9	165°59.6	14.1'	00°25.8	14.9'	56.9'	
SD = 16.0'		SD = 15.7'						
SD = 16.0' d = 1.0'		SD = 15.7'						

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

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

**April 01, 02, 03 UT (Fri., Sat., Sun.)**

Aries		Venus		Mars		Jupiter		Saturn		Stars	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec
0	189°20.1	222°16.7	\$12°20.6	227°11.6	\$16°10.6	196°55.8	\$04°22.6	224°36.9	\$15°03.4	Alpheratz	357°37.5
1	204°22.5	237°16.5	20.0	242°12.2	10.0	211°57.7	22.4	239°39.1	03.3	Ankaa	353°09.8
2	219°25.0	252°16.3	19.3	257°12.8	09.5	226°59.6	22.1	254°41.3	03.2	Schedar	349°34.2
3	234°27.5	267°16.2	.. 18.7	272°13.4	.. 08.9	242°01.5	.. 21.9	269°43.6	.. 03.1	Diphda	348°49.9
4	249°29.9	282°16.0	18.0	287°14.0	08.3	257°03.4	21.7	284°45.8	03.1	Achernar	335°22.5
5	264°32.4	297°15.9	17.4	302°14.6	07.8	272°05.4	21.5	299°48.1	03.0	Hamal	327°54.1
6	279°34.9	312°15.7	\$12°16.7	317°15.2	\$16°07.2	287°07.3	\$04°21.2	314°50.3	\$15°02.9	Polaris	315°30.9
7	294°37.3	327°15.6	16.0	332°15.8	06.6	302°09.2	21.0	329°52.5	02.9	Acamar	315°13.9
8	309°39.8	342°15.4	15.4	347°16.4	06.1	317°11.1	20.8	344°54.8	02.8	Menkar	314°08.8
9	324°42.3	357°15.2	.. 14.7	2°16.9	.. 05.5	332°13.1	.. 20.5	359°57.0	.. 02.7	Mirfak	308°31.9
10	339°44.7	12°15.1	14.0	17°17.5	04.9	347°15.0	20.3	14°59.2	02.7	Aldebaran	290°42.4
11	354°47.2	27°14.9	13.4	32°18.1	04.4	2°16.9	20.1	30°01.5	02.6	Rigel	281°06.2
12	9°49.6	42°14.8	\$12°12.7	47°18.7	\$16°03.8	17°18.8	\$04°19.9	45°03.7	\$15°02.5	Capella	280°25.5
13	24°52.1	57°14.6	12.1	62°19.3	03.2	32°20.8	19.6	60°06.0	02.5	Bellatrix	278°25.5
14	39°54.6	72°14.5	11.4	77°19.9	02.7	47°22.7	19.4	75°08.2	02.4	Elnath	278°04.9
15	54°57.0	87°14.3	.. 10.7	92°20.5	.. 02.1	62°24.6	.. 19.2	90°10.4	.. 02.3	Alnilam	275°40.2
16	69°59.5	102°14.1	10.1	107°21.1	01.5	77°26.5	19.0	105°12.7	02.3	Betelgeuse	270°54.6
17	85°02.0	117°14.0	09.4	122°21.7	01.0	92°28.4	18.7	120°14.9	02.2	Canopus	263°53.5
18	100°04.4	132°13.8	\$12°08.7	137°22.3	\$16°00.4	107°30.4	\$04°18.5	135°17.2	\$15°02.1	Sirius	258°28.3
19	115°06.9	147°13.7	08.0	152°22.9	15°59.8	122°32.3	18.3	150°19.4	02.0	Adhara	255°07.7
20	130°09.4	162°13.5	07.4	167°23.5	59.3	137°34.2	18.0	165°21.6	02.0	Procyon	244°53.2
21	145°11.8	177°13.4	.. 06.7	182°24.1	.. 58.7	152°36.1	.. 17.8	180°23.9	.. 01.9	Pollux	243°20.0
22	160°14.3	192°13.2	06.0	197°24.6	58.1	167°38.1	17.6	195°26.1	01.8	Avior	234°15.4
23	175°16.8	207°13.0	05.4	212°25.2	57.5	182°40.0	17.4	210°28.4	01.8	Suhail	222°47.7
Mer.pass. 11:21		ν -0.2° d 0.7° m -4.34		ν 0.6° d 0.6° m 1.06		ν 1.9° d 0.2° m -2.05		ν 2.2° d 0.1° m 0.83		Miaplacidus	221°38.2
										Alphard	217°49.8

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	190°19.2	222°12.9	\$12°04.7	227°25.8	\$15°57.0	197°41.9	\$04°17.1	225°30.6	\$15°01.7
1	205°21.7	237°12.7	04.0	242°26.4	56.4	212°43.8	16.9	240°32.8	01.6
2	220°24.1	252°12.6	03.3	257°27.0	55.8	227°45.8	16.7	255°35.1	01.6
3	235°26.6	267°12.4	.. 02.7	272°27.6	.. 55.3	242°47.7	.. 16.5	270°37.3	.. 01.5
4	250°29.1	282°12.2	02.0	287°28.2	54.7	257°49.6	16.2	285°39.6	01.4
5	265°31.5	297°12.1	01.3	302°28.8	54.1	272°51.5	16.0	300°41.8	01.4
6	280°34.0	312°11.9	\$12°00.6	317°29.4	\$15°53.5	287°53.5	\$04°15.8	315°44.0	\$15°01.3
7	295°36.5	327°11.8	12°00.0	332°30.0	53.0	302°55.4	15.5	330°46.3	01.2
8	310°38.9	342°11.6	11°59.3	347°30.6	52.4	317°57.3	15.3	345°48.5	01.2
9	325°41.4	357°11.4	.. 58.6	2°31.2	.. 51.8	332°59.2	.. 15.1	0°50.8	.. 01.1
10	340°43.9	12°11.3	57.9	17°31.8	51.3	348°01.1	14.9	15°53.0	01.0
11	355°46.3	27°11.1	57.2	32°32.4	50.7	3°03.1	14.6	30°55.2	01.0
12	10°48.8	42°11.0	\$11°56.6	47°33.0	\$15°50.1	18°05.0	\$04°14.4	45°57.5	\$15°00.9
13	25°51.3	57°10.8	55.9	62°33.6	49.5	33°06.9	14.2	60°59.7	00.8
14	40°53.7	72°10.6	55.2	77°34.2	49.0	48°08.8	14.0	76°02.0	00.7
15	55°56.2	87°10.5	.. 54.5	92°34.8	.. 48.4	63°10.8	.. 13.7	91°04.2	.. 00.7
16	70°58.6	102°10.3	53.8	107°35.4	47.8	78°12.7	13.5	106°06.4	00.6
17	86°01.1	117°10.2	53.1	122°35.9	47.2	93°14.6	13.3	121°08.7	00.5
18	101°03.6	132°10.0	\$11°52.5	137°36.5	\$15°46.7	108°16.5	\$04°13.1	136°10.9	\$15°00.5
19	116°06.0	147°09.8	51.8	152°37.1	46.1	123°18.5	12.8	151°13.2	00.4
20	131°08.5	162°09.7	51.1	167°37.7	45.5	138°20.4	12.6	166°15.4	00.3
21	146°11.0	177°09.5	.. 50.4	182°38.3	.. 44.9	153°22.3	.. 12.4	181°17.7	.. 00.3
22	161°13.4	192°09.3	49.7	197°38.9	44.3	168°24.2	12.1	196°19.9	00.2
23	176°15.9	207°09.2	49.0	212°39.5	43.8	183°26.2	11.9	211°22.1	00.1
Mer.pass. 11:17		$\nu$ -0.2' d 0.7' m -4.33		$\nu$ 0.6' d 0.6' m 1.06		$\nu$ 1.9' d 0.2' m -2.05		$\nu$ 2.2' d 0.1' m 0.83	

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	191°18.4	222°09.0	S11°48.3	227°40.1	S15°43.2	198°28.1	S04°11.7	226°24.4	S15°00.1
1	206°20.8	237°08.9	47.6	242°40.7	42.6	213°30.0	11.5	241°26.6	15°00.0
2	221°23.3	252°08.7	47.0	257°41.3	42.0	228°31.9	11.2	256°28.9	14°59.9
3	236°25.7	267°08.5	.. 46.3	272°41.9	.. 41.5	243°33.9	.. 11.0	271°31.1	.. 59.9
4	251°28.2	282°08.4	45.6	287°42.5	40.9	258°35.8	10.8	286°33.4	59.8
5	266°30.7	297°08.2	44.9	302°43.1	40.3	273°37.7	10.6	301°35.6	59.7
6	281°33.1	312°08.0	S11°44.2	317°43.7	S15°39.7	288°39.6	S04°10.3	316°37.8	S14°59.7
7	296°35.6	327°07.9	43.5	332°44.3	39.1	303°41.6	10.1	331°40.1	59.6
8	311°38.1	342°07.7	42.8	347°44.9	38.6	318°43.5	09.9	346°42.3	59.5
9	326°40.5	357°07.6	.. 42.1	2°45.5	.. 38.0	333°45.4	.. 09.7	1°44.6	.. 59.5
10	341°43.0	12°07.4	41.4	17°46.1	37.4	348°47.3	09.4	16°46.8	59.4
11	356°45.5	27°07.2	40.7	32°46.7	36.8	3°49.3	09.2	31°49.1	59.3
12	11°47.9	42°07.1	S11°40.0	47°47.3	S15°36.2	18°51.2	S04°09.0	46°51.3	S14°59.3
13	26°50.4	57°06.9	39.3	62°47.9	35.7	33°53.1	08.7	61°53.5	59.2
14	41°52.9	72°06.7	38.6	77°48.5	35.1	48°55.0	08.5	76°55.8	59.1
15	56°55.3	87°06.6	.. 37.9	92°49.1	.. 34.5	63°57.0	.. 08.3	91°58.0	.. 59.1
16	71°57.8	102°06.4	37.2	107°49.7	33.9	78°58.9	08.1	107°00.3	59.0
17	87°00.2	117°06.2	36.5	122°50.3	33.3	94°00.8	07.8	122°02.5	58.9
18	102°02.7	132°06.1	S11°35.8	137°50.9	S15°32.8	109°02.7	S04°07.6	137°04.8	S14°58.9
19	117°05.2	147°05.9	35.1	152°51.5	32.2	124°04.7	07.4	152°07.0	58.8
20	132°07.6	162°05.8	34.4	167°52.1	31.6	139°06.6	07.2	167°09.3	58.7
21	147°10.1	177°05.6	.. 33.7	182°52.7	.. 31.0	154°08.5	.. 06.9	182°11.5	.. 58.7
22	162°12.6	192°05.4	33.0	197°53.3	30.4	160°10.5	06.7	197°13.7	58.6
23	177°15.0	207°05.3	32.3	212°53.9	29.9	184°12.4	06.5	212°16.0	58.5
Mer.pass. 11:13		$\nu$ -0.2' d 0.7' m -4.32	$\nu$ 0.6' d 0.6' m 1.05	$\nu$ 1.9' d 0.2' m -2.05	$\nu$ 2.2' d 0.1' m 0.83				

	SHA	Dec
Alpheratz	357°37.5	29°12.6
Ankaa	353°09.8	-42°11.3
Schedar	349°34.2	56°39.4
Diphda	348°49.9	-17°52.1
Achernar	335°22.5	-57°07.6
Hamal	327°54.1	23°33.9
Polaris	315°30.9	89°21.6
Acamar	315°13.9	-40°13.2
Menkar	314°08.8	4°10.4
Mirfak	308°31.9	49°56.4
Aldebaran	290°42.4	16°33.1
Rigel	281°06.2	-8°10.7
Capella	280°25.5	46°01.3
Bellatrix	278°25.5	6°22.1
Elnath	278°04.9	28°37.6
Alnilam	275°40.2	-1°11.4
Betelgeuse	270°54.6	7°24.6
Canopus	263°53.5	-52°42.7
Sirius	258°28.3	-16°45.0
Adhara	255°07.7	-29°00.4
Procyon	244°53.2	5°10.0
Pollux	243°20.0	27°58.4
Avior	234°15.4	-59°35.1
Suhail	222°47.7	-43°31.5
Miaplacidus	221°38.2	-69°48.7
Alphard	217°49.8	-8°45.4
Regulus	207°36.6	11°51.5
Dubhe	193°43.3	61°38.0
Denebola	182°27.0	14°26.8
Gienah	175°45.6	-17°40.0
Acrux	173°02.0	-63°13.3
Gacrux	171°53.6	-57°14.3
Alioth	166°14.5	55°50.4
Spica	158°24.4	-11°16.7
Alkaid	152°53.4	49°12.1
Hadar	148°38.6	-60°28.7
Menkent	148°00.0	-36°28.7
Arcturus	145°49.7	19°03.9
Rigel Kent.	139°42.9	-60°55.5
Kochab	137°18.8	74°03.7
Zuben' ubi	136°58.3	-16°08.1
Alphecca	126°05.4	26°38.2
Antares	112°18.4	-26°28.8
Atria	107°14.5	-69°03.8
Sabik	102°05.3	-15°45.2
Shaula	96°13.4	-37°07.1
Rasalhague	96°00.6	12°32.4
Eltanin	90°43.1	51°28.8
Kaus Aust.	83°35.5	-34°22.4
Vega	80°34.7	38°47.9
Nunki	75°50.6	-26°16.1
Altair	62°02.3	8°55.4
Peacock	53°09.6	-56°39.7
Deneb	49°27.6	45°21.2
Enif	33°41.3	9°58.4
Al Na'ir	27°36.2	-46°51.2
Fomalhaut	15°17.4	-29°30.4
Scheat	13°47.7	28°11.9
Markab	13°32.5	15°19.2

Apr 01 Fri	SHA	Mer.pass
Venus	32°56.6	09:11
Mars	37°51.6	08:51
Jupiter	7°35.7	10:51
Saturn	35°16.8	09:00

Apr 02 Sat	SHA	Mer.pass
Venus	31°53.7	09:11
Mars	37°06.6	08:50
Jupiter	7°22.7	10:48
Saturn	35°11.4	08:57

Apr 03 Sun	SHA	Mer.pass
Venus	30°50.7	09:12
Mars	36°21.8	08:49
Jupiter	7°09.7	10:45
Saturn	25°06.9	09:52

Saturn	55	00.0	08.55
<b>Horizontal parallax</b>			
Venus:	0.2		
Mars:	0.1		

DUT1 = UT1-UTC = -0.0995 sec  $\Delta T = TT-UT1 = +69.2835$  sec

2022 April 01 to Apr. 03 UT

h	Sun			Moon			
Fri	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	178°59.8	N04°26.9	180°32.6	14.1'	S00°11.0	14.9'	56.8'
1	194°00.0	27.9	195°05.7	14.1'	N00°03.9	14.8'	56.8'
2	209°00.1	28.8	209°38.9	14.1'	00°18.7	14.8'	56.8'
3	224°00.3	29.8	224°12.0	14.2'	00°33.5	14.8'	56.8'
4	239°00.5	30.8	238°45.2	14.2'	00°48.4	14.8'	56.8'
5	254°00.7	31.7	253°18.3	14.2'	01°03.2	14.8'	56.7'
6	269°00.9	N04°32.7	267°51.5	14.2'	N01°17.9	14.8'	56.7'
7	284°01.1	33.7	282°24.8	14.2'	01°32.7	14.7'	56.7'
8	299°01.3	34.6	296°58.0	14.3'	01°47.5	14.7'	56.7'
9	314°01.4	35.6	311°31.3	14.3'	02°02.2	14.7'	56.6'
10	329°01.6	36.6	326°04.5	14.3'	02°16.9	14.7'	56.6'
11	344°01.8	37.5	340°37.8	14.3'	02°31.6	14.7'	56.6'
12	359°02.0	N04°38.5	355°11.1	14.3'	N02°46.2	14.6'	56.6'
13	14°02.2	39.5	9°44.4	14.3'	03°00.9	14.6'	56.5'
14	29°02.4	40.4	24°17.8	14.3'	03°15.5	14.6'	56.5'
15	44°02.5	41.4	38°51.1	14.3'	03°30.1	14.6'	56.5'
16	59°02.7	42.4	53°24.4	14.4'	03°44.6	14.5'	56.5'
17	74°02.9	43.3	67°57.8	14.4'	03°59.2	14.5'	56.5'
18	89°03.1	N04°44.3	82°31.1	14.4'	N04°13.7	14.5'	56.4'
19	104°03.3	45.2	97°04.5	14.4'	04°28.1	14.4'	56.4'
20	119°03.5	46.2	111°37.9	14.4'	04°42.6	14.4'	56.4'
21	134°03.6	47.2	126°11.3	14.4'	04°57.0	14.4'	56.4'
22	149°03.8	48.1	140°44.6	14.4'	05°11.4	14.3'	56.3'
23	164°04.0	49.1	155°18.0	14.4'	05°25.7	14.3'	56.3'
	SD = 16.0'			SD = 15.5'			

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

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

Day	Sun		Moon		Age 0-2 0-3%
	Eqn.of Time	Mer.	Mer.	Pass	
	00 <sup>h</sup> mm:ss	12 <sup>h</sup> mm:ss	Pass Upper hh:mm	Pass Lower hh:mm	0-2 0-3%
01	04:01	03:52	12:04	12:20	—
02	03:43	03:34	12:04	13:04	00:42
03	03:26	03:17	12:03	13:48	01:26

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

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	192°17.5	222°05.1	\$11°31.6	227°54.5	\$15°29.3	199°14.3	\$04°06.3	227°18.2	\$14°58.5					Alpheratz	357°37.5	29°12.6	
1	207°20.0	237°04.9	30.9	242°55.1	28.7	214°16.2	06.0	242°20.5	58.4					Ankaa	353°09.8	-42°11.3	
2	222°22.4	252°04.8	30.2	257°55.7	28.1	229°18.2	05.8	257°22.7	58.3					Schedar	349°34.2	56°39.4	
3	237°24.9	267°04.6	.. 29.5	272°56.3	.. 27.5	244°20.1	.. 05.6	272°25.0	.. 58.3					Diphda	348°49.9	-17°52.1	
4	252°27.3	282°04.4	28.7	287°56.9	26.9	259°22.0	05.4	287°27.2	58.2					Achernar	335°22.5	-57°07.6	
5	267°29.8	297°04.3	28.0	302°57.5	26.3	274°23.9	05.1	302°29.5	58.1					Hamal	327°54.1	23°33.9	
6	282°32.3	312°04.1	\$11°27.3	317°58.1	\$15°25.8	289°25.9	\$04°04.9	317°31.7	\$14°58.1					Polaris	315°31.5	89°21.6	
7	297°34.7	327°03.9	26.6	332°58.7	25.2	304°27.8	04.7	332°34.0	58.0					Acamar	315°13.9	-40°13.2	
8	312°37.2	342°03.8	25.9	347°59.3	24.6	319°29.7	04.5	347°36.2	57.9					Menkar	314°08.8	4°10.4	
9	327°39.7	357°03.6	.. 25.2	2°59.9	.. 24.0	334°31.6	.. 04.2	2°38.4	.. 57.9					Mirfak	308°31.9	49°56.4	
10	342°42.1	12°03.4	24.5	18°00.5	23.4	349°33.6	04.0	17°40.7	57.8					Aldebaran	290°42.4	16°33.1	
11	357°44.6	27°03.3	23.8	33°01.1	22.8	4°35.5	03.8	32°42.9	57.7					Rigel	281°06.2	-8°10.7	
12	12°47.1	42°03.1	\$11°23.0	48°01.7	\$15°22.3	19°37.4	\$04°03.5	47°45.2	\$14°57.7					Capella	280°25.5	46°01.3	
13	27°49.5	57°02.9	22.3	63°02.3	21.7	34°39.4	03.3	62°47.4	57.6					Bellatrix	278°25.5	6°22.1	
14	42°52.0	72°02.8	21.6	78°02.9	21.1	49°41.3	03.1	77°49.7	57.5					Elnath	278°04.9	28°37.6	
15	57°54.5	87°02.6	.. 20.9	93°03.6	.. 20.5	64°43.2	.. 02.9	92°51.9	.. 57.5					Alnilam	275°40.2	-1°11.4	
16	72°56.9	102°02.4	20.2	108°04.2	19.9	79°45.1	02.6	107°54.2	57.4					Betelgeuse	270°54.7	7°24.6	
17	87°59.4	117°02.3	19.5	123°04.8	19.3	94°47.1	02.4	122°56.4	57.3					Canopus	263°53.5	-52°42.7	
18	103°01.8	132°02.1	\$11°18.7	138°05.4	\$15°18.7	109°49.0	\$04°02.2	137°58.7	\$14°57.3					Sirius	258°28.3	-16°45.0	
19	118°04.3	147°01.9	18.0	153°06.0	18.1	124°50.9	02.0	153°00.9	57.2					Adhara	255°07.7	-29°00.4	
20	133°06.8	162°01.8	17.3	168°06.6	17.6	139°52.8	01.7	168°03.2	57.1					Procyon	244°53.2	5°10.0	
21	148°09.2	177°01.6	.. 16.6	183°07.2	.. 17.0	154°54.8	.. 01.5	183°05.4	.. 57.1					Pollux	243°20.1	27°58.4	
22	163°11.7	192°01.4	15.9	198°07.8	16.4	169°56.7	01.3	198°07.7	57.0					Avior	234°15.4	-59°35.1	
23	178°14.2	207°01.3	15.1	213°08.4	15.8	184°58.6	01.1	213°09.9	56.9					Suhail	222°47.8	-43°31.5	
Mer.pass. 11:09			ν -0.2° d 0.7' m -4.31	ν 0.6° d 0.6' m 1.04	ν 1.9° d 0.2' m -2.06	ν 2.2° d 0.1' m 0.83								Miaplacidus	221°38.2	-69°48.7	
Mer.pass. 11:09			ν -0.2° d 0.7' m -4.31	ν 0.6° d 0.6' m 1.04	ν 1.9° d 0.2' m -2.06	ν 2.2° d 0.1' m 0.83								Alphard	217°49.8	-8°45.4	
Mer.pass. 11:09			ν -0.2° d 0.7' m -4.30	ν 0.6° d 0.6' m 1.04	ν 1.9° d 0.2' m -2.06	ν 2.2° d 0.1' m 0.83								Regulus	207°36.7	11°51.5	
Mer.pass. 11:09			ν -0.2° d 0.7' m -4.30	ν 0.6° d 0.6' m 1.04	ν 1.9° d 0.2' m -2.06	ν 2.2° d 0.1' m 0.83								Dubhe	193°43.3	61°38.0	
Mer.pass. 11:09			ν -0.2° d 0.7' m -4.30	ν 0.6° d 0.6' m 1.04	ν 1.9° d 0.2' m -2.06	ν 2.2° d 0.1' m 0.83								Denebola	182°27.0	14°26.9	
Mer.pass. 11:09			ν -0.2° d 0.7' m -4.30	ν 0.6° d 0.6' m 1.04	ν 1.9° d 0.2' m -2.06	ν 2.2° d 0.1' m 0.83								Gienah	175°45.6	-17°40.0	
Mer.pass. 11:09			ν -0.2° d 0.7' m -4.30	ν 0.6° d 0.6' m 1.04	ν 1.9° d 0.2' m -2.06	ν 2.2° d 0.1' m 0.83								Acrux	173°01.9	-63°13.3	
Mer.pass. 11:09			ν -0.2° d 0.7' m -4.30	ν 0.6° d 0.6' m 1.04	ν 1.9° d 0.2' m -2.06	ν 2.2° d 0.1' m 0.83								Gacrux	171°53.6	-57°14.3	
Mer.pass. 11:09			ν -0.2° d 0.7' m -4.30	ν 0.6° d 0.6' m 1.04	ν 1.9° d 0.2' m -2.06	ν 2.2° d 0.1' m 0.83								Alioth	166°14.5	55°50.4	
Mer.pass. 11:09			ν -0.2° d 0.7' m -4.30	ν 0.6° d 0.6' m 1.04	ν 1.9° d 0.2' m -2.06	ν 2.2° d 0.1' m 0.83								Spica	158°24.4	-11°16.7	
Mer.pass. 11:09			ν -0.2° d 0.7' m -4.30	ν 0.6° d 0.6' m 1.04	ν 1.9° d 0.2' m -2.06	ν 2.2° d 0.1' m 0.83								Alkaid	152°53.4	49°12.1	
Mer.pass. 11:09			ν -0.2° d 0.7' m -4.30	ν 0.6° d 0.6' m 1.04	ν 1.9° d 0.2' m -2.06	ν 2.2° d 0.1' m 0.83								Hadar	148°38.6	-60°28.7	
Mer.pass. 11:09			ν -0.2° d 0.7' m -4.30	ν 0.6° d 0.6' m 1.04	ν 1.9° d 0.2' m -2.06	ν 2.2° d 0.1' m 0.83								Menkent	147°59.9	-36°28.7	
Mer.pass. 11:09			ν -0.2° d 0.7' m -4.30	ν 0.6° d 0.6' m 1.04	ν 1.9° d 0.2' m -2.06	ν 2.2° d 0.1' m 0.83								Arcturus	145°49.7	19°03.9	
Mer.pass. 11:09			ν -0.2° d 0.7' m -4.30	ν 0.6° d 0.6' m 1.04	ν 1.9° d 0.2' m -2.06	ν 2.2° d 0.1' m 0.83								Rigel	139°42.8	-60°55.5	
Mer.pass. 11:09			ν -0.2° d 0.7' m -4.30	ν 0.6° d 0.6' m 1.04	ν 1.9° d 0.2' m -2.06	ν 2.2° d 0.1' m 0.83								Kochab	137°18.8	74°03.7	
Mer.pass. 11:09			ν -0.2° d 0.7' m -4.30	ν 0.6° d 0.6' m 1.04	ν 1.9° d 0.2' m -2.06	ν 2.2° d 0.1' m 0.83								Zuben'ubi	136°58.3	-16°08.1	
Mer.pass. 11:09			ν -0.2° d 0.7' m -4.30	ν 0.6° d 0.6' m 1.04	ν 1.9° d 0.2' m -2.06	ν 2.2° d 0.1' m 0.83								Alphecca	126°05.4	26°38.2	
Mer.pass. 11:09			ν -0.2° d 0.7' m -4.30	ν 0.6° d 0.6' m 1.04	ν 1.9° d 0.2' m -2.06	ν 2.2° d 0.1' m 0.83								Antares	112°18.4	-26°28.8	
Mer.pass. 11:09			ν -0.2° d 0.7' m -4.30	ν 0.6° d 0.6' m 1.04	ν 1.9° d 0.2' m -2.06	ν 2.2° d 0.1' m 0.83								Atria	107°14.4	-69°03.8	
Mer.pass. 11:09			ν -0.2° d 0.7' m -4.30	ν 0.6° d 0.6' m 1.04	ν 1.9° d 0.2' m -2.06	ν 2.2° d 0.1' m 0.83								Sabik	102°05.3	-15°45.2	
Mer.pass. 11:09			ν -0.2° d 0.7' m -4.30	ν 0.6° d 0.6' m 1.04	ν 1.9° d 0.2' m -2.06	ν 2.2° d 0.1' m 0.83								Shaula	96°13.3	-37°07.1	
Mer.pass. 11:09			ν -0.2° d 0.7' m -4.30	ν 0.6° d 0.6' m 1.04	ν 1.9° d 0.2' m -2.06	ν 2.2° d 0.1' m 0.83								Rasalhague	96°00.6	12°32.4	
Mer.pass. 11:09			ν -0.2° d 0.7' m -4.30	ν 0.6° d 0.6' m 1.04	ν 1.9° d 0.2' m -2.06	ν 2.2° d 0.1' m 0.83								Eltanin	90°43.1	51°28.8	
Mer.pass. 11:09			ν -0.2° d 0.7' m -4.30	ν 0.6° d 0.6' m 1.04	ν 1.9° d 0.2' m -2.06	ν 2.2° d 0.1' m 0.83								Kaus Aust.	83°35.5	-34°22.4	
Mer.pass. 11:09			ν -0.2° d 0.7' m -4.30	ν 0.6° d 0.6' m 1.04	ν 1.9° d 0.2' m -2.06	ν 2.2° d 0.1' m 0.83								Vega	80°34.7	38°47.9	
Mer.pass. 11:09			ν -0.2° d 0.7' m -4.30	ν 0.6° d 0.6' m 1.04	ν 1.9° d 0.2' m -2.06	ν 2.2° d 0.1' m 0.83								Nunki	75°50.6	-26°16.1	
Mer.pass. 11:09			ν -0.2° d 0.7' m -4.30	ν 0.6° d 0.6' m 1.04	ν 1.9° d 0.2' m -2.06	ν 2.2° d 0.1' m 0.83								Altair	62°02.2	8°55.4	
Mer.pass. 11:09			ν -0.2° d 0.7' m -4.30	ν 0.6° d 0.6' m 1.04	ν 1.9° d 0.2' m -2.06	ν 2.2° d 0.1' m 0.83								Peacock	53°09.5	-56°39.7	
Mer.pass. 11:09			ν -0.2° d 0.7' m -4.30	ν 0.6° d 0.6' m 1.04	ν 1.9° d 0.2' m -2.06	ν 2.2° d 0.1' m 0.83								Deneb	49°27.5	45°21.2	
Mer.pass. 11:09			ν -0.2° d 0.7' m -4.30	ν 0.6° d 0.6' m 1.04	ν 1.9° d 0.2' m -2.06	ν 2.2° d 0.1' m 0.83								Enif	33°41.2	9°58.4	
Mer.pass. 11:09			ν -0.2° d 0.7' m -4.30	ν 0.6° d 0.6' m 1.04	ν 1.9° d 0.2' m -2.06	ν 2.2° d 0.1' m 0.83								Al Na'ir	27°36.1	-46°51.2	
Mer.pass. 11:09			ν -0.2° d 0.7' m -4.30	ν 0.6° d 0.6' m 1.04	ν 1.9° d 0.2' m -2.06	ν 2.2° d 0.1' m 0.83								Fomalhaut	15°17.4	-29°30.4	
Mer.pass. 11:09			ν -0.2° d 0.7' m -4.30	ν 0.6° d 0.6' m 1.04	ν 1												

DUT1 = UT1-UTC = -0.1001 sec  $\Delta T = TT-UT1 = +69.2841$  sec

2022 April 04 to Apr. 06 UT

h		Sun		Moon				
Mon		GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	179°13.0	N05°36.1	148°20.4	13.5'	N16°06.8	11.5'	55.2'	
1	194°13.1	37.1	162°52.9	13.5'	16°18.3	11.4'	55.2'	
2	209°13.3	38.0	177°25.4	13.5'	16°29.7	11.3'	55.2'	
3	224°13.5	.. 39.0	191°57.9	13.4'	16°41.0	11.2'	55.1'	
4	239°13.7	39.9	206°30.3	13.4'	16°52.2	11.1'	55.1'	
5	254°13.9	40.9	221°02.7	13.4'	17°03.3	11.0'	55.1'	
6	269°14.0	N05°41.8	235°35.1	13.3'	N17°14.3	11.0'	55.1'	
7	284°14.2	42.8	250°07.4	13.3'	17°25.3	10.9'	55.1'	
8	299°14.4	43.7	264°39.7	13.2'	17°36.2	10.8'	55.0'	
9	314°14.6	.. 44.7	279°11.9	13.2'	17°47.0	10.7'	55.0'	
10	329°14.8	45.6	293°44.1	13.2'	17°57.7	10.6'	55.0'	
11	344°14.9	46.6	308°16.3	13.1'	18°08.3	10.5'	55.0'	
12	359°15.1	N05°47.5	322°48.4	13.1'	N18°18.8	10.4'	55.0'	
13	14°15.3	48.5	337°20.5	13.1'	18°29.3	10.4'	54.9'	
14	29°15.5	49.4	351°52.6	13.0'	18°39.7	10.3'	54.9'	
15	44°15.7	.. 50.4	6°24.6	13.0'	18°49.9	10.2'	54.9'	
16	59°15.8	51.4	20°56.6	12.9'	19°00.1	10.1'	54.9'	
17	74°16.0	52.3	35°28.5	12.9'	19°10.2	10.0'	54.9'	
18	89°16.2	N05°53.3	50°00.4	12.9'	N19°20.2	9.9'	54.9'	
19	104°16.4	54.2	64°32.3	12.8'	19°30.1	9.8'	54.8'	
20	119°16.6	55.2	79°04.1	12.8'	19°39.9	9.7'	54.8'	
21	134°16.7	.. 56.1	93°35.9	12.7'	19°49.6	9.6'	54.8'	
22	149°16.9	57.1	108°07.6	12.7'	19°59.3	9.5'	54.8'	
23	164°17.1	58.0	122°39.3	12.7'	20°08.8	9.4'	54.8'	
	SD = 16.0'		SD = 15.1'					
Tue		GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	179°17.3	N05°59.0	137°11.0	12.6'	N20°18.2	9.3'	54.7'	
1	194°17.5	05°59.9	151°42.6	12.6'	20°27.6	9.2'	54.7'	
2	209°17.6	06°00.9	166°14.2	12.5'	20°36.8	9.1'	54.7'	
3	224°17.8	.. 01.8	180°45.7	12.5'	20°45.9	9.0'	54.7'	
4	239°18.0	02.8	195°17.2	12.5'	20°55.0	8.9'	54.7'	
5	254°18.2	03.7	209°48.7	12.4'	21°03.9	8.8'	54.7'	
6	269°18.3	N06°04.7	224°20.1	12.4'	N21°12.8	8.7'	54.7'	
7	284°18.5	05.6	238°51.5	12.3'	21°21.5	8.6'	54.6'	
8	299°18.7	06.6	253°22.8	12.3'	21°30.2	8.5'	54.6'	
9	314°18.9	.. 07.5	267°54.1	12.3'	21°38.7	8.4'	54.6'	
10	329°19.1	08.5	282°25.4	12.2'	21°47.2	8.3'	54.6'	
11	344°19.2	09.4	296°56.6	12.2'	21°55.5	8.2'	54.6'	
12	359°19.4	N06°10.4	311°27.7	12.1'	N22°03.7	8.1'	54.6'	
13	14°19.6	11.3	325°58.9	12.1'	22°11.9	8.0'	54.5'	
14	29°19.8	12.3	340°29.9	12.0'	22°19.9	7.9'	54.5'	
15	44°20.0	.. 13.2	355°01.0	12.0'	22°27.8	7.8'	54.5'	
16	59°20.1	14.2	9°32.0	12.0'	22°35.6	7.7'	54.5'	
17	74°20.3	15.1	24°03.0	11.9'	22°43.3	7.6'	54.5'	
18	89°20.5	N06°16.1	38°33.9	11.9'	N22°50.9	7.5'	54.5'	
19	104°20.7	17.0	53°04.8	11.8'	22°58.4	7.4'	54.5'	
20	119°20.8	17.9	67°35.6	11.8'	23°05.8	7.3'	54.5'	
21	134°21.0	.. 18.9	82°06.4	11.8'	23°13.1	7.2'	54.4'	
22	149°21.2	19.8	96°37.2	11.7'	23°20.3	7.1'	54.4'	
23	164°21.4	20.8	111°07.9	11.7'	23°27.3	6.9'	54.4'	
	SD = 16.0'		SD = 14.9'					
Wed		GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	179°21.6	N06°21.7	125°38.6	11.6'	N23°34.3	6.8'	54.4'	
1	194°21.7	22.7	140°09.2	11.6'	23°41.1	6.7'	54.4'	
2	209°21.9	23.6	154°39.8	11.6'	23°47.8	6.6'	54.4'	
3	224°22.1	.. 24.6	169°10.4	11.5'	23°54.4	6.5'	54.4'	
4	239°22.3	25.5	183°40.9	11.5'	24°00.9	6.4'	54.4'	
5	254°22.4	26.5	198°11.4	11.4'	24°07.3	6.3'	54.3'	
6	269°22.6	N06°27.4	212°41.8	11.4'	N24°13.6	6.2'	54.3'	
7	284°22.8	28.4	227°12.2	11.4'	24°19.8	6.0'	54.3'	
8	299°23.0	29.3	241°42.6	11.3'	24°25.8	5.9'	54.3'	
9	314°23.1	.. 30.2	256°13.0	11.3'	24°31.7	5.8'	54.3'	
10	329°23.3	31.2	270°43.3	11.3'	24°37.5	5.7'	54.3'	
11	344°23.5	32.1	285°13.5	11.2'	24°43.2	5.6'	54.3'	
12	359°23.7	N06°33.1	299°43.8	11.2'	N24°48.8	5.5'	54.3'	
13	14°23.9	34.0	314°13.9	11.2'	24°54.3	5.3'	54.3'	
14	29°24.0	35.0	328°44.1	11.1'	24°59.6	5.2'	54.3'	
15	44°24.2	.. 35.9	343°14.2	11.1'	25°04.8	5.1'	54.3'	
16	59°24.4	36.9	357°44.3	11.1'	25°09.9	5.0'	54.2'	
17	74°24.6	37.8	12°14.4	11.0'	25°14.9	4.9'	54.2'	
18	89°24.7	N06°38.7	26°44.4	11.0'	N25°19.8	4.7'	54.2'	
19	104°24.9	39.7	41°14.4	11.0'	25°24.5	4.6'	54.2'	
20	119°25.1	40.6	55°44.4	10.9'	25°29.2	4.5'	54.2'	
21	134°25.3	.. 41.6	70°14.3	10.9'	25°33.7	4.4'	54.2'	
22	149°25.4	42.5	84°44.2	10.9'	25°38.1	4.3'	54.2'	
23	164°25.6	43.4	99°14.1	10.8'	25°42.3	4.1'	54.2'	
	SD = 16.0'		SD = 14.8'					

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

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

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	195°14.9	221°53.0	\$10°39.0	228°38.2	\$14°46.6	201°33.2	\$03°50.1	230°00.2	\$14°53.7	Alpheratz	357°37.5	29°12.5					
1	210°17.4	236°52.8	38.2	243°38.8	46.0	216°35.1	49.8	245°02.4	53.7	Ankaa	353°09.8	-42°11.2					
2	225°19.8	251°52.6	37.5	258°39.4	45.4	231°37.0	49.6	260°04.7	53.6	Schedar	349°34.2	56°39.4					
3	240°22.3	266°52.4	.. 36.7	273°40.1	.. 44.8	246°39.0	.. 49.4	275°06.9	.. 53.6	Diphda	348°49.9	-17°52.1					
4	255°24.8	281°52.3	35.9	288°40.7	44.2	261°40.9	49.2	290°09.2	53.5	Achernar	335°22.5	-57°07.6					
5	270°27.2	296°52.1	35.2	303°41.3	43.6	276°42.8	48.9	305°11.4	53.4	Hamal	327°54.1	23°33.9					
6	285°29.7	311°51.9	\$10°34.4	318°41.9	\$14°43.0	291°44.8	\$03°48.7	320°13.7	\$14°53.4	Polaris	315°31.9	89°21.6					
7	300°32.2	326°51.7	33.7	333°42.5	42.4	306°46.7	48.5	335°16.0	53.3	Acamar	315°13.9	-40°13.2					
8	315°34.6	341°51.6	32.9	348°43.1	41.8	321°48.6	48.3	350°18.2	53.2	Menkar	314°08.8	4°10.4					
9	330°37.1	356°51.4	.. 32.2	3°43.7	.. 41.2	336°50.6	.. 48.0	5°20.5	.. 53.2	Mirfak	308°31.9	49°56.4					
10	345°39.6	11°51.2	31.4	18°44.3	40.6	351°52.5	47.8	20°22.7	53.1	Aldebaran	290°42.5	16°33.1					
11	0°42.0	26°51.1	30.6	33°45.0	40.0	6°54.4	47.6	35°25.0	53.0	Rigel	281°06.2	-8°10.7					
12	15°44.5	41°50.9	\$10°29.9	48°45.6	\$14°39.4	21°56.4	\$03°47.4	50°27.2	\$14°53.0	Capella	280°25.5	46°01.3					
13	30°46.9	56°50.7	29.1	63°46.2	38.8	36°58.3	47.1	65°29.5	52.9	Bellatrix	278°25.5	6°22.1					
14	45°49.4	71°50.5	28.3	78°46.8	38.2	52°00.2	46.9	80°31.7	52.9	Elnath	278°04.9	28°37.6					
15	60°51.9	86°50.4	.. 27.6	93°47.4	.. 37.6	67°02.2	.. 46.7	95°34.0	.. 52.8	Alnilam	275°40.2	-1°11.4					
16	75°54.3	101°50.2	26.8	108°48.0	37.0	82°04.1	46.5	110°36.2	52.7	Betelgeuse	270°54.7	7°24.6					
17	90°56.8	116°50.0	26.1	123°48.7	36.4	97°06.0	46.2	125°38.5	52.7	Canopus	263°53.5	-52°42.7					
18	105°59.3	131°49.9	\$10°25.3	138°49.3	\$14°35.8	112°08.0	\$03°46.0	140°40.8	\$14°52.6	Sirius	258°28.3	-16°45.0					
19	121°01.7	146°49.7	24.5	153°49.9	35.2	127°09.9	45.8	155°43.0	52.5	Adhara	255°07.7	-29°00.4					
20	136°04.2	161°49.5	23.8	168°50.5	34.6	142°11.8	45.6	170°45.3	52.5	Procyon	244°53.2	5°10.0					
21	151°06.7	176°49.3	.. 23.0	183°51.1	.. 34.0	157°13.8	.. 45.4	185°47.5	.. 52.4	Pollux	243°20.1	27°58.4					
22	166°09.1	191°49.2	22.2	198°51.7	33.4	172°15.7	45.1	200°49.8	52.3	Avior	234°15.5	-59°35.1					
23	181°11.6	206°49.0	21.4	213°52.3	32.8	187°17.6	44.9	215°52.0	52.3	Suhail	222°47.8	-43°31.5					
Mer.pass. 10:57			ν -0.2' d 0.8' m -4.29	ν 0.6' d 0.6' m 1.02	ν 1.9' d 0.2' m -2.06	ν 2.3' d 0.1' m 0.83	Mer.pass. 10:53			Alphard	217°49.8	-8°45.4					
Fri			GHA	GHA	Dec	GHA	GHA	Dec	GHA	Dec	Dubhe	193°43.3	61°38.0				
0	196°14.0	221°48.8	\$10°20.7	228°53.0	\$14°32.2	202°19.6	\$03°44.7	230°54.3	\$14°52.2	Denebola	182°27.0	14°26.9					
1	211°16.5	236°48.6	19.9	243°53.6	31.6	217°21.5	44.5	245°56.5	52.2	Gienah	175°45.6	-17°40.0					
2	226°19.0	251°48.5	19.1	258°54.2	30.9	232°23.4	44.2	260°58.8	52.1	Acrux	173°01.9	-63°13.4					
3	241°21.4	266°48.3	.. 18.4	273°54.8	.. 30.3	247°25.4	.. 44.0	276°01.1	.. 52.0	Gacrux	171°53.6	-57°14.3					
4	256°23.9	281°48.1	17.6	288°55.4	29.7	262°27.3	43.8	291°03.3	52.0	Alioth	166°14.5	55°50.4					
5	271°26.4	296°47.9	16.8	303°56.0	29.1	277°29.2	43.6	306°05.6	51.9	Alkaid	152°53.4	49°12.1					
6	286°28.8	311°47.8	\$10°16.1	318°56.7	\$14°28.5	292°31.2	\$03°43.3	321°07.8	\$14°51.8	Hadar	148°38.6	-60°28.7					
7	301°31.3	326°47.6	15.3	333°57.3	27.9	307°33.1	43.1	336°10.1	51.8	Menkent	147°59.9	-36°28.7					
8	316°33.8	341°47.4	14.5	348°57.9	27.3	322°35.0	42.9	351°12.3	51.7	Arcturus	145°49.7	19°03.9					
9	331°36.2	356°47.3	.. 13.7	3°58.5	.. 26.7	337°37.0	.. 42.7	6°14.6	.. 51.6	Rigel Kent.	139°42.8	-60°55.5					
10	346°38.7	11°47.1	13.0	18°59.1	26.1	352°38.9	42.4	21°16.9	51.6	Kochab	137°18.7	74°03.7					
11	1°41.2	26°46.9	12.2	32°59.7	25.5	7°40.8	42.2	36°19.1	51.5	Zuben 'ubi	136°58.2	-16°08.1					
12	16°43.6	41°46.7	\$10°11.4	49°00.4	\$14°24.9	22°42.8	\$03°42.0	51°21.4	\$14°51.5	Alphecca	126°05.4	26°38.2					
13	31°46.1	56°46.6	10.6	64°01.0	24.3	37°44.7	41.8	66°23.6	51.4	Antares	112°18.4	-26°28.8					
14	46°48.5	71°46.4	09.8	79°01.6	23.7	52°46.6	41.6	81°25.9	51.3	Atria	107°14.4	-69°03.8					
15	61°51.0	86°46.2	.. 09.1	94°02.2	.. 23.0	67°48.6	.. 41.3	96°28.1	.. 51.3	Sabik	102°05.2	-15°45.2					
16	76°53.5	101°46.0	08.3	109°02.8	22.4	82°50.5	41.1	111°30.4	51.2	Shaula	96°13.3	-37°07.1					
17	91°55.9	116°45.9	07.5	124°03.5	21.8	97°52.4	40.9	126°32.7	51.1	Rasalhague	96°00.5	12°32.5					
18	106°58.4	131°45.7	\$10°06.7	139°04.1	\$14°21.2	112°54.4	\$03°40.7	141°34.9	\$14°51.1	Eltanin	90°43.1	51°28.8					
19	122°00.9	146°45.5	05.9	154°04.7	20.6	127°56.3	40.4	156°37.2	51.0	Kaus Aust.	83°35.5	-34°22.4					
20	137°03.3	161°45.3	05.2	169°05.3	20.0	142°58.2	40.2	171°39.4	51.0	Vega	80°34.7	38°47.9					
21	152°05.8	176°45.2	.. 04.4	184°05.9	.. 19.4	158°00.2	.. 40.0	186°41.7	.. 50.9	Nunki	75°50.6	-26°16.1					
22	167°08.3	191°45.0	03.6	199°06.6	18.8	173°02.1	39.8	201°43.9	50.8	Altair	62°02.2	8°55.4					
23	182°10.7	206°44.8	02.8	214°07.2	18.2	188°04.0	39.5	216°46.2	50.8	Peacock	53°09.5	-56°39.7					
Mer.pass. 10:53			ν -0.2' d 0.8' m -4.28	ν 0.6' d 0.6' m 1.01	ν 1.9' d 0.2' m -2.06	ν 2.3' d 0.1' m 0.83	Mer.pass. 10:49			Deneb	49°27.5	45°21.2					
Sat			GHA	GHA	Dec	GHA	GHA	Dec	GHA	Dec	Scheat	13°47.7	28°11.9				
0	197°13.2	221°44.6	\$10°02.0	229°07.8	\$14°17.5	203°06.0	\$03°39.3	231°48.5	\$14°50.7	Markab	13°32.4	15°19.2					
1	212°15.7	236°44.5	01.2	244°08.4	16.9	218°07.9	39.1	246°50.7	50.6								
2	227°18.1	251°44.3	10°00.5	259°09.0	16.3	233°09.8	38.9	261°53.0	50.6								
3	242°20.6	266°44.1	09°59.7	274°09.7	.. 15.7	248°11.8	.. 38.7	276°55.2	.. 50.5								
4	257°23.0	281°43.9	58.9	289°10.3	15.1	263°13.7	38.4	291°57.5	50.5								
5	272°25.5	296°43.8	58.1	304°10.9	14.5	278°15.6	38.2	306°59.8	50.4								
6	287°28.0	311°43.6	\$09°57.3	319°11.5	\$14°13.9	293°17.6	\$03°38.0	322°02.0	\$14°50.3								
7	302°30.4	326°43.4	56.5	334°12.1	13.3	308°19.5	37.8	337°04.3	50.3								
8	317°32.9	341°43.2	55.7	349°12.8	12.6	323°21.4	37.5	352°06.5	50.2								
9	332°35.4	356°43.1	.. 54.9	4°13.4	.. 12.0	338°23.4	.. 37.3	7°08.8	.. 50.1								
10	347°37.8	11°42.9	54.2	19°14.0	11.4	353°25.3	37.1	22°11.1	50.1								
11	2°40.3	26°42.7	53.4	34°14.6	10.8	8°27.3	36.9	37°13.3	50.0								
12	17°42.8	41°42.5	\$09°52.6	49°15.2	\$14°10.2	23°29.2	\$03°36.7	52°15.6	\$14°50.0								
13	32°45.2	56°42.4	51.8	64°15.9	09.6	38°31.1	36.4	67°17.8	49.9								
14	47°47.7	71°42.2	51.0	79°16.5	09.0	53°33.1	36.2	82°20.1	49.8								
15	62°50.2	86°42.0	.. 50.2	94°17.1	.. 08.4	68°35.0	.. 36.0	97°22.4	.. 49.8								

DUT1 = UT1-UTC = -0.0991 sec  $\Delta T = TT-UT1 = +69.2831$  sec

2022 April 07 to Apr. 09 UT

h		Sun		Moon				
Thu		GHA	Dec	GHA	$\nu$	Dec	d	HP
0	179°25.8	N06°44.4	113°43.9	10.8'	N25°46.5	4.0'	54.2'	
1	194°26.0	45.3	128°13.7	10.8'	25°50.5	3.9'	54.2'	
2	209°26.1	46.3	142°43.5	10.8'	25°54.4	3.8'	54.2'	
3	224°26.3	47.2	157°13.3	10.7'	25°58.2	3.7'	54.2'	
4	239°26.5	48.2	171°43.0	10.7'	26°01.8	3.5'	54.2'	
5	254°26.7	49.1	186°12.7	10.7'	26°05.3	3.4'	54.2'	
6	269°26.8	N06°50.0	200°42.4	10.7'	N26°08.7	3.3'	54.2'	
7	284°27.0	51.0	215°12.0	10.6'	26°12.0	3.2'	54.2'	
8	299°27.2	51.9	229°41.7	10.6'	26°15.2	3.0'	54.2'	
9	314°27.4	52.9	244°11.3	10.6'	26°18.2	2.9'	54.2'	
10	329°27.5	53.8	258°40.9	10.6'	26°21.1	2.8'	54.2'	
11	344°27.7	54.7	273°10.4	10.5'	26°23.9	2.7'	54.2'	
12	359°27.9	N06°55.7	287°40.0	10.5'	N26°26.5	2.5'	54.2'	
13	14°28.1	56.6	302°09.5	10.5'	26°29.1	2.4'	54.1'	
14	29°28.2	57.6	316°39.0	10.5'	26°31.4	2.3'	54.1'	
15	44°28.4	58.5	331°08.5	10.5'	26°33.7	2.1'	54.1'	
16	59°28.6	06°59.4	345°38.0	10.4'	26°35.9	2.0'	54.1'	
17	74°28.8	07°00.4	0°07.4	10.4'	26°37.9	1.9'	54.1'	
18	89°28.9	N07°01.3	14°36.8	10.4'	N26°39.8	1.8'	54.1'	
19	104°29.1	02.2	29°06.3	10.4'	26°41.5	1.6'	54.1'	
20	119°29.3	03.2	43°35.7	10.4'	26°43.2	1.5'	54.1'	
21	134°29.4	04.1	58°05.0	10.4'	26°44.7	1.4'	54.1'	
22	149°29.6	05.1	72°34.4	10.4'	26°46.1	1.3'	54.1'	
23	164°29.8	06.0	87°03.8	10.4'	26°47.3	1.1'	54.1'	
	SD = 16.0'	d = 0.9'		SD = 14.8'				

Fri	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	179°30.0	N07°06.9	101°33.1	10.3'	N26°48.5	1.0'	54.1'
1	194°30.1	07.9	116°02.5	10.3'	26°49.5	0.9'	54.1'
2	209°30.3	08.8	130°31.8	10.3'	26°50.3	0.7'	54.2'
3	224°30.5	09.7	145°01.1	10.3'	26°51.1	0.6'	54.2'
4	239°30.7	10.7	159°30.4	10.3'	26°51.7	0.5'	54.2'
5	254°30.8	11.6	173°59.8	10.3'	26°52.2	0.4'	54.2'
6	269°31.0	N07°12.5	188°29.1	10.3'	N26°52.5	0.2'	54.2'
7	284°31.2	13.5	202°58.3	10.3'	26°52.7	0.1'	54.2'
8	299°31.4	14.4	217°27.6	10.3'	26°52.8	-0.0'	54.2'
9	314°31.5	15.3	231°56.9	10.3'	26°52.8	-0.2'	54.2'
10	329°31.7	16.3	246°26.2	10.3'	26°52.6	-0.3'	54.2'
11	344°31.9	17.2	260°55.5	10.3'	26°52.3	-0.4'	54.2'
12	359°32.0	N07°18.2	275°24.8	10.3'	N26°51.9	-0.5'	54.2'
13	14°32.2	19.1	289°54.0	10.3'	26°51.4	-0.7'	54.2'
14	29°32.4	20.0	304°23.3	10.3'	26°50.7	-0.8'	54.2'
15	44°32.6	21.0	318°52.6	10.3'	26°49.9	-0.9'	54.2'
16	59°32.7	21.9	333°21.9	10.3'	26°48.9	-1.1'	54.2'
17	74°32.9	22.8	347°51.2	10.3'	26°47.9	-1.2'	54.2'
18	89°33.1	N07°23.8	2°20.5	10.3'	N26°46.7	-1.3'	54.2'
19	104°33.2	24.7	16°49.8	10.3'	26°45.4	-1.5'	54.2'
20	119°33.4	25.6	31°19.0	10.3'	26°43.9	-1.6'	54.2'
21	134°33.6	26.5	45°48.4	10.3'	26°42.3	-1.7'	54.2'
22	149°33.8	27.5	60°17.7	10.3'	26°40.6	-1.8'	54.3'
23	164°33.9	28.4	74°47.0	10.3'	26°38.8	-2.0'	54.3'
	SD = 16.0'	d = 0.9'		SD = 14.8'			

Sat	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	179°34.1	N07°29.3	89°16.3	10.3'	N26°36.8	-2.1'	54.3'
1	194°34.3	30.3	103°45.6	10.3'	26°34.7	-2.2'	54.3'
2	209°34.4	31.2	118°15.0	10.4'	26°32.5	-2.4'	54.3'
3	224°34.6	32.1	132°44.4	10.4'	26°30.1	-2.5'	54.3'
4	239°34.8	33.1	147°13.7	10.4'	26°27.6	-2.6'	54.3'
5	254°35.0	34.0	161°43.1	10.4'	26°25.0	-2.7'	54.3'
6	269°35.1	N07°34.9	176°12.5	10.4'	N26°22.3	-2.9'	54.3'
7	284°35.3	35.9	190°41.9	10.4'	26°19.4	-3.0'	54.3'
8	299°35.5	36.8	205°11.3	10.4'	26°16.4	-3.1'	54.3'
9	314°35.6	37.7	219°40.8	10.5'	26°13.3	-3.2'	54.4'
10	329°35.8	38.6	234°10.2	10.5'	26°10.1	-3.4'	54.4'
11	344°36.0	39.6	248°39.7	10.5'	26°06.7	-3.5'	54.4'
12	359°36.1	N07°40.5	263°09.2	10.5'	N26°03.2	-3.6'	54.4'
13	14°36.3	41.4	277°38.7	10.5'	25°59.6	-3.8'	54.4'
14	29°36.5	42.4	292°08.2	10.5'	25°55.8	-3.9'	54.4'
15	44°36.6	43.3	306°37.8	10.6'	25°51.9	-4.0'	54.4'
16	59°36.8	44.2	321°07.4	10.6'	25°47.9	-4.1'	54.4'
17	74°37.0	45.1	335°36.9	10.6'	25°43.8	-4.3'	54.5'
18	89°37.2	N07°46.1	350°06.6	10.6'	N25°39.5	-4.4'	54.5'
19	104°37.3	47.0	4°36.2	10.7'	25°35.2	-4.5'	54.5'
20	119°37.5	47.9	19°05.9	10.7'	25°30.7	-4.6'	54.5'
21	134°37.7	48.9	33°35.5	10.7'	25°26.0	-4.8'	54.5'
22	149°37.8	49.8	48°05.2	10.7'	25°21.3	-4.9'	54.5'
23	164°38.0	50.7	62°35.0	10.8'	25°16.4	-5.0'	54.5'
	SD = 16.0'	d = 0.9'		SD = 14.8'			

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

Lat.	Moonrise		Thu	Sat	Moonset	
	Thu	Fri			Thu	Fri
N 72°						
N 70°						
68°						
66°						
64°	04:43				04:20	
62°	06:10	06:41	07:48		02:54	04:09
60°	06:47	07:25	08:27		02:18	03:24
N 58°	07:13	07:54	08:54		01:52	02:55
56°	07:34	08:17	09:15		01:31	02:32
54°	07:51	08:35	09:33		01:14	02:14
52°	08:06	08:51				

**April 10, 11, 12 UT (Sun., Mon., Tue.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	198°12.3	221°40.4	\$09°43.0	229°22.7	\$14°02.8	203°52.4	\$03°34.0	232°42.7	\$14°49.2					Alpheratz	357°37.5	29°12.5	
1	213°14.8	236°40.3	42.2	244°23.3	02.2	218°54.4	33.8	247°45.0	49.2					Ankaa	353°09.8	-42°11.2	
2	228°17.3	251°40.1	41.4	259°24.0	01.6	233°56.3	33.5	262°47.2	49.1					Schedar	349°34.2	56°39.3	
3	243°19.7	266°39.9	· · 40.6	274°24.6	· · 01.0	248°58.2	· · 33.3	277°49.5	· · 49.0					Diphda	348°49.9	-17°52.1	
4	258°22.2	281°39.7	39.8	289°25.2	14°00.3	264°00.2	33.1	292°51.8	49.0					Achernar	335°22.5	-57°07.6	
5	273°24.6	296°39.5	39.0	304°25.8	13°59.7	279°02.1	32.9	307°54.0	48.9					Hamal	327°54.1	23°33.9	
6	288°27.1	311°39.4	\$09°38.2	319°26.5	\$13°59.1	294°04.0	\$03°32.7	322°56.3	\$14°48.9					Polaris	315°32.4	89°21.5	
7	303°29.6	326°39.2	37.4	334°27.1	58.5	309°06.0	32.4	337°58.5	48.8					Acamar	315°13.9	-40°13.2	
8	318°32.0	341°39.0	36.6	349°27.7	57.9	324°07.9	32.2	353°00.8	48.7					Menkar	314°08.8	4°10.4	
9	333°34.5	356°38.8	· · 35.8	4°28.3	· · 57.2	339°09.9	· · 32.0	8°03.1	· · 48.7					Mirfak	308°31.9	49°56.4	
10	348°37.0	11°38.7	35.0	19°29.0	56.6	354°11.8	31.8	23°05.3	48.6					Aldebaran	290°42.5	16°33.1	
11	3°39.4	26°38.5	34.2	34°29.6	56.0	9°13.7	31.5	38°07.6	48.5					Rigel	281°06.2	-8°10.7	
12	18°41.9	41°38.3	\$09°33.4	49°30.2	\$13°55.4	24°15.7	\$03°31.3	53°09.9	\$14°48.5					Capella	280°25.5	46°01.3	
13	33°44.4	56°38.1	32.6	64°30.8	54.8	39°17.6	31.1	68°12.1	48.4					Bellatrix	278°25.5	6°22.1	
14	48°46.8	71°38.0	31.8	79°31.5	54.2	54°19.5	30.9	83°14.4	48.4					Elnath	278°04.9	28°37.6	
15	63°49.3	86°37.8	· · 31.0	94°32.1	· · 53.5	69°21.5	· · 30.7	98°16.6	· · 48.3					Alnilam	275°40.2	-1°11.4	
16	78°51.8	101°37.6	30.2	109°32.7	52.9	84°23.4	30.4	113°18.9	48.2					Betelgeuse	270°54.7	7°24.6	
17	93°54.2	116°37.4	29.4	124°33.3	52.3	99°25.4	30.2	128°21.2	48.2					Canopus	263°53.5	-52°42.7	
18	108°56.7	131°37.3	\$09°28.5	139°34.0	\$13°51.7	114°27.3	\$03°30.0	143°23.4	\$14°48.1					Sirius	258°28.3	-16°45.0	
19	123°59.1	146°37.1	27.7	154°34.6	51.1	129°29.2	29.8	158°25.7	48.1					Adhara	255°07.7	-29°00.4	
20	139°01.6	161°36.9	26.9	169°35.2	50.4	144°31.2	29.6	173°28.0	48.0					Procyon	244°53.2	5°10.0	
21	154°04.1	176°36.7	· · 26.1	184°35.9	· · 49.8	159°33.1	· · 29.3	188°30.2	· · 47.9					Pollux	243°20.1	27°58.4	
22	169°06.5	191°36.5	25.3	199°36.5	49.2	174°35.0	29.1	203°32.5	47.9					Avior	234°15.5	-59°35.1	
23	184°09.0	206°36.4	24.5	214°37.1	48.6	189°37.0	28.9	218°34.8	47.8					Suhail	222°47.8	-43°31.6	
Mer.pass. 10:45			ν -0.2' d 0.8' m -4.26	ν 0.6' d 0.6' m 1.00	ν 1.9' d 0.2' m -2.07	ν 2.3' d 0.1' m 0.83											
Mon			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Denebola	193°43.3	61°38.0	
0	199°11.5	221°36.2	\$09°23.7	229°37.7	\$13°47.9	204°38.9	\$03°28.7	233°37.0	\$14°47.8					Gienah	175°45.6	-17°40.0	
1	214°13.9	236°36.0	22.9	244°38.4	47.3	219°40.9	28.4	248°39.3	47.7					Acrux	173°01.9	-63°13.4	
2	229°16.4	251°35.8	22.0	259°39.0	46.7	234°42.8	28.2	263°41.5	47.6					Gacrux	171°53.6	-57°14.3	
3	244°18.9	266°35.7	· · 21.2	274°39.6	· · 46.1	249°44.7	· · 28.0	278°43.8	· · 47.6					Alioth	166°14.4	55°50.4	
4	259°21.3	281°35.5	20.4	289°40.2	45.5	264°46.7	27.8	293°46.1	47.5					Spica	158°24.4	-11°16.7	
5	274°23.8	296°35.3	19.6	304°40.9	44.8	279°48.6	27.6	308°48.3	47.5					Alkaid	152°53.3	49°12.1	
6	289°26.3	311°35.1	\$09°18.8	319°41.5	\$13°44.2	294°50.5	\$03°27.3	323°50.6	\$14°47.4					Hadar	148°38.6	-60°28.7	
7	304°28.7	326°35.0	18.0	334°42.1	43.6	309°52.5	27.1	338°52.9	47.3					Menkent	147°59.9	-36°28.8	
8	319°31.2	341°34.8	17.1	349°42.8	43.0	324°54.4	26.9	353°55.1	47.3					Arcturus	145°49.7	19°03.9	
9	334°33.6	356°34.6	· · 16.3	4°43.4	· · 42.3	339°56.4	· · 26.7	8°57.4	· · 47.2					Rigel Kent.	139°42.8	-60°55.5	
10	349°36.1	11°34.4	15.5	19°44.0	41.7	354°58.3	26.5	23°59.7	47.2					Kochab	137°18.7	74°03.7	
11	4°38.6	26°34.2	14.7	34°44.6	41.1	10°00.2	26.2	39°01.9	47.1					Zuben'ubi	136°58.2	-16°08.1	
12	19°41.0	41°34.1	\$09°13.9	49°45.3	\$13°40.5	25°02.2	\$03°26.0	54°04.2	\$14°47.0					Alphecca	126°05.4	26°38.2	
13	34°43.5	56°33.9	13.0	64°45.9	39.8	40°04.1	25.8	69°06.5	47.0					Antares	112°18.4	-26°28.8	
14	49°46.0	71°33.7	12.2	79°46.5	39.2	55°06.1	25.6	84°08.7	46.9					Atria	107°14.3	-69°03.8	
15	64°48.4	86°33.5	· · 11.4	94°47.2	· · 38.6	70°08.0	· · 25.4	99°11.0	· · 46.9					Sabik	102°05.2	-15°45.2	
16	79°50.9	101°33.4	10.6	109°47.8	38.0	85°09.9	25.1	114°13.3	46.8					Shaula	96°13.3	-37°07.1	
17	94°53.4	116°33.2	09.8	124°48.4	37.3	100°11.9	24.9	129°15.5	46.7					Rasalhague	96°00.5	12°32.5	
18	109°55.8	131°33.0	\$09°08.9	139°49.1	\$13°36.7	115°13.8	\$03°24.7	144°17.8	\$14°46.7					Eltanin	90°43.0	51°28.8	
19	124°58.3	146°32.8	08.1	154°49.7	36.1	130°15.8	24.5	159°20.1	46.6					Kaus Aust.	83°35.4	-34°22.4	
20	140°00.7	161°32.6	07.3	169°50.3	35.5	145°17.7	24.3	174°22.3	46.6					Vega	80°34.7	38°47.9	
21	155°03.2	176°32.5	· · 06.5	184°50.9	· · 34.8	160°19.6	· · 24.0	189°24.6	· · 46.5					Nunki	75°50.5	-26°16.1	
22	170°05.7	191°32.3	05.6	199°51.6	34.2	175°21.6	23.8	204°26.9	46.4					Altair	62°02.2	8°55.4	
23	185°08.1	206°32.1	04.8	214°52.2	33.6	190°23.5	23.6	219°29.1	46.4					Peacock	53°09.5	-56°39.6	
Mer.pass. 10:41			ν -0.2' d 0.8' m -4.25	ν 0.6' d 0.6' m 0.99	ν 1.9' d 0.2' m -2.07	ν 2.3' d 0.1' m 0.83											
Tue			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Fomalhaut	15°17.3	-29°30.4	
0	200°10.6	221°31.9	\$09°04.0	229°52.8	\$13°33.0	205°25.5	\$03°23.4	234°31.4	\$14°46.3					Scheat	13°47.7	28°11.9	
1	215°13.1	236°31.8	03.2	244°53.5	32.3	220°27.4	23.1	249°33.7	46.3					Markab	13°32.4	15°19.2	
2	230°15.5	251°31.6	02.3	259°54.1	31.7	235°29.3	22.9	264°35.9	46.2					Apr 10 Sun	SHA	Mer.pass	
3	245°18.0	266°31.4	· · 01.5	274°54.7	· · 31.1	250°31.3	· · 22.7	279°38.2	· · 46.1					Venus	23°28.1	09:13	
4	260°20.5	281°31.2	00°07.5	289°55.4	30.4	265°33.2	22.5	294°40.5	46.1					Mars	31°10.4	08:42	
5	275°22.9	296°31.0	08°59.8	304°56.0	29.8	280°35.2	22.3	309°42.7	46.0					Jupiter	5°40.1	10:23	
6	290°25.4	311°30.9	\$08°59.0	319°56.6	\$13°29.2	295°37.1	\$03°22.0	324°45.0	\$14°46.0					Saturn	34°30.4	08:28	
7	305°27.9	326°30.7	58.2	334°57.3	28.6	310°39.0	21.8	339°47.3	45.9					Apr 11 Mon	SHA	Mer.pass	
8	320°30.3	341°30.5	57.3	349°57.9	27.9	325°41.0	21.6	354°49.5	45.8					Venus	22°24.7	09:14	
9	335°32.8	356°30.3	· · 56.5	4°58.5	· · 27.3	340°42.9	· · 21.4	9°51.8	· · 45.8					Mars	30°26.3	08:41	
10	350°35.2	11°30.2	55.7	19°59.2	26.7	355°44.9	21.2	24°54.1	45.7					Jupiter	5°27.4	10:20	
11	5°37.7	26°30.0	54.8	34°59.8	26.0	10°46.8	20.9	39°56.3	45.7					Saturn	34°25.5	08:24	
12	20°40.2	41°2															

DUT1 = UT1-UTC = -0.0974 sec  $\Delta T = TT-UT1 = +69.2814$  sec

2022 April 10 to Apr. 12 UT

h		Sun		Moon			
Sun	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	179°38.2	N07°51.6	77°04.7	10.8'	N25°11.4	-5.1'	54.6'
1	194°38.3	52.6	91°34.5	10.8'	25°06.3	-5.2'	54.6'
2	209°38.5	53.5	106°04.3	10.8'	25°01.0	-5.4'	54.6'
3	224°38.7	54.4	120°34.1	10.9'	24°55.7	-5.5'	54.6'
4	239°38.8	55.3	135°04.0	10.9'	24°50.2	-5.6'	54.6'
5	254°39.0	56.3	149°33.9	10.9'	24°44.6	-5.7'	54.6'
6	269°39.2	N07°52.2	164°03.8	10.9'	N24°38.9	-5.9'	54.7'
7	284°39.3	58.1	178°33.7	11.0'	24°33.0	-6.0'	54.7'
8	299°39.5	07°59.0	193°03.7	11.0'	24°27.0	-6.1'	54.7'
9	314°39.7	08°00.0	207°33.7	11.0'	24°20.9	-6.2'	54.7'
10	329°39.8	00.9	222°03.7	11.1'	24°14.7	-6.3'	54.7'
11	344°40.0	01.8	236°33.8	11.1'	24°08.4	-6.4'	54.8'
12	359°40.2	N08°02.7	251°03.9	11.1'	N24°02.0	-6.6'	54.8'
13	14°40.3	03.6	265°34.0	11.2'	23°55.4	-6.7'	54.8'
14	29°40.5	04.6	280°04.2	11.2'	23°48.7	-6.8'	54.8'
15	44°40.7	05.5	294°34.4	11.2'	23°41.9	-6.9'	54.8'
16	59°40.8	06.4	309°04.6	11.2'	23°35.0	-7.0'	54.8'
17	74°41.0	07.3	323°34.8	11.3'	23°27.9	-7.2'	54.9'
18	89°41.2	N08°08.3	338°05.1	11.3'	N23°20.8	-7.3'	54.9'
19	104°41.3	09.2	352°35.4	11.3'	23°13.5	-7.4'	54.9'
20	119°41.5	10.1	7°05.8	11.4'	23°06.2	-7.5'	54.9'
21	134°41.7	11.0	21°36.1	11.4'	22°58.7	-7.6'	55.0'
22	149°41.8	11.9	36°06.5	11.4'	22°51.0	-7.7'	55.0'
23	164°42.0	12.9	50°37.0	11.5'	22°43.3	-7.8'	55.0'
SD = 16.0'		SD = 14.9'					
Mon		GHA		GHA			
0	179°42.2	N08°13.8	65°07.5	11.5'	N22°35.5	-7.9'	55.0'
1	194°42.3	14.7	79°38.0	11.5'	22°27.5	-8.1'	55.0'
2	209°42.5	15.6	94°08.5	11.6'	22°19.5	-8.2'	55.1'
3	224°42.7	16.5	108°39.1	11.6'	22°11.3	-8.3'	55.1'
4	239°42.8	17.5	123°09.7	11.6'	22°03.0	-8.4'	55.1'
5	254°43.0	18.4	137°40.4	11.7'	21°54.6	-8.5'	55.1'
6	269°43.2	N08°19.3	152°11.0	11.7'	N21°46.1	-8.6'	55.2'
7	284°43.3	20.2	166°41.8	11.7'	21°37.5	-8.7'	55.2'
8	299°43.5	21.1	181°12.5	11.8'	21°28.8	-8.8'	55.2'
9	314°43.7	22.1	195°43.3	11.8'	21°20.0	-8.9'	55.2'
10	329°43.8	23.0	210°14.1	11.8'	21°11.1	-9.0'	55.3'
11	344°44.0	23.9	224°45.0	11.9'	21°02.0	-9.1'	55.3'
12	359°44.2	N08°24.8	239°15.8	11.9'	N20°52.9	-9.3'	55.3'
13	14°44.3	25.7	253°46.8	12.0'	20°43.6	-9.4'	55.3'
14	29°44.5	26.6	268°17.7	12.0'	20°34.3	-9.5'	55.4'
15	44°44.6	27.6	282°48.7	12.0'	20°24.8	-9.6'	55.4'
16	59°44.8	28.5	297°19.7	12.1'	20°15.2	-9.7'	55.4'
17	74°45.0	29.4	311°50.8	12.1'	20°05.6	-9.8'	55.4'
18	89°45.1	N08°30.3	326°21.8	12.1'	N19°55.8	-9.9'	55.5'
19	104°45.3	31.2	340°53.0	12.1'	19°45.9	-10.0'	55.5'
20	119°45.5	32.1	355°24.1	12.2'	19°35.9	-10.1'	55.5'
21	134°45.6	33.1	9°55.3	12.2'	19°25.9	-10.2'	55.5'
22	149°45.8	34.0	24°26.5	12.2'	19°15.7	-10.3'	55.6'
23	164°46.0	34.9	38°57.7	12.3'	19°05.4	-10.4'	55.6'
SD = 16.0'		SD = 15.0'					
Tue	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	179°46.1	N08°35.8	53°29.0	12.3'	N18°55.0	-10.5'	55.6'
1	194°46.3	36.7	68°00.3	12.3'	18°44.6	-10.6'	55.7'
2	209°46.4	37.6	82°31.7	12.4'	18°34.0	-10.7'	55.7'
3	224°46.6	38.5	97°03.0	12.4'	18°23.3	-10.8'	55.7'
4	239°46.8	39.5	111°34.4	12.4'	18°12.6	-10.9'	55.7'
5	254°46.9	40.4	126°05.9	12.5'	18°01.7	-11.0'	55.8'
6	269°47.1	N08°41.3	140°37.3	12.5'	N17°50.8	-11.0'	55.8'
7	284°47.3	42.2	155°08.8	12.5'	17°39.7	-11.1'	55.8'
8	299°47.4	43.1	169°40.3	12.5'	17°28.6	-11.2'	55.9'
9	314°47.6	44.0	184°11.9	12.6'	17°17.4	-11.3'	55.9'
10	329°47.7	44.9	198°43.5	12.6'	17°06.0	-11.4'	55.9'
11	344°47.9	45.8	213°15.1	12.6'	16°54.6	-11.5'	55.9'
12	359°48.1	N08°46.8	227°46.7	12.7'	N16°43.1	-11.6'	56.0'
13	14°48.2	47.7	242°18.4	12.7'	16°31.5	-11.7'	56.0'
14	29°48.4	48.6	256°50.0	12.7'	16°19.9	-11.8'	56.0'
15	44°48.5	49.5	271°21.7	12.7'	16°08.1	-11.9'	56.1'
16	59°48.7	50.4	285°53.5	12.8'	15°56.2	-11.9'	56.1'
17	74°48.9	51.3	300°25.2	12.8'	15°44.3	-12.0'	56.1'
18	89°49.0	N08°52.2	314°57.0	12.8'	N15°32.3	-12.1'	56.2'
19	104°49.2	53.1	329°28.8	12.8'	15°20.1	-12.2'	56.2'
20	119°49.3	54.0	344°00.7	12.9'	15°07.9	-12.3'	56.2'
21	134°49.5	54.9	358°32.5	12.9'	14°55.7	-12.4'	56.2'
22	149°49.7	55.8	13°04.4	12.9'	14°43.3	-12.4'	56.3'
23	164°49.8	56.8	27°36.3	12.9'	14°30.9	-12.5'	56.3'
SD = 16.0'		SD = 15.2'					

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

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

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	201°09.7	221°27.7	\$08°44.0	230°08.0	\$13°17.8	206°12.0	\$03°18.1	235°25.8	\$14°44.9					Alpheratz	357°37.5	29°12.5	
1	216°12.2	236°27.5	43.1	245°08.7	17.2	221°14.0	17.9	250°28.1	44.8					Ankaa	353°09.8	-42°11.2	
2	231°14.7	251°27.3	42.3	260°09.3	16.6	236°15.9	17.6	265°30.4	44.8					Schedar	349°34.2	56°39.3	
3	246°17.1	266°27.1	.. 41.4	275°09.9	.. 15.9	251°17.9	.. 17.4	280°32.7	.. 44.7					Diphda	348°49.9	-17°52.1	
4	261°19.6	281°26.9	40.6	290°10.6	15.3	266°19.8	17.2	295°34.9	44.7					Achernar	335°22.5	-57°07.6	
5	276°22.1	296°26.8	39.7	305°11.2	14.7	281°21.8	17.0	310°37.2	44.6					Hamal	327°54.1	23°33.9	
6	291°24.5	311°26.6	\$08°38.9	320°11.8	\$13°14.1	296°23.7	\$03°16.8	325°39.5	\$14°44.5					Polaris	315°33.1	89°21.5	
7	306°27.0	326°26.4	38.1	335°12.5	13.4	311°25.6	16.6	340°41.7	44.5					Acamar	315°13.9	-40°13.1	
8	321°29.5	341°26.2	37.2	350°13.1	12.8	326°27.6	16.3	355°44.0	44.4					Menkar	314°08.8	4°10.4	
9	336°31.9	356°26.0	.. 36.4	5°13.7	.. 12.2	341°29.5	.. 16.1	10°46.3	.. 44.4					Mirfak	308°31.9	49°56.4	
10	351°34.4	11°25.9	35.5	20°14.4	11.5	356°31.5	15.9	25°48.6	44.3					Aldebaran	290°42.5	16°33.1	
11	6°36.8	26°25.7	34.7	35°15.0	10.9	11°33.4	15.7	40°50.8	44.3					Rigel	281°06.2	-8°10.7	
12	21°39.3	41°25.5	\$08°33.8	50°15.6	\$13°10.2	26°35.4	\$03°15.5	55°53.1	\$14°44.2					Capella	280°25.5	46°01.3	
13	36°41.8	56°25.3	33.0	65°16.3	09.6	41°37.3	15.2	70°55.4	44.1					Bellatrix	278°25.5	6°22.1	
14	51°44.2	71°25.1	32.1	80°16.9	09.0	56°39.2	15.0	85°57.6	44.1					Elnath	278°04.9	28°37.6	
15	66°46.7	86°25.0	.. 31.3	95°17.6	.. 08.3	71°41.2	.. 14.8	100°59.9	.. 44.0					Alnilam	275°40.2	-1°11.4	
16	81°49.2	101°24.8	30.4	110°18.2	07.7	86°43.1	14.6	116°02.2	44.0					Betelgeuse	270°54.7	7°24.6	
17	96°51.6	116°24.6	29.6	125°18.8	07.1	101°45.1	14.4	131°04.5	43.9					Canopus	263°53.6	-52°42.7	
18	111°54.1	131°24.4	\$08°28.7	140°19.5	\$13°06.4	116°47.0	\$03°14.1	146°06.7	\$14°43.8					Sirius	258°28.3	-16°45.0	
19	126°56.6	146°24.3	27.9	155°20.1	05.8	131°49.0	13.9	161°09.0	43.8					Adhara	255°07.7	-29°00.4	
20	141°59.0	161°24.1	27.0	170°20.7	05.2	146°50.9	13.7	176°11.3	43.7					Procyon	244°53.2	5°10.0	
21	157°01.5	176°23.9	.. 26.2	185°21.4	.. 04.5	161°52.8	.. 13.5	191°13.5	.. 43.7					Pollux	243°20.1	27°58.4	
22	172°04.0	191°23.7	25.3	200°22.0	03.9	176°54.8	13.3	206°15.8	43.6					Avior	234°15.5	-59°35.1	
23	187°06.4	206°23.5	24.5	215°22.7	03.3	191°56.7	13.0	221°18.1	43.6					Suhail	222°47.8	-43°31.6	
Mer.pass. 10:34			ν -0.2' d 0.8' m -4.24	ν 0.6' d 0.6' m 0.98	ν 1.9' d 0.2' m -2.07	ν 2.3' d 0.1' m 0.82								Miaplacidus	221°38.4	-69°48.7	
														Alphard	217°49.8	-8°45.4	
														Regulus	207°36.7	11°51.5	
														Dubhe	193°43.3	61°38.1	
														Denebola	182°27.0	14°26.9	
														Gienah	175°45.6	-17°40.0	
														Acrux	173°02.0	-63°13.4	
														Gacrux	171°53.6	-57°14.3	
														Alioth	166°14.4	55°50.4	
														Spica	158°24.4	-11°16.7	
														Alkaid	152°53.3	49°12.1	
														Hadar	148°38.6	-60°28.8	
														Menkent	147°59.9	-36°28.8	
														Arcturus	145°49.7	19°03.9	
														Rigel Kent	139°42.8	-60°55.5	
														Kochab	137°18.7	74°03.7	
														Zuben'ubi	136°58.2	-16°08.1	
														Alphecca	126°05.4	26°38.2	
														Antares	112°18.4	-26°28.8	
														Atria	107°14.3	-69°03.8	
														Sabik	102°05.2	-15°45.2	
														Shaula	96°13.2	-37°07.1	
														Rasalhague	96°00.5	12°32.5	
														Eltanin	90°43.0	51°28.8	
														Kaus Aust.	83°35.4	-34°22.4	
														Vega	80°34.6	38°47.9	
														Nunki	75°50.5	-26°16.1	
														Altair	62°02.2	8°55.4	
														Peacock	53°09.4	-56°39.6	
														Deneb	49°27.5	45°21.2	
														Enif	33°41.2	9°58.4	
														Al Na'ir	27°36.1	-46°51.2	
														Fomalhaut	15°17.3	-29°30.3	
														Scheat	13°47.7	28°11.9	
														Markab	13°32.4	15°19.2	
Apr 13 Wed									SHA	Mer.pass							
Venus									20°17.9	09:14							
Mars									28°58.3	08:39							
Jupiter									5°02.3	10:14							
Saturn									34°16.1	08:17							
Apr 14 Thu									SHA	Mer.pass							
Venus									19°14.5	09:15							
Mars									28°14.4	08:38							
Jupiter									4°49.8	10:11							
Saturn									34°11.5	08:13							
Apr 15 Fri									SHA	Mer.pass							
Venus									18°11.0	09:15							
Mars									27°30.6	08:37							
Jupiter									4°37.3	10:08							
Saturn									34°06.9	08:10							
Horizontal parallax																	
Venus:									0.2								
Mars:									0.1								

DUT1 = UT1-UTC = -0.0964 sec  $\Delta T = TT-UT1 = +69.2804$  sec

2022 April 13 to Apr. 15 UT

h		Sun		Moon				
Wed		GHA	Dec	GHA	$\nu$	Dec	d	HP
0	179°50.0	N08°57.7		42°08.2	12.9'	N14°18.3	-12.6'	56.3'
1	194°50.1	58.6		56°40.1	13.0'	14°05.7	-12.7'	56.4'
2	209°50.3	08°59.5		71°12.1	13.0'	13°53.0	-12.8'	56.4'
3	224°50.5	09°00.4		85°44.1	13.0'	13°40.3	-12.8'	56.4'
4	239°50.6	01.3		100°16.1	13.0'	13°27.4	-12.9'	56.5'
5	254°50.8	02.2		114°48.1	13.0'	13°14.5	-13.0'	56.5'
6	269°50.9	N09°03.1		129°20.1	13.0'	N13°01.5	-13.1'	56.5'
7	284°51.1	04.0		143°52.2	13.1'	12°48.4	-13.1'	56.6'
8	299°51.3	04.9		158°24.2	13.1'	12°35.3	-13.2'	56.6'
9	314°51.4	.. 05.8		172°56.3	13.1'	12°22.1	-13.3'	56.6'
10	329°51.6	06.7		187°28.4	13.1'	12°08.8	-13.4'	56.7'
11	344°51.7	07.6		202°00.5	13.1'	11°55.4	-13.4'	56.7'
12	359°51.9	N09°08.5		216°32.6	13.1'	N11°42.0	-13.5'	56.7'
13	14°52.0	09.4		231°04.7	13.1'	11°28.5	-13.6'	56.8'
14	29°52.2	10.4		245°36.9	13.2'	11°14.9	-13.6'	56.8'
15	44°52.4	.. 11.3		260°09.0	13.2'	11°01.3	-13.7'	56.8'
16	59°52.5	12.2		274°41.2	13.2'	10°47.6	-13.8'	56.9'
17	74°52.7	13.1		289°13.4	13.2'	10°33.8	-13.8'	56.9'
18	89°52.8	N09°14.0		303°45.5	13.2'	N10°19.9	-13.9'	56.9'
19	104°53.0	14.9		318°17.7	13.2'	10°06.0	-14.0'	57.0'
20	119°53.1	15.8		332°49.9	13.2'	09°52.1	-14.0'	57.0'
21	134°53.3	.. 16.7		347°22.1	13.2'	09°38.0	-14.1'	57.0'
22	149°53.5	17.6		1°54.3	13.2'	09°23.9	-14.2'	57.1'
23	164°53.6	18.5		16°26.5	13.2'	09°09.8	-14.2'	57.1'
SD = 15.9'		SD = 15.4'						

Thu		GHA	Dec	GHA	$\nu$	Dec	d	HP
0	179°53.8	N09°19.4		30°58.7	13.2'	N08°55.6	-14.3'	57.1'
1	194°53.9	20.3		45°30.9	13.2'	08°41.3	-14.3'	57.2'
2	209°54.1	21.2		60°03.1	13.2'	08°27.0	-14.4'	57.2'
3	224°54.2	.. 22.1		74°35.3	13.2'	08°12.6	-14.4'	57.2'
4	239°54.4	23.0		89°07.6	13.2'	07°58.2	-14.5'	57.3'
5	254°54.6	23.9		103°39.8	13.2'	07°43.7	-14.5'	57.3'
6	269°54.7	N09°24.8		118°12.0	13.2'	N07°29.1	-14.6'	57.3'
7	284°54.9	25.7		132°44.2	13.2'	07°14.5	-14.7'	57.4'
8	299°55.0	26.6		147°16.4	13.2'	06°59.9	-14.7'	57.4'
9	314°55.2	.. 27.5		161°48.6	13.2'	06°45.2	-14.8'	57.4'
10	329°55.3	28.4		176°20.7	13.2'	06°30.4	-14.8'	57.5'
11	344°55.5	29.3		190°52.9	13.2'	06°15.6	-14.8'	57.5'
12	359°55.6	N09°30.2		205°25.1	13.2'	N06°00.8	-14.9'	57.5'
13	14°55.8	31.1		219°57.3	13.2'	05°45.9	-14.9'	57.6'
14	29°55.9	32.0		234°29.4	13.1'	05°30.9	-15.0'	57.6'
15	44°56.1	.. 32.9		249°01.5	13.1'	05°15.9	-15.0'	57.6'
16	59°56.3	33.8		263°33.7	13.1'	05°00.9	-15.1'	57.7'
17	74°56.4	34.7		278°05.8	13.1'	04°45.8	-15.1'	57.7'
18	89°56.6	N09°35.6		292°37.9	13.1'	N04°30.7	-15.1'	57.7'
19	104°56.7	36.5		307°10.0	13.1'	04°15.6	-15.2'	57.8'
20	119°56.9	37.4		321°42.0	13.1'	04°00.4	-15.2'	57.8'
21	134°57.0	.. 38.3		336°14.1	13.0'	03°45.2	-15.3'	57.8'
22	149°57.2	39.1		350°46.1	13.0'	03°29.9	-15.3'	57.9'
23	164°57.3	40.0		5°18.1	13.0'	03°14.6	-15.3'	57.9'
SD = 15.9'		SD = 15.6'						

Fri		GHA	Dec	GHA	$\nu$	Dec	d	HP
0	179°57.5	N09°40.9		19°50.1	13.0'	N02°59.3	-15.4'	57.9'
1	194°57.6	41.8		34°22.1	13.0'	02°44.0	-15.4'	57.9'
2	209°57.8	42.7		48°54.1	12.9'	02°28.6	-15.4'	58.0'
3	224°57.9	.. 43.6		63°26.0	12.9'	02°13.1	-15.4'	58.0'
4	239°58.1	44.5		77°57.9	12.9'	01°57.7	-15.5'	58.0'
5	254°58.2	45.4		92°29.8	12.9'	01°42.2	-15.5'	58.1'
6	269°58.4	N09°46.3		107°01.6	12.8'	N01°26.7	-15.5'	58.1'
7	284°58.6	47.2		121°33.4	12.8'	01°11.2	-15.5'	58.1'
8	299°58.7	48.1		136°05.2	12.8'	00°55.6	-15.6'	58.2'
9	314°58.9	.. 49.0		150°37.0	12.7'	00°40.1	-15.6'	58.2'
10	329°59.0	49.9		165°08.7	12.7'	00°24.5	-15.6'	58.2'
11	344°59.2	50.8		179°40.4	12.7'	N00°08.9	-15.6'	58.3'
12	359°59.3	N09°51.7		194°12.1	12.6'	S00°06.8	-15.6'	58.3'
13	14°59.5	52.6		208°43.7	12.6'	00°22.4	-15.7'	58.3'
14	29°59.6	53.4		223°15.3	12.6'	00°38.1	-15.7'	58.4'
15	44°59.8	.. 54.3		237°46.9	12.5'	00°53.7	-15.7'	58.4'
16	59°59.9	55.2		252°18.4	12.5'	01°09.4	-15.7'	58.4'
17	75°00.1	56.1		266°49.9	12.4'	01°25.1	-15.7'	58.4'
18	90°00.2	N09°57.0		281°21.4	12.4'	S01°40.8	-15.7'	58.5'
19	105°00.4	57.9		295°52.8	12.4'	01°56.5	-15.7'	58.5'
20	120°00.5	58.8		310°24.1	12.3'	02°12.3	-15.7'	58.5'
21	135°00.7	09°59.7		324°55.5	12.3'	02°28.0	-15.7'	58.6'
22	150°00.8	10°00.6		339°26.7	12.2'	02°43.7	-15.7'	58.6'
23	165°01.0	01.4		353°58.0	12.2'	02°59.5	-15.7'	58.6'
SD = 15.9'		SD = 15.8'						

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

Lat.		Moonrise		Sunset		Moonset	
	Wed	Thu	Fri	Wed	Fri	Thu	Fri
N 72°	13:03	15:22	17:35	06:21	05:41	05:09	
N 70°	13:24	15:29	17:33	05:59	05:31	05:	

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

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	204°07.2	221°14.7	\$07°42.0	230°54.1	\$12°31.8	208°32.1	\$03°02.4	238°09.6	\$14°40.8					Alpheratz	357°37.4	29°12.5	
1	219°09.6	236°14.5	41.1	245°54.7	31.2	223°34.0	02.2	253°11.9	40.7					Ankaa	353°09.8	-42°11.2	
2	234°12.1	251°14.3	40.2	260°55.4	30.5	238°36.0	01.9	268°14.2	40.7					Schedar	349°34.2	56°39.3	
3	249°14.5	266°14.2	39.4	275°56.0	29.9	253°37.9	01.7	283°16.5	40.6					Diphda	348°49.9	-17°52.0	
4	264°17.0	281°14.0	38.5	290°56.7	29.2	268°39.9	01.5	298°18.7	40.6					Achernar	335°22.5	-57°07.5	
5	279°19.5	296°13.8	37.6	305°57.3	28.6	283°41.8	01.3	313°21.0	40.5					Hamal	327°54.1	23°33.9	
6	294°21.9	311°13.6	\$07°36.7	320°58.0	\$12°27.9	298°43.8	\$03°01.1	328°23.3	\$14°40.5					Polaris	315°33.5	89°21.5	
7	309°24.4	326°13.4	35.8	335°58.6	27.3	313°45.7	00.8	343°25.6	40.4					Acamar	315°13.9	-40°13.1	
8	324°26.9	341°13.3	34.9	350°59.3	26.7	328°47.7	00.6	358°27.9	40.3					Menkar	314°08.8	4°10.4	
9	339°29.3	356°13.1	34.1	5°59.9	26.0	343°49.6	00.4	13°30.1	40.3					Mirfak	308°32.0	49°56.4	
10	354°31.8	11°12.9	33.2	21°00.5	25.4	358°51.6	00.2	28°32.4	40.2					Aldebaran	290°42.5	16°33.1	
11	9°34.3	26°12.7	32.3	36°01.2	24.7	13°53.5	03°00.0	43°34.7	40.2					Rigel	281°06.3	-8°10.7	
12	24°36.7	41°12.5	\$07°31.4	51°01.8	\$12°24.1	28°55.5	\$02°59.8	58°37.0	\$14°40.1					Capella	280°25.5	46°01.3	
13	39°39.2	56°12.4	30.5	66°02.5	23.4	43°57.4	59.5	73°39.3	40.1					Bellatrix	278°25.5	6°22.1	
14	54°41.7	71°12.2	29.6	81°03.1	22.8	58°59.4	59.3	88°41.5	40.0					Elnath	278°05.0	28°37.5	
15	69°44.1	86°12.0	28.7	96°03.8	22.1	74°01.3	59.1	103°43.8	40.0					Alnilam	275°40.2	-1°11.4	
16	84°46.6	101°11.8	27.9	111°04.4	21.5	89°03.3	58.9	118°46.1	39.9					Betelgeuse	270°54.7	7°24.6	
17	99°49.0	116°11.6	27.0	126°05.1	20.8	104°05.2	58.7	133°48.4	39.8					Canopus	263°53.6	-52°42.7	
18	114°51.5	131°11.5	\$07°26.1	141°05.7	\$12°20.2	119°07.2	\$02°58.5	148°50.7	\$14°39.8					Sirius	258°28.3	-16°45.0	
19	129°54.0	146°11.3	25.2	156°06.4	19.5	134°09.1	58.2	163°52.9	39.7					Adhara	255°07.7	-29°00.4	
20	144°56.4	161°11.1	24.3	171°07.0	18.9	149°11.1	58.0	178°55.2	39.7					Procyon	244°53.2	5°10.0	
21	159°58.9	176°10.9	23.4	186°07.7	18.2	164°13.0	57.8	193°57.5	39.6					Pollux	243°20.1	27°58.4	
22	175°01.4	191°10.7	22.5	201°08.3	17.6	179°15.0	57.6	208°59.8	39.6					Avior	234°15.6	-59°35.1	
23	190°03.8	206°10.5	21.6	216°09.0	16.9	194°16.9	57.4	224°02.1	39.5					Suhail	222°47.8	-43°31.6	
Mer.pass. 10:22		ν -0.2° d 0.9° m -4.21		ν 0.6° d 0.6° m 0.96		ν 1.9° d 0.2° m -2.08		ν 2.3° d 0.1° m 0.82									
Sun		GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec					
0	205°06.3	221°10.4	\$07°20.7	231°09.6	\$12°16.3	209°18.9	\$02°57.2	239°04.3	\$14°39.5					Denebola	182°27.0	14°38.1	
1	220°08.8	236°10.2	19.9	246°10.3	15.6	224°20.8	57.0	254°06.6	39.4					Gienah	175°45.6	-17°40.0	
2	235°11.2	251°10.0	19.0	261°10.9	15.0	239°22.8	56.7	269°08.9	39.3					Acrux	173°02.0	-63°13.4	
3	250°13.7	266°09.8	18.1	276°11.6	14.3	254°24.7	56.5	284°11.2	39.3					Gacrux	171°53.6	-57°14.3	
4	265°16.1	281°09.6	17.2	291°12.2	13.7	269°26.7	56.3	299°13.5	39.2					Alioth	166°14.4	55°50.4	
5	280°18.6	296°09.5	16.3	306°12.9	13.0	284°28.6	56.1	314°15.8	39.2					Spica	158°24.4	-11°16.7	
6	295°21.1	311°09.3	\$07°15.4	321°13.5	\$12°12.4	299°30.6	\$02°55.9	329°18.0	\$14°39.1					Alkaid	152°53.3	49°12.1	
7	310°23.5	326°09.1	14.5	336°14.2	11.7	314°32.5	55.7	344°20.3	39.1					Hadar	148°38.6	-60°28.8	
8	325°26.0	341°08.9	13.6	351°14.8	11.1	329°34.5	55.4	359°22.6	39.0					Menkent	147°59.9	-36°28.8	
9	340°28.5	356°08.7	12.7	6°15.4	10.4	344°36.4	55.2	14°24.9	39.0					Arcturus	145°49.7	19°03.9	
10	355°30.9	11°08.6	11.8	21°16.1	09.7	359°38.4	55.0	29°27.2	38.9					Rigel Kent.	139°42.8	-60°55.6	
11	10°33.4	26°08.4	10.9	36°16.7	09.1	14°40.3	54.8	44°29.5	38.9					Kochab	137°18.7	74°03.8	
12	25°35.9	41°08.2	\$07°10.0	51°17.4	\$12°08.4	29°42.3	\$02°54.6	59°31.7	\$14°38.8					Zuben'ubi	136°58.2	-16°08.1	
13	40°38.3	56°08.0	09.1	66°18.0	07.8	44°44.2	54.4	74°34.0	38.8					Alphecca	126°05.4	26°38.3	
14	55°40.8	71°07.8	08.2	81°18.7	07.1	59°46.2	54.1	89°36.3	38.7					Antares	112°18.3	-26°28.8	
15	70°43.3	86°07.6	07.3	96°19.3	06.5	74°48.1	53.9	104°38.6	38.6					Atria	107°14.3	-69°03.8	
16	85°45.7	101°07.5	06.4	111°20.0	05.8	89°50.1	53.7	119°40.9	38.6					Sabik	102°05.2	-15°45.2	
17	100°48.2	116°07.3	05.5	126°20.7	05.2	104°52.0	53.5	134°43.2	38.5					Shaula	96°13.2	-37°07.1	
18	115°50.6	131°07.1	\$07°04.6	141°21.3	\$12°04.5	119°54.0	\$02°53.3	149°45.4	\$14°38.5					Rasalhague	96°00.5	12°32.5	
19	130°53.1	146°06.9	03.7	156°22.0	03.9	134°55.9	53.1	164°47.7	38.4					Eltanin	90°43.0	51°28.8	
20	145°55.6	161°06.7	02.8	171°22.6	03.2	149°57.9	52.9	179°50.0	38.4					Kaus Aust.	83°35.4	-34°22.4	
21	160°58.0	176°06.6	01.9	186°23.3	02.6	164°59.8	52.6	194°52.3	38.3					Vega	80°34.6	38°47.9	
22	176°00.5	191°06.4	01.0	201°23.9	01.9	180°01.8	52.4	209°54.6	38.3					Nunki	75°50.5	-26°16.1	
23	191°03.0	206°06.2	00.1	216°24.6	01.3	195°03.7	52.2	224°56.9	38.2					Altair	62°02.2	8°55.4	
Mer.pass. 10:18		ν -0.2° d 0.9° m -4.20		ν 0.6° d 0.7° m 0.95		ν 2.0° d 0.2° m -2.08		ν 2.3° d 0.1° m 0.82									
Mon		GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec					
0	206°05.4	221°06.0	\$06°59.2	231°25.2	\$12°00.6	210°05.7	\$02°52.0	239°59.2	\$14°38.2					Fomalhaut	15°17.3	-29°30.3	
1	221°07.9	236°05.8	58.3	246°25.9	11°59.9	225°07.6	51.8	255°01.4	38.1					Scheat	13°47.7	28°11.9	
2	236°10.4	251°05.6	57.4	261°26.5	59.3	240°09.6	51.6	270°03.7	38.1					Markab	13°32.4	15°19.2	
3	251°12.8	266°05.5	56.5	276°27.2	58.6	255°11.5	51.3	285°06.0	38.0					Apr 16 Sat	SHA	Mer.pass	
4	266°15.3	281°05.3	55.6	291°27.8	58.0	270°13.5	51.1	300°08.3	37.9					Venus	17°07.6	09:15	
5	281°17.0	296°05.1	54.7	306°28.5	57.3	285°15.4	50.9	315°10.6	37.9					Mars	26°46.9	08:36	
6	296°20.2	311°04.9	\$06°53.8	321°29.1	\$11°56.7	300°17.4	\$02°50.7	330°12.9	\$14°37.8					Jupiter	4°24.9	10:05	
7	311°22.7	326°04.7	52.9	336°29.8	56.0	315°19.4	50.5	345°15.2	37.8					Saturn	34°02.5	08:06	
8	326°25.1	341°04.6	52.0	351°30.4	55.3	330°21.3	50.3	0°17.4	37.7					Apr 17 Sun	SHA	Mer.pass	
9	341°27.6	356°04.4	51.0	6°31.1	54.7	345°23.3	50.1	15°19.7	37.7					Venus	16°04.1	09:15	
10	356°30.1	11°04.2	50.1	21°31.7	54.0	0°25.2	49.8	30°22.0	37.6					Mars	26°03.3	08:35	
11	11°32.5	26°04.0	49.2	36°32.4	53.4	15°27.2	49.6	45°24.3	37.6					Jupiter	4°12.6	10:01	
12	26°35.0	41°03.8	\$06°48.3	51°33.0	\$11°52.7	30°29.1	\$02°49.4	60°26.6	\$14°37.5					Saturn	33°58.1	08:02	
13	41°37.5	56°03.6	47.4	66°													

DUT1 = UT1-UTC = -0.0974 sec  $\Delta T = TT-UT1 = +69.2814$  sec

2022 April 16 to Apr. 18 UT

h		Sun		Moon				
Sat		GHA	Dec	GHA	$\nu$	Dec	d	HP
0	180°01.1	N10°02.3		8°29.1	12.1'	S03°15.2	-15.7'	58.7'
1	195°01.3	03.2	23°00.3	12.1'	03°30.9	-15.7'	58.7'	
2	210°01.4	04.1	37°31.4	12.0'	03°46.7	-15.7'	58.7'	
3	225°01.6	.. 05.0	52°02.4	12.0'	04°02.4	-15.7'	58.7'	
4	240°01.7	05.9	66°33.4	11.9'	04°18.1	-15.7'	58.8'	
5	255°01.9	06.8	81°04.3	11.9'	04°33.9	-15.7'	58.8'	
6	270°02.0	N10°07.7	95°35.2	11.8'	S04°49.6	-15.7'	58.8'	
7	285°02.2	08.5	110°06.1	11.8'	05°05.3	-15.7'	58.8'	
8	300°02.3	09.4	124°36.8	11.7'	05°21.0	-15.7'	58.9'	
9	315°02.4	.. 10.3	139°07.6	11.7'	05°36.6	-15.7'	58.9'	
10	330°02.6	11.2	153°38.2	11.6'	05°52.3	-15.7'	58.9'	
11	345°02.7	12.1	168°08.8	11.5'	06°08.0	-15.6'	58.9'	
12	0°02.9	N10°13.0	182°39.4	11.5'	S06°23.6	-15.6'	59.0'	
13	15°03.0	13.9	197°09.9	11.4'	06°39.2	-15.6'	59.0'	
14	30°03.2	14.7	211°40.3	11.4'	06°54.8	-15.6'	59.0'	
15	45°03.3	.. 15.6	226°10.6	11.3'	07°10.4	-15.5'	59.1'	
16	60°03.5	16.5	240°40.9	11.2'	07°25.9	-15.5'	59.1'	
17	75°03.6	17.4	255°11.2	11.2'	07°41.4	-15.5'	59.1'	
18	90°03.8	N10°18.3	269°41.3	11.1'	S07°56.9	-15.5'	59.1'	
19	105°03.9	19.2	284°11.4	11.0'	08°12.4	-15.4'	59.1'	
20	120°04.1	20.0	298°41.5	11.0'	08°27.8	-15.4'	59.2'	
21	135°04.2	.. 20.9	313°11.4	10.9'	08°43.2	-15.4'	59.2'	
22	150°04.4	21.8	327°41.3	10.8'	08°58.6	-15.3'	59.2'	
23	165°04.5	22.7	342°11.1	10.8'	09°13.9	-15.3'	59.2'	
	SD = 15.9'	d = 0.9'		SD = 16.0'				

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

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

Day	Sun		Moon	
	Eqn.of	Time	Mer.	Mer. Pass.
	00 <sup>h</sup>	12 <sup>h</sup>	Upper	Age
mm:ss	mm:ss	hh:mm	hh:mm	99-98%
16	00:04	00:12	12:00	-- 11:49
17	00:19	00:26	12:00	00:14 12:39
18	00:32	00:39	11:59	01:06 13:33

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

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	207°04.6	221°01.6	\$06°37.4	231°40.9	\$11°44.8	210°52.6	\$02°46.8	240°54.0	\$14°36.9					Alpheratz	357°37.4	29°12.5	
1	222°07.0	236°01.5	36.5	246°41.5	44.2	225°54.5	46.6	255°56.3	36.8					Ankaa	353°09.8	-42°11.2	
2	237°09.5	251°01.3	35.5	261°42.2	43.5	240°56.5	46.4	270°58.6	36.8					Schedar	349°34.1	56°39.3	
3	252°12.0	266°01.1	34.6	276°42.9	42.8	255°58.4	46.2	286°00.9	36.7					Diphda	348°49.9	-17°52.0	
4	267°14.4	281°00.9	33.7	291°43.5	42.2	271°00.4	46.0	301°03.2	36.7					Achernar	335°22.5	-57°07.5	
5	282°16.9	296°00.7	32.8	306°44.2	41.5	286°02.3	45.8	316°05.5	36.6					Hamal	327°54.1	23°33.9	
6	297°19.4	311°00.5	\$06°31.9	321°44.8	\$11°40.9	301°04.3	\$02°45.5	331°07.8	\$14°36.6					Polaris	315°33.6	89°21.5	
7	312°21.8	326°00.4	31.0	336°45.5	40.2	316°06.2	45.3	346°10.1	36.5					Acamar	315°13.9	-40°13.1	
8	327°24.3	341°00.2	30.0	351°46.1	39.5	331°08.2	45.1	1°12.3	36.5					Menkar	314°08.8	4°10.4	
9	342°26.7	356°00.0	29.1	6°46.8	38.9	346°10.2	44.9	16°14.6	36.4					Mirfak	308°32.0	49°56.3	
10	357°29.2	10°59.8	28.2	21°47.4	38.2	1°12.1	44.7	31°16.9	36.4					Aldebaran	290°42.5	16°33.1	
11	12°31.7	25°59.6	27.3	36°48.1	37.6	16°14.1	44.5	46°19.2	36.3					Rigel	281°06.3	-8°10.7	
12	27°34.1	40°59.4	\$06°26.4	51°48.8	\$11°36.9	31°16.0	\$02°44.3	61°21.5	\$14°36.3					Capella	280°25.5	46°01.3	
13	42°36.6	55°59.3	25.4	66°49.4	36.2	46°18.0	44.1	76°23.8	36.2					Bellatrix	278°25.5	6°22.1	
14	57°39.1	70°59.1	24.5	81°50.1	35.6	61°19.9	43.8	91°26.1	36.1					Elnath	278°05.0	28°37.5	
15	72°41.5	85°58.9	23.6	96°50.7	34.9	76°21.9	43.6	106°28.4	36.1					Alnilam	275°40.2	-1°11.4	
16	87°44.0	100°58.7	22.7	111°51.4	34.2	91°23.8	43.4	121°30.7	36.0					Betelgeuse	270°54.7	7°24.6	
17	102°46.5	115°58.5	21.7	126°52.0	33.6	106°25.8	43.2	136°33.0	36.0					Canopus	263°53.6	-52°42.7	
18	117°48.9	130°58.3	\$06°20.8	141°52.7	\$11°32.9	121°27.8	\$02°43.0	151°35.2	\$14°35.9					Sirius	258°28.4	-16°45.0	
19	132°51.4	145°58.2	19.9	156°53.4	32.3	136°29.7	42.8	166°37.5	35.9					Adhara	255°07.7	-29°00.4	
20	147°53.9	160°58.0	19.0	171°54.0	31.6	151°31.7	42.6	181°39.8	35.8					Procyon	244°53.3	5°10.0	
21	162°56.3	175°57.8	18.1	186°54.7	30.9	166°33.6	42.3	196°42.1	35.8					Pollux	243°20.1	27°58.4	
22	177°58.8	190°57.6	17.1	201°55.3	30.3	181°35.6	42.1	211°44.4	35.7					Avior	234°15.6	-59°35.1	
23	193°01.2	205°57.4	16.2	216°56.0	29.6	196°37.5	41.9	226°46.7	35.7					Suhail	222°47.8	-43°31.6	
Mer.pass. 10:10			ν -0.2' d 0.9' m -4.19	ν 0.7' d 0.7' m 0.94	ν 2.0' d 0.2' m -2.08	ν 2.3' d 0.1' m 0.82								Miaplacidus	221°38.4	-69°48.7	
Mer.pass. 10:10			ν -0.2' d 0.9' m -4.19	ν 0.7' d 0.7' m 0.94	ν 2.0' d 0.2' m -2.08	ν 2.3' d 0.1' m 0.82								Alphard	217°49.9	-8°45.4	
Mer.pass. 10:10			ν -0.2' d 0.9' m -4.18	ν 0.7' d 0.7' m 0.93	ν 2.0' d 0.2' m -2.09	ν 2.3' d 0.1' m 0.81								Regulus	207°36.7	11°51.5	
Mer.pass. 10:10			ν -0.2' d 0.9' m -4.18	ν 0.7' d 0.7' m 0.93	ν 2.0' d 0.2' m -2.09	ν 2.3' d 0.1' m 0.81								Dubhe	193°43.4	61°38.1	
Mer.pass. 10:10			ν -0.2' d 0.9' m -4.18	ν 0.7' d 0.7' m 0.93	ν 2.0' d 0.2' m -2.09	ν 2.3' d 0.1' m 0.81								Denebola	182°27.0	14°26.9	
Mer.pass. 10:10			ν -0.2' d 0.9' m -4.18	ν 0.7' d 0.7' m 0.93	ν 2.0' d 0.2' m -2.09	ν 2.3' d 0.1' m 0.81								Gienah	175°45.6	-17°40.0	
Mer.pass. 10:10			ν -0.2' d 0.9' m -4.18	ν 0.7' d 0.7' m 0.93	ν 2.0' d 0.2' m -2.09	ν 2.3' d 0.1' m 0.81								Acrux	173°02.0	-63°13.4	
Mer.pass. 10:10			ν -0.2' d 0.9' m -4.18	ν 0.7' d 0.7' m 0.93	ν 2.0' d 0.2' m -2.09	ν 2.3' d 0.1' m 0.81								Gacrux	171°53.6	-57°14.4	
Mer.pass. 10:10			ν -0.2' d 0.9' m -4.18	ν 0.7' d 0.7' m 0.93	ν 2.0' d 0.2' m -2.09	ν 2.3' d 0.1' m 0.81								Alioth	166°14.5	55°50.4	
Mer.pass. 10:10			ν -0.2' d 0.9' m -4.18	ν 0.7' d 0.7' m 0.93	ν 2.0' d 0.2' m -2.09	ν 2.3' d 0.1' m 0.81								Spica	158°24.4	-11°16.7	
Mer.pass. 10:10			ν -0.2' d 0.9' m -4.18	ν 0.7' d 0.7' m 0.93	ν 2.0' d 0.2' m -2.09	ν 2.3' d 0.1' m 0.81								Alkaid	152°53.3	49°12.1	
Mer.pass. 10:10			ν -0.2' d 0.9' m -4.18	ν 0.7' d 0.7' m 0.93	ν 2.0' d 0.2' m -2.09	ν 2.3' d 0.1' m 0.81								Hadar	148°38.6	-60°28.8	
Mer.pass. 10:10			ν -0.2' d 0.9' m -4.18	ν 0.7' d 0.7' m 0.93	ν 2.0' d 0.2' m -2.09	ν 2.3' d 0.1' m 0.81								Menkent	147°59.9	-36°28.8	
Mer.pass. 10:10			ν -0.2' d 0.9' m -4.18	ν 0.7' d 0.7' m 0.93	ν 2.0' d 0.2' m -2.09	ν 2.3' d 0.1' m 0.81								Arcturus	145°49.7	19°03.9	
Mer.pass. 10:10			ν -0.2' d 0.9' m -4.18	ν 0.7' d 0.7' m 0.93	ν 2.0' d 0.2' m -2.09	ν 2.3' d 0.1' m 0.81								Rigel	139°42.8	-60°55.6	
Mer.pass. 10:10			ν -0.2' d 0.9' m -4.18	ν 0.7' d 0.7' m 0.93	ν 2.0' d 0.2' m -2.09	ν 2.3' d 0.1' m 0.81								Kochab	137°18.7	74°03.8	
Mer.pass. 10:10			ν -0.2' d 0.9' m -4.18	ν 0.7' d 0.7' m 0.93	ν 2.0' d 0.2' m -2.09	ν 2.3' d 0.1' m 0.81								Zuben'ubi	136°58.2	-16°08.1	
Mer.pass. 10:10			ν -0.2' d 0.9' m -4.18	ν 0.7' d 0.7' m 0.93	ν 2.0' d 0.2' m -2.09	ν 2.3' d 0.1' m 0.81								Alphecca	126°05.3	26°38.3	
Mer.pass. 10:10			ν -0.2' d 0.9' m -4.18	ν 0.7' d 0.7' m 0.93	ν 2.0' d 0.2' m -2.09	ν 2.3' d 0.1' m 0.81								Antares	112°18.3	-26°28.8	
Mer.pass. 10:10			ν -0.2' d 0.9' m -4.18	ν 0.7' d 0.7' m 0.93	ν 2.0' d 0.2' m -2.09	ν 2.3' d 0.1' m 0.81								Atria	107°14.2	-69°03.8	
Mer.pass. 10:10			ν -0.2' d 0.9' m -4.18	ν 0.7' d 0.7' m 0.93	ν 2.0' d 0.2' m -2.09	ν 2.3' d 0.1' m 0.81								Sabik	102°05.2	-15°45.2	
Mer.pass. 10:10			ν -0.2' d 0.9' m -4.18	ν 0.7' d 0.7' m 0.93	ν 2.0' d 0.2' m -2.09	ν 2.3' d 0.1' m 0.81								Shaula	96°13.2	-37°07.1	
Mer.pass. 10:10			ν -0.2' d 0.9' m -4.18	ν 0.7' d 0.7' m 0.93	ν 2.0' d 0.2' m -2.09	ν 2.3' d 0.1' m 0.81								Rasalhague	96°00.5	12°32.5	
Mer.pass. 10:10			ν -0.2' d 0.9' m -4.18	ν 0.7' d 0.7' m 0.93	ν 2.0' d 0.2' m -2.09	ν 2.3' d 0.1' m 0.81								Eltanin	90°43.0	51°28.8	
Mer.pass. 10:10			ν -0.2' d 0.9' m -4.18	ν 0.7' d 0.7' m 0.93	ν 2.0' d 0.2' m -2.09	ν 2.3' d 0.1' m 0.81								Kaus Aust.	83°35.4	-34°22.4	
Mer.pass. 10:10			ν -0.2' d 0.9' m -4.18	ν 0.7' d 0.7' m 0.93	ν 2.0' d 0.2' m -2.09	ν 2.3' d 0.1' m 0.81								Vega	80°34.6	38°47.9	
Mer.pass. 10:10			ν -0.2' d 0.9' m -4.18	ν 0.7' d 0.7' m 0.93	ν 2.0' d 0.2' m -2.09	ν 2.3' d 0.1' m 0.81								Nunki	75°50.5	-26°16.1	
Mer.pass. 10:10			ν -0.2' d 0.9' m -4.18	ν 0.7' d 0.7' m 0.93	ν 2.0' d 0.2' m -2.09	ν 2.3' d 0.1' m 0.81								Altair	62°02.1	8°55.4	
Mer.pass. 10:10			ν -0.2' d 0.9' m -4.18	ν 0.7' d 0.7' m 0.93	ν 2.0' d 0.2' m -2.09	ν 2.3' d 0.1' m 0.81								Peacock	53°09.4	-56°39.6	
Mer.pass. 10:10			ν -0.2' d 0.9' m -4.18	ν 0.7' d 0.7' m 0.93	ν 2.0' d 0.2' m -2.09	ν 2.3' d 0.1' m 0.81								Deneb	49°27.4	45°21.2	
Mer.pass. 10:10			ν -0.2' d 0.9' m -4.18	ν 0.7' d 0.7' m 0.93	ν 2.0' d 0.2' m -2.09	ν 2.3' d 0.1' m 0.81								Enif	33°41.2	9°58.4	
Mer.pass. 10:10			ν -0.2' d 0.9' m -4.18	ν 0.7' d 0.7' m 0.93	ν 2.0' d 0.2' m -2.09	ν 2.3' d 0.1' m 0.81								Al Na'ir	27°36.0	-46°51.1	
Mer.pass. 10:10			ν -0.2' d 0.9' m -4.18	ν 0.7' d 0.7' m 0.93	ν 2.0' d 0.2' m -2.09	ν 2.3' d 0.1' m 0.81								Fomalhaut	15°17.3	-29°30.3	
Mer.pass. 10:10			ν -0.2' d 0.9' m -4.18	ν 0.7' d 0.7' m 0.93	ν 2.0' d 0.2' m -2.09	ν 2.3' d 0.1' m											

DUT1 = UT1-UTC = -0.0988 sec  $\Delta T = TT-UT1 = +69.2828$  sec

2022 April 19 to Apr. 21 UT

h Sun			Moon				
Tue	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	180°11.4	N11°05.5	330°49.1	6.4'	S20°23.5	-11.2'	59.9'
1	195°11.6	06.4	345°14.5	6.3'	20°34.7	-11.1'	59.9'
2	210°11.7	07.2	359°39.8	6.2'	20°45.8	-10.9'	59.9'
3	225°11.8	.. 08.1	14°05.0	6.1'	20°56.7	-10.8'	60.0'
4	240°12.0	09.0	28°30.1	6.0'	21°07.5	-10.7'	60.0'
5	255°12.1	09.8	42°55.1	5.9'	21°18.2	-10.5'	60.0'
6	270°12.2	N11°10.7	57°20.1	5.8'	S21°28.7	-10.4'	60.0'
7	285°12.4	11.6	71°44.9	5.7'	21°39.1	-10.2'	60.0'
8	300°12.5	12.4	86°09.7	5.7'	21°49.3	-10.1'	60.0'
9	315°12.7	.. 13.3	100°34.3	5.6'	21°59.4	-10.0'	60.0'
10	330°12.8	14.2	114°58.9	5.5'	22°09.4	-9.8'	60.0'
11	345°12.9	15.0	129°23.4	5.4'	22°19.2	-9.7'	60.0'
12	0°13.1	N11°15.9	143°47.8	5.3'	S22°28.9	-9.5'	60.0'
13	15°13.2	16.7	158°12.1	5.2'	22°38.4	-9.4'	60.0'
14	30°13.3	17.6	172°36.3	5.1'	22°47.8	-9.2'	60.0'
15	45°13.5	.. 18.5	187°00.4	5.1'	22°57.0	-9.1'	60.0'
16	60°13.6	19.3	201°24.5	5.0'	23°06.0	-8.9'	60.0'
17	75°13.7	20.2	215°48.4	4.9'	23°14.9	-8.7'	60.0'
18	90°13.9	N11°21.1	230°12.3	4.8'	S23°23.7	-8.6'	60.0'
19	105°14.0	21.9	244°36.1	4.7'	23°32.3	-8.4'	60.0'
20	120°14.1	22.8	258°59.8	4.6'	23°40.7	-8.3'	60.0'
21	135°14.3	.. 23.6	273°23.5	4.6'	23°48.9	-8.1'	60.0'
22	150°14.4	24.5	287°47.1	4.5'	23°57.1	-7.9'	60.0'
23	165°14.5	25.4	302°10.6	4.4'	24°05.0	-7.8'	60.0'
SD = 15.9' $d = 0.9'$			SD = 16.3'				
Wed	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	180°14.7	N11°26.2	316°34.0	4.4'	S24°12.8	-7.6'	60.0'
1	195°14.8	27.1	330°57.3	4.3'	24°20.4	-7.4'	60.0'
2	210°14.9	27.9	345°20.6	4.2'	24°27.8	-7.3'	60.0'
3	225°15.1	.. 28.8	359°43.8	4.1'	24°35.1	-7.1'	60.0'
4	240°15.2	29.6	14°07.0	4.1'	24°42.2	-6.9'	60.0'
5	255°15.3	30.5	28°30.1	4.0'	24°49.1	-6.7'	59.9'
6	270°15.5	N11°31.4	42°53.1	4.0'	S24°55.8	-6.6'	59.9'
7	285°15.6	32.2	57°16.0	3.9'	25°02.4	-6.4'	59.9'
8	300°15.7	33.1	71°38.9	3.8'	25°08.8	-6.2'	59.9'
9	315°15.9	.. 33.9	86°01.8	3.8'	25°15.0	-6.0'	59.9'
10	330°16.0	34.8	100°24.6	3.7'	25°21.1	-5.9'	59.9'
11	345°16.1	35.6	114°47.3	3.7'	25°26.9	-5.7'	59.9'
12	0°16.2	N11°36.5	129°10.0	3.6'	S25°32.6	-5.5'	59.9'
13	15°16.4	37.3	143°32.6	3.6'	25°38.1	-5.3'	59.9'
14	30°16.5	38.2	157°55.2	3.5'	25°43.4	-5.1'	59.9'
15	45°16.6	.. 39.1	172°17.7	3.5'	25°48.6	-5.0'	59.9'
16	60°16.8	39.9	186°40.2	3.4'	25°53.5	-4.8'	59.9'
17	75°16.9	40.8	201°02.6	3.4'	25°58.3	-4.6'	59.9'
18	90°17.0	N11°41.6	215°25.0	3.4'	S26°02.9	-4.4'	59.9'
19	105°17.2	42.5	229°47.4	3.3'	26°07.3	-4.2'	59.9'
20	120°17.3	43.3	244°09.7	3.3'	26°11.5	-4.0'	59.8'
21	135°17.4	.. 44.2	258°32.0	3.3'	26°15.5	-3.8'	59.8'
22	150°17.5	45.0	272°54.3	3.2'	26°19.3	-3.6'	59.8'
23	165°17.7	45.9	287°16.5	3.2'	26°23.0	-3.5'	59.8'
SD = 15.9' $d = 0.9'$			SD = 16.4'				
Thu	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	180°17.8	N11°46.7	301°38.8	3.2'	S26°26.5	-3.3'	59.8'
1	195°17.9	47.6	316°01.0	3.2'	26°29.7	-3.1'	59.8'
2	210°18.1	48.4	330°23.1	3.2'	26°32.8	-2.9'	59.8'
3	225°18.2	.. 49.3	344°45.3	3.1'	26°35.7	-2.7'	59.8'
4	240°18.3	50.1	359°07.4	3.1'	26°38.4	-2.5'	59.8'
5	255°18.4	51.0	13°29.5	3.1'	26°40.9	-2.3'	59.8'
6	270°18.6	N11°51.8	27°51.7	3.1'	S26°43.2	-2.1'	59.7'
7	285°18.7	52.7	42°13.8	3.1'	26°45.4	-1.9'	59.7'
8	300°18.8	53.5	56°35.9	3.1'	26°47.3	-1.7'	59.7'
9	315°18.9	.. 54.4	70°58.0	3.1'	26°49.0	-1.6'	59.7'
10	330°19.1	55.2	85°20.1	3.1'	26°50.6	-1.4'	59.7'
11	345°19.2	56.1	99°42.2	3.1'	26°52.0	-1.2'	59.7'
12	0°19.3	N11°56.9	114°04.3	3.1'	S26°53.1	-1.0'	59.7'
13	15°19.4	57.8	128°26.4	3.1'	26°54.1	-0.8'	59.7'
14	30°19.6	58.6	142°48.5	3.1'	26°54.9	-0.6'	59.6'
15	45°19.7	11°59.5	157°10.6	3.1'	26°55.5	-0.4'	59.6'
16	60°19.8	12°00.3	171°32.8	3.2'	26°55.9	-0.2'	59.6'
17	75°19.9	01.1	185°54.9	3.2'	26°56.1	-0.0'	59.6'
18	90°20.1	N12°02.0	200°17.1	3.2'	S26°56.1	0.2'	59.6'
19	105°20.2	02.8	214°39.3	3.2'	26°56.0	0.4'	59.6'
20	120°20.3	03.7	229°01.5	3.3'	26°55.6	0.5'	59.6'
21	135°20.4	.. 04.5	243°23.8	3.3'	26°55.1	0.7'	59.5'
22	150°20.6	05.4	257°46.1	3.3'	26°54.3	0.9'	59.5'
23	165°20.7	06.2	272°08.4	3.4'	26°53.4	1.1'	59.5'
SD = 15.9' $d = 0.9'$			SD = 16.3'				

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

Day	Sun		Mer. Pass. Upper hh:mm	Mer. Pass. Lower hh:mm	Moon	
	Eqn. of Time 00 <sup>h</sup> mm:ss	00 <sup>h</sup> mm:ss			Mer. Pass. 18-20 93-77%	Age
19	00:46	00:52	11:59	02:01	14:31	
20	00:59	01:05	11:59	03:01	15:32	
21	01:11	01:17	11:59	04:04	16:35	

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

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	210°02.0	220°48.4	S05°30.3	232°28.4	S10°56.9	213°13.5	S02°31.5	243°39.1	S14°33.2					Alpheratz	357°37.4	29°12.5	
1	225°04.5	235°48.2	29.4	247°29.1	56.2	228°15.5	31.3	258°41.4	33.2					Ankaa	353°09.8	-42°11.2	
2	240°06.9	250°48.1	28.4	262°29.7	55.6	243°17.4	31.1	273°43.7	33.1					Schedar	349°34.1	56°39.3	
3	255°09.4	265°47.9	27.5	277°30.4	54.9	258°19.4	30.9	288°46.0	33.1					Diphda	348°49.9	-17°52.0	
4	270°11.8	280°47.7	26.5	292°31.0	54.2	273°21.4	30.7	303°48.3	33.0					Achernar	335°22.5	-57°07.5	
5	285°14.3	295°47.5	25.6	307°31.7	53.5	288°23.3	30.4	318°50.6	33.0					Hamal	327°54.1	23°33.9	
6	300°16.8	310°47.3	S05°24.6	322°32.4	S10°52.9	303°25.3	S02°30.2	333°52.9	S14°32.9					Polaris	315°33.7	89°21.5	
7	315°19.2	325°47.1	23.7	337°33.0	52.2	318°27.2	30.0	348°55.2	32.9					Acamar	315°13.9	-40°13.1	
8	330°21.7	340°47.0	22.7	352°33.7	51.5	333°29.2	29.8	3°57.5	32.8					Menkar	314°08.8	4°10.4	
9	345°24.2	355°46.8	21.8	7°34.4	50.9	348°31.2	29.6	18°59.8	32.8					Mirfak	308°31.9	49°56.3	
10	0°26.6	10°46.6	20.8	22°35.0	50.2	3°33.1	29.4	34°02.1	32.7					Aldebaran	290°42.5	16°33.1	
11	15°29.1	25°46.4	19.9	37°35.7	49.5	18°35.1	29.2	49°04.4	32.7					Rigel	281°06.3	-8°10.7	
12	30°31.6	40°46.2	S05°18.9	52°36.4	S10°48.8	33°37.0	S02°29.0	64°06.7	S14°32.6					Capella	280°25.5	46°01.3	
13	45°34.0	55°46.0	18.0	67°37.0	48.2	48°39.0	28.8	79°09.0	32.6					Bellatrix	278°25.5	6°22.1	
14	60°36.5	70°45.9	17.0	82°37.7	47.5	63°41.0	28.5	94°11.3	32.5					Elnath	278°05.0	28°37.5	
15	75°39.0	85°45.7	16.1	97°38.4	46.8	78°42.9	28.3	109°13.6	32.5					Alnilam	275°40.2	-1°11.4	
16	90°41.4	100°45.5	15.1	112°39.0	46.1	93°44.9	28.1	124°15.9	32.4					Betelgeuse	270°54.7	7°24.6	
17	105°43.9	115°45.3	14.2	127°39.7	45.5	108°46.9	27.9	139°18.2	32.4					Canopus	263°53.6	-52°42.7	
18	120°46.3	130°45.1	S05°13.2	142°40.4	S10°44.8	123°48.8	S02°27.7	154°20.5	S14°32.3					Sirius	258°28.4	-16°45.0	
19	135°48.8	145°44.9	12.3	157°41.0	44.1	138°50.8	27.5	169°22.8	32.3					Adhara	255°07.8	-29°00.4	
20	150°51.3	160°44.7	11.3	172°41.7	43.4	153°52.7	27.3	184°25.1	32.2					Procyon	244°53.3	5°10.0	
21	165°53.7	175°44.6	10.3	187°42.4	42.8	168°54.7	27.1	199°27.4	32.2					Pollux	243°20.1	27°58.4	
22	180°56.2	190°44.4	9.4	202°43.0	42.1	183°56.7	26.9	214°29.7	32.1					Avisor	234°15.6	-59°35.1	
23	195°58.7	205°44.2	8.4	217°43.7	41.4	198°58.6	26.7	229°32.0	32.1					Suhail	222°47.9	-43°31.6	
Mer.pass. 09:58			ν -0.2° d 0.9° m -4.17	ν 0.7° d 0.7° m 0.92			ν 2.0° d 0.2° m -2.09			ν 2.3° d 0.0° m 0.81							
Sat			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	211°01.1	220°44.0	S05°07.5	232°44.4	S10°40.7	214°00.6	S02°26.4	244°34.3	S14°32.0					Denebola	182°27.0	14°26.9	
1	226°03.6	235°43.8	06.5	247°45.0	40.1	229°02.6	26.2	259°36.6	32.0					Gienah	175°45.6	-17°40.0	
2	241°06.1	250°43.6	05.6	262°45.7	39.4	244°04.5	26.0	274°38.9	31.9					Acrux	173°02.0	-63°13.4	
3	256°08.5	265°43.4	04.6	277°46.4	38.7	259°06.5	25.8	289°41.2	31.9					Gacrux	171°53.6	-57°14.4	
4	271°11.0	280°43.3	03.6	292°47.0	38.0	274°08.5	25.6	304°43.5	31.8					Alioth	166°14.5	55°50.4	
5	286°13.5	295°43.1	02.7	307°47.7	37.4	289°10.4	25.4	319°45.8	31.8					Spica	158°24.4	-11°16.7	
6	301°15.9	310°42.9	S05°01.7	322°48.4	S10°36.7	304°12.4	S02°25.2	334°48.1	S14°31.7					Alkaid	152°53.3	49°12.1	
7	316°18.4	325°42.7	05°00.8	337°49.1	36.0	319°14.3	25.0	349°50.4	31.7					Hadar	148°38.5	-60°28.8	
8	331°20.8	340°42.5	04°59.8	352°49.7	35.3	334°16.3	24.8	4°52.7	31.6					Menkent	147°59.9	-36°28.8	
9	346°23.3	355°42.3	05.8	7°50.4	34.7	349°18.3	24.5	19°55.0	31.6					Arcturus	145°49.6	19°03.9	
10	1°25.8	10°42.2	57.9	22°51.1	34.0	4°20.2	24.3	34°57.3	31.5					Rigel Kent.	139°42.7	-60°55.6	
11	16°28.2	25°42.0	56.9	37°51.7	33.3	19°22.2	24.1	49°59.6	31.5					Kochab	137°18.7	74°03.8	
12	31°30.7	40°41.8	S04°56.0	52°52.4	S10°32.6	34°24.2	S02°23.9	65°01.9	S14°31.5					Zuben'ubi	136°58.2	-16°08.1	
13	46°33.2	55°41.6	55.0	67°53.1	32.0	49°26.1	23.7	80°04.2	31.4					Alphecca	126°05.3	26°38.3	
14	61°35.6	70°41.4	54.0	82°53.7	31.3	64°28.1	23.5	95°06.5	31.4					Antares	112°18.3	-26°28.9	
15	76°38.1	85°41.2	53.1	97°54.4	30.6	79°30.1	23.3	110°08.8	31.3					Atria	107°14.1	-69°03.8	
16	91°40.6	100°41.0	52.1	112°55.1	29.9	94°32.0	23.1	125°11.1	31.3					Sabik	102°05.1	-15°45.2	
17	106°43.0	115°40.9	51.2	127°55.7	29.2	109°34.0	22.9	140°13.4	31.2					Shaula	96°13.2	-37°07.1	
18	121°45.5	130°40.7	S04°50.2	142°56.4	S10°28.6	124°36.0	S02°22.7	155°15.7	S14°31.2					Rasalhague	96°00.4	12°32.5	
19	136°48.0	145°40.5	49.2	157°57.1	27.9	139°37.9	22.5	170°18.1	31.1					Eltanin	90°42.9	51°28.9	
20	151°50.4	160°40.3	48.3	172°57.8	27.2	154°39.9	22.2	185°20.4	31.1					Kaus Aust.	83°35.3	-34°22.4	
21	166°52.9	175°40.1	47.3	187°58.4	26.5	169°41.8	22.0	200°22.7	31.0					Vega	80°34.6	38°48.0	
22	181°55.3	190°39.9	46.3	202°59.1	25.9	184°43.8	21.8	215°25.0	31.0					Nunki	75°50.4	-26°16.1	
23	196°57.8	205°39.7	45.4	217°59.8	25.2	199°45.8	21.6	230°27.3	30.9					Altair	62°02.1	8°55.4	
Mer.pass. 09:54			ν -0.2° d 1.0° m -4.16	ν 0.7° d 0.7° m 0.91			ν 2.0° d 0.2° m -2.09			ν 2.3° d 0.0° m 0.81							
Sun			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	212°00.3	220°39.6	S04°44.4	233°00.4	S10°24.5	214°47.7	S02°21.4	245°29.6	S14°30.9					Fomalhaut	15°17.2	-29°30.3	
1	227°02.7	235°39.4	43.4	248°01.1	23.8	229°49.7	21.2	260°31.9	30.8					Scheat	13°47.6	28°11.9	
2	242°05.2	250°39.2	42.5	263°01.8	23.1	244°51.7	21.0	275°34.2	30.8					Markab	13°32.4	15°19.3	
3	257°07.7	265°39.0	41.5	278°02.4	22.5	259°53.6	20.8	290°36.5	30.7								
4	272°10.1	280°38.8	40.5	293°03.1	21.8	274°55.6	20.6	305°38.8	30.7								
5	287°12.6	295°38.6	39.6	308°03.8	21.1	289°57.6	20.4	320°41.1	30.6								
6	302°15.1	310°38.4	S04°38.6	323°04.5	S10°20.4	304°59.5	S02°20.1	335°43.4	S14°30.6								
7	317°17.5	325°38.3	37.6	338°05.1	19.7	320°01.5	19.9	350°45.7	30.6								
8	332°20.0	340°38.1	36.7	353°05.8	19.1	335°03.5	19.7	5°48.0	30.5								
9	347°22.4	355°37.9	35.7	8°06.5	18.4	350°05.4	19.5	20°50.3	30.5								
10	2°24.9	10°37.7	34.7	23°07.2	17.7	5°07.4	19.3	35°52.6	30.4								
11	17°27.4	25°37.5	33.7	38°07.8	17.0	20°09.4	19.1	50°54.9	30.4								
12	32°29.8	40°37.3	S04°32.8	53°08.5	S10°16.3	35°11.3	S02°18.9	65°57.2	S14°30.3								
13	47°32.3	55°37.1	31.8	68°09.2	15.7	50°13.3	18.7	80°59.5	30.3								
14	62°34.																

DUT1 = UT1-UTC = -0.0983 sec  $\Delta T = TT-UT1 = +69.2823$  sec

2022 April 22 to Apr. 24 UT

h		Sun		Moon			
Fri	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	180°20.8	N12°07.1	286°30.7	3.4'	S26°52.3	1.3'	59.5'
1	195°20.9	07.9	300°53.1	3.4'	26°51.0	1.5'	59.5'
2	210°21.1	08.7	315°15.6	3.5'	26°49.5	1.7'	59.5'
3	225°21.2	09.6	329°38.0	3.5'	26°47.8	1.9'	59.5'
4	240°21.3	10.4	344°00.5	3.6'	26°46.0	2.0'	59.4'
5	255°21.4	11.3	358°23.1	3.6'	26°43.9	2.2'	59.4'
6	270°21.5	N12°12.1	12°45.7	3.7'	S26°41.7	2.4'	59.4'
7	285°21.7	12.9	27°08.4	3.7'	26°39.3	2.6'	59.4'
8	300°21.8	13.8	41°31.1	3.8'	26°36.7	2.8'	59.4'
9	315°21.9	14.6	55°53.8	3.8'	26°33.9	3.0'	59.4'
10	330°22.0	15.5	70°16.7	3.9'	26°30.9	3.1'	59.3'
11	345°22.2	16.3	84°39.5	3.9'	26°27.8	3.3'	59.3'
12	0°22.3	N12°17.1	99°02.5	4.0'	S26°24.5	3.5'	59.3'
13	15°22.4	18.0	113°25.5	4.1'	26°21.0	3.7'	59.3'
14	30°22.5	18.8	127°48.5	4.1'	26°17.3	3.9'	59.3'
15	45°22.6	19.7	142°11.7	4.2'	26°13.5	4.0'	59.3'
16	60°22.8	20.5	156°34.9	4.3'	26°09.4	4.2'	59.2'
17	75°22.9	21.3	170°58.2	4.3'	26°05.2	4.4'	59.2'
18	90°23.0	N12°22.2	185°21.5	4.4'	S26°00.8	4.5'	59.2'
19	105°23.1	23.0	199°44.9	4.5'	25°56.3	4.7'	59.2'
20	120°23.2	23.8	214°08.4	4.6'	25°51.6	4.9'	59.2'
21	135°23.4	24.7	228°32.0	4.7'	25°46.7	5.1'	59.1'
22	150°23.5	25.5	242°55.7	4.7'	25°41.6	5.2'	59.1'
23	165°23.6	26.3	257°19.4	4.8'	25°36.4	5.4'	59.1'
		SD = 15.9'	d = 0.8'	SD = 16.2'			

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

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

Day	Sun		Moon	
	Eqn.of Time	Mer.	Mer. Pass.	Age
	00 <sup>h</sup>	12 <sup>h</sup>	Upper	21-23
	mm:ss	mm:ss	hh:mm	67-44%
22	01:23	01:29	11:59	05:07
23	01:35	01:40	11:58	06:08
24	01:46	01:51	11:58	07:05
			19:32	19:32

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

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	212°59.4	220°35.1	\$04°21.1	233°16.6	\$10°08.2	215°34.9	\$02°16.4	246°24.9	\$14°29.8					Alpheratz	357°37.4	29°12.5	
1	228°01.9	235°34.9	20.1	248°17.2	07.5	230°36.9	16.2	261°27.2	29.7					Ankaa	353°09.8	-42°11.1	
2	243°04.3	250°34.7	19.2	263°17.9	06.8	245°38.9	16.0	276°29.5	29.7					Schedar	349°34.1	56°39.3	
3	258°06.8	265°34.5	.. 18.2	278°18.6	.. 06.1	260°40.9	.. 15.8	291°31.8	.. 29.6					Diphda	348°49.9	-17°52.0	
4	273°09.3	280°34.4	17.2	293°19.3	05.4	275°42.8	15.6	306°34.1	29.6					Achernar	335°22.5	-57°07.5	
5	288°11.7	295°34.2	16.2	308°19.9	04.7	290°44.8	15.4	321°36.4	29.5					Hamal	327°54.1	23°33.9	
6	303°14.2	310°34.0	\$04°15.2	323°20.6	\$10°04.1	305°46.8	\$02°15.1	336°38.8	\$14°29.5					Polaris	315°33.9	89°21.5	
7	318°16.7	325°33.8	14.3	338°21.3	03.4	320°48.7	14.9	351°41.1	29.4					Acamar	315°13.9	-40°13.1	
8	333°19.1	340°33.6	13.3	353°22.0	02.7	335°50.7	14.7	6°43.4	29.4					Menkar	314°08.8	4°10.5	
9	348°21.6	355°33.4	.. 12.3	8°22.6	.. 02.0	350°52.7	.. 14.5	21°45.7	.. 29.3					Mirfak	308°31.9	49°56.3	
10	3°24.1	10°33.2	11.3	23°23.3	01.3	5°54.6	14.3	36°48.0	29.3					Aldebaran	290°42.5	16°33.1	
11	18°26.5	25°33.1	10.4	38°24.0	00.6	20°56.6	14.1	51°50.3	29.3					Rigel	281°06.3	-8°10.7	
12	33°29.0	40°32.9	\$04°09.4	53°24.7	\$10°00.0	35°58.6	\$02°13.9	66°52.6	\$14°29.2					Capella	280°25.6	46°01.2	
13	48°31.4	55°32.7	08.4	68°25.3	09°59.3	51°00.5	13.7	81°54.9	29.2					Bellatrix	278°25.5	6°22.1	
14	63°33.9	70°32.5	07.4	83°26.0	58.6	66°02.5	13.5	96°57.2	29.1					Elnath	278°05.0	28°37.5	
15	78°36.4	85°32.3	.. 06.4	98°26.7	.. 57.9	81°04.5	.. 13.3	111°59.5	.. 29.1					Alnilam	275°40.2	-1°11.4	
16	93°38.8	100°32.1	05.5	113°27.4	57.2	96°06.4	13.1	127°01.8	29.0					Betelgeuse	270°54.7	7°24.6	
17	108°41.3	115°31.9	04.5	128°28.1	56.5	111°08.4	12.9	142°04.2	29.0					Canopus	263°53.7	-52°42.7	
18	123°43.8	130°31.7	\$04°03.5	143°28.7	\$09°55.9	126°10.4	\$02°12.7	157°06.5	\$14°28.9					Sirius	258°28.4	-16°45.0	
19	138°46.2	145°31.6	02.5	158°29.4	55.2	141°12.4	12.4	172°08.8	28.9					Adhara	255°07.8	-29°00.3	
20	153°48.7	160°31.4	01.5	173°30.1	54.5	156°14.3	12.2	187°11.1	28.8					Procyon	244°53.3	5°10.0	
21	168°51.2	175°31.2	04°00.6	188°30.8	.. 53.8	171°16.3	.. 12.0	202°13.4	.. 28.8					Pollux	243°20.1	27°58.4	
22	183°53.6	190°31.0	03°59.6	203°31.4	53.1	186°18.3	11.8	217°15.7	28.8					Avior	234°15.7	-59°35.1	
23	198°56.1	205°30.8	58.6	218°32.1	52.4	201°20.2	11.6	232°18.0	28.7					Suhail	222°47.9	-43°31.6	
Mer.pass. 09:46			ν -0.2' d 1.0' m -4.15	ν 0.7' d 0.7' m 0.90	ν 2.0' d 0.2' m -2.10	ν 2.3' d 0.0' m 0.81								Miaplacidus	221°38.5	-69°48.8	
Tue			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Regulus	207°36.7	11°51.5	
0	213°58.5	220°30.6	\$03°57.6	233°32.8	\$09°51.7	216°22.2	\$02°11.4	247°20.3	\$14°28.7					Dubhe	193°43.4	61°38.1	
1	229°01.0	235°30.4	56.6	248°33.5	51.1	231°24.2	11.2	262°22.6	28.6					Denebola	182°27.0	14°26.9	
2	244°03.5	250°30.2	55.6	263°34.1	50.4	246°26.2	11.0	277°25.0	28.6					Gienah	175°45.6	-17°40.0	
3	259°05.9	265°30.1	.. 54.7	278°34.8	.. 49.7	261°28.1	.. 10.8	292°27.3	.. 28.5					Acru	173°02.0	-63°13.5	
4	274°08.4	280°29.9	53.7	293°35.5	49.0	276°30.1	10.6	307°29.6	28.5					Gacrux	171°53.6	-57°14.4	
5	289°10.9	295°29.7	52.7	308°36.2	48.3	291°32.1	10.4	322°31.9	28.4					Alioth	166°14.5	55°50.5	
6	304°13.3	310°29.5	\$03°51.7	323°36.9	\$09°47.6	306°34.0	\$02°10.2	337°34.2	\$14°28.4					Spica	158°24.4	-11°16.7	
7	319°15.8	325°29.3	50.7	338°37.5	46.9	321°36.0	10.0	352°36.5	28.4					Alkaid	152°53.3	49°12.2	
8	334°18.3	340°29.1	49.7	353°38.2	46.3	336°38.0	09.8	7°38.8	28.3					Hadar	148°38.5	-60°28.8	
9	349°20.7	355°28.9	.. 48.7	8°38.9	.. 45.6	351°39.9	.. 09.5	22°41.1	.. 28.3					Menkent	147°59.9	-36°28.8	
10	4°23.2	10°28.8	47.8	23°39.6	44.9	6°41.9	09.3	37°43.4	28.2					Arcturus	145°49.6	19°04.0	
11	19°25.7	25°28.6	46.8	38°40.2	44.2	21°43.9	09.1	52°45.8	28.2					Rigel	139°42.7	-60°55.6	
12	34°28.1	40°28.4	\$03°45.8	53°40.9	\$09°43.5	36°45.9	\$02°08.9	67°48.1	\$14°28.1					Kochab	137°18.6	74°03.8	
13	49°30.6	55°28.2	44.8	68°41.6	42.8	51°47.8	08.7	82°50.4	28.1					Zuben'ubi	136°58.2	-16°08.1	
14	64°33.0	70°28.0	43.8	83°42.3	42.1	66°49.8	08.5	97°52.7	28.0					Alphecca	126°05.3	26°38.3	
15	79°35.5	85°27.8	.. 42.8	98°43.0	.. 41.4	81°51.8	.. 08.3	112°55.0	.. 28.0					Antares	112°18.3	-26°28.9	
16	94°38.0	100°27.6	41.8	113°43.6	40.8	96°53.8	08.1	127°57.3	28.0					Atria	107°14.1	-69°03.8	
17	109°40.4	115°27.4	40.8	128°44.3	40.1	111°55.7	07.9	142°59.6	27.9					Sabik	102°05.1	-15°45.2	
18	124°42.9	130°27.3	\$03°39.8	143°45.0	\$09°39.4	126°57.7	\$02°07.7	158°01.9	\$14°27.9					Shaula	96°13.1	-37°07.1	
19	139°45.4	145°27.1	38.9	158°45.7	38.7	141°59.7	07.5	173°04.3	27.8					Rasalhague	96°00.4	12°32.5	
20	154°47.8	160°26.9	37.9	173°46.4	38.0	157°01.6	07.3	188°06.6	27.8					Eltanin	90°42.9	51°28.9	
21	169°50.3	175°26.7	.. 36.9	188°47.0	.. 37.3	172°03.6	.. 07.1	203°08.9	.. 27.7					Kaus Aust.	83°35.3	-34°22.4	
22	184°52.8	190°26.5	35.9	203°47.7	36.6	187°05.6	06.9	218°11.2	27.7					Vega	80°34.5	38°48.0	
23	199°55.2	205°26.3	34.9	218°48.4	35.9	202°07.6	06.7	233°13.5	27.6					Nunki	75°50.4	-26°16.1	
Mer.pass. 09:43			ν -0.2' d 1.0' m -4.14	ν 0.7' d 0.7' m 0.89	ν 2.0' d 0.2' m -2.10	ν 2.3' d 0.0' m 0.80								Altair	62°02.1	8°55.4	
Wed			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Fomalhaut	15°17.2	-46°51.1	
0	214°57.7	220°26.1	\$03°33.9	233°49.1	\$09°35.3	217°09.5	\$02°06.5	248°15.8	\$14°27.6					Scheat	13°47.6	28°11.9	
1	230°00.1	235°25.9	32.9	248°49.8	34.6	232°11.5	06.2	263°18.1	27.6					Markab	13°32.3	15°19.3	
2	245°02.6	250°25.8	31.9	263°50.4	33.9	247°13.5	06.0	278°20.5	27.5								
3	260°05.1	265°25.6	.. 30.9	278°51.1	.. 33.2	262°15.5	.. 05.8	293°22.8	.. 27.5								
4	275°07.5	280°25.4	29.9	293°51.8	32.5	277°17.4	05.6	308°25.1	27.4								
5	290°10.0	295°25.2	28.9	308°52.5	31.8	292°19.4	05.4	323°27.4	27.4								
6	305°12.5	310°25.0	\$03°27.9	323°53.2	\$09°31.1	307°21.4	\$02°05.2	338°29.7	\$14°27.3								
7	320°14.9	325°24.8	27.0	338°53.8	30.4	322°23.3	05.0	353°32.0	27.3								
8	335°17.4	340°24.6	26.0	353°54.5	29.7	337°25.3	04.8	8°34.3	27.3								
9	350°19.9	355°24.4	.. 25.0	8°55.2	.. 29.0	352°27.3	.. 04.6	23°36.7	.. 27.2								
10	5°22.3	10°24.3	24.0	23°55.9	28.4	7°29.3	04.4	38°39.0	27.2								
11	20°24.8	25°24.1	23.0	38°56.6	27.7	22°31.2	04.2	53°41.3	27.1								
12	35°27.3	40°23.9	\$03°22.0	53°57.2	\$09°27.0	37°33.2	\$02°04.0	68°43.6	\$14°27.1								
13	50°29.7	55°23.7	21.0	68°57.9	26.3	52°35.2	03.8	83°45.9	27.0								
14</td																	

DUT1 = UT1-UTC = -0.0973 sec  $\Delta T = TT-UT1 = +69.2813$  sec

2022 April 25 to Apr. 27 UT

h		Sun		Moon				
Mon		GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0		180°29.2	N13°06.8	244°40.7	9.7'	S18°25.0	11.7'	58.1'
1		195°29.3	07.6	259°09.4	9.8'	18°13.3	11.8'	58.1'
2		210°29.4	08.4	273°38.2	9.9'	18°01.4	11.9'	58.1'
3		225°29.5	.. 09.3	288°07.1	10.0'	17°49.5	12.0'	58.1'
4		240°29.6	10.1	302°36.2	10.1'	17°37.5	12.1'	58.0'
5		255°29.7	10.9	317°05.3	10.2'	17°25.5	12.2'	58.0'
6		270°29.8	N13°11.7	331°34.4	10.3'	S17°13.3	12.2'	58.0'
7		285°29.9	12.5	346°03.7	10.4'	17°01.1	12.3'	58.0'
8		300°30.0	13.3	0°33.1	10.5'	16°48.7	12.4'	57.9'
9		315°30.1	.. 14.2	15°02.6	10.6'	16°36.3	12.5'	57.9'
10		330°30.2	15.0	29°32.2	10.7'	16°23.9	12.6'	57.9'
11		345°30.3	15.8	44°01.9	10.8'	16°11.3	12.6'	57.9'
12		0°30.4	N13°16.6	58°31.6	10.9'	S15°58.7	12.7'	57.9'
13		15°30.5	17.4	73°01.5	10.9'	15°46.0	12.8'	57.8'
14		30°30.6	18.2	87°31.4	11.0'	15°33.2	12.8'	57.8'
15		45°30.8	.. 19.0	102°01.5	11.1'	15°20.3	12.9'	57.8'
16		60°30.9	19.8	116°31.6	11.2'	15°07.4	13.0'	57.8'
17		75°31.0	20.6	131°01.8	11.3'	14°54.4	13.1'	57.8'
18		90°31.1	N13°21.5	145°32.1	11.4'	S14°41.4	13.1'	57.7'
19		105°31.2	22.3	160°02.5	11.5'	14°28.2	13.2'	57.7'
20		120°31.3	23.1	174°32.9	11.6'	14°15.1	13.2'	57.7'
21		135°31.4	.. 23.9	189°03.5	11.6'	14°01.8	13.3'	57.7'
22		150°31.5	24.7	203°34.1	11.7'	13°48.5	13.4'	57.6'
23		165°31.6	25.5	218°04.8	11.8'	13°35.2	13.4'	57.6'
		SD = 15.9'		SD = 15.8'				
		SD = 15.9'		SD = 15.8'				
Tue		GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0		180°31.7	N13°26.3	232°35.6	11.9'	S13°21.7	13.5'	57.6'
1		195°31.8	27.1	247°06.5	12.0'	13°08.3	13.5'	57.6'
2		210°31.9	27.9	261°37.5	12.0'	12°54.7	13.6'	57.6'
3		225°32.0	.. 28.7	276°08.5	12.1'	12°41.1	13.6'	57.5'
4		240°32.1	29.5	290°39.6	12.2'	12°27.5	13.7'	57.5'
5		255°32.2	30.4	305°10.8	12.3'	12°13.8	13.7'	57.5'
6		270°32.3	N13°31.2	319°42.1	12.3'	S12°00.1	13.8'	57.5'
7		285°32.4	32.0	334°13.4	12.4'	11°46.3	13.8'	57.4'
8		300°32.5	32.8	348°44.8	12.5'	11°32.5	13.9'	57.4'
9		315°32.6	.. 33.6	3°16.3	12.6'	11°18.6	13.9'	57.4'
10		330°32.7	34.4	17°47.9	12.6'	11°04.7	14.0'	57.4'
11		345°32.8	35.2	32°19.5	12.7'	10°50.7	14.0'	57.4'
12		0°32.9	N13°36.0	46°51.2	12.8'	S10°36.7	14.0'	57.3'
13		15°33.0	36.8	61°22.9	12.8'	10°22.6	14.1'	57.3'
14		30°33.1	37.6	75°54.8	12.9'	10°08.5	14.1'	57.3'
15		45°33.2	.. 38.4	90°26.6	13.0'	09°54.4	14.2'	57.3'
16		60°33.3	39.2	104°58.6	13.0'	09°40.3	14.2'	57.3'
17		75°33.4	40.0	119°30.6	13.1'	09°26.1	14.2'	57.2'
18		90°33.5	N13°40.8	134°02.7	13.1'	S09°11.8	14.3'	57.2'
19		105°33.6	41.6	148°34.9	13.2'	08°57.6	14.3'	57.2'
20		120°33.7	42.4	163°07.1	13.3'	08°43.3	14.3'	57.2'
21		135°33.8	.. 43.2	177°39.3	13.3'	08°28.9	14.4'	57.1'
22		150°33.9	44.0	192°11.6	13.4'	08°14.6	14.4'	57.1'
23		165°34.0	44.8	206°44.0	13.4'	08°00.2	14.4'	57.1'
		SD = 15.9'		SD = 15.7'				
		SD = 15.9'		SD = 15.7'				
Wed		GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0		180°34.1	N13°45.6	221°16.4	13.5'	S07°45.8	14.4'	57.1'
1		195°34.2	46.4	235°48.9	13.5'	07°31.4	14.5'	57.1'
2		210°34.3	47.2	250°21.5	13.6'	07°16.9	14.5'	57.0'
3		225°34.4	.. 48.0	264°54.1	13.6'	07°02.4	14.5'	57.0'
4		240°34.5	48.8	279°26.7	13.7'	06°47.9	14.5'	57.0'
5		255°34.6	49.6	293°59.4	13.7'	06°33.4	14.5'	57.0'
6		270°34.7	N13°50.4	308°32.1	13.8'	S06°18.8	14.6'	57.0'
7		285°34.8	51.2	323°04.9	13.8'	06°04.3	14.6'	56.9'
8		300°34.9	52.0	337°37.8	13.9'	05°49.7	14.6'	56.9'
9		315°35.0	.. 52.8	352°10.6	13.9'	05°35.1	14.6'	56.9'
10		330°35.1	53.6	6°43.6	14.0'	05°20.5	14.6'	56.9'
11		345°35.2	54.4	21°16.5	14.0'	05°05.9	14.6'	56.9'
12		0°35.2	N13°55.2	35°49.5	14.1'	S04°51.2	14.7'	56.8'
13		15°35.3	55.9	50°22.6	14.1'	04°36.6	14.7'	56.8'
14		30°35.4	56.7	64°55.7	14.1'	04°21.9	14.7'	56.8'
15		45°35.5	.. 57.5	79°28.8	14.2'	04°07.2	14.7'	56.8'
16		60°35.6	58.3	94°02.0	14.2'	03°52.6	14.7'	56.7'
17		75°35.7	59.1	108°35.2	14.2'	03°37.9	14.7'	56.7'
18		90°35.8	N13°59.9	123°08.4	14.3'	S03°23.2	14.7'	56.7'
19		105°35.9	14°00.7	137°41.7	14.3'	03°08.5	14.7'	56.7'
20		120°36.0	01.5	152°15.0	14.3'	02°53.8	14.7'	56.7'
21		135°36.1	.. 02.3	166°48.3	14.4'	02°39.1	14.7'	56.6'
22		150°36.2	03.1	181°21.7	14.4'	02°24.4	14.7'	56.6'
23		165°36.3	03.9	195°55.1	14.4'	02°09.7	14.7'	56.6'
		SD = 15.9'		SD = 15.6'				
		SD = 15.9'		SD = 15.6'				

Lat.	Twilight		Sunrise	Sunset	Twilight	
	Naut.	Civil			Civil	Naut.
N 72°	--	--	02:31	21:30	--	--
N 70°	--	00:53	02:59	21:00	23:21	--
68°	--	01:52	03:21	20:38	22:10	--
66°	--	02:25	03:37	20:21	21:35	--
64°	00:46	02:48	03:51	20:07	21:11	23:25
62°	01:38	03:07	04:02	19:55	20:52	22:23
60°	02:08	03:22	04:12	19:45	20:36	21:51
N 58°	02:30	03:34	04:20	19:37	20:23	21:28
56°	02:48	03:45	04:28	19:29	20:12	21:10
54°	03:02	03:54	04:34	19:22	20:03	20:55
52°	03:14	04:03	04:40	19:16	19:54	20:43
50°	03:25	04:10	04:46	19:11	19:47	20:32
48°	03:47	04:26	04:57	18:59	19:31	20:10
N 40°	04:03	04:38	05:07	18:50	19:18	19:54
35°	04:16	04:48	05:15	18:41	19:08	19:40
30°	04:27	04:57	05:22	18:34	19:29	19:29
20°	04:44	05:11	05:34	18:22	18:45	19:12
N 10°	04:58	05:23	05:45	18:11	18:33	18:58
0°	05:08	05:33	05:54	18:01	18:22	18:47
S 10°	05:18	05:43	06:04	17:51	18:13	18:38
20°	05:26	05:52	06:14	17:41	18:04	18:30
30°	05:33	06:01	06:26	17:29	17:54	18:22
35°	05:37	06:06	06:32	17:23	17:49	18:19
40°	05:40	06:12	06:40	17:15	17:43	18:15
45°	05:44	06:18	06:49	17:06	17:37	18:11
S 50°	05:47	06:25	06:59	16:56	17:30	18:08
52°	05:49	06:28	07:04	16:51	17:26	18:06
54°	05:50	06:32	07:09	16:46	17:23	18:04
56°	05:52	06:36	07:15	16:40	17:19	18:03
58°	05:54	06:40	07:22	16:33	17:15	18:01
S 60°	05:55	06:44	07:29	16:26	17:10	17:59
Lat.	Mon	Moonrise	Tue	Wed	Mon	Tue
N 72°	06:45	05:28	04:49	09:34	12:33	14:48
N 70°	05:51	05:07	04:40	10:26	12:51	14:55
68°	05:18	04:51	04:32	10:58	13:06	15:00
66°	04:53	04:38	04:25	11:21	13:17	15:04
64°	04:34	04:26	04:20	11:39	13:27	15:07
62°	04:18	04:17	04:15	11:54	13:35	15:11
60°	04:05	04:09	04:11	12:06	13:42	15:13
N 58°	03:53	04:01	04:07	12:17	13:48	15:16
56°	03:43	03:55	04:04	12:26	13:54	15:18
54°	03:34	03:49	04:01	12:34	13:58	15:20
52°	03:26	03:44	03:58	12:41	14:03	15:21
50°	03:19	03:39	03:5			

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

Aries				Venus				Mars				Jupiter				Saturn				Stars			
Thu	GHA	GHA	Dec	GHA	GHA	Dec	GHA	GHA	GHA	Dec	GHA	GHA	Dec	GHA	GHA	Dec	SHA	Dec					
0	215°56.8	220°21.6	\$03°10.0	234°05.4	\$09°18.7	217°56.9	\$02°01.5	249°11.4	\$14°26.6								Alpheratz	357°37.4	29°12.5				
1	230°59.3	235°21.4	09.0	249°06.1	18.0	232°58.9	01.3	264°13.7	26.5								Ankaa	353°09.7	-42°11.1				
2	246°01.8	250°21.2	08.0	264°06.8	17.3	248°00.9	01.1	279°16.0	26.5								Schedar	349°34.1	56°39.3				
3	261°04.2	265°21.1	· 07.0	279°07.5	· 16.6	263°02.8	· 00.9	294°18.4	· 26.4								Diphda	348°49.9	-17°52.0				
4	276°06.7	280°20.9	06.0	294°08.2	15.9	278°04.8	00.7	309°20.7	26.4								Achernar	335°22.5	-57°07.5				
5	291°09.1	295°20.7	05.0	309°08.9	15.2	293°06.8	00.5	324°23.0	26.3								Hamal	327°54.1	23°33.9				
6	306°11.6	310°20.5	\$03°04.0	324°09.5	\$09°14.5	308°08.8	\$02°00.3	339°25.3	\$14°26.3								Polaris	315°34.2	89°21.5				
7	321°14.1	325°20.3	03.0	339°10.2	13.8	323°10.8	02°00.1	354°27.6	26.3								Acamar	315°13.9	-40°13.1				
8	336°16.5	340°20.1	02.0	354°10.9	13.1	338°12.7	01°59.9	9°30.0	26.2								Menkar	314°08.8	4°10.5				
9	351°19.0	355°19.9	· 01.0	9°11.6	· 12.4	353°14.7	· 59.7	24°32.3	· 26.2								Mirfak	308°32.0	49°56.3				
10	6°21.5	10°19.7	03°00.0	24°12.3	11.8	8°16.7	59.5	39°34.6	26.1								Aldebaran	290°42.5	16°33.1				
11	21°23.9	25°19.5	02°59.0	39°13.0	11.1	23°18.7	59.3	54°36.9	26.1								Rigel	281°06.3	-8°10.7				
12	36°26.4	40°19.4	\$02°58.0	54°13.6	\$09°10.4	38°20.6	\$01°59.1	69°39.2	\$14°26.1								Capella	280°25.6	46°01.2				
13	51°28.9	55°19.2	57.0	69°14.3	09.7	53°22.6	58.9	84°41.6	26.0								Bellatrix	278°25.5	6°22.1				
14	66°31.3	70°19.0	56.0	84°15.0	09.0	68°24.6	58.7	99°43.9	26.0								Elnath	278°05.0	28°37.5				
15	81°33.8	85°18.8	· 55.0	99°15.7	· 08.3	83°26.6	· 58.5	114°46.2	· 25.9								Alnilam	275°40.2	-1°11.4				
16	96°36.2	100°18.6	54.0	114°16.4	07.6	98°28.5	58.3	129°48.5	25.9								Betelgeuse	270°54.7	7°24.6				
17	111°38.7	115°18.4	53.0	129°17.1	06.9	113°30.5	58.1	144°50.8	25.8								Canopus	263°53.7	-52°42.7				
18	126°41.2	130°18.2	\$02°52.0	144°17.8	\$09°06.2	128°32.5	\$01°57.8	159°53.2	\$14°25.8								Sirius	258°28.4	-16°45.0				
19	141°43.6	145°18.0	51.0	159°18.4	05.5	143°34.5	57.6	174°55.5	25.8								Adhara	255°07.8	-29°00.3				
20	156°46.1	160°17.8	50.0	174°19.1	04.8	158°36.5	57.4	189°57.8	25.7								Procyon	244°53.3	5°10.0				
21	171°48.6	175°17.6	· 49.0	189°19.8	· 04.1	173°38.4	· 57.2	205°00.1	· 25.7								Pollux	243°20.2	27°58.4				
22	186°51.0	190°17.5	48.0	204°20.5	03.4	188°40.4	57.0	220°02.4	25.6								Avior	234°15.7	-59°35.1				
23	201°53.5	205°17.3	47.0	219°21.2	02.7	203°42.4	56.8	235°04.8	25.6								Suhail	222°47.9	-43°31.6				
Mer.pass. 09:35				ν -0.2° d 1.0° m -4.13	ν 0.7° d 0.7° m 0.88	ν 2.0° d 0.2° m -2.11	ν 2.3° d 0.0° m 0.80																
Fri				GHA	GHA	Dec	GHA	GHA	GHA	Dec	GHA	GHA	Dec	GHA	GHA	Dec	SHA	Dec					
0	216°56.0	220°17.1	\$02°46.0	234°21.9	\$09°02.0	218°44.4	\$01°56.6	250°07.1	\$14°25.6								Denebola	182°27.0	14°26.9				
1	231°58.4	235°16.9	44.9	249°22.6	01.3	233°46.3	56.4	265°09.4	25.5								Gienah	175°45.6	-17°40.0				
2	247°00.9	250°16.7	43.9	264°23.2	00.6	248°48.3	56.2	280°11.7	25.5								Acrux	173°02.0	-63°13.5				
3	262°03.4	265°16.5	· 42.9	279°23.9	09°00.0	263°50.3	· 56.0	295°14.0	· 25.4								Gacrux	171°53.6	-57°14.4				
4	277°05.8	280°16.3	41.9	294°24.6	08°59.3	278°52.3	55.8	310°16.4	25.4								Alioth	166°14.5	55°50.5				
5	292°08.3	295°16.1	40.9	309°25.3	58.6	293°54.3	55.6	325°18.7	25.3								Spica	158°24.4	-11°16.7				
6	307°10.7	310°15.9	\$02°39.9	324°26.0	\$08°57.9	308°56.2	\$01°55.4	340°21.0	\$14°25.3								Alkaid	152°53.3	49°12.2				
7	322°13.2	325°15.8	38.9	339°26.7	57.2	323°58.2	55.2	355°23.3	25.3								Hadar	148°38.5	-60°28.8				
8	337°15.7	340°15.6	37.9	354°27.4	56.5	339°00.2	55.0	10°25.6	25.2								Menkent	147°59.9	-36°28.8				
9	352°18.1	355°15.4	· 36.9	9°28.1	· 55.8	354°02.2	· 54.8	25°28.0	· 25.2								Arcturus	145°49.6	19°04.0				
10	7°20.6	10°15.2	35.9	24°28.7	55.1	9°04.2	54.6	40°30.3	25.1								Rigel Kent	139°42.7	-60°55.6				
11	22°23.1	25°15.0	34.9	39°29.4	54.4	24°06.1	54.4	55°32.6	25.1								Kochab	137°18.6	74°03.8				
12	37°25.5	40°14.8	\$02°33.9	54°30.1	\$08°53.7	39°08.1	\$01°54.2	70°34.9	\$14°25.1								Zuben 'ubi	136°58.2	-16°08.1				
13	52°28.0	55°14.6	32.8	69°30.8	53.0	54°10.1	54.0	85°37.3	25.0								Alphecca	126°05.3	26°38.3				
14	67°30.5	70°14.4	31.8	84°31.5	52.3	69°12.1	53.8	100°39.6	25.0								Antares	112°18.3	-26°28.9				
15	82°32.9	85°14.2	· 30.8	99°32.2	· 51.6	84°14.1	· 53.6	115°41.9	· 24.9								Atria	107°14.1	-69°03.9				
16	97°35.4	100°14.0	29.8	114°32.9	50.9	99°16.0	53.4	130°44.2	24.9								Sabik	102°05.1	-15°45.2				
17	112°37.8	115°13.9	28.8	129°33.6	50.2	114°18.0	53.2	145°46.6	24.9								Shaula	96°13.1	-37°07.1				
18	127°40.3	130°13.7	\$02°27.8	144°34.2	\$08°49.5	129°20.0	\$01°53.0	160°48.9	\$14°24.8								Rasalhague	96°00.4	12°32.5				
19	142°42.8	145°13.5	26.8	159°34.9	48.8	144°22.0	52.8	175°51.2	24.8								Eltanin	90°42.9	51°28.9				
20	157°45.2	160°13.3	25.8	174°35.6	48.1	159°24.0	52.6	190°53.5	24.7								Kaus Aust.	83°35.3	-34°22.4				
21	172°47.7	175°13.1	· 24.8	189°36.3	· 47.4	174°25.9	· 52.4	205°55.8	· 24.7								Vega	80°34.5	38°48.0				
22	187°50.2	190°12.9	23.7	204°37.0	46.7	189°27.9	52.2	220°58.2	24.6								Nunki	75°50.4	-26°16.1				
23	202°52.6	205°12.7	22.7	219°37.7	46.0	204°29.9	52.0	236°00.5	24.6								Altair	62°02.1	8°55.4				
Mer.pass. 09:31				ν -0.2° d 1.0° m -4.12	ν 0.7° d 0.7° m 0.87	ν 2.0° d 0.2° m -2.11	ν 2.3° d 0.0° m 0.80																
Sat				GHA	GHA	Dec	GHA	GHA	GHA	Dec	GHA	GHA	Dec	GHA	GHA	Dec	SHA	Dec					
0	217°55.1	220°12.5	\$02°21.7	234°38.4	\$08°45.3	219°31.9	\$01°51.8	251°02.8	\$14°24.6														
1	232°57.6	235°12.3	20.7	249°39.1	44.6	234°33.9	51.6	266°05.1	24.5														
2	248°00.0	250°12.1	19.7	264°39.8	43.9	249°35.8	51.4	281°07.5	24.5														
3	263°02.5	265°12.0	· 18.7	279°40.5	· 43.2	264°37.8	· 51.1	296°09.8	· 24.4														
4	278°05.0	280°11.8	17.7	294°41.1	42.5	279°39.8	50.9	311°12.1	24.4														
5	293°07.4	295°11.6	16.7	309°41.8	41.8	294°41.8	50.7	326°14.4	24.4														
6	308°09.9	310°11.4	\$02°15.6	324°42.5	\$08°41.1	309°43.8	\$01°50.5	341°16.8	\$14°24.3														
7	323°12.3	325°11.2	14.6	339°43.2	40.4	324°45.7	50.3	356°19.1	24.3														

DUT1 = UT1-UTC = -0.0974 sec  $\Delta T = TT-UT1 = +69.2814$  sec

2022 April 28 to Apr. 30 UT

h		Sun		Moon				
Thu		GHA	Dec	GHA	$\nu$	Dec	d	HP
0	180°36.4	N14°04.7		210°28.5	14.5'	S01°55.0	14.7'	56.6'
1	195°36.5	05.4		225°02.0	14.5'	01°40.3	14.7'	56.6'
2	210°36.6	06.2		239°35.5	14.5'	01°25.6	14.7'	56.5'
3	225°36.6	.. 07.0		254°09.0	14.5'	01°10.9	14.7'	56.5'
4	240°36.7	07.8		268°42.5	14.6'	00°56.2	14.7'	56.5'
5	255°36.8	08.6		283°16.1	14.6'	00°41.5	14.7'	56.5'
6	270°36.9	N14°09.4		297°49.6	14.6'	S00°26.8	14.7'	56.5'
7	285°37.0	10.2		312°23.2	14.6'	S00°12.1	14.7'	56.4'
8	300°37.1	11.0		326°56.8	14.6'	N00°02.5	14.7'	56.4'
9	315°37.2	.. 11.7		341°30.5	14.7'	00°17.2	14.6'	56.4'
10	330°37.3	12.5		356°04.1	14.7'	00°31.8	14.6'	56.4'
11	345°37.4	13.3		10°37.8	14.7'	00°46.5	14.6'	56.4'
12	0°37.5	N14°14.1		25°11.5	14.7'	N01°01.1	14.6'	56.3'
13	15°37.6	14.9		39°45.2	14.7'	01°15.7	14.6'	56.3'
14	30°37.6	15.7		54°18.9	14.7'	01°30.3	14.6'	56.3'
15	45°37.7	.. 16.4		68°52.6	14.7'	01°44.9	14.6'	56.3'
16	60°37.8	17.2		83°26.4	14.8'	01°59.4	14.5'	56.2'
17	75°37.9	18.0		98°00.1	14.8'	02°14.0	14.5'	56.2'
18	90°38.0	N14°18.8		112°33.9	14.8'	N02°28.5	14.5'	56.2'
19	105°38.1	19.6		127°07.7	14.8'	02°43.0	14.5'	56.2'
20	120°38.2	20.4		141°41.4	14.8'	02°57.5	14.5'	56.2'
21	135°38.3	.. 21.1		156°15.2	14.8'	03°11.9	14.4'	56.1'
22	150°38.3	21.9		170°49.0	14.8'	03°26.3	14.4'	56.1'
23	165°38.4	22.7		185°22.8	14.8'	03°40.8	14.4'	56.1'
	SD = 15.9'	d = 0.8'		SD = 15.4'				
	SD = 15.9'	d = 0.8'		SD = 15.3'				
Sat		GHA	Dec	GHA	$\nu$	Dec	d	HP
0	180°38.5	N14°23.5		199°56.6	14.8'	N03°55.1	14.4'	56.1'
1	195°38.6	24.3		214°30.4	14.8'	04°09.5	14.3'	56.1'
2	210°38.7	25.0		229°04.2	14.8'	04°23.8	14.3'	56.0'
3	225°38.8	.. 25.8		243°38.0	14.8'	04°38.1	14.3'	56.0'
4	240°38.9	26.6		258°11.8	14.8'	04°52.4	14.2'	56.0'
5	255°39.0	27.4		272°45.6	14.8'	05°06.7	14.2'	56.0'
6	270°39.0	N14°28.1		287°19.4	14.8'	N05°20.9	14.2'	56.0'
7	285°39.1	28.9		301°53.2	14.8'	05°35.1	14.2'	55.9'
8	300°39.2	29.7		316°27.0	14.8'	05°49.2	14.1'	55.9'
9	315°39.3	.. 30.5		331°00.8	14.8'	06°03.4	14.1'	55.9'
10	330°39.4	31.2		345°34.5	14.8'	06°17.4	14.1'	55.9'
11	345°39.5	32.0		0°08.3	14.8'	06°31.5	14.0'	55.9'
12	0°39.5	N14°32.8		14°42.1	14.8'	N06°45.5	14.0'	55.8'
13	15°39.6	33.6		29°15.8	14.7'	06°59.5	13.9'	55.8'
14	30°39.7	34.3		43°49.6	14.7'	07°13.4	13.9'	55.8'
15	45°39.8	.. 35.1		58°23.3	14.7'	07°27.3	13.9'	55.8'
16	60°39.9	35.9		72°57.0	14.7'	07°41.2	13.8'	55.8'
17	75°40.0	36.7		87°30.8	14.7'	07°55.0	13.8'	55.7'
18	90°40.0	N14°37.4		102°04.5	14.7'	N08°08.8	13.7'	55.7'
19	105°40.1	38.2		116°38.1	14.7'	08°22.5	13.7'	55.7'
20	120°40.2	39.0		131°11.8	14.7'	08°36.2	13.6'	55.7'
21	135°40.3	.. 39.8		145°45.5	14.6'	08°49.9	13.6'	55.7'
22	150°40.4	40.5		160°19.1	14.6'	09°03.5	13.6'	55.7'
23	165°40.5	41.3		174°52.7	14.6'	09°17.0	13.5'	55.6'
	SD = 15.9'	d = 0.8'		SD = 15.3'				
Sat		GHA	Dec	GHA	$\nu$	Dec	d	HP
0	180°40.5	N14°42.1		189°26.3	14.6'	N09°30.5	13.5'	55.6'
1	195°40.6	42.8		203°59.9	14.6'	09°44.0	13.4'	55.6'
2	210°40.7	43.6		218°33.5	14.5'	09°57.4	13.4'	55.6'
3	225°40.8	.. 44.4		233°07.0	14.5'	10°10.7	13.3'	55.6'
4	240°40.9	45.1		247°40.6	14.5'	10°24.1	13.3'	55.5'
5	255°40.9	45.9		262°14.1	14.5'	10°37.3	13.2'	55.5'
6	270°41.0	N14°46.7		276°47.5	14.5'	N10°50.5	13.1'	55.5'
7	285°41.1	47.4		291°21.0	14.4'	11°03.7	13.1'	55.5'
8	300°41.2	48.2		305°54.4	14.4'	11°16.8	13.0'	55.5'
9	315°41.3	.. 49.0		320°27.8	14.4'	11°29.8	13.0'	55.4'
10	330°41.3	49.7		335°01.2	14.4'	11°42.8	12.9'	55.4'
11	345°41.4	50.5		349°34.6	14.3'	11°55.7	12.9'	55.4'
12	0°41.5	N14°51.3		4°07.9	14.3'	N12°08.6	12.8'	55.4'
13	15°41.6	52.0		18°41.2	14.3'	12°21.4	12.7'	55.4'
14	30°41.7	52.8		33°14.5	14.2'	12°34.1	12.7'	55.3'
15	45°41.7	.. 53.6		47°47.7	14.2'	12°46.8	12.6'	55.3'
16	60°41.8	54.3		62°20.9	14.2'	12°59.4	12.6'	55.3'
17	75°41.9	55.1		76°54.1	14.2'	13°12.0	12.5'	55.3'
18	90°42.0	N14°55.8		91°27.3	14.1'	N13°24.5	12.4'	55.3'
19	105°42.0	56.6		106°00.4	14.1'	13°36.9	12.4'	55.3'
20	120°42.1	57.4		120°33.5	14.1'	13°49.3	12.3'	55.2'
21	135°42.2	.. 58.1		135°06.5	14.0'	14°01.6	12.2'	55.2'
22	150°42.3	58.9		149°39.6	14.0'	14°13.8	12.2'	55.2'
23	165°42.3	59.6		164°12.6	14.0'	14°26.0	12.1'	55.2'
	SD = 15.9'	d = 0.8'		SD = 15.2'				

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

## May 01, 02, 03 UT (Sun., Mon., Tue.)

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	218°54.2	220°07.9	S01°57.3	234°55.0	S08°28.5	220°19.5	S01°46.9	251°58.7	S14°23.6	Alpheratz	357°37.4	29°12.5					
1	233°56.7	235°07.7	56.3	249°55.7	27.8	235°21.4	46.7	267°01.0	23.6	Ankaa	353°09.7	-42°11.1					
2	248°59.2	250°07.6	55.3	264°56.4	27.1	250°23.4	46.5	282°03.3	23.5	Schedar	349°34.1	56°39.3					
3	264°01.6	265°07.4	.. 54.3	279°57.0	.. 26.4	265°25.4	.. 46.3	297°05.6	.. 23.5	Diphda	348°49.8	-17°52.0					
4	279°04.1	280°07.2	53.3	294°57.7	25.7	280°27.4	46.1	312°08.0	23.5	Achernar	335°22.5	-57°07.5					
5	294°06.6	295°07.0	52.2	309°58.4	25.0	295°29.4	45.9	327°10.3	23.4	Hamal	327°54.1	23°33.9					
6	309°09.0	310°06.8	S01°51.2	324°59.1	S08°24.3	310°31.4	S01°45.7	342°12.6	S14°23.4	Polaris	315°34.1	89°21.4					
7	324°11.5	325°06.6	50.2	339°59.8	23.6	325°33.3	45.5	357°15.0	23.3	Acamar	315°13.9	-40°13.1					
8	339°13.9	340°06.4	49.2	355°00.5	22.9	340°35.3	45.3	12°17.3	23.3	Menkar	314°08.8	4°10.5					
9	354°16.4	355°06.2	.. 48.2	10°01.2	.. 22.2	355°37.3	.. 45.1	27°19.6	.. 23.3	Mirfak	308°32.0	49°56.3					
10	9°18.9	10°06.0	47.1	25°01.9	21.5	10°39.3	44.9	42°21.9	23.2	Aldebaran	290°42.5	16°33.1					
11	24°21.3	25°05.8	46.1	40°02.6	20.8	25°41.3	44.7	57°24.3	23.2	Rigel	281°06.3	-8°10.7					
12	39°23.8	40°05.6	S01°45.1	55°03.3	S08°20.1	40°43.3	S01°44.5	72°26.6	S14°23.1	Capella	280°25.6	46°01.2					
13	54°26.3	55°05.4	44.1	70°04.0	19.4	55°45.3	44.3	87°28.9	23.1	Bellatrix	278°25.5	6°22.1					
14	69°28.7	70°05.2	43.0	85°04.7	18.7	70°47.2	44.1	102°31.3	23.1	Elnath	278°05.0	28°37.5					
15	84°31.2	85°05.1	.. 42.0	100°05.4	.. 18.0	85°49.2	.. 43.9	117°33.6	.. 23.0	Alnilam	275°40.3	-1°11.4					
16	99°33.7	100°04.9	41.0	115°06.1	17.3	100°51.2	43.7	132°35.9	23.0	Betelgeuse	270°54.7	7°24.6					
17	114°36.1	115°04.7	40.0	130°06.8	16.6	115°53.2	43.5	147°38.2	23.0	Canopus	263°53.7	-52°42.7					
18	129°38.6	130°04.5	S01°39.0	145°07.4	S08°15.9	130°55.2	S01°43.3	162°40.6	S14°22.9	Sirius	258°28.4	-16°45.0					
19	144°41.1	145°04.3	37.9	160°08.1	15.2	145°57.2	43.1	177°42.9	22.9	Adhara	255°07.8	-29°00.3					
20	159°43.5	160°04.1	36.9	175°08.8	14.5	160°59.2	42.9	192°45.2	22.8	Procyon	244°53.3	5°10.0					
21	174°46.0	175°03.9	.. 35.9	190°09.5	.. 13.8	176°01.1	.. 42.7	207°47.6	.. 22.8	Pollux	243°20.2	27°58.4					
22	189°48.4	190°03.7	34.9	205°10.2	13.1	191°03.1	42.5	222°49.9	22.8	Avior	234°15.7	-59°35.1					
23	204°50.9	205°03.5	33.8	220°10.9	12.4	206°05.1	42.3	237°52.2	22.7	Suhail	222°47.9	-43°31.6					
Mer.pass. 09:23			ν -0.2° d 1.0' m -4.11	ν 0.7° d 0.7' m 0.85	ν 2.0° d 0.2' m -2.12	ν 2.3° d 0.0' m 0.79	Mer.pass. 09:19			ν -0.2° d 1.0' m -4.10	ν 0.7° d 0.7' m 0.85	ν 2.0° d 0.2' m -2.12	ν 2.3° d 0.0' m 0.79	Mer.pass. 09:15			
Mon			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	219°53.4	220°03.3	S01°32.8	235°11.6	S08°11.7	221°07.1	S01°42.1	252°54.6	S14°22.7	Denebola	182°27.0	14°26.9					
1	234°55.8	235°03.1	31.8	250°12.3	11.0	236°09.1	41.9	267°56.9	22.7	Gienah	175°45.6	-17°40.0					
2	249°58.3	250°02.9	30.8	265°13.0	10.3	251°11.1	41.7	282°59.2	22.6	Acrux	173°02.0	-63°13.5					
3	265°00.8	265°02.7	.. 29.7	280°13.7	.. 09.6	266°13.1	.. 41.5	298°01.6	.. 22.6	Gacrux	171°53.6	-57°14.4					
4	280°03.2	280°02.5	28.7	295°14.4	08.9	281°15.1	41.3	313°03.9	22.5	Alioth	166°14.5	55°50.5					
5	295°05.7	295°02.4	27.7	310°15.1	08.2	296°17.0	41.1	328°06.2	22.5	Spica	158°24.4	-11°16.7					
6	310°08.2	310°02.2	S01°26.7	325°15.8	S08°07.5	311°19.0	S01°40.9	343°08.6	S14°22.5	Alkaid	152°53.3	49°12.2					
7	325°10.6	325°02.0	25.6	340°16.5	06.8	326°21.0	40.7	358°10.9	22.4	Hadar	148°38.5	-60°28.8					
8	340°13.1	340°01.8	24.6	355°17.2	06.1	341°23.0	40.5	13°13.2	22.4	Menkent	147°59.9	-36°28.8					
9	355°15.6	355°01.6	.. 23.6	10°17.9	.. 05.4	356°25.0	.. 40.3	28°15.6	.. 22.3	Arcturus	145°49.6	19°04.0					
10	10°18.0	10°01.4	22.5	25°18.6	04.7	11°27.0	40.1	43°17.9	22.3	Rigel Kent.	139°42.7	-60°55.6					
11	25°20.5	25°01.2	21.5	40°19.3	04.0	26°29.0	39.9	58°20.2	22.3	Kochab	137°18.6	74°03.8					
12	40°22.9	40°01.0	S01°20.5	55°20.0	S08°03.3	41°31.0	S01°39.7	73°22.6	S14°22.2	Zuben 'ubi	136°58.2	-16°08.1					
13	55°25.4	55°00.8	19.5	70°20.7	02.6	56°32.9	39.5	88°24.9	22.2	Alphecca	126°05.3	26°38.3					
14	70°27.9	70°06.6	18.4	85°21.4	01.9	71°34.9	39.3	103°27.2	22.2	Antares	112°18.3	-26°28.9					
15	85°30.3	85°00.4	.. 17.4	100°22.1	.. 01.1	86°36.9	.. 39.1	118°29.6	.. 22.1	Atria	107°14.0	-69°03.9					
16	100°32.8	100°00.2	16.4	115°22.8	08°00.4	101°38.9	38.9	133°31.9	22.1	Sabik	102°05.1	-15°45.2					
17	115°35.3	115°00.0	15.3	130°23.5	07°59.7	116°40.9	38.7	148°34.2	22.1	Shaula	96°13.1	-37°07.1					
18	130°37.7	129°59.8	S01°14.3	145°24.2	S07°59.0	131°42.9	S01°38.5	163°36.6	S14°22.0	Rasalhague	96°00.4	12°32.5					
19	145°40.2	144°59.6	13.3	160°24.9	58.3	146°44.9	38.3	178°38.9	22.0	Eltanin	90°42.9	51°28.9					
20	160°42.7	159°59.4	12.3	175°25.6	57.6	161°46.9	38.1	193°41.2	21.9	Kaus Aust.	83°35.3	-34°22.4					
21	175°45.1	174°59.3	.. 11.2	190°26.3	.. 56.9	176°48.8	.. 37.9	208°43.6	.. 21.9	Vega	80°34.5	38°48.0					
22	190°47.6	189°59.1	10.2	205°26.9	56.2	191°50.8	37.7	223°45.9	21.9	Nunki	75°50.4	-26°16.1					
23	205°50.0	204°58.9	09.2	220°27.6	55.5	206°52.8	37.5	238°48.2	21.8	Altair	62°02.0	8°55.4					
Mer.pass. 09:19			ν -0.2° d 1.0' m -4.10	ν 0.7° d 0.7' m 0.85	ν 2.0° d 0.2' m -2.12	ν 2.3° d 0.0' m 0.79	Mer.pass. 09:15			ν -0.2° d 1.0' m -4.10	ν 0.7° d 0.7' m 0.84	ν 2.0° d 0.2' m -2.12	ν 2.3° d 0.0' m 0.79	Mer.pass. 09:15			
Tue			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	220°52.5	219°58.7	S01°08.1	235°28.3	S07°54.8	221°54.8	S01°37.3	253°50.6	S14°21.8	May 01 Sun	1°13.7	09:20					
1	235°55.0	234°58.5	07.1	250°29.0	54.1	236°56.8	37.1	268°52.9	21.8	Venus	16°00.7	08:20					
2	250°57.4	249°58.3	06.1	265°29.7	53.4	251°58.8	36.9	283°55.2	21.7	Mars	1°25.2	09:17					
3	265°59.9	264°58.1	.. 05.0	280°30.4	.. 52.7	267°00.8	.. 36.7	298°57.6	.. 21.7	Jupiter	1°02.3	09:11					
4	281°02.4	279°57.9	04.0	295°31.1	52.0	282°02.8	36.5	313°59.9	21.6	Saturn	33°04.4	07:11					
5	296°04.8	294°57.7	03.0	310°31.8	51.3	297°04.8	36.3	329°02.2	21.6	May 02 Mon	83°35.3	-34°22.4					
6	311°07.3	309°57.5	S01°02.0	325°32.5	S07°50.6	312°06.8	S01°36.1	344°04.6	S14°21.6	Venus	0°09.9	09:20					
7	326°09.8	324°57.3	01°00.9	340°33.2	49.9	327°08.7	35.9	359°06.9	21.5	Mars	15°18.2	08:19					
8	341°12.2	339°57.1	00°59.9	355°33.9	49.2	342°10.7	35.7	14°09.2	21.5	Jupiter	1°13.7	09:14					
9	356°14.7	354°56.9	.. 58.9	10°34.6	.. 48.5	357°12.7	.. 35.5	29°11.6	.. 21.5	Saturn	33°01.2	07:07					
10	11°17.2	9°56.7	57.8	25°35.3	47.7	12°14.7	35.3	44°13.9	21.4	May 03 Tue	359°06.2	09:20					
11	26°19.6	24°56.5	56.8	40°36.0	47.0	27°16.7	35.1	59°16.3	21.4	Venus	14°35.8	08:18					
12	41°22.1	39°56.3	S00°55.8	55°36.7	S07°46.3	42°18.7	S01°34.9	74°18.6	S14°21.4	Mars	1°02.3	09:11		</td			

DUT1 = UT1-UTC = -0.0975 sec  $\Delta T = TT-UT1 = +69.2815$  sec

2022 May 01 to May. 03 UT

h		Sun		Moon			
Sun	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	180°42.4	N15°00.4	178°45.5	13.9'	N14°38.1	12.0'	55.2'
1	195°42.5	01.2	193°18.4	13.9'	14°50.1	12.0'	55.1'
2	210°42.6	01.9	207°51.3	13.8'	15°02.1	11.9'	55.1'
3	225°42.7	.. 02.7	222°24.2	13.8'	15°14.0	11.8'	55.1'
4	240°42.7	03.4	236°57.0	13.8'	15°25.8	11.7'	55.1'
5	255°42.8	04.2	251°29.7	13.7'	15°37.5	11.7'	55.1'
6	270°42.9	N15°05.0	266°02.5	13.7'	N15°49.2	11.6'	55.1'
7	285°42.9	05.7	280°35.2	13.7'	16°00.8	11.5'	55.0'
8	300°43.0	06.5	295°07.8	13.6'	16°12.3	11.4'	55.0'
9	315°43.1	.. 07.2	309°40.5	13.6'	16°23.8	11.4'	55.0'
10	330°43.2	08.0	324°13.0	13.5'	16°35.1	11.3'	55.0'
11	345°43.2	08.7	338°45.6	13.5'	16°46.4	11.2'	55.0'
12	0°43.3	N15°09.5	353°18.1	13.5'	N16°57.6	11.1'	55.0'
13	15°43.4	10.2	7°50.5	13.4'	17°08.8	11.0'	54.9'
14	30°43.5	11.0	22°23.0	13.4'	17°19.8	11.0'	54.9'
15	45°43.5	.. 11.7	36°55.3	13.3'	17°30.8	10.9'	54.9'
16	60°43.6	12.5	51°27.7	13.3'	17°41.6	10.8'	54.9'
17	75°43.7	13.3	66°00.0	13.3'	17°52.4	10.7'	54.9'
18	90°43.8	N15°14.0	80°32.2	13.2'	N18°03.2	10.6'	54.9'
19	105°43.8	14.8	95°04.4	13.2'	18°13.8	10.5'	54.8'
20	120°43.9	15.5	109°36.6	13.1'	18°24.3	10.5'	54.8'
21	135°44.0	.. 16.3	124°08.7	13.1'	18°34.8	10.4'	54.8'
22	150°44.0	17.0	138°40.8	13.0'	18°45.2	10.3'	54.8'
23	165°44.1	17.8	153°12.8	13.0'	18°55.4	10.2'	54.8'
SD = 15.9'		SD = 15.0'					
Mon	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	180°44.2	N15°18.5	167°44.8	12.9'	N19°05.6	10.1'	54.8'
1	195°44.2	19.3	182°16.8	12.9'	19°15.7	10.0'	54.8'
2	210°44.3	20.0	196°48.7	12.9'	19°25.8	9.9'	54.7'
3	225°44.4	.. 20.7	211°20.5	12.8'	19°35.7	9.8'	54.7'
4	240°44.5	21.5	225°52.4	12.8'	19°45.5	9.7'	54.7'
5	255°44.5	22.2	240°24.1	12.7'	19°55.3	9.6'	54.7'
6	270°44.6	N15°23.0	254°55.9	12.7'	N20°04.9	9.6'	54.7'
7	285°44.7	23.7	269°27.5	12.6'	20°14.4	9.5'	54.7'
8	300°44.7	24.5	283°59.2	12.6'	20°23.9	9.4'	54.6'
9	315°44.8	.. 25.2	298°30.8	12.5'	20°33.3	9.3'	54.6'
10	330°44.9	26.0	313°02.3	12.5'	20°42.5	9.2'	54.6'
11	345°44.9	26.7	327°33.8	12.5'	20°51.7	9.1'	54.6'
12	0°45.0	N15°27.5	342°05.3	12.4'	N21°00.8	9.0'	54.6'
13	15°45.1	28.2	356°36.7	12.4'	21°09.7	8.9'	54.6'
14	30°45.1	28.9	11°08.0	12.3'	21°18.6	8.8'	54.6'
15	45°45.2	.. 29.7	25°39.4	12.3'	21°27.4	8.7'	54.6'
16	60°45.3	30.4	40°10.6	12.2'	21°36.0	8.6'	54.5'
17	75°45.3	31.2	54°41.9	12.2'	21°44.6	8.5'	54.5'
18	90°45.4	N15°31.9	69°13.1	12.1'	N21°53.1	8.4'	54.5'
19	105°45.5	32.6	83°44.2	12.1'	22°01.4	8.3'	54.5'
20	120°45.5	33.4	98°15.3	12.1'	22°09.7	8.2'	54.5'
21	135°45.6	.. 34.1	112°46.4	12.0'	22°17.8	8.0'	54.5'
22	150°45.7	34.9	127°17.4	12.0'	22°25.9	7.9'	54.5'
23	165°45.7	35.6	141°48.3	11.9'	22°33.8	7.8'	54.4'
SD = 15.9'		SD = 14.9'					
Tue	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	180°45.8	N15°36.3	156°19.2	11.9'	N22°41.7	7.7'	54.4'
1	195°45.9	37.1	170°50.1	11.8'	22°49.4	7.6'	54.4'
2	210°45.9	37.8	185°21.0	11.8'	22°57.0	7.5'	54.4'
3	225°46.0	.. 38.6	199°51.7	11.7'	23°04.5	7.4'	54.4'
4	240°46.0	39.3	214°22.5	11.7'	23°11.9	7.3'	54.4'
5	255°46.1	40.0	228°53.2	11.7'	23°19.2	7.2'	54.4'
6	270°46.2	N15°40.8	243°23.9	11.6'	N23°26.4	7.1'	54.4'
7	285°46.2	41.5	257°54.5	11.6'	23°33.5	7.0'	54.4'
8	300°46.3	42.2	272°25.1	11.5'	23°40.5	6.8'	54.3'
9	315°46.4	.. 43.0	286°55.6	11.5'	23°47.3	6.7'	54.3'
10	330°46.4	43.7	301°26.1	11.5'	23°54.0	6.6'	54.3'
11	345°46.5	44.4	315°56.6	11.4'	24°00.7	6.5'	54.3'
12	0°46.6	N15°45.2	330°27.0	11.4'	N24°07.2	6.4'	54.3'
13	15°46.6	45.9	344°57.4	11.3'	24°13.6	6.3'	54.3'
14	30°46.7	46.6	359°27.7	11.3'	24°19.8	6.2'	54.3'
15	45°46.7	.. 47.4	13°58.0	11.3'	24°26.0	6.0'	54.3'
16	60°46.8	48.1	28°28.3	11.2'	24°32.1	5.9'	54.3'
17	75°46.9	48.8	42°58.5	11.2'	24°38.0	5.8'	54.2'
18	90°46.9	N15°49.6	57°28.7	11.2'	N24°43.8	5.7'	54.2'
19	105°47.0	50.3	71°58.8	11.1'	24°49.5	5.6'	54.2'
20	120°47.0	51.0	86°29.0	11.1'	24°55.1	5.5'	54.2'
21	135°47.1	.. 51.7	100°59.0	11.0'	25°00.5	5.3'	54.2'
22	150°47.2	52.5	115°29.1	11.0'	25°05.9	5.2'	54.2'
23	165°47.2	53.2	129°59.1	11.0'	25°11.1	5.1'	54.2'
SD = 15.9'		SD = 14.8'					

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

Day	Sun		Moon		Age
	Eqn.of	Time	Mer.	Mer. Pass.	
	00 <sup>h</sup> mm:ss	12 <sup>h</sup> mm:ss	Pass	Upper hh:mm	Lower hh:mm
01	02:50	02:53	11:57	12:28	00:05
02	02:57	03:00	11:57	13:14	00:51
03	03:03	03:06	11:57	14:02	01:38

## May 04, 05, 06 UT (Wed., Thu., Fri.)

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	221°51.7	219°54.0	S00°43.4	235°45.1	S07°37.8	222°42.6	S01°32.6	254°46.6	S14°20.9	Alpheratz	357°37.3	29°12.5					
1	236°54.1	234°53.8	42.3	250°45.8	37.1	237°44.6	32.4	269°49.0	20.9	Ankaa	353°09.7	-42°11.1					
2	251°56.6	249°53.6	41.3	265°46.5	36.4	252°46.6	32.2	284°51.3	20.9	Schedar	349°34.0	56°39.3					
3	266°59.0	264°53.4	40.2	280°47.2	35.7	267°48.6	32.0	299°53.7	20.8	Diphda	348°49.8	-17°52.0					
4	282°01.5	279°53.2	39.2	295°47.9	35.0	282°50.6	31.8	314°56.0	20.8	Achernar	335°22.4	-57°07.4					
5	297°04.0	294°53.0	38.2	310°48.6	34.3	297°52.6	31.6	329°58.3	20.7	Hamal	327°54.1	23°33.9					
6	312°06.4	309°52.8	S00°37.1	325°49.3	S07°33.6	312°54.6	S01°31.4	345°00.7	S14°20.7	Polaris	315°33.8	89°21.4					
7	327°08.9	324°52.6	36.1	340°50.1	32.9	327°56.6	31.2	0°03.0	20.7	Acamar	315°13.9	-40°13.0					
8	342°11.4	339°52.4	35.1	355°50.8	32.2	342°58.5	31.0	15°05.4	20.6	Menkar	314°08.8	4°10.5					
9	357°13.8	354°52.2	34.0	10°51.5	31.5	358°00.5	30.8	30°07.7	20.6	Mirfak	308°31.9	49°56.3					
10	12°16.3	9°52.0	33.0	25°52.2	30.8	13°02.5	30.6	45°10.0	20.6	Aldebaran	290°42.5	16°33.1					
11	27°18.8	24°51.8	32.0	40°52.9	30.1	28°04.5	30.4	60°12.4	20.5	Rigel	281°06.3	-8°10.7					
12	42°21.2	39°51.6	S00°30.9	55°53.6	S07°29.3	43°06.5	S01°30.2	75°14.7	S14°20.5	Capella	280°25.6	46°01.2					
13	57°23.7	54°51.4	29.9	70°54.3	28.6	58°08.5	30.0	90°17.1	20.5	Bellatrix	278°25.5	6°22.1					
14	72°26.2	69°51.2	28.8	85°55.0	27.9	73°10.5	29.8	105°19.4	20.4	Elnath	278°05.0	28°37.5					
15	87°28.6	84°51.0	27.8	100°55.7	27.2	88°12.5	29.6	120°21.7	20.4	Alnilam	275°40.3	-1°11.4					
16	102°31.1	99°50.8	26.8	115°56.4	26.5	103°14.5	29.4	135°24.1	20.4	Betelgeuse	270°54.7	7°24.6					
17	117°33.5	114°50.6	25.7	130°57.1	25.8	118°16.5	29.2	150°26.4	20.3	Canopus	263°53.7	-52°42.7					
18	132°36.0	129°50.4	S00°24.7	145°57.8	S07°25.1	133°18.5	S01°29.0	165°28.8	S14°20.3	Sirius	258°28.4	-16°45.0					
19	147°38.5	144°50.2	23.6	160°58.5	24.4	148°20.5	28.8	180°31.1	20.3	Adhara	255°07.8	-29°00.3					
20	162°40.9	159°50.0	22.6	175°59.2	23.7	163°22.5	28.6	195°33.5	20.2	Procyon	244°53.3	5°10.0					
21	177°43.4	174°49.8	21.6	190°59.9	23.0	178°24.5	28.4	210°35.8	20.2	Pollux	243°20.2	27°58.4					
22	192°45.9	189°49.6	20.5	206°00.6	22.3	193°26.5	28.3	225°38.1	20.2	Avior	234°15.7	-59°35.1					
23	207°48.3	204°49.4	19.5	221°01.3	21.5	208°28.5	28.1	240°40.5	20.1	Suhail	222°47.9	-43°31.6					
Mer.pass. 09:11			ν -0.2° d 1.0' m -4.09	ν 0.7° d 0.7' m 0.83	ν 2.0° d 0.2' m -2.12	ν 2.3° d 0.0' m 0.78	Mer.pass. 09:07			Alplacidus	221°38.7	-69°48.8					
Fri			ν -0.2° d 1.0' m -4.09	ν 0.7° d 0.7' m 0.83	ν 2.0° d 0.2' m -2.12	ν 2.3° d 0.0' m 0.78	Alphard			Alphard	217°49.9	-8°45.4					
Thu			ν -0.2° d 1.0' m -4.09	ν 0.7° d 0.7' m 0.83	ν 2.0° d 0.2' m -2.12	ν 2.3° d 0.0' m 0.78	Regulus			Regulus	207°36.7	11°51.5					
Fri			ν -0.2° d 1.0' m -4.09	ν 0.7° d 0.7' m 0.83	ν 2.0° d 0.2' m -2.12	ν 2.3° d 0.0' m 0.78	Dubhe			Dubhe	193°43.5	61°38.1					
Sat			ν -0.2° d 1.0' m -4.09	ν 0.7° d 0.7' m 0.83	ν 2.0° d 0.2' m -2.12	ν 2.3° d 0.0' m 0.78	Denebola			Denebola	182°27.0	14°26.9					
Sun			ν -0.2° d 1.0' m -4.09	ν 0.7° d 0.7' m 0.83	ν 2.0° d 0.2' m -2.12	ν 2.3° d 0.0' m 0.78	Gienah			Gienah	175°45.6	-17°40.0					
Mon			ν -0.2° d 1.0' m -4.09	ν 0.7° d 0.7' m 0.83	ν 2.0° d 0.2' m -2.12	ν 2.3° d 0.0' m 0.78	Acrux			Acrux	173°02.0	-63°13.5					
Tue			ν -0.2° d 1.0' m -4.09	ν 0.7° d 0.7' m 0.83	ν 2.0° d 0.2' m -2.12	ν 2.3° d 0.0' m 0.78	Gacrux			Gacrux	171°53.6	-57°14.4					
Wed			ν -0.2° d 1.0' m -4.09	ν 0.7° d 0.7' m 0.83	ν 2.0° d 0.2' m -2.12	ν 2.3° d 0.0' m 0.78	Alioth			Alioth	166°14.5	55°50.5					
Thu			ν -0.2° d 1.0' m -4.09	ν 0.7° d 0.7' m 0.83	ν 2.0° d 0.2' m -2.12	ν 2.3° d 0.0' m 0.78	Spica			Spica	158°24.4	-11°16.7					
Fri			ν -0.2° d 1.0' m -4.09	ν 0.7° d 0.7' m 0.83	ν 2.0° d 0.2' m -2.12	ν 2.3° d 0.0' m 0.78	Alkaid			Alkaid	152°53.3	49°12.2					
Sat			ν -0.2° d 1.0' m -4.09	ν 0.7° d 0.7' m 0.83	ν 2.0° d 0.2' m -2.12	ν 2.3° d 0.0' m 0.78	Hadar			Hadar	148°38.5	-60°28.9					
Sun			ν -0.2° d 1.0' m -4.09	ν 0.7° d 0.7' m 0.83	ν 2.0° d 0.2' m -2.12	ν 2.3° d 0.0' m 0.78	Menkent			Menkent	147°59.9	-36°28.8					
Mon			ν -0.2° d 1.0' m -4.09	ν 0.7° d 0.7' m 0.83	ν 2.0° d 0.2' m -2.12	ν 2.3° d 0.0' m 0.78	Arcturus			Arcturus	145°49.6	19°04.0					
Tue			ν -0.2° d 1.0' m -4.09	ν 0.7° d 0.7' m 0.83	ν 2.0° d 0.2' m -2.12	ν 2.3° d 0.0' m 0.78	Rigel Kent.			Rigel Kent.	139°42.7	-60°55.6					
Wed			ν -0.2° d 1.0' m -4.09	ν 0.7° d 0.7' m 0.83	ν 2.0° d 0.2' m -2.12	ν 2.3° d 0.0' m 0.78	Kochab			Kochab	137°18.6	74°03.9					
Thu			ν -0.2° d 1.0' m -4.09	ν 0.7° d 0.7' m 0.83	ν 2.0° d 0.2' m -2.12	ν 2.3° d 0.0' m 0.78	Zuben'ubi			Zuben'ubi	136°58.2	-16°08.1					
Fri			ν -0.2° d 1.0' m -4.09	ν 0.7° d 0.7' m 0.83	ν 2.0° d 0.2' m -2.12	ν 2.3° d 0.0' m 0.78	Alphecca			Alphecca	126°05.3	26°38.3					
Sat			ν -0.2° d 1.0' m -4.09	ν 0.7° d 0.7' m 0.83	ν 2.0° d 0.2' m -2.12	ν 2.3° d 0.0' m 0.78	Antares			Antares	112°18.2	-26°28.9					
Sun			ν -0.2° d 1.0' m -4.09	ν 0.7° d 0.7' m 0.83	ν 2.0° d 0.2' m -2.12	ν 2.3° d 0.0' m 0.78	Atria			Atria	107°14.0	-69°03.9					
Mon			ν -0.2° d 1.0' m -4.09	ν 0.7° d 0.7' m 0.83	ν 2.0° d 0.2' m -2.12	ν 2.3° d 0.0' m 0.78	Sabik			Sabik	102°05.1	-15°45.2					
Tue			ν -0.2° d 1.0' m -4.09	ν 0.7° d 0.7' m 0.83	ν 2.0° d 0.2' m -2.12	ν 2.3° d 0.0' m 0.78	Shaula			Shaula	96°13.1	-37°07.1					
Wed			ν -0.2° d 1.0' m -4.09	ν 0.7° d 0.7' m 0.83	ν 2.0° d 0.2' m -2.12	ν 2.3° d 0.0' m 0.78	Rasalhague			Rasalhague	96°00.4	12°32.5					
Thu			ν -0.2° d 1.0' m -4.09	ν 0.7° d 0.7' m 0.83	ν 2.0° d 0.2' m -2.12	ν 2.3° d 0.0' m 0.78	Eltanin			Eltanin	90°42.8	51°28.9					
Fri			ν -0.2° d 1.0' m -4.09	ν 0.7° d 0.7' m 0.83	ν 2.0° d 0.2' m -2.12	ν 2.3° d 0.0' m 0.78	Kaus Aust.			Kaus Aust.	83°35.2	-34°22.4					
Sat			ν -0.2° d 1.0' m -4.09	ν 0.7° d 0.7' m 0.83	ν 2.0° d 0.2' m -2.12	ν 2.3° d 0.0' m 0.78	Vega			Vega	80°34.5	38°48.0					
Sun			ν -0.2° d 1.0' m -4.09	ν 0.7° d 0.7' m 0.83	ν 2.0° d 0.2' m -2.12	ν 2.3° d 0.0' m 0.78	Nunki			Nunki	75°50.3	-26°16.1					
Mon			ν -0.2° d 1.0' m -4.09	ν 0.7° d 0.7' m 0.83	ν 2.0° d 0.2' m -2.12	ν 2.3° d 0.0' m 0.78	Altair			Altair	62°02.0	8°55.5					
Tue			ν -0.2° d 1.0' m -4.09	ν 0.7° d 0.7' m 0.83	ν 2.0° d 0.2' m -2.12	ν 2.3° d 0.0' m 0.78	Peacock			Peacock	53°09.2	-56°39.6					
Wed			ν -0.2° d 1.0' m -4.09	ν 0.7° d 0.7' m 0.83	ν 2.0° d 0.2' m -2.12	ν 2.3° d 0.0' m 0.78	Deneb			Deneb	49°27.3	45°21.2					
Thu			ν -0.2° d 1.0' m -4.09	ν 0.7° d 0.7' m 0.83	ν 2.0° d 0.2' m -2.12	ν 2.3° d 0.0' m 0.78	Enif			Enif	33°41.0	9°58.4					
Fri			ν -0.2° d 1.0' m -4.09	ν 0.7° d 0.7' m 0.83	ν 2.0° d 0.2' m -2.12	ν 2.3° d 0.0' m 0.78	Al Na'ir			Al Na'ir	27°35.9	-46°51.1					
Sat			ν -0.2° d 1.0' m -4.09	ν 0.7° d 0.7' m 0.83	ν 2.0° d												

DUT1 = UT1-UTC = -0.0969 sec  $\Delta T = TT-UT1 = +69.2809$  sec

2022 May 04 to May. 06 UT

h		Sun		Moon				
Wed		GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	180°47.3	N15°53.9	144°29.1	10.9'	N25°16.2	5.0'	54.2'	
1	195°47.3	54.7	158°59.0	10.9'	25°21.2	4.9'	54.2'	
2	210°47.4	55.4	173°28.9	10.9'	25°26.1	4.7'	54.2'	
3	225°47.5	.. 56.1	187°58.8	10.9'	25°30.8	4.6'	54.2'	
4	240°47.5	56.8	202°28.7	10.8'	25°35.4	4.5'	54.2'	
5	255°47.6	57.6	216°58.5	10.8'	25°39.9	4.4'	54.2'	
6	270°47.6	N15°58.3	231°28.3	10.8'	N25°44.3	4.3'	54.1'	
7	285°47.7	59.0	245°58.1	10.7'	25°48.5	4.1'	54.1'	
8	300°47.7	15°59.7	260°27.8	10.7'	25°52.7	4.0'	54.1'	
9	315°47.8	16°00.5	274°57.5	10.7'	25°56.7	3.9'	54.1'	
10	330°47.9	01.2	289°27.2	10.7'	26°00.5	3.8'	54.1'	
11	345°47.9	01.9	303°56.9	10.6'	26°04.3	3.6'	54.1'	
12	0°48.0	N16°02.6	318°26.5	10.6'	N26°07.9	3.5'	54.1'	
13	15°48.0	03.3	332°56.1	10.6'	26°11.4	3.4'	54.1'	
14	30°48.1	04.1	347°25.7	10.6'	26°14.8	3.3'	54.1'	
15	45°48.1	.. 04.8	1°55.3	10.5'	26°18.1	3.1'	54.1'	
16	60°48.2	05.5	16°24.8	10.5'	26°21.2	3.0'	54.1'	
17	75°48.2	06.2	30°54.3	10.5'	26°24.2	2.9'	54.1'	
18	90°48.3	N16°06.9	45°23.9	10.5'	N26°27.1	2.7'	54.1'	
19	105°48.4	07.7	59°53.3	10.5'	26°29.8	2.6'	54.1'	
20	120°48.4	08.4	74°22.8	10.5'	26°32.4	2.5'	54.1'	
21	135°48.5	.. 09.1	88°52.3	10.4'	26°34.9	2.4'	54.1'	
22	150°48.5	09.8	103°21.7	10.4'	26°37.3	2.2'	54.1'	
23	165°48.6	10.5	117°51.1	10.4'	26°39.5	2.1'	54.1'	
		SD = 15.9'		SD = 14.8'				
Thu		GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	180°48.6	N16°11.2	132°20.5	10.4'	N26°41.7	2.0'	54.1'	
1	195°48.7	12.0	146°49.9	10.4'	26°43.6	1.9'	54.0'	
2	210°48.7	12.7	161°19.3	10.4'	26°45.5	1.7'	54.0'	
3	225°48.8	.. 13.4	175°48.7	10.4'	26°47.2	1.6'	54.0'	
4	240°48.8	14.1	190°18.1	10.4'	26°48.8	1.5'	54.0'	
5	255°48.9	14.8	204°47.4	10.3'	26°50.3	1.3'	54.0'	
6	270°48.9	N16°15.5	219°16.7	10.3'	N26°51.6	1.2'	54.0'	
7	285°49.0	16.2	233°46.1	10.3'	26°52.8	1.1'	54.0'	
8	300°49.0	17.0	248°15.4	10.3'	26°53.9	1.0'	54.0'	
9	315°49.1	.. 17.7	262°44.7	10.3'	26°54.9	0.8'	54.0'	
10	330°49.1	18.4	277°14.1	10.3'	26°55.7	0.7'	54.0'	
11	345°49.2	19.1	291°43.4	10.3'	26°56.4	0.6'	54.0'	
12	0°49.2	N16°19.8	306°12.7	10.3'	N26°57.0	0.4'	54.0'	
13	15°49.3	20.5	320°42.0	10.3'	26°57.4	0.3'	54.0'	
14	30°49.3	21.2	335°11.3	10.3'	26°57.7	0.2'	54.0'	
15	45°49.4	.. 21.9	349°40.6	10.3'	26°57.9	0.1'	54.0'	
16	60°49.4	22.6	4°09.9	10.3'	26°58.0	-0.1'	54.0'	
17	75°49.5	23.4	18°39.2	10.3'	26°57.9	-0.2'	54.0'	
18	90°49.5	N16°24.1	33°08.6	10.3'	N26°57.7	-0.3'	54.0'	
19	105°49.6	24.8	47°37.9	10.3'	26°57.3	-0.5'	54.0'	
20	120°49.6	25.5	62°07.2	10.3'	26°56.9	-0.6'	54.0'	
21	135°49.7	.. 26.2	76°36.5	10.3'	26°56.3	-0.7'	54.0'	
22	150°49.7	26.9	91°05.9	10.3'	26°55.5	-0.9'	54.0'	
23	165°49.8	27.6	105°35.2	10.4'	26°54.7	-1.0'	54.0'	
		SD = 15.9'		SD = 14.7'				
Fri		GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	180°49.8	N16°28.3	120°04.6	10.4'	N26°53.7	-1.1'	54.0'	
1	195°49.9	29.0	134°33.9	10.4'	26°52.6	-1.2'	54.1'	
2	210°49.9	29.7	149°03.3	10.4'	26°51.4	-1.4'	54.1'	
3	225°50.0	.. 30.4	163°32.7	10.4'	26°50.0	-1.5'	54.1'	
4	240°50.0	31.1	178°02.1	10.4'	26°48.5	-1.6'	54.1'	
5	255°50.1	31.8	192°31.5	10.4'	26°46.9	-1.8'	54.1'	
6	270°50.1	N16°32.5	207°00.9	10.4'	N26°45.1	-1.9'	54.1'	
7	285°50.2	33.2	221°30.3	10.5'	26°43.2	-2.0'	54.1'	
8	300°50.2	33.9	235°59.8	10.5'	26°41.2	-2.1'	54.1'	
9	315°50.2	.. 34.6	250°29.3	10.5'	26°39.1	-2.3'	54.1'	
10	330°50.3	35.3	264°58.7	10.5'	26°36.8	-2.4'	54.1'	
11	345°50.3	36.0	279°28.2	10.5'	26°34.5	-2.5'	54.1'	
12	0°50.4	N16°36.7	293°57.8	10.5'	N26°31.9	-2.6'	54.1'	
13	15°50.4	37.4	308°27.3	10.6'	26°29.3	-2.8'	54.1'	
14	30°50.5	38.1	322°56.9	10.6'	26°26.5	-2.9'	54.1'	
15	45°50.5	.. 38.8	337°26.5	10.6'	26°23.6	-3.0'	54.1'	
16	60°50.6	39.5	351°56.1	10.6'	26°20.6	-3.1'	54.1'	
17	75°50.6	40.2	6°25.7	10.7'	26°17.5	-3.3'	54.1'	
18	90°50.6	N16°40.9	20°55.3	10.7'	N26°14.2	-3.4'	54.1'	
19	105°50.7	41.6	35°25.0	10.7'	26°10.8	-3.5'	54.1'	
20	120°50.7	42.3	49°54.7	10.7'	26°07.3	-3.6'	54.2'	
21	135°50.8	.. 43.0	64°24.4	10.8'	26°03.7	-3.8'	54.2'	
22	150°50.8	43.7	78°54.2	10.8'	25°59.9	-3.9'	54.2'	
23	165°50.9	44.4	93°24.0	10.8'	25°56.0	-4.0'	54.2'	
		SD = 15.8'		SD = 14.7'				

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

Lat.	Wed	Moonrise Thu	Fri	Wed	Moonset Thu	Fri
N 72°		---	---	---	---	---
N 70°		---	---	---	---	---
68°		---	---	---	---	---
66°		---	---	---	---	---
64°	03:19	---	---	01:28	---	---
62°	04:15	04:35	05:27	00:33	01:58	02:51
60°	04:48	05:18	06:11	00:00	01:15	02:08
N 58°	05:12	05:47	06:40	---	00:46	01:38
56°	05:32	06:10	07:02	---	00:23	01:16
54°	05:48	06:28	07:20	---	00:05	00:58
52°	06:03	06:43	07:36	23:50	---	00:42
50°	06:15	06:57	07:49	23:36	---	00:29
45°	06:41	07:25	08:17	23:09	---	00:01
N 40°	07:01	07:46	08:38	22:47	23:39	---
35°	07:18	08:04	08:56	22:29</		

## May 07, 08, 09 UT (Sat., Sun., Mon.)

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	224°49.1	219°39.6	N00°31.6	236°35.9	S06°46.7	225°06.4	S01°18.5	257°35.4	S14°18.5					Alpheratz	357°37.3	29°12.5	
1	239°51.5	234°39.4	32.7	251°36.6	46.0	240°08.4	18.3	272°37.8	18.5					Ankaa	353°09.7	-42°11.1	
2	254°54.0	249°39.2	33.7	266°37.4	45.2	255°10.4	18.1	287°40.1	18.4					Schedar	349°34.0	56°39.3	
3	269°56.5	264°39.0	34.8	281°38.1	44.5	270°12.4	18.0	302°42.5	18.4					Diphda	348°49.8	-17°52.0	
4	284°58.9	279°38.8	35.8	296°38.8	43.8	285°14.4	17.8	317°44.8	18.4					Achernar	335°22.4	-57°07.4	
5	300°01.4	294°38.6	36.9	311°39.5	43.1	300°16.4	17.6	332°47.2	18.3					Hamal	327°54.0	23°33.9	
6	315°03.9	309°38.4	N00°37.9	326°40.2	S06°42.4	315°18.4	S01°17.4	347°49.5	S14°18.3					Polaris	315°33.5	89°21.4	
7	330°06.3	324°38.2	39.0	341°40.9	41.7	330°20.4	17.2	2°51.9	18.3					Acamar	315°13.9	-40°13.0	
8	345°08.8	339°38.0	40.0	356°41.6	41.0	345°22.4	17.0	17°54.2	18.3					Menkar	314°08.8	4°10.5	
9	0°11.3	354°37.8	41.1	11°42.3	40.2	0°24.4	16.8	32°56.6	18.2					Mirfak	308°31.9	49°56.3	
10	15°13.7	9°37.6	42.1	26°43.0	39.5	15°26.4	16.6	47°58.9	18.2					Aldebaran	290°42.5	16°33.1	
11	30°16.2	24°37.4	43.2	41°43.7	38.8	30°28.4	16.4	63°01.3	18.2					Rigel	281°06.3	-8°10.7	
12	45°18.6	39°37.2	N00°44.2	56°44.5	S06°38.1	45°30.4	S01°16.2	78°03.6	S14°18.1					Capella	280°25.6	46°01.2	
13	60°21.1	54°37.0	45.3	71°45.2	37.4	60°32.4	16.0	93°06.0	18.1					Bellatrix	278°25.5	6°22.1	
14	75°23.6	69°36.8	46.3	86°45.9	36.7	75°34.4	15.8	108°08.3	18.1					Elnath	278°05.0	28°37.5	
15	90°26.0	84°36.6	47.4	101°46.6	36.0	90°36.4	15.6	123°10.7	18.0					Alnilam	275°40.3	-1°11.4	
16	105°28.5	99°36.4	48.4	116°47.3	35.2	105°38.4	15.5	138°13.0	18.0					Betelgeuse	270°54.7	7°24.6	
17	120°31.0	114°36.2	49.5	131°48.0	34.5	120°40.4	15.3	153°15.4	18.0					Canopus	263°53.8	-52°42.7	
18	135°33.4	129°36.0	N00°50.5	146°48.7	S06°33.8	135°42.4	S01°15.1	168°17.7	S14°17.9					Sirius	258°28.4	-16°45.0	
19	150°35.9	144°35.8	51.6	161°49.4	33.1	150°44.4	14.9	183°20.1	17.9					Adhara	255°07.8	-29°00.3	
20	165°38.4	159°35.6	52.6	176°50.1	32.4	165°46.4	14.7	198°22.4	17.9					Procyon	244°53.3	5°10.0	
21	180°40.8	174°35.4	53.7	191°50.9	31.7	180°48.4	14.5	213°24.8	17.8					Pollux	243°20.2	27°58.4	
22	195°43.3	189°35.1	54.7	206°51.6	30.9	195°50.5	14.3	228°27.1	17.8					Avior	234°15.8	-59°35.1	
23	210°45.7	204°34.9	55.8	221°52.3	30.2	210°52.5	14.1	243°29.5	17.8					Suhail	222°47.9	-43°31.6	
Mer.pass.			08:59	ν -0.2° d 1.0' m -4.08			ν 0.7° d 0.7' m 0.81			ν 2.0° d 0.2' m -2.13			ν 2.3° d 0.0' m 0.78				
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	225°48.2	219°34.7	N00°56.8	236°53.0	S06°29.5	225°54.5	S01°13.9	258°31.9	S14°17.8					Denebola	193°43.5	61°38.1	
1	240°50.7	234°34.5	57.9	251°53.7	28.8	240°56.5	13.7	273°34.2	17.7					Gienah	175°45.6	-17°40.0	
2	255°53.1	249°34.3	00°58.9	266°54.4	28.1	255°58.5	13.5	288°36.6	17.7					Acru	173°02.0	-63°13.5	
3	270°55.6	264°34.1	01°00.0	281°55.1	27.4	271°00.5	13.3	303°38.9	17.7					Gacrux	171°53.6	-57°14.4	
4	285°58.1	279°33.9	01.0	296°55.8	26.7	286°02.5	13.2	318°41.3	17.6					Alioth	166°14.5	55°50.5	
5	301°00.5	294°33.7	02.1	311°56.6	25.9	301°04.5	13.0	333°43.6	17.6					Spica	158°24.4	-11°16.7	
6	316°03.0	309°33.5	N01°03.1	326°57.3	S06°25.2	316°06.5	S01°12.8	348°46.0	S14°17.6					Alkaid	152°53.3	49°12.2	
7	331°05.5	324°33.3	04.2	341°58.0	24.5	331°08.5	12.6	3°48.3	17.5					Hadar	148°38.5	-60°28.9	
8	346°07.9	339°33.1	05.2	356°58.7	23.8	346°10.5	12.4	18°50.7	17.5					Menkent	147°59.8	-36°28.8	
9	1°10.4	354°32.9	06.3	11°59.4	23.1	1°12.5	12.2	33°53.0	17.5					Arcturus	145°49.6	19°04.0	
10	16°12.9	9°32.7	07.3	27°00.1	22.4	16°14.5	12.0	48°55.4	17.5					Rigel Kent.	139°42.7	-60°55.7	
11	31°15.3	24°32.5	08.4	42°00.8	21.6	31°16.5	11.8	63°57.7	17.4					Kochab	137°18.6	74°03.9	
12	46°17.8	39°32.3	N01°09.4	57°01.5	S06°20.9	46°18.5	S01°11.6	79°00.1	S14°17.4					Zuben'ubi	136°58.1	-16°08.1	
13	61°20.2	54°32.1	10.5	72°02.3	20.2	61°20.5	11.4	94°02.5	17.4					Alphecca	126°05.3	26°38.3	
14	76°22.7	69°31.9	11.5	87°03.0	19.5	76°22.5	11.2	109°04.8	17.3					Antares	112°18.2	-26°28.9	
15	91°25.2	84°31.6	12.6	102°03.7	18.8	91°24.5	11.1	124°07.2	17.3					Atria	107°13.9	-69°03.9	
16	106°27.6	99°31.4	13.6	117°04.4	18.1	106°26.6	10.9	139°09.5	17.3					Sabik	102°05.0	-15°45.2	
17	121°30.1	114°31.2	14.7	132°05.1	17.3	121°28.6	10.7	154°11.9	17.2					Shaula	96°13.0	-37°07.1	
18	136°32.6	129°31.0	N01°15.7	147°05.8	S06°16.6	136°30.6	S01°10.5	169°14.2	S14°17.2					Rasalhague	96°00.3	12°32.5	
19	151°35.0	144°30.8	16.8	162°06.5	15.9	151°32.6	10.3	184°16.6	17.2					Eltanin	90°42.8	51°28.9	
20	166°37.5	159°30.6	17.8	177°07.3	15.2	166°34.6	10.1	199°18.9	17.2					Kaus Aust.	83°35.2	-34°22.4	
21	181°40.0	174°30.4	18.9	192°08.0	14.5	181°36.6	09.9	214°21.3	17.1					Vega	80°34.4	38°48.0	
22	196°42.4	189°30.2	20.0	207°08.7	13.8	196°38.6	09.7	229°23.7	17.1					Nunki	75°50.3	-26°16.1	
23	211°44.9	204°30.0	21.0	222°09.4	13.0	211°40.6	09.5	244°26.0	17.1					Altair	62°02.0	8°55.5	
Mer.pass.			08:55	ν -0.2° d 1.1' m -4.07			ν 0.7° d 0.7' m 0.80			ν 2.0° d 0.2' m -2.14			ν 2.4° d 0.0' m 0.77				
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	226°47.4	219°29.8	N01°22.1	237°10.1	S06°12.3	226°42.6	S01°09.3	259°28.4	S14°17.0					Markab	13°32.3	15°19.3	
1	241°49.8	234°29.6	23.1	252°10.8	11.6	241°44.6	09.2	274°30.7	17.0					May 07 Sat	SHA	Mer.pass	
2	256°52.3	249°29.4	24.2	267°11.5	10.9	256°46.6	09.0	289°33.1	17.0					Venus	354°50.6	09:21	
3	271°54.7	264°29.2	25.2	282°12.3	10.2	271°48.6	08.8	304°35.4	17.0					Mars	11°46.9	08:13	
4	286°57.2	279°28.9	26.3	297°13.0	09.5	286°50.6	08.6	319°37.8	16.9					Jupiter	0°17.3	08:58	
5	301°59.7	294°28.7	27.3	312°13.7	08.7	301°52.7	08.4	334°40.2	16.9					Saturn	32°46.3	06:49	
6	317°02.1	309°28.5	N01°28.4	327°14.4	S06°08.0	316°54.7	S01°08.2	349°42.5	S14°16.9					May 08 Sun	SHA	Mer.pass	
7	332°04.6	324°28.3	29.4	342°15.1	07.3	331°56.7	08.0	4°44.9	16.8					Venus	353°46.5	09:22	
8	347°07.1	339°28.1	30.5	357°15.8	06.6	346°58.7	07.8	19°47.2	16.8					Mars	11°04.8	08:12	
9	2°09.5	354°27.9	31.5	12°16.6	05.9	2°00.7	07.6	34°49.6	16.8					Jupiter	0°06.2	08:55	
10	17°12.0	9°27.7	32.6	27°17.3	05.1	17°02.7	07.4	49°51.9	16.8					Saturn	32°43.6	06:45	
11	32°14.5	24°27.5	33.6	42°18.0	04.4	32											

DUT1 = UT1-UTC = -0.0956 sec  $\Delta T = TT-UT1 = +69.2796$  sec

2022 May 07 to May. 09 UT

h		Sun		Moon				
Sat		GHA	Dec	GHA	$\nu$	Dec	d	HP
0	180°50.9	N16°45.1	107°53.8	10.8'	N25°52.0	-4.1'	54.2'	
1	195°50.9	45.8	122°23.6	10.9'	25°47.9	-4.3'	54.2'	
2	210°51.0	46.5	136°53.5	10.9'	25°43.6	-4.4'	54.2'	
3	225°51.0	47.1	151°23.4	10.9'	25°39.2	-4.5'	54.2'	
4	240°51.1	47.8	165°53.3	11.0'	25°34.7	-4.6'	54.2'	
5	255°51.1	48.5	180°23.3	11.0'	25°30.1	-4.7'	54.2'	
6	270°51.1	N16°49.2	194°53.2	11.0'	N25°25.3	-4.9'	54.3'	
7	285°51.2	49.9	209°23.3	11.0'	25°20.5	-5.0'	54.3'	
8	300°51.2	50.6	223°53.3	11.1'	25°15.5	-5.1'	54.3'	
9	315°51.3	51.3	238°23.4	11.1'	25°10.4	-5.2'	54.3'	
10	330°51.3	52.0	252°53.5	11.1'	25°05.2	-5.3'	54.3'	
11	345°51.3	52.7	267°23.7	11.2'	24°59.8	-5.5'	54.3'	
12	0°51.4	N16°53.4	281°53.8	11.2'	N24°54.4	-5.6'	54.3'	
13	15°51.4	54.0	296°24.1	11.3'	24°48.8	-5.7'	54.3'	
14	30°51.5	54.7	310°54.3	11.3'	24°43.1	-5.8'	54.4'	
15	45°51.5	55.4	325°24.6	11.3'	24°37.3	-5.9'	54.4'	
16	60°51.5	56.1	339°54.9	11.4'	24°31.3	-6.0'	54.4'	
17	75°51.6	56.8	354°25.3	11.4'	24°25.3	-6.2'	54.4'	
18	90°51.6	N16°57.5	8°55.7	11.4'	N24°19.1	-6.3'	54.4'	
19	105°51.7	58.2	23°26.1	11.5'	24°12.9	-6.4'	54.4'	
20	120°51.7	58.8	37°56.6	11.5'	24°06.5	-6.5'	54.4'	
21	135°51.7	16°59.5	52°27.1	11.5'	24°00.0	-6.6'	54.5'	
22	150°51.8	17°00.2	66°57.6	11.6'	23°53.3	-6.7'	54.5'	
23	165°51.8	00.9	81°28.2	11.6'	23°46.6	-6.8'	54.5'	
SD = 15.8'		SD = 14.8'						

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

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

Day	Sun			Moon		
	Eqn.of	Time	Mer.	Mer. Pass.	Upper	Age
	00 <sup>h</sup>	12 <sup>h</sup>	Pass	Lower	hh:mm	7-9
mm:ss	mm:ss	mm:ss	hh:mm	hh:mm	hh:mm	31-50%
07	03:24	03:26	11:57	17:23	04:58	
08	03:27	03:29	11:57	18:11	05:47	
09	03:31	03:32	11:56	18:58	06:35	

## May 10, 11, 12 UT (Tue., Wed., Thu.)

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	227°46.5	219°24.8	N01°47.4	237°27.3	S05°55.1	227°30.8	S01°04.8	260°25.0	S14°16.4					Alpheratz	357°37.3	29°12.5	
1	242°49.0	234°24.5	48.4	252°28.0	54.4	242°32.9	04.6	275°27.3	16.3					Ankaa	353°09.7	-42°11.1	
2	257°51.4	249°24.3	49.5	267°28.7	53.7	257°34.9	04.4	290°29.7	16.3					Schedar	349°34.0	56°39.3	
3	272°53.9	264°24.1	50.5	282°29.5	52.9	272°36.9	04.2	305°32.1	16.3					Diphda	348°49.8	-17°51.9	
4	287°56.3	279°23.9	51.6	297°30.2	52.2	287°38.9	04.0	320°34.4	16.2					Achernar	335°22.4	-57°07.4	
5	302°58.8	294°23.7	52.6	312°30.9	51.5	302°40.9	03.9	335°36.8	16.2					Hamal	327°54.0	23°33.9	
6	318°01.3	309°23.5	N01°53.7	327°31.6	S05°50.8	317°42.9	S01°03.7	350°39.1	S14°16.2					Polaris	315°33.4	89°21.4	
7	333°03.7	324°23.3	54.8	342°32.3	50.1	332°44.9	03.5	5°41.5	16.2					Acamar	315°13.9	-40°13.0	
8	348°06.2	339°23.1	55.8	357°33.0	49.3	347°46.9	03.3	20°43.9	16.1					Menkar	314°08.8	4°10.5	
9	3°08.7	354°22.8	56.9	12°33.8	48.6	2°48.9	03.1	35°46.2	16.1					Mirfak	308°31.9	49°56.3	
10	18°11.1	9°22.6	57.9	27°34.5	47.9	17°51.0	02.9	50°48.6	16.1					Aldebaran	290°42.5	16°33.1	
11	33°13.6	24°22.4	01°59.0	42°35.2	47.2	32°53.0	02.7	65°51.0	16.1					Rigel	281°06.3	-8°10.7	
12	48°16.1	39°22.2	N02°00.0	57°35.9	S05°46.5	47°55.0	S01°02.5	80°53.3	S14°16.0					Capella	280°25.6	46°01.2	
13	63°18.5	54°22.0	01.1	72°36.6	45.7	62°57.0	02.4	95°55.7	16.0					Bellatrix	278°25.5	6°22.1	
14	78°21.0	69°21.8	02.1	87°37.4	45.0	77°59.0	02.2	110°58.0	16.0					Elnath	278°05.0	28°37.5	
15	93°23.5	84°21.6	03.2	102°38.1	44.3	93°01.0	02.0	126°00.4	15.9					Alnilam	275°40.3	-1°11.4	
16	108°25.9	99°21.4	04.3	117°38.8	43.6	108°03.0	01.8	141°02.8	15.9					Betelgeuse	270°54.8	7°24.6	
17	123°28.4	114°21.1	05.3	132°39.5	42.9	123°05.1	01.6	156°05.1	15.9					Canopus	263°53.8	-52°42.6	
18	138°30.8	129°20.9	N02°06.4	147°40.2	S05°42.1	138°07.1	S01°01.4	171°07.5	S14°15.9					Sirius	258°28.4	-16°44.9	
19	153°33.3	144°20.7	07.4	162°41.0	41.4	153°09.1	01.2	186°09.9	15.8					Adhara	255°07.8	-29°00.3	
20	168°35.8	159°20.5	08.5	177°41.7	40.7	168°11.1	01.0	201°12.2	15.8					Procyon	244°53.3	5°10.0	
21	183°38.2	174°20.3	09.5	192°42.4	40.0	183°13.1	00.9	216°14.6	15.8					Pollux	243°20.2	27°58.4	
22	198°40.7	189°20.1	10.6	207°43.1	39.3	198°15.1	00.7	231°16.9	15.8					Avior	234°15.8	-59°35.1	
23	213°43.2	204°19.9	11.7	222°43.8	38.5	213°17.1	00.5	246°19.3	15.7					Suhail	222°48.0	-43°31.6	
Mer.pass. 08:47		ν -0.2° d 1.1' m -4.06	ν 0.7° d 0.7' m 0.79	ν 2.0° d 0.2' m -2.14	ν 2.4° d 0.0' m 0.77												
Mer.pass. 08:44		ν -0.2° d 1.1' m -4.05	ν 0.7° d 0.7' m 0.78	ν 2.0° d 0.2' m -2.15	ν 2.4° d 0.0' m 0.76												
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	228°45.6	219°19.7	N02°12.7	237°44.6	S05°37.8	228°19.2	S01°00.3	261°21.7	S14°15.7					Denebola	193°43.5	61°38.1	
1	243°48.1	234°19.4	13.8	252°45.3	37.1	243°21.2	01°00.1	276°24.0	15.7					Gienah	175°45.6	-17°40.0	
2	258°50.6	249°19.2	14.8	267°46.0	36.4	258°23.2	00°59.9	291°26.4	15.7					Acrux	173°02.0	-63°13.5	
3	273°53.0	264°19.0	15.9	282°46.7	35.7	273°25.2	05.7	306°28.8	15.6					Gacrux	171°53.7	-57°14.4	
4	288°55.5	279°18.8	16.9	297°47.4	34.9	288°27.2	59.6	321°31.1	15.6					Alioth	166°14.5	55°50.5	
5	303°57.9	294°18.6	18.0	312°48.2	34.2	303°29.2	59.4	336°33.5	15.6					Spica	158°24.4	-11°16.7	
6	319°00.4	309°18.4	N02°19.1	327°48.9	S05°33.5	318°31.2	S00°59.2	351°35.9	S14°15.5					Alkaid	152°53.3	49°12.2	
7	334°02.9	324°18.1	20.1	342°49.6	32.8	333°33.3	59.0	6°38.2	15.5					Hadar	148°38.5	-60°28.9	
8	349°05.3	339°17.9	21.2	357°50.3	32.1	348°35.3	58.8	21°40.6	15.5					Menkent	147°59.8	-36°28.8	
9	4°07.8	354°17.7	22.2	12°51.0	31.3	3°37.3	58.6	36°43.0	15.5					Arcturus	145°49.6	19°04.0	
10	19°10.3	9°17.5	23.3	27°51.8	30.6	18°39.3	58.4	51°45.3	15.4					Rigel Kent.	139°42.7	-60°55.7	
11	34°12.7	24°17.3	24.3	42°52.5	29.9	33°41.3	58.2	66°47.7	15.4					Kochab	137°18.6	74°03.9	
12	49°15.2	39°17.1	N02°25.4	57°53.2	S05°29.2	48°43.3	S00°58.1	81°50.1	S14°15.4					Zuben'ubi	136°58.1	-16°08.1	
13	64°17.7	54°16.9	26.5	72°53.9	28.5	63°45.4	57.9	96°52.4	15.4					Alphecca	126°05.3	26°38.3	
14	79°20.1	69°16.6	27.5	87°54.6	27.7	78°47.4	57.7	111°54.8	15.3					Antares	112°18.2	-26°28.9	
15	94°22.6	84°16.4	28.6	102°55.4	27.0	93°49.4	57.5	126°57.2	15.3					Atria	107°13.9	-69°03.9	
16	109°25.1	99°16.2	29.6	117°56.1	26.3	108°51.4	57.3	141°59.5	15.3					Sabik	102°05.0	-15°45.2	
17	124°27.5	114°16.0	30.7	132°56.8	25.6	123°53.4	57.1	157°01.9	15.3					Shaula	96°13.0	-37°07.1	
18	139°30.0	129°15.8	N02°31.8	147°57.5	S05°24.9	138°55.4	S00°56.9	172°04.3	S14°15.2					Rasalhague	96°00.3	12°32.5	
19	154°32.4	144°15.6	32.8	162°58.3	24.1	153°57.5	56.8	187°06.6	15.2					Eltanin	90°42.8	51°28.9	
20	169°34.9	159°15.3	33.9	177°59.0	23.4	168°59.5	56.6	202°09.0	15.2					Kaus Aust.	83°35.2	-34°22.4	
21	184°37.4	174°15.1	34.9	192°59.7	22.7	184°01.5	56.4	217°11.4	15.2					Vega	80°34.4	38°48.0	
22	199°39.8	189°14.9	36.0	208°00.4	22.0	199°03.5	56.2	232°13.7	15.1					Nunki	75°50.3	-26°16.1	
23	214°42.3	204°14.7	37.0	223°01.1	21.2	214°05.5	56.0	247°16.1	15.1					Altair	62°02.0	8°55.5	
Mer.pass. 08:44		ν -0.2° d 1.1' m -4.05	ν 0.7° d 0.7' m 0.78	ν 2.0° d 0.2' m -2.15	ν 2.4° d 0.0' m 0.76												
Mer.pass. 08:40		ν -0.2° d 1.1' m -4.05	ν 0.7° d 0.7' m 0.78	ν 2.0° d 0.2' m -2.15	ν 2.4° d 0.0' m 0.76												
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	229°44.8	219°14.5	N02°38.1	238°01.9	S05°20.5	229°07.5	S00°55.8	262°18.5	S14°15.1					May 10 Tue	SHA	Mer.pass	
1	244°47.2	234°14.2	39.2	253°02.6	19.8	244°09.6	55.6	277°20.8	15.1					Venus	351°38.3	09:22	
2	259°49.7	249°14.0	40.2	268°03.3	19.1	259°11.6	55.5	292°23.2	15.0					Mars	9°40.8	08:10	
3	274°52.2	264°13.8	41.3	283°04.0	18.4	274°13.6	55.3	307°25.6	15.0					Jupiter	359°44.4	08:49	
4	289°54.6	279°13.6	42.3	298°04.8	17.6	289°15.6	55.1	322°27.9	15.0					Saturn	32°38.5	06:37	
5	304°57.1	294°13.4	43.4	313°05.5	16.9	304°17.6	54.9	337°30.3	15.0					May 11 Wed	SHA	Mer.pass	
6	319°59.6	309°13.2	N02°44.5	328°06.2	S05°16.2	319°19.6	S00°54.7	352°32.7	S14°14.9					Venus	350°34.0	09:23	
7	335°02.0	324°12.9	45.5	343°06.9	15.5	334°21.7	54.5	7°35.0	14.9					Mars	8°58.9	08:09	
8	350°04.5	339°12.7	46.6	358°07.6	14.8	349°23.7	54.3	22°37.4	14.9					Jupiter	359°33.5	08:46	
9	5°06.9	354°12.5	47.6	13°08.4	14.0	4°25.7	54.2	37°39.8	14.9					Saturn	32°36.0	06:34	
10	20°09.4	9°12.3</td															

DUT1 = UT1-UTC = -0.0948 sec  $\Delta T = TT-UT1 = +69.2788$  sec

2022 May 10 to May. 12 UT

h		Sun		Moon				
Tue		GHA	Dec	GHA	$\nu$	Dec	d	HP
0	180°53.3	N17°33.7		73°12.5	13.4'	N16°09.6	-11.7'	55.6'
1	195°53.3	34.3		87°44.9	13.4'	15°57.9	-11.7'	55.6'
2	210°53.3	35.0		102°17.2	13.4'	15°46.2	-11.8'	55.7'
3	225°53.4	35.7		116°49.6	13.4'	15°34.3	-11.9'	55.7'
4	240°53.4	36.3		131°22.1	13.4'	15°22.4	-12.0'	55.7'
5	255°53.4	37.0		145°54.5	13.5'	15°10.4	-12.1'	55.8'
6	270°53.4	N17°37.6		160°27.0	13.5'	N14°58.4	-12.1'	55.8'
7	285°53.5	38.3		174°59.5	13.5'	14°46.2	-12.2'	55.8'
8	300°53.5	38.9		189°32.0	13.5'	14°34.0	-12.3'	55.8'
9	315°53.5	39.6		204°04.5	13.6'	14°21.7	-12.4'	55.9'
10	330°53.5	40.2		218°37.1	13.6'	14°09.3	-12.5'	55.9'
11	345°53.5	40.9		233°09.7	13.6'	13°56.8	-12.5'	55.9'
12	0°53.6	N17°41.5		247°42.3	13.6'	N13°44.3	-12.6'	56.0'
13	15°53.6	42.2		262°14.9	13.6'	13°31.7	-12.7'	56.0'
14	30°53.6	42.8		276°47.5	13.6'	13°19.0	-12.8'	56.0'
15	45°53.6	43.5		291°20.1	13.7'	13°06.3	-12.8'	56.1'
16	60°53.7	44.1		305°52.8	13.7'	12°53.4	-12.9'	56.1'
17	75°53.7	44.8		320°25.5	13.7'	12°40.5	-13.0'	56.1'
18	90°53.7	N17°45.4		334°58.2	13.7'	N12°27.6	-13.0'	56.2'
19	105°53.7	46.1		349°30.9	13.7'	12°14.5	-13.1'	56.2'
20	120°53.7	46.7		4°03.6	13.7'	12°01.4	-13.2'	56.2'
21	135°53.8	47.4		18°36.3	13.7'	11°48.2	-13.2'	56.3'
22	150°53.8	48.0		33°09.0	13.7'	11°35.0	-13.3'	56.3'
23	165°53.8	48.7		47°41.8	13.8'	11°21.7	-13.4'	56.3'
SD = 15.8'		SD = 15.2'						

Wed		GHA	Dec	GHA	$\nu$	Dec	d	HP
0	180°53.8	N17°49.3		62°14.5	13.8'	N11°08.3	-13.4'	56.4'
1	195°53.8	49.9		76°47.3	13.8'	10°54.8	-13.5'	56.4'
2	210°53.8	50.6		91°20.1	13.8'	10°41.3	-13.6'	56.4'
3	225°53.9	51.2		105°52.8	13.8'	10°27.7	-13.6'	56.5'
4	240°53.9	51.9		120°25.6	13.8'	10°14.1	-13.7'	56.5'
5	255°53.9	52.5		134°58.4	13.8'	10°00.4	-13.8'	56.5'
6	270°53.9	N17°53.2		149°31.2	13.8'	N09°46.6	-13.8'	56.6'
7	285°53.9	53.8		164°04.0	13.8'	09°32.8	-13.9'	56.6'
8	300°54.0	54.4		178°36.7	13.8'	09°18.9	-13.9'	56.7'
9	315°54.0	55.1		193°09.5	13.8'	09°04.9	-14.0'	56.7'
10	330°54.0	55.7		207°42.3	13.8'	08°50.9	-14.1'	56.7'
11	345°54.0	56.4		222°15.1	13.8'	08°36.9	-14.1'	56.8'
12	0°54.0	N17°57.0		236°47.9	13.8'	N08°22.8	-14.2'	56.8'
13	15°54.0	57.6		251°20.7	13.8'	08°08.6	-14.2'	56.8'
14	30°54.0	58.3		265°53.4	13.8'	07°54.3	-14.3'	56.9'
15	45°54.1	58.9		280°26.2	13.8'	07°40.1	-14.3'	56.9'
16	60°54.1	17°59.6		294°59.0	13.8'	07°25.7	-14.4'	56.9'
17	75°54.1	18°00.2		309°31.7	13.7'	07°11.3	-14.4'	57.0'
18	90°54.1	N18°00.8		324°04.5	13.7'	N06°56.9	-14.5'	57.0'
19	105°54.1	01.5		338°37.2	13.7'	06°42.4	-14.5'	57.1'
20	120°54.1	02.1		353°09.9	13.7'	06°27.9	-14.6'	57.1'
21	135°54.2	02.7		7°42.6	13.7'	06°13.3	-14.6'	57.1'
22	150°54.2	03.4		22°15.3	13.7'	05°58.6	-14.7'	57.2'
23	165°54.2	04.0		36°48.0	13.7'	05°43.9	-14.7'	57.2'
SD = 15.8'		SD = 15.4'						

Thu		GHA	Dec	GHA	$\nu$	Dec	d	HP
0	180°54.2	N18°04.6		51°20.7	13.6'	N05°29.2	-14.8'	57.2'
1	195°54.2	05.3		65°53.3	13.6'	05°14.4	-14.8'	57.3'
2	210°54.2	05.9		80°25.9	13.6'	04°59.6	-14.9'	57.3'
3	225°54.2	06.5		94°58.6	13.6'	04°44.7	-14.9'	57.4'
4	240°54.2	07.1		109°31.1	13.6'	04°29.8	-14.9'	57.4'
5	255°54.3	07.8		124°03.7	13.5'	04°14.9	-15.0'	57.4'
6	270°54.3	N18°08.4		138°36.3	13.5'	N03°59.9	-15.0'	57.5'
7	285°54.3	09.0		153°08.8	13.5'	03°44.9	-15.1'	57.5'
8	300°54.3	09.7		167°41.3	13.5'	03°29.8	-15.1'	57.5'
9	315°54.3	10.3		182°13.8	13.4'	03°14.7	-15.1'	57.6'
10	330°54.3	10.9		196°46.2	13.4'	02°59.5	-15.2'	57.6'
11	345°54.3	11.5		211°18.6	13.4'	02°44.4	-15.2'	57.7'
12	0°54.3	N18°12.2		225°51.0	13.4'	N02°29.2	-15.2'	57.7'
13	15°54.3	12.8		240°23.4	13.3'	02°13.9	-15.3'	57.7'
14	30°54.3	13.4		254°55.7	13.3'	01°58.6	-15.3'	57.8'
15	45°54.4	14.0		269°28.0	13.3'	01°43.3	-15.3'	57.8'
16	60°54.4	14.7		284°00.3	13.2'	01°28.0	-15.4'	57.9'
17	75°54.4	15.3		298°32.5	13.2'	01°12.7	-15.4'	57.9'
18	90°54.4	N18°15.9		313°04.7	13.2'	N00°57.3	-15.4'	57.9'
19	105°54.4	16.5		327°36.8	13.1'	00°41.9	-15.4'	58.0'
20	120°54.4	17.2		342°08.9	13.1'	00°26.4	-15.5'	58.0'
21	135°54.4	17.8		356°41.0	13.0'	N00°11.0	-15.5'	58.0'
22	150°54.4	18.4		11°13.0	13.0'	S00°04.5	-15.5'	58.1'
23	165°54.4	19.0		25°45.0	12.9'	00°20.0	-15.5'	58.1'
SD = 15.8'		SD = 15.6'						

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

## May 13, 14, 15 UT (Fri., Sat., Sun.)

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	230°43.9	219°09.2	N03°03.5	238°19.2	S05°03.2	229°56.0	S00°51.4	263°15.3	S14°14.5								
1	245°46.4	234°09.0	04.6	253°19.9	02.5	244°58.0	51.2	278°17.7	14.5								
2	260°48.8	249°08.7	05.6	268°20.7	01.8	260°00.0	51.0	293°20.1	14.4								
3	275°51.3	264°08.5	.. 06.7	283°21.4	.. 01.0	275°02.1	.. 50.8	308°22.5	.. 14.4								
4	290°53.8	279°08.3	07.8	298°22.1	05°00.3	290°04.1	50.7	323°24.8	14.4								
5	305°56.2	294°08.1	08.8	313°22.8	04°59.6	305°06.1	50.5	338°27.2	14.4								
6	320°58.7	309°07.9	N03°09.9	328°23.6	S04°58.9	320°08.1	S00°50.3	353°29.6	S14°14.4								
7	336°01.2	324°07.6	10.9	343°24.3	58.1	335°10.2	50.1	8°31.9	14.3								
8	351°03.6	339°07.4	12.0	358°25.0	57.4	350°12.2	49.9	23°34.3	14.3								
9	6°06.1	354°07.2	.. 13.1	13°25.7	.. 56.7	5°14.2	.. 49.7	38°36.7	.. 14.3								
10	21°08.5	9°07.0	14.1	28°26.5	56.0	20°16.2	49.6	53°39.1	14.3								
11	36°11.0	24°06.7	15.2	43°27.2	55.2	35°18.2	49.4	68°41.4	14.2								
12	51°13.5	39°06.5	N03°16.2	58°27.9	S04°54.5	50°20.3	S00°49.2	83°43.8	S14°14.2								
13	66°15.9	54°06.3	17.3	73°28.7	53.8	65°22.3	49.0	98°46.2	14.2								
14	81°18.4	69°06.1	18.4	88°29.4	53.1	80°24.3	48.8	113°48.6	14.2								
15	96°20.9	84°05.8	.. 19.4	103°30.1	.. 52.4	95°26.3	.. 48.7	128°50.9	.. 14.1								
16	111°23.3	99°05.6	20.5	118°30.8	51.6	110°28.4	48.5	143°53.3	14.1								
17	126°25.8	114°05.4	21.5	133°31.6	50.9	125°30.4	48.3	158°55.7	14.1								
18	141°28.3	129°05.2	N03°22.6	148°32.3	S04°50.2	140°32.4	S00°48.1	173°58.1	S14°14.1								
19	156°30.7	144°04.9	23.7	163°33.0	49.5	155°34.4	47.9	189°00.4	14.0								
20	171°33.2	159°04.7	24.7	178°33.7	48.7	170°36.5	47.7	204°02.8	14.0								
21	186°35.6	174°04.5	.. 25.8	193°34.5	.. 48.0	185°38.5	.. 47.6	219°05.2	.. 14.0								
22	201°38.1	189°04.3	26.8	208°35.2	47.3	200°40.5	47.4	234°07.6	14.0								
23	216°40.6	204°04.0	27.9	223°35.9	46.6	215°42.5	47.2	249°09.9	14.0								
Mer.pass. 08:36			ν -0.2° d 1.1' m -4.05			ν 0.7° d 0.7' m 0.77			ν 2.0° d 0.2' m -2.16			ν 2.4° d 0.0' m 0.76					
Mer.pass. 08:36																	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	231°43.0	219°03.8	N03°29.0	238°36.6	S04°45.8	230°44.6	S00°47.0	264°12.3	S14°13.9								
1	246°45.5	234°03.6	30.0	253°37.4	45.1	245°46.6	46.8	279°14.7	13.9								
2	261°48.0	249°03.4	31.1	268°38.1	44.4	260°48.6	46.6	294°17.1	13.9								
3	276°50.4	264°03.1	.. 32.1	283°38.8	.. 43.7	275°50.6	.. 46.5	309°19.4	.. 13.9								
4	291°52.9	279°02.9	33.2	298°39.5	42.9	290°52.7	46.3	324°21.8	13.8								
5	306°55.4	294°02.7	34.3	313°40.3	42.2	305°54.7	46.1	339°24.2	13.8								
6	321°57.8	309°02.5	N03°35.3	328°41.0	S04°41.5	320°56.7	S00°45.9	354°26.6	S14°13.8								
7	337°00.3	324°02.2	36.4	343°41.7	40.8	335°58.7	45.7	9°28.9	13.8								
8	352°02.8	339°02.0	37.4	358°42.5	40.1	351°00.8	45.6	24°31.3	13.8								
9	7°05.2	354°01.8	.. 38.5	13°43.2	.. 39.3	6°02.8	.. 45.4	39°33.7	.. 13.7								
10	22°07.7	9°01.6	39.6	28°43.9	38.6	21°04.8	45.2	54°36.1	13.7								
11	37°10.1	24°01.3	40.6	43°44.6	37.9	36°06.8	45.0	69°38.4	13.7								
12	52°12.6	39°01.1	N03°41.7	58°45.4	S04°37.2	51°08.9	S00°44.8	84°40.8	S14°13.7								
13	67°15.1	54°00.9	42.7	73°46.1	36.4	66°10.9	44.6	99°43.2	13.6								
14	82°17.5	69°00.6	43.8	88°46.8	35.7	81°12.9	44.5	114°45.6	13.6								
15	97°20.0	84°00.4	.. 44.9	103°47.6	.. 35.0	96°14.9	.. 44.3	129°48.0	.. 13.6								
16	112°22.5	99°00.2	45.9	118°48.3	34.3	111°17.0	44.1	144°50.3	13.6								
17	127°24.9	114°00.0	47.0	133°49.0	33.5	126°19.0	43.9	159°52.7	13.6								
18	142°27.4	128°59.7	N03°48.0	148°49.7	S04°32.8	141°21.0	S00°43.7	174°55.1	S14°13.5								
19	157°29.9	143°59.5	49.1	163°50.5	32.1	156°23.0	43.6	189°57.5	13.5								
20	172°32.3	158°59.3	50.2	178°51.2	31.4	171°25.1	43.4	204°59.8	13.5								
21	187°34.8	173°59.0	.. 51.2	193°51.9	.. 30.6	186°27.1	.. 43.2	220°02.2	.. 13.5								
22	202°37.3	188°58.8	52.3	208°52.7	29.9	201°29.1	43.0	235°04.6	13.4								
23	217°39.7	203°58.6	53.3	223°53.4	29.2	216°31.2	42.8	250°07.0	13.4								
Mer.pass. 08:32			ν -0.2° d 1.1' m -4.04			ν 0.7° d 0.7' m 0.76			ν 2.0° d 0.2' m -2.16			ν 2.4° d 0.0' m 0.76					
Mer.pass. 08:32																	
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	232°42.2	218°58.3	N03°54.4	238°54.1	S04°28.5	231°33.2	S00°42.7	265°09.4	S14°13.4								
1	247°44.6	233°58.1	55.5	253°54.8	27.7	246°35.2	42.5	280°11.7	13.4								
2	262°47.1	248°57.9	56.5	268°55.6	27.0	261°37.2	42.3	295°14.1	13.4								
3	277°49.6	263°57.7	.. 56.7	283°56.3	.. 26.3	276°39.3	.. 42.1	310°16.5	.. 13.3								
4	292°52.0	278°57.4	58.6	298°57.0	25.6	291°41.3	41.9	325°18.9	13.3								
5	307°54.5	293°57.2	03°59.7	313°57.8	24.8	306°43.3	41.8	340°21.3	13.3								
6	322°57.0	308°57.0	N04°00.8	328°58.5	S04°24.1	321°45.4	S00°41.6	355°23.6	S14°13.3								
7	337°59.4	323°56.7	01.8	343°59.2	23.4	336°47.4	41.4	10°26.0	13.3								
8	353°01.9	338°56.5	02.9	358°59.9	22.7	351°49.4	41.2	25°28.4	13.2								
9	8°04.4	353°56.3	.. 03.9	14°00.7	.. 21.9	6°51.4	.. 41.0	40°30.8	.. 13.2								
10	23°06.8	8°56.0	05.0	29°01.4	21.2	21°53.5	40.9	55°33.2	13.2								
11	38°09.3	23°55.8	06.1	44°02.1	20.5	36°55.5	40.7	70°35.5	13.2								
12	53°11.7	38°55.6	N04°07.1	59°02.9	S04°19.8	51°57.5	S00°40.5	85°37.9	S14°13.2								
13	68°14.2	53°55.3	08.2	74°03.6	19.0	66°59.6	40.3	100°40.3	13.1								
14	83°16.7	68°55.1	09.2	89°04.3	18.3	82°01.6	40.1	115°42.7	13.1								
15	98°19.1	83°54.9	.. 10.3	104°05.1	.. 17.6	97°03.6	.. 40.0	130°45.1	.. 13.1								
16	113°21.6	98°54.6	11.4	119°05.8	16.9	112°05.7	39.8	145°47.5	13.1								
17	128°24.1	113°54.4	12.4	134°06.5	16.1	127°07.7	39.6	160°49.8	13.1								
18	143°26.5	128°54.2	N04°13.5	149°07.2	S04°15.4	142°09.7	S00°39.4	175°52.2	S14°13.0								
19	158°29.0	143°53.9	14.5	164°08.0	14.7	157°11.7	39.2	190°54.6	13.0								
20	173°31.5	158°53.7	15.6	179°08.7	14.0	172°13.8	39.1	205									

DUT1 = UT1-UTC = -0.0961 sec  $\Delta T = TT-UT1 = +69.2801$  sec

2022 May 13 to May. 15 UT

h	Sun			Moon			
Fri	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	180°54.4	N18°19.6	40°17.0	12.9'	S00°35.6	-15.5'	58.2'
1	195°54.4	20.3	54°48.9	12.9'	00°51.1	-15.6'	58.2'
2	210°54.4	20.9	69°20.7	12.8'	01°06.7	-15.6'	58.2'
3	225°54.5	21.5	83°52.5	12.8'	01°22.2	-15.6'	58.3'
4	240°54.5	22.1	98°24.3	12.7'	01°37.8	-15.6'	58.3'
5	255°54.5	22.7	112°56.0	12.7'	01°53.4	-15.6'	58.3'
6	270°54.5	N18°23.3	127°27.6	12.6'	S02°09.1	-15.6'	58.4'
7	285°54.5	24.0	141°59.2	12.5'	02°24.7	-15.6'	58.4'
8	300°54.5	24.6	156°30.8	12.5'	02°40.3	-15.6'	58.5'
9	315°54.5	25.2	171°02.3	12.4'	02°56.0	-15.7'	58.5'
10	330°54.5	25.8	185°33.7	12.4'	03°11.6	-15.7'	58.5'
11	345°54.5	26.4	200°05.1	12.3'	03°27.3	-15.7'	58.6'
12	0°54.5	N18°27.0	214°36.4	12.3'	S03°42.9	-15.7'	58.6'
13	15°54.5	27.6	229°07.7	12.2'	03°58.6	-15.7'	58.6'
14	30°54.5	28.3	243°38.9	12.1'	04°14.3	-15.7'	58.7'
15	45°54.5	28.9	258°10.0	12.1'	04°29.9	-15.7'	58.7'
16	60°54.5	29.5	272°41.1	12.0'	04°45.6	-15.7'	58.8'
17	75°54.5	30.1	287°12.1	11.9'	05°01.3	-15.7'	58.8'
18	90°54.5	N18°30.7	301°43.0	11.9'	S05°16.9	-15.7'	58.8'
19	105°54.5	31.3	316°13.9	11.8'	05°32.6	-15.6'	58.9'
20	120°54.5	31.9	330°44.7	11.7'	05°48.2	-15.6'	58.9'
21	135°54.5	32.5	345°15.5	11.7'	06°03.9	-15.6'	58.9'
22	150°54.5	33.1	359°46.1	11.6'	06°19.5	-15.6'	59.0'
23	165°54.5	33.7	14°16.7	11.5'	06°35.1	-15.6'	59.0'
	SD = 15.8'			SD = 15.9'			
	d = 0.6'			SD = 15.9'			
Sat	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	180°54.5	N18°34.3	28°47.2	11.4'	S06°50.7	-15.6'	59.0'
1	195°54.5	34.9	43°17.7	11.4'	07°06.3	-15.6'	59.1'
2	210°54.5	35.5	57°48.0	11.3'	07°21.8	-15.5'	59.1'
3	225°54.5	36.2	72°18.3	11.2'	07°37.4	-15.5'	59.1'
4	240°54.5	36.8	86°48.6	11.1'	07°52.9	-15.5'	59.2'
5	255°54.5	37.4	101°18.7	11.1'	08°08.4	-15.5'	59.2'
6	270°54.5	N18°38.0	115°48.7	11.0'	S08°23.9	-15.5'	59.3'
7	285°54.5	38.6	130°18.7	10.9'	08°39.3	-15.4'	59.3'
8	300°54.5	39.2	144°48.6	10.8'	08°54.7	-15.4'	59.3'
9	315°54.5	39.8	159°18.4	10.7'	09°10.1	-15.4'	59.4'
10	330°54.5	40.4	173°48.1	10.6'	09°25.5	-15.3'	59.4'
11	345°54.5	41.0	188°17.7	10.5'	09°40.8	-15.3'	59.4'
12	0°54.5	N18°41.6	202°47.3	10.5'	S09°56.1	-15.3'	59.4'
13	15°54.5	42.2	217°16.7	10.4'	10°11.4	-15.2'	59.5'
14	30°54.5	42.8	231°46.1	10.3'	10°26.6	-15.2'	59.5'
15	45°54.5	43.4	246°15.4	10.2'	10°41.8	-15.1'	59.5'
16	60°54.5	44.0	260°44.6	10.1'	10°56.9	-15.1'	59.6'
17	75°54.5	44.6	275°13.7	10.0'	11°12.0	-15.0'	59.6'
18	90°54.5	N18°45.2	289°42.6	9.9'	S11°27.1	-15.0'	59.6'
19	105°54.5	45.8	304°11.5	9.8'	11°42.1	-15.0'	59.7'
20	120°54.5	46.4	318°40.3	9.7'	11°57.0	-14.9'	59.7'
21	135°54.5	46.9	333°09.1	9.6'	12°11.9	-14.8'	59.7'
22	150°54.5	47.5	347°37.7	9.5'	12°26.8	-14.8'	59.8'
23	165°54.5	48.1	2°06.2	9.4'	12°41.6	-14.7'	59.8'
	SD = 15.8'			SD = 16.1'			
	d = 0.6'			SD = 16.1'			
Sun	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	180°54.5	N18°48.7	16°34.6	9.3'	S12°56.3	-14.7'	59.8'
1	195°54.5	49.3	31°02.9	9.2'	13°11.0	-14.6'	59.8'
2	210°54.5	49.9	45°31.1	9.1'	13°25.6	-14.6'	59.9'
3	225°54.5	50.5	59°59.2	9.0'	13°40.1	-14.5'	59.9'
4	240°54.5	51.1	74°27.2	8.9'	13°54.6	-14.4'	59.9'
5	255°54.5	51.7	88°55.1	8.8'	14°09.1	-14.4'	60.0'
6	270°54.5	N18°52.3	103°22.9	8.7'	S14°23.4	-14.3'	60.0'
7	285°54.5	52.9	117°50.5	8.6'	14°37.7	-14.2'	60.0'
8	300°54.5	53.5	132°18.1	8.5'	14°51.9	-14.1'	60.0'
9	315°54.4	54.0	146°45.6	8.4'	15°06.0	-14.1'	60.1'
10	330°54.4	54.6	161°13.0	8.3'	15°20.1	-14.0'	60.1'
11	345°54.4	55.2	175°40.2	8.1'	15°34.0	-13.9'	60.1'
12	0°54.4	N18°55.8	190°07.3	8.0'	S15°47.9	-13.8'	60.1'
13	15°54.4	56.4	204°34.4	7.9'	16°01.7	-13.7'	60.2'
14	30°54.4	57.0	219°01.3	7.8'	16°15.5	-13.6'	60.2'
15	45°54.4	57.6	233°28.1	7.7'	16°29.1	-13.5'	60.2'
16	60°54.4	58.1	247°54.8	7.6'	16°42.6	-13.5'	60.2'
17	75°54.4	58.7	262°21.4	7.5'	16°56.1	-13.4'	60.3'
18	90°54.4	N18°59.3	276°47.9	7.4'	S17°09.4	-13.3'	60.3'
19	105°54.4	281°14.2	7.2'	17°22.7	-13.2'	60.3'	
20	120°54.4	19°00.5	305°40.5	7.1'	17°35.9	-13.1'	60.3'
21	135°54.4	01.1	320°06.6	7.0'	17°48.9	-13.0'	60.4'
22	150°54.3	01.6	334°32.6	6.9'	18°01.9	-12.9'	60.4'
23	165°54.3	02.2	348°58.6	6.8'	18°14.7	-12.7'	60.4'
	SD = 15.8'			SD = 16.3'			

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

## May 16, 17, 18 UT (Mon., Tue., Wed.)

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	233°41.3	218°52.8	N04°19.8	239°11.6	S04°11.1	232°21.9	S00°38.3	266°06.5	S14°12.9					Alpheratz	357°37.3	29°12.5	
1	248°43.8	233°52.5	20.9	254°12.4	10.3	247°23.9	38.2	281°08.9	12.9					Ankaa	353°09.6	-42°11.0	
2	263°46.2	248°52.3	22.0	269°13.1	09.6	262°26.0	38.0	296°11.3	12.9					Schedar	349°33.9	56°39.3	
3	278°48.7	263°52.1	.. 23.0	284°13.8	.. 08.9	277°28.0	.. 37.8	311°13.7	.. 12.8					Diphda	348°49.8	-17°51.9	
4	293°51.2	278°51.8	24.1	299°14.6	08.2	292°30.0	37.6	326°16.0	12.8					Achernar	335°22.4	-57°07.4	
5	308°53.6	293°51.6	25.1	314°15.3	07.4	307°32.1	37.4	341°18.4	12.8					Hamal	327°54.0	23°33.9	
6	323°56.1	308°51.3	N04°26.2	329°16.0	S04°06.7	322°34.1	S00°37.3	356°20.8	S14°12.8					Polaris	315°32.6	89°21.4	
7	338°58.6	323°51.1	27.3	344°16.8	06.0	337°36.1	37.1	11°23.2	12.8					Acamar	315°13.9	-40°13.0	
8	354°01.0	338°50.9	28.3	359°17.5	05.3	352°38.2	36.9	26°25.6	12.7					Menkar	314°08.8	4°10.5	
9	9°03.5	353°50.6	.. 29.4	14°18.2	.. 04.5	7°40.2	.. 36.7	41°28.0	.. 12.7					Mirfak	308°31.9	49°56.3	
10	24°06.0	8°50.4	30.4	29°18.9	03.8	22°42.2	36.6	56°30.3	12.7					Aldebaran	290°42.5	16°33.1	
11	39°08.4	23°50.2	31.5	44°19.7	03.1	37°44.3	36.4	71°32.7	12.7					Rigel	281°06.3	-8°10.7	
12	54°10.9	38°49.9	N04°32.6	59°20.4	S04°02.3	52°46.3	S00°36.2	86°35.1	S14°12.7					Capella	280°25.6	46°01.2	
13	69°13.4	53°49.7	33.6	74°21.1	01.6	67°48.3	36.0	101°37.5	12.7					Bellatrix	278°25.6	6°22.1	
14	84°15.8	68°49.4	34.7	89°21.9	00.9	82°50.4	35.8	116°39.9	12.6					Elnath	278°05.0	28°37.5	
15	99°18.3	83°49.2	.. 35.7	104°22.6	04°00.2	97°52.4	.. 35.7	131°42.3	.. 12.6					Alnilam	275°40.3	-1°11.4	
16	114°20.7	98°49.0	36.8	119°23.3	03°59.4	112°54.4	35.5	146°44.7	12.6					Betelgeuse	270°54.8	7°24.6	
17	129°23.2	113°48.7	37.9	134°24.1	58.7	127°56.5	35.3	161°47.0	12.6					Canopus	263°53.8	-52°42.6	
18	144°25.7	128°48.5	N04°38.9	149°24.8	S03°58.0	142°58.5	S00°35.1	176°49.4	S14°12.6					Sirius	258°28.4	-16°44.9	
19	159°28.1	143°48.3	40.0	164°25.5	57.3	158°00.5	35.0	191°51.8	12.5					Adhara	255°07.9	-29°00.3	
20	174°30.6	158°48.0	41.0	179°26.3	56.5	173°02.6	34.8	206°54.2	12.5					Procyon	244°53.3	5°10.0	
21	189°33.1	173°47.8	.. 42.1	194°27.0	.. 55.8	188°04.6	.. 34.6	221°56.6	.. 12.5					Pollux	243°20.2	27°58.4	
22	204°35.5	188°47.5	43.1	209°27.7	55.1	203°06.6	34.4	236°59.0	12.5					Avior	234°15.9	-59°35.1	
23	219°38.0	203°47.3	44.2	224°28.5	54.4	218°08.7	34.2	252°01.4	12.5					Suhail	222°48.0	-43°31.6	
Mer.pass. 08:24			ν -0.2° d 1.1' m -4.03	ν 0.7° d 0.7' m 0.75	ν 2.0° d 0.2' m -2.17	ν 2.4° d 0.0' m 0.75											
Tue			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	234°40.5	218°47.1	N04°45.3	239°29.2	S03°53.6	233°10.7	S00°34.1	267°03.7	S14°12.4					Denebola	193°43.5	61°38.1	
1	249°42.9	233°46.8	46.3	254°29.9	52.9	248°12.7	33.9	282°06.1	12.4					Gienah	175°45.7	-17°40.0	
2	264°45.4	248°46.6	47.4	269°30.7	52.2	263°14.8	33.7	297°08.5	12.4					Acrux	173°02.1	-63°13.5	
3	279°47.9	263°46.3	.. 48.4	284°31.4	.. 51.5	278°16.8	.. 33.5	312°10.9	.. 12.4					Gacrux	171°53.7	-57°14.5	
4	294°50.3	278°46.1	49.5	299°32.1	50.7	293°18.8	33.4	327°13.3	12.4					Alioth	166°14.5	55°50.5	
5	309°52.8	293°45.9	50.6	314°32.9	50.0	308°20.9	33.2	342°15.7	12.3					Spica	158°24.4	-11°16.7	
6	324°55.2	308°45.6	N04°51.6	329°33.6	S03°49.3	323°22.9	S00°33.0	357°18.1	S14°12.3					Alkaid	152°53.3	49°12.3	
7	339°57.7	323°45.4	52.7	344°34.3	48.6	338°25.0	32.8	12°20.5	12.3					Hadar	148°38.5	-60°28.9	
8	355°00.2	338°45.1	53.7	359°35.1	47.8	353°27.0	32.6	27°22.8	12.3					Menkent	147°59.8	-36°28.8	
9	10°02.6	353°44.9	.. 54.8	14°35.8	.. 47.1	8°29.0	.. 32.5	42°25.2	.. 12.3					Arcturus	145°49.6	19°04.0	
10	25°05.1	8°44.6	55.9	29°36.5	46.4	23°31.1	32.3	57°27.6	12.3					Rigel Kent.	139°42.7	-60°55.7	
11	40°07.6	23°44.4	56.9	44°37.3	45.6	38°33.1	32.1	72°30.0	12.2					Kochab	137°18.7	74°03.9	
12	55°10.0	38°44.2	N04°58.0	59°38.0	S03°44.9	53°35.1	S00°31.9	87°32.4	S14°12.2					Zuben'ubi	136°58.1	-16°08.1	
13	70°12.5	53°43.9	04°59.0	74°38.7	44.2	68°37.2	31.8	102°34.8	12.2					Alphecca	126°05.3	26°38.4	
14	85°15.0	68°43.7	05°00.1	89°39.5	43.5	83°39.2	31.6	117°37.2	12.2					Antares	112°18.2	-26°28.9	
15	100°17.4	83°43.4	.. 01.1	104°40.2	.. 42.7	98°41.2	.. 31.4	132°39.6	.. 12.2					Atria	107°13.9	-69°03.9	
16	115°19.9	98°43.2	02.2	119°40.9	42.0	113°43.3	31.2	147°42.0	12.1					Sabik	102°05.0	-15°45.2	
17	130°22.4	113°42.9	03.3	134°41.7	41.3	128°45.3	31.1	162°44.3	12.1					Shaula	96°13.0	-37°07.1	
18	145°24.8	128°42.7	N05°04.3	149°42.4	S03°40.6	143°47.4	S00°30.9	177°46.7	S14°12.1					Rasalhague	96°00.3	12°32.5	
19	160°27.3	143°42.5	05.4	164°43.1	39.8	158°49.4	30.7	192°49.1	12.1					Eltanin	90°42.8	51°29.0	
20	175°29.7	158°42.2	06.4	179°43.9	39.1	173°51.4	30.5	207°51.5	12.1					Kaus Aust.	83°35.1	-34°22.4	
21	190°32.2	173°42.0	.. 07.5	194°44.6	.. 38.4	188°53.5	.. 30.4	222°53.9	.. 12.1					Vega	80°34.4	38°48.0	
22	205°34.7	188°41.7	08.6	209°45.4	37.6	203°55.5	30.2	237°56.3	12.0					Nunki	75°50.2	-26°16.1	
23	220°37.1	203°41.5	09.6	224°46.1	36.9	218°57.6	30.0	252°58.7	12.0					Altair	62°01.9	8°55.5	
Mer.pass. 08:20			ν -0.2° d 1.1' m -4.03	ν 0.7° d 0.7' m 0.74	ν 2.0° d 0.2' m -2.17	ν 2.4° d 0.0' m 0.75											
Wed			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	235°39.6	218°41.2	N05°10.7	239°46.8	S03°36.2	233°59.6	S00°29.8	268°01.1	S14°12.0					Fomalhaut	15°17.1	-29°30.2	
1	250°42.1	233°41.0	11.7	254°47.6	35.5	249°01.6	29.7	283°03.5	12.0					Scheat	13°47.4	28°11.9	
2	265°44.5	248°40.7	12.8	269°48.3	34.7	264°03.7	29.5	298°05.9	12.0					Markab	13°32.2	15°19.3	
3	280°47.0	263°40.5	.. 13.8	284°49.0	.. 34.0	279°05.7	.. 29.3	313°08.3	.. 12.0					May 16 Mon	345°11.4	09:25	
4	295°49.5	278°40.2	14.9	299°49.8	33.3	294°07.7	29.1	328°10.6	11.9					Mars	5°30.3	08:03	
5	310°51.9	293°40.0	16.0	314°50.5	32.6	309°09.8	29.0	343°13.0	11.9					Jupiter	358°40.6	08:29	
6	325°54.4	308°39.8	N05°17.0	329°51.2	S03°31.8	324°11.8	S00°28.8	358°15.4	S14°11.9					Saturn	32°25.2	06:15	
7	340°56.9	323°39.5	18.1	344°52.0	31.1	339°13.9	28.6	13°17.8	11.9					May 17 Tue	344°06.6	09:25	
8	355°59.3	338°39.3	19.1	359°52.7	30.4	354°15.9	28.4	28°20.2	11.9					Mars	4°48.7	08:02	
9	11°01.8	353°39.0	.. 20.2	14°53.4	.. 29.7	9°17.9	.. 28.2	43°22.6	.. 11.9					Jupiter	358°30.2	08:26	
10	26°04.2	8°38.8	21.2	29°54.2	28.9	24°20.0	28.1	58°25.0	11.8					Saturn	32°23.3	06:11	
11	41°06.7	23°38.5	22.3	44°54.9	28.2	39°22.0	27.9	73°27.4	11.8					May 18 Wed	343°01.6	09:25	
12	56°09.2	38°38.3	N05°23.4	59°55.7	S03°27.5	54°24.1</td											

DUT1 = UT1-UTC = -0.0979 sec  $\Delta T = TT-UT1 = +69.2819$  sec

2022 May 16 to May. 18 UT

h		Sun		Moon				
Mon		GHA	Dec	GHA	$\nu$	Dec	d	HP
0	180°54.3	N19°02.8		3°24.3	6.7'	\$18°27.5	-12.6'	60.4'
1	195°54.3	03.4		17°50.0	6.6'	18°40.1	-12.5'	60.4'
2	210°54.3	04.0		32°15.6	6.5'	18°52.6	-12.4'	60.4'
3	225°54.3	.. 04.5		46°41.0	6.3'	19°05.0	-12.3'	60.5'
4	240°54.3	05.1		61°06.4	6.2'	19°17.3	-12.2'	60.5'
5	255°54.3	05.7		75°31.6	6.1'	19°29.5	-12.1'	60.5'
6	270°54.3	N19°06.3		89°56.7	6.0'	\$19°41.5	-11.9'	60.5'
7	285°54.2	06.8		104°21.7	5.9'	19°53.5	-11.8'	60.5'
8	300°54.2	07.4		118°46.6	5.8'	20°05.3	-11.7'	60.5'
9	315°54.2	.. 08.0		133°11.4	5.7'	20°17.0	-11.5'	60.6'
10	330°54.2	08.6		147°36.0	5.5'	20°28.5	-11.4'	60.6'
11	345°54.2	09.1		162°00.6	5.4'	20°39.9	-11.3'	60.6'
12	0°54.2	N19°09.7		176°25.0	5.3'	\$20°51.2	-11.1'	60.6'
13	15°54.2	10.3		190°49.3	5.2'	21°02.4	-11.0'	60.6'
14	30°54.2	10.9		205°13.5	5.1'	21°13.4	-10.9'	60.6'
15	45°54.1	.. 11.4		219°37.6	5.0'	21°24.2	-10.7'	60.6'
16	60°54.1	12.0		234°01.6	4.9'	21°35.0	-10.6'	60.6'
17	75°54.1	12.6		248°25.5	4.8'	21°45.5	-10.4'	60.7'
18	90°54.1	N19°13.1		262°49.3	4.7'	\$21°56.0	-10.3'	60.7'
19	105°54.1	13.7		277°13.0	4.6'	22°06.3	-10.1'	60.7'
20	120°54.1	14.3		291°36.5	4.5'	22°16.4	-10.0'	60.7'
21	135°54.1	.. 14.8		306°00.0	4.4'	22°26.4	-9.8'	60.7'
22	150°54.0	15.4		320°23.3	4.3'	22°36.2	-9.7'	60.7'
23	165°54.0	16.0		334°46.6	4.1'	22°45.9	-9.5'	60.7'
	SD = 15.8' $d = 0.6'$			SD = 16.5'				

Tue	GHA	Dec	GHA	$\nu$	Dec	d	HP	
0	180°54.0	N19°16.5	349°09.7	4.0'	\$22°55.5	-9.4'	60.7'	
1	195°54.0	17.1	3°32.8	3.9'	23°04.8	-9.2'	60.7'	
2	210°54.0	17.7	17°55.7	3.9'	23°14.0	-9.0'	60.7'	
3	225°54.0	.. 18.2	32°18.6	3.8'	23°23.1	-8.9'	60.7'	
4	240°53.9	18.8	46°41.3	3.7'	23°31.9	-8.7'	60.8'	
5	255°53.9	19.4	61°04.0	3.6'	23°40.6	-8.5'	60.8'	
6	270°53.9	N19°19.9	75°26.6	3.5'	\$23°49.2	-8.4'	60.8'	
7	285°53.9	20.5	89°49.0	3.4'	23°57.5	-8.2'	60.8'	
8	300°53.9	21.1	104°11.4	3.3'	24°05.7	-8.0'	60.8'	
9	315°53.8	.. 21.6	118°33.7	3.2'	24°13.8	-7.8'	60.8'	
10	330°53.8	22.2	132°55.9	3.1'	24°21.6	-7.7'	60.8'	
11	345°53.8	22.7	147°18.1	3.0'	24°29.3	-7.5'	60.8'	
12	0°53.8	N19°23.3	161°40.1	3.0'	\$24°36.8	-7.3'	60.8'	
13	15°53.8	23.9	176°02.1	2.9'	24°44.1	-7.1'	60.8'	
14	30°53.8	24.4	190°24.0	2.8'	24°51.2	-6.9'	60.8'	
15	45°53.7	.. 25.0	204°45.8	2.7'	24°58.1	-6.8'	60.8'	
16	60°53.7	25.5	219°07.5	2.7'	25°04.9	-6.6'	60.8'	
17	75°53.7	26.1	233°29.2	2.6'	25°11.5	-6.4'	60.8'	
18	90°53.7	N19°26.6	247°50.8	2.5'	\$25°17.9	-6.2'	60.8'	
19	105°53.7	27.2	262°12.3	2.5'	25°24.1	-6.0'	60.8'	
20	120°53.6	27.8	276°33.8	2.4'	25°30.1	-5.8'	60.8'	
21	135°53.6	.. 28.3	290°55.2	2.3'	25°35.9	-5.6'	60.8'	
22	150°53.6	28.9	305°16.5	2.3'	25°41.5	-5.4'	60.8'	
23	165°53.6	29.4	319°37.8	2.2'	25°46.9	-5.2'	60.8'	
	SD = 15.8' $d = 0.6'$			SD = 16.6'				

Wed	GHA	Dec	GHA	$\nu$	Dec	d	HP	
0	180°53.5	N19°30.0	333°59.0	2.2'	\$25°52.2	-5.0'	60.8'	
1	195°53.5	30.5	348°20.2	2.1'	25°57.2	-4.8'	60.8'	
2	210°53.5	31.1	2°41.3	2.1'	26°02.1	-4.6'	60.8'	
3	225°53.5	.. 31.6	17°02.4	2.0'	26°06.7	-4.4'	60.8'	
4	240°53.5	32.2	31°23.4	2.0'	26°11.2	-4.3'	60.7'	
5	255°53.4	32.7	45°44.4	2.0'	26°15.4	-4.1'	60.7'	
6	270°53.4	N19°33.3	60°05.4	1.9'	\$26°19.5	-3.9'	60.7'	
7	285°53.4	33.8	74°26.3	1.9'	26°23.3	-3.6'	60.7'	
8	300°53.4	34.4	88°47.2	1.9'	26°27.0	-3.4'	60.7'	
9	315°53.3	.. 34.9	103°08.1	1.8'	26°30.4	-3.2'	60.7'	
10	330°53.3	35.5	117°28.9	1.8'	26°33.6	-3.0'	60.7'	
11	345°53.3	36.0	131°49.7	1.8'	26°36.7	-2.8'	60.7'	
12	0°53.3	N19°36.6	146°10.5	1.8'	\$26°39.5	-2.6'	60.7'	
13	15°53.2	37.1	160°31.3	1.8'	26°42.2	-2.4'	60.7'	
14	30°53.2	37.6	174°52.0	1.7'	26°44.6	-2.2'	60.7'	
15	45°53.2	.. 38.2	189°12.8	1.7'	26°46.8	-2.0'	60.7'	
16	60°53.2	38.7	203°33.5	1.7'	26°48.8	-1.8'	60.6'	
17	75°53.1	39.3	217°54.3	1.7'	26°50.7	-1.6'	60.6'	
18	90°53.1	N19°39.8	232°15.0	1.7'	\$26°52.3	-1.4'	60.6'	
19	105°53.1	40.4	246°35.7	1.7'	26°53.7	-1.2'	60.6'	
20	120°53.1	40.9	260°56.5	1.7'	26°54.9	-1.0'	60.6'	
21	135°53.0	.. 41.4	275°17.2	1.8'	26°55.9	-0.8'	60.6'	
22	150°53.0	42.0	289°38.0	1.8'	26°56.7	-0.6'	60.6'	
23	165°53.0	42.5	303°58.7	1.8'	26°57.3	-0.4'	60.6'	
	SD = 15.8' $d = 0.6'$			SD = 16.6'				

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

## May 19, 20, 21 UT (Thu., Fri., Sat.)

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	236°38.7	218°35.3	N05°36.0	240°04.5	S03°18.7	234°48.6	S00°25.6	268°58.5	S14°11.6								
1	251°41.2	233°35.0	37.1	255°05.2	18.0	249°50.6	25.5	284°00.9	11.6								
2	266°43.7	248°34.8	38.2	270°06.0	17.3	264°52.7	25.3	299°03.3	11.6								
3	281°46.1	263°34.5	· · 39.2	285°06.7	· · 16.6	279°54.7	· · 25.1	314°05.7	· · 11.6								
4	296°48.6	278°34.3	40.3	300°07.4	15.8	294°56.7	24.9	329°08.1	11.5								
5	311°51.1	293°34.0	41.3	315°08.2	15.1	309°58.8	24.8	344°10.5	11.5								
6	326°53.5	308°33.8	N05°42.4	330°08.9	S03°14.4	325°00.8	S00°24.6	359°12.9	S14°11.5								
7	341°56.0	323°33.5	43.4	345°09.6	13.6	340°02.9	24.4	14°15.3	11.5								
8	356°58.5	338°33.3	44.5	0°10.4	12.9	355°04.9	24.2	29°17.7	11.5								
9	12°00.9	353°33.0	· · 45.5	15°11.1	· · 12.2	10°07.0	· · 24.1	44°20.1	· · 11.5								
10	27°03.4	8°32.7	46.6	30°11.9	11.5	25°09.0	23.9	59°22.5	11.4								
11	42°05.8	23°32.5	47.7	45°12.6	10.7	40°11.0	23.7	74°24.9	11.4								
12	57°08.3	38°32.2	N05°48.7	60°13.3	S03°10.0	55°13.1	S00°23.5	89°27.2	S14°11.4								
13	72°10.8	53°32.0	49.8	75°14.1	09.3	70°15.1	23.4	104°29.6	11.4								
14	87°13.2	68°31.7	50.8	90°14.8	08.6	85°17.2	23.2	119°32.0	11.4								
15	102°15.7	83°31.5	· · 51.9	105°15.6	· · 07.8	100°19.2	· · 23.0	134°34.4	· · 11.4								
16	117°18.2	98°31.2	52.9	120°16.3	07.1	115°21.3	22.9	149°36.8	11.4								
17	132°20.6	113°31.0	54.0	135°17.0	06.4	130°23.3	22.7	164°39.2	11.3								
18	147°23.1	128°30.7	N05°55.0	150°17.8	S03°05.6	145°25.4	S00°22.5	179°41.6	S14°11.3								
19	162°25.6	143°30.5	56.1	165°18.5	04.9	160°27.4	22.3	194°44.0	11.3								
20	177°28.0	158°30.2	57.1	180°19.2	04.2	175°29.4	22.2	209°46.4	11.3								
21	192°30.5	173°29.9	· · 58.2	195°20.0	· · 03.5	190°31.5	· · 22.0	224°48.8	· · 11.3								
22	207°33.0	188°29.7	05°59.3	210°20.7	02.7	205°33.5	21.8	239°51.2	11.3								
23	222°35.4	203°29.4	06°00.3	225°21.5	02.0	220°35.6	21.6	254°53.6	11.3								
Mer.pass. 08:12			ν -0.3° d 1.1' m -4.02	ν 0.7° d 0.7' m 0.72	ν 2.0° d 0.2' m -2.18	ν 2.4° d 0.0' m 0.74											
Fri			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	237°37.9	218°29.2	N06°01.4	240°22.2	S03°01.3	235°37.6	S00°21.5	269°56.0	S14°11.2								
1	252°40.3	233°28.9	02.4	255°22.9	03°00.5	250°39.7	21.3	284°58.4	11.2								
2	267°42.8	248°28.7	03.5	270°23.7	02°59.8	265°41.7	21.1	300°00.8	11.2								
3	282°45.3	263°28.4	· · 04.5	285°24.4	· · 59.1	280°43.8	· · 21.0	315°03.2	· · 11.2								
4	297°47.7	278°28.1	05.6	300°25.2	58.4	295°45.8	20.8	330°05.6	11.2								
5	312°50.2	293°27.9	06.6	315°25.9	57.6	310°47.9	20.6	345°08.0	11.2								
6	327°52.7	308°27.6	N06°07.7	330°26.6	S02°56.9	325°49.9	S00°20.4	0°10.4	S14°11.2								
7	342°55.1	323°27.4	08.7	345°27.4	56.2	340°52.0	20.3	15°12.8	11.1								
8	357°57.6	338°27.1	09.8	0°28.1	55.5	355°54.0	20.1	30°15.2	11.1								
9	13°00.1	353°26.8	· · 10.8	15°28.9	· · 54.7	10°56.1	· · 19.9	45°17.6	· · 11.1								
10	28°02.5	8°26.6	11.9	30°29.6	54.0	25°58.1	19.8	60°20.0	11.1								
11	43°05.0	23°26.3	12.9	45°30.3	53.3	41°00.1	19.6	75°22.4	11.1								
12	58°07.5	38°26.1	N06°14.0	60°31.1	S02°52.5	56°02.2	S00°19.4	90°24.8	S14°11.1								
13	73°09.9	53°25.8	15.1	75°31.8	51.8	71°04.2	19.2	105°27.2	11.1								
14	88°12.4	68°25.5	16.1	90°32.6	51.1	86°06.3	19.1	120°29.6	11.0								
15	103°14.8	83°25.3	· · 17.2	105°33.3	· · 50.4	101°08.3	· · 18.9	135°32.0	· · 11.0								
16	118°17.3	98°25.0	18.2	120°34.0	49.6	116°10.4	18.7	150°34.4	11.0								
17	133°19.8	113°24.8	19.3	135°34.8	48.9	131°12.4	18.6	165°36.8	11.0								
18	148°22.2	128°24.5	N06°20.3	150°35.5	S02°48.2	146°14.5	S00°18.4	180°39.2	S14°11.0								
19	163°24.7	143°24.2	21.4	165°36.3	47.4	161°16.5	18.2	195°41.6	11.0								
20	178°27.2	158°24.0	22.4	180°37.0	46.7	176°18.6	18.0	210°44.0	11.0								
21	193°29.6	173°23.7	· · 23.5	195°37.7	· · 46.0	191°20.6	· · 17.9	225°46.4	· · 10.9								
22	208°32.1	188°23.5	24.5	210°38.5	45.3	206°22.7	17.7	240°48.8	10.9								
23	223°34.6	203°23.2	25.6	225°39.2	44.5	221°24.7	17.5	255°51.2	10.9								
Mer.pass. 08:08			ν -0.3° d 1.1' m -4.02	ν 0.7° d 0.7' m 0.72	ν 2.0° d 0.2' m -2.18	ν 2.4° d 0.0' m 0.74											
Sat			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	238°37.0	218°22.9	N06°26.6	240°40.0	S02°43.8	236°26.8	S00°17.4	270°53.6	S14°10.9								
1	253°39.5	233°22.7	27.7	255°40.7	43.1	251°28.8	17.2	285°56.0	10.9								
2	268°42.0	248°22.4	28.7	270°41.4	42.3	266°30.9	17.0	300°58.4	10.9								
3	283°44.4	263°22.1	· · 29.8	285°42.2	· · 41.6	281°32.9	· · 16.9	316°00.8	· · 10.9								
4	298°46.9	278°21.9	30.8	300°42.9	40.9	296°35.0	16.7	331°03.2	10.8								
5	313°49.3	293°21.6	31.9	315°43.7	40.2	311°37.0	16.5	346°05.6	10.8								
6	328°51.8	308°21.3	N06°32.9	330°44.4	S02°39.4	326°39.1	S00°16.3	1°08.0	S14°10.8								
7	343°54.3	323°21.1	34.0	345°45.1	38.7	341°41.1	16.2	16°10.4	10.8								
8	358°56.7	338°20.8	35.0	0°45.9	38.0	356°43.2	16.0	31°12.8	10.8								
9	13°59.2	353°20.5	· · 36.1	15°46.6	· · 37.3	11°45.2	· · 15.8	46°15.3	· · 10.8								
10	29°01.7	8°20.3	37.1	30°47.4	36.5	26°47.3	15.7	61°17.7	10.8								
11	44°04.1	23°20.0	38.2	45°48.1	35.8	41°49.3	15.5	76°20.1	10.8								
12	59°06.6	38°19.8	N06°39.2	60°48.9	S02°35.1	56°51.4	S00°15.3	91°22.5	S14°10.7								
13	74°09.1	53°19.5	40.3	75°49.6	34.3	71°53.4	15.2	106°24.9	10.7								
14	89°11.5	68°19.2	41.3	90°50.3	33.6	86°55.5	15.0	121°27.3	10.7								
15	104°14.0	83°19.0	· · 42.4	105°51.1	· · 32.9	101°57.6	· · 14.8	136°29.7	· · 10.7								
16	119°16.5	98°18.7	43.4	120°51.8	32.2	116°59.6	14.6	151°32.1	10.7								
17	134°18.9	113°18.4	44.5	135°52.6	31.4	132°01.7	14.5	166°34.5	10.7								
18	149°21.4	128°18.1	N06°45.5	150°53.3	S02°30.7	147°03.7	S00°14.3	181°36.9	S14°10.7								
19																	

DUT1 = UT1-UTC = -0.0982 sec  $\Delta T = TT-UT1 = +69.2822$  sec

2022 May 19 to May. 21 UT

h		Sun		Moon				
Thu		GHA	Dec	GHA	$\nu$	Dec	d	HP
0	180°52.9	N19°43.1	318°19.5	1.8'	S26°57.6	-0.2'	60.5'	
1	195°52.9	43.6	332°40.3	1.8'	26°57.8	0.0'	60.5'	
2	210°52.9	44.1	347°01.1	1.9'	26°57.8	0.2'	60.5'	
3	225°52.9	44.7	1°22.0	1.9'	26°57.6	0.4'	60.5'	
4	240°52.8	45.2	15°42.9	1.9'	26°57.1	0.6'	60.5'	
5	255°52.8	45.7	30°03.8	1.9'	26°56.5	0.8'	60.5'	
6	270°52.8	N19°46.3	44°24.7	2.0'	S26°55.7	1.0'	60.4'	
7	285°52.7	46.8	58°45.7	2.0'	26°54.6	1.2'	60.4'	
8	300°52.7	47.4	73°06.8	2.1'	26°53.4	1.4'	60.4'	
9	315°52.7	47.9	87°27.8	2.1'	26°51.9	1.6'	60.4'	
10	330°52.7	48.4	101°48.9	2.2'	26°50.3	1.8'	60.4'	
11	345°52.6	49.0	116°10.1	2.2'	26°48.5	2.0'	60.4'	
12	0°52.6	N19°49.5	130°31.3	2.3'	S26°46.4	2.2'	60.3'	
13	15°52.6	50.0	144°52.6	2.3'	26°44.2	2.4'	60.3'	
14	30°52.5	50.5	159°13.9	2.4'	26°41.8	2.6'	60.3'	
15	45°52.5	51.1	173°35.3	2.5'	26°39.1	2.8'	60.3'	
16	60°52.5	51.6	187°56.8	2.5'	26°36.3	3.0'	60.3'	
17	75°52.4	52.1	202°18.3	2.6'	26°33.3	3.2'	60.2'	
18	90°52.4	N19°52.7	216°39.9	2.7'	S26°30.1	3.4'	60.2'	
19	105°52.4	53.2	231°01.6	2.7'	26°26.7	3.6'	60.2'	
20	120°52.3	53.7	245°23.3	2.8'	26°23.1	3.8'	60.2'	
21	135°52.3	54.2	259°45.1	2.9'	26°19.3	4.0'	60.1'	
22	150°52.3	54.8	274°07.0	3.0'	26°15.4	4.2'	60.1'	
23	165°52.2	55.3	288°28.9	3.0'	26°11.2	4.3'	60.1'	
	SD = 15.8'	d = 0.5'		SD = 16.5'				
Fri		GHA	Dec	GHA	$\nu$	Dec	d	HP
0	180°52.2	N19°55.8	302°51.0	3.1'	S26°06.9	4.5'	60.1'	
1	195°52.2	56.3	317°13.1	3.2'	26°02.4	4.7'	60.1'	
2	210°52.1	56.9	331°35.3	3.3'	25°57.7	4.9'	60.0'	
3	225°52.1	57.4	345°57.7	3.4'	25°52.8	5.1'	60.0'	
4	240°52.1	57.9	0°20.1	3.5'	25°47.7	5.2'	60.0'	
5	255°52.0	58.4	14°42.5	3.6'	25°42.5	5.4'	60.0'	
6	270°52.0	N19°59.0	29°05.1	3.7'	S25°37.1	5.6'	59.9'	
7	285°52.0	19°59.5	43°27.8	3.8'	25°31.5	5.8'	59.9'	
8	300°51.9	20°00.0	57°50.6	3.9'	25°25.7	5.9'	59.9'	
9	315°51.9	00.5	72°13.5	4.0'	25°19.8	6.1'	59.9'	
10	330°51.9	01.0	86°36.5	4.1'	25°13.7	6.3'	59.8'	
11	345°51.8	01.6	100°59.5	4.2'	25°07.4	6.4'	59.8'	
12	0°51.8	N20°02.1	115°22.7	4.3'	S25°00.9	6.6'	59.8'	
13	15°51.7	02.6	129°46.0	4.4'	24°54.3	6.8'	59.8'	
14	30°51.7	03.1	144°09.4	4.5'	24°47.6	6.9'	59.7'	
15	45°51.7	03.6	158°32.9	4.6'	24°40.6	7.1'	59.7'	
16	60°51.6	04.1	172°56.5	4.7'	24°33.5	7.3'	59.7'	
17	75°51.6	04.7	187°20.3	4.8'	24°26.3	7.4'	59.7'	
18	90°51.6	N20°05.2	201°44.1	5.0'	S24°18.9	7.6'	59.6'	
19	105°51.5	05.7	216°08.1	5.1'	24°11.3	7.7'	59.6'	
20	120°51.5	06.2	230°32.1	5.2'	24°03.6	7.9'	59.6'	
21	135°51.4	06.7	244°56.3	5.3'	23°55.7	8.0'	59.5'	
22	150°51.4	07.2	259°20.6	5.4'	23°47.7	8.2'	59.5'	
23	165°51.4	07.7	273°45.1	5.5'	23°39.5	8.3'	59.5'	
	SD = 15.8'	d = 0.5'		SD = 16.4'				
Sat		GHA	Dec	GHA	$\nu$	Dec	d	HP
0	180°51.3	N20°08.2	288°09.6	5.7'	S23°31.2	8.5'	59.5'	
1	195°51.3	08.7	302°34.2	5.8'	23°22.7	8.6'	59.4'	
2	210°51.2	09.3	316°59.0	5.9'	23°14.1	8.7'	59.4'	
3	225°51.2	09.8	331°23.9	6.0'	23°05.4	8.9'	59.4'	
4	240°51.2	10.3	345°48.9	6.1'	22°56.5	9.0'	59.3'	
5	255°51.1	10.8	0°14.1	6.3'	22°47.5	9.2'	59.3'	
6	270°51.1	N20°11.3	14°39.3	6.4'	S22°38.3	9.3'	59.3'	
7	285°51.0	11.8	29°04.7	6.5'	22°29.1	9.4'	59.3'	
8	300°51.0	12.3	43°30.2	6.6'	22°19.6	9.5'	59.2'	
9	315°51.0	12.8	57°55.8	6.7'	22°10.1	9.7'	59.2'	
10	330°50.9	13.3	72°21.5	6.9'	22°00.4	9.8'	59.2'	
11	345°50.9	13.8	86°47.4	7.0'	21°50.6	9.9'	59.1'	
12	0°50.8	N20°14.3	101°13.4	7.1'	S21°40.7	10.0'	59.1'	
13	15°50.8	14.8	115°39.5	7.2'	21°30.6	10.2'	59.1'	
14	30°50.8	15.3	130°05.7	7.3'	21°20.5	10.3'	59.1'	
15	45°50.7	15.8	144°32.1	7.5'	21°10.2	10.4'	59.0'	
16	60°50.7	16.3	158°58.5	7.6'	20°59.8	10.5'	59.0'	
17	75°50.6	16.8	173°25.1	7.7'	20°49.3	10.6'	59.0'	
18	90°50.6	N20°17.3	187°51.8	7.8'	S20°38.6	10.7'	58.9'	
19	105°50.5	17.8	202°18.7	8.0'	20°27.9	10.8'	58.9'	
20	120°50.5	18.3	216°45.6	8.1'	20°17.1	11.0'	58.9'	
21	135°50.4	18.8	231°12.7	8.2'	20°06.1	11.1'	58.8'	
22	150°50.4	19.3	245°39.9	8.3'	19°55.0	11.2'	58.8'	
23	165°50.4	19.8	260°07.2	8.4'	19°43.9	11.3'	58.8'	
	SD = 15.8'	d = 0.5'		SD = 16.2'				

Lat.	Twilight		Sunrise	Sunset	Twilight	
	Naut.	Civil			Civil	Naut.
N 72°	—	—	—	—	—	—
N 70°	—	—	—	—	—	—
68°	—	—	01:17	22:43	—	—
66°	—	—	02:02	21:54	—	—
64°	—	00:14	02:32	21:24	—	—
62°	—	01:29	02:54	21:01	22:28	—
60°	—	02:03	03:11	20:43	21:53	—
N 58°	00:12	02:28	03:26	20:28	21:28	—
56°	01:21	02:47	03:39	20:16	21:08	22:36
54°	01:52	04:25	04:53	19:00	19:29	20:04
52°	02:15	03:16	03:59	19:55	20:39	21:40
50°	02:33	03:27	04:08	19:46	20:27	21:22
48°	03:06	03:51	04:26	19:28	20:03	20:48
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	20:04
30°	04:06	04:37	05:04	18:50	19:16	19:48
20°	04:30	04:58	05:22	18:31	18:55	19:23
N 10°	04:49	05:16	05:38	18:15	18:37	19:04
0°	05:05	05:31	05:53	18:00	18:22	18:48
S 10°	05:20	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	17:19	17:52
45°	06:08	06:44	07:17	16:36	17:08	17:44
S 50°	06:17	06:57	07:33	16:19	16:56	17:36
52°	06:21	07:03	07:41	16:11	16:50	17:32
54°	06:25	07:09	07:50	16:03	16:43	17:27
56°	06:30	07:16	08:00	15:53	16:36	17:23
58°	06:34	07:24	08:11	15:42	16:28	17:18
S 60°	06:40	07:33	08:24	15:29	16:20	17:13
Lat.	Thu	Moonrise	Fri	Sat	Thu	Moonset
		Fri		Sat		
N 72°	—	—	—	—	—	—
N 70°	—	—	—	—	—	—
68°	—	—	03:50	—	—	06:21
66°	—	—	03:01	—	—	07:09
64°	—	—	02:30	03:59	05:41	07:40
62°	01:50	02:23	02:06	03:59	05:41	07:40
60°	01:00	01:46	02:06	04:49	06:18	08:03
N 58°	00:28	01:20	01:47	05:21	06:44	08:21
56°	00:05	00:59	01:31	05:44	07:04	08:37
54°	—	00:41	01:18	06:03	07:21	08:50
50°	—	00:26	01:06	06:19	07:36	09:01
45°	23:47	—	00:32	07:02	08:15	09:33
N 40°	23:26	—	00:14	07:24	08:35	09:50
35°	23:08	23:59	—	07:43	08:52	10:04
30°	22:53	23:46	—	07:58	09:07	10:17
20°	22:27	23:23	—	08:25	09:32	10:38
N 10°	22:04	23:04	23:57	08:48	09:54	10:56
0°	21:44	22:45	23:42	09:10	10:13	11:13
S 10°	21:23	22:27	23:27	09:31	10:33	11:29
20°	21:00	22:07	23:11	09:54	10:54	11:47
30°	20:34	21:44	22:52	10:21	11:19	1

## May 22, 23, 24 UT (Sun., Mon., Tue.)

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	239°36.2	218°16.5	N06°51.8	240°57.8	S02°26.3	237°16.0	S00°13.3	271°51.3	S14°10.6					Alpheratz	357°37.2	29°12.6	
1	254°38.6	233°16.3	52.9	255°58.5	25.6	252°18.1	13.1	286°53.7	10.6					Ankaa	353°09.6	-42°11.0	
2	269°41.1	248°16.0	53.9	270°59.2	24.9	267°20.1	13.0	301°56.1	10.6					Schedar	349°33.9	56°39.3	
3	284°43.6	263°15.7	.. 55.0	286°00.0	.. 24.1	282°22.2	.. 12.8	316°58.5	.. 10.6					Diphda	348°49.7	-17°51.9	
4	299°46.0	278°15.5	56.0	301°00.7	23.4	297°24.2	12.6	332°01.0	10.6					Achernar	335°22.3	-57°07.3	
5	314°48.5	293°15.2	57.1	316°01.5	22.7	312°26.3	12.5	347°03.4	10.5					Hamal	327°54.0	23°33.9	
6	329°50.9	308°14.9	N06°58.1	331°02.2	S02°22.0	327°28.4	S00°12.3	2°05.8	S14°10.5					Polaris	315°31.4	89°21.3	
7	344°53.4	323°14.6	06°59.2	346°03.0	21.2	342°30.4	12.1	17°08.2	10.5					Acamar	315°13.9	-40°12.9	
8	359°55.9	338°14.4	07°00.2	1°03.7	20.5	357°32.5	11.9	32°10.6	10.5					Menkar	314°08.8	4°10.5	
9	14°58.3	353°14.1	.. 01.3	16°04.4	.. 19.8	12°34.5	.. 11.8	47°13.0	.. 10.5					Mirfak	308°31.9	49°56.3	
10	30°00.8	8°13.8	02.3	31°05.2	19.0	27°36.6	11.6	62°15.4	10.5					Aldebaran	290°42.5	16°33.1	
11	45°03.3	23°13.6	03.3	46°05.9	18.3	42°38.6	11.4	77°17.8	10.5					Rigel	281°06.3	-8°10.6	
12	60°05.7	38°13.3	N07°04.4	61°06.7	S02°17.6	57°40.7	S00°11.3	92°20.2	S14°10.5					Capella	280°25.6	46°01.2	
13	75°08.2	53°13.0	05.4	76°07.4	16.9	72°42.7	11.1	107°22.6	10.4					Bellatrix	278°25.5	6°22.1	
14	90°10.7	68°12.7	06.5	91°08.2	16.1	87°44.8	10.9	122°25.0	10.4					Elnath	278°05.0	28°37.5	
15	105°13.1	83°12.5	.. 07.5	106°08.9	.. 15.4	102°46.9	.. 10.8	137°27.4	.. 10.4					Alnilam	275°40.3	-1°11.3	
16	120°15.6	98°12.2	08.6	121°09.6	14.7	117°48.9	10.6	152°29.8	10.4					Betelgeuse	270°54.8	7°24.6	
17	135°18.1	113°11.9	09.6	136°10.4	13.9	132°51.0	10.4	167°32.3	10.4					Canopus	263°53.8	-52°42.6	
18	150°20.5	128°11.6	N07°10.7	151°11.1	S02°13.2	147°53.0	S00°10.3	182°34.7	S14°10.4					Sirius	258°28.4	-16°44.9	
19	165°23.0	143°11.4	11.7	166°11.9	12.5	162°55.1	10.1	197°37.1	10.4					Adhara	255°07.9	-29°00.3	
20	180°25.4	158°11.1	12.8	181°12.6	11.8	177°57.1	09.9	212°39.5	10.4					Procyon	244°53.3	5°10.0	
21	195°27.9	173°10.8	.. 13.8	196°13.4	.. 11.0	192°59.2	.. 09.8	227°41.9	.. 10.4					Pollux	243°20.2	27°58.4	
22	210°30.4	188°10.5	14.9	211°14.1	10.3	208°01.3	09.6	242°44.3	10.4					Avior	234°15.9	-59°35.1	
23	225°32.8	203°10.3	15.9	226°14.9	09.6	223°03.3	09.4	257°46.7	10.3					Suhail	222°48.0	-43°31.6	
Mer.pass. 08:00			ν -0.3° d 1.0' m -4.01	ν 0.7° d 0.7' m 0.70			ν 2.1° d 0.2' m -2.19			ν 2.4° d 0.0' m 0.73							
Mon			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec				
0	240°35.3	218°10.0	N07°16.9	241°15.6	S02°08.9	238°05.4	S00°09.3	272°49.1	S14°10.3					Denebola	193°43.6	61°38.2	
1	255°37.8	233°09.8	18.0	256°16.3	08.1	253°07.4	09.1	287°51.5	10.3					Gienah	175°45.7	-17°40.0	
2	270°40.2	248°09.4	19.0	271°17.1	07.4	268°09.5	08.9	302°53.9	10.3					Acrux	173°02.1	-63°13.6	
3	285°42.7	263°09.2	.. 20.1	286°17.8	.. 06.7	283°11.5	.. 08.8	317°56.4	.. 10.3					Gacrux	171°53.7	-57°14.5	
4	300°45.2	278°08.9	21.1	301°18.6	05.9	298°13.6	08.6	332°58.8	10.3					Alioth	166°14.5	55°50.6	
5	315°47.6	293°08.6	22.2	316°19.3	05.2	313°15.7	08.4	348°01.2	10.3					Spica	158°24.4	-11°16.7	
6	330°50.1	308°08.3	N07°23.2	331°20.1	S02°04.5	328°17.7	S00°08.3	3°03.6	S14°10.3					Alkaid	152°53.4	49°12.3	
7	345°52.6	323°08.0	24.2	346°20.8	03.8	343°19.8	08.1	18°06.0	10.3					Hadar	148°38.5	-60°28.9	
8	0°55.0	338°07.8	25.3	1°21.6	03.0	358°21.8	07.9	33°08.4	10.2					Menkent	147°59.8	-36°28.9	
9	15°57.5	353°07.5	.. 26.3	16°22.3	.. 02.3	13°23.9	.. 07.8	48°10.8	.. 10.2					Arcturus	145°49.6	19°04.0	
10	30°59.9	8°07.2	27.4	31°23.0	01.6	28°26.0	07.6	63°13.2	10.2					Rigel Kent.	139°42.7	-60°55.7	
11	46°02.4	23°06.9	28.4	46°23.8	00.8	43°28.0	07.4	78°15.6	10.2					Kochab	137°18.7	74°03.9	
12	61°04.9	38°06.6	N07°29.5	61°24.5	S02°00.1	58°30.1	S00°07.3	93°18.1	S14°10.2					Zuben'ubi	136°58.1	-16°08.1	
13	76°07.3	53°06.4	30.5	76°25.3	01°59.4	73°32.1	07.1	108°20.5	10.2					Alphecca	126°05.2	26°38.4	
14	91°09.8	68°06.1	31.6	91°26.0	58.7	88°34.2	06.9	123°22.9	10.2					Antares	112°18.1	-26°28.9	
15	106°12.3	83°05.8	.. 32.6	106°26.8	.. 57.9	103°36.3	.. 06.8	138°25.3	.. 10.2					Atria	107°13.8	-69°04.0	
16	121°14.7	98°05.5	33.6	121°27.5	57.2	118°38.3	06.6	153°27.7	10.2					Sabik	102°05.0	-15°45.2	
17	136°17.2	113°05.2	34.7	136°28.3	56.5	133°40.4	06.4	168°30.1	10.2					Shaula	96°12.9	-37°07.1	
18	151°19.7	128°05.0	N07°35.7	151°29.0	S01°55.7	148°42.4	S00°06.3	183°32.5	S14°10.1					Rasalhague	96°00.3	12°32.6	
19	166°22.1	143°04.7	36.8	166°29.8	55.0	163°44.5	06.1	198°34.9	10.1					Eltanin	90°42.7	51°29.0	
20	181°24.6	158°04.4	37.8	181°30.5	54.3	178°46.6	06.0	213°37.4	10.1					Kaus Aust.	83°35.1	-34°22.4	
21	196°27.0	173°04.1	.. 38.8	196°31.2	.. 53.6	193°48.6	.. 05.8	228°39.8	.. 10.1					Vega	80°34.3	38°48.1	
22	211°29.5	188°03.8	39.9	211°32.0	52.8	208°50.7	05.6	243°42.2	10.1					Nunki	75°50.2	-26°16.1	
23	226°32.0	203°03.5	40.9	226°32.7	52.1	223°52.7	05.5	258°44.6	10.1					Altair	62°01.9	8°55.5	
Mer.pass. 07:56			ν -0.3° d 1.0' m -4.00	ν 0.7° d 0.7' m 0.70			ν 2.1° d 0.2' m -2.20			ν 2.4° d 0.0' m 0.72							
Tue			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec				
0	241°34.4	218°03.3	N07°42.0	241°33.5	S01°51.4	238°54.8	S00°05.3	273°47.0	S14°10.1					Fomalhaut	15°17.0	-29°30.2	
1	256°36.9	233°03.0	43.0	256°34.2	50.6	253°56.9	05.1	288°49.4	10.1					Scheat	13°47.4	28°12.0	
2	271°39.4	248°02.7	44.0	271°35.0	49.9	268°58.9	05.0	303°51.8	10.1					Markab	13°32.1	15°19.3	
3	286°41.8	263°02.4	.. 45.1	286°35.7	.. 49.2	284°01.0	.. 04.8	318°54.3	.. 10.1					May 22 Sun			
4	301°44.3	278°02.1	46.1	301°36.5	48.5	299°03.1	04.6	333°56.7	10.1					Venus	338°40.4	09:27	
5	316°46.8	293°01.8	47.2	316°37.2	47.7	314°05.1	04.5	348°59.1	10.0					Mars	1°21.6	07:56	
6	331°49.2	308°01.6	N07°48.2	331°38.0	S01°47.0	329°07.2	S00°04.3	4°01.5	S14°10.0					Jupiter	357°39.9	08:10	
7	346°51.7	323°01.3	49.2	346°38.7	46.3	344°09.2	04.1	19°03.9	10.0					Saturn	32°15.2	05:52	
8	1°54.2	338°01.0	50.3	1°39.5	45.6	359°11.3	04.0	34°06.3	10.0					May 23 Mon			
9	16°56.6	353°00.7	.. 51.3	16°40.2	.. 44.8	14°13.4	.. 03.8	49°08.7	.. 10.0					Venus	337°34.7	09:28	
10	31°59.1	8°00.4	52.4	31°41.0	44.1	29°15.4	03.6	64°11.2	10.0					Mars	0°40.3	07:55	
11	47°01.5	23°00.1	53.4	46°41.7	43.4	44°17.5	03.5	79°13.6	10.0					Jupiter	357°30.1	08:07	
12	62°04																

DUT1 = UT1-UTC = -0.0977 sec  $\Delta T = TT-UT1 = +69.2817$  sec

2022 May 22 to May. 24 UT

h		Sun		Moon				
Sun		GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	180°50.3	N20°20.3	274°34.7	8.6'	S19°32.6	11.4'	58.8'	
1	195°50.3	20.8	289°02.2	8.7'	19°21.2	11.5'	58.7'	
2	210°50.2	21.3	303°29.9	8.8'	19°09.8	11.6'	58.7'	
3	225°50.2	21.8	317°57.7	8.9'	18°58.2	11.7'	58.7'	
4	240°50.1	22.3	332°25.6	9.0'	18°46.5	11.8'	58.6'	
5	255°50.1	22.8	346°53.6	9.1'	18°34.8	11.8'	58.6'	
6	270°50.0	N20°23.3	1°21.8	9.3'	S18°23.0	11.9'	58.6'	
7	285°50.0	23.8	15°50.0	9.4'	18°11.0	12.0'	58.5'	
8	300°49.9	24.3	30°18.4	9.5'	17°59.0	12.1'	58.5'	
9	315°49.9	24.8	44°46.9	9.6'	17°46.9	12.2'	58.5'	
10	330°49.8	25.2	59°15.5	9.7'	17°34.7	12.3'	58.4'	
11	345°49.8	25.7	73°44.2	9.8'	17°22.4	12.4'	58.4'	
12	0°49.8	N20°26.2	88°13.0	9.9'	S17°10.1	12.4'	58.4'	
13	15°49.7	26.7	102°41.9	10.0'	16°57.7	12.5'	58.4'	
14	30°49.7	27.2	117°11.0	10.2'	16°45.1	12.6'	58.3'	
15	45°49.6	27.7	131°40.1	10.3'	16°32.6	12.7'	58.3'	
16	60°49.6	28.2	146°09.4	10.4'	16°19.9	12.7'	58.3'	
17	75°49.5	28.7	160°38.8	10.5'	16°07.2	12.8'	58.2'	
18	90°49.5	N20°29.1	175°08.2	10.6'	S15°54.4	12.9'	58.2'	
19	105°49.4	29.6	189°37.8	10.7'	15°41.5	12.9'	58.2'	
20	120°49.4	30.1	204°07.5	10.8'	15°28.5	13.0'	58.1'	
21	135°49.3	30.6	218°37.3	10.9'	15°15.5	13.1'	58.1'	
22	150°49.3	31.1	233°07.2	11.0'	15°02.5	13.1'	58.1'	
23	165°49.2	31.6	247°37.1	11.1'	14°49.3	13.2'	58.0'	
	SD = 15.8'	d = 0.5'		SD = 16.0'				

Mon	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	180°49.2	N20°32.0	262°07.2	11.2'	S14°36.1	13.3'	58.0'
1	195°49.1	32.5	276°37.4	11.3'	14°22.9	13.3'	58.0'
2	210°49.1	33.0	291°07.7	11.4'	14°09.5	13.4'	58.0'
3	225°49.0	33.5	305°38.1	11.5'	13°56.2	13.4'	57.9'
4	240°49.0	34.0	320°08.5	11.6'	13°42.7	13.5'	57.9'
5	255°48.9	34.4	334°39.1	11.7'	13°29.3	13.5'	57.9'
6	270°48.8	N20°34.9	349°09.8	11.8'	S13°15.7	13.6'	57.8'
7	285°48.8	35.4	3°40.5	11.8'	13°02.1	13.6'	57.8'
8	300°48.7	35.9	18°11.4	11.9'	12°48.5	13.7'	57.8'
9	315°48.7	36.4	32°42.3	12.0'	12°34.8	13.7'	57.7'
10	330°48.6	36.8	47°13.3	12.1'	12°21.1	13.8'	57.7'
11	345°48.6	37.3	61°44.4	12.2'	12°07.3	13.8'	57.7'
12	0°48.5	N20°37.8	76°15.6	12.3'	S11°53.4	13.9'	57.7'
13	15°48.5	38.3	90°46.9	12.4'	11°39.6	13.9'	57.6'
14	30°48.4	38.7	105°18.3	12.4'	11°25.7	14.0'	57.6'
15	45°48.4	39.2	119°49.7	12.5'	11°11.7	14.0'	57.6'
16	60°48.3	39.7	134°21.2	12.6'	10°57.7	14.0'	57.5'
17	75°48.3	40.1	148°52.8	12.7'	10°43.7	14.1'	57.5'
18	90°48.2	N20°40.6	163°24.5	12.8'	S10°29.6	14.1'	57.5'
19	105°48.1	41.1	177°56.3	12.8'	10°15.5	14.1'	57.4'
20	120°48.1	41.6	192°28.1	12.9'	10°01.4	14.2'	57.4'
21	135°48.0	42.0	207°00.0	13.0'	09°47.2	14.2'	57.4'
22	150°48.0	42.5	221°32.0	13.1'	09°33.0	14.2'	57.4'
23	165°47.9	43.0	236°04.1	13.1'	09°18.8	14.3'	57.3'
	SD = 15.8'	d = 0.5'		SD = 15.8'			

Tue	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	180°47.9	N20°43.4	250°36.2	13.2'	S09°04.5	14.3'	57.3'
1	195°47.8	43.9	265°08.4	13.3'	08°50.3	14.3'	57.3'
2	210°47.8	44.4	279°40.7	13.3'	08°35.9	14.3'	57.2'
3	225°47.7	44.8	294°13.0	13.4'	08°21.6	14.4'	57.2'
4	240°47.6	45.3	308°45.4	13.5'	08°07.2	14.4'	57.2'
5	255°47.6	45.8	323°17.9	13.5'	07°52.9	14.4'	57.2'
6	270°47.5	N20°46.2	337°50.4	13.6'	S07°38.5	14.4'	57.1'
7	285°47.5	46.7	352°23.0	13.6'	07°24.0	14.4'	57.1'
8	300°47.4	47.1	6°55.6	13.7'	07°09.6	14.5'	57.1'
9	315°47.4	47.6	21°28.3	13.8'	06°55.1	14.5'	57.0'
10	330°47.3	48.1	36°01.1	13.8'	06°40.6	14.5'	57.0'
11	345°47.2	48.5	50°33.9	13.9'	06°26.1	14.5'	57.0'
12	0°47.2	N20°49.0	65°06.8	13.9'	S06°11.6	14.5'	57.0'
13	15°47.1	49.4	79°39.8	14.0'	05°57.1	14.5'	56.9'
14	30°47.1	49.9	94°12.7	14.0'	05°42.6	14.6'	56.9'
15	45°47.0	50.4	108°45.8	14.1'	05°28.0	14.6'	56.9'
16	60°46.9	50.8	123°18.9	14.1'	05°13.5	14.6'	56.8'
17	75°46.9	51.3	137°52.0	14.2'	04°58.9	14.6'	56.8'
18	90°46.8	N20°51.7	152°25.2	14.2'	S04°44.3	14.6'	56.8'
19	105°46.8	52.2	166°58.4	14.3'	04°29.7	14.6'	56.8'
20	120°46.7	52.6	181°31.7	14.3'	04°15.1	14.6'	56.7'
21	135°46.6	53.1	196°05.0	14.4'	04°00.5	14.6'	56.7'
22	150°46.6	53.5	210°38.4	14.4'	03°45.9	14.6'	56.7'
23	165°46.5	54.0	225°11.8	14.4'	03°31.3	14.6'	56.7'
	SD = 15.8'	d = 0.5'		SD = 15.6'			

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

## May 25, 26, 27 UT (Wed., Thu., Fri.)

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	242°33.6	217°56.4	N08°06.9	241°51.4	S01°33.9	239°44.3	S00°01.4	274°45.0	S14°09.9	Alpheratz	357°37.2	29°12.6					
1	257°36.0	232°56.1	07.9	256°52.2	33.2	254°46.4	01.2	289°47.4	09.9	Ankaa	353°09.6	-42°11.0					
2	272°38.5	247°55.8	09.0	271°52.9	32.5	269°48.5	01.0	304°49.8	09.9	Schedar	349°33.8	56°39.3					
3	287°41.0	262°55.5	10.0	286°53.7	31.7	284°50.5	00.9	319°52.2	09.9	Diphda	348°49.7	-17°51.9					
4	302°43.4	277°55.2	11.0	301°54.4	31.0	299°52.6	00.7	334°54.7	09.9	Achernar	335°22.3	-57°07.3					
5	317°45.9	292°54.9	12.1	316°55.2	30.3	314°54.7	00.5	349°57.1	09.9	Hamal	327°54.0	23°33.9					
6	332°48.4	307°54.6	N08°13.1	331°55.9	S01°29.5	329°56.7	S00°00.4	4°59.5	S14°09.8	Polaris	315°30.9	89°21.3					
7	347°50.8	322°54.3	14.1	346°56.7	28.8	344°58.8	00.2	20°01.9	09.8	Acamar	315°13.9	-40°12.9					
8	2°53.3	337°54.0	15.2	1°57.4	28.1	0°00.9	S00°00.1	35°04.3	09.8	Menkar	314°08.7	4°10.5					
9	17°55.8	352°53.8	16.2	16°58.1	27.4	15°02.9	N00°00.1	50°06.8	09.8	Mirfak	308°31.9	49°56.3					
10	32°58.2	7°53.5	17.2	31°58.9	26.6	30°05.0	00.3	65°09.2	09.8	Aldebaran	290°42.5	16°33.2					
11	48°00.7	22°53.2	18.3	46°59.6	25.9	45°07.1	00.4	80°11.6	09.8	Rigel	281°06.3	-8°10.6					
12	63°03.1	37°52.9	N08°19.3	62°00.4	S01°25.2	60°09.1	N00°00.6	95°14.0	S14°09.8	Capella	280°25.6	46°01.2					
13	78°05.6	52°52.6	20.3	77°01.1	24.4	75°11.2	00.8	110°16.4	09.8	Bellatrix	278°25.5	6°22.1					
14	93°08.1	67°52.3	21.4	92°01.9	23.7	90°13.3	00.9	125°18.9	09.8	Elnath	278°05.0	28°37.5					
15	108°10.5	82°52.0	22.4	107°02.6	23.0	105°15.3	01.1	140°21.3	09.8	Alnilam	275°40.3	-1°11.3					
16	123°13.0	97°51.7	23.4	122°03.4	22.3	120°17.4	01.2	155°23.7	09.8	Betelgeuse	270°54.8	7°24.6					
17	138°15.5	112°51.4	24.5	137°04.1	21.5	135°19.5	01.4	170°26.1	09.8	Canopus	263°53.8	-52°42.6					
18	153°17.9	127°51.1	N08°25.5	152°04.9	S01°20.8	150°21.6	N00°01.6	185°28.5	S14°09.8	Sirius	258°28.5	-16°44.9					
19	168°20.4	142°50.8	26.5	167°05.6	20.1	165°23.6	01.7	200°31.0	09.8	Adhara	255°07.9	-29°00.3					
20	183°22.9	157°50.5	27.6	182°06.4	19.4	180°25.7	01.9	215°33.4	09.7	Procyon	244°53.3	5°10.0					
21	198°25.3	172°50.2	28.6	197°07.1	18.6	195°27.8	02.1	230°35.8	09.7	Pollux	243°20.2	27°58.4					
22	213°27.8	187°49.9	29.6	212°07.9	17.9	210°29.8	02.2	245°38.2	09.7	Avior	234°15.9	-59°35.1					
23	228°30.3	202°49.6	30.7	227°08.6	17.2	225°31.9	02.4	260°40.7	09.7	Suhail	222°48.1	-43°31.6					
Mer.pass. 07:48			ν -0.3° d 1.0' m -4.00	ν 0.7° d 0.7' m 0.68	ν 2.1° d 0.2' m -2.20	ν 2.4° d 0.0' m 0.72	Miaplacidus			221°39.0	-69°48.8						
Thu			Mer.pass. 07:45	ν -0.3° d 1.0' m -3.99	ν 0.7° d 0.7' m 0.67	ν 2.1° d 0.2' m -2.21	ν 2.4° d 0.0' m 0.71	Alphard			217°50.0	-8°45.4					
									Regulus			207°36.8	11°51.6				
									Dubhe			193°43.6	61°38.2				
									Denebola			182°27.1	14°26.9				
									Gienah			175°45.7	-17°40.0				
									Acrux			173°02.1	-63°13.6				
									Gacrux			171°53.7	-57°14.5				
									Alioth			166°14.6	55°50.6				
									Spica			158°24.4	-11°16.7				
									Alkaid			152°53.4	49°12.3				
									Hadar			148°38.5	-60°29.0				
									Menkent			147°59.8	-36°28.9				
									Arcturus			145°49.6	19°04.0				
									Rigel Kent.			139°42.7	-60°55.7				
									Kochab			137°18.7	74°04.0				
									Zuben' ubi			136°58.1	-16°08.1				
									Alphecca			126°05.2	26°38.4				
									Antares			112°18.1	-26°28.9				
									Atria			107°13.8	-69°04.0				
									Sabik			102°04.9	-15°45.2				
									Shaula			96°12.9	-37°07.1				
									Rasalhague			96°00.2	12°32.6				
									Eltanin			90°42.7	51°29.0				
									Kaus Aust.			83°35.1	-34°22.4				
									Vega			80°34.3	38°48.1				
									Nunki			75°50.2	-26°16.1				
									Altair			62°01.9	8°55.5				
									Peacock			53°08.9	-56°39.6				
									Deneb			49°27.1	45°21.3				
									Enif			33°40.9	9°58.5				
									Al Na'ir			27°35.6	-46°51.0				
									Fomalhaut			15°17.0	-29°30.2				
									Scheat			13°47.4	28°12.0				
									Markab			13°32.1	15°19.3				
May 25 Wed			SHA			Mer.pass											
			Venus			335°22.8			09:28								
			Mars			359°17.8			07:52								
			Jupiter			357°10.8			08:00								
			Saturn			32°11.4			05:40								
May 26 Thu			SHA			Mer.pass											
			Venus			334°16.6			09:29								
			Mars			358°36.7			07:51								
			Jupiter			357°01.3			07:57								
			Saturn			32°10.4			05:36								
May 27 Fri			SHA			Mer.pass											

DUT1 = UT1-UTC = -0.0982 sec  $\Delta T = TT-UT1 = +69.2822$  sec

2022 May 25 to May. 27 UT

h		Sun		Moon				
Wed		GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	180° 46.4	N20° 54.4		239° 45.3	14.5'	S03° 16.7	14.6'	56.6'
1	195° 46.4	54.9		254° 18.7	14.5'	03° 02.1	14.6'	56.6'
2	210° 46.3	55.4		268° 52.3	14.6'	02° 47.5	14.6'	56.6'
3	225° 46.3	.. 55.8		283° 25.8	14.6'	02° 32.9	14.6'	56.6'
4	240° 46.2	56.3		297° 59.4	14.6'	02° 18.3	14.6'	55.6'
5	255° 46.1	56.7		312° 33.1	14.7'	02° 03.7	14.6'	56.5'
6	270° 46.1	N20° 57.1		327° 06.7	14.7'	S01° 49.1	14.6'	56.5'
7	285° 46.0	57.6		341° 40.4	14.7'	01° 34.5	14.6'	56.5'
8	300° 45.9	58.0		356° 14.2	14.8'	01° 19.9	14.6'	56.4'
9	315° 45.9	.. 58.5		10° 47.9	14.8'	01° 05.3	14.6'	56.4'
10	330° 45.8	58.9		25° 21.7	14.8'	00° 50.7	14.6'	56.4'
11	345° 45.8	59.4		39° 55.5	14.8'	00° 36.2	14.6'	56.3'
12	0° 45.7	N20° 59.8		54° 29.4	14.9'	S00° 21.6	14.5'	56.3'
13	15° 45.6	21° 00.3		69° 03.2	14.9'	S00° 07.1	14.5'	56.3'
14	30° 45.6	00.7		83° 37.1	14.9'	N00° 07.5	14.5'	56.3'
15	45° 45.5	.. 01.2		98° 11.0	14.9'	00° 22.0	14.5'	56.3'
16	60° 45.4	01.6		112° 45.0	15.0'	00° 36.5	14.5'	56.2'
17	75° 45.4	02.0		127° 18.9	15.0'	00° 51.0	14.5'	56.2'
18	90° 45.3	N21° 02.5		141° 52.9	15.0'	N01° 05.5	14.5'	56.2'
19	105° 45.2	02.9		156° 26.9	15.0'	01° 20.0	14.4'	56.2'
20	120° 45.2	03.4		171° 00.9	15.0'	01° 34.4	14.4'	56.1'
21	135° 45.1	.. 03.8		185° 34.9	15.0'	01° 48.8	14.4'	56.1'
22	150° 45.0	04.2		200° 08.9	15.0'	02° 03.2	14.4'	56.1'
23	165° 45.0	04.7		214° 43.0	15.1'	02° 17.6	14.4'	56.1'
	SD = 15.8'	d = 0.5'		SD = 15.4'				

Thu	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	180° 44.9	N21° 05.1	229° 17.1	15.1'	N02° 32.0	14.4'	56.0'
1	195° 44.8	05.5	243° 51.1	15.1'	02° 46.4	14.3'	56.0'
2	210° 44.8	06.0	258° 25.2	15.1'	03° 00.7	14.3'	56.0'
3	225° 44.7	.. 06.4	272° 59.3	15.1'	03° 15.0	14.3'	56.0'
4	240° 44.6	06.9	287° 33.4	15.1'	03° 29.3	14.3'	55.9'
5	255° 44.6	07.3	302° 07.5	15.1'	03° 43.5	14.2'	55.9'
6	270° 44.5	N21° 07.7	316° 41.6	15.1'	N03° 57.8	14.2'	55.9'
7	285° 44.4	08.2	331° 15.7	15.1'	04° 12.0	14.2'	55.9'
8	300° 44.4	08.6	345° 49.9	15.1'	04° 26.1	14.1'	55.8'
9	315° 44.3	.. 09.0	0° 24.0	15.1'	04° 40.3	14.1'	55.8'
10	330° 44.2	09.4	14° 58.1	15.1'	04° 54.4	14.1'	55.8'
11	345° 44.1	09.9	29° 32.2	15.1'	05° 08.5	14.1'	55.8'
12	0° 44.1	N21° 10.3	44° 06.4	15.1'	N05° 22.6	14.0'	55.8'
13	15° 44.0	10.7	58° 40.5	15.1'	05° 36.6	14.0'	55.7'
14	30° 43.9	11.2	73° 14.6	15.1'	05° 50.6	14.0'	55.7'
15	45° 43.9	.. 11.6	87° 48.7	15.1'	06° 04.5	13.9'	55.7'
16	60° 43.8	12.0	102° 22.8	15.1'	06° 18.5	13.9'	55.7'
17	75° 43.7	12.4	116° 56.9	15.1'	06° 32.4	13.9'	55.7'
18	90° 43.7	N21° 12.9	131° 31.0	15.1'	N06° 46.2	13.8'	55.6'
19	105° 43.6	13.3	146° 05.1	15.1'	07° 00.0	13.8'	55.6'
20	120° 43.5	13.7	160° 39.2	15.1'	07° 13.8	13.7'	55.6'
21	135° 43.4	.. 14.1	175° 13.3	15.1'	07° 27.5	13.7'	55.6'
22	150° 43.4	14.6	189° 47.3	15.0'	07° 41.2	13.7'	55.5'
23	165° 43.3	15.0	204° 21.4	15.0'	07° 54.9	13.6'	55.5'
	SD = 15.8'	d = 0.4'		SD = 15.3'			

Fri	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	180° 43.2	N21° 15.4	218° 55.4	15.0'	N08° 08.5	13.6'	55.5'
1	195° 43.2	15.8	233° 29.4	15.0'	08° 22.1	13.5'	55.5'
2	210° 43.1	16.3	248° 03.4	15.0'	08° 35.6	13.5'	55.5'
3	225° 43.0	.. 16.7	262° 37.4	15.0'	08° 49.1	13.4'	55.4'
4	240° 42.9	17.1	277° 11.4	15.0'	09° 02.6	13.4'	55.4'
5	255° 42.9	17.5	291° 45.4	14.9'	09° 16.0	13.4'	55.4'
6	270° 42.8	N21° 17.9	306° 19.3	14.9'	N09° 29.3	13.3'	55.4'
7	285° 42.7	18.3	320° 53.2	14.9'	09° 42.7	13.3'	55.4'
8	300° 42.6	18.8	335° 27.1	14.9'	09° 55.9	13.2'	55.3'
9	315° 42.6	.. 19.2	350° 01.0	14.9'	10° 09.1	13.2'	55.3'
10	330° 42.5	19.6	4° 34.9	14.8'	10° 22.3	13.1'	55.3'
11	345° 42.4	20.0	19° 08.7	14.8'	10° 35.4	13.1'	55.3'
12	0° 42.3	N21° 20.4	33° 42.5	14.8'	N10° 48.5	13.0'	55.3'
13	15° 42.3	20.8	48° 16.3	14.8'	11° 01.5	13.0'	55.3'
14	30° 42.2	21.3	62° 50.1	14.7'	11° 14.4	12.9'	55.2'
15	45° 42.1	.. 21.7	77° 23.8	14.7'	11° 27.3	12.8'	55.2'
16	60° 42.0	22.1	91° 57.5	14.7'	11° 40.2	12.8'	55.2'
17	75° 42.0	22.5	106° 31.2	14.7'	11° 53.0	12.7'	55.2'
18	90° 41.9	N21° 22.9	121° 04.9	14.6'	N12° 05.7	12.7'	55.2'
19	105° 41.8	23.3	135° 38.5	14.6'	12° 18.4	12.6'	55.1'
20	120° 41.7	23.7	150° 12.1	14.6'	12° 31.0	12.6'	55.1'
21	135° 41.7	.. 24.1	164° 45.7	14.5'	12° 43.6	12.5'	55.1'
22	150° 41.6	24.5	179° 19.2	14.5'	12° 56.1	12.4'	55.1'
23	165° 41.5	24.9	193° 52.7	14.5'	13° 08.5	12.4'	55.1'
	SD = 15.8'	d = 0.4'		SD = 15.1'			

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

## May 28, 29, 30 UT (Sat., Sun., Mon.)

Aries			Venus			Mars			Jupiter			Saturn		
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Stars	SHA	Dec
0	245°31.0	217°34.7	N09°20.9	242°45.5	S00°41.6	242°13.5	N00°10.2	277°39.5	S14°09.5			Alpheratz	357°37.2	29°12.6
1	260°33.5	232°34.3	21.9	257°46.2	40.8	257°15.6	10.3	292°41.9	09.5			Ankaa	353°09.5	-42°11.0
2	275°35.9	247°34.0	23.0	272°47.0	40.1	272°17.7	10.5	307°44.4	09.5			Schedar	349°33.8	56°39.2
3	290°38.4	262°33.7	24.0	287°47.7	39.4	287°19.8	10.6	322°46.8	09.5			Diphda	348°49.7	-17°51.9
4	305°40.8	277°33.4	25.0	302°48.5	38.7	302°21.8	10.8	337°49.2	09.5			Achernar	335°22.3	-57°07.3
5	320°43.3	292°33.1	26.0	317°49.2	37.9	317°23.9	11.0	352°51.7	09.5			Hamal	327°53.9	23°33.9
6	335°45.8	307°32.8	N09°27.0	332°50.0	S00°37.2	332°26.0	N00°11.1	7°54.1	S14°09.5			Polaris	315°30.1	89°21.3
7	350°48.2	322°32.5	28.1	347°50.7	36.5	347°28.1	11.3	22°56.5	09.5			Acamar	315°13.8	-40°12.9
8	5°50.7	337°32.1	29.1	2°51.5	35.8	2°30.2	11.4	37°59.0	09.4			Menkar	314°08.7	4°10.5
9	20°53.2	352°31.8	30.1	17°52.2	35.0	17°32.2	11.6	53°01.4	09.4			Mirfak	308°31.9	49°56.2
10	35°55.6	7°31.5	31.1	32°53.0	34.3	32°34.3	11.7	68°03.8	09.4			Aldebaran	290°42.5	16°33.2
11	50°58.1	22°31.2	32.1	47°53.7	33.6	47°36.4	11.9	83°06.3	09.4			Rigel	281°06.3	-8°10.6
12	66°00.6	37°30.9	N09°33.1	62°54.5	S00°32.8	62°38.5	N00°12.1	98°08.7	S14°09.4			Capella	280°25.6	46°01.2
13	81°03.0	52°30.5	34.2	77°55.3	32.1	77°40.6	12.2	113°11.1	09.4			Bellatrix	278°25.5	6°22.1
14	96°05.5	67°30.2	35.2	92°56.0	31.4	92°42.6	12.4	128°13.6	09.4			Elnath	278°05.0	28°37.5
15	111°08.0	82°29.9	36.2	107°56.8	30.7	107°44.7	12.5	143°16.0	09.4			Alnilam	275°40.3	-1°11.3
16	126°10.4	97°29.6	37.2	122°57.5	29.9	122°46.8	12.7	158°18.4	09.4			Betelgeuse	270°54.8	7°24.6
17	141°12.9	112°29.3	38.2	137°58.3	29.2	137°48.9	12.8	173°20.8	09.4			Canopus	263°53.9	-52°42.6
18	156°15.3	127°29.0	N09°39.2	152°59.0	S00°28.5	152°51.0	N00°13.0	188°23.3	S14°09.4			Sirius	258°28.5	-16°44.9
19	171°17.8	142°28.6	40.2	167°59.8	27.8	167°53.1	13.2	203°25.7	09.4			Adhara	255°07.9	-29°00.3
20	186°20.3	157°28.3	41.3	183°00.5	27.0	182°55.1	13.3	218°28.1	09.4			Procyon	244°53.4	5°10.0
21	201°22.7	172°28.0	42.3	198°01.3	26.3	197°57.2	13.5	233°30.6	09.4			Pollux	243°20.2	27°58.4
22	216°25.2	187°27.7	43.3	213°02.0	25.6	212°59.3	13.6	248°33.0	09.4			Avior	234°16.0	-59°35.1
23	231°27.7	202°27.4	44.3	228°02.8	24.9	228°01.4	13.8	263°35.4	09.4			Suhail	222°48.1	-43°31.6
Mer.pass. 07:37		ν -0.3° d 1.0' m -3.99	ν 0.8° d 0.7' m 0.66	ν 2.1° d 0.2' m -2.22	ν 2.4° d 0.0' m 0.70							Miaplacidus	221°39.0	-69°48.8

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Stars	SHA	Dec
0	246°30.1	217°27.0	N09°45.3	243°03.6	S00°24.1	243°03.5	N00°13.9	278°37.9	S14°09.4			Denebola	182°27.1	14°26.9
1	261°32.6	232°26.7	46.3	258°04.3	23.4	258°05.5	14.1	293°40.3	09.4			Gienah	175°45.7	-17°40.0
2	276°35.1	247°26.4	47.3	273°05.1	22.7	273°07.6	14.2	308°42.7	09.4			Acrux	173°02.1	-63°13.6
3	291°37.5	262°26.1	48.4	288°05.8	22.0	288°09.7	14.4	323°45.2	09.4			Gacrux	171°53.7	-57°14.5
4	306°40.0	277°25.7	49.4	303°06.6	21.2	303°11.8	14.5	338°47.6	09.4			Alioth	166°14.6	55°50.6
5	321°42.5	292°25.4	50.4	318°07.3	20.5	318°13.9	14.7	353°50.1	09.4			Spica	158°24.4	-11°16.7
6	336°44.9	307°25.1	N09°51.4	333°08.1	S00°19.8	333°16.0	N00°14.9	8°52.5	S14°09.4			Alkaid	152°53.4	49°12.3
7	351°47.4	322°24.8	52.4	348°08.8	19.1	348°18.0	15.0	23°54.9	09.4			Hadar	148°38.5	-60°29.0
8	6°49.8	337°24.4	53.4	3°09.6	18.3	3°20.1	15.2	38°57.4	09.4			Menkent	147°59.8	-36°28.9
9	21°52.3	352°24.1	54.4	18°10.3	17.6	18°22.2	15.3	53°59.8	09.4			Arcturus	145°49.6	19°04.0
10	36°54.8	7°23.8	55.4	33°11.1	16.9	33°24.3	15.5	69°02.2	09.4			Rigel Kent.	139°42.7	-60°55.7
11	51°57.2	22°23.5	56.4	48°11.9	16.2	48°26.4	15.6	84°04.7	09.4			Kochab	137°18.7	74°04.0
12	66°59.7	37°23.1	N09°57.5	63°12.6	S00°15.4	63°28.5	N00°15.8	99°07.1	S14°09.4			Zuben'ubi	136°58.1	-16°08.1
13	82°02.2	52°22.8	58.5	78°13.4	14.7	78°30.6	15.9	114°09.5	09.4			Alphecca	126°05.2	26°38.4
14	97°04.6	67°22.5	59.5	93°14.1	14.0	93°32.6	16.1	129°12.0	09.4			Antares	112°18.1	-26°28.9
15	112°07.1	82°22.2	10.0	108°14.9	13.3	108°34.7	16.2	144°14.4	09.4			Atria	107°13.7	-69°04.0
16	127°09.6	97°21.8	01.5	123°15.6	12.5	123°36.8	16.4	159°16.8	09.4			Sabik	102°04.9	-15°45.1
17	142°12.0	112°21.5	02.5	138°16.4	11.8	138°38.9	16.6	174°19.3	09.4			Shaula	96°12.9	-37°07.1
18	157°14.5	127°21.2	N10°03.5	153°17.1	S00°11.1	153°41.0	N00°16.7	189°21.7	S14°09.4			Rasalhague	96°00.2	12°32.6
19	172°17.0	142°20.9	04.5	168°17.9	10.4	168°43.1	16.9	204°24.2	09.4			Eltanin	90°42.7	51°29.0
20	187°19.4	157°20.5	05.5	183°18.7	09.6	183°45.2	17.0	219°26.6	09.4			Kaus Aust.	83°35.0	-34°22.4
21	202°21.9	172°20.2	06.5	198°19.4	08.9	198°47.2	17.2	234°29.0	09.4			Vega	80°34.3	38°48.1
22	217°24.3	187°19.9	07.5	213°20.2	08.2	213°49.3	17.3	249°31.5	09.4			Nunki	75°50.2	-26°16.1
23	232°26.8	202°19.5	08.5	228°20.9	07.5	228°51.4	17.5	264°33.9	09.4			Altair	62°01.8	8°55.5
Mer.pass. 07:33		ν -0.3° d 1.0' m -3.98	ν 0.8° d 0.7' m 0.65	ν 2.1° d 0.2' m -2.22	ν 2.4° d 0.0' m 0.70							Peacock	53°08.8	-56°39.6

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Stars	SHA	Dec
0	247°29.3	217°19.2	N10°09.5	243°21.7	S00°06.7	243°53.5	N00°17.6	279°36.3	S14°09.4			Fomalhaut	15°17.0	-29°30.2
1	262°31.7	232°18.9	10.6	258°22.4	06.0	258°55.6	17.8	294°38.8	09.4			Scheat	13°47.3	28°12.0
2	277°34.2	247°18.6	11.6	273°23.2	05.3	273°57.7	17.9	309°41.2	09.4			Markab	13°32.1	15°19.3
3	292°36.7	262°18.2	12.6	288°24.0	04.6	288°59.8	18.1	324°43.7	09.4			May 28 Sat	SHA	Mer.pass
4	307°39.1	277°17.9	13.6	303°24.7	03.8	304°01.9	18.2	339°46.1	09.4			Venus	332°03.7	09:30
5	322°41.6	292°17.6	14.6	318°25.5	03.1	319°03.9	18.4	354°48.5	09.4			Mars	357°14.5	07:49
6	337°44.1	307°17.2	N10°15.6	333°26.2	S00°02.4	334°06.0	N00°18.5	9°51.0	S14°09.4			Jupiter	356°42.5	07:50
7	352°46.5	322°16.9	16.6	348°27.0	01.7	349°08.1	18.7	24°53.4	09.4			Saturn	32°08.5	05:28
8	7°49.0	337°16.6	17.6	3°27.7	01.0	4°10.2	18.9	39°55.9	09.4			May 29 Sun	SHA	Mer.pass
9	22°51.4	352°16.2	18.6	18°28.5	S00°00.2	19°12.3	19.0	54°58.3	09.4			Venus	330°56.9	09:30
10	37°53.9	7°15.9	19.6	33°29.3	N00°05.5	34°14.4	19.2	70°00.7	09.4			Mars	356°33.4	07:47
11	52°56.4	22°15.6	20.6	48°30.0	01.2	49°16.5	19.3	85°03.2	09.4			Jupiter	356°33.3	07:47
12	67°58.8	37°15.2	N10°21.6	63°30.8	N00°01.9	64°18.6	N00°19.5	100°05.6	S14°09.4			Saturn	32°07.7	05:25
13	83°01.3	52°14.9												

DUT1 = UT1-UTC = -0.0986 sec  $\Delta T = TT-UT1 = +69.2826$  sec

2022 May 28 to May. 30 UT

h		Sun			Moon			
Sat		GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	180°41.4	N21°25.3	208°26.2	14.4'	N13°20.9	12.3'	55.1'	
1	195°41.4	25.8	222°59.6	14.4'	13°33.2	12.3'	55.0'	
2	210°41.3	26.2	237°33.0	14.4'	13°45.5	12.2'	55.0'	
3	225°41.2	.. 26.6	252°06.4	14.3'	13°57.7	12.1'	55.0'	
4	240°41.1	27.0	266°39.7	14.3'	14°09.8	12.1'	55.0'	
5	255°41.0	27.4	281°13.0	14.3'	14°21.9	12.0'	55.0'	
6	270°41.0	N21°27.8	295°46.3	14.2'	N14°33.9	11.9'	54.9'	
7	285°40.9	28.2	310°19.5	14.2'	14°45.8	11.9'	54.9'	
8	300°40.8	28.6	324°52.7	14.2'	14°57.7	11.8'	54.9'	
9	315°40.7	.. 29.0	339°25.9	14.1'	15°09.5	11.7'	54.9'	
10	330°40.6	29.4	353°59.0	14.1'	15°21.2	11.7'	54.9'	
11	345°40.6	29.8	8°32.0	14.0'	15°32.8	11.6'	54.9'	
12	0°40.5	N21°30.2	23°05.1	14.0'	N15°44.4	11.5'	54.9'	
13	15°40.4	30.6	37°38.1	14.0'	15°55.9	11.4'	54.8'	
14	30°40.3	31.0	52°11.0	13.9'	16°07.4	11.4'	54.8'	
15	45°40.3	.. 31.4	66°43.9	13.9'	16°18.7	11.3'	54.8'	
16	60°40.2	31.8	81°16.8	13.8'	16°30.0	11.2'	54.8'	
17	75°40.1	32.2	95°49.6	13.8'	16°41.2	11.1'	54.8'	
18	90°40.0	N21°32.6	110°22.4	13.7'	N16°52.4	11.1'	54.8'	
19	105°39.9	32.9	124°55.1	13.7'	17°03.4	11.0'	54.7'	
20	120°39.8	33.3	139°27.8	13.7'	17°14.4	10.9'	54.7'	
21	135°39.8	.. 33.7	154°00.5	13.6'	17°25.3	10.8'	54.7'	
22	150°39.7	34.1	168°33.1	13.6'	17°36.1	10.7'	54.7'	
23	165°39.6	34.5	183°05.7	13.5'	17°46.9	10.7'	54.7'	
	SD = 15.8'	d = 0.4'		SD = 15.0'				

Sun	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	180°39.5	N21°34.9	197°38.2	13.5'	N17°57.6	10.6'	54.7'
1	195°39.4	35.3	212°10.6	13.4'	18°08.1	10.5'	54.7'
2	210°39.4	35.7	226°43.1	13.4'	18°18.6	10.4'	54.6'
3	225°39.3	.. 36.1	241°15.5	13.3'	18°29.1	10.3'	54.6'
4	240°39.2	36.5	255°47.8	13.3'	18°39.4	10.2'	54.6'
5	255°39.1	36.9	270°20.1	13.2'	18°49.6	10.2'	54.6'
6	270°39.0	N21°37.2	284°52.3	13.2'	N18°59.8	10.1'	54.6'
7	285°38.9	37.6	299°24.5	13.1'	19°09.9	10.0'	54.6'
8	300°38.9	38.0	313°56.6	13.1'	19°19.9	9.9'	54.6'
9	315°38.8	.. 38.4	328°28.7	13.0'	19°29.8	9.8'	54.5'
10	330°38.7	38.8	343°00.8	13.0'	19°39.6	9.7'	54.5'
11	345°38.6	39.2	357°32.8	13.0'	19°49.3	9.6'	54.5'
12	0°38.5	N21°39.5	12°04.7	12.9'	N19°58.9	9.5'	54.5'
13	15°38.4	39.9	26°36.6	12.9'	20°08.4	9.4'	54.5'
14	30°38.4	40.3	41°08.5	12.8'	20°17.9	9.4'	54.5'
15	45°38.3	.. 40.7	55°40.3	12.8'	20°27.2	9.3'	54.5'
16	60°38.2	41.1	70°12.1	12.7'	20°36.5	9.2'	54.5'
17	75°38.1	41.5	84°43.8	12.7'	20°45.7	9.1'	54.4'
18	90°38.0	N21°41.8	99°15.4	12.6'	N20°54.7	9.0'	54.4'
19	105°37.9	42.2	113°47.0	12.6'	21°03.7	8.9'	54.4'
20	120°37.8	42.6	128°18.6	12.5'	21°12.6	8.8'	54.4'
21	135°37.8	.. 43.0	142°50.1	12.5'	21°21.4	8.7'	54.4'
22	150°37.7	43.3	157°21.6	12.4'	21°30.0	8.6'	54.4'
23	165°37.6	43.7	171°53.0	12.4'	21°38.6	8.5'	54.4'
	SD = 15.8'	d = 0.4'		SD = 14.9'			

Mon	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	180°37.5	N21°44.1	186°24.4	12.3'	N21°47.1	8.4'	54.4'
1	195°37.4	44.5	200°55.7	12.3'	21°55.5	8.3'	54.3'
2	210°37.3	44.8	215°26.9	12.2'	22°03.8	8.2'	54.3'
3	225°37.2	.. 45.2	229°58.2	12.2'	22°11.9	8.1'	54.3'
4	240°37.1	45.6	244°29.3	12.1'	22°20.0	8.0'	54.3'
5	255°37.1	46.0	259°00.5	12.1'	22°28.0	7.9'	54.3'
6	270°37.0	N21°46.3	273°31.5	12.0'	N22°35.8	7.8'	54.3'
7	285°36.9	46.7	288°02.6	12.0'	22°43.6	7.7'	54.3'
8	300°36.8	47.1	302°33.5	11.9'	22°51.3	7.5'	54.3'
9	315°36.7	.. 47.4	317°04.5	11.9'	22°58.8	7.4'	54.3'
10	330°36.6	47.8	331°35.4	11.8'	23°06.2	7.3'	54.3'
11	345°36.5	48.2	346°06.2	11.8'	23°13.6	7.2'	54.2'
12	0°36.4	N21°48.5	0°37.0	11.8'	N23°20.8	7.1'	54.2'
13	15°36.4	48.9	15°07.8	11.7'	23°27.9	7.0'	54.2'
14	30°36.3	49.3	29°38.5	11.7'	23°34.9	6.9'	54.2'
15	45°36.2	.. 49.6	44°09.1	11.6'	23°41.8	6.8'	54.2'
16	60°36.1	50.0	58°39.8	11.6'	23°48.6	6.7'	54.2'
17	75°36.0	50.4	73°10.3	11.5'	23°55.3	6.6'	54.2'
18	90°35.9	N21°50.7	87°40.9	11.5'	N24°01.9	6.4'	54.2'
19	105°35.8	51.1	102°11.3	11.4'	24°08.3	6.3'	54.2'
20	120°35.7	51.5	116°41.8	11.4'	24°14.6	6.2'	54.2'
21	135°35.6	.. 51.8	131°12.2	11.4'	24°20.9	6.1'	54.1'
22	150°35.5	52.2	145°42.5	11.3'	24°27.0	6.0'	54.1'
23	165°35.5	52.5	160°12.9	11.3'	24°33.0	5.9'	54.1'
	SD = 15.8'	d = 0.4'		SD = 14.8'			

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

## May 31, 01, 02 UT (Tue., Wed., Thu.)

Aries			Venus			Mars			Jupiter			Saturn		
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Stars	SHA	Dec
0	248°28.4	217°11.2	N10°33.6	243°39.9	N00°10.6	244°43.6	N00°21.3	280°34.9	S14°09.4			Alpheratz	357°37.1	29°12.6
1	263°30.9	232°10.9	34.6	258°40.6	11.3	259°45.7	21.4	295°37.3	09.4			Ankaa	353°09.5	-42°11.0
2	278°33.3	247°10.5	35.6	273°41.4	12.1	274°47.8	21.6	310°39.8	09.4			Schedar	349°33.8	56°39.2
3	293°35.8	262°10.2	36.6	288°42.1	12.8	289°49.9	21.7	325°42.2	09.4			Diphda	348°49.7	-17°51.9
4	308°38.3	277°09.8	37.6	303°42.9	13.5	304°52.0	21.9	340°44.7	09.4			Achernar	335°22.3	-57°07.3
5	323°40.7	292°09.5	38.6	318°43.7	14.2	319°54.1	22.0	355°47.1	09.4			Hamal	327°53.9	23°33.9
6	338°43.2	307°09.2	N10°39.6	333°44.4	N00°15.0	334°56.2	N00°22.2	10°49.6	S14°09.4			Polaris	315°29.2	89°21.3
7	353°45.7	322°08.8	40.6	348°45.2	15.7	349°58.3	22.3	25°52.0	09.4			Acamar	315°13.8	-40°12.9
8	8°48.1	337°08.5	41.6	3°45.9	16.4	5°00.4	22.5	40°54.4	09.4			Menkar	314°08.7	4°10.5
9	23°50.6	352°08.1	42.6	18°46.7	17.1	20°02.5	22.6	55°56.9	09.4			Mirfak	308°31.8	49°56.2
10	38°53.1	7°07.8	43.6	33°47.4	17.9	35°04.6	22.8	70°59.3	09.4			Aldebaran	290°42.5	16°33.2
11	53°55.5	22°07.4	44.6	48°48.2	18.6	50°06.7	22.9	86°01.8	09.4			Rigel	281°06.3	-8°10.6
12	68°58.0	37°07.1	N10°45.6	63°49.0	N00°19.3	65°08.8	N00°23.1	101°04.2	S14°09.4			Capella	280°25.6	46°01.2
13	84°00.4	52°06.8	46.6	78°49.7	20.0	80°10.9	23.2	116°06.7	09.4			Bellatrix	278°25.5	6°22.1
14	99°02.9	67°06.4	47.6	93°50.5	20.7	95°13.0	23.4	131°09.1	09.4			Elnath	278°05.0	28°37.5
15	114°05.4	82°06.1	48.6	108°51.2	21.5	110°15.0	23.5	146°11.5	09.4			Alnilam	275°40.3	-1°11.3
16	129°07.8	97°05.7	49.5	123°52.0	22.2	125°17.1	23.7	161°14.0	09.4			Betelgeuse	270°54.8	7°24.6
17	144°10.3	112°05.4	50.5	138°52.8	22.9	140°19.2	23.8	176°16.4	09.4			Canopus	263°53.9	-52°42.6
18	159°12.8	127°05.0	N10°51.5	153°53.5	N00°23.6	155°21.3	N00°24.0	191°18.9	S14°09.4			Sirius	258°28.5	-16°44.9
19	174°15.2	142°04.7	52.5	168°54.3	24.4	170°23.4	24.1	206°21.3	09.4			Adhara	255°07.9	-29°00.3
20	189°17.7	157°04.4	53.5	183°55.0	25.1	185°25.5	24.3	221°23.8	09.4			Procyon	244°53.4	5°10.0
21	204°20.2	172°04.0	54.5	198°55.8	25.8	200°27.6	24.4	236°26.2	09.4			Pollux	243°20.2	27°58.4
22	219°22.6	187°03.7	55.5	213°56.6	26.5	215°29.7	24.6	251°28.7	09.4			Avior	234°16.0	-59°35.1
23	234°25.1	202°03.3	56.5	228°57.3	27.2	230°31.8	24.7	266°31.1	09.4			Suhail	222°48.1	-43°31.5
Mer.pass. 07:25		ν -0.3° d 1.0° m -3.98	ν 0.8° d 0.7° m 0.64	ν 2.1° d 0.2° m -2.23	ν 2.4° d -0.0° m 0.69							Miaplacidus	221°39.1	-69°48.8

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Stars	SHA	Dec
0	249°27.6	217°03.0	N10°57.5	243°58.1	N00°28.0	245°33.9	N00°24.9	281°33.6	S14°09.4			Denebola	193°43.7	61°38.2
1	264°30.0	232°02.6	58.5	258°58.8	28.7	260°36.0	25.0	296°36.0	09.4			Gienah	175°45.7	-17°40.0
2	279°32.5	247°02.3	10°59.5	273°59.6	29.4	275°38.1	25.2	311°38.4	09.4			Acru	173°02.2	-63°13.6
3	294°34.9	262°01.9	11°00.5	289°00.4	30.1	290°40.2	25.3	326°40.9	09.4			Gacrux	171°53.7	-57°14.5
4	309°37.4	277°01.6	01.4	304°01.1	30.9	305°42.3	25.5	341°43.3	09.4			Alioth	166°14.6	55°50.6
5	324°39.9	292°01.2	02.4	319°01.9	31.6	320°44.4	25.6	356°45.8	09.4			Alkaid	152°53.4	49°12.3
6	339°42.3	307°00.9	N11°03.4	334°02.6	N00°32.3	335°46.5	N00°25.8	11°48.2	S14°09.4			Hadar	148°38.5	-60°29.0
7	354°44.8	322°00.5	04.4	349°03.4	33.0	350°48.6	25.9	26°50.7	09.4			Menkent	147°59.8	-36°28.9
8	9°47.3	337°00.2	05.4	4°04.2	33.7	5°50.7	26.1	41°53.1	09.4			Arcturus	145°49.6	19°04.0
9	24°49.7	351°59.8	06.4	19°04.9	34.5	20°52.8	26.2	56°55.6	09.4			Rigel Kent.	139°42.7	-60°55.8
10	39°52.2	6°59.5	07.4	34°05.7	35.2	35°54.9	26.4	71°58.0	09.4			Kochab	137°18.8	74°04.0
11	54°54.7	21°59.1	08.4	49°06.4	35.9	50°57.0	26.5	87°00.5	09.4			Zuben'ubi	136°58.1	-16°08.1
12	69°57.1	36°58.8	N11°09.3	64°07.2	N00°36.6	65°59.1	N00°26.7	102°02.9	S14°09.4			Alphecca	126°05.2	26°38.4
13	84°59.6	51°58.4	10.3	79°08.0	37.4	81°01.2	26.8	117°05.4	09.4			Antares	112°18.1	-26°28.9
14	100°02.1	66°58.1	11.3	94°08.7	38.1	96°03.3	27.0	132°07.8	09.4			Atria	107°13.7	-69°04.0
15	115°04.5	81°57.7	12.3	109°09.5	38.8	111°05.4	27.1	147°10.3	09.4			Sabik	102°04.9	-15°45.1
16	130°07.0	96°57.4	13.3	124°10.2	39.5	126°07.5	27.3	162°12.7	09.4			Shaula	96°12.9	-37°07.1
17	145°09.4	111°57.0	14.3	139°11.0	40.2	141°09.6	27.4	177°15.2	09.4			Rasalhague	96°00.2	12°32.6
18	160°11.9	126°56.7	N11°15.3	154°11.8	N00°41.0	156°11.7	N00°27.6	192°17.6	S14°09.4			Eltanin	90°42.7	51°29.0
19	175°14.4	141°56.3	16.2	169°12.5	41.7	171°13.8	27.7	207°20.1	09.4			Kaus Aust.	83°35.0	-34°22.4
20	190°16.8	156°55.9	17.2	184°13.3	42.4	186°15.9	27.8	222°22.5	09.4			Vega	80°34.3	38°48.1
21	205°19.3	171°55.6	18.2	199°14.0	43.1	201°18.0	28.0	237°25.0	09.4			Nunki	75°50.1	-26°16.1
22	220°21.8	186°55.2	19.2	214°14.8	43.8	216°20.1	28.1	252°27.4	09.4			Altair	62°01.8	8°55.5
23	235°24.2	201°54.9	20.2	229°15.6	44.6	231°22.2	28.3	267°29.9	09.4			Peacock	53°08.8	-56°39.6
Mer.pass. 07:21		ν -0.3° d 1.0° m -3.97	ν 0.8° d 0.7° m 0.63	ν 2.1° d 0.1° m -2.24	ν 2.4° d -0.0° m 0.69							Deneb	49°27.0	45°21.3

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Stars	SHA	Dec
0	250°26.7	216°54.5	N11°21.2	244°16.3	N00°45.3	246°24.3	N00°28.4	282°32.3	S14°09.4			Fomalhaut	15°16.9	-29°30.2
1	265°29.2	231°54.2	22.1	259°17.1	46.0	261°26.4	28.6	297°34.8	09.5			Scheat	13°47.3	28°12.0
2	280°31.6	246°53.8	23.1	274°17.9	46.7	276°28.5	28.7	312°37.2	09.5			Markab	13°32.1	15°19.3
3	295°34.1	261°53.5	24.1	289°18.6	47.4	291°30.6	28.9	327°39.7	09.5			May 31 Tue	SHA	Mer.pass
4	310°36.6	276°53.1	25.1	304°19.4	48.2	306°32.7	29.0	342°42.1	09.5			Venus	328°42.8	09:31
5	325°39.0	291°52.7	26.1	319°20.1	48.9	321°34.8	29.2	357°44.6	09.5			Mars	355°11.5	07:45
6	340°41.5	306°52.4	N11°27.1	334°20.9	N00°49.6	336°36.9	N00°29.3	12°47.0	S14°09.5			Jupiter	356°15.2	07:40
7	355°43.9	321°52.0	28.0	349°21.7	50.3	351°39.0	29.5	27°49.5	09.5			Saturn	32°06.5	05:17
8	10°46.4	336°51.7	29.0	4°22.4	51.1	6°41.1	29.6	42°51.9	09.5			Jun 01 Wed	SHA	Mer.pass
9	25°48.9	351°51.3	30.0	19°23.2	51.8	21°43.2	29.8	57°54.4	09.5			Venus	327°35.4	09:32
10	40°51.3	6°50.9	31.0	34°23.9	52.5	36°45.3	29.9	72°56.8	09.5			Mars	354°30.5	07:44
11	55°53.8	21°50.6	31.9	49°24.7	53.2	51°47.4	30.0	87°59.3	09.5			Jupiter	356°06.4	07:37
12	70°56.3	36°50.2	N11°32.9	64°25.5	N00°53.9	66°49.5	N00°30.2	103°01.7	S14°09.5			Saturn	32°06.0	05:13
13	85°58.7	51°49												

DUT1 = UT1-UTC = -0.0969 sec  $\Delta T = TT-UT1 = +69.2809$  sec

2022 May 31 to Jun. 02 UT

h		Sun		Moon				
Tue		GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	180°35.4	N21°52.9	174°43.1	11.2'	N24°38.8	5.8'	54.1'	
1	195°35.3	53.3	189°13.4	11.2'	24°44.6	5.6'	54.1'	
2	210°35.2	53.6	203°43.6	11.2'	24°50.2	5.5'	54.1'	
3	225°35.1	.. 54.0	218°13.7	11.1'	24°55.8	5.4'	54.1'	
4	240°35.0	54.3	232°43.9	11.1'	25°01.2	5.3'	54.1'	
5	255°34.9	54.7	247°13.9	11.0'	25°06.5	5.2'	54.1'	
6	270°34.8	N21°55.0	261°44.0	11.0'	N25°11.6	5.1'	54.1'	
7	285°34.7	55.4	276°14.0	11.0'	25°16.7	4.9'	54.1'	
8	300°34.6	55.8	290°44.0	10.9'	25°21.6	4.8'	54.1'	
9	315°34.5	.. 56.1	305°13.9	10.9'	25°26.4	4.7'	54.1'	
10	330°34.4	56.5	319°43.8	10.9'	25°31.1	4.6'	54.0'	
11	345°34.3	56.8	334°13.7	10.8'	25°35.7	4.4'	54.0'	
12	0°34.3	N21°57.2	348°43.6	10.8'	N25°40.1	4.3'	54.0'	
13	15°34.2	57.5	3°13.4	10.8'	25°44.4	4.2'	54.0'	
14	30°34.1	57.9	17°43.2	10.8'	25°48.6	4.1'	54.0'	
15	45°34.0	.. 58.2	32°12.9	10.7'	25°52.7	4.0'	54.0'	
16	60°33.9	58.6	46°42.6	10.7'	25°56.7	3.8'	54.0'	
17	75°33.8	58.9	61°12.3	10.7'	26°00.5	3.7'	54.0'	
18	90°33.7	N21°59.3	75°42.0	10.6'	N26°04.2	3.6'	54.0'	
19	105°33.6	21°59.6	90°11.6	10.6'	26°07.8	3.5'	54.0'	
20	120°33.5	22°00.0	104°41.3	10.6'	26°11.3	3.3'	54.0'	
21	135°33.4	.. 00.3	119°10.9	10.6'	26°14.6	3.2'	54.0'	
22	150°33.3	00.6	133°40.4	10.5'	26°17.8	3.1'	54.0'	
23	165°33.2	01.0	148°10.0	10.5'	26°20.9	3.0'	54.0'	
	SD = 15.8'	d = 0.4'		SD = 14.8'				

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

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

Day	Sun		Moon		Age
	Eqn. of	Time	Mer.	Mer. Pass.	
	00 <sup>h</sup>	12 <sup>h</sup>	Pass	Upper	Lower
	mm:ss	mm:ss	hh:mm	hh:mm	hh:mm
31	02:21	02:17	11:58	12:47	00:22
01	02:13	02:08	11:58	13:37	01:12
02	02:03	01:58	11:58	14:28	02:03

## June 03, 04, 05 UT (Fri., Sat., Sun.)

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	251°25.8	216°45.9	N11°44.6	244°34.6	N01°02.6	247°14.7	N00°31.9	283°31.1	S14°09.5								
1	266°28.3	231°45.5	45.6	259°35.4	03.3	262°16.8	32.1	298°33.6	09.5								
2	281°30.8	246°45.1	46.6	274°36.1	04.0	277°19.0	32.2	313°36.1	09.6								
3	296°33.2	261°44.8	· · 47.6	289°36.9	· · 04.7	292°21.1	· · 32.4	328°38.5	· · 09.6								
4	311°35.7	276°44.4	48.5	304°37.7	05.4	307°23.2	32.5	343°41.0	09.6								
5	326°38.2	291°44.0	49.5	319°38.4	06.2	322°25.3	32.7	358°43.4	09.6								
6	341°40.6	306°43.7	N11°50.5	334°39.2	N01°06.9	337°27.4	N00°32.8	13°45.9	S14°09.6								
7	356°43.1	321°43.3	51.4	349°40.0	07.6	352°29.5	33.0	28°48.3	09.6								
8	11°45.5	336°42.9	52.4	4°40.7	08.3	7°31.6	33.1	43°50.8	09.6								
9	26°48.0	351°42.6	· · 53.4	19°41.5	· · 09.0	22°33.7	· · 33.2	58°53.2	· · 09.6								
10	41°50.5	6°42.2	54.4	34°42.3	09.8	37°35.8	33.4	73°55.7	09.6								
11	56°52.9	21°41.8	55.3	49°43.0	10.5	52°37.9	33.5	88°58.1	09.6								
12	71°55.4	36°41.4	N11°56.3	64°43.8	N01°11.2	67°40.0	N00°33.7	104°00.6	S14°09.6								
13	86°57.9	51°41.1	57.3	79°44.5	11.9	82°42.1	33.8	119°03.1	09.6								
14	102°00.3	66°40.7	58.2	94°45.3	12.6	97°44.2	34.0	134°05.5	09.6								
15	117°02.8	81°40.3	11°59.2	109°46.1	· · 13.4	112°46.3	· · 34.1	149°08.0	· · 09.6								
16	132°05.3	96°40.0	12°00.2	124°46.8	14.1	127°48.5	34.2	164°10.4	09.6								
17	147°07.7	111°39.6	01.1	139°47.6	14.8	142°50.6	34.4	179°12.9	09.6								
18	162°10.2	126°39.2	N12°02.1	154°48.4	N01°15.5	157°52.7	N00°34.5	194°15.3	S14°09.6								
19	177°12.7	141°38.8	03.1	169°49.1	16.2	172°54.8	34.7	209°17.8	09.6								
20	192°15.1	156°38.5	04.0	184°49.9	16.9	187°56.9	34.8	224°20.3	09.6								
21	207°17.6	171°38.1	· · 05.0	199°50.7	· · 17.7	202°59.0	· · 35.0	239°22.7	· · 09.7								
22	222°20.0	186°37.7	06.0	214°51.4	18.4	218°01.1	35.1	254°25.2	09.7								
23	237°22.5	201°37.3	06.9	229°52.2	19.1	233°03.2	35.2	269°27.6	09.7								
Mer.pass. 07:13			ν -0.4° d 1.0' m -3.97	ν 0.8° d 0.7' m 0.62	ν 2.1° d 0.1' m -2.25	ν 2.5° d -0.0' m 0.68											
Sat			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec						
0	252°25.0	216°37.0	N12°07.9	244°52.9	N01°19.8	248°05.3	N00°35.4	284°30.1	S14°09.7								
1	267°27.4	231°36.6	08.9	259°53.7	20.5	263°07.4	35.5	299°32.5	09.7								
2	282°29.9	246°36.2	09.8	274°54.5	21.2	278°09.5	35.7	314°35.0	09.7								
3	297°32.4	261°35.8	· · 10.8	289°55.2	· · 22.0	293°11.7	· · 35.8	329°37.5	· · 09.7								
4	312°34.8	276°35.5	11.7	304°56.0	22.7	308°13.8	36.0	344°39.9	09.7								
5	327°37.3	291°35.1	12.7	319°56.8	23.4	323°15.9	36.1	359°42.4	09.7								
6	342°39.8	306°34.7	N12°13.7	334°57.5	N01°24.1	338°18.0	N00°36.2	14°44.8	S14°09.7								
7	357°42.2	321°34.3	14.6	349°58.3	24.8	353°20.1	36.4	29°47.3	09.7								
8	12°44.7	336°34.0	15.6	4°59.1	25.6	8°22.2	36.5	44°49.8	09.7								
9	27°47.2	351°33.6	· · 16.6	19°59.8	· · 26.3	23°24.3	· · 36.7	59°52.2	· · 09.7								
10	42°49.6	6°33.2	17.5	35°00.6	27.0	38°26.4	36.8	74°54.7	09.7								
11	57°52.1	21°32.8	18.5	50°01.4	27.7	53°28.6	37.0	89°57.1	09.7								
12	72°54.5	36°32.4	N12°19.4	65°02.1	N01°28.4	68°30.7	N00°37.1	104°59.6	S14°09.8								
13	87°57.0	51°32.1	20.4	80°02.9	29.1	83°32.8	37.2	120°02.1	09.8								
14	102°59.5	66°31.7	21.3	95°03.7	29.9	98°34.9	37.4	135°04.5	09.8								
15	118°01.9	81°31.3	· · 22.3	110°04.4	· · 30.6	113°37.0	· · 37.5	150°07.0	· · 09.8								
16	133°04.4	96°30.9	23.3	125°05.2	31.3	128°39.1	37.7	165°09.4	09.8								
17	148°06.9	111°30.5	24.2	140°06.0	32.0	143°41.2	37.8	180°11.9	09.8								
18	163°09.3	126°30.2	N12°25.2	155°06.7	N01°32.7	158°43.3	N00°37.9	195°14.4	S14°09.8								
19	178°11.8	141°29.8	26.1	170°07.5	33.4	173°45.5	38.1	210°16.8	09.8								
20	193°14.3	156°29.4	27.1	185°08.2	34.2	188°47.6	38.2	225°19.3	09.8								
21	208°16.7	171°29.0	· · 28.0	200°09.0	· · 34.9	203°49.7	· · 38.4	240°21.7	· · 09.8								
22	223°19.2	186°28.6	29.0	215°09.8	35.6	218°51.8	38.5	255°24.2	09.8								
23	238°21.6	201°28.2	30.0	230°10.5	36.3	233°53.9	38.6	270°26.7	09.8								
Mer.pass. 07:09			ν -0.4° d 1.0' m -3.97	ν 0.8° d 0.7' m 0.61	ν 2.1° d 0.1' m -2.25	ν 2.5° d -0.0' m 0.68											
Sun			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec						
0	253°24.1	216°27.8	N12°30.9	245°11.3	N01°37.0	248°56.0	N00°38.8	285°29.1	S14°09.8								
1	268°26.6	231°27.5	31.9	260°12.1	37.7	263°58.1	38.9	300°31.6	09.8								
2	283°29.0	246°27.1	32.8	275°12.8	38.5	279°00.3	39.1	315°34.0	09.9								
3	298°31.5	261°26.7	· · 33.8	290°13.6	· · 39.2	294°02.4	· · 39.2	330°36.5	· · 09.9								
4	313°34.0	276°26.3	34.7	305°14.4	39.9	309°04.5	39.3	345°39.0	09.9								
5	328°36.4	291°25.9	35.7	320°15.1	40.6	324°06.6	39.5	0°41.4	09.9								
6	343°38.9	306°25.5	N12°36.6	335°15.9	N01°41.3	339°08.7	N00°39.6	15°43.9	S14°09.9								
7	358°41.4	321°25.1	37.6	350°16.7	42.0	354°10.8	39.8	30°46.4	09.9								
8	13°43.8	336°24.8	38.5	5°17.4	42.7	9°13.0	39.9	45°48.8	09.9								
9	28°46.3	351°24.4	· · 39.5	20°18.2	· · 43.5	24°15.1	· · 40.0	60°51.3	· · 09.9								
10	43°48.8	6°24.0	40.4	35°19.0	44.2	39°17.2	40.2	75°53.7	09.9								
11	58°51.2	21°23.6	41.4	50°19.7	44.9	54°19.3	40.3	90°56.2	09.9								
12	73°53.7	36°23.2	N12°42.3	65°20.5	N01°45.6	69°21.4	N00°40.5	105°58.7	S14°09.9								
13	88°56.1	51°22.8	43.3	80°21.3	46.3	84°23.5	40.6	121°01.1	09.9								
14	103°58.6	66°22.4	44.2	95°22.0	47.0	99°25.7	40.7	136°03.6	09.9								
15	119°01.1	81°22.0	· · 45.2	110°22.8	· · 47.8	114°27.8	· · 40.9	151°06.1	· · 10.0								
16	134°03.5	96°21.6	46.1	125°23.6	48.5	129°29.9	41.0	166°08.5	10.0								
17	149°06.0	111°21.2	47.1	140°24.3	49.2	144°32.0	41.2	181°11.0	10.0								
18	164°08.5	126°20.9	N12°48.0	155°25.1	N01°49.9	159°34.1	N00°41.3	196°13.5	S14°10.0								
19	179°10.9	141°20.5	49.0	170°25.9	50.6	174°36.2	41.4	211°15.9	10.0								
20	194°13.4	156°20.1	49.9	185°26.6	51.3	189°38.4	41.6	226°18.4	10.0								
21	209°15.9	171°19.7	· · 50.9														

DUT1 = UT1-UTC = -0.0936 sec  $\Delta T = TT-UT1 = +69.2776$  sec

2022 June 03 to Jun. 05 UT

h	Sun			Moon			
Fri	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	180°28.4	N22°17.0	138°11.6	10.7'	N26°14.8	-3.3'	54.0'
1	195°28.3	17.3	152°41.4	10.8'	26°11.5	-3.4'	54.0'
2	210°28.2	17.7	167°11.1	10.8'	26°08.0	-3.6'	54.0'
3	225°28.0	18.0	181°40.9	10.8'	26°04.5	-3.7'	54.0'
4	240°27.9	18.3	196°10.7	10.9'	26°00.8	-3.8'	54.0'
5	255°27.8	18.6	210°40.6	10.9'	25°57.0	-3.9'	54.0'
6	270°27.7	N22°18.9	225°10.5	10.9'	N25°53.1	-4.0'	54.0'
7	285°27.6	19.2	239°40.4	10.9'	25°49.0	-4.2'	54.0'
8	300°27.5	19.5	254°10.3	11.0'	25°44.9	-4.3'	54.0'
9	315°27.4	19.8	268°40.3	11.0'	25°40.6	-4.4'	54.0'
10	330°27.3	20.1	283°10.3	11.1'	25°36.2	-4.5'	54.0'
11	345°27.2	20.4	297°40.4	11.1'	25°31.6	-4.6'	54.0'
12	0°27.1	N22°20.7	312°10.5	11.1'	N25°27.0	-4.8'	54.0'
13	15°27.0	21.0	326°40.6	11.2'	25°22.2	-4.9'	54.0'
14	30°26.9	21.3	341°10.7	11.2'	25°17.3	-5.0'	54.0'
15	45°26.8	21.6	355°40.9	11.2'	25°12.3	-5.1'	54.1'
16	60°26.7	21.9	10°11.2	11.3'	25°07.2	-5.2'	54.1'
17	75°26.6	22.2	24°41.5	11.3'	25°01.9	-5.4'	54.1'
18	90°26.5	N22°22.5	39°11.8	11.4'	N24°56.6	-5.5'	54.1'
19	105°26.4	22.8	53°42.1	11.4'	24°51.1	-5.6'	54.1'
20	120°26.3	23.1	68°12.5	11.4'	24°45.5	-5.7'	54.1'
21	135°26.2	23.4	82°42.9	11.5'	24°39.8	-5.8'	54.1'
22	150°26.1	23.7	97°13.4	11.5'	24°34.0	-5.9'	54.1'
23	165°25.9	24.0	111°43.9	11.6'	24°28.1	-6.0'	54.1'
	SD = 15.8'			SD = 14.7'			

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

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

Day	Sun		Moon		Age
	Eqn.of	Time	Mer.	Mer. Pass.	
	00 <sup>h</sup>	12 <sup>h</sup>	Pass.	Upper	4-6
	mm:ss	mm:ss	hh:mm	hh:mm	11-25%
03	01:53	01:48	11:58	15:18	02:53
04	01:43	01:38	11:58	16:06	03:42
05	01:33	01:28	11:59	16:53	04:30

## June 06, 07, 08 UT (Mon., Tue., Wed.)

Aries		Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	254°23.3	216°18.5	N12°53.7	245°29.7	N01°54.2	249°46.8	N00°42.1	286°28.3	S14°10.0
1	269°25.7	231°18.1	54.6	260°30.5	54.9	264°49.0	42.3	301°30.7	10.0
2	284°28.2	246°17.7	55.6	275°31.2	55.6	279°51.1	42.4	316°33.2	10.0
3	299°30.6	261°17.3	.. 56.5	290°32.0	.. 56.3	294°53.2	.. 42.5	331°35.7	.. 10.1
4	314°33.1	276°16.9	57.5	305°32.8	57.0	309°55.3	42.7	346°38.1	10.1
5	329°35.6	291°16.5	58.4	320°33.5	57.8	324°57.4	42.8	1°40.6	10.1
6	344°38.0	306°16.1	N12°59.3	335°34.3	N01°58.5	339°59.6	N00°43.0	16°43.0	S14°10.1
7	359°40.5	321°15.7	13°00.3	350°35.1	59.2	355°01.7	43.1	31°45.5	10.1
8	14°43.0	336°15.3	01.2	5°35.8	01°59.9	10°03.8	43.2	46°48.0	10.1
9	29°45.4	351°14.9	.. 02.2	20°36.6	02°00.6	25°05.9	.. 43.4	61°50.5	.. 10.1
10	44°47.9	6°14.5	03.1	35°37.4	01.3	40°08.1	43.5	76°52.9	10.1
11	59°50.4	21°14.1	04.0	50°38.2	02.0	55°10.2	43.6	91°55.4	10.1
12	74°52.8	36°13.7	N13°05.0	65°38.9	N02°02.8	70°12.3	N00°43.8	106°57.9	S14°10.1
13	89°55.3	51°13.3	05.9	80°39.7	03.5	85°14.4	43.9	122°00.3	10.2
14	104°57.8	66°12.9	06.9	95°40.5	04.2	100°16.5	44.1	137°02.8	10.2
15	120°00.2	81°12.5	.. 07.8	110°41.2	.. 04.9	115°18.7	.. 44.2	152°05.3	.. 10.2
16	135°02.7	96°12.1	08.7	125°42.0	05.6	130°20.8	44.3	167°07.7	10.2
17	150°05.1	111°11.7	09.7	140°42.8	06.3	145°22.9	44.5	182°10.2	10.2
18	165°07.6	126°11.3	N13°10.6	155°43.5	N02°07.0	160°25.0	N00°44.6	197°12.7	S14°10.2
19	180°10.1	141°10.9	11.5	170°44.3	07.7	175°27.2	44.7	212°15.1	10.2
20	195°12.5	156°10.5	12.5	185°45.1	08.5	190°29.3	44.9	227°17.6	10.2
21	210°15.0	171°10.1	.. 13.4	200°45.8	.. 09.2	205°31.4	.. 45.0	242°20.1	.. 10.2
22	225°17.5	186°09.7	14.4	215°46.6	09.9	220°33.5	45.1	257°22.5	10.2
23	240°19.9	201°09.3	15.3	230°47.4	10.6	235°35.7	45.3	272°25.0	10.3

Mer.pass. 07:01  $\nu$  -0.4° d 0.9° m -3.96  $\nu$  0.8° d 0.7° m 0.59  $\nu$  2.1° d 0.1° m -2.26  $\nu$  2.5° d -0.0° m 0.67

Stars		
	SHA	Dec
Alpheratz	357°37.1	29°12.6
Ankaa	353°09.4	-42°10.9
Schedar	349°33.7	56°39.3
Diphda	348°49.6	-17°51.8
Achernar	335°22.2	-57°07.2
Hamal	327°53.9	23°33.9
Polaris	315°27.5	89°21.3
Acamar	315°13.8	-40°12.9
Menkar	314°08.7	4°10.5
Mirfak	308°31.8	49°56.2
Aldebaran	290°42.4	16°33.2
Rigel	281°06.3	-8°10.6
Capella	280°25.5	46°01.2
Bellatrix	278°25.5	6°22.1
Elnath	278°05.0	28°37.5
Alnilam	275°40.2	-1°11.3
Betelgeuse	270°54.7	7°24.6
Canopus	263°53.9	-52°42.5
Sirius	258°28.5	-16°44.9
Adhara	255°07.9	-29°00.2
Procyon	244°53.4	5°10.1
Pollux	243°20.2	27°58.4
Avior	234°16.0	-59°35.0
Suhail	222°48.1	-43°31.5
Miaplacidus	221°39.1	-69°48.7
Alphard	217°50.0	-8°45.4
Regulus	207°36.8	11°51.6
Dubhe	193°43.7	61°38.2
Denebola	182°27.1	14°26.9
Gienah	175°45.7	-17°40.0
Acrux	173°02.2	-63°13.6
Gacrux	171°53.8	-57°14.5
Alioth	166°14.6	55°50.6
Spica	158°24.4	-11°16.7
Alkaid	152°53.4	49°12.3
Hadar	148°38.6	-60°29.0
Menkent	147°59.9	-36°28.9
Arcturus	145°49.6	19°04.1
Rigel Kent.	139°42.7	-60°55.8
Kochab	137°18.8	74°04.0
Zuben'ubi	136°58.1	-16°08.1
Alphecca	126°05.2	26°38.4
Antares	112°18.1	-26°28.9
Atria	107°13.7	-69°04.0
Sabik	102°04.9	-15°45.1
Shaula	96°12.9	-37°07.2
Rasalhague	96°00.2	12°32.6
Eltanin	90°42.7	51°29.1
Kaus Aust.	83°35.0	-34°22.4
Vega	80°34.3	38°48.1
Nunki	75°50.1	-26°16.1
Altair	62°01.8	8°55.6
Peacock	53°08.7	-56°39.6
Deneb	49°27.0	45°21.3
Enif	33°40.8	9°58.5
Al Na'ir	27°35.5	-46°51.0
Fomalhaut	15°16.9	-29°30.1
Scheat	13°47.3	28°12.0
Markab	13°32.0	15°19.4

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	255°22.4	216°08.9	N13°16.2	245°48.1	N02°11.3	250°37.8	N00°45.4	287°27.5	S14°10.3
1	270°24.9	231°08.5	17.2	260°48.9	12.0	265°39.9	45.6	302°29.9	10.3
2	285°27.3	246°08.1	18.1	275°49.7	12.7	280°42.0	45.7	317°32.4	10.3
3	300°29.8	261°07.7	.. 19.0	290°50.4	.. 13.4	295°44.2	.. 45.8	332°34.9	.. 10.3
4	315°32.2	276°07.3	19.9	305°51.2	14.2	310°46.3	46.0	347°37.4	10.3
5	330°34.7	291°06.9	20.9	320°52.0	14.9	325°48.4	46.1	2°39.8	10.3
6	345°37.2	306°06.5	N13°21.8	335°52.8	N02°15.6	340°50.5	N00°46.2	17°42.3	S14°10.3
7	0°39.6	321°06.1	22.7	350°53.5	16.3	355°52.7	46.4	32°44.8	10.3
8	15°42.1	336°05.6	23.7	5°54.3	17.0	10°54.8	46.5	47°47.2	10.3
9	30°44.6	351°05.2	.. 24.6	20°55.1	.. 17.7	25°56.9	.. 46.6	62°49.7	.. 10.4
10	45°47.0	6°04.8	25.5	35°55.8	18.4	40°59.0	46.8	77°52.2	10.4
11	60°49.5	21°04.4	26.5	50°56.6	19.1	56°01.2	46.9	92°54.7	10.4
12	75°52.0	36°04.0	N13°27.4	65°57.4	N02°19.9	71°03.3	N00°47.0	107°57.1	S14°10.4
13	90°54.4	51°03.6	28.3	80°58.1	20.6	86°05.4	47.2	122°59.6	10.4
14	105°56.9	66°03.2	29.2	95°58.9	21.3	101°07.5	47.3	138°02.1	10.4
15	120°59.4	81°02.8	.. 30.2	110°59.7	.. 22.0	116°09.7	.. 47.4	153°04.5	.. 10.4
16	136°01.8	96°02.4	31.1	126°00.4	22.7	131°11.8	47.6	168°07.0	10.4
17	151°04.3	111°02.0	32.0	141°01.2	23.4	146°13.9	47.7	183°09.5	10.4
18	166°06.7	126°01.5	N13°32.9	156°02.0	N02°24.1	161°16.1	N00°47.8	198°12.0	S14°10.5
19	181°09.2	141°01.1	33.9	171°02.8	24.8	176°18.2	48.0	213°14.4	10.5
20	196°11.7	156°00.7	34.8	186°03.5	25.5	191°20.3	48.1	228°16.9	10.5
21	211°14.1	171°00.3	.. 35.7	201°04.3	.. 26.3	206°22.4	.. 48.3	243°19.4	.. 10.5
22	226°16.6	185°59.9	36.6	216°05.1	27.0	221°24.6	48.4	258°21.9	10.5
23	241°19.1	200°59.5	37.6	231°05.8	27.7	236°26.7	48.5	273°24.3	10.5

Mer.pass. 06:57  $\nu$  -0.4° d 0.9° m -3.96  $\nu$  0.8° d 0.7° m 0.59  $\nu$  2.1° d 0.1° m -2.27  $\nu$  2.5° d -0.0° m 0.66

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	256°21.5	215°59.1	N13°38.5	246°06.6	N02°28.4	251°28.8	N00°48.7	288°26.8	S14°10.5
1	271°24.0	230°58.6	39.4	261°07.4	29.1	266°31.0	48.8	303°29.3	10.5
2	286°26.5	245°58.2	40.3	276°08.1	29.8	281°33.1	48.9	318°31.7	10.5
3	301°28.9	260°57.8	.. 41.2	291°08.9	.. 30.5	296°35.2	.. 49.1	333°34.2	.. 10.6
4	316°31.4	275°57.4	42.2	306°09.7	31.2	311°37.3	49.2	348°36.7	10.6
5	331°33.9	290°57.0	43.1	321°10.5	31.9	326°39.5	49.3	3°39.2	10.6
6	346°36.3	305°56.6	N13°44.0	336°11.2	N02°32.6	341°41.6	N00°49.5	18°41.6	S14°10.6
7	1°38.8	320°56.1	44.9	351°12.0	33.4	356°43.7	49.6	33°44.1	10.6
8	16°41.2	335°55.7	45.8	6°12.8	34.1	11°45.9	49.7	48°46.6	10.6
9	31°43.7	350°55.3	.. 46.8	21°13.5	.. 34.8	26°48.0	.. 49.9	63°49.1	.. 10.6
10	46°46.2	5°54.9	47.7	36°14.3	35.5	41°50.1	50.0	78°51.5	10.6
11	61°48.6	20°54.5	48.6	51°15.1	36.2	56°52.3	50.1	93°54.0	10.7
12	76°51.1	35°54.0	N13°49.5	66°15.8	N02°36.9	71°54.4	N00°50.2	108°56.5	S14°10.7
13	91°53.6	50°53.6	50.4	81°16.6	37.6	86°56.5	50.4	123°59.0	10.7
14	106°56.0	65°53.2	51.3	96°17.4	38.3	101°58.7	50.5	139°01.4	10.7
15</td									

DUT1 = UT1-UTC = -0.0908 sec  $\Delta T = TT-UT1 = +69.2748$  sec

2022 June 06 to Jun. 08 UT

h		Sun		Moon				
Mon		GHA	Dec	GHA	$\nu$	Dec	d	HP
0	180° 20.6	N22° 37.7	103° 32.9	13.7'	N17° 30.1	-10.9'	54.9'	
1	195° 20.4	37.9	118° 05.6	13.7'	17° 19.2	-10.9'	54.9'	
2	210° 20.3	38.2	132° 38.3	13.7'	17° 08.3	-11.0'	55.0'	
3	225° 20.2	.. 38.4	147° 11.0	13.8'	16° 57.2	-11.1'	55.0'	
4	240° 20.1	38.7	161° 43.8	13.8'	16° 46.1	-11.2'	55.0'	
5	255° 20.0	39.0	176° 16.6	13.8'	16° 35.0	-11.3'	55.0'	
6	270° 19.9	N22° 39.2	190° 49.4	13.9'	N16° 23.7	-11.3'	55.0'	
7	285° 19.8	39.5	205° 22.3	13.9'	16° 12.4	-11.4'	55.1'	
8	300° 19.6	39.7	219° 55.2	13.9'	16° 00.9	-11.5'	55.1'	
9	315° 19.5	.. 40.0	234° 28.1	14.0'	15° 49.5	-11.6'	55.1'	
10	330° 19.4	40.2	249° 01.1	14.0'	15° 37.9	-11.6'	55.1'	
11	345° 19.3	40.5	263° 34.1	14.0'	15° 26.2	-11.7'	55.2'	
12	0° 19.2	N22° 40.8	278° 07.1	14.1'	N15° 14.5	-11.8'	55.2'	
13	15° 19.1	41.0	292° 40.2	14.1'	15° 02.7	-11.9'	55.2'	
14	30° 19.0	41.3	307° 13.3	14.1'	14° 50.9	-11.9'	55.2'	
15	45° 18.8	.. 41.5	321° 46.4	14.1'	14° 38.9	-12.0'	55.3'	
16	60° 18.7	41.8	336° 19.5	14.2'	14° 26.9	-12.1'	55.3'	
17	75° 18.6	42.0	350° 52.7	14.2'	14° 14.8	-12.2'	55.3'	
18	90° 18.5	N22° 42.3	5° 25.8	14.2'	N14° 02.7	-12.2'	55.3'	
19	105° 18.4	42.5	19° 59.1	14.2'	13° 50.4	-12.3'	55.4'	
20	120° 18.3	42.8	34° 32.3	14.3'	13° 38.1	-12.4'	55.4'	
21	135° 18.2	.. 43.0	49° 05.5	14.3'	13° 25.8	-12.4'	55.4'	
22	150° 18.0	43.3	63° 38.8	14.3'	13° 13.3	-12.5'	55.5'	
23	165° 17.9	43.5	78° 12.1	14.3'	13° 00.8	-12.6'	55.5'	
	SD = 15.8'	d = 0.3'		SD = 15.0'				

Tue	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	180° 17.8	N22° 43.7	92° 45.4	14.3'	N12° 48.3	-12.6'	55.5'
1	195° 17.7	44.0	107° 18.8	14.4'	12° 35.6	-12.7'	55.5'
2	210° 17.6	44.2	121° 52.1	14.4'	12° 22.9	-12.8'	55.6'
3	225° 17.5	.. 44.5	136° 25.5	14.4'	12° 10.2	-12.8'	55.6'
4	240° 17.3	44.7	150° 58.9	14.4'	11° 57.4	-12.9'	55.6'
5	255° 17.2	45.0	165° 32.3	14.4'	11° 44.5	-13.0'	55.7'
6	270° 17.1	N22° 45.2	180° 05.7	14.4'	N11° 31.5	-13.0'	55.7'
7	285° 17.0	45.4	194° 39.2	14.4'	11° 18.5	-13.1'	55.7'
8	300° 16.9	45.7	209° 12.6	14.5'	11° 05.4	-13.1'	55.8'
9	315° 16.8	.. 45.9	223° 46.1	14.5'	10° 52.3	-13.2'	55.8'
10	330° 16.6	46.2	238° 19.5	14.5'	10° 39.1	-13.3'	55.8'
11	345° 16.5	46.4	252° 53.0	14.5'	10° 25.8	-13.3'	55.8'
12	0° 16.4	N22° 46.6	267° 26.5	14.5'	N10° 12.5	-13.4'	55.9'
13	15° 16.3	46.9	282° 00.0	14.5'	09° 59.2	-13.4'	55.9'
14	30° 16.2	47.1	296° 33.5	14.5'	09° 45.7	-13.5'	55.9'
15	45° 16.1	.. 47.3	311° 07.0	14.5'	09° 32.2	-13.5'	56.0'
16	60° 15.9	47.6	325° 40.5	14.5'	09° 18.7	-13.6'	56.0'
17	75° 15.8	47.8	340° 14.1	14.5'	09° 05.1	-13.6'	56.0'
18	90° 15.7	N22° 48.0	354° 47.6	14.5'	N08° 51.5	-13.7'	56.1'
19	105° 15.6	48.3	9° 21.1	14.5'	08° 37.8	-13.8'	56.1'
20	120° 15.5	48.5	23° 54.6	14.5'	08° 24.0	-13.8'	56.1'
21	135° 15.3	.. 48.7	38° 28.2	14.5'	08° 10.2	-13.9'	56.2'
22	150° 15.2	49.0	53° 01.7	14.5'	07° 56.4	-13.9'	56.2'
23	165° 15.1	49.2	67° 35.2	14.5'	07° 42.5	-14.0'	56.2'
	SD = 15.8'	d = 0.2'		SD = 15.1'			

Wed	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	180° 15.0	N22° 49.4	82° 08.7	14.5'	N07° 28.5	-14.0'	56.3'
1	195° 14.9	49.7	96° 42.2	14.5'	07° 14.5	-14.0'	56.3'
2	210° 14.7	49.9	111° 15.8	14.5'	07° 00.5	-14.1'	56.3'
3	225° 14.6	.. 50.1	125° 49.3	14.5'	06° 46.4	-14.1'	56.4'
4	240° 14.5	50.3	140° 22.7	14.5'	06° 32.2	-14.2'	56.4'
5	255° 14.4	50.6	154° 56.2	14.5'	06° 18.0	-14.2'	56.4'
6	270° 14.3	N22° 50.8	169° 29.7	14.5'	N06° 03.8	-14.3'	56.5'
7	285° 14.2	51.0	184° 03.2	14.5'	05° 49.5	-14.3'	56.5'
8	300° 14.0	51.2	198° 36.6	14.4'	05° 35.2	-14.4'	56.5'
9	315° 13.9	.. 51.4	213° 10.1	14.4'	05° 20.8	-14.4'	56.6'
10	330° 13.8	51.7	227° 43.5	14.4'	05° 06.4	-14.4'	56.6'
11	345° 13.7	51.9	242° 16.9	14.4'	04° 52.0	-14.5'	56.7'
12	0° 13.6	N22° 52.1	256° 50.3	14.4'	N04° 37.5	-14.5'	56.7'
13	15° 13.4	52.3	271° 23.7	14.4'	04° 23.0	-14.6'	56.7'
14	30° 13.3	52.6	285° 57.0	14.3'	04° 08.4	-14.6'	56.8'
15	45° 13.2	.. 52.8	300° 30.4	14.3'	03° 53.8	-14.6'	56.8'
16	60° 13.1	53.0	315° 03.7	14.3'	03° 39.2	-14.7'	56.8'
17	75° 12.9	53.2	329° 37.0	14.3'	03° 24.5	-14.7'	56.9'
18	90° 12.8	N22° 53.4	344° 10.2	14.2'	N03° 09.8	-14.7'	56.9'
19	105° 12.7	53.6	358° 43.5	14.2'	02° 55.1	-14.8'	56.9'
20	120° 12.6	53.9	13° 16.7	14.2'	02° 40.3	-14.8'	57.0'
21	135° 12.5	.. 54.1	27° 49.9	14.2'	02° 25.5	-14.8'	57.0'
22	150° 12.3	54.3	42° 23.0	14.1'	02° 10.7	-14.9'	57.1'
23	165° 12.2	54.5	56° 56.1	14.1'	01° 55.8	-14.9'	57.1'
	SD = 15.8'	d = 0.2'		SD = 15.3'			

Lat.	Twilight		Sunrise	Sunset	Twilight	
	Naut.	Civil			Civil	Naut.
N 72°						
N 70°						
68°						
66°	-:-	-:-	00:45	23:18	-:-	-:-
64°	-:-	-:-	01:45	22:15	-:-	-:-
62°	-:-	-:-	02:18	21:41	-:-	-:-
60°	-:-	01:10	02:42	21:17	22:50	-:-
N 58°	-:-	01:50	03:01	20:58	22:09	-:-
56°	-:-	02:17	03:17	20:42	21:42	-:-
54°	01:04	02:38	03:30	20:28	21:21	22:56
52°	01:41	02:54	03:42	20:16	21:04	22:18
50°	02:06	03:09	03:52	20:06	20:50	21:53
45°	02:49	03:37	04:14	19:44	20:21	21:10
N 40°	03:18	03:59	04:31	19:27	19:59	20:40
35°	03:40	04:16	04:46	19:12	19:42	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	19:32
N 10°	04:48	05:15	05:38	18:20	18:43	19:10
0°	05:07	05:33	05:55	18:03	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	06:35	07:03	16:55	17:23	17:55
40°	06:12	06:46	07:16	16:41	17:12	17:46
45°	06:22	06:59	07:33	16:25	16:59	17:36
S 50°	06:33	07:14	07:52	16:05	16:43	17:24
52°	06:38	07:22	08:02	15:56	16:36	17:19
54°	06:44	07:29	08:13	15:45	16:28	17:14
56°	06:49	07:38	08:25	15:33	16:20	17:08
58°	06:56	07:48	08:39	15:19	16:10	17:02
S 60°	07:03	07:59	08:55	15:02	15:59	16:55
Lat.	Mon	Moonrise	Wed	Mon	Moonset	Wed
N 72°	07:09	09:46	11:56	03:43	02:39	02:02
N 70°	07:53	10:04	12:03	02:57	02:19	01:53
68°	08:23	10:18	12:08	02:26	02:03	01:45
66°	08:44	10:30	12:13	02:03	01:50	01:38
64°	09:01	10:40	12:17	01:45	01:39	01:32
62°	09:15	10:48	12:20	01:30	01:29	01:27
60°	09:27	10:55	12:23	01:17	01:21	01:23
N 58°	09:37	11:01	12:25	01:07	01:14	01:19
56°	09:46	11:06	12:27	00:57	01:07	01:16
54°	09:54	11:11	12:29	00:48	01:02	01:13
52°	10:01	11:15	12:31	00:41	00:56	01:10
50°	1					

## June 09, 10, 11 UT (Thu., Fri., Sat.)

Aries			Venus			Mars		Jupiter		Saturn		Stars	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec
0	257°20.7	215°49.0	N14°00.5	246°25.1	N02°45.4	252°20.0	N00°51.8	289°26.2	S14°10.8			Alpheratz	357°37.1
1	272°23.1	230°48.5	01.4	261°25.9	46.1	267°22.1	52.0	304°28.7	10.8			Ankaa	353°09.4
2	287°25.6	245°48.1	02.3	276°26.6	46.8	282°24.3	52.1	319°31.2	10.8			Schedar	349°33.7
3	302°28.1	260°47.7	03.2	291°27.4	47.5	297°26.4	52.2	334°33.6	09.9			Diphda	348°49.6
4	317°30.5	275°47.3	04.1	306°28.2	48.2	312°28.5	52.4	349°36.1	10.9			Achernar	335°22.2
5	332°33.0	290°46.8	05.0	321°29.0	48.9	327°30.7	52.5	4°38.6	10.9			Hamal	327°53.9
6	347°35.5	305°46.4	N14°05.9	336°29.7	N02°49.7	342°32.8	N00°52.6	19°41.1	S14°10.9			Polaris	315°26.7
7	2°37.9	320°46.0	06.8	351°30.5	50.4	357°34.9	52.7	34°43.6	10.9			Acamar	315°13.8
8	17°40.4	335°45.6	07.7	6°31.3	51.1	12°37.1	52.9	49°46.0	10.9			Menkar	314°08.7
9	32°42.8	350°45.1	08.6	21°32.0	51.8	27°39.2	53.0	64°48.5	10.9			Mirfak	308°31.8
10	47°45.3	5°44.7	09.5	36°32.8	52.5	42°41.4	53.1	79°51.0	10.9			Aldebaran	290°42.4
11	62°47.8	20°44.3	10.4	51°33.6	53.2	57°43.5	53.3	94°53.5	11.0			Rigel	281°06.3
12	77°50.2	35°43.8	N14°11.3	66°34.4	N02°53.9	72°45.6	N00°53.4	109°56.0	S14°11.0			Capella	280°25.5
13	92°52.7	50°43.4	12.2	81°35.1	54.6	87°47.8	53.5	124°58.4	11.0			Bellatrix	278°25.5
14	107°55.2	65°43.0	13.2	96°35.9	55.3	102°49.9	53.7	140°00.9	11.0			Elnath	278°05.0
15	122°57.6	80°42.5	14.1	111°36.7	56.0	117°52.0	53.8	155°03.4	11.0			Alnilam	275°40.2
16	138°00.1	95°42.1	15.0	126°37.4	56.7	132°54.2	53.9	170°05.9	11.0			Betelgeuse	270°54.7
17	153°02.6	110°41.7	15.9	141°38.2	57.4	147°56.3	54.1	185°08.4	11.0			Canopus	263°53.9
18	168°05.0	125°41.2	N14°16.8	156°39.0	N02°58.1	162°58.5	N00°54.2	200°10.8	S14°11.1			Sirius	258°28.5
19	183°07.5	140°40.8	17.7	171°39.8	58.9	178°00.6	54.3	215°13.3	11.1			Adhara	255°07.9
20	198°09.9	155°40.4	18.6	186°40.5	02°59.6	193°02.7	54.4	230°15.8	11.1			Procyon	244°53.4
21	213°12.4	170°39.9	19.5	201°41.3	03°00.3	208°04.9	54.6	245°18.3	11.1			Pollux	243°20.2
22	228°14.9	185°39.5	20.4	216°42.1	01.0	223°07.0	54.7	260°20.8	11.1			Avior	234°16.0
23	243°17.3	200°39.1	21.3	231°42.8	01.7	238°09.2	54.8	275°23.2	11.1			Suhail	222°48.1
Mer.pass.			06:50	ν -0.4° d 0.9° m -3.95		ν 0.8° d 0.7° m 0.57		ν 2.1° d 0.1° m -2.28		ν 2.5° d -0.0° m 0.65		Alplacidus	221°39.2
Mer.pass.			06:50	ν -0.4° d 0.9° m -3.95		ν 0.8° d 0.7° m 0.56		ν 2.1° d 0.1° m -2.29		ν 2.5° d -0.0° m 0.65		Alphard	217°50.0
Fri												Regulus	207°36.8
												Dubhe	193°43.7
												Denebola	182°27.1
												Gienah	175°45.7
												Acru	173°02.2
												Gacrux	171°53.8
												Alioth	166°14.7
												Spica	158°24.4
												Alkaid	152°53.4
												Hadar	148°38.6
												Menkent	147°59.9
												Arcturus	145°49.6
												Rigil Kent	139°42.7
												Kochab	137°18.8
												Zuben'ubi	136°58.1
												Alphecca	126°05.2
												Antares	112°18.1
												Atria	107°13.7
												Sabik	102°04.9
												Shaula	96°12.9
												Rasalhague	96°00.2
												Eltanin	90°42.6
												Kaus Aust.	83°35.0
												Vega	80°34.3
												Nunki	75°50.1
												Altair	62°01.8
												Peacock	53°08.7
												Deneb	49°26.9
												Enif	33°40.8
												Al Na'ir	27°35.5
												Fomalhaut	15°16.9
												Scheat	13°47.2
												Markab	13°32.0
Sat												15°19.4	
Jun 09 Thu												Jun 09 Thu	SHA
												Venus	318°28.3
												Mars	349°04.4
												Jupiter	354°59.3
												Saturn	32°05.5
Jun 10 Fri												Jun 10 Fri	SHA
												Venus	317°18.8
												Mars	348°23.8
												Jupiter	354°51.5
												Saturn	32°05.9
Jun 11 Sat												Jun 11 Sat	SHA
												Venus	316°09.1
												Mars	347°43.2
												Jupiter	354°43.8
												Saturn	32°06.4
Horizontal parallax													
Venus: 0.1													
Mars: 0.1													

$$\text{DUT1} = \text{UT1-UTC} = -0.0893 \text{ sec} \quad \Delta T = \text{TT-UT1} = +69.2733 \text{ sec}$$

2022 June 09 to Jun. 11 UT

h	Sun		Moon					
	Thu	GHA	Dec	GHA	$\nu$	Dec	d	HP
0		180°12.1	N22°54.7	71°29.2	14.1'	N01°41.0	-14.9'	57.1'
1		195°12.0	54.9	86°02.3	14.0'	01°26.0	-14.9'	57.2'
2		210°11.9	55.1	100°35.3	14.0'	01°11.1	-15.0'	57.2'
3		225°11.7	.. 55.3	115°08.3	14.0'	00°56.1	-15.0'	57.3'
4		240°11.6	55.5	129°41.3	13.9'	00°41.1	-15.0'	57.3'
5		255°11.5	55.8	144°14.2	13.9'	00°26.1	-15.0'	57.3'
6		270°11.4	N22°56.0	158°47.0	13.8'	N00°11.1	-15.1'	57.4'
7		285°11.2	56.2	173°19.9	13.8'	S00°04.0	-15.1'	57.4'
8		300°11.1	56.4	187°52.7	13.7'	00°19.1	-15.1'	57.4'
9		315°11.0	.. 56.6	202°25.4	13.7'	00°34.2	-15.1'	57.5'
10		330°10.9	56.8	216°58.1	13.7'	00°49.3	-15.1'	57.5'
11		345°10.8	57.0	231°30.8	13.6'	01°04.4	-15.2'	57.6'
12		0°10.6	N22°57.2	246°03.4	13.6'	S01°19.6	-15.2'	57.6'
13		15°10.5	57.4	260°36.0	13.5'	01°34.8	-15.2'	57.6'
14		30°10.4	57.6	275°08.5	13.5'	01°50.0	-15.2'	57.7'
15		45°10.3	.. 57.8	289°40.9	13.4'	02°05.2	-15.2'	57.7'
16		60°10.1	58.0	304°13.3	13.4'	02°20.4	-15.2'	57.8'
17		75°10.0	58.2	318°45.7	13.3'	02°35.6	-15.2'	57.8'
18		90°09.9	N22°58.4	333°18.0	13.2'	S02°50.8	-15.2'	57.8'
19		105°09.8	58.6	347°50.2	13.2'	03°06.1	-15.2'	57.9'
20		120°09.7	58.8	2°22.4	13.1'	03°21.3	-15.3'	57.9'
21		135°09.5	.. 59.0	16°54.5	13.1'	03°36.6	-15.3'	58.0'
22		150°09.4	59.2	31°26.6	13.0'	03°51.8	-15.3'	58.0'
23		165°09.3	59.4	45°58.6	12.9'	04°07.1	-15.3'	58.0'
	SD = 15.8'	d = 0.2'				SD = 15.6'		

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

Fri	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	180°09.2	N22°59.6	60°30.5	12.9'	S04°22.4	-15.3'	58.1'
1	195°09.0	22°59.8	75°02.4	12.8'	04°37.6	-15.3'	58.1'
2	210°08.9	23°00.0	89°34.2	12.7'	04°52.9	-15.3'	58.2'
3	225°08.8	.. 00.2	104°06.0	12.7'	05°08.2	-15.3'	58.2'
4	240°08.7	00.3	118°37.6	12.6'	05°23.4	-15.3'	58.2'
5	255°08.5	00.5	133°09.2	12.5'	05°38.7	-15.3'	58.3'
6	270°08.4	N23°00.7	147°40.8	12.5'	S05°53.9	-15.2'	58.3'
7	285°08.3	00.9	162°12.2	12.4'	06°09.2	-15.2'	58.4'
8	300°08.2	01.1	176°43.6	12.3'	06°24.4	-15.2'	58.4'
9	315°08.0	.. 01.3	191°14.9	12.2'	06°39.6	-15.2'	58.4'
10	330°07.9	01.5	205°46.1	12.1'	06°54.9	-15.2'	58.5'
11	345°07.8	01.7	220°17.3	12.1'	07°10.1	-15.2'	58.5'
12	0°07.7	N23°01.9	234°48.3	12.0'	S07°25.3	-15.2'	58.6'
13	15°07.5	02.0	249°19.3	11.9'	07°40.4	-15.2'	58.6'
14	30°07.4	02.2	263°50.2	11.8'	07°55.6	-15.1'	58.6'
15	45°07.3	.. 02.4	278°21.1	11.7'	08°10.8	-15.1'	58.7'
16	60°07.2	02.6	292°51.8	11.6'	08°25.9	-15.1'	58.7'
17	75°07.0	02.8	307°22.4	11.6'	08°41.0	-15.1'	58.8'
18	90°06.9	N23°03.0	321°53.0	11.5'	S08°56.1	-15.1'	58.8'
19	105°06.8	03.1	336°23.5	11.4'	09°11.1	-15.0'	58.8'
20	120°06.7	03.3	350°53.9	11.3'	09°26.1	-15.0'	58.9'
21	135°06.5	.. 03.5	5°24.1	11.2'	09°41.1	-15.0'	58.9'
22	150°06.4	03.7	19°54.3	11.1'	09°56.1	-14.9'	59.0'
23	165°06.3	03.9	34°24.4	11.0'	10°11.1	-14.9'	59.0'
	SD = 15.7'	$d = 0.2'$			SD = 15.8'		

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

Sat	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	180°06.2	N23°04.0	48°54.5	10.9'	\$10°26.0	-14.9'	59.0'
1	195°06.0	04.2	63°24.4	10.8'	10°40.9	-14.8'	59.1'
2	210°05.9	04.4	77°54.2	10.7'	10°55.7	-14.8'	59.1'
3	225°05.8	.. 04.6	92°23.9	10.6'	11°10.5	-14.8'	59.2'
4	240°05.7	04.8	106°53.5	10.5'	11°25.3	-14.7'	59.2'
5	255°05.5	04.9	121°23.0	10.4'	11°40.0	-14.7'	59.2'
6	270°05.4	N23°05.1	135°52.4	10.3'	\$11°54.7	-14.6'	59.3'
7	285°05.3	05.3	150°21.7	10.2'	12°09.3	-14.6'	59.3'
8	300°05.2	05.4	164°50.9	10.1'	12°23.9	-14.5'	59.3'
9	315°05.0	.. 05.6	179°20.0	10.0'	12°38.4	-14.5'	59.4'
10	330°04.9	05.8	193°49.0	9.9'	12°52.9	-14.4'	59.4'
11	345°04.8	06.0	208°17.8	9.8'	13°07.3	-14.4'	59.5'
12	0°04.7	N23°06.1	222°46.6	9.6'	\$13°21.7	-14.3'	59.5'
13	15°04.5	06.3	237°15.2	9.5'	13°36.1	-14.3'	59.5'
14	30°04.4	06.5	251°43.8	9.4'	13°50.3	-14.2'	59.6'
15	45°04.3	.. 06.6	266°12.2	9.3'	14°04.5	-14.1'	59.6'
16	60°04.1	06.8	280°40.5	9.2'	14°18.7	-14.1'	59.6'
17	75°04.0	07.0	295°08.7	9.1'	14°32.8	-14.0'	59.7'
18	90°03.9	N23°07.1	309°36.8	9.0'	\$14°46.8	-14.0'	59.7'
19	105°03.8	07.3	324°04.7	8.8'	15°00.7	-13.9'	59.7'
20	120°03.6	07.5	338°32.6	8.7'	15°14.6	-13.8'	59.8'
21	135°03.5	.. 07.6	353°00.3	8.6'	15°28.4	-13.7'	59.8'
22	150°03.4	07.8	7°27.9	8.5'	15°42.2	-13.7'	59.9'
23	165°03.3	07.9	21°55.4	8.4'	15°55.8	-13.6'	59.9'
	SD = 15.7'	$d = 0.2'$			SD = 16.1'		

Day	Sun		Moon			Age 10-12 64-83%
	Eqn.of 00 <sup>h</sup> mm:ss	Time 12 <sup>h</sup> mm:ss	Mer. Pass hh:mm	Mer.Pass. Upper hh:mm	Mer.Pass. Lower hh:mm	
09	00:48	00:43	11:59	19:50	07:28	
10	00:37	00:31	11:59	20:38	08:14	
11	00:25	00:19	12:00	21:29	09:03	

## June 12, 13, 14 UT (Sun., Mon., Tue.)

Aries			Venus			Mars			Jupiter			Saturn		
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Stars	SHA	Dec
0	260°18.1	215°17.2	N15°04.6	247°20.8	N03°36.2	254°54.2	N01°01.0	292°25.0	S14°11.9			Alpheratz	357°37.0	29°12.6
1	275°20.5	230°16.7	05.5	262°21.5	36.9	269°56.4	01.2	307°27.5	11.9			Ankaa	353°09.4	-42°10.9
2	290°23.0	245°16.2	06.4	277°22.3	37.6	284°58.5	01.3	322°30.0	11.9			Schedar	349°33.6	56°39.3
3	305°25.5	260°15.8	07.3	292°23.1	38.3	300°00.7	01.4	337°32.5	11.9			Diphda	348°49.6	-17°51.8
4	320°27.9	275°15.3	08.1	307°23.9	39.0	315°02.8	01.5	352°35.0	12.0			Achernar	335°22.2	-57°07.2
5	335°30.4	290°14.9	09.0	322°24.6	39.7	330°05.0	01.7	7°37.5	12.0			Hamal	327°53.8	23°33.9
6	350°32.9	305°14.4	N15°09.9	337°25.4	N03°40.4	345°07.1	N01°01.8	22°40.0	S14°12.0			Polaris	315°25.5	89°21.3
7	5°35.3	320°13.9	10.7	352°26.2	41.1	0°09.3	01.9	37°42.5	12.0			Acamar	315°13.8	-40°12.8
8	20°37.8	335°13.5	11.6	7°27.0	41.8	15°11.4	02.0	52°45.0	12.0			Menkar	314°08.7	4°10.6
9	35°40.3	350°13.0	12.5	22°27.7	42.5	30°13.6	02.2	67°47.4	12.0			Mirfak	308°31.7	49°56.2
10	50°42.7	5°12.6	13.3	37°28.5	43.2	45°15.8	02.3	82°49.9	12.1			Aldebaran	290°42.4	16°33.2
11	65°45.2	20°12.1	14.2	52°29.3	43.9	60°17.9	02.4	97°52.4	12.1			Rigel	281°06.3	-8°10.6
12	80°47.7	35°11.6	N15°15.1	67°30.1	N03°44.6	75°20.1	N01°02.5	112°54.9	S14°12.1			Capella	280°25.5	46°01.1
13	95°50.1	50°11.2	15.9	82°30.8	45.3	90°22.2	02.6	127°57.4	12.1			Bellatrix	278°25.5	6°22.1
14	110°52.6	65°10.7	16.8	97°31.6	46.0	105°24.4	02.8	142°59.9	12.1			Elnath	278°05.0	28°37.5
15	125°55.0	80°10.2	17.7	112°32.4	46.7	120°26.5	02.9	158°02.4	12.2			Alnilam	275°40.2	-1°11.3
16	140°57.5	95°09.8	18.5	127°33.2	47.4	135°28.7	03.0	173°04.9	12.2			Betelgeuse	270°54.7	7°24.6
17	156°00.0	110°09.3	19.4	142°33.9	48.1	150°30.8	03.1	188°07.4	12.2			Canopus	263°53.9	-52°42.5
18	171°02.4	125°08.8	N15°20.2	157°34.7	N03°48.8	165°33.0	N01°03.3	203°09.9	S14°12.2			Sirius	258°28.5	-16°44.9
19	186°04.9	140°08.4	21.1	172°35.5	49.5	180°35.1	03.4	218°12.4	12.2			Adhara	255°07.9	-29°00.2
20	201°07.4	155°07.9	22.0	187°36.3	50.2	195°37.3	03.5	233°14.9	12.2			Procyon	244°53.4	5°10.1
21	216°09.8	170°07.4	22.8	202°37.0	50.9	210°39.4	03.6	248°17.3	12.3			Pollux	243°20.3	27°58.4
22	231°12.3	185°07.0	23.7	217°37.8	51.6	225°41.6	03.8	263°19.8	12.3			Avior	234°16.1	-59°35.0
23	246°14.8	200°06.5	24.5	232°38.6	52.3	240°43.7	03.9	278°22.3	12.3			Suhail	222°48.1	-43°31.5
Mer.pass.		06:38	ν -0.5° d 0.9° m -3.95	ν 0.8° d 0.7° m 0.55	ν 2.2° d 0.1° m -2.30	ν 2.5° d -0.0° m 0.64						Miaplacidus	221°39.2	-69°48.7

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Stars	SHA	Dec
0	261°17.2	215°06.0	N15°25.4	247°39.4	N03°53.0	255°45.9	N01°04.0	293°24.8	S14°12.3			Denebola	182°27.1	14°27.0
1	276°19.7	230°05.6	26.3	262°40.1	53.7	270°48.1	04.1	308°27.3	12.3			Gienah	175°45.7	-17°40.0
2	291°22.2	245°05.1	27.1	277°40.9	54.4	285°50.2	04.2	323°29.8	12.4			Acrux	173°02.3	-63°13.6
3	306°24.6	260°04.6	28.0	292°41.7	55.1	300°52.4	04.4	338°32.3	12.4			Gacrux	171°53.8	-57°14.5
4	321°27.1	275°04.1	28.8	307°42.5	55.8	315°54.5	04.5	353°34.8	12.4			Alioth	166°14.7	55°50.6
5	336°29.5	290°03.7	29.7	322°43.2	56.5	330°56.7	04.6	8°37.3	12.4			Spica	158°24.4	-11°16.7
6	351°32.0	305°03.2	N15°30.5	337°44.0	N03°57.2	345°58.8	N01°04.7	23°39.8	S14°12.4			Alkaid	152°53.4	49°12.3
7	6°34.5	320°02.7	31.4	352°44.8	57.9	1°01.0	04.8	38°42.3	12.4			Hadar	148°38.6	-60°29.0
8	21°36.9	335°02.3	32.2	7°45.6	58.6	16°03.1	05.0	53°44.8	12.5			Menkent	147°59.9	-36°28.9
9	36°39.4	350°01.8	33.1	22°46.3	03°59.3	31°05.3	05.1	68°47.3	12.5			Arcturus	145°49.6	19°04.1
10	51°41.9	5°01.3	34.0	37°47.1	04°00.0	46°07.5	05.2	83°49.8	12.5			Rigel Kent.	139°42.7	-60°55.8
11	66°44.3	20°00.8	34.8	52°47.9	06.7	61°09.6	05.3	98°52.3	12.5			Kochab	137°18.9	74°04.0
12	81°46.8	35°00.4	N15°35.7	67°48.7	N04°01.4	76°11.8	N01°05.5	113°54.8	S14°12.5			Zuben'ubi	136°58.1	-16°08.1
13	96°49.3	49°59.9	36.5	82°49.4	02.1	91°13.9	05.6	128°57.2	12.6			Alphecca	126°05.2	26°38.5
14	111°51.7	64°59.4	37.4	97°50.2	02.8	106°16.1	05.7	143°59.7	12.6			Antares	112°18.1	-26°28.9
15	126°54.2	79°58.9	38.2	112°51.0	03.4	121°18.3	05.8	159°02.2	12.6			Atria	107°13.7	-69°04.0
16	141°56.7	94°58.5	39.1	127°51.8	04.1	136°20.4	05.9	174°04.7	12.6			Sabik	102°04.9	-15°45.1
17	156°59.1	109°58.0	39.9	142°52.6	04.8	151°22.6	06.1	189°07.2	12.6			Shaula	96°12.8	-37°07.2
18	172°01.6	124°57.5	N15°40.8	157°53.3	N04°05.5	166°24.7	N01°06.2	204°09.7	S14°12.7			Rasalhague	96°00.2	12°32.6
19	187°04.0	139°57.0	41.6	172°54.1	06.2	181°26.9	06.3	219°12.2	12.7			Eltanin	90°42.6	51°29.1
20	202°06.5	154°56.5	42.5	187°54.9	06.9	196°29.0	06.4	234°14.7	12.7			Kaus Aust.	83°35.0	-34°22.4
21	217°09.0	169°56.1	43.3	202°55.7	07.6	211°31.2	06.5	249°17.2	12.7			Vega	80°34.2	38°48.2
22	232°11.4	184°55.6	44.1	217°56.4	08.3	226°33.4	06.7	264°19.7	12.7			Nunki	75°50.1	-26°16.1
23	247°13.9	199°55.1	45.0	232°57.2	09.0	241°35.5	06.8	279°22.2	12.7			Altair	62°01.8	8°55.6
Mer.pass.		06:34	ν -0.5° d 0.9° m -3.94	ν 0.8° d 0.7° m 0.54	ν 2.2° d 0.1° m -2.30	ν 2.5° d -0.0° m 0.64						Peacock	53°08.7	-56°39.6

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Stars	SHA	Dec
0	262°16.4	214°54.6	N15°45.8	247°58.0	N04°09.7	256°37.7	N01°06.9	294°24.7	S14°12.8			Almalich	15°16.8	-29°30.1
1	277°18.8	229°54.1	46.7	262°58.8	10.4	271°39.8	07.0	309°27.2	12.8			Scheat	13°47.2	28°12.0
2	292°21.3	244°53.7	47.5	277°59.5	11.1	286°42.0	07.1	324°29.7	12.8			Markab	13°32.0	15°19.4
3	307°23.8	259°53.2	48.4	293°00.3	11.8	301°44.2	07.3	339°32.2	12.8			Jun 12 Sun	314°59.1	09:39
4	322°26.2	274°52.7	49.2	308°01.1	12.5	316°46.3	07.4	354°34.7	12.8			Venus	347°02.7	07:30
5	337°28.7	289°52.2	50.0	323°01.9	13.2	331°48.5	07.5	9°37.2	12.9			Mars	347°36.2	06:59
6	352°31.2	304°51.7	N15°50.9	338°02.7	N04°13.9	346°50.7	N01°07.6	24°39.7	S14°12.9			Jupiter	32°06.9	04:30
7	7°33.6	319°51.2	51.7	353°03.4	14.6	1°52.8	07.7	39°42.2	12.9			Saturn	32°07.6	04:26
8	22°36.1	334°50.8	52.6	8°04.2	15.3	16°55.0	07.9	54°44.7	12.9			Jun 13 Mon	313°48.8	09:40
9	37°38.5	349°50.3	53.4	23°05.0	16.0	31°57.1	08.0	69°47.2	12.9			Venus	346°22.1	07:29
10	52°41.0	4°49.8	54.2	38°05.8	16.7	46°59.3	08.1	84°49.7	13.0			Mars	354°28.7	06:56
11	67°43.5	19°49.3	55.1	53°06.5	17.4	62°01.5	08.2	99°52.2	13.0			Jupiter	32°07.6	04:26
12	82°45.9	34°48.8	N15°55.9	68°07.3	N04°18.1	77°03.6	N01°08.3	114°54.7	S14°13.0			Saturn	32°08.3	04:22
13	97°48.4													

DUT1 = UT1-UTC = -0.0885 sec  $\Delta T = TT-UT1 = +69.2725$  sec

2022 June 12 to Jun. 14 UT

h		Sun		Moon				Lat.		Twilight						Twilight		
Sun		GHA	Dec	GHA	$\nu$	Dec	$d$	HP	Naut.	Civil					Civil	Naut.		
0	180°03.1	N23°08.1	36°22.7	8.2'	\$16°09.4	-13.5'	59.9'		N 72°	□	□				□	□	□	
1	195°03.0	08.3	50°49.9	8.1'	16°22.9	-13.4'	60.0'		N 70°	□	□				□	□	□	
2	210°02.9	08.4	65°17.1	8.0'	16°36.3	-13.3'	60.0'		68°	□	□				□	□	□	
3	225°02.7	.. 08.6	79°44.0	7.9'	16°49.7	-13.2'	60.0'		66°	□	□				□	□	□	
4	240°02.6	08.7	94°10.9	7.7'	17°02.9	-13.2'	60.1'		64°	:-:	:-:	01:35	22:26	:-:	:-:	:-:	:-:	
5	255°02.5	08.9	108°37.6	7.6'	17°16.1	-13.1'	60.1'		62°	:-:	:-:	02:12	21:49	:-:	:-:	:-:	:-:	
6	270°02.4	N23°09.1	123°04.3	7.5'	\$17°29.2	-13.0'	60.1'		60°	:-:	00:57	02:37	21:24	23:05	:-:	:-:	:-:	:-:
7	285°02.2	09.2	137°30.7	7.4'	17°42.1	-12.9'	60.2'											
8	300°02.1	09.4	151°57.1	7.2'	17°55.0	-12.8'	60.2'											
9	315°02.0	.. 09.5	166°23.3	7.1'	18°07.8	-12.7'	60.2'											
10	330°01.8	09.7	180°49.4	7.0'	18°20.5	-12.6'	60.2'											
11	345°01.7	09.8	195°15.4	6.8'	18°33.1	-12.5'	60.3'											
12	0°01.6	N23°10.0	209°41.2	6.7'	\$18°45.5	-12.4'	60.3'											
13	15°01.5	10.1	224°07.0	6.6'	18°57.9	-12.3'	60.3'											
14	30°01.3	10.3	238°32.5	6.5'	19°10.2	-12.2'	60.4'											
15	45°01.2	.. 10.4	252°58.0	6.3'	19°22.3	-12.0'	60.4'											
16	60°01.1	10.6	267°23.3	6.2'	19°34.4	-11.9'	60.4'											
17	75°00.9	10.7	281°48.5	6.1'	19°46.3	-11.8'	60.5'											
18	90°00.8	N23°10.9	296°13.6	5.9'	\$19°58.1	-11.7'	60.5'											
19	105°00.7	11.0	310°38.5	5.8'	20°09.8	-11.6'	60.5'											
20	120°00.6	11.2	325°03.3	5.7'	20°21.4	-11.4'	60.5'											
21	135°00.4	.. 11.3	339°28.0	5.6'	20°32.8	-11.3'	60.6'											
22	150°00.3	11.5	353°52.6	5.4'	20°44.1	-11.2'	60.6'											
23	165°00.2	11.6	8°17.0	5.3'	20°55.3	-11.1'	60.6'											
	SD = 15.7'		d = 0.2'		SD = 16.3'													
Mon		GHA	Dec	GHA	$\nu$	Dec	$d$	HP										
0	180°00.0	N23°11.8	22°41.3	5.2'	\$21°06.4	-10.9'	60.6'											
1	194°59.9	11.9	37°05.5	5.0'	21°17.3	-10.8'	60.7'											
2	209°59.8	12.0	51°29.5	4.9'	21°28.1	-10.6'	60.7'											
3	224°59.7	.. 12.2	65°53.4	4.8'	21°38.7	-10.5'	60.7'											
4	239°59.5	12.3	80°17.2	4.7'	21°49.2	-10.4'	60.7'											
5	254°59.4	12.5	94°40.9	4.5'	21°59.6	-10.2'	60.8'											
6	269°59.3	N23°12.6	109°04.4	4.4'	\$22°09.8	-10.1'	60.8'											
7	284°59.1	12.8	123°27.8	4.3'	22°19.9	-9.9'	60.8'											
8	299°59.0	12.9	137°51.1	4.2'	22°29.8	-9.8'	60.8'											
9	314°58.9	.. 13.0	152°14.3	4.0'	22°39.6	-9.6'	60.9'											
10	329°58.7	13.2	166°37.3	3.9'	22°49.2	-9.5'	60.9'											
11	344°58.6	13.3	181°00.2	3.8'	22°58.7	-9.3'	60.9'											
12	359°58.5	N23°13.4	195°23.0	3.7'	\$23°08.0	-9.1'	60.9'											
13	14°58.4	13.6	209°45.7	3.6'	23°17.1	-9.0'	60.9'											
14	29°58.2	13.7	224°08.3	3.5'	23°26.1	-8.8'	61.0'											
15	44°58.1	.. 13.8	238°30.7	3.3'	23°34.9	-8.7'	61.0'											
16	59°58.0	14.0	252°53.1	3.2'	23°43.6	-8.5'	61.0'											
17	74°57.8	14.1	267°15.3	3.1'	23°52.1	-8.3'	61.0'											
18	89°57.7	N23°14.2	281°37.4	3.0'	\$24°00.4	-8.1'	61.0'											
19	104°57.6	14.4	295°59.4	2.9'	24°08.5	-8.0'	61.0'											
20	119°57.4	14.5	310°21.3	2.8'	24°16.5	-7.8'	61.1'											
21	134°57.3	.. 14.6	324°43.1	2.7'	24°24.3	-7.6'	61.1'											
22	149°57.2	14.8	339°04.8	2.6'	24°31.9	-7.4'	61.1'											
23	164°57.0	14.9	353°26.4	2.5'	24°39.4	-7.3'	61.1'											
	SD = 15.7'		d = 0.1'		SD = 16.5'													
Tue		GHA	Dec	GHA	$\nu$	Dec	$d$	HP										
0	179°56.9	N23°15.0	7°47.9	2.4'	\$24°46.6	-7.1'	61.1'											
1	194°56.8	15.1	22°09.3	2.3'	24°53.7	-6.9'	61.1'											
2	209°56.7	15.3	36°30.6	2.2'	25°00.6	-6.7'	61.1'											
3	224°56.5	.. 15.4	50°51.8	2.1'	25°07.3	-6.5'	61.1'											
4	239°56.4	15.5	65°12.9	2.0'	25°13.8	-6.3'	61.2'											
5	254°56.3	15.6	79°33.9	1.9'	25°20.1	-6.1'	61.2'											
6	269°56.1	N23°15.8	93°54.9	1.9'	\$25°26.3	-5.9'	61.2'											
7	284°56.0	15.9	108°15.7	1.8'	25°32.2	-5.7'	61.2'											
8	299°55.9	16.0	122°36.5	1.7'	25°37.9	-5.5'	61.2'											
9	314°55.7	.. 16.1	136°57.2	1.6'	25°43.5	-5.4'	61.2'											
10	329°55.6	16.2	151°17.8	1.5'	25°48.8	-5.2'	61.2'											
11	344°55.5	16.4	165°38.4	1.5'	25°54.0	-5.0'	61.2'											
12	359°55.3	N23°16.5	179°58.9	1.4'	\$25°58.9	-4.7'	61.2'											
13	14°55.2	16.6	194°19.3	1.3'	26°03.7	-4.5'	61.2'											
14	29°55.1	16.7	208°39.6	1.3'	26°08.2	-4.3'	61.2'											
15	44°54.9	.. 16.8	222°59.9	1.2'	26°12.6	-4.1'	61.2'											
16	59°54.8	16.9	237°20.2	1.2'	26°16.7	-3.9'	61.3'											
17	74°54.7	17.1	251°40.3	1.1'	26°20.7	-3.7'	61.3'											
18	89°54.6	N23°17.2	266°00.5	1.1'	\$26°24.4	-3.5'	61.3'											
19	104°54.4	17.3	280°20.5	1.0'	26°27.9	-3.3'	61.3'											
20	119°54.3	17.4	294°40.6	1.0'	26°31.2	-3.1'	61.3'											
21	134°54.2	.. 17.5	309°00.6	1.0'	26°34.3	-2.9'	61.3'											
22	149°54.0	17.6	323°20.5	0.9'	26°37.2	-2.7'	61.3'											
23	164°53.9	17.7	337°40.4	0.9'	26°39.9	-2.5'	61.3'											
	SD = 15.7'		d = 0.1'		SD = 16.7'													
Day		Sun		Moon														
		Eqn.of Time		Mer.		Mer.Pass.		Upper		Lower		Age						
		00 <sup>h</sup>		00 <sup>h</sup>		12 <sup>h</sup>		mm:ss		hh:mm		hh:mm		hh:mm		hh:mm		
12		00:13		00:06														

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

Aries			Venus			Mars			Jupiter			Saturn		
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Stars	SHA	Dec
0	263°15.5	214°42.9	N16°05.9	248°16.6	N04°26.4	257°29.6	N01°09.7	295°24.7	S14°13.3			Alpheratz	357°37.0	29°12.6
1	278°18.0	229°42.4	06.7	263°17.4	27.1	272°31.8	09.9	310°27.2	13.3			Ankaa	353°09.4	-42°10.9
2	293°20.4	244°42.0	07.6	278°18.2	27.8	287°33.9	10.0	325°29.7	13.3			Schedar	349°33.6	56°39.3
3	308°22.9	259°41.5	.. 08.4	293°19.0	.. 28.5	302°36.1	.. 10.1	340°32.2	.. 13.3			Diphda	348°49.5	-17°51.8
4	323°25.4	274°41.0	09.2	308°19.8	29.2	317°38.3	10.2	355°34.7	13.3			Achernar	335°22.1	-57°07.2
5	338°27.8	289°40.5	10.1	323°20.5	29.9	332°40.4	10.3	10°37.2	13.4			Hamal	327°53.8	23°33.9
6	353°30.3	304°40.0	N16°10.9	338°21.3	N04°30.6	347°42.6	N01°10.4	25°39.7	S14°13.4			Polaris	315°24.1	89°21.2
7	8°32.8	319°39.5	11.7	353°22.1	31.3	2°44.8	10.6	40°42.2	13.4			Acamar	315°13.7	-40°12.8
8	23°35.2	334°39.0	12.5	8°22.9	32.0	17°46.9	10.7	55°44.7	13.4			Menkar	314°08.6	4°10.6
9	38°37.7	349°38.5	.. 13.4	23°23.6	.. 32.6	32°49.1	.. 10.8	70°47.2	.. 13.4			Mirfak	308°31.7	49°56.2
10	53°40.1	4°38.0	14.2	38°24.4	33.3	47°51.3	10.9	85°49.7	13.5			Aldebaran	290°42.4	16°33.2
11	68°42.6	19°37.5	15.0	53°25.2	34.0	62°53.4	11.0	100°52.2	13.5			Rigel	281°06.3	-8°10.6
12	83°45.1	34°37.0	N16°15.8	68°26.0	N04°34.7	77°55.6	N01°11.1	115°54.7	S14°13.5			Capella	280°25.5	46°01.1
13	98°47.5	49°36.5	16.7	83°26.8	35.4	92°57.8	11.3	130°57.2	13.5			Bellatrix	278°25.5	6°22.2
14	113°50.0	64°36.0	17.5	98°27.5	36.1	107°59.9	11.4	145°59.7	13.6			Elnath	278°04.9	28°37.5
15	128°52.5	79°35.5	.. 18.3	113°28.3	.. 36.8	123°02.1	.. 11.5	161°02.2	.. 13.6			Alnilam	275°40.2	-1°11.3
16	143°54.9	94°35.0	19.1	128°29.1	37.5	138°04.3	11.6	176°04.7	13.6			Betelgeuse	270°54.7	7°24.6
17	158°57.4	109°34.5	19.9	143°29.9	38.2	153°06.5	11.7	191°07.2	13.6			Canopus	263°53.9	-52°42.5
18	173°59.9	124°34.0	N16°20.8	158°30.7	N04°38.9	168°08.6	N01°11.8	206°09.7	S14°13.6			Sirius	258°28.5	-16°44.8
19	189°02.3	139°33.5	21.6	173°31.4	39.6	183°10.8	11.9	221°12.2	13.7			Adhara	255°07.9	-29°00.2
20	204°04.8	154°33.0	22.4	188°32.2	40.3	198°13.0	12.1	236°14.7	13.7			Procyon	244°53.4	5°10.1
21	219°07.3	169°32.5	.. 23.2	203°33.0	.. 40.9	213°15.1	.. 12.2	251°17.2	.. 13.7			Pollux	243°20.2	27°58.4
22	234°09.7	184°32.0	24.0	218°33.8	41.6	228°17.3	12.3	266°19.7	13.7			Avior	234°16.1	-59°35.0
23	249°12.2	199°31.5	24.8	233°34.5	42.3	243°19.5	12.4	281°22.2	13.7			Suhail	222°48.1	-43°31.5
Mer.pass. 06:26		ν -0.5° d 0.8° m -3.94	ν 0.8° d 0.7° m 0.53		ν 2.2° d 0.1° m -2.32		ν 2.5° d -0.0° m 0.63							

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Stars	SHA	Dec
0	264°14.6	214°31.0	N16°25.7	248°35.3	N04°43.0	258°21.6	N01°12.5	296°24.8	S14°13.8			Denebola	182°27.1	14°27.0
1	279°17.1	229°30.5	26.5	263°36.1	43.7	273°23.8	12.6	311°27.3	13.8			Gienah	175°45.7	-17°40.0
2	294°19.6	244°30.0	27.3	278°36.9	44.4	288°26.0	12.8	326°29.8	13.8			Acrux	173°02.3	-63°13.6
3	309°22.0	259°29.5	.. 28.1	293°37.7	.. 45.1	303°28.2	.. 12.9	341°32.3	.. 13.8			Gacrux	171°53.8	-57°14.5
4	324°24.5	274°29.0	28.9	308°38.4	45.8	318°30.3	13.0	356°34.8	13.9			Alioth	166°14.7	55°50.6
5	339°27.0	289°28.5	29.7	323°39.2	46.5	333°32.5	13.1	11°37.3	13.9			Spica	158°24.4	-11°16.7
6	354°29.4	304°27.9	N16°30.5	338°40.0	N04°47.2	348°34.7	N01°13.2	26°39.8	S14°13.9			Alkaid	152°53.4	49°12.4
7	9°31.9	319°27.4	31.3	353°40.8	47.9	3°36.9	13.3	41°42.3	13.9			Hadar	148°38.6	-60°29.0
8	24°34.4	334°26.9	32.2	8°41.6	48.5	18°39.0	13.4	56°44.8	14.0			Menkent	147°59.9	-36°28.9
9	39°36.8	349°26.4	.. 33.0	23°42.3	.. 49.2	33°41.2	.. 13.6	71°47.3	.. 14.0			Arcturus	145°49.6	19°04.1
10	54°39.3	4°25.9	33.8	38°43.1	49.9	48°43.4	13.7	86°49.8	14.0			Rigel Kent.	139°42.7	-60°55.8
11	69°41.8	19°25.4	34.6	53°43.9	50.6	63°45.5	13.8	101°52.3	14.0			Kochab	137°18.9	74°04.0
12	84°44.2	34°24.9	N16°35.4	68°44.7	N04°51.3	78°47.7	N01°13.9	116°54.8	S14°14.0			Zuben'ubi	136°58.1	-16°08.1
13	99°46.7	49°24.4	36.2	83°45.4	52.0	93°49.9	14.0	131°57.3	14.1			Alphecca	126°05.2	26°38.5
14	114°49.1	64°23.9	37.0	98°46.2	52.7	108°52.1	14.1	146°59.8	14.1			Antares	112°18.1	-26°28.9
15	129°51.6	79°23.4	.. 37.8	113°47.0	.. 53.4	123°54.2	.. 14.2	162°02.3	.. 14.1			Atria	107°13.6	-69°04.1
16	144°54.1	94°22.9	38.6	128°47.8	54.1	138°56.4	14.3	177°04.9	14.1			Sabik	102°04.9	-15°45.1
17	159°56.5	109°22.3	39.4	143°48.6	54.8	153°58.6	14.5	192°07.4	14.2			Shaula	96°12.8	-37°07.2
18	174°59.0	124°21.8	N16°40.2	158°49.3	N04°55.4	169°00.8	N01°14.6	207°09.9	S14°14.2			Rasalhague	96°00.2	12°32.6
19	190°01.5	139°21.3	41.0	173°50.1	56.1	184°02.9	14.7	222°12.4	14.2			Eltanin	90°42.6	51°29.1
20	205°03.9	154°20.8	41.8	188°50.9	56.8	199°05.1	14.8	237°14.9	14.2			Kaus Aust.	83°34.9	-34°22.4
21	220°06.4	169°20.3	.. 42.6	203°51.7	.. 57.5	214°07.3	.. 14.9	252°17.4	.. 14.3			Vega	80°34.2	38°48.2
22	235°08.9	184°19.8	43.4	218°52.5	58.2	229°09.5	15.0	267°19.9	14.3			Nunki	75°50.0	-26°16.1
23	250°11.3	199°19.3	44.2	233°53.2	58.9	244°11.6	15.1	282°22.4	14.3			Altair	62°01.7	8°55.6
Mer.pass. 06:22		ν -0.5° d 0.8° m -3.94	ν 0.8° d 0.7° m 0.52		ν 2.2° d 0.1° m -2.32		ν 2.5° d -0.0° m 0.62							

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Stars	SHA	Dec
0	265°13.8	214°18.7	N16°45.0	248°54.0	N04°59.6	259°13.8	N01°15.2	297°24.9	S14°14.3			Jun 15 Wed	SHA	Mer.pass
1	280°16.3	229°18.2	45.8	263°54.8	05°00.3	274°16.0	15.4	312°27.4	14.3			Venus	311°27.4	09:41
2	295°18.7	244°17.7	46.6	278°55.6	01.0	289°18.2	15.5	327°29.9	14.4			Mars	345°01.1	07:27
3	310°21.2	259°17.2	.. 47.4	293°56.4	.. 01.6	304°20.4	.. 15.6	342°32.4	.. 14.4			Jupiter	354°14.1	06:49
4	325°23.6	274°16.7	48.2	308°57.1	02.3	319°22.5	15.7	357°35.0	14.4			Saturn	32°09.2	04:18
5	340°26.1	289°16.2	49.0	323°57.9	03.0	334°24.7	15.8	12°37.5	14.4			Jun 16 Thu	SHA	Mer.pass
6	355°28.6	304°15.6	N16°49.8	338°58.7	N05°03.7	349°26.9	N01°15.9	27°40.0	S14°14.5			Venus	310°16.3	09:42
7	10°31.0	319°15.1	50.6	353°59.5	04.4	4°29.1	16.0	42°42.5	14.5			Mars	344°20.7	07:25
8	25°33.5	334°14.6	51.4	9°00.3	05.1	19°31.2	16.1	57°45.0	14.5			Jupiter	354°07.0	06:46
9	40°36.0	349°14.1	.. 52.2	24°01.0	.. 05.8	34°33.4	.. 16.3	72°47.5	.. 14.5			Saturn	32°10.1	04:14
10	55°38.4	4°13.6	53.0	39°01.8	06.5	49°35.6	16.4	87°50.0	14.6			Jun 17 Fri	SHA	Mer.pass
11	70°40.9	19°13.0	53.8	54°02.6	07.1	64°37.8	16.5	102°52.5	14.6			Venus	309°05.0	09:43

DUT1 = UT1-UTC = -0.0860 sec  $\Delta T = TT-UT1 = +69.2700$  sec

2022 June 15 to Jun. 17 UT

h		Sun		Moon				Twilight							
Wed	GHA	Dec	GHA	$\nu$	Dec	$d$	HP	Lat.	Naut.	Civil	Sunrise	Sunset	Civil	Naut.	
0	179°53.8	N23°17.8	352°00.3	0.9'	S26°42.3	-2.3'	61.3'	N 72°							
1	194°53.6	18.0	6°20.2	0.8'	26°44.6	-2.0'	61.3'	N 70°							
2	209°53.5	18.1	20°40.0	0.8'	26°46.6	-1.8'	61.3'	68°							
3	224°53.4	18.2	34°59.8	0.8'	26°48.5	-1.6'	61.3'	66°							
4	239°53.2	18.3	49°19.6	0.8'	26°50.1	-1.4'	61.3'	64°	--	--	01:33	22:30	--	--	
5	254°53.1	18.4	63°39.4	0.8'	26°51.5	-1.2'	61.3'	62°	--	--	02:10	21:52	--	--	
6	269°53.0	N23°18.5	77°59.1	0.8'	S26°52.7	-1.0'	61.3'	60°	--	00:52	02:36	21:26	23:11	--	
7	284°52.8	18.6	92°18.9	0.8'	26°53.6	-0.8'	61.3'	N 58°	--	01:41	02:56	21:05	22:21	--	
8	299°52.7	18.7	106°38.7	0.8'	26°54.4	-0.5'	61.2'	56°	--	02:11	03:13	20:49	21:51	--	
9	314°52.6	18.8	120°58.4	0.8'	26°54.9	-0.3'	61.2'	54°	00:48	02:33	03:27	20:35	21:29	23:15	
10	329°52.4	18.9	135°18.2	0.8'	26°55.3	-0.1'	61.2'	52°	01:33	02:51	03:39	20:22	21:11	22:29	
11	344°52.3	19.0	149°37.9	0.8'	26°55.4	0.1'	61.2'	50°	02:00	03:06	03:50	20:11	20:56	22:01	
12	359°52.2	N23°19.1	163°57.7	0.8'	S26°55.3	0.3'	61.2'	45°	02:46	03:35	04:13	19:49	20:26	21:16	
13	14°52.0	19.2	178°17.5	0.8'	26°55.0	0.5'	61.2'	N 40°	03:16	03:58	04:31	19:31	20:04	20:45	
14	29°51.9	19.3	192°37.3	0.8'	26°54.5	0.7'	61.2'	35°	03:39	04:16	04:46	19:16	19:46	20:22	
15	44°51.8	19.4	206°57.1	0.9'	26°53.7	1.0'	61.2'	30°	03:58	04:31	04:59	19:03	19:30	20:04	
16	59°51.6	19.5	221°17.0	0.9'	26°52.8	1.2'	61.2'	20°	04:27	04:56	05:21	18:41	19:05	19:35	
17	74°51.5	19.6	235°36.9	0.9'	26°51.6	1.4'	61.2'	N 10°	04:49	05:16	05:40	18:22	18:45	19:12	
18	89°51.4	N23°19.7	249°56.8	0.9'	S26°50.2	1.6'	61.2'	0°	05:08	05:35	05:57	18:04	18:27	18:53	
19	104°51.2	19.8	264°16.7	1.0'	26°48.6	1.8'	61.2'	S 10°	05:25	05:52	06:14	17:47	18:10	18:36	
20	119°51.1	19.9	278°36.7	1.0'	26°46.8	2.0'	61.2'	20°	05:41	06:09	06:33	17:28	17:53	18:20	
21	134°51.0	20.0	292°56.8	1.1'	26°44.8	2.2'	61.1'	30°	05:58	06:28	06:54	17:07	17:34	18:04	
22	149°50.8	20.1	307°16.8	1.1'	26°42.6	2.4'	61.1'	35°	06:07	06:38	07:06	16:55	17:23	17:55	
23	164°50.7	20.2	321°37.0	1.2'	26°40.2	2.6'	61.1'	40°	06:16	06:50	07:21	16:41	17:11	17:45	
	SD = 15.7'		d = 0.1'				SD = 16.7'	45°	06:26	07:04	07:37	16:24	16:58	17:35	
Thu	GHA	Dec	GHA	$\nu$	Dec	$d$	HP	Lat.	Wed	Moonrise	Fri	Wed	Moonset	Fri	
0	179°50.6	N23°20.3	335°57.1	1.2'	S26°37.5	2.8'	61.1'	N 72°	■■■	■■■	■■■	■■■	■■■	■■■	
1	194°50.4	20.4	350°17.4	1.3'	26°34.7	3.1'	61.1'	N 70°	■■■	■■■	■■■	■■■	■■■	■■■	
2	209°50.3	20.5	4°37.6	1.3'	26°31.6	3.3'	61.1'	68°	■■■	■■■	■■■	■■■	■■■	■■■	
3	224°50.2	20.5	18°58.0	1.4'	26°28.4	3.5'	61.1'	66°	■■■	■■■	■■■	■■■	■■■	■■■	
4	239°50.0	20.6	33°18.4	1.5'	26°24.9	3.7'	61.0'	64°	■■■	■■■	01:21			04:21	
5	254°49.9	20.7	47°38.9	1.5'	26°21.2	3.9'	61.0'	62°	...	00:24	00:39	01:45	03:01	05:02	
6	269°49.8	N23°20.8	61°59.4	1.6'	S26°17.4	4.1'	61.0'	60°	23:40	...	00:11	02:31	03:45	05:30	
7	284°49.6	20.9	76°20.0	1.7'	26°13.3	4.3'	61.0'	N 58°	23:10	23:48	...	03:02	04:15	05:51	
8	299°49.5	21.0	90°40.7	1.8'	26°09.1	4.5'	61.0'	56°	22:48	23:30	23:56	03:25	04:37	06:09	
9	314°49.4	21.1	105°01.5	1.9'	26°04.6	4.7'	61.0'	54°	22:29	23:15	23:44	03:44	04:55	06:24	
10	329°49.2	21.2	119°22.4	1.9'	25°59.9	4.9'	60.9'	52°	22:13	23:02	23:34	04:00	05:11	06:37	
11	344°49.1	21.2	133°43.3	2.0'	25°55.1	5.0'	60.9'	50°	22:00	22:50	23:25	04:13	05:24	06:48	
12	359°49.0	N23°21.3	148°04.3	2.1'	S25°50.0	5.2'	60.9'	45°	21:32	22:26	23:06	04:42	05:52	07:11	
13	14°48.8	21.4	162°25.4	2.2'	25°44.8	5.4'	60.9'	N 40°	21:10	22:06	22:50	05:04	06:14	07:30	
14	29°48.7	21.5	176°46.7	2.3'	25°39.4	5.6'	60.9'	35°	20:52	21:50	22:37	05:22	06:32	07:46	
15	44°48.6	21.6	191°08.0	2.4'	25°33.7	5.8'	60.8'	30°	20:36	21:35	22:25	05:38	06:47	07:59	
16	59°48.4	21.7	205°29.3	2.5'	25°27.9	6.0'	60.8'	20°	20:09	21:11	22:05	06:05	07:13	08:22	
17	74°48.3	21.7	219°50.8	2.6'	25°21.9	6.2'	60.8'	N 10°	19:46	20:50	21:48	06:28	07:36	08:42	
	SD = 15.7'		d = 0.1'				SD = 16.7'	0°	19:25	20:30	21:31	06:49	07:56	09:00	
Fri	GHA	Dec	GHA	$\nu$	Dec	$d$	HP	Lat.	Wed	Moonrise	Fri	Wed	Moonset	Fri	
0	179°47.4	N23°22.3	320°24.2	3.4'	S24°35.0	7.4'	60.6'	S 10°	19:03	20:11	21:15	07:11	08:17	09:18	
1	194°47.2	22.4	334°46.6	3.5'	24°27.5	7.6'	60.6'	20°	18:40	19:49	20:57	07:34	08:39	09:37	
2	209°47.1	22.4	349°09.1	3.6'	24°20.0	7.8'	60.6'	30°	18:14	19:25	20:37	08:01	09:05	10:00	
3	224°47.0	22.5	3°31.7	3.7'	24°12.2	7.9'	60.6'	35°	17:58	19:10	20:25	08:16	09:20	10:13	
4	239°46.8	22.6	17°54.4	3.8'	24°04.3	8.1'	60.5'	40°	17:40	18:54	20:11	08:35	09:37	10:27	
5	254°46.7	22.7	32°17.2	3.9'	23°56.2	8.2'	60.5'	45°	17:18	18:33	19:54	08:57	09:58	10:45	
6	269°46.6	N23°22.7	46°40.1	4.1'	S23°48.0	8.4'	60.5'	S 50°	16:50	18:08	19:34	09:25	10:24	11:06	
7	284°46.4	22.8	61°03.2	4.2'	23°39.6	8.6'	60.4'	52°	16:36	17:56	19:24	09:38	10:37	11:17	
8	299°46.3	22.9	75°26.4	4.3'	23°31.0	8.7'	60.4'	54°	16:21	17:42	19:13	09:54	10:51	11:28	
9	314°46.1	22.9	89°49.7	4.4'	23°22.3	8.9'	60.4'	56°	16:02	17:25	19:01	10:13	11:08	11:41	
10	329°46.0	23.0	104°13.2	4.6'	23°13.4	9.0'	60.4'	58°	15:40	17:06	18:46	10:35	11:28	11:56	
11	344°45.9	23.1	118°36.7	4.7'	23°04.4	9.2'	60.3'	S 60°	15:10	16:41	18:29	11:05	11:53	12:14	
	SD = 15.7'		d = 0.1'				SD = 16.5'	00h	Eqn.of Time	Sun	Mer.	Mer.Pass.	Moon	Age	
				00h	00:25	00:31	Mer.Pass.	00:00	00:00	Upper	Lower	Mer.Pass.	Mer.Pass.	Mer.Pass.	
				mm:36	00:38	00:44	hh:mm	mm:36	mm:36	hh:mm	hh:mm	hh:mm	hh:mm	hh:mm	
				mm:33	00:51	00:57	hh:mm	mm:33	mm:33	hh:mm	hh:mm	hh:mm	hh:mm	hh:mm	
15				00:25	00:31	12:01		00:33	13:07						
16				00:38	00:44	12:01		01:41	14:13						
17				00:51	00:57	12:01		02:45	15:16						

## June 18, 19, 20 UT (Sat., Sun., Mon.)

Aries		Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	266°12.9	214°06.2	N17°04.0	249°12.7	N05°16.1	260°06.1	N01°17.9	298°25.2	S14°14.9
1	281°15.4	229°05.7	04.8	264°13.5	16.7	275°08.3	18.0	313°27.7	14.9
2	296°17.9	244°05.2	05.6	279°14.3	17.4	290°10.5	18.1	328°30.2	15.0
3	311°20.3	259°04.6	.. 06.4	294°15.1	.. 18.1	305°12.7	.. 18.2	343°32.7	.. 15.0
4	326°22.8	274°04.1	07.1	309°15.9	18.8	320°14.9	18.4	358°35.2	15.0
5	341°25.3	289°03.6	07.9	324°16.6	19.5	335°17.0	18.5	13°37.7	15.0
6	356°27.7	304°03.0	N17°08.7	339°17.4	N05°20.2	350°19.2	N01°18.6	28°40.2	S14°15.1
7	11°30.2	319°02.5	09.5	354°18.2	20.8	5°21.4	18.7	43°42.8	15.1
8	26°32.6	334°02.0	10.3	9°19.0	21.5	20°23.6	18.8	58°45.3	15.1
9	41°35.1	349°01.5	.. 11.0	24°19.8	.. 22.2	35°25.8	.. 18.9	73°47.8	.. 15.1
10	56°37.6	4°00.9	11.8	39°20.6	22.9	50°28.0	19.0	88°50.3	15.2
11	71°40.0	19°00.4	12.6	54°21.3	23.6	65°30.1	19.1	103°52.8	15.2
12	86°42.5	33°59.9	N17°13.4	69°22.1	N05°24.3	80°32.3	N01°19.2	118°55.3	S14°15.2
13	101°45.0	48°59.3	14.1	84°22.9	25.0	95°34.5	19.3	133°57.8	15.2
14	116°47.4	63°58.8	14.9	99°23.7	25.6	110°36.7	19.4	149°00.4	15.3
15	131°49.9	78°58.3	.. 15.7	114°24.5	.. 26.3	125°38.9	.. 19.5	164°02.9	.. 15.3
16	146°52.4	93°57.7	16.5	129°25.2	27.0	140°41.1	19.7	179°05.4	15.3
17	161°54.8	108°57.2	17.2	144°26.0	27.7	155°43.3	19.8	194°07.9	15.3
18	176°57.3	123°56.6	N17°18.0	159°26.8	N05°28.4	170°45.4	N01°19.9	209°10.4	S14°15.4
19	191°59.7	138°56.1	18.8	174°27.6	29.1	185°47.6	20.0	224°12.9	15.4
20	207°02.2	153°55.6	19.5	189°28.4	29.7	200°49.8	20.1	239°15.5	15.4
21	222°04.7	168°55.0	.. 20.3	204°29.1	.. 30.4	215°52.0	.. 20.2	254°18.0	.. 15.4
22	237°07.1	183°54.5	21.1	219°29.9	31.1	230°54.2	20.3	269°20.5	15.5
23	252°09.6	198°54.0	21.8	234°30.7	31.8	245°56.4	20.4	284°23.0	15.5
Mer.pass. 06:14		ν -0.5° d 0.8° m -3.93	ν 0.8° d 0.7° m 0.50	ν 2.2° d 0.1° m -2.33		ν 2.5° d -0.0° m 0.61			

Stars	
SHA	Dec
Alpheratz	357°37.0
Ankaa	353°09.3
Schedar	349°33.5
Diphda	348°49.5
Achernar	335°22.1
Hamal	327°53.8
Polaris	315°23.1
Acamar	315°13.7
Menkar	314°08.6
Mirfak	308°31.7
Aldebaran	290°42.4
Rigel	281°06.2
Capella	280°25.5
Bellatrix	278°25.5
Elnath	278°04.9
Alnilam	275°40.2
Betelgeuse	270°54.7
Canopus	263°53.9
Sirius	258°28.4
Adhara	255°07.9
Procyon	244°53.4
Pollux	243°20.2
Avior	234°16.1
Suhail	222°48.2
Miaplacidus	221°39.3
Alphard	217°50.0
Regulus	207°36.8
Dubhe	193°43.8
Denebola	182°27.1
Gienah	175°45.7
Acrux	173°02.3
Gacrux	171°53.9
Alioth	166°14.7
Spica	158°24.4
Alkaid	152°53.5
Hadar	148°38.6
Menkent	147°59.9
Arcturus	145°49.6
Rigel Kent.	139°42.7
Kochab	137°19.0
Zuben'ubi	136°58.1
Alphecca	126°05.2
Antares	112°18.1
Atria	107°13.6
Sabik	102°04.9
Shaula	96°12.8
Rasalhague	96°00.2
Eltanin	90°42.6
Kaus Aust.	83°34.9
Vega	80°34.2
Nunki	75°50.0
Altair	62°01.7
Peacock	53°08.6
Deneb	49°26.9
Enif	33°40.7
Al Na'ir	27°35.4
Fomalhaut	15°16.8
Scheat	13°47.2
Markab	13°31.9

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	267°12.1	213°53.4	N17°22.6	249°31.5	N05°32.5	260°58.6	N01°20.5	299°25.5	S14°15.5
1	282°14.5	228°52.9	23.4	264°32.3	33.1	276°00.8	20.6	314°28.0	15.5
2	297°17.0	243°52.3	24.1	279°33.1	33.8	291°02.9	20.7	329°30.5	15.6
3	312°19.5	258°51.8	.. 24.9	294°33.8	.. 34.5	306°05.1	.. 20.8	344°33.1	.. 15.6
4	327°21.9	273°51.3	25.7	309°34.6	35.2	321°07.3	20.9	359°35.6	15.6
5	342°24.4	288°50.7	26.4	324°35.4	35.9	336°09.5	21.1	14°38.1	15.6
6	357°26.9	303°50.2	N17°27.2	339°36.2	N05°36.6	351°11.7	N01°21.2	29°40.6	S14°15.7
7	12°29.3	318°49.6	28.0	354°37.0	37.2	6°13.9	21.3	44°43.1	15.7
8	27°31.8	333°49.1	28.7	9°37.7	37.9	21°16.1	21.4	59°45.6	15.7
9	42°34.2	348°48.5	.. 29.5	24°38.5	.. 38.6	36°18.3	.. 21.5	74°48.2	.. 15.8
10	57°36.7	3°48.0	30.2	39°39.3	39.3	51°20.5	21.6	89°50.7	15.8
11	72°39.2	18°47.5	31.0	54°40.1	40.0	66°22.6	21.7	104°53.2	15.8
12	87°41.6	33°46.9	N17°31.8	69°40.9	N05°40.6	81°24.8	N01°21.8	119°55.7	S14°15.8
13	102°44.1	48°46.4	32.5	84°41.7	41.3	96°27.0	21.9	134°58.2	15.9
14	117°46.6	63°45.8	33.3	99°42.4	42.0	111°29.2	22.0	150°00.8	15.9
15	132°49.0	78°45.3	.. 34.0	114°43.2	.. 42.7	126°31.4	.. 22.1	165°03.3	.. 15.9
16	147°51.5	93°44.7	34.8	129°44.0	43.4	141°33.6	22.2	180°05.8	15.9
17	162°54.0	108°44.2	35.5	144°44.8	44.0	156°35.8	22.3	195°08.3	16.0
18	177°56.4	123°43.6	N17°36.3	159°45.6	N05°44.7	171°38.0	N01°22.4	210°10.8	S14°16.0
19	192°58.9	138°43.1	37.0	174°46.3	45.4	186°40.2	22.5	225°13.4	16.0
20	208°01.4	153°42.5	37.8	189°47.1	46.1	201°42.4	22.6	240°15.9	16.0
21	223°03.8	168°42.0	.. 38.6	204°47.9	.. 46.8	216°44.6	.. 22.7	255°18.4	.. 16.1
22	238°06.3	183°41.4	39.3	219°48.7	47.4	231°46.8	22.8	270°20.9	16.1
23	253°08.7	198°40.9	40.1	234°49.5	48.1	246°49.0	23.0	285°23.4	16.1
Mer.pass. 06:10		ν -0.5° d 0.8° m -3.93	ν 0.8° d 0.7° m 0.50	ν 2.2° d 0.1° m -2.34		ν 2.5° d -0.0° m 0.61			

Jun 18 Sat	SHA	Mer.pass
Venus	307°53.3	09:44
Mars	342°59.8	07:23
Jupiter	353°53.2	06:39
Saturn	32°12.2	04:06
Jun 19 Sun	SHA	Mer.pass
Venus	306°41.3	09:45
Mars	342°19.4	07:22
Jupiter	353°46.5	06:35
Saturn	32°13.4	04:02
Jun 20 Mon	SHA	Mer.pass
Venus	305°29.1	09:46
Mars	341°39.1	07:20
Jupiter	353°39.9	06:32
Saturn	32°14.7	03:58
Horizontal parallax	Venus:	0.1
	Mars:	0.1

DUT1 = UT1-UTC = -0.0824 sec  $\Delta T = TT-UT1 = +69.2664$  sec

2022 June 18 to Jun. 20 UT

h	Sun			Moon			
Sat	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	179°44.1	N23°23.9	305°54.9	6.4'	S20°54.4	10.9'	59.9'
1	194°44.0	24.0	320°20.3	6.5'	20°43.5	11.0'	59.9'
2	209°43.9	24.0	334°45.9	6.7'	20°32.5	11.1'	59.9'
3	224°43.7	.. 24.1	349°11.5	6.8'	20°21.3	11.3'	59.8'
4	239°43.6	24.1	3°37.3	6.9'	20°10.1	11.4'	59.8'
5	254°43.4	24.2	18°03.3	7.1'	19°58.7	11.5'	59.8'
6	269°43.3	N23°24.2	32°29.3	7.2'	S19°47.2	11.6'	59.7'
7	284°43.2	24.3	46°55.5	7.3'	19°35.6	11.7'	59.7'
8	299°43.0	24.3	61°21.9	7.5'	19°23.9	11.8'	59.7'
9	314°42.9	.. 24.4	75°48.3	7.6'	19°12.1	11.9'	59.6'
10	329°42.8	24.4	90°14.9	7.7'	19°00.2	12.0'	59.6'
11	344°42.6	24.5	104°41.6	7.8'	18°48.2	12.1'	59.6'
12	359°42.5	N23°24.5	119°08.5	8.0'	S18°36.1	12.2'	59.5'
13	14°42.4	24.6	133°35.4	8.1'	18°23.9	12.3'	59.5'
14	29°42.2	24.6	148°02.5	8.2'	18°11.6	12.4'	59.5'
15	44°42.1	.. 24.7	162°29.8	8.4'	17°59.2	12.5'	59.4'
16	59°42.0	24.7	176°57.1	8.5'	17°46.8	12.6'	59.4'
17	74°41.8	24.8	191°24.6	8.6'	17°34.2	12.7'	59.4'
18	89°41.7	N23°24.8	205°52.2	8.7'	S17°21.5	12.7'	59.3'
19	104°41.6	24.9	220°20.0	8.9'	17°08.8	12.8'	59.3'
20	119°41.4	24.9	234°47.8	9.0'	16°56.0	12.9'	59.2'
21	134°41.3	.. 25.0	249°15.8	9.1'	16°43.1	13.0'	59.2'
22	149°41.1	25.0	263°43.9	9.2'	16°30.1	13.1'	59.2'
23	164°41.0	25.0	278°12.1	9.3'	16°17.1	13.1'	59.1'
	SD = 15.7'			SD = 16.3'			

Lat.	Twilight		Sunrise	Sunset	Twilight	
	Naut.	Civil			Civil	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	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	07:22	16:41	17:12	17:46
45°	06:27	07:05	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	17:07
58°	07:03	07:56	08:48	15:15	16:07	17:00
S 60°	07:11	08:07	09:05	14:58	15:55	16:52

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

Day	Sun			Moon		
	Eqn. of Time	Mer. Pass.	Upper hh:mm	Mer. Pass.	Lower hh:mm	Age
	00 <sup>h</sup> mm:ss	12 <sup>h</sup> mm:ss	hh:mm	hh:mm	hh:mm	19-21 82-62%
18	01:03	01:10	12:01	03:45	16:13	
19	01:16	01:23	12:01	04:39	17:04	
20	01:30	01:36	12:02	05:28	17:51	

## June 21, 22, 23 UT (Tue., Wed., Thu.)

Aries		Venus		Mars		Jupiter		Saturn		Stars	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec
0	269°10.3	213°27.0	N17°58.6	250°09.1	N06°05.0	262°43.9	N01°25.5	301°26.5	S14°16.8	Alpheratz	357°37.0
1	284°12.8	228°26.4	17°59.3	265°09.8	05.7	277°46.1	25.6	316°29.0	16.9	Ankaa	353°09.3
2	299°15.3	243°25.8	18°00.1	280°10.6	06.4	292°48.3	25.7	331°31.5	16.9	Schedar	349°33.5
3	314°17.7	258°25.3	.. 00.8	295°11.4	.. 07.1	307°50.5	.. 25.8	346°34.0	.. 16.9	Diphda	348°49.5
4	329°20.2	273°24.7	01.5	310°12.2	07.7	322°52.7	25.9	1°36.6	16.9	Achernar	335°22.1
5	344°22.7	288°24.1	02.2	325°13.0	08.4	337°54.9	26.0	16°39.1	17.0	Hamal	327°53.8
6	359°25.1	303°23.6	N18°03.0	340°13.8	N06°09.1	352°57.1	N01°26.1	31°41.6	S14°17.0	Polaris	315°22.1
7	14°27.6	318°23.0	03.7	355°14.5	09.8	7°59.3	26.3	46°44.1	17.0	Acamar	315°13.7
8	29°30.1	333°22.4	04.4	10°15.3	10.4	23°01.5	26.4	61°46.7	17.1	Menkar	314°08.6
9	44°32.5	348°21.9	.. 05.2	25°16.1	.. 11.1	38°03.7	.. 26.5	76°49.2	.. 17.1	Mirfak	308°31.7
10	59°35.0	3°21.3	05.9	40°16.9	11.8	53°05.9	26.6	91°51.7	17.1	Aldebaran	290°42.4
11	74°37.5	18°20.7	06.6	55°17.7	12.5	68°08.1	26.7	106°54.2	17.1	Rigel	281°06.2
12	89°39.9	33°20.2	N18°07.3	70°18.5	N06°13.1	83°10.3	N01°26.8	121°56.8	S14°17.2	Capella	280°25.5
13	104°42.4	48°19.6	08.0	85°19.2	13.8	98°12.5	26.9	136°59.3	17.2	Bellatrix	278°25.5
14	119°44.8	63°19.0	08.8	100°20.0	14.5	113°14.7	27.0	152°01.8	17.2	Elnath	278°04.9
15	134°47.3	78°18.5	.. 09.5	115°20.8	.. 15.2	128°16.9	.. 27.1	167°04.4	.. 17.3	Alnilam	275°40.2
16	149°49.8	93°17.9	10.2	130°21.6	15.8	143°19.1	27.2	182°06.9	17.3	Betelgeuse	270°54.7
17	164°52.2	108°17.3	10.9	145°22.4	16.5	158°21.3	27.3	197°09.4	17.3	Canopus	263°53.9
18	179°54.7	123°16.7	N18°11.7	160°23.2	N06°17.2	173°23.5	N01°27.4	212°11.9	S14°17.4	Sirius	258°28.4
19	194°57.2	138°16.2	12.4	175°23.9	17.9	188°25.7	27.5	227°14.5	17.4	Adhara	255°07.9
20	209°59.6	153°15.6	13.1	190°24.7	18.5	203°27.9	27.6	242°17.0	17.4	Procyon	244°53.4
21	225°02.1	168°15.0	.. 13.8	205°25.5	.. 19.2	218°30.1	.. 27.7	257°19.5	.. 17.4	Pollux	243°20.2
22	240°04.6	183°14.4	14.5	220°26.3	19.9	233°32.3	27.8	272°22.0	17.5	Avior	234°16.1
23	255°07.0	198°13.9	15.2	235°27.1	20.5	248°34.5	27.9	287°24.6	17.5	Suhail	222°48.2
Mer.pass. 06:02		ν -0.6° d 0.7° m -3.93		ν 0.8° d 0.7° m 0.48		ν 2.2° d 0.1° m -2.35		ν 2.5° d -0.0° m 0.60		Miaplacidus	
Mer.pass. 06:02		ν -0.6° d 0.7° m -3.93		ν 0.8° d 0.7° m 0.48		ν 2.2° d 0.1° m -2.35		ν 2.5° d -0.0° m 0.60		Alphard	
Wed		GHA		GHA		GHA		GHA		Dubhe	
0	270°09.5	213°13.3	N18°16.0	250°27.9	N06°21.2	263°36.7	N01°28.0	302°27.1	S14°17.5	Denebola	193°43.8
1	285°11.9	228°12.7	16.7	265°28.7	21.9	278°38.9	28.1	317°29.6	17.6	Gienah	182°27.1
2	300°14.4	243°12.2	17.4	280°29.4	22.6	293°41.1	28.2	332°32.2	17.6	Acrux	175°45.7
3	315°16.9	258°11.6	.. 18.1	295°30.2	.. 23.2	308°43.3	.. 28.3	347°34.7	.. 17.6	Gacrux	173°02.3
4	330°19.3	273°11.0	18.8	310°31.0	23.9	323°45.5	28.4	2°37.2	17.7	Alioth	171°53.9
5	345°21.8	288°10.4	19.5	325°31.8	24.6	338°47.7	28.5	17°39.7	17.7	Alkaid	166°14.7
6	0°24.3	303°09.8	N18°20.2	340°32.6	N06°25.2	353°49.9	N01°28.6	32°42.3	S14°17.7	Hadar	166°53.5
7	15°26.7	318°09.3	20.9	355°33.4	25.9	8°52.2	28.6	47°44.8	17.7	Menkent	148°38.6
8	30°29.2	333°08.7	21.6	10°34.1	26.6	23°54.4	28.7	62°47.3	17.8	Arcturus	147°59.9
9	45°31.7	348°08.1	.. 22.4	25°34.9	.. 27.3	38°56.6	.. 28.8	77°49.8	.. 17.8	Rigel Kent.	145°49.7
10	60°34.1	3°07.5	23.1	40°35.7	27.9	53°58.8	28.9	92°52.4	17.8	Kochab	139°42.8
11	75°36.6	18°06.9	23.8	55°36.5	28.6	69°01.0	29.0	107°54.9	17.9	Zuben'ubi	137°19.0
12	90°39.1	33°06.4	N18°24.5	70°37.3	N06°29.3	84°03.2	N01°29.1	122°57.4	S14°17.9	Alphecca	136°58.1
13	105°41.5	48°05.8	25.2	85°38.1	29.9	99°05.4	29.2	138°00.0	17.9	Antares	126°05.2
14	120°44.0	63°05.2	25.9	100°38.9	30.6	114°07.6	29.3	153°02.5	18.0	Atria	112°18.1
15	135°46.4	78°04.6	.. 26.6	115°39.6	.. 31.3	129°09.8	.. 29.4	168°05.0	.. 18.0	Sabik	107°13.6
16	150°48.9	93°04.0	27.3	130°40.4	31.9	144°12.0	29.5	183°07.6	18.0	Shaula	102°04.9
17	165°51.4	108°03.5	28.0	145°41.2	32.6	159°14.2	29.6	198°10.1	18.0	Rasalhague	96°00.2
18	180°53.8	123°02.9	N18°28.7	160°42.0	N06°33.3	174°16.4	N01°29.7	213°12.6	S14°18.1	Eltanin	90°42.6
19	195°56.3	138°02.3	29.4	175°42.8	34.0	189°18.7	29.8	228°15.1	18.1	Kaus Aust.	83°34.9
20	210°58.8	153°01.7	30.1	190°43.6	34.6	204°20.9	29.9	243°17.7	18.1	Vega	80°34.2
21	226°01.2	168°01.1	.. 30.8	205°44.4	.. 35.3	219°23.1	.. 30.0	258°20.2	.. 18.2	Nunki	75°50.0
22	241°03.7	183°00.5	31.5	220°45.1	36.0	234°25.3	30.1	273°22.7	18.2	Altair	62°01.7
23	256°06.2	197°59.9	32.2	235°45.9	36.6	249°27.5	30.2	288°25.3	18.2	Peacock	53°08.6
Mer.pass. 05:58		ν -0.6° d 0.7° m -3.93		ν 0.8° d 0.7° m 0.47		ν 2.2° d 0.1° m -2.36		ν 2.5° d -0.0° m 0.59		Deneb	
Thu		GHA		GHA		GHA		GHA		Markab	
0	271°08.6	212°59.4	N18°32.9	250°46.7	N06°37.3	264°29.7	N01°30.3	303°27.8	S14°18.3	Alphard	15°16.7
1	286°11.1	227°58.8	33.6	265°47.5	38.0	279°31.9	30.4	318°30.3	18.3	Scheat	13°47.1
2	301°13.6	242°58.2	34.3	280°48.3	38.6	294°34.1	30.5	333°32.9	18.3	Markab	13°31.9
3	316°16.0	257°57.6	.. 35.0	295°49.1	.. 39.3	309°36.3	.. 30.6	348°35.4	.. 18.4	Jun 21 Tue	15°19.4
4	331°18.5	272°57.0	35.7	310°49.9	40.0	324°38.6	30.7	3°37.9	18.4	Venus	304°16.6
5	346°20.9	287°56.4	36.4	325°50.6	40.6	339°40.8	30.8	18°40.5	18.4	Mars	340°58.7
6	1°23.4	302°55.8	N18°37.0	340°51.4	N06°41.3	354°43.0	N01°30.9	33°43.0	S14°18.5	Jupiter	345°33.5
7	16°25.9	317°55.2	37.7	355°52.2	42.0	9°45.2	31.0	48°45.5	18.5	Saturn	32°16.1
8	31°28.3	332°54.7	38.4	10°53.0	42.6	24°47.4	31.1	63°48.1	18.5	Jun 22 Wed	03:54
9	46°30.8	347°54.1	.. 39.1	25°53.8	.. 43.3	39°49.6	.. 31.2	78°50.6	.. 18.5	Venus	303°03.8
10	61°33.3	2°53.5	39.8	40°54.6	44.0	54°51.8	31.3	93°53.1	18.6	Mars	340°18.4
11	76°35.7	17°52.9	40.5	55°55.4	44.6	69°54.0	31.4	108°55.7	18.6	Jupiter	345°27.2
12	91°38.2	32°52.3	N18°41.2	70°56.1	N06°45.3	84°56.3	N01°31.5	123°58.2	S14°18.6	Saturn	32°17.6
13	106°40.7	47°51.7	41.9	85°56.9	46.0	99°58.5	31.6	139°00.7	18.7	Jun 23 Thu	03:50
14	121°43.1	62°51.1	42.5	100°57.7	46.6	115°00.7	31.7	154°03.3	18.7	Venus	304°09.48
15	136°45.6	77°50.5	.. 43.2	115°58.5	.. 47.3	130°02.9	.. 31.7	169°05.8	.. 18.7	Mars	339°38.1
16	151°48.0	92°49.9	43.9	130°59.3	48.0	145°05.1	31.8	184°08.3	18.8	Jupiter	353°21.1
17	166°50.5	107°49.3	44.6	146°00.1	48.6	160°07.3	31.9	199°10.9	18.8	Saturn	32°19.2
18	181°53.0	122°48.7	N18°45.3	161°00.9	N06°49.3	175°09.5	N01°32.0	214°13.4	S14°18.8	Horizontal parallax	03:46
19	196°55.4	137°48.1	46.0	176°01.6	50.0	190°11.8	32.1	229°15.9	18.9	Venus:	0.1
20	211°57.9	152°47.5	46.6	191°02.4	50.6	205°14.0	32.2	244°18.5	18.9	Mars:	0.1
21	227°00.4	167°46.9	.. 47.3	206°03.2	.. 51.3	220°16.2	.. 32.3	259°21.0	.. 18.9		
22	242°02.8	182°46.3	48.0	221°04.0	52.0	235°18.4	32.4	274°23.5	19.0		
23	257°05.3	197°45.7	48.7	236°04.8	52.6	250°20.6	32.5	289°26.1	19.0</		

DUT1 = UT1-UTC = -0.0803 sec  $\Delta T = TT-UT1 = +69.2643$  sec

2022 June 21 to Jun. 23 UT

h		Sun			Moon			
Tue		GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	179°34.3	N23°26.2	269°19.7	13.8'	S04°38.9	14.8'	57.3'	
1	194°34.2	26.2	283°52.5	13.8'	04°24.1	14.8'	57.3'	
2	209°34.1	26.2	298°25.3	13.9'	04°09.3	14.8'	57.3'	
3	224°33.9	.. 26.3	312°58.2	13.9'	03°54.4	14.8'	57.2'	
4	239°33.8	26.3	327°31.1	14.0'	03°39.6	14.8'	57.2'	
5	254°33.7	26.3	342°04.1	14.0'	03°24.8	14.8'	57.1'	
6	269°33.5	N23°26.3	356°37.1	14.1'	S03°10.0	14.8'	57.1'	
7	284°33.4	26.3	11°10.2	14.1'	02°55.2	14.8'	57.1'	
8	299°33.3	26.3	25°43.3	14.2'	02°40.4	14.8'	57.0'	
9	314°33.1	.. 26.3	40°16.5	14.2'	02°25.6	14.8'	57.0'	
10	329°33.0	26.3	54°49.7	14.3'	02°10.8	14.8'	57.0'	
11	344°32.9	26.3	69°22.9	14.3'	01°56.0	14.8'	56.9'	
12	359°32.7	N23°26.3	83°56.2	14.3'	S01°41.2	14.8'	56.9'	
13	14°32.6	26.3	98°29.6	14.4'	01°26.5	14.8'	56.9'	
14	29°32.4	26.3	113°03.0	14.4'	01°11.7	14.7'	56.8'	
15	44°32.3	.. 26.3	127°36.4	14.5'	00°57.0	14.7'	56.8'	
16	59°32.2	26.3	142°09.9	14.5'	00°42.2	14.7'	56.8'	
17	74°32.0	26.2	156°43.4	14.5'	00°27.5	14.7'	56.7'	
18	89°31.9	N23°26.2	171°16.9	14.6'	S00°12.8	14.7'	56.7'	
19	104°31.8	26.2	185°50.5	14.6'	N00°01.9	14.7'	56.7'	
20	119°31.6	26.2	200°24.1	14.6'	00°16.5	14.6'	56.6'	
21	134°31.5	.. 26.2	214°57.7	14.7'	00°31.2	14.6'	56.6'	
22	149°31.4	26.2	229°31.4	14.7'	00°45.8	14.6'	56.6'	
23	164°31.2	26.2	244°05.0	14.7'	01°00.4	14.6'	56.5'	
		SD = 15.7' $d = 0.0'$			SD = 15.6'			
Wed		GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	179°31.1	N23°26.2	258°38.8	14.7'	N01°15.0	14.6'	56.5'	
1	194°30.9	26.2	273°12.5	14.8'	01°29.6	14.5'	56.5'	
2	209°30.8	26.2	287°46.3	14.8'	01°44.1	14.5'	56.4'	
3	224°30.7	.. 26.2	302°20.1	14.8'	01°58.6	14.5'	56.4'	
4	239°30.5	26.1	316°53.9	14.8'	02°13.1	14.5'	56.4'	
5	254°30.4	26.1	331°27.7	14.9'	02°27.6	14.4'	56.4'	
6	269°30.3	N23°26.1	346°01.6	14.9'	N02°42.1	14.4'	56.3'	
7	284°30.1	26.1	0°35.5	14.9'	02°56.5	14.4'	56.3'	
8	299°30.0	26.1	15°09.4	14.9'	03°10.9	14.4'	56.3'	
9	314°29.9	.. 26.1	29°43.3	14.9'	03°25.2	14.3'	56.2'	
10	329°29.7	26.0	44°17.2	14.9'	03°39.6	14.3'	56.2'	
11	344°29.6	26.0	58°51.1	15.0'	03°53.9	14.3'	56.2'	
12	359°29.5	N23°26.0	73°25.1	15.0'	N04°08.2	14.2'	56.1'	
13	14°29.3	26.0	87°59.1	15.0'	04°22.4	14.2'	56.1'	
14	29°29.2	26.0	102°33.0	15.0'	04°36.6	14.2'	56.1'	
15	44°29.0	.. 26.0	117°07.0	15.0'	04°50.8	14.1'	56.1'	
16	59°28.9	25.9	131°41.0	15.0'	05°04.9	14.1'	56.0'	
17	74°28.8	25.9	146°15.0	15.0'	05°19.1	14.1'	56.0'	
18	89°28.6	N23°25.9	160°49.0	15.0'	N05°33.1	14.0'	56.0'	
19	104°28.5	25.9	175°23.0	15.0'	05°47.2	14.0'	55.9'	
20	119°28.4	25.8	189°57.1	15.0'	06°01.2	14.0'	55.9'	
21	134°28.2	.. 25.8	204°31.1	15.0'	06°15.1	13.9'	55.9'	
22	149°28.1	25.8	219°05.1	15.0'	06°29.1	13.9'	55.9'	
23	164°28.0	25.8	233°39.1	15.0'	06°42.9	13.8'	55.8'	
		SD = 15.7' $d = -0.0'$			SD = 15.4'			
Thu		GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	179°27.8	N23°25.7	248°13.1	15.0'	N06°56.8	13.8'	55.8'	
1	194°27.7	25.7	262°47.1	15.0'	07°10.6	13.8'	55.8'	
2	209°27.6	25.7	277°21.2	15.0'	07°24.4	13.7'	55.7'	
3	224°27.4	.. 25.6	291°55.2	15.0'	07°38.1	13.7'	55.7'	
4	239°27.3	25.6	306°29.2	15.0'	07°51.8	13.6'	55.7'	
5	254°27.1	25.6	321°03.2	15.0'	08°05.4	13.6'	55.7'	
6	269°27.0	N23°25.6	335°37.2	15.0'	N08°19.0	13.5'	55.6'	
7	284°26.9	25.5	350°11.2	15.0'	08°32.5	13.5'	55.6'	
8	299°26.7	25.5	4°45.1	15.0'	08°46.0	13.4'	55.6'	
9	314°26.6	.. 25.5	19°19.1	15.0'	08°59.5	13.4'	55.6'	
10	329°26.5	25.4	33°53.1	14.9'	09°12.9	13.4'	55.5'	
11	344°26.3	25.4	48°27.0	14.9'	09°26.2	13.3'	55.5'	
12	359°26.2	N23°25.3	63°00.9	14.9'	N09°39.5	13.3'	55.5'	
13	14°26.1	25.3	77°34.9	14.9'	09°52.8	13.2'	55.5'	
14	29°25.9	25.3	92°08.8	14.9'	10°06.0	13.1'	55.4'	
15	44°25.8	.. 25.2	106°42.6	14.9'	10°19.1	13.1'	55.4'	
16	59°25.7	25.2	121°16.5	14.9'	10°32.2	13.0'	55.4'	
17	74°25.5	25.2	135°50.4	14.8'	10°45.2	13.0'	55.4'	
18	89°25.4	N23°25.1	150°24.2	14.8'	N10°58.2	12.9'	55.3'	
19	104°25.3	25.1	164°58.0	14.8'	11°11.2	12.9'	55.3'	
20	119°25.1	25.0	179°31.8	14.8'	11°24.0	12.8'	55.3'	
21	134°25.0	.. 25.0	194°05.6	14.8'	11°36.9	12.8'	55.3'	
22	149°24.8	24.9	208°39.3	14.7'	11°49.6	12.7'	55.2'	
23	164°24.7	24.9	223°13.1	14.7'	12°02.3	12.6'	55.2'	
		SD = 15.7' $d = -0.0'$			SD = 15.2'			

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

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

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	272°07.8	212°45.1	N18°49.4	251°05.6	N06°53.3	265°22.8	N01°32.6	304°28.6	S14°19.0	Alpheratz	357°36.9	29°12.6					
1	287°10.2	227°44.5	50.0	266°06.4	54.0	280°25.1	32.7	319°31.1	19.1	Ankaa	353°09.3	-42°10.9					
2	302°12.7	242°43.9	50.7	281°07.2	54.6	295°27.3	32.8	334°33.7	19.1	Schedar	349°33.5	56°39.3					
3	317°15.2	257°43.3	· · 51.4	296°07.9	· · 55.3	310°29.5	· · 32.9	349°36.2	· · 19.1	Diphda	348°49.5	-17°51.8					
4	332°17.6	272°42.7	52.1	311°08.7	56.0	325°31.7	33.0	4°38.7	19.2	Achernar	335°22.0	-57°07.2					
5	347°20.1	287°42.1	52.7	326°09.5	56.6	340°33.9	33.1	19°41.3	19.2	Hamal	327°53.7	23°33.9					
6	2°22.5	302°41.5	N18°53.4	341°10.3	N06°57.3	355°36.2	N01°33.2	34°43.8	S14°19.2	Polaris	315°20.8	89°21.2					
7	17°25.0	317°40.9	54.1	356°11.1	57.9	10°38.4	33.3	49°46.3	19.3	Acamar	315°13.7	-40°12.8					
8	32°27.5	332°40.3	54.8	11°11.9	58.6	25°40.6	33.4	64°48.9	19.3	Menkar	314°08.6	4°10.6					
9	47°29.9	347°39.7	· · 55.4	26°12.7	· · 59.3	40°42.8	· · 33.4	79°51.4	· · 19.3	Mirfak	308°31.6	49°56.2					
10	62°32.4	2°39.1	56.1	41°13.4	06°59.9	55°45.0	33.5	94°54.0	19.4	Aldebaran	290°42.4	16°33.2					
11	77°34.9	17°38.5	56.8	56°14.2	07°00.6	70°47.2	33.6	109°56.5	19.4	Rigel	281°06.2	-8°10.5					
12	92°37.3	32°37.9	N18°57.4	71°15.0	N07°01.3	85°49.5	N01°33.7	124°59.0	S14°19.4	Capella	280°25.5	46°01.1					
13	107°39.8	47°37.3	58.1	86°15.8	01.9	100°51.7	33.8	140°01.6	19.5	Bellatrix	278°25.5	6°22.2					
14	122°42.3	62°36.7	58.8	101°16.6	02.6	115°53.9	33.9	155°04.1	19.5	Elnath	278°04.9	28°37.5					
15	137°44.7	77°36.1	18°59.4	116°17.4	· · 03.3	130°56.1	· · 34.0	170°06.6	· · 19.5	Alnilam	275°40.2	-1°11.3					
16	152°47.2	92°35.5	19°00.1	131°18.2	03.9	145°58.3	34.1	185°09.2	19.6	Betelgeuse	270°54.7	7°24.7					
17	167°49.7	107°34.9	00.8	146°19.0	04.6	161°00.6	34.2	200°11.7	19.6	Canopus	263°53.9	-52°42.4					
18	182°52.1	122°34.3	N19°01.4	161°19.7	N07°05.2	176°02.8	N01°34.3	215°14.3	S14°19.6	Sirius	258°28.4	-16°44.8					
19	197°54.6	137°33.7	02.1	176°20.5	05.9	191°05.0	34.4	230°16.8	19.7	Adhara	255°07.9	-29°00.2					
20	212°57.0	152°33.1	02.7	191°21.3	06.6	206°07.2	34.5	245°19.3	19.7	Procyon	244°53.4	5°10.1					
21	227°59.5	167°32.5	· · 03.4	206°22.1	· · 07.2	221°09.5	· · 34.6	260°21.9	· · 19.7	Pollux	243°20.2	27°58.4					
22	243°02.0	182°31.9	04.1	221°22.9	07.9	236°11.7	34.6	275°24.4	19.8	Avior	234°16.1	-59°35.0					
23	258°04.4	197°31.3	04.7	236°23.7	08.5	251°13.9	34.7	290°26.9	19.8	Suhail	222°48.2	-43°31.5					
Mer.pass. 05:51			ν -0.6° d 0.7° m -3.92	ν 0.8° d 0.7° m 0.46	ν 2.2° d 0.1° m -2.37	ν 2.5° d -0.0° m 0.58	Mer.pass. 05:47			Alplacidus	221°39.3	-69°48.7					
Sat			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec				Alphard	217°50.0	-8°45.3
0	273°06.9	212°30.6	N19°05.4	251°24.5	N07°09.2	266°16.1	N01°34.8	305°29.5	S14°19.8	Regulus	207°36.9	11°51.6					
1	288°09.4	227°30.0	06.0	266°25.3	09.9	281°18.3	34.9	320°32.0	19.9	Dubhe	193°43.8	61°38.2					
2	303°11.8	242°29.4	06.7	281°26.0	10.5	296°20.6	35.0	335°34.6	19.9	Denebola	182°27.1	14°27.0					
3	318°14.3	257°28.8	· · 07.4	296°26.8	· · 11.2	311°22.8	· · 35.1	350°37.1	· · 19.9	Gienah	175°45.7	-17°40.0					
4	333°16.8	272°28.2	08.0	311°27.6	11.9	326°25.0	35.2	5°39.6	20.0	Acrua	173°02.4	-63°13.6					
5	348°19.2	287°27.6	08.7	326°28.4	12.5	341°27.2	35.3	20°42.2	20.0	Gacrux	171°53.9	-57°14.5					
6	3°21.7	302°27.0	N19°09.3	341°29.2	N07°13.2	356°29.5	N01°35.4	35°44.7	S14°20.0	Alioth	166°14.8	55°50.6					
7	18°24.1	317°26.4	10.0	356°30.0	13.8	11°31.7	35.5	50°47.3	20.1	Spica	158°24.4	-11°16.7					
8	33°26.6	332°25.7	10.6	11°30.8	14.5	26°33.9	35.6	65°49.8	20.1	Alkaid	152°53.5	49°12.4					
9	48°29.1	347°25.1	· · 11.3	26°31.6	· · 15.1	41°36.1	· · 35.6	80°52.3	· · 20.1	Hadar	148°38.6	60°29.0					
10	63°31.5	2°24.5	11.9	41°32.3	15.8	56°38.4	35.7	95°54.9	20.2	Menkent	147°59.9	-36°28.9					
11	78°34.0	17°23.9	12.6	56°33.1	16.5	71°40.6	35.8	110°57.4	20.2	Arcturus	145°49.7	19°04.1					
12	93°36.5	32°23.3	N19°13.2	71°33.9	N07°17.1	86°42.8	N01°35.9	126°00.0	S14°20.2	Rigel Kent	139°42.8	-60°55.8					
13	108°38.9	47°22.7	13.9	86°34.7	17.8	101°45.0	36.0	141°02.5	20.3	Kochab	137°19.0	74°04.1					
14	123°41.4	62°22.1	14.5	101°35.5	18.4	116°47.3	36.1	156°05.0	20.3	Zuben'ubi	136°58.1	-16°08.1					
15	138°43.9	77°21.4	· · 15.2	116°36.3	· · 19.1	131°49.5	· · 36.2	171°07.6	· · 20.3	Alphecca	126°05.2	26°38.5					
16	153°46.3	92°20.8	15.8	131°37.1	19.8	146°51.7	36.3	186°10.1	20.4	Antares	112°18.1	-26°28.9					
17	168°48.8	107°20.2	16.5	146°37.9	20.4	161°54.0	36.4	201°12.7	20.4	Atria	107°13.6	-69°04.1					
18	183°51.3	122°19.6	N19°17.1	161°38.7	N07°21.1	176°56.2	N01°36.5	216°15.2	S14°20.4	Sabik	102°04.9	-15°45.1					
19	198°53.7	137°19.0	17.7	176°39.4	21.7	191°58.4	36.5	231°17.7	20.5	Shaula	96°12.8	-37°07.2					
20	213°56.2	152°18.4	18.4	191°40.2	22.4	207°00.6	36.6	246°20.3	20.5	Rasalhague	96°00.2	12°32.7					
21	228°58.6	167°17.7	· · 19.0	206°41.0	· · 23.1	222°02.9	· · 36.7	261°22.8	· · 20.5	Eltanin	90°42.6	51°29.9					
22	244°01.1	182°17.1	19.7	221°41.8	23.7	237°05.1	36.8	276°25.4	20.6	Kaus Aust.	83°34.9	-34°22.4					
23	259°03.6	197°16.5	20.3	236°42.6	24.4	252°07.3	36.9	291°27.9	20.6	Vega	80°34.2	38°48.2					
Mer.pass. 05:47			ν -0.6° d 0.7° m -3.92	ν 0.8° d 0.7° m 0.45	ν 2.2° d 0.1° m -2.38	ν 2.5° d -0.0° m 0.58	Mer.pass. 05:43			Nunki	75°50.0	-26°16.1					
Sun			GHA	GHA	Dec	GHA	Dec	GHA	Dec	Alnair	62°01.7	8°55.6					
0	274°06.0	212°15.9	N19°20.9	251°43.4	N07°25.0	267°09.6	N01°37.0	306°30.5	S14°20.6	Peacock	53°08.5	-56°39.6					
1	289°08.5	227°15.2	21.6	266°44.2	25.7	282°11.8	37.1	321°33.0	20.7	Deneb	49°26.8	45°21.4					
2	304°11.0	242°14.6	22.2	281°45.0	26.3	297°14.0	37.2	336°35.5	20.7	Markab	33°40.6	9°58.6					
3	319°13.4	257°14.0	· · 22.9	296°45.8	· · 27.0	312°16.2	· · 37.3	351°38.1	· · 20.7	Fomalhaut	15°16.7	-29°30.1					
4	334°15.9	272°13.4	23.5	311°46.5	27.7	327°18.5	37.3	6°40.6	20.8	Scheat	13°47.1	28°12.1					
5	349°18.4	287°12.8	24.1	326°47.3	28.3	342°20.7	37.4	21°43.2	20.8	Markab	13°31.9	15°19.4					
6	4°20.8	302°12.1	N19°24.8	341°48.1	N07°29.0	357°22.9	N01°37.5	36°45.7	S14°20.8	Jun 24 Fri	SHA	Mer.pass					
7	19°23.3	317°11.5	25.4	356°48.9	29.6	12°25.2	37.6	51°48.3	20.9	Venus	300°37.4	09:49					
8	34°25.8	332°10.9	26.0	11°49.7	30.3	27°27.4	37.7	66°50.8	20.9	Mars	338°57.8	07:15					
9	49°28.2	347°10.3	· · 26.7	26°50.5	· · 30.9	42°29.6	· · 37.8	81°53.3	· · 21.0	Jupiter	353°15.1	06:18					
10	64°30.7	2°09.6	27.3	41°51.3	31.6	57°31.9	37.9	96°55.9	21.0	Saturn	32°20.8	03:41					
11	79°33.1	17°09.0	27.9	56°52.1	32.2	72°34.1	38.0	111°58.4	21.0	Jun 25 Sat	SHA	Mer.pass					
12	94°35.6	32°08.4	N19°28.5	71°52.9	N07°32.9	87°36.3	N01°38.0	127°01.0	S14°21.1	Venus	299°23.7	09:50					
13	109°38.1	47°07.8	29.2	86°53.6	33.6	102°38.6	38.1	142°03.5	21.1	Mars	338°17.6						

DUT1 = UT1-UTC = -0.0783 sec  $\Delta T = TT-UT1 = +69.2623$  sec

2022 June 24 to Jun. 26 UT

h		Sun		Moon			
Fri	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	179°24.6	N23°24.9	237°46.8	14.7'	N12°15.0	12.6'	55.2'
1	194°24.4	24.8	252°20.4	14.7'	12°27.6	12.5'	55.2'
2	209°24.3	24.8	266°54.1	14.6'	12°40.1	12.5'	55.2'
3	224°24.2	.. 24.7	281°27.7	14.6'	12°52.6	12.4'	55.1'
4	239°24.0	24.7	296°01.3	14.6'	13°05.0	12.3'	55.1'
5	254°23.9	24.6	310°34.9	14.5'	13°17.3	12.3'	55.1'
6	269°23.8	N23°24.6	325°08.4	14.5'	N13°29.6	12.2'	55.1'
7	284°23.6	24.5	339°42.0	14.5'	13°41.8	12.2'	55.1'
8	299°23.5	24.5	354°15.4	14.5'	13°54.0	12.1'	55.0'
9	314°23.4	.. 24.4	8°48.9	14.4'	14°06.0	12.0'	55.0'
10	329°23.2	24.4	23°22.3	14.4'	14°18.1	12.0'	55.0'
11	344°23.1	24.3	37°55.7	14.4'	14°30.0	11.9'	55.0'
12	359°23.0	N23°24.3	52°29.1	14.3'	N14°41.9	11.8'	54.9'
13	14°22.8	24.2	67°02.4	14.3'	14°53.7	11.7'	54.9'
14	29°22.7	24.2	81°35.7	14.3'	15°05.5	11.7'	54.9'
15	44°22.6	.. 24.1	96°08.9	14.2'	15°17.1	11.6'	54.9'
16	59°22.4	24.0	110°42.1	14.2'	15°28.7	11.5'	54.9'
17	74°22.3	24.0	125°15.3	14.1'	15°40.3	11.5'	54.9'
18	89°22.2	N23°23.9	139°48.4	14.1'	N15°51.7	11.4'	54.8'
19	104°22.0	23.9	154°21.5	14.1'	16°03.1	11.3'	54.8'
20	119°21.9	23.8	168°54.6	14.0'	16°14.5	11.2'	54.8'
21	134°21.8	.. 23.8	183°27.6	14.0'	16°25.7	11.2'	54.8'
22	149°21.6	23.7	198°00.6	13.9'	16°36.9	11.1'	54.8'
23	164°21.5	23.6	212°33.6	13.9'	16°48.0	11.0'	54.7'
SD = 15.7'		d = -0.0'		SD = 15.1'			
SD = 15.7' d = -0.0' SD = 15.1'							
Sat	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	179°21.4	N23°23.6	227°06.5	13.9'	N16°59.0	10.9'	54.7'
1	194°21.2	23.5	241°39.3	13.8'	17°09.9	10.9'	54.7'
2	209°21.1	23.4	256°12.2	13.8'	17°20.8	10.8'	54.7'
3	224°21.0	.. 23.4	270°44.9	13.7'	17°31.5	10.7'	54.7'
4	239°20.8	23.3	285°17.7	13.7'	17°42.2	10.6'	54.7'
5	254°20.7	23.3	299°50.4	13.6'	17°52.9	10.5'	54.6'
6	269°20.5	N23°23.2	314°23.0	13.6'	N18°03.4	10.5'	54.6'
7	284°20.4	23.1	328°55.6	13.6'	18°13.9	10.4'	54.6'
8	299°20.3	23.1	343°28.2	13.5'	18°24.2	10.3'	54.6'
9	314°20.1	.. 23.0	358°00.7	13.5'	18°34.5	10.2'	54.6'
10	329°20.0	22.9	12°33.2	13.4'	18°44.7	10.1'	54.6'
11	344°19.9	22.8	27°05.6	13.4'	18°54.9	10.0'	54.5'
12	359°19.7	N23°22.8	41°38.0	13.3'	N19°04.9	9.9'	54.5'
13	14°19.6	22.7	56°10.3	13.3'	19°14.8	9.9'	54.5'
14	29°19.5	22.6	70°42.6	13.2'	19°24.7	9.8'	54.5'
15	44°19.3	.. 22.6	85°14.8	13.2'	19°34.5	9.7'	54.5'
16	59°19.2	22.5	99°47.0	13.1'	19°44.2	9.6'	54.5'
17	74°19.1	22.4	114°19.2	13.1'	19°53.8	9.5'	54.5'
18	89°18.9	N23°22.3	128°51.3	13.0'	N20°03.3	9.4'	54.4'
19	104°18.8	22.3	143°23.3	13.0'	20°12.7	9.3'	54.4'
20	119°18.7	22.2	157°55.3	13.0'	20°22.0	9.2'	54.4'
21	134°18.6	.. 22.1	172°27.3	12.9'	20°31.2	9.1'	54.4'
22	149°18.4	22.0	186°59.2	12.9'	20°40.4	9.0'	54.4'
23	164°18.3	22.0	201°31.0	12.8'	20°49.4	8.9'	54.4'
SD = 15.7'		d = -0.1'		SD = 14.9'			
SD = 15.7' d = -0.1' SD = 14.9'							
Sun	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	179°18.2	N23°21.9	216°02.8	12.8'	N20°58.4	8.9'	54.4'
1	194°18.0	21.8	230°34.6	12.7'	21°07.2	8.8'	54.3'
2	209°17.9	21.7	245°06.3	12.7'	21°16.0	8.7'	54.3'
3	224°17.8	.. 21.6	259°38.0	12.6'	21°24.6	8.6'	54.3'
4	239°17.6	21.6	274°09.6	12.6'	21°33.2	8.5'	54.3'
5	254°17.5	21.5	288°41.1	12.5'	21°41.7	8.4'	54.3'
6	269°17.4	N23°21.4	303°12.6	12.5'	N21°50.0	8.3'	54.3'
7	284°17.2	21.3	317°44.1	12.4'	21°58.3	8.2'	54.3'
8	299°17.1	21.2	332°15.5	12.4'	22°06.5	8.1'	54.3'
9	314°17.0	.. 21.1	346°46.9	12.3'	22°14.5	8.0'	54.2'
10	329°16.8	21.0	1°18.2	12.3'	22°22.5	7.9'	54.2'
11	344°16.7	21.0	15°49.5	12.2'	22°30.4	7.8'	54.2'
12	359°16.6	N23°20.9	30°20.7	12.2'	N22°38.1	7.7'	54.2'
13	14°16.4	20.8	44°51.9	12.1'	22°45.8	7.6'	54.2'
14	29°16.3	20.7	59°23.0	12.1'	22°53.3	7.4'	54.2'
15	44°16.2	.. 20.6	73°54.1	12.0'	23°00.8	7.3'	54.2'
16	59°16.0	20.5	88°25.1	12.0'	23°08.1	7.2'	54.2'
17	74°15.9	20.4	102°56.1	11.9'	23°15.4	7.1'	54.2'
18	89°15.8	N23°20.3	117°27.0	11.9'	N23°22.5	7.0'	54.2'
19	104°15.6	20.2	131°57.9	11.8'	23°29.5	6.9'	54.1'
20	119°15.5	20.1	146°28.8	11.8'	23°36.4	6.8'	54.1'
21	134°15.4	.. 20.1	160°59.5	11.7'	23°43.2	6.7'	54.1'
22	149°15.2	20.0	175°30.3	11.7'	23°49.9	6.6'	54.1'
23	164°15.1	19.9	190°01.0	11.7'	23°56.5	6.5'	54.1'
SD = 15.7'		d = -0.1'		SD = 14.8'			
SD = 15.7' d = -0.1' SD = 14.8'							

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

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

## June 27, 28, 29 UT (Mon., Tue., Wed.)

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	275°05.2	212°00.8	N19°36.0	252°02.3	N07°40.7	268°03.1	N01°39.1	307°31.5	S14°21.5					Alpheratz	357°36.9	29°12.6	
1	290°07.6	227°00.2	36.6	267°03.1	41.4	283°05.4	39.2	322°34.1	21.5					Ankaa	353°09.2	-42°10.9	
2	305°10.1	241°59.6	37.3	282°03.9	42.1	298°07.6	39.3	337°36.6	21.6					Schedar	349°33.4	56°39.3	
3	320°12.6	256°58.9	.. 37.9	297°04.7	.. 42.7	313°09.8	.. 39.3	352°39.1	.. 21.6					Diphda	348°49.4	-17°51.8	
4	335°15.0	271°58.3	38.5	312°05.5	43.4	328°12.1	39.4	7°41.7	21.6					Achernar	335°22.0	-57°07.2	
5	350°17.5	286°57.7	39.1	327°06.3	44.0	343°14.3	39.5	22°44.2	21.7					Hamal	327°53.7	23°33.9	
6	5°20.0	301°57.0	N19°39.7	342°07.1	N07°44.7	358°16.5	N01°39.6	37°46.8	S14°21.7					Polaris	315°19.4	89°21.2	
7	20°22.4	316°56.4	40.3	357°07.9	45.3	13°18.8	39.7	52°49.3	21.7					Acamar	315°13.7	-40°12.7	
8	35°24.9	331°55.7	40.9	12°08.7	46.0	28°21.0	39.8	67°51.9	21.8					Menkar	314°08.6	4°10.6	
9	50°27.4	346°55.1	.. 41.5	27°09.5	.. 46.6	43°23.3	.. 39.9	82°54.4	.. 21.8					Mirfak	308°31.6	49°56.2	
10	65°29.8	1°54.5	42.2	42°10.2	47.3	58°25.5	39.9	97°57.0	21.8					Aldebaran	290°42.3	16°33.2	
11	80°32.3	16°53.8	42.8	57°11.0	47.9	73°27.7	40.0	112°59.5	21.9					Rigel	281°06.2	-8°10.5	
12	95°34.8	31°53.2	N19°43.4	72°11.8	N07°48.6	88°30.0	N01°40.1	128°02.1	S14°21.9					Capella	280°25.4	46°01.1	
13	110°37.2	46°52.6	44.0	87°12.6	49.2	103°32.2	40.2	143°04.6	22.0					Bellatrix	278°25.5	6°22.2	
14	125°39.7	61°51.9	44.6	102°13.4	49.9	118°34.4	40.3	158°07.2	22.0					Elnath	278°04.9	28°37.5	
15	140°42.1	76°51.3	.. 45.2	117°14.2	.. 50.5	133°36.7	.. 40.4	173°09.7	.. 22.0					Alnilam	275°40.2	-1°11.3	
16	155°44.6	91°50.6	45.8	132°15.0	51.2	148°38.9	40.4	188°12.3	22.1					Betelgeuse	270°54.7	7°24.7	
17	170°47.1	106°50.0	46.4	147°15.8	51.8	163°41.2	40.5	203°14.8	22.1					Canopus	263°53.9	-52°42.4	
18	185°49.5	121°49.4	N19°47.0	162°16.6	N07°52.5	178°43.4	N01°40.6	218°17.4	S14°22.1					Sirius	258°28.4	-16°44.8	
19	200°52.0	136°48.7	47.6	177°17.4	53.1	193°45.6	40.7	233°19.9	22.2					Adhara	255°07.9	-29°00.1	
20	215°54.5	151°48.1	48.2	192°18.1	53.8	208°47.9	40.8	248°22.5	22.2					Procyon	244°53.4	5°10.1	
21	230°56.9	166°47.4	.. 48.8	207°18.9	.. 54.4	223°50.1	.. 40.9	263°25.0	.. 22.3					Pollux	243°20.2	27°58.4	
22	245°59.4	181°46.8	49.4	222°19.7	55.1	238°52.4	40.9	278°27.6	22.3					Avior	234°16.1	-59°35.0	
23	261°01.9	196°46.1	50.0	237°20.5	55.7	253°54.6	41.0	293°30.1	22.3					Suhail	222°48.2	-43°31.5	
Mer.pass. 05:39			ν -0.6° d 0.6° m -3.92	ν 0.8° d 0.7° m 0.43			ν 2.2° d 0.1° m -2.39			ν 2.5° d -0.0° m 0.57							
Tue			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Denebola	193°43.9	61°38.1	
0	276°04.3	211°45.5	N19°50.6	252°21.3	N07°56.4	268°56.9	N01°41.1	308°32.7	S14°22.4					Gienah	175°45.7	-17°40.0	
1	291°06.8	226°44.9	51.2	267°22.1	57.0	283°59.1	41.2	323°35.2	22.4					Acrux	173°02.4	-63°13.6	
2	306°09.2	241°44.2	51.8	282°22.9	57.7	299°01.3	41.3	338°37.8	22.4					Gacrux	171°53.9	-57°14.5	
3	321°11.7	256°43.6	.. 52.4	297°23.7	.. 58.3	314°03.6	.. 41.4	353°40.3	.. 22.5					Alioth	166°14.8	55°50.6	
4	336°14.2	271°42.9	53.0	312°24.5	59.0	329°05.8	41.4	8°42.9	22.5					Spica	158°24.4	-11°16.7	
5	351°16.6	286°42.3	53.6	327°25.3	07°59.6	344°08.1	41.5	23°45.4	22.6					Alkaid	152°53.5	49°12.4	
6	6°19.1	301°41.6	N19°54.2	342°26.1	N08°00.3	359°10.3	N01°41.6	38°48.0	S14°22.6					Hadar	148°38.6	-60°29.0	
7	21°21.6	316°41.0	54.8	357°26.9	00.9	14°12.5	41.7	53°50.5	22.6					Menkent	147°59.9	-36°28.9	
8	36°24.0	331°40.3	55.4	12°27.6	01.6	29°14.8	41.8	68°53.1	22.7					Arcturus	145°49.7	19°04.1	
9	51°26.5	346°39.7	.. 56.0	27°28.4	.. 02.2	44°17.0	.. 41.9	83°55.6	.. 22.7					Rigel Kent.	139°42.8	-60°55.8	
10	66°29.0	1°39.0	56.5	42°29.2	02.9	59°19.3	41.9	98°58.2	22.7					Kochab	137°19.1	74°04.1	
11	81°31.4	16°38.4	57.1	57°30.0	03.5	74°21.5	42.0	114°00.7	22.8					Zuben'ubi	136°58.1	-16°08.1	
12	96°33.9	31°37.7	N19°57.7	72°30.8	N08°04.1	89°23.8	N01°42.1	129°03.3	S14°22.8					Alphecca	126°05.2	26°38.5	
13	111°36.4	46°37.1	58.3	87°31.6	04.8	104°26.0	42.2	144°05.8	22.9					Antares	112°18.1	-26°28.9	
14	126°38.8	61°36.4	58.9	102°32.4	05.4	119°28.3	42.3	159°08.4	22.9					Atria	107°13.6	-69°04.1	
15	141°41.3	76°35.8	19°55.9	117°33.2	.. 06.1	134°30.5	.. 42.3	174°10.9	.. 22.9					Sabik	102°04.8	-15°45.1	
16	156°43.7	91°35.1	20°00.1	132°34.0	06.7	149°32.8	42.4	189°13.5	23.0					Shaula	96°12.8	-37°07.2	
17	171°46.2	106°34.5	00.6	147°34.8	07.4	164°35.0	42.5	204°16.0	23.0					Rasalhague	96°00.2	12°32.7	
18	186°48.7	121°33.8	N20°01.2	162°35.6	N08°08.0	179°37.2	N01°42.6	219°18.6	S14°23.0					Eltanin	90°42.6	51°29.2	
19	201°51.1	136°33.2	01.8	177°36.4	08.7	194°39.5	42.7	234°21.1	23.1					Kaus Aust.	83°34.9	-34°22.4	
20	216°53.6	151°32.5	02.4	192°37.1	09.3	209°41.7	42.8	249°23.7	23.1					Vega	80°34.2	38°48.2	
21	231°56.1	166°31.9	.. 03.0	207°37.9	.. 10.0	224°44.0	.. 42.8	264°26.2	.. 23.2					Nunki	75°50.0	-26°16.1	
22	246°58.5	181°31.2	03.5	222°38.7	10.6	239°46.2	42.9	279°28.8	23.2					Altair	62°01.7	8°55.6	
23	262°01.0	196°30.6	04.1	237°39.5	11.2	254°48.5	43.0	294°31.3	23.2					Peacock	53°08.5	-56°39.6	
Mer.pass. 05:35			ν -0.6° d 0.6° m -3.92	ν 0.8° d 0.6° m 0.43			ν 2.2° d 0.1° m -2.40			ν 2.5° d -0.0° m 0.56							
Wed			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Fomalhaut	15°16.7	-29°30.1	
0	277°03.5	211°29.9	N20°04.7	252°40.3	N08°11.9	269°50.7	N01°43.1	309°33.9	S14°23.3					Scheat	13°47.1	28°12.1	
1	292°05.9	226°29.3	05.3	267°41.1	12.5	284°53.0	43.2	324°36.4	23.3					Markab	13°31.9	15°19.4	
2	307°08.4	241°28.6	05.8	282°41.9	13.2	299°55.2	43.2	339°39.0	23.3					Jun 27 Mon			
3	322°10.9	256°28.0	.. 06.4	297°42.7	.. 13.8	314°57.5	.. 43.3	354°41.5	.. 23.4					Venus	296°55.6	09:52	
4	337°13.3	271°27.3	07.0	312°43.5	14.5	329°59.7	43.4	9°44.1	23.4					Mars	336°57.2	07:11	
5	352°15.8	286°26.6	07.6	327°44.3	15.1	345°02.0	43.5	24°46.7	23.5					Jupiter	352°57.9	06:07	
6	7°18.2	301°26.0	N20°08.1	342°45.1	N08°15.8	0°04.2	N01°43.6	39°49.2	S14°23.5					Saturn	32°26.3	03:29	
7	22°20.7	316°25.3	08.7	357°45.9	16.4	15°06.5	43.6	54°51.8	23.5					Jun 28 Tue			
8	37°23.2	331°24.7	09.3	12°46.7	17.0	30°08.7	43.7	69°54.3	23.6					Venus	295°41.2	09:53	
9	52°25.6	346°24.0	.. 09.9	27°47.5	.. 17.7	45°11.0	.. 43.8	84°56.9	.. 23.6					Mars	336°17.0	07:10	
10	67°28.1	1°23.4	10.4	42°48.2	18.3	60°13.2	43.9	99°59.4	23.7					Jupiter	352°52.5	06:03	
11	82°30.6	16°22.7	11.0	57°49.0	19.0	75°15.5	44.0	115°02.0	23.7					Saturn	32°28.3	03:25	
12	97°33.0																

DUT1 = UT1-UTC = -0.0748 sec  $\Delta T = TT-UT1 = +69.2588$  sec

2022 June 27 to Jun. 29 UT

h		Sun		Moon				
Mon		GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	179°15.0	N23°19.8	204°31.7	11.6'	N24°03.0	6.4'	54.1'	
1	194°14.9	19.7	219°02.3	11.6'	24°09.3	6.2'	54.1'	
2	209°14.7	19.6	233°32.8	11.5'	24°15.6	6.1'	54.1'	
3	224°14.6	19.5	248°03.4	11.5'	24°21.7	6.0'	54.1'	
4	239°14.5	19.4	262°33.8	11.4'	24°27.7	5.9'	54.1'	
5	254°14.3	19.3	277°04.3	11.4'	24°33.6	5.8'	54.1'	
6	269°14.2	N23°19.2	291°34.7	11.4'	N24°39.4	5.7'	54.0'	
7	284°14.1	19.1	306°05.0	11.3'	24°45.1	5.6'	54.0'	
8	299°13.9	19.0	320°35.3	11.3'	24°50.6	5.4'	54.0'	
9	314°13.8	18.9	335°05.6	11.2'	24°56.1	5.3'	54.0'	
10	329°13.7	18.8	349°35.8	11.2'	25°01.4	5.2'	54.0'	
11	344°13.5	18.7	4°06.0	11.2'	25°06.6	5.1'	54.0'	
12	359°13.4	N23°18.6	18°36.2	11.1'	N25°11.7	5.0'	54.0'	
13	14°13.3	18.5	33°06.3	11.1'	25°16.7	4.9'	54.0'	
14	29°13.2	18.3	47°36.4	11.0'	25°21.5	4.7'	54.0'	
15	44°13.0	18.2	62°06.4	11.0'	25°26.3	4.6'	54.0'	
16	59°12.9	18.1	76°36.4	11.0'	25°30.9	4.5'	54.0'	
17	74°12.8	18.0	91°06.4	10.9'	25°35.4	4.4'	54.0'	
18	89°12.6	N23°17.9	105°36.3	10.9'	N25°39.8	4.3'	54.0'	
19	104°12.5	17.8	120°06.2	10.9'	25°44.0	4.1'	54.0'	
20	119°12.4	17.7	134°36.1	10.8'	25°48.1	4.0'	54.0'	
21	134°12.2	17.6	149°05.9	10.8'	25°52.1	3.9'	54.0'	
22	149°12.1	17.5	163°35.8	10.8'	25°56.0	3.8'	53.9'	
23	164°12.0	17.4	178°05.5	10.7'	25°59.8	3.6'	53.9'	
	SD = 15.7'	d = -0.1'		SD = 14.8'				

Tue	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	179°11.9	N23°17.2	192°35.3	10.7'	N26°03.4	3.5'	53.9'
1	194°11.7	17.1	207°05.0	10.7'	26°06.9	3.4'	53.9'
2	209°11.6	17.0	221°34.7	10.7'	26°10.3	3.3'	53.9'
3	224°11.5	16.9	236°04.3	10.6'	26°13.6	3.1'	53.9'
4	239°11.3	16.8	250°34.0	10.6'	26°16.7	3.0'	53.9'
5	254°11.2	16.7	265°03.6	10.6'	26°19.8	2.9'	53.9'
6	269°11.1	N23°16.6	279°33.2	10.6'	N26°22.7	2.8'	53.9'
7	284°11.0	16.4	294°02.7	10.5'	26°25.4	2.6'	53.9'
8	299°10.8	16.3	308°32.3	10.5'	26°28.1	2.5'	53.9'
9	314°10.7	16.2	323°01.8	10.5'	26°30.6	2.4'	53.9'
10	329°10.6	16.1	337°31.3	10.5'	26°33.0	2.3'	53.9'
11	344°10.4	16.0	352°00.8	10.5'	26°35.2	2.1'	53.9'
12	359°10.3	N23°15.8	6°30.2	10.4'	N26°37.4	2.0'	53.9'
13	14°10.2	15.7	20°59.7	10.4'	26°39.4	1.9'	53.9'
14	29°10.1	15.6	35°29.1	10.4'	26°41.2	1.7'	53.9'
15	44°09.9	15.5	49°58.5	10.4'	26°43.0	1.6'	53.9'
16	59°09.8	15.3	64°27.9	10.4'	26°44.6	1.5'	53.9'
17	74°09.7	15.2	78°57.3	10.4'	26°46.1	1.4'	53.9'
18	89°09.5	N23°15.1	93°26.7	10.4'	N26°47.5	1.2'	53.9'
19	104°09.4	15.0	107°56.1	10.4'	26°48.7	1.1'	53.9'
20	119°09.3	14.8	122°25.4	10.3'	26°49.8	1.0'	53.9'
21	134°09.2	14.7	136°54.8	10.3'	26°50.8	0.8'	53.9'
22	149°09.0	14.6	151°24.1	10.3'	26°51.6	0.7'	53.9'
23	164°08.9	14.5	165°53.4	10.3'	26°52.3	0.6'	53.9'
	SD = 15.7'	d = -0.1'		SD = 14.7'			

Wed	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	179°08.8	N23°14.3	180°22.8	10.3'	N26°52.9	0.5'	53.9'
1	194°08.6	14.2	194°52.1	10.3'	26°53.4	0.3'	53.9'
2	209°08.5	14.1	209°21.4	10.3'	26°53.7	0.2'	53.9'
3	224°08.4	13.9	223°50.7	10.3'	26°53.9	0.1'	53.9'
4	239°08.3	13.8	238°20.1	10.3'	26°54.0	-0.1'	53.9'
5	254°08.1	13.7	252°49.4	10.3'	26°53.9	-0.2'	53.9'
6	269°08.0	N23°13.5	267°18.7	10.3'	N26°53.8	-0.3'	53.9'
7	284°07.9	13.4	281°48.0	10.3'	26°53.5	-0.4'	53.9'
8	299°07.8	13.3	296°17.3	10.3'	26°53.0	-0.6'	53.9'
9	314°07.6	13.1	310°46.7	10.3'	26°52.4	-0.7'	53.9'
10	329°07.5	13.0	325°16.0	10.3'	26°51.7	-0.8'	53.9'
11	344°07.4	12.8	339°45.4	10.4'	26°50.9	-1.0'	53.9'
12	359°07.3	N23°12.7	354°14.7	10.4'	N26°49.9	-1.1'	53.9'
13	14°07.1	12.6	8°44.1	10.4'	26°48.9	-1.2'	53.9'
14	29°07.0	12.4	23°13.4	10.4'	26°47.6	-1.3'	53.9'
15	44°06.9	12.3	37°42.8	10.4'	26°46.3	-1.5'	53.9'
16	59°06.7	12.1	52°12.2	10.4'	26°44.8	-1.6'	53.9'
17	74°06.6	12.0	66°41.6	10.4'	26°43.2	-1.7'	53.9'
18	89°06.5	N23°11.9	81°11.1	10.4'	N26°41.5	-1.9'	53.9'
19	104°06.4	11.7	95°40.5	10.5'	26°39.6	-2.0'	53.9'
20	119°06.2	11.6	110°10.0	10.5'	26°37.6	-2.1'	53.9'
21	134°06.1	11.4	124°39.4	10.5'	26°35.5	-2.2'	53.9'
22	149°06.0	11.3	139°08.9	10.5'	26°33.3	-2.4'	53.9'
23	164°05.9	11.1	153°38.4	10.5'	26°30.9	-2.5'	53.9'
	SD = 15.7'	d = -0.1'		SD = 14.7'			

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

## June 30, 01, 02 UT (Thu., Fri., Sat.)

Aries			Venus			Mars		Jupiter		Saturn		Stars		
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	278°02.6	211°14.1	N20°18.3	252°59.4	N08°27.3	270°44.8	N01°45.0	310°35.2	S14°24.2			Alpheratz	357°36.9	
1	293°05.1	226°13.4	18.8	268°00.1	28.0	285°47.0	45.0	325°37.8	24.2			Ankaa	353°09.2	
2	308°07.5	241°12.8	19.4	283°00.9	28.6	300°49.3	45.1	340°40.3	24.3			Schedar	349°33.4	
3	323°10.0	256°12.1	19.9	298°01.7	29.2	315°51.5	45.2	355°42.9	24.3			Diphda	348°49.4	
4	338°12.5	271°11.4	20.5	313°02.5	29.9	330°53.8	45.3	10°45.4	24.4			Achernar	335°22.0	
5	353°14.9	286°10.8	21.0	328°03.3	30.5	345°56.0	45.4	25°48.0	24.4			Hamal	327°53.7	
6	8°17.4	301°10.1	N20°21.6	343°04.1	N08°31.2	0°58.3	N01°45.4	40°50.5	S14°24.4			Polaris	315°18.0	
7	23°19.9	316°09.4	22.1	358°04.9	31.8	16°00.5	45.5	55°53.1	24.5			Acamar	315°13.6	
8	38°22.3	331°08.7	22.7	13°05.7	32.4	31°02.8	45.6	70°55.7	24.5			Menkar	314°08.5	
9	53°24.8	346°08.1	23.2	28°06.5	33.1	46°05.1	45.7	85°58.2	24.6			Mirfak	308°31.6	
10	68°27.2	1°07.4	23.8	43°07.3	33.7	61°07.3	45.7	101°00.8	24.6			Aldebaran	290°42.3	
11	83°29.7	16°06.7	24.3	58°08.1	34.3	76°09.6	45.8	116°03.3	24.6			Rigel	281°06.2	
12	98°32.2	31°06.1	N20°24.9	73°08.9	N08°35.0	91°11.8	N01°45.9	131°05.9	S14°24.7			Capella	280°25.4	
13	113°34.6	46°05.4	25.4	88°09.7	35.6	106°14.1	46.0	146°08.4	24.7			Bellatrix	278°25.4	
14	128°37.1	61°04.7	26.0	103°10.5	36.3	121°16.3	46.0	161°11.0	24.8			Elnath	278°04.9	
15	143°39.6	76°04.1	26.5	118°11.3	36.9	136°18.6	46.1	176°13.6	24.8			Alnilam	275°40.2	
16	158°42.0	91°03.4	27.0	133°12.1	37.5	151°20.9	46.2	191°16.1	24.8			Betelgeuse	270°54.7	
17	173°44.5	106°02.7	27.6	148°12.9	38.2	166°23.1	46.3	206°18.7	24.9			Canopus	263°53.9	
18	188°47.0	121°02.0	N20°28.1	163°13.7	N08°38.8	181°25.4	N01°46.3	221°21.2	S14°24.9			Sirius	258°28.4	
19	203°49.4	136°01.4	28.7	178°14.4	39.5	196°27.6	46.4	236°23.8	25.0			Adhara	255°07.9	
20	218°51.9	151°00.7	29.2	193°15.2	40.1	211°29.9	46.5	251°26.4	25.0			Procyon	244°53.3	
21	233°54.4	166°00.0	29.7	208°16.0	40.7	226°32.2	46.6	266°28.9	25.0			Pollux	243°20.2	
22	248°56.8	180°59.3	30.3	223°16.8	41.4	241°34.4	46.6	281°31.5	25.1			Avior	234°16.1	
23	263°59.3	195°58.7	30.8	238°17.6	42.0	256°36.7	46.7	296°34.0	25.1			Suhail	222°48.2	
Mer.pass.		05:27	ν -0.7° d 0.6° m -3.92			ν 0.8° d 0.6° m 0.41		ν 2.3° d 0.1° m -2.41		ν 2.6° d -0.0° m 0.55		Miaplacidus		
Fri		GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec		
0	279°01.7	210°58.0	N20°31.3	253°18.4	N08°42.6	271°38.9	N01°46.8	311°36.6	S14°25.2			Alphard	217°50.0	
1	294°04.2	225°57.3	31.9	268°19.2	43.3	286°41.2	46.9	326°39.2	25.2			Regulus	207°36.9	
2	309°06.7	240°56.6	32.4	283°20.0	43.9	301°43.5	46.9	341°41.7	25.2			Dubhe	193°43.9	
3	324°09.1	255°56.0	32.9	298°20.8	44.5	316°45.7	47.0	356°44.3	25.3			Denebola	182°27.2	
4	339°11.6	270°55.3	33.5	313°21.6	45.2	331°48.0	47.1	11°46.8	25.3			Gienah	175°45.8	
5	354°14.1	285°54.6	34.0	328°22.4	45.8	346°50.2	47.2	26°49.4	25.4			Acrux	173°02.4	
6	9°16.5	300°53.9	N20°34.5	343°23.2	N08°46.4	1°52.5	N01°47.2	41°52.0	S14°25.4			Gacrux	171°53.9	
7	24°19.0	315°53.2	35.1	358°24.0	47.1	16°54.8	47.3	56°54.5	25.4			Alioth	166°14.8	
8	39°21.5	330°52.6	35.6	13°24.8	47.7	31°57.0	47.4	71°57.1	25.5			Spica	158°24.4	
9	54°23.9	345°51.9	36.1	28°25.6	48.3	46°59.3	47.5	86°59.6	25.5			Alkaid	152°53.5	
10	69°26.4	0°51.2	36.6	43°26.4	49.0	62°01.6	47.5	102°02.2	25.6			Hadar	148°38.7	
11	84°28.8	15°50.5	37.2	58°27.2	49.6	77°03.8	47.6	117°04.8	25.6			Menken	147°59.9	
12	99°31.3	30°49.8	N20°37.7	73°28.0	N08°50.3	92°06.1	N01°47.7	132°07.3	S14°25.7			Arcturus	145°49.7	
13	114°33.8	45°49.2	38.2	88°28.8	50.9	107°08.4	47.8	147°09.9	25.7			Rigil Kent.	139°42.8	
14	129°36.2	60°48.5	38.7	103°29.6	51.5	122°10.6	47.8	162°12.4	25.7			Kochab	137°19.1	
15	144°38.7	75°47.8	39.2	118°30.4	52.2	137°12.9	47.9	177°15.0	25.8			Zuben'ubi	136°58.1	
16	159°41.2	90°47.1	39.8	133°31.2	52.8	152°15.1	48.0	192°17.6	25.8			Alphecca	126°05.2	
17	174°43.6	105°46.4	40.3	148°31.9	53.4	167°17.4	48.0	207°20.1	25.9			Antares	112°18.1	
18	189°46.1	120°45.7	N20°40.8	163°32.7	N08°54.1	182°19.7	N01°48.1	222°22.7	S14°25.9			Atria	107°13.6	
19	204°48.6	135°45.1	41.3	178°33.5	54.7	197°21.9	48.2	237°25.3	25.9			Sabik	102°04.8	
20	219°51.0	150°44.4	41.8	193°34.3	55.3	212°24.2	48.3	252°27.8	26.0			Shaula	96°12.8	
21	234°53.5	165°43.7	42.3	208°35.1	55.9	227°26.5	48.3	267°30.4	26.0			Rasalhague	96°00.1	
22	249°56.0	180°43.0	42.9	223°35.9	56.6	242°28.7	48.4	282°32.9	26.1			Eltanin	90°42.6	
23	264°58.4	195°42.3	43.4	238°36.7	57.2	257°31.0	48.5	297°35.5	26.1			Kaus Aust.	83°34.9	
Mer.pass.		05:23	ν -0.7° d 0.5° m -3.91			ν 0.8° d 0.6° m 0.40		ν 2.3° d 0.1° m -2.42		ν 2.6° d -0.0° m 0.55		Kaus		
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Mer.pass	
0	280°00.9	210°41.6	N20°43.9	253°37.5	N08°57.8	272°33.3	N01°48.6	312°38.1	S14°26.1			Venus	293°11.5	
1	295°03.3	225°41.0	44.4	268°38.3	58.5	287°35.5	48.6	327°40.6	26.2			Mars	334°56.8	
2	310°05.8	240°40.3	44.9	283°39.1	59.1	302°37.8	48.7	342°43.2	26.2			Jupiter	352°42.2	
3	325°08.3	255°39.6	45.4	298°39.9	08°59.7	317°40.1	48.8	357°45.8	26.3			Saturn	32°32.6	
4	340°10.7	270°39.9	45.9	313°40.7	09°00.4	332°42.3	48.8	12°48.3	26.3			Jun 30 Thu	09:56	
5	355°13.2	285°38.2	46.4	328°41.5	01.0	347°44.6	48.9	27°50.9	26.4			Venus	291°56.2	
6	10°15.7	300°37.5	N20°46.9	343°42.3	N09°01.6	2°46.9	N01°49.0	42°53.5	S14°26.4			Mars	334°56.8	
7	25°18.1	315°36.8	47.4	358°43.1	02.3	17°49.2	49.1	57°56.0	26.4			Jupiter	352°42.2	
8	40°20.6	330°36.1	47.9	13°43.9	02.9	32°51.4	49.1	72°58.6	26.5			Saturn	32°34.8	
9	55°23.1	345°35.4	48.4	28°44.7	03.5	47°53.7	49.2	88°01.1	26.5			Jul 01 Fri	05:56	
10	70°25.5	0°34.8	48.9	43°45.5	04.1	62°56.0	49.3	103°03.7	26.6			Venus	291°56.2	
11	85°28.0	15°34.1	49.4	58°46.3	04.8	77°58.2	49.3	118°06.3	26.6			Mars	334°56.8	
12	100°30.5	30°33.4	N20°49.9	73°47.1	N09°05.4	93°00.5	N01°49.4	133°08.8	S14°26.7			Jupiter	352°37.2	
13	115°32.9	45°32.7	50.4	88°47.9	06.0	108°02.8	49.5	148°11.4	26.7			Saturn	32°34.8	
14	130°35.4	60°32.0	50.9	103°48.7	06.7	123°05.0	49.5	163°14.0	26.7			Jul 02 Sat	05:56	
15	145°37.8	75°31.3	51.4	118°49.5	07.3	138°07.3	49.6	178°16.5	26.8			Venus	290°40.8	
16	160°40.3	90°30.6	51.9	133°50.3	07.9	153°09.6	49.7	193°19.1	26.8			Mars	333°36.6	
17	175°42.8	105°29.9	52.4	148°51.1	08.5	168°11.9	49.8	208°21.7	26.9			Jupiter	352°32.4	
18	190°45.2	120°29.2	N20°52.9	163°51.9	N09°09.2	183°14.1	N01°49.8	223°24.2	S14°26.9			Saturn	32°37.2	
19	205°47.7	135°28.5	53.4	178°52.7	09.8	198°16.4	49.9	238°26.8	26.9			Horizontal parallax		
20	220°50.2	150°27.8	53.9	193°53.5	10.4	213°18.7	50.0	253°29.4	27.0			Venus:	0.1	
21	235°52.6	165°27.1	54.4	208°54.3	11.1	228°20.9	50.0	268°31.9	27.0			Mars:	0.1	
22	250°55.1	180°26.4												

DUT1 = UT1-UTC = -0.0702 sec  $\Delta T = TT-UT1 = +69.2542$  sec

2022 June 30 to Jul. 02 UT

h Sun			Moon				
Thu	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	179°05.7	N23°11.0	168°08.0	10.6'	N26°28.4	-2.6'	53.9'
1	194°05.6	10.8	182°37.5	10.6'	26°25.8	-2.7'	53.9'
2	209°05.5	10.7	197°07.1	10.6'	26°23.1	-2.9'	53.9'
3	224°05.4	10.5	211°36.7	10.6'	26°20.2	-3.0'	53.9'
4	239°05.2	10.4	226°06.3	10.7'	26°17.2	-3.1'	53.9'
5	254°05.1	10.2	240°36.0	10.7'	26°14.1	-3.2'	53.9'
6	269°05.0	N23°10.1	255°05.7	10.7'	N26°10.8	-3.4'	53.9'
7	284°04.9	09.9	269°35.4	10.7'	26°07.5	-3.5'	53.9'
8	299°04.7	09.8	284°05.1	10.8'	26°04.0	-3.6'	53.9'
9	314°04.6	09.6	298°34.9	10.8'	26°00.4	-3.7'	53.9'
10	329°04.5	09.5	313°04.7	10.8'	25°56.6	-3.9'	53.9'
11	344°04.4	09.3	327°34.5	10.9'	25°52.8	-4.0'	53.9'
12	359°04.2	N23°09.2	342°04.4	10.9'	N25°48.8	-4.1'	53.9'
13	14°04.1	09.0	356°34.3	10.9'	25°44.7	-4.2'	53.9'
14	29°04.0	08.9	11°04.2	11.0'	25°40.4	-4.4'	53.9'
15	44°03.9	08.7	25°34.2	11.0'	25°36.1	-4.5'	53.9'
16	59°03.8	08.5	40°04.2	11.0'	25°31.6	-4.6'	54.0'
17	74°03.6	08.4	54°34.2	11.1'	25°27.0	-4.7'	54.0'
18	89°03.5	N23°08.2	69°04.3	11.1'	N25°22.3	-4.8'	54.0'
19	104°03.4	08.1	83°34.4	11.1'	25°17.5	-4.9'	54.0'
20	119°03.3	07.9	98°04.5	11.2'	25°12.5	-5.1'	54.0'
21	134°03.1	07.7	112°34.7	11.2'	25°07.5	-5.2'	54.0'
22	149°03.0	07.6	127°04.9	11.3'	25°02.3	-5.3'	54.0'
23	164°02.9	07.4	141°35.2	11.3'	24°57.0	-5.4'	54.0'
	SD = 15.7'			SD = 14.7'			
Fri	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	179°02.8	N23°07.2	156°05.5	11.3'	N24°51.6	-5.5'	54.0'
1	194°02.6	07.1	170°35.8	11.4'	24°46.0	-5.6'	54.0'
2	209°02.5	06.9	185°06.2	11.4'	24°40.4	-5.8'	54.0'
3	224°02.4	06.7	199°36.6	11.5'	24°34.6	-5.9'	54.0'
4	239°02.3	06.6	214°07.1	11.5'	24°28.7	-6.0'	54.0'
5	254°02.2	06.4	228°37.6	11.6'	24°22.7	-6.1'	54.0'
6	269°02.0	N23°06.2	243°08.2	11.6'	N24°16.6	-6.2'	54.0'
7	284°01.9	06.1	257°38.8	11.6'	24°10.4	-6.3'	54.1'
8	299°01.8	05.9	272°09.4	11.7'	24°04.1	-6.4'	54.1'
9	314°01.7	05.7	286°40.1	11.7'	23°57.6	-6.6'	54.1'
10	329°01.6	05.6	301°10.9	11.8'	23°51.1	-6.7'	54.1'
11	344°01.4	05.4	315°41.7	11.8'	23°44.4	-6.8'	54.1'
12	359°01.3	N23°05.2	330°12.5	11.9'	N23°37.7	-6.9'	54.1'
13	14°01.2	05.0	344°43.4	11.9'	23°30.8	-7.0'	54.1'
14	29°01.1	04.9	359°14.3	12.0'	23°23.8	-7.1'	54.1'
15	44°00.9	04.7	13°45.3	12.0'	23°16.7	-7.2'	54.1'
16	59°00.8	04.5	28°16.3	12.1'	23°09.5	-7.3'	54.1'
17	74°00.7	04.3	42°47.3	12.1'	23°02.2	-7.4'	54.1'
18	89°00.6	N23°04.2	57°18.5	12.2'	N22°54.8	-7.5'	54.2'
19	104°00.5	04.0	71°49.6	12.2'	22°47.2	-7.6'	54.2'
20	119°00.3	03.8	86°20.8	12.3'	22°39.6	-7.7'	54.2'
21	134°00.2	03.6	100°52.1	12.3'	22°31.9	-7.8'	54.2'
22	149°00.1	03.5	115°23.4	12.4'	22°24.1	-7.9'	54.2'
23	164°00.0	03.3	129°54.8	12.4'	22°16.1	-8.0'	54.2'
	SD = 15.7'			SD = 14.7'			
Sat	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	178°59.9	N23°03.1	144°26.2	12.5'	N22°08.1	-8.1'	54.2'
1	193°59.7	02.9	158°57.6	12.5'	22°00.0	-8.2'	54.2'
2	208°59.6	02.7	173°29.1	12.6'	21°51.7	-8.3'	54.2'
3	223°59.5	02.5	188°00.7	12.6'	21°43.4	-8.4'	54.2'
4	238°59.4	02.4	202°32.3	12.7'	21°35.0	-8.5'	54.3'
5	253°59.3	02.2	217°04.0	12.7'	21°26.4	-8.6'	54.3'
6	268°59.1	N23°02.0	231°35.7	12.8'	N21°17.8	-8.7'	54.3'
7	283°59.0	01.8	246°07.4	12.8'	21°09.1	-8.8'	54.3'
8	298°58.9	01.6	260°39.2	12.9'	21°00.3	-8.9'	54.3'
9	313°58.8	01.4	275°11.1	12.9'	20°51.3	-9.0'	54.3'
10	328°58.7	01.2	289°43.0	12.9'	20°42.3	-9.1'	54.3'
11	343°58.6	01.1	304°14.9	13.0'	20°33.2	-9.2'	54.3'
12	358°58.4	N23°00.9	318°46.9	13.0'	N20°24.0	-9.3'	54.4'
13	13°58.3	00.7	333°19.0	13.1'	20°14.8	-9.4'	54.4'
14	28°58.2	00.5	347°51.1	13.1'	20°05.4	-9.5'	54.4'
15	43°58.1	00.3	2°23.2	13.2'	19°55.9	-9.6'	54.4'
16	58°58.0	23°00.1	16°55.4	13.2'	19°46.3	-9.6'	54.4'
17	73°57.8	22°59.9	31°27.6	13.3'	19°36.7	-9.7'	54.4'
18	88°57.7	N22°59.7	45°59.9	13.3'	N19°27.0	-9.8'	54.4'
19	103°57.6	59.5	60°32.3	13.4'	19°17.1	-9.9'	54.5'
20	118°57.5	59.3	75°04.6	13.4'	19°07.2	-10.0'	54.5'
21	133°57.4	59.1	89°37.1	13.5'	18°57.2	-10.1'	54.5'
22	148°57.3	58.9	104°09.5	13.5'	18°47.1	-10.2'	54.5'
23	163°57.1	58.7	118°42.1	13.6'	18°37.0	-10.3'	54.5'
	SD = 15.7'			SD = 14.8'			

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

## July 03, 04, 05 UT (Sun., Mon., Tue.)

Aries		Venus		Mars		Jupiter		Saturn		Stars	
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec
0	281°00.0	210°25.0	N20°55.9	253°56.6	N09°12.9	273°27.8	N01°50.2	313°39.6	S14°27.2	Alpheratz	357°36.8
1	296°02.5	225°24.4	56.4	268°57.4	13.6	288°30.0	50.3	328°42.2	27.2	Ankaa	353°09.2
2	311°05.0	240°23.7	56.8	283°58.2	14.2	303°32.3	50.4	343°44.8	27.2	Schedar	349°33.4
3	326°07.4	255°23.0	.. 57.3	298°59.0	.. 14.8	318°34.6	.. 50.4	358°47.3	.. 27.3	Diphda	348°49.4
4	341°09.9	270°22.3	57.8	313°59.8	15.4	333°36.9	50.5	13°49.9	27.3	Achernar	335°21.9
5	356°12.3	285°21.6	58.3	329°00.6	16.1	348°39.1	50.6	28°52.5	27.4	Hamal	327°53.7
6	11°14.8	300°20.9	N20°58.8	344°01.4	N09°16.7	3°41.4	N01°50.6	43°55.0	S14°27.4	Polaris	315°16.8
7	26°17.3	315°20.2	59.3	359°02.2	17.3	18°43.7	50.7	58°57.6	27.5	Acamar	315°13.6
8	41°19.7	330°19.5	20°59.8	14°03.0	18.0	33°46.0	50.8	74°00.2	27.5	Menkar	314°08.5
9	56°22.2	345°18.8	21°00.2	29°03.8	.. 18.6	48°48.2	.. 50.9	89°02.7	.. 27.5	Mirfak	308°31.5
10	71°24.7	0°18.1	00.7	44°04.6	19.2	63°50.5	50.9	104°05.3	27.6	Aldebaran	290°42.3
11	86°27.1	15°17.4	01.2	59°05.4	19.8	78°52.8	51.0	119°07.9	27.6	Rigel	281°06.2
12	101°29.6	30°16.7	N21°01.7	74°06.2	N09°20.5	93°55.1	N01°51.1	134°10.4	S14°27.7	Capella	280°25.4
13	116°32.1	45°16.0	02.1	89°07.0	21.1	108°57.4	51.1	149°13.0	27.7	Bellatrix	278°25.4
14	131°34.5	60°15.3	02.6	104°07.8	21.7	123°59.6	51.2	164°15.6	27.8	Elnath	278°04.9
15	146°37.0	75°14.6	.. 03.1	119°08.6	.. 22.3	139°01.9	.. 51.3	179°18.1	.. 27.8	Alnilak	275°40.2
16	161°39.4	90°13.9	03.6	134°09.4	22.9	154°04.2	51.3	194°20.7	27.9	Betelgeuse	270°54.7
17	176°41.9	105°13.2	04.0	149°10.2	23.6	169°06.5	51.4	209°23.3	27.9	Canopus	263°53.9
18	191°44.4	120°12.5	N21°04.5	164°11.0	N09°24.2	184°08.7	N01°51.5	224°25.8	S14°27.9	Sirius	258°28.4
19	206°46.8	135°11.7	05.0	179°11.8	24.8	199°11.0	51.5	239°28.4	28.0	Adhara	255°07.9
20	221°49.3	150°11.0	05.5	194°12.6	25.4	214°13.3	51.6	254°31.0	28.0	Procyon	244°53.3
21	236°51.8	165°10.3	.. 05.9	209°13.4	.. 26.1	229°15.6	.. 51.7	269°33.6	.. 28.1	Pollux	243°20.2
22	251°54.2	180°09.6	06.4	224°14.2	26.7	244°17.9	51.7	284°36.1	28.1	Avior	234°16.2
23	266°56.7	195°08.9	06.9	239°15.0	27.3	259°20.1	51.8	299°38.7	28.2	Suhail	222°48.2
Mer.pass. 05:15		$\nu -0.7' d 0.5' m -3.91$		$\nu 0.8' d 0.6' m 0.39$		$\nu 2.3' d 0.1' m -2.43$		$\nu 2.6' d -0.0' m 0.54$		Miaplacidus	
Mon		GHA		GHA		GHA		GHA		GHA	
0	281°59.2	210°08.2	N21°07.3	254°15.8	N09°27.9	274°22.4	N01°51.9	314°41.3	S14°28.2	Denebola	193°43.9
1	297°01.6	225°07.5	07.8	269°16.6	28.6	289°24.7	51.9	329°43.8	28.2	Gienah	175°45.8
2	312°04.1	240°06.8	08.3	284°17.4	29.2	304°27.0	52.0	344°46.4	28.3	Acrux	173°02.4
3	327°06.6	255°06.1	.. 08.7	299°18.2	.. 29.8	319°29.3	.. 52.1	359°49.0	.. 28.3	Gacrux	171°54.0
4	342°09.0	270°05.4	09.2	314°19.0	30.4	334°31.5	52.1	14°51.5	28.4	Alioth	166°14.8
5	357°11.5	285°04.7	09.6	329°19.8	31.0	349°33.8	52.2	29°54.1	28.4	Spica	158°24.4
6	12°13.9	300°04.0	N21°10.1	344°20.6	N09°31.7	4°36.1	N01°52.2	44°56.7	S14°28.5	Alkaid	152°53.5
7	27°16.4	315°03.3	10.6	359°21.4	32.3	19°38.4	52.3	59°59.3	28.5	Hadar	148°38.7
8	42°18.9	330°02.6	11.0	14°22.2	32.9	34°40.7	52.4	75°01.8	28.6	Menkent	147°59.9
9	57°21.3	345°01.9	.. 11.5	29°23.0	.. 33.5	49°43.0	.. 52.4	90°04.4	.. 28.6	Arcturus	145°49.7
10	72°23.8	0°01.1	11.9	44°23.8	34.1	64°45.2	52.5	105°07.0	28.6	Rigel Kent.	139°42.8
11	87°26.3	15°00.4	12.4	59°24.6	34.8	79°47.5	52.6	120°09.5	28.7	Zuben' ubi	136°58.1
12	102°28.7	29°59.7	N21°12.8	74°25.4	N09°35.4	94°49.8	N01°52.6	135°12.1	S14°28.7	Alphecca	126°05.3
13	117°31.2	44°59.0	13.3	89°26.2	36.0	109°52.1	52.7	150°14.7	28.8	Antares	112°18.1
14	132°33.7	59°58.3	13.7	104°27.0	36.6	124°54.4	52.8	165°17.3	28.8	Atria	107°13.6
15	147°36.1	74°57.6	.. 14.2	119°27.8	.. 37.2	139°56.7	.. 52.8	180°19.8	.. 28.9	Sabik	102°04.8
16	162°38.6	89°56.9	14.6	134°28.6	37.9	154°58.9	52.9	195°22.4	28.9	Shaula	96°12.8
17	177°41.1	104°56.2	15.1	149°29.4	38.5	170°01.2	53.0	210°25.0	29.0	Rasalhague	96°00.1
18	192°43.5	119°55.4	N21°15.5	164°30.2	N09°39.1	185°03.5	N01°53.0	225°27.5	S14°29.0	Eltanin	90°42.6
19	207°46.0	134°54.7	16.0	179°31.0	39.7	200°05.8	53.1	240°30.1	29.0	Kaus Aust.	83°34.9
20	222°48.4	149°54.0	16.4	194°31.8	40.3	215°08.1	53.1	255°32.7	29.1	Vega	80°34.2
21	237°50.9	164°53.3	.. 16.9	209°32.6	.. 41.0	230°10.4	.. 53.2	270°35.3	.. 29.1	Nunki	75°50.0
22	252°53.4	179°52.6	17.3	224°33.4	41.6	245°12.7	53.3	285°37.8	29.2	Altair	62°01.6
23	267°55.8	194°51.9	17.8	239°34.2	42.2	260°14.9	53.3	300°40.4	29.2	Peacock	53°08.5
Mer.pass. 05:11		$\nu -0.7' d 0.5' m -3.91$		$\nu 0.8' d 0.6' m 0.38$		$\nu 2.3' d 0.1' m -2.44$		$\nu 2.6' d -0.0' m 0.53$		Deneb	
Tue		GHA		GHA		GHA		GHA		GHA	
0	282°58.3	209°51.2	N21°18.2	254°35.0	N09°42.8	275°17.2	N01°53.4	315°43.0	S14°29.3	Fomalhaut	15°16.6
1	298°00.8	224°50.4	18.7	269°35.8	43.4	290°19.5	53.5	330°45.6	29.3	Scheat	13°47.0
2	313°03.2	239°49.7	19.1	284°36.6	44.0	305°21.8	53.5	345°48.1	29.4	Markab	13°31.8
3	328°05.7	254°49.0	.. 19.5	299°37.4	.. 44.7	320°24.1	.. 53.6	0°50.7	.. 29.4	Jul 03 Sun	289°25.0
4	343°08.2	269°48.3	20.0	314°38.2	45.3	335°26.4	53.7	15°53.3	29.4	Venus	09:59
5	358°10.6	284°47.6	20.4	329°39.0	45.9	350°28.7	53.7	30°55.8	29.5	Mars	07:04
6	13°13.1	299°46.9	N21°20.9	344°39.8	N09°46.5	5°31.0	N01°53.8	45°58.4	S14°29.5	Jupiter	352°27.7
7	28°15.5	314°46.1	21.3	359°40.6	47.1	20°33.2	53.8	61°01.0	29.6	Saturn	32°39.6
8	43°18.0	329°45.4	21.7	14°41.4	47.7	35°35.5	53.9	76°03.6	29.6	Jul 04 Mon	288°09.1
9	58°20.5	344°44.7	.. 22.2	29°42.2	.. 48.4	50°37.8	.. 54.0	91°06.1	.. 29.7	Venus	10:00
10	73°22.9	359°44.0	22.6	44°43.0	49.0	65°40.1	54.0	106°08.7	29.7	Mars	07:03
11	88°25.4	14°43.3	23.0	59°43.8	49.6	80°42.4	54.1	121°11.3	29.8	Jupiter	05:42
12	103°27.9	29°42.5	N21°23.5	74°44.6	N09°50.2	95°44.7	N01°54.1	136°13.9	S14°29.8	Saturn	32°42.1
13	118°30.3	44°41.8	23.9	89°45.4	50.8	110°47.0	54.2	151°16.4	29.9	Jul 05 Tue	286°52.9
14	133°32.8	59°41.1	24.3	104°46.2	51.4	125°49.3	54.3	166°19.0	29.9	Venus	10:01
15	148°35.3	74°40.4	.. 24.7	119°47.0	.. 52.0	140°51.6	.. 54.3	181°21.6	.. 29.9	Mars	07:01
16	163°37.7	89°39.7	25.2	134°47.8	52.7	155°53.9	54.4	196°24.2	30.0	Jupiter	05:38
17	178°40.2	104°38.9	25.6	149°48.6	53.3	170°56.2	54.5	211°26.7	30.0	Saturn	02:57
18	193°42.7	119°38.2	N21°26.0	164°49.4	N09°53.9	185°58.4	N01°54.5	226°29.3	S14°30.1	Horizontal parallax	
19	208°45.1	134°37.5	26.4	179°50.2	54.5	201°00.7	54.6	241°31.9	30.1	Venus:	0.1
20	223°47.6	149°36.8	26.9	194°51.0	55.1	216°03.0	54.6	256°34.5	30.2	Mars:	0.1
21	238°50.0	164°36.1	.. 27.3	209°51.8	.. 55.7	231°05.3	.. 54.7	271°37.0	.. 30.2	Jupiter:	05:38
22	253°52.5	179°35.3	27.7	224°52.6	56.3	246°07.6	54.8	286°39.6	30.3	Saturn:	02:57
23	268°55.0	194°34.6	28.1	239°53.4	57.0	261°09.9	54.8	301°42.2	30.3		
Mer.pass. 05:07		$\nu -0.7' d 0.4' m -3.91$		$\nu 0.8' d 0.6' m 0.37$		$\nu 2.3' d 0.1' m -2.45$		$\$			

DUT1 = UT1-UTC = -0.0659 sec  $\Delta T = TT-UT1 = +69.2499$  sec

2022 July 03 to Jul. 05 UT

h		Sun		Moon				
Sun		GHA	Dec	GHA	$\nu$	Dec	d	HP
0	178°57.0	N22°58.5	133°14.6	13.6'	N18°26.7	-10.3'	54.5'	
1	193°56.9	58.3	147°47.2	13.7'	18°16.4	-10.4'	54.5'	
2	208°56.8	58.1	162°19.9	13.7'	18°06.0	-10.5'	54.6'	
3	223°56.7	57.9	176°52.6	13.7'	17°55.5	-10.6'	54.6'	
4	238°56.6	57.7	191°25.3	13.8'	17°44.9	-10.7'	54.6'	
5	253°56.4	57.5	205°58.1	13.8'	17°34.2	-10.7'	54.6'	
6	268°56.3	N22°57.3	220°30.9	13.9'	N17°23.5	-10.8'	54.6'	
7	283°56.2	57.1	235°03.8	13.9'	17°12.7	-10.9'	54.6'	
8	298°56.1	56.9	249°36.7	14.0'	17°01.8	-11.0'	54.7'	
9	313°56.0	56.7	264°09.7	14.0'	16°50.8	-11.1'	54.7'	
10	328°55.9	56.5	278°42.7	14.0'	16°39.8	-11.1'	54.7'	
11	343°55.8	56.3	293°15.7	14.1'	16°28.6	-11.2'	54.7'	
12	358°55.6	N22°56.1	307°48.8	14.1'	N16°17.4	-11.3'	54.7'	
13	13°55.5	55.9	322°21.9	14.2'	16°06.2	-11.3'	54.8'	
14	28°55.4	55.7	336°55.0	14.2'	15°54.8	-11.4'	54.8'	
15	43°55.3	55.5	351°28.2	14.2'	15°43.4	-11.5'	54.8'	
16	58°55.2	55.3	6°01.5	14.3'	15°31.9	-11.6'	54.8'	
17	73°55.1	55.1	20°34.7	14.3'	15°20.3	-11.6'	54.8'	
18	88°55.0	N22°54.9	35°08.0	14.3'	N15°08.7	-11.7'	54.8'	
19	103°54.8	54.7	49°41.4	14.4'	14°57.0	-11.8'	54.9'	
20	118°54.7	54.4	64°14.7	14.4'	14°45.2	-11.8'	54.9'	
21	133°54.6	54.2	78°48.1	14.4'	14°33.4	-11.9'	54.9'	
22	148°54.5	54.0	93°21.6	14.5'	14°21.5	-12.0'	54.9'	
23	163°54.4	53.8	107°55.1	14.5'	14°09.5	-12.0'	54.9'	
SD = 15.7'		SD = 14.9'						
Mon		GHA		Dec		GHA		$\nu$
0	178°54.3	N22°53.6	122°28.6	14.5'	N13°57.4	-12.1'	55.0'	
1	193°54.2	53.4	137°02.1	14.6'	13°45.3	-12.2'	55.0'	
2	208°54.0	53.2	151°35.7	14.6'	13°33.2	-12.2'	55.0'	
3	223°53.9	52.9	166°09.2	14.6'	13°20.9	-12.3'	55.0'	
4	238°53.8	52.7	180°42.9	14.7'	13°08.6	-12.4'	55.1'	
5	253°53.7	52.5	195°16.5	14.7'	12°56.3	-12.4'	55.1'	
6	268°53.6	N22°52.3	209°50.2	14.7'	N12°43.8	-12.5'	55.1'	
7	283°53.5	52.1	224°23.9	14.7'	12°31.3	-12.5'	55.1'	
8	298°53.4	51.9	238°57.6	14.8'	12°18.8	-12.6'	55.1'	
9	313°53.3	51.6	253°31.4	14.8'	12°06.2	-12.7'	55.2'	
10	328°53.1	51.4	268°05.2	14.8'	11°53.5	-12.7'	55.2'	
11	343°53.0	51.2	282°39.0	14.8'	11°40.8	-12.8'	55.2'	
12	358°52.9	N22°51.0	297°12.8	14.8'	N11°28.0	-12.8'	55.2'	
13	13°52.8	50.7	311°46.6	14.9'	11°15.2	-12.9'	55.3'	
14	28°52.7	50.5	326°20.5	14.9'	11°02.3	-12.9'	55.3'	
15	43°52.6	50.3	340°54.4	14.9'	10°49.4	-13.0'	55.3'	
16	58°52.5	50.1	355°28.3	14.9'	10°36.4	-13.1'	55.3'	
17	73°52.4	49.8	10°02.2	14.9'	10°23.3	-13.1'	55.3'	
18	88°52.3	N22°49.6	24°36.2	15.0'	N10°10.2	-13.2'	55.4'	
19	103°52.1	49.4	39°10.1	15.0'	09°57.0	-13.2'	55.4'	
20	118°52.0	49.2	53°44.1	15.0'	09°43.8	-13.3'	55.4'	
21	133°51.9	48.9	68°18.1	15.0'	09°30.6	-13.3'	55.4'	
22	148°51.8	48.7	82°52.1	15.0'	09°17.3	-13.4'	55.5'	
23	163°51.7	48.5	97°26.1	15.0'	09°03.9	-13.4'	55.5'	
SD = 15.7'		SD = 15.0'						
Tue		GHA	Dec	GHA	$\nu$	Dec	d	HP
0	178°51.6	N22°48.2	112°00.1	15.0'	N08°50.5	-13.5'	55.5'	
1	193°51.5	48.0	126°34.1	15.0'	08°37.0	-13.5'	55.5'	
2	208°51.4	47.8	141°08.2	15.0'	08°23.5	-13.5'	55.6'	
3	223°51.3	47.5	155°42.2	15.1'	08°10.0	-13.6'	55.6'	
4	238°51.2	47.3	170°16.3	15.1'	07°56.4	-13.6'	55.6'	
5	253°51.1	47.1	184°50.3	15.1'	07°42.8	-13.7'	55.7'	
6	268°50.9	N22°46.8	199°24.4	15.1'	N07°29.1	-13.7'	55.7'	
7	283°50.8	46.6	213°58.4	15.1'	07°15.4	-13.8'	55.7'	
8	298°50.7	46.4	228°32.5	15.1'	07°01.6	-13.8'	55.7'	
9	313°50.6	46.1	243°06.6	15.1'	06°47.8	-13.8'	55.8'	
10	328°50.5	45.9	257°40.7	15.1'	06°33.9	-13.9'	55.8'	
11	343°50.4	45.7	272°14.7	15.1'	06°20.0	-13.9'	55.8'	
12	358°50.3	N22°45.4	286°48.8	15.1'	N06°06.1	-14.0'	55.8'	
13	13°50.2	45.2	301°22.9	15.1'	05°52.1	-14.0'	55.9'	
14	28°50.1	44.9	315°56.9	15.1'	05°38.1	-14.0'	55.9'	
15	43°50.0	44.7	330°31.0	15.1'	05°24.1	-14.1'	55.9'	
16	58°49.9	44.5	345°05.0	15.0'	05°10.0	-14.1'	56.0'	
17	73°49.8	44.2	359°39.1	15.0'	04°55.9	-14.1'	56.0'	
18	88°49.6	N22°44.0	14°13.1	15.0'	N04°41.8	-14.2'	56.0'	
19	103°49.5	43.7	28°47.2	15.0'	04°27.6	-14.2'	56.0'	
20	118°49.4	43.5	43°21.2	15.0'	04°13.4	-14.2'	56.1'	
21	133°49.3	43.2	57°55.2	15.0'	03°59.1	-14.3'	56.1'	
22	148°49.2	43.0	72°29.2	15.0'	03°44.9	-14.3'	56.1'	
23	163°49.1	42.7	87°03.2	15.0'	03°30.6	-14.3'	56.2'	
SD = 15.7'		SD = 15.1'						

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

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

## July 06, 07, 08 UT (Wed., Thu., Fri.)

Aries			Venus			Mars			Jupiter			Saturn			Stars	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	283°57.4	209°33.9	N21°28.5	254°54.2	N09°57.6	276°12.2	N01°54.9	316°44.8	S14°30.4					Alpheratz	357°36.8	
1	298°59.9	224°33.2	29.0	269°55.0	58.2	291°14.5	54.9	331°47.4	30.4					Ankaa	353°09.2	
2	314°02.4	239°32.4	29.4	284°55.8	58.8	306°16.8	55.0	346°49.9	30.4					Schedar	349°33.3	
3	329°04.8	254°31.7	.. 29.8	299°56.6	09°59.4	321°19.1	.. 55.1	1°52.5	.. 30.5					Diphda	348°49.4	
4	344°07.3	269°31.0	30.2	314°57.4	10°00.0	336°21.4	55.1	16°55.1	30.5					Achernar	335°21.9	
5	359°09.8	284°30.3	30.6	329°58.2	00.6	351°23.7	55.2	31°57.7	30.6					Hamal	327°53.6	
6	14°12.2	299°29.5	N21°31.0	344°59.0	N10°01.2	6°26.0	N01°55.2	47°00.2	S14°30.6					Polaris	315°15.6	
7	29°14.7	314°28.8	31.4	359°59.9	01.8	21°28.3	55.3	62°02.8	30.7					Acamar	315°13.6	
8	44°17.1	329°28.1	31.9	15°00.7	02.5	36°30.6	55.4	77°05.4	30.7					Menkar	314°08.5	
9	59°19.6	344°27.3	.. 32.3	30°01.5	.. 03.1	51°32.9	.. 55.4	92°08.0	.. 30.8					Mirfak	308°31.5	
10	74°22.1	359°26.6	32.7	45°02.3	03.7	66°35.2	55.5	107°10.5	30.8					Aldebaran	290°42.3	
11	89°24.5	14°25.9	33.1	60°03.1	04.3	81°37.5	55.5	122°13.1	30.9					Rigel	281°06.2	
12	104°27.0	29°25.2	N21°33.5	75°03.9	N10°04.9	96°39.8	N01°55.6	137°15.7	S14°30.9					Capella	280°25.4	
13	119°29.5	44°24.4	33.9	90°04.7	05.5	111°42.0	55.6	152°18.3	31.0					Bellatrix	278°25.4	
14	134°31.9	59°23.7	34.3	105°05.5	06.1	126°44.3	55.7	167°20.9	31.0					Elnath	278°04.8	
15	149°34.4	74°23.0	.. 34.7	120°06.3	.. 06.7	141°46.6	.. 55.8	182°23.4	.. 31.0					Alnilam	275°40.1	
16	164°36.9	89°22.2	35.1	135°07.1	07.3	156°48.9	55.8	197°26.0	31.1					Betelgeuse	270°54.7	
17	179°39.3	104°21.5	35.5	150°07.9	08.0	171°51.2	55.9	212°28.6	31.1					Canopus	263°53.9	
18	194°41.8	119°20.8	N21°35.9	165°08.7	N10°08.6	186°53.5	N01°55.9	227°31.2	S14°31.2					Sirius	258°28.4	
19	209°44.3	134°20.0	36.3	180°09.5	09.2	201°55.8	56.0	242°33.7	31.2					Adhara	255°07.9	
20	224°46.7	149°19.3	36.7	195°10.3	09.8	216°58.1	56.1	257°36.3	31.3					Procyon	244°53.3	
21	239°49.2	164°18.6	.. 37.1	210°11.1	.. 10.4	232°00.4	.. 56.1	272°38.9	.. 31.3					Pollux	243°20.2	
22	254°51.6	179°17.8	37.5	225°11.9	11.0	247°02.7	56.2	287°41.5	31.4					Avior	234°16.2	
23	269°54.1	194°17.1	37.9	240°12.7	11.6	262°05.0	56.2	302°44.1	31.4					Suhail	222°48.2	
Mer.pass. 05:03		$\nu$ -0.7° d 0.4° m -3.91		$\nu$ 0.8° d 0.6° m 0.36		$\nu$ 2.3° d 0.1° m -2.46		$\nu$ 2.6° d -0.0° m 0.52								
Mer.pass. 05:03																
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	284°56.6	209°16.4	N21°38.3	255°13.5	N10°12.2	277°07.3	N01°56.3	317°46.6	S14°31.5					Denebola	182°27.2	
1	299°59.0	224°15.6	38.7	270°14.3	12.8	292°09.6	56.3	332°49.2	31.5					Gienah	175°45.8	
2	315°01.5	239°14.9	39.1	285°15.1	13.4	307°11.9	56.4	347°51.8	31.6					Crux	173°02.5	
3	330°04.0	254°14.2	.. 39.5	300°15.9	.. 14.0	322°14.2	.. 56.5	2°54.4	.. 31.6					Gacrux	171°54.0	
4	345°06.4	269°13.4	39.9	315°16.7	14.6	337°16.5	56.5	17°57.0	31.7					Alioth	166°14.8	
5	0°08.9	284°12.7	40.3	330°17.5	15.2	352°18.8	56.6	32°59.5	31.7					Spica	158°24.4	
6	15°11.4	299°12.0	N21°40.6	345°18.3	N10°15.9	7°21.1	N01°56.6	48°02.1	S14°31.7					Alkaid	152°53.5	
7	30°13.8	314°11.2	41.0	0°19.1	16.5	22°23.4	56.7	63°04.7	31.8					Hadar	148°38.7	
8	45°16.3	329°10.5	41.4	15°19.9	17.1	37°25.8	56.7	78°07.3	31.8					Menkent	147°59.9	
9	60°18.8	344°09.8	.. 41.8	30°20.7	.. 17.7	52°28.1	.. 56.8	93°09.9	.. 31.9					Arcturus	145°49.7	
10	75°21.2	359°09.0	42.2	45°21.5	18.3	67°30.4	56.8	108°12.4	31.9					Rigel Kent.	139°42.8	
11	90°23.7	14°08.3	42.6	60°22.3	18.9	82°32.7	56.9	123°15.0	32.0					Kochab	137°19.2	
12	105°26.1	29°07.6	N21°43.0	75°23.1	N10°19.5	97°35.0	N01°57.0	138°17.6	S14°32.0					Zuben 'ubi	136°58.1	
13	120°28.6	44°06.8	43.3	90°23.9	20.1	112°37.3	57.0	153°20.2	32.1					Alphecca	126°05.3	
14	135°31.1	59°06.1	43.7	105°24.8	20.7	127°39.6	57.1	168°22.8	32.1					Antares	112°18.1	
15	150°33.5	74°05.3	.. 44.1	120°25.6	.. 21.3	142°41.9	.. 57.1	183°25.3	.. 32.2					Atria	107°13.6	
16	165°36.0	89°04.6	44.5	135°26.4	21.9	157°44.2	57.2	198°27.9	32.2					Sabik	102°04.8	
17	180°38.5	104°03.9	44.9	150°27.2	22.5	172°46.5	57.2	213°30.5	32.3					Shaula	96°12.8	
18	195°40.9	119°03.1	N21°45.2	165°28.0	N10°23.1	187°48.8	N01°57.3	228°33.1	S14°32.3					Rasalhague	96°00.1	
19	210°43.4	134°02.4	45.6	180°28.8	23.7	202°51.1	57.3	243°35.7	32.4					Eltanin	90°42.6	
20	225°45.9	149°01.6	46.0	195°29.6	24.3	217°53.4	57.4	258°38.3	32.4					Kaus Aust.	83°34.9	
21	240°48.3	164°00.9	.. 46.4	210°30.4	.. 24.9	232°55.7	.. 57.5	273°40.8	.. 32.5					Vega	80°34.2	
22	255°50.8	179°00.2	46.7	225°31.2	25.5	247°58.0	57.5	288°43.4	32.5					Nunki	75°49.9	
23	270°53.2	193°59.4	47.1	240°32.0	26.1	263°00.3	57.6	303°46.0	32.6					Altair	62°01.6	
Mer.pass. 04:59		$\nu$ -0.7° d 0.4° m -3.91		$\nu$ 0.8° d 0.6° m 0.36		$\nu$ 2.3° d 0.1° m -2.46		$\nu$ 2.6° d -0.0° m 0.52								
Mer.pass. 04:59																
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	285°55.7	208°58.7	N21°47.5	255°32.8	N10°26.7	278°02.6	N01°57.6	318°48.6	S14°32.6					Fomalhaut	15°16.6	
1	300°58.2	223°57.9	47.8	270°33.6	27.3	293°04.9	57.7	333°51.2	32.6					Scheat	13°47.0	
2	316°00.6	238°57.2	48.2	285°34.4	27.9	308°07.3	57.7	348°53.8	32.7					Markab	13°31.8	
3	331°03.1	253°56.5	.. 48.6	300°35.2	.. 28.5	323°09.6	.. 57.8	3°56.3	.. 32.7					15°19.5		
4	346°05.6	268°55.7	48.9	315°36.0	29.1	338°11.9	57.8	18°58.9	32.8					Jul 06 Wed	SHA	Mer.pass
5	1°08.0	283°55.0	49.3	330°36.8	29.7	353°14.2	57.9	34°01.5	32.8					Venus	285°36.4	10:02
6	16°10.5	298°54.2	N21°49.7	345°37.6	N10°30.3	8°16.5	N01°57.9	49°04.1	S14°32.9					Mars	330°56.8	07:00
7	31°13.0	313°53.5	50.0	0°38.4	30.9	23°18.8	58.0	64°06.7	32.9					Jupiter	352°14.8	05:34
8	46°15.4	328°52.7	50.4	15°39.2	31.5	38°21.1	58.0	79°09.3	33.0					Saturn	32°47.3	02:53
9	61°17.9	343°52.0	.. 50.8	30°40.0	.. 32.1	53°23.4	.. 58.1	94°11.8	.. 33.0					Jul 07 Thu	SHA	Mer.pass
10	76°20.4	358°51.2	51.1	45°40.8	32.8	68°25.7	58.1	109°14.4	33.1					Venus	284°19.8	10:03
11	91°22.8	13°50.5	51.5	60°41.7	33.4	83°28.0	58.2	124°17.0	33.1					Mars	330°16.9	06:59
12	106°25.3	28°49.7	N21°51.8	75°42.5	N10°34.0	98°30.3	N01°58.3	139°19.6	S14°33.2					Jupiter	352°10.8	05:31
13	121°27.7	43°49.0	52.2	90°43.3	34.6	113°32.7	58.3	154°22.2	33.2					Saturn	32°50.1	02:48
14	136°30.2	58°48.3	52.													

DUT1 = UT1-UTC = -0.0635 sec  $\Delta T = TT-UT1 = +69.2475$  sec

2022 July 06 to Jul. 08 UT

h		Sun		Moon				Lat.		Twilight		Sunrise		Sunset		Twilight		
Wed		GHA	Dec	GHA	$\nu$	Dec	$d$	HP	Naut.	Civil					Civil	Naut.		
0	178°49.0	N22°42.5	101°37.1	14.9'	N03°16.2	-14.4'	56.2'		N 72°									
1	193°48.9	42.3	116°11.1	14.9'	03°01.9	-14.4'	56.2'		N 70°									
2	208°48.8	42.0	130°45.0	14.9'	02°47.5	-14.4'	56.3'		68°									
3	223°48.7	41.8	145°18.9	14.9'	02°33.1	-14.4'	56.3'		66°	-:-	-:-	00:58	23:08	-:-	-:-	-:-	-:-	
4	238°48.6	41.5	159°52.8	14.9'	02°18.6	-14.5'	56.3'		64°	-:-	-:-	01:54	22:14	-:-	-:-	-:-	-:-	
5	253°48.5	41.3	174°26.7	14.8'	02°04.1	-14.5'	56.4'		62°	-:-	-:-	02:26	21:43	-:-	-:-	-:-	-:-	
6	268°48.4	N22°41.0	180°00.5	14.8'	N01°49.6	-14.5'	56.4'		60°	-:-	01:20	02:50	21:19	22:48	-:-	-:-	-:-	-:-
7	283°48.3	40.7	203°34.3	14.8'	01°35.1	-14.5'	56.4'											
8	298°48.2	40.5	218°08.1	14.8'	01°20.6	-14.6'	56.5'											
9	313°48.1	40.2	232°41.9	14.7'	01°06.0	-14.6'	56.5'											
10	328°48.0	40.0	247°15.6	14.7'	00°51.4	-14.6'	56.5'											
11	343°47.9	39.7	261°49.4	14.7'	00°36.8	-14.6'	56.5'											
12	358°47.8	N22°39.5	276°23.0	14.7'	N00°22.2	-14.6'	56.6'											
13	13°47.6	39.2	290°56.7	14.6'	N00°07.6	-14.7'	56.6'											
14	28°47.5	39.0	305°30.3	14.6'	S00°07.1	-14.7'	56.6'											
15	43°47.4	38.7	320°03.9	14.6'	00°21.8	-14.7'	56.7'											
16	58°47.3	38.4	334°37.5	14.5'	00°36.5	-14.7'	56.7'											
17	73°47.2	38.2	349°11.0	14.5'	00°51.2	-14.7'	56.7'											
18	88°47.1	N22°37.9	3°44.5	14.4'	S01°05.9	-14.7'	56.8'											
19	103°47.0	37.7	18°17.9	14.4'	01°20.6	-14.7'	56.8'											
20	118°46.9	37.4	32°51.3	14.4'	01°35.4	-14.8'	56.9'											
21	133°46.8	37.1	47°24.6	14.3'	01°50.1	-14.8'	56.9'											
22	148°46.7	36.9	61°58.0	14.3'	02°04.9	-14.8'	56.9'											
23	163°46.6	36.6	76°31.2	14.2'	02°19.7	-14.8'	57.0'											
			SD = 15.7'	d = -0.2'			SD = 15.3'											
Thu		GHA	Dec	GHA	$\nu$	Dec	$d$	HP										
0	178°46.5	N22°36.4	91°04.5	14.2'	S02°34.4	-14.8'	57.0'											
1	193°46.4	36.1	105°37.6	14.1'	02°49.2	-14.8'	57.0'											
2	208°46.3	35.8	120°10.8	14.1'	03°04.0	-14.8'	57.1'											
3	223°46.2	35.6	134°43.8	14.0'	03°18.8	-14.8'	57.1'											
4	238°46.1	35.3	149°16.9	14.0'	03°33.6	-14.8'	57.1'											
5	253°46.0	35.0	163°49.8	13.9'	03°48.4	-14.8'	57.2'											
6	268°45.9	N22°34.8	178°22.8	13.9'	S04°03.2	-14.8'	57.2'											
7	283°45.8	34.5	192°55.6	13.8'	04°18.0	-14.8'	57.2'											
8	298°45.7	34.2	207°28.4	13.8'	04°32.8	-14.8'	57.3'											
9	313°45.6	34.0	222°01.2	13.7'	04°47.6	-14.8'	57.3'											
10	328°45.5	33.7	236°33.9	13.6'	05°02.5	-14.8'	57.3'											
11	343°45.4	33.4	251°06.5	13.6'	05°17.3	-14.8'	57.4'											
12	358°45.3	N22°33.1	265°39.1	13.5'	S05°32.0	-14.8'	57.4'											
13	13°45.2	32.9	280°11.6	13.4'	05°46.8	-14.8'	57.5'											
14	28°45.1	32.6	294°44.0	13.4'	06°01.6	-14.8'	57.5'											
15	43°45.0	32.3	309°16.4	13.3'	06°16.4	-14.8'	57.5'											
16	58°44.9	32.0	323°48.7	13.2'	06°31.1	-14.8'	57.6'											
17	73°44.8	31.8	338°21.0	13.2'	06°45.9	-14.7'	57.6'											
18	88°44.7	N22°31.5	352°53.1	13.1'	S07°00.6	-14.7'	57.6'											
19	103°44.6	31.2	7°25.2	13.0'	07°15.4	-14.7'	57.7'											
20	118°44.5	30.9	21°57.3	13.0'	07°30.1	-14.7'	57.7'											
21	133°44.4	30.7	36°29.2	12.9'	07°44.8	-14.7'	57.7'											
22	148°44.3	30.4	51°01.1	12.8'	07°59.5	-14.7'	57.8'											
23	163°44.2	30.1	65°32.9	12.7'	08°14.1	-14.6'	57.8'											
			SD = 15.7'	d = -0.3'			SD = 15.5'											
Fri		GHA	Dec	GHA	$\nu$	Dec	$d$	HP										
0	178°44.1	N22°29.8	80°04.6	12.6'	S08°28.8	-14.6'	57.9'											
1	193°44.0	29.5	94°36.2	12.6'	08°43.4	-14.6'	57.9'											
2	208°43.9	29.3	109°07.8	12.5'	08°58.0	-14.6'	57.9'											
3	223°43.8	29.0	123°39.3	12.4'	09°12.6	-14.6'	58.0'											
4	238°43.7	28.7	138°10.7	12.3'	09°27.1	-14.5'	58.0'											
5	253°43.6	28.4	152°42.0	12.2'	09°41.6	-14.5'	58.0'											
6	268°43.5	N22°28.1	167°13.2	12.1'	S09°56.1	-14.5'	58.1'											
7	283°43.4	27.8	181°44.3	12.0'	10°10.6	-14.4'	58.1'											
8	298°43.4	27.6	196°15.4	12.0'	10°25.0	-14.4'	58.2'											
9	313°43.3	27.3	210°46.3	11.9'	10°39.4	-14.4'	58.2'											
10	328°43.2	27.0	225°17.2	11.8'	10°53.8	-14.3'	58.2'											
11	343°43.1	26.7	239°47.9	11.7'	11°08.1	-14.3'	58.3'											
12	358°43.0	N22°26.4	254°18.6	11.6'	S11°22.4	-14.3'	58.3'											
13	13°42.9	26.1	268°49.2	11.5'	11°36.7	-14.2'	58.4'											
14	28°42.8	25.8	283°19.7	11.4'	11°50.9	-14.2'	58.4'											
15	43°42.7	25.5	297°50.0	11.3'	12°05.1	-14.1'	58.4'											
16	58°42.6	25.3	312°20.3	11.2'	12°19.2	-14.1'	58.5'											
17	73°42.5	25.0	326°50.5	11.1'	12°33.3	-14.0'	58.5'											
18	88°42.4	N22°24.7	341°20.6	11.0'	S12°47.4	-14.0'	58.5'											
19	103°42.3	24.4	355°50.5	10.9'	13°01.4	-14.0'	58.6'											
20	118°42.2	24.1	10°20.4	10.8'	13°15.3	-13.9'	58.6'											
21	133°42.1	23.8	24°50.2	10.7'	13°29.2	-13.9'	58.7'											
22	148°42.0	23.5	39°19.8	10.5'	13°43.1	-13.8'	58.7'											
23	163°41.9	23.2	53°49.4	10.4'	13°56.9	-13.7'	58.7'											
			SD = 15.7'	d = -0.3'			SD = 15.8'											

Day	Sun			Moon			Mer.Pass. Age 7-9 39-60%
	Eqn.of Time	00 <sup>h</sup> mm:ss	12 <sup>h</sup> mm:ss	Mer. Pass	Upper hh:mm	Lower hh:mm	
06	04:44	04:49	12:05	17:45	05:23		
07	04:54	04:59	12:05	18:29	06:07		
08	05:03	05:08					

## July 09, 10, 11 UT (Sat., Sun., Mon.)

Aries			Venus			Mars		Jupiter		Saturn		Stars	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec
0	286°54.9	208°40.8	N21°56.1	255°52.1	N10°41.1	278°58.1	N01°58.9	319°50.6	S14°33.8			Alpheratz	357°36.8
1	301°57.3	223°40.0	56.4	270°52.9	41.7	294°00.4	58.9	334°53.2	33.8			Ankaa	353°09.1
2	316°59.8	238°39.3	56.8	285°53.7	42.3	309°02.7	59.0	349°55.8	33.9			Schedar	349°33.3
3	332°02.2	253°38.5	· · 57.1	300°54.5	· · 42.9	324°05.0	· · 59.0	4°58.4	· · 33.9			Diphda	348°49.3
4	347°04.7	268°37.8	57.4	315°55.4	43.5	339°07.4	59.1	20°00.9	34.0			Achernar	335°21.9
5	2°07.2	283°37.0	57.8	330°56.2	44.1	354°09.7	59.1	35°03.5	34.0			Hamal	327°53.6
6	17°09.6	298°36.3	N21°58.1	345°57.0	N10°44.7	9°12.0	N01°59.2	50°06.1	S14°34.1			Polaris	315°14.1
7	32°12.1	313°35.5	58.5	0°57.8	45.3	24°14.3	59.2	65°08.7	34.1			Acamar	315°13.6
8	47°14.6	328°34.8	58.8	15°58.6	45.9	39°16.6	59.3	80°11.3	34.2			Menkar	314°08.5
9	62°17.0	343°34.0	· · 59.1	30°59.4	· · 46.5	54°18.9	· · 59.3	95°13.9	· · 34.2			Mirfak	308°31.5
10	77°19.5	358°33.3	59.5	46°00.2	47.1	69°21.3	59.4	110°16.5	34.2			Aldebaran	290°42.3
11	92°22.0	13°32.5	21°59.8	61°01.0	47.7	84°23.6	59.4	125°19.1	34.3			Rigel	281°06.2
12	107°24.4	28°31.7	N22°00.1	76°01.8	N10°48.3	99°25.9	N01°59.5	140°21.6	S14°34.3			Capella	280°25.4
13	122°26.9	43°31.0	00.5	91°02.6	48.9	114°28.2	59.5	155°24.2	34.4			Bellatrix	278°25.4
14	137°29.3	58°30.2	00.8	106°03.4	49.5	129°30.5	59.6	170°26.8	34.4			Elnath	278°04.8
15	152°31.8	73°29.5	· · 01.1	121°04.2	· · 50.1	144°32.8	· · 59.6	185°29.4	· · 34.5			Alnilam	275°40.1
16	167°34.3	88°28.7	01.5	136°05.0	50.7	159°35.2	59.7	200°32.0	34.5			Betelgeuse	270°54.6
17	182°36.7	103°28.0	01.8	151°05.8	51.3	174°37.5	59.7	215°34.6	34.6			Canopus	263°53.9
18	197°39.2	118°27.2	N22°02.1	166°06.7	N10°51.9	189°39.8	N01°59.8	230°37.2	S14°34.6			Sirius	258°28.4
19	212°41.7	133°26.5	02.4	181°07.5	52.5	204°42.1	59.8	245°39.7	34.7			Adhara	255°07.9
20	227°44.1	148°25.7	02.8	196°08.3	53.0	219°44.4	59.9	260°42.3	34.7			Procyon	244°53.3
21	242°46.6	163°24.9	· · 03.1	211°09.1	· · 53.6	234°46.8	01°59.9	275°44.9	· · 34.8			Pollux	243°20.2
22	257°49.1	178°24.2	03.4	226°09.9	54.2	249°49.1	02°00.0	290°47.5	34.8			Avior	234°16.2
23	272°51.5	193°23.4	03.7	241°10.7	54.8	264°51.4	00.0	305°50.1	34.9			Suhail	222°48.2
Mer.pass. 04:52		ν -0.8° d 0.3° m -3.91	ν 0.8° d 0.6° m 0.34	ν 2.3° d 0.1° m -2.48	ν 2.6° d -0.0° m 0.51							Miaplacidus	221°39.5
Mer.pass. 04:52		ν -0.8° d 0.3° m -3.91	ν 0.8° d 0.6° m 0.34	ν 2.3° d 0.1° m -2.48	ν 2.6° d -0.0° m 0.51							Alphard	217°50.1
Mer.pass. 04:52		ν -0.8° d 0.3° m -3.91	ν 0.8° d 0.6° m 0.34	ν 2.3° d 0.1° m -2.48	ν 2.6° d -0.0° m 0.51							Regulus	207°36.9
Mer.pass. 04:52		ν -0.8° d 0.3° m -3.91	ν 0.8° d 0.6° m 0.34	ν 2.3° d 0.1° m -2.48	ν 2.6° d -0.0° m 0.51							Dubhe	193°43.9
Mer.pass. 04:52		ν -0.8° d 0.3° m -3.91	ν 0.8° d 0.6° m 0.34	ν 2.3° d 0.1° m -2.48	ν 2.6° d -0.0° m 0.51							Denebola	182°27.2
Mer.pass. 04:52		ν -0.8° d 0.3° m -3.91	ν 0.8° d 0.6° m 0.34	ν 2.3° d 0.1° m -2.48	ν 2.6° d -0.0° m 0.51							Gienah	175°45.8
Mer.pass. 04:52		ν -0.8° d 0.3° m -3.91	ν 0.8° d 0.6° m 0.34	ν 2.3° d 0.1° m -2.48	ν 2.6° d -0.0° m 0.51							Acrua	173°02.5
Mer.pass. 04:52		ν -0.8° d 0.3° m -3.91	ν 0.8° d 0.6° m 0.34	ν 2.3° d 0.1° m -2.48	ν 2.6° d -0.0° m 0.51							Gacrux	171°54.0
Mer.pass. 04:52		ν -0.8° d 0.3° m -3.91	ν 0.8° d 0.6° m 0.34	ν 2.3° d 0.1° m -2.48	ν 2.6° d -0.0° m 0.51							Alioth	166°14.9
Mer.pass. 04:52		ν -0.8° d 0.3° m -3.91	ν 0.8° d 0.6° m 0.34	ν 2.3° d 0.1° m -2.48	ν 2.6° d -0.0° m 0.51							Spica	158°24.4
Mer.pass. 04:52		ν -0.8° d 0.3° m -3.91	ν 0.8° d 0.6° m 0.34	ν 2.3° d 0.1° m -2.48	ν 2.6° d -0.0° m 0.51							Alkaid	152°53.6
Mer.pass. 04:52		ν -0.8° d 0.3° m -3.91	ν 0.8° d 0.6° m 0.34	ν 2.3° d 0.1° m -2.48	ν 2.6° d -0.0° m 0.51							Hadar	148°38.7
Mer.pass. 04:52		ν -0.8° d 0.3° m -3.91	ν 0.8° d 0.6° m 0.34	ν 2.3° d 0.1° m -2.48	ν 2.6° d -0.0° m 0.51							Menkent	147°59.9
Mer.pass. 04:52		ν -0.8° d 0.3° m -3.91	ν 0.8° d 0.6° m 0.34	ν 2.3° d 0.1° m -2.48	ν 2.6° d -0.0° m 0.51							Arcturus	145°49.7
Mer.pass. 04:52		ν -0.8° d 0.3° m -3.91	ν 0.8° d 0.6° m 0.34	ν 2.3° d 0.1° m -2.48	ν 2.6° d -0.0° m 0.51							Rigel Kent.	139°42.9
Mer.pass. 04:52		ν -0.8° d 0.3° m -3.91	ν 0.8° d 0.6° m 0.34	ν 2.3° d 0.1° m -2.48	ν 2.6° d -0.0° m 0.51							Kochab	137°19.3
Mer.pass. 04:52		ν -0.8° d 0.3° m -3.91	ν 0.8° d 0.6° m 0.34	ν 2.3° d 0.1° m -2.48	ν 2.6° d -0.0° m 0.51							Zuben' ubi	136°58.1
Mer.pass. 04:52		ν -0.8° d 0.3° m -3.91	ν 0.8° d 0.6° m 0.34	ν 2.3° d 0.1° m -2.48	ν 2.6° d -0.0° m 0.51							Alphecca	126°05.3
Mer.pass. 04:52		ν -0.8° d 0.3° m -3.91	ν 0.8° d 0.6° m 0.34	ν 2.3° d 0.1° m -2.48	ν 2.6° d -0.0° m 0.51							Antares	112°18.1
Mer.pass. 04:52		ν -0.8° d 0.3° m -3.91	ν 0.8° d 0.6° m 0.34	ν 2.3° d 0.1° m -2.48	ν 2.6° d -0.0° m 0.51							Atria	107°13.7
Mer.pass. 04:52		ν -0.8° d 0.3° m -3.91	ν 0.8° d 0.6° m 0.34	ν 2.3° d 0.1° m -2.48	ν 2.6° d -0.0° m 0.51							Sabik	102°04.8
Mer.pass. 04:52		ν -0.8° d 0.3° m -3.91	ν 0.8° d 0.6° m 0.34	ν 2.3° d 0.1° m -2.48	ν 2.6° d -0.0° m 0.51							Shaula	96°12.8
Mer.pass. 04:52		ν -0.8° d 0.3° m -3.91	ν 0.8° d 0.6° m 0.34	ν 2.3° d 0.1° m -2.48	ν 2.6° d -0.0° m 0.51							Rasalhague	96°00.1
Mer.pass. 04:52		ν -0.8° d 0.3° m -3.91	ν 0.8° d 0.6° m 0.34	ν 2.3° d 0.1° m -2.48	ν 2.6° d -0.0° m 0.51							Eltanin	90°42.6
Mer.pass. 04:52		ν -0.8° d 0.3° m -3.91	ν 0.8° d 0.6° m 0.34	ν 2.3° d 0.1° m -2.48	ν 2.6° d -0.0° m 0.51							Kaus Aust.	83°34.9
Mer.pass. 04:52		ν -0.8° d 0.3° m -3.91	ν 0.8° d 0.6° m 0.34	ν 2.3° d 0.1° m -2.48	ν 2.6° d -0.0° m 0.51							Vega	80°34.2
Mer.pass. 04:52		ν -0.8° d 0.3° m -3.91	ν 0.8° d 0.6° m 0.34	ν 2.3° d 0.1° m -2.48	ν 2.6° d -0.0° m 0.51							Nunki	75°49.9
Mer.pass. 04:52		ν -0.8° d 0.3° m -3.91	ν 0.8° d 0.6° m 0.34	ν 2.3° d 0.1° m -2.48	ν 2.6° d -0.0° m 0.51							Altair	62°01.6
Mer.pass. 04:52		ν -0.8° d 0.3° m -3.91	ν 0.8° d 0.6° m 0.34	ν 2.3° d 0.1° m -2.48	ν 2.6° d -0.0° m 0.51							Peacock	53°08.4
Mer.pass. 04:52		ν -0.8° d 0.3° m -3.91	ν 0.8° d 0.6° m 0.34	ν 2.3° d 0.1° m -2.48	ν 2.6° d -0.0° m 0.51							Deneb	49°26.8
Mer.pass. 04:52		ν -0.8° d 0.3° m -3.91	ν 0.8° d 0.6° m 0.34	ν 2.3° d 0.1° m -2.48	ν 2.6° d -0.0° m 0.51							Enif	33°40.6
Mer.pass. 04:52		ν -0.8° d 0.3° m -3.91	ν 0.8° d 0.6° m 0.34	ν 2.3° d 0.1° m -2.48	ν 2.6° d -0.0° m 0.51							Al Na'ir	27°35.2
Mer.pass. 04:52		ν -0.8° d 0.3° m -3.91	ν 0.8° d 0.6° m 0.34	ν 2.3° d 0.1° m -2.48	ν 2.6° d -0.0° m 0.51							Fomalhaut	15°16.6
Mer.pass. 04:52		ν -0.8° d 0.3° m -3.91	ν 0.8° d 0.6° m 0.34	ν 2.3° d 0.1° m -2.48	ν 2.6° d -0.0° m 0.51							Scheat	13°47.0
Mer.pass. 04:52		ν -0.8° d 0.3° m -3.91	ν 0.8° d 0.6° m 0.34	ν 2.3° d 0.1° m -2.48	ν 2.6° d -0.0° m 0.51							Markab	13°31.8
Jul 09 Sat		SHA	Mer.pass										
Venus		281°45.9	10:06										
Mars		328°57.3	06:56										
Jupiter		352°03.2	05:23										
Saturn		32°55.8	02:40										
Jul 10 Sun		SHA	Mer.pass										
Venus		280°28.7	10:07										
Mars		328°17.5	06:55										
Jupiter		351°59.7	05:20										
Saturn		32°58.7	02:36										
Jul 11 Mon		SHA	Mer.pass										
Venus		279°11.3	10:08		</								

DUT1 = UT1-UTC = -0.0620 sec  $\Delta T = TT-UT1 = +69.2460$  sec

2022 July 09 to Jul. 11 UT

h		Sun		Moon				
Sat		GHA	Dec	GHA	$\nu$	Dec	d	HP
0	178°41.8	N22°22.9	68°18.8	10.3'	S14°10.6	-13.7'	58.8'	
1	193°41.7	22.6	82°48.1	10.2'	14°24.3	-13.6'	58.8'	
2	208°41.6	22.3	97°17.3	10.1'	14°37.9	-13.6'	58.8'	
3	223°41.6	22.0	111°46.4	10.0'	14°51.5	-13.5'	58.9'	
4	238°41.5	21.7	126°15.4	9.9'	15°05.0	-13.4'	58.9'	
5	253°41.4	21.4	140°44.3	9.7'	15°18.4	-13.4'	59.0'	
6	268°41.3	N22°21.1	155°13.0	9.6'	S15°31.8	-13.3'	59.0'	
7	283°41.2	20.8	169°41.6	9.5'	15°45.1	-13.2'	59.0'	
8	298°41.1	20.5	184°10.2	9.4'	15°58.3	-13.2'	59.1'	
9	313°41.0	20.2	198°38.5	9.3'	16°11.5	-13.1'	59.1'	
10	328°40.9	19.9	213°06.8	9.2'	16°24.6	-13.0'	59.1'	
11	343°40.8	19.6	227°35.0	9.0'	16°37.6	-12.9'	59.2'	
12	358°40.7	N22°19.3	242°03.0	8.9'	S16°50.5	-12.9'	59.2'	
13	13°40.6	19.0	256°30.9	8.8'	17°03.4	-12.8'	59.3'	
14	28°40.5	18.7	270°58.7	8.7'	17°16.2	-12.7'	59.3'	
15	43°40.5	18.4	285°26.3	8.5'	17°28.9	-12.6'	59.3'	
16	58°40.4	18.1	299°53.9	8.4'	17°41.5	-12.5'	59.4'	
17	73°40.3	17.8	314°21.3	8.3'	17°54.0	-12.4'	59.4'	
18	88°40.2	N22°17.5	328°48.5	8.1'	S18°06.4	-12.3'	59.4'	
19	103°40.1	17.2	343°15.7	8.0'	18°18.7	-12.2'	59.5'	
20	118°40.0	16.8	357°42.7	7.9'	18°31.0	-12.1'	59.5'	
21	133°39.9	16.5	12°09.6	7.8'	18°43.1	-12.1'	59.5'	
22	148°39.8	16.2	26°36.4	7.6'	18°55.2	-12.0'	59.6'	
23	163°39.7	15.9	41°03.0	7.5'	19°07.1	-11.9'	59.6'	
		SD = 15.7'		d = -0.3'		SD = 16.0'		
Sun		GHA	Dec	GHA	$\nu$	Dec	d	HP
0	178°39.7	N22°15.6	55°29.5	7.4'	S19°19.0	-11.7'	59.7'	
1	193°39.6	15.3	69°55.8	7.2'	19°30.7	-11.6'	59.7'	
2	208°39.5	15.0	84°22.1	7.1'	19°42.4	-11.5'	59.7'	
3	223°39.4	14.7	98°48.2	7.0'	19°53.9	-11.4'	59.8'	
4	238°39.3	14.3	113°14.2	6.8'	20°05.3	-11.3'	59.8'	
5	253°39.2	14.0	127°40.0	6.7'	20°16.7	-11.2'	59.8'	
6	268°39.1	N22°13.7	142°05.7	6.6'	S20°27.9	-11.1'	59.9'	
7	283°39.0	13.4	156°31.3	6.4'	20°38.9	-11.0'	59.9'	
8	298°39.0	13.1	170°56.7	6.3'	20°49.9	-10.8'	59.9'	
9	313°38.9	12.8	185°22.0	6.2'	21°00.7	-10.7'	60.0'	
10	328°38.8	12.4	199°47.2	6.0'	21°11.5	-10.6'	60.0'	
11	343°38.7	12.1	214°12.2	5.9'	21°22.1	-10.5'	60.0'	
12	358°38.6	N22°11.8	228°37.1	5.8'	S21°32.5	-10.3'	60.1'	
13	13°38.5	11.5	243°01.9	5.6'	21°42.9	-10.2'	60.1'	
14	28°38.4	11.2	257°26.5	5.5'	21°53.1	-10.1'	60.1'	
15	43°38.3	10.8	271°51.0	5.4'	22°03.2	-9.9'	60.2'	
16	58°38.3	10.5	286°15.4	5.2'	22°13.1	-9.8'	60.2'	
17	73°38.2	10.2	300°39.7	5.1'	22°22.9	-9.7'	60.2'	
18	88°38.1	N22°09.9	315°03.8	5.0'	S22°32.6	-9.5'	60.2'	
19	103°38.0	09.5	329°27.7	4.9'	22°42.1	-9.4'	60.3'	
20	118°37.9	09.2	343°51.6	4.7'	22°51.5	-9.2'	60.3'	
21	133°37.8	08.9	358°15.3	4.6'	23°00.7	-9.1'	60.3'	
22	148°37.8	08.6	12°38.9	4.5'	23°09.8	-8.9'	60.4'	
23	163°37.7	08.2	27°02.4	4.3'	23°18.7	-8.8'	60.4'	
		SD = 15.7'		d = -0.3'		SD = 16.3'		
Mon		GHA	Dec	GHA	$\nu$	Dec	d	HP
0	178°37.6	N22°07.9	41°25.7	4.2'	S23°27.5	-8.6'	60.4'	
1	193°37.5	07.6	55°48.9	4.1'	23°36.1	-8.5'	60.4'	
2	208°37.4	07.2	70°12.0	4.0'	23°44.6	-8.3'	60.5'	
3	223°37.3	06.9	84°35.0	3.8'	23°52.9	-8.1'	60.5'	
4	238°37.2	06.6	98°57.8	3.7'	24°01.0	-8.0'	60.5'	
5	253°37.2	06.3	113°20.6	3.6'	24°09.0	-7.8'	60.6'	
6	268°37.1	N22°05.9	127°43.2	3.5'	S24°16.8	-7.7'	60.6'	
7	283°37.0	05.6	142°05.7	3.4'	24°24.5	-7.5'	60.6'	
8	298°36.9	05.3	156°28.0	3.3'	24°32.0	-7.3'	60.6'	
9	313°36.8	04.9	170°50.3	3.1'	24°39.3	-7.1'	60.7'	
10	328°36.8	04.6	185°12.4	3.0'	24°46.4	-7.0'	60.7'	
11	343°36.7	04.3	199°34.5	2.9'	24°53.4	-6.8'	60.7'	
12	358°36.6	N22°03.9	213°56.4	2.8'	S25°00.2	-6.6'	60.7'	
13	13°36.5	03.6	228°18.2	2.7'	25°06.8	-6.4'	60.8'	
14	28°36.4	03.2	242°39.9	2.6'	25°13.2	-6.2'	60.8'	
15	43°36.3	02.9	257°01.5	2.5'	25°19.5	-6.1'	60.8'	
16	58°36.3	02.6	271°23.0	2.4'	25°25.5	-5.9'	60.8'	
17	73°36.2	02.2	285°44.4	2.3'	25°31.4	-5.7'	60.8'	
18	88°36.1	N22°01.9	300°05.7	2.2'	S25°37.1	-5.5'	60.9'	
19	103°36.0	01.6	314°26.9	2.1'	25°42.6	-5.3'	60.9'	
20	118°35.9	01.2	328°48.0	2.0'	25°47.9	-5.1'	60.9'	
21	133°35.9	00.9	343°09.0	1.9'	25°53.1	-4.9'	60.9'	
22	148°35.8	00.5	357°30.0	1.9'	25°58.0	-4.7'	60.9'	
23	163°35.7	00.2	11°50.8	1.8'	26°02.7	-4.5'	61.0'	
		SD = 15.7'		d = -0.3'		SD = 16.5'		

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

**July 12, 13, 14 UT (Tue., Wed., Thu.)**

Aries		Venus		Mars		Jupiter		Saturn		Stars	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec
0	289°52.3	207°45.9	N22°18.2	256°50.3	N11°23.6	281°45.5	N02°02.2	322°57.1	S14°37.4	Alpheratz	357°36.8
1	304°54.7	222°45.2	18.5	271°51.1	24.2	296°47.8	02.3	337°59.7	37.4	Ankaa	353°09.1
2	319°57.2	237°44.4	18.8	286°52.0	24.8	311°50.1	02.3	353°02.3	37.5	Schedar	349°33.2
3	334°59.7	252°43.6	19.0	301°52.8	25.4	326°52.5	02.4	8°04.9	37.5	Diphda	348°49.3
4	350°02.1	267°42.9	19.3	316°53.6	25.9	341°54.8	02.4	23°07.5	37.6	Achernar	335°21.8
5	5°04.6	282°42.1	19.6	331°54.4	26.5	356°57.1	02.4	38°10.0	37.6	Hamal	327°53.6
6	20°07.1	297°41.3	N22°19.8	346°55.2	N11°27.1	11°59.5	N02°02.5	53°12.6	S14°37.7	Polaris	315°12.3
7	35°09.5	312°40.5	20.1	1°56.0	27.7	27°01.8	02.5	68°15.2	37.7	Acamar	315°13.5
8	50°12.0	327°39.8	20.4	16°56.8	28.3	42°04.2	02.6	83°17.8	37.8	Menkar	314°08.4
9	65°14.5	342°39.0	20.6	31°57.6	28.8	57°06.5	02.6	98°20.4	37.8	Mirfak	308°31.5
10	80°16.9	357°38.2	20.9	46°58.4	29.4	72°08.8	02.6	113°23.0	37.9	Aldebaran	290°42.2
11	95°19.4	12°37.4	21.1	61°59.3	30.0	87°11.2	02.7	128°25.6	37.9	Rigel	281°06.1
12	110°21.8	27°36.7	N22°21.4	77°00.1	N11°30.6	102°13.5	N02°02.7	143°28.2	S14°38.0	Capella	280°25.3
13	125°24.3	42°35.9	21.7	92°00.9	31.2	117°15.8	02.8	158°30.8	38.0	Bellatrix	278°25.4
14	140°26.8	57°35.1	21.9	107°01.7	31.7	132°18.2	02.8	173°33.4	38.1	Elnath	278°04.8
15	155°29.2	72°34.3	22.2	122°02.5	32.3	147°20.5	02.8	188°36.0	38.1	Alnilam	275°40.1
16	170°31.7	87°33.6	22.4	137°03.3	32.9	162°22.9	02.9	203°38.6	38.2	Betelgeuse	270°54.6
17	185°34.2	102°32.8	22.7	152°04.1	33.5	177°25.2	02.9	218°41.2	38.2	Canopus	263°53.8
18	200°36.6	117°32.0	N22°22.9	167°04.9	N11°34.1	192°27.5	N02°03.0	233°43.8	S14°38.3	Sirius	258°28.4
19	215°39.1	132°31.2	23.2	182°05.8	34.6	207°29.9	03.0	248°46.4	38.3	Adhara	255°07.9
20	230°41.6	147°30.4	23.4	197°06.6	35.2	222°32.2	03.0	263°49.0	38.4	Procyon	244°53.3
21	245°44.0	162°29.7	23.7	212°07.4	35.8	237°34.6	03.1	278°51.6	38.4	Pollux	243°20.2
22	260°46.5	177°28.9	23.9	227°08.2	36.4	252°36.9	03.1	293°54.2	38.5	Avior	234°16.2
23	275°49.0	192°28.1	24.2	242°09.0	37.0	267°39.3	03.2	308°56.8	38.6	Suhail	222°48.2
Mer.pass. 04:40		ν -0.8° d 0.3' m -3.90		ν 0.8° d 0.6' m 0.31		ν 2.3° d 0.0' m -2.50		ν 2.6° d -0.1' m 0.50		Miaplacidus	
Wed		GHA		GHA		GHA		GHA		Regulus	
0	290°51.4	207°27.3	N22°24.4	257°09.8	N11°37.5	282°41.6	N02°03.2	323°59.4	S14°38.6	Denebola	207°36.9
1	305°53.9	222°26.5	24.6	272°10.6	38.1	297°43.9	03.2	339°02.0	38.7	Gienah	193°44.0
2	320°56.3	237°25.8	24.9	287°11.4	38.7	312°46.3	03.3	354°04.6	38.7	Acru	182°27.2
3	335°58.8	252°25.0	25.1	302°12.2	39.3	327°48.6	03.3	9°07.2	38.8	Gacrux	175°45.8
4	351°01.3	267°24.2	25.4	317°13.1	39.8	342°51.0	03.4	24°09.8	38.8	Alioth	173°02.5
5	6°03.7	282°23.4	25.6	332°13.9	40.4	357°53.3	03.4	39°12.4	38.9	Spica	166°14.9
6	21°06.2	297°22.6	N22°25.9	347°14.7	N11°41.0	12°55.7	N02°03.4	54°15.0	S14°38.9	Alkaid	155°50.6
7	36°08.7	312°21.9	26.1	2°15.5	41.6	27°58.0	03.5	69°17.6	39.0	Hadar	148°38.7
8	51°11.1	327°21.1	26.3	17°16.3	42.1	43°00.3	03.5	84°20.1	39.0	Menkent	147°59.9
9	66°13.6	342°20.3	26.6	32°17.1	42.7	58°02.7	03.6	99°22.7	39.1	Arcturus	145°49.7
10	81°16.1	357°19.5	26.8	47°17.9	43.3	73°05.0	03.6	114°25.3	39.1	Rigil Kent.	139°42.9
11	96°18.5	12°18.7	27.0	62°18.7	43.9	88°07.4	03.6	129°27.9	39.2	Kochab	137°19.3
12	111°21.0	27°18.0	N22°27.3	77°19.6	N11°44.4	103°09.7	N02°03.7	144°30.5	S14°39.2	Zuben 'ubi	136°58.1
13	126°23.5	42°17.2	27.5	92°20.4	45.0	118°12.1	03.7	159°33.1	39.3	Alphecca	126°05.3
14	141°25.9	57°16.4	27.7	107°21.2	45.6	133°14.4	03.7	174°35.7	39.3	Antares	112°18.1
15	156°28.4	72°15.6	27.9	122°22.0	46.2	148°16.8	03.8	189°38.3	39.4	Atria	107°13.7
16	171°30.8	87°14.8	28.2	137°22.8	46.7	163°19.1	03.8	204°40.9	39.4	Sabik	102°04.8
17	186°33.3	102°14.0	28.4	152°23.6	47.3	178°21.5	03.8	219°43.5	39.5	Shaula	96°12.8
18	201°35.8	117°13.3	N22°28.6	167°24.4	N11°47.9	193°23.8	N02°03.9	234°46.1	S14°39.5	Rasalhague	96°00.1
19	216°38.2	132°12.5	28.9	182°25.3	48.5	208°26.1	03.9	249°48.7	39.6	Eltanin	90°42.6
20	231°40.7	147°11.7	29.1	197°26.1	49.0	223°28.5	04.0	264°51.3	39.7	Kaus Aust.	83°34.8
21	246°43.2	162°10.9	29.3	212°26.9	49.6	238°30.8	04.0	279°53.9	39.7	Vega	80°34.2
22	261°45.6	177°10.1	29.5	227°27.7	50.2	253°33.2	04.0	294°56.5	39.8	Nunki	75°49.9
23	276°48.1	192°09.3	29.7	242°28.5	50.7	268°35.5	04.1	309°59.1	39.8	Altair	62°01.6
Mer.pass. 04:36		ν -0.8° d 0.2' m -3.90		ν 0.8° d 0.6' m 0.31		ν 2.3° d 0.0' m -2.51		ν 2.6° d -0.1' m 0.49		Peacock	
Thu		GHA		GHA		GHA		GHA		Deneb	
0	291°50.6	207°08.6	N22°30.0	257°29.3	N11°51.3	283°37.9	N02°04.1	325°01.7	S14°39.9	Fomalhaut	15°16.6
1	306°53.0	222°07.8	30.2	272°30.1	51.9	298°40.2	04.1	340°04.3	39.9	Scheat	13°47.0
2	321°55.5	237°07.0	30.4	287°30.9	52.5	313°42.6	04.2	355°06.9	40.0	Markab	13°31.7
3	336°58.0	252°06.2	30.6	302°31.8	53.0	328°44.9	04.2	10°09.5	40.0	Jul 12 Tue	
4	352°00.4	267°05.4	30.8	317°32.6	53.6	343°47.3	04.2	25°12.1	40.1	Venus	
5	7°02.9	282°04.6	31.0	332°33.4	54.2	358°49.6	04.3	40°14.7	40.1	Mer.pass	
6	22°05.3	297°03.8	N22°31.2	347°34.2	N11°54.7	13°52.0	N02°04.3	55°17.3	S14°40.2	Jul 13 Wed	
7	37°07.8	312°03.1	31.5	2°35.0	55.3	28°54.3	04.4	70°19.9	40.2	Mars	
8	52°10.3	327°02.3	31.7	17°35.8	55.9	43°56.7	04.4	85°22.5	40.3	Jupiter	
9	67°12.7	342°01.5	31.9	32°36.6	56.4	58°59.0	04.4	100°25.1	40.3	Saturn	
10	82°15.2	357°00.7	32.1	47°37.5	57.0	74°01.4	04.5	115°27.7	40.4	Jul 14 Thu	
11	97°17.7	11°59.9	32.3	62°38.3	57.6	89°03.7	04.5	130°30.3	40.5	Venus	
12	112°20.1	26°59.1	N22°32.5	77°39.1	N11°58.2	104°06.1	N02°04.5	145°32.9	S14°40.5	Mer.pass	
13	127°22.6	41°58.3	32.7	92°39.9	58.7	119°08.5	04.6	160°35.5	40.6	Mars	
14	142°25.1	56°57.5	32.9	107°40.7	59.3	134°10.8	04.6	175°38.1	40.6	Jupiter	
15	157°27.5	71°56.8	33.1	122°41.5	59.9	149°13.2	04.6	190°40.7	40.7	Saturn	
16	172°30.0	86°56.0	33.3	137°42.4	60.4	164°15.5	04.7	205°43.3	40.7	Jul 14 Thu	
17	187°32.4	101°55.2	33.5	152°43.2	61.0	179°17.9	04.7	220°45.9	40.8	Venus	
18	202°34.9	116°54.4	N22°33.7	167°44.0	N12°01.6	194°20.2	N02°04.7	235°48.5	S14°40.8	Mer.pass	
19	217°37.4	131°53.6	33.9	182°44.8	62.1	209°22.6	04.8	250°51.1	40.9	Mars	
20	232°39.8	146°52.8	34.1	197°45.6	62.7	224°24.9	04.8	265°53.7	40.9	Jupiter	
21	247°42.3	161°52.0	34.3	212°46.4	63.3	239°27.3	04.8	280°56.3	41.0	Saturn	
22	262°44.8	176°51.2	34.5	227°47.2	63.8	254°29.6	04.9	295°58.9	41.0	Horizontal parallax	
23	277°47.2	191°50.4	34.7	242°48.1	64.4	269°32.0	04.9	311°01.6	41.1	Venus:	
Mer.pass. 04:32		ν -0.8° d 0.2' m -3.90		ν 0.8° d 0.6' m 0.30		ν					

DUT1 = UT1-UTC = -0.0591 sec  $\Delta T = TT-UT1 = +69.2431$  sec

2022 July 12 to Jul. 14 UT

h		Sun		Moon				
Tue		GHA	Dec	GHA	$\nu$	Dec	d	HP
0	178°35.6	N21°59.8	26°11.6	1.7'	\$26°07.3	-4.3'	61.0'	
1	193°35.5	59.5	40°32.3	1.6'	26°11.6	-4.1'	61.0'	
2	208°35.5	59.1	54°52.9	1.5'	26°15.7	-3.9'	61.0'	
3	223°35.4	58.8	69°13.4	1.5'	26°19.7	-3.7'	61.0'	
4	238°35.3	58.5	83°33.9	1.4'	26°23.4	-3.5'	61.1'	
5	253°35.2	58.1	97°54.3	1.3'	26°26.9	-3.3'	61.1'	
6	268°35.2	N21°57.8	112°14.6	1.3'	\$26°30.3	-3.1'	61.1'	
7	283°35.1	57.4	126°34.9	1.2'	26°33.4	-2.9'	61.1'	
8	298°35.0	57.1	140°55.1	1.2'	26°36.3	-2.7'	61.1'	
9	313°34.9	56.7	155°15.3	1.1'	26°39.0	-2.5'	61.1'	
10	328°34.8	56.4	169°35.4	1.1'	26°41.5	-2.3'	61.1'	
11	343°34.8	56.0	183°55.4	1.0'	26°43.8	-2.1'	61.2'	
12	358°34.7	N21°55.7	198°15.4	1.0'	\$26°45.9	-1.9'	61.2'	
13	13°34.6	55.3	212°35.4	0.9'	26°47.8	-1.7'	61.2'	
14	28°34.5	55.0	226°55.3	0.9'	26°49.5	-1.5'	61.2'	
15	43°34.5	54.6	241°15.2	0.9'	26°50.9	-1.2'	61.2'	
16	58°34.4	54.3	255°35.1	0.8'	26°52.2	-1.0'	61.2'	
17	73°34.3	53.9	269°54.9	0.8'	26°53.2	-0.8'	61.2'	
18	88°34.2	N21°53.5	284°14.7	0.8'	\$26°54.0	-0.6'	61.2'	
19	103°34.2	53.2	298°34.5	0.8'	26°54.6	-0.4'	61.2'	
20	118°34.1	52.8	312°54.2	0.7'	26°55.0	-0.2'	61.2'	
21	133°34.0	52.5	327°14.0	0.7'	26°55.2	0.0'	61.3'	
22	148°33.9	52.1	341°33.7	0.7'	26°55.1	0.3'	61.3'	
23	163°33.9	51.8	355°53.4	0.7'	26°54.9	0.5'	61.3'	
		SD = 15.7'		d = -0.3'		SD = 16.6'		
Wed		GHA	Dec	GHA	$\nu$	Dec	d	HP
0	178°33.8	N21°51.4	10°13.1	0.7'	\$26°54.4	0.7'	61.3'	
1	193°33.7	51.0	24°32.9	0.7'	26°53.7	0.9'	61.3'	
2	208°33.6	50.7	38°52.6	0.7'	26°52.8	1.1'	61.3'	
3	223°33.6	50.3	53°12.3	0.7'	26°51.7	1.3'	61.3'	
4	238°33.5	50.0	67°32.1	0.7'	26°50.3	1.5'	61.3'	
5	253°33.4	49.6	81°51.8	0.8'	26°48.8	1.8'	61.3'	
6	268°33.3	N21°49.2	96°11.6	0.8'	\$26°47.0	2.0'	61.3'	
7	283°33.3	48.9	110°31.4	0.8'	26°45.1	2.2'	61.3'	
8	298°33.2	48.5	124°51.2	0.8'	26°42.9	2.4'	61.3'	
9	313°33.1	48.1	139°11.0	0.9'	26°40.5	2.6'	61.3'	
10	328°33.1	47.8	153°30.9	0.9'	26°37.9	2.8'	61.3'	
11	343°33.0	47.4	167°50.8	0.9'	26°35.0	3.0'	61.3'	
12	358°32.9	N21°47.0	182°10.7	1.0'	\$26°32.0	3.2'	61.3'	
13	13°32.8	46.7	196°30.7	1.0'	26°28.7	3.5'	61.3'	
14	28°32.8	46.3	210°50.7	1.1'	26°25.3	3.7'	61.3'	
15	43°32.7	45.9	225°10.8	1.1'	26°21.6	3.9'	61.3'	
16	58°32.6	45.6	239°30.9	1.2'	26°17.7	4.1'	61.3'	
17	73°32.6	45.2	253°51.1	1.2'	26°13.7	4.3'	61.3'	
18	88°32.5	N21°44.8	268°11.3	1.3'	\$26°09.4	4.5'	61.3'	
19	103°32.4	44.4	282°31.6	1.4'	26°04.9	4.7'	61.3'	
20	118°32.3	44.1	296°52.0	1.4'	26°00.2	4.9'	61.3'	
21	133°32.3	43.7	311°12.4	1.5'	25°55.3	5.1'	61.3'	
22	148°32.2	43.3	325°32.9	1.6'	25°50.2	5.3'	61.2'	
23	163°32.1	43.0	339°53.4	1.6'	25°44.9	5.5'	61.2'	
		SD = 15.7'		d = -0.4'		SD = 16.7'		
Thu		GHA	Dec	GHA	$\nu$	Dec	d	HP
0	178°32.1	N21°42.6	354°14.1	1.7'	\$25°39.4	5.7'	61.2'	
1	193°32.0	42.2	8°34.8	1.8'	25°33.7	5.9'	61.2'	
2	208°31.9	41.8	22°55.6	1.9'	25°27.8	6.1'	61.2'	
3	223°31.9	41.4	37°16.5	2.0'	25°21.8	6.3'	61.2'	
4	238°31.8	41.1	51°37.4	2.1'	25°15.5	6.5'	61.2'	
5	253°31.7	40.7	65°58.5	2.1'	25°09.0	6.7'	61.2'	
6	268°31.7	N21°40.3	80°19.6	2.2'	\$25°02.4	6.8'	61.2'	
7	283°31.6	39.9	94°40.9	2.3'	24°55.5	7.0'	61.2'	
8	298°31.5	39.6	109°02.2	2.4'	24°48.5	7.2'	61.1'	
9	313°31.5	39.2	123°23.6	2.5'	24°41.3	7.4'	61.1'	
10	328°31.4	38.8	137°45.1	2.6'	24°33.9	7.6'	61.1'	
11	343°31.3	38.4	152°06.8	2.7'	24°26.3	7.8'	61.1'	
12	358°31.3	N21°38.0	166°28.5	2.8'	\$24°18.6	7.9'	61.1'	
13	13°31.2	37.6	180°50.3	2.9'	24°10.6	8.1'	61.1'	
14	28°31.1	37.3	195°12.3	3.1'	24°02.5	8.3'	61.1'	
15	43°31.1	36.9	209°34.3	3.2'	23°54.2	8.4'	61.0'	
16	58°31.0	36.5	223°56.5	3.3'	23°45.8	8.6'	61.0'	
17	73°30.9	36.1	238°18.8	3.4'	23°37.2	8.8'	61.0'	
18	88°30.9	N21°35.7	252°41.2	3.5'	\$23°28.4	9.0'	61.0'	
19	103°30.8	35.3	267°03.7	3.6'	23°19.4	9.1'	61.0'	
20	118°30.7	34.9	281°26.3	3.7'	23°10.3	9.3'	61.0'	
21	133°30.7	34.6	295°49.0	3.9'	23°01.1	9.4'	60.9'	
22	148°30.6	34.2	310°11.9	4.0'	22°51.6	9.6'	60.9'	
23	163°30.5	33.8	324°34.9	4.1'	22°42.0	9.7'	60.9'	
		SD = 15.7'		d = -0.4'		SD = 16.7'		

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

## July 15, 16, 17 UT (Fri., Sat., Sun.)

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	292°49.7	206°49.6	N22°34.9	257°48.9	N12°05.0	284°34.4	N02°04.9	326°04.2	S14°41.1	Alpheratz	357°36.7	29°12.7					
1	307°52.2	221°48.9	35.1	272°49.7	05.5	299°36.7	05.0	341°06.8	41.2	Ankaa	353°09.1	-42°10.8					
2	322°54.6	236°48.1	35.3	287°50.5	06.1	314°39.1	05.0	356°09.4	41.3	Schedar	349°33.2	56°39.3					
3	337°57.1	251°47.3	.. 35.5	302°51.3	.. 06.7	329°41.4	.. 05.0	11°12.0	.. 41.3	Diphda	348°49.3	-17°51.7					
4	352°59.6	266°46.5	35.6	317°52.1	07.2	344°43.8	05.1	26°14.6	41.4	Achernar	335°21.8	-57°07.1					
5	8°02.0	281°45.7	35.8	332°52.9	07.8	359°46.1	05.1	41°17.2	41.4	Hamal	327°53.6	23°34.0					
6	23°04.5	296°44.9	N22°36.0	347°53.8	N12°08.4	14°48.5	N02°05.1	56°19.8	S14°41.5	Polaris	315°10.9	89°21.2					
7	38°06.9	311°44.1	36.2	2°54.6	08.9	29°50.9	05.2	71°22.4	41.5	Acamar	315°13.5	-40°12.7					
8	53°09.4	326°43.3	36.4	17°55.4	09.5	44°53.2	05.2	86°25.0	41.6	Menkar	314°08.4	4°10.7					
9	68°11.9	341°42.5	.. 36.6	32°56.2	.. 10.1	59°55.6	.. 05.2	101°27.6	.. 41.6	Mirfak	308°31.4	49°56.2					
10	83°14.3	356°41.7	36.8	47°57.0	10.6	74°57.9	05.3	116°30.2	41.7	Aldebaran	290°42.2	16°33.2					
11	98°16.8	11°40.9	36.9	62°57.8	11.2	90°00.3	05.3	131°32.8	41.7	Rigel	281°06.1	-8°10.5					
12	113°19.3	26°40.1	N22°37.1	77°58.7	N12°11.7	105°02.7	N02°05.3	146°35.4	S14°41.8	Capella	280°25.3	46°01.1					
13	128°21.7	41°39.3	37.3	92°59.5	12.3	120°05.0	05.3	161°38.0	41.9	Bellatrix	278°25.4	6°22.2					
14	143°24.2	56°38.5	37.5	108°00.3	12.9	135°07.4	05.4	176°40.6	41.9	Elnath	278°04.8	28°37.5					
15	158°26.7	71°37.8	.. 37.6	123°01.1	.. 13.4	150°09.7	.. 05.4	191°43.2	.. 42.0	Alnilam	275°40.1	-1°11.2					
16	173°29.1	86°37.0	37.8	138°01.9	14.0	165°12.1	05.4	206°45.8	42.0	Betelgeuse	270°54.6	7°24.7					
17	188°31.6	101°36.2	38.0	153°02.7	14.6	180°14.5	05.5	221°48.4	42.1	Canopus	263°53.8	-52°42.3					
18	203°34.1	116°35.4	N22°38.2	168°03.6	N12°15.1	195°16.8	N02°05.5	236°51.0	S14°42.1	Sirius	258°28.4	-16°44.7					
19	218°36.5	131°34.6	38.3	183°04.4	15.7	210°19.2	05.5	251°53.6	42.2	Adhara	255°07.8	-29°00.1					
20	233°39.0	146°33.8	38.5	198°05.2	16.2	225°21.5	05.6	266°56.2	42.2	Procyon	244°53.3	5°10.1					
21	248°41.4	161°33.0	.. 38.7	213°06.0	.. 16.8	240°23.9	.. 05.6	281°58.8	.. 42.3	Pollux	243°20.2	27°58.4					
22	263°43.9	176°32.2	38.8	228°06.8	17.4	255°26.3	05.6	297°01.4	42.3	Avior	234°16.2	-59°34.9					
23	278°46.4	191°31.4	39.0	243°07.6	17.9	270°28.6	05.7	312°04.0	42.4	Suhail	222°48.2	-43°31.4					
Mer.pass. 04:28			ν -0.8' d 0.2' m -3.90	ν 0.8' d 0.6' m 0.29	ν 2.4' d 0.0' m -2.52	ν 2.6' d -0.1' m 0.48	Mer.pass. 04:28			Mer.pass. 04:28			Mer.pass. 04:28				
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	293°48.8	206°30.6	N22°39.2	258°08.5	N12°18.5	285°31.0	N02°05.7	327°06.6	S14°42.5	Denebola	182°27.2	14°27.0					
1	308°51.3	221°29.8	39.3	273°09.3	19.1	300°33.4	05.7	342°09.2	42.5	Gienah	175°45.8	-17°40.0					
2	323°53.8	236°29.0	39.5	288°10.1	19.6	315°35.7	05.7	357°11.9	42.6	Acrua	173°02.5	-63°13.6					
3	338°56.2	251°28.2	.. 39.7	303°10.9	.. 20.2	330°38.1	.. 05.8	12°14.5	.. 42.6	Gacrux	171°54.0	-57°14.5					
4	353°58.7	266°27.4	39.8	318°11.7	20.7	345°40.4	05.8	27°17.1	42.7	Alioth	166°14.9	55°50.6					
5	9°01.2	281°26.6	40.0	333°12.5	21.3	0°42.8	05.8	42°19.7	42.7	Spica	158°24.5	-11°16.7					
6	24°03.6	296°25.8	N22°40.2	348°13.4	N12°21.9	15°45.2	N02°05.9	57°22.3	S14°42.8	Alkaid	152°53.6	49°12.4					
7	39°06.1	311°25.0	40.3	3°14.2	22.4	30°47.5	05.9	72°24.9	42.8	Hadar	148°38.8	-60°29.1					
8	54°08.6	326°24.2	40.5	18°15.0	23.0	45°49.9	05.9	87°27.5	42.9	Menkent	147°59.9	-36°28.9					
9	69°11.0	341°23.4	.. 40.6	33°15.8	.. 23.5	60°52.3	.. 05.9	102°30.1	.. 42.9	Arcturus	145°49.7	19°04.1					
10	84°13.5	356°22.6	40.8	48°16.6	24.1	75°54.6	06.0	117°32.7	43.0	Rigel Kent.	139°42.9	-60°55.9					
11	99°15.9	11°21.8	40.9	63°17.5	24.6	90°57.0	06.0	132°35.3	43.1	Kochab	137°19.4	74°04.1					
12	114°18.4	26°21.0	N22°41.1	78°18.3	N12°25.2	105°59.4	N02°06.0	147°37.9	S14°43.1	Zuben'ubi	136°58.1	-16°08.1					
13	129°20.9	41°20.2	41.2	93°19.1	25.8	121°01.7	06.1	162°40.5	43.2	Alphecca	126°05.3	26°38.5					
14	144°23.3	56°19.4	41.4	108°19.9	26.3	136°04.1	06.1	177°43.1	43.2	Antares	112°18.1	-26°28.9					
15	159°25.8	71°18.6	.. 41.5	123°20.7	.. 26.9	151°06.5	.. 06.1	192°45.7	.. 43.3	Atria	107°13.7	-69°04.2					
16	174°28.3	86°17.8	41.7	138°21.5	27.4	166°08.8	06.1	207°48.3	43.3	Sabik	102°04.8	-15°45.1					
17	189°30.7	101°17.0	41.8	153°22.4	28.0	181°11.2	06.2	222°50.9	43.4	Shaula	96°12.8	-37°07.2					
18	204°33.2	116°16.2	N22°42.0	168°23.2	N12°28.5	196°13.6	N02°06.2	237°53.5	S14°43.4	Rasalhague	96°00.1	12°32.7					
19	219°35.7	131°15.4	42.1	183°24.0	29.1	211°15.9	06.2	252°56.2	43.5	Eltanin	90°42.6	51°29.3					
20	234°38.1	146°14.6	42.3	198°24.8	29.7	226°18.3	06.3	267°58.8	43.5	Kaus Aust.	83°34.8	-34°22.4					
21	249°40.6	161°13.8	.. 42.4	213°25.6	.. 30.2	241°20.7	.. 06.3	283°01.4	.. 43.6	Vega	80°34.2	38°48.3					
22	264°43.0	176°13.0	42.6	228°26.5	30.8	256°23.1	06.3	298°04.0	43.7	Nunki	75°49.9	-26°16.1					
23	279°45.5	191°12.2	42.7	243°27.3	31.3	271°25.4	06.3	313°06.6	43.7	Altair	62°01.6	8°55.7					
Mer.pass. 04:24			ν -0.8' d 0.2' m -3.90	ν 0.8' d 0.6' m 0.28	ν 2.4' d 0.0' m -2.53	ν 2.6' d -0.1' m 0.48	Mer.pass. 04:24			Mer.pass. 04:24			Mer.pass. 04:24				
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	294°48.0	206°11.4	N22°42.8	258°28.1	N12°31.9	286°27.8	N02°06.4	328°09.2	S14°43.8	Jul 15 Fri	273°59.9	10:13					
1	309°50.4	221°10.6	43.0	273°28.9	32.4	301°30.2	06.4	343°11.8	43.8	Venus	324°59.2	06:48					
2	324°52.9	236°09.8	43.1	288°29.7	33.0	316°32.5	06.4	358°14.4	43.9	Mars	351°44.7	05:01					
3	339°55.4	251°09.0	.. 43.3	303°30.5	.. 33.5	331°34.9	.. 06.4	13°17.0	.. 43.9	Jupiter	33°14.5	02:15					
4	354°57.8	266°08.2	43.4	318°31.4	34.1	346°37.3	06.5	28°19.6	44.0	Saturn	272°41.8	10:15					
5	10°00.3	281°07.4	43.5	333°32.2	34.7	1°39.7	06.5	43°22.2	44.0	Jul 16 Sat	324°19.6	06:47					
6	25°02.8	296°06.6	N22°43.7	348°33.0	N12°35.2	16°42.0	N02°06.5	58°24.8	S14°44.1	Jul 16 Sun	351°42.2	04:57					
7	40°05.2	311°05.8	43.8	3°33.8	35.8	31°44.4	06.5	73°27.4	44.2	Venus	271°23.4	10:16					
8	55°07.7	326°05.0	43.9	18°34.6	36.3	46°46.8	06.6	88°30.1	44.2	Mars	323°40.1	06:46					
9	70°10.2	341°04.2	.. 44.0	33°35.5	.. 36.9	61°49.1	.. 06.6	103°32.7	.. 44.3	Jupiter	351°39.8	04:53					
10	85°12.6	356°03.4	44.2	48°36.3	37.4	76°51.5	06.6	118°35.3	44.3	Saturn	33°21.2	02:07					
11	100°15.1	11°02.6	44.3	63°37.1	38.0	91°53.9	06.6	133°37.9	44.4	Jul 17 Sun	280°44.8	04:48					
12	115°17.5	26°01.8	N22°44.4	78°37.9	N12°38.5	106°56.3	N02°06.7	148°40.5	S14°44.4	Horizontal parallax	Venus:	0.1					
13	130°20.0	41°01.0	44.6	93°38.7	39.1	121°58.6	06.7	163°43.1	44.5	Mars	283°58.8	44.8	</td				

DUT1 = UT1-UTC = -0.0553 sec  $\Delta T = TT-UT1 = +69.2393$  sec

2022 July 15 to Jul. 17 UT

h	Sun			Moon			
Fri	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	178°30.5	N21°33.4	338°58.0	4.2'	S22°32.3	9.9'	60.9'
1	193°30.4	33.0	353°21.2	4.3'	22°22.4	10.0'	60.8'
2	208°30.3	32.6	7°44.5	4.5'	22°12.3	10.2'	60.8'
3	223°30.3	.. 32.2	22°08.0	4.6'	22°02.2	10.3'	60.8'
4	238°30.2	31.8	36°31.6	4.7'	21°51.8	10.5'	60.8'
5	253°30.1	31.4	50°55.3	4.8'	21°41.3	10.6'	60.8'
6	268°30.1	N21°31.0	65°19.1	5.0'	S21°30.7	10.8'	60.7'
7	283°30.0	30.6	79°43.1	5.1'	21°19.9	10.9'	60.7'
8	298°30.0	30.2	94°07.2	5.2'	21°09.0	11.0'	60.7'
9	313°29.9	.. 29.9	108°31.5	5.4'	20°58.0	11.2'	60.7'
10	328°29.8	29.5	122°55.8	5.5'	20°46.9	11.3'	60.6'
11	343°29.8	29.1	137°20.3	5.6'	20°35.6	11.4'	60.6'
12	358°29.7	N21°28.7	151°44.9	5.7'	S20°24.1	11.5'	60.6'
13	13°29.7	28.3	166°09.7	5.9'	20°12.6	11.7'	60.6'
14	28°29.6	27.9	180°34.5	6.0'	20°00.9	11.8'	60.5'
15	43°29.5	.. 27.5	194°59.5	6.1'	19°49.1	11.9'	60.5'
16	58°29.5	27.1	209°24.7	6.3'	19°37.2	12.0'	60.5'
17	73°29.4	26.7	223°49.9	6.4'	19°25.2	12.1'	60.4'
18	88°29.3	N21°26.3	238°15.3	6.5'	S19°13.0	12.3'	60.4'
19	103°29.3	25.9	252°40.9	6.7'	19°00.8	12.4'	60.4'
20	118°29.2	25.5	267°06.5	6.8'	18°48.4	12.5'	60.4'
21	133°29.2	.. 25.1	281°32.3	6.9'	18°36.0	12.6'	60.3'
22	148°29.1	24.6	295°58.2	7.0'	18°23.4	12.7'	60.3'
23	163°29.0	24.2	310°24.2	7.2'	18°10.7	12.8'	60.3'
	SD = 15.7'			SD = 16.6'			

Sat	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	178°29.0	N21°23.8	324°50.4	7.3'	S17°57.9	12.9'	60.2'
1	193°28.9	23.4	339°16.7	7.4'	17°45.1	13.0'	60.2'
2	208°28.9	23.0	353°43.1	7.6'	17°32.1	13.1'	60.2'
3	223°28.8	.. 22.6	8°09.7	7.7'	17°19.0	13.2'	60.1'
4	238°28.8	22.2	22°36.4	7.8'	17°05.9	13.2'	60.1'
5	253°28.7	21.8	37°03.2	7.9'	16°52.6	13.3'	60.1'
6	268°28.6	N21°21.4	51°30.1	8.1'	S16°39.3	13.4'	60.0'
7	283°28.6	21.0	65°57.1	8.2'	16°25.9	13.5'	60.0'
8	298°28.5	20.6	80°24.3	8.3'	16°12.4	13.6'	60.0'
9	313°28.5	.. 20.2	94°51.6	8.4'	15°58.8	13.7'	59.9'
10	328°28.4	19.7	109°19.0	8.5'	15°45.1	13.7'	59.9'
11	343°28.4	19.3	123°46.6	8.7'	15°31.4	13.8'	59.9'
12	358°28.3	N21°18.9	138°14.2	8.8'	S15°17.6	13.9'	59.8'
13	13°28.2	18.5	152°42.0	8.9'	15°03.7	14.0'	59.8'
14	28°28.2	18.1	167°09.9	9.0'	14°49.8	14.0'	59.8'
15	43°28.1	.. 17.7	181°37.9	9.1'	14°35.7	14.1'	59.7'
16	58°28.1	17.3	196°06.1	9.3'	14°21.6	14.2'	59.7'
17	73°28.0	16.9	210°34.3	9.4'	14°07.5	14.2'	59.7'
18	88°28.0	N21°16.4	225°02.7	9.5'	S13°53.3	14.3'	59.6'
19	103°27.9	16.0	239°31.2	9.6'	13°39.0	14.3'	59.6'
20	118°27.9	15.6	253°59.8	9.7'	13°24.7	14.4'	59.5'
21	133°27.8	.. 15.2	268°28.5	9.8'	13°10.3	14.4'	59.5'
22	148°27.7	14.8	282°57.3	9.9'	12°55.8	14.5'	59.5'
23	163°27.7	14.3	297°26.2	10.0'	12°41.3	14.5'	59.4'
	SD = 15.7'			SD = 16.4'			

Sun	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	178°27.6	N21°13.9	311°55.3	10.1'	S12°26.8	14.6'	59.4'
1	193°27.6	13.5	326°24.4	10.2'	12°12.2	14.6'	59.4'
2	208°27.5	13.1	340°53.6	10.4'	11°57.5	14.7'	59.3'
3	223°27.5	.. 12.7	355°23.0	10.5'	11°42.9	14.7'	59.3'
4	238°27.4	12.2	9°52.4	10.6'	11°28.1	14.8'	59.2'
5	253°27.4	11.8	24°22.0	10.7'	11°13.3	14.8'	59.2'
6	268°27.3	N21°11.4	38°51.7	10.8'	S10°58.5	14.9'	59.2'
7	283°27.3	11.0	53°21.4	10.9'	10°43.7	14.9'	59.1'
8	298°27.2	10.5	67°51.3	11.0'	10°28.8	14.9'	59.1'
9	313°27.2	.. 10.1	82°21.1	11.1'	10°13.9	15.0'	59.0'
10	328°27.1	09.7	96°51.3	11.1'	09°58.9	15.0'	59.0'
11	343°27.1	09.3	111°21.4	11.2'	09°43.9	15.0'	59.0'
12	358°27.0	N21°08.8	125°51.7	11.3'	S09°28.9	15.0'	58.9'
13	13°27.0	08.4	140°22.0	11.4'	09°13.9	15.1'	58.9'
14	28°26.9	08.0	154°52.4	11.5'	08°58.8	15.1'	58.9'
15	43°26.9	.. 07.5	169°22.9	11.6'	08°43.7	15.1'	58.8'
16	58°26.8	07.1	183°53.6	11.7'	08°28.6	15.1'	58.8'
17	73°26.8	06.7	198°24.2	11.8'	08°13.4	15.2'	58.7'
18	88°26.7	N21°06.2	212°55.0	11.9'	S07°58.3	15.2'	58.7'
19	103°26.7	05.8	227°25.9	11.9'	07°43.1	15.2'	58.7'
20	118°26.6	05.4	241°56.8	12.0'	07°27.9	15.2'	58.6'
21	133°26.6	.. 04.9	256°27.8	12.1'	07°12.7	15.2'	58.6'
22	148°26.5	04.5	270°58.9	12.2'	06°57.4	15.2'	58.5'
23	163°26.5	04.1	285°30.1	12.3'	06°42.2	15.3'	58.5'
	SD = 15.7'			SD = 16.2'			

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

Day	Sun			Moon		
	Eqn.of	Time	Mer.	Mer. Pass.	Upper	Age
	00h	12h	Pass.	Lower	hh:mm	98-85%
15	05:58	06:01	12:06	01:28	13:58	
16	06:04	06:07	12:06	02:26	14:53	
17	06:09	06:12	12:06	03:19	15:44	

**July 18, 19, 20 UT (Mon., Tue., Wed.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	295°47.1	205°52.1	N22°45.9	258°47.8	N12°45.1	287°24.8	N02°07.0	329°11.8	S14°45.1							
1	310°49.6	220°51.3	46.0	273°48.6	45.7	302°27.2	07.0	344°14.4	45.2							
2	325°52.0	235°50.5	46.1	288°49.4	46.2	317°29.5	07.0	359°17.0	45.2							
3	340°54.5	250°49.7	46.2	303°50.2	46.8	332°31.9	07.0	14°19.6	45.3							
4	355°57.0	265°48.9	46.3	318°51.0	47.3	347°34.3	07.1	29°22.2	45.3							
5	10°59.4	280°48.1	46.4	333°51.9	47.9	2°36.7	07.1	44°24.9	45.4							
6	26°01.9	295°47.3	N22°46.5	348°52.7	N12°48.4	17°39.1	N02°07.1	59°27.5	S14°45.4							
7	41°04.4	310°46.5	46.6	3°53.5	49.0	32°41.4	07.1	74°30.1	45.5							
8	56°06.8	325°45.7	46.7	18°54.3	49.5	47°43.8	07.1	89°32.7	45.6							
9	71°09.3	340°44.9	46.8	33°55.2	50.1	62°46.2	07.2	104°35.3	45.6							
10	86°11.8	355°44.1	46.9	48°56.0	50.6	77°48.6	07.2	119°37.9	45.7							
11	101°14.2	10°43.3	47.0	63°56.8	51.2	92°51.0	07.2	134°40.5	45.7							
12	116°16.7	25°42.5	N22°47.1	78°57.6	N12°51.7	107°53.3	N02°07.2	149°43.1	S14°45.8							
13	131°19.1	40°41.7	47.2	93°58.4	52.3	122°55.7	07.3	164°45.7	45.8							
14	146°21.6	55°40.8	47.3	108°59.3	52.8	137°58.1	07.3	179°48.4	45.9							
15	161°24.1	70°40.0	47.4	124°00.1	53.4	153°00.5	07.3	194°51.0	46.0							
16	176°26.5	85°39.2	47.5	139°00.9	53.9	168°02.9	07.3	209°53.6	46.0							
17	191°29.0	100°38.4	47.6	154°01.7	54.5	183°05.3	07.3	224°56.2	46.1							
18	206°31.5	115°37.6	N22°47.7	169°02.6	N12°55.0	198°07.6	N02°07.4	239°58.8	S14°46.1							
19	221°33.9	130°36.8	47.8	184°03.4	55.5	213°10.0	07.4	255°01.4	46.2							
20	236°36.4	145°36.0	47.9	199°04.2	56.1	228°12.4	07.4	270°04.0	46.2							
21	251°38.9	160°35.2	48.0	214°05.0	56.6	243°14.8	07.4	285°06.6	46.3							
22	266°41.3	175°34.4	48.1	229°05.8	57.2	258°17.2	07.4	300°09.2	46.3							
23	281°43.8	190°33.6	48.2	244°06.7	57.7	273°19.6	07.5	315°11.9	46.4							
Mer.pass. 04:16		ν -0.8° d 0.1' m -3.90			ν 0.8° d 0.5' m 0.26			ν 2.4° d 0.0' m -2.55			ν 2.6° d -0.1' m 0.47					
Tue		GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec		
0	296°46.3	205°32.8	N22°48.2	259°07.5	N12°58.3	288°21.9	N02°07.5	330°14.5	S14°46.5							
1	311°48.7	220°32.0	48.3	274°08.3	58.8	303°24.3	07.5	345°17.1	46.5							
2	326°51.2	235°31.1	48.4	289°09.1	59.4	318°26.7	07.5	0°19.7	46.6							
3	341°53.6	250°30.3	48.5	304°10.0	59.9	333°29.1	07.5	15°22.3	46.6							
4	356°56.1	265°29.5	48.6	319°10.8	60.4	348°31.5	07.6	30°24.9	46.7							
5	11°58.6	280°28.7	48.7	334°11.6	01.0	3°33.9	07.6	45°27.5	46.7							
6	27°01.0	295°27.9	N22°48.7	349°12.4	N13°01.5	18°36.3	N02°07.6	60°30.2	S14°46.8							
7	42°03.5	310°27.1	48.8	4°13.2	02.1	33°38.6	07.6	75°32.8	46.9							
8	57°06.0	325°26.3	48.9	19°14.1	02.6	48°41.0	07.6	90°35.4	46.9							
9	72°08.4	340°25.5	49.0	34°14.9	03.1	63°43.4	07.7	105°38.0	47.0							
10	87°10.9	355°24.7	49.0	49°15.7	03.7	78°45.8	07.7	120°40.6	47.0							
11	102°13.4	10°23.8	49.1	64°16.5	04.2	93°48.2	07.7	135°43.2	47.1							
12	117°15.8	25°23.0	N22°49.2	79°17.4	N13°04.8	108°50.6	N02°07.7	150°45.8	S14°47.1							
13	132°18.3	40°22.2	49.3	94°18.2	05.3	123°53.0	07.7	165°48.4	47.2							
14	147°20.7	55°21.4	49.3	109°19.0	05.9	138°55.4	07.8	180°51.1	47.3							
15	162°23.2	70°20.6	49.4	124°19.8	06.4	153°57.8	07.8	195°53.7	47.3							
16	177°25.7	85°19.8	49.5	139°20.7	06.9	169°00.1	07.8	210°56.3	47.4							
17	192°28.1	100°19.0	49.5	154°21.5	07.5	184°02.5	07.8	225°58.9	47.4							
18	207°30.6	115°18.2	N22°49.6	169°22.3	N13°08.0	199°04.9	N02°07.8	241°01.5	S14°47.5							
19	222°33.1	130°17.4	49.7	184°23.1	08.6	214°07.3	07.8	256°04.1	47.5							
20	237°35.5	145°16.5	49.7	199°24.0	09.1	229°09.7	07.9	271°06.7	47.6							
21	252°38.0	160°15.7	49.8	214°24.8	09.6	244°12.1	07.9	286°09.4	47.7							
22	267°40.5	175°14.9	49.9	229°25.6	10.2	259°14.5	07.9	301°12.0	47.7							
23	282°42.9	190°14.1	49.9	244°26.4	10.7	274°16.9	07.9	316°14.6	47.8							
Mer.pass. 04:12		ν -0.8° d 0.1' m -3.90			ν 0.8° d 0.5' m 0.26			ν 2.4° d 0.0' m -2.55			ν 2.6° d -0.1' m 0.46					
Wed		GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec		
0	297°45.4	205°13.3	N22°50.0	259°27.3	N13°11.2	289°19.3	N02°07.9	331°17.2	S14°47.8							
1	312°47.9	220°12.5	50.0	274°28.1	11.8	304°21.7	08.0	346°19.8	47.9							
2	327°50.3	235°11.7	50.1	289°28.9	12.3	319°24.1	08.0	1°22.4	47.9							
3	342°52.8	250°10.9	50.1	304°29.7	12.9	334°26.5	08.0	16°25.0	48.0							
4	357°55.2	265°10.0	50.2	319°30.6	13.4	349°28.8	08.0	31°27.7	48.1							
5	12°57.7	280°09.2	50.2	334°31.4	13.9	4°31.2	08.0	46°30.3	48.1							
6	28°00.2	295°08.4	N22°50.3	349°32.2	N13°14.5	19°33.6	N02°08.0	61°32.9	S14°48.2							
7	43°02.6	310°07.6	50.4	4°33.0	15.0	34°36.0	08.1	76°35.5	48.2							
8	58°05.1	325°06.8	50.4	19°33.9	15.5	49°38.4	08.1	91°38.1	48.3							
9	73°07.6	340°06.0	50.5	34°34.7	16.1	64°40.8	08.1	106°40.7	48.4							
10	88°10.0	355°05.2	50.5	49°35.5	16.6	79°43.2	08.1	121°43.4	48.4							
11	103°12.5	10°04.3	50.5	64°36.3	17.2	94°45.6	08.1	136°46.0	48.5							
12	118°15.0	25°03.5	N22°50.6	79°37.2	N13°17.7	109°48.0	N02°08.1	151°48.6	S14°48.5							
13	133°17.4	40°02.7	50.6	94°38.0	18.2	124°50.4	08.1	166°51.2	48.6							
14	148°19.9	55°01.9	50.7	109°38.8	18.8	139°52.8	08.2	181°53.8	48.6							
15	163°22.4	70°01.1	50.7	124°39.6	19.3	154°55.2	08.2	196°56.4	48.7							
16	178°24.8	85°00.3	50.8	139°40.5	19.8	169°57.6	08.2	211°59.1	48.8							
17	193°27.3	99°59.5	50.8	154°41.3	20.4	185°00.0	08.2	227°01.7	48.8							
18	208°29.7	114°58.6	N22°50.8	169°42.1	N13°20.9	200°02.4	N02°08.2	242°04.3	S14°48.9							
19	223°32.2	129°57.8	50.9	184°42.9	21.4	215°04.8	08.2	257°06.9	48.9							
20	238°34.7	144°57.0	50.9	199°43.8	22.0	230°07.2	08.3	272°09.5	49.0							
21	253°37.1	159°56.2	51.0	214°44.6	22.5	245°09.6	08.3	287°12.1	49.0							
22	268°39.6	174°55.4	51.0	229°45.4	23.0	260°12.0	08.3	302°14.8	49.1							
23	283°42.1	189°54.6	51.0	244°46.2	23.6	275°14.4</										

DUT1 = UT1-UTC = -0.0529 sec  $\Delta T = TT-UT1 = +69.2369$  sec

2022 July 18 to Jul. 20 UT

h		Sun			Moon			
Mon		GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	178°26.4	N21°03.6	300°01.4	12.3'	S06°26.9	15.3'	58.5'	
1	193°26.4	03.2	314°32.7	12.4'	06°11.7	15.3'	58.4'	
2	208°26.3	02.8	329°04.1	12.5'	05°56.4	15.3'	58.4'	
3	223°26.3	.. 02.3	343°35.6	12.6'	05°41.1	15.3'	58.3'	
4	238°26.2	01.9	358°07.2	12.6'	05°25.9	15.3'	58.3'	
5	253°26.2	01.5	12°38.8	12.7'	05°10.6	15.3'	58.3'	
6	268°26.1	N21°01.0	27°10.5	12.8'	S04°55.3	15.3'	58.2'	
7	283°26.1	00.6	41°42.3	12.8'	04°40.0	15.3'	58.2'	
8	298°26.0	21°00.1	56°14.1	12.9'	04°24.7	15.3'	58.1'	
9	313°26.0	20°59.7	70°46.0	13.0'	04°09.4	15.3'	58.1'	
10	328°25.9	59.3	85°17.9	13.0'	03°54.1	15.3'	58.1'	
11	343°25.9	58.8	99°50.0	13.1'	03°38.8	15.3'	58.0'	
12	358°25.9	N20°58.4	114°22.0	13.1'	S03°23.5	15.3'	58.0'	
13	13°25.8	57.9	128°54.2	13.2'	03°08.3	15.3'	57.9'	
14	28°25.8	57.5	143°26.4	13.3'	02°53.0	15.3'	57.9'	
15	43°25.7	.. 57.0	157°58.6	13.3'	02°37.7	15.3'	57.9'	
16	58°25.7	56.6	172°31.0	13.4'	02°22.5	15.2'	57.8'	
17	73°25.6	56.2	187°03.3	13.4'	02°07.3	15.2'	57.8'	
18	88°25.6	N20°55.7	201°35.7	13.5'	S01°52.0	15.2'	57.7'	
19	103°25.5	55.3	216°08.2	13.5'	01°36.8	15.2'	57.7'	
20	118°25.5	54.8	230°40.7	13.6'	01°21.6	15.2'	57.7'	
21	133°25.5	.. 54.4	245°13.3	13.6'	01°06.4	15.2'	57.6'	
22	148°25.4	53.9	259°45.9	13.7'	00°51.3	15.2'	57.6'	
23	163°25.4	53.5	274°18.6	13.7'	00°36.1	15.1'	57.5'	
	SD = 15.7'		SD = 15.9'					

Tue	GHA	Dec	GHA	$\nu$	Dec	$d$	HP	
0	178°25.3	N20°53.0	288°51.3	13.8'	S00°21.0	15.1'	57.5'	
1	193°25.3	52.6	303°24.0	13.8'	S00°05.9	15.1'	57.5'	
2	208°25.2	52.1	317°56.8	13.8'	N00°09.2	15.1'	57.4'	
3	223°25.2	.. 51.7	332°29.7	13.9'	00°24.3	15.0'	57.4'	
4	238°25.2	51.2	347°02.5	13.9'	00°39.4	15.0'	57.3'	
5	253°25.1	50.8	1°35.5	13.9'	00°54.4	15.0'	57.3'	
6	268°25.1	N20°50.3	16°08.4	14.0'	N01°09.4	15.0'	57.3'	
7	283°25.0	49.8	30°41.4	14.0'	01°24.4	14.9'	57.2'	
8	298°25.0	49.4	45°14.4	14.1'	01°39.3	14.9'	57.2'	
9	313°25.0	.. 48.9	59°47.5	14.1'	01°54.2	14.9'	57.2'	
10	328°24.9	48.5	74°20.5	14.1'	02°09.1	14.9'	57.1'	
11	343°24.9	48.0	88°53.7	14.1'	02°24.0	14.8'	57.1'	
12	358°24.8	N20°47.6	103°26.8	14.2'	N02°38.8	14.8'	57.0'	
13	13°24.8	47.1	118°00.0	14.2'	02°53.6	14.8'	57.0'	
14	28°24.7	46.6	132°33.2	14.2'	03°08.4	14.7'	57.0'	
15	43°24.7	.. 46.2	147°06.4	14.2'	03°23.1	14.7'	56.9'	
16	58°24.7	45.7	161°39.6	14.3'	03°37.8	14.7'	56.9'	
17	73°24.6	45.3	176°12.9	14.3'	03°52.5	14.6'	56.9'	
18	88°24.6	N20°44.8	190°46.2	14.3'	N04°07.1	14.6'	56.8'	
19	103°24.6	44.3	205°19.5	14.3'	04°21.7	14.6'	56.8'	
20	118°24.5	43.9	219°52.9	14.4'	04°36.2	14.5'	56.7'	
21	133°24.5	.. 43.4	234°26.2	14.4'	04°50.8	14.5'	56.7'	
22	148°24.4	43.0	248°59.6	14.4'	05°05.2	14.4'	56.7'	
23	163°24.4	42.5	263°33.0	14.4'	05°19.7	14.4'	56.6'	
	SD = 15.7'		SD = 15.7'					

Wed	GHA	Dec	GHA	$\nu$	Dec	$d$	HP	
0	178°24.4	N20°42.0	278°06.4	14.4'	N05°34.1	14.4'	56.6'	
1	193°24.3	41.6	292°39.8	14.4'	05°48.4	14.3'	56.6'	
2	208°24.3	41.1	307°13.2	14.4'	06°02.7	14.3'	56.5'	
3	223°24.3	.. 40.6	321°46.6	14.4'	06°17.0	14.2'	56.5'	
4	238°24.2	40.2	336°20.1	14.5'	06°31.2	14.2'	56.5'	
5	253°24.2	39.7	350°53.5	14.5'	06°45.4	14.1'	56.4'	
6	268°24.1	N20°39.2	5°27.0	14.5'	N06°59.5	14.1'	56.4'	
7	283°24.1	38.8	20°00.5	14.5'	07°13.6	14.0'	56.4'	
8	298°24.1	38.3	34°33.9	14.5'	07°27.6	14.0'	56.3'	
9	313°24.0	.. 37.8	49°07.4	14.5'	07°41.6	13.9'	56.3'	
10	328°24.0	37.3	63°40.9	14.5'	07°55.6	13.9'	56.3'	
11	343°24.0	36.9	78°14.4	14.5'	08°09.4	13.8'	56.2'	
12	358°23.9	N20°36.4	92°47.9	14.5'	N08°23.3	13.8'	56.2'	
13	13°23.9	35.9	107°21.4	14.5'	08°37.1	13.7'	56.2'	
14	28°23.9	35.5	121°54.8	14.5'	08°50.8	13.7'	56.1'	
15	43°23.8	.. 35.0	136°28.3	14.5'	09°04.5	13.6'	56.1'	
16	58°23.8	34.5	151°01.8	14.5'	09°18.1	13.6'	56.1'	
17	73°23.8	34.0	165°35.3	14.5'	09°31.7	13.5'	56.0'	
18	88°23.7	N20°33.6	180°08.7	14.5'	N09°45.2	13.5'	56.0'	
19	103°23.7	33.1	194°42.2	14.5'	09°58.7	13.4'	56.0'	
20	118°23.7	32.6	209°15.7	14.4'	10°12.1	13.3'	55.9'	
21	133°23.6	.. 32.1	223°49.1	14.4'	10°25.4	13.3'	55.9'	
22	148°23.6	31.6	238°22.5	14.4'	10°38.7	13.2'	55.9'	
23	163°23.6	31.2	252°56.0	14.4'	10°51.9	13.2'	55.8'	
	SD = 15.7'		SD = 15.4'					

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

## July 21, 22, 23 UT (Thu., Fri., Sat.)

Aries			Venus			Mars			Jupiter			Saturn			Stars	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	298°44.5	204°53.8	N22°51.1	259°47.1	N13°24.1	290°16.8	N02°08.3	332°20.0	S14°49.2					Alpheratz	357°36.7	
1	313°47.0	219°52.9	51.1	274°47.9	24.6	305°19.2	08.3	347°22.6	49.3					Ankaa	353°09.0	
2	328°49.5	234°52.1	51.1	289°48.7	25.2	320°21.6	08.3	2°25.2	49.3					Schedar	349°33.1	
3	343°51.9	249°51.3	.. 51.1	304°49.6	.. 25.7	335°24.0	.. 08.4	17°27.8	.. 49.4					Diphda	348°49.2	
4	358°54.4	264°50.5	51.2	319°50.4	26.2	350°26.4	08.4	32°30.5	49.5					Achernar	335°21.7	
5	13°56.8	279°49.7	51.2	334°51.2	26.7	5°28.8	08.4	47°33.1	49.5					Hamal	327°53.5	
6	28°59.3	294°48.9	N22°51.2	349°52.0	N13°27.3	20°31.2	N02°08.4	62°35.7	S14°49.6					Polaris	315°08.1	
7	44°01.8	309°48.0	51.2	4°52.9	27.8	35°33.6	08.4	77°38.3	49.6					Acamar	315°13.5	
8	59°04.2	324°47.2	51.3	19°53.7	28.3	50°36.0	08.4	92°40.9	49.7					Menkar	314°08.4	
9	74°06.7	339°46.4	.. 51.3	34°54.5	.. 28.9	65°38.4	.. 08.4	107°43.5	.. 49.7					Mirfak	308°31.4	
10	89°09.2	354°45.6	51.3	49°55.4	29.4	80°40.8	08.4	122°46.2	49.8					Aldebaran	290°42.2	
11	104°11.6	9°44.8	51.3	64°56.2	29.9	95°43.2	08.5	137°48.8	49.9					Rigel	281°06.1	
12	119°14.1	24°44.0	N22°51.3	79°57.0	N13°30.5	110°45.6	N02°08.5	152°51.4	S14°49.9					Capella	280°25.3	
13	134°16.6	39°43.1	51.4	94°57.8	31.0	125°48.0	08.5	167°54.0	50.0					Bellatrix	278°25.3	
14	149°19.0	54°42.3	51.4	109°58.7	31.5	140°50.4	08.5	182°56.6	50.0					Elnath	278°04.7	
15	164°21.5	69°41.5	.. 51.4	124°59.5	.. 32.0	155°52.8	.. 08.5	197°59.3	.. 50.1					Alnilam	275°40.1	
16	179°24.0	84°40.7	51.4	140°00.3	32.6	170°55.2	08.5	213°01.9	50.2					Betelgeuse	270°54.6	
17	194°26.4	99°39.9	51.4	155°01.1	33.1	185°57.6	08.5	228°04.5	50.2					Canopus	263°53.8	
18	209°28.9	114°39.1	N22°51.4	170°02.0	N13°33.6	201°00.0	N02°08.5	243°07.1	S14°50.3					Sirius	258°28.4	
19	224°31.3	129°38.2	51.4	185°02.8	34.2	216°02.4	08.6	258°09.7	50.3					Adhara	255°07.8	
20	239°33.8	144°37.4	51.5	200°03.6	34.7	231°04.8	08.6	273°12.3	50.4					Procyon	244°53.3	
21	254°36.3	159°36.6	.. 51.5	215°04.5	.. 35.2	246°07.3	.. 08.6	288°15.0	.. 50.4					Pollux	243°20.2	
22	269°38.7	174°35.8	51.5	230°05.3	35.7	261°09.7	08.6	303°17.6	50.5					Avior	234°16.2	
23	284°41.2	189°35.0	51.5	245°06.1	36.3	276°12.1	08.6	318°20.2	50.6					Suhail	222°48.2	
Mer.pass.		04:04	ν -0.8° d 0.0' m -3.90			ν 0.8° d 0.5' m 0.24			ν 2.4° d 0.0' m -2.57			ν 2.6° d -0.1' m 0.45			Miaplacidus	
Fri		GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Dubhe	193°44.0
0	299°43.7	204°34.2	N22°51.5	260°07.0	N13°36.8	291°14.5	N02°08.6	333°22.8	S14°50.6					Denebola	182°27.2	
1	314°46.1	219°33.3	51.5	275°07.8	37.3	306°16.9	08.6	349°25.4	50.7					Gienah	175°45.8	
2	329°48.6	234°32.5	51.5	290°08.6	37.8	321°19.3	08.6	3°28.1	50.7					Crux	173°02.6	
3	344°51.1	249°31.7	.. 51.5	305°09.4	.. 38.4	336°21.7	.. 08.6	18°30.7	.. 50.8					Gacrux	171°54.1	
4	359°53.5	264°30.9	51.5	320°10.3	38.9	351°24.1	08.6	33°33.3	50.9					Alioth	166°14.9	
5	14°56.0	279°30.1	51.5	335°11.1	39.4	6°26.5	08.7	48°35.9	50.9					Spica	158°24.5	
6	29°58.5	294°29.2	N22°51.5	350°11.9	N13°39.9	21°28.9	N02°08.7	63°38.5	S14°51.0					Alkaid	152°53.6	
7	45°00.9	309°28.4	51.5	5°12.8	40.5	36°31.3	08.7	78°41.2	51.0					Hadar	148°38.8	
8	60°03.4	324°27.6	51.5	20°13.6	41.0	51°33.7	08.7	93°43.8	51.1					Menkent	148°00.0	
9	75°05.8	339°26.8	.. 51.5	35°14.4	.. 41.5	66°36.2	.. 08.7	108°46.4	.. 51.2					Arcturus	145°49.7	
10	90°08.3	354°26.0	51.5	50°15.3	42.0	81°38.6	08.7	123°49.0	51.2					Rigel Kent.	139°42.9	
11	105°10.8	9°25.2	51.5	65°16.1	42.6	96°41.0	08.7	138°51.6	51.3					Kochab	137°19.5	
12	120°13.2	24°24.3	N22°51.4	80°16.9	N13°43.1	111°43.4	N02°08.7	153°54.3	S14°51.3					Zuben' ubi	136°58.2	
13	135°15.7	39°23.5	51.4	95°17.7	43.6	126°45.8	08.7	168°56.9	51.4					Alphecca	126°05.3	
14	150°18.2	54°22.7	51.4	110°18.6	44.1	141°48.2	08.7	183°59.5	51.4					Antares	112°18.1	
15	165°20.6	69°21.9	.. 51.4	125°19.4	.. 44.7	156°50.6	.. 08.8	199°02.1	.. 51.5					Atria	107°13.7	
16	180°23.1	84°21.1	51.4	140°20.2	45.2	171°53.0	08.8	214°04.7	51.6					Sabik	102°04.8	
17	195°25.6	99°20.2	51.4	155°21.1	45.7	186°55.4	08.8	229°07.4	51.6					Shaula	96°12.8	
18	210°28.0	114°19.4	N22°51.4	170°21.9	N13°46.2	201°57.9	N02°08.8	244°10.0	S14°51.7					Rasalhague	96°00.1	
19	225°30.5	129°18.6	51.4	185°22.7	46.7	217°00.3	08.8	259°12.6	51.7					Eltanin	90°42.7	
20	240°32.9	144°17.8	51.3	200°23.6	47.3	232°02.7	08.8	274°15.2	51.8					Kaus Aust.	83°34.8	
21	255°35.4	159°17.0	.. 51.3	215°24.4	.. 47.8	247°05.1	.. 08.8	289°17.8	.. 51.9					Vega	80°34.2	
22	270°37.9	174°16.1	51.3	230°25.2	48.3	262°07.5	08.8	304°20.5	51.9					Nunki	75°49.9	
23	285°40.3	189°15.3	51.3	245°26.1	48.8	277°09.9	08.8	319°23.1	52.0					Altair	62°01.6	
Mer.pass.		04:00	ν -0.8° d 0.0' m -3.90			ν 0.8° d 0.5' m 0.23			ν 2.4° d 0.0' m -2.58			ν 2.6° d -0.1' m 0.45			Peacock	
Sat		GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Fomalhaut	15°16.5
0	300°42.8	204°14.5	N22°51.3	260°26.9	N13°49.4	292°12.3	N02°08.8	334°25.7	S14°52.0					Scheat	13°46.9	
1	315°45.3	219°13.7	51.2	275°27.7	49.9	307°14.8	08.8	349°28.3	52.1					Markab	13°31.7	
2	330°47.7	234°12.9	51.2	290°28.6	50.4	322°17.2	08.8	4°31.0	52.2					15°19.5		
3	345°50.2	249°12.0	.. 51.2	305°29.4	.. 50.9	337°19.6	.. 08.9	19°33.6	.. 52.2					Jul 21 Thu	SHA	
4	0°52.7	264°11.2	51.1	320°30.2	51.4	352°22.0	08.9	34°36.2	52.3					Venus	266°09.2	
5	15°55.1	279°10.4	51.1	335°31.0	52.0	7°24.4	08.9	49°38.8	52.3					Mars	321°02.5	
6	30°57.6	294°09.6	N22°51.1	350°31.9	N13°52.5	22°26.8	N02°08.9	64°41.4	S14°52.4					Jupiter	351°32.3	
7	46°00.1	309°08.8	51.1	5°32.7	53.0	37°29.3	08.9	79°44.1	52.5					Saturn	33°35.5	
8	61°02.5	324°07.9	51.0	20°33.5	53.5	52°31.7	08.9	94°46.7	52.5					Jul 22 Fri	SHA	
9	76°05.0	339°07.1	.. 51.0	35°34.4	.. 54.0	67°34.1	.. 08.9	109°49.3	.. 52.6					Venus	264°50.5	
10	91°07.4	354°06.3	51.0	50°35.2	54.5	82°36.5	08.9	124°51.9	52.6					Mars	320°23.3	
11	106°09.9	9°05.5	50.9	65°36.0	55.1	97°38.9	08.9	139°54.6	52.7					Jupiter	351°30.8	
12	121°12.4	24°04.7	N22°50.9	80°36.9	N13°55.6	112°41.3	N02°08.9	154°57.2	S14°52.7					Saturn	33°39.2	
13	136°14.8	39°03.8	50.9	95°37.7	56.1	127°43.8	08.9	169°59.8	52.8					Jul 23 Sat	SHA	
14	151°17.3	54°03.0	50.8	110°38.5	56.6	142°46.2	08.9	185°02.4	52.9					Venus	263°31.7	
15	166°19.8	69°02.2	.. 50.8	125°39.4	.. 57.1	157°48.6	.. 08.9	200°05.0	.. 52.9					Mars	319°44.1	
16	181°22.2	84°01.4	50.7	140°40.2	57.6	172°51.0	08.9	215°07.7	53.0					Jupiter	351°	

DUT1 = UT1-UTC = -0.0509 sec  $\Delta T = TT-UT1 = +69.2349$  sec

2022 July 21 to Jul. 23 UT

h		Sun		Moon				Lat.		Twilight		Sunrise		Sunset		Twilight	
Thu		GHA	Dec	GHA	$\nu$	Dec	$d$	HP	Naut.	Civil					Civil	Naut.	
0		178°23.5	N20°30.7	267°29.4	14.4'	N11°05.1	13.1'	55.8'	N 72°	□	□	□	□	□	□	□	
1		193°23.5	30.2	282°02.8	14.4'	11°18.2	13.0'	55.8'	N 70°	□	□	□	□	□	□	□	
2		208°23.5	29.7	296°36.2	14.4'	11°31.2	13.0'	55.7'	68°	--	--	01:14	22:52	--	--	--	
3		223°23.4	29.3	311°09.6	14.4'	11°44.2	12.9'	55.7'	66°	--	--	02:05	22:04	--	--	--	
4		238°23.4	28.8	325°42.9	14.3'	11°57.1	12.9'	55.7'	64°	--	--	02:36	21:34	--	--	--	
5		253°23.4	28.3	340°16.3	14.3'	12°10.0	12.8'	55.7'	62°	--	01:31	02:59	21:12	22:38	--		
6		268°23.4	N20°27.8	354°49.6	14.3'	N12°22.8	12.7'	55.6'	60°	--	02:08	03:18	20:54	22:03	--		
7		283°23.3	27.3	9°22.9	14.3'	12°35.5	12.7'	55.6'	N 58°	--	02:33	03:33	20:39	21:38	--		
8		298°23.3	26.8	23°56.2	14.3'	12°48.2	12.6'	55.6'	56°	01:23	02:53	03:46	20:26	21:18	22:46		
9		313°23.3	26.4	38°29.5	14.3'	13°00.8	12.5'	55.5'	54°	01:57	03:09	03:57	20:15	21:02	22:14		
10		328°23.2	25.9	53°02.7	14.2'	13°13.3	12.5'	55.5'	52°	02:21	03:23	04:07	20:05	20:49	21:50		
11		343°23.2	25.4	67°36.0	14.2'	13°25.8	12.4'	55.5'	50°	02:39	03:35	04:16	19:56	20:37	21:32		
12		358°23.2	N20°24.9	82°09.2	14.2'	N13°38.2	12.3'	55.5'	45°	03:14	03:59	04:34	19:38	20:13	20:58		
13		13°23.1	24.4	96°42.4	14.2'	13°50.5	12.3'	55.4'	N 40°	03:39	04:18	04:49	19:23	19:54	20:33		
14		28°23.1	23.9	111°15.5	14.1'	14°02.7	12.2'	55.4'	35°	03:59	04:33	05:02	19:11	19:39	20:14		
15		43°23.1	23.4	125°48.7	14.1'	14°14.9	12.1'	55.4'	30°	04:15	04:47	05:13	19:00	19:26	19:58		
16		58°23.1	22.9	140°21.8	14.1'	14°27.0	12.0'	55.3'	20°	04:40	05:08	05:32	18:41	19:05	19:33		
17		73°23.0	22.5	154°54.9	14.1'	14°39.1	12.0'	55.3'	N 10°	04:59	05:25	05:48	18:25	18:47	19:14		
18		88°23.0	N20°22.0	169°28.0	14.0'	N14°51.0	11.9'	55.3'	0°	05:15	05:41	06:03	18:10	18:32	18:58		
19		103°23.0	21.5	184°01.0	14.0'	15°02.9	11.8'	55.3'	S 10°	05:30	05:55	06:18	17:55	18:18	18:43		
20		118°23.0	21.0	198°34.0	14.0'	15°14.8	11.7'	55.2'	20°	05:43	06:10	06:34	17:40	18:03	18:30		
21		133°22.9	20.5	213°07.0	13.9'	15°26.5	11.7'	55.2'	30°	05:57	06:26	06:52	17:22	17:47	18:17		
22		148°22.9	20.0	227°39.9	13.9'	15°38.2	11.6'	55.2'	35°	06:04	06:35	07:02	17:11	17:39	18:10		
23		163°22.9	19.5	242°12.8	13.9'	15°49.8	11.5'	55.2'	40°	06:11	06:44	07:14	17:00	17:29	18:02		
		SD = 15.7'		d = -0.5'		SD = 15.2'				45°		06:19		06:55		07:28	
Fri		GHA	Dec	GHA	$\nu$	Dec	$d$	HP	Naut.	Civil					Civil	Naut.	
0		178°22.8	N20°19.0	256°45.7	13.9'	N16°01.3	11.4'	55.1'	N 50°	06:28	07:08	07:45	16:29	17:05	17:45		
1		193°22.8	18.5	271°18.6	13.8'	16°12.7	11.4'	55.1'	52°	06:32	07:14	07:53	16:21	16:59	17:41		
2		208°22.8	18.0	285°51.4	13.8'	16°24.1	11.3'	55.1'	54°	06:37	07:21	08:02	16:12	16:53	17:37		
3		223°22.8	17.5	300°24.2	13.8'	16°35.4	11.2'	55.1'	56°	06:41	07:28	08:12	16:02	16:46	17:32		
4		238°22.7	17.0	314°57.0	13.7'	16°46.6	11.1'	55.0'	58°	06:46	07:36	08:23	15:51	16:38	17:27		
5		253°22.7	16.5	329°29.7	13.7'	16°57.7	11.0'	55.0'	S 60°	06:52	07:45	08:36	15:37	16:29	17:22		
6		268°22.7	N20°16.0	344°02.4	13.7'	N17°08.7	11.0'	55.0'									
7		283°22.7	15.5	358°35.0	13.6'	17°19.7	10.9'	55.0'									
8		298°22.6	15.0	13°07.6	13.6'	17°30.6	10.8'	55.0'									
9		313°22.6	14.5	27°40.2	13.5'	17°41.4	10.7'	54.9'									
10		328°22.6	14.0	42°12.8	13.5'	17°52.1	10.6'	54.9'									
11		343°22.6	13.5	56°45.3	13.5'	18°02.7	10.5'	54.9'									
12		358°22.6	N20°13.0	71°17.7	13.4'	N18°13.3	10.5'	54.9'									
13		13°22.5	12.5	85°50.2	13.4'	18°23.7	10.4'	54.8'									
14		28°22.5	12.0	100°22.5	13.3'	18°34.1	10.3'	54.8'									
15		43°22.5	11.5	114°54.9	13.3'	18°44.4	10.2'	54.8'									
16		58°22.5	11.0	129°27.2	13.3'	18°54.6	10.1'	54.8'									
17		73°22.4	10.5	143°59.5	13.2'	19°04.7	10.0'	54.8'									
18		88°22.4	N20°10.0	158°31.7	13.2'	N19°14.7	9.9'	54.7'									
19		103°22.4	09.5	173°03.9	13.1'	19°24.6	9.8'	54.7'									
20		118°22.4	09.0	187°36.0	13.1'	19°34.5	9.7'	54.7'									
21		133°22.4	08.5	202°08.1	13.1'	19°44.2	9.7'	54.7'									
22		148°22.3	08.0	216°40.2	13.0'	19°53.9	9.6'	54.7'									
23		163°22.3	07.5	231°12.2	13.0'	20°03.5	9.5'	54.6'									
		SD = 15.7'		d = -0.5'		SD = 15.0'				SD = 15.0'		SD = 14.9'		SD = 14.9'		SD = 14.9'	
Sat		GHA	Dec	GHA	$\nu$	Dec	$d$	HP	Naut.	Civil					Civil	Naut.	
0		178°22.3	N20°07.0	245°44.2	12.9'	N20°12.9	9.4'	54.6'	N 50°	20:57	□	□	16:07	□	□	□	
1		193°22.3	06.5	260°16.1	12.9'	20°22.3	9.3'	54.6'	52°	21:31	20:22	15:35	18:19	□	□	□	
2		208°22.3	06.0	274°48.0	12.8'	20°31.6	9.2'	54.6'	54°	21:56	21:22	15:12	17:19	□	□	□	
3		223°22.2	05.5	289°19.9	12.8'	20°40.8	9.1'	54.6'	56°	22:15	21:57	21:24	14:54	16:45	18:56	□	
4		238°22.2	05.0	303°51.7	12.8'	20°49.9	9.0'	54.6'	58°	22:30	22:23	22:13	14:40	16:21	18:08	□	
5		253°22.2	04.4	318°23.4	12.7'	20°58.9	8.9'	54.5'	S 60°	06:52	07:45	08:36	15:37	16:29	17:22	□	
6		268°22.2	N20°03.9	332°55.1	12.7'	N21°07.8	8.8'	54.5'									
7		283°22.2	03.4	347°26.8	12.6'	21°16.6	8.7'	54.5'									
8		298°22.1	02.9	1°58.4	12.6'	21°25.3	8.6'	54.5'									
9		313°22.1	02.4	16°30.0	12.5'	21°33.9	8.5'	54.5'									
10		328°22.1	01.9	31°01.6	12.5'	21°42.4	8.4'	54.5'									
11		343°22.1	01.4	45°33.0	12.4'	21°50.8	8.3'	54.4'									
12		358°22.1	N20°00.9	60°04.5	12.4'	N21°59.1	8.2'	54.4'									
13		13°22.1	20°00.3	74°35.9	12.4'	22°07.3	8.1'	54.4'									
14		28°22.0	19°59.8	89°07.2	12.3'	22°15.4	8.0'	54.4'									
15		43°22.0	• 59.3	103°38.6	12.3'	22°23.4	7.9'	54.4'									
16		58°22.0	58.8	118°09.8	12.2'	22°31.3	7.8'	54.4'									
17		73°22.0	58.3	132°41.0	12.2'	22°39.1	7.7'	54.3'									
18		88°22.0	N19°57.8	147°12.2	12.1'	N22°46.8	7.6'	54.3'									
19		103°22.0	57.2	161°43.4	12.1'	22°54.3	7.5'	54.3'									
20		118°21.9	56.7	176°14.4	12.0'	23°01.8	7.4'	54.3'									
21		133°21.9	• 56.2	190°45.5	12.0'	23°09.2	7.3'	54.3'									
22		148°21.9	55.7	205°16.5	12.0'												

## July 24, 25, 26 UT (Sun., Mon., Tue.)

Aries		Venus		Mars		Jupiter		Saturn		Stars	
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec
0	301°41.9	203°54.8	N22°50.4	260°46.9	N14°01.8	293°10.4	N02°09.0	335°28.7	S14°53.5	Alpheratz	357°36.7
1	316°44.4	218°54.0	50.3	275°47.7	02.3	308°12.8	09.0	350°31.3	53.5	Ankaa	353°09.0
2	331°46.9	233°53.2	50.3	290°48.6	02.8	323°15.2	09.0	5°33.9	53.6	Schedar	349°33.1
3	346°49.3	248°52.4	.. 50.2	305°49.4	.. 03.3	338°17.7	.. 09.0	20°36.5	.. 53.6	Diphda	348°49.2
4	1°51.8	263°51.5	50.2	320°50.2	03.8	353°20.1	09.0	35°39.1	53.7	Achernar	335°21.7
5	16°54.3	278°50.7	50.1	335°51.1	04.3	8°22.5	09.0	50°41.8	53.8	Hamal	327°53.5
6	31°56.7	293°49.9	N22°50.0	350°51.9	N14°04.9	23°24.9	N02°09.0	65°44.4	S14°53.8	Polaris	315°06.4
7	46°59.2	308°49.1	50.0	5°52.7	05.4	38°27.4	09.0	80°47.0	53.9	Acamar	315°13.4
8	62°01.7	323°48.3	49.9	20°53.6	05.9	53°29.8	09.0	95°49.6	53.9	Menkar	314°08.4
9	77°04.1	338°47.4	.. 49.9	35°54.4	.. 06.4	68°32.2	.. 09.0	110°52.3	.. 54.0	Mirfak	308°31.3
10	92°06.6	353°46.6	49.8	50°55.2	06.9	83°34.6	09.0	125°54.9	54.1	Aldebaran	290°42.2
11	107°09.1	8°45.8	49.7	65°56.1	07.4	98°37.1	09.0	140°57.5	54.1	Rigel	281°06.1
12	122°11.5	23°45.0	N22°49.7	80°56.9	N14°07.9	113°39.5	N02°09.0	156°00.1	S14°54.2	Capella	280°25.2
13	137°14.0	38°44.1	49.6	95°57.7	08.4	128°41.9	09.0	171°02.8	54.2	Bellatrix	278°25.3
14	152°16.4	53°43.3	49.5	110°58.6	08.9	143°44.3	09.0	186°05.4	54.3	Elnath	278°04.7
15	167°18.9	68°42.5	.. 49.5	125°59.4	.. 09.5	158°46.8	.. 09.0	201°08.0	.. 54.4	Alnilam	275°40.1
16	182°21.4	83°41.7	49.4	141°00.2	10.0	173°49.2	09.0	216°10.6	54.4	Betelgeuse	270°54.6
17	197°23.8	98°40.9	49.3	156°01.1	10.5	188°51.6	09.0	231°13.3	54.5	Canopus	263°53.8
18	212°26.3	113°40.0	N22°49.3	171°01.9	N14°11.0	203°54.0	N02°09.0	246°15.9	S14°54.5	Sirius	258°28.3
19	227°28.8	128°39.2	49.2	186°02.8	11.5	218°56.5	09.0	261°18.5	54.6	Adhara	255°07.8
20	242°31.2	143°38.4	49.1	201°03.6	12.0	233°58.9	09.0	276°21.1	54.7	Procyon	244°53.3
21	257°33.7	158°37.6	.. 49.1	216°04.4	.. 12.5	249°01.3	.. 09.0	291°23.8	.. 54.7	Pollux	243°20.2
22	272°36.2	173°36.8	49.0	231°05.3	13.0	264°03.8	09.0	306°26.4	54.8	Avior	234°16.2
23	287°38.6	188°35.9	48.9	246°06.1	13.5	279°06.2	09.0	321°29.0	54.8	Suhail	222°48.2
Mer.pass. 03:53		ν -0.8° d -0.1° m -3.90		ν 0.8° d 0.5° m 0.21		ν 2.4° d 0.0° m -2.59		ν 2.6° d -0.1° m 0.44		Miaplacidus	
Mon		GHA		GHA		GHA		GHA		GHA	
0	302°41.1	203°35.1	N22°48.8	261°06.9	N14°14.0	294°08.6	N02°09.0	336°31.6	S14°54.9	Denebola	193°44.0
1	317°43.6	218°34.3	48.7	276°07.8	14.5	309°11.1	09.0	351°34.3	55.0	Gienah	182°27.2
2	332°46.0	233°33.5	48.7	291°08.6	15.1	324°13.5	09.0	6°36.9	55.0	Acrux	175°45.8
3	347°48.5	248°32.7	.. 48.6	306°09.5	.. 15.6	339°15.9	.. 09.0	21°39.5	.. 55.1	Gacrux	173°02.6
4	2°50.9	263°31.8	48.5	321°10.3	16.1	354°18.3	09.0	36°42.1	55.1	Alioth	171°54.1
5	17°53.4	278°31.0	48.4	336°11.1	16.6	9°20.8	09.0	51°44.8	55.2	Spica	166°14.9
6	32°55.9	293°30.2	N22°48.3	351°12.0	N14°17.1	24°23.2	N02°09.0	66°47.4	S14°55.3	Alkaid	158°24.5
7	47°58.3	308°29.4	48.3	6°12.8	17.6	39°25.6	09.0	81°50.0	55.3	Hadar	152°53.7
8	63°00.8	323°28.5	48.2	21°13.6	18.1	54°28.1	09.0	96°52.7	55.4	Menkent	148°00.0
9	78°03.3	338°27.7	.. 48.1	36°14.5	.. 18.6	69°30.5	.. 09.0	111°55.3	.. 55.5	Arcturus	145°49.7
10	93°05.7	353°26.9	48.0	51°15.3	19.1	84°32.9	09.0	126°57.9	55.5	Rigel Kent.	139°43.0
11	108°08.2	8°26.1	47.9	66°16.2	19.6	99°35.4	09.0	142°00.5	55.6	Kochab	137°19.5
12	123°10.7	23°25.3	N22°47.8	81°17.0	N14°20.1	114°37.8	N02°09.0	157°03.2	S14°55.6	Zuben'ubi	136°58.2
13	138°13.1	38°24.4	47.7	96°17.8	20.6	129°40.2	09.0	172°05.8	55.7	Alphecca	126°05.3
14	153°15.6	53°23.6	47.6	111°18.7	21.1	144°42.7	09.0	187°08.4	55.8	Antares	112°18.1
15	168°18.0	68°22.8	.. 47.5	126°19.5	.. 21.6	159°45.1	.. 09.0	202°10.0	.. 55.8	Atria	107°13.7
16	183°20.5	83°22.0	47.4	141°20.4	22.1	174°47.5	09.0	217°13.7	55.9	Sabik	102°04.8
17	198°23.0	98°21.2	47.3	156°21.2	22.6	189°50.0	09.0	232°16.3	55.9	Shaula	96°12.8
18	213°25.4	113°20.3	N22°47.2	171°22.0	N14°23.1	204°52.4	N02°09.0	247°18.9	S14°56.0	Rasalhague	96°00.2
19	228°27.9	128°19.5	47.1	186°22.9	23.7	219°54.8	09.0	262°21.5	56.1	Eltanin	90°42.7
20	243°30.4	143°18.7	47.0	201°23.7	24.2	234°57.3	09.0	277°24.2	56.1	Kaus Aust.	83°34.8
21	258°32.8	158°17.9	.. 46.9	216°24.5	.. 24.7	249°59.7	.. 09.0	292°26.8	.. 56.2	Vega	80°34.2
22	273°35.3	173°17.0	46.8	231°25.4	25.2	265°02.2	09.0	307°29.4	56.2	Nunki	75°49.9
23	288°37.8	188°16.2	46.7	246°26.2	25.7	280°04.6	09.0	322°32.1	56.3	Altair	62°01.6
Mer.pass. 03:49		ν -0.8° d -0.1° m -3.90		ν 0.8° d 0.5° m 0.20		ν 2.4° d 0.0° m -2.60		ν 2.6° d -0.1° m 0.43		Peacock	
Tue		GHA		GHA		GHA		GHA		GHA	
0	303°40.2	203°15.4	N22°46.6	261°27.1	N14°26.2	295°07.0	N02°09.0	337°34.7	S14°56.4	Fomalhaut	15°16.5
1	318°42.7	218°14.6	46.5	276°27.9	26.7	310°09.5	09.0	352°37.3	56.4	Scheat	13°46.9
2	333°45.2	233°13.8	46.4	291°28.7	27.2	325°11.9	09.0	7°39.9	56.5	Markab	13°31.7
3	348°47.6	248°12.9	.. 46.3	306°29.6	.. 27.7	340°14.3	.. 09.0	22°42.6	.. 56.5	Jul 24 Sun	15°19.5
4	3°50.1	263°12.1	46.2	321°30.4	28.2	355°16.8	09.0	37°45.2	56.6	Venus	262°12.9
5	18°52.5	278°11.3	46.1	336°31.3	28.7	10°19.2	09.0	52°47.8	56.7	Mars	319°04.9
6	33°55.0	293°10.5	N22°46.0	351°32.1	N14°29.2	25°21.7	N02°09.0	67°50.4	S14°56.7	Jupiter	351°28.4
7	48°57.5	308°09.7	45.9	6°33.0	29.7	40°24.1	09.0	82°53.1	56.8	Saturn	33°46.7
8	63°59.9	323°08.8	45.7	21°33.8	30.2	55°26.5	09.0	97°55.7	56.8	Jul 25 Mon	01:38
9	79°02.4	338°08.0	.. 45.6	36°34.6	.. 30.7	70°29.0	.. 09.0	112°58.3	.. 56.9	Venus	260°54.0
10	94°04.9	353°07.2	45.5	51°35.5	31.2	85°31.4	09.0	128°01.0	57.0	Mars	318°25.9
11	109°07.3	8°06.4	45.4	66°36.3	31.7	100°33.9	09.0	143°03.6	57.0	Jupiter	351°27.5
12	124°09.8	23°05.6	N22°45.3	81°37.2	N14°32.2	115°36.3	N02°09.0	158°06.2	S14°57.1	Saturn	33°50.6
13	139°12.3	38°04.7	45.2	96°38.0	32.7	130°38.7	09.0	173°08.8	57.2	Jul 26 Tue	01:34
14	154°14.7	53°03.9	45.0	111°38.8	33.2	145°41.2	09.0	188°11.5	57.2	Venus	259°35.2
15	169°17.2	68°03.1	.. 44.9	126°39.7	.. 33.7	160°43.6	.. 09.0	203°14.1	.. 57.3	Mars	317°46.8
16	184°19.7	83°02.3	44.8	141°40.5	34.2	175°46.1	09.0	218°16.7	57.3	Jupiter	351°26.8
17	199°22.1	98°01.4	44.7	156°41.4	34.7	190°48.5	09.0	233°19.4	57.4	Saturn	33°54.5
18	214°24.6	113°00.6	N22°44.5	171°42.2	N14°35.2	205°51.0	N02°09.0	248°22.0	S14°57.5	Horizontal parallax	01:29
19	229°27.0	127°59.8	44.4	186°43.1	35.7	220°53.4	09.0	263°24.6	57.5	Venus:	0.1
20	244°29.5	142°59.0	44.3	201°43.9	36.2	235°55.8	09.0	278°27.2	57.6	Mars:	0.1
21	259°32.0	157°58.2	.. 44.2	216°44.7	.. 36.7	250°58.3	.. 09.0	293°29.9	.. 57.6	July 24, 25, 26 UT (Sun., Mon., Tue.)	01:29
22	274°34.4	172°57.3	44.0	231°45.6	37.1	266°00.7	09.0	308°32.5	57.7	Mer.pass.	01:29
23	289°36.9	187°56.5	43.9	246°46.4	37.6	281°03.2	08.9	323°35.1	57.8	Mer.pass.	01:29
Mer.pass. 03:45		ν -0.8° d -0.1° m -3.90		ν 0.8° d 0.5° m 0.19		ν 2.4° d -0.0° m -2.61		ν 2.6° d -0.1° m			

DUT1 = UT1-UTC = -0.0476 sec  $\Delta T = TT-UT1 = +69.2316$  sec

2022 July 24 to Jul. 26 UT

h		Sun		Moon			
Sun	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	178°21.9	N19°54.6	234°18.3	11.9'	N23°30.6	6.9'	54.3'
1	193°21.9	54.1	248°49.2	11.8'	23°37.6	6.8'	54.2'
2	208°21.9	53.6	263°20.0	11.8'	23°44.4	6.7'	54.2'
3	223°21.8	53.1	277°50.8	11.7'	23°51.1	6.6'	54.2'
4	238°21.8	52.5	292°21.5	11.7'	23°57.7	6.5'	54.2'
5	253°21.8	52.0	306°52.2	11.6'	24°04.2	6.4'	54.2'
6	268°21.8	N19°51.5	321°22.9	11.6'	N24°10.6	6.3'	54.2'
7	283°21.8	51.0	335°53.5	11.6'	24°16.9	6.2'	54.2'
8	298°21.8	50.4	350°24.0	11.5'	24°23.0	6.0'	54.2'
9	313°21.8	49.9	4°54.6	11.5'	24°29.1	5.9'	54.2'
10	328°21.8	49.4	19°25.0	11.4'	24°35.0	5.8'	54.1'
11	343°21.7	48.9	33°55.5	11.4'	24°40.8	5.7'	54.1'
12	358°21.7	N19°48.3	48°25.9	11.4'	N24°46.5	5.6'	54.1'
13	13°21.7	47.8	62°56.2	11.3'	24°52.1	5.5'	54.1'
14	28°21.7	47.3	77°26.5	11.3'	24°57.5	5.3'	54.1'
15	43°21.7	46.7	91°56.8	11.2'	25°02.9	5.2'	54.1'
16	58°21.7	46.2	106°27.1	11.2'	25°08.1	5.1'	54.1'
17	73°21.7	45.7	120°57.3	11.2'	25°13.2	5.0'	54.1'
18	88°21.7	N19°45.1	135°27.4	11.1'	N25°18.2	4.9'	54.1'
19	103°21.7	44.6	149°57.6	11.1'	25°23.1	4.8'	54.1'
20	118°21.7	44.1	164°27.7	11.1'	25°29.7	4.6'	54.1'
21	133°21.6	43.5	178°57.7	11.0'	25°32.5	4.5'	54.0'
22	148°21.6	43.0	193°27.7	11.0'	25°37.0	4.4'	54.0'
23	163°21.6	42.5	207°57.7	11.0'	25°41.4	4.3'	54.0'
		SD = 15.7'	d = -0.5'	SD = 14.8'			
Mon	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	178°21.6	N19°41.9	222°27.7	10.9'	N25°45.7	4.2'	54.0'
1	193°21.6	41.4	236°57.6	10.9'	25°49.9	4.0'	54.0'
2	208°21.6	40.9	251°27.5	10.9'	25°53.9	3.9'	54.0'
3	223°21.6	40.3	265°57.4	10.8'	25°57.8	3.8'	54.0'
4	238°21.6	39.8	280°27.2	10.8'	26°01.6	3.7'	54.0'
5	253°21.6	39.3	294°57.0	10.8'	26°05.3	3.5'	54.0'
6	268°21.6	N19°38.7	309°26.8	10.7'	N26°08.8	3.4'	54.0'
7	283°21.6	38.2	323°56.5	10.7'	26°12.2	3.3'	54.0'
8	298°21.6	37.6	338°26.2	10.7'	26°15.5	3.2'	54.0'
9	313°21.6	37.1	352°55.9	10.7'	26°18.7	3.0'	54.0'
10	328°21.5	36.6	7°25.5	10.6'	26°21.7	2.9'	54.0'
11	343°21.5	36.0	21°55.2	10.6'	26°24.6	2.8'	54.0'
12	358°21.5	N19°35.5	36°24.8	10.6'	N26°27.4	2.7'	54.0'
13	13°21.5	34.9	50°54.4	10.6'	26°30.1	2.5'	54.0'
14	28°21.5	34.4	65°23.9	10.5'	26°32.6	2.4'	53.9'
15	43°21.5	33.8	79°53.5	10.5'	26°35.0	2.3'	53.9'
16	58°21.5	33.3	94°23.0	10.5'	26°37.3	2.2'	53.9'
17	73°21.5	32.8	108°52.5	10.5'	26°39.5	2.0'	53.9'
18	88°21.5	N19°32.2	123°22.0	10.5'	N26°41.5	1.9'	53.9'
19	103°21.5	31.7	137°51.5	10.4'	26°43.4	1.8'	53.9'
20	118°21.5	31.1	152°20.9	10.4'	26°45.2	1.6'	53.9'
21	133°21.5	30.6	166°50.3	10.4'	26°46.9	1.5'	53.9'
22	148°21.5	30.0	181°19.8	10.4'	26°48.4	1.4'	53.9'
23	163°21.5	29.5	195°49.2	10.4'	26°49.8	1.3'	53.9'
		SD = 15.7'	d = -0.5'	SD = 14.7'			
Tue	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	178°21.5	N19°28.9	210°18.6	10.4'	N26°51.0	1.1'	53.9'
1	193°21.5	28.4	224°47.9	10.4'	26°52.2	1.0'	53.9'
2	208°21.5	27.8	239°17.3	10.4'	26°53.2	0.9'	53.9'
3	223°21.5	27.3	253°46.7	10.4'	26°54.1	0.7'	53.9'
4	238°21.5	26.7	268°16.0	10.3'	26°54.8	0.6'	53.9'
5	253°21.5	26.2	282°45.4	10.3'	26°55.4	0.5'	53.9'
6	268°21.5	N19°25.6	297°14.7	10.3'	N26°55.9	0.4'	53.9'
7	283°21.5	25.1	311°44.0	10.3'	26°56.3	0.2'	53.9'
8	298°21.5	24.5	326°13.4	10.3'	26°56.5	0.1'	53.9'
9	313°21.5	24.0	340°42.7	10.3'	26°56.6	-0.0'	53.9'
10	328°21.5	23.4	355°12.0	10.3'	26°56.6	-0.2'	53.9'
11	343°21.5	22.8	9°41.3	10.3'	26°56.4	-0.3'	53.9'
12	358°21.5	N19°22.3	24°10.6	10.3'	N26°56.2	-0.4'	53.9'
13	13°21.5	21.7	38°40.0	10.3'	26°55.7	-0.5'	53.9'
14	28°21.5	21.2	53°09.3	10.3'	26°55.2	-0.7'	53.9'
15	43°21.5	20.6	67°38.6	10.3'	26°54.5	-0.8'	53.9'
16	58°21.5	20.1	82°08.0	10.3'	26°53.7	-0.9'	53.9'
17	73°21.5	19.5	96°37.3	10.3'	26°52.8	-1.1'	53.9'
18	88°21.5	N19°18.9	111°06.6	10.3'	N26°51.7	-1.2'	53.9'
19	103°21.5	18.4	125°36.0	10.4'	26°50.5	-1.3'	53.9'
20	118°21.5	17.8	140°05.3	10.4'	26°49.2	-1.4'	53.9'
21	133°21.5	17.3	154°34.7	10.4'	26°47.8	-1.6'	53.9'
22	148°21.5	16.7	169°04.1	10.4'	26°46.2	-1.7'	53.9'
23	163°21.5	16.1	183°33.5	10.4'	26°44.5	-1.8'	53.9'
		SD = 15.7'	d = -0.5'	SD = 14.7'			

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

## July 27, 28, 29 UT (Wed., Thu., Fri.)

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	304°39.4	202°55.7	N22°43.8	261°47.3	N14°38.1	296°05.6	N02°08.9	338°37.8	S14°57.8								
1	319°41.8	217°54.9	43.6	276°48.1	38.6	311°08.1	08.9	353°40.4	57.9								
2	334°44.3	232°54.1	43.5	291°49.0	39.1	326°10.5	08.9	8°43.0	57.9								
3	349°46.8	247°53.2	· · 43.4	306°49.8	· · 39.6	341°13.0	· · 08.9	23°45.6	· · 58.0								
4	4°49.2	262°52.4	43.2	321°50.6	40.1	356°15.4	08.9	38°48.3	58.1								
5	19°51.7	277°51.6	43.1	336°51.5	40.6	11°17.9	08.9	53°50.9	58.1								
6	34°54.2	292°50.8	N22°43.0	351°52.3	N14°41.1	26°20.3	N02°08.9	68°53.5	S14°58.2								
7	49°56.6	307°50.0	42.8	6°53.2	41.6	41°22.8	08.9	83°56.2	58.3								
8	64°59.1	322°49.1	42.7	21°54.0	42.1	56°25.2	08.9	98°58.8	58.3								
9	80°01.5	337°48.3	· · 42.5	36°54.9	· · 42.6	71°27.6	· · 08.9	114°01.4	· · 58.4								
10	95°04.0	352°47.5	42.4	51°55.7	43.1	86°30.1	08.9	129°04.1	58.4								
11	110°06.5	7°46.7	42.2	66°56.5	43.6	101°32.5	08.9	144°06.7	58.5								
12	125°08.9	22°45.9	N22°42.1	81°57.4	N14°44.1	116°35.0	N02°08.9	159°09.3	S14°58.6								
13	140°11.4	37°45.0	41.9	96°58.2	44.6	131°37.4	08.9	174°11.9	58.6								
14	155°13.9	52°44.2	41.8	111°59.1	45.1	146°39.9	08.9	189°14.6	58.7								
15	170°16.3	67°43.4	· · 41.7	126°59.9	· · 45.5	161°42.3	· · 08.8	204°17.2	· · 58.7								
16	185°18.8	82°42.6	41.5	142°00.8	46.0	176°44.8	08.8	219°19.8	58.8								
17	200°21.3	97°41.8	41.3	157°01.6	46.5	191°47.2	08.8	234°22.5	58.9								
18	215°23.7	112°40.9	N22°41.2	172°02.5	N14°47.0	206°49.7	N02°08.8	249°25.1	S14°58.9								
19	230°26.2	127°40.1	41.0	187°03.3	47.5	221°52.1	08.8	264°27.7	59.0								
20	245°28.7	142°39.3	40.9	202°04.2	48.0	236°54.6	08.8	279°30.4	59.1								
21	260°31.1	157°38.5	· · 40.7	217°05.0	· · 48.5	251°57.0	· · 08.8	294°33.0	· · 59.1								
22	275°33.6	172°37.7	40.6	232°05.8	49.0	266°59.5	08.8	309°35.6	59.2								
23	290°36.0	187°36.8	40.4	247°06.7	49.5	282°01.9	08.8	324°38.3	59.2								
Mer.pass. 03:41			ν -0.8° d -0.1° m -3.90	ν 0.8° d 0.5° m 0.19	ν 2.4° d -0.0° m -2.62	ν 2.6° d -0.1° m 0.43											
Thu			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	305°38.5	202°36.0	N22°40.3	262°07.5	N14°50.0	297°04.4	N02°08.8	339°40.9	S14°59.3								
1	320°41.0	217°35.7	40.1	277°08.4	50.5	312°06.9	08.8	354°43.5	59.4								
2	335°43.4	232°34.4	39.9	292°09.2	50.9	327°09.3	08.8	9°46.1	59.4								
3	350°45.9	247°33.6	· · 39.8	307°10.1	· · 51.4	342°11.8	· · 08.8	24°48.8	· · 59.5								
4	5°48.4	262°32.7	39.6	322°10.9	51.9	357°14.2	08.7	39°51.4	59.6								
5	20°50.8	277°31.9	39.4	337°11.8	52.4	12°16.7	08.7	54°54.0	59.6								
6	35°53.3	292°31.1	N22°39.3	352°12.6	N14°52.9	27°19.1	N02°08.7	69°56.7	S14°59.7								
7	50°55.8	307°30.3	39.1	7°13.5	53.4	42°21.6	08.7	84°59.3	59.7								
8	65°58.2	322°29.5	38.9	22°14.3	53.9	57°24.0	08.7	100°01.9	59.8								
9	81°00.7	337°28.6	· · 38.8	37°15.2	· · 54.4	72°26.5	· · 08.7	115°04.6	· · 59.9								
10	96°03.1	352°27.8	38.6	52°16.0	54.8	87°28.9	08.7	130°07.2	14°59.9								
11	111°05.6	7°27.0	38.4	67°16.9	55.3	102°31.4	08.7	145°09.8	15°00.0								
12	126°08.1	22°26.2	N22°38.3	82°17.7	N14°55.8	117°33.9	N02°08.7	160°12.5	S15°00.0								
13	141°10.5	37°25.4	38.1	97°18.6	56.3	132°36.3	08.7	175°15.1	00.1								
14	156°13.0	52°24.6	37.9	112°19.4	56.8	147°38.8	08.6	190°17.7	00.2								
15	171°15.5	67°23.7	· · 37.7	127°20.2	· · 57.3	162°41.2	· · 08.6	205°20.4	· · 00.2								
16	186°17.9	82°22.9	37.5	142°21.1	57.8	177°43.7	08.6	220°23.0	00.3								
17	201°20.4	97°22.1	37.4	157°21.9	58.3	192°46.1	08.6	235°25.6	00.4								
18	216°22.9	112°21.3	N22°37.2	172°22.8	N14°58.7	207°48.6	N02°08.6	250°28.3	S15°00.4								
19	231°25.3	127°20.5	37.0	187°23.6	59.2	222°51.1	08.6	265°30.9	00.5								
20	246°27.8	142°19.6	36.8	202°24.5	14°59.7	237°53.5	08.6	280°33.5	00.5								
21	261°30.3	157°18.8	· · 36.6	217°25.3	15°00.2	252°56.0	· · 08.6	295°36.1	· · 00.6								
22	276°32.7	172°18.0	36.5	232°26.2	00.7	267°58.4	08.6	310°38.8	00.7								
23	291°35.2	187°17.2	36.3	247°27.0	01.2	283°00.9	08.5	325°41.4	00.7								
Mer.pass. 03:37			ν -0.8° d -0.2° m -3.89	ν 0.8° d 0.5° m 0.18	ν 2.5° d -0.0° m -2.63	ν 2.6° d -0.1° m 0.42											
Fri			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	306°37.6	202°16.4	N22°36.1	262°27.9	N15°01.6	298°03.4	N02°08.5	340°44.0	S15°00.8								
1	321°40.1	217°15.5	35.9	277°28.7	02.1	313°05.8	08.5	355°46.7	00.9								
2	336°42.6	232°14.7	35.7	292°29.6	02.6	328°08.3	08.5	10°49.3	00.9								
3	351°45.0	247°13.9	· · 35.5	307°30.4	· · 03.1	343°10.7	· · 08.5	25°51.9	· · 01.0								
4	6°47.5	262°13.1	35.3	322°31.3	03.6	358°13.2	08.5	40°54.6	01.0								
5	21°50.0	277°12.3	35.1	337°32.1	04.1	13°15.7	08.5	55°57.2	01.1								
6	36°52.4	292°11.5	N22°34.9	352°33.0	N15°04.5	28°18.1	N02°08.5	70°59.8	S15°01.2								
7	51°54.9	307°10.6	34.7	7°33.8	05.0	43°20.6	08.4	86°02.5	01.2								
8	66°57.4	322°09.8	34.5	22°34.7	05.5	58°23.1	08.4	101°05.1	01.3								
9	81°59.8	337°09.0	· · 34.3	37°35.5	· · 06.0	73°25.5	· · 08.4	116°07.7	· · 01.4								
10	97°02.3	352°08.2	34.2	52°36.4	06.5	88°28.0	08.4	131°10.4	01.4								
11	112°04.8	7°07.4	34.0	67°37.2	06.9	103°30.4	08.4	146°13.0	01.5								
12	127°07.2	22°06.6	N22°33.8	82°38.1	N15°07.4	118°32.9	N02°08.4	161°15.6	S15°01.5								
13	142°09.7	37°05.7	33.5	97°38.9	07.9	133°35.4	08.4	176°18.3	01.6								
14	157°12.1	52°04.9	33.3	112°39.8	08.4	148°37.8	08.4	191°20.9	01.7								
15	172°14.6	67°04.1	· · 33.1	127°40.6	· · 08.9	163°40.3	· · 08.3	206°23.5	· · 01.7								
16	187°17.1	82°03.3	32.9	142°41.5	09.3	178°42.8	08.3	221°26.2	01.8								
17	202°19.5	97°02.5	32.7	157°42.4	09.8	193°45.2	08.3	236°28.8	01.8								
18	217°22.0	112°01.7	N22°32.5	172°43.2	N15°10.3	208°47.7	N02°08.3	251°31.4	S15°01.9								
19	232°24.5	127°00.8	32.3	187°44.1	10.8	223°50.2	08.3	266°34.1	02.0								
20	247°26.9	142°00.0	32.1	202°44.9	11.3	238°52.6	08.3	281°36.7	02.0								
21	262°29.4	156°59.2	· · 31.9														

DUT1 = UT1-UTC = -0.0433 sec  $\Delta T = TT-UT1 = +69.2273$  sec

2022 July 27 to Jul. 29 UT

h	Sun		Moon				
Wed	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	178°21.5	N19°15.6	198°02.9	10.4'	N26°42.6	-2.0'	53.9'
1	193°21.5	15.0	212°32.3	10.4'	26°40.7	-2.1'	53.9'
2	208°21.5	14.5	227°01.7	10.4'	26°38.6	-2.2'	53.9'
3	223°21.5	.. 13.9	241°31.2	10.5'	26°36.4	-2.3'	53.9'
4	238°21.5	13.3	256°00.6	10.5'	26°34.0	-2.5'	53.9'
5	253°21.5	12.8	270°30.1	10.5'	26°31.6	-2.6'	53.9'
6	268°21.5	N19°12.2	284°59.6	10.5'	N26°29.0	-2.7'	53.9'
7	283°21.6	11.6	299°29.1	10.5'	26°26.2	-2.9'	53.9'
8	298°21.6	11.1	313°58.7	10.6'	26°23.4	-3.0'	53.9'
9	313°21.6	.. 10.5	328°28.2	10.6'	26°20.4	-3.1'	54.0'
10	328°21.6	09.9	342°57.8	10.6'	26°17.3	-3.2'	54.0'
11	343°21.6	09.4	357°27.4	10.6'	26°14.1	-3.4'	54.0'
12	358°21.6	N19°08.8	11°57.1	10.7'	N26°10.7	-3.5'	54.0'
13	13°21.6	08.2	26°26.7	10.7'	26°07.2	-3.6'	54.0'
14	28°21.6	07.7	40°56.4	10.7'	26°03.6	-3.7'	54.0'
15	43°21.6	.. 07.1	55°26.1	10.7'	25°59.9	-3.9'	54.0'
16	58°21.6	06.5	69°55.9	10.8'	25°56.0	-4.0'	54.0'
17	73°21.6	05.9	84°25.6	10.8'	25°52.0	-4.1'	54.0'
18	88°21.6	N19°05.4	98°55.4	10.8'	N25°47.9	-4.2'	54.0'
19	103°21.6	04.8	113°25.3	10.9'	25°43.7	-4.3'	54.0'
20	118°21.7	04.2	127°55.1	10.9'	25°39.4	-4.5'	54.0'
21	133°21.7	.. 03.6	142°25.0	10.9'	25°34.9	-4.6'	54.0'
22	148°21.7	03.1	156°54.9	11.0'	25°30.3	-4.7'	54.0'
23	163°21.7	02.5	171°24.9	11.0'	25°25.6	-4.8'	54.0'
	SD = 15.7'		SD = 14.7'				

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

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

Day	Sun		Moon	
	Eqn.of	Time	Mer.	Mer.
	00 <sup>h</sup>	12 <sup>h</sup>	Pass.	Pass.
	mm:ss	mm:ss	Upper	Lower
			hh:mm	hh:mm
27	06:34	06:34	12:07	11:11
28	06:33	06:33	12:07	12:00
29	06:32	06:31	12:07	12:48

## July 30, 31, 01 UT (Sat., Sun., Mon.)

Aries			Venus			Mars			Jupiter			Saturn		
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Stars	SHA	Dec
0	307°36.8	201°56.8	N22°31.3	262°48.3	N15°13.2	299°02.5	N02°08.2	341°47.2	S15°02.3			Alpheratz	357°36.6	29°12.8
1	322°39.3	216°55.9	31.0	277°49.2	13.6	314°05.0	08.2	356°49.9	02.3			Ankaa	353°08.9	-42°10.8
2	337°41.7	231°55.1	30.8	292°50.0	14.1	329°07.4	08.2	11°52.5	02.4			Schedar	349°33.0	56°39.4
3	352°44.2	246°54.3	.. 30.6	307°50.9	.. 14.6	344°09.9	.. 08.2	26°55.2	.. 02.5			Diphda	348°49.2	-17°51.7
4	7°46.6	261°53.5	30.4	322°51.7	15.1	359°12.4	08.2	41°57.8	02.5			Achernar	335°21.6	-57°07.1
5	22°49.1	276°52.7	30.2	337°52.6	15.5	14°18.8	08.1	57°00.4	02.6			Hamal	327°53.4	23°34.0
6	37°51.6	291°51.9	N22°29.9	352°53.4	N15°16.0	29°17.3	N02°08.1	72°03.1	S15°02.7			Polaris	315°03.4	89°21.2
7	52°54.0	306°51.1	29.7	7°54.3	16.5	44°19.8	08.1	87°05.7	02.7			Acamar	315°13.4	-40°12.6
8	67°56.5	321°50.2	29.5	22°55.1	17.0	59°22.3	08.1	102°08.3	02.8			Menkar	314°08.3	4°10.7
9	82°59.0	336°49.4	.. 29.3	37°56.0	.. 17.4	74°24.7	.. 08.1	117°11.0	.. 02.8			Mirfak	308°31.3	49°56.2
10	98°01.4	351°48.6	29.1	52°56.9	17.9	89°27.2	08.1	132°13.6	02.9			Aldebaran	290°42.1	16°33.2
11	113°03.9	6°47.8	28.8	67°57.7	18.4	104°29.7	08.0	147°16.2	03.0			Rigel	281°06.0	-8°10.4
12	128°06.4	21°47.0	N22°28.6	82°58.6	N15°18.9	119°32.1	N02°08.0	162°18.9	S15°03.0			Capella	280°25.2	46°01.1
13	143°08.8	36°46.2	28.4	97°59.4	19.3	134°34.6	08.0	177°21.5	03.1			Bellatrix	278°25.3	6°22.2
14	158°11.3	51°45.4	28.1	113°00.3	19.8	149°37.1	08.0	192°24.1	03.2			Elnath	278°04.7	28°37.5
15	173°13.7	66°44.5	.. 27.9	128°01.1	.. 20.3	164°39.6	.. 08.0	207°26.8	.. 03.2			Alnilam	275°40.0	-1°11.2
16	188°16.2	81°43.7	27.7	143°02.0	20.8	179°42.0	08.0	222°29.4	03.3			Betelgeuse	270°54.5	7°24.7
17	203°18.7	96°42.9	27.4	158°02.8	21.2	194°44.5	07.9	237°32.0	03.4			Canopus	263°53.8	-52°42.2
18	218°21.1	111°42.1	N22°27.2	173°03.7	N15°21.7	209°47.0	N02°07.9	252°34.7	S15°03.4			Sirius	258°28.3	-16°44.7
19	233°23.6	126°41.3	27.0	188°04.6	22.2	224°49.5	07.9	267°37.3	03.5			Adhara	255°07.8	-29°00.0
20	248°26.1	141°40.5	26.7	203°05.4	22.6	239°51.9	07.9	282°39.9	03.5			Procyon	244°53.3	5°10.1
21	263°28.5	156°39.7	.. 26.5	218°06.3	.. 23.1	254°54.4	.. 07.9	297°42.6	.. 03.6			Pollux	243°20.1	27°58.4
22	278°31.0	171°38.8	26.3	233°07.1	23.6	269°56.9	07.9	312°45.2	03.7			Avior	234°16.2	-59°34.8
23	293°33.5	186°38.0	26.0	248°08.0	24.1	284°59.3	07.8	327°47.9	03.7			Suhail	222°48.2	-43°31.3
Mer.pass. 03:29		ν -0.8° d -0.2° m -3.89		ν 0.9° d 0.5° m 0.16		ν 2.5° d -0.0° m -2.64		ν 2.6° d -0.1° m 0.41						

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Stars	SHA	Dec
0	308°35.9	201°37.2	N22°25.8	263°08.8	N15°24.5	300°01.8	N02°07.8	342°50.5	S15°03.8			Denebola	182°27.2	14°27.0
1	323°38.4	216°36.4	25.5	278°09.7	25.0	315°04.3	07.8	357°53.1	03.9			Gienah	175°45.8	-17°40.0
2	338°40.9	231°35.6	25.3	293°10.5	25.5	330°06.8	07.8	12°55.8	03.9			Acrux	173°02.7	-63°13.6
3	353°43.3	246°34.8	.. 25.0	308°11.4	.. 25.9	345°09.3	.. 07.8	27°58.4	.. 04.0			Gacrux	171°54.1	-57°14.5
4	8°45.8	261°34.0	24.8	323°12.3	26.4	0°11.7	07.7	43°01.0	04.0			Alioth	166°15.0	55°50.6
5	23°48.2	276°33.2	24.5	338°13.1	26.9	15°14.2	07.7	58°03.7	04.1			Spica	158°24.5	-11°16.7
6	38°50.7	291°32.3	N22°24.3	353°14.0	N15°27.4	30°16.7	N02°07.7	73°06.3	S15°04.2			Alkaid	152°53.7	49°12.4
7	53°53.2	306°31.5	24.1	8°14.8	27.8	45°19.2	07.7	88°08.9	04.2			Hadar	148°38.9	-60°29.1
8	68°55.6	321°30.7	23.8	23°15.7	28.3	60°21.6	07.7	103°11.6	04.3			Menkent	148°00.0	-36°28.9
9	83°58.1	336°29.9	.. 23.6	38°16.5	.. 28.8	75°24.1	.. 07.6	118°14.2	.. 04.4			Arcturus	145°49.8	19°04.1
10	99°00.6	351°29.1	23.3	53°17.4	29.2	90°26.6	07.6	133°16.8	04.4			Rigel Kent.	139°43.0	-60°55.9
11	114°03.0	6°28.3	23.0	68°18.3	29.7	105°29.1	07.6	148°19.5	04.5			Kochab	137°19.7	74°04.1
12	129°05.5	21°27.5	N22°22.8	83°19.1	N15°30.2	120°31.6	N02°07.6	163°22.1	S15°04.5			Zuben'ubi	136°58.2	-16°08.1
13	144°08.0	36°26.7	22.5	98°20.0	30.6	135°34.0	07.6	178°24.8	04.6			Alphecca	126°05.3	26°38.6
14	159°10.4	51°25.8	22.3	113°20.8	31.1	150°36.5	07.5	193°27.4	04.7			Antares	112°18.1	-26°28.9
15	174°12.9	66°25.0	.. 22.0	128°21.7	.. 31.6	165°39.0	.. 07.5	208°30.0	.. 04.7			Atria	107°13.8	-69°04.2
16	189°15.4	81°24.2	21.8	143°22.6	32.0	180°41.5	07.5	223°32.7	04.8			Sabik	102°04.9	-15°45.1
17	204°17.8	96°23.4	21.5	158°23.4	32.5	195°44.0	07.5	238°35.3	04.9			Shaula	96°12.8	-37°07.2
18	219°20.3	111°22.6	N22°21.2	173°24.3	N15°33.0	210°46.4	N02°07.5	253°37.9	S15°04.9			Rasalhague	96°00.2	12°32.7
19	234°22.7	126°21.8	21.0	188°25.1	33.4	225°48.9	07.4	268°40.6	05.0			Eltanin	90°42.7	51°29.3
20	249°25.2	141°21.0	20.7	203°26.0	33.9	240°51.4	07.4	283°43.2	05.1			Kaus Aust.	83°34.8	-34°22.4
21	264°27.7	156°20.2	.. 20.4	218°26.9	.. 34.4	255°53.9	.. 07.4	298°45.9	.. 05.1			Vega	80°34.2	38°48.4
22	279°30.1	171°19.4	20.2	233°27.7	34.8	270°56.4	07.4	313°48.5	05.2			Nunki	75°49.9	-26°16.1
23	294°32.6	186°18.6	19.9	248°28.6	35.3	285°58.8	07.4	328°51.1	05.2			Altair	62°01.6	8°55.7
Mer.pass. 03:25		ν -0.8° d -0.2° m -3.89		ν 0.9° d 0.5° m 0.15		ν 2.5° d -0.0° m -2.65		ν 2.6° d -0.1° m 0.41						

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Stars	SHA	Dec
0	309°35.1	201°17.7	N22°19.6	263°29.4	N15°35.7	301°01.3	N02°07.3	343°53.8	S15°05.3			Jul 30 Sat	SHA	Mer.pass
1	324°37.5	216°16.9	19.4	278°30.3	36.2	316°03.8	07.3	358°56.4	05.4			Venus	254°20.0	10:33
2	339°40.0	231°16.1	19.1	293°31.2	36.7	331°06.3	07.3	13°59.0	05.4			Mars	315°11.5	06:28
3	354°42.5	246°15.3	.. 18.8	308°32.0	.. 37.1	346°08.8	.. 07.3	29°01.7	.. 05.5			Jupiter	351°25.7	04:03
4	9°44.9	261°14.5	18.6	323°32.9	37.6	1°11.3	07.3	44°04.3	05.6			Saturn	34°10.5	01:13
5	24°47.4	276°13.7	18.3	338°33.7	38.1	16°13.8	07.2	59°06.9	05.6			Jul 31 Sun	SHA	Mer.pass
6	39°49.8	291°12.9	N22°18.0	353°34.6	N15°38.5	31°16.2	N02°07.2	74°09.6	S15°05.7			Venus	253°01.3	10:34
7	54°52.3	306°12.1	17.7	8°35.5	39.0	46°18.7	07.2	89°12.2	05.7			Mars	314°32.9	06:27
8	69°54.8	321°11.3	17.5	23°36.3	39.5	61°21.2	07.2	104°14.9	05.8			Jupiter	351°25.9	03:59
9	84°57.2	336°10.5	.. 17.2	38°37.2	.. 39.9	76°23.7	.. 07.1	119°17.5	.. 05.9			Saturn	34°14.6	01:08
10	99°59.7	351°09.7	16.9	53°38.0	40.4	91°26.2	07.1	134°20.1	05.9			Aug 01 Mon	SHA	Mer.pass
11	115°02.2	6°08.8	16.6	68°38.9	40.8	106°28.7	07.1	149°22.8	06.0			Venus	251°42.7	10:35
12	130°04.6	21°08.0	N22°16.3	83°39.8	N15°41.3	121°31.2	N02°07.1	164°25.4	S15°06.1			Mars		

DUT1 = UT1-UTC = -0.0392 sec  $\Delta T = TT-UT1 = +69.2232$  sec

2022 July 30 to Aug. 01 UT

h		Sun			Moon			Twilight					
Lat.	Naut.	Civil	Sunrise	Sunset	Civil	Naut.							
<b>N 72°</b>													
<b>N 70°</b>	—	—	01:17	22:48	—	—							
68°	—	—	02:10	21:59	—	—							
66°	—	—	02:41	21:28	—	—							
64°	—	01:33	03:05	21:06	22:34	—	—						
62°	—	02:11	03:23	20:48	21:59	—	—						
60°	—	02:37	03:38	20:33	21:34	—	—						
<b>N 58°</b>	01:25	02:57	03:51	20:20	21:14	22:43							
56°	01:59	03:13	04:02	20:10	20:58	22:11							
54°	02:23	03:27	04:12	20:00	20:45	21:47							
52°	02:42	03:39	04:20	19:52	20:33	21:29							
50°	02:57	03:49	04:28	19:44	20:23	21:14							
45°	03:27	04:10	04:44	19:28	20:02	20:44							
<b>N 40°</b>	03:49	04:27	04:57	19:15	19:45	20:23							
35°	04:07	04:41	05:09	19:04	19:32	20:05							
30°	04:21	04:52	05:18	18:54	19:20	19:51							
20°	04:44	05:12	05:35	18:38	19:01	19:29							
<b>N 10°</b>	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							
<b>S 10°</b>	05:29	05:54	06:16	17:57	18:19	18:44							
20°	05:41	06:07	06:30	17:43	18:06	18:33							
30°	05:52	06:21	06:46	17:27	17:52	18:21							
35°	05:58	06:29	06:55	17:18	17:45	18:15							
40°	06:04	06:37	07:06	17:07	17:36	18:09							
45°	06:11	06:47	07:18	16:55	17:27	18:02							
<b>S 50°</b>	06:18	06:58	07:33	16:40	17:16	17:55							
52°	06:22	07:03	07:40	16:33	17:11	17:52							
54°	06:25	07:08	07:48	16:26	17:05	17:48							
56°	06:29	07:14	07:56	16:17	16:59	17:45							
58°	06:33	07:21	08:06	16:08	16:53	17:41							
S 60°	06:37	07:29	08:17	15:56	16:45	17:37							
Lat.	Sat	Moonrise		Sat	Moonset								
<b>N 72°</b>		04:42	07:01	23:32	22:45	22:12							
<b>N 70°</b>	02:38	05:12	07:14	23:01	22:30	22:06							
68°	03:29	05:34	07:24	22:38	22:17	22:00							
66°	04:01	05:51	07:33	22:20	22:07	21:56							
64°	04:24	06:04	07:40	22:05	21:58	21:52							
62°	04:43	06:16	07:46	21:52	21:51	21:49							
60°	04:58	06:25	07:52	21:41	21:44	21:46							
<b>N 58°</b>	05:10	06:34	07:56	21:32	21:38	21:43							
56°	05:21	06:41	08:00	21:24	21:33	21:41							
54°	05:31	06:48	08:04	21:16	21:28	21:39							
52°	05:40	06:54	08:07	21:10	21:24	21:37							
50°	05:47	06:59	08:10	21:04	21:20	21:35							
45°	06:04	07:10	08:17	20:51	21:12	21:31							
<b>N 40°</b>	06:17	07:20	08:22	20:40	21:05	21:28							
35°	06:28	07:28	08:27	20:31	20:59	21:25							
30°	06:38	07:35	08:31	20:23	20:54	21:23							
20°	06:55	07:47	08:38	20:09	20:44	21:18							
<b>N 10°</b>	07:09	07:57	08:45	19:56	20:36	21:14							
0°	07:23	08:07	08:50	19:44	20:28	21:11							
<b>S 10°</b>	07:36	08:17	08:56	19:33	20:20	21:07							
20°	07:51	08:28	09:02	19:20	20:12	21:03							
30°	08:07	08:39	09:09	19:05	20:02	20:58							
35°	08:17	08:46	09:13	18:57	19:56	20:56							
40°	08:28	08:54	09:18	18:47	19:50	20:53							
45°	08:40	09:03	09:23	18:36	19:42	20:49							
<b>S 50°</b>	08:56	09:14	09:29	18:22	19:33	20:45							
52°	09:03	09:19	09:32	18:15	19:29	20:43							
54°	09:11	09:24	09:35	18:08	19:24	20:41							
56°	09:20	09:30	09:39	18:00	19:19	20:38							
58°	09:30	09:37	09:42	17:50	19:13	20:36							
S 60°	09:41	09:45	09:47	17:40	19:07	20:33							
Day	Eqn.of Time		Moon										
	00 <sup>h</sup>		Mer.										
	mm:ss		Pass										
			Upper										
			Lower										
			hh:mm										
30	06:30	06:29	12:06	13:34	01:11								
31	06:28	06:26	12:06	14:18	01:56								
01	06:24	06:23	12:06	15:01	02:39								

## August 02, 03, 04 UT (Tue., Wed., Thu.)

Aries		Venus		Mars		Jupiter		Saturn	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	310°34.2	200°58.4	N22°12.9	263°50.1	N15°46.8	302°01.0	N02°06.8	344°57.1	S15°06.8
1	325°36.7	215°57.5	12.6	278°51.0	47.3	317°03.5	06.8	359°59.7	06.9
2	340°39.1	230°56.7	12.3	293°51.9	47.7	332°06.0	06.7	15°02.3	07.0
3	355°41.6	245°55.9	.. 12.0	308°52.7	.. 48.2	347°08.5	.. 06.7	30°05.0	.. 07.0
4	10°44.1	260°55.1	11.7	323°53.6	48.6	2°11.0	06.7	45°07.6	07.1
5	25°46.5	275°54.3	11.4	338°54.4	49.1	17°13.5	06.7	60°10.3	07.1
6	40°49.0	290°53.5	N22°11.1	353°55.3	N15°49.6	32°16.0	N02°06.6	75°12.9	S15°07.2
7	55°51.4	305°52.7	10.8	8°56.2	50.0	47°18.5	06.6	90°15.5	07.3
8	70°53.9	320°51.9	10.5	23°57.0	50.5	62°21.0	06.6	105°18.2	07.3
9	85°56.4	335°51.1	.. 10.1	38°57.9	.. 50.9	77°23.5	.. 06.6	120°20.8	.. 07.4
10	100°58.8	350°50.3	09.8	53°58.8	51.4	92°25.9	06.5	135°23.5	07.5
11	116°01.3	5°49.5	09.5	68°59.6	51.8	107°28.4	06.5	150°26.1	07.5
12	131°03.8	20°48.7	N22°09.2	84°00.5	N15°52.3	122°30.9	N02°06.5	165°28.7	S15°07.6
13	146°06.2	35°47.9	08.9	99°01.4	52.7	137°33.4	06.5	180°31.4	07.6
14	161°08.7	50°47.1	08.6	114°02.2	53.2	152°35.9	06.4	195°34.0	07.7
15	176°11.2	65°46.3	.. 08.3	129°03.1	.. 53.6	167°38.4	.. 06.4	210°36.6	.. 07.8
16	191°13.6	80°45.5	08.0	144°04.0	54.1	182°40.9	06.4	225°39.3	07.8
17	206°16.1	95°44.7	07.7	159°04.8	54.6	197°43.4	06.3	240°41.9	07.9
18	221°18.6	110°43.9	N22°07.3	174°05.7	N15°55.0	212°45.9	N02°06.3	255°44.6	S15°08.0
19	236°21.0	125°43.1	07.0	189°06.6	55.5	227°48.4	06.3	270°47.2	08.0
20	251°23.5	140°42.3	06.7	204°07.4	55.9	242°50.9	06.3	285°49.8	08.1
21	266°25.9	155°41.5	.. 06.4	219°08.3	.. 56.4	257°53.4	.. 06.2	300°52.5	.. 08.2
22	281°28.4	170°40.7	06.1	234°09.2	56.8	272°55.9	06.2	315°55.1	08.2
23	296°30.9	185°39.9	05.8	249°10.0	57.3	287°58.4	06.2	330°57.8	08.3
Mer.pass. 03:17		ν -0.8° d -0.3° m -3.89		ν 0.9° d 0.5° m 0.13		ν 2.5° d -0.0° m -2.67		ν 2.6° d -0.1° m 0.40	

Stars		
SHA	Dec	
Alpheratz	357°36.6	
Ankaa	353°08.9	
Schedar	349°33.0	
Diphda	348°49.2	
Achernar	335°21.6	
Hamal	327°53.4	
Polaris	315°02.0	
Acamar	315°13.4	
Menkar	314°08.3	
Mirfak	308°31.2	
Aldebaran	290°42.1	
Rigel	281°06.0	
Capella	280°25.2	
Bellatrix	278°25.3	
Elnath	278°04.7	
Alnilam	275°40.0	
Betelgeuse	270°54.5	
Canopus	263°53.7	
Sirius	258°28.3	
Adhara	255°07.8	
Procyon	244°53.3	
Pollux	243°20.1	
Avior	234°16.2	
Suhail	222°48.2	
Miaplacidus	221°39.6	
Alphard	217°50.0	
Regulus	207°36.9	
Dubhe	193°44.0	
Denebola	182°27.2	
Gienah	175°45.8	
Acrux	173°02.7	
Gacrux	171°54.2	
Alioth	166°15.0	
Spica	158°24.5	
Alkaid	152°53.7	
Hadar	148°38.9	
Menkent	148°00.0	
Arcturus	145°49.8	
Rigil Kent.	139°43.0	
Kochab	137°19.7	
Zuben'ubi	136°58.2	
Alphecca	126°05.3	
Antares	112°18.1	
Atria	107°13.8	
Sabik	102°04.9	
Shaula	96°12.8	
Rasalhague	96°00.2	
Eltanin	90°42.7	
Kaus Aust.	83°34.8	
Vega	80°34.2	
Nunki	75°49.9	
Altair	62°01.6	
Peacock	53°08.3	
Deneb	49°26.7	
Enif	33°40.4	
Al Na'ir	27°35.0	
Fomalhaut	15°16.4	
Scheat	13°46.8	
Markab	13°31.6	
Aug 02 Tue	SHA	Mer.pass
Venus	250°24.2	10:37
Mars	313°15.9	06:24
Jupiter	351°26.8	03:51
Saturn	34°22.9	01:00
Aug 03 Wed	SHA	Mer.pass
Venus	249°05.7	10:38
Mars	312°37.6	06:23
Jupiter	351°27.6	03:47
Saturn	34°27.1	00:56
Aug 04 Thu	SHA	Mer.pass
Venus	247°47.4	10:39
Mars	311°59.3	06:22
Jupiter	351°28.5	03:43
Saturn	34°31.3	00:52
Horizontal parallax		
Venus:	0.1	
Mars:	0.1	

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	312°32.5	200°19.9	N21°57.4	264°31.8	N16°08.5	304°00.9	N02°05.5	347°03.8	S15°09.9
1	327°34.9	215°19.1	57.0	279°32.7	08.9	319°03.5	05.4	2°06.4	09.9
2	342°37.4	230°18.3	56.7	294°33.5	09.4	334°06.0	05.4	17°09.0	10.0
3	357°39.9	245°17.5	.. 56.3	309°34.4	.. 09.8	349°08.5	.. 05.4	32°11.7	.. 10.1
4	12°42.3	260°16.7	56.0	324°35.3	10.2	4°11.0	05.3	47°14.3	10.1
5	27°44.8	275°15.9	55.6	339°36.2	10.7	19°13.5	05.3	62°17.0	10.2
6	42°47.3	290°15.1	N21°55.2	354°37.0	N16°11.1	34°16.0	N02°05.3	77°19.6	S15°10.3
7	57°49.7	305°14.3	54.9	9°37.9	11.6	49°18.5	05.2	92°22.3	10.3
8	72°52.2	320°13.5	54.5	24°38.8	12.0	64°21.0	05.2	107°24.9	10.4
9	87°54.7	335°12.7	.. 54.2	39°39.6	.. 12.5	79°23.5	.. 05.2	122°27.5	.. 10.5
10	102°57.1	350°11.9	53.8	54°40.5	12.9	94°26.0	05.1	137°30.2	10.5
11	117°59.6	5°11.1	53.4	69°41.4	13.3	109°28.5	05.1	152°32.8	10.6
12	133°02.0	20°10.3	N21°53.1	84°42.3	N16°13.8	124°31.0	N02°05.1	167°35.5	S15°10.6
13	148°04.5	35°09.5	52.7	99°43.1	14.2	139°33.5	05.0	182°38.1	10.7
14	163°07.0	50°08.7	52.4	114°44.0	14.7	154°36.1	05.0	197°40.7	10.8
15	178°09.4	65°07.9	.. 52.0	129°44.9	.. 15.1	169°38.6	.. 05.0	212°43.4	.. 10.8
16	193°11.9	80°07.1	51.6	144°45.8	15.6	184°41.1	04.9	227°46.0	10.9
17	208°14.4	95°06.3	51.3	159°46.6	16.0	199°43.6	04.9	242°48.7	11.0
18	223°16.8	110°05.6	N21°50.9	174°47.5	N16°16.4	214°46.1	N02°04.9	257°51.3	S15°11.0
19	238°19.3	125°04.8	50.5	189°48.4	16.9	229°48.6	04.8	272°53.9	11.1
20	253°21.8	140°04.0	50.1	204°49.3	17.3	244°51.1	04.8	287°56.6	11.2
21	268°24.2	155°03.2	.. 49.8	219°50.1	.. 17.8	259°53.6	.. 04.8	302°59.2	.. 11.2
22	283°26.7	170°02.4	49.4	234°51.0	18.2	274°56.2	04.7	318°01.9	11.3
23	298°29.1	185°01.6	49.0	249°51.9	18.6	289°58.7	04.7	333°04.5	11.3
Mer.pass. 03:09		ν -0.8° d -0.4° m -3.89		ν 0.9° d 0.4° m 0.11		ν 2.5° d -0.0° m -2.68		ν 2.6° d -0.1° m 0.39	

DUT1 = UT1-UTC = -0.0368 sec  $\Delta T = TT-UT1 = +69.2208$  sec

2022 August 02 to Aug. 04 UT

h		Sun		Moon				Lat.		Twilight				Sunrise		Sunset		Twilight	
Tue		GHA	Dec	GHA	$\nu$	Dec	$d$	HP	Naut.	Civil				Civil	Naut.			Civil	Naut.
0	178°24.8	N17°49.0	130°59.8	15.2'	N04°25.4	-14.2'	55.8'												
1	193°24.9	48.4	145°34.1	15.2'	04°11.2	-14.2'	55.8'												
2	208°24.9	47.7	160°08.3	15.2'	03°57.0	-14.2'	55.8'												
3	223°25.0	47.1	174°42.5	15.2'	03°42.8	-14.2'	55.8'												
4	238°25.0	46.4	189°16.7	15.2'	03°28.6	-14.3'	55.9'												
5	253°25.1	45.8	203°50.9	15.2'	03°14.3	-14.3'	55.9'												
6	268°25.1	N17°45.2	218°25.1	15.2'	N03°00.0	-14.3'	55.9'												
7	283°25.1	44.5	232°59.2	15.2'	02°45.7	-14.3'	55.9'												
8	298°25.2	43.9	247°33.4	15.2'	02°31.4	-14.4'	56.0'												
9	313°25.2	43.2	262°07.6	15.1'	02°17.0	-14.4'	56.0'												
10	328°25.3	42.6	276°41.7	15.1'	02°02.6	-14.4'	56.0'												
11	343°25.3	41.9	291°15.8	15.1'	01°48.2	-14.4'	56.0'												
12	358°25.4	N17°41.3	305°50.0	15.1'	N01°33.8	-14.4'	56.0'												
13	13°25.4	40.7	320°24.1	15.1'	01°19.4	-14.5'	56.1'												
14	28°25.5	40.0	334°58.1	15.1'	01°04.9	-14.5'	56.1'												
15	43°25.5	39.4	349°32.2	15.0'	00°50.5	-14.5'	56.1'												
16	58°25.6	38.7	4°06.2	15.0'	00°36.0	-14.5'	56.1'												
17	73°25.6	38.1	18°40.3	15.0'	00°21.5	-14.5'	56.2'												
18	88°25.7	N17°37.4	33°14.3	15.0'	N00°07.0	-14.5'	56.2'												
19	103°25.7	36.8	47°48.3	15.0'	S00°07.6	-14.5'	56.2'												
20	118°25.7	36.1	62°22.2	14.9'	00°22.1	-14.5'	56.2'												
21	133°25.8	35.5	76°56.1	14.9'	00°36.6	-14.6'	56.3'												
22	148°25.8	34.8	91°30.0	14.9'	00°51.2	-14.6'	56.3'												
23	163°25.9	34.2	106°03.9	14.8'	01°05.8	-14.6'	56.3'												
SD = 15.8'		d = -0.6'		SD = 15.2'															
Wed		GHA	Dec	GHA	$\nu$	Dec	$d$	HP											
0	178°25.9	N17°33.5	120°37.8	14.8'	S01°20.3	-14.6'	56.4'												
1	193°26.0	32.9	135°11.6	14.8'	01°34.9	-14.6'	56.4'												
2	208°26.0	32.2	149°45.4	14.8'	01°49.5	-14.6'	56.4'												
3	223°26.1	31.6	164°19.1	14.7'	02°04.1	-14.6'	56.4'												
4	238°26.1	30.9	178°52.8	14.7'	02°18.7	-14.6'	56.5'												
5	253°26.2	30.3	193°26.5	14.6'	02°33.3	-14.6'	56.5'												
6	268°26.2	N17°29.6	208°00.2	14.6'	S02°47.9	-14.6'	56.5'												
7	283°26.3	29.0	222°33.8	14.6'	03°02.5	-14.6'	56.5'												
8	298°26.3	28.3	237°07.4	14.5'	03°17.1	-14.6'	56.6'												
9	313°26.4	27.7	251°40.9	14.5'	03°31.7	-14.6'	56.6'												
10	328°26.4	27.0	266°14.4	14.5'	03°46.3	-14.6'	56.6'												
11	343°26.5	26.3	280°47.8	14.4'	04°00.9	-14.6'	56.6'												
12	358°26.5	N17°25.7	295°21.3	14.4'	S04°15.5	-14.6'	56.7'												
13	13°26.6	25.0	309°54.6	14.3'	04°30.1	-14.6'	56.7'												
14	28°26.6	24.4	324°27.9	14.3'	04°44.7	-14.6'	56.7'												
15	43°26.7	23.7	339°01.2	14.2'	04°59.3	-14.6'	56.8'												
16	58°26.8	23.1	353°34.4	14.2'	05°13.9	-14.6'	56.8'												
17	73°26.8	22.4	8°07.6	14.1'	05°28.4	-14.6'	56.8'												
18	88°26.9	N17°21.7	22°40.7	14.1'	S05°43.0	-14.5'	56.8'												
19	103°26.9	21.1	37°13.8	14.0'	05°57.5	-14.5'	56.9'												
20	118°27.0	20.4	51°46.8	14.0'	06°12.0	-14.5'	56.9'												
21	133°27.0	19.8	66°19.7	13.9'	06°26.6	-14.5'	56.9'												
22	148°27.1	19.1	80°52.6	13.8'	06°41.1	-14.5'	57.0'												
23	163°27.1	18.4	95°25.5	13.8'	06°55.5	-14.5'	57.0'												
SD = 15.8'		d = -0.7'		SD = 15.4'															
Thu		GHA	Dec	GHA	$\nu$	Dec	$d$	HP											
0	178°27.2	N17°17.8	109°58.3	13.7'	S07°10.0	-14.5'	57.0'												
1	193°27.2	17.1	124°31.0	13.7'	07°24.5	-14.4'	57.0'												
2	208°27.3	16.4	139°03.7	13.6'	07°38.9	-14.4'	57.1'												
3	223°27.4	15.8	153°36.3	13.5'	07°53.3	-14.4'	57.1'												
4	238°27.4	15.1	168°08.8	13.5'	08°07.7	-14.4'	57.1'												
5	253°27.5	14.5	182°41.3	13.4'	08°22.1	-14.3'	57.2'												
6	268°27.5	N17°13.8	197°13.7	13.3'	S08°36.4	-14.3'	57.2'												
7	283°27.6	13.1	211°46.0	13.3'	08°50.7	-14.3'	57.2'												
8	298°27.6	12.5	226°18.3	13.2'	09°05.0	-14.3'	57.2'												
9	313°27.7	11.8	240°50.5	13.1'	09°19.3	-14.2'	57.3'												
10	328°27.8	11.1	255°22.6	13.1'	09°33.5	-14.2'	57.3'												
11	343°27.8	10.5	269°54.6	13.0'	09°47.8	-14.2'	57.3'												
12	358°27.9	N17°09.8	284°26.6	12.9'	S10°01.9	-14.1'	57.4'												
13	13°27.9	09.1	298°58.5	12.8'	10°16.1	-14.1'	57.4'												
14	28°28.0	08.5	313°30.3	12.7'	10°30.2	-14.1'	57.4'												
15	43°28.1	07.8	328°02.1	12.7'	10°44.3	-14.0'	57.5'												
16	58°28.1	07.1	342°33.8	12.6'	10°58.3	-14.0'	57.5'												
17	73°28.2	06.4	357°05.4	12.5'	11°12.3	-14.0'	57.5'												
18	88°28.2	N17°05.8	11°36.9	12.4'	S11°26.3	-13.9'	57.5'												
19	103°28.3	05.1	26°08.3	12.3'	11°40.2	-13.9'	57.6'												
20	118°28.4	04.4	40°39.6	12.3'	11°54.1	-13.8'	57.6'												
21	133°28.4	03.8	55°10.9	12.2'	12°08.0	-13.8'	57.6'												
22	148°28.5	03.1	69°42.0	12.1'	12°21.8	-13.8'	57.7'												
23	163°28.5	02.4	84°13.1	12.0'	12°35.5	-13.7'	57.7'												
SD = 15.8'		d = -0.7'		SD = 15.5'															

Day	Sun			Moon		
Eqn.of Time	00<sup>h</sup</sup>					

## August 05, 06, 07 UT (Fri., Sat., Sun.)

Aries			Venus			Mars		Jupiter		Saturn		Stars		
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	313°31.6	200°00.8	N21°48.6	264°52.8	N16°19.1	305°01.2	N02°04.7	348°07.2	S15°11.4			Alpheratz	357°36.6	
1	328°34.1	215°00.0	48.3	279°53.6	19.5	320°03.7	04.6	3°09.8	11.5			Ankaa	353°08.9	
2	343°36.5	229°59.2	47.9	294°54.5	19.9	335°06.2	04.6	18°12.4	11.5			Schedar	349°33.0	
3	358°39.0	244°58.4	· · 47.5	309°55.4	· · 20.4	350°08.7	· · 04.6	33°15.1	· · 11.6			Diphda	348°49.1	
4	13°41.5	259°57.6	47.1	324°56.3	20.8	5°11.2	04.5	48°17.7	11.7			Achernar	335°21.5	
5	28°43.9	274°56.8	46.8	339°57.2	21.3	20°13.8	04.5	63°20.4	11.7			Hamal	327°53.4	
6	43°46.4	289°56.1	N21°46.4	354°58.0	N16°21.7	35°16.3	N02°04.5	78°23.0	S15°11.8			Polaris	315°00.4	
7	58°48.9	304°55.3	46.0	9°58.9	22.1	50°18.8	04.4	93°25.6	11.9			Acamar	315°13.3	
8	73°51.3	319°54.5	45.6	24°59.8	22.6	65°21.3	04.4	108°28.3	11.9			Menkar	314°08.3	
9	88°53.8	334°53.7	· · 45.2	40°00.7	· · 23.0	80°23.8	· · 04.4	123°30.9	· · 12.0			Mirfak	308°31.2	
10	103°56.3	349°52.9	44.8	55°01.5	23.4	95°26.3	04.3	138°33.6	12.1			Aldebaran	290°42.1	
11	118°58.7	4°52.1	44.4	70°24.4	23.9	110°28.8	04.3	153°36.2	12.1			Rigel	281°06.0	
12	134°01.2	19°51.3	N21°44.1	85°03.3	N16°24.3	125°31.4	N02°04.3	168°38.9	S15°12.2			Capella	280°25.1	
13	149°03.6	34°50.5	43.7	100°04.2	24.7	140°33.9	04.2	183°41.5	12.2			Bellatrix	278°25.2	
14	164°06.1	49°49.7	43.3	115°05.1	25.2	155°36.4	04.2	198°44.1	12.3			Elnath	278°04.6	
15	179°08.6	64°48.9	· · 42.9	130°05.9	· · 25.6	170°38.9	· · 04.1	213°46.8	· · 12.4			Alnilam	275°40.0	
16	194°11.0	79°48.2	42.5	145°06.8	26.0	185°41.4	04.1	228°49.4	12.4			Betelgeuse	270°54.5	
17	209°13.5	94°47.4	42.1	160°07.7	26.5	200°44.0	04.1	243°52.1	12.5			Canopus	263°53.7	
18	224°16.0	109°46.6	N21°41.7	175°08.6	N16°26.9	215°46.5	N02°04.0	258°54.7	S15°12.6			Sirius	258°28.3	
19	239°18.4	124°45.8	41.3	190°09.5	27.3	230°49.0	04.0	273°57.4	12.6			Adhara	255°07.8	
20	254°20.9	139°45.0	40.9	205°10.3	27.8	245°51.5	04.0	289°00.0	12.7			Procyon	244°53.2	
21	269°23.4	154°44.2	· · 40.5	220°11.2	· · 28.2	260°54.0	· · 03.9	304°02.6	· · 12.8			Pollux	243°20.1	
22	284°25.8	169°43.4	40.1	235°12.1	28.6	275°56.6	03.9	319°05.3	12.8			Avior	234°16.2	
23	299°28.3	184°42.6	39.7	250°13.0	29.1	290°59.1	03.8	334°07.9	12.9			Suhail	222°48.2	
Mer.pass. 03:05			ν -0.8' d -0.4' m -3.89	ν 0.9' d 0.4' m 0.10	ν 2.5' d -0.0' m -2.69	ν 2.6' d -0.1' m 0.38								
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec			
0	314°30.8	199°41.9	N21°39.3	265°13.9	N16°29.5	306°01.6	N02°03.8	349°10.6	S15°13.0			Denebola	182°27.2	
1	329°33.2	214°41.1	38.9	280°14.7	29.9	321°04.1	03.8	4°13.2	13.0			Gienah	175°45.8	
2	344°35.7	229°40.3	38.5	295°15.6	30.4	336°06.6	03.7	19°15.9	13.1			Acru	173°02.7	
3	359°38.1	244°39.5	· · 38.1	310°16.5	· · 30.8	351°09.2	· · 03.7	34°18.5	· · 13.1			Gacrux	171°54.2	
4	14°40.6	259°38.7	37.7	325°17.4	31.2	6°11.7	03.7	49°21.1	13.2			Alioth	166°15.0	
5	29°43.1	274°37.9	37.3	340°18.3	31.7	21°14.2	03.6	64°23.8	13.3			Spica	158°24.5	
6	44°45.3	289°37.1	N21°36.9	355°19.1	N16°32.1	36°16.7	N02°03.6	79°26.4	S15°13.3			Alkaid	152°53.7	
7	59°48.0	304°36.4	36.5	10°20.0	32.5	51°19.2	03.5	94°29.1	13.4			Hadar	148°38.9	
8	74°50.5	319°35.6	36.1	25°20.9	33.0	66°21.8	03.5	109°31.7	13.5			Menkent	148°00.0	
9	89°52.9	334°34.8	· · 35.6	40°21.8	· · 33.4	81°24.3	· · 03.5	124°34.4	· · 13.5			Arcturus	145°49.8	
10	104°55.4	349°34.0	35.2	55°22.7	33.8	96°26.8	03.4	139°37.0	13.6			Rigel Kent.	139°43.1	
11	119°57.9	4°33.2	34.8	70°23.5	34.2	111°29.3	03.4	154°39.6	13.7			Kochab	137°19.8	
12	135°00.3	19°32.4	N21°34.4	85°24.4	N16°34.7	126°31.9	N02°03.4	169°42.3	S15°13.7			Zuben' ubi	136°58.2	
13	150°02.8	34°31.7	34.0	100°25.3	35.1	141°34.4	03.3	184°44.9	13.8			Alphecca	126°05.4	
14	165°05.2	49°30.9	33.6	115°26.2	35.5	156°36.9	03.3	199°47.6	13.8			Antares	112°18.1	
15	180°07.7	64°30.1	· · 33.1	130°27.1	· · 36.0	171°39.4	· · 03.2	214°50.2	· · 13.9			Atria	107°13.8	
16	195°10.2	79°29.3	32.7	145°28.0	36.4	186°42.0	03.2	229°52.9	14.0			Sabik	102°04.9	
17	210°12.6	94°28.5	32.3	160°28.8	36.8	201°44.5	03.2	244°55.5	14.0			Shaula	96°12.8	
18	225°15.1	109°27.7	N21°31.9	175°29.7	N16°37.2	216°47.0	N02°03.1	259°58.1	S15°14.1			Rasalhague	96°00.2	
19	240°17.6	124°27.0	31.5	190°30.6	37.7	231°49.6	03.1	275°00.8	14.2			Eltanin	90°42.7	
20	255°20.0	139°26.2	31.0	205°31.5	38.1	246°52.1	03.0	290°03.4	14.2			Kaus Aust.	83°34.8	
21	270°22.5	154°25.4	· · 30.6	220°32.4	· · 38.5	261°54.6	· · 03.0	305°06.1	· · 14.3			Vega	80°34.2	
22	285°25.0	169°24.6	30.2	235°33.3	38.9	276°57.1	03.0	320°08.7	14.4			Nunki	75°49.9	
23	300°27.4	184°23.8	29.8	250°34.2	39.4	291°59.7	02.9	335°11.4	14.4			Altair	62°01.6	
Mer.pass. 03:01			ν -0.8' d -0.4' m -3.89	ν 0.9' d 0.4' m 0.09	ν 2.5' d -0.0' m -2.70	ν 2.6' d -0.1' m 0.38								
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec			
0	315°29.9	199°23.1	N21°29.3	265°35.0	N16°39.8	307°02.2	N02°02.9	350°14.0	S15°14.5			Fomalhaut	15°16.4	
1	330°32.4	214°22.3	28.9	280°35.9	40.2	322°04.7	02.8	5°16.6	14.6			Scheat	13°46.8	
2	345°34.8	229°21.5	28.5	295°36.8	40.6	337°07.2	02.8	20°19.3	14.6			Markab	13°31.6	
3	0°37.3	244°20.7	· · 28.0	310°37.7	· · 41.1	352°09.8	· · 02.8	35°21.9	· · 14.7			Aug 05 Fri	SHA	Mer.pass
4	15°39.7	259°19.9	27.6	325°38.6	41.5	7°12.3	02.7	50°24.6	14.7			Venus	246°29.2	10:41
5	30°42.2	274°19.2	27.2	340°39.5	41.9	22°14.8	02.7	65°27.2	14.8			Mars	311°21.2	06:20
6	45°44.7	289°18.4	N21°26.7	355°40.4	N16°42.3	37°17.4	N02°02.6	80°29.9	S15°14.9			Jupiter	351°29.6	03:39
7	60°47.1	304°17.6	26.3	10°41.2	42.8	52°19.9	02.6	95°32.5	14.9			Saturn	34°35.5	00:47
8	75°49.6	319°16.8	25.9	25°42.1	43.2	67°22.4	02.6	110°35.1	15.0			Aug 06 Sat	SHA	Mer.pass
9	90°52.1	334°16.0	· · 25.4	40°43.0	· · 43.6	82°25.0	· · 02.5	125°37.8	· · 15.1			Venus	245°11.1	10:42
10	105°54.5	349°15.3	25.0	55°43.9	44.0	97°27.5	02.5	140°40.4	15.1			Mars	310°43.1	06:19
11	120°57.0	4°14.5	24.6	70°44.8	44.5	112°30.0	02.4	155°43.1	15.2			Jupiter	351°30.8	03:35
12	135°59.5	19°13.7	N21°24.1	85°45.7	N16°44.9	127°32.6	N02°02.4	170°45.7	S15°15.3			Saturn	34°39.8	00:43
13	151°01.9	34°12.9	23.7	100°46.6	45.3	142°35.1	02.3	185°48.4	15.3			Aug 07 Sun	SHA	Mer.pass
14	166°04.4	49°12.2	23.2	115°47.4	45.7	157°37.6	02.3	200°51.0	15.4			Venus	243°53.2	10:43
15	181°06.9	64°11.4	· · 22.8	130°48.3	· · 46.1	172°40.2	· · 02.3	215°53.7	· · 15.5			Mars	310°05.1	06:17
16	196°09.3	79°10.6	22.3	145°49.2	46.6	187°42.7	02.2	230°56.3	15.5			Jupiter	351°32.3	03:31
17	211°11.8	94°09.8	21.9	160°50.1	47.0	202°45.2	02.2	245°58.9	15.6			Saturn	34°44.1	00:39
18	226°14.2	109°09.1	N21°21.4	175°51.0	N16°47.4	217°47.8	N02°02.1	261°01.6	S15°15.6			Horizontal parallax		
19	241°16.7	124°08.3	21.0	190°51.9	47.8	230°50.3	02.1	276°04.2	15.7			Venus:	0.1	
20	256°19.2	139°07.5	20.5	205°52.8	48.2	247°52.8	02.0	291°06.9	15.8			Mars:</td		

DUT1 = UT1-UTC = -0.0353 sec  $\Delta T = TT-UT1 = +69.2193$  sec

2022 August 05 to Aug. 07 UT

h	Sun			Moon			
Fri	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	178°28.6	N17°01.7	98°44.1	11.9'	S12°49.2	-13.7'	57.7'
1	193°28.7	01.1	113°15.0	11.8'	13°02.9	-13.6'	57.8'
2	208°28.7	17°00.4	127°45.8	11.7'	13°16.5	-13.6'	57.8'
3	223°28.8	16°59.7	142°16.5	11.6'	13°30.1	-13.5'	57.8'
4	238°28.8	59.0	156°47.1	11.5'	13°43.6	-13.5'	57.9'
5	253°28.9	58.4	171°17.7	11.4'	13°57.0	-13.4'	57.9'
6	268°29.0	N16°57.7	185°48.1	11.3'	S14°10.4	-13.3'	57.9'
7	283°29.0	57.0	200°18.4	11.2'	14°23.8	-13.3'	57.9'
8	298°29.1	56.3	214°48.6	11.1'	14°37.1	-13.2'	58.0'
9	313°29.2	.. 55.7	229°18.8	11.0'	14°50.3	-13.2'	58.0'
10	328°29.2	55.0	243°48.8	10.9'	15°03.5	-13.1'	58.0'
11	343°29.3	54.3	258°18.7	10.8'	15°16.6	-13.0'	58.1'
12	358°29.4	N16°53.6	272°48.5	10.7'	S15°29.6	-13.0'	58.1'
13	13°29.4	52.9	287°18.3	10.6'	15°42.6	-12.9'	58.1'
14	28°29.5	52.3	301°47.9	10.5'	15°55.5	-12.8'	58.2'
15	43°29.6	.. 51.6	316°17.4	10.4'	16°08.3	-12.8'	58.2'
16	58°29.6	50.9	330°46.8	10.3'	16°21.1	-12.7'	58.2'
17	73°29.7	50.2	345°16.1	10.2'	16°33.8	-12.6'	58.3'
18	88°29.8	N16°49.5	359°45.3	10.1'	S16°46.4	-12.5'	58.3'
19	103°29.8	48.8	14°14.3	10.0'	16°59.0	-12.5'	58.3'
20	118°29.9	48.2	28°43.3	9.9'	17°11.4	-12.4'	58.4'
21	133°30.0	.. 47.5	43°12.2	9.7'	17°23.8	-12.3'	58.4'
22	148°30.0	46.8	57°40.9	9.6'	17°36.1	-12.2'	58.4'
23	163°30.1	46.1	72°09.5	9.5'	17°48.3	-12.1'	58.5'
	SD = 15.8'			SD = 15.7'			

Sat	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	178°30.2	N16°45.4	86°38.0	9.4'	S18°00.5	-12.1'	58.5'
1	193°30.2	44.7	101°06.4	9.3'	18°12.5	-12.0'	58.5'
2	208°30.3	44.1	115°34.7	9.2'	18°24.5	-11.9'	58.6'
3	223°30.4	.. 43.4	130°02.9	9.0'	18°36.4	-11.8'	58.6'
4	238°30.4	42.7	144°30.9	8.9'	18°48.2	-11.7'	58.6'
5	253°30.5	42.0	158°58.8	8.8'	18°59.9	-11.6'	58.6'
6	268°30.6	N16°41.3	173°26.6	8.7'	S19°11.5	-11.5'	58.7'
7	283°30.6	40.6	187°54.3	8.6'	19°23.0	-11.4'	58.7'
8	298°30.7	39.9	202°21.9	8.4'	19°34.4	-11.3'	58.7'
9	313°30.8	.. 39.2	216°49.3	8.3'	19°45.7	-11.2'	58.8'
10	328°30.9	38.5	231°16.7	8.2'	19°56.9	-11.1'	58.8'
11	343°30.9	37.9	245°43.9	8.1'	20°08.0	-11.0'	58.8'
12	358°31.0	N16°37.2	260°10.9	8.0'	S20°19.0	-10.9'	58.9'
13	13°31.1	36.5	274°37.9	7.8'	20°29.9	-10.8'	58.9'
14	28°31.1	35.8	289°04.7	7.7'	20°40.7	-10.7'	58.9'
15	43°31.2	.. 35.1	303°31.5	7.6'	20°51.3	-10.6'	59.0'
16	58°31.3	34.4	317°58.0	7.5'	21°01.9	-10.4'	59.0'
17	73°31.4	33.7	332°24.5	7.3'	21°12.3	-10.3'	59.0'
18	88°31.4	N16°33.0	346°50.9	7.2'	S21°22.7	-10.2'	59.1'
19	103°31.5	32.3	1°17.1	7.1'	21°32.9	-10.1'	59.1'
20	118°31.6	31.6	15°43.2	7.0'	21°43.0	-10.0'	59.1'
21	133°31.6	.. 30.9	30°09.1	6.8'	21°52.9	-9.8'	59.1'
22	148°31.7	30.2	44°35.0	6.7'	22°02.8	-9.7'	59.2'
23	163°31.8	29.5	59°00.7	6.6'	22°12.5	-9.6'	59.2'
	SD = 15.8'			SD = 16.0'			

Sun	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	178°31.9	N16°28.8	73°26.3	6.5'	S22°22.1	-9.5'	59.2'
1	193°31.9	28.1	87°51.8	6.4'	22°31.5	-9.3'	59.3'
2	208°32.0	27.5	102°17.1	6.2'	22°40.9	-9.2'	59.3'
3	223°32.1	.. 26.8	116°42.4	6.1'	22°50.0	-9.1'	59.3'
4	238°32.2	26.1	131°07.5	6.0'	22°59.1	-8.9'	59.4'
5	253°32.2	25.4	145°32.5	5.9'	23°08.0	-8.8'	59.4'
6	268°32.3	N16°24.7	159°57.3	5.7'	S23°16.8	-8.6'	59.4'
7	283°32.4	24.0	174°22.1	5.6'	23°25.5	-8.5'	59.4'
8	298°32.5	23.3	188°46.7	5.5'	23°34.0	-8.4'	59.5'
9	313°32.6	.. 22.6	203°11.2	5.4'	23°42.3	-8.2'	59.5'
10	328°32.6	21.9	217°35.6	5.3'	23°50.5	-8.1'	59.5'
11	343°32.7	21.2	231°59.8	5.1'	23°58.6	-7.9'	59.6'
12	358°32.8	N16°20.5	246°24.0	5.0'	S24°06.5	-7.8'	59.6'
13	13°32.9	19.8	260°48.0	4.9'	24°14.2	-7.6'	59.6'
14	28°32.9	19.1	275°11.9	4.8'	24°21.8	-7.4'	59.6'
15	43°33.0	.. 18.3	289°35.7	4.7'	24°29.3	-7.3'	59.7'
16	58°33.1	17.6	303°59.4	4.6'	24°36.6	-7.1'	59.7'
17	73°33.2	16.9	318°22.9	4.5'	24°43.7	-7.0'	59.7'
18	88°33.3	N16°16.2	332°46.4	4.3'	S24°50.7	-6.8'	59.8'
19	103°33.3	15.5	347°09.8	4.2'	24°57.5	-6.6'	59.8'
20	118°33.4	14.8	1°33.0	4.1'	25°04.1	-6.5'	59.8'
21	133°33.5	.. 14.1	15°56.1	4.0'	25°10.6	-6.3'	59.8'
22	148°33.6	13.4	30°19.1	3.9'	25°16.9	-6.1'	59.9'
23	163°33.7	12.7	44°42.1	3.8'	25°23.1	-6.0'	59.9'
	SD = 15.8'			SD = 16.2'			

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

## August 08, 09, 10 UT (Mon., Tue., Wed.)

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	316°29.0	199°04.4	N21°18.7	265°56.3	N16°49.9	308°03.0	N02°01.9	351°17.4	S15°16.0								
1	331°31.5	214°03.6	18.3	280°57.2	50.3	323°05.5	01.8	6°20.1	16.1								
2	346°34.0	229°02.9	17.8	295°58.1	50.8	338°08.0	01.8	21°22.7	16.2								
3	1°36.4	244°02.1	.. 17.4	310°59.0	.. 51.2	353°10.6	.. 01.7	36°25.4	.. 16.2								
4	16°38.9	259°01.3	16.9	325°59.9	51.6	8°13.1	01.7	51°28.0	16.3								
5	31°41.4	274°00.5	16.5	341°00.8	52.0	23°15.6	01.7	66°30.7	16.4								
6	46°43.8	288°59.8	N21°16.0	356°01.7	N16°52.4	38°18.2	N02°01.6	81°33.3	S15°16.4								
7	61°46.3	303°59.0	15.5	11°02.6	52.9	53°20.7	01.6	96°36.0	16.5								
8	76°48.7	318°58.2	15.1	26°03.5	53.3	68°23.3	01.5	111°38.6	16.5								
9	91°51.2	333°57.5	.. 14.6	41°04.3	.. 53.7	83°25.8	.. 01.5	126°41.2	.. 16.6								
10	106°53.7	348°56.7	14.1	56°05.2	54.1	98°28.3	01.4	141°43.9	16.7								
11	121°56.1	3°55.9	13.7	71°06.1	54.5	113°30.9	01.4	156°46.5	16.7								
12	136°58.6	18°55.1	N21°13.2	86°07.0	N16°54.9	128°33.4	N02°01.3	171°49.2	S15°16.8								
13	152°01.1	33°54.4	12.7	101°07.9	55.4	143°36.0	01.3	186°51.8	16.9								
14	167°03.5	48°53.6	12.3	116°08.8	55.8	158°38.5	01.3	201°54.5	16.9								
15	182°06.0	63°52.8	.. 11.8	131°09.7	.. 56.2	173°41.0	.. 01.2	216°57.1	.. 17.0								
16	197°08.5	78°52.1	11.3	146°10.6	56.6	188°43.6	01.2	231°59.8	17.1								
17	212°10.9	93°51.3	10.9	161°11.5	57.0	203°46.1	01.1	247°02.4	17.1								
18	227°13.4	108°50.5	N21°10.4	176°12.4	N16°57.4	218°48.7	N02°01.1	262°05.0	S15°17.2								
19	242°15.9	123°49.8	09.9	191°13.3	57.8	233°51.2	01.0	277°07.7	17.3								
20	257°18.3	138°49.0	09.4	206°14.2	58.3	248°53.7	01.0	292°10.3	17.3								
21	272°20.8	153°48.2	.. 09.0	221°15.1	.. 58.7	263°56.3	.. 00.9	307°13.0	.. 17.4								
22	287°23.2	168°47.4	08.5	236°16.0	59.1	278°58.8	00.9	322°15.6	17.4								
23	302°25.7	183°46.7	08.0	251°16.8	59.5	294°01.4	00.8	337°18.3	17.5								
Mer.pass. 02:54			ν -0.8° d -0.5° m -3.89	ν 0.9° d 0.4° m 0.07			ν 2.5° d -0.0° m -2.71			ν 2.6° d -0.1° m 0.36							
Tue			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	317°28.2	198°45.9	N21°07.5	266°17.7	N16°59.9	309°03.9	N02°00.8	352°20.9	S15°17.6								
1	332°30.6	213°45.1	07.0	281°18.6	17°00.3	324°06.5	00.7	7°23.6	17.6								
2	347°33.1	228°44.4	06.6	296°19.5	00.7	339°09.0	00.7	22°26.2	17.7								
3	2°35.6	243°43.6	.. 06.1	311°20.4	.. 01.1	354°11.5	.. 00.7	37°28.9	.. 17.8								
4	17°38.0	258°42.8	05.6	326°21.3	01.6	9°14.1	00.6	52°31.5	17.8								
5	32°40.5	273°42.1	05.1	341°22.2	02.0	24°16.6	00.6	67°34.1	17.9								
6	47°43.0	288°41.3	N21°04.6	356°23.1	N17°02.4	39°19.2	N02°00.5	82°36.8	S15°18.0								
7	62°45.4	303°40.5	04.1	11°24.0	02.8	54°21.7	00.5	97°39.4	18.0								
8	77°47.9	318°39.8	03.7	26°24.9	03.2	69°24.3	00.4	112°42.1	18.1								
9	92°50.4	333°39.0	.. 03.2	41°25.8	.. 03.6	84°26.8	.. 00.4	127°44.7	.. 18.2								
10	107°52.8	348°38.3	02.7	56°26.7	04.0	99°29.4	00.3	142°47.4	18.2								
11	122°55.3	3°37.5	02.2	71°27.6	04.4	114°31.9	00.3	157°50.0	18.3								
12	137°57.7	18°36.7	N21°01.7	86°28.5	N17°04.8	129°34.5	N02°00.2	172°52.7	S15°18.3								
13	153°00.2	33°36.0	01.2	101°29.4	05.2	144°37.0	00.2	187°55.3	18.4								
14	168°02.7	48°35.2	00.7	116°30.3	05.7	159°39.6	00.1	202°57.9	18.5								
15	183°05.1	63°34.4	21°00.2	131°31.2	.. 06.1	174°42.1	.. 00.1	218°00.6	.. 18.5								
16	198°07.6	78°33.7	20°59.7	146°32.1	06.5	189°44.7	00.0	233°03.2	18.6								
17	213°10.1	93°32.9	59.2	161°33.0	06.9	204°47.2	02°00.0	248°05.9	18.7								
18	228°12.5	108°32.2	N20°58.7	176°33.9	N17°07.3	219°49.7	N01°59.9	263°08.5	S15°18.7								
19	243°15.0	123°31.4	58.2	191°34.8	07.7	234°52.3	59.9	278°11.2	18.8								
20	258°17.5	138°30.6	57.7	206°35.7	08.1	249°54.8	59.8	293°13.8	18.9								
21	273°19.9	153°29.9	.. 57.2	221°36.6	.. 08.5	264°57.4	.. 59.8	308°16.5	.. 18.9								
22	288°22.4	168°29.1	56.7	236°37.5	08.9	279°59.9	59.7	323°19.1	19.0								
23	303°24.9	183°28.3	56.2	251°38.4	09.3	295°02.5	59.7	338°21.8	19.1								
Mer.pass. 02:50			ν -0.8° d -0.5° m -3.89	ν 0.9° d 0.4° m 0.06			ν 2.5° d -0.0° m -2.72			ν 2.6° d -0.1° m 0.35							
Wed			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	318°27.3	198°27.6	N20°55.7	266°39.3	N17°09.7	310°05.0	N01°59.6	353°24.4	S15°19.1								
1	333°29.8	213°26.8	55.2	281°40.2	10.1	325°07.6	59.6	8°27.0	19.2								
2	348°32.2	228°26.1	54.7	296°41.1	10.5	340°10.2	59.5	23°29.7	19.2								
3	3°34.7	243°25.3	.. 54.2	311°42.0	.. 10.9	355°12.7	.. 59.5	38°32.3	.. 19.3								
4	18°37.2	258°24.5	53.7	326°42.9	11.3	10°15.3	59.4	53°35.0	19.4								
5	33°39.6	273°23.8	53.2	341°43.8	11.8	25°17.8	59.4	68°37.6	19.4								
6	48°42.1	288°23.0	N20°52.6	356°44.7	N17°12.2	40°20.4	N01°59.3	83°40.3	S15°19.5								
7	63°44.6	303°22.3	52.1	11°45.6	12.6	55°22.9	59.3	98°42.9	19.6								
8	78°47.0	318°21.5	51.6	26°46.5	13.0	70°25.5	59.2	113°45.6	19.6								
9	93°49.5	333°20.8	.. 51.1	41°47.4	.. 13.4	85°28.0	.. 59.2	128°48.2	.. 19.7								
10	108°52.0	348°20.0	50.6	56°48.3	13.8	100°30.6	59.1	143°50.9	19.8								
11	123°54.4	3°19.2	50.1	71°49.2	14.2	115°33.1	59.1	158°53.5	19.8								
12	138°56.9	18°18.5	N20°49.6	86°50.1	N17°14.6	130°35.7	N01°59.0	173°56.1	S15°19.9								
13	153°59.3	33°17.7	49.0	101°51.0	15.0	145°38.2	59.0	188°58.8	20.0								
14	169°01.8	48°17.0	48.5	116°51.9	15.4	160°40.8	58.9	204°01.4	20.0								
15	184°04.3	63°16.2	.. 48.0	131°52.8	.. 15.8	175°43.3	.. 58.9	219°04.1	.. 20.1								
16	199°06.7	78°15.5	47.5	146°53.7	16.2	190°45.9	58.8	234°06.7	20.1								
17	214°09.2	93°14.7	47.0	161°54.6	16.6	205°48.5	58.8	249°09.4	20.2								
18	229°11.7	108°14.0	N20°46.4	176°55.5	N17°17.0	220°51.0	N01°58.7	264°12.0	S15°20.3								
19	244°14.1	123°13.2	45.9	191°56.4	17.4	235°53.6	58.7	279°14.7	20.3								
20	259°16.6	138°12.4	45.4	206°57.3	17.8												

DUT1 = UT1-UTC = -0.0330 sec  $\Delta T = TT-UT1 = +69.2170$  sec

2022 August 08 to Aug. 10 UT

h		Sun		Moon				
Mon		GHA	Dec	GHA	$\nu$	Dec	d	HP
0	178°33.7	N16°12.0	59°04.9	3.7'	\$25°29.0	-5.8'	59.9'	
1	193°33.8	11.3	73°27.6	3.6'	25°34.8	-5.6'	59.9'	
2	208°33.9	10.6	87°50.2	3.5'	25°40.4	-5.4'	60.0'	
3	223°34.0	09.9	102°12.7	3.4'	25°45.9	-5.3'	60.0'	
4	238°34.1	09.2	116°35.1	3.3'	25°51.2	-5.1'	60.0'	
5	253°34.1	08.5	130°57.4	3.2'	25°56.2	-4.9'	60.0'	
6	268°34.2	N16°07.7	145°19.7	3.1'	\$26°01.2	-4.7'	60.1'	
7	283°34.3	07.0	159°41.8	3.1'	26°05.9	-4.5'	60.1'	
8	298°34.4	06.3	174°03.9	3.0'	26°10.4	-4.4'	60.1'	
9	313°34.5	05.6	188°25.8	2.9'	26°14.8	-4.2'	60.1'	
10	328°34.6	04.9	202°47.7	2.8'	26°18.9	-4.0'	60.2'	
11	343°34.6	04.2	217°09.5	2.7'	26°22.9	-3.8'	60.2'	
12	358°34.7	N16°03.5	231°31.2	2.6'	\$26°26.7	-3.6'	60.2'	
13	13°34.8	02.8	245°52.9	2.6'	26°30.3	-3.4'	60.2'	
14	28°34.9	02.1	260°14.5	2.5'	26°33.7	-3.2'	60.3'	
15	43°35.0	01.3	274°36.0	2.4'	26°37.0	-3.0'	60.3'	
16	58°35.1	16°00.6	288°57.4	2.4'	26°40.0	-2.8'	60.3'	
17	73°35.2	15°59.9	303°18.7	2.3'	26°42.8	-2.6'	60.3'	
18	88°35.2	N15°59.2	317°40.0	2.2'	\$26°45.5	-2.4'	60.3'	
19	103°35.3	58.5	332°01.3	2.2'	26°47.9	-2.2'	60.4'	
20	118°35.4	57.8	346°22.4	2.1'	26°50.1	-2.0'	60.4'	
21	133°35.5	57.0	0°43.6	2.1'	26°52.2	-1.8'	60.4'	
22	148°35.6	56.3	15°04.6	2.0'	26°54.0	-1.6'	60.4'	
23	163°35.7	55.6	29°25.6	2.0'	26°55.7	-1.4'	60.4'	
	SD = 15.8'	d = -0.7'		SD = 16.3'				

Tue		GHA		Dec				
	Mon	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	178°35.8	N15°54.9	43°46.6	1.9'	\$26°57.1	-1.2'	60.5'	
1	193°35.8	54.2	58°07.5	1.9'	26°58.3	-1.0'	60.5'	
2	208°35.9	53.5	72°28.4	1.8'	26°59.4	-0.8'	60.5'	
3	223°36.0	0.1	52.7	86°49.3	1.8'	27°00.2	-0.6'	60.5'
4	238°36.1	52.0	101°10.1	1.8'	27°00.8	-0.4'	60.5'	
5	253°36.2	51.3	115°30.8	1.7'	27°01.3	-0.2'	60.5'	
6	268°36.3	N15°50.6	129°51.6	1.7'	\$27°01.5	-0.0'	60.6'	
7	283°36.4	49.9	144°12.3	1.7'	27°01.5	0.2'	60.6'	
8	298°36.5	49.1	158°33.0	1.7'	27°01.3	0.4'	60.6'	
9	313°36.6	0.1	48.4	172°53.7	1.7'	27°00.9	0.6'	60.6'
10	328°36.6	47.7	187°14.3	1.6'	27°00.3	0.8'	60.6'	
11	343°36.7	47.0	201°35.0	1.6'	26°59.5	1.0'	60.6'	
12	358°36.8	N15°46.3	215°55.6	1.6'	\$26°58.5	1.2'	60.7'	
13	13°36.9	45.5	230°16.2	1.6'	26°57.3	1.4'	60.7'	
14	28°37.0	44.8	244°36.8	1.6'	26°55.8	1.6'	60.7'	
15	43°37.1	0.1	44.1	258°57.5	1.6'	26°54.2	1.8'	60.7'
16	58°37.2	43.4	273°18.1	1.6'	26°52.3	2.1'	60.7'	
17	73°37.3	42.6	287°38.7	1.6'	26°50.3	2.3'	60.7'	
18	88°37.4	N15°41.9	301°59.3	1.6'	\$26°48.0	2.5'	60.7'	
19	103°37.5	41.2	316°20.0	1.7'	26°45.6	2.7'	60.7'	
20	118°37.6	40.5	330°40.6	1.7'	26°42.9	2.9'	60.7'	
21	133°37.6	0.1	39.7	345°01.3	1.7'	26°40.0	3.1'	60.8'
22	148°37.7	39.0	359°22.0	1.7'	26°36.9	3.3'	60.8'	
23	163°37.8	38.3	13°42.7	1.7'	26°33.7	3.5'	60.8'	
	SD = 15.8'	d = -0.7'		SD = 16.5'				

Wed		GHA		Dec				
	Mon	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	178°37.9	N15°37.5	28°03.5	1.8'	\$26°30.2	3.7'	60.8'	
1	193°38.0	36.8	42°24.2	1.8'	26°26.5	3.9'	60.8'	
2	208°38.1	36.1	56°45.0	1.8'	26°22.6	4.1'	60.8'	
3	223°38.2	0.1	35.4	71°05.9	1.9'	26°18.5	4.3'	60.8'
4	238°38.3	34.6	85°26.8	1.9'	26°14.2	4.5'	60.8'	
5	253°38.4	33.9	99°47.7	2.0'	26°09.7	4.7'	60.8'	
6	268°38.5	N15°33.2	114°08.7	2.0'	\$26°05.0	4.9'	60.8'	
7	283°38.6	32.4	128°29.7	2.1'	26°00.1	5.1'	60.8'	
8	298°38.7	31.7	142°50.7	2.1'	25°55.0	5.3'	60.8'	
9	313°38.8	0.1	31.0	157°11.9	2.2'	25°49.7	5.5'	60.8'
10	328°38.9	30.2	171°33.0	2.2'	25°44.2	5.7'	60.8'	
11	343°39.0	29.5	185°54.3	2.3'	25°38.5	5.9'	60.8'	
12	358°39.1	N15°28.8	200°15.5	2.4'	\$25°32.6	6.1'	60.9'	
13	13°39.2	28.0	214°36.9	2.4'	25°26.6	6.3'	60.9'	
14	28°39.3	27.3	228°58.3	2.5'	25°20.3	6.5'	60.9'	
15	43°39.4	0.1	26.6	243°19.8	2.6'	25°13.8	6.6'	60.9'
16	58°39.5	25.8	257°41.4	2.6'	25°07.2	6.8'	60.9'	
17	73°39.6	25.1	272°03.0	2.7'	25°00.4	7.0'	60.9'	
18	88°39.6	N15°24.4	286°24.7	2.8'	\$24°53.4	7.2'	60.9'	
19	103°39.7	23.6	300°46.5	2.9'	24°46.2	7.4'	60.9'	
20	118°39.8	22.9	315°08.3	2.9'	24°38.8	7.6'	60.9'	
21	133°39.9	0.1	22.2	329°30.3	3.0'	24°31.2	7.7'	60.9'
22	148°40.0	21.4	343°52.3	3.1'	24°23.5	7.9'	60.9'	
23	163°40.1	20.7	358°14.4	3.2'	24°15.5	8.1'	60.9'	
	SD = 15.8'	d = -0.7'		SD = 16.6'				

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

## August 11, 12, 13 UT (Thu., Fri., Sat.)

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	319°26.5	198°09.4	N20°43.3	267°00.9	N17°19.4	311°06.4	N01°58.4	354°27.9	S15°20.7					Alpheratz	357°36.5	29°12.8	
1	334°28.9	213°08.7	42.7	282°01.8	19.8	326°08.9	58.4	9°30.5	20.7					Ankaa	353°08.8	-42°10.8	
2	349°31.4	228°07.9	42.2	297°02.7	20.2	341°11.5	58.3	24°33.2	20.8					Schedar	349°32.9	56°39.4	
3	4°33.8	243°07.2	.. 41.7	312°03.6	.. 20.6	356°14.0	.. 58.3	39°35.8	.. 20.9					Diphda	348°49.1	-17°51.6	
4	19°36.3	258°06.4	41.1	327°04.5	21.0	11°16.6	58.2	54°38.5	20.9					Achernar	335°21.5	-57°07.1	
5	34°38.8	273°05.7	40.6	342°05.4	21.4	26°19.2	58.1	69°41.1	21.0					Hamal	327°53.3	23°34.1	
6	49°41.2	288°04.9	N20°40.1	357°06.3	N17°21.8	41°21.7	N01°58.1	84°43.8	S15°21.0					Polaris	314°57.0	89°21.2	
7	64°43.7	303°04.2	39.5	12°07.2	22.2	56°24.3	58.0	99°46.4	21.1					Acamar	315°13.3	-40°12.6	
8	79°46.2	318°03.4	39.0	27°08.1	22.6	71°26.8	58.0	114°49.1	21.2					Menkar	314°08.2	4°10.7	
9	94°48.6	333°02.7	.. 38.5	42°09.0	.. 23.0	86°29.4	.. 57.9	129°51.7	.. 21.2					Mirfak	308°31.1	49°56.2	
10	109°51.1	348°01.9	37.9	57°09.9	23.4	101°32.0	57.9	144°54.4	21.3					Aldebaran	290°42.0	16°33.3	
11	124°53.6	3°01.2	37.4	72°10.9	23.8	116°34.5	57.8	159°57.0	21.4					Rigel	281°05.9	-8°10.4	
12	139°56.0	18°00.4	N20°36.8	87°11.8	N17°24.2	131°37.1	N01°57.8	174°59.6	S15°21.4					Capella	280°25.1	46°01.1	
13	154°58.5	32°59.7	36.3	102°12.7	24.6	146°39.6	57.7	190°02.3	21.5					Bellatrix	278°25.2	6°22.3	
14	170°01.0	47°58.9	35.7	117°13.6	25.0	161°42.2	57.7	205°04.9	21.6					Elnath	278°04.6	28°37.5	
15	185°03.4	62°58.2	.. 35.2	132°14.5	.. 25.4	176°44.8	.. 57.6	220°07.6	.. 21.6					Alnilam	275°39.9	-1°11.1	
16	200°05.9	77°57.4	34.7	147°15.4	25.8	191°47.3	57.6	235°10.2	21.7					Betelgeuse	270°54.4	7°24.7	
17	215°08.3	92°56.7	34.1	162°16.3	26.1	206°49.9	57.5	250°12.9	21.8					Canopus	263°53.7	-52°42.2	
18	230°10.8	107°55.9	N20°33.6	177°17.2	N17°26.5	221°52.5	N01°57.4	265°15.5	S15°21.8					Sirius	258°28.3	-16°44.6	
19	245°13.3	122°55.2	33.0	192°18.1	26.9	236°55.0	57.4	280°18.2	21.9					Adhara	255°07.7	-29°00.0	
20	260°15.7	137°54.4	32.5	207°19.0	27.3	251°57.6	57.3	295°20.8	21.9					Procyon	244°53.2	5°10.1	
21	275°18.2	152°53.7	.. 31.9	222°19.9	.. 27.7	267°00.1	.. 57.3	310°23.5	.. 22.0					Pollux	243°20.1	27°58.3	
22	290°20.7	167°52.9	31.4	237°20.8	28.1	282°02.7	57.2	325°26.1	22.1					Avior	234°16.2	-59°34.7	
23	305°23.1	182°52.2	30.8	252°21.7	28.5	297°05.3	57.2	340°28.8	22.1					Suhail	229°48.2	-43°31.3	
Mer.pass. 02:42		ν -0.8° d -0.5° m -3.89	ν 0.9° d 0.4° m 0.04		ν 2.6° d -0.1° m -2.73	ν 2.6° d -0.1° m 0.34											
Fri		GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Dubhe	193°44.0	61°38.0
0	320°25.6	197°51.5	N20°30.2	267°22.7	N17°28.9	312°07.8	N01°57.1	355°31.4	S15°22.2					Denebola	182°27.2	14°27.0	
1	335°28.1	212°50.7	29.7	282°23.6	29.3	327°10.4	57.1	10°34.0	22.3					Gienah	175°45.9	-17°39.9	
2	350°30.5	227°50.0	29.1	297°24.5	29.7	342°13.0	57.0	25°36.7	22.3					Acru	173°02.8	-63°13.6	
3	5°33.0	242°49.2	.. 28.6	312°25.4	.. 30.1	357°15.5	.. 56.9	40°39.3	.. 22.4					Gacrux	171°54.2	-57°14.5	
4	20°35.5	257°48.5	28.0	327°26.3	30.5	12°18.1	56.9	55°42.0	22.5					Alioth	166°15.0	55°50.6	
5	35°37.9	272°47.7	27.5	342°27.2	30.9	27°20.7	56.8	70°44.6	22.5					Spica	158°24.5	-11°16.6	
6	50°40.4	287°47.0	N20°26.9	357°28.1	N17°31.3	42°23.2	N01°56.8	85°47.3	S15°22.6					Alkaid	152°53.8	49°12.4	
7	65°42.8	302°46.2	26.3	12°29.0	31.7	57°25.8	56.7	100°49.9	22.7					Hadar	148°39.0	-60°29.1	
8	80°45.3	317°45.5	25.8	27°29.9	32.0	72°28.4	56.7	115°52.6	22.7					Menkent	148°00.1	-36°28.9	
9	95°47.8	332°44.8	.. 25.2	42°30.8	.. 32.4	87°30.9	.. 56.6	130°55.2	.. 22.8					Arcturus	145°49.8	19°04.1	
10	110°50.2	347°44.0	24.6	57°31.8	32.8	102°33.5	56.5	145°57.9	22.8					Rigel Kent.	139°43.1	-60°55.9	
11	125°52.7	2°43.3	24.1	72°32.7	33.2	117°36.1	56.5	161°00.5	22.9					Kochab	137°19.9	74°04.1	
12	140°55.2	17°42.5	N20°23.5	87°33.6	N17°33.6	132°38.6	N01°56.4	176°03.2	S15°23.0					Zuben'ubi	136°58.2	-16°08.1	
13	155°57.6	32°41.8	22.9	102°34.5	34.0	147°41.2	56.4	191°05.8	23.0					Alphecca	126°05.4	26°38.6	
14	171°00.1	47°41.1	22.4	117°35.4	34.4	162°43.8	56.3	206°08.4	23.1					Antares	112°18.1	-26°28.9	
15	186°02.6	62°40.3	.. 21.8	132°36.3	.. 34.8	177°46.4	.. 56.3	221°11.1	.. 23.2					Atria	107°13.9	-69°04.3	
16	201°05.0	77°39.6	21.2	147°37.2	35.2	192°48.9	56.2	236°13.7	23.2					Sabik	102°04.9	-15°45.1	
17	216°07.5	92°38.8	20.7	162°38.1	35.6	207°51.5	56.1	251°16.4	23.3					Shaula	96°12.8	-37°07.3	
18	231°09.9	107°38.1	N20°20.1	177°39.1	N17°35.9	222°54.1	N01°56.1	266°19.0	S15°23.4					Rasalhague	96°00.2	12°32.8	
19	246°12.4	122°37.4	19.5	192°40.0	36.3	237°56.6	56.0	281°21.7	23.4					Eltanin	90°42.8	51°29.4	
20	261°14.9	137°36.6	18.9	207°40.9	36.7	252°59.2	56.0	296°24.3	23.5					Kaus Aust.	83°34.8	-34°22.5	
21	276°17.3	152°35.9	.. 18.4	222°41.8	.. 37.1	268°01.8	.. 55.9	311°27.0	.. 23.6					Vega	80°34.2	38°48.4	
22	291°19.8	167°35.1	17.8	237°42.7	37.5	283°04.4	55.9	326°29.6	23.6					Nunki	75°49.9	-26°16.1	
23	306°22.3	182°34.4	17.2	252°43.6	37.9	298°06.9	55.8	341°32.3	23.7					Altair	62°01.6	8°55.8	
Mer.pass. 02:38		ν -0.7° d -0.6° m -3.89	ν 0.9° d 0.4° m 0.03		ν 2.6° d -0.1° m -2.74	ν 2.6° d -0.1° m 0.32											
Sat		GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Markab	13°31.6	15°19.6
0	321°24.7	197°33.7	N20°16.6	267°44.5	N17°38.3	313°09.5	N01°55.7	356°34.9	S15°23.7					Aug 11 Thu	SHA	Mer.pass	
1	336°27.2	212°32.9	16.0	282°45.5	38.7	328°12.1	55.7	11°37.6	23.8					Venus	238°43.0	10:48	
2	351°29.7	227°32.2	15.5	297°46.4	39.0	343°14.6	55.6	26°40.2	23.9					Mars	307°34.4	06:12	
3	6°32.1	242°31.5	.. 14.9	312°47.3	.. 39.4	358°17.2	.. 55.6	41°42.9	.. 23.9					Jupiter	351°39.9	03:15	
4	21°34.6	257°30.7	14.3	327°48.2	39.8	13°19.8	55.5	56°45.5	24.0					Saturn	35°01.4	00:22	
5	36°37.1	272°30.0	13.7	342°49.1	40.2	28°22.4	55.4	71°48.1	24.1								
6	51°39.5	287°29.3	N20°13.1	357°50.0	N17°40.6	43°24.9	N01°55.4	86°50.8	S15°24.1					Aug 12 Fri	SHA	Mer.pass	
7	66°42.0	302°28.5	12.5	12°50.9	41.0	58°27.5	55.3	101°53.4	24.2					Venus	237°25.9	10:49	
8	81°44.4	317°27.8	12.0	27°51.9	41.4	73°30.1	55.3	116°56.1	24.3					Mars	306°57.1	06:10	
9	96°46.9	332°27.0	.. 11.4	42°52.8	.. 41.7	88°32.7	.. 55.2	131°58.7	.. 24.3					Jupiter	351°42.2	03:11	
10	111°49.4	347°26.3	10.8	57°53.7	42.1	103°35.2	55.1	147°01.4	24.4					Saturn	35°05.8	00:18	
11	126°51.8	2°25.6	10.2	72°54.6	42.5	118°37.8	55.1	162°04.0	24.5								
12	141°54.3	17°24.8	N20°09.6	87°55.5	N1												

DUT1 = UT1-UTC = -0.0298 sec  $\Delta T = TT-UT1 = +69.2138$  sec

2022 August 11 to Aug. 13 UT

h	Sun		Moon				
Thu	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	178°40.2	N15°19.9	12°36.6	3.3'	S24°07.4	8.3'	60.8'
1	193°40.3	19.2	26°58.9	3.4'	23°59.2	8.5'	60.8'
2	208°40.4	18.5	41°21.3	3.5'	23°50.7	8.6'	60.8'
3	223°40.5	17.7	55°43.8	3.6'	23°42.1	8.8'	60.8'
4	238°40.6	17.0	70°06.3	3.7'	23°33.3	9.0'	60.8'
5	253°40.7	16.2	84°29.0	3.8'	23°24.3	9.1'	60.8'
6	268°40.8	N15°15.5	98°51.7	3.9'	S23°15.2	9.3'	60.8'
7	283°40.9	14.8	113°14.6	4.0'	23°05.9	9.5'	60.8'
8	298°41.0	14.0	127°37.6	4.1'	22°56.4	9.6'	60.8'
9	313°41.1	13.3	142°00.6	4.2'	22°46.8	9.8'	60.8'
10	328°41.2	12.5	156°23.8	4.3'	22°37.1	9.9'	60.8'
11	343°41.4	11.8	170°47.1	4.4'	22°27.1	10.1'	60.8'
12	358°41.5	N15°11.0	185°10.4	4.5'	S22°17.0	10.2'	60.8'
13	13°41.6	10.3	199°33.9	4.6'	22°06.8	10.4'	60.8'
14	28°41.7	09.6	213°57.5	4.7'	21°56.4	10.5'	60.7'
15	43°41.8	08.8	228°21.2	4.8'	21°45.9	10.7'	60.7'
16	58°41.9	08.1	242°45.0	4.9'	21°35.2	10.8'	60.7'
17	73°42.0	07.3	257°08.9	5.0'	21°24.3	11.0'	60.7'
18	88°42.1	N15°06.6	271°32.9	5.1'	S21°13.4	11.1'	60.7'
19	103°42.2	05.8	285°57.1	5.2'	21°02.3	11.3'	60.7'
20	118°42.3	05.1	300°21.3	5.4'	20°51.0	11.4'	60.7'
21	133°42.4	04.3	314°45.7	5.5'	20°39.6	11.5'	60.7'
22	148°42.5	03.6	329°10.1	5.6'	20°28.1	11.7'	60.6'
23	163°42.6	02.8	343°34.7	5.7'	20°16.4	11.8'	60.6'
	SD = 15.8'		d = -0.7'				SD = 16.6'
							SD = 16.6'

Fri	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	178°42.7	N15°02.1	357°59.4	5.8'	S20°04.7	11.9'	60.6'
1	193°42.8	01.3	12°24.2	5.9'	19°52.7	12.0'	60.6'
2	208°42.9	15°00.6	26°49.2	6.0'	19°40.7	12.2'	60.6'
3	223°43.0	14°59.8	41°14.2	6.2'	19°28.5	12.3'	60.6'
4	238°43.1	59.1	55°39.4	6.3'	19°16.3	12.4'	60.6'
5	253°43.2	58.3	70°04.7	6.4'	19°03.9	12.5'	60.5'
6	268°43.3	N14°57.6	84°30.0	6.5'	S18°51.3	12.6'	60.5'
7	283°43.4	56.8	98°55.6	6.6'	18°38.7	12.7'	60.5'
8	298°43.6	56.1	113°21.2	6.7'	18°26.0	12.9'	60.5'
9	313°43.7	55.3	127°46.9	6.9'	18°13.1	13.0'	60.5'
10	328°43.8	54.6	142°12.8	7.0'	18°00.1	13.1'	60.4'
11	343°43.9	53.8	156°38.7	7.1'	17°47.1	13.2'	60.4'
12	358°44.0	N14°53.1	171°04.8	7.2'	S17°33.9	13.3'	60.4'
13	13°44.1	52.3	185°31.0	7.3'	17°20.6	13.4'	60.4'
14	28°44.2	51.6	199°57.3	7.4'	17°07.2	13.5'	60.4'
15	43°44.3	50.8	214°23.7	7.5'	16°53.8	13.6'	60.3'
16	58°44.4	50.1	228°50.3	7.7'	16°40.2	13.7'	60.3'
17	73°44.5	49.3	243°16.9	7.8'	16°26.5	13.7'	60.3'
18	88°44.6	N14°48.6	257°43.7	7.9'	S16°12.8	13.8'	60.3'
19	103°44.7	47.8	272°10.6	8.0'	15°59.0	13.9'	60.2'
20	118°44.9	47.0	286°37.6	8.1'	15°45.0	14.0'	60.2'
21	133°45.0	46.3	301°04.7	8.2'	15°31.0	14.1'	60.2'
22	148°45.1	45.5	315°31.9	8.3'	15°16.9	14.2'	60.2'
23	163°45.2	44.8	329°59.2	8.4'	15°02.8	14.2'	60.1'
	SD = 15.8'		d = -0.7'				SD = 16.5'
							SD = 16.5'

Sat	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	178°45.3	N14°44.0	344°26.6	8.5'	S14°48.5	14.3'	60.1'
1	193°45.4	43.2	358°54.1	8.6'	14°34.2	14.4'	60.1'
2	208°45.5	42.5	13°21.8	8.7'	14°19.8	14.5'	60.1'
3	223°45.6	41.7	27°49.5	8.9'	14°05.3	14.5'	60.0'
4	238°45.7	41.0	42°17.4	9.0'	13°50.8	14.6'	60.0'
5	253°45.9	40.2	56°45.3	9.1'	13°36.2	14.7'	60.0'
6	268°46.0	N14°39.4	71°13.4	9.2'	S13°21.5	14.7'	60.0'
7	283°46.1	38.7	85°41.6	9.3'	13°06.8	14.8'	59.9'
8	298°46.2	37.9	100°09.9	9.4'	12°52.0	14.9'	59.9'
9	313°46.3	37.2	114°38.2	9.5'	12°37.1	14.9'	59.9'
10	328°46.4	36.4	129°06.7	9.6'	12°22.2	15.0'	59.8'
11	343°46.5	35.6	143°35.3	9.7'	12°07.3	15.0'	59.8'
12	358°46.6	N14°34.9	158°03.9	9.8'	S11°52.2	15.1'	59.8'
13	13°46.8	34.1	172°32.7	9.9'	11°37.2	15.1'	59.8'
14	28°46.9	33.3	187°01.6	10.0'	11°22.1	15.2'	59.7'
15	43°47.0	32.6	201°30.5	10.1'	11°06.9	15.2'	59.7'
16	58°47.1	31.8	215°59.6	10.2'	10°51.7	15.3'	59.7'
17	73°47.2	31.1	230°28.8	10.2'	10°36.4	15.3'	59.6'
18	88°47.3	N14°30.3	244°58.0	10.3'	S10°21.1	15.3'	59.6'
19	103°47.5	29.5	259°27.3	10.4'	10°05.8	15.4'	59.6'
20	118°47.6	28.8	273°56.8	10.5'	09°50.4	15.4'	59.5'
21	133°47.7	28.0	288°26.3	10.6'	09°35.0	15.4'	59.5'
22	148°47.8	27.2	302°55.9	10.7'	09°19.6	15.5'	59.5'
23	163°47.9	26.5	317°25.6	10.8'	09°04.1	15.5'	59.4'
	SD = 15.8'		d = -0.8'				SD = 16.4'
							SD = 16.4'

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

## August 14, 15, 16 UT (Sun., Mon., Tue.)

Aries		Venus		Mars		Jupiter		Saturn		Stars	
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec
0	322°23.9	197°16.1	N20°02.4	268°06.5	N17°47.5	314°11.3	N01°54.3	357°38.4	S15°25.3	Alpheratz	357°36.5
1	337°26.3	212°15.3	01.8	283°07.5	47.8	329°13.9	54.2	12°41.1	25.4	Ankaa	353°08.8
2	352°28.8	227°14.6	01.2	298°08.4	48.2	344°16.5	54.2	27°43.7	25.4	Schedar	349°32.9
3	7°31.3	242°13.9	.. 00.6	313°09.3	.. 48.6	359°19.1	.. 54.1	42°46.4	.. 25.5	Diphda	348°49.1
4	22°33.7	257°13.2	20°00.0	328°10.2	49.0	14°21.7	54.0	57°49.0	25.5	Achernar	335°21.4
5	37°36.2	272°12.4	19°59.4	343°11.2	49.4	29°24.2	54.0	72°51.7	25.6	Hamal	327°53.3
6	52°38.7	287°11.7	N19°58.8	358°12.1	N17°49.7	44°26.8	N01°53.9	87°54.3	S15°25.7	Polaris	314°55.6
7	67°41.1	302°11.0	58.2	13°13.0	50.1	59°29.4	53.9	102°57.0	25.7	Acamar	315°13.2
8	82°43.6	317°10.3	57.6	28°13.9	50.5	74°32.0	53.8	117°59.6	25.8	Menkar	314°08.2
9	97°46.0	332°09.5	.. 56.9	43°14.8	.. 50.9	89°34.6	.. 53.7	133°02.3	.. 25.9	Mirfak	308°31.1
10	112°48.5	347°08.8	56.3	58°15.8	51.3	104°37.1	53.7	148°04.9	25.9	Aldebaran	290°42.0
11	127°51.0	2°08.1	55.7	73°16.7	51.6	119°39.7	53.6	163°07.5	26.0	Rigel	281°05.9
12	142°53.4	17°07.4	N19°55.1	88°17.6	N17°52.0	134°42.3	N01°53.5	178°10.2	S15°26.1	Capella	280°25.0
13	157°55.9	32°06.6	54.5	103°18.5	52.4	149°44.9	53.5	193°12.8	26.1	Bellatrix	278°25.2
14	172°58.4	47°05.9	53.9	118°19.4	52.8	164°47.5	53.4	208°15.5	26.2	Elnath	278°04.6
15	188°00.8	62°05.2	.. 53.2	133°20.4	.. 53.1	179°50.1	.. 53.4	223°18.1	.. 26.2	Alnilam	275°39.9
16	203°03.3	77°04.5	52.6	148°21.3	53.5	194°52.6	53.3	238°20.8	26.3	Betelgeuse	270°54.4
17	218°05.8	92°03.7	52.0	163°22.2	53.9	209°55.2	53.2	253°23.4	26.4	Canopus	263°53.7
18	233°08.2	107°03.0	N19°51.4	178°23.1	N17°54.3	224°57.8	N01°53.2	268°26.1	S15°26.4	Sirius	258°28.2
19	248°10.7	122°02.3	50.8	193°24.1	54.6	240°00.4	53.1	283°28.7	26.5	Adhara	255°07.7
20	263°13.2	137°01.6	50.1	208°25.0	55.0	255°03.0	53.0	298°31.4	26.6	Procyon	244°53.2
21	278°15.6	152°00.8	.. 49.5	223°25.9	.. 55.4	270°05.6	.. 53.0	313°34.0	.. 26.6	Pollux	243°20.1
22	293°18.1	167°00.1	48.9	238°26.8	55.8	285°08.2	52.9	328°36.7	26.7	Avior	234°16.1
23	308°20.5	181°59.4	48.3	253°27.8	56.1	300°10.7	52.8	343°39.3	26.8	Suhail	222°48.2
Mer.pass. 02:30		ν -0.7° d -0.6° m -3.89	ν 0.9° d 0.4° m 0.01	ν 2.6° d -0.1° m -2.76	ν 2.6° d -0.1° m 0.30	Miplacidus		221°39.6	.. -69°48.5	Alphard	217°50.0
										Regulus	207°36.9
										Dubhe	193°44.1
										Denebola	182°27.2
										Gienah	175°45.9
										Acrux	173°02.8
										Gacrux	171°54.2
										Alioth	166°15.1
										Spica	158°24.5
										Alkaid	152°53.8
										Hadar	148°39.0
										Menkent	148°00.1
										Arcturus	145°49.8
										Rigel Kent.	139°43.1
										Kochab	137°19.9
										Zuben'ubi	136°58.2
										Alphecca	126°05.4
										Antares	112°18.1
										Atria	107°13.9
										Sabik	102°04.9
										Shaula	96°12.8
										Rasalhague	96°00.2
										Eltanin	90°42.8
										Kaus Aust.	83°34.8
										Vega	80°34.2
										Nunki	75°49.9
										Altair	62°01.6
										Peacock	53°08.3
										Deneb	49°26.7
										Enif	33°40.4
										Al Na'ir	27°34.9
										Fomalhaut	15°16.4
										Scheat	13°46.8
										Markab	13°31.6
Aug 14 Sun		SHA		Mer.pass							
Venus		234°52.2		10:51							
Mars		305°42.7		06:07							
Jupiter		351°47.5		03:03							
Saturn		35°14.6		00:09							
Aug 15 Mon		SHA		Mer.pass							
Venus		233°35.7		10:53							
Mars		305°05.7		06:06							
Jupiter		351°50.3		02:59							
Saturn		35°18.9		00:05							
Aug 16 Tue		SHA		Mer.pass							
Venus		232°19.4		10:54							
Mars		304°28.8		06:04							
Jupiter		351°53.4		02:54							
Saturn		35°23.3		00:01							
Horizontal parallax											
Venus:		0.1									
Mars:		0.1									

DUT1 = UT1-UTC = -0.0283 sec  $\Delta T = TT-UT1 = +69.2123$  sec

2022 August 14 to Aug. 16 UT

h		Sun		Moon			
Sun	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	178°48.0	N14°25.7	331°55.4	10.9'	S08°48.6	15.5'	59.4'
1	193°48.1	24.9	346°25.2	10.9'	08°33.0	15.6'	59.4'
2	208°48.3	24.1	0°55.2	11.0'	08°17.5	15.6'	59.3'
3	223°48.4	23.4	15°25.2	11.1'	08°01.9	15.6'	59.3'
4	238°48.5	22.6	29°55.3	11.2'	07°46.3	15.6'	59.3'
5	253°48.6	21.8	44°25.5	11.3'	07°30.6	15.7'	59.2'
6	268°48.7	N14°21.1	58°55.8	11.3'	S07°15.0	15.7'	59.2'
7	283°48.9	20.3	73°26.1	11.4'	06°59.3	15.7'	59.2'
8	298°49.0	19.5	87°56.5	11.5'	06°43.6	15.7'	59.1'
9	313°49.1	18.8	102°27.0	11.6'	06°27.9	15.7'	59.1'
10	328°49.2	18.0	116°57.6	11.6'	06°12.2	15.7'	59.0'
11	343°49.3	17.2	131°28.2	11.7'	05°56.5	15.7'	59.0'
12	358°49.5	N14°16.4	145°58.9	11.8'	S05°40.7	15.7'	59.0'
13	13°49.6	15.7	160°29.7	11.9'	05°25.0	15.8'	58.9'
14	28°49.7	14.9	175°00.6	11.9'	05°09.2	15.8'	58.9'
15	43°49.8	14.1	189°31.5	12.0'	04°53.5	15.8'	58.9'
16	58°49.9	13.3	204°02.5	12.1'	04°37.7	15.8'	58.8'
17	73°50.1	12.6	218°33.5	12.1'	04°21.9	15.8'	58.8'
18	88°50.2	N14°11.8	233°04.7	12.2'	S04°06.2	15.8'	58.8'
19	103°50.3	11.0	247°35.8	12.2'	03°50.4	15.8'	58.7'
20	118°50.4	10.2	262°07.1	12.3'	03°34.6	15.8'	58.7'
21	133°50.5	09.5	276°38.4	12.4'	03°18.9	15.8'	58.6'
22	148°50.7	08.7	291°09.7	12.4'	03°03.1	15.8'	58.6'
23	163°50.8	07.9	305°41.1	12.5'	02°47.3	15.7'	58.6'
		SD = 15.8'	d = -0.8'	SD = 16.2'			

Mon	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	178°50.9	N14°07.1	320°12.6	12.5'	S02°31.6	15.7'	58.5'
1	193°51.0	06.4	334°44.1	12.6'	02°15.9	15.7'	58.5'
2	208°51.1	05.6	349°15.7	12.6'	02°00.1	15.7'	58.5'
3	223°51.3	04.8	3°47.4	12.7'	01°44.4	15.7'	58.4'
4	238°51.4	04.0	18°19.0	12.7'	01°28.7	15.7'	58.4'
5	253°51.5	03.2	32°50.8	12.8'	01°13.0	15.7'	58.3'
6	268°51.6	N14°02.5	47°22.5	12.8'	S00°57.4	15.7'	58.3'
7	283°51.8	01.7	61°54.4	12.9'	00°41.7	15.6'	58.3'
8	298°51.9	00.9	76°26.3	12.9'	00°26.1	15.6'	58.2'
9	313°52.0	14°00.1	90°58.2	13.0'	S00°10.4	15.6'	58.2'
10	328°52.1	13°59.3	105°30.1	13.0'	N00°05.2	15.6'	58.2'
11	343°52.3	58.6	120°02.1	13.0'	00°20.7	15.6'	58.1'
12	358°52.4	N13°57.8	134°34.2	13.1'	N00°36.3	15.5'	58.1'
13	13°52.5	57.0	149°06.3	13.1'	00°51.8	15.5'	58.0'
14	28°52.6	56.2	163°38.4	13.2'	01°07.3	15.5'	58.0'
15	43°52.8	55.4	178°10.6	13.2'	01°22.8	15.4'	58.0'
16	58°52.9	54.6	192°42.8	13.2'	01°38.2	15.4'	57.9'
17	73°53.0	53.9	207°15.0	13.3'	01°53.7	15.4'	57.9'
18	88°53.1	N13°53.1	221°47.3	13.3'	N02°09.0	15.4'	57.8'
19	103°53.3	52.3	236°19.6	13.3'	02°24.4	15.3'	57.8'
20	118°53.4	51.5	250°51.9	13.4'	02°39.7	15.3'	57.8'
21	133°53.5	50.7	265°24.2	13.4'	02°55.0	15.3'	57.7'
22	148°53.6	49.9	279°56.6	13.4'	03°10.3	15.2'	57.7'
23	163°53.8	49.2	294°29.1	13.4'	03°25.5	15.2'	57.7'
		SD = 15.8'	d = -0.8'	SD = 16.0'			

Tue	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	178°53.9	N13°48.4	309°01.5	13.5'	N03°40.7	15.1'	57.6'
1	193°54.0	47.6	323°34.0	13.5'	03°55.8	15.1'	57.6'
2	208°54.2	46.8	338°06.5	13.5'	04°10.9	15.1'	57.5'
3	223°54.3	46.0	352°39.0	13.5'	04°26.0	15.0'	57.5'
4	238°54.4	45.2	7°11.5	13.6'	04°41.0	15.0'	57.5'
5	253°54.5	44.4	21°44.1	13.6'	04°56.0	14.9'	57.4'
6	268°54.7	N13°43.6	36°16.7	13.6'	N05°11.0	14.9'	57.4'
7	283°54.8	42.8	50°49.3	13.6'	05°25.9	14.9'	57.3'
8	298°54.9	42.1	65°21.9	13.6'	05°40.7	14.8'	57.3'
9	313°55.1	41.3	79°54.5	13.6'	05°55.5	14.8'	57.3'
10	328°55.2	40.5	94°27.1	13.7'	06°10.3	14.7'	57.2'
11	343°55.3	39.7	108°59.8	13.7'	06°25.0	14.7'	57.2'
12	358°55.4	N13°38.9	123°32.5	13.7'	N06°39.7	14.6'	57.2'
13	13°55.6	38.1	138°05.2	13.7'	06°54.3	14.6'	57.1'
14	28°55.7	37.3	152°37.9	13.7'	07°08.8	14.5'	57.1'
15	43°55.8	36.5	167°10.6	13.7'	07°23.3	14.5'	57.0'
16	58°56.0	35.7	181°43.3	13.7'	07°37.8	14.4'	57.0'
17	73°56.1	34.9	196°16.0	13.7'	07°52.2	14.4'	57.0'
18	88°56.2	N13°34.1	210°48.7	13.7'	N08°06.6	14.3'	56.9'
19	103°56.4	33.3	225°21.4	13.7'	08°20.9	14.2'	56.9'
20	118°56.5	32.6	239°54.2	13.7'	08°35.1	14.2'	56.9'
21	133°56.6	31.8	254°26.9	13.7'	08°49.3	14.1'	56.8'
22	148°56.8	31.0	268°59.7	13.7'	09°03.4	14.1'	56.8'
23	163°56.9	30.2	283°32.4	13.7'	09°17.5	14.0'	56.7'
		SD = 15.8'	d = -0.8'	SD = 15.7'			

Lat.	Twilight		Sunrise	Sunset	Twilight	
	Naut.	Civil			Civil	Naut.
N 72°	—:—	—:—	02:24	21:39	—:—	—:—
N 70°	—:—	—:—	02:56	21:09	23:32	—:—
68°	—:—	01:43	03:19	20:47	22:19	—:—
66°	—:—	02:21	03:37	20:29	21:44	—:—
64°	—:—	02:47	03:52	20:15	21:19	23:36
62°	01:32	03:07	04:04	20:03	21:00	22:31
60°	02:06	03:23	04:14	19:53	20:44	21:59
N 58°	02:30	03:36	04:23	19:45	20:31	21:36
56°	02:48	03:47	04:31	19:37	20:20	21:18
54°	03:04	03:57	04:38	19:30	20:10	21:03
52°	03:17	04:06	04:44	19:24	20:02	20:51
50°	03:28	04:13	04:50	19:18	19:54	20:40
48°	03:50	04:30	05:02	19:07	19:39	20:18
N 40°	04:07	04:42	05:11	18:57	19:26	20:01
35°	04:21	04:53	05:20	18:49	19:15	19:47
30°	04:32	05:02	05:27	18:41	19:06	19:36
20°	04:50	05:17	05:40	18:29	18:52	19:19
N 10°	05:04	05:29	05:51	18:18	18:40	19:05
0°	05:15	05:40	06:01	18:08	18:29	18:54
S 10°	05:25	05:50	06:11	17:58	18:20	18:45
20°	05:33	05:59	06:22	17:47	18:10	18:36
30°	05:41	06:09	06:34	17:36	18:00	18:28
35°	05:45	06:15	06:41	17:29	17:55	18:25
40°	05:49	06:20	06:48	17:21	17:49	18:21
45°	05:52	06:27	06:57	17:12	17:43	18:17
S 50°	05:56	06:35	07:08	17:01	17:35	18:13
52°	05:58	06:38	07:13	16:56	17:32	18:12
54°	06:00	06:42	07:19	16:51	17:28	18:10
56°	06:02	06:46	07:25	16:45	17:24	18:08
58°	06:04	06:50	07:32	16:38	17:20	18:06
S 60°	06:06	06:55	07:40	16:30	17:15	18:04
Lat.	Sun	Moonrise	Sun	Moonset	Mon	Tue
	Sun	Mon	Tue	Sun	Mon	Tue
N 72°	21:16	20:44	20:11	06:33	08:51	11:04
N 70°	21:12	20:48	20:23	06:44	08:52	10:54
68°	21:08	20:51	20:34	06:53	08:52	10:46
66°	21:05	20:53	20:42	07:01	08:53	10:40
64°	21:02	20:56	20:49	07:07	08:53	10:34
62°	21:00	20:58	20:55	07:12	08:53	10:30
60°	20:58	20:59	21:01	07:17	08:53	10:26
N 58°	20:56	21:01	21:06	07:21	08:54	10:22
56°	20:54	21:02	21:10	07:25	08:54	10:19
54°	20:53	21:03	21:14	07:28	08:54	10:16
50°	20:50	21:05	21:21	07:34	08:54	10:12
45°	20:47	21:08	2			

## August 17, 18, 19 UT (Wed., Thu., Fri.)

Aries		Venus		Mars		Jupiter		Saturn		Stars	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec
0	325°21.3	196°24.5	N19°16.4	269°13.4	N18°14.1	317°17.9	N01°49.5	0°49.0	S15°29.9	Alpheratz	357°36.5
1	340°23.7	211°23.8	15.7	284°14.4	14.5	332°20.5	49.5	15°51.7	29.9	Ankaa	353°08.8
2	355°26.2	226°23.1	15.0	299°15.3	14.9	347°23.1	49.4	30°54.3	30.0	Schedar	349°32.9
3	10°28.7	241°22.4	14.3	314°16.2	15.2	2°25.7	49.3	45°56.9	30.1	Diphda	348°49.1
4	25°31.1	256°21.7	13.7	329°17.2	15.6	17°28.3	49.2	60°59.6	30.1	Achernar	335°21.4
5	40°33.6	271°21.0	13.0	344°18.1	15.9	32°30.9	49.2	76°02.2	30.2	Hamal	327°53.3
6	55°36.1	286°20.3	N19°12.3	359°19.0	N18°16.3	47°33.5	N01°49.1	91°04.9	S15°30.3	Polaris	314°54.1
7	70°38.5	301°19.6	11.6	14°20.0	16.7	62°36.1	49.0	106°07.5	30.3	Acamar	315°13.2
8	85°41.0	316°18.9	10.9	29°20.9	17.0	77°38.7	49.0	121°10.2	30.4	Menkar	314°08.2
9	100°43.5	331°18.2	10.3	44°21.9	17.4	92°41.3	48.9	136°12.8	30.5	Mirfak	308°31.1
10	115°45.9	346°17.5	09.6	59°22.8	17.7	107°43.9	48.8	151°15.5	30.5	Aldebaran	290°42.0
11	130°48.4	1°16.8	08.9	74°23.7	18.1	122°46.5	48.7	166°18.1	30.6	Rigel	281°05.9
12	145°50.9	16°16.1	N19°08.2	89°24.7	N18°18.5	137°49.1	N01°48.7	181°20.8	S15°30.6	Capella	280°25.0
13	160°53.3	31°15.4	07.5	104°25.6	18.8	152°51.7	48.6	196°23.4	30.7	Bellatrix	278°25.1
14	175°55.8	46°14.7	06.8	119°26.6	19.2	167°54.3	48.5	211°26.1	30.8	Elnath	278°04.5
15	190°58.2	61°14.0	06.1	134°27.5	19.5	182°56.9	48.5	226°28.7	30.8	Alnilam	275°39.9
16	206°00.7	76°13.3	05.5	149°28.5	19.9	197°59.5	48.4	241°31.4	30.9	Betelgeuse	270°54.4
17	221°03.2	91°12.6	04.8	164°29.4	20.2	213°02.1	48.3	256°34.0	31.0	Canopus	263°53.6
18	236°05.6	106°11.9	N19°04.1	179°30.3	N18°20.6	228°04.7	N01°48.2	271°36.6	S15°31.0	Sirius	258°28.2
19	251°08.1	121°11.2	03.4	194°31.3	21.0	243°07.3	48.2	286°39.3	31.1	Adhara	255°07.7
20	266°10.6	136°10.5	02.7	209°32.2	21.3	258°09.9	48.1	301°41.9	31.1	Procyon	244°53.2
21	281°13.0	151°09.8	02.0	224°33.2	21.7	273°12.6	48.0	316°44.6	31.2	Pollux	243°20.0
22	296°15.5	166°09.2	01.3	239°34.1	22.0	288°15.2	48.0	331°47.2	31.3	Avior	234°16.1
23	311°18.0	181°08.5	00.6	254°35.1	22.4	303°17.8	47.9	346°49.9	31.3	Suhail	222°48.2
Mer.pass. 02:18		ν -0.7° d -0.7° m -3.89		ν 0.9° d 0.4° m -0.02		ν 2.6° d -0.1° m -2.78		ν 2.6° d -0.1° m 0.31		Miaplacidus	
Thu		GHA		GHA		GHA		GHA		Dubhe	
0	326°20.4	196°07.8	N18°59.9	269°36.0	N18°22.7	318°20.4	N01°47.8	1°52.5	S15°31.4	Denebola	193°44.1
1	341°22.9	211°07.1	59.2	284°36.9	23.1	333°23.0	47.7	16°55.2	31.5	Gienah	175°45.9
2	356°25.3	226°06.4	58.5	299°37.9	23.4	348°25.6	47.7	31°57.8	31.5	Acrux	173°02.8
3	11°27.8	241°05.7	57.8	314°38.8	23.8	3°28.2	47.6	47°00.5	31.6	Gacrux	171°54.3
4	26°30.3	256°05.0	57.1	329°39.8	24.1	18°30.8	47.5	62°03.1	31.7	Alioth	166°15.1
5	41°32.7	271°04.3	56.4	344°40.7	24.5	33°33.4	47.4	77°05.8	31.7	Alkaid	152°53.8
6	56°35.2	286°03.6	N18°55.7	359°41.7	N18°24.8	48°36.0	N01°47.4	92°08.4	S15°31.8	Hadar	148°39.0
7	71°37.7	301°02.9	55.0	14°42.6	25.2	63°38.6	47.3	107°11.1	31.8	Menkent	148°00.1
8	86°40.1	316°02.2	54.3	29°43.6	25.6	78°41.3	47.2	122°13.7	31.9	Arcturus	145°49.8
9	101°42.6	331°01.5	53.6	44°44.5	25.9	93°43.9	47.1	137°16.3	32.0	Rigel Kent.	139°43.2
10	116°45.1	346°00.8	52.9	59°45.5	26.3	108°46.5	47.1	152°19.0	32.0	Kochab	137°20.0
11	131°47.5	1°00.2	52.2	74°46.4	26.6	123°49.1	47.0	167°21.6	32.1	Zuben'ubi	136°58.3
12	146°50.0	15°59.5	N18°51.5	89°47.3	N18°27.0	138°51.7	N01°46.9	182°24.3	S15°32.2	Alphecca	126°05.4
13	161°52.5	30°58.8	50.8	104°48.3	27.3	153°54.3	46.8	197°26.9	32.2	Antares	112°18.2
14	176°54.9	45°58.1	50.0	119°49.2	27.7	168°56.9	46.8	212°29.6	32.3	Atria	107°13.9
15	191°57.4	60°57.4	49.3	134°50.2	28.0	183°59.5	46.7	227°32.2	32.4	Sabik	102°04.9
16	206°59.8	75°56.7	48.6	149°51.1	28.4	199°02.2	46.6	242°34.9	32.4	Shaula	96°12.8
17	222°02.3	90°56.0	47.9	164°52.1	28.7	214°04.8	46.5	257°37.5	32.5	Rasalhague	96°00.2
18	237°04.8	105°55.3	N18°47.2	179°53.0	N18°29.1	229°07.4	N01°46.5	272°40.2	S15°32.5	Eltanin	90°42.8
19	252°07.2	120°54.7	46.5	194°54.0	29.4	244°10.0	46.4	287°42.8	32.6	Kaus Aust.	83°34.9
20	267°09.7	135°54.0	45.8	209°54.9	29.8	259°12.6	46.3	302°45.5	32.7	Vega	80°34.3
21	282°12.2	150°53.3	45.0	224°55.9	30.1	274°15.2	46.2	317°48.1	32.7	Nunki	75°49.9
22	297°14.6	165°52.6	44.3	239°56.8	30.5	289°17.8	46.2	332°50.8	32.8	Altair	62°01.6
23	312°17.1	180°51.9	43.6	254°57.8	30.8	304°20.4	46.1	347°53.4	32.9	Peacock	53°08.3
Mer.pass. 02:14		ν -0.7° d -0.7° m -3.89		ν 0.9° d 0.4° m -0.03		ν 2.6° d -0.1° m -2.79		ν 2.6° d -0.1° m 0.32		Deneb	
Fri		GHA		GHA		GHA		GHA		Dubhe	
0	327°19.6	195°51.2	N18°42.9	269°58.7	N18°31.2	319°23.1	N01°46.0	2°56.0	S15°32.9	Denebola	182°27.2
1	342°22.0	210°50.5	42.2	284°59.7	31.5	334°25.7	45.9	17°58.7	33.0	Gienah	175°45.9
2	357°24.5	225°49.9	41.4	300°00.6	31.9	349°28.3	45.9	33°01.3	33.0	Acrux	173°02.8
3	12°27.0	240°49.2	40.7	315°01.6	32.2	4°30.9	45.8	48°04.0	33.1	Gacrux	171°54.3
4	27°29.4	255°48.5	40.0	330°02.5	32.5	19°33.5	45.7	63°06.6	33.2	Alioth	166°15.1
5	42°31.9	270°47.8	39.3	345°03.5	32.9	34°36.1	45.6	78°09.3	33.2	Alkaid	152°53.8
6	57°34.3	285°47.1	N18°38.6	0°04.4	N18°33.2	49°38.8	N01°45.6	93°11.9	S15°33.3	Hadar	148°39.0
7	72°36.8	300°46.4	37.8	15°05.4	33.6	64°41.4	45.5	108°14.6	33.4	Menkent	148°00.1
8	87°39.3	315°45.8	37.1	30°06.4	33.9	79°44.0	45.4	123°17.2	33.4	Arcturus	145°49.8
9	102°41.7	330°45.1	36.4	45°07.3	34.3	94°46.6	45.3	138°19.9	33.5	Rigel Kent.	139°43.2
10	117°44.2	345°44.4	35.6	60°08.3	34.6	109°49.2	45.2	153°22.5	33.5	Kochab	137°20.0
11	132°46.7	0°43.7	34.9	75°09.2	35.0	124°51.9	45.2	168°25.2	33.6	Zuben'ubi	136°58.3
12	147°49.1	15°43.0	N18°34.2	90°10.2	N18°35.3	139°54.5	N01°45.1	183°27.8	S15°33.7	Alphecca	126°05.4
13	162°51.6	30°42.4	33.5	105°11.1	35.7	154°57.1	45.0	198°30.4	33.7	Denebola	112°18.2
14	177°54.1	45°41.7	32.7	120°12.1	36.0	169°59.7	44.9	213°33.1	33.8	Gienah	107°13.9
15	192°56.5	60°41.0	32.0	135°13.0	36.3	185°02.3	44.9	228°35.7	33.9	Acrux	102°04.9
16	207°59.0	75°40.3	31.3	150°14.0	36.7	200°04.9	44.8	243°38.4	33.9	Gacrux	96°12.8
17	223°01.4	90°39.6	30.5	165°14.9	37.0	215°07.6	44.7	258°41.0	34.0	Alioth	91°39.9
18	238°03.9	105°39.0	N18°29.8	180°15.9	N18°37.4	230°10.2	N01°44.6	273°43.7	S15°34.0	Alkaid	80°49.9
19	253°06.4	120°38.3	29.0	195°16.9	37.7	245°12.8	44.5	288°46.3	34.1	Hadar	75°49.9
20	268°08.8	135°37.6	28.3	210°17.8	38.1	260°15.4	44.5	303°49.0	34.2	Menkent	60°06.3
21	283°11.3	150°36.9	27.6	225°18.8	38.4	275°18.1	44.4	318°51.6	34.2	Arcturus	55°06.3
22	298°13.8	165°36.3	26.8	240°19.7	38.7	290°20.7	44.3	333°54.3	34.3	Rigel Kent.	40°49.9
23	313°16.2	180°35.6	26.1	255°20.7	39.1	305°23.3	44.2	348°56.9	34.4	Kochab	35°31.6
Mer.pass. 02:10		ν -0.7° d -0.7° m -3.89		ν 1.0° d 0.3° m -0.04		ν 2.6° d -0.1° m -2.79		ν 2.6° d -0.1° m 0.33		Markab	
Aug 17 Wed											

DUT1 = UT1-UTC = -0.0271 sec  $\Delta T = TT-UT1 = +69.2111$  sec

2022 August 17 to Aug. 19 UT

h		Sun		Moon				
Wed		GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	178°57.0	N13°29.4	298°05.1	13.7'	N09°31.5	13.9'	56.7'	
1	193°57.2	28.6	312°37.9	13.7'	09°45.4	13.9'	56.7'	
2	208°57.3	27.8	327°10.6	13.7'	09°59.3	13.8'	56.6'	
3	223°57.4	.. 27.0	341°43.4	13.7'	10°13.1	13.8'	56.6'	
4	238°57.6	26.2	356°16.1	13.7'	10°26.9	13.7'	56.6'	
5	253°57.7	25.4	10°48.8	13.7'	10°40.6	13.6'	56.5'	
6	268°57.8	N13°24.6	25°21.6	13.7'	N10°54.2	13.6'	56.5'	
7	283°58.0	23.8	39°54.3	13.7'	11°07.8	13.5'	56.5'	
8	298°58.1	23.0	54°27.0	13.7'	11°21.3	13.4'	56.4'	
9	313°58.2	.. 22.2	68°59.7	13.7'	11°34.7	13.4'	56.4'	
10	328°58.4	21.4	83°32.4	13.7'	11°48.1	13.3'	56.4'	
11	343°58.5	20.6	98°05.1	13.7'	12°01.4	13.2'	56.3'	
12	358°58.6	N13°19.8	112°37.7	13.7'	N12°14.6	13.2'	56.3'	
13	13°58.8	19.0	127°10.4	13.6'	12°27.8	13.1'	56.3'	
14	28°58.9	18.2	141°43.0	13.6'	12°40.8	13.0'	56.2'	
15	43°59.0	.. 17.4	156°15.7	13.6'	12°53.9	12.9'	56.2'	
16	58°59.2	16.6	170°48.3	13.6'	13°06.8	12.9'	56.2'	
17	73°59.3	15.8	185°20.9	13.6'	13°19.7	12.8'	56.1'	
18	88°59.5	N13°15.0	199°53.5	13.6'	N13°32.5	12.7'	56.1'	
19	103°59.6	14.2	214°26.0	13.6'	13°45.2	12.6'	56.1'	
20	118°59.7	13.4	228°58.6	13.5'	13°57.8	12.6'	56.0'	
21	133°59.9	.. 12.6	243°31.1	13.5'	14°10.4	12.5'	56.0'	
22	149°00.0	11.8	258°03.6	13.5'	14°22.9	12.4'	56.0'	
23	164°00.1	11.0	272°36.1	13.5'	14°35.3	12.3'	55.9'	
SD = 15.8'		SD = 15.5'						

Thu	GHA	Dec	GHA	$\nu$	Dec	$d$	HP	
0	179°00.3	N13°10.2	287°08.6	13.5'	N14°47.6	12.3'	55.9'	
1	194°00.4	09.4	301°41.0	13.4'	14°59.9	12.2'	55.9'	
2	209°00.6	08.5	316°13.5	13.4'	15°12.1	12.1'	55.8'	
3	224°00.7	.. 07.7	330°45.9	13.4'	15°24.2	12.0'	55.8'	
4	239°00.8	06.9	345°18.3	13.4'	15°36.2	11.9'	55.8'	
5	254°01.0	06.1	359°50.6	13.3'	15°48.1	11.9'	55.7'	
6	269°01.1	N13°05.3	14°23.0	13.3'	N16°00.0	11.8'	55.7'	
7	284°01.2	04.5	28°55.3	13.3'	16°11.8	11.7'	55.7'	
8	299°01.4	03.7	43°27.5	13.3'	16°23.4	11.6'	55.7'	
9	314°01.5	.. 02.9	57°59.8	13.2'	16°35.0	11.5'	55.6'	
10	329°01.7	02.1	72°32.0	13.2'	16°46.6	11.4'	55.6'	
11	344°01.8	01.3	87°04.2	13.2'	16°58.0	11.3'	55.6'	
12	359°01.9	N13°00.5	101°36.4	13.1'	N17°09.3	11.3'	55.5'	
13	14°02.1	12°59.7	116°08.5	13.1'	17°20.6	11.2'	55.5'	
14	29°02.2	58.9	130°40.6	13.1'	17°31.8	11.1'	55.5'	
15	44°02.4	.. 58.0	145°12.7	13.0'	17°42.8	11.0'	55.4'	
16	59°02.5	57.2	159°44.8	13.0'	17°53.8	10.9'	55.4'	
17	74°02.7	56.4	174°16.8	13.0'	18°04.7	10.8'	55.4'	
18	89°02.8	N12°55.6	188°48.8	13.0'	N18°15.5	10.7'	55.4'	
19	104°02.9	54.8	203°20.7	12.9'	18°26.3	10.6'	55.3'	
20	119°03.1	54.0	217°52.6	12.9'	18°36.9	10.5'	55.3'	
21	134°03.2	.. 53.2	232°24.5	12.9'	18°47.4	10.4'	55.3'	
22	149°03.4	52.4	246°56.4	12.8'	18°57.9	10.3'	55.3'	
23	164°03.5	51.6	261°28.2	12.8'	19°08.2	10.3'	55.2'	
SD = 15.8'		SD = 15.2'						

Fri	GHA	Dec	GHA	$\nu$	Dec	$d$	HP	
0	179°03.6	N12°50.7	276°00.0	12.7'	N19°18.5	10.2'	55.2'	
1	194°03.8	49.9	290°31.7	12.7'	19°28.6	10.1'	55.2'	
2	209°03.9	49.1	305°03.4	12.7'	19°38.7	10.0'	55.2'	
3	224°04.1	.. 48.3	319°35.1	12.6'	19°48.7	9.9'	55.1'	
4	239°04.2	47.5	334°06.7	12.6'	19°58.5	9.8'	55.1'	
5	254°04.4	46.7	348°38.3	12.6'	20°08.3	9.7'	55.1'	
6	269°04.5	N12°45.9	3°09.9	12.5'	N20°18.0	9.6'	55.1'	
7	284°04.7	45.0	17°41.4	12.5'	20°27.5	9.5'	55.0'	
8	299°04.8	44.2	32°12.9	12.5'	20°37.0	9.4'	55.0'	
9	314°04.9	.. 43.4	46°44.4	12.4'	20°46.4	9.3'	55.0'	
10	329°05.1	42.6	61°15.8	12.4'	20°55.7	9.2'	55.0'	
11	344°05.2	41.8	75°47.2	12.3'	21°04.8	9.1'	54.9'	
12	359°05.4	N12°41.0	90°18.5	12.3'	N21°13.9	9.0'	54.9'	
13	14°05.5	40.1	104°49.8	12.3'	21°22.9	8.9'	54.9'	
14	29°05.7	39.3	119°21.1	12.2'	21°31.7	8.8'	54.9'	
15	44°05.8	.. 38.5	133°52.3	12.2'	21°40.5	8.7'	54.9'	
16	59°06.0	37.7	148°23.5	12.1'	21°49.2	8.6'	54.8'	
17	74°06.1	36.9	162°54.7	12.1'	21°57.7	8.4'	54.8'	
18	89°06.3	N12°36.0	177°25.8	12.1'	N22°06.2	8.3'	54.8'	
19	104°06.4	35.2	191°56.8	12.0'	22°14.5	8.2'	54.8'	
20	119°06.5	34.4	206°27.9	12.0'	22°22.7	8.1'	54.7'	
21	134°06.7	.. 33.6	220°58.8	12.0'	22°30.9	8.0'	54.7'	
22	149°06.8	32.8	235°29.8	11.9'	22°38.9	7.9'	54.7'	
23	164°07.0	31.9	250°00.7	11.9'	22°46.8	7.8'	54.7'	
SD = 15.8'		SD = 15.1'						

Lat.	Twilight		Sunrise	Sunset	Twilight	
	Naut.	Civil			Civil	Naut.
N 72°	—:—	—:—	02:44	21:19	—:—	—:—
N 70°	—:—	01:12	03:11	20:53	22:44	—:—
68°	—:—	02:05	03:32	20:33	21:57	—:—
66°	—:—	02:36	03:48	20:17	21:28	—:—
64°	01:04	02:59	04:01	20:05	21:06	22:54
62°	01:50	03:17	04:12	19:54	20:49	22:12
60°	02:19	03:31	04:21	19:45	20:34	21:45
N 58°	02:40	03:43	04:29	19:37	20:22	21:25
56°	02:57	03:54	04:37	19:30	20:12	21:08
54°	03:11	04:03	04:43	19:23	20:03	20:54
52°	03:23	04:11	04:49	19:18	19:55	20:43
50°	03:34	04:18	04:54	19:13	19:48	20:33
48°	03:55	04:33	05:05	19:02	19:33	20:12
N 40°	04:11	04:46	05:14	18:53	19:21	19:56
35°	04:24	04:56	05:22	18:45	19:12	19:43
30°	04:34	05:04	05:29	18:38	19:03	19:33
20°	04:51	05:18	05:41	18:27	18:49	19:16
N 10°	05:04	05:29	05:51	18:17	18:38	19:03
0°	05:15	05:39	06:01	18:07	18:28	18:53
S 10°	05:51	06:29	07:03	17:06	17:39	18:17
52°	05:53	06:32	07:07	17:01	17:36	18:16
54°	05:54	06:35	07:12	16:56	17:33	18:15
56°	05:55	06:39	07:18	16:51	17:30	18:13
58°	05:57	06:43	07:24	16:44	17:26	18:12
S 60°	05:58	06:47	07:31	16:37	17:22	18:10
Lat.	Wed	Moonrise	Thu	Fri	Wed	Moonset
N 72°	19:28	□	□	□	13:23	□
N 70°	19:54	19:04	19:45	19:45	12:59	15:25
68°	20:13	19:45	20:13	19:47	12:41	14:45
66°	20:29	20:13	20:13	19:47	12:27	14:18
64°	20:42	20:35	20:25	20:25	12:15	13:57
62°	20:54	20:52	20:53	20:53	12:05	13:41
60°	21:03	21:07	21:14	21:14	11:57	13:27
N 58°	21:12	21:19	21:31	21:31	11:49	13:15
56°	21:19	21:30	21:46	21:46	11:43	13:05
54°	21:26	21:40	21:59	21:59	11:37	12:56
50°	21:32	21:56	22:20	22:20	11:27	12:41
48°	21:49	22:13	22:41	22:41	11:17	12:26
N 40°	21:59	22:26	22:58	22:58	11:09	12:14
35°	22:07	22:38	23:12	23:12	11:01	12:03
30°	22:15	22:48	23:25	23:25	10:55	11:54
20°	22:28	23:06	23:47	23:47	10:44	11:38
N 10°	22:39	23:21	—:—	—:—	10:35	1

## August 20, 21, 22 UT (Sat., Sun., Mon.)

Aries Venus Mars Jupiter Saturn Stars											
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec
0	328°18.7	195°34.9	N18°25.3	270°21.6	N18°39.4	320°25.9	N01°44.1	3°59.6	S15°34.4	Alpheratz	357°36.5
1	343°21.2	210°34.2	24.6	285°22.6	39.8	335°28.5	44.1	19°02.2	34.5	Ankaa	353°08.8
2	358°23.6	225°33.6	23.9	300°23.6	40.1	350°31.2	44.0	34°04.8	34.6	Schedar	349°32.8
3	13°26.1	240°32.9	.. 23.1	315°24.5	.. 40.5	5°33.8	.. 43.9	49°07.5	.. 34.6	Diphda	348°49.0
4	28°28.6	255°32.2	22.4	330°25.5	40.8	20°36.4	43.8	64°10.1	34.7	Achernar	335°21.4
5	43°31.0	270°31.5	21.6	345°26.4	41.1	35°39.0	43.8	79°12.8	34.7	Hamal	327°53.3
6	58°33.5	285°30.9	N18°20.9	0°27.4	N18°41.5	50°41.7	N01°43.7	94°15.4	S15°34.8	Polaris	314°52.4
7	73°35.9	300°30.2	20.1	15°28.4	41.8	65°44.3	43.6	109°18.1	34.9	Acamar	315°13.2
8	88°38.4	315°29.5	19.4	30°29.3	42.2	80°46.9	43.5	124°20.7	34.9	Menkar	314°08.1
9	103°40.9	330°28.8	.. 18.6	45°30.3	.. 42.5	95°49.5	.. 43.4	139°23.4	.. 35.0	Mirfak	308°31.0
10	118°43.3	345°28.2	17.9	60°31.2	42.8	110°52.2	43.4	154°26.0	35.1	Aldebaran	290°41.9
11	133°45.8	0°27.5	17.1	75°32.2	43.2	125°54.8	43.3	169°28.7	35.1	Rigel	281°05.9
12	148°48.3	15°26.8	N18°16.4	90°33.2	N18°43.5	140°57.4	N01°43.2	184°31.3	S15°35.2	Capella	280°25.0
13	163°50.7	30°26.2	15.6	105°34.1	43.8	156°00.0	43.1	199°34.0	35.2	Bellatrix	278°25.1
14	178°53.2	45°25.5	14.9	120°35.1	44.2	171°02.7	43.0	214°36.6	35.3	Elnath	278°04.5
15	193°55.7	60°24.8	.. 14.1	135°36.0	.. 44.5	186°05.3	.. 43.0	229°39.2	.. 35.4	Alnilam	275°39.9
16	208°58.1	75°24.2	13.4	150°37.0	44.9	201°07.9	42.9	244°41.9	35.4	Betelgeuse	270°54.4
17	224°00.6	90°23.5	12.6	165°38.0	45.2	216°10.5	42.8	259°44.5	35.5	Canopus	263°53.6
18	239°03.1	105°22.8	N18°11.8	180°38.9	N18°45.5	231°13.2	N01°42.7	274°47.2	S15°35.6	Sirius	258°28.2
19	254°05.5	120°22.2	11.1	195°39.9	45.9	246°15.8	42.6	289°49.8	35.6	Adhara	255°07.7
20	269°08.0	135°21.5	10.3	210°40.9	46.2	261°18.4	42.5	304°52.5	35.7	Procyon	244°53.2
21	284°10.4	150°20.8	.. 09.6	225°41.8	.. 46.5	276°21.0	.. 42.5	319°55.1	.. 35.7	Pollux	243°20.0
22	299°12.9	165°20.2	08.8	240°42.8	46.9	291°23.7	42.4	334°57.8	35.8	Avior	234°16.1
23	314°15.4	180°19.5	08.0	255°43.8	47.2	306°26.3	42.3	350°00.4	35.9	Suhail	222°48.2
Mer.pass. 02:06		ν -0.7° d -0.7° m -3.89	ν 1.0° d 0.3° m -0.05	ν 2.6° d -0.1° m -2.80	ν 2.6° d -0.1° m 0.34	Miplacidus		221°39.6	.. 69°48.4	Alphard	217°50.0
Mer.pass. 02:06		ν -0.7° d -0.7° m -3.89	ν 1.0° d 0.3° m -0.05	ν 2.6° d -0.1° m -2.80	ν 2.6° d -0.1° m 0.34	Regulus		207°36.9	.. 8°45.2	Dubhe	193°44.1
Mer.pass. 02:06		ν -0.7° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.06	ν 2.6° d -0.1° m -2.81	ν 2.6° d -0.1° m 0.35	Denebola		61°38.0	.. 11°51.6	Gienah	182°27.2
Mer.pass. 02:06		ν -0.7° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.06	ν 2.6° d -0.1° m -2.81	ν 2.6° d -0.1° m 0.35	Menkent		36.0	.. 14°27.0	Acrux	175°45.9
Mer.pass. 02:06		ν -0.7° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.06	ν 2.6° d -0.1° m -2.81	ν 2.6° d -0.1° m 0.35	Arcturus		36.0	.. 17°39.9	Gacrux	173°02.8
Mer.pass. 02:06		ν -0.7° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.06	ν 2.6° d -0.1° m -2.81	ν 2.6° d -0.1° m 0.35	Rigel Kent.		36.0	.. 63°13.5	Alioth	171°54.3
Mer.pass. 02:06		ν -0.7° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.06	ν 2.6° d -0.1° m -2.81	ν 2.6° d -0.1° m 0.35	Kochab		36.0	.. 57°14.4	Spica	166°15.1
Mer.pass. 02:06		ν -0.7° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.06	ν 2.6° d -0.1° m -2.81	ν 2.6° d -0.1° m 0.35	Alkaid		36.0	.. 55°50.5	Hadar	158°24.6
Mer.pass. 02:06		ν -0.7° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.06	ν 2.6° d -0.1° m -2.81	ν 2.6° d -0.1° m 0.35	Menkent		36.0	.. 11°16.6	Alnilam	152°53.8
Mer.pass. 02:06		ν -0.7° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.06	ν 2.6° d -0.1° m -2.81	ν 2.6° d -0.1° m 0.35	Arcturus		36.0	.. 60°29.0	Alkaid	148°39.1
Mer.pass. 02:06		ν -0.7° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.06	ν 2.6° d -0.1° m -2.81	ν 2.6° d -0.1° m 0.35	Rigel Kent.		36.0	.. 26.8	Hadar	148°00.1
Mer.pass. 02:06		ν -0.7° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.06	ν 2.6° d -0.1° m -2.81	ν 2.6° d -0.1° m 0.35	Zuben 'ubi		36.0	.. 19°41.1	Spica	145°49.8
Mer.pass. 02:06		ν -0.7° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.06	ν 2.6° d -0.1° m -2.81	ν 2.6° d -0.1° m 0.35	Alkaid		36.0	.. 74.0	Alnilam	139°43.2
Mer.pass. 02:06		ν -0.7° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.06	ν 2.6° d -0.1° m -2.81	ν 2.6° d -0.1° m 0.35	Kochab		36.0	.. 74.0	Alkaid	137°20.1
Mer.pass. 02:06		ν -0.7° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.06	ν 2.6° d -0.1° m -2.81	ν 2.6° d -0.1° m 0.35	Zuben 'ubi		36.0	.. 16.1	Hadar	148°39.1
Mer.pass. 02:06		ν -0.7° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.06	ν 2.6° d -0.1° m -2.81	ν 2.6° d -0.1° m 0.35	Spica		36.0	.. 29.4	Alnilam	148°00.1
Mer.pass. 02:06		ν -0.7° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.06	ν 2.6° d -0.1° m -2.81	ν 2.6° d -0.1° m 0.35	Alkaid		36.0	.. 69.4	Hadar	148°39.1
Mer.pass. 02:06		ν -0.7° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.06	ν 2.6° d -0.1° m -2.81	ν 2.6° d -0.1° m 0.35	Menkent		36.0	.. 19.4	Alnilam	148°00.1
Mer.pass. 02:06		ν -0.7° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.06	ν 2.6° d -0.1° m -2.81	ν 2.6° d -0.1° m 0.35	Arcturus		36.0	.. 57.8	Alkaid	148°39.1
Mer.pass. 02:06		ν -0.7° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.06	ν 2.6° d -0.1° m -2.81	ν 2.6° d -0.1° m 0.35	Zuben 'ubi		36.0	.. 16.1	Hadar	148°39.1
Mer.pass. 02:06		ν -0.7° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.06	ν 2.6° d -0.1° m -2.81	ν 2.6° d -0.1° m 0.35	Spica		36.0	.. 29.4	Alnilam	148°00.1
Mer.pass. 02:06		ν -0.7° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.06	ν 2.6° d -0.1° m -2.81	ν 2.6° d -0.1° m 0.35	Alkaid		36.0	.. 69.4	Hadar	148°39.1
Mer.pass. 02:06		ν -0.7° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.06	ν 2.6° d -0.1° m -2.81	ν 2.6° d -0.1° m 0.35	Menkent		36.0	.. 19.4	Alnilam	148°00.1
Mer.pass. 02:06		ν -0.7° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.06	ν 2.6° d -0.1° m -2.81	ν 2.6° d -0.1° m 0.35	Arcturus		36.0	.. 57.8	Alkaid	148°39.1
Mer.pass. 02:06		ν -0.7° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.06	ν 2.6° d -0.1° m -2.81	ν 2.6° d -0.1° m 0.35	Zuben 'ubi		36.0	.. 16.1	Hadar	148°39.1
Mer.pass. 02:06		ν -0.7° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.06	ν 2.6° d -0.1° m -2.81	ν 2.6° d -0.1° m 0.35	Spica		36.0	.. 29.4	Alnilam	148°00.1
Mer.pass. 02:06		ν -0.7° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.06	ν 2.6° d -0.1° m -2.81	ν 2.6° d -0.1° m 0.35	Alkaid		36.0	.. 69.4	Hadar	148°39.1
Mer.pass. 02:06		ν -0.7° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.06	ν 2.6° d -0.1° m -2.81	ν 2.6° d -0.1° m 0.35	Menkent		36.0	.. 19.4	Alnilam	148°00.1
Mer.pass. 02:06		ν -0.7° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.06	ν 2.6° d -0.1° m -2.81	ν 2.6° d -0.1° m 0.35	Arcturus		36.0	.. 57.8	Alkaid	148°39.1
Mer.pass. 02:06		ν -0.7° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.06	ν 2.6° d -0.1° m -2.81	ν 2.6° d -0.1° m 0.35	Zuben 'ubi		36.0	.. 16.1	Hadar	148°39.1
Mer.pass. 02:06		ν -0.7° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.06	ν 2.6° d -0.1° m -2.81	ν 2.6° d -0.1° m 0.35	Spica		36.0	.. 29.4	Alnilam	148°00.1
Mer.pass. 02:06		ν -0.7° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.06	ν 2.6° d -0.1° m -2.81	ν 2.6° d -0.1° m 0.35	Alkaid		36.0	.. 69.4	Hadar	148°39.1
Mer.pass. 02:06		ν -0.7° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.06	ν 2.6° d -0.1° m -2.81	ν 2.6° d -0.1° m 0.35	Menkent		36.0	.. 19.4	Alnilam	148°00.1
Mer.pass. 02:06		ν -0.7° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.06	ν 2.6° d -0.1° m -2.81	ν 2.6° d -0.1° m 0.35	Arcturus		36.0	.. 57.8	Alkaid	148°39.1
Mer.pass. 02:06		ν -0.7° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.06	ν 2.6° d -0.1° m -2.81	ν 2.6° d -0.1° m 0.35	Zuben 'ubi		36.0	.. 16.1	Hadar	148°39.1
Mer.pass. 02:06		ν -0.7° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.06	ν 2.6° d -0.1° m -2.81	ν 2.6° d -0.1° m 0.35	Spica		36.0	.. 29.4	Alnilam	148°00.1
Mer.pass. 02:06		ν -0.7° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.06	ν 2.6° d -0.1° m -2.81	ν 2.6° d -0.1° m 0.35	Alkaid		36.0	.. 69.4	Hadar	148°39.1
Mer.pass. 02:06		ν -0.7° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.06	ν 2.6° d -0.1° m -2.81	ν 2.6° d -0.1° m 0.35	Menkent		36.0	.. 1		

DUT1 = UT1-UTC = -0.0242 sec  $\Delta T = TT-UT1 = +69.2082$  sec

2022 August 20 to Aug. 22 UT

h	Sun			Moon			
Sat	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	179°07.1	N12°31.1	264°31.6	11.8'	N22°54.6	7.7'	54.7'
1	194°07.3	30.3	279°02.4	11.8'	23°02.3	7.6'	54.7'
2	209°07.4	29.5	293°33.2	11.8'	23°09.9	7.5'	54.6'
3	224°07.6	28.6	308°04.0	11.7'	23°17.3	7.4'	54.6'
4	239°07.7	27.8	322°34.7	11.7'	23°24.7	7.2'	54.6'
5	254°07.9	27.0	337°05.4	11.6'	23°32.0	7.1'	54.6'
6	269°08.0	N12°26.2	351°36.0	11.6'	N23°39.1	7.0'	54.6'
7	284°08.2	25.4	6°06.6	11.6'	23°46.1	6.9'	54.5'
8	299°08.3	24.5	20°37.2	11.5'	23°53.0	6.8'	54.5'
9	314°08.5	23.7	35°07.7	11.5'	23°59.8	6.7'	54.5'
10	329°08.6	22.9	49°38.2	11.5'	24°06.5	6.6'	54.5'
11	344°08.8	22.1	64°08.7	11.4'	24°13.1	6.5'	54.5'
12	359°08.9	N12°21.2	78°39.1	11.4'	N24°19.5	6.3'	54.5'
13	14°09.1	20.4	93°09.4	11.3'	24°25.9	6.2'	54.4'
14	29°09.2	19.6	107°39.8	11.3'	24°32.1	6.1'	54.4'
15	44°09.4	18.7	122°10.1	11.3'	24°38.2	6.0'	54.4'
16	59°09.5	17.9	136°40.4	11.2'	24°44.2	5.9'	54.4'
17	74°09.7	17.1	151°10.6	11.2'	24°50.0	5.8'	54.4'
18	89°09.8	N12°16.3	165°40.8	11.2'	N24°55.8	5.6'	54.4'
19	104°10.0	15.4	180°10.9	11.1'	25°01.4	5.5'	54.4'
20	119°10.1	14.6	194°41.1	11.1'	25°06.9	5.4'	54.3'
21	134°10.3	13.8	209°11.2	11.1'	25°12.3	5.3'	54.3'
22	149°10.4	13.0	223°41.2	11.0'	25°17.6	5.2'	54.3'
23	164°10.6	12.1	238°11.3	11.0'	25°22.8	5.0'	54.3'
	SD = 15.8' $d = -0.8'$			SD = 14.9'			
Sun	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	179°10.7	N12°11.3	252°41.3	11.0'	N25°27.8	4.9'	54.3'
1	194°10.9	10.5	267°11.2	10.9'	25°32.7	4.8'	54.3'
2	209°11.0	09.6	281°41.2	10.9'	25°37.5	4.7'	54.3'
3	224°11.2	08.8	296°11.1	10.9'	25°42.2	4.5'	54.3'
4	239°11.4	08.0	310°40.9	10.8'	25°46.7	4.4'	54.2'
5	254°11.5	07.1	325°10.8	10.8'	25°51.1	4.3'	54.2'
6	269°11.7	N12°06.3	339°40.6	10.8'	N25°55.4	4.2'	54.2'
7	284°11.8	05.5	354°10.4	10.8'	25°59.6	4.1'	54.2'
8	299°12.0	04.6	8°40.1	10.7'	26°03.7	3.9'	54.2'
9	314°12.1	03.8	23°09.8	10.7'	26°07.6	3.8'	54.2'
10	329°12.3	03.0	37°39.6	10.7'	26°11.4	3.7'	54.2'
11	344°12.4	02.1	52°09.2	10.7'	26°15.1	3.6'	54.2'
12	359°12.6	N12°01.3	66°38.9	10.6'	N26°18.6	3.4'	54.2'
13	14°12.7	12°00.5	81°08.5	10.6'	26°22.0	3.3'	54.2'
14	29°12.9	11°59.6	95°38.1	10.6'	26°25.3	3.2'	54.2'
15	44°13.1	58.8	110°07.7	10.6'	26°28.5	3.0'	54.1'
16	59°13.2	58.0	124°37.2	10.5'	26°31.6	2.9'	54.1'
17	74°13.4	57.1	139°06.8	10.5'	26°34.5	2.8'	54.1'
18	89°13.5	N11°56.3	153°36.3	10.5'	N26°37.3	2.7'	54.1'
19	104°13.7	55.5	168°05.8	10.5'	26°39.9	2.5'	54.1'
20	119°13.8	54.6	182°35.3	10.5'	26°42.5	2.4'	54.1'
21	134°14.0	53.8	197°04.7	10.4'	26°44.9	2.3'	54.1'
22	149°14.1	52.9	211°34.2	10.4'	26°47.2	2.2'	54.1'
23	164°14.3	52.1	226°03.6	10.4'	26°49.3	2.0'	54.1'
	SD = 15.8' $d = -0.8'$			SD = 14.8'			
Mon	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	179°14.5	N11°51.3	240°33.0	10.4'	N26°51.4	1.9'	54.1'
1	194°14.6	50.4	255°02.4	10.4'	26°53.3	1.8'	54.1'
2	209°14.8	49.6	269°31.8	10.4'	26°55.0	1.6'	54.1'
3	224°14.9	48.8	284°01.1	10.4'	26°56.7	1.5'	54.1'
4	239°15.1	47.9	299°30.5	10.3'	26°58.2	1.4'	54.1'
5	254°15.2	47.1	312°59.8	10.3'	26°59.6	1.3'	54.1'
6	269°15.4	N11°46.2	327°29.2	10.3'	N27°00.8	1.1'	54.1'
7	284°15.6	45.4	341°58.5	10.3'	27°01.9	1.0'	54.1'
8	299°15.7	44.6	356°27.8	10.3'	27°02.9	0.9'	54.0'
9	314°15.9	43.7	10°57.1	10.3'	27°03.8	0.7'	54.0'
10	329°16.0	42.9	25°26.4	10.3'	27°04.5	0.6'	54.0'
11	344°16.2	42.0	39°55.7	10.3'	27°05.1	0.5'	54.0'
12	359°16.4	N11°41.2	54°25.0	10.3'	N27°05.6	0.3'	54.0'
13	14°16.5	40.3	68°54.3	10.3'	27°05.9	0.2'	54.0'
14	29°16.7	39.5	83°23.6	10.3'	27°06.2	0.1'	54.0'
15	44°16.8	38.7	97°52.8	10.3'	27°06.2	-0.0'	54.0'
16	59°17.0	37.8	112°22.1	10.3'	27°06.2	-0.2'	54.0'
17	74°17.2	37.0	126°51.4	10.3'	27°06.0	-0.3'	54.0'
18	89°17.3	N11°36.1	141°20.7	10.3'	N27°05.7	-0.4'	54.0'
19	104°17.5	35.3	155°50.0	10.3'	27°05.3	-0.6'	54.0'
20	119°17.6	34.4	170°19.3	10.3'	27°04.7	-0.7'	54.0'
21	134°17.8	33.6	184°48.6	10.3'	27°04.0	-0.8'	54.0'
22	149°18.0	32.8	199°17.9	10.3'	27°03.2	-1.0'	54.0'
23	164°18.1	31.9	213°47.2	10.3'	27°02.2	-1.1'	54.0'
	SD = 15.8' $d = -0.8'$			SD = 14.7'			

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

## August 23, 24, 25 UT (Tue., Wed., Thu.)

Aries		Venus		Mars		Jupiter		Saturn		Stars	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec
0	331°16.1	194°47.3	N17°29.6	271°31.4	N19°03.3	323°35.4	N01°38.2	7°10.0	S15°38.9	Alpheratz	357°36.5
1	346°18.6	209°46.7	28.8	286°32.4	03.6	338°38.1	38.1	22°12.7	39.0	Ankaa	353°08.7
2	1°21.0	224°46.1	28.0	301°33.4	04.0	353°40.7	38.0	37°15.3	39.0	Schedar	349°32.8
3	16°23.5	239°45.4	27.2	316°34.4	04.3	8°43.4	37.9	52°18.0	39.1	Diphda	348°49.0
4	31°26.0	254°44.8	26.4	331°35.3	04.6	23°46.0	37.8	67°20.6	39.1	Achernar	335°21.3
5	46°28.4	269°44.1	25.5	346°36.3	04.9	38°48.7	37.7	82°23.2	39.2	Hamal	327°53.2
6	61°30.9	284°43.5	N17°24.7	1°37.3	N19°05.3	53°51.3	N01°37.6	97°25.9	S15°39.3	Polaris	314°50.8
7	76°33.4	299°42.8	23.9	16°38.3	05.6	68°54.0	37.6	112°28.5	39.3	Acamar	315°13.2
8	91°35.8	314°42.2	23.1	31°39.3	05.9	83°56.6	37.5	127°31.2	39.4	Menkar	314°08.1
9	106°38.3	329°41.5	22.3	46°40.3	06.2	98°59.2	37.4	142°33.8	39.5	Mirfak	308°31.0
10	121°40.8	344°40.9	21.5	61°41.2	06.5	114°01.9	37.3	157°36.5	39.5	Aldebaran	290°41.9
11	136°43.2	359°40.3	20.7	76°42.2	06.9	129°04.5	37.2	172°39.1	39.6	Rigel	281°05.9
12	151°45.7	14°39.6	N17°19.8	91°43.2	N19°07.2	144°07.2	N01°37.1	187°41.8	S15°39.6	Capella	280°24.9
13	166°48.2	29°39.0	19.0	106°44.2	07.5	159°09.8	37.0	202°44.4	39.7	Bellatrix	278°25.1
14	181°50.6	44°38.3	18.2	121°45.2	07.8	174°12.5	36.9	217°47.0	39.8	Elnath	278°04.5
15	196°53.1	59°37.7	17.4	136°46.2	08.1	189°15.1	36.8	232°49.7	39.8	Alnilam	275°39.8
16	211°55.5	74°37.1	16.6	151°47.1	08.4	204°17.8	36.8	247°52.3	39.9	Betelgeuse	270°54.4
17	226°58.0	89°36.4	15.8	166°48.1	08.8	219°20.4	36.7	262°55.0	39.9	Canopus	263°53.6
18	242°00.5	104°35.8	N17°14.9	181°49.1	N19°09.1	234°23.1	N01°36.6	277°57.6	S15°40.0	Sirius	258°28.2
19	257°02.9	119°35.1	14.1	196°50.1	09.4	249°25.7	36.5	293°00.3	40.1	Adhara	255°07.7
20	272°05.4	134°34.5	13.3	211°51.1	09.7	264°28.3	36.4	308°02.9	40.1	Procyon	244°53.1
21	287°07.9	149°33.9	12.5	226°52.1	10.0	279°31.0	36.3	323°05.5	40.2	Pollux	243°20.0
22	302°10.3	164°33.2	11.6	241°53.1	10.3	294°33.6	36.2	338°08.2	40.3	Avior	234°16.1
23	317°12.8	179°32.6	10.8	256°54.1	10.7	309°36.3	36.1	353°10.8	40.3	Suhail	222°48.2
Mer.pass. 01:55		ν -0.6° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.08	ν 2.6° d -0.1° m -2.82	ν 2.6° d -0.1° m 0.36	Miaplacidus		221°39.6	69°48.4	Alphard	217°50.0
Mer.pass. 01:55		ν -0.6° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.08	ν 2.6° d -0.1° m -2.82	ν 2.6° d -0.1° m 0.36	Regulus		207°36.9	11°51.6	Dubhe	193°44.1
Mer.pass. 01:55		ν -0.6° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.08	ν 2.6° d -0.1° m -2.82	ν 2.6° d -0.1° m 0.36	Denebola		61°37.9	14°27.0	Gienah	182°27.2
Mer.pass. 01:55		ν -0.6° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.08	ν 2.6° d -0.1° m -2.82	ν 2.6° d -0.1° m 0.36	Gacrux		175°45.9	-17°39.9	Acrux	173°02.8
Mer.pass. 01:55		ν -0.6° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.08	ν 2.6° d -0.1° m -2.82	ν 2.6° d -0.1° m 0.36	Alioth		171°54.3	-57°14.4	Gacrux	171°54.3
Mer.pass. 01:55		ν -0.6° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.08	ν 2.6° d -0.1° m -2.82	ν 2.6° d -0.1° m 0.36	Spica		166°15.1	55°50.5	Alioth	166°15.1
Mer.pass. 01:55		ν -0.6° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.08	ν 2.6° d -0.1° m -2.82	ν 2.6° d -0.1° m 0.36	Alkaid		158°24.6	-11°16.6	Spica	158°24.6
Mer.pass. 01:55		ν -0.6° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.08	ν 2.6° d -0.1° m -2.82	ν 2.6° d -0.1° m 0.36	Hadar		152°53.8	49°12.3	Alkaid	152°53.8
Mer.pass. 01:55		ν -0.6° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.08	ν 2.6° d -0.1° m -2.82	ν 2.6° d -0.1° m 0.36	Menkent		148°39.1	-60°29.0	Hadar	148°39.1
Mer.pass. 01:55		ν -0.6° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.08	ν 2.6° d -0.1° m -2.82	ν 2.6° d -0.1° m 0.36	Arcturus		148°00.1	-36°28.9	Menkent	148°00.1
Mer.pass. 01:55		ν -0.6° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.08	ν 2.6° d -0.1° m -2.82	ν 2.6° d -0.1° m 0.36	Rigel Kent.		145°49.8	19°04.1	Arcturus	145°49.8
Mer.pass. 01:55		ν -0.6° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.08	ν 2.6° d -0.1° m -2.82	ν 2.6° d -0.1° m 0.36	Kochab		139°43.2	-60°55.9	Rigel Kent.	139°43.2
Mer.pass. 01:55		ν -0.6° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.08	ν 2.6° d -0.1° m -2.82	ν 2.6° d -0.1° m 0.36	Zuben'ubi		137°20.1	74°04.1	Kochab	137°20.1
Mer.pass. 01:55		ν -0.6° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.08	ν 2.6° d -0.1° m -2.82	ν 2.6° d -0.1° m 0.36	Alphecca		136°58.3	-16°08.1	Zuben'ubi	136°58.3
Mer.pass. 01:55		ν -0.6° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.08	ν 2.6° d -0.1° m -2.82	ν 2.6° d -0.1° m 0.36	Antares		126°05.4	26°38.6	Alphecca	126°05.4
Mer.pass. 01:55		ν -0.6° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.08	ν 2.6° d -0.1° m -2.82	ν 2.6° d -0.1° m 0.36	Atria		112°18.2	-26°28.9	Antares	112°18.2
Mer.pass. 01:55		ν -0.6° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.08	ν 2.6° d -0.1° m -2.82	ν 2.6° d -0.1° m 0.36	Sabik		107°14.0	-69°04.3	Atria	107°14.0
Mer.pass. 01:55		ν -0.6° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.08	ν 2.6° d -0.1° m -2.82	ν 2.6° d -0.1° m 0.36	Shaula		102°04.9	-15°45.1	Sabik	102°04.9
Mer.pass. 01:55		ν -0.6° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.08	ν 2.6° d -0.1° m -2.82	ν 2.6° d -0.1° m 0.36	Rasalhague		96°12.9	-37°07.3	Shaula	96°12.9
Mer.pass. 01:55		ν -0.6° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.08	ν 2.6° d -0.1° m -2.82	ν 2.6° d -0.1° m 0.36	Eltanin		90°42.8	51°29.4	Rasalhague	90°42.8
Mer.pass. 01:55		ν -0.6° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.08	ν 2.6° d -0.1° m -2.82	ν 2.6° d -0.1° m 0.36	Kaus Aust.		83°34.9	-34°22.5	Eltanin	83°34.9
Mer.pass. 01:55		ν -0.6° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.08	ν 2.6° d -0.1° m -2.82	ν 2.6° d -0.1° m 0.36	Vega		80°34.3	38°48.5	Kaus Aust.	80°34.3
Mer.pass. 01:55		ν -0.6° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.08	ν 2.6° d -0.1° m -2.82	ν 2.6° d -0.1° m 0.36	Nunki		75°49.9	-26°16.1	Vega	75°49.9
Mer.pass. 01:55		ν -0.6° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.08	ν 2.6° d -0.1° m -2.82	ν 2.6° d -0.1° m 0.36	Altair		62°01.6	8°55.8	Nunki	62°01.6
Mer.pass. 01:55		ν -0.6° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.08	ν 2.6° d -0.1° m -2.82	ν 2.6° d -0.1° m 0.36	Peacock		53°08.3	-56°39.8	Altair	53°08.3
Mer.pass. 01:55		ν -0.6° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.08	ν 2.6° d -0.1° m -2.82	ν 2.6° d -0.1° m 0.36	Deneb		49°26.7	45°21.8	Peacock	49°26.7
Mer.pass. 01:55		ν -0.6° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.08	ν 2.6° d -0.1° m -2.82	ν 2.6° d -0.1° m 0.36	Enif		33°40.4	9°58.8	Deneb	33°40.4
Mer.pass. 01:55		ν -0.6° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.08	ν 2.6° d -0.1° m -2.82	ν 2.6° d -0.1° m 0.36	Al Na'ir		27°34.9	-46°51.0	Enif	27°34.9
Mer.pass. 01:55		ν -0.6° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.08	ν 2.6° d -0.1° m -2.82	ν 2.6° d -0.1° m 0.36	Fomalhaut		15°16.3	-29°30.1	Al Na'ir	15°16.3
Mer.pass. 01:55		ν -0.6° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.08	ν 2.6° d -0.1° m -2.82	ν 2.6° d -0.1° m 0.36	Scheat		13°46.7	28°12.3	Fomalhaut	13°46.7
Mer.pass. 01:55		ν -0.6° d -0.8° m -3.89	ν 1.0° d 0.3° m -0.08	ν 2.6° d -0.1° m -2.82	ν 2.6° d -0.1° m 0.36	Markab		13°31.5	15°19.6	Scheat	13°31.5
Aug 23 Tue		SHA	Mer.pass								
Venus		223°31.2	11:01								
Mars		300°15.3	05:54								
Jupiter		352°19.3	02:25								
Saturn		35°53.9	23:27								
Aug 24 Wed		SHA	Mer.pass								
Venus		222°16.7	11:02								
Mars		299°39.8	05:52								
Jupiter		352°23.7	02:21								
Saturn		35°58.2	23:23								
Aug 25 Thu		SHA	Mer.pass								
Venus		221°02.4	11:03								
Mars		299°04.5	05:50								
Jupiter		352°28.2	02:17								
Saturn		36°02.5	23:19	</td							

DUT1 = UT1-UTC = -0.0200 sec  $\Delta T = TT-UT1 = +69.2040$  sec

2022 August 23 to Aug. 25 UT

h		Sun		Moon				
Tue		GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	179°18.3	N11°31.1	228°16.5	10.3'	N27°01.1	-1.2'	54.0'	
1	194°18.4	30.2	242°45.8	10.3'	26°59.9	-1.3'	54.0'	
2	209°18.6	29.4	257°15.1	10.3'	26°58.6	-1.5'	54.0'	
3	224°18.8	28.5	271°44.4	10.3'	26°57.1	-1.6'	54.0'	
4	239°18.9	27.7	286°13.8	10.4'	26°55.5	-1.7'	54.0'	
5	254°19.1	26.8	300°43.1	10.4'	26°53.7	-1.9'	54.0'	
6	269°19.3	N11°26.0	315°12.5	10.4'	N26°51.9	-2.0'	54.0'	
7	284°19.4	25.1	329°41.9	10.4'	26°49.9	-2.1'	54.0'	
8	299°19.6	24.3	344°11.3	10.4'	26°47.8	-2.3'	54.0'	
9	314°19.7	23.4	358°40.7	10.4'	26°45.5	-2.4'	54.0'	
10	329°19.9	22.6	13°10.1	10.4'	26°43.1	-2.5'	54.0'	
11	344°20.1	21.7	27°39.6	10.5'	26°40.6	-2.6'	54.0'	
12	359°20.2	N11°20.9	42°09.1	10.5'	N26°38.0	-2.8'	54.0'	
13	14°20.4	20.0	56°38.5	10.5'	26°35.2	-2.9'	54.0'	
14	29°20.6	19.2	71°08.1	10.5'	26°32.3	-3.0'	54.1'	
15	44°20.7	18.3	85°37.6	10.5'	26°29.3	-3.1'	54.1'	
16	59°20.9	17.5	100°07.1	10.6'	26°26.2	-3.3'	54.1'	
17	74°21.1	16.6	114°36.7	10.6'	26°22.9	-3.4'	54.1'	
18	89°21.2	N11°15.8	129°06.3	10.6'	N26°19.5	-3.5'	54.1'	
19	104°21.4	14.9	143°35.9	10.6'	26°16.0	-3.6'	54.1'	
20	119°21.6	14.1	158°05.6	10.7'	26°12.3	-3.8'	54.1'	
21	134°21.7	13.2	172°35.2	10.7'	26°08.5	-3.9'	54.1'	
22	149°21.9	12.4	187°04.9	10.7'	26°04.6	-4.0'	54.1'	
23	164°22.1	11.5	201°34.7	10.8'	26°00.6	-4.1'	54.1'	
SD = 15.8'		SD = 14.7'						

Wed	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	179°22.2	N11°10.7	216°04.4	10.8'	N25°56.5	-4.3'	54.1'
1	194°22.4	09.8	230°34.2	10.8'	25°52.2	-4.4'	54.1'
2	209°22.6	09.0	245°04.0	10.8'	25°47.8	-4.5'	54.1'
3	224°22.7	08.1	259°33.8	10.9'	25°43.3	-4.6'	54.1'
4	239°22.9	07.3	274°03.7	10.9'	25°38.6	-4.8'	54.1'
5	254°23.1	06.4	288°33.6	10.9'	25°33.9	-4.9'	54.1'
6	269°23.2	N11°05.5	303°03.6	11.0'	N25°29.0	-5.0'	54.1'
7	284°23.4	04.7	317°33.5	11.0'	25°24.0	-5.1'	54.1'
8	299°23.6	03.8	332°03.6	11.0'	25°18.9	-5.2'	54.2'
9	314°23.7	03.0	346°33.6	11.1'	25°13.6	-5.4'	54.2'
10	329°23.9	02.1	1°03.7	11.1'	25°08.2	-5.5'	54.2'
11	344°24.1	01.3	15°33.8	11.2'	25°02.7	-5.6'	54.2'
12	359°24.2	N11°00.4	30°03.9	11.2'	N24°57.1	-5.7'	54.2'
13	14°24.4	10°59.6	44°34.1	11.2'	24°51.4	-5.8'	54.2'
14	29°24.6	58.7	59°04.4	11.3'	24°45.6	-6.0'	54.2'
15	44°24.7	57.8	73°34.6	11.3'	24°39.6	-6.1'	54.2'
16	59°24.9	57.0	88°04.9	11.3'	24°33.5	-6.2'	54.2'
17	74°25.1	56.1	102°35.3	11.4'	24°27.3	-6.3'	54.2'
18	89°25.2	N10°55.3	117°05.7	11.4'	N24°21.0	-6.4'	54.2'
19	104°25.4	54.4	131°36.1	11.5'	24°14.6	-6.5'	54.2'
20	119°25.6	53.5	146°06.6	11.5'	24°08.1	-6.7'	54.3'
21	134°25.8	52.7	160°37.1	11.6'	24°01.4	-6.8'	54.3'
22	149°25.9	51.8	175°07.6	11.6'	23°54.6	-6.9'	54.3'
23	164°26.1	51.0	189°38.2	11.6'	23°47.7	-7.0'	54.3'
SD = 15.8'		SD = 14.8'					

Thu	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	179°26.3	N10°50.1	204°08.8	11.7'	N23°40.7	-7.1'	54.3'
1	194°26.4	49.2	218°39.5	11.7'	23°33.6	-7.2'	54.3'
2	209°26.6	48.4	233°10.2	11.8'	23°26.4	-7.3'	54.3'
3	224°26.8	47.5	247°41.0	11.8'	23°19.1	-7.4'	54.3'
4	239°26.9	46.7	262°11.8	11.9'	23°11.7	-7.5'	54.3'
5	254°27.1	45.8	276°42.7	11.9'	23°04.1	-7.7'	54.3'
6	269°27.3	N10°44.9	291°13.6	11.9'	N22°56.5	-7.8'	54.4'
7	284°27.5	44.1	305°44.5	12.0'	22°48.7	-7.9'	54.4'
8	299°27.6	43.2	320°15.5	12.0'	22°40.8	-8.0'	54.4'
9	314°27.8	42.3	334°46.5	12.1'	22°32.8	-8.1'	54.4'
10	329°28.0	41.5	349°17.6	12.1'	22°24.8	-8.2'	54.4'
11	344°28.1	40.6	3°48.8	12.2'	22°16.6	-8.3'	54.4'
12	359°28.3	N10°39.8	18°19.9	12.2'	N22°08.3	-8.4'	54.4'
13	14°28.5	38.9	32°51.1	12.3'	21°59.9	-8.5'	54.4'
14	29°28.7	38.0	47°22.4	12.3'	21°51.4	-8.6'	54.5'
15	44°28.8	37.2	61°53.7	12.4'	21°42.8	-8.7'	54.5'
16	59°29.0	36.3	76°25.1	12.4'	21°34.1	-8.8'	54.5'
17	74°29.2	35.4	90°56.5	12.5'	21°25.3	-8.9'	54.5'
18	89°29.4	N10°34.6	105°27.9	12.5'	N21°16.4	-9.0'	54.5'
19	104°29.5	33.7	119°59.4	12.5'	21°07.4	-9.1'	54.5'
20	119°29.7	32.8	134°31.0	12.6'	20°58.3	-9.2'	54.5'
21	134°29.9	32.0	149°02.6	12.6'	20°49.1	-9.3'	54.5'
22	149°30.1	31.1	163°34.2	12.7'	20°39.8	-9.4'	54.6'
23	164°30.2	30.2	178°05.9	12.7'	20°30.4	-9.5'	54.6'
SD = 15.8'		SD = 14.8'					

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

Lat.	Tue	Moonrise Wed	Thu	Tue	Moonset Wed	Thu
N 72°						
N 70°						
68°						
66°						
64°						
62°						
60°						
N 58°						
56°						
54°						
52°						
50°						
48°						
N 40°						
35°						
30°						

## August 26, 27, 28 UT (Fri., Sat., Sun.)

Aries			Venus			Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	334°13.5	194°01.9	N16°29.4	272°42.9	N19°25.8	326°46.4	N01°31.6	10°20.3	S15°43.3		
1	349°16.0	209°01.3	28.5	287°43.9	26.1	341°49.1	31.5	25°23.0	43.4		
2	4°18.5	224°00.7	27.6	302°44.9	26.4	356°51.7	31.4	40°25.6	43.4		
3	19°20.9	239°00.1	.. 26.8	317°45.9	.. 26.8	11°54.4	.. 31.3	55°28.3	.. 43.5		
4	34°23.4	253°59.4	25.9	332°46.9	27.1	26°57.0	31.2	70°30.9	43.5		
5	49°25.9	268°58.8	25.0	347°47.9	27.4	41°59.7	31.1	85°33.5	43.6		
6	64°28.3	283°58.2	N16°24.1	2°48.9	N19°27.7	57°02.4	N01°31.0	100°36.2	S15°43.7		
7	79°30.8	298°57.6	23.3	17°50.0	28.0	72°05.0	31.0	115°38.8	43.7		
8	94°33.2	313°57.0	22.4	32°51.0	28.3	87°07.7	30.9	130°41.5	43.8		
9	109°35.7	328°56.4	.. 21.5	47°52.0	.. 28.6	102°10.4	.. 30.8	145°44.1	.. 43.8		
10	124°38.2	343°55.8	20.7	62°53.0	28.9	117°13.0	30.7	160°46.8	43.9		
11	139°40.6	358°55.1	19.8	77°54.0	29.2	132°15.7	30.6	175°49.4	44.0		
12	154°43.1	13°54.5	N16°18.9	92°55.0	N19°29.5	147°18.4	N01°30.5	190°52.0	S15°44.0		
13	169°45.6	28°53.9	18.0	107°56.0	29.8	162°21.0	30.4	205°54.7	44.1		
14	184°48.0	43°53.3	17.1	122°57.0	30.1	177°23.7	30.3	220°57.3	44.1		
15	199°50.5	58°52.7	.. 16.3	137°58.0	.. 30.4	192°26.3	.. 30.2	236°00.0	.. 44.2		
16	214°53.0	73°52.1	15.4	152°59.0	30.7	207°29.0	30.1	251°02.6	44.3		
17	229°55.4	88°51.5	14.5	168°00.1	31.0	222°31.7	30.0	266°05.2	44.3		
18	244°57.9	103°50.9	N16°13.6	183°01.1	N19°31.3	237°34.3	N01°29.9	281°07.9	S15°44.4		
19	260°00.4	118°50.3	12.8	198°02.1	31.6	252°37.0	29.8	296°10.5	44.4		
20	275°02.8	133°49.7	11.9	213°03.1	31.9	267°39.7	29.7	311°13.2	44.5		
21	290°05.3	148°49.0	.. 11.0	228°04.1	.. 32.2	282°42.3	.. 29.6	326°15.8	.. 44.6		
22	305°07.7	163°48.4	10.1	243°05.1	32.5	297°45.0	29.5	341°18.4	44.6		
23	320°10.2	178°47.8	09.2	258°06.1	32.8	312°47.7	29.4	356°21.1	44.7		
Mer.pass. 01:43			ν -0.6° d -0.9° m -3.89	ν 1.0° d 0.3° m -0.12	ν 2.7° d -0.1° m -2.84	ν 2.6° d -0.1° m 0.38					

Stars	
SHA	Dec
Alpheratz	357°36.5
Ankaa	353°08.7
Schedar	349°32.8
Diphda	348°49.0
Achernar	335°21.3
Hamal	327°53.2
Polaris	314°49.4
Acamar	315°13.1
Menkar	314°08.1
Mirfak	308°31.0
Aldebaran	290°41.9
Rigel	281°05.8
Capella	280°24.9
Bellatrix	278°25.1
Elnath	278°04.5
Alnilam	275°39.8
Betelgeuse	270°54.3
Canopus	263°53.6
Sirius	258°28.2
Adhara	255°07.6
Procyon	244°53.1
Pollux	243°20.0
Avior	234°16.1
Suhail	222°48.2
Miaplacidus	221°39.6
Alphard	217°50.0
Regulus	207°36.8
Dubhe	193°44.1
Denebola	182°27.2
Gienah	175°45.9
Acrua	173°02.9
Gacrux	171°54.3
Alioth	166°15.1
Spica	158°24.6
Alkaid	152°53.8
Hadar	148°39.1
Menkent	148°00.1
Arcturus	145°49.9
Rigel Kent.	139°43.2
Kochab	137°20.2
Zuben'ubi	136°58.3
Alphecca	126°05.4
Antares	112°18.2
Atria	107°14.0
Sabik	102°04.9
Shaula	96°12.9
Rasalhague	96°00.2
Eltanin	90°42.9
Kaus Aust.	83°34.9
Vega	80°34.3
Nunki	75°49.9
Altair	62°01.6
Peacock	53°08.3
Deneb	49°26.7
Enif	33°40.4
Al Na'ir	27°34.9
Fomalhaut	15°16.3
Scheat	13°46.7
Markab	13°31.5

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	
0	335°12.7	193°47.2	N16°08.3	273°07.2	N19°33.0	327°50.3	N01°29.3	11°23.7	S15°44.7	
1	350°15.1	208°46.6	07.4	288°08.2	33.3	342°53.0	29.2	26°26.4	44.8	
2	5°17.6	223°46.0	06.6	303°09.2	33.6	357°55.7	29.1	41°29.0	44.9	
3	20°20.1	238°45.4	.. 05.7	318°10.2	.. 33.9	12°58.3	.. 29.0	56°31.7	.. 44.9	
4	35°22.5	253°44.8	04.8	333°11.2	34.2	28°01.0	28.9	71°34.3	45.0	
5	50°25.0	268°44.2	03.9	348°12.2	34.5	43°03.7	28.8	86°36.9	45.0	
6	65°27.5	283°43.6	N16°03.0	3°13.2	N19°34.8	58°06.4	N01°28.7	101°39.6	S15°45.1	
7	80°29.9	298°43.0	02.1	18°14.3	35.1	73°09.0	28.6	116°42.2	45.1	
8	95°32.4	313°42.4	01.2	33°15.3	35.4	88°11.7	28.5	131°44.9	45.2	
9	110°34.9	328°41.8	16°00.3	48°16.3	.. 35.7	103°14.4	.. 28.4	146°47.5	.. 45.3	
10	125°37.3	343°41.2	15°59.4	63°17.3	36.0	118°17.0	28.3	161°50.1	45.3	
11	140°39.8	358°40.6	58.5	78°18.3	36.3	133°19.7	28.2	176°52.8	45.4	
12	155°42.2	13°40.0	N15°57.7	93°19.4	N19°36.6	148°22.4	N01°28.1	191°55.4	S15°45.4	
13	170°44.7	28°39.4	56.8	108°20.4	36.9	163°25.0	28.0	206°58.1	45.5	
14	185°47.2	43°38.8	55.9	123°21.4	37.2	178°27.7	27.9	222°00.7	45.6	
15	200°49.6	58°38.2	.. 55.0	138°22.4	.. 37.5	193°30.4	.. 27.8	237°03.3	.. 45.6	
16	215°52.1	73°37.6	54.1	153°23.4	37.8	208°33.1	27.7	252°06.0	45.7	
17	230°54.6	88°37.0	53.2	168°24.5	38.1	223°35.7	27.6	267°08.6	45.7	
18	245°57.0	103°36.4	N15°52.3	183°25.5	N19°38.4	238°38.4	N01°27.5	282°11.3	S15°45.8	
19	260°59.5	118°35.8	51.4	198°26.5	38.6	253°41.1	27.4	297°13.9	45.9	
20	276°02.0	133°35.2	50.5	213°27.5	38.9	268°43.7	27.3	312°16.5	45.9	
21	291°04.4	148°34.6	.. 49.6	228°28.5	.. 39.2	283°46.4	.. 27.2	327°19.2	.. 46.0	
22	306°06.9	163°34.0	48.7	243°29.6	39.5	298°49.1	27.1	342°21.8	46.0	
23	321°09.3	178°33.4	47.8	258°30.6	39.8	313°51.8	27.0	357°24.5	46.1	
Mer.pass. 01:39			ν -0.6° d -0.9° m -3.89	ν 1.0° d 0.3° m -0.13	ν 2.7° d -0.1° m -2.84	ν 2.6° d -0.1° m 0.38				

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	336°11.8	193°32.8	N15°46.9	273°31.6	N19°40.1	328°54.4	N01°26.9	12°27.1	S15°46.2
1	351°14.3	208°32.2	46.0	288°32.6	40.4	343°57.1	26.8	27°29.7	46.2
2	6°16.7	223°31.6	45.1	303°33.7	40.7	358°59.8	26.7	42°32.4	46.3
3	21°19.2	238°31.0	.. 44.1	318°34.7	.. 41.0	14°02.5	.. 26.6	57°35.0	.. 46.3
4	36°21.7	253°30.4	43.2	333°35.7	41.3	29°05.1	26.5	72°37.7	46.4
5	51°24.1	268°29.8	42.3	348°36.7	41.6	44°07.8	26.4	87°40.3	46.5
6	66°26.6	283°29.2	N15°41.4	3°37.8	N19°41.8	59°10.5	N01°26.3	102°42.9	S15°46.5
7	81°29.1	298°28.6	40.5	18°38.8	42.1	74°13.2	26.2	117°45.6	46.6
8	96°31.5	313°28.0	39.6	33°39.8	42.4	89°15.8	26.1	132°48.2	46.6
9	111°34.0	328°27.4	.. 38.7	48°40.8	.. 42.7	104°18.5	.. 26.0	147°50.9	.. 46.7
10	126°36.5	343°26.8	37.8	63°41.9	43.0	119°21.2	25.9	162°53.5	46.8
11	141°38.9	358°26.3	36.9	78°42.9	43.3	134°23.9	25.8	177°56.1	46.8
12	156°41.4	13°25.7	N15°36.0	93°43.9	N19°43.6	149°26.5	N01°25.7	192°58.8	S15°46.9
13	171°43.8	28°25.1	35.0	108°45.0	43.9	164°29.2	25.6	208°01.4	46.9
14	186°46.3	43°24.5	34.1	123°46.0	44.2	179°31.9	25.5	223°04.1	47.0
15	201°48.8	58°23.9	.. 33.2	138°47.0	.. 44.4	194°34.6	.. 25.4	238°06.7	.. 47.0
16	216°51.2	73°23.3	32.3	153°48.0	44.7	209°37.3	25.3	253°09.3	47.1
17	231°53.7	88°22.7	31.4	168°49.1	45.0	224°39.9	25.2	268°12.0	47.2
18	246°56.2	103°22.1	N15°30.5	183°50.1	N19°45.3	239°42.6	N01°25.1	28	

DUT1 = UT1-UTC = -0.0163 sec  $\Delta T = TT-UT1 = +69.2003$  sec

2022 August 26 to Aug. 28 UT

h	Sun			Moon			
Fri	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	179°30.4	N10°29.4	192°37.6	12.8'	N20°20.9	-9.6'	54.6'
1	194°30.6	28.5	207°09.4	12.8'	20°11.3	-9.7'	54.6'
2	209°30.8	27.6	221°41.2	12.9'	20°01.6	-9.8'	54.6'
3	224°30.9	26.8	236°13.1	12.9'	19°51.8	-9.9'	54.6'
4	239°31.1	25.9	250°45.0	13.0'	19°42.0	-10.0'	54.6'
5	254°31.3	25.0	265°17.0	13.0'	19°32.0	-10.1'	54.7'
6	269°31.5	N10°24.2	279°49.0	13.1'	N19°22.0	-10.1'	54.7'
7	284°31.6	23.3	294°21.0	13.1'	19°11.8	-10.2'	54.7'
8	299°31.8	22.4	308°53.1	13.1'	19°01.6	-10.3'	54.7'
9	314°32.0	21.5	323°25.3	13.2'	18°51.3	-10.4'	54.7'
10	329°32.2	20.7	337°57.5	13.2'	18°40.9	-10.5'	54.7'
11	344°32.3	19.8	352°29.7	13.3'	18°30.4	-10.6'	54.7'
12	359°32.5	N10°18.9	7°02.0	13.3'	N18°19.8	-10.7'	54.8'
13	14°32.7	18.1	21°34.3	13.4'	18°09.1	-10.8'	54.8'
14	29°32.9	17.2	36°06.7	13.4'	17°58.4	-10.8'	54.8'
15	44°33.0	16.3	50°39.1	13.5'	17°47.5	-10.9'	54.8'
16	59°33.2	15.4	65°11.6	13.5'	17°36.6	-11.0'	54.8'
17	74°33.4	14.6	79°44.1	13.5'	17°25.6	-11.1'	54.8'
18	89°33.6	N10°13.7	94°16.6	13.6'	N17°14.5	-11.2'	54.8'
19	104°33.8	12.8	108°49.2	13.6'	17°03.4	-11.2'	54.9'
20	119°33.9	12.0	123°21.8	13.7'	16°52.1	-11.3'	54.9'
21	134°34.1	11.1	137°54.5	13.7'	16°40.8	-11.4'	54.9'
22	149°34.3	10.2	152°27.2	13.7'	16°29.4	-11.5'	54.9'
23	164°34.5	09.3	166°59.9	13.8'	16°17.9	-11.6'	54.9'
	SD = 15.8' d = -0.9'			SD = 14.9'			
	SD = 15.8' d = -0.9'			SD = 15.0'			
	SD = 15.8' d = -0.9'			SD = 15.0'			
	SD = 15.8' d = -0.9'			SD = 15.1'			

Lat.	Twilight		Sunrise	Sunset	Twilight	
	Naut.	Civil			Civil	Naut.
N 72°	—	01:49	03:36	20:24	22:06	—
N 70°	—	02:29	03:53	20:07	21:29	—
68°	—	02:56	04:07	19:53	21:03	23:30
66°	01:34	03:16	04:18	19:42	20:44	22:22
64°	02:10	03:32	04:28	19:33	20:28	21:48
62°	02:35	03:45	04:36	19:25	20:16	21:25
60°	02:54	03:56	04:43	19:19	20:05	21:06
N 58°	03:09	04:06	04:49	19:13	19:56	20:51
56°	03:22	04:14	04:54	19:07	19:48	20:39
54°	03:33	04:21	04:59	19:03	19:41	20:28
52°	03:42	04:27	05:03	18:59	19:34	20:19
50°	03:51	04:33	05:07	18:55	19:29	20:11
48°	04:08	04:45	05:16	18:46	19:17	19:54
N 40°	04:21	04:55	05:23	18:39	19:08	19:41
35°	04:32	05:03	05:29	18:34	19:00	19:31
30°	04:41	05:10	05:34	18:28	18:53	19:22
20°	04:54	05:21	05:43	18:20	18:42	19:08
N 10°	05:05	05:30	05:51	18:12	18:33	18:58
0°	05:13	05:37	05:58	18:05	18:26	18:50
S 10°	05:19	05:44	06:05	17:58	18:19	18:44
20°	05:25	05:51	06:13	17:51	18:13	18:39
30°	05:29	05:57	06:21	17:42	18:07	18:34
35°	05:31	06:00	06:26	17:38	18:03	18:33
40°	05:33	06:04	06:31	17:32	18:00	18:31
45°	05:34	06:08	06:38	17:26	17:56	18:30
S 50°	05:35	06:12	06:45	17:19	17:52	18:29
52°	05:35	06:14	06:48	17:16	17:50	18:29
54°	05:35	06:16	06:52	17:12	17:48	18:29
56°	05:35	06:18	06:56	17:08	17:46	18:29
58°	05:35	06:21	07:01	17:03	17:43	18:29
S 60°	05:35	06:23	07:06	16:58	17:41	18:29
Lat.	Fri	Moonrise		Fri	Moonset	
		Sat	Sun		Sat	Sun
N 72°	—	02:00	04:33	22:09	21:09	20:33
N 70°	—	02:40	04:50	21:27	20:50	20:24
68°	00:51	03:08	05:03	20:58	20:35	20:17
66°	01:33	03:28	05:14	20:36	20:22	20:11
64°	02:01	03:44	05:23	20:19	20:12	20:05
62°	02:23	03:58	05:30	20:05	20:03	20:01
60°	02:40	04:09	05:37	19:52	19:55	19:57
N 58°	02:54	04:19	05:43	19:42	19:48	19:53
56°	03:07	04:27	05:48	19:32	19:42	19:50
54°	03:18	04:35	05:52	19:24	19:37	19:47
52°	03:27	04:42	05:57	19:17	19:32	19:45
50°	03:35	04:48	06:00	19:10	19:27	19:42
45°	03:53	05:01	06:08	18:56	19:18	19:37
N 40°	04:08	05:11	06:15	18:44	19:09	19:33
35°	04:20	05:21	06:21	18:33	19:02	19:29
30°	04:31	05:29	06:26	18:24	18:56	19:26
20°	04:49	05:42	06:34	18:09	18:45	19:20
N 10°	05:05	05:54	06:42	17:55	18:35	19:15
0°	05:20	06:05	06:49	17:42	18:26	19:10
S 10°	05:35	06:16	06:56	17:29	18:17	19:05
20°	05:50	06:28	07:04	17:15	18:07	18:59
30°	06:08	06:41	07:12	16:59	17:56	18:53
35°	06:19	06:49	07:17	16:49	17:50	18:50
40°	06:31	06:58	07:22	16:39	17:42	18:46
45°	06:44	07:08	07:29	16:26	17:33	18:41
S 50°	07:01	07:20	07:36	16:10	17:23	18:35
52°	07:09	07:26	07:40	16:03	17:18	18:33
54°	07:18	07:32	07:44	15:55	17:12	18:30
56°	07:28	07:39	07:48	15:45	17:06	18:26
58°	07:39	07:47	07:53	15:35	16:59	18:23
S 60°	07:52	07:56	07:58	15:23	16:51	18:19
Day		Sun		Moon		
		Eqn.of 00 <sup>h</sup> mm:ss	Time 12 <sup>h</sup> mm:ss	Mer. Pass. Upper hh:mm	Mer. Pass. Lower hh:mm	Age 29-1 2-1%
26	01:58	01:50		12:02	11:31	23:54
27	01:41	01:33		12:02	12:16	—
28	01:24	01:15		12:01	12:59	00:38

## August 29, 30, 31 UT (Mon., Tue., Wed.)

Aries			Venus			Mars			Jupiter			Saturn			Stars	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	337°10.9	193°18.6	N15°24.9	273°56.3	N19°47.0	329°58.7	N01°24.5	13°30.4	S15°47.6							
1	352°13.4	208°18.0	24.0	288°57.3	47.3	345°01.4	24.4	28°33.1	47.6							
2	7°15.9	223°17.4	23.1	303°58.4	47.6	0°04.0	24.3	43°35.7	47.7							
3	22°18.3	238°16.8	22.2	318°59.4	47.9	15°06.7	24.2	58°38.4	47.7							
4	37°20.8	253°16.3	21.2	334°00.4	48.1	30°09.4	24.1	73°41.0	47.8							
5	52°23.3	268°15.7	20.3	349°01.5	48.4	45°12.1	24.0	88°43.6	47.9							
6	67°25.7	283°15.1	N15°19.4	4°02.5	N19°48.7	60°14.8	N01°23.9	103°46.3	S15°47.9							
7	82°28.2	298°14.5	18.5	19°03.5	49.0	75°17.4	23.8	118°48.9	48.0							
8	97°30.7	313°13.9	17.5	34°04.6	49.3	90°20.1	23.7	133°51.5	48.0							
9	112°33.1	328°13.3	16.6	49°05.6	49.6	105°22.8	23.6	148°54.2	48.1							
10	127°35.6	343°12.8	15.7	64°06.7	49.8	120°25.5	23.5	163°56.8	48.2							
11	142°38.1	358°12.2	14.8	79°07.7	50.1	135°28.2	23.4	178°59.5	48.2							
12	157°40.5	13°11.6	N15°13.8	94°08.7	N19°50.4	150°30.9	N01°23.3	194°02.1	S15°48.3							
13	172°43.0	28°11.0	12.9	109°09.8	50.7	165°33.5	23.2	209°04.7	48.3							
14	187°45.4	43°10.4	12.0	124°10.8	51.0	180°36.2	23.1	224°07.4	48.4							
15	202°47.9	58°09.8	11.0	139°11.8	51.3	195°38.9	23.0	239°10.0	48.5							
16	217°50.4	73°09.3	10.1	154°12.9	51.5	210°41.6	22.9	254°12.7	48.5							
17	232°52.8	88°08.7	09.2	169°13.9	51.8	225°44.3	22.8	269°15.3	48.6							
18	247°55.3	103°08.1	N15°08.2	184°15.0	N19°52.1	240°47.0	N01°22.7	284°17.9	S15°48.6							
19	262°57.8	118°07.5	07.3	199°16.0	52.4	255°49.6	22.6	299°20.6	48.7							
20	278°00.2	133°07.0	06.3	214°17.0	52.7	270°52.3	22.5	314°23.2	48.7							
21	293°02.7	148°06.4	05.4	229°18.1	52.9	285°55.0	22.4	329°25.8	48.8							
22	308°05.2	163°05.8	04.5	244°19.1	53.2	300°57.7	22.3	344°28.5	48.9							
23	323°07.6	178°05.2	03.5	259°20.2	53.5	316°00.4	22.2	359°31.1	48.9							
Mer.pass. 01:31		ν -0.6° d -0.9° m -3.89	ν 1.0° d 0.3° m -0.15	ν 2.7° d -0.1° m -2.86	ν 2.6° d -0.1° m 0.39											
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	338°10.1	193°04.6	N15°02.6	274°21.2	N19°53.8	331°03.1	N01°22.1	14°33.8	S15°49.0							
1	353°12.5	208°04.1	01.7	289°22.3	54.1	346°05.7	21.9	29°36.4	49.0							
2	8°15.0	223°03.5	15°00.7	304°23.3	54.3	1°08.4	21.8	44°39.0	49.1							
3	23°17.5	238°02.9	14°59.8	319°24.3	54.6	16°11.1	21.7	59°41.7	49.1							
4	38°19.9	253°02.3	58.8	334°25.4	54.9	31°13.8	21.6	74°44.3	49.2							
5	53°22.4	268°01.8	57.9	349°26.4	55.2	46°16.5	21.5	89°46.9	49.3							
6	68°24.9	283°01.2	N14°56.9	4°27.5	N19°55.4	61°19.2	N01°21.4	104°49.6	S15°49.3							
7	83°27.3	298°00.6	56.0	19°28.5	55.7	76°21.9	21.3	119°52.2	49.4							
8	98°29.8	313°00.0	55.0	34°29.6	56.0	91°24.6	21.2	134°54.8	49.4							
9	113°32.3	327°59.5	54.1	49°30.6	56.3	106°27.2	21.1	149°57.5	49.5							
10	128°34.7	342°58.9	53.2	64°31.7	56.5	121°29.9	21.0	165°00.1	49.6							
11	143°37.2	357°58.3	52.2	79°32.7	56.8	136°32.6	20.9	180°02.8	49.6							
12	158°39.7	12°57.8	N14°51.3	94°33.8	N19°57.1	151°35.3	N01°20.8	195°05.4	S15°49.7							
13	173°42.1	27°57.2	50.3	109°34.8	57.4	166°38.0	20.7	210°08.0	49.7							
14	188°44.6	42°56.6	49.4	124°35.9	57.7	181°40.7	20.6	225°10.7	49.8							
15	203°47.0	57°56.0	48.4	139°36.9	57.9	196°43.4	20.5	240°13.3	49.8							
16	218°49.5	72°55.5	47.5	154°38.0	58.2	211°46.1	20.4	255°15.9	49.9							
17	233°52.0	87°54.9	46.5	169°39.0	58.5	226°48.7	20.3	270°18.6	50.0							
18	248°54.4	102°54.3	N14°45.6	184°40.1	N19°58.8	241°51.4	N01°20.2	285°21.2	S15°50.0							
19	263°56.9	117°53.8	44.6	199°41.1	59.0	256°54.1	20.1	300°23.8	50.1							
20	278°59.4	132°53.2	43.6	214°42.2	59.3	271°56.8	19.9	315°26.5	50.1							
21	294°01.8	147°52.6	42.7	229°43.2	59.6	286°59.5	19.8	330°29.1	50.2							
22	309°04.3	162°52.1	41.7	244°44.3	19°59.8	302°02.2	19.7	345°31.8	50.2							
23	324°06.8	177°51.5	40.8	259°45.3	20°00.1	317°04.9	19.6	0°34.4	50.3							
Mer.pass. 01:27		ν -0.6° d -0.9° m -3.89	ν 1.0° d 0.3° m -0.17	ν 2.7° d -0.1° m -2.86	ν 2.6° d -0.1° m 0.40											
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	339°09.2	192°50.9	N14°39.8	274°46.4	N20°00.4	332°07.6	N01°19.5	15°37.0	S15°50.4							
1	354°11.7	207°50.4	38.9	289°47.4	00.7	347°10.3	19.4	30°39.7	50.4							
2	9°14.2	222°49.8	37.9	304°48.5	00.9	2°13.0	19.3	45°42.3	50.5							
3	24°16.6	237°49.2	36.9	319°49.5	01.2	17°15.6	19.2	60°44.9	50.5							
4	39°19.1	252°48.7	36.0	334°50.6	01.5	32°18.3	19.1	75°47.6	50.6							
5	54°21.5	267°48.1	35.0	349°51.6	01.8	47°21.0	19.0	90°50.2	50.6							
6	69°24.0	282°47.5	N14°34.1	4°52.7	N20°02.0	62°23.7	N01°18.9	105°52.8	S15°50.7							
7	84°26.5	297°47.0	33.1	19°53.8	02.3	77°26.4	18.8	120°55.5	50.8							
8	99°28.9	312°46.4	32.1	34°54.8	02.6	92°29.1	18.7	135°58.1	50.8							
9	114°31.4	327°45.8	31.2	49°55.9	02.8	107°31.8	18.6	151°00.7	50.9							
10	129°33.9	342°45.3	30.2	64°56.9	03.1	122°34.5	18.5	166°03.4	50.9							
11	144°36.3	357°44.7	29.2	79°58.0	03.4	137°37.2	18.3	181°06.0	51.0							
12	159°38.8	12°44.1	N14°28.3	94°59.0	N20°03.6	152°39.9	N01°18.2	196°08.7	S15°51.0							
13	174°41.3	27°43.6	27.3	110°00.1	03.9	167°42.6	18.1	211°11.3	51.1							
14	189°43.7	42°43.0	26.3	125°01.2	04.2	182°45.3	18.0	226°13.9	51.2							
15	204°46.2	57°42.5	25.4	140°02.2	04.5	197°48.0	17.9	241°16.6	51.2							
16	219°48.6	72°41.9	24.4	155°03.3	04.7	212°50.7	17.8	256°19.2	51.3							
17	234°51.1	87°41.3	23.4	170°04.3	05.0	227°53.4	17.7	271°21.8	51.3							
18	249°53.6	102°40.8	N14°22.5	185°05.4	N20°05.3	242°56.0	N01°17.6	286°24.5	S15°51.4							
19	264°56.0	117°40.2	21.5	200°06.5	05.5	257°58.7	17.5	301°27.1	51.4							
20	279°58.5	132°39.7	20.5	215°07.5	05.8	273°01.4	17.4	316°29.7	51.5							
21	295°01.0	147°39.1	19.6	230°08.6	06.1	288°04.1	17.3	331°32.4	51.6							
22	310°03.4	162°38.5	18.6	245°09.7	06.3	303°06.8	17.2	346°35.0	51.6							
23	325°05.9	177°38.0	17.6	260°10.7	06.6	318°09.5	17.1	1°37.6	51.7							
Mer.pass. 01:23		ν -0.6° d -1.0° m -3.89	ν 1.1° d 0.3° m -0.18	ν 2.7° d -0.1° m -2.87												

DUT1 = UT1-UTC = -0.0141 sec  $\Delta T = TT-UT1 = +69.1981$  sec

2022 August 29 to Aug. 31 UT

h	Sun			Moon			
Mon	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	179°43.4	N09°26.2	160°22.2	15.0'	N05°38.9	-14.2'	55.8'
1	194°43.6	25.3	174°56.2	15.0'	05°24.6	-14.3'	55.8'
2	209°43.8	24.4	189°30.2	15.0'	05°10.4	-14.3'	55.9'
3	224°44.0	23.5	204°04.2	15.0'	04°56.1	-14.3'	55.9'
4	239°44.2	22.6	218°38.2	15.0'	04°41.8	-14.4'	55.9'
5	254°44.3	21.7	233°12.1	15.0'	04°27.4	-14.4'	55.9'
6	269°44.5	N09°20.8	247°46.1	15.0'	N04°13.0	-14.4'	55.9'
7	284°44.7	19.9	262°20.1	15.0'	03°58.6	-14.4'	56.0'
8	299°44.9	19.1	276°54.1	15.0'	03°44.2	-14.5'	56.0'
9	314°45.1	18.2	291°28.1	15.0'	03°29.7	-14.5'	56.0'
10	329°45.3	17.3	306°02.0	15.0'	03°15.3	-14.5'	56.0'
11	344°45.5	16.4	320°36.0	15.0'	03°00.8	-14.5'	56.0'
12	359°45.7	N09°15.5	335°10.0	15.0'	N02°46.2	-14.5'	56.1'
13	14°45.8	14.6	349°43.9	14.9'	02°31.7	-14.6'	56.1'
14	29°46.0	13.7	4°17.9	14.9'	02°17.1	-14.6'	56.1'
15	44°46.2	12.8	18°51.8	14.9'	02°02.5	-14.6'	56.1'
16	59°46.4	11.9	33°25.7	14.9'	01°47.9	-14.6'	56.1'
17	74°46.6	11.0	47°59.6	14.9'	01°33.3	-14.6'	56.2'
18	89°46.8	N09°10.1	62°33.5	14.9'	N01°18.7	-14.7'	56.2'
19	104°47.0	09.3	77°07.4	14.9'	01°04.0	-14.7'	56.2'
20	119°47.2	08.4	91°41.3	14.9'	00°49.3	-14.7'	56.2'
21	134°47.4	07.5	106°15.2	14.8'	00°34.6	-14.7'	56.2'
22	149°47.5	06.6	120°49.0	14.8'	00°19.9	-14.7'	56.3'
23	164°47.7	05.7	135°22.8	14.8'	00°05.2	-14.7'	56.3'
	SD = 15.8'			SD = 15.2'			

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

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

Day	Sun			Moon		
	Eqn.of Time	Mer.	Mer. Pass	Upper	Lower	Age
	00 <sup>h</sup>	12 <sup>h</sup>	Pass	hh:mm	hh:mm	3-13%
29	01:06	00:57		12:01	13:42	01:21
30	00:48	00:39		12:01	14:26	02:04
31	00:30	00:21		12:00	15:10	02:48

## September 01, 02, 03 UT (Thu., Fri., Sat.)

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	340°08.4	192°37.4	N14°16.6	275°11.8	N20°06.9	333°12.2	N01°16.9	16°40.3	S15°51.7					Alpheratz	357°36.5	29°12.9	
1	355°10.8	207°36.9	15.7	290°12.8	07.1	348°14.9	16.8	31°42.9	51.8					Ankaa	353°08.7	-42°10.8	
2	10°13.3	222°36.3	14.7	305°13.9	07.4	3°17.6	16.7	46°45.5	51.8					Schedar	349°32.8	56°39.6	
3	25°15.8	237°35.8	.. 13.7	320°15.0	.. 07.7	18°20.3	.. 16.6	61°48.2	.. 51.9					Diphda	348°49.0	-17°51.6	
4	40°18.2	252°35.2	12.7	335°16.0	07.9	33°23.0	16.5	76°50.8	52.0					Achernar	335°21.2	-57°07.1	
5	55°20.7	267°34.7	11.8	350°17.1	08.2	48°25.7	16.4	91°53.4	52.0					Hamal	327°53.2	23°34.1	
6	70°23.1	282°34.1	N14°10.8	5°18.2	N20°08.5	63°28.4	N01°16.3	106°56.1	S15°52.1					Polaris	314°46.6	89°21.3	
7	85°25.6	297°33.5	09.8	20°19.2	08.7	78°31.1	16.2	121°58.7	52.1					Acamar	315°13.1	-40°12.6	
8	100°28.1	312°33.0	08.8	35°20.3	09.0	93°33.8	16.1	137°01.3	52.2					Menkar	314°08.1	4°10.8	
9	115°30.5	327°32.4	.. 07.8	50°21.4	.. 09.3	108°36.5	.. 16.0	152°04.0	.. 52.2					Mirfak	308°30.9	49°56.3	
10	130°33.0	342°31.9	06.9	65°22.4	09.5	123°39.2	15.9	167°06.6	52.3					Aldebaran	290°41.9	16°33.3	
11	145°35.5	357°31.3	05.9	80°23.5	09.8	138°41.9	15.7	182°09.2	52.3					Rigel	281°05.8	-8°10.4	
12	160°37.9	12°30.8	N14°04.9	95°24.6	N20°10.0	153°44.6	N01°15.6	197°11.9	S15°52.4					Capella	280°24.9	46°01.1	
13	175°40.4	27°30.2	03.9	110°25.6	10.3	168°47.3	15.5	212°14.5	52.5					Bellatrix	278°25.0	6°22.3	
14	190°42.9	42°29.7	02.9	125°26.7	10.6	183°50.0	15.4	227°17.1	52.5					Elnath	278°04.4	28°37.5	
15	205°45.3	57°29.1	.. 01.9	140°27.8	.. 10.8	198°52.7	.. 15.3	242°19.8	.. 52.6					Alnilam	275°39.8	-1°11.1	
16	220°47.8	72°28.6	01.0	155°28.9	11.1	213°55.4	15.2	257°22.4	52.6					Betelgeuse	270°54.3	7°24.8	
17	235°50.2	87°28.0	14°00.0	170°29.9	11.4	228°58.1	15.1	272°25.0	52.7					Canopus	263°53.5	-52°42.1	
18	250°52.7	102°27.5	N13°59.0	185°31.0	N20°11.6	244°00.8	N01°15.0	287°27.7	S15°52.7					Sirius	258°28.1	-16°44.6	
19	265°55.2	117°26.9	58.0	200°32.1	11.9	259°03.5	14.9	302°30.3	52.8					Adhara	255°07.6	-28°59.9	
20	280°57.6	132°26.4	57.0	215°33.1	12.2	274°06.2	14.8	317°32.9	52.9					Procyon	244°53.1	5°10.2	
21	296°00.1	147°25.8	.. 56.0	230°34.2	.. 12.4	289°08.9	.. 14.6	332°35.6	.. 52.9					Pollux	243°20.0	27°58.3	
22	311°02.6	162°25.3	55.0	245°35.3	12.7	304°11.6	14.5	347°38.2	53.0					Avior	234°16.0	-59°34.6	
23	326°05.0	177°24.7	54.0	260°36.4	12.9	319°14.3	14.4	2°40.8	53.0					Suhail	222°48.1	-43°31.2	
Mer.pass. 01:19			ν -0.6° d -1.0' m -3.89	ν 1.1' d 0.3' m -0.19			ν 2.7' d -0.1' m -2.87			ν 2.6' d -0.1' m 0.40							
Fri			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec				
0	341°07.5	192°24.2	N13°53.1	275°37.4	N20°13.2	334°17.0	N01°14.3	17°43.5	S15°53.1					Deneb	182°27.2	14°26.9	
1	356°10.0	207°23.6	52.1	290°38.5	13.5	349°19.7	14.2	32°46.1	53.1					Gienah	175°45.9	-17°39.9	
2	11°12.4	222°23.1	51.1	305°39.6	13.7	4°22.4	14.1	47°48.7	53.2					Acrux	173°02.9	-63°13.5	
3	26°14.9	237°22.5	.. 50.1	320°40.7	.. 14.0	19°25.1	.. 14.0	62°51.4	.. 53.2					Gacrux	171°54.3	-57°14.4	
4	41°17.4	252°22.0	49.1	335°41.7	14.2	34°27.8	13.9	77°54.0	53.3					Alioth	166°15.1	55°50.5	
5	56°19.8	267°21.4	48.1	350°42.8	14.5	49°30.5	13.8	92°56.6	53.4					Spica	158°24.6	-11°16.6	
6	71°22.3	282°20.9	N13°47.1	5°43.9	N20°14.8	64°33.2	N01°13.7	107°59.3	S15°53.4					Alkaid	152°53.9	49°12.3	
7	86°24.7	297°20.4	46.1	20°45.0	15.0	79°35.9	13.5	123°01.9	53.5					Hadar	148°39.2	-60°29.0	
8	101°27.2	312°19.8	45.1	35°46.0	15.3	94°38.6	13.4	138°04.5	53.5					Menkent	148°00.2	-36°28.9	
9	116°29.7	327°19.3	.. 44.1	50°47.1	.. 15.5	109°41.3	.. 13.3	153°07.2	.. 53.6					Arcturus	145°49.9	19°04.1	
10	131°32.1	342°18.7	43.1	65°48.2	15.8	124°44.0	13.2	168°09.8	53.6					Rigel Kent.	139°43.3	-60°55.8	
11	146°34.6	357°18.2	42.1	80°49.3	16.1	139°46.7	13.1	183°12.4	53.7					Kochab	137°20.3	74°04.1	
12	161°37.1	12°17.6	N13°41.1	95°50.4	N20°16.3	154°49.4	N01°13.0	198°15.1	S15°53.7					Zuben 'ubi	136°58.3	-16°08.1	
13	176°39.5	27°17.1	40.1	110°51.4	16.6	169°52.1	12.9	213°17.7	53.8					Alphecca	126°05.5	26°38.6	
14	191°42.0	42°16.6	39.1	125°52.5	16.8	184°54.8	12.8	228°20.3	53.9					Antares	112°18.2	-26°28.9	
15	206°44.5	57°16.0	.. 38.1	140°53.6	.. 17.1	199°57.5	.. 12.6	243°23.0	.. 53.9					Atria	107°14.1	-69°04.3	
16	221°46.9	72°15.5	37.1	155°54.7	17.3	215°00.2	12.5	258°25.6	54.0					Sabik	102°05.0	-15°45.1	
17	236°49.4	87°14.9	36.1	170°55.8	17.6	230°03.0	12.4	273°28.2	54.0					Shaula	96°12.9	-37°07.3	
18	251°51.9	102°14.4	N13°35.1	185°56.8	N20°17.9	245°05.7	N01°12.3	288°30.9	S15°54.1					Rasalhague	96°00.3	12°32.8	
19	266°54.3	117°13.8	34.1	200°57.9	18.1	260°08.4	12.2	303°33.5	54.1					Eltanin	90°42.9	51°29.4	
20	281°56.8	132°13.3	33.1	215°59.0	18.4	275°11.1	12.1	318°36.1	54.2					Kaus Aust.	83°34.9	-34°22.5	
21	296°59.2	147°12.8	.. 32.1	231°00.1	.. 18.6	290°13.8	.. 12.0	333°38.7	.. 54.2					Vega	80°34.3	38°48.5	
22	312°01.7	162°12.2	31.1	246°01.2	18.9	305°16.5	11.9	348°41.4	54.3					Nunki	75°50.0	-26°16.1	
23	327°04.2	177°11.7	30.1	261°02.3	19.1	320°19.2	11.8	3°44.0	54.4					Altair	62°01.6	8°55.8	
Mer.pass. 01:15			ν -0.5' d -1.0' m -3.89	ν 1.1' d 0.3' m -0.20			ν 2.7' d -0.1' m -2.88			ν 2.6' d -0.1' m 0.41							
Sat			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec				
0	342°06.6	192°11.2	N13°29.1	276°03.3	N20°19.4	335°21.9	N01°11.6	18°46.6	S15°54.4					Sep 01 Thu	SHA	Mer.pass	
1	357°09.1	207°10.6	28.1	291°04.4	19.6	350°24.6	11.5	33°49.3	54.5					Venus	212°29.1	11:10	
2	12°11.6	222°10.1	27.1	306°05.5	19.9	5°27.3	11.4	48°51.9	54.5					Mars	295°03.4	05:39	
3	27°14.0	237°09.5	.. 26.1	321°06.6	.. 20.2	20°30.0	.. 11.3	63°54.5	.. 54.6					Jupiter	353°03.9	01:47	
4	42°16.5	252°09.0	25.1	336°07.7	20.4	35°32.7	11.2	78°57.2	54.6					Saturn	36°31.9	22:49	
5	57°19.0	267°08.5	24.0	351°08.8	20.7	50°35.4	11.1	93°59.8	54.7								
6	72°21.4	282°07.9	N13°23.0	6°09.9	N20°20.9	65°38.1	N01°11.0	109°02.4	S15°54.7					Sep 02 Fri	SHA	Mer.pass	
7	87°23.9	297°07.4	22.0	21°10.9	21.2	80°40.8	10.8	124°05.1	54.8					Venus	211°16.7	11:11	
8	102°26.3	312°06.9	21.0	36°12.0	21.4	95°43.6	10.7	139°07.7	54.9					Mars	294°29.9	05:37	
9	117°28.8	327°06.3	.. 20.0	51°13.1	.. 21.7	110°46.3	.. 10.6	154°10.3	.. 54.9					Jupiter	353°09.5	01:43	
10	132°31.3	342°05.8	19.0	66°14.2	21.9	125°49.0	10.5	169°12.9	55.0					Saturn	36°36.0	22:45	
11	147°33.7	357°05.3	18.0	81°15.3	22.2	140°51.7	10.4	184°15.6	55.0								
12	162°36.2	12°04.7	N13°17.0	96°16.4	N20°22.4	155°54.4	N01°										

DUT1 = UT1-UTC = -0.0135 sec  $\Delta T = TT-UT1 = +69.1975$  sec

2022 September 01 to Sep. 03 UT

h		Sun		Moon				
Thu		GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	179°57.2	N08°21.6	128°15.5	12.5'	S11°47.5	-13.9'	57.3'	
1	194°57.4	20.7	142°47.0	12.4'	12°01.4	-13.8'	57.4'	
2	209°57.6	19.8	157°18.5	12.4'	12°15.2	-13.8'	57.4'	
3	224°57.8	18.9	171°49.8	12.3'	12°29.0	-13.8'	57.4'	
4	239°58.0	18.0	186°21.1	12.2'	12°42.8	-13.7'	57.4'	
5	254°58.2	17.1	200°52.3	12.1'	12°56.5	-13.6'	57.5'	
6	269°58.4	N08°16.2	215°23.5	12.0'	S13°10.1	-13.6'	57.5'	
7	284°58.6	15.3	229°54.5	12.0'	13°23.7	-13.5'	57.5'	
8	299°58.8	14.4	244°25.5	11.9'	13°37.2	-13.5'	57.5'	
9	314°59.0	13.5	258°56.4	11.8'	13°50.7	-13.4'	57.5'	
10	329°59.2	12.5	273°27.2	11.7'	14°04.2	-13.4'	57.6'	
11	344°59.4	11.6	287°57.9	11.6'	14°17.5	-13.3'	57.6'	
12	359°59.6	N08°10.7	302°28.5	11.5'	S14°30.8	-13.2'	57.6'	
13	14°59.8	09.8	316°59.1	11.5'	14°44.1	-13.2'	57.6'	
14	30°00.0	08.9	331°29.5	11.4'	14°57.2	-13.1'	57.7'	
15	45°00.2	08.0	345°59.9	11.3'	15°10.4	-13.0'	57.7'	
16	60°00.4	07.1	0°30.2	11.2'	15°23.4	-13.0'	57.7'	
17	75°00.6	06.2	15°00.4	11.1'	15°36.4	-12.9'	57.7'	
18	90°00.8	N08°05.3	29°30.5	11.0'	S15°49.3	-12.8'	57.7'	
19	105°01.0	04.4	44°00.5	10.9'	16°02.1	-12.8'	57.8'	
20	120°01.2	03.5	58°30.4	10.8'	16°14.9	-12.7'	57.8'	
21	135°01.4	02.5	73°00.2	10.7'	16°27.6	-12.6'	57.8'	
22	150°01.6	01.6	87°29.9	10.6'	16°40.2	-12.5'	57.8'	
23	165°01.8	00.7	101°59.6	10.5'	16°52.8	-12.5'	57.9'	
		SD = 15.8'		d = -0.9'		SD = 15.6'		
Fri		GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	180°02.0	N07°59.8	116°29.1	10.4'	S17°05.2	-12.4'	57.9'	
1	195°02.2	58.9	130°58.5	10.3'	17°17.6	-12.3'	57.9'	
2	210°02.4	58.0	145°27.9	10.2'	17°29.9	-12.2'	57.9'	
3	225°02.6	57.1	159°57.1	10.1'	17°42.2	-12.1'	58.0'	
4	240°02.8	56.2	174°26.3	10.0'	17°54.3	-12.1'	58.0'	
5	255°03.0	55.3	188°55.3	9.9'	18°06.3	-12.0'	58.0'	
6	270°03.2	N07°54.4	203°24.2	9.8'	S18°18.3	-11.9'	58.0'	
7	285°03.4	53.4	217°53.1	9.7'	18°30.2	-11.8'	58.0'	
8	300°03.6	52.5	232°21.8	9.6'	18°42.0	-11.7'	58.1'	
9	315°03.8	51.6	246°50.4	9.5'	18°53.7	-11.6'	58.1'	
10	330°04.0	50.7	261°19.0	9.4'	19°05.3	-11.5'	58.1'	
11	345°04.2	49.8	275°47.4	9.3'	19°16.8	-11.4'	58.1'	
12	0°04.4	N07°48.9	290°15.7	9.2'	S19°28.2	-11.3'	58.2'	
13	15°04.6	48.0	304°43.9	9.1'	19°39.5	-11.2'	58.2'	
14	30°04.8	47.0	319°12.0	9.0'	19°50.7	-11.1'	58.2'	
15	45°05.0	46.1	333°40.0	8.9'	20°01.8	-11.0'	58.2'	
16	60°05.2	45.2	348°07.9	8.8'	20°12.8	-10.9'	58.2'	
17	75°05.4	44.3	235°7.7	8.7'	20°23.7	-10.8'	58.3'	
18	90°05.6	N07°43.4	17°03.4	8.6'	S20°34.5	-10.7'	58.3'	
19	105°05.8	42.5	31°31.0	8.5'	20°45.2	-10.6'	58.3'	
20	120°06.0	41.6	45°58.5	8.4'	20°55.7	-10.5'	58.3'	
21	135°06.2	40.6	60°25.8	8.3'	21°06.2	-10.3'	58.4'	
22	150°06.4	39.7	74°53.1	8.1'	21°16.6	-10.2'	58.4'	
23	165°06.6	38.8	89°20.2	8.0'	21°26.8	-10.1'	58.4'	
		SD = 15.8'		d = -0.9'		SD = 15.8'		
Sat		GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	180°06.8	N07°37.9	103°47.3	7.9'	S21°36.9	-10.0'	58.4'	
1	195°07.0	37.0	118°14.2	7.8'	21°46.9	-9.9'	58.4'	
2	210°07.2	36.1	132°41.0	7.7'	21°56.8	-9.8'	58.5'	
3	225°07.4	35.2	147°07.7	7.6'	22°06.6	-9.6'	58.5'	
4	240°07.6	34.2	161°34.3	7.5'	22°16.2	-9.5'	58.5'	
5	255°07.8	33.3	176°00.8	7.4'	22°25.7	-9.4'	58.5'	
6	270°08.0	N07°32.4	190°27.2	7.3'	S22°35.1	-9.3'	58.6'	
7	285°08.2	31.5	204°53.5	7.2'	22°44.4	-9.1'	58.6'	
8	300°08.5	30.6	219°19.7	7.1'	22°53.5	-9.0'	58.6'	
9	315°08.7	29.6	233°45.7	7.0'	23°02.5	-8.9'	58.6'	
10	330°08.9	28.7	248°11.7	6.8'	23°11.3	-8.7'	58.6'	
11	345°09.1	27.8	262°37.5	6.7'	23°20.1	-8.6'	58.7'	
12	0°09.3	N07°26.9	277°03.3	6.6'	S23°28.7	-8.5'	58.7'	
13	15°09.5	26.0	291°28.9	6.5'	23°37.1	-8.3'	58.7'	
14	30°09.7	25.1	305°54.5	6.4'	23°45.4	-8.2'	58.7'	
15	45°09.9	24.1	320°19.9	6.3'	23°53.6	-8.0'	58.8'	
16	60°10.1	23.2	334°45.2	6.2'	24°01.7	-7.9'	58.8'	
17	75°10.3	22.3	349°10.4	6.1'	24°09.6	-7.7'	58.8'	
18	90°10.5	N07°21.4	3°35.5	6.0'	S24°17.3	-7.6'	58.8'	
19	105°10.7	20.5	18°00.5	5.9'	24°24.9	-7.5'	58.8'	
20	120°10.9	19.5	32°25.5	5.8'	24°32.4	-7.3'	58.9'	
21	135°11.1	18.6	46°50.3	5.7'	24°39.7	-7.1'	58.9'	
22	150°11.3	17.7	61°15.0	5.6'	24°46.8	-7.0'	58.9'	
23	165°11.5	16.8	75°39.6	5.5'	24°53.8	-6.8'	58.9'	
		SD = 15.8'		d = -0.9'		SD = 15.9'		

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

## September 04, 05, 06 UT (Sun., Mon., Tue.)

Aries			Venus			Mars			Jupiter			Saturn		
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Stars	SHA	Dec
0	343°05.8	191°58.4	N13°04.7	276°29.5	N20°25.4	336°26.9	N01°08.9	19°49.8	S15°55.7			Alpheratz	357°36.4	29°12.9
1	358°08.2	206°57.8	03.7	291°30.6	25.7	351°29.6	08.8	34°52.4	55.8			Ankaa	353°08.7	-42°10.9
2	13°10.7	221°57.3	02.7	306°31.7	25.9	6°32.3	08.7	49°55.0	55.8			Schedar	349°32.7	56°39.6
3	28°13.2	236°56.8	.. 01.7	321°32.8	.. 26.2	21°35.1	.. 08.6	64°57.7	.. 55.9			Diphda	348°49.0	-17°51.6
4	43°15.6	251°56.2	13°00.7	336°33.9	26.4	36°37.8	08.5	80°00.3	55.9			Achernar	335°21.2	-57°07.1
5	58°18.1	266°55.7	12°59.6	351°35.0	26.7	51°40.5	08.3	95°02.9	56.0			Hamal	327°53.2	23°34.1
6	73°20.6	281°55.2	N12°58.6	6°36.1	N20°26.9	66°43.2	N01°08.2	110°05.5	S15°56.1			Polaris	314°44.9	89°21.3
7	88°23.0	296°54.7	57.6	21°37.2	27.2	81°45.9	08.1	125°08.2	56.1			Acamar	315°13.1	-40°12.6
8	103°25.5	311°54.1	56.6	36°38.3	27.4	96°48.6	08.0	140°10.8	56.2			Menkar	314°08.0	4°10.8
9	118°28.0	326°53.6	.. 55.5	51°39.4	.. 27.7	111°51.3	.. 07.9	155°13.4	.. 56.2			Mirfak	308°30.9	49°56.3
10	133°30.4	341°53.1	54.5	66°40.5	27.9	126°54.0	07.8	170°16.1	56.3			Aldebaran	290°41.8	16°33.3
11	148°32.9	356°52.6	53.5	81°41.6	28.2	141°56.8	07.7	185°18.7	56.3			Rigel	281°05.8	-8°10.4
12	163°35.3	11°52.0	N12°52.4	96°42.7	N20°28.4	156°59.5	N01°07.5	200°21.3	S15°56.4			Capella	280°24.8	46°01.1
13	178°37.8	26°51.5	51.4	111°43.8	28.7	172°02.2	07.4	215°23.9	56.4			Bellatrix	278°25.0	6°22.3
14	193°40.3	41°51.0	50.4	126°44.9	28.9	187°04.9	07.3	230°26.6	56.5			Elnath	278°04.4	28°37.5
15	208°42.7	56°50.5	.. 49.3	141°46.0	.. 29.2	202°07.6	.. 07.2	245°29.2	.. 56.5			Alnilam	275°39.8	-1°11.1
16	223°45.2	71°49.9	48.3	156°47.1	29.4	217°10.3	07.1	260°31.8	56.6			Betelgeuse	270°54.3	7°24.8
17	238°47.7	86°49.4	47.3	171°48.2	29.7	232°13.0	07.0	275°34.4	56.7			Canopus	263°53.5	-52°42.1
18	253°50.1	101°48.9	N12°46.2	186°49.3	N20°29.9	247°15.8	N01°06.8	290°37.1	S15°56.7			Sirius	258°28.1	-16°44.6
19	268°52.6	116°48.4	45.2	201°50.4	30.1	262°18.5	06.7	305°39.7	56.8			Adhara	255°07.6	-28°59.9
20	283°55.1	131°47.9	44.2	216°51.5	30.4	277°21.2	06.6	320°42.3	56.8			Procyon	244°53.1	5°10.2
21	298°57.5	146°47.3	.. 43.1	231°52.6	.. 30.6	292°23.9	.. 06.5	335°45.0	.. 56.9			Pollux	243°19.9	27°58.3
22	314°00.0	161°46.8	42.1	246°53.7	30.9	307°26.6	06.4	350°47.6	56.9			Avior	234°16.0	-59°34.6
23	329°02.5	176°46.3	41.1	261°54.9	31.1	322°29.3	06.3	5°50.2	57.0			Suhail	222°48.1	-43°31.2
Mer.pass. 01:07		ν -0.5° d -1.0' m -3.89	ν 1.1' d 0.2' m -0.23	ν 2.7' d -0.1' m -2.89	ν 2.6' d -0.1' m 0.42							Miaplacidus	221°39.5	-69°48.4

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Stars	SHA	Dec
0	344°04.9	191°45.8	N12°40.0	276°56.0	N20°31.4	337°32.0	N01°06.2	20°52.8	S15°57.0			Denebola	182°27.2	14°26.9
1	359°07.4	206°45.3	39.0	291°57.1	31.6	352°34.8	06.0	35°55.5	57.1			Gienah	175°45.9	-17°39.9
2	14°09.8	221°44.7	38.0	306°58.2	31.9	7°37.5	05.9	50°58.1	57.1			Acrux	173°02.9	-63°13.5
3	29°12.3	236°44.2	.. 36.9	321°59.3	.. 32.1	22°40.2	.. 05.8	66°00.7	.. 57.2			Gacrux	171°54.3	-57°14.4
4	44°14.8	251°43.7	35.9	337°00.4	32.3	37°42.9	05.7	81°03.4	57.2			Alioth	166°15.2	55°50.5
5	59°17.2	266°43.2	34.8	352°01.5	32.6	52°45.6	05.6	96°06.0	57.3			Spica	158°24.6	-11°16.6
6	74°19.7	281°42.7	N12°33.8	7°02.6	N20°32.8	67°48.4	N01°05.5	111°08.6	S15°57.3			Alkaid	152°53.9	49°12.3
7	89°22.2	296°42.1	32.8	22°03.7	33.1	82°51.1	05.3	126°11.2	57.4			Hadar	148°39.2	-60°29.0
8	104°24.6	311°41.6	31.7	37°04.8	33.3	97°53.8	05.2	141°13.9	57.5			Menkent	148°00.2	-36°28.9
9	119°27.1	326°41.1	.. 30.7	52°05.9	.. 33.6	112°56.5	.. 05.1	156°16.5	.. 57.5			Arcturus	145°49.9	19°04.1
10	134°29.6	341°40.6	29.6	67°07.1	33.8	127°59.2	05.0	171°19.1	57.6			Rigil Kent.	139°43.3	-60°55.8
11	149°32.0	356°40.1	28.6	82°08.2	34.0	143°01.9	04.9	186°21.7	57.6			Kochab	137°20.3	74°04.0
12	164°34.5	11°39.6	N12°27.6	97°09.3	N20°34.3	158°04.7	N01°04.8	201°24.4	S15°57.7			Zuben'ubi	136°58.3	-16°08.1
13	179°37.0	26°39.0	26.5	112°10.4	34.5	173°07.4	04.6	216°27.0	57.7			Alphecca	126°05.5	26°38.6
14	194°39.4	41°38.5	25.5	127°11.5	34.8	188°10.1	04.5	231°29.6	57.8			Antares	112°18.2	-26°28.9
15	209°41.9	56°38.0	.. 24.4	142°12.6	.. 35.0	203°12.8	.. 04.4	246°32.2	.. 57.8			Atria	107°14.2	-69°04.3
16	224°44.3	71°37.5	23.4	157°13.7	35.2	218°15.4	04.3	261°34.9	57.9			Sabik	102°05.0	-15°45.1
17	239°46.8	86°37.0	22.3	172°14.9	35.5	233°18.3	04.2	276°37.5	57.9			Shaula	96°12.9	-37°07.3
18	254°49.3	101°36.5	N12°21.3	187°16.0	N20°35.7	248°21.0	N01°04.0	291°40.1	S15°58.0			Rasalhague	96°00.3	12°32.8
19	269°51.7	116°36.0	20.2	202°17.1	36.0	263°23.7	03.9	306°42.7	58.0			Eltanin	90°42.9	51°29.4
20	284°54.2	131°35.5	19.2	217°18.2	36.2	278°26.4	03.8	321°45.4	58.1			Kaus Aust.	83°34.9	-34°22.5
21	299°56.7	146°34.9	.. 18.1	232°19.3	.. 36.4	293°29.1	.. 03.7	336°48.0	.. 58.1			Vega	80°34.3	38°48.5
22	314°59.1	161°34.4	17.1	247°20.4	36.7	308°31.9	03.6	351°50.6	58.2			Nunki	75°50.0	-26°16.1
23	330°01.6	176°33.9	16.0	262°21.6	36.9	323°34.6	03.5	6°53.3	58.3			Altair	62°01.6	8°55.8
Mer.pass. 01:03		ν -0.5° d -1.0' m -3.89	ν 1.1' d 0.2' m -0.24	ν 2.7' d -0.1' m -2.89	ν 2.6' d -0.1' m 0.42							Peacock	53°08.3	-56°39.8

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Stars	SHA	Dec
0	345°04.1	191°33.4	N12°15.0	277°22.7	N20°37.2	338°37.3	N01°03.3	21°55.9	S15°58.3			Fomalhaut	15°16.3	-29°30.1
1	0°06.5	206°32.9	13.9	292°23.8	37.4	353°40.0	03.2	36°58.5	58.4			Scheat	13°46.7	28°12.4
2	15°09.0	221°32.4	12.9	307°24.9	37.6	8°42.7	03.1	52°01.1	58.4			Markab	13°31.5	15°19.7
3	30°11.5	236°31.9	.. 11.8	322°26.0	.. 37.9	23°45.5	.. 03.0	67°03.8	.. 58.5			Sep 04 Sun	SHA	Mer.pass
4	45°13.9	251°31.4	10.8	337°27.2	38.1	38°48.2	02.9	82°06.4	58.5			Venus	208°52.6	11:13
5	60°16.4	266°30.9	09.7	352°28.3	38.3	53°50.9	02.8	97°09.0	58.6			Mars	293°23.7	05:34
6	75°18.8	281°30.3	N12°08.7	7°29.4	N20°38.6	68°53.6	N01°02.6	112°11.6	S15°58.6			Jupiter	353°21.1	01:34
7	90°21.3	296°29.8	07.6	22°30.5	38.8	83°56.3	02.5	127°14.3	58.7			Saturn	36°44.0	22:37
8	105°23.8	311°29.3	06.5	37°31.6	39.1	98°59.1	02.4	142°16.9	58.7			Sep 05 Mon	SHA	Mer.pass
9	120°26.2	326°28.8	.. 05.5	52°32.8	.. 39.3	114°01.8	.. 02.3	157°19.5	.. 58.8			Venus	207°40.9	11:13
10	135°28.7	341°28.3	04.4	67°33.9	39.5	129°04.5	02.2	172°22.1	58.8			Mars	292°51.0	05:32
11	150°31.2	356°27.8	03.4	82°35.0	39.8	144°07.2	02.0	187°24.8	58.9			Jupiter	353°27.1	01:30
12	165°33.6	11°27.3	N12°02.3	97°36.1	N20°40.0	159°10.0	N01°01.9	202°27.4						

DUT1 = UT1-UTC = -0.0124 sec  $\Delta T = TT-UT1 = +69.1964$  sec

2022 September 04 to Sep. 06 UT

h Sun			Moon				
Sun	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	180°11.7	N07°15.9	90°04.1	5.4'	\$25°00.6	-6.7'	58.9'
1	195°11.9	14.9	104°28.5	5.3'	25°07.3	-6.5'	59.0'
2	210°12.1	14.0	118°52.8	5.2'	25°13.9	-6.4'	59.0'
3	225°12.4	.. 13.1	133°17.1	5.1'	25°20.2	-6.2'	59.0'
4	240°12.6	12.2	147°41.2	5.0'	25°26.4	-6.0'	59.0'
5	255°12.8	11.3	162°05.2	4.9'	25°32.5	-5.9'	59.0'
6	270°13.0	N07°10.3	176°29.2	4.9'	\$25°38.4	-5.7'	59.1'
7	285°13.2	09.4	190°53.0	4.8'	25°44.1	-5.6'	59.1'
8	300°13.4	08.5	205°16.8	4.7'	25°49.6	-5.4'	59.1'
9	315°13.6	.. 07.6	219°40.5	4.6'	25°55.0	-5.2'	59.1'
10	330°13.8	06.6	234°04.1	4.5'	26°00.2	-5.0'	59.1'
11	345°14.0	05.7	248°27.6	4.4'	26°05.3	-4.9'	59.2'
12	0°14.2	N07°04.8	262°51.1	4.4'	\$26°10.2	-4.7'	59.2'
13	15°14.4	03.9	277°14.4	4.3'	26°14.9	-4.5'	59.2'
14	30°14.6	02.9	291°37.7	4.2'	26°19.4	-4.4'	59.2'
15	45°14.8	.. 02.0	306°00.9	4.1'	26°23.7	-4.2'	59.2'
16	60°15.0	01.1	320°24.0	4.1'	26°27.9	-4.0'	59.3'
17	75°15.3	07°00.2	334°47.1	4.0'	26°31.9	-3.8'	59.3'
18	90°15.5	N06°59.3	349°10.0	3.9'	\$26°35.7	-3.6'	59.3'
19	105°15.7	58.3	3°32.9	3.8'	26°39.4	-3.5'	59.3'
20	120°15.9	57.4	17°55.8	3.8'	26°42.9	-3.3'	59.3'
21	135°16.1	.. 56.5	32°18.6	3.7'	26°46.1	-3.1'	59.4'
22	150°16.3	55.6	46°41.3	3.7'	26°49.2	-2.9'	59.4'
23	165°16.5	54.6	61°03.9	3.6'	26°52.1	-2.7'	59.4'
	SD = 15.9'	d = -0.9'		SD = 16.1'			

Mon	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	180°16.7	N06°53.7	75°26.5	3.5'	\$26°54.9	-2.5'	59.4'
1	195°16.9	52.8	89°49.1	3.5'	26°57.4	-2.4'	59.4'
2	210°17.1	51.9	104°11.6	3.4'	26°59.8	-2.2'	59.4'
3	225°17.3	.. 50.9	118°34.0	3.4'	27°01.9	-2.0'	59.5'
4	240°17.6	50.0	132°56.4	3.3'	27°03.9	-1.8'	59.5'
5	255°17.8	49.1	147°18.7	3.3'	27°05.7	-1.6'	59.5'
6	270°18.0	N06°48.1	161°41.0	3.2'	\$27°07.3	-1.4'	59.5'
7	285°18.2	47.2	176°03.2	3.2'	27°08.8	-1.2'	59.5'
8	300°18.4	46.3	190°25.4	3.2'	27°10.0	-1.0'	59.5'
9	315°18.6	.. 45.4	204°47.6	3.1'	27°11.0	-0.8'	59.6'
10	330°18.8	44.4	219°09.7	3.1'	27°11.9	-0.7'	59.6'
11	345°19.0	43.5	233°31.8	3.1'	27°12.5	-0.5'	59.6'
12	0°19.2	N06°42.6	247°53.9	3.0'	\$27°13.0	-0.3'	59.6'
13	15°19.4	41.7	262°16.0	3.0'	27°13.2	-0.1'	59.6'
14	30°19.7	40.7	276°38.0	3.0'	27°13.3	0.1'	59.6'
15	45°19.9	.. 39.8	291°00.0	3.0'	27°13.2	0.3'	59.7'
16	60°20.1	38.9	305°21.9	3.0'	27°12.9	0.5'	59.7'
17	75°20.3	37.9	319°43.9	2.9'	27°12.3	0.7'	59.7'
18	90°20.5	N06°37.0	334°05.8	2.9'	\$27°11.6	0.9'	59.7'
19	105°20.7	36.1	348°27.8	2.9'	27°10.7	1.1'	59.7'
20	120°20.9	35.2	2°49.7	2.9'	27°09.6	1.3'	59.7'
21	135°21.1	.. 34.2	17°11.6	2.9'	27°08.4	1.5'	59.7'
22	150°21.3	33.3	31°33.5	2.9'	27°06.9	1.7'	59.8'
23	165°21.5	32.4	45°55.4	2.9'	27°05.2	1.9'	59.8'
	SD = 15.9'	d = -0.9'		SD = 16.2'			

Tue	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	180°21.8	N06°31.4	60°17.3	2.9'	\$27°03.3	2.1'	59.8'
1	195°22.0	30.5	74°39.2	2.9'	27°01.2	2.3'	59.8'
2	210°22.2	29.6	89°01.2	2.9'	26°59.0	2.5'	59.8'
3	225°22.4	.. 28.6	103°23.1	2.9'	26°56.5	2.7'	59.8'
4	240°22.6	27.7	117°45.0	3.0'	26°53.9	2.8'	59.8'
5	255°22.8	26.8	132°07.0	3.0'	26°51.0	3.0'	59.8'
6	270°23.0	N06°25.9	146°29.0	3.0'	\$26°48.0	3.2'	59.9'
7	285°23.2	24.9	160°50.9	3.0'	26°44.7	3.4'	59.9'
8	300°23.5	24.0	175°13.0	3.0'	26°41.3	3.6'	59.9'
9	315°23.7	.. 23.1	189°35.0	3.1'	26°37.7	3.8'	59.9'
10	330°23.9	22.1	203°57.1	3.1'	26°33.9	4.0'	59.9'
11	345°24.1	21.2	218°19.1	3.1'	26°29.9	4.2'	59.9'
12	0°24.3	N06°20.3	232°41.3	3.2'	\$26°25.7	4.4'	59.9'
13	15°24.5	19.3	247°03.4	3.2'	26°21.3	4.6'	59.9'
14	30°24.7	18.4	261°25.6	3.2'	26°16.7	4.8'	59.9'
15	45°24.9	.. 17.5	275°47.8	3.3'	26°11.9	5.0'	60.0'
16	60°25.2	16.5	290°10.1	3.3'	26°07.0	5.1'	60.0'
17	75°25.4	15.6	304°32.4	3.4'	26°01.8	5.3'	60.0'
18	90°25.6	N06°14.7	318°54.8	3.4'	\$25°56.5	5.5'	60.0'
19	105°25.8	13.7	333°17.2	3.5'	25°51.0	5.7'	60.0'
20	120°26.0	12.8	347°39.7	3.5'	25°45.3	5.9'	60.0'
21	135°26.2	.. 11.9	2°02.2	3.6'	25°39.4	6.1'	60.0'
22	150°26.4	10.9	16°24.7	3.6'	25°33.3	6.2'	60.0'
23	165°26.6	10.0	30°47.4	3.7'	25°27.1	6.4'	60.0'
	SD = 15.9'	d = -0.9'		SD = 16.3'			

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

Day	Sun		Moon			
	Eqn.of Time	Mer.	Mer. Pass.	Age		
	00 <sup>h</sup> mm:ss	12 <sup>h</sup> mm:ss	Pass hh:mm	Upper hh:mm	Lower hh:mm	8-10 53-75%
04	00:47	00:57	11:59	18:45	06:15	
05	01:07	01:17	11:59	19:48	07:16	
06	01:27	01:37	11:58	20:52	08:20	

## September 07, 08, 09 UT (Wed., Thu., Fri.)

Aries		Venus		Mars		Jupiter		Saturn		Stars	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec
0	346°03.2	191°21.2	N11°49.6	277°49.7	N20°42.8	339°42.7	N01°00.5	22°58.9	S15°59.6	Alpheratz	357°36.4
1	1°05.7	206°20.7	48.5	292°50.8	43.0	354°45.4	00.4	38°01.5	59.6	Ankaa	353°08.7
2	16°08.1	221°20.2	47.4	307°51.9	43.3	9°48.1	00.3	53°04.1	59.7	Schedar	349°32.7
3	31°10.6	236°19.7	44.6	322°53.1	43.5	24°50.8	00.1	68°06.7	59.7	Diphda	348°48.9
4	46°13.1	251°19.2	45.3	337°54.2	43.7	39°53.6	01°00.0	83°09.4	59.8	Achernar	335°21.2
5	61°15.5	266°18.7	44.2	352°55.3	44.0	54°56.3	00°59.9	98°12.0	59.8	Hamal	327°53.1
6	76°18.0	281°18.2	N11°43.2	7°56.5	N20°44.2	69°59.0	N00°59.8	113°14.6	S15°59.9	Polaris	314°43.4
7	91°20.4	296°17.7	42.1	22°57.6	44.4	85°01.7	59.7	128°17.2	15°59.9	Acamar	315°13.0
8	106°22.9	311°17.2	41.0	37°58.7	44.7	100°04.5	59.5	143°19.8	16°00.0	Menkar	314°08.0
9	121°25.4	326°16.7	40.0	52°59.9	44.9	115°07.2	59.4	158°22.5	00.0	Mirfak	308°30.8
10	136°27.8	341°16.2	38.9	68°01.0	45.1	130°09.9	59.3	173°25.1	00.1	Aldebaran	290°41.8
11	151°30.3	356°15.7	37.8	83°02.2	45.4	145°12.6	59.2	188°27.7	00.1	Rigel	281°05.7
12	166°32.8	11°15.2	N11°36.8	98°03.3	N20°45.6	160°15.4	N00°59.1	203°30.3	S16°00.2	Capella	280°24.8
13	181°35.2	26°14.8	35.7	113°04.4	45.8	175°18.1	58.9	218°33.0	00.2	Bellatrix	278°25.0
14	196°37.7	41°14.3	34.6	128°05.6	46.1	190°20.8	58.8	233°35.6	00.3	Elnath	278°04.3
15	211°40.2	56°13.8	33.5	143°06.7	46.3	205°23.5	58.7	248°38.2	00.3	Alnilam	275°39.7
16	226°42.6	71°13.3	32.5	158°07.8	46.5	220°26.3	58.6	263°40.8	00.4	Betelgeuse	270°54.3
17	241°45.1	86°12.8	31.4	173°09.0	46.7	235°29.0	58.5	278°43.4	00.5	Canopus	263°53.4
18	256°47.6	101°12.3	N11°30.3	188°10.1	N20°47.0	250°31.7	N00°58.3	293°46.1	S16°00.5	Sirius	258°28.1
19	271°50.0	116°11.8	29.2	203°11.3	47.2	265°34.5	58.2	308°48.7	00.6	Adhara	255°07.6
20	286°52.5	131°11.3	28.2	218°12.4	47.4	280°37.2	58.1	323°51.3	00.6	Procyon	244°53.1
21	301°54.9	146°10.8	27.1	233°13.6	47.7	295°39.9	58.0	338°53.9	00.7	Pollux	243°19.9
22	316°57.4	161°10.3	26.0	248°14.7	47.9	310°42.6	57.9	353°56.6	00.7	Avior	234°16.0
23	331°59.9	176°09.8	24.9	263°15.8	48.1	325°45.4	57.7	8°59.2	00.8	Suhail	222°48.1
Mer.pass. 00:56		ν -0.5° d -1.1' m -3.89		ν 1.1' d 0.2' m -0.27		ν 2.7' d -0.1' m -2.90		ν 2.6' d -0.1' m 0.43		Miaplacidus	221°39.5
Mer.pass. 00:56		ν -0.5' d -1.1' m -3.89		ν 1.1' d 0.2' m -0.27		ν 2.7' d -0.1' m -2.90		ν 2.6' d -0.1' m 0.43		Alphard	217°49.9
Mer.pass. 00:56		ν -0.5' d -1.1' m -3.89		ν 1.1' d 0.2' m -0.28		ν 2.7' d -0.1' m -2.90		ν 2.6' d -0.1' m 0.43		Regulus	207°36.8
Mer.pass. 00:56		ν -0.5' d -1.1' m -3.89		ν 1.1' d 0.2' m -0.28		ν 2.7' d -0.1' m -2.90		ν 2.6' d -0.1' m 0.43		Dubhe	193°44.0
Mer.pass. 00:56		ν -0.5' d -1.1' m -3.89		ν 1.1' d 0.2' m -0.28		ν 2.7' d -0.1' m -2.90		ν 2.6' d -0.1' m 0.43		Denebola	182°27.2
Mer.pass. 00:56		ν -0.5' d -1.1' m -3.89		ν 1.1' d 0.2' m -0.28		ν 2.7' d -0.1' m -2.90		ν 2.6' d -0.1' m 0.43		Gienah	175°45.9
Mer.pass. 00:56		ν -0.5' d -1.1' m -3.89		ν 1.1' d 0.2' m -0.28		ν 2.7' d -0.1' m -2.90		ν 2.6' d -0.1' m 0.43		Acrux	173°02.9
Mer.pass. 00:56		ν -0.5' d -1.1' m -3.89		ν 1.1' d 0.2' m -0.28		ν 2.7' d -0.1' m -2.90		ν 2.6' d -0.1' m 0.43		Gacrux	171°54.3
Mer.pass. 00:56		ν -0.5' d -1.1' m -3.89		ν 1.1' d 0.2' m -0.28		ν 2.7' d -0.1' m -2.90		ν 2.6' d -0.1' m 0.43		Alioth	166°15.2
Mer.pass. 00:56		ν -0.5' d -1.1' m -3.89		ν 1.1' d 0.2' m -0.28		ν 2.7' d -0.1' m -2.90		ν 2.6' d -0.1' m 0.43		Spica	158°24.6
Mer.pass. 00:56		ν -0.5' d -1.1' m -3.89		ν 1.1' d 0.2' m -0.28		ν 2.7' d -0.1' m -2.90		ν 2.6' d -0.1' m 0.43		Alkaid	152°53.9
Mer.pass. 00:56		ν -0.5' d -1.1' m -3.89		ν 1.1' d 0.2' m -0.28		ν 2.7' d -0.1' m -2.90		ν 2.6' d -0.1' m 0.43		Hadar	148°39.2
Mer.pass. 00:56		ν -0.5' d -1.1' m -3.89		ν 1.1' d 0.2' m -0.28		ν 2.7' d -0.1' m -2.90		ν 2.6' d -0.1' m 0.43		Menkent	148°00.2
Mer.pass. 00:56		ν -0.5' d -1.1' m -3.89		ν 1.1' d 0.2' m -0.28		ν 2.7' d -0.1' m -2.90		ν 2.6' d -0.1' m 0.43		Arcturus	145°49.9
Mer.pass. 00:56		ν -0.5' d -1.1' m -3.89		ν 1.1' d 0.2' m -0.28		ν 2.7' d -0.1' m -2.90		ν 2.6' d -0.1' m 0.43		Rigil Kent.	139°43.3
Mer.pass. 00:56		ν -0.5' d -1.1' m -3.89		ν 1.1' d 0.2' m -0.28		ν 2.7' d -0.1' m -2.90		ν 2.6' d -0.1' m 0.43		Kochab	137°20.4
Mer.pass. 00:56		ν -0.5' d -1.1' m -3.89		ν 1.1' d 0.2' m -0.28		ν 2.7' d -0.1' m -2.90		ν 2.6' d -0.1' m 0.43		Zuben' ubi	136°58.3
Mer.pass. 00:56		ν -0.5' d -1.1' m -3.89		ν 1.1' d 0.2' m -0.28		ν 2.7' d -0.1' m -2.90		ν 2.6' d -0.1' m 0.43		Alphecca	126°05.5
Mer.pass. 00:56		ν -0.5' d -1.1' m -3.89		ν 1.1' d 0.2' m -0.28		ν 2.7' d -0.1' m -2.90		ν 2.6' d -0.1' m 0.43		Antares	112°18.2
Mer.pass. 00:56		ν -0.5' d -1.1' m -3.89		ν 1.1' d 0.2' m -0.28		ν 2.7' d -0.1' m -2.90		ν 2.6' d -0.1' m 0.43		Atria	107°14.2
Mer.pass. 00:56		ν -0.5' d -1.1' m -3.89		ν 1.1' d 0.2' m -0.28		ν 2.7' d -0.1' m -2.90		ν 2.6' d -0.1' m 0.43		Sabik	102°05.0
Mer.pass. 00:56		ν -0.5' d -1.1' m -3.89		ν 1.1' d 0.2' m -0.28		ν 2.7' d -0.1' m -2.90		ν 2.6' d -0.1' m 0.43		Shaula	96°12.9
Mer.pass. 00:56		ν -0.5' d -1.1' m -3.89		ν 1.1' d 0.2' m -0.28		ν 2.7' d -0.1' m -2.90		ν 2.6' d -0.1' m 0.43		Rasalhague	96°00.3
Mer.pass. 00:56		ν -0.5' d -1.1' m -3.89		ν 1.1' d 0.2' m -0.28		ν 2.7' d -0.1' m -2.90		ν 2.6' d -0.1' m 0.43		Eltanin	90°42.9
Mer.pass. 00:56		ν -0.5' d -1.1' m -3.89		ν 1.1' d 0.2' m -0.28		ν 2.7' d -0.1' m -2.90		ν 2.6' d -0.1' m 0.43		Kaus Aust.	83°34.9
Mer.pass. 00:56		ν -0.5' d -1.1' m -3.89		ν 1.1' d 0.2' m -0.28		ν 2.7' d -0.1' m -2.90		ν 2.6' d -0.1' m 0.43		Vega	80°34.4
Mer.pass. 00:56		ν -0.5' d -1.1' m -3.89		ν 1.1' d 0.2' m -0.28		ν 2.7' d -0.1' m -2.90		ν 2.6' d -0.1' m 0.43		Nunki	75°50.0
Mer.pass. 00:56		ν -0.5' d -1.1' m -3.89		ν 1.1' d 0.2' m -0.28		ν 2.7' d -0.1' m -2.90		ν 2.6' d -0.1' m 0.43		Altair	62°01.6
Mer.pass. 00:56		ν -0.5' d -1.1' m -3.89		ν 1.1' d 0.2' m -0.28		ν 2.7' d -0.1' m -2.90		ν 2.6' d -0.1' m 0.43		Peacock	53°08.3
Mer.pass. 00:56		ν -0.5' d -1.1' m -3.89		ν 1.1' d 0.2' m -0.28		ν 2.7' d -0.1' m -2.90		ν 2.6' d -0.1' m 0.43		Deneb	49°26.7
Mer.pass. 00:56		ν -0.5' d -1.1' m -3.89		ν 1.1' d 0.2' m -0.28		ν 2.7' d -0.1' m -2.90		ν 2.6' d -0.1' m 0.43		Enif	33°40.4
Mer.pass. 00:56		ν -0.5' d -1.1' m -3.89		ν 1.1' d 0.2' m -0.28		ν 2.7' d -0.1' m -2.90		ν 2.6' d -0.1' m 0.43		Al Na'ir	27°34.9
Mer.pass. 00:56		ν -0.5' d -1.1' m -3.89		ν 1.1' d 0.2' m -0.28		ν 2.7' d -0.1' m -2.90		ν 2.6' d -0.1' m 0.43		Fomalhaut	15°16.3
Mer.pass. 00:56		ν -0.5' d -1.1' m -3.89									

DUT1 = UT1-UTC = -0.0104 sec  $\Delta T = TT-UT1 = +69.1944$  sec

2022 September 07 to Sep. 09 UT

h		Sun		Moon				
Wed		GHA	Dec	GHA	$\nu$	Dec	d	HP
0	180°26.9	N06°09.1		45°10.0	3.7'	S25°20.7	6.6'	60.0'
1	195°27.1	08.1		59°32.8	3.8'	25°14.0	6.8'	60.0'
2	210°27.3	07.2		73°55.6	3.9'	25°07.3	7.0'	60.0'
3	225°27.5	.. 06.3		88°18.5	3.9'	25°00.3	7.1'	60.0'
4	240°27.7	05.3		102°41.4	4.0'	24°53.1	7.3'	60.0'
5	255°27.9	04.4		117°04.4	4.1'	24°45.8	7.5'	60.0'
6	270°28.1	N06°03.5		131°27.5	4.1'	S24°38.3	7.7'	60.1'
7	285°28.4	02.5		145°50.6	4.2'	24°30.7	7.8'	60.1'
8	300°28.6	01.6		160°13.8	4.3'	24°22.8	8.0'	60.1'
9	315°28.8	06°00.7		174°37.1	4.4'	24°14.8	8.2'	60.1'
10	330°29.0	05°59.7		189°00.5	4.4'	24°06.7	8.3'	60.1'
11	345°29.2	58.8		203°23.9	4.5'	23°58.3	8.5'	60.1'
12	0°29.4	N05°57.8		217°47.5	4.6'	S23°49.8	8.7'	60.1'
13	15°29.6	56.9		232°11.1	4.7'	23°41.1	8.8'	60.1'
14	30°29.9	56.0		246°34.7	4.8'	23°32.3	9.0'	60.1'
15	45°30.1	.. 55.0		260°58.5	4.9'	23°23.3	9.2'	60.1'
16	60°30.3	54.1		275°22.4	4.9'	23°14.1	9.3'	60.1'
17	75°30.5	53.2		289°46.3	5.0'	23°04.8	9.5'	60.1'
18	90°30.7	N05°52.2		304°10.3	5.1'	S22°55.4	9.6'	60.1'
19	105°30.9	51.3		318°34.4	5.2'	22°45.7	9.8'	60.1'
20	120°31.2	50.4		332°58.6	5.3'	22°36.0	9.9'	60.1'
21	135°31.4	.. 49.4		347°22.9	5.4'	22°26.0	10.1'	60.1'
22	150°31.6	48.5		1°47.3	5.5'	22°16.0	10.2'	60.1'
23	165°31.8	47.5		16°11.8	5.6'	22°05.7	10.4'	60.1'
	SD = 15.9'		d = -0.9'	SD = 16.4'				

Thu	GHA	Dec	GHA	$\nu$	Dec	d	HP	
0	180°32.0	N05°46.6	30°36.3	5.7'	S21°55.4	10.5'	60.1'	
1	195°32.2	45.7	45°01.0	5.7'	21°44.8	10.7'	60.1'	
2	210°32.4	44.7	59°25.7	5.8'	21°34.2	10.8'	60.1'	
3	225°32.7	.. 43.8	73°50.6	5.9'	21°23.4	10.9'	60.1'	
4	240°32.9	42.8	88°15.5	6.0'	21°12.4	11.1'	60.1'	
5	255°33.1	41.9	102°40.6	6.1'	21°01.4	11.2'	60.1'	
6	270°33.3	N05°41.0	117°05.7	6.2'	S20°50.1	11.3'	60.1'	
7	285°33.5	40.0	131°30.9	6.3'	20°38.8	11.5'	60.1'	
8	300°33.7	39.1	145°56.2	6.4'	20°27.3	11.6'	60.0'	
9	315°34.0	.. 38.1	160°21.7	6.5'	20°15.7	11.7'	60.0'	
10	330°34.2	37.2	174°47.2	6.6'	20°04.0	11.9'	60.0'	
11	345°34.4	36.3	189°12.8	6.7'	19°52.1	12.0'	60.0'	
12	0°34.6	N05°35.3	203°38.5	6.8'	S19°40.1	12.1'	60.0'	
13	15°34.8	34.4	218°04.3	6.9'	19°28.0	12.2'	60.0'	
14	30°35.0	33.4	232°30.2	7.0'	19°15.8	12.4'	60.0'	
15	45°35.3	.. 32.5	246°56.2	7.1'	19°03.4	12.5'	60.0'	
16	60°35.5	31.6	261°22.3	7.2'	18°50.9	12.6'	60.0'	
17	75°35.7	30.6	275°48.6	7.3'	18°38.4	12.7'	60.0'	
18	90°35.9	N05°29.7	290°14.9	7.4'	S18°25.7	12.8'	60.0'	
19	105°36.1	28.7	304°41.3	7.5'	18°12.9	12.9'	60.0'	
20	120°36.3	27.8	319°07.8	7.6'	17°59.9	13.0'	60.0'	
21	135°36.6	.. 26.9	333°34.4	7.7'	17°46.9	13.1'	59.9'	
22	150°36.8	25.9	348°01.1	7.8'	17°33.8	13.2'	59.9'	
23	165°37.0	25.0	2°27.8	7.9'	17°20.6	13.3'	59.9'	
	SD = 15.9'		d = -0.9'	SD = 16.4'				

Fri	GHA	Dec	GHA	$\nu$	Dec	d	HP	
0	180°37.2	N05°24.0	16°54.7	8.0'	S17°07.2	13.4'	59.9'	
1	195°37.4	23.1	31°21.7	8.1'	16°53.8	13.5'	59.9'	
2	210°37.7	22.2	45°48.8	8.2'	16°40.3	13.6'	59.9'	
3	225°37.9	.. 21.2	60°16.0	8.3'	16°26.6	13.7'	59.9'	
4	240°38.1	20.3	74°43.3	8.4'	16°12.9	13.8'	59.9'	
5	255°38.3	19.3	89°10.6	8.5'	15°59.1	13.9'	59.9'	
6	270°38.5	N05°18.4	103°38.1	8.6'	S15°45.2	14.0'	59.8'	
7	285°38.7	17.4	118°05.7	8.7'	15°31.2	14.1'	59.8'	
8	300°39.0	16.5	132°33.3	8.7'	15°17.2	14.2'	59.8'	
9	315°39.2	.. 15.6	147°01.1	8.8'	15°03.0	14.2'	59.8'	
10	330°39.4	14.6	161°28.9	8.9'	14°48.8	14.3'	59.8'	
11	345°39.6	13.7	175°56.9	9.0'	14°34.5	14.4'	59.8'	
12	0°39.8	N05°12.7	190°24.9	9.1'	S14°20.1	14.5'	59.8'	
13	15°40.1	11.8	204°53.0	9.2'	14°05.6	14.5'	59.7'	
14	30°40.3	10.8	219°21.2	9.3'	13°51.1	14.6'	59.7'	
15	45°40.5	.. 09.9	233°49.5	9.4'	13°36.4	14.7'	59.7'	
16	60°40.7	08.9	248°17.9	9.5'	13°21.8	14.8'	59.7'	
17	75°40.9	08.0	262°46.4	9.6'	13°07.0	14.8'	59.7'	
18	90°41.1	N05°07.1	277°14.9	9.6'	S12°52.2	14.9'	59.7'	
19	105°41.4	06.1	291°43.6	9.7'	12°37.3	14.9'	59.6'	
20	120°41.6	05.2	306°12.3	9.8'	12°22.4	15.0'	59.6'	
21	135°41.8	.. 04.2	320°41.1	9.9'	12°07.3	15.1'	59.6'	
22	150°42.0	03.3	335°10.0	10.0'	11°52.3	15.1'	59.6'	
23	165°42.2	02.3	349°39.0	10.1'	11°37.2	15.2'	59.6'	
	SD = 15.9'		d = -0.9'	SD = 16.3'				

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

## September 10, 11, 12 UT (Sat., Sun., Mon.)

Aries			Venus			Mars			Jupiter			Saturn		
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Saturn		
0	349°00.6	190°46.0	N10°31.5	279°12.5	N20°59.0	342°59.3	N00°51.7	26°07.5	S16°03.2					
1	4°03.1	205°45.5	30.3	294°13.6	59.2	358°02.1	51.6	41°10.1	03.3					
2	19°05.5	220°45.0	29.2	309°14.8	59.5	13°04.8	51.5	56°12.8	03.3					
3	34°08.0	235°44.6	28.1	324°16.0	59.7	28°07.5	51.4	71°15.4	03.4					
4	49°10.5	250°44.1	27.0	339°17.1	59.9	43°10.3	51.2	86°18.0	03.4					
5	64°12.9	265°43.6	25.9	354°18.3	21°00.1	58°13.0	51.1	101°20.6	03.5					
6	79°15.4	280°43.1	N10°24.8	9°19.5	N21°00.3	73°15.7	N00°51.0	116°23.2	S16°03.5					
7	94°17.9	295°42.6	23.7	24°20.7	00.5	88°18.5	50.9	131°25.8	03.6					
8	109°20.3	310°42.2	22.6	39°21.8	00.8	103°21.2	50.7	146°28.4	03.6					
9	124°22.8	325°41.7	21.5	54°23.0	01.0	118°24.0	50.6	161°31.1	03.7					
10	139°25.3	340°41.2	20.4	69°24.2	01.2	133°26.7	50.5	176°33.7	03.7					
11	154°27.7	355°40.8	19.3	84°25.4	01.4	148°29.4	50.4	191°36.3	03.8					
12	169°30.2	10°40.3	N10°18.2	99°26.5	N21°01.6	163°32.2	N00°50.2	206°38.9	S16°03.8					
13	184°32.6	25°39.8	17.1	114°27.7	01.8	178°34.9	50.1	221°41.5	03.9					
14	199°35.1	40°39.3	15.9	129°28.9	02.1	193°37.7	50.0	236°44.1	03.9					
15	214°37.6	55°38.9	14.8	144°30.1	02.3	208°40.4	49.9	251°46.8	04.0					
16	229°40.0	70°38.4	13.7	159°31.2	02.5	223°43.1	49.7	266°49.4	04.0					
17	244°42.5	85°37.9	12.6	174°32.4	02.7	238°45.9	49.6	281°52.0	04.1					
18	259°45.0	100°37.4	N10°11.5	189°33.6	N21°02.9	253°48.6	N00°49.5	296°54.6	S16°04.1					
19	274°47.4	115°37.0	10.4	204°34.8	03.1	268°51.4	49.4	311°57.2	04.2					
20	289°49.9	130°36.5	09.3	219°36.0	03.3	283°54.1	49.2	326°59.8	04.2					
21	304°52.4	145°36.0	08.2	234°37.1	03.5	298°56.8	49.1	342°02.4	04.3					
22	319°54.8	160°35.6	07.0	249°38.3	03.8	313°59.6	49.0	357°05.1	04.3					
23	334°57.3	175°35.1	05.9	264°39.5	04.0	329°02.3	48.9	12°07.7	04.4					
Mer.pass. 00:44		ν -0.5° d -1.1' m -3.89	ν 1.2° d 0.2° m -0.31	ν 2.7° d -0.1° m -2.91	ν 2.6° d -0.0° m 0.44									

Stars	
SHA	Dec
Alpheratz	357°36.4
Ankaa	353°08.6
Schedar	349°32.7
Diphda	348°48.9
Achernar	335°21.2
Hamal	327°53.1
Polaris	314°42.3
Acamar	315°13.0
Menkar	314°08.0
Mirfak	308°30.8
Aldebaran	290°41.8
Rigel	281°05.7
Capella	280°24.7
Bellatrix	278°25.0
Elnath	278°04.3
Alnilam	275°39.7
Betelgeuse	270°54.2
Canopus	263°53.4
Sirius	258°28.1
Adhara	255°07.5
Procyon	244°53.0
Pollux	243°19.9
Avior	234°16.0
Suhail	222°48.1
Miaplacidus	221°39.5
Alphard	217°49.9
Regulus	207°36.8
Dubhe	193°44.0
Denebola	182°27.2
Gienah	175°45.9
Acrux	173°02.9
Gacrux	171°54.3
Alioth	166°15.2
Spica	158°24.6
Alkaid	152°53.9
Hadar	148°39.2
Menkent	148°00.2
Arcturus	145°49.9
Rigel Kent.	139°43.4
Kochab	137°20.4
Zuben'ubi	136°58.3
Alphecca	126°05.5
Antares	112°18.3
Atria	107°14.2
Sabik	102°05.0
Shaula	96°12.9
Rasalhague	96°00.3
Eltanin	90°43.0
Kaus Aust.	83°34.9
Vega	80°34.4
Nunki	75°50.0
Altair	62°01.6
Peacock	53°08.3
Deneb	49°26.8
Enif	33°40.4
Al Na'ir	27°34.9
Fomalhaut	15°16.3
Scheat	13°46.7
Markab	13°31.5

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec					
0	349°59.8	190°34.6	N10°04.8	279°40.7	N21°04.2	344°05.1	N00°48.7	27°10.3	S16°04.4					
1	5°02.2	205°34.1	03.7	294°41.9	04.4	359°07.8	48.6	42°12.9	04.5					
2	20°04.7	220°33.7	02.6	309°43.0	04.6	14°10.5	48.5	57°15.5	04.5					
3	35°07.1	235°33.2	01.5	324°44.2	04.8	29°13.3	48.4	72°18.1	04.6					
4	50°09.6	250°32.7	10°00.3	339°45.4	05.0	44°16.0	48.2	87°20.8	04.6					
5	65°12.1	265°32.3	09.5	354°46.6	05.2	59°18.8	48.1	102°23.4	04.7					
6	80°14.5	280°31.8	N09°58.1	9°47.8	N21°05.5	74°21.5	N00°48.0	117°26.0	S16°04.7					
7	95°17.0	295°31.3	57.0	24°49.0	05.7	89°24.2	47.9	132°28.6	04.8					
8	110°19.5	310°30.9	55.9	39°50.2	05.9	104°27.0	47.7	147°31.2	04.8					
9	125°21.9	325°30.4	54.7	54°51.3	06.1	119°29.7	47.6	162°33.8	04.8					
10	140°24.4	340°29.9	53.6	69°52.5	06.3	134°32.5	47.5	177°36.4	04.9					
11	155°26.9	355°29.5	52.5	84°53.7	06.5	149°35.2	47.4	192°39.0	04.9					
12	170°29.3	10°29.0	N09°51.4	99°54.9	N21°06.7	164°38.0	N00°47.2	207°41.7	S16°05.0					
13	185°31.8	25°28.5	50.3	114°56.1	06.9	179°40.7	47.1	222°44.3	05.0					
14	200°34.2	40°28.1	49.1	129°57.3	07.1	194°43.4	47.0	237°46.9	05.1					
15	215°36.7	55°27.6	48.0	144°58.5	07.3	209°46.2	46.9	252°49.5	05.1					
16	230°39.2	70°27.1	46.9	159°59.7	07.6	224°48.9	46.7	267°52.1	05.2					
17	245°41.6	85°26.7	45.8	175°00.9	07.8	239°51.7	46.6	282°54.7	05.2					
18	260°44.1	100°26.2	N09°44.6	190°02.0	N21°08.0	254°54.4	N00°46.5	297°57.3	S16°05.3					
19	275°46.6	115°25.7	43.5	205°03.2	08.2	269°57.2	46.3	313°00.0	05.3					
20	290°49.0	130°25.3	42.4	220°04.4	08.4	284°59.9	46.2	328°02.6	05.4					
21	305°51.5	145°24.8	41.3	235°05.6	08.6	300°02.7	46.1	343°05.2	05.4					
22	320°54.0	160°24.3	40.1	250°06.8	08.8	315°05.4	46.0	358°07.8	05.5					
23	335°56.4	175°23.9	39.0	265°08.0	09.0	330°08.1	45.8	13°10.4	05.5					
Mer.pass. 00:40		ν -0.5° d -1.1' m -3.89	ν 1.2° d 0.2° m -0.32	ν 2.7° d -0.1° m -2.91	ν 2.6° d -0.0° m 0.44									

Sep 10 Sat	SHA	Mer.pass
Venus	201°45.4	11:17
Mars	290°11.9	05:23
Jupiter	353°58.7	01:08
Saturn	37°06.9	22:12
Sep 11 Sun	SHA	Mer.pass
Venus	200°34.9	11:18
Mars	289°40.9	05:21
Jupiter	354°05.3	01:03
Saturn	37°10.5	22:07
Sep 12 Mon	SHA	Mer.pass
Venus	199°24.5	11:19
Mars	289°10.3	05:19
Jupiter	354°12.0	00:59
Saturn	37°14.1	22:03
Horizontal parallax		
Venus:	0.1	
Mars:	0.2	

DUT1 = UT1-UTC = -0.0099 sec  $\Delta T = TT-UT1 = +69.1939$  sec

2022 September 10 to Sep. 12 UT

h		Sun		Moon				
Sat		GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	180°42.5	N05°01.4	4°08.1	10.1'	S11°22.0	15.2'	59.5'	
1	195°42.7	05°00.4	18°37.2	10.2'	11°06.8	15.3'	59.5'	
2	210°42.9	04°59.5	33°06.5	10.3'	10°51.5	15.3'	59.5'	
3	225°43.1	.. 58.5	47°35.8	10.4'	10°36.1	15.4'	59.5'	
4	240°43.3	57.6	62°05.2	10.5'	10°20.8	15.4'	59.5'	
5	255°43.6	56.7	76°34.6	10.5'	10°05.3	15.5'	59.4'	
6	270°43.8	N04°55.7	91°04.2	10.6'	S09°49.9	15.5'	59.4'	
7	285°44.0	54.8	105°33.8	10.7'	09°34.4	15.5'	59.4'	
8	300°44.2	53.8	120°03.5	10.8'	09°18.8	15.6'	59.4'	
9	315°44.4	.. 52.9	134°33.2	10.8'	09°03.2	15.6'	59.4'	
10	330°44.7	51.9	149°03.1	10.9'	08°47.6	15.7'	59.3'	
11	345°44.9	51.0	163°33.0	11.0'	08°32.0	15.7'	59.3'	
12	0°45.1	N04°50.0	178°03.0	11.0'	S08°16.3	15.7'	59.3'	
13	15°45.3	49.1	192°33.0	11.1'	08°00.5	15.8'	59.3'	
14	30°45.5	48.1	207°03.1	11.2'	07°44.8	15.8'	59.2'	
15	45°45.8	.. 47.2	221°33.3	11.3'	07°29.0	15.8'	59.2'	
16	60°46.0	46.2	236°03.6	11.3'	07°13.2	15.8'	59.2'	
17	75°46.2	45.3	250°33.9	11.4'	06°57.4	15.9'	59.2'	
18	90°46.4	N04°44.3	265°04.3	11.4'	S06°41.5	15.9'	59.1'	
19	105°46.6	43.4	279°34.7	11.5'	06°25.7	15.9'	59.1'	
20	120°46.9	42.4	294°05.2	11.6'	06°09.8	15.9'	59.1'	
21	135°47.1	.. 41.5	308°35.8	11.6'	05°53.9	15.9'	59.1'	
22	150°47.3	40.5	323°06.4	11.7'	05°37.9	15.9'	59.0'	
23	165°47.5	39.6	337°37.1	11.7'	05°22.0	16.0'	59.0'	
SD = 15.9'		SD = 16.2'						

Sun	GHA	Dec	GHA	$\nu$	Dec	$d$	HP	
0	180°47.7	N04°38.6	352°07.8	11.8'	S05°06.0	16.0'	59.0'	
1	195°48.0	37.7	6°38.6	11.9'	04°50.1	16.0'	58.9'	
2	210°48.2	36.7	21°09.5	11.9'	04°34.1	16.0'	58.9'	
3	225°48.4	.. 35.8	35°40.4	12.0'	04°18.1	16.0'	58.9'	
4	240°48.6	34.8	50°11.3	12.0'	04°02.1	16.0'	58.9'	
5	255°48.8	33.9	64°42.3	12.1'	03°46.1	16.0'	58.8'	
6	270°49.1	N04°32.9	79°13.4	12.1'	S03°30.1	16.0'	58.8'	
7	285°49.3	32.0	93°44.5	12.2'	03°14.1	16.0'	58.8'	
8	300°49.5	31.0	108°15.7	12.2'	02°58.1	16.0'	58.8'	
9	315°49.7	.. 30.1	122°46.9	12.3'	02°42.1	16.0'	58.7'	
10	330°49.9	29.1	137°18.1	12.3'	02°26.1	16.0'	58.7'	
11	345°50.2	28.2	151°49.4	12.3'	02°10.1	16.0'	58.7'	
12	0°50.4	N04°27.2	166°20.7	12.4'	S01°54.1	16.0'	58.6'	
13	15°50.6	26.3	180°52.1	12.4'	01°38.2	16.0'	58.6'	
14	30°50.8	25.3	195°23.5	12.5'	01°22.2	16.0'	58.6'	
15	45°51.0	.. 24.4	209°55.0	12.5'	01°06.2	15.9'	58.5'	
16	60°51.3	23.4	224°26.5	12.5'	00°50.3	15.9'	58.5'	
17	75°51.5	22.5	238°58.1	12.6'	00°34.3	15.9'	58.5'	
18	90°51.7	N04°21.5	253°29.6	12.6'	S00°18.4	15.9'	58.5'	
19	105°51.9	20.6	268°01.2	12.6'	S00°02.5	15.9'	58.4'	
20	120°52.2	19.6	282°32.9	12.7'	N00°13.4	15.9'	58.4'	
21	135°52.4	.. 18.7	297°04.6	12.7'	00°29.2	15.9'	58.4'	
22	150°52.6	17.7	311°36.3	12.7'	00°45.1	15.8'	58.3'	
23	165°52.8	16.8	326°08.0	12.8'	01°00.9	15.8'	58.3'	
SD = 15.9'		SD = 16.1'						

Mon	GHA	Dec	GHA	$\nu$	Dec	$d$	HP	
0	180°53.0	N04°15.8	340°39.8	12.8'	N01°16.7	15.8'	58.3'	
1	195°53.3	14.9	355°11.6	12.8'	01°32.5	15.8'	58.2'	
2	210°53.5	13.9	9°43.4	12.9'	01°48.3	15.7'	58.2'	
3	225°53.7	.. 13.0	24°15.3	12.9'	02°04.0	15.7'	58.2'	
4	240°53.9	12.0	38°47.2	12.9'	02°19.7	15.7'	58.1'	
5	255°54.2	11.1	53°19.1	12.9'	02°35.4	15.6'	58.1'	
6	270°54.4	N04°10.1	67°51.0	13.0'	N02°51.0	15.6'	58.1'	
7	285°54.6	09.2	82°23.0	13.0'	03°06.6	15.6'	58.0'	
8	300°54.8	08.2	96°54.9	13.0'	03°22.2	15.5'	58.0'	
9	315°55.0	.. 07.3	111°26.9	13.0'	03°37.8	15.5'	58.0'	
10	330°55.3	06.3	125°59.0	13.0'	03°53.3	15.5'	57.9'	
11	345°55.5	05.3	140°31.0	13.0'	04°08.7	15.4'	57.9'	
12	0°55.7	N04°04.4	155°03.0	13.1'	N04°24.2	15.4'	57.9'	
13	15°55.9	03.4	169°35.1	13.1'	04°39.6	15.4'	57.8'	
14	30°56.1	02.5	184°07.2	13.1'	04°54.9	15.3'	57.8'	
15	45°56.4	.. 01.5	198°39.3	13.1'	05°10.3	15.3'	57.8'	
16	60°56.6	04°00.6	213°11.4	13.1'	05°25.5	15.2'	57.7'	
17	75°56.8	03°59.6	227°43.5	13.1'	05°40.8	15.2'	57.7'	
18	90°57.0	N03°58.7	242°15.6	13.1'	N05°55.9	15.1'	57.7'	
19	105°57.3	57.7	256°47.8	13.1'	06°11.1	15.1'	57.6'	
20	120°57.5	56.8	271°19.9	13.2'	06°26.2	15.0'	57.6'	
21	135°57.7	.. 55.8	285°52.1	13.2'	06°41.2	15.0'	57.6'	
22	150°57.9	54.8	300°24.2	13.2'	06°56.2	14.9'	57.5'	
23	165°58.1	53.9	314°56.4	13.2'	07°11.2	14.9'	57.5'	
SD = 15.9'		SD = 15.9'						

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

## September 13, 14, 15 UT (Tue., Wed., Thu.)

Aries Venus Mars Jupiter Saturn Stars											
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec
0	351°58.0	190°12.4	N09°10.7	280°38.1	N21°14.1	346°16.8	N00°42.7	29°15.7	S16°06.7	Alpheratz	357°36.4
1	7°00.5	205°11.9	09.5	295°39.3	14.3	1°19.5	42.5	44°18.3	06.8	Ankaa	353°08.6
2	22°03.0	220°11.5	08.4	310°40.5	14.5	16°22.3	42.4	59°20.9	06.8	Schedar	349°32.7
3	37°05.4	235°11.0	.. 07.3	325°41.7	.. 14.7	31°25.0	.. 42.3	74°23.5	.. 06.8	Diphda	348°48.9
4	52°07.9	250°10.6	06.1	340°42.9	15.0	46°27.8	42.2	89°26.1	06.9	Achernar	335°21.1
5	67°10.3	265°10.1	05.0	355°44.1	15.2	61°30.5	42.0	104°28.7	06.9	Hamal	327°53.1
6	82°12.8	280°09.7	N09°03.8	10°45.3	N21°15.4	76°33.3	N00°41.9	119°31.3	S16°07.0	Polaris	314°41.0
7	97°15.3	295°09.2	02.7	25°46.6	15.6	91°36.0	41.8	134°33.9	07.0	Acamar	315°13.0
8	112°17.7	310°08.7	01.6	40°47.8	15.8	106°38.8	41.6	149°36.6	07.1	Menkar	314°08.0
9	127°20.2	325°08.3	09°00.4	55°49.0	.. 16.0	121°41.5	.. 41.5	164°39.2	.. 07.1	Mirfak	308°30.8
10	142°22.7	340°07.8	08°59.3	70°50.2	16.2	136°44.3	41.4	179°41.8	07.2	Aldebaran	290°41.8
11	157°25.1	355°07.4	58.1	85°51.4	16.4	151°47.0	41.3	194°44.4	07.2	Rigel	281°05.7
12	172°27.6	10°06.9	N08°57.0	100°52.6	N21°16.6	166°49.8	N00°41.1	209°47.0	S16°07.3	Capella	280°24.7
13	187°30.1	25°06.5	55.8	115°53.8	16.8	181°52.5	41.0	224°49.6	07.3	Bellatrix	278°24.9
14	202°32.5	40°06.0	54.7	130°55.1	17.0	196°55.3	40.9	239°52.2	07.4	Elnath	278°04.3
15	217°35.0	55°05.6	.. 53.5	145°56.3	.. 17.2	211°58.0	.. 40.7	254°54.8	.. 07.4	Alnilam	275°39.7
16	232°37.4	70°05.1	52.4	160°57.5	17.4	227°00.8	40.6	269°57.4	07.4	Betelgeuse	270°54.2
17	247°39.9	85°04.7	51.3	175°58.7	17.6	242°03.5	40.5	285°00.0	07.5	Canopus	263°53.4
18	262°42.4	100°04.2	N08°50.1	190°59.9	N21°17.8	257°06.3	N00°40.4	300°02.6	S16°07.5	Sirius	258°28.0
19	277°44.8	115°03.8	49.0	206°01.2	18.0	272°09.0	40.2	315°05.2	07.6	Adhara	255°07.5
20	292°47.3	130°03.3	47.8	221°02.4	18.2	287°11.8	40.1	330°07.9	07.6	Procyon	244°53.0
21	307°49.8	145°02.9	.. 46.7	236°03.6	.. 18.4	302°14.5	.. 40.0	345°10.5	.. 07.7	Pollux	243°19.9
22	322°52.2	160°02.4	45.5	251°04.8	18.5	317°17.3	39.8	0°13.1	07.7	Avior	234°16.0
23	337°54.7	175°02.0	44.4	266°06.1	18.7	332°20.0	39.7	15°15.7	07.8	Suhail	222°48.1
Mer.pass. 00:32		ν -0.5° d -1.1' m -3.89	ν 1.2° d 0.2° m -0.35	ν 2.7° d -0.1° m -2.92	ν 2.6° d -0.0° m 0.45	Miaplacidus		221°39.4	.. 69°48.3	Alphard	217°49.9
										Regulus	207°36.8
										Dubhe	193°44.0
										Denebola	182°27.2
										Gienah	175°45.9
										Acrux	173°02.9
										Gacrux	171°54.3
										Alioth	166°15.2
										Spica	158°24.6
										Alkaid	152°53.9
										Hadar	148°39.2
										Menkent	148°00.2
										Arcturus	145°49.9
										Rigil Kent.	139°43.4
										Kochab	137°20.5
										Zuben'ubi	136°58.4
										Alphecca	126°05.5
										Antares	112°18.3
										Atria	107°14.3
										Sabik	102°05.0
										Shaula	96°13.0
										Rasalhague	96°00.3
										Eltanin	90°43.0
										Kaus Aust.	83°35.0
										Vega	80°34.4
										Nunki	75°50.0
										Altair	62°01.6
										Peacock	53°08.3
										Deneb	49°26.8
										Enif	33°40.4
										Al Na'ir	27°34.9
										Fomalhaut	15°16.3
										Scheat	13°46.7
										Markab	13°31.5
Sep 13 Tue		SHA	Mer.pass								
		Venus	198°14.4								
		Mars	288°40.0								
		Jupiter	354°18.8								
		Saturn	37°17.7								
Sep 14 Wed		SHA	Mer.pass								
		Venus	197°04.4								
		Mars	288°10.1								
		Jupiter	354°25.6								
		Saturn	37°21.1								
Sep 15 Thu		SHA	Mer.pass								
		Venus	195°54.5								
		Mars	287°40.5								
		Jupiter	354°32.5								
		Saturn	37°24.5								
Horizontal parallax											
Venus: 0.1											
Mars: 0.2											
Mer.pass. 00:24										ν -0.4° d -1.2' m -3.89	ν 1.2° d 0.2' m -0.38
										ν 2.8° d -0.1° m -2.93	ν 2.6° d -0.0° m 0.46

DUT1 = UT1-UTC = -0.0109 sec  $\Delta T = TT-UT1 = +69.1949$  sec

2022 September 13 to Sep. 15 UT

h		Sun		Moon				
Tue		GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	180°58.4	N03°52.9	329°28.6	13.2'	N07°26.1	14.8'	57.5'	
1	195°58.6	52.0	344°00.8	13.2'	07°40.9	14.8'	57.4'	
2	210°58.8	51.0	358°32.9	13.2'	07°55.7	14.7'	57.4'	
3	225°59.0	50.1	13°05.1	13.2'	08°10.4	14.7'	57.4'	
4	240°59.3	49.1	27°37.3	13.2'	08°25.1	14.6'	57.3'	
5	255°59.5	48.2	42°09.5	13.2'	08°39.7	14.6'	57.3'	
6	270°59.7	N03°47.2	56°41.7	13.2'	N08°54.3	14.5'	57.3'	
7	285°59.9	46.2	71°13.8	13.2'	09°08.8	14.4'	57.2'	
8	301°00.2	45.3	85°46.0	13.2'	09°23.2	14.4'	57.2'	
9	316°00.4	44.3	100°18.2	13.2'	09°37.6	14.3'	57.2'	
10	331°00.6	43.4	114°50.4	13.2'	09°51.9	14.3'	57.1'	
11	346°00.8	42.4	129°22.5	13.2'	10°06.2	14.2'	57.1'	
12	1°01.0	N03°41.5	143°54.7	13.1'	N10°20.4	14.1'	57.1'	
13	16°01.3	40.5	158°26.8	13.1'	10°34.5	14.1'	57.0'	
14	31°01.5	39.6	172°59.0	13.1'	10°48.6	14.0'	57.0'	
15	46°01.7	38.6	187°31.1	13.1'	11°02.6	13.9'	57.0'	
16	61°01.9	37.6	202°03.2	13.1'	11°16.5	13.9'	56.9'	
17	76°02.2	36.7	216°35.3	13.1'	11°30.3	13.8'	56.9'	
18	91°02.4	N03°35.7	231°07.4	13.1'	N11°44.1	13.7'	56.9'	
19	106°02.6	34.8	245°39.5	13.1'	11°57.9	13.6'	56.8'	
20	121°02.8	33.8	260°11.6	13.1'	12°11.5	13.6'	56.8'	
21	136°03.1	32.8	274°43.7	13.0'	12°25.1	13.5'	56.8'	
22	151°03.3	31.9	289°15.7	13.0'	12°38.6	13.4'	56.7'	
23	166°03.5	30.9	303°47.7	13.0'	12°52.0	13.4'	56.7'	
		SD = 15.9'		SD = 15.7'				

Wed	GHA	Dec	GHA	$\nu$	Dec	$d$	HP	
0	181°03.7	N03°30.0	318°19.8	13.0'	N13°05.4	13.3'	56.7'	
1	196°03.9	29.0	332°51.8	13.0'	13°18.6	13.2'	56.6'	
2	211°04.2	28.1	347°23.7	13.0'	13°31.8	13.1'	56.6'	
3	226°04.4	27.1	1°55.7	12.9'	13°45.0	13.0'	56.6'	
4	241°04.6	26.1	16°27.6	12.9'	13°58.0	13.0'	56.5'	
5	256°04.8	25.2	30°59.6	12.9'	14°11.0	12.9'	56.5'	
6	271°05.1	N03°24.2	45°31.5	12.9'	N14°23.9	12.8'	56.5'	
7	286°05.3	23.3	60°03.4	12.9'	14°36.7	12.7'	56.4'	
8	301°05.5	22.3	74°35.2	12.8'	14°49.4	12.6'	56.4'	
9	316°05.7	21.3	89°07.1	12.8'	15°02.0	12.6'	56.4'	
10	331°06.0	20.4	103°38.9	12.8'	15°14.6	12.5'	56.3'	
11	346°06.2	19.4	118°10.7	12.8'	15°27.1	12.4'	56.3'	
12	1°06.4	N03°18.5	132°42.4	12.7'	N15°39.5	12.3'	56.3'	
13	16°06.6	17.5	147°14.2	12.7'	15°51.8	12.2'	56.2'	
14	31°06.8	16.6	161°45.9	12.7'	16°04.0	12.1'	56.2'	
15	46°07.1	15.6	176°17.6	12.7'	16°16.1	12.0'	56.2'	
16	61°07.3	14.6	190°49.3	12.6'	16°28.1	11.9'	56.1'	
17	76°07.5	13.7	205°20.9	12.6'	16°40.1	11.9'	56.1'	
18	91°07.7	N03°12.7	219°52.5	12.6'	N16°51.9	11.8'	56.1'	
19	106°08.0	11.8	234°24.1	12.6'	17°03.7	11.7'	56.1'	
20	121°08.2	10.8	248°55.7	12.5'	17°15.4	11.6'	56.0'	
21	136°08.4	9.8	263°27.2	12.5'	17°27.0	11.5'	56.0'	
22	151°08.6	08.9	277°58.7	12.5'	17°38.5	11.4'	56.0'	
23	166°08.9	07.9	292°30.2	12.4'	17°49.9	11.3'	55.9'	
		SD = 15.9'		SD = 15.5'				

Thu	GHA	Dec	GHA	$\nu$	Dec	$d$	HP	
0	181°09.1	N03°06.9	307°01.6	12.4'	N18°01.2	11.2'	55.9'	
1	196°09.3	06.0	321°33.0	12.4'	18°12.4	11.1'	55.9'	
2	211°09.5	05.0	336°04.4	12.3'	18°23.5	11.0'	55.8'	
3	226°09.8	04.1	350°35.7	12.3'	18°34.5	10.9'	55.8'	
4	241°10.0	03.1	5°07.1	12.3'	18°45.4	10.8'	55.8'	
5	256°10.2	02.1	19°38.3	12.3'	18°56.3	10.7'	55.8'	
6	271°10.4	N03°01.2	34°09.6	12.2'	N19°07.0	10.6'	55.7'	
7	286°10.6	03°00.2	48°40.8	12.2'	19°17.6	10.5'	55.7'	
8	301°10.9	02°59.3	63°12.0	12.2'	19°28.1	10.4'	55.7'	
9	316°11.1	02.5	77°43.1	12.1'	19°38.5	10.3'	55.6'	
10	331°11.3	57.3	92°14.3	12.1'	19°48.9	10.2'	55.6'	
11	346°11.5	56.4	106°45.3	12.1'	19°59.1	10.1'	55.6'	
12	1°11.8	N02°55.4	121°16.4	12.0'	N20°09.2	10.0'	55.6'	
13	16°12.0	54.5	135°47.4	12.0'	20°19.2	9.9'	55.5'	
14	31°12.2	53.5	150°18.4	11.9'	20°29.1	9.8'	55.5'	
15	46°12.4	52.5	164°49.3	11.9'	20°38.9	9.7'	55.5'	
16	61°12.7	51.6	179°20.2	11.9'	20°48.6	9.6'	55.5'	
17	76°12.9	50.6	193°51.1	11.8'	20°58.2	9.5'	55.4'	
18	91°13.1	N02°49.6	208°22.0	11.8'	N21°07.7	9.4'	55.4'	
19	106°13.3	48.7	222°52.8	11.8'	21°17.1	9.3'	55.4'	
20	121°13.6	47.7	237°23.5	11.7'	21°26.4	9.2'	55.3'	
21	136°13.8	46.8	251°54.3	11.7'	21°35.5	9.1'	55.3'	
22	151°14.0	45.8	266°25.0	11.7'	21°44.6	8.9'	55.3'	
23	166°14.2	44.8	280°55.7	11.6'	21°53.5	8.8'	55.3'	
		SD = 15.9'		SD = 15.2'				

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

## September 16, 17, 18 UT (Fri., Sat., Sun.)

Aries			Venus			Mars		Jupiter		Saturn		Stars		
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	354°55.4	189°40.3	N07°47.6	282°06.8	N21°28.2	349°35.0	N00°33.4	32°23.3	S16°10.0			Alpheratz	357°36.4	
1	9°57.9	204°39.8	46.4	297°08.0	28.4	4°37.7	33.2	47°25.9	10.0			Ankaa	353°08.6	
2	25°00.4	219°39.4	45.2	312°09.3	28.6	19°40.5	33.1	62°28.5	10.1			Schedar	349°32.7	
3	40°02.8	234°38.9	44.1	327°10.5	28.8	34°43.2	33.0	77°31.1	10.1			Diphda	348°48.9	
4	55°05.3	249°38.5	42.9	342°11.8	29.0	49°46.0	32.9	92°33.7	10.1			Achernar	335°21.1	
5	70°07.8	264°38.1	41.7	357°13.0	29.2	64°48.8	32.7	107°36.3	10.2			Hamal	327°53.1	
6	85°10.2	279°37.6	N07°40.5	12°14.3	N21°29.3	79°51.5	N00°32.6	122°38.9	S16°10.2			Polaris	314°39.5	
7	100°12.7	294°37.2	39.4	27°15.6	29.5	94°54.3	32.5	137°41.5	10.3			Acamar	315°13.0	
8	115°15.2	309°36.8	38.2	42°16.8	29.7	109°57.0	32.3	152°44.1	10.3			Menkar	314°08.0	
9	130°17.6	324°36.3	37.0	57°18.1	29.9	124°59.8	32.2	167°46.7	10.4			Mirfak	308°30.7	
10	145°20.1	339°35.9	35.8	72°19.3	30.1	140°02.5	32.1	182°49.3	10.4			Aldebaran	290°41.7	
11	160°22.5	354°35.5	34.7	87°20.6	30.3	155°05.3	31.9	197°51.9	10.4			Rigel	281°05.7	
12	175°25.0	9°35.0	N07°33.5	102°21.9	N21°30.5	170°08.1	N00°31.8	212°54.5	S16°10.5			Capella	280°24.7	
13	190°27.5	24°34.6	32.3	117°23.1	30.7	185°10.8	31.7	227°57.1	10.5			Bellatrix	278°24.9	
14	205°29.9	39°34.2	31.2	132°24.4	30.8	200°13.6	31.5	242°59.7	10.6			Elnath	278°04.3	
15	220°32.4	54°33.7	30.0	147°25.6	31.0	215°16.3	31.4	258°02.3	10.6			Alnilam	275°39.7	
16	235°34.9	69°33.3	28.8	162°26.9	31.2	230°19.1	31.3	273°04.9	10.7			Betelgeuse	270°54.2	
17	250°37.3	84°32.9	27.6	177°28.2	31.4	245°21.8	31.1	288°07.5	10.7			Canopus	263°53.4	
18	265°39.8	99°32.4	N07°26.5	192°29.4	N21°31.6	260°24.6	N00°31.0	303°10.1	S16°10.7			Sirius	258°28.0	
19	280°42.3	114°32.0	25.3	207°30.7	31.8	275°27.4	30.9	318°12.7	10.8			Adhara	255°07.5	
20	295°44.7	129°31.6	24.1	222°32.0	31.9	290°30.1	30.8	333°15.3	10.8			Procyon	244°53.0	
21	310°47.2	144°31.1	22.9	237°33.2	32.1	305°32.9	30.6	348°17.9	10.9			Pollux	243°19.8	
22	325°49.6	159°30.7	21.7	252°34.5	32.3	320°35.6	30.5	3°20.5	10.9			Avior	234°15.9	
23	340°52.1	174°30.3	20.6	267°35.8	32.5	335°38.4	30.4	18°23.1	11.0			Suhail	222°48.1	
Mer.pass. 00:20			ν -0.4' d -1.2' m -3.89	ν 1.3' d 0.2' m -0.39	ν 2.8' d -0.1' m -2.93	ν 2.6' d -0.0' m 0.47								
Sat			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec			
0	355°54.6	189°29.8	N07°19.4	282°37.1	N21°32.7	350°41.2	N00°30.2	33°25.7	S16°11.0			Denebola	182°27.2	
1	10°57.0	204°29.4	18.2	297°38.3	32.9	5°43.9	30.1	48°28.3	11.0			Gienah	175°45.9	
2	25°59.5	219°29.0	17.0	312°39.6	33.1	20°46.7	30.0	63°30.9	11.1			Acru	173°02.9	
3	41°02.0	234°28.5	15.9	327°40.9	33.2	35°49.4	31.1	78°33.5	11.1			Gacrux	171°54.3	
4	56°04.4	249°28.1	14.7	342°42.1	33.4	50°52.2	29.7	93°36.1	11.2			Alioth	166°15.2	
5	71°06.9	264°27.7	13.5	357°43.4	33.6	65°55.0	29.6	108°38.7	11.2			Spica	158°24.6	
6	86°09.4	279°27.2	N07°12.3	12°44.7	N21°33.8	80°57.7	N00°29.4	123°41.3	S16°11.3			Alkaid	152°53.9	
7	101°11.8	294°26.8	11.1	27°46.0	34.0	96°00.5	29.3	138°43.9	11.3			Hadar	148°39.2	
8	116°14.3	309°26.4	10.0	42°47.2	34.2	111°03.2	29.2	153°46.5	11.3			Menkent	148°00.2	
9	131°16.8	324°26.0	08.8	57°48.5	34.3	126°06.0	29.0	168°49.1	11.4			Arcturus	145°49.9	
10	146°19.2	339°25.5	07.6	72°49.8	34.5	141°08.8	28.9	183°51.7	11.4			Rigel Kent.	139°43.4	
11	161°21.7	354°25.1	06.4	87°51.1	34.7	156°11.5	28.8	198°54.3	11.5			Kochab	137°20.5	
12	176°24.1	9°24.7	N07°05.2	102°52.3	N21°34.9	171°14.3	N00°28.7	213°56.9	S16°11.5			Zuben'ubi	136°58.4	
13	191°26.6	24°24.2	04.0	117°53.6	35.1	186°17.0	28.5	228°59.5	11.6			Alphecca	126°05.5	
14	206°29.1	39°23.8	02.9	132°54.9	35.2	201°19.8	28.4	244°02.1	11.6			Antares	112°18.3	
15	221°31.5	54°23.4	01.7	147°56.2	35.4	216°22.6	28.3	259°04.7	11.6			Atria	107°14.3	
16	236°34.0	69°23.0	07°00.5	162°57.5	35.6	231°25.3	28.1	274°07.3	11.7			Sabik	102°05.0	
17	251°36.5	84°22.5	06°59.3	177°58.7	35.8	246°28.1	28.0	289°09.9	11.7			Shaula	96°13.0	
18	266°38.9	99°22.1	N06°58.1	193°00.0	N21°36.0	261°30.8	N00°27.9	304°12.5	S16°11.8			Rasalhague	96°00.3	
19	281°41.4	114°21.7	56.9	208°01.3	36.2	276°33.6	27.7	319°15.1	11.8			Eltanin	90°43.0	
20	296°43.9	129°21.2	55.8	223°02.6	36.3	291°36.4	27.6	334°17.7	11.9			Kaus Aust.	83°35.0	
21	311°46.3	144°20.8	54.6	238°03.9	36.5	306°39.1	27.5	349°20.3	11.9			Vega	80°34.4	
22	326°48.8	159°20.4	53.4	253°05.2	36.7	321°41.9	27.3	4°22.9	11.9			Nunki	75°50.0	
23	341°51.3	174°20.0	52.2	268°06.4	36.9	336°44.6	27.2	19°25.5	12.0			Altair	62°01.6	
Mer.pass. 00:16			ν -0.4' d -1.2' m -3.89	ν 1.3' d 0.2' m -0.40	ν 2.8' d -0.1' m -2.93	ν 2.6' d -0.0' m 0.47								
Sun			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec			
0	356°53.7	189°19.5	N06°51.0	283°07.7	N21°37.1	351°47.4	N00°27.1	34°28.1	S16°12.0			Fomalhaut	15°16.3	
1	11°56.2	204°19.1	49.8	298°09.0	37.2	6°50.2	26.9	49°30.6	12.1			Scheat	13°46.7	
2	26°58.6	219°18.7	48.6	313°10.3	37.4	21°52.9	26.8	64°33.2	12.1			Markab	13°31.5	
3	42°01.1	234°18.3	47.4	328°11.6	37.6	36°55.7	26.7	79°35.8	12.1			Sep 16 Fri	SHA	Mer.pass
4	57°03.6	249°17.8	46.3	343°12.9	37.8	51°58.5	26.5	94°38.4	12.2			Venus	194°44.8	11:22
5	72°06.0	264°17.4	45.1	358°14.2	38.0	67°01.2	26.4	109°41.0	12.2			Mars	287°11.3	05:11
6	87°08.5	279°17.0	N06°43.9	13°15.5	N21°38.1	82°04.0	N00°26.3	124°43.6	S16°12.3			Jupiter	354°39.5	00:42
7	102°11.0	294°16.6	42.7	28°16.8	38.3	97°06.7	26.1	139°46.2	12.3			Saturn	37°27.9	21:47
8	117°13.4	309°16.1	41.5	43°18.0	38.5	112°09.5	26.0	154°48.8	12.4			Sep 17 Sat	SHA	Mer.pass
9	132°15.9	324°15.7	40.3	58°19.3	38.7	127°12.3	25.9	169°51.4	12.4			Venus	193°35.3	11:22
10	147°18.4	339°15.3	39.1	73°20.6	38.8	142°15.0	25.8	184°54.0	12.4			Mars	286°42.5	05:09
11	162°20.8	354°14.9	37.9	88°21.9	39.0	157°17.8	25.6	199°56.6	12.5			Jupiter	354°46.6	00:37
12	177°23.3	9°14.4	N06°36.7	103°23.2	N21°39.2	172°20.5	N00°25.5	214°59.2	S16°12.5			Saturn	37°31.1	21:43
13	192°25.8	24°14.0	35.5	118°24.5	39.4	187°23.3	25.4	230°01.8	12.6			Sep 18 Sun	SHA	Mer.pass
14	207°28.2	39°13.6	34.4	133°25.8	39.6	202°26.1	25.2	245°04.4	12.6			Venus	192°25.8	11:23
15	222°30.7	54°13.2	33.2	148°27.1	39.7	217°28.8	25.1	260°07.0	12.6			Mars	286°14.0	05:07
16	237°33.1	69°12.7	32.0	163°28.4	39.9	232°31.6	25.0	275°09.6	12.7			Jupiter	354°53.7	00:33
17	252°35.6	84°12.3	30.8	178°29.7	40.1	247°34.4	24.8	290°12.2	12.7			Saturn	37°34.3	21:38
18	267°38.1	99°11.9	N06°29.6	193°31.0	N21°40.3	262°37.1	N00°24.7	305°14.8	S16°12.8			Horizontal parallax		
19	282°40.5	114°11.5	28.4	208°32.3	40.4	277°39.9	24.6	320°17.4	12.8			Venus:	0.1	
20	297°43.0	129°11.1	27.2	223°33.6	40.6	292°42.7	24.4	335°20.0	12.8			Mars:	0.2	
21	312°45.5	144°10.6	26.0	238°34.9	40.8	307°45.4								

DUT1 = UT1-UTC = -0.0106 sec  $\Delta T = TT-UT1 = +69.1946$  sec

2022 September 16 to Sep. 18 UT

h	Sun			Moon			
Fri	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	181°14.4	N02°43.9	295°26.3	11.6'	N22°02.3	8.7'	55.2'
1	196°14.7	42.9	309°56.9	11.6'	22°11.1	8.6'	55.2'
2	211°14.9	41.9	324°27.4	11.5'	22°19.7	8.5'	55.2'
3	226°15.1	41.0	338°58.0	11.5'	22°28.2	8.4'	55.2'
4	241°15.3	40.0	353°28.5	11.5'	22°36.6	8.3'	55.1'
5	256°15.6	39.0	7°58.9	11.4'	22°44.8	8.2'	55.1'
6	271°15.8	N02°38.1	22°29.3	11.4'	N22°53.0	8.0'	55.1'
7	286°16.0	37.1	36°59.7	11.3'	23°01.0	7.9'	55.1'
8	301°16.2	36.2	51°30.1	11.3'	23°09.0	7.8'	55.1'
9	316°16.5	35.2	66°00.4	11.3'	23°16.8	7.7'	55.0'
10	331°16.7	34.2	80°30.7	11.2'	23°24.5	7.6'	55.0'
11	346°16.9	33.3	95°00.9	11.2'	23°32.1	7.5'	55.0'
12	1°17.1	N02°32.3	109°31.1	11.2'	N23°39.5	7.3'	55.0'
13	16°17.4	31.3	124°01.3	11.1'	23°46.9	7.2'	54.9'
14	31°17.6	30.4	138°31.4	11.1'	23°54.1	7.1'	54.9'
15	46°17.8	29.4	153°01.5	11.1'	24°01.2	7.0'	54.9'
16	61°18.0	28.4	167°31.6	11.0'	24°08.2	6.9'	54.9'
17	76°18.3	27.5	182°01.7	11.0'	24°15.1	6.8'	54.9'
18	91°18.5	N02°26.5	196°31.7	11.0'	N24°21.8	6.6'	54.8'
19	106°18.7	25.5	211°01.7	10.9'	24°28.5	6.5'	54.8'
20	121°18.9	24.6	225°31.6	10.9'	24°35.0	6.4'	54.8'
21	136°19.1	23.6	240°01.5	10.9'	24°41.4	6.3'	54.8'
22	151°19.4	22.7	254°31.4	10.9'	24°47.6	6.1'	54.8'
23	166°19.6	21.7	269°01.3	10.8'	24°53.8	6.0'	54.7'
	SD = 15.9'			SD = 15.1'			

Sat	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	181°19.8	N02°20.7	283°31.1	10.8'	N24°59.8	5.9'	54.7'
1	196°20.0	19.8	298°00.9	10.8'	25°05.7	5.8'	54.7'
2	211°20.3	18.8	312°30.7	10.7'	25°11.5	5.7'	54.7'
3	226°20.5	18.7	327°00.4	10.7'	25°17.1	5.5'	54.7'
4	241°20.7	16.9	341°30.1	10.7'	25°22.7	5.4'	54.7'
5	256°20.9	15.9	355°59.8	10.7'	25°28.1	5.3'	54.6'
6	271°21.2	N02°14.9	10°29.4	10.6'	N25°33.4	5.2'	54.6'
7	286°21.4	14.0	24°59.1	10.6'	25°38.5	5.0'	54.6'
8	301°21.6	13.0	39°28.7	10.6'	25°43.6	4.9'	54.6'
9	316°21.8	12.0	53°58.3	10.6'	25°48.5	4.8'	54.6'
10	331°22.1	11.1	68°27.8	10.5'	25°53.2	4.7'	54.6'
11	346°22.3	10.1	82°57.3	10.5'	25°57.9	4.5'	54.5'
12	1°22.5	N02°09.1	97°26.8	10.5'	N26°02.4	4.4'	54.5'
13	16°22.7	08.2	111°56.3	10.5'	26°06.8	4.3'	54.5'
14	31°22.9	07.2	126°25.8	10.4'	26°11.1	4.1'	54.5'
15	46°23.2	06.2	140°55.2	10.4'	26°15.2	4.0'	54.5'
16	61°23.4	05.3	155°24.6	10.4'	26°19.2	3.9'	54.5'
17	76°23.6	04.3	169°54.0	10.4'	26°23.1	3.8'	54.4'
18	91°23.8	N02°03.3	184°23.4	10.4'	N26°26.9	3.6'	54.4'
19	106°24.1	02.4	198°52.7	10.3'	26°30.5	3.5'	54.4'
20	121°24.3	01.4	213°22.1	10.3'	26°34.0	3.4'	54.4'
21	136°24.5	02°00.4	227°51.4	10.3'	26°37.4	3.2'	54.4'
22	151°24.7	01°59.5	242°20.7	10.3'	26°40.6	3.1'	54.4'
23	166°25.0	58.5	256°50.0	10.3'	26°43.7	3.0'	54.4'
	SD = 15.9'			SD = 14.9'			

Sun	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	181°25.2	N01°57.5	271°19.3	10.3'	N26°46.7	2.8'	54.4'
1	196°25.4	56.6	285°48.5	10.2'	26°49.5	2.7'	54.3'
2	211°25.6	55.6	300°17.8	10.2'	26°52.3	2.6'	54.3'
3	226°25.9	54.6	314°47.0	10.2'	26°54.9	2.5'	54.3'
4	241°26.1	53.7	329°16.2	10.2'	26°57.3	2.3'	54.3'
5	256°26.3	52.7	343°45.4	10.2'	26°59.6	2.2'	54.3'
6	271°26.5	N01°51.7	358°14.6	10.2'	N27°01.8	2.1'	54.3'
7	286°26.7	50.8	12°43.8	10.2'	27°03.9	1.9'	54.3'
8	301°27.0	49.8	27°13.0	10.2'	27°05.8	1.8'	54.3'
9	316°27.2	48.8	41°42.2	10.2'	27°07.6	1.7'	54.3'
10	331°27.4	47.9	56°11.3	10.2'	27°09.3	1.5'	54.3'
11	346°27.6	46.9	70°40.5	10.2'	27°10.8	1.4'	54.3'
12	1°27.9	N01°45.9	85°09.6	10.1'	N27°12.3	1.3'	54.2'
13	16°28.1	45.0	99°38.8	10.1'	27°13.5	1.1'	54.2'
14	31°28.3	44.0	114°07.9	10.1'	27°14.7	1.0'	54.2'
15	46°28.5	43.0	128°37.1	10.1'	27°15.7	0.9'	54.2'
16	61°28.8	42.0	143°06.2	10.1'	27°16.6	0.7'	54.2'
17	76°29.0	41.1	157°35.4	10.1'	27°17.3	0.6'	54.2'
18	91°29.2	N01°40.1	172°04.5	10.1'	N27°17.9	0.5'	54.2'
19	106°29.4	39.1	186°33.6	10.1'	27°18.4	0.4'	54.2'
20	121°29.6	38.2	201°02.8	10.1'	27°18.8	0.2'	54.2'
21	136°29.9	37.2	215°31.9	10.2'	27°19.0	0.1'	54.2'
22	151°30.1	36.2	230°01.1	10.2'	27°19.1	-0.0'	54.2'
23	166°30.3	35.3	244°30.2	10.2'	27°19.0	-0.2'	54.2'
	SD = 15.9'			SD = 14.8'			

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

Lat.	Fri	Moonrise		Fri	Moonset	
		Sat	Sun		Sat	Sun
N 72°						
N 70°						
68°						
66°						
64°	18:23				15:10	
62°	19:02	19:08	19:34	14:32	16:11	17:31
60°	19:29	19:48	20:25	14:05	15:31	16:40
N 58°	19:51	20:16	20:56	13:45	15:04	16:09
56°	20:08	20:37	21:20	13:28	14:42	15:45
54°	20:23	20:55	21:39	13:13</td		

## September 19, 20, 21 UT (Mon., Tue., Wed.)

Aries			Venus			Mars			Jupiter			Saturn		
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Stars	SHA	Dec
0	357°52.9	189°09.4	N06°22.4	283°38.8	N21°41.3	352°53.7	N00°23.9	35°30.3	S16°13.0			Alpheratz	357°36.4	29°13.0
1	12°55.3	204°08.9	21.2	298°40.1	41.5	7°56.5	23.8	50°32.9	13.1			Ankaa	353°08.6	-42°10.9
2	27°57.8	219°08.5	20.0	313°41.4	41.7	22°59.2	23.6	65°35.5	13.1			Schedar	349°32.7	56°39.7
3	43°00.2	234°08.1	18.8	328°42.7	41.8	38°02.0	23.5	80°38.1	13.1			Diphda	348°48.9	-17°51.6
4	58°02.7	249°07.7	17.6	343°44.0	42.0	53°04.8	23.4	95°40.7	13.2			Achernar	335°21.1	-57°07.2
5	73°05.2	264°07.3	16.4	358°45.3	42.2	68°07.5	23.2	110°43.3	13.2			Hamal	327°53.1	23°34.2
6	88°07.6	279°06.8	N06°15.2	13°46.6	N21°42.4	83°10.3	N00°23.1	125°45.9	S16°13.3			Polaris	314°38.1	89°21.3
7	103°10.1	294°06.4	14.1	284°47.9	42.5	98°13.0	23.0	140°48.5	13.3			Acamar	315°12.9	-40°12.6
8	118°12.6	309°06.0	12.9	43°49.3	42.7	113°15.8	22.8	155°51.1	13.3			Menkar	314°07.9	4°10.8
9	133°15.0	324°05.6	11.7	58°50.6	42.9	128°18.6	22.7	170°53.7	13.4			Mirfak	308°30.7	49°56.3
10	148°17.5	339°05.2	10.5	73°51.9	43.1	143°21.3	22.6	185°56.3	13.4			Aldebaran	290°41.7	16°33.3
11	163°20.0	354°04.7	09.3	88°53.2	43.2	158°24.1	22.4	200°58.8	13.5			Rigel	281°05.7	-8°10.3
12	178°22.4	9°04.3	N06°08.1	103°54.5	N21°43.4	173°26.9	N00°22.3	216°01.4	S16°13.5			Capella	280°24.7	46°01.1
13	193°24.9	24°03.9	06.9	118°55.8	43.6	188°29.6	22.2	231°04.0	13.5			Bellatrix	278°24.9	6°22.3
14	208°27.4	39°03.5	05.7	133°57.1	43.8	203°32.4	22.0	246°06.6	13.6			Elnath	278°04.2	28°37.5
15	223°29.8	54°03.1	04.5	148°58.4	43.9	218°35.2	21.9	261°09.2	13.6			Alnilam	275°39.7	-1°11.1
16	238°32.3	69°02.7	03.3	163°59.7	44.1	233°37.9	21.8	276°11.8	13.7			Betelgeuse	270°54.2	7°24.8
17	253°34.7	84°02.2	02.1	179°01.1	44.3	248°40.7	21.6	291°14.4	13.7			Canopus	263°53.3	-52°42.1
18	268°37.2	99°01.8	N06°00.9	194°02.4	N21°44.4	263°43.5	N00°21.5	306°17.0	S16°13.7			Sirius	258°28.0	-16°44.6
19	283°39.7	114°01.4	05°59.7	209°03.7	44.6	278°46.2	21.4	321°19.6	13.8			Adhara	255°07.5	-28°59.9
20	298°42.1	129°01.0	58.5	224°05.0	44.8	293°49.0	21.2	336°22.2	13.8			Procyon	244°53.0	5°10.2
21	313°44.6	144°00.6	57.3	239°06.3	45.0	308°51.8	21.1	351°24.8	13.9			Pollux	243°19.8	27°58.3
22	328°47.1	159°00.1	56.1	254°07.6	45.1	323°54.5	21.0	6°27.4	13.9			Avior	234°15.9	-59°34.6
23	343°49.5	173°59.7	54.9	269°09.0	45.3	338°57.3	20.8	21°29.9	13.9			Suhail	222°48.0	-43°31.1
Mer.pass. 00:08		ν -0.4° d -1.2' m -3.89	ν 1.3' d 0.2' m -0.43	ν 2.8' d -0.1' m -2.93	ν 2.6' d -0.0' m 0.48							Miaplacidus	221°39.4	-69°48.3

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Stars	SHA	Dec
0	358°52.0	188°59.3	N05°53.7	284°10.3	N21°45.5	354°00.0	N00°20.7	36°32.5	S16°14.0			Denebola	182°27.2	14°26.9
1	13°54.5	203°58.9	52.5	299°11.6	45.7	9°02.8	20.6	51°35.1	14.0			Gienah	175°45.9	-17°39.9
2	28°56.9	218°58.5	51.2	314°12.9	45.8	24°05.6	20.4	66°37.7	14.1			Acrux	173°02.9	-63°13.4
3	43°59.4	233°58.1	50.0	329°14.3	46.0	39°08.3	20.3	81°40.3	14.1			Gacrux	171°54.3	-57°14.3
4	59°01.9	248°57.7	48.8	344°15.6	46.2	54°11.1	20.2	96°42.9	14.1			Alioth	166°15.2	55°50.4
5	74°04.3	263°57.2	47.6	359°16.9	46.3	69°13.9	20.0	111°45.5	14.2			Spica	158°24.6	-11°16.6
6	89°06.8	278°56.8	N05°46.4	14°18.2	N21°46.5	84°16.6	N00°19.9	126°48.1	S16°14.2			Alkaid	152°53.9	49°12.3
7	104°09.2	293°56.4	45.2	29°19.5	46.7	99°19.4	19.8	141°50.7	14.3			Hadar	148°39.2	-60°29.0
8	119°11.7	308°56.0	44.0	44°20.9	46.8	114°22.2	19.6	156°53.3	14.3			Menkent	148°00.2	-36°28.8
9	134°14.2	323°55.6	42.8	59°22.2	47.0	129°24.9	19.5	171°55.8	14.3			Arcturus	145°49.9	19°04.1
10	149°16.6	338°55.2	41.6	74°23.5	47.2	144°27.7	19.4	186°58.4	14.4			Rigil Kent.	139°43.4	-60°55.8
11	164°19.1	353°54.7	40.4	89°24.9	47.4	159°30.5	19.3	202°01.0	14.4			Kochab	137°20.6	74°04.0
12	179°21.6	8°54.3	N05°39.2	104°26.2	N21°47.5	174°33.2	N00°19.1	217°03.6	S16°14.4			Zuben'ubi	136°58.4	-16°08.0
13	194°24.0	23°53.9	38.0	119°27.5	47.7	189°36.0	19.0	232°06.2	14.5			Alphecca	126°05.6	26°38.6
14	209°26.5	38°53.5	36.8	134°28.8	47.9	204°38.8	18.9	247°08.8	14.5			Antares	112°18.3	-26°28.9
15	224°29.0	53°53.1	35.6	149°30.2	48.0	219°41.5	18.7	262°11.4	14.6			Atria	107°14.3	-69°04.3
16	239°31.4	68°52.7	34.4	164°31.5	48.2	234°44.3	18.6	277°14.0	14.6			Sabik	102°05.0	-15°45.1
17	254°33.9	83°52.3	33.2	179°32.8	48.4	249°47.1	18.5	292°16.5	14.6			Shaula	96°13.0	-37°07.3
18	269°36.3	98°51.8	N05°32.0	194°34.2	N21°48.5	264°49.8	N00°18.3	307°19.1	S16°14.7			Rasalhague	96°00.3	12°32.8
19	284°38.8	113°51.4	30.8	209°35.5	48.7	279°52.6	18.2	322°21.7	14.7			Eltanin	90°43.1	51°29.4
20	299°41.3	128°51.0	29.5	224°36.8	48.9	294°55.4	18.1	337°24.3	14.8			Kaus Aust.	83°35.0	-34°22.5
21	314°43.7	143°50.6	28.3	239°38.2	49.0	309°58.1	17.9	352°26.9	14.8			Vega	80°34.4	38°48.5
22	329°46.2	158°50.2	27.1	254°39.5	49.2	325°00.9	17.8	7°29.5	14.8			Nunki	75°50.0	-26°16.1
23	344°48.7	173°49.8	25.9	269°40.9	49.4	340°03.7	17.7	22°32.1	14.9			Altair	62°01.7	8°55.8
Mer.pass. 00:05		ν -0.4° d -1.2' m -3.89	ν 1.3' d 0.2' m -0.45	ν 2.8' d -0.1' m -2.94	ν 2.6' d -0.0' m 0.48							Peacock	53°08.4	-56°39.9

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Stars	SHA	Dec
0	359°51.1	188°49.4	N05°24.7	284°42.2	N21°49.5	355°06.4	N00°17.5	37°34.7	S16°14.9			Fomalhaut	15°16.3	-29°30.1
1	14°53.6	203°49.0	23.5	299°43.5	49.7	10°09.2	17.4	52°37.3	15.0			Scheat	13°46.7	28°12.4
2	29°56.1	218°48.5	22.3	314°44.9	49.9	25°12.0	17.3	67°39.8	15.0			Markab	13°31.5	15°19.7
3	44°58.5	233°48.1	21.1	329°46.2	50.0	40°14.7	17.1	82°42.4	15.0			Sep 19 Mon	SHA	Mer.pass
4	60°01.0	248°47.7	19.9	344°47.5	50.2	55°17.5	17.0	97°45.0	15.1			Venus	191°16.5	11:24
5	75°03.5	263°47.3	18.7	359°48.9	50.4	70°20.3	16.9	112°47.6	15.1			Mars	285°45.9	05:05
6	90°05.9	278°46.9	N05°17.4	14°50.2	N21°50.5	85°23.0	N00°16.7	127°50.2	S16°15.1			Jupiter	355°00.8	00:28
7	105°08.4	293°46.5	16.2	29°51.6	50.7	100°25.8	16.6	142°52.8	15.2			Saturn	37°37.5	21:34
8	120°10.8	308°46.1	15.0	44°52.9	50.9	115°28.6	16.5	157°55.4	15.2			Sep 20 Tue	SHA	Mer.pass
9	135°13.3	323°45.7	13.8	59°54.3	51.0	130°31.3	16.3	172°57.9	15.3			Venus	190°07.3	11:24
10	150°15.8	338°45.3	12.6	74°55.6	51.2	145°34.1	16.2	188°00.5	15.3			Mars	285°18.3	05:03
11	165°18.2	353°44.8	11.4	89°57.0	51.4	160°36.9	16.0	203°03.1	15.3			Jupiter	355°08.1	00:24
12	180°20.7	8°44.4	N05°10.2	104°58.3	N21°51.5	175°39.6	N00°15.9	218°05.7	S16°15.4			Saturn	37°40.5	21:30
13	195°23.2													

DUT1 = UT1-UTC = -0.0085 sec  $\Delta T = TT-UT1 = +69.1925$  sec

2022 September 19 to Sep. 21 UT

h		Sun		Moon				
Mon		GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	181°30.5	N01°34.3	258°59.4	10.2'	N27°18.9	-0.3'	54.2'	
1	196°30.8	33.3	273°28.6	10.2'	27°18.6	-0.4'	54.2'	
2	211°31.0	32.4	287°57.8	10.2'	27°18.1	-0.6'	54.2'	
3	226°31.2	.. 31.4	302°26.9	10.2'	27°17.6	-0.7'	54.2'	
4	241°31.4	30.4	316°56.1	10.2'	27°16.9	-0.8'	54.2'	
5	256°31.7	29.5	331°25.3	10.2'	27°16.0	-1.0'	54.2'	
6	271°31.9	N01°28.5	345°54.5	10.2'	N27°15.1	-1.1'	54.1'	
7	286°32.1	27.5	0°23.8	10.2'	27°14.0	-1.2'	54.1'	
8	301°32.3	26.5	14°53.0	10.3'	27°12.8	-1.4'	54.1'	
9	316°32.5	.. 25.6	29°22.3	10.3'	27°11.4	-1.5'	54.1'	
10	331°32.8	24.6	43°51.5	10.3'	27°09.9	-1.6'	54.1'	
11	346°33.0	23.6	58°20.8	10.3'	27°08.3	-1.7'	54.1'	
12	1°33.2	N01°22.7	72°50.1	10.3'	N27°06.6	-1.9'	54.1'	
13	16°33.4	21.7	87°19.4	10.3'	27°04.7	-2.0'	54.1'	
14	31°33.7	20.7	101°48.8	10.4'	27°02.7	-2.1'	54.1'	
15	46°33.9	.. 19.8	116°18.1	10.4'	27°00.6	-2.3'	54.1'	
16	61°34.1	18.8	130°47.5	10.4'	26°58.3	-2.4'	54.1'	
17	76°34.3	17.8	145°16.9	10.4'	26°55.9	-2.5'	54.1'	
18	91°34.5	N01°16.8	159°46.3	10.4'	N26°53.4	-2.6'	54.1'	
19	106°34.8	15.9	174°15.7	10.5'	26°50.7	-2.8'	54.1'	
20	121°35.0	14.9	188°45.2	10.5'	26°48.0	-2.9'	54.1'	
21	136°35.2	.. 13.9	203°14.7	10.5'	26°45.1	-3.0'	54.1'	
22	151°35.4	13.0	217°44.2	10.5'	26°42.0	-3.2'	54.1'	
23	166°35.7	12.0	232°13.7	10.6'	26°38.9	-3.3'	54.1'	
	SD = 15.9'		SD = 14.8'					

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

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

Day	Sun		Moon		Age
	Eqn. of Time	Mer. Pass.	Mer. Pass.	Upper	
	00 <sup>h</sup> mm:ss	12 <sup>h</sup> mm:ss	hh:mm	hh:mm	23-25 40-22%
19	06:02	06:13	11:54	06:58	19:24
20	06:24	06:34	11:53	07:49	20:14
21	06:45	06:55	11:53	08:38	21:02

## September 22, 23, 24 UT (Thu., Fri., Sat.)

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	0°50.3	188°39.5	N04°55.6	285°14.5	N21°53.5	356°12.9	N00°14.3	38°36.7	S16°15.8	Alpheratz	357°36.4	29°13.0					
1	15°52.7	203°39.1	54.4	300°15.9	53.7	11°15.6	14.2	53°39.3	15.9	Ankaa	353°08.6	-42°10.9					
2	30°55.2	218°38.7	53.2	315°17.2	53.8	26°18.4	14.0	68°41.9	15.9	Schedar	349°32.6	56°39.7					
3	45°57.7	233°38.3	.. 51.9	330°18.6	.. 54.0	41°21.2	.. 13.9	83°44.5	.. 15.9	Diphda	348°48.9	-17°51.6					
4	61°00.1	248°37.9	50.7	345°20.0	54.2	56°23.9	13.8	98°47.1	16.0	Achernar	335°21.1	-57°07.2					
5	76°02.6	263°37.5	49.5	0°21.3	54.3	71°26.7	13.6	113°49.6	16.0	Hamal	327°53.1	23°34.2					
6	91°05.1	278°37.1	N04°48.3	15°22.7	N21°54.5	86°29.5	N00°13.5	128°52.2	S16°16.1	Polaris	314°36.9	89°21.3					
7	106°07.5	293°36.7	47.1	30°24.0	54.7	101°32.2	13.4	143°54.8	16.1	Acamar	315°12.9	-40°12.6					
8	121°10.0	308°36.3	45.9	45°25.4	54.8	116°35.0	13.2	158°57.4	16.1	Menkar	314°07.9	4°10.8					
9	136°12.5	323°35.8	.. 44.6	60°26.8	.. 55.0	131°37.8	.. 13.1	174°00.0	.. 16.2	Mirfak	308°30.7	49°56.4					
10	151°14.9	338°35.4	43.4	75°28.1	55.1	146°40.5	13.0	189°02.6	16.2	Aldebaran	290°41.7	16°33.3					
11	166°17.4	353°35.0	42.2	90°29.5	55.3	161°43.3	12.8	204°05.1	16.2	Rigel	281°05.6	-8°10.3					
12	181°19.8	8°34.6	N04°41.0	105°30.9	N21°55.5	176°46.1	N00°12.7	219°07.7	S16°16.3	Capella	280°24.6	46°01.1					
13	196°22.3	23°34.2	39.8	120°32.2	55.6	191°48.8	12.6	234°10.3	16.3	Bellatrix	278°24.9	6°22.3					
14	211°24.8	38°33.8	38.5	135°33.6	55.8	206°51.6	12.4	249°12.9	16.3	Elnath	278°04.2	28°37.5					
15	226°27.2	53°33.4	.. 37.3	150°35.0	.. 56.0	221°54.4	.. 12.3	264°15.5	.. 16.4	Alnilam	275°39.6	-1°11.1					
16	241°29.7	68°33.0	36.1	165°36.3	56.1	236°57.2	12.2	279°18.1	16.4	Betelgeuse	270°54.1	7°24.8					
17	256°32.2	83°32.6	34.9	180°37.7	56.3	251°59.9	12.0	294°20.6	16.5	Canopus	263°53.3	-52°42.1					
18	271°34.6	98°32.2	N04°33.7	195°39.1	N21°56.4	267°02.7	N00°11.9	309°23.2	S16°16.5	Sirius	258°28.0	-16°44.6					
19	286°37.1	113°31.8	32.4	210°40.4	56.6	282°05.5	11.8	324°25.8	16.5	Adhara	255°07.5	-28°59.9					
20	301°39.6	128°31.4	31.2	225°41.8	56.8	297°08.2	11.6	339°28.4	16.6	Procyon	244°53.0	5°10.2					
21	316°42.0	143°31.0	.. 30.0	240°43.2	.. 56.9	312°11.0	.. 11.5	354°31.0	.. 16.6	Pollux	243°19.8	27°58.3					
22	331°44.5	158°30.6	28.8	255°44.6	57.1	327°13.8	11.4	9°33.5	16.6	Avior	234°15.9	-59°34.6					
23	346°46.9	173°30.2	27.6	270°45.9	57.2	342°16.5	11.2	24°36.1	16.7	Suhail	222°48.0	-43°31.1					
Mer.pass. 23:53			ν -0.4° d -1.2' m -3.89	ν 1.4° d 0.2' m -0.48	ν 2.8° d -0.1' m -2.94	ν 2.6° d -0.0' m 0.49	Mer.pass. 23:53			Mer.pass. 23:53			Mer.pass. 23:53				
Fri			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Fri			
0	1°49.4	188°29.8	N04°26.3	285°47.3	N21°57.4	357°19.3	N00°11.1	39°38.7	S16°16.7	Denebola	182°27.2	14°26.9					
1	16°51.9	203°29.3	25.1	300°48.7	57.6	12°22.1	11.0	54°41.3	16.8	Gienah	175°45.9	-17°39.9					
2	31°54.3	218°28.9	23.9	315°50.1	57.7	27°24.8	10.8	69°43.9	16.8	Acrux	173°02.9	-63°13.4					
3	46°56.8	233°28.5	.. 22.7	330°51.4	.. 57.9	42°27.6	.. 10.7	84°46.4	.. 16.8	Gacrux	171°54.3	-57°14.3					
4	61°59.3	248°28.1	21.4	345°52.8	58.0	57°30.4	10.6	99°49.0	16.9	Alioth	166°15.2	55°50.4					
5	77°01.7	263°27.7	20.2	0°54.2	58.2	72°33.2	10.4	114°51.6	16.9	Spica	158°24.6	-11°16.6					
6	92°04.2	278°27.3	N04°19.0	15°55.6	N21°58.4	87°35.9	N00°10.3	129°54.2	S16°16.9	Alkaid	152°53.9	49°12.2					
7	107°06.7	293°26.9	17.8	30°56.9	58.5	102°38.7	10.2	144°56.8	17.0	Hadar	148°39.3	-60°29.0					
8	122°09.1	308°26.5	16.5	45°58.3	58.7	117°41.5	10.0	159°59.3	17.0	Menkent	148°00.2	-36°28.8					
9	137°11.6	323°26.1	.. 15.3	60°59.7	.. 58.8	132°44.2	.. 09.9	175°01.9	.. 17.0	Arcturus	145°49.9	19°04.1					
10	152°14.1	338°25.7	14.1	76°01.1	59.0	147°47.0	09.8	190°04.5	17.1	Rigel Kent.	139°43.4	-60°55.8					
11	167°16.5	353°25.3	12.9	91°02.5	59.1	162°49.8	09.6	205°07.1	17.1	Kochab	137°20.6	74°04.0					
12	182°19.0	8°24.9	N04°11.6	106°03.9	N21°59.3	177°52.5	N00°09.5	220°09.7	S16°17.1	Zuben 'ubi	136°58.4	-16°08.0					
13	197°21.4	23°24.5	10.4	121°05.2	59.5	192°55.3	09.4	235°12.2	17.2	Alphecca	126°05.6	26°38.5					
14	212°23.9	38°24.1	09.2	136°06.6	59.6	207°58.1	09.2	250°14.8	17.2	Antares	112°18.3	-26°28.9					
15	227°26.4	53°23.7	.. 08.0	151°08.0	.. 59.8	223°00.9	.. 09.1	265°17.4	.. 17.3	Atria	107°14.4	-69°04.3					
16	242°28.8	68°23.3	06.7	166°09.4	21°59.9	238°03.6	09.0	280°20.0	17.3	Sabik	102°05.0	-15°45.1					
17	257°31.3	83°22.9	05.5	181°10.8	22°00.1	253°06.4	08.8	295°22.6	17.3	Shaula	96°13.0	-37°07.3					
18	272°33.8	98°22.5	N04°04.3	196°12.2	N22°00.2	268°09.2	N00°08.7	310°25.1	S16°17.4	Rasalhague	96°00.4	12°32.8					
19	287°36.2	113°22.1	03.1	211°13.6	00.4	283°11.9	08.6	325°27.7	17.4	Eltanin	90°43.1	51°29.4					
20	302°38.7	128°21.7	01.8	226°15.0	00.6	298°14.7	08.4	340°30.3	17.4	Kaus Aust.	83°35.0	-34°22.5					
21	317°41.2	143°21.3	04°00.6	241°16.4	.. 00.7	313°17.5	.. 08.3	355°32.9	.. 17.5	Vega	80°34.4	38°48.5					
22	332°43.6	158°20.9	03°59.4	256°17.7	00.9	328°20.2	08.2	10°35.5	17.5	Nunki	75°50.0	-26°16.1					
23	347°46.1	173°20.5	58.2	271°19.1	01.0	343°23.0	08.0	25°38.0	17.5	Altair	62°01.7	8°55.8					
Mer.pass. 23:49			ν -0.4° d -1.2' m -3.89	ν 1.4° d 0.2' m -0.50	ν 2.8° d -0.1' m -2.94	ν 2.6° d -0.0' m 0.50	Mer.pass. 23:49			Mer.pass. 23:49			Mer.pass. 23:49				
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Mer.pass		
0	2°48.5	188°20.1	N03°56.9	286°20.5	N22°01.2	358°25.8	N00°07.9	40°40.6	S16°17.6	Sep 22 Thu	187°49.2	11:26					
1	17°51.0	203°19.7	55.7	301°21.9	01.3	13°28.6	07.8	55°43.2	17.6	Venus	284°24.3	04:59					
2	32°53.5	218°19.3	54.5	316°23.3	01.5	28°31.3	07.6	70°45.8	17.6	Mars	355°22.6	00:15					
3	47°55.9	233°18.9	.. 53.2	331°24.7	.. 01.7	43°34.1	.. 07.5	85°48.3	.. 17.7	Jupiter	37°46.4	21:22					
4	62°58.4	248°18.5	52.0	346°26.1	01.8	58°36.9	07.4	100°50.9	17.7	Saturn	37°49.3	21:18					
5	78°00.9	263°18.1	50.8	1°27.5	02.0	73°39.6	07.2	115°53.5	17.7	Sep 23 Fri			Sep 23 Fri				
6	93°03.3	278°17.7	N03°49.6	16°28.9	N22°02.1	88°42.4	N00°07.1	130°56.1	S16°17.8	Venu. SHA	186°40.3	11:26					
7	108°05.8	293°17.3	48.3	31°30.3	02.3	103°45.2	07.0	145°58.7	17.8	Mars SHA	283°57.9	04:56					
8	123°08.3	308°16.9	47.1	46°31.7	02.4	118°47.9	06.8	161°01.2	17.9	Jupiter SHA	355°29.9	00:11					
9	138°10.7	323°16.5	.. 45.9	61°33.1	.. 02.6	133°50.7	.. 06.7	176°03.8	.. 17.9	Saturn SHA	37°49.3	21:14					
10	153°13.2	338°16.1	44.6	76°34.5	02.7	148°53.5	06.5	191°06.4	17.9	Sep 24 Sat			Sep 24 Sat				
11	168°15.7	353°15.7	43.4	91°35.9	02.9	163°56.3	06.4	206°09.0	18.0	Venu. Mer.pass	185°31.5	11:27					
12	183°18.1	8°15.3	N03°42.2	106°37.3	N22°03.1	178°59.0	N00°06.3	221°11.5	S16°18.0	Mars Mer.pass	283°32.0	04:54					
13	198°20.6	23°14.9	41.0	121°38.7	03.2	194°01.8	06.1	236°14.1	18.0	Jupiter Mer.pass	355°37.2	00:06					
14	213°23.0	38°14.5	39.7	136°40.1	03.4	209°04.6	06.0	251°16.7	18.1	Saturn Mer.pass	37°52.1	21:14					
15	228°25.5	53°14.1	.. 38.5	151°41.5	.. 03.5	224°07.3	.. 05.9	266°19.3	.. 18.1	Horizontal parallax			Horizontal parallax				
16	243°28.0	68°13.7	37.3	166°42.9	03.7	239°10.1	05.7	281°21.8	18.1	Venu. 0.1			Mars 0.2				
17	258°30.4	83°13.3	36.0	181°44.4	03.8	254°12.9	05.6	296°24.4	18.2								

DUT1 = UT1-UTC = -0.0062 sec  $\Delta T = TT-UT1 = +69.1902$  sec

2022 September 22 to Sep. 24 UT

h		Sun		Moon				
Thu		GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	181°46.5	N00°24.4		223°04.2	12.5'	N21°36.9	-8.9'	54.6'
1	196°46.7	23.4		237°35.6	12.5'	21°28.0	-9.0'	54.6'
2	211°47.0	22.4		252°07.1	12.6'	21°18.9	-9.1'	54.6'
3	226°47.2	.. 21.5		266°38.7	12.6'	21°09.8	-9.2'	54.6'
4	241°47.4	20.5		281°10.3	12.6'	21°00.6	-9.3'	54.6'
5	256°47.6	19.5		295°41.9	12.7'	20°51.2	-9.4'	54.6'
6	271°47.8	N00°18.6		310°13.6	12.7'	N20°41.8	-9.5'	54.7'
7	286°48.1	17.6		324°45.3	12.8'	20°32.2	-9.6'	54.7'
8	301°48.3	16.6		339°17.1	12.8'	20°22.6	-9.7'	54.7'
9	316°48.5	.. 15.6		353°48.9	12.9'	20°12.9	-9.8'	54.7'
10	331°48.7	14.7		8°20.8	12.9'	20°03.0	-9.9'	54.7'
11	346°48.9	13.7		22°52.7	12.9'	19°53.1	-10.0'	54.7'
12	1°49.2	N00°12.7		37°24.6	13.0'	N19°43.1	-10.1'	54.8'
13	16°49.4	11.7		51°56.6	13.0'	19°33.0	-10.2'	54.8'
14	31°49.6	10.8		66°28.7	13.1'	19°22.8	-10.3'	54.8'
15	46°49.8	.. 09.8		81°00.7	13.1'	19°12.5	-10.4'	54.8'
16	61°50.0	08.8		95°32.8	13.2'	19°02.1	-10.5'	54.8'
17	76°50.3	07.9		110°05.0	13.2'	18°51.6	-10.6'	54.8'
18	91°50.5	N00°06.9		124°37.2	13.2'	N18°41.1	-10.7'	54.9'
19	106°50.7	05.9		139°09.4	13.3'	18°30.4	-10.7'	54.9'
20	121°50.9	04.9		153°41.7	13.3'	18°19.7	-10.8'	54.9'
21	136°51.1	.. 04.0		168°14.0	13.4'	18°08.9	-10.9'	54.9'
22	151°51.4	03.0		182°46.4	13.4'	17°58.0	-11.0'	54.9'
23	166°51.6	02.0		197°18.8	13.4'	17°47.0	-11.1'	55.0'
	SD = 15.9'	d = -1.0'		SD = 14.9'				
	SD = 15.9'	d = -1.0'		SD = 15.0'				
	SD = 15.9'	d = -1.0'		SD = 15.1'				

Lat.	Twilight		Sunrise	Sunset	Twilight	
	Naut.	Civil			Civil	Naut.
N 72°	03:04	04:34	05:43	18:00	19:08	20:36
N 70°	03:23	04:42	05:44	17:59	19:00	20:18
68°	03:38	04:48	05:44	17:58	18:54	20:03
66°	03:50	04:54	05:45	17:58	18:49	19:52
64°	04:00	04:58	05:46	17:58	18:45	19:43
62°	04:08	05:02	05:46	17:57	18:42	19:35
60°	04:15	05:05	05:46	17:57	18:39	19:28
N 58°	04:20	05:07	05:47	17:57	18:36	19:23
56°	04:26	05:10	05:47	17:57	18:34	19:18
54°	04:30	05:12	05:47	17:56	18:32	19:13
52°	04:34	05:14	05:47	17:56	18:30	19:10
50°	04:37	05:15	05:48	17:56	18:28	19:06
48°	04:44	05:19	05:48	17:56	18:25	18:59
N 40°	04:50	05:21	05:48	17:56	18:23	18:54
35°	04:54	05:23	05:49	17:56	18:21	18:50
30°	04:57	05:25	05:49	17:55	18:19	18:47
20°	05:01	05:27	05:49	17:55	18:17	18:43
N 10°	05:04	05:28	05:49	17:55	18:16	18:41
0°	05:04	05:28	05:49	17:56	18:16	18:40
S 10°	05:04	05:28	05:49	17:56	18:17	18:41
20°	05:01	05:27	05:49	17:56	18:18	18:44
30°	04:57	05:25	05:48	17:57	18:21	18:49
35°	04:53	05:23	05:48	17:57	18:22	18:52
40°	04:49	05:21	05:48	17:58	18:25	18:56
45°	04:44	05:18	05:47	17:58	18:27	19:02
S 50°	04:37	05:15	05:47	17:59	18:31	19:09
52°	04:33	05:13	05:47	17:59	18:33	19:13
54°	04:29	05:11	05:46	17:59	18:35	19:17
56°	04:25	05:09	05:46	18:00	18:37	19:21
58°	04:20	05:07	05:46	18:00	18:40	19:27
S 60°	04:14	05:04	05:45	18:01	18:43	19:33
Lat.	Thu	Fri	Sat	Thu	Fri	Sat
N 72°	22:26	.. ..	01:51	21:31	19:41	18:58
N 70°	23:52	.. ..	02:14	20:04	19:15	18:46
68°	.. ..	00:30	02:32	19:25	18:56	18:36
66°	.. ..	00:56	02:46	18:57	18:40	18:27
64°	.. ..	01:17	02:58	18:36	18:27	18:20
62°	.. ..	01:33	03:07	18:18	18:16	18:14
60°	00:16	01:47	03:16	18:04	18:07	18:09
N 58°	00:33	01:58	03:23	17:52	17:59	18:04
56°	00:47	02:08	03:29	17:41	17:51	18:00
54°	00:59	02:17	03:35	17:31	17:45	17:56
52°	01:10	02:25	03:40	17:23	17:39	17:52
50°	01:19	02:32	03:45	17:15	17:34	17:49
45°	01:39	02:47	03:55	16:59	17:22	17:42
N 40°	01:55	02:59	04:03	16:45	17:12	17:37
35°	02:09	03:09	04:10	16:34	17:04	17:31
30°	02:21	03:19	04:16	16:24	16:57	17:27
20°	02:41	03:34	04:27	16:06	16:44	17:19
N 10°	02:58	03:48	04:36	15:51	16:33	17:12
0°	03:14	04:00	04:45	15:37	16:22	17:06
S 10°	03:30	04:13	04:54	15:22	16:11	16:59
20°	03:48	04:26	05:03	15:07	16:00	16:52
30°	04:07	04:42	05:13	14:49	15:46	16:44
35°	04:19	04:50	05:19	14:38	15:39	16:39
40°	04:32	05:00	05:26	14:26	15:30	16:34
45°	04:47	05:12	05:34	14:12	15:19	16:28
S 50°	05:06	05:26	05:43	13:54	15:07	16:20
52°	05:15	05:33	05:47	13:46	15:01	16:17
54°	05:25	05:40	05:52	13:36	14:54	16:13
56°	05:36	05:48	05:57	13:26	14:47	16:08
58°	05:49	05:57	06:03	13:14	14:39	16:04
S 60°	06:04	06:08	06:10	12:59	14:29	15:58
Day	Eqn.of Time	Mer.	Mer.	Mer.	Mer.	Age
	00 <sup>h</sup> mm:ss	12 <sup>h</sup> mm:ss	Pass hh:mm	Upper hh:mm	Lower hh:mm	26-28 15-4%
22	07:06	07:17	11:53	09:26	21:49	
23	07:27	07:38	11:52	10:11	22:33	
24	07:48	07:59	11:52	10:55	23:17	

## September 25, 26, 27 UT (Sun., Mon., Tue.)

Aries			Venus			Mars			Jupiter			Saturn		
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Stars	SHA	Dec
0	3°47.7	188°10.5	N03°27.4	286°54.2	N22°04.9	359°32.3	N00°04.7	41°42.4	S16°18.4			Alpheratz	357°36.4	29°13.0
1	18°50.1	203°10.1	26.2	301°55.6	05.0	14°35.1	04.5	56°45.0	18.4			Ankaa	353°08.6	-42°10.9
2	33°52.6	218°09.7	24.9	316°57.1	05.2	29°37.8	04.4	71°47.6	18.5			Schedar	349°32.6	56°39.7
3	48°55.1	233°09.3	.. 23.7	331°58.5	.. 05.4	44°40.6	.. 04.3	86°50.2	.. 18.5			Diphda	348°48.9	-17°51.6
4	63°57.5	248°08.9	22.5	346°59.9	05.5	59°43.4	04.1	101°52.7	18.5			Achernar	335°21.1	-57°07.2
5	79°00.0	263°08.5	21.2	2°01.3	05.7	74°46.1	04.0	116°55.3	18.6			Hamal	327°53.0	23°34.2
6	94°02.5	278°08.1	N03°20.0	17°02.7	N22°05.8	89°48.9	N00°03.9	131°57.9	S16°18.6			Polaris	314°35.9	89°21.4
7	109°04.9	293°07.7	18.8	32°04.1	06.0	104°51.7	03.7	147°00.5	18.6			Acamar	315°12.9	-40°12.6
8	124°07.4	308°07.3	17.5	47°05.6	06.1	119°54.4	03.6	162°03.0	18.7			Menkar	314°07.9	4°10.8
9	139°09.9	323°06.9	.. 16.3	62°07.0	.. 06.3	134°57.2	.. 03.5	177°05.6	.. 18.7			Mirfak	308°30.7	49°56.4
10	154°12.3	338°06.5	15.1	77°08.4	06.4	150°00.0	03.3	192°08.2	18.7			Aldebaran	290°41.7	16°33.3
11	169°14.8	353°06.1	13.8	92°09.8	06.6	165°02.8	03.2	207°10.7	18.8			Rigel	281°05.6	-8°10.3
12	184°17.3	8°05.7	N03°12.6	107°11.3	N22°06.7	180°05.5	N00°03.1	222°13.3	S16°18.8			Capella	280°24.6	46°01.1
13	199°19.7	23°05.3	11.4	122°12.7	06.9	195°08.3	02.9	237°15.9	18.8			Bellatrix	278°24.9	6°22.3
14	214°22.2	38°04.9	10.1	137°14.1	07.0	210°11.1	02.8	252°18.5	18.9			Elnath	278°04.2	28°37.5
15	229°24.6	53°04.5	.. 08.9	152°15.5	.. 07.2	225°13.8	.. 02.7	267°21.0	.. 18.9			Alnilam	275°39.6	-1°11.1
16	244°27.1	68°04.1	07.7	167°17.0	07.3	240°16.6	02.5	282°23.6	18.9			Betelgeuse	270°54.1	7°24.8
17	259°29.6	83°03.7	06.4	182°18.4	07.5	255°19.4	02.4	297°26.2	19.0			Canopus	263°53.3	-52°42.1
18	274°32.0	98°03.3	N03°05.2	197°19.8	N22°07.6	270°22.2	N00°02.3	312°28.8	S16°19.0			Sirius	258°28.0	-16°44.6
19	289°34.5	113°02.9	03.9	212°21.2	07.8	285°24.9	02.1	327°31.3	19.0			Adhara	255°07.4	-28°59.9
20	304°37.0	128°02.5	02.7	227°22.7	07.9	300°27.7	02.0	342°33.9	19.1			Procyon	244°52.9	5°10.2
21	319°39.4	143°02.1	.. 01.5	242°24.1	.. 08.1	315°30.5	.. 01.9	357°36.5	.. 19.1			Pollux	243°19.8	27°58.3
22	334°41.9	158°01.7	03°00.2	257°25.5	08.2	330°33.2	01.7	12°39.0	19.1			Avior	234°15.8	-59°34.5
23	349°44.4	173°01.3	02°59.0	272°27.0	08.4	345°36.0	01.6	27°41.6	19.2			Suhail	222°48.0	-43°31.1
Mer.pass. 23:41		ν -0.4° d -1.2' m -3.89	ν 1.4° d 0.2' m -0.53	ν 2.8° d -0.1' m -2.94	ν 2.6° d -0.0' m 0.50							Miaplacidus	221°39.3	-69°48.3

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Stars	SHA	Dec
0	4°46.8	188°00.9	N02°57.8	287°28.4	N22°08.5	0°38.8	N00°01.5	42°44.2	S16°19.2			Denebola	182°27.2	14°26.9
1	19°49.3	203°00.5	55.6	302°29.8	08.7	15°41.6	01.3	57°46.8	19.2			Gienah	175°45.9	-17°39.9
2	34°51.8	218°00.1	55.3	317°31.3	08.8	30°44.3	01.2	72°49.3	19.3			Acrux	173°02.9	-63°13.4
3	49°54.2	232°59.7	.. 54.0	332°32.7	.. 09.0	45°47.1	.. 01.1	87°51.9	.. 19.3			Gacrux	171°54.4	-57°14.3
4	64°56.7	247°59.3	52.8	347°34.2	09.1	60°49.9	00.9	102°54.5	19.3			Alioth	166°15.2	55°50.4
5	79°59.1	262°58.9	51.6	2°35.6	09.3	75°52.6	00.8	117°57.0	19.4			Spica	158°24.6	-11°16.6
6	95°01.6	277°58.5	N02°50.3	17°37.0	N22°09.4	90°55.4	N00°00.7	132°59.6	S16°19.4			Alkaid	152°54.0	49°12.2
7	110°04.1	292°58.1	49.1	32°38.5	09.6	105°58.2	00.5	148°02.2	19.4			Hadar	148°39.3	-60°28.9
8	125°06.5	307°57.7	47.9	47°39.9	09.7	121°01.0	00.4	163°04.7	19.5			Menkent	148°00.2	-36°28.8
9	140°09.0	322°57.3	.. 46.6	62°41.3	.. 09.9	136°03.7	.. 00.3	178°07.3	.. 19.5			Arcturus	145°49.9	19°04.1
10	155°11.5	337°56.9	45.4	77°42.8	10.0	151°06.5	N00°00.1	193°09.9	19.5			Rigel Kent.	139°43.5	-60°55.8
11	170°13.9	352°56.5	44.1	92°44.2	10.2	166°09.3	S00°00.0	208°12.5	19.6			Kochab	137°20.6	74°04.0
12	185°16.4	7°56.1	N02°42.9	107°45.7	N22°10.3	181°12.0	S00°00.1	223°15.0	S16°19.6			Zuben'ubi	136°58.4	-16°08.0
13	200°18.9	22°55.8	41.7	122°47.1	10.4	196°14.8	00.3	238°17.6	19.6			Alphecca	126°05.6	26°38.5
14	215°21.3	37°55.4	40.4	137°48.6	10.6	211°17.6	00.4	253°20.2	19.7			Antares	112°18.3	-26°28.9
15	230°23.8	52°55.0	.. 39.2	152°50.0	.. 10.7	226°20.4	.. 00.5	268°22.7	.. 19.7			Atria	107°14.4	-69°04.3
16	245°26.2	67°54.6	37.9	167°51.5	10.9	241°23.1	00.7	283°25.3	19.7			Sabik	102°05.1	-15°45.1
17	260°28.7	82°54.2	36.7	182°52.9	11.0	256°25.9	00.8	298°27.9	19.8			Shaula	96°13.0	-37°07.3
18	275°31.2	97°53.8	N02°35.5	197°54.4	N22°11.2	271°28.7	S00°00.9	313°30.4	S16°19.8			Rasalhague	96°00.4	12°32.8
19	290°33.6	112°53.4	34.2	212°55.8	11.3	286°31.4	01.1	328°33.0	19.8			Eltanin	90°43.1	51°29.4
20	305°36.1	127°53.0	33.0	227°57.3	11.5	301°34.2	01.2	343°35.6	19.9			Kaus Aust.	83°35.0	-34°22.5
21	320°38.6	142°52.6	.. 31.7	242°58.7	.. 11.6	316°37.0	.. 01.3	358°38.1	.. 19.9			Vega	80°34.5	38°48.5
22	335°41.0	157°52.2	30.5	258°00.2	11.8	331°39.8	01.5	13°40.7	19.9			Nunki	75°50.1	-26°16.1
23	350°43.5	172°51.8	29.3	273°01.6	11.9	346°42.5	01.6	28°43.3	20.0			Altair	62°01.7	8°55.8
Mer.pass. 23:37		ν -0.4° d -1.2' m -3.89	ν 1.4° d 0.1' m -0.54	ν 2.8° d -0.1' m -2.94	ν 2.6° d -0.0' m 0.51							Peacock	53°08.4	-56°39.9

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Stars	SHA	Dec
0	5°46.0	187°51.4	N02°28.0	288°03.1	N22°12.1	1°45.3	S00°01.7	43°45.8	S16°20.0			Fomalhaut	15°16.3	-29°30.1
1	20°48.4	202°51.0	26.8	303°04.5	12.2	16°48.1	01.9	58°48.4	20.0			Scheat	13°46.7	28°12.4
2	35°50.9	217°50.6	25.5	318°06.0	12.4	31°50.8	02.0	73°51.0	20.0			Markab	13°31.5	15°19.7
3	50°53.4	232°50.2	.. 24.3	333°07.4	.. 12.5	46°53.6	.. 02.1	88°53.5	.. 20.1			Sep 25 Sun	184°22.8	11:28
4	65°55.8	247°49.8	23.0	348°08.9	12.6	61°56.4	02.3	103°56.1	20.1			Venus	184°22.8	11:28
5	80°58.3	262°49.4	21.8	3°10.4	12.8	76°59.2	02.4	118°58.7	20.1			Mars	283°06.5	04:52
6	96°00.7	277°49.0	N02°20.6	18°11.8	N22°12.9	92°01.9	S00°02.5	134°01.3	S16°20.2			Jupiter	355°44.6	00:02
7	111°03.2	292°48.6	19.3	33°13.3	13.1	107°04.7	02.7	149°03.8	20.2			Saturn	37°54.8	21:10
8	126°05.7	307°48.2	18.1	48°14.7	13.2	122°07.5	02.8	164°06.4	20.2			Sep 26 Mon	183°14.1	11:28
9	141°08.1	322°47.9	.. 16.8	63°16.2	.. 13.4	137°10.2	.. 02.9	179°09.0	.. 20.3			Venus	183°14.1	11:28
10	156°10.6	337°47.5	15.6	78°17.7	13.5	152°13.0	03.1	194°11.5	20.3			Mars	282°41.6	04:50
11	171°13.1	352°47.1	14.3	93°19.1	13.7	167°15.8	03.2	209°14.1	20.3			Jupiter	355°52.0	23:53
12	186°15.5	7°46.7	N02°13.1	108°20.6	N22°13.8	182°18.6</td								

DUT1 = UT1-UTC = -0.0053 sec  $\Delta T = TT-UT1 = +69.1893$  sec

2022 September 25 to Sep. 27 UT

h		Sun		Moon			
Sun	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	182°02.2	S00°45.7	190°23.8	14.6'	N07°19.8	-14.2'	56.0'
1	197°02.5	46.7	204°57.5	14.6'	07°05.6	-14.3'	56.0'
2	212°02.7	47.6	219°31.1	14.6'	06°51.3	-14.3'	56.0'
3	227°02.9	48.6	234°04.8	14.7'	06°37.0	-14.4'	56.1'
4	242°03.1	49.6	248°38.4	14.7'	06°22.6	-14.4'	56.1'
5	257°03.3	50.6	263°12.1	14.7'	06°08.2	-14.4'	56.1'
6	272°03.5	S00°51.5	277°45.7	14.7'	N05°53.8	-14.5'	56.1'
7	287°03.8	52.5	292°19.4	14.7'	05°39.3	-14.5'	56.2'
8	302°04.0	53.5	306°53.0	14.7'	05°24.8	-14.5'	56.2'
9	317°04.2	54.5	321°26.7	14.7'	05°10.3	-14.6'	56.2'
10	332°04.4	55.4	336°00.3	14.6'	04°55.7	-14.6'	56.2'
11	347°04.6	56.4	350°34.0	14.6'	04°41.1	-14.6'	56.3'
12	2°04.8	S00°57.4	5°07.6	14.6'	N04°26.5	-14.7'	56.3'
13	17°05.0	58.4	19°41.3	14.6'	04°11.8	-14.7'	56.3'
14	32°05.3	00°59.3	34°14.9	14.6'	03°57.1	-14.7'	56.3'
15	47°05.5	01°00.3	48°48.5	14.6'	03°42.3	-14.8'	56.3'
16	62°05.7	01.3	63°22.1	14.6'	03°27.6	-14.8'	56.4'
17	77°05.9	02.2	77°55.8	14.6'	03°12.8	-14.8'	56.4'
18	92°06.1	S01°03.2	92°29.4	14.6'	N02°58.0	-14.8'	56.4'
19	107°06.3	04.2	107°02.9	14.6'	02°43.1	-14.9'	56.4'
20	122°06.6	05.2	121°36.5	14.6'	02°28.3	-14.9'	56.5'
21	137°06.8	06.1	136°10.1	14.6'	02°13.4	-14.9'	56.5'
22	152°07.0	07.1	150°43.6	14.5'	01°58.5	-14.9'	56.5'
23	167°07.2	08.1	165°17.2	14.5'	01°43.6	-14.9'	56.5'
	SD = 15.9'		SD = 15.3'				

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

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

Day	Sun			Moon	
	Eqn.of	Time	Mer.	Mer. Pass.	Age
	00 <sup>h</sup>	12 <sup>h</sup>	Pass	Upper	0-2
25	08:09	08:19	11:52	11:39	—
26	08:30	08:40	11:51	12:23	00:01
27	08:50	09:00	11:51	13:08	00:45

## September 28, 29, 30 UT (Wed., Thu., Fri.)

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	6°45.1	187°41.9	N01°58.2	288°38.2	N22°15.5	2°51.8	\$00°04.9	44°47.4	S16°20.7					Alpheratz	357°36.4	29°13.0	
1	21°47.6	202°41.6	56.9	303°39.7	15.7	17°54.6	05.1	59°50.0	20.8					Ankaa	353°08.6	-42°10.9	
2	36°50.0	217°41.2	55.7	318°41.2	15.8	32°57.4	05.2	74°52.6	20.8					Schedar	349°32.6	56°39.7	
3	51°52.5	232°40.8	.. 54.4	333°42.7	.. 16.0	48°00.1	.. 05.3	89°55.1	.. 20.8					Diphda	348°48.9	-17°51.7	
4	66°55.0	247°40.4	53.2	348°44.2	16.1	63°02.9	05.5	104°57.7	20.9					Achernar	335°21.1	-57°07.2	
5	81°57.4	262°40.0	52.0	3°45.6	16.2	78°05.7	05.6	120°00.2	20.9					Hamal	327°53.0	23°34.2	
6	96°59.9	277°39.6	N01°50.7	18°47.1	N22°16.4	93°08.4	\$00°05.7	135°02.8	S16°20.9					Polaris	314°34.8	89°21.4	
7	112°02.3	292°39.2	49.5	33°48.6	16.5	108°11.2	05.9	150°05.4	20.9					Acamar	315°12.9	-40°12.6	
8	127°04.8	307°38.8	48.2	48°50.1	16.7	123°14.0	06.0	165°07.9	21.0					Menkar	314°07.9	4°10.8	
9	142°07.3	322°38.4	.. 47.0	63°51.6	.. 16.8	138°16.8	.. 06.1	180°10.5	.. 21.0					Mirfak	308°30.6	49°56.4	
10	157°09.7	337°38.0	45.7	78°53.0	17.0	153°19.5	06.3	195°13.1	21.0					Aldebaran	290°41.7	16°33.3	
11	172°12.2	352°37.6	44.5	93°54.5	17.1	168°22.3	06.4	210°15.6	21.1					Rigel	281°05.6	-8°10.3	
12	187°14.7	7°37.2	N01°43.2	108°56.0	N22°17.2	183°25.1	\$00°06.5	225°18.2	S16°21.1					Capella	280°24.6	46°01.1	
13	202°17.1	22°36.8	42.0	123°57.5	17.4	198°27.8	06.7	240°20.8	21.1					Bellatrix	278°24.8	6°22.3	
14	217°19.6	37°36.4	40.7	138°59.0	17.5	213°30.6	06.8	255°23.3	21.2					Elnath	278°04.2	28°37.5	
15	232°22.1	52°36.1	.. 39.5	154°00.5	.. 17.7	228°33.4	.. 06.9	270°25.9	.. 21.2					Alnilam	275°39.6	-1°11.1	
16	247°24.5	67°35.7	38.2	169°02.0	17.8	243°36.2	07.1	285°28.4	21.2					Betelgeuse	270°54.1	7°24.8	
17	262°27.0	82°35.3	37.0	184°03.5	17.9	258°38.9	07.2	300°31.0	21.2					Canopus	263°53.2	-52°42.1	
18	277°29.4	97°34.9	N01°35.7	199°05.0	N22°18.1	273°41.7	\$00°07.3	315°33.6	S16°21.3					Sirius	258°27.9	-16°44.6	
19	292°31.9	112°34.5	34.5	214°06.4	18.2	288°44.5	07.5	330°36.1	21.3					Adhara	255°07.4	-28°59.9	
20	307°34.4	127°34.1	33.3	229°07.9	18.4	303°47.2	07.6	345°38.7	21.3					Procyon	244°52.9	5°10.1	
21	322°36.8	142°33.7	.. 32.0	244°09.4	.. 18.5	318°50.0	.. 07.7	0°41.2	.. 21.4					Pollux	243°19.8	27°58.3	
22	337°39.3	157°33.3	30.8	259°10.9	18.6	333°52.8	07.9	15°43.8	21.4					Avisor	234°15.8	-59°34.5	
23	352°41.8	172°32.9	29.5	274°12.4	18.8	348°55.6	08.0	30°46.4	21.4					Suhail	222°48.0	-43°31.1	
Mer.pass.		23:29	ν -0.4° d -1.2' m -3.89			ν 1.5' d 0.1' m -0.58			ν 2.8' d -0.1' m -2.94			ν 2.6' d -0.0' m 0.52					
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	7°44.2	187°32.5	N01°28.3	289°13.9	N22°18.9	3°58.3	\$00°08.1	45°48.9	S16°21.4					Denebola	182°27.2	14°26.9	
1	22°46.7	202°32.1	27.0	304°15.4	19.1	19°01.1	08.3	60°51.5	21.5					Gienah	175°45.9	-17°39.9	
2	37°49.2	217°31.7	25.8	319°16.9	19.2	34°03.9	08.4	75°54.0	21.5					Acrux	173°02.9	-63°13.4	
3	52°51.6	232°31.3	.. 24.5	334°18.4	.. 19.3	49°06.6	.. 08.5	90°56.6	.. 21.5					Gacrux	171°54.4	-57°14.3	
4	67°54.1	247°31.0	23.3	349°19.9	19.5	64°09.4	08.7	105°59.2	21.6					Alioth	166°15.2	55°50.4	
5	82°56.6	262°30.6	22.0	4°21.4	19.6	79°12.2	08.8	121°01.7	21.6					Spica	158°24.6	-11°16.6	
6	97°59.0	277°30.2	N01°20.8	19°22.9	N22°19.8	94°15.0	\$00°08.9	136°04.3	S16°21.6					Alkaid	152°54.0	49°12.2	
7	113°01.5	292°29.8	19.5	34°24.4	19.9	109°17.7	09.1	151°06.8	21.6					Hadar	148°39.3	-60°28.9	
8	128°03.9	307°29.4	18.3	49°25.9	20.0	124°20.5	09.2	166°09.4	21.7					Menkent	148°00.2	-36°28.8	
9	143°06.4	322°29.0	.. 17.0	64°27.4	.. 20.2	139°23.3	.. 09.3	181°12.0	.. 21.7					Arcturus	145°50.0	19°04.1	
10	158°08.9	337°28.6	15.8	79°28.9	20.3	154°26.0	09.5	196°14.5	21.7					Rigil Kent.	139°43.5	-60°55.8	
11	173°11.3	352°28.2	14.5	94°30.5	20.5	169°28.8	09.6	211°17.1	21.8					Kochab	137°20.7	74°03.9	
12	188°13.8	7°27.8	N01°13.3	109°32.0	N22°20.6	184°31.6	\$00°09.7	226°19.6	S16°21.8					Zuben'ubi	136°58.4	-16°08.0	
13	203°16.3	22°27.4	12.0	124°33.5	20.7	199°34.3	09.9	241°22.2	21.8					Alphecca	126°05.6	26°38.5	
14	218°18.7	37°27.0	10.8	139°35.0	20.9	214°37.1	10.0	256°24.8	21.9					Antares	112°18.3	-26°28.9	
15	233°21.2	52°26.6	.. 09.5	154°36.5	.. 21.0	229°39.9	.. 10.1	271°27.3	.. 21.9					Atria	107°14.5	-69°04.3	
16	248°23.7	67°26.3	08.3	169°38.0	21.2	244°42.7	10.3	286°29.9	21.9					Sabik	102°05.1	-15°45.1	
17	263°26.1	82°25.9	07.0	184°39.5	21.3	259°45.4	10.4	301°32.4	21.9					Shaula	96°13.0	-37°07.3	
18	278°28.6	97°25.5	N01°05.8	199°41.0	N22°21.4	274°48.2	\$00°10.5	316°35.0	S16°22.0					Rasalhague	96°00.4	12°32.8	
19	293°31.1	112°25.1	04.5	214°42.5	21.6	289°51.0	10.6	331°37.6	22.0					Eltanin	90°43.1	51°29.4	
20	308°33.5	127°24.7	03.3	229°44.1	21.7	304°53.7	10.8	346°40.1	22.0					Kaus Aust.	83°35.0	-34°22.5	
21	323°36.0	142°24.3	.. 02.0	244°45.6	.. 21.8	319°56.5	.. 10.9	1°42.7	.. 22.0					Vega	80°34.5	38°48.5	
22	338°38.4	157°23.9	01°00.8	259°47.1	22.0	334°59.3	11.0	16°45.2	22.1					Nunki	75°50.1	-26°16.1	
23	353°40.9	172°23.5	00°59.5	274°48.6	22.1	350°02.1	11.2	31°47.8	22.1					Altair	62°01.7	8°55.8	
Mer.pass.		23:25	ν -0.4° d -1.2' m -3.89			ν 1.5' d 0.1' m -0.59			ν 2.8' d -0.1' m -2.94			ν 2.6' d -0.0' m 0.52					
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	8°43.4	187°23.1	N00°58.3	289°50.1	N22°22.3	5°04.8	\$00°11.3	46°50.3	S16°22.1					Fomalhaut	15°16.3	-29°30.1	
1	23°45.8	202°22.7	57.0	304°51.7	22.4	20°07.6	11.4	61°52.9	22.2					Scheat	13°46.7	28°12.5	
2	38°48.3	217°22.3	55.8	319°53.2	22.5	35°10.4	11.6	76°55.5	22.2					Markab	13°31.5	15°19.7	
3	53°50.8	232°22.0	.. 54.5	334°54.7	.. 22.7	50°13.1	.. 11.7	91°58.0	.. 22.2					Sep 28 Wed	SHA	Mer.pass	
4	68°53.2	247°21.6	53.3	349°56.2	22.8	65°15.9	11.8	107°00.6	22.2					Venus	180°56.9	11:30	
5	83°55.7	262°21.2	52.0	4°57.7	22.9	80°18.7	12.0	122°03.1	22.3					Mars	281°53.1	04:45	
6	98°58.2	277°20.8	N00°50.8	19°59.3	N22°23.1	95°21.4	\$00°12.1	137°05.7	S16°22.3					Jupiter	356°06.7	23:44	
7	114°00.6	292°20.4	49.5	35°00.8	23.2	110°24.2	12.2	152°08.2	22.3					Saturn	38°02.3	20:57	
8	129°03.1	307°20.0	48.3	50°02.3	23.4	125°27.0	12.4	167°10.8	22.4					Sep 29 Thu	SHA	Mer.pass	
9	144°05.5	322°19.6	.. 47.0	65°03.9	.. 23.5	140°29.8	.. 12.5	182°13.3	.. 22.4					Venus	179°48.3	11:30	
10	159°08.0	337°19.2	45.8	80°05.4	23.6	155°32.5	12.6	197°15.9	22.4					Mars	281°29.7	04:43	
11	174°10.5	352°18.8	44.5	95°06.9	23.8	170°35.3	12.8	212°18.5	22.4					Jupiter	356°14.1	23:40	
12	189°12.9	7°18.4	N00°43.3	110°08.4	N22°23.9	185°38.1	\$00°12.9	227°21.0	S16°22.5				</				

DUT1 = UT1-UTC = -0.0062 sec  $\Delta T = TT-UT1 = +69.1902$  sec

2022 September 28 to Sep. 30 UT

h		Sun		Moon			
Wed	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	182°17.6	S01°55.8	158°00.5	12.4'	S10°29.7	-14.5'	57.6'
1	197°17.8	56.8	172°31.9	12.4'	10°44.2	-14.4'	57.6'
2	212°18.0	57.7	187°03.3	12.3'	10°58.6	-14.4'	57.6'
3	227°18.2	.. 58.7	201°34.6	12.2'	11°13.0	-14.3'	57.6'
4	242°18.4	01°59.7	216°05.9	12.2'	11°27.3	-14.3'	57.7'
5	257°18.7	02°00.7	230°37.0	12.1'	11°41.6	-14.3'	57.7'
6	272°18.9	S02°01.6	245°08.1	12.0'	S11°55.9	-14.2'	57.7'
7	287°19.1	02.6	259°39.1	11.9'	12°10.1	-14.2'	57.7'
8	302°19.3	03.6	274°10.1	11.9'	12°24.2	-14.1'	57.7'
9	317°19.5	.. 04.6	288°41.0	11.8'	12°38.3	-14.0'	57.8'
10	332°19.7	05.5	303°11.8	11.7'	12°52.4	-14.0'	57.8'
11	347°19.9	06.5	317°42.5	11.6'	13°06.4	-13.9'	57.8'
12	2°20.1	S02°07.5	332°13.1	11.6'	S13°20.3	-13.9'	57.8'
13	17°20.3	08.4	346°43.7	11.5'	13°34.2	-13.8'	57.8'
14	32°20.5	09.4	1°14.2	11.4'	13°48.0	-13.8'	57.9'
15	47°20.7	.. 10.4	15°44.6	11.3'	14°01.7	-13.7'	57.9'
16	62°21.0	11.4	30°14.9	11.2'	14°15.4	-13.6'	57.9'
17	77°21.2	12.3	44°45.1	11.2'	14°29.1	-13.6'	57.9'
18	92°21.4	S02°13.3	59°15.3	11.1'	S14°42.6	-13.5'	57.9'
19	107°21.6	14.3	73°45.3	11.0'	14°56.1	-13.4'	57.9'
20	122°21.8	15.3	88°15.3	10.9'	15°09.6	-13.4'	58.0'
21	137°22.0	.. 16.2	102°45.2	10.8'	15°22.9	-13.3'	58.0'
22	152°22.2	17.2	117°15.0	10.7'	15°36.2	-13.2'	58.0'
23	167°22.4	18.2	131°44.7	10.6'	15°49.4	-13.1'	58.0'
SD = 16.0'		SD = 15.7'					
Thu	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	182°22.6	S02°19.1	146°14.4	10.5'	S16°02.5	-13.1'	58.0'
1	197°22.8	20.1	160°43.9	10.5'	16°15.6	-13.0'	58.1'
2	212°23.0	21.1	175°13.4	10.4'	16°28.6	-12.9'	58.1'
3	227°23.2	.. 22.1	189°42.7	10.3'	16°41.5	-12.8'	58.1'
4	242°23.5	23.0	204°12.0	10.2'	16°54.3	-12.7'	58.1'
5	257°23.7	24.0	218°41.2	10.1'	17°07.0	-12.7'	58.1'
6	272°23.9	S02°25.0	233°10.3	10.0'	S17°19.7	-12.6'	58.1'
7	287°24.1	26.0	247°39.3	9.9'	17°32.3	-12.5'	58.2'
8	302°24.3	26.9	262°08.2	9.8'	17°44.7	-12.4'	58.2'
9	317°24.5	.. 27.9	276°37.0	9.7'	17°57.1	-12.3'	58.2'
10	332°24.7	28.9	291°05.7	9.6'	18°09.4	-12.2'	58.2'
11	347°24.9	29.8	305°34.3	9.5'	18°21.6	-12.1'	58.2'
12	2°25.1	S02°30.8	320°02.8	9.4'	S18°33.8	-12.0'	58.2'
13	17°25.3	31.8	334°31.3	9.3'	18°45.8	-11.9'	58.2'
14	32°25.5	32.8	348°59.6	9.2'	18°57.7	-11.8'	58.3'
15	47°25.7	.. 33.7	3°27.8	9.1'	19°09.5	-11.7'	58.3'
16	62°25.9	34.7	17°56.0	9.0'	19°21.2	-11.6'	58.3'
17	77°26.1	35.7	32°24.0	8.9'	19°32.9	-11.5'	58.3'
18	92°26.4	S02°36.6	46°51.9	8.8'	S19°44.4	-11.4'	58.3'
19	107°26.6	37.6	61°19.8	8.7'	19°55.8	-11.3'	58.3'
20	122°26.8	38.6	75°47.5	8.6'	20°07.1	-11.2'	58.4'
21	137°27.0	.. 39.6	90°15.2	8.5'	20°18.3	-11.1'	58.4'
22	152°27.2	40.5	104°42.7	8.4'	20°29.4	-11.0'	58.4'
23	167°27.4	41.5	119°10.2	8.3'	20°40.3	-10.9'	58.4'
SD = 16.0'		SD = 15.8'					
Fri	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	182°27.6	S02°42.5	133°37.5	8.3'	S20°51.2	-10.7'	58.4'
1	197°27.8	43.4	148°04.8	8.2'	21°01.9	-10.6'	58.4'
2	212°28.0	44.4	162°31.9	8.1'	21°12.6	-10.5'	58.4'
3	227°28.2	.. 45.4	176°59.0	8.0'	21°23.1	-10.4'	58.5'
4	242°28.4	46.4	191°25.9	7.9'	21°33.5	-10.3'	58.5'
5	257°28.6	47.3	205°52.8	7.8'	21°43.8	-10.1'	58.5'
6	272°28.8	S02°48.3	220°19.5	7.7'	S21°53.9	-10.0'	58.5'
7	287°29.0	49.3	234°46.2	7.6'	22°03.9	-9.9'	58.5'
8	302°29.2	50.2	249°12.7	7.5'	22°13.8	-9.8'	58.5'
9	317°29.4	.. 51.2	263°39.2	7.4'	22°23.6	-9.6'	58.5'
10	332°29.6	52.2	278°05.6	7.3'	22°33.2	-9.5'	58.6'
11	347°29.8	53.1	292°31.8	7.2'	22°42.7	-9.4'	58.6'
12	2°30.0	S02°54.1	306°58.0	7.1'	S22°52.1	-9.2'	58.6'
13	17°30.2	55.1	321°24.1	7.0'	23°01.4	-9.1'	58.6'
14	32°30.5	56.1	335°50.0	6.9'	23°10.5	-9.0'	58.6'
15	47°30.7	.. 57.0	350°15.9	6.8'	23°19.4	-8.8'	58.6'
16	62°30.9	58.0	4°41.7	6.7'	23°28.3	-8.7'	58.6'
17	77°31.1	59.0	19°07.4	6.6'	23°37.0	-8.6'	58.6'
18	92°31.3	S02°59.9	33°33.0	6.5'	S23°45.5	-8.4'	58.7'
19	107°31.5	03°00.9	47°58.5	6.4'	23°53.9	-8.3'	58.7'
20	122°31.7	01.9	62°23.9	6.3'	24°02.2	-8.1'	58.7'
21	137°31.9	.. 02.9	76°49.2	6.2'	24°10.3	-8.0'	58.7'
22	152°32.1	03.8	91°14.4	6.1'	24°18.3	-7.8'	58.7'
23	167°32.3	04.8	105°39.6	6.0'	24°26.1	-7.7'	58.7'
SD = 16.0'		SD = 15.9'					

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

## October 01, 02, 03 UT (Sat., Sun., Mon.)

Aries		Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	9°42.5	187°13.7	N00°28.3	290°26.9	N22°25.5	6°11.3	\$00°14.5	47°51.7	S16°22.8
1	24°45.0	202°13.3	27.0	305°28.4	25.7	21°14.1	14.6	62°54.2	22.8
2	39°47.4	217°13.0	25.7	320°30.0	25.8	36°16.8	14.7	77°56.8	22.8
3	54°49.9	232°12.6	24.5	335°31.5	25.9	51°19.6	14.9	92°59.3	22.9
4	69°52.4	247°12.2	23.2	350°33.1	26.1	66°22.4	15.0	108°01.9	22.9
5	84°54.8	262°11.8	22.0	5°34.6	26.2	81°25.2	15.1	123°04.4	22.9
6	99°57.3	277°11.4	N00°20.7	20°36.1	N22°26.3	96°27.9	\$00°15.3	138°07.0	S16°22.9
7	114°59.8	292°11.0	19.5	35°37.7	26.5	111°30.7	15.4	153°09.5	23.0
8	130°02.2	307°10.6	18.2	50°39.2	26.6	126°33.5	15.5	168°12.1	23.0
9	145°04.7	322°10.2	17.0	65°40.8	26.7	141°36.2	15.7	183°14.6	23.0
10	160°07.2	337°09.8	15.7	80°42.3	26.9	156°39.0	15.8	198°17.2	23.1
11	175°09.6	352°09.4	14.5	95°43.9	27.0	171°41.8	15.9	213°19.7	23.1
12	190°12.1	7°09.0	N00°13.2	110°45.5	N22°27.1	186°44.5	\$00°16.0	228°22.3	S16°23.1
13	205°14.5	22°08.7	12.0	125°47.0	27.3	201°47.3	16.2	243°24.8	23.1
14	220°17.0	37°08.3	10.7	140°48.6	27.4	216°50.1	16.3	258°27.4	23.2
15	235°19.5	52°07.9	09.5	155°50.1	27.5	231°52.8	16.4	273°29.9	23.2
16	250°21.9	67°07.5	08.2	170°51.7	27.7	246°55.6	16.6	288°32.5	23.2
17	265°24.4	82°07.1	07.0	185°53.2	27.8	261°58.4	16.7	303°35.0	23.2
18	280°26.9	97°06.7	N00°05.7	200°54.8	N22°27.9	277°01.2	\$00°16.8	318°37.6	S16°23.3
19	295°29.3	112°06.3	04.4	215°56.4	28.1	292°03.9	17.0	333°40.2	23.3
20	310°31.8	127°05.9	03.2	230°57.9	28.2	307°06.7	17.1	348°42.7	23.3
21	325°34.3	142°05.5	01.9	245°59.5	28.3	322°09.5	17.2	3°45.3	23.3
22	340°36.7	157°05.1	N00°00.7	261°01.0	28.5	337°12.2	17.4	18°47.8	23.4
23	355°39.2	172°04.7	S00°00.6	276°02.6	28.6	352°15.0	17.5	33°50.4	23.4
Mer.pass. 23:17		ν -0.4° d -1.3° m -3.89		ν 1.5° d 0.1° m -0.63		ν 2.8° d -0.1° m -2.94		ν 2.6° d -0.0° m 0.53	

Stars		
	SHA	Dec
Alpheratz	357°36.4	29°13.0
Ankaa	353°08.6	-42°10.9
Schedar	349°32.6	56°39.7
Diphda	348°48.9	-17°51.7
Achernar	335°21.0	-57°07.2
Hamal	327°53.0	23°34.2
Polaris	314°33.4	89°21.4
Acamar	315°12.9	-40°12.6
Menkar	314°07.9	4°10.8
Mirfak	308°30.6	49°56.4
Aldebaran	290°41.6	16°33.3
Rigel	281°05.6	-8°10.3
Capella	280°24.5	46°01.1
Bellatrix	278°24.8	6°22.3
Elnath	278°04.2	28°37.5
Alnilam	275°39.6	-1°11.1
Betelgeuse	270°54.1	7°24.8
Canopus	263°53.2	-52°42.1
Sirius	258°27.9	-16°44.6
Adhara	255°07.4	-28°59.9
Procyon	244°52.9	5°10.1
Pollux	243°19.7	27°58.3
Avior	234°15.8	-59°34.5
Suhail	222°48.0	-43°31.1
Miaplacidus	221°39.2	-69°48.2
Alphard	217°49.8	-8°45.2
Regulus	207°36.7	11°51.5
Dubhe	193°43.9	61°37.7
Denebola	182°27.2	14°26.9
Gienah	175°45.9	-17°39.9
Acrux	173°02.9	-63°13.3
Gacrux	171°54.3	-57°14.3
Alioth	166°15.2	55°50.3
Spica	158°24.6	-11°16.6
Alkaid	152°54.0	49°12.2
Hadar	148°39.3	-60°28.9
Menkent	148°00.2	-36°28.8
Arcturus	145°50.0	19°04.1
Rigil Kent.	139°43.5	-60°55.7
Kochab	137°20.7	74°03.9
Zuben'ubi	136°58.4	-16°08.0
Alphecca	126°05.6	26°38.5
Antares	112°18.3	-26°28.9
Atria	107°14.5	-69°04.3
Sabik	102°05.1	-15°45.1
Shaula	96°13.1	-37°07.3
Rasalhague	96°00.4	12°32.8
Eltanin	90°43.2	51°29.4
Kaus Aust.	83°35.1	-34°22.5
Vega	80°34.5	38°48.5
Nunki	75°50.1	-26°16.1
Altair	62°01.7	8°55.8
Peacock	53°08.4	-56°39.9
Deneb	49°26.9	45°21.9
Enif	33°40.4	9°58.9
Al Na'ir	27°34.9	-46°51.2
Fomalhaut	15°16.3	-29°30.1
Scheat	13°46.7	28°12.5
Markab	13°31.5	15°19.7
Oct 01 Sat	SHA	Mer.pass
Venus	177°31.2	11:31
Mars	280°44.4	04:38
Jupiter	356°28.8	23:31
Saturn	38°09.2	20:45
Oct 02 Sun	SHA	Mer.pass
Venus	176°22.7	11:32
Mars	280°22.5	04:35
Jupiter	356°36.1	23:26
Saturn	38°11.2	20:41
Oct 03 Mon	SHA	Mer.pass
Venus	175°14.2	11:33
Mars	280°01.2	04:33
Jupiter	356°43.4	23:22
Saturn	38°13.3	20:37
Horizontal parallax		
Venus:	0.1	
Mars:	0.2	

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	11°40.8	186°55.0	S00°31.9	291°42.0	N22°31.9	8°24.2	\$00°20.7	49°54.0	S16°24.0
1	26°43.3	201°54.6	33.2	306°43.6	32.0	23°27.0	20.9	64°56.6	24.0
2	41°45.7	216°54.2	34.4	321°45.2	32.1	38°29.7	21.0	79°59.1	24.1
3	56°48.2	231°53.8	35.7	336°46.8	32.3	53°32.5	21.1	95°01.7	24.1
4	71°50.6	246°53.4	36.9	351°48.4	32.4	68°35.3	21.3	110°04.2	24.1
5	86°53.1	261°53.0	38.2	6°50.0	32.5	83°38.0	21.4	125°06.8	24.1
6	101°55.6	276°52.6	S00°39.4	21°51.6	N22°32.7	98°40.8	\$00°21.5	140°09.3	S16°24.2
7	116°58.0	291°52.2	40.7	36°53.2	32.8	113°43.6	21.6	155°11.9	24.2
8	132°00.5	306°51.8	42.0	51°54.8	32.9	128°46.3	21.8	170°14.4	24.2
9	147°03.0	321°51.4	43.2	66°56.4	33.0	143°49.1	21.9	185°17.0	24.2
10	162°05.4	336°51.1	44.5	81°58.0	33.2	158°51.9	22.0	200°19.5	24.3
11	177°07.9	351°50.7	45.7	96°59.6	33.3	173°54.6	22.2	215°22.0	24.3
12	192°10.4	6°50.3	S00°47.0	112°01.2	N22°33.4	188°57.4	\$00°22.3	230°24.6	S16°24.3
13	207°12.8	21°49.9	48.2	127°02.8	33.6	204°00.2	22.4	245°27.1	24.3
14	222°15.3	36°49.5	49.5	142°04.4	33.7	219°02.9	22.5	260°29.7	24.3
15	237°17.8	51°49.1	50.7	157°06.0	33.8	234°05.7	22.7	275°32.2	24.4
16	252°20.2	66°48.7	52.0	172°07.6	33.9	249°08.5	22.8	290°34.8	24.4
17	267°22.7	81°48.3	53.2	187°09.2	34.1	264°11.2	22.9	305°37.3	24.4
18	282°25.1	96°47.9	S00°54.5	202°10.8	N22°34.2	279°14.0	\$00°23.1	320°39.6	S16°24.4
19	297°27.6	111°47.5	55.8	217°12.4	34.3	294°16.8	23.2	335°42.4	24.5
20	312°30.1	126°47.1	57.0	232°14.0	34.5	309°19.5	23.3	350°44.9	24.5
21	327°32.5	141°46.7	58.3	247°15.6	34.6	324°22.3	23.4	5°47.5	24.5
22	342°35.0	156°46.4	00°59.5	262°17.2	34.7	339°25.1	23.6	20°50.0	24.5
23	357°37.5	171°46.0	01°00.8	277°18.8	34.8	354°27.8	23.7	35°52.6	24.6
Mer.pass. 23:09		ν -0.4° d -1.3° m -3.89		ν 1.6° d 0.1° m -0.66		ν 2.8° d -0.1° m -2.93		ν 2.5° d -0.0° m 0.54	

DUT1 = UT1-UTC = -0.0065 sec  $\Delta T = TT-UT1 = +69.1905$  sec

2022 October 01 to Oct. 03 UT

h		Sun		Moon				
Sat		GHA	Dec	GHA	$\nu$	Dec	d	HP
0	182°32.5	S03°05.8	120°04.6	6.0'	S24°33.8	-7.5'	58.7'	
1	197°32.7	06.7	134°29.6	5.9'	24°41.3	-7.4'	58.7'	
2	212°32.9	07.7	148°54.4	5.8'	24°48.6	-7.2'	58.8'	
3	227°33.1	.. 08.7	163°19.2	5.7'	24°55.9	-7.1'	58.8'	
4	242°33.3	09.6	177°43.9	5.6'	25°02.9	-6.9'	58.8'	
5	257°33.5	10.6	192°08.5	5.5'	25°09.8	-6.7'	58.8'	
6	272°33.7	S03°11.6	206°33.1	5.4'	S25°16.5	-6.6'	58.8'	
7	287°33.9	12.6	220°57.5	5.4'	25°23.1	-6.4'	58.8'	
8	302°34.1	13.5	235°21.9	5.3'	25°29.5	-6.3'	58.8'	
9	317°34.3	.. 14.5	249°46.2	5.2'	25°35.8	-6.1'	58.8'	
10	332°34.5	15.5	264°10.4	5.1'	25°41.9	-5.9'	58.8'	
11	347°34.7	16.4	278°34.5	5.1'	25°47.8	-5.8'	58.9'	
12	2°34.9	S03°17.4	292°58.6	5.0'	S25°53.6	-5.6'	58.9'	
13	17°35.1	18.4	307°22.6	4.9'	25°59.2	-5.4'	58.9'	
14	32°35.3	19.3	321°46.5	4.8'	26°04.6	-5.3'	58.9'	
15	47°35.5	.. 20.3	336°10.3	4.8'	26°09.9	-5.1'	58.9'	
16	62°35.7	21.3	350°34.1	4.7'	26°15.0	-4.9'	58.9'	
17	77°35.9	22.2	4°57.8	4.6'	26°19.9	-4.7'	58.9'	
18	92°36.1	S03°23.2	19°21.5	4.6'	S26°24.6	-4.6'	58.9'	
19	107°36.3	24.2	33°45.0	4.5'	26°29.2	-4.4'	58.9'	
20	122°36.5	25.2	48°08.6	4.5'	26°33.6	-4.2'	58.9'	
21	137°36.7	.. 26.1	62°32.0	4.4'	26°37.8	-4.0'	59.0'	
22	152°36.9	27.1	76°55.4	4.3'	26°41.9	-3.9'	59.0'	
23	167°37.1	28.1	91°18.8	4.3'	26°45.7	-3.7'	59.0'	
SD = 16.0'		SD = 16.0'						

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

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

Day	Sun		Mer.	Moon	
	Eqn.of Time	Mer. Pass		Mer. Pass	Age
	00 <sup>h</sup>	12 <sup>h</sup>	Pass	Lower	6-8
	mm:ss	mm:ss	hh:mm	hh:mm	28-50%
01	10:10	10:20	11:50	16:39	04:09
02	10:29	10:39	11:49	17:41	05:10
03	10:48	10:58	11:49	18:43	06:12

## October 04, 05, 06 UT (Tue., Wed., Thu.)

Aries Venus Mars Jupiter Saturn Stars										SHA	Dec	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Alpheratz	357°36.4	
0	12°39.9	186°45.6	\$01°02.0	292°20.4	N22°35.0	9°30.6	\$00°23.8	50°55.1	S16°24.6	Ankaa	353°08.6	
1	27°42.4	201°45.2	03.3	307°22.1	35.1	24°33.4	24.0	65°57.6	24.6	Schedar	349°32.6	
2	42°44.9	216°44.8	04.5	322°23.7	35.2	39°36.1	24.1	81°00.2	24.6	Diphda	348°48.9	
3	57°47.3	231°44.4	.. 05.8	337°25.3	.. 35.4	54°38.9	.. 24.2	96°02.7	.. 24.6	Achernar	335°21.0	
4	72°49.8	246°44.0	07.1	352°26.9	35.5	69°41.7	24.3	111°05.3	24.7	Hamal	327°53.0	
5	87°52.3	261°43.6	08.3	7°28.5	35.6	84°44.4	24.5	126°07.8	24.7	Polaris	314°32.3	
6	102°54.7	276°43.2	\$01°09.6	22°30.1	N22°35.7	99°47.2	\$00°24.6	141°10.4	S16°24.7	Acamar	315°12.9	
7	117°57.2	291°42.8	10.8	37°31.8	35.9	114°50.0	24.7	156°12.9	24.7	Menkar	314°07.9	
8	132°59.6	306°42.4	12.1	52°33.4	36.0	129°52.7	24.9	171°15.4	24.8	Mirfak	308°30.6	
9	148°02.1	321°42.0	.. 13.3	67°35.0	.. 36.1	144°55.5	.. 25.0	186°18.0	.. 24.8	Aldebaran	290°41.6	
10	163°04.6	336°41.6	14.6	82°36.6	36.3	159°58.2	25.1	201°20.5	24.8	Rigel	281°05.5	
11	178°07.0	351°41.3	15.8	97°38.2	36.4	175°01.0	25.2	216°23.1	24.8	Capella	280°24.5	
12	193°09.5	6°40.9	\$01°17.1	112°39.9	N22°36.5	190°03.8	\$00°25.4	231°25.6	S16°24.9	Bellatrix	278°24.8	
13	208°12.0	21°40.5	18.3	127°41.5	36.6	205°06.5	25.5	246°28.1	24.9	Elnath	278°04.1	
14	223°14.4	36°40.1	19.6	142°43.1	36.8	220°09.3	25.6	261°30.7	24.9	Alnilam	275°39.5	
15	238°16.9	51°39.7	.. 20.9	157°44.7	.. 36.9	235°12.1	.. 25.8	276°33.2	.. 24.9	Betelgeuse	270°54.0	
16	253°19.4	66°39.3	22.1	172°46.4	37.0	250°14.8	25.9	291°35.8	24.9	Canopus	263°53.2	
17	268°21.8	81°38.9	23.4	187°48.0	37.1	265°17.6	26.0	306°38.3	25.0	Sirius	258°27.9	
18	283°24.3	96°38.5	\$01°24.6	202°49.6	N22°37.3	280°20.4	\$00°26.1	321°40.8	S16°25.0	Adhara	255°07.4	
19	298°26.8	111°38.1	25.9	217°51.3	37.4	295°23.1	26.3	336°43.4	25.0	Procyon	244°52.9	
20	313°29.2	126°37.7	27.1	232°52.9	37.5	310°25.9	26.4	351°45.9	25.0	Pollux	243°19.7	
21	328°31.7	141°37.3	.. 28.4	247°54.5	.. 37.6	325°28.7	.. 26.5	6°48.5	.. 25.1	Avior	234°15.7	
22	343°34.1	156°36.9	29.6	262°56.2	37.8	340°31.4	26.7	21°51.0	25.1	Suhail	222°47.9	
23	358°36.6	171°36.5	30.9	277°57.8	37.9	355°34.2	26.8	36°53.5	25.1	Miaplacidus	221°39.2	
Mer.pass. 23:06		ν -0.4° d -1.3' m -3.89	ν 1.6° d 0.1° m -0.68	ν 2.8° d -0.1° m -2.93	ν 2.5° d -0.0° m 0.55	Alphard		217°49.8	-8°45.2	Regulus	207°36.7	
Wed		GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Dubhe	193°43.9
0	13°39.1	186°36.1	\$01°32.2	292°59.4	N22°38.0	10°37.0	\$00°26.9	51°56.1	S16°25.1	Denebola	182°27.2	
1	28°41.5	201°35.7	33.4	308°01.1	38.1	25°39.7	27.0	66°58.6	25.1	Gienah	175°45.9	
2	43°44.0	216°35.4	34.7	323°02.7	38.3	40°42.5	27.2	82°01.2	25.2	Acrux	173°02.9	
3	58°46.5	231°35.0	.. 35.9	338°04.4	.. 38.4	55°45.2	.. 27.3	97°03.7	.. 25.2	Gacrux	171°54.3	
4	73°48.9	246°34.6	37.2	353°06.0	38.5	70°48.0	27.4	112°06.2	25.2	Alioth	166°15.2	
5	88°51.4	261°34.2	38.4	8°07.6	38.7	85°50.8	27.5	127°08.8	25.2	Spica	158°24.6	
6	103°53.9	276°33.8	\$01°39.7	23°09.3	N22°38.8	100°53.5	\$00°27.7	142°11.3	S16°25.2	Alkaid	152°54.0	
7	118°56.3	291°33.4	40.9	38°10.9	38.9	115°56.3	27.8	157°13.8	25.3	Hadar	148°39.3	
8	133°58.8	306°33.0	42.2	53°12.6	39.0	130°59.1	27.9	172°16.4	25.3	Menkent	148°00.2	
9	149°01.2	321°32.6	.. 43.4	68°14.2	.. 39.2	146°01.8	.. 28.1	187°18.9	.. 25.3	Arcturus	145°50.0	
10	164°03.7	336°32.2	44.7	83°15.9	39.3	161°04.6	28.2	202°21.4	25.3	Rigel Kent.	139°43.5	
11	179°06.2	351°31.8	46.0	98°17.5	39.4	176°07.3	28.3	217°24.0	25.4	Kochab	137°20.8	
12	194°08.6	6°31.4	\$01°47.2	113°19.2	N22°39.5	191°10.1	\$00°28.4	232°26.5	S16°25.4	Zuben'ubi	136°58.4	
13	209°11.1	21°31.0	48.5	128°20.8	39.7	206°12.9	28.6	247°29.1	25.4	Alphecca	126°05.6	
14	224°13.6	36°30.6	49.7	143°22.5	39.8	221°15.6	28.7	262°31.6	25.4	Antares	112°18.4	
15	239°16.0	51°30.2	.. 51.0	158°24.1	.. 39.9	236°18.4	.. 28.8	277°34.1	.. 25.4	Atria	107°14.5	
16	254°18.5	66°29.8	52.2	173°25.8	40.0	251°21.2	28.9	292°36.7	25.5	Sabik	102°05.1	
17	269°21.0	81°29.4	53.5	188°27.4	40.2	266°23.9	29.1	307°39.2	25.5	Shaula	96°13.1	
18	284°23.4	96°29.0	\$01°54.7	203°29.1	N22°40.3	281°26.7	\$00°29.2	322°41.7	S16°25.5	Rasalhague	96°00.4	
19	299°25.9	111°28.6	56.0	218°30.7	40.4	296°29.5	29.3	337°44.3	25.5	Eltanin	90°43.2	
20	314°28.4	126°28.3	57.2	233°32.4	40.5	311°32.2	29.4	352°46.8	25.5	Kaus Aust.	83°35.1	
21	329°30.8	141°27.9	.. 58.5	248°34.1	.. 40.7	326°35.0	.. 29.6	7°49.3	.. 25.6	Vega	80°34.5	
22	344°33.3	156°27.5	01°59.8	263°35.7	40.8	341°37.7	29.7	22°51.9	25.6	Nunki	75°50.1	
23	359°35.7	171°27.1	02°01.0	278°37.4	40.9	356°40.5	29.8	37°54.4	25.6	Altair	62°01.7	
Mer.pass. 23:02		ν -0.4° d -1.3' m -3.89	ν 1.6° d 0.1° m -0.70	ν 2.8° d -0.1° m -2.93	ν 2.5° d -0.0° m 0.55	Peacock		53°08.5	-56°39.9	Deneb	49°26.9	
Thu		GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Enif	33°40.4
0	14°38.2	186°26.7	\$02°02.3	293°39.0	N22°41.0	11°43.3	\$00°30.0	52°56.9	S16°25.6	AI Na'ir	27°34.9	
1	29°40.7	201°26.3	03.5	308°40.7	41.1	26°46.0	30.1	67°59.5	25.6	Fomalhaut	15°16.3	
2	44°43.1	216°25.9	04.8	323°42.4	41.3	41°48.8	30.2	83°02.0	25.7	Scheat	13°46.7	
3	59°45.6	231°25.5	.. 06.0	338°44.0	.. 41.4	56°51.5	.. 30.3	98°04.6	.. 25.7	Markab	13°31.5	
4	74°48.1	246°25.1	07.3	353°45.7	41.5	71°54.3	30.5	113°07.1	25.7	Oct 04 Tue	SHA	Mer.pass
5	89°50.5	261°24.7	08.5	8°47.4	41.6	86°57.1	30.6	128°09.6	25.7	Venus	174°05.6	11:33
6	104°53.0	276°24.3	\$02°09.8	23°49.0	N22°41.8	101°59.8	\$00°30.7	143°12.2	S16°25.7	Mars	179°40.5	04:30
7	119°55.5	291°23.9	11.0	38°50.7	41.9	117°02.6	30.8	158°14.7	25.8	Jupiter	356°50.7	23:18
8	134°57.9	306°23.5	12.3	53°52.4	42.0	132°05.4	31.0	173°17.2	25.8	Saturn	38°15.2	20:33
9	150°00.4	321°23.1	.. 13.5	68°54.0	.. 42.1	147°08.1	.. 31.1	188°19.8	.. 25.8	Oct 05 Wed	SHA	Mer.pass
10	165°02.9	336°22.7	14.8	83°55.7	42.3	162°10.9	31.2	203°22.3	25.8	Venus	172°57.1	11:34
11	180°05.3	351°22.3	16.1	98°57.4	42.4	177°13.6	31.3	218°24.8	25.8	Mars	279°20.4	04:28
12	195°07.8	6°21.9	\$02°17.3	113°59.1	N22°42.5	192°16.4	\$00°31.5	233°27.4	S16°25.9	Jupiter	356°57.9	23:13
13	210°10.2	21°21.5	18.6	129°00.7	42.6	207°19.2	31.6	248°29.9	25.9	Saturn	38°17.0	20:29
14	225°12.7	36°21.1	19.8	144°02.4	42.8	222°21.9	31.7	263°32.4	25.9	Oct 06 Thu	SHA	Mer.pass
15	240°15.2	51°20.7	.. 21.1	159°04.1	.. 42.9	237°24.7	.. 31.8	278°35.0	.. 25.9	Venus	171°48.5	11:35
16	255°17.6	66°20.3	22.3	174°05.8	43.0	252°27.4	32.0	293°37.5	25.9	Mars	279°00.8	04:25
17	270°20.1	81°19.9	23.6	189°07.4	43.1	267°30.2	32.1	308°40.0	26.0	Jupiter	357°05.1	23:09
18	285°22.6	96°19.5	\$02°24.8	204°09.1	N22°43.2	282°33.0	\$00°32.2	323°42.5	S16°26.0	Saturn	38°18.7	20:25
19	300°25.0	111°19.1	26.1	219°10.8	43.4	297°35.7	32.3	338°45.1	26.0	Horizontal parallax	Venus:	0.1
20	315°27.5	126°18.7	27.3	234°12.5	43.5	312°38.5	32.5	353°47.6	26.0	Mars:	0.2	
21	330°30.0	141°18.4	.. 28.6	249°14.2	.. 43.6	327°41.2	.. 32.6	8°50.1	.. 26.0			
22	345°32.4	156°18.0	29.8	264°15.9	43.7	342°44.0	32.7	23°52.7	26.1			
23	0°34.9	171°17.6	31.1	279°17.5	43.9	357°46.8	32.8	38°55.2	26.1			
Mer.pass. 22:58		ν -0.4° d -1.3' m -3.89	ν 1.7° d 0.1° m -0.71	ν 2.8° d -0.1° m -2.93	ν 2.5° d -0.0° m 0.56							

DUT1 = UT1-UTC = -0.0057 sec  $\Delta T = TT-UT1 = +69.1897$  sec

2022 October 04 to Oct. 06 UT

h		Sun		Moon			
Tue	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	182°46.8	S04°15.4	75°59.6	4.4'	S26°08.7	5.4'	59.3'
1	197°47.0	16.4	90°23.0	4.4'	26°03.4	5.5'	59.3'
2	212°47.2	17.3	104°46.4	4.5'	25°57.8	5.7'	59.3'
3	227°47.3	18.3	119°09.9	4.5'	25°52.1	5.9'	59.3'
4	242°47.5	19.3	133°33.4	4.6'	25°46.2	6.1'	59.3'
5	257°47.7	20.2	147°57.0	4.7'	25°40.2	6.2'	59.3'
6	272°47.9	S04°21.2	162°20.7	4.7'	S25°33.9	6.4'	59.3'
7	287°48.1	22.2	176°44.4	4.8'	25°27.5	6.6'	59.3'
8	302°48.3	23.1	191°08.2	4.9'	25°20.9	6.7'	59.3'
9	317°48.5	24.1	205°32.1	4.9'	25°14.2	6.9'	59.3'
10	332°48.7	25.1	219°56.0	5.0'	25°07.3	7.1'	59.3'
11	347°48.9	26.0	234°20.0	5.1'	25°00.2	7.2'	59.3'
12	2°49.1	S04°27.0	248°44.1	5.1'	S24°53.0	7.4'	59.3'
13	17°49.3	27.9	263°08.2	5.2'	24°45.6	7.6'	59.3'
14	32°49.5	28.9	277°32.5	5.3'	24°38.0	7.7'	59.3'
15	47°49.7	29.9	291°56.8	5.4'	24°30.2	7.9'	59.3'
16	62°49.8	30.8	306°21.1	5.5'	24°22.4	8.1'	59.3'
17	77°50.0	31.8	320°45.6	5.5'	24°14.3	8.2'	59.3'
18	92°50.2	S04°32.8	335°10.1	5.6'	S24°06.1	8.4'	59.3'
19	107°50.4	33.7	349°34.7	5.7'	23°57.7	8.5'	59.3'
20	122°50.6	34.7	3°59.4	5.8'	23°49.2	8.7'	59.3'
21	137°50.8	35.6	18°24.2	5.9'	23°40.5	8.8'	59.3'
22	152°51.0	36.6	32°49.1	5.9'	23°31.7	9.0'	59.3'
23	167°51.2	37.6	47°14.0	6.0'	23°22.7	9.1'	59.3'
SD = 16.0'		SD = 16.2'					

Wed	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	182°51.4	S04°38.5	61°39.0	6.1'	S23°13.6	9.3'	59.3'
1	197°51.6	39.5	76°04.1	6.2'	23°04.3	9.4'	59.3'
2	212°51.8	40.5	90°29.3	6.3'	22°54.9	9.6'	59.3'
3	227°51.9	41.4	104°54.6	6.4'	22°45.4	9.7'	59.3'
4	242°52.1	42.4	119°20.0	6.5'	22°35.7	9.8'	59.3'
5	257°52.3	43.3	133°45.5	6.5'	22°25.8	10.0'	59.3'
6	272°52.5	S04°44.3	148°11.0	6.6'	S22°15.8	10.1'	59.3'
7	287°52.7	45.3	162°36.6	6.7'	22°05.7	10.3'	59.3'
8	302°52.9	46.2	177°02.4	6.8'	21°55.4	10.4'	59.3'
9	317°53.1	47.2	191°28.2	6.9'	21°45.0	10.5'	59.3'
10	332°53.3	48.2	205°54.1	7.0'	21°34.5	10.7'	59.3'
11	347°53.5	49.1	220°20.1	7.1'	21°23.8	10.8'	59.3'
12	2°53.6	S04°50.1	234°46.2	7.2'	S21°13.0	10.9'	59.3'
13	17°53.8	51.0	249°12.4	7.3'	21°02.1	11.1'	59.3'
14	32°54.0	52.0	263°38.6	7.4'	20°51.1	11.2'	59.2'
15	47°54.2	53.0	278°05.0	7.5'	20°39.9	11.3'	59.2'
16	62°54.4	53.9	292°31.4	7.5'	20°28.6	11.4'	59.2'
17	77°54.6	54.9	306°58.0	7.6'	20°17.2	11.5'	59.2'
18	92°54.8	S04°55.8	321°24.6	7.7'	S20°05.6	11.7'	59.2'
19	107°55.0	56.8	335°51.4	7.8'	19°53.9	11.8'	59.2'
20	122°55.1	57.8	350°18.2	7.9'	19°42.2	11.9'	59.2'
21	137°55.3	58.7	4°45.1	8.0'	19°30.3	12.0'	59.2'
22	152°55.5	04°59.7	19°12.1	8.1'	19°18.2	12.1'	59.2'
23	167°55.7	05°00.6	33°39.2	8.2'	19°06.1	12.2'	59.2'
SD = 16.0'		SD = 16.2'					

Thu	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	182°55.9	S05°01.6	48°06.4	8.3'	S18°53.9	12.3'	59.2'
1	197°56.1	02.6	62°33.7	8.4'	18°41.5	12.5'	59.2'
2	212°56.3	03.5	77°01.0	8.5'	18°29.1	12.6'	59.2'
3	227°56.5	04.5	91°28.5	8.5'	18°16.5	12.7'	59.2'
4	242°56.6	05.4	105°56.0	8.6'	18°03.9	12.8'	59.2'
5	257°56.8	06.4	120°23.7	8.7'	17°51.1	12.9'	59.2'
6	272°57.0	S05°07.4	134°51.4	8.8'	S17°38.2	13.0'	59.2'
7	287°57.2	08.3	149°19.2	8.9'	17°25.3	13.1'	59.2'
8	302°57.4	09.3	163°47.1	9.0'	17°12.2	13.2'	59.1'
9	317°57.6	10.2	178°15.1	9.1'	16°59.1	13.3'	59.1'
10	332°57.7	11.2	192°43.2	9.2'	16°45.8	13.3'	59.1'
11	347°57.9	12.1	207°11.4	9.3'	16°32.5	13.4'	59.1'
12	2°58.1	S05°13.1	221°39.6	9.3'	S16°19.0	13.5'	59.1'
13	17°58.3	14.1	236°08.0	9.4'	16°05.5	13.6'	59.1'
14	32°58.5	15.0	250°36.4	9.5'	15°51.9	13.7'	59.1'
15	47°58.7	16.0	265°04.9	9.6'	15°38.2	13.8'	59.1'
16	62°58.9	16.9	279°33.5	9.7'	15°24.4	13.9'	59.1'
17	77°59.0	17.9	294°02.2	9.8'	15°10.6	13.9'	59.1'
18	92°59.2	S05°18.8	308°30.9	9.8'	S14°56.6	14.0'	59.1'
19	107°59.4	19.8	322°59.8	9.9'	14°42.6	14.1'	59.0'
20	122°59.6	20.8	337°28.7	10.0'	14°28.5	14.2'	59.0'
21	137°59.8	21.7	351°57.7	10.1'	14°14.3	14.2'	59.0'
22	153°00.0	22.7	6°26.8	10.2'	14°00.1	14.3'	59.0'
23	168°00.1	23.6	20°56.0	10.2'	13°45.8	14.4'	59.0'
SD = 16.0'		SD = 16.1'					

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

Lat.	Tue	Moonrise		Thu	Moonset	
		Wed	Tue		Wed	Thu
N 72°	■	■	19:07	■	■	■
N 70°	■	20:08	18:36	■	21:33	...
68°	■	18:55	18:13	■	22:44	...
66°	■	18:18	17:55	■	23:21	...
64°	18:09	17:51	17:40	21:30	23:46	...
62°	17:31	17:30	17:28	22:07	...	00:06
60°	17:04	17:13	17:17	22:33	...	00:22
N 58°	16:43	16:59	17:08	22:54	...	00:36
56°	16:25	16:46	17:00	23:11	...	00:47
54°</						

## October 07, 08, 09 UT (Fri., Sat., Sun.)

Aries			Venus			Mars		Jupiter		Saturn		Stars		
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	15°37.3	186°17.2	S02°32.3	294°19.2	N22°44.0	12°49.5	S00°33.0	53°57.7	S16°26.1			Alpheratz	357°36.4	
1	30°39.8	201°16.8	33.6	309°20.9	44.1	27°52.3	33.1	69°00.3	26.1			Ankaa	353°08.6	
2	45°42.3	216°16.4	34.9	324°22.6	44.2	42°55.0	33.2	84°02.8	26.1			Schedar	349°32.6	
3	60°44.7	231°16.0	36.1	339°24.3	44.4	57°57.8	33.3	99°05.3	26.2			Diphda	348°48.9	
4	75°47.2	246°15.6	37.4	354°26.0	44.5	73°00.6	33.5	114°07.9	26.2			Achernar	335°21.0	
5	90°49.7	261°15.2	38.6	9°27.7	44.6	88°03.3	33.6	129°10.4	26.2			Hamal	327°53.0	
6	105°52.1	276°14.8	S02°39.9	24°29.4	N22°44.7	103°06.1	S00°33.7	144°12.9	S16°26.2			Polaris	314°31.5	
7	120°54.6	291°14.4	41.1	39°31.1	44.8	118°08.8	33.8	159°15.4	26.2			Acamar	315°12.8	
8	135°57.1	306°14.0	42.4	54°32.8	45.0	133°11.6	34.0	174°18.0	26.3			Menkar	314°07.8	
9	150°59.5	321°13.6	43.6	69°34.5	45.1	148°14.4	34.1	189°20.5	26.3			Mirfak	308°30.5	
10	166°02.0	336°13.2	44.9	84°36.2	45.2	163°17.1	34.2	204°23.0	26.3			Aldebaran	290°41.6	
11	181°04.5	351°12.8	46.1	99°37.9	45.3	178°19.9	34.3	219°25.6	26.3			Rigel	281°05.5	
12	196°06.9	6°12.4	S02°47.4	114°39.6	N22°45.5	193°22.6	S00°34.5	234°28.1	S16°26.3			Capella	280°24.5	
13	211°09.4	21°12.0	48.6	129°41.3	45.6	208°25.4	34.6	249°30.6	26.3			Bellatrix	278°24.8	
14	226°11.8	36°11.6	49.9	144°43.0	45.7	223°28.2	34.7	264°33.1	26.4			Elnath	278°04.1	
15	241°14.3	51°11.2	51.1	159°44.7	45.8	238°30.9	34.8	279°35.7	26.4			Alnilam	275°39.5	
16	256°16.8	66°10.8	52.4	174°46.4	45.9	253°33.7	35.0	294°38.2	26.4			Betelgeuse	270°54.0	
17	271°19.2	81°10.4	53.6	189°48.1	46.1	268°36.4	35.1	309°40.7	26.4			Canopus	263°53.1	
18	286°21.7	96°10.0	S02°54.9	204°49.8	N22°46.2	283°39.2	S00°35.2	324°43.3	S16°26.4			Sirius	258°27.9	
19	301°24.2	111°09.6	56.1	219°51.5	46.3	298°41.9	35.3	339°45.8	26.5			Adhara	255°07.3	
20	316°26.6	126°09.2	57.4	234°53.2	46.4	313°44.7	35.5	354°48.3	26.5			Procyon	244°52.8	
21	331°29.1	141°08.8	58.6	249°54.9	46.5	328°47.5	35.6	9°50.8	26.5			Pollux	243°19.7	
22	346°31.6	156°08.4	02°59.9	264°56.6	46.7	343°50.2	35.7	24°53.4	26.5			Avior	234°15.7	
23	1°34.0	171°08.0	03°01.1	279°58.3	46.8	358°53.0	35.8	39°55.9	26.5			Suhail	222°47.9	
Mer.pass. 22:54			ν -0.4' d -1.3' m -3.89	ν 1.7' d 0.1' m -0.73	ν 2.8' d -0.1' m -2.93	ν 2.5' d -0.0' m 0.56								
Mer.pass. 22:54			ν -0.4' d -1.3' m -3.89	ν 1.7' d 0.1' m -0.73	ν 2.8' d -0.1' m -2.93	ν 2.5' d -0.0' m 0.56								
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	16°36.5	186°07.6	S03°02.4	295°00.0	N22°46.9	13°55.7	S00°36.0	54°58.4	S16°26.5			Denebola	182°27.2	
1	31°39.0	201°07.2	03.7	310°01.8	47.0	29°58.5	36.1	70°01.0	26.6			Gienah	175°45.9	
2	46°41.4	216°06.8	04.9	325°03.5	47.1	44°01.2	36.2	85°03.5	26.6			Acrux	173°02.9	
3	61°43.9	231°06.4	06.2	340°05.2	47.3	59°04.0	36.3	100°06.0	26.6			Gacrux	171°54.3	
4	76°46.3	246°06.0	07.4	355°06.9	47.4	74°06.8	36.5	115°08.5	26.6			Alioth	166°15.2	
5	91°48.8	261°05.6	08.7	10°08.6	47.5	89°09.5	36.6	130°11.1	26.6			Spica	158°24.6	
6	106°51.3	276°05.2	S03°09.9	25°10.4	N22°47.6	104°12.3	S00°36.7	145°13.6	S16°26.7			Alkaid	152°54.0	
7	121°53.7	291°04.8	11.2	40°12.1	47.8	119°15.0	36.8	160°16.1	26.7			Hadar	148°39.3	
8	136°56.2	306°04.4	12.4	55°13.8	47.9	134°17.8	36.9	175°18.6	26.7			Menkent	148°00.2	
9	151°58.7	321°04.0	13.7	70°15.5	48.0	149°20.5	37.1	190°21.2	26.7			Arcturus	145°50.0	
10	167°01.1	336°03.6	14.9	85°17.2	48.1	164°23.3	37.2	205°23.7	26.7			Rigel Kent	139°43.5	
11	182°03.6	351°03.2	16.2	100°19.0	48.2	179°26.1	37.3	220°26.2	26.7			Kochab	137°20.8	
12	197°06.1	6°02.8	S03°17.4	115°20.7	N22°48.4	194°28.8	S00°37.4	235°28.7	S16°26.8			Zuben'ubi	136°58.4	
13	212°08.5	21°02.4	18.7	130°22.4	48.5	209°31.6	37.6	250°31.3	26.8			Alphecca	126°05.6	
14	227°11.0	36°02.0	19.9	145°24.2	48.6	224°34.3	37.7	265°33.8	26.8			Antares	112°18.4	
15	242°13.4	51°01.6	21.2	160°25.9	48.7	239°37.1	37.8	280°36.3	26.8			Atria	107°14.6	
16	257°15.9	66°01.2	22.4	175°27.6	48.8	254°39.8	37.9	295°38.8	26.8			Sabik	102°05.1	
17	272°18.4	81°00.8	23.7	190°29.3	49.0	269°42.6	38.1	310°41.4	26.8			Shaula	96°13.1	
18	287°20.8	96°00.4	S03°24.9	205°31.1	N22°49.1	284°45.3	S00°38.2	325°43.9	S16°26.9			Rasalhague	96°00.4	
19	302°23.3	111°00.0	26.2	220°32.8	49.2	299°48.1	38.3	340°46.4	26.9			Eltanin	90°43.2	
20	317°25.8	125°59.6	27.4	235°34.5	49.3	314°50.9	38.4	355°48.9	26.9			Kaus Aust.	83°35.1	
21	332°28.2	140°59.2	28.7	250°36.3	49.4	329°53.6	38.5	10°51.5	26.9			Vega	80°34.5	
22	347°30.7	155°58.8	29.9	265°38.0	49.6	344°56.4	38.7	25°54.0	26.9			Nunki	75°50.1	
23	2°33.2	170°58.3	31.2	280°39.8	49.7	359°59.1	38.8	40°56.5	26.9			Altair	62°01.7	
Mer.pass. 22:50			ν -0.4' d -1.3' m -3.89	ν 1.7' d 0.1' m -0.75	ν 2.8' d -0.1' m -2.92	ν 2.5' d -0.0' m 0.57								
Mer.pass. 22:50			ν -0.4' d -1.3' m -3.89	ν 1.7' d 0.1' m -0.77	ν 2.8' d -0.1' m -2.92	ν 2.5' d -0.0' m 0.57								
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	17°35.6	185°57.9	S03°32.4	295°41.5	N22°49.8	15°01.9	S00°38.9	55°59.0	S16°27.0			Fomalhaut	15°16.3	
1	32°38.1	200°57.5	33.7	310°43.2	49.9	30°04.6	39.0	71°01.5	27.0			Scheat	13°46.7	
2	47°40.6	215°57.1	34.9	325°45.0	50.0	45°07.4	39.2	86°04.1	27.0			Markab	13°31.5	
3	62°43.0	230°56.7	36.2	340°46.7	50.2	60°10.1	39.3	101°06.6	27.0			Oct 07 Fri	SHA	Mer.pass
4	77°45.5	245°56.3	37.4	355°48.5	50.3	75°12.9	39.4	116°09.1	27.0			Venus	170°39.8	11:35
5	92°47.9	260°55.9	38.6	10°50.2	50.4	90°15.6	39.5	131°11.6	27.0			Mars	278°41.9	04:22
6	107°50.4	275°55.5	S03°39.9	25°52.0	N22°50.5	105°18.4	S00°39.6	146°14.2	S16°27.1			Jupiter	357°12.2	23:04
7	122°52.9	290°55.1	41.1	40°53.7	50.6	120°21.2	39.8	161°16.7	27.1			Saturn	38°20.4	20:21
8	137°55.3	305°54.7	42.4	55°55.5	50.7	135°23.9	39.9	176°19.2	27.1			Oct 08 Sat	SHA	Mer.pass
9	152°57.8	320°54.3	43.6	70°57.2	50.9	150°26.7	40.0	191°21.7	27.1			Venus	169°31.1	11:36
10	168°00.3	335°53.9	44.9	85°59.0	51.0	165°29.4	40.1	206°24.2	27.1			Mars	278°23.6	04:20
11	183°02.7	350°53.5	46.1	101°00.7	51.1	180°32.2	40.3	221°26.8	27.1			Jupiter	357°19.2	23:00
12	198°05.2	5°53.1	S03°47.4	116°02.5	N22°51.2	195°34.9	S00°40.4	236°29.3	S16°27.2			Saturn	38°21.9	20:17
13	213°07.7	20°52.7	48.6	131°04.2	51.3	210°37.7	40.5	251°31.8	27.2			Oct 09 Sun	SHA	Mer.pass
14	228°10.1	35°52.3	49.9	146°06.0	51.5	225°40.4	40.6	266°34.3	27.2			Venus	168°22.3	11:36
15	243°12.6	50°51.9	51.1	161°07.7	51.6	240°43.2	40.7	281°36.8	27.2			Mars	278°05.9	04:17
16	258°15.0	65°51.5	52.4	176°09.5	51.7	255°45.9	40.9	296°39.4	27.2			Jupiter	357°26.3	22:56
17	273°17.5	80°51.1	53.6	191°11.3	51.8	270°48.7	41.0	311°41.9	27.2			Saturn	38°23.4	20:13
18	288°20.0	95°50.7	S03°54.9	206°13.0	N22°51.9	285°51.4	S00°41.1	326°44.4	S16°27.2			Horizontal parallax		
19	303°22.4	110°50.3	56.1	221°14.8	52.1	300°54.2	41.2	341°46.9	27.3			Venus:	0.1	

DUT1 = UT1-UTC = -0.0059 sec  $\Delta T = TT-UT1 = +69.1899$  sec

2022 October 07 to Oct. 09 UT

h		Sun		Moon				Twilight						Twilight	
Fri	GHA	Dec	GHA	$\nu$	Dec	d	HP	Lat.	Naut.	Civil	Sunrise	Sunset	Civil	Naut.	
0	183°00.3	S05°24.6	35°25.2	10.3'	S13°31.4	14.5'	59.0'	N 72°	04:23	05:42	06:50	16:43	17:50	19:09	
1	198°00.5	25.5	49°54.5	10.4'	13°16.9	14.5'	59.0'	N 70°	04:31	05:42	06:43	16:50	17:51	19:02	
2	213°00.7	26.5	64°23.9	10.5'	13°02.4	14.6'	59.0'	68°	04:37	05:42	06:38	16:56	17:51	18:56	
3	228°00.9	27.5	78°53.4	10.5'	12°47.8	14.7'	59.0'	66°	04:42	05:41	06:33	17:01	17:52	18:51	
4	243°01.0	28.4	93°22.9	10.6'	12°33.2	14.7'	58.9'	64°	04:46	05:41	06:29	17:05	17:52	18:47	
5	258°01.2	29.4	107°52.6	10.7'	12°18.4	14.8'	58.9'	62°	04:49	05:41	06:25	17:09	17:53	18:44	
6	273°01.4	S05°30.3	122°22.3	10.8'	S12°03.7	14.8'	58.9'	60°	04:52	05:40	06:22	17:12	17:53	18:41	
7	288°01.6	31.3	136°52.0	10.8'	11°48.8	14.9'	58.9'	N 58°	04:54	05:40	06:19	17:15	17:54	18:39	
8	303°01.8	32.2	151°21.9	10.9'	11°33.9	14.9'	58.9'	56°	04:56	05:40	06:17	17:17	17:54	18:37	
9	318°02.0	33.2	165°51.8	11.0'	11°19.0	15.0'	58.9'	54°	04:58	05:39	06:15	17:20	17:55	18:36	
10	333°02.1	34.2	180°21.8	11.0'	11°04.0	15.0'	58.9'	52°	05:00	05:39	06:13	17:22	17:55	18:34	
11	348°02.3	35.1	194°51.8	11.1'	10°49.0	15.1'	58.9'	50°	05:01	05:38	06:11	17:24	17:56	18:33	
12	3°02.5	S05°36.1	209°21.9	11.2'	S10°33.9	15.1'	58.8'	45°	05:03	05:37	06:07	17:28	17:57	18:31	
13	18°02.7	37.0	223°52.1	11.2'	10°18.7	15.2'	58.8'	N 40°	05:05	05:36	06:03	17:31	17:58	18:30	
14	33°02.9	38.0	238°22.3	11.3'	10°03.5	15.2'	58.8'	35°	05:05	05:35	06:00	17:34	18:00	18:29	
15	48°03.0	38.9	252°52.6	11.4'	09°48.3	15.3'	58.8'	30°	05:06	05:33	05:57	17:37	18:01	18:29	
16	63°03.2	39.9	267°23.0	11.4'	09°33.0	15.3'	58.8'	20°	05:05	05:31	05:53	17:42	18:04	18:30	
17	78°03.4	40.8	281°53.5	11.5'	09°17.7	15.4'	58.8'	N 10°	05:03	05:27	05:48	17:47	18:08	18:32	
18	93°03.6	S05°41.8	296°23.9	11.6'	S09°02.3	15.4'	58.8'	0°	04:59	05:24	05:44	17:51	18:12	18:36	
19	108°03.8	42.7	310°54.5	11.6'	08°46.9	15.4'	58.7'	S 10°	04:54	05:19	05:40	17:55	18:16	18:41	
20	123°03.9	43.7	325°25.1	11.7'	08°31.4	15.5'	58.7'	20°	04:47	05:13	05:35	18:00	18:22	18:48	
21	138°04.1	44.7	339°55.8	11.7'	08°16.0	15.5'	58.7'	30°	04:38	05:06	05:30	18:05	18:30	18:58	
22	153°04.3	45.6	354°26.5	11.8'	08°00.4	15.5'	58.7'	35°	04:31	05:01	05:27	18:09	18:34	19:05	
23	168°04.5	46.6	8°57.3	11.8'	07°44.9	15.6'	58.7'	40°	04:24	04:56	05:23	18:12	18:40	19:12	
			SD = 16.0'	d = -1.0'		SD = 16.1'		45°	04:14	04:49	05:19	18:17	18:47	19:22	
Sat	GHA	Dec	GHA	$\nu$	Dec	d	HP	S 50°	04:01	04:41	05:14	18:22	18:55	19:35	
0	183°04.6	S05°47.5	23°28.2	11.9'	S07°29.3	15.6'	58.7'	52°	03:55	04:37	05:12	18:24	18:59	19:41	
1	198°04.8	48.5	37°59.1	12.0'	07°13.7	15.6'	58.6'	54°	03:49	04:33	05:09	18:27	19:04	19:48	
2	213°05.0	49.4	52°30.0	12.0'	06°58.1	15.7'	58.6'	56°	03:41	04:28	05:06	18:30	19:08	19:56	
3	228°05.2	50.4	67°01.0	12.1'	06°42.4	15.7'	58.6'	58°	03:32	04:23	05:03	18:33	19:14	20:05	
4	243°05.4	51.3	81°32.1	12.1'	06°26.7	15.7'	58.6'	S 60°	03:22	04:16	05:00	18:37	19:21	20:16	
			SD = 16.0'	d = -1.0'		SD = 16.0'									
Sat	GHA	Dec	GHA	$\nu$	Dec	d	HP	Lat.	Fri	Sat	Sun	Fri	Sat	Sun	
0	183°04.6	S05°47.5	23°28.2	11.9'	S07°29.3	15.6'	58.7'	N 72°	18:13	17:37	17:04	00:27	03:06	05:23	
1	198°04.8	48.5	37°59.1	12.0'	07°13.7	15.6'	58.6'	N 70°	18:00	17:33	17:09	00:56	03:16	05:23	
2	213°05.0	49.4	52°30.0	12.0'	06°58.1	15.7'	58.6'	68°	17:49	17:30	17:12	01:17	03:25	05:23	
3	228°05.2	50.4	67°01.0	12.1'	06°42.4	15.7'	58.6'	66°	17:40	17:27	17:15	01:33	03:32	05:23	
4	243°05.4	51.3	81°32.1	12.1'	06°26.7	15.7'	58.6'	64°	17:32	17:25	17:18	01:46	03:37	05:23	
5	258°05.5	52.3	96°03.2	12.2'	06°11.0	15.7'	58.6'	62°	17:25	17:23	17:20	01:58	03:42	05:23	
6	273°05.7	S05°53.2	110°34.3	12.2'	S05°55.3	15.8'	58.6'	60°	17:20	17:21	17:22	02:07	03:47	05:23	
7	288°05.9	54.2	125°05.5	12.2'	05°39.5	15.8'	58.5'	N 58°	17:14	17:19	17:23	02:15	03:51	05:23	
8	303°06.1	55.1	139°36.8	12.3'	05°23.7	15.8'	58.5'	56°	17:10	17:18	17:25	02:22	03:54	05:22	
9	318°06.2	56.1	154°08.0	12.3'	05°08.0	15.8'	58.5'	54°	17:06	17:16	17:26	02:29	03:57	05:22	
10	333°06.4	57.0	168°39.4	12.4'	04°52.2	15.8'	58.5'	52°	17:02	17:15	17:28	02:34	04:00	05:22	
11	348°06.6	58.0	183°10.8	12.4'	04°36.3	15.8'	58.5'	50°	16:58	17:14	17:29	02:40	04:02	05:22	
12	3°06.8	S05°58.9	197°42.2	12.5'	S04°20.5	15.8'	58.4'	45°	16:51	17:12	17:32	02:51	04:07	05:22	
13	18°06.9	05°59.9	212°13.6	12.5'	04°04.6	15.9'	58.4'	S 10°	16:04	16:57	17:48	03:55	04:39	05:21	
14	33°07.1	06°00.9	226°45.1	12.5'	03°48.8	15.9'	58.4'	20°	15:57	16:55	17:51	04:05	04:44	05:21	
15	48°07.3	07.8	241°16.7	12.6'	03°32.9	15.9'	58.4'	30°	15:48	16:52	17:54	04:16	04:49	05:21	
16	63°07.5	08.8	255°48.3	12.6'	03°17.1	15.9'	58.4'	35°	15:43	16:50	17:56	04:22	04:52	05:21	
17	78°07.6	09.7	270°19.9	12.6'	03°01.2	15.9'	58.3'	40°	15:38	16:49	17:58	04:29	04:56	05:20	
18	93°07.8	S06°04.7	284°51.5	12.7'	S02°45.3	15.9'	58.3'	45°	15:31	16:47	18:00	04:38	05:00	05:20	
19	108°08.0	05.6	299°23.2	12.7'	02°29.4	15.9'	58.3'	S 50°	15:23	16:44	18:03	04:48	05:05	05:20	
20	123°08.2	06.6	313°54.9	12.7'	02°13.5	15.9'	58.3'	52°	15:19	16:43	18:05	04:52	05:07	05:20	
21	138°08.3	07.5	328°26.7	12.8'	01°57.6	15.9'	58.3'	54°	15:15	16:42	18:06	04:57	05:09	05:20	
22	153°08.5	08.5	342°58.4	12.8'	01°41.7	15.9'	58.2'	56°	15:11	16:41	18:08	05:03	05:12	05:19	
23	168°08.7	09.4	357°30.2	12.8'	01°25.9	15.9'	58.2'	58°	15:06	16:39	18:10	05:09	05:15	05:19	
			SD = 16.0'	d = -1.0'		SD = 15.9'		S 60°	15:00	16:37	18:12	05:16	05:18	05:19	
			SD = 16.0'	d = -1.0'		SD = 15.9'									
Sun	GHA	Dec	GHA	$\nu$	Dec	d	HP	Day	Eqn.of Time	00 <sup>h</sup>	12 <sup>h</sup>	Mer.	Mer. Pass.	Moon	
0	183°08.9	S06°10.4	12°02.1	12.9'	S01°10.0	15.9'	58.2'		00:mm:ss	mm:ss	mm:ss	Pass	Upper	Mer.	
1	198°09.0	11.3	26°34.0	12.9'	00°54.1	15.9'	58.2'		00:mm:ss	mm:ss	mm:ss	Pass	Lower	Mer.	
2	213°09.2	12.3	41°05.8	12.9'	00°38.3	15.9'	58.2'		00:mm:ss	mm:ss	mm:ss	Pass	hh:mm	Pass	
3	228°09.4	13.2	55°37.8	12.9'	00°22.4	15.8'	58.1'		00:mm:ss	mm:ss	mm:ss	Pass	hh:mm	Pass	
4	243°09.6	14.2	70°09.7	13.0'	00°06.5	15.8'	58.1'		00:mm:ss	mm:ss	mm:ss	Pass	hh:mm	Pass	
5	258°09.7	15.1	84°41.7	13.0'	N00°09.3	15.8'	58.1'		00:mm:ss	mm:ss	mm:ss	Pass	hh:mm	Pass	
6	273°09.9	S06°16.1	99°13.7	13.0'	N00°25.1	15.8'	58.1'		00:mm:ss	mm:ss	mm:ss	Pass	hh:mm	Pass	
7	288°10.1	17.0	113°45.7	13.0'	00°40.9	15.8'	58.0'		00:mm:ss	mm:ss	mm:ss	Pass	hh:mm	Pass	
8	303°10.3	18.0	128°17.7	13.0'	00°56.7	15.8'	58.0'		00:mm:ss	mm:ss	mm:ss	Pass	hh:mm	Pass	
9	318°10.4	18.9	142°49.7	13.1'	01°12.5	15.8'	58.0'		00:mm:ss	mm:ss	mm:ss	Pass	hh:mm	Pass	
10	333°10.6	19.9	157°21.8	13.1'	01°28.3	15.7'	58.0'		00:mm:ss	mm:ss	mm:ss	Pass	hh:mm	Pass	
11	348°10.8	20.8	171°53.9	13.1'	01°44.0	15.7'	57.9'		00:mm:ss	mm:ss	mm:ss	Pass	hh:mm	Pass	
12	3°10.9</td														

## October 10, 11, 12 UT (Mon., Tue., Wed.)

Aries		Venus		Mars		Jupiter		Saturn		Stars	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec
0	18°34.8	185°48.2	\$04°02.4	296°23.6	N22°52.6	16°08.0	\$00°41.8	56°59.5	S16°27.3	Alpheratz	357°36.4
1	33°37.2	200°47.8	03.6	311°25.4	52.8	31°10.7	41.9	72°02.0	27.4	Ankaa	353°08.6
2	48°39.7	215°47.4	04.8	326°27.1	52.9	46°13.5	42.1	87°04.6	27.4	Schedar	349°32.6
3	63°42.2	230°47.0	.. 06.1	341°28.9	.. 53.0	61°16.2	.. 42.2	102°07.1	.. 27.4	Diphda	348°48.9
4	78°44.6	245°46.6	07.3	356°30.7	53.1	76°19.0	42.3	117°09.6	27.4	Achernar	335°21.0
5	93°47.1	260°46.2	08.6	11°32.4	53.2	91°21.7	42.4	132°12.1	27.4	Hamal	327°53.0
6	108°49.5	275°45.8	\$04°09.8	26°34.2	N22°53.4	106°24.5	\$00°42.6	147°14.6	S16°27.4	Polaris	314°30.6
7	123°52.0	290°45.4	11.1	41°36.0	53.5	121°27.2	42.7	162°17.2	27.4	Acamar	315°12.8
8	138°54.5	305°45.0	12.3	56°37.8	53.6	136°30.0	42.8	177°19.7	27.5	Menkar	314°07.8
9	153°56.9	320°44.6	.. 13.6	71°39.6	.. 53.7	151°32.7	.. 42.9	192°22.2	.. 27.5	Mirfak	308°30.5
10	168°59.4	335°44.1	14.8	86°41.3	53.8	166°35.5	43.0	207°24.7	27.5	Aldebaran	290°41.6
11	184°01.9	350°43.7	16.1	101°43.1	53.9	181°38.2	43.2	222°27.2	27.5	Rigel	281°05.5
12	199°04.3	5°43.3	\$04°17.3	116°44.9	N22°54.1	196°41.0	\$00°43.3	237°29.7	S16°27.5	Capella	280°24.4
13	214°06.8	20°42.9	18.5	131°46.7	54.2	211°43.7	43.4	252°32.3	27.5	Bellatrix	278°24.7
14	229°09.3	35°42.5	19.8	146°48.5	54.3	226°46.5	43.5	267°34.8	27.5	Elnath	278°04.1
15	244°11.7	50°42.1	.. 21.0	161°50.2	.. 54.4	241°49.2	.. 43.6	282°37.3	.. 27.6	Alnilam	275°39.5
16	259°14.2	65°41.7	22.3	176°52.0	54.5	256°52.0	43.8	297°39.8	27.6	Betelgeuse	270°54.0
17	274°16.6	80°41.3	23.5	191°53.8	54.6	271°54.7	43.9	312°42.3	27.6	Canopus	263°53.1
18	289°19.1	95°40.9	\$04°24.8	206°55.6	N22°54.8	286°57.5	\$00°44.0	327°44.8	S16°27.6	Sirius	258°27.8
19	304°21.6	110°40.5	26.0	221°57.4	54.9	302°00.2	44.1	342°47.4	27.6	Adhara	255°07.3
20	319°24.0	125°40.1	27.3	236°59.2	55.0	317°03.0	44.2	357°49.9	27.6	Procyon	244°52.8
21	334°26.5	140°39.6	.. 28.5	252°01.0	.. 55.1	332°05.7	.. 44.3	12°52.4	.. 27.6	Pollux	243°19.7
22	349°29.0	155°39.2	29.7	267°02.8	55.2	347°08.5	44.5	27°54.9	27.7	Avior	234°15.7
23	4°31.4	170°38.8	31.0	282°04.6	55.4	2°11.2	44.6	42°57.4	27.7	Suhail	222°47.9
Mer.pass. 22:42		ν -0.4° d -1.2' m -3.89		ν 1.8' d 0.1' m -0.79		ν 2.8' d -0.1' m -2.92		ν 2.5' d -0.0' m 0.57		Mer.pass. 22:38	
Tue		GHA		GHA		GHA		GHA		GHA	
0	19°33.9	185°38.4	\$04°32.2	297°06.4	N22°55.5	17°14.0	\$00°44.7	57°59.9	S16°27.7	Denebola	182°27.2
1	34°36.4	200°38.0	33.5	312°08.1	55.6	32°16.7	44.8	73°02.4	27.7	Gienah	175°45.8
2	49°38.8	215°37.6	34.7	327°09.9	55.7	47°19.5	44.9	88°05.0	27.7	Acrux	173°02.9
3	64°41.3	230°37.2	.. 36.0	342°11.7	.. 55.8	62°22.2	.. 45.1	103°07.5	.. 27.7	Gacrux	171°54.3
4	79°43.8	245°36.8	37.2	357°13.5	55.9	77°25.0	45.2	118°10.0	27.7	Alioth	166°15.2
5	94°46.2	260°36.4	38.4	12°15.3	56.1	92°27.7	45.3	133°12.5	27.8	Spica	158°24.6
6	109°48.7	275°35.9	\$04°39.7	27°17.1	N22°56.2	107°30.5	\$00°45.4	148°15.0	S16°27.8	Alkaid	152°54.0
7	124°51.1	290°35.5	40.9	42°19.0	56.3	122°33.2	45.5	163°17.5	27.8	Hadar	148°39.3
8	139°53.6	305°35.1	42.2	57°20.8	56.4	137°36.0	45.7	178°20.0	27.8	Menkent	148°00.2
9	154°56.1	320°34.7	.. 43.4	72°22.6	.. 56.5	152°38.7	.. 45.8	193°22.6	.. 27.8	Arcturus	145°50.0
10	169°58.5	335°34.3	44.7	87°24.4	56.6	167°41.4	45.9	208°25.1	27.8	Rigel Kent.	139°43.5
11	185°01.0	350°33.9	45.9	102°26.2	56.8	182°44.2	46.0	223°27.6	27.8	Kochab	137°20.8
12	200°03.5	5°33.5	\$04°47.1	117°28.0	N22°56.9	197°46.9	\$00°46.1	238°30.1	S16°27.9	Zuben'ubi	136°58.4
13	215°05.9	20°33.1	48.4	132°29.8	57.0	212°49.7	46.2	253°32.6	27.9	Alphecca	126°05.6
14	230°08.4	35°32.6	49.6	147°31.6	57.1	227°52.4	46.4	268°35.1	27.9	Antares	112°18.4
15	245°10.9	50°32.2	.. 50.9	162°33.4	.. 57.2	242°55.2	.. 46.5	283°37.6	.. 27.9	Atria	107°14.6
16	260°13.3	65°31.8	52.1	177°35.2	57.3	257°57.9	46.6	298°40.2	27.9	Sabik	102°05.1
17	275°15.8	80°31.4	53.3	192°37.0	57.5	273°00.7	46.7	313°42.7	27.9	Shaula	96°13.1
18	290°18.2	95°31.0	\$04°54.6	207°38.9	N22°57.6	288°03.4	\$00°46.8	328°45.2	S16°27.9	Rasalhague	96°00.4
19	305°20.7	110°30.6	55.8	222°40.7	57.7	303°06.2	47.0	343°47.7	27.9	Eltanin	90°43.2
20	320°23.2	125°30.2	57.1	237°42.5	57.8	318°08.9	47.1	358°50.2	28.0	Kaus Aust.	83°35.1
21	335°25.6	140°29.7	.. 58.3	252°44.3	.. 57.9	333°11.7	.. 47.2	13°52.7	.. 28.0	Vega	80°34.6
22	350°28.1	155°29.3	04°59.5	267°46.1	58.0	348°14.4	47.3	28°55.2	28.0	Nunki	75°50.1
23	5°30.6	170°28.9	05°00.8	282°48.0	58.1	3°17.2	47.4	43°57.7	28.0	Altair	62°01.7
Mer.pass. 22:38		ν -0.4° d -1.2' m -3.89		ν 1.8' d 0.1' m -0.80		ν 2.7' d -0.1' m -2.92		ν 2.5' d -0.0' m 0.58		Mer.pass. 22:30	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Mer.pass
0	20°33.0	185°28.5	\$05°02.0	297°49.8	N22°58.3	18°19.9	\$00°47.5	59°00.2	S16°28.0	Oct 10 Mon	167°13.5
1	35°35.5	200°28.1	03.3	312°51.6	58.4	33°22.6	47.7	74°02.8	28.0	Venus	277°48.8
2	50°38.0	215°27.7	04.5	327°53.4	58.5	48°25.4	47.8	89°05.3	28.0	Mars	357°33.2
3	65°40.4	230°27.2	.. 05.7	342°55.3	.. 58.6	63°28.1	.. 47.9	104°07.8	.. 28.0	Jupiter	38°24.8
4	80°42.9	245°26.8	07.0	357°57.1	58.7	78°30.9	48.0	119°10.3	28.1	Saturn	11:37
5	95°45.4	260°26.4	08.2	12°58.9	58.8	93°33.6	48.1	134°12.8	28.1	Oct 11 Tue	166°04.5
6	110°47.8	275°26.0	\$05°09.5	28°00.8	N22°59.0	108°36.4	\$00°48.2	149°15.3	S16°28.1	Venus	11:41
7	125°50.3	290°25.6	10.7	43°02.6	59.1	123°39.1	48.4	164°17.8	28.1	Mars	22:51
8	140°52.7	305°25.2	11.9	58°04.4	59.2	138°41.9	48.5	179°20.3	28.1	Jupiter	22:43
9	155°55.2	320°24.8	.. 13.2	73°06.3	.. 59.3	153°44.6	.. 48.6	194°22.8	.. 28.1	Saturn	20:09
10	170°57.7	335°24.3	14.4	88°08.1	59.4	168°47.4	48.7	209°25.3	28.1	Oct 12 Wed	164°55.5
11	186°00.1	350°23.9	15.7	103°09.9	59.5	183°50.1	48.8	224°27.9	28.1	Venus	11:38
12	201°02.6	5°23.5	\$05°16.9	118°11.8	N22°59.7	198°52.8	\$00°48.9	239°30.4	S16°28.2	Mars	277°16.8
13	216°05.1	20°23.1	18.1	133°13.6	59.8	213°55.6	49.1	254°32.9	28.2	Jupiter	357°46.9
14	231°07.5	35°22.7	19.4	148°15.4	22°59.9	228°58.3	49.2	269°35.4	28.2	Saturn	22:43
15	246°10.0	50°22.2	.. 20.6	163°17.3	23°00.0	244°01.1	.. 49.3	284°37.9	.. 28.2	Horizontal parallax	0.1
16	261°12.5	65°21.8	21.8	178°19.1	00.1	259°03.8	49.4	299°40.4	28.2	Venus:	0.2
17	276°14.9	80°21.4	23.1	193°21.0	00.2	274°06.6	49.5	314°42.9	28.2	Mars:	0.2
18	291°17.4	95°21.0	\$05°24.3	208°22.8	N23°00.3	289°09.3	\$00°49.6	329°45.4	S16°28.2	Mer.pass. 22:34	ν -0.4° d -1.2' m -3.89
19	306°19.9	110°20.6	25.5	223°24.7	00.5	304°12.0	49.8	344°47.9	28.2	Mer.pass. 22:34	ν 1.8' d 0.1' m -0.82
20	321°22.3	125°20.2	26.8	238°26.5	00.6	319°14.8	49.9	359°50.4	28.3	Mer.pass. 22:34	ν 2.7' d -0.1' m -2.91
21	336°24.8	140°19.7	.. 28.0	253°28.4	.. 00.7	334°17.5	.. 50.0	14°52.9	.. 28.3	Mer.pass. 22:34	ν 2.5' d -0.0' m 0.58
22	351°27.2	155°19.3	29.3	268°30.2	00.8	349°20.3	50.1	29°55.4	28.3	Mer.pass. 22:34	ν 2.5' d -0.0' m 0.58
23	6°29.7	170°18.9	30.5	283°32.1	00.9	4°23.0	50.2	44°58.0	28.3	Mer.pass. 22:34	ν 2.5' d -0.0' m 0.58

DUT1 = UT1-UTC = -0.0076 sec  $\Delta T = TT-UT1 = +69.1916$  sec

2022 October 10 to Oct. 12 UT

h		Sun		Moon			
Mon	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	183°13.0	S06°33.1	0°52.0	13.2'	N05°06.3	15.3'	57.6'
1	198°13.2	34.1	15°24.2	13.2'	05°21.7	15.3'	57.6'
2	213°13.3	35.0	29°56.4	13.2'	05°37.0	15.3'	57.6'
3	228°13.5	.. 36.0	44°28.6	13.2'	05°52.2	15.2'	57.6'
4	243°13.7	36.9	59°00.9	13.2'	06°07.4	15.2'	57.5'
5	258°13.8	37.9	73°33.1	13.2'	06°22.6	15.1'	57.5'
6	273°14.0	S06°38.8	88°05.3	13.2'	N06°37.8	15.1'	57.5'
7	288°14.2	39.8	102°37.5	13.2'	06°52.9	15.0'	57.5'
8	303°14.3	40.7	117°09.7	13.2'	07°07.9	15.0'	57.4'
9	318°14.5	.. 41.6	131°41.9	13.2'	07°22.9	15.0'	57.4'
10	333°14.7	42.6	146°14.1	13.2'	07°37.9	14.9'	57.4'
11	348°14.8	43.5	160°46.3	13.2'	07°52.8	14.9'	57.3'
12	3°15.0	S06°44.5	175°18.4	13.2'	N08°07.6	14.8'	57.3'
13	18°15.2	45.4	189°50.6	13.2'	08°22.4	14.7'	57.3'
14	33°15.3	46.4	204°22.8	13.1'	08°37.2	14.7'	57.3'
15	48°15.5	.. 47.3	218°54.9	13.1'	08°51.9	14.6'	57.2'
16	63°15.7	48.3	233°27.0	13.1'	09°06.5	14.6'	57.2'
17	78°15.8	49.2	247°59.2	13.1'	09°21.1	14.5'	57.2'
18	93°16.0	S06°50.1	262°31.3	13.1'	N09°35.6	14.5'	57.2'
19	108°16.2	51.1	277°03.4	13.1'	09°50.1	14.4'	57.1'
20	123°16.3	52.0	291°35.5	13.1'	10°04.5	14.4'	57.1'
21	138°16.5	.. 53.0	306°07.5	13.1'	10°18.9	14.3'	57.1'
22	153°16.7	53.9	320°39.6	13.0'	10°33.1	14.2'	57.1'
23	168°16.8	54.9	335°11.6	13.0'	10°47.4	14.2'	57.0'
SD = 16.0'		SD = 15.7'					
Tue		SD = 15.7'					
Tue	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	183°17.0	S06°55.8	349°43.6	13.0'	N11°01.5	14.1'	57.0'
1	198°17.1	56.7	4°15.6	13.0'	11°15.6	14.0'	57.0'
2	213°17.3	57.7	18°47.6	13.0'	11°29.7	14.0'	56.9'
3	228°17.5	.. 58.6	33°19.6	12.9'	11°43.6	13.9'	56.9'
4	243°17.6	06°59.6	47°51.5	12.9'	11°57.5	13.8'	56.9'
5	258°17.8	07°00.5	62°23.4	12.9'	12°11.4	13.8'	56.9'
6	273°18.0	S07°01.5	76°55.3	12.9'	N12°25.1	13.7'	56.8'
7	288°18.1	02.4	91°27.2	12.9'	12°38.8	13.6'	56.8'
8	303°18.3	03.3	105°59.1	12.8'	12°52.4	13.5'	56.8'
9	318°18.5	.. 04.3	120°30.9	12.8'	13°06.0	13.5'	56.8'
10	333°18.6	05.2	135°02.7	12.8'	13°19.5	13.4'	56.7'
11	348°18.8	06.2	149°34.5	12.8'	13°32.9	13.3'	56.7'
12	3°18.9	S07°07.1	164°06.2	12.7'	N13°46.2	13.2'	56.7'
13	18°19.1	08.1	178°38.0	12.7'	13°59.4	13.2'	56.6'
14	33°19.3	09.0	193°09.7	12.7'	14°12.6	13.1'	56.6'
15	48°19.4	.. 09.9	207°41.3	12.6'	14°25.7	13.0'	56.6'
16	63°19.6	10.9	222°13.0	12.6'	14°38.7	12.9'	56.6'
17	78°19.7	11.8	236°44.6	12.6'	14°51.6	12.8'	56.5'
18	93°19.9	S07°12.8	251°16.2	12.6'	N15°04.5	12.8'	56.5'
19	108°20.1	13.7	265°47.7	12.5'	15°17.2	12.7'	56.5'
20	123°20.2	14.6	280°19.2	12.5'	15°29.9	12.6'	56.4'
21	138°20.4	.. 15.6	294°50.7	12.5'	15°42.5	12.5'	56.4'
22	153°20.5	16.5	309°22.2	12.4'	15°55.0	12.4'	56.4'
23	168°20.7	17.5	323°53.6	12.4'	16°07.4	12.3'	56.4'
SD = 16.0'		SD = 15.5'					
Wed		SD = 15.5'					
Wed	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	183°20.9	S07°18.4	338°25.0	12.4'	N16°19.7	12.2'	56.3'
1	198°21.0	19.3	352°56.4	12.3'	16°32.0	12.2'	56.3'
2	213°21.2	20.3	7°27.7	12.3'	16°44.1	12.1'	56.3'
3	228°21.3	.. 21.2	21°59.0	12.3'	16°56.2	12.0'	56.3'
4	243°21.5	22.1	36°30.3	12.2'	17°08.2	11.9'	56.2'
5	258°21.7	23.1	51°01.5	12.2'	17°20.1	11.8'	56.2'
6	273°21.8	S07°24.0	65°32.7	12.2'	N17°31.9	11.7'	56.2'
7	288°22.0	25.0	80°03.9	12.1'	17°43.6	11.6'	56.1'
8	303°22.1	25.9	94°35.0	12.1'	17°55.2	11.5'	56.1'
9	318°22.3	.. 26.8	109°06.1	12.1'	18°06.7	11.4'	56.1'
10	333°22.4	27.8	123°37.1	12.0'	18°18.1	11.3'	56.1'
11	348°22.6	28.7	138°08.1	12.0'	18°29.4	11.2'	56.0'
12	3°22.8	S07°29.6	152°39.1	11.9'	N18°40.6	11.1'	56.0'
13	18°22.9	30.6	167°10.1	11.9'	18°51.7	11.0'	56.0'
14	33°23.1	31.5	181°41.0	11.9'	19°02.7	10.9'	56.0'
15	48°23.2	.. 32.5	196°11.8	11.8'	19°13.6	10.8'	55.9'
16	63°23.4	33.4	210°42.7	11.8'	19°24.5	10.7'	55.9'
17	78°23.5	34.3	225°13.5	11.8'	19°35.2	10.6'	55.9'
18	93°23.7	S07°35.3	239°44.2	11.7'	N19°45.8	10.5'	55.9'
19	108°23.8	36.2	254°14.9	11.7'	19°56.3	10.4'	55.8'
20	123°24.0	37.1	268°45.6	11.6'	20°06.7	10.3'	55.8'
21	138°24.2	.. 38.1	283°16.3	11.6'	20°17.0	10.2'	55.8'
22	153°24.3	39.0	297°46.9	11.6'	20°27.2	10.1'	55.8'
23	168°24.5	39.9	312°17.4	11.5'	20°37.2	10.0'	55.7'
SD = 16.0'		SD = 15.4'					

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

## October 13, 14, 15 UT (Thu., Fri., Sat.)

Aries			Venus			Mars		Jupiter		Saturn		
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	
0	21°32.2	185°18.5	S05°31.7	298°33.9	N23°01.0	19°25.8	S00°50.3	60°00.5	S16°28.3			
1	36°34.6	200°18.1	33.0	313°35.8	01.2	34°28.5	50.5	75°03.0	28.3			
2	51°37.1	215°17.6	34.2	328°37.6	01.3	49°31.2	50.6	90°05.5	28.3			
3	66°39.6	230°17.2	.. 35.4	343°39.5	.. 01.4	64°34.0	.. 50.7	105°08.0	.. 28.3			
4	81°42.0	245°16.8	36.7	358°41.3	01.5	79°36.7	50.8	120°10.5	28.3			
5	96°44.5	260°16.4	37.9	13°43.2	01.6	94°39.5	50.9	135°13.0	28.4			
6	111°47.0	275°15.9	S05°39.1	28°45.1	N23°01.7	109°42.2	S00°51.0	150°15.5	S16°28.4			
7	126°49.4	290°15.5	40.4	43°46.9	01.8	124°44.9	51.1	165°18.0	28.4			
8	141°51.9	305°15.1	41.6	58°48.8	02.0	139°47.7	51.3	180°20.5	28.4			
9	156°54.4	320°14.7	.. 42.8	73°50.6	.. 02.1	154°50.4	.. 51.4	195°23.0	.. 28.4			
10	171°56.8	335°14.3	44.1	88°52.5	02.2	169°53.2	51.5	210°25.5	28.4			
11	186°59.3	350°13.8	45.3	103°54.4	02.3	184°55.9	51.6	225°28.0	28.4			
12	202°01.7	5°13.4	S05°46.5	118°56.2	N23°02.4	199°58.7	S00°51.7	240°30.5	S16°28.4			
13	217°04.2	20°13.0	47.8	133°58.1	02.5	215°01.4	51.8	255°33.0	28.4			
14	232°06.7	35°12.6	49.0	149°00.0	02.6	230°04.1	52.0	270°35.5	28.4			
15	247°09.1	50°12.1	.. 50.2	164°01.9	.. 02.8	245°06.9	.. 52.1	285°38.0	.. 28.5			
16	262°11.6	65°11.7	51.5	179°03.7	02.9	260°09.6	52.2	300°40.6	28.5			
17	277°14.1	80°11.3	52.7	194°05.6	03.0	275°12.4	52.3	315°43.1	28.5			
18	292°16.5	95°10.9	S05°53.9	209°07.5	N23°03.1	290°15.1	S00°52.4	330°45.6	S16°28.5			
19	307°19.0	110°10.4	55.2	224°09.3	03.2	305°17.8	52.5	345°48.1	28.5			
20	322°21.5	125°10.0	56.4	239°11.2	03.3	320°20.6	52.6	0°50.6	28.5			
21	337°23.9	140°09.6	.. 57.6	254°13.1	.. 03.4	335°23.3	.. 52.8	15°53.1	.. 28.5			
22	352°26.4	155°09.2	05°58.9	269°15.0	03.6	350°26.0	52.9	30°55.6	28.5			
23	7°28.8	170°08.7	06°00.1	284°16.9	03.7	5°28.8	53.0	45°58.1	28.5			
Mer.pass. 22:30		ν -0.4° d -1.2° m -3.89			ν 1.9° d 0.1° m -0.84			ν 2.7° d -0.1° m -2.91			ν 2.5° d -0.0° m 0.59	

Stars	
SHA	Dec
Alpheratz	357°36.4
Ankaa	353°08.6
Schedar	349°32.6
Diphda	348°48.9
Achernar	335°21.0
Hamal	327°53.0
Polaris	314°29.6
Acamar	315°12.8
Menkar	314°07.8
Mirfak	308°30.5
Aldebaran	290°41.5
Rigel	281°05.5
Capella	280°24.4
Bellatrix	278°24.7
Elnath	278°04.1
Alnilam	275°39.5
Betelgeuse	270°54.0
Canopus	263°53.1
Sirius	258°27.8
Adhara	255°07.3
Procyon	244°52.8
Pollux	243°19.6
Avior	234°15.6
Suhail	222°47.9
Miaplacidus	221°39.1
Alphard	217°49.8
Regulus	207°36.6
Dubhe	193°43.8
Denebola	182°27.2
Gienah	175°45.8
Acru	173°02.9
Gacrux	171°54.3
Alioth	166°15.2
Spica	158°24.6
Alkaid	152°54.0
Hadar	148°39.3
Menkent	148°00.2
Arcturus	145°50.0
Rigel Kent.	139°43.5
Kochab	137°20.9
Zuben'ubi	136°58.4
Alphecca	126°05.6
Antares	112°18.4
Atria	107°14.6
Sabik	102°05.1
Shaula	96°13.1
Rasalhague	96°00.4
Eltanin	90°43.3
Kaus Aust.	83°35.1
Vega	80°34.6
Nunki	75°50.1
Altair	62°01.8
Peacock	53°08.5
Deneb	49°26.9
Enif	33°40.5
Al Na'ir	27°35.0
Fomalhaut	15°16.3
Scheat	13°46.7
Markab	13°31.5

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec			
0	22°31.3	185°08.3	S06°01.3	299°18.7	N23°03.8	20°31.5	S00°53.1	61°00.6	S16°28.6			
1	37°33.8	200°07.9	02.6	314°20.6	03.9	35°34.3	53.2	76°03.1	28.6			
2	52°36.2	215°07.5	03.8	329°22.5	04.0	50°37.0	53.3	91°05.6	28.6			
3	67°38.7	230°07.0	.. 05.0	344°24.4	.. 04.1	65°39.7	.. 53.4	106°08.1	.. 28.6			
4	82°41.2	245°06.6	06.2	359°26.3	04.2	80°42.5	53.5	121°10.6	28.6			
5	97°43.6	260°06.2	07.5	14°28.2	04.4	95°45.2	53.7	136°13.1	28.6			
6	112°46.1	275°05.8	S06°08.7	29°30.1	N23°04.5	110°48.0	S00°53.8	151°15.6	S16°28.6			
7	127°48.6	290°05.3	09.9	44°32.0	04.6	125°50.7	53.9	166°18.1	28.6			
8	142°51.0	305°04.9	11.2	59°33.9	04.7	140°53.4	54.0	181°20.6	28.6			
9	157°53.5	320°04.5	.. 12.4	74°35.7	.. 04.8	155°56.2	.. 54.1	196°23.1	.. 28.6			
10	172°56.0	335°04.1	13.6	89°37.6	04.9	170°58.9	54.2	211°25.6	28.6			
11	187°58.4	350°03.6	14.8	104°39.5	05.0	186°01.6	54.3	226°28.1	28.7			
12	203°00.9	5°03.2	S06°16.1	119°41.4	N23°05.2	201°04.4	S00°54.5	241°30.6	S16°28.7			
13	218°03.3	20°02.8	17.3	134°43.3	05.3	216°07.1	54.6	256°33.1	28.7			
14	233°05.8	35°02.3	18.5	149°45.2	05.4	231°09.8	54.7	271°35.6	28.7			
15	248°08.3	50°01.9	.. 19.8	164°47.1	.. 05.5	246°12.6	.. 54.8	286°38.1	.. 28.7			
16	263°10.7	65°01.5	21.0	179°49.0	05.6	261°15.3	54.9	301°40.6	28.7			
17	278°13.2	80°01.1	22.2	194°50.9	05.7	276°18.1	55.0	316°43.1	28.7			
18	293°15.7	95°00.6	S06°23.4	209°52.8	N23°05.8	291°20.8	S00°55.1	331°45.6	S16°28.7			
19	308°18.1	110°00.2	24.7	224°54.8	06.0	306°23.5	55.2	346°48.1	28.7			
20	323°20.6	124°59.8	25.9	239°56.7	06.1	321°26.3	55.3	1°50.6	28.7			
21	338°23.1	139°59.3	.. 27.1	254°58.6	.. 06.2	336°29.0	.. 55.5	16°53.1	.. 28.7			
22	353°25.5	154°58.9	28.3	270°00.5	06.3	351°31.7	55.6	31°55.6	28.8			
23	8°28.0	169°58.5	29.6	285°02.4	06.4	6°34.5	55.7	46°58.1	28.8			
Mer.pass. 22:26		ν -0.4° d -1.2° m -3.89			ν 1.9° d 0.1° m -0.86			ν 2.7° d -0.1° m -2.91			ν 2.5° d -0.0° m 0.59	

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	23°30.5	184°58.0	S06°30.8	300°04.3	N23°06.5	21°37.2	S00°55.8	62°00.6	S16°28.8
1	38°32.9	199°57.6	32.0	315°06.2	06.6	36°39.9	55.9	77°03.1	28.8
2	53°35.4	214°57.2	33.2	330°08.1	06.8	51°42.7	56.0	92°05.6	28.8
3	68°37.8	229°56.7	.. 34.5	345°10.1	.. 06.9	66°45.4	.. 56.1	107°08.1	.. 28.8
4	83°40.3	244°56.3	35.7	0°12.0	07.0	81°48.1	56.2	122°10.6	28.8
5	98°42.8	259°55.9	36.9	15°13.9	07.1	96°50.9	56.4	137°13.1	28.8
6	113°45.2	274°55.5	S06°38.1	30°15.8	N23°07.2	111°53.6	S00°56.5	152°15.6	S16°28.8
7	128°47.7	289°55.0	39.4	45°17.7	07.3	126°56.3	56.6	167°18.1	28.8
8	143°50.2	304°54.6	40.6	60°19.7	07.4	141°59.1	56.7	182°20.6	28.8
9	158°52.6	319°54.2	.. 41.8	75°21.6	.. 07.5	157°01.8	.. 56.8	197°23.1	.. 28.9
10	173°55.1	334°53.7	43.0	90°23.5	07.7	172°04.5	56.9	212°25.6	28.9
11	188°57.6	349°53.3	44.3	105°25.4	07.8	187°07.3	57.0	227°28.1	28.9
12	204°00.0	4°52.8	S06°45.5	120°27.4	N23°07.9	202°10.0	S00°57.1	242°30.6	S16°28.9
13	219°02.5	19°52.4	46.7	135°29.3	08.0	217°12.7	57.2	257°33.1	28.9
14	234°05.0	34°52.0	47.9	150°31.2	08.1	232°15.5	57.4	272°35.6	28.9
15	249°07.4	49°51.5	.. 49.1	165°33.2	.. 08.2	247°18.2	.. 57.5	287°38.1	.. 28.9
16	264°09.9	64°51.1	50.4	180°35.1	08.3	262°20.9	57.6	302°40.6	28.9
17	279°12.3	79°50.7	51.6	195°37.0	08.5	277°23.7			

DUT1 = UT1-UTC = -0.0084 sec  $\Delta T = TT-UT1 = +69.1924$  sec

2022 October 13 to Oct. 15 UT

h	Sun		Moon				
Thu	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	183°24.6	S07°40.9	326°48.0	11.5'	N20°47.2	9.9'	55.7'
1	198°24.8	41.8	341°18.4	11.5'	20°57.1	9.8'	55.7'
2	213°24.9	42.7	355°48.9	11.4'	21°06.8	9.6'	55.6'
3	228°25.1	.. 43.7	10°19.3	11.4'	21°16.5	9.5'	55.6'
4	243°25.2	44.6	24°49.7	11.3'	21°26.0	9.4'	55.6'
5	258°25.4	45.6	39°20.0	11.3'	21°35.5	9.3'	55.6'
6	273°25.5	S07°46.5	53°50.3	11.3'	N21°44.8	9.2'	55.5'
7	288°25.7	47.4	68°20.6	11.2'	21°54.0	9.1'	55.5'
8	303°25.8	48.4	82°50.8	11.2'	22°03.1	9.0'	55.5'
9	318°26.0	.. 49.3	97°21.0	11.2'	22°12.0	8.9'	55.5'
10	333°26.1	50.2	111°51.2	11.1'	22°20.9	8.7'	55.5'
11	348°26.3	51.2	126°21.3	11.1'	22°29.6	8.6'	55.4'
12	3°26.4	S07°52.1	140°51.3	11.0'	N22°38.3	8.5'	55.4'
13	18°26.6	53.0	155°21.4	11.0'	22°46.8	8.4'	55.4'
14	33°26.7	54.0	169°51.4	11.0'	22°55.2	8.3'	55.4'
15	48°26.9	.. 54.9	184°21.4	10.9'	23°03.4	8.2'	55.3'
16	63°27.0	55.8	198°51.3	10.9'	23°11.6	8.0'	55.3'
17	78°27.2	56.7	213°21.2	10.9'	23°19.6	7.9'	55.3'
18	93°27.3	S07°57.7	227°51.0	10.8'	N23°27.6	7.8'	55.3'
19	108°27.5	58.6	242°20.9	10.8'	23°35.4	7.7'	55.2'
20	123°27.6	07°59.5	256°50.7	10.8'	23°43.0	7.6'	55.2'
21	138°27.8	08°00.5	271°20.4	10.7'	23°50.6	7.4'	55.2'
22	153°27.9	01.4	285°50.1	10.7'	23°58.0	7.3'	55.2'
23	168°28.1	02.3	300°19.8	10.7'	24°05.4	7.2'	55.2'
	SD = 16.0'		d = -0.9'				
			SD = 15.2'				

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

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

Day	Sun		Moon		
	Eqn.of Time	00 <sup>h</sup> mm:ss	12 <sup>h</sup> mm:ss	Mer. Pass	Mer. Pass.
13	13:38	13:46	11:46	02:17	14:42
14	13:53	14:00	11:46	03:07	15:32
15	14:07	14:14	11:46	03:58	16:24

## October 16, 17, 18 UT (Sun., Mon., Tue.)

Aries		Venus		Mars		Jupiter		Saturn	
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	24°29.6	184°47.6	\$07°00.1	300°50.6	N23°09.2	22°42.8	\$00°58.5	63°00.5	S16°29.0
1	39°32.1	199°47.2	01.4	315°52.6	09.4	37°45.5	58.6	78°03.0	29.0
2	54°34.5	214°46.7	02.6	330°54.5	09.5	52°48.3	58.7	93°05.5	29.0
3	69°37.0	229°46.3	.. 03.8	345°56.4	.. 09.6	67°51.0	.. 58.8	108°08.0	.. 29.0
4	84°39.4	244°45.9	05.0	0°58.4	09.7	82°53.7	58.9	123°10.5	29.0
5	99°41.9	259°45.4	06.2	16°00.3	09.8	97°56.4	59.0	138°13.0	29.0
6	114°44.4	274°45.0	\$07°07.4	31°02.3	N23°09.9	112°59.2	\$00°59.1	153°15.5	S16°29.0
7	129°46.8	289°44.6	08.7	46°04.3	10.0	128°01.9	59.2	168°18.0	29.0
8	144°49.3	304°44.1	09.9	61°06.2	10.2	143°04.6	59.3	183°20.5	29.0
9	159°51.8	319°43.7	.. 11.1	76°08.2	.. 10.3	158°07.4	.. 59.4	198°23.0	.. 29.0
10	174°54.2	334°43.2	12.3	91°10.1	10.4	173°10.1	59.5	213°25.5	29.0
11	189°56.7	349°42.8	13.5	106°12.1	10.5	188°12.8	59.7	228°28.0	29.0
12	204°59.2	4°42.4	\$07°14.7	121°14.0	N23°10.6	203°15.5	\$00°59.8	243°30.5	S16°29.1
13	220°01.6	19°41.9	16.0	136°16.0	10.7	218°18.3	00°59.9	258°32.9	29.1
14	235°04.1	34°41.5	17.2	151°18.0	10.8	233°21.0	01°00.0	273°35.4	29.1
15	250°06.6	49°41.0	.. 18.4	166°19.9	.. 10.9	248°23.7	.. 00.1	288°37.9	.. 29.1
16	265°09.0	64°40.6	19.6	181°21.9	11.1	263°26.5	00.2	303°40.4	29.1
17	280°11.5	79°40.1	20.8	196°23.9	11.2	278°29.2	00.3	318°42.9	29.1
18	295°13.9	94°39.7	\$07°22.0	211°25.8	N23°11.3	293°31.9	S01°00.4	333°45.4	S16°29.1
19	310°16.4	109°39.3	23.3	226°27.8	11.4	308°34.6	00.5	348°47.9	29.1
20	325°18.9	124°38.8	24.5	241°29.8	11.5	323°37.4	00.6	3°50.4	29.1
21	340°21.3	139°38.4	.. 25.7	256°31.7	.. 11.6	338°40.1	.. 00.7	18°52.9	.. 29.1
22	355°23.8	154°37.9	26.9	271°33.7	11.7	353°42.8	00.8	33°55.4	29.1
23	10°26.3	169°37.5	28.1	286°35.7	11.8	8°45.5	01.0	48°57.9	29.1
Mer.pass. 22:18		$\nu -0.4' d -1.2' m -3.89$		$\nu 1.9' d 0.1' m -0.90$		$\nu 2.7' d -0.1' m -2.90$		$\nu 2.5' d -0.0' m 0.60$	

Stars		
	SHA	Dec
Alpheratz	357°36.4	29°13.1
Ankaa	353°08.6	-42°11.0
Schedar	349°32.6	56°39.8
Diphda	348°48.8	-17°51.7
Achernar	335°21.0	-57°07.3
Hamal	327°53.0	23°34.2
Polaris	314°28.6	89°21.5
Acamar	315°12.8	-40°12.7
Menkar	314°07.8	4°10.8
Mirfak	308°30.5	49°56.4
Aldebaran	290°41.5	16°33.3
Rigel	281°05.5	-8°10.4
Capella	280°24.4	46°01.1
Bellatrix	278°24.7	6°22.3
Elnath	278°04.0	28°37.6
Alnilam	275°39.5	-1°11.1
Betelgeuse	270°54.0	7°24.8
Canopus	263°53.0	-52°42.1
Sirius	258°27.8	-16°44.6
Adhara	255°07.3	-28°59.9
Procyon	244°52.8	5°10.1
Pollux	243°19.6	27°58.3
Avior	234°15.6	-59°34.5
Suhail	222°47.8	-43°31.1
Miaplacidus	221°39.0	-69°48.2
Alphard	217°49.7	-8°45.2
Regulus	207°36.6	11°51.5
Dubhe	193°43.8	61°37.6
Denebola	182°27.1	14°26.8
Gienah	175°45.8	-17°39.9
Acrux	173°02.9	-63°13.3
Gacrux	171°54.3	-57°14.2
Alioth	166°15.2	55°50.3
Spica	158°24.6	-11°16.6
Alkaid	152°54.0	49°12.1
Hadar	148°39.3	-60°28.9
Menkent	148°00.2	-36°28.8
Arcturus	145°50.0	19°04.0
Rigil Kent.	139°43.5	-60°55.7
Kochab	137°20.9	74°03.8
Zuben'ubi	136°58.4	-16°08.0
Alphecca	126°05.6	26°38.5
Antares	112°18.4	-26°28.9
Atria	107°14.6	-69°04.2
Sabik	102°05.1	-15°45.1
Shaula	96°13.1	-37°07.3
Rasalhague	96°00.5	12°32.8
Eltanin	90°43.3	51°29.4
Kaus Aust.	83°35.1	-34°22.5
Vega	80°34.6	38°48.5
Nunki	75°50.1	-26°16.1
Altair	62°01.8	8°55.8
Peacock	53°08.6	-56°39.9
Deneb	49°27.0	45°21.9
Enif	33°40.5	9°58.9
Al Na'ir	27°35.0	-46°51.2
Fomalhaut	15°16.3	-29°30.2
Scheat	13°46.7	28°12.5
Markab	13°31.5	15°19.8
Oct 16 Sun	SHA	Mer.pass
Venus	160°18.0	11:41
Mars	276°21.0	03:56
Jupiter	358°13.2	22:25
Saturn	38°30.9	19:45
Oct 17 Mon	SHA	Mer.pass
Venus	159°08.3	11:42
Mars	276°08.9	03:53
Jupiter	358°19.5	22:21
Saturn	38°31.6	19:41
Oct 18 Tue	SHA	Mer.pass
Venus	157°58.4	11:43
Mars	275°57.6	03:50
Jupiter	358°25.8	22:16
Saturn	38°32.2	19:37
Horizontal parallax		
Venus:	0.1	
Mars:	0.2	

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	26°27.9	184°26.3	\$07°58.4	302°25.5	N23°14.7	24°53.7	S01°03.6	65°00.1	S16°29.3
1	41°30.3	199°25.9	07°59.6	317°27.5	14.8	39°56.4	03.7	80°02.6	29.3
2	56°32.8	214°25.4	08°00.8	332°29.5	14.9	54°59.1	03.8	95°05.1	29.3
3	71°35.3	229°25.0	.. 02.0	347°31.5	.. 15.0	70°01.8	.. 03.9	110°07.5	.. 29.3
4	86°37.7	244°24.5	03.2	2°33.5	15.1	85°04.5	04.0	125°10.0	29.3
5	101°40.2	259°24.0	04.4	17°35.6	15.2	100°07.3	04.1	140°12.5	29.3
6	116°42.7	274°23.6	\$08°05.6	32°37.6	N23°15.3	115°10.0	S01°04.2	155°15.0	S16°29.3
7	131°45.1	289°23.1	06.8	47°39.6	15.4	130°12.7	04.4	170°17.5	29.3
8	146°47.6	304°22.7	08.0	62°41.6	15.6	145°15.4	04.5	185°20.0	29.3
9	161°50.0	319°22.2	.. 09.2	77°43.6	.. 15.7	160°18.1	.. 04.6	200°22.4	.. 29.3
10	176°52.5	334°21.8	10.4	92°45.7	15.8	175°20.9	04.7	215°24.9	29.3
11	191°55.0	349°21.3	11.6	107°47.7	15.9	190°23.6	04.8	230°27.4	29.3
12	206°57.4	4°20.9	\$08°12.8	122°49.7	N23°16.0	205°26.3	S01°04.9	245°29.9	S16°29.3
13	221°59.9	19°20.4	14.0	137°51.7	16.1	220°29.0	05.0	260°32.4	29.3
14	237°02.4	34°20.0	15.2	152°53.8	16.2	235°31.7	05.1	275°34.9	29.3
15	252°04.8	49°19.5	.. 16.4	167°55.8	.. 16.3	250°34.5	.. 05.2	290°37.4	.. 29.3
16	267°07.3	64°19.1	17.6	182°57.8	16.4	265°37.2	05.3	305°39.8	29.3
17	282°09.8	79°18.6	18.8	197°59.9	16.6	280°39.9	05.4	320°42.3	29.3
18	297°12.2	94°18.1	\$08°20.0	213°01.9	N23°16.7	295°42.6	S01°05.5	335°44.8	S16°29.3
19	312°14.7	109°17.7	21.2	228°03.9	16.8	310°45.3	05.6	350°47.3	29.3
20	327°17.2	124°17.2	22.4	243°06.0	16.9	325°48.1	05.7	5°49.8	29.3
21	342°19.6	139°16.8	.. 23.6	258°08.0	.. 17.0	340°50.8	.. 05.8	20°52.3	.. 29.3
22	357°22.1	154°16.3	24.8	273°10.0	17.1	355°53.5	05.9	35°54.7	29.3
23	12°24.5	169°15.9	26.0	288°12.1	17.2	10°56.2	06.0	50°57.2	29.3
Mer.pass. 22:10	$\nu -0.5' d -1.2' m -3.89$	$\nu 2.0' d 0.1' m -0.94$	$\nu 2.7' d -0.1' m -2.89$	$\nu 2.5' d -0.0' m 0.61$					

DUT1 = UT1-UTC = -0.0075 sec  $\Delta T = TT-UT1 = +69.1915$  sec

2022 October 16 to Oct. 18 UT

h		Sun		Moon			
Sun	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	183°35.1	S08°47.7	290°07.1	9.9'	N27°25.8	0.8'	54.3'
1	198°35.2	48.6	304°36.0	9.9'	27°26.6	0.6'	54.3'
2	213°35.3	49.5	319°04.9	9.9'	27°27.2	0.5'	54.3'
3	228°35.5	.. 50.5	333°33.8	9.9'	27°27.7	0.4'	54.3'
4	243°35.6	51.4	348°02.7	9.9'	27°28.1	0.2'	54.3'
5	258°35.7	52.3	2°31.7	10.0'	27°28.3	0.1'	54.3'
6	273°35.9	S08°53.2	17°00.6	10.0'	N27°28.4	-0.0'	54.3'
7	288°36.0	54.1	31°29.6	10.0'	27°28.4	-0.2'	54.3'
8	303°36.1	55.1	45°58.6	10.0'	27°28.2	-0.3'	54.3'
9	318°36.3	.. 56.0	60°27.6	10.0'	27°27.9	-0.4'	54.3'
10	333°36.4	56.9	74°56.6	10.0'	27°27.5	-0.6'	54.3'
11	348°36.5	57.8	89°25.6	10.0'	27°26.9	-0.7'	54.3'
12	3°36.7	S08°58.7	103°54.6	10.1'	N27°26.2	-0.8'	54.2'
13	18°36.8	08°59.6	118°23.7	10.1'	27°25.4	-1.0'	54.2'
14	33°36.9	09°00.6	132°52.8	10.1'	27°24.4	-1.1'	54.2'
15	48°37.1	.. 01.5	147°21.8	10.1'	27°23.3	-1.2'	54.2'
16	63°37.2	02.4	161°51.0	10.1'	27°22.1	-1.4'	54.2'
17	78°37.3	03.3	176°20.1	10.2'	27°20.7	-1.5'	54.2'
18	93°37.5	S09°04.2	190°49.2	10.2'	N27°19.2	-1.6'	54.2'
19	108°37.6	05.1	205°18.4	10.2'	27°17.6	-1.8'	54.2'
20	123°37.7	06.1	219°47.6	10.2'	27°15.9	-1.9'	54.2'
21	138°37.9	.. 07.0	234°16.8	10.3'	27°14.0	-2.0'	54.2'
22	153°38.0	07.9	248°46.1	10.3'	27°12.0	-2.1'	54.2'
23	168°38.1	08.8	263°15.4	10.3'	27°09.8	-2.3'	54.2'
		SD = 16.0'	d = -0.9'	SD = 14.8'			

Mon	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	183°38.2	S09°09.7	277°44.7	10.3'	N27°07.5	-2.4'	54.2'
1	198°38.4	10.6	292°14.0	10.4'	27°05.1	-2.5'	54.2'
2	213°38.5	11.6	306°43.4	10.4'	27°02.6	-2.7'	54.2'
3	228°38.6	.. 12.5	321°12.8	10.4'	26°59.9	-2.8'	54.2'
4	243°38.8	13.4	335°42.2	10.5'	26°57.2	-2.9'	54.2'
5	258°38.9	14.3	350°11.6	10.5'	26°54.2	-3.0'	54.2'
6	273°39.0	S09°15.2	4°41.1	10.5'	N26°51.2	-3.2'	54.2'
7	288°39.2	16.1	19°10.6	10.5'	26°48.0	-3.3'	54.2'
8	303°39.3	17.0	33°40.2	10.6'	26°44.7	-3.4'	54.2'
9	318°39.4	.. 18.0	48°09.8	10.6'	26°41.3	-3.6'	54.2'
10	333°39.5	18.9	62°39.4	10.7'	26°37.7	-3.7'	54.2'
11	348°39.7	19.8	77°09.0	10.7'	26°34.1	-3.8'	54.2'
12	3°39.8	S09°20.7	91°38.7	10.7'	N26°30.3	-3.9'	54.2'
13	18°39.9	21.6	106°08.4	10.8'	26°26.3	-4.1'	54.2'
14	33°40.0	22.5	120°38.2	10.8'	26°22.3	-4.2'	54.2'
15	48°40.2	.. 23.4	135°08.0	10.8'	26°18.1	-4.3'	54.2'
16	63°40.3	24.3	149°37.8	10.9'	26°13.8	-4.4'	54.2'
17	78°40.4	25.3	164°07.7	10.9'	26°09.4	-4.5'	54.2'
18	93°40.5	S09°26.2	178°37.6	11.0'	N26°04.8	-4.7'	54.2'
19	108°40.7	27.1	193°07.6	11.0'	26°00.2	-4.8'	54.2'
20	123°40.8	28.0	207°37.6	11.0'	25°55.4	-4.9'	54.2'
21	138°40.9	.. 28.9	222°07.6	11.1'	25°50.5	-5.0'	54.2'
22	153°41.0	29.8	236°37.7	11.1'	25°45.4	-5.1'	54.2'
23	168°41.2	30.7	251°07.8	11.2'	25°40.3	-5.3'	54.2'
		SD = 16.0'	d = -0.9'	SD = 14.8'			

Tue	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	183°41.3	S09°31.6	265°38.0	11.2'	N25°35.0	-5.4'	54.2'
1	198°41.4	32.5	280°08.2	11.2'	25°29.6	-5.5'	54.2'
2	213°41.5	33.5	294°38.4	11.3'	25°24.1	-5.6'	54.2'
3	228°41.7	.. 34.4	309°08.7	11.3'	25°18.5	-5.7'	54.2'
4	243°41.8	35.3	323°39.0	11.4'	25°12.8	-5.9'	54.2'
5	258°41.9	36.2	338°09.4	11.4'	25°06.9	-6.0'	54.2'
6	273°42.0	S09°37.1	352°39.8	11.5'	N25°00.9	-6.1'	54.2'
7	288°42.1	38.0	7°10.3	11.5'	24°54.8	-6.2'	54.2'
8	303°42.3	38.9	21°40.8	11.6'	24°48.6	-6.3'	54.2'
9	318°42.4	.. 39.8	36°11.4	11.6'	24°42.3	-6.4'	54.2'
10	333°42.5	40.7	50°42.0	11.6'	24°35.9	-6.5'	54.3'
11	348°42.6	41.6	65°12.6	11.7'	24°29.3	-6.7'	54.3'
12	3°42.8	S09°42.5	79°43.3	11.7'	N24°22.7	-6.8'	54.3'
13	18°42.9	43.4	94°14.0	11.8'	24°15.9	-6.9'	54.3'
14	33°43.0	44.3	108°44.8	11.8'	24°09.0	-7.0'	54.3'
15	48°43.1	.. 45.3	123°15.7	11.9'	24°02.0	-7.1'	54.3'
16	63°43.2	46.2	137°46.5	11.9'	23°54.9	-7.2'	54.3'
17	78°43.4	47.1	152°17.5	12.0'	23°47.7	-7.3'	54.3'
18	93°43.5	S09°48.0	166°48.4	12.0'	N23°40.4	-7.4'	54.3'
19	108°43.6	48.9	181°19.5	12.1'	23°32.9	-7.5'	54.3'
20	123°43.7	49.8	195°50.5	12.1'	23°25.4	-7.7'	54.3'
21	138°43.8	.. 50.7	210°21.7	12.2'	23°17.7	-7.8'	54.4'
22	153°43.9	51.6	224°52.8	12.2'	23°10.0	-7.9'	54.4'
23	168°44.1	52.5	239°24.0	12.3'	23°02.1	-8.0'	54.4'
		SD = 16.0'	d = -0.9'	SD = 14.8'			

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

## October 19, 20, 21 UT (Wed., Thu., Fri.)

Aries		Venus		Mars		Jupiter		Saturn		Stars	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec
0	27°27.0	184°15.4	\$08°27.2	303°14.1	N23°17.3	25°58.9	\$01°06.1	65°59.7	S16°29.4	Alpheratz	357°36.4
1	42°29.5	199°14.9	28.4	318°16.2	17.5	41°01.6	06.2	81°02.2	29.4	Ankaa	353°08.6
2	57°31.9	214°14.5	29.6	333°18.2	17.6	56°04.4	06.3	96°04.7	29.4	Schedar	349°32.6
3	72°34.4	229°14.0	.. 30.8	348°20.3	.. 17.7	71°07.1	.. 06.4	111°07.2	.. 29.4	Diphda	348°48.8
4	87°36.9	244°13.6	32.0	3°22.3	17.8	86°09.8	06.5	126°09.6	29.4	Achernar	335°21.0
5	102°39.3	259°13.1	33.2	18°24.3	17.9	101°12.5	06.6	141°12.1	29.4	Hamal	327°52.9
6	117°41.8	274°12.6	\$08°34.4	33°26.4	N23°18.0	116°15.2	\$01°06.7	156°14.6	S16°29.4	Polaris	314°27.9
7	132°44.3	289°12.2	35.6	48°28.4	18.1	131°17.9	06.8	171°17.1	29.4	Acamar	315°12.8
8	147°46.7	304°11.7	36.8	63°30.5	18.2	146°20.7	06.9	186°19.6	29.4	Menkar	314°07.8
9	162°49.2	319°11.3	.. 38.0	78°32.6	.. 18.4	161°23.4	.. 07.0	201°22.0	.. 29.4	Mirfak	308°30.5
10	177°51.7	334°10.8	39.2	93°34.6	18.5	176°26.1	07.1	216°24.5	29.4	Aldebaran	290°41.5
11	192°54.1	349°10.3	40.4	108°36.7	18.6	191°28.8	07.2	231°27.0	29.4	Rigel	281°05.4
12	207°56.6	4°09.9	\$08°41.6	123°38.7	N23°18.7	206°31.5	\$01°07.3	246°29.5	S16°29.4	Capella	280°24.3
13	222°59.0	19°09.4	42.8	138°40.8	18.8	221°34.2	07.4	261°32.0	29.4	Bellatrix	278°24.7
14	238°01.5	34°09.0	44.0	153°42.9	18.9	236°37.0	07.6	276°34.4	29.4	Elnath	278°04.0
15	253°04.0	49°08.5	.. 45.2	168°44.9	.. 19.0	251°39.7	.. 07.7	291°36.9	.. 29.4	Alnilam	275°39.4
16	268°06.4	64°08.0	46.4	183°47.0	19.1	266°42.4	07.8	306°39.4	29.4	Betelgeuse	270°53.9
17	283°08.9	79°07.6	47.6	198°49.0	19.2	281°45.1	07.9	321°41.9	29.4	Canopus	263°53.0
18	298°11.4	94°07.1	\$08°48.8	213°51.1	N23°19.4	296°47.8	\$01°08.0	336°44.4	S16°29.4	Sirius	258°27.8
19	313°13.8	109°06.6	49.9	228°53.2	19.5	311°50.5	08.1	351°46.8	29.4	Adhara	255°07.2
20	328°16.3	124°06.2	51.1	243°55.3	19.6	326°53.2	08.2	6°49.3	29.4	Procyon	244°52.8
21	343°18.8	139°05.7	.. 52.3	258°57.3	.. 19.7	341°56.0	.. 08.3	21°51.8	.. 29.4	Pollux	243°19.6
22	358°21.2	154°05.2	53.5	273°59.4	19.8	356°58.7	08.4	36°54.3	29.4	Avior	234°15.6
23	13°23.7	169°04.8	54.7	289°01.5	19.9	12°01.4	08.5	51°56.8	29.4	Suhail	222°47.8
Mer.pass. 22:07		ν -0.5° d -1.2' m -3.89	ν 2.0° d 0.1' m -0.96	ν 2.7° d -0.1' m -2.88	ν 2.5° d -0.0' m 0.62						
Thu		GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	
0	28°26.1	184°04.3	\$08°55.9	304°03.5	N23°20.0	27°04.1	\$01°08.6	66°59.2	S16°29.4	Denebola	207°36.6
1	43°28.6	199°03.8	57.1	319°05.6	20.1	42°06.8	08.7	82°01.7	29.4	Gienah	115°51.5
2	58°31.1	214°03.4	58.3	334°07.7	20.3	57°09.5	08.8	97°04.2	29.4	Acrux	193°43.8
3	73°33.5	229°02.9	08°59.5	349°09.8	.. 20.4	72°12.2	.. 08.9	112°06.7	.. 29.4	Gacrux	175°45.8
4	88°36.0	244°02.4	09°00.7	4°11.9	20.5	87°14.9	09.0	127°09.1	29.4	Alioth	173°02.8
5	103°38.5	259°02.0	01.9	19°13.9	20.6	102°17.7	09.1	142°11.6	29.4	Spica	166°15.2
6	118°40.9	274°01.5	\$09°03.0	34°16.0	N23°20.7	117°20.4	\$01°09.2	157°14.1	S16°29.4	Alkaid	158°24.6
7	133°43.4	289°01.0	04.2	49°18.1	20.8	132°23.1	09.3	172°16.6	29.4	Hadar	152°54.0
8	148°45.9	304°00.6	05.4	64°20.2	20.9	147°25.8	09.4	187°19.1	29.4	Menkent	148°00.2
9	163°48.3	319°00.1	.. 06.6	79°22.3	.. 21.0	162°28.5	.. 09.5	202°21.5	.. 29.4	Arcturus	145°50.0
10	178°50.8	333°59.6	07.8	94°24.4	21.2	177°31.2	09.6	217°24.0	29.4	Rigel Kent.	139°43.5
11	193°53.3	348°59.2	09.0	109°26.5	21.3	192°33.9	09.7	232°26.5	29.4	Kochab	137°20.9
12	208°55.7	3°58.7	\$09°10.2	124°28.6	N23°21.4	207°36.6	\$01°09.8	247°29.0	S16°29.4	Zuben'ubi	136°58.4
13	223°58.2	18°58.2	11.4	139°30.7	21.5	222°39.3	09.9	262°31.4	29.4	Alphecca	126°05.6
14	239°00.6	33°57.8	12.5	154°32.8	21.6	237°42.0	10.0	277°33.9	29.4	Antares	112°18.4
15	254°03.1	48°57.3	.. 13.7	169°34.9	.. 21.7	252°44.8	.. 10.1	292°36.4	.. 29.4	Atria	107°14.7
16	269°05.6	63°56.8	14.9	184°37.0	21.8	267°47.5	10.2	307°38.9	29.4	Sabik	102°05.1
17	284°08.0	78°56.3	16.1	199°39.1	21.9	282°50.2	10.3	322°41.3	29.4	Shaula	96°13.1
18	299°10.5	93°55.9	\$09°17.3	214°41.2	N23°22.0	297°52.9	\$01°10.4	337°43.8	S16°29.4	Rasalhague	96°00.5
19	314°13.0	108°55.4	18.5	229°43.3	22.2	312°55.6	10.5	352°46.3	29.4	Eltanin	90°43.3
20	329°15.4	123°54.9	19.7	244°45.4	22.3	327°58.3	10.6	7°48.8	29.4	Kaus Aust.	83°35.1
21	344°17.9	138°54.5	.. 20.8	259°47.5	.. 22.4	343°01.0	.. 10.7	22°51.2	.. 29.4	Vega	80°34.6
22	359°20.4	153°54.0	22.0	274°49.6	22.5	358°03.7	10.8	37°53.7	29.4	Nunki	75°50.2
23	14°22.8	168°53.5	23.2	289°51.7	22.6	13°06.4	10.9	52°56.2	29.4	Altair	62°01.8
Mer.pass. 22:03		ν -0.5° d -1.2' m -3.89	ν 2.1° d 0.1' m -0.98	ν 2.7° d -0.1' m -2.88	ν 2.5° d -0.0' m 0.62						
Fri		GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	
0	29°25.3	183°53.0	\$09°24.4	304°53.8	N23°22.7	28°09.1	\$01°11.0	67°58.7	S16°29.4	Fomalhaut	15°16.3
1	44°27.8	198°52.6	25.6	319°55.9	22.8	43°11.8	11.1	83°01.1	29.4	Scheat	13°46.7
2	59°30.2	213°52.1	26.8	334°58.0	22.9	58°14.5	11.1	98°03.6	29.4	Markab	13°31.5
3	74°32.7	228°51.6	.. 27.9	350°00.1	.. 23.1	73°17.3	.. 11.2	113°06.1	.. 29.4	Oct 19 Wed	38°32.7
4	89°35.1	243°51.1	29.1	5°02.2	23.2	88°20.0	11.3	128°08.6	29.4	Venus	156°48.4
5	104°37.6	258°50.7	30.3	20°04.4	23.3	103°22.7	11.4	143°11.0	29.4	Mars	125°47.1
6	119°40.1	273°50.2	\$09°31.5	35°06.5	N23°23.4	118°25.4	\$01°11.5	158°13.5	S16°29.4	Jupiter	358°31.9
7	134°42.5	288°49.7	32.7	50°08.6	23.5	133°28.1	11.6	173°16.0	29.4	Saturn	38°32.7
8	149°45.0	303°49.2	33.8	65°10.7	23.6	148°30.8	11.7	188°18.4	29.5	Oct 20 Thu	19:33
9	164°47.5	318°48.7	.. 35.0	80°12.9	.. 23.7	163°33.5	.. 11.8	203°20.9	.. 29.5	Venus	155°38.2
10	179°49.9	333°48.3	36.2	95°15.0	23.8	178°36.2	11.9	218°23.4	29.5	Mars	125°37.4
11	194°52.4	348°47.8	37.4	110°17.1	23.9	193°38.9	12.0	233°25.9	29.5	Jupiter	358°37.9
12	209°54.9	3°47.3	\$09°38.6	125°19.2	N23°24.1	208°41.6	\$01°12.1	248°28.3	S16°29.5	Saturn	38°33.1
13	224°57.3	18°46.8	39.7	140°21.4	24.2	223°44.3	12.2	263°30.8	29.5	Oct 21 Fri	19:29
14	239°59.8	33°46.4	40.9	155°23.5	24.3	238°47.0	12.3	278°33.3	29.5	Venus	154°27.7
15	255°02.2	48°45.9	.. 42.1	170°25.6	.. 24.4	253°49.7	.. 12.4	293°35.7	.. 29.5	Mars	125°28.5
16	270°04.7	63°45.4	43.3	185°27.8	24.5	268°52.4	12.5	308°38.2	29.4	Jupiter	358°43.8
17	285°07.2	78°44.9	44.4	200°29.9	24.6	283°55.1	12.6	323°40.7	29.4	Saturn	38°33.4
18	300°09.6	93°44.4	\$09°45.6	215°32.0	N23°24.7	298°57.8	\$01°12.7	338°43.2	S16°29.4	Horizontal parallax	19:25
19	315°12.1	108°44.0	46.8	230°34.2	24.8	314°03.2	12.8	353°45.6	29.4	Venus:	0.1
20	330°14.6	123°43.5	48.0	245°36.3	25.0	329°03.2	12.9	8°48.1	29.4	Mars:	0.2
21	345°17.0	138°43.0	.. 49.1	260°38.4	.. 25.1	344°05.9	.. 13.0	23°50.6	.. 29.4		
22	0°19.5	153°42.5	50.3	275°40.6	25.2	359°08.6	13.1	38°53.0	29.4		
23	15°22.0	168°42.0	51.5	290°42.7	25.3	14°11.4	13.2	53°55.5	29.4		
Mer.pass. 21:59		ν -0.5° d -1.2' m -3.89	ν 2.1° d 0.1' m -1.00	ν 2.7° d -0.1' m -2.87	ν 2.5° d -0.0' m 0.63						

DUT1 = UT1-UTC = -0.0064 sec  $\Delta T = TT-UT1 = +69.1904$  sec

2022 October 19 to Oct. 21 UT

h		Sun		Moon				
Wed		GHA	Dec	GHA	$\nu$	Dec	d	HP
0	183°44.2	S09°53.4	253°55.3	12.3'	N22°54.2	-8.1'	54.4'	
1	198°44.3	54.3	268°26.6	12.4'	22°46.1	-8.2'	54.4'	
2	213°44.4	55.2	282°57.9	12.4'	22°37.9	-8.3'	54.4'	
3	228°44.5	.. 56.1	297°29.3	12.4'	22°29.6	-8.4'	54.4'	
4	243°44.6	57.0	312°00.8	12.5'	22°21.2	-8.5'	54.4'	
5	258°44.8	57.9	326°32.3	12.5'	22°12.7	-8.6'	54.4'	
6	273°44.9	S09°58.8	341°03.8	12.6'	N22°04.2	-8.7'	54.5'	
7	288°45.0	09°59.7	355°35.4	12.6'	21°55.5	-8.8'	54.5'	
8	303°45.1	10°00.6	10°07.0	12.7'	21°46.7	-8.9'	54.5'	
9	318°45.2	.. 01.5	24°38.7	12.7'	21°37.8	-9.0'	54.5'	
10	333°45.3	02.4	39°10.4	12.8'	21°28.8	-9.1'	54.5'	
11	348°45.4	03.3	53°42.2	12.8'	21°19.7	-9.2'	54.5'	
12	3°45.6	S10°04.2	68°14.0	12.9'	N21°10.5	-9.3'	54.5'	
13	18°45.7	05.1	82°45.9	12.9'	21°01.2	-9.4'	54.6'	
14	33°45.8	06.0	97°17.8	13.0'	20°51.8	-9.5'	54.6'	
15	48°45.9	.. 06.9	111°49.8	13.0'	20°42.4	-9.6'	54.6'	
16	63°46.0	07.8	126°21.8	13.0'	20°32.8	-9.7'	54.6'	
17	78°46.1	08.7	140°53.8	13.1'	20°23.1	-9.8'	54.6'	
18	93°46.2	S10°09.6	155°25.9	13.1'	N20°13.3	-9.9'	54.6'	
19	108°46.4	10.5	169°58.0	13.2'	20°03.5	-10.0'	54.7'	
20	123°46.5	11.4	184°30.2	13.2'	19°53.5	-10.0'	54.7'	
21	138°46.6	.. 12.3	199°02.4	13.3'	19°43.5	-10.1'	54.7'	
22	153°46.7	13.2	213°34.7	13.3'	19°33.4	-10.2'	54.7'	
23	168°46.8	14.1	228°07.0	13.3'	19°23.1	-10.3'	54.7'	
	SD = 16.0'		d = -0.9'		SD = 14.8'			
Thu		GHA	Dec	GHA	$\nu$	Dec	d	HP
0	183°46.9	S10°15.0	242°39.3	13.4'	N19°12.8	-10.4'	54.7'	
1	198°47.0	15.9	257°11.7	13.4'	19°02.4	-10.5'	54.8'	
2	213°47.1	16.8	271°44.1	13.5'	18°51.9	-10.6'	54.8'	
3	228°47.2	.. 17.7	286°16.6	13.5'	18°41.3	-10.7'	54.8'	
4	243°47.3	18.6	300°49.1	13.5'	18°30.7	-10.8'	54.8'	
5	258°47.5	19.5	315°21.6	13.6'	18°19.9	-10.8'	54.8'	
6	273°47.6	S10°20.4	329°54.2	13.6'	N18°09.1	-10.9'	54.8'	
7	288°47.7	21.3	344°26.8	13.7'	17°58.2	-11.0'	54.9'	
8	303°47.8	22.2	358°59.5	13.7'	17°47.1	-11.1'	54.9'	
9	318°47.9	.. 23.1	13°32.2	13.7'	17°36.0	-11.2'	54.9'	
10	333°48.0	24.0	28°04.9	13.8'	17°24.9	-11.3'	54.9'	
11	348°48.1	24.9	42°37.7	13.8'	17°13.6	-11.3'	54.9'	
12	3°48.2	S10°25.8	57°10.5	13.8'	N17°02.3	-11.4'	55.0'	
13	18°48.3	26.7	71°43.4	13.9'	16°50.8	-11.5'	55.0'	
14	33°48.4	27.6	86°16.3	13.9'	16°39.3	-11.6'	55.0'	
15	48°48.5	.. 28.5	100°49.2	13.9'	16°27.8	-11.7'	55.0'	
16	63°48.6	29.4	115°22.1	14.0'	16°16.1	-11.7'	55.1'	
17	78°48.7	30.3	129°55.1	14.0'	16°04.4	-11.8'	55.1'	
18	93°48.8	S10°31.2	144°28.1	14.0'	N15°52.5	-11.9'	55.1'	
19	108°48.9	32.0	159°01.2	14.1'	15°40.6	-12.0'	55.1'	
20	123°49.1	32.9	173°34.2	14.1'	15°28.7	-12.0'	55.1'	
21	138°49.2	.. 33.8	188°07.3	14.1'	15°16.6	-12.1'	55.2'	
22	153°49.3	34.7	202°40.5	14.2'	15°04.5	-12.2'	55.2'	
23	168°49.4	35.6	217°13.6	14.2'	14°52.3	-12.3'	55.2'	
	SD = 16.1'		d = -0.9'		SD = 14.9'			
Fri		GHA	Dec	GHA	$\nu$	Dec	d	HP
0	183°49.5	S10°36.5	231°46.8	14.2'	N14°40.0	-12.3'	55.2'	
1	198°49.6	37.4	246°20.1	14.2'	14°27.7	-12.4'	55.3'	
2	213°49.7	38.3	260°53.3	14.3'	14°15.3	-12.5'	55.3'	
3	228°49.8	.. 39.2	275°26.6	14.3'	14°02.8	-12.6'	55.3'	
4	243°49.9	40.1	289°59.9	14.3'	13°50.2	-12.6'	55.3'	
5	258°50.0	41.0	304°33.2	14.3'	13°37.6	-12.7'	55.4'	
6	273°50.1	S10°41.9	319°06.6	14.4'	N13°24.9	-12.8'	55.4'	
7	288°50.2	42.7	333°39.9	14.4'	13°12.2	-12.8'	55.4'	
8	303°50.3	43.6	348°13.3	14.4'	12°59.3	-12.9'	55.4'	
9	318°50.4	.. 44.5	2°46.7	14.4'	12°46.4	-13.0'	55.5'	
10	333°50.5	45.4	17°20.2	14.5'	12°33.5	-13.0'	55.5'	
11	348°50.6	46.3	31°53.6	14.5'	12°20.5	-13.1'	55.5'	
12	3°50.7	S10°47.2	46°27.1	14.5'	N12°07.4	-13.2'	55.5'	
13	18°50.8	48.1	61°00.6	14.5'	11°54.2	-13.2'	55.6'	
14	33°50.9	49.0	75°34.1	14.5'	11°41.0	-13.3'	55.6'	
15	48°51.0	.. 49.9	90°07.6	14.5'	11°27.7	-13.3'	55.6'	
16	63°51.1	50.7	104°41.2	14.6'	11°14.4	-13.4'	55.6'	
17	78°51.2	51.6	119°14.8	14.6'	11°01.0	-13.5'	55.7'	
18	93°51.3	S10°52.5	133°48.3	14.6'	N10°47.5	-13.5'	55.7'	
19	108°51.4	53.4	148°21.9	14.6'	10°34.0	-13.6'	55.7'	
20	123°51.5	54.3	162°55.5	14.6'	10°20.4	-13.6'	55.7'	
21	138°51.6	.. 55.2	177°29.1	14.6'	10°06.8	-13.7'	55.8'	
22	153°51.7	56.1	192°02.7	14.6'	09°53.1	-13.7'	55.8'	
23	168°51.8	56.9	206°36.4	14.6'	09°39.4	-13.8'	55.8'	
	SD = 16.1'		d = -0.9'		SD = 15.1'			

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

## October 22, 23, 24 UT (Sat., Sun., Mon.)

Aries			Venus			Mars			Jupiter			Saturn		
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Stars	SHA	Dec
0	30°24.4	183°41.6	\$09°52.7	305°44.9	N23°25.4	29°14.1	\$01°13.3	68°58.0	S16°29.4			Alpheratz	357°36.4	29°13.1
1	45°26.9	198°41.1	53.8	320°47.0	25.5	44°16.8	13.4	84°00.5	29.4			Ankaa	353°08.6	-42°11.0
2	60°29.4	213°40.6	55.0	335°49.2	25.6	59°19.5	13.5	99°02.9	29.4			Schedar	349°32.6	56°39.8
3	75°31.8	228°40.1	.. 56.2	350°51.3	.. 25.7	74°22.2	.. 13.6	114°05.4	.. 29.4			Diphda	348°48.8	-17°51.7
4	90°34.3	243°39.6	57.4	5°53.5	25.8	89°24.9	13.7	129°07.9	29.4			Achernar	335°21.0	-57°07.3
5	105°36.7	258°39.1	58.5	20°55.6	26.0	104°27.6	13.8	144°10.3	29.4			Hamal	327°52.9	23°34.3
6	120°39.2	273°38.6	\$09°59.7	35°57.8	N23°26.1	119°30.3	\$01°13.9	159°12.8	S16°29.4			Polaris	314°27.4	89°21.5
7	135°41.7	288°38.2	10°00.9	50°59.9	26.2	134°33.0	14.0	174°15.3	29.4			Acamar	315°12.8	-40°12.7
8	150°44.1	303°37.7	02.0	66°02.1	26.3	149°35.7	14.0	189°17.7	29.4			Menkar	314°07.8	4°10.8
9	165°46.6	318°37.2	.. 03.2	81°04.3	.. 26.4	164°38.4	.. 14.1	204°20.2	.. 29.4			Mirfak	308°30.4	49°56.5
10	180°49.1	333°36.7	04.4	96°06.4	26.5	179°41.1	14.2	219°22.7	29.4			Aldebaran	290°41.5	16°33.3
11	195°51.5	348°36.2	05.5	111°08.6	26.6	194°43.8	14.3	234°25.1	29.4			Rigel	281°05.4	-8°10.4
12	210°54.0	3°35.7	\$10°06.7	126°10.7	N23°26.7	209°46.5	\$01°14.4	249°27.6	S16°29.4			Capella	280°24.3	46°01.1
13	225°56.5	18°35.2	07.9	141°12.9	26.9	224°49.2	14.5	264°30.1	29.4			Bellatrix	278°24.7	6°22.3
14	240°58.9	33°34.8	09.0	156°15.1	27.0	239°51.9	14.6	279°32.5	29.4			Elnath	278°04.0	28°37.6
15	256°01.4	48°34.3	.. 10.2	171°17.2	.. 27.1	254°54.6	.. 14.7	294°35.0	.. 29.4			Alnilam	275°39.4	-1°11.1
16	271°03.8	63°33.8	11.4	186°19.4	27.2	269°57.3	14.8	309°37.5	29.4			Betelgeuse	270°53.9	7°24.8
17	286°06.3	78°33.3	12.6	201°21.6	27.3	285°00.0	14.9	324°39.9	29.4			Canopus	263°53.0	-52°42.1
18	301°08.8	93°32.8	\$10°13.7	216°23.8	N23°27.4	300°02.7	\$01°15.0	339°42.4	S16°29.4			Sirius	258°27.8	-16°44.6
19	316°11.2	108°32.3	14.9	231°25.9	27.5	315°05.4	15.1	354°44.9	29.4			Adhara	255°07.2	-28°59.9
20	331°13.7	123°31.8	16.0	246°28.1	27.6	330°08.1	15.2	9°47.3	29.4			Procyon	244°52.7	5°10.1
21	346°16.2	138°31.3	.. 17.2	261°30.3	.. 27.7	345°10.8	.. 15.3	24°49.8	.. 29.4			Pollux	243°19.5	27°58.3
22	1°18.6	153°30.8	18.4	276°32.5	27.9	0°13.5	15.4	39°52.3	29.4			Avgor	234°15.5	-59°34.5
23	16°21.1	168°30.4	19.5	291°34.6	28.0	15°16.1	15.5	54°54.7	29.4			Suhail	222°47.8	-43°31.1
Mer.pass.		21:55	ν -0.5° d -1.2° m -3.89			ν 2.1° d 0.1° m -1.02			ν 2.7° d -0.1° m -2.87			ν 2.5° d 0.0° m 0.63		

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec					
0	31°23.6	183°29.9	\$10°20.7	306°36.8	N23°28.1	30°18.8	\$01°15.6	69°57.2	S16°29.4					
1	46°26.0	198°29.4	21.9	321°39.0	28.2	45°21.5	15.6	84°59.7	29.4					
2	61°28.5	213°28.9	23.0	336°41.2	28.3	60°24.2	15.7	100°02.1	29.4					
3	76°31.0	228°28.4	.. 24.2	351°43.4	.. 28.4	75°26.9	.. 15.8	115°04.6	.. 29.4					
4	91°33.4	243°27.9	25.4	6°45.6	28.5	90°29.6	15.9	130°07.1	29.4					
5	106°35.9	258°27.4	26.5	21°47.7	28.6	105°32.3	16.0	145°09.5	29.4					
6	121°38.3	273°26.9	\$10°27.7	36°49.9	N23°28.8	120°35.0	\$01°16.1	160°12.0	S16°29.4					
7	136°40.8	288°26.4	28.8	51°52.1	28.9	135°37.7	16.2	175°14.5	29.4					
8	151°43.3	303°25.9	30.0	66°54.3	29.0	150°40.4	16.3	190°16.9	29.4					
9	166°45.7	318°25.4	.. 31.2	81°56.5	.. 29.1	165°43.1	.. 16.4	205°19.4	.. 29.4					
10	181°48.2	333°24.9	32.3	96°58.7	29.2	180°45.8	16.5	220°21.9	29.4					
11	196°50.7	348°24.4	33.5	112°00.9	29.3	195°48.5	16.6	235°24.3	29.4					
12	211°53.1	3°23.9	\$10°34.6	127°03.1	N23°29.4	210°51.2	\$01°16.7	250°26.8	S16°29.4					
13	226°55.6	18°23.4	35.8	142°05.3	29.5	225°53.9	16.8	265°29.2	29.4					
14	241°58.1	33°22.9	37.0	157°07.5	29.6	240°56.6	16.8	280°31.7	29.4					
15	257°00.5	48°22.5	.. 38.1	172°09.7	.. 29.8	255°59.3	.. 16.9	295°34.2	.. 29.4					
16	272°03.0	63°22.0	39.3	187°11.9	29.9	271°02.0	17.0	310°36.6	29.4					
17	287°05.4	78°21.5	40.4	202°14.1	30.0	286°04.7	17.1	325°39.1	29.4					
18	302°07.9	93°21.0	\$10°41.6	217°16.3	N23°30.1	301°07.4	\$01°17.2	340°41.6	S16°29.4					
19	317°10.4	108°20.5	42.7	232°18.5	30.2	316°10.0	17.3	355°44.0	29.4					
20	332°12.8	123°20.0	43.9	247°20.8	30.3	331°12.7	17.4	10°46.5	29.4					
21	347°15.3	138°19.5	.. 45.1	262°23.0	.. 30.4	346°15.4	.. 17.5	25°48.9	.. 29.4					
22	2°17.8	153°19.0	46.2	277°25.2	30.5	1°18.1	17.6	40°51.4	29.4					
23	17°20.2	168°18.5	47.4	292°27.4	30.7	16°20.8	17.7	55°53.9	29.4					
Mer.pass.		21:51	ν -0.5° d -1.2° m -3.89			ν 2.2° d 0.1° m -1.04			ν 2.7° d -0.1° m -2.86			ν 2.5° d 0.0° m 0.64		

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	32°22.7	183°18.0	\$10°48.5	307°29.6	N23°30.8	31°23.5	\$01°17.8	70°56.3	S16°29.3
1	47°25.2	198°17.5	49.7	322°31.8	30.9	46°26.2	17.8	85°58.8	29.3
2	62°27.6	213°17.0	50.8	337°34.1	31.0	61°28.9	17.9	101°01.2	29.3
3	77°30.1	228°16.5	.. 52.0	352°36.3	.. 31.1	76°31.6	.. 18.0	116°03.7	.. 29.3
4	92°32.6	243°16.0	53.1	7°38.5	31.2	91°34.3	18.1	131°06.2	29.3
5	107°35.0	258°15.5	54.3	22°40.7	31.3	106°37.0	18.2	146°08.6	29.3
6	122°37.5	273°15.0	\$10°55.4	37°43.0	N23°31.4	121°39.7	\$01°18.3	161°11.1	S16°29.3
7	137°39.9	288°14.5	56.6	52°45.2	31.5	136°42.3	18.4	176°13.6	29.3
8	152°42.4	303°13.9	57.7	67°47.4	31.7	151°45.0	18.5	191°16.0	29.3
9	167°44.9	318°13.4	10°58.9	82°49.6	.. 31.8	166°47.7	.. 18.6	206°18.5	.. 29.3
10	182°47.3	333°12.9	11°00.0	97°51.9	31.9	181°50.4	18.7	221°20.9	29.3
11	197°49.8	348°12.4	01.2	112°54.1	32.0	196°53.1	18.7	236°23.4	29.3
12	212°52.3	3°11.9	\$11°02.3	127°56.4	N23°32.1	211°55.8	\$01°18.8	251°25.8	S16°29.3
13	227°54.7	18°11.4	03.5	142°58.6	32.2	226°58.5	18.9	266°28.3	29.3
14	242°57.2	33°10.9	04.6	158°00.8	32.3	242°01.2	19.0	281°30.8	29.3
15	257°59.7	48°10.4	.. 05.8	173°03.1	.. 32.4	257°03.9	.. 19.1	296°33.2	.. 29.3
16	273°02.1	63°09.9	06.9	188°05.3	32.6	272°06.5	19.2	311°35.7	29.3
17	288°04.6	78°09.4	08.1	203°07.6	32.7	287°09.2	19.3	326°38.1	29.3
18	303°07.1	93°08.9	\$11°09.2	218°09.8	N23°32.8	302°11.9	\$01°19.4	341°40.6	S16°29.3
19	318°09.5	108°08.4	10.4	233°12.0	32.9	317°14.6	19.5	356°43.1	29.3
20	333°12.0	123°07.9	11.5	248°14.3	33.0	332°17.3	19.5	11°45.5	29.3
21	348°14.4	138°07.4	.. 12.6	263°16.5	.. 33.1	347°20.0	.. 19.6	26°48.0	.. 29.3
22	3°16.9	153°06.9	13.8	278°18.8	33.2	2°22.7	19.7	41°50.4	29.3
23	18°19.4	168°06.3	14.9	293°21.1	33.3	17°25.4	19.8	56°52.9	29.3
Mer.pass.		21:47	ν -0.5° d -1.2° m -3.89			ν 2.2° d 0.1° m -1.07			ν 2.7° d -

DUT1 = UT1-UTC = -0.0067 sec  $\Delta T = TT-UT1 = +69.1907$  sec

2022 October 22 to Oct. 24 UT

h	Sun			Moon			
Sat	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	183°51.9	S10°57.8	221°10.0	14.6'	N09°25.6	-13.9'	55.8'
1	198°52.0	58.7	235°43.7	14.7'	09°11.7	-13.9'	55.9'
2	213°52.1	10°59.6	250°17.3	14.7'	08°57.8	-14.0'	55.9'
3	228°52.2	11°00.5	264°51.0	14.7'	08°43.8	-14.0'	55.9'
4	243°52.2	01.4	279°24.6	14.7'	08°29.8	-14.1'	56.0'
5	258°52.3	02.3	293°58.3	14.7'	08°15.8	-14.1'	56.0'
6	273°52.4	S11°03.1	308°32.0	14.7'	N08°01.7	-14.2'	56.0'
7	288°52.5	04.0	323°05.7	14.7'	07°47.5	-14.2'	56.0'
8	303°52.6	04.9	337°39.3	14.7'	07°33.3	-14.3'	56.1'
9	318°52.7	.. 05.8	352°13.0	14.7'	07°19.1	-14.3'	56.1'
10	333°52.8	06.7	6°46.7	14.7'	07°04.8	-14.3'	56.1'
11	348°52.9	07.6	21°20.4	14.7'	06°50.4	-14.4'	56.2'
12	3°53.0	S11°08.4	35°54.0	14.7'	N06°36.0	-14.4'	56.2'
13	18°53.1	09.3	50°27.7	14.7'	06°21.6	-14.5'	56.2'
14	33°53.2	10.2	65°01.4	14.7'	06°07.1	-14.5'	56.2'
15	48°53.3	.. 11.1	79°35.0	14.7'	05°52.6	-14.6'	56.3'
16	63°53.4	12.0	94°08.7	14.6'	05°38.0	-14.6'	56.3'
17	78°53.5	12.8	108°42.3	14.6'	05°23.4	-14.6'	56.3'
18	93°53.6	S11°13.7	123°16.0	14.6'	N05°08.8	-14.7'	56.4'
19	108°53.6	14.6	137°49.6	14.6'	04°54.1	-14.7'	56.4'
20	123°53.7	15.5	152°23.2	14.6'	04°39.4	-14.7'	56.4'
21	138°53.8	.. 16.4	166°56.8	14.6'	04°24.7	-14.8'	56.4'
22	153°53.9	17.2	181°30.4	14.6'	04°09.9	-14.8'	56.5'
23	168°54.0	18.1	196°04.0	14.6'	03°55.1	-14.8'	56.5'
	SD = 16.1' d = -0.9'			SD = 15.2'			

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

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

Day	Sun			Moon		
	Eqn.of	Time	Mer.	Mer. Pass.	Upper	Age
	00 <sup>h</sup>	12 <sup>h</sup>	Pass	Lower	hh:mm	27-3%
22	15:27	15:32	11:44	09:32	21:54	
23	15:36	15:41	11:44	10:16	22:38	
24	15:45	15:48	11:44	11:00	23:24	

## October 25, 26, 27 UT (Tue., Wed., Thu.)

Aries			Venus			Mars			Jupiter			Saturn		
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Stars	SHA	Dec
0	33°21.8	183°05.8	\$11°16.1	308°23.3	N23°33.5	32°28.0	S01°19.9	71°55.3	S16°29.2			Alpheratz	357°36.4	29°13.1
1	48°24.3	198°05.3	17.2	323°25.6	33.6	47°30.7	20.0	86°57.8	29.2			Ankaa	353°08.6	-42°11.0
2	63°26.8	213°04.8	18.4	338°27.8	33.7	62°33.4	20.1	102°00.3	29.2			Schedar	349°32.6	56°39.8
3	78°29.2	228°04.3	.. 19.5	353°30.1	.. 33.8	77°36.1	.. 20.2	117°02.7	.. 29.2			Diphda	348°48.8	-17°51.7
4	93°31.7	243°03.8	20.6	8°32.3	33.9	92°38.8	20.2	132°05.2	29.2			Achernar	335°21.0	-57°07.3
5	108°34.2	258°03.3	21.8	23°34.6	34.0	107°41.5	20.3	147°07.6	29.2			Hamal	327°52.9	23°34.3
6	123°36.6	273°02.8	\$11°22.9	38°36.9	N23°34.1	122°44.1	S01°20.4	162°10.1	S16°29.2			Polaris	314°26.7	89°21.5
7	138°39.1	288°02.3	24.1	53°39.1	34.2	137°46.8	20.5	177°12.5	29.2			Acamar	315°12.8	-40°12.7
8	153°41.5	303°01.7	25.2	68°41.4	34.3	152°49.5	20.6	192°15.0	29.2			Menkar	314°07.8	4°10.8
9	168°44.0	318°01.2	.. 26.3	83°43.7	.. 34.5	167°52.2	.. 20.7	207°17.5	.. 29.2			Mirfak	308°30.4	49°56.5
10	183°46.5	333°00.7	27.5	98°45.9	34.6	182°54.9	20.8	222°19.9	29.2			Aldebaran	290°41.5	16°33.3
11	198°48.9	348°00.2	28.6	113°48.2	34.7	197°57.6	20.9	237°22.4	29.2			Rigel	281°05.4	-8°10.4
12	213°51.4	2°59.7	\$11°29.8	128°50.5	N23°34.8	213°00.2	S01°20.9	252°24.8	S16°29.2			Capella	280°24.3	46°01.1
13	228°53.9	17°59.2	30.9	143°52.8	34.9	228°02.9	21.0	267°27.3	29.2			Bellatrix	278°24.6	6°22.3
14	243°56.3	32°58.7	32.0	158°55.0	35.0	243°05.6	21.1	282°29.7	29.2			Elnath	278°04.0	28°37.6
15	258°58.8	47°58.1	.. 33.2	173°57.3	.. 35.1	258°08.3	.. 21.2	297°32.2	.. 29.2			Alnilam	275°39.4	-1°11.1
16	274°01.3	62°57.6	34.3	188°59.6	35.2	273°11.0	21.3	312°34.6	29.2			Betelgeuse	270°53.9	7°24.8
17	289°03.7	77°57.1	35.4	204°01.9	35.4	288°13.7	21.4	327°37.1	29.2			Canopus	263°53.0	-52°42.1
18	304°06.2	92°56.6	\$11°36.6	219°04.2	N23°35.5	303°16.3	S01°21.5	342°39.5	S16°29.2			Sirius	258°27.7	-16°44.6
19	319°08.7	107°56.1	37.7	234°06.4	35.6	318°19.0	21.5	357°42.0	29.1			Adhara	255°07.2	-28°59.9
20	334°11.1	122°55.6	38.8	249°08.7	35.7	333°21.7	21.6	12°44.5	29.1			Procyon	244°52.7	5°10.1
21	349°13.6	137°55.0	.. 40.0	264°11.0	.. 35.8	348°24.4	.. 21.7	27°46.9	.. 29.1			Pollux	243°19.5	27°58.2
22	4°16.0	152°54.5	41.1	279°13.3	35.9	3°27.1	21.8	42°49.4	29.1			Avgor	234°15.5	-59°34.5
23	19°18.5	167°54.0	42.2	294°15.6	36.0	18°29.7	21.9	57°51.8	29.1			Suhail	222°47.8	-43°31.1
	Mer.pass. 21:43		ν -0.5° d -1.1' m -3.90	ν 2.3' d 0.1' m -1.09		ν 2.7' d -0.1' m -2.85	ν 2.5' d 0.0' m 0.64					Miaplacidus	221°38.9	-69°48.2

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Stars	SHA	Dec
0	34°21.0	182°53.5	\$11°43.4	309°17.9	N23°36.1	33°32.4	S01°22.0	72°54.3	S16°29.1			Denebola	182°27.1	14°26.8
1	49°23.4	197°53.0	44.5	324°20.2	36.3	48°35.1	22.1	87°56.7	29.1			Gienah	175°45.8	-17°39.9
2	64°25.9	212°52.4	45.6	339°22.5	36.4	63°37.8	22.1	102°59.2	29.1			Acrux	173°02.8	-63°13.3
3	79°28.4	227°51.9	.. 46.8	354°24.8	.. 36.5	78°40.5	.. 22.2	118°01.6	.. 29.1			Gacrux	171°54.2	-57°14.2
4	94°30.8	242°51.4	47.9	9°27.1	36.6	93°43.1	22.3	133°04.1	29.1			Alioth	166°15.1	55°50.2
5	109°33.3	257°50.9	49.0	24°29.4	36.7	108°45.8	22.4	148°06.5	29.1			Spica	158°24.6	-11°16.6
6	124°35.8	272°50.4	\$11°50.2	39°31.7	N23°36.8	123°48.5	S01°22.5	163°09.0	S16°29.1			Alkaid	152°54.0	49°12.1
7	139°38.2	287°49.8	51.3	54°34.0	36.9	138°51.2	22.6	178°11.4	29.1			Hadar	148°39.3	-60°28.8
8	154°40.7	302°49.3	52.4	69°36.3	37.0	153°53.9	22.6	193°13.9	29.1			Menkent	148°00.2	-36°28.7
9	169°43.1	317°48.8	.. 53.5	84°38.6	.. 37.2	168°56.5	.. 22.7	208°16.3	.. 29.1			Arcturus	145°50.0	19°04.0
10	184°45.6	332°48.3	54.7	99°40.9	37.3	183°59.2	22.8	223°18.8	29.1			Rigel Kent.	139°43.5	-60°55.7
11	199°48.1	347°47.7	55.8	114°43.2	37.4	199°01.9	22.9	238°21.2	29.0			Kochab	137°20.9	74°03.8
12	214°50.5	2°47.2	\$11°56.9	129°45.5	N23°37.5	214°04.6	S01°23.0	253°23.7	S16°29.0			Zuben'ubi	136°58.4	-16°08.0
13	229°53.0	17°46.7	58.0	144°47.8	37.6	229°07.2	23.1	268°26.1	29.0			Alphecca	126°05.7	26°38.5
14	244°55.5	32°46.2	11°59.2	159°50.1	37.7	244°09.9	23.2	283°28.6	29.0			Antares	112°18.4	-26°28.9
15	259°57.9	47°45.6	12°00.3	174°52.4	.. 37.8	259°12.6	.. 23.2	298°31.0	.. 29.0			Atria	107°14.7	-69°04.2
16	275°00.4	62°45.1	01.4	189°54.8	37.9	274°15.3	23.3	313°33.5	29.0			Sabik	102°05.2	-15°45.1
17	290°02.9	77°44.6	02.5	204°57.1	38.1	289°17.9	23.4	328°35.9	29.0			Shaula	96°13.2	-37°07.2
18	305°05.3	92°44.1	\$12°03.7	219°59.4	N23°38.2	304°20.6	S01°23.5	343°38.4	S16°29.0			Rasalhague	96°00.5	12°32.8
19	320°07.8	107°43.5	04.8	235°01.7	38.3	319°23.3	23.6	358°40.8	29.0			Eltanin	90°43.3	51°29.4
20	335°10.3	122°43.0	05.9	250°04.0	38.4	334°26.0	23.7	13°43.3	29.0			Kaus Aust.	83°35.2	-34°22.5
21	350°12.7	137°42.5	.. 07.0	265°06.4	.. 38.5	349°28.6	.. 23.7	28°45.7	.. 29.0			Vega	80°34.7	38°48.5
22	5°15.2	152°42.0	08.1	280°08.7	38.6	4°31.3	23.8	43°48.2	29.0			Nunki	75°50.2	-26°16.1
23	20°17.6	167°41.4	09.3	295°11.0	38.7	19°34.0	23.9	58°50.6	29.0			Altair	62°01.8	8°55.8
	Mer.pass. 21:39		ν -0.5° d -1.1' m -3.90	ν 2.3' d 0.1' m -1.11		ν 2.7' d -0.1' m -2.85	ν 2.5' d 0.0' m 0.65					Peacock	53°08.6	-56°39.9

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Stars	SHA	Dec
0	35°20.1	182°40.9	\$12°10.4	310°13.4	N23°38.8	34°36.7	S01°24.0	73°53.1	S16°29.0			Alnair	15°16.3	-29°30.2
1	50°22.6	197°40.4	11.5	325°15.7	39.0	49°39.3	24.1	88°55.5	28.9			Scheat	13°46.8	28°12.5
2	65°25.0	212°39.8	12.6	340°18.0	39.1	64°42.0	24.1	103°58.0	28.9			Markab	13°31.5	15°19.8
3	80°27.5	227°39.3	.. 13.7	355°20.4	.. 39.2	79°44.7	.. 24.2	119°00.4	.. 28.9			Oct 25 Tue	SHA	Mer.pass
4	95°30.0	242°38.8	14.9	10°22.7	39.3	94°47.4	24.3	134°02.9	28.9			Venus	149°44.0	11:48
5	110°32.4	257°38.2	16.0	25°25.0	39.4	109°50.0	24.4	149°05.3	28.9			Mars	275°01.5	03:26
6	125°34.9	272°37.7	\$12°17.1	40°27.4	N23°39.5	124°52.7	S01°24.5	164°07.8	S16°28.9			Jupiter	359°06.2	21:46
7	140°37.4	287°37.2	18.2	55°29.7	39.6	139°55.4	24.6	179°10.2	28.9			Saturn	38°33.5	19:09
8	155°39.8	302°36.6	19.3	70°32.1	39.7	154°58.1	24.6	194°12.7	28.9			Oct 26 Wed	SHA	Mer.pass
9	170°42.3	317°36.1	.. 20.4	85°34.4	.. 39.9	170°00.7	.. 24.7	209°15.1	.. 28.9			Venus	148°32.5	11:49
10	185°44.8	332°35.6	21.6	100°36.7	40.0	185°03.4	24.8	224°17.6	28.9			Mars	274°56.9	03:22
11	200°47.2	347°35.0	22.7	115°39.1	40.1	200°06.1	24.9	239°20.0	28.9			Jupiter	359°11.5	21:42
12	215°49.7	2°34.5	\$12°23.8											

DUT1 = UT1-UTC = -0.0086 sec  $\Delta T = TT-UT1 = +69.1926$  sec

2022 October 25 to Oct. 27 UT

h		Sun		Moon				
Tue		GHA	Dec	GHA	$\nu$	Dec	d	HP
0	183°58.0	S12°00.8		188°49.2	12.5'	S08°30.1	-15.1'	57.9'
1	198°58.1	01.7	203°20.7	12.4'	08°45.2	-15.1'	57.9'	
2	213°58.2	02.5	217°52.1	12.3'	09°00.2	-15.0'	58.0'	
3	228°58.2	03.4	232°23.4	12.3'	09°15.3	-15.0'	58.0'	
4	243°58.3	04.3	246°54.7	12.2'	09°30.3	-15.0'	58.0'	
5	258°58.4	05.1	261°25.8	12.1'	09°45.2	-14.9'	58.0'	
6	273°58.5	S12°06.0	275°57.0	12.0'	S10°00.1	-14.9'	58.1'	
7	288°58.5	06.8	290°28.0	12.0'	10°15.0	-14.9'	58.1'	
8	303°58.6	07.7	304°58.9	11.9'	10°29.9	-14.8'	58.1'	
9	318°58.7	08.6	319°29.8	11.8'	10°44.7	-14.8'	58.1'	
10	333°58.8	09.4	334°00.6	11.7'	10°59.5	-14.7'	58.2'	
11	348°58.8	10.3	348°31.3	11.6'	11°14.2	-14.7'	58.2'	
12	3°58.9	S12°11.1	3°01.9	11.6'	S11°28.9	-14.6'	58.2'	
13	18°59.0	12.0	17°32.5	11.5'	11°43.6	-14.6'	58.2'	
14	33°59.0	12.9	32°03.0	11.4'	11°58.2	-14.6'	58.3'	
15	48°59.1	13.7	46°33.3	11.3'	12°12.7	-14.5'	58.3'	
16	63°59.2	14.6	61°03.6	11.2'	12°27.2	-14.4'	58.3'	
17	78°59.2	15.4	75°33.9	11.1'	12°41.7	-14.4'	58.3'	
18	93°59.3	S12°16.3	90°04.0	11.0'	S12°56.1	-14.3'	58.4'	
19	108°59.4	17.2	104°34.0	10.9'	13°10.4	-14.3'	58.4'	
20	123°59.4	18.0	119°04.0	10.9'	13°24.7	-14.2'	58.4'	
21	138°59.5	18.9	133°33.8	10.8'	13°38.9	-14.2'	58.4'	
22	153°59.6	19.7	148°03.6	10.7'	13°53.1	-14.1'	58.5'	
23	168°59.7	20.6	162°33.3	10.6'	14°07.2	-14.0'	58.5'	
		SD = 16.1'		d = -0.9'		SD = 15.8'		
Wed		GHA	Dec	GHA	$\nu$	Dec	d	HP
0	183°59.7	S12°21.4	177°02.8	10.5'	S14°21.2	-14.0'	58.5'	
1	198°59.8	22.3	191°32.3	10.4'	14°35.2	-13.9'	58.5'	
2	213°59.9	23.1	206°01.7	10.3'	14°49.1	-13.8'	58.5'	
3	228°59.9	24.0	220°31.0	10.2'	15°02.9	-13.8'	58.6'	
4	244°00.0	24.9	235°00.2	10.1'	15°16.7	-13.7'	58.6'	
5	259°00.0	25.7	249°29.4	10.0'	15°30.4	-13.6'	58.6'	
6	274°00.1	S12°26.6	263°58.4	9.9'	S15°44.0	-13.5'	58.6'	
7	289°00.2	27.4	278°27.3	9.8'	15°57.6	-13.5'	58.6'	
8	304°00.2	28.3	292°56.1	9.7'	16°11.0	-13.4'	58.7'	
9	319°00.3	29.1	307°24.8	9.6'	16°24.4	-13.3'	58.7'	
10	334°00.4	30.0	321°53.5	9.5'	16°37.7	-13.2'	58.7'	
11	349°00.4	30.8	336°22.0	9.4'	16°51.0	-13.1'	58.7'	
12	4°00.5	S12°31.7	350°50.4	9.3'	S17°04.1	-13.1'	58.7'	
13	19°00.6	32.5	5°18.7	9.2'	17°17.1	-13.0'	58.8'	
14	34°00.6	33.4	19°46.9	9.1'	17°30.1	-12.9'	58.8'	
15	49°00.7	34.2	34°15.0	9.0'	17°43.0	-12.8'	58.8'	
16	64°00.7	35.1	48°43.1	8.9'	17°55.8	-12.7'	58.8'	
17	79°00.8	35.9	63°11.0	8.8'	18°08.5	-12.6'	58.8'	
18	94°00.9	S12°36.8	77°38.8	8.7'	S18°21.0	-12.5'	58.9'	
19	109°00.9	37.6	92°06.5	8.6'	18°33.5	-12.4'	58.9'	
20	124°01.0	38.5	106°34.1	8.5'	18°45.9	-12.3'	58.9'	
21	139°01.1	39.3	121°01.6	8.4'	18°58.2	-12.2'	58.9'	
22	154°01.1	40.2	135°29.0	8.3'	19°10.4	-12.1'	58.9'	
23	169°01.2	41.0	149°56.2	8.2'	19°22.5	-12.0'	58.9'	
		SD = 16.1'		d = -0.9'		SD = 16.0'		
Thu		GHA	Dec	GHA	$\nu$	Dec	d	HP
0	184°01.2	S12°41.9	164°23.4	8.1'	S19°34.5	-11.9'	59.0'	
1	199°01.3	42.7	178°50.5	8.0'	19°46.4	-11.8'	59.0'	
2	214°01.4	43.6	193°17.5	7.9'	19°58.1	-11.6'	59.0'	
3	229°01.4	44.4	207°44.3	7.8'	20°09.8	-11.5'	59.0'	
4	244°01.5	45.3	222°11.1	7.7'	20°21.3	-11.4'	59.0'	
5	259°01.5	46.1	236°37.8	7.6'	20°32.7	-11.3'	59.0'	
6	274°01.6	S12°47.0	251°04.3	7.4'	S20°44.0	-11.2'	59.1'	
7	289°01.6	47.8	265°30.8	7.3'	20°55.2	-11.1'	59.1'	
8	304°01.7	48.6	279°57.1	7.2'	21°06.3	-10.9'	59.1'	
9	319°01.8	49.5	294°23.3	7.1'	21°17.2	-10.8'	59.1'	
10	334°01.8	50.3	308°49.5	7.0'	21°28.0	-10.7'	59.1'	
11	349°01.9	51.2	323°15.5	6.9'	21°38.7	-10.6'	59.1'	
12	4°01.9	S12°52.0	337°41.4	6.8'	S21°49.3	-10.4'	59.1'	
13	19°02.0	52.9	352°07.2	6.7'	21°59.7	-10.3'	59.2'	
14	34°02.0	53.7	6°32.9	6.6'	22°10.0	-10.2'	59.2'	
15	49°02.1	54.6	20°58.6	6.5'	22°20.2	-10.0'	59.2'	
16	64°02.1	55.4	35°24.1	6.4'	22°30.2	-9.9'	59.2'	
17	79°02.2	56.2	49°49.5	6.3'	22°40.1	-9.7'	59.2'	
18	94°02.3	S12°57.1	64°14.8	6.2'	S22°49.8	-9.6'	59.2'	
19	109°02.3	57.9	78°40.0	6.1'	22°59.4	-9.5'	59.2'	
20	124°02.4	58.8	93°05.1	6.0'	23°08.9	-9.3'	59.2'	
21	139°02.4	12°59.6	107°30.1	5.9'	23°18.2	-9.2'	59.2'	
22	154°02.5	13°00.4	121°55.0	5.8'	23°27.4	-9.0'	59.3'	
23	169°02.5	01.3	136°19.9	5.7'	23°36.4	-8.9'	59.3'	
		SD = 16.1'		d = -0.8'		SD = 16.1'		

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

## October 28, 29, 30 UT (Fri., Sat., Sun.)

Aries			Venus			Mars		Jupiter		Saturn		Stars		
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	36°19.3	182°28.1	\$12°37.1	311°09.8	N23°41.5	35°40.8	\$01°25.9	74°51.8	\$16°28.8			Alpheratz	357°36.4	
1	51°21.7	197°27.5	38.2	326°12.1	41.7	50°43.4	26.0	89°54.2	28.7			Ankaa	353°08.6	
2	66°24.2	212°27.0	39.3	341°14.5	41.8	65°46.1	26.1	104°56.7	28.7			Schedar	349°32.6	
3	81°26.6	227°26.4	40.4	356°16.9	41.9	80°48.8	26.2	119°59.1	28.7			Diphda	348°48.8	
4	96°29.1	242°25.9	41.5	11°19.2	42.0	95°51.4	26.2	135°01.6	28.7			Achernar	335°21.0	
5	111°31.6	257°25.3	42.6	26°21.6	42.1	110°54.1	26.3	150°04.0	28.7			Hamal	327°52.9	
6	126°34.0	272°24.8	\$12°43.7	41°24.0	N23°42.2	125°56.8	\$01°26.4	165°06.5	\$16°28.7			Polaris	314°25.9	
7	141°36.5	287°24.3	44.9	56°26.4	42.3	140°59.4	26.5	180°08.9	28.7			Acamar	315°12.8	
8	156°39.0	302°23.7	46.0	71°28.8	42.4	156°02.1	26.5	195°11.3	28.7			Menkar	314°07.8	
9	171°41.4	317°23.2	47.1	86°31.1	42.6	171°04.8	26.6	210°13.8	28.7			Mirfak	308°30.4	
10	186°43.9	332°22.6	48.2	101°33.5	42.7	186°07.4	26.7	225°16.2	28.7			Aldebaran	290°41.4	
11	201°46.4	347°22.1	49.3	116°35.9	42.8	201°10.1	26.8	240°18.7	28.7			Rigel	281°05.4	
12	216°48.8	2°21.5	\$12°50.4	131°38.3	N23°42.9	216°12.8	\$01°26.9	255°21.1	\$16°28.6			Capella	280°24.3	
13	231°51.3	17°21.0	51.5	146°40.7	43.0	231°15.4	26.9	270°23.6	28.6			Bellatrix	278°24.6	
14	246°53.8	32°20.5	52.6	161°43.1	43.1	246°18.1	27.0	285°26.0	28.6			Elnath	278°03.9	
15	261°56.2	47°19.9	53.7	176°45.5	43.2	261°20.8	27.1	300°28.4	28.6			Alnilam	275°39.4	
16	276°58.7	62°19.4	54.8	191°47.9	43.3	276°23.4	27.2	315°30.9	28.6			Betelgeuse	270°53.9	
17	292°01.1	77°18.8	55.9	206°50.3	43.5	291°26.1	27.2	330°33.3	28.6			Canopus	263°52.9	
18	307°03.6	92°18.3	\$12°57.0	221°52.6	N23°43.6	306°28.7	\$01°27.3	345°35.8	\$16°28.6			Sirius	258°27.7	
19	322°06.1	107°17.7	58.1	236°55.0	43.7	321°31.4	27.4	0°38.2	28.6			Adhara	255°07.2	
20	337°08.5	122°17.2	12°59.2	251°57.4	43.8	336°34.1	27.5	15°40.6	28.6			Procyon	244°52.7	
21	352°11.0	137°16.6	13°00.2	266°59.9	43.9	351°36.7	27.6	30°43.1	28.6			Pollux	243°19.5	
22	7°13.5	152°16.1	01.3	282°02.3	44.0	6°39.4	27.6	45°45.5	28.5			Arior	234°15.5	
23	22°15.9	167°15.5	02.4	297°04.7	44.1	21°42.1	27.7	60°48.0	28.5			Suhail	222°47.7	
Mer.pass. 21:31			ν -0.5' d -1.1' m -3.90	ν 2.4' d 0.1' m -1.15	ν 2.7' d -0.1' m -2.84	ν 2.4' d 0.0' m 0.66						Alplacidus	221°38.8	
Mer.pass. 21:31			ν -0.6' d -1.1' m -3.90	ν 2.4' d 0.1' m -1.15	ν 2.7' d -0.1' m -2.84	ν 2.4' d 0.0' m 0.66						Alphard	217°49.6	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Regulus	207°36.5	
0	37°18.4	182°15.0	\$13°03.5	312°07.1	N23°44.3	36°44.7	\$01°27.8	75°50.4	\$16°28.5			Dubhe	193°43.7	
1	52°20.9	197°14.4	04.6	327°09.5	44.4	51°47.4	29.8	90°52.8	28.5			Denebola	182°27.1	
2	67°23.3	212°13.9	05.7	342°11.9	44.5	66°50.0	27.9	105°55.3	28.5			Gienah	175°45.8	
3	82°25.8	227°13.3	06.8	357°14.3	44.6	81°52.7	28.0	120°57.7	28.5			Acrux	173°02.8	
4	97°28.2	242°12.8	07.9	12°16.7	44.7	96°55.4	28.1	136°00.2	28.5			Gacrux	171°54.2	
5	112°30.7	257°12.2	09.0	27°19.1	44.8	111°58.0	28.2	151°02.6	28.5			Alioth	166°15.1	
6	127°33.2	272°11.7	\$13°10.1	42°21.5	N23°44.9	127°00.7	\$01°28.2	166°05.0	\$16°28.5			Spica	158°24.6	
7	142°35.6	287°11.1	11.2	57°24.0	45.0	142°03.3	28.3	181°07.5	28.5			Alkaid	152°54.0	
8	157°38.1	302°10.5	12.3	72°26.4	45.2	157°06.0	28.4	196°09.9	28.4			Hadar	148°39.3	
9	172°40.6	317°10.0	13.4	87°28.8	45.3	172°08.7	28.5	211°12.4	28.4			Menkent	148°00.2	
10	187°43.0	332°09.4	14.4	102°31.2	45.4	187°11.3	28.5	226°14.8	28.4			Arcturus	145°50.0	
11	202°45.5	347°08.9	15.5	117°33.6	45.5	202°14.0	28.6	241°17.2	28.4			Rigel Kent	139°43.5	
12	217°48.0	2°08.3	\$13°16.6	132°36.1	N23°45.6	217°16.6	\$01°28.7	256°19.7	\$16°28.4			Kochab	137°21.0	
13	232°50.4	17°07.8	17.7	147°38.5	45.7	232°19.3	28.8	271°22.1	28.4			Zuben' ubi	136°58.4	
14	247°52.9	32°07.2	18.8	162°40.9	45.8	247°22.0	28.8	286°24.6	28.4			Alphecca	126°05.7	
15	262°55.4	47°06.7	19.9	177°43.4	46.0	262°24.6	28.9	301°27.0	28.4			Antares	112°18.4	
16	277°57.8	62°06.1	21.0	192°45.8	46.1	277°27.3	29.0	316°29.4	28.4			Atria	107°14.7	
17	293°00.3	77°05.5	22.1	207°48.2	46.2	292°29.9	29.1	331°31.9	28.3			Sabik	102°05.2	
18	308°02.7	92°05.0	\$13°23.1	222°50.7	N23°46.3	307°32.6	\$01°29.1	346°34.3	\$16°28.3			Shaula	96°13.2	
19	323°05.2	107°04.4	24.2	237°53.1	46.4	322°35.2	29.2	1°36.7	28.3			Rasalhague	96°00.5	
20	338°07.7	122°03.9	25.3	252°55.5	46.5	337°37.9	29.3	16°39.2	28.3			Eltanin	90°43.4	
21	353°10.1	137°03.3	26.4	267°58.0	46.6	352°40.6	29.4	31°41.6	28.3			Kaus Aust.	83°35.2	
22	8°12.6	152°02.7	27.5	283°00.4	46.7	7°43.2	29.4	46°44.0	28.3			Vega	80°34.7	
23	23°15.1	167°02.2	28.6	298°02.9	46.9	22°45.9	29.5	61°46.5	28.3			Nunki	75°50.2	
Mer.pass. 21:27			ν -0.6' d -1.1' m -3.90	ν 2.4' d 0.1' m -1.17	ν 2.7' d -0.1' m -2.83	ν 2.4' d 0.0' m 0.66						Altair	62°01.8	
Mer.pass. 21:27			ν -0.6' d -1.1' m -3.90	ν 2.4' d 0.1' m -1.20	ν 2.7' d -0.1' m -2.82	ν 2.4' d 0.0' m 0.67						Peacock	53°08.6	
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Fomalhaut	15°16.3	
0	38°17.5	182°01.6	\$13°29.6	313°05.3	N23°47.0	37°48.5	\$01°29.6	76°48.9	\$16°28.3			Scheat	13°46.8	
1	53°20.0	197°01.1	30.7	328°07.8	47.1	52°51.2	29.7	91°51.4	28.3			Markab	13°31.5	
2	68°22.5	212°00.5	31.8	343°10.2	47.2	67°53.8	29.7	106°53.8	28.2			Oct 28 Fri	SHA	Mer.pass
3	83°24.9	226°59.9	32.9	358°12.7	47.3	82°56.5	29.8	121°56.2	28.2			Venus	146°08.8	11:51
4	98°27.4	241°59.4	34.0	13°15.1	47.4	97°59.1	29.9	136°58.7	28.2			Mars	274°50.5	03:15
5	113°29.9	256°58.8	35.0	28°17.6	47.5	113°01.8	29.9	152°01.1	28.2			Jupiter	359°21.5	21:33
6	128°32.3	271°58.2	\$13°36.1	43°20.0	N23°47.7	128°04.4	\$01°30.0	167°03.5	\$16°28.2			Saturn	38°32.5	18:57
7	143°34.8	286°57.7	37.2	58°22.5	47.8	143°07.1	30.1	182°06.0	28.2			Oct 29 Sat	SHA	Mer.pass
8	158°37.2	301°57.1	38.3	73°24.9	47.9	158°09.7	30.2	197°08.4	28.2			Venus	144°56.6	11:51
9	173°39.7	316°55.5	39.3	88°27.4	48.0	173°12.4	30.2	212°10.8	28.2			Mars	274°48.7	03:11
10	188°42.2	331°56.0	40.4	103°29.9	48.1	188°15.1	30.3	227°13.3	28.1			Jupiter	359°26.3	21:29
11	203°44.6	346°55.4	41.5	118°32.3	48.2	203°17.7	30.4	242°15.7	28.1			Saturn	38°32.0	18:54
12	218°47.1	1°54.9	\$13°42.6	133°34.8	N23°48.3	218°20.4	\$01°30.4	257°18.1	\$16°28.1			Oct 30 Sun	SHA	Mer.pass
13	233°49.6	16°54.3	43.6	148°37.3	48.4	233°23.0	30.5	272°20.6	28.1			Venus	143°44.1	11:52
14	248°52.0	31°53.7	44.7	163°39.7	48.6	248°25.7	30.6	287°23.0	28.1			Mars	274°47.8	03:07
15	263°54.5	46°53.1	45.8	178°42.2	48.7	263°28.3	30.7	302°25.4	28.1			Jupiter	359°31.0	21:25
16	278°57.0	61°52.6	46.9	193°44.7	48.8	278°31.0	30.7	317°27.9	28.1			Saturn	38°31.4	18:50
17	293°59.4	76°52.0	47.9	208°47.1	48.9	293°33.6	30.8	332°30.3	28.1			Horizontal parallax		
18	309°01.9	91°51.4	\$13°49.0	223°49.6	N23°49.0	308°36.3	\$01°30.9	347°32.7	\$16°28.0			Venus:	0.1	
19	324°04.4	106°50.9	50.1	238°52.1	49.1	323°38								

DUT1 = UT1-UTC = -0.0098 sec  $\Delta T = TT-UT1 = +69.1938$  sec

2022 October 28 to Oct. 30 UT

h		Sun		Moon			
Fri	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	184°02.6	S13°02.1	150°44.6	5.6'	S23°45.3	-8.7'	59.3'
1	199°02.6	03.0	165°09.2	5.5'	23°54.0	-8.6'	59.3'
2	214°02.7	03.8	179°33.7	5.4'	24°02.6	-8.4'	59.3'
3	229°02.7	.. 04.6	193°58.2	5.3'	24°11.0	-8.3'	59.3'
4	244°02.8	05.5	208°22.5	5.3'	24°19.3	-8.1'	59.3'
5	259°02.8	06.3	222°46.8	5.2'	24°27.4	-8.0'	59.3'
6	274°02.9	S13°07.2	237°10.9	5.1'	S24°35.3	-7.8'	59.3'
7	289°02.9	08.0	251°35.0	5.0'	24°43.1	-7.6'	59.3'
8	304°03.0	08.8	265°59.0	4.9'	24°50.8	-7.5'	59.3'
9	319°03.0	.. 09.7	280°22.9	4.8'	24°58.2	-7.3'	59.4'
10	334°03.1	10.5	294°46.7	4.7'	25°05.5	-7.1'	59.4'
11	349°03.1	11.3	309°10.5	4.7'	25°12.7	-7.0'	59.4'
12	4°03.2	S13°12.2	323°34.1	4.6'	S25°19.6	-6.8'	59.4'
13	19°03.2	13.0	337°57.7	4.5'	25°26.4	-6.6'	59.4'
14	34°03.3	13.8	352°21.2	4.4'	25°33.1	-6.5'	59.4'
15	49°03.3	.. 14.7	6°44.6	4.4'	25°39.5	-6.3'	59.4'
16	64°03.4	15.5	21°08.0	4.3'	25°45.8	-6.1'	59.4'
17	79°03.4	16.3	35°31.3	4.2'	25°51.9	-5.9'	59.4'
18	94°03.4	S13°17.2	49°54.5	4.1'	S25°57.9	-5.8'	59.4'
19	109°03.5	18.0	64°17.6	4.1'	26°03.6	-5.6'	59.4'
20	124°03.5	18.8	78°40.7	4.0'	26°09.2	-5.4'	59.4'
21	139°03.6	.. 19.7	93°03.7	3.9'	26°14.6	-5.2'	59.4'
22	154°03.6	20.5	107°26.6	3.9'	26°19.8	-5.0'	59.4'
23	169°03.7	21.3	121°49.5	3.8'	26°24.9	-4.9'	59.4'
		SD = 16.1' d = -0.8'		SD = 16.2'			

Sat	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	184°03.7	S13°22.2	136°12.3	3.8'	S26°29.7	-4.7'	59.4'
1	199°03.8	23.0	150°35.1	3.7'	26°34.4	-4.5'	59.4'
2	214°03.8	23.8	164°57.8	3.7'	26°38.9	-4.3'	59.4'
3	229°03.8	.. 24.7	179°20.5	3.6'	26°43.2	-4.1'	59.4'
4	244°03.9	25.5	193°43.1	3.6'	26°47.4	-3.9'	59.4'
5	259°03.9	26.3	208°05.7	3.5'	26°51.3	-3.8'	59.4'
6	274°04.0	S13°27.1	222°28.2	3.5'	S26°55.1	-3.6'	59.5'
7	289°04.0	28.0	236°50.7	3.4'	26°58.6	-3.4'	59.5'
8	304°04.1	28.8	251°13.1	3.4'	27°02.0	-3.2'	59.5'
9	319°04.1	.. 29.6	265°35.5	3.4'	27°05.2	-3.0'	59.5'
10	334°04.1	30.5	279°57.9	3.3'	27°08.2	-2.8'	59.5'
11	349°04.2	31.3	294°20.2	3.3'	27°11.0	-2.6'	59.5'
12	4°04.2	S13°32.1	308°42.5	3.3'	S27°13.6	-2.4'	59.5'
13	19°04.3	32.9	323°04.8	3.2'	27°16.1	-2.2'	59.5'
14	34°04.3	33.8	337°27.0	3.2'	27°18.3	-2.0'	59.5'
15	49°04.3	.. 34.6	351°49.2	3.2'	27°20.3	-1.9'	59.5'
16	64°04.4	35.4	6°11.4	3.2'	27°22.2	-1.7'	59.5'
17	79°04.4	36.2	20°33.6	3.2'	27°23.9	-1.5'	59.5'
18	94°04.4	S13°37.1	34°55.8	3.2'	S27°25.3	-1.3'	59.5'
19	109°04.5	37.9	49°17.9	3.1'	27°26.6	-1.1'	59.5'
20	124°04.5	38.7	63°40.1	3.1'	27°27.7	-0.9'	59.5'
21	139°04.6	.. 39.5	78°02.2	3.1'	27°28.6	-0.7'	59.5'
22	154°04.6	40.3	92°24.3	3.1'	27°29.3	-0.5'	59.5'
23	169°04.6	41.2	106°46.5	3.1'	27°29.8	-0.3'	59.5'
		SD = 16.1' d = -0.8'		SD = 16.2'			

Sun	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	184°04.7	S13°42.0	121°08.6	3.1'	S27°30.1	-0.1'	59.4'
1	199°04.7	42.8	135°30.7	3.1'	27°30.2	0.1'	59.4'
2	214°04.7	43.6	149°52.8	3.1'	27°30.1	0.3'	59.4'
3	229°04.8	.. 44.5	164°15.0	3.2'	27°29.8	0.5'	59.4'
4	244°04.8	45.3	178°37.1	3.2'	27°29.3	0.7'	59.4'
5	259°04.8	46.1	192°59.3	3.2'	27°28.7	0.9'	59.4'
6	274°04.9	S13°46.9	207°21.5	3.2'	S27°27.8	1.0'	59.4'
7	289°04.9	47.7	221°43.7	3.2'	27°26.8	1.2'	59.4'
8	304°04.9	48.6	236°05.9	3.2'	27°25.5	1.4'	59.4'
9	319°05.0	.. 49.4	250°28.2	3.3'	27°24.1	1.6'	59.4'
10	334°05.0	50.2	264°50.5	3.3'	27°22.5	1.8'	59.4'
11	349°05.0	51.0	279°12.8	3.3'	27°20.7	2.0'	59.4'
12	4°05.1	S13°51.8	293°35.1	3.4'	S27°18.7	2.2'	59.4'
13	19°05.1	52.6	307°57.5	3.4'	27°16.5	2.4'	59.4'
14	34°05.1	53.5	322°19.9	3.4'	27°14.1	2.6'	59.4'
15	49°05.2	.. 54.3	336°42.3	3.5'	27°11.5	2.8'	59.4'
16	64°05.2	55.1	351°04.8	3.5'	27°08.7	3.0'	59.4'
17	79°05.2	55.9	5°27.3	3.6'	27°05.8	3.1'	59.4'
18	94°05.3	S13°56.7	19°49.9	3.6'	S27°02.6	3.3'	59.4'
19	109°05.3	57.5	34°12.5	3.7'	26°59.3	3.5'	59.4'
20	124°05.3	58.4	48°35.2	3.7'	26°55.8	3.7'	59.4'
21	139°05.4	13°59.2	62°57.9	3.8'	26°52.1	3.9'	59.4'
22	154°05.4	14°00.0	77°20.7	3.8'	26°48.2	4.1'	59.4'
23	169°05.4	00.8	91°43.5	3.9'	26°44.1	4.2'	59.3'
		SD = 16.1' d = -0.8'		SD = 16.2'			

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

## October 31, 01, 02 UT (Mon., Tue., Wed.)

Aries			Venus			Mars			Jupiter			Saturn		
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Stars	SHA	Dec
0	39°16.7	181°48.0	\$13°55.4	314°04.5	N23°49.7	38°52.2	\$01°31.3	77°47.3	S16°28.0			Alpheratz	357°36.4	29°13.1
1	54°19.1	196°47.4	56.5	329°07.0	49.8	53°54.8	31.4	92°49.8	28.0			Ankaa	353°08.6	-42°11.0
2	69°21.6	211°46.9	57.5	344°09.5	49.9	68°57.5	31.4	107°52.2	27.9			Schedar	349°32.6	56°39.9
3	84°24.1	226°46.3	.. 58.6	359°12.0	.. 50.0	84°00.1	.. 31.5	122°54.6	.. 27.9			Diphda	348°48.8	-17°51.7
4	99°26.5	241°45.7	13°59.7	14°14.5	50.1	99°02.7	31.6	137°57.0	27.9			Achernar	335°21.0	-57°07.3
5	114°29.0	256°45.1	14°00.7	29°16.9	50.3	114°05.4	31.7	152°59.5	27.9			Hamal	327°52.9	23°34.3
6	129°31.5	271°44.6	\$14°01.8	44°19.4	N23°50.4	129°08.0	\$01°31.7	168°01.9	S16°27.9			Polaris	314°25.3	89°21.6
7	144°33.9	286°44.0	02.9	59°21.9	50.5	144°10.7	31.8	183°04.3	27.9			Acamar	315°12.7	-40°12.7
8	159°36.4	301°43.4	03.9	74°24.4	50.6	159°13.3	31.9	198°06.8	27.9			Menkar	314°07.7	4°10.8
9	174°38.9	316°42.8	.. 05.0	89°26.9	.. 50.7	174°16.0	.. 31.9	213°09.2	.. 27.9			Mirfak	308°30.4	49°56.5
10	189°41.3	331°42.3	06.0	104°29.4	50.8	189°18.6	32.0	228°11.6	27.8			Aldebaran	290°41.4	16°33.3
11	204°43.8	346°41.7	07.1	119°31.9	50.9	204°21.3	32.1	243°14.1	27.8			Rigel	281°05.4	-8°10.4
12	219°46.2	1°41.1	\$14°08.2	134°34.4	N23°51.1	219°23.9	\$01°32.1	258°16.5	S16°27.8			Capella	280°24.2	46°01.1
13	234°48.7	16°40.5	09.2	149°36.9	51.2	234°26.6	32.2	273°18.9	27.8			Bellatrix	278°24.6	6°22.3
14	249°51.2	31°39.9	10.3	164°39.5	51.3	249°29.2	32.3	288°21.3	27.8			Elnath	278°03.9	28°37.6
15	264°53.6	46°39.4	.. 11.3	179°42.0	.. 51.4	264°31.9	.. 32.3	303°23.8	.. 27.8			Alnilam	275°39.4	-1°11.1
16	279°56.1	61°38.8	12.4	194°44.5	51.5	279°34.5	32.4	318°26.2	27.8			Betelgeuse	270°53.9	7°24.8
17	294°58.6	76°38.2	13.5	209°47.0	51.6	294°37.1	32.5	333°28.6	27.7			Canopus	263°52.9	-52°42.1
18	310°01.0	91°37.6	\$14°14.5	224°49.5	N23°51.7	309°39.8	\$01°32.5	348°31.1	S16°27.7			Sirius	258°27.7	-16°44.6
19	325°03.5	106°37.0	15.6	239°52.0	51.9	324°42.4	32.6	3°33.5	27.7			Adhara	255°07.1	-28°59.9
20	340°06.0	121°36.5	16.6	254°54.5	52.0	339°45.1	32.7	18°35.9	27.7			Procyon	244°52.7	5°10.1
21	355°08.4	136°35.9	.. 17.7	269°57.1	.. 52.1	354°47.7	.. 32.7	33°38.3	.. 27.7			Pollux	243°19.5	27°58.2
22	10°10.9	151°35.3	18.7	284°59.6	52.2	9°50.4	32.8	48°40.8	27.7			Avior	234°15.4	-59°34.5
23	25°13.4	166°34.7	19.8	300°02.1	52.3	24°53.0	32.9	63°43.2	27.7			Suhail	222°47.7	-43°31.1
Mer.pass. 21:19		ν -0.6° d -1.1' m -3.90		ν 2.5° d 0.1' m -1.22		ν 2.6° d -0.1' m -2.82		ν 2.4° d 0.0' m 0.67		Miaplacidus			221°38.8	-69°48.2

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Stars	SHA	Dec
0	40°15.8	181°34.1	\$14°20.8	315°04.6	N23°52.4	39°55.6	\$01°32.9	78°45.6	S16°27.6			Denebola	182°27.1	14°26.8
1	55°18.3	196°33.5	21.9	330°07.2	52.5	54°58.3	33.0	93°48.1	27.6			Gienah	175°45.8	-17°39.9
2	70°20.7	211°33.0	22.9	345°09.7	52.7	70°00.9	33.1	108°50.5	27.6			Acrux	173°02.7	-63°13.2
3	85°23.2	226°32.4	.. 24.0	0°12.2	.. 52.8	85°03.6	.. 33.1	123°52.9	.. 27.6			Gacrux	171°54.2	-57°14.2
4	100°25.7	241°31.8	25.0	15°14.7	52.9	100°06.2	33.2	138°55.3	27.6			Alioth	166°15.1	55°50.2
5	115°28.1	256°31.2	26.1	30°17.3	53.0	115°08.8	33.3	153°57.8	27.6			Spica	158°24.6	-11°16.6
6	130°30.6	271°30.6	\$14°27.1	45°19.8	N23°53.1	130°11.5	\$01°33.3	169°00.2	S16°27.6			Alkaid	152°53.9	49°12.0
7	145°33.1	286°30.0	28.2	60°22.3	53.2	145°14.1	33.4	184°02.6	27.5			Hadar	148°39.3	-60°28.8
8	160°35.5	301°29.4	29.2	75°24.9	53.3	160°16.8	33.5	199°05.0	27.5			Menkent	148°00.2	-36°28.7
9	175°38.0	316°28.9	.. 30.3	90°27.4	.. 53.4	175°19.4	.. 33.5	214°07.5	.. 27.5			Arcturus	145°49.9	19°04.0
10	190°40.5	331°28.3	31.3	105°30.0	53.6	190°22.0	33.6	229°09.9	27.5			Rigel Kent.	139°43.5	-60°55.6
11	205°42.9	346°27.7	32.4	120°32.5	53.7	205°24.7	33.7	244°12.3	27.5			Kochab	137°21.0	74°03.7
12	220°45.4	1°27.1	\$14°33.4	135°35.0	N23°53.8	220°27.3	\$01°33.7	259°14.7	S16°27.5			Zuben'ubi	136°58.4	-16°08.0
13	235°47.8	16°26.5	34.5	150°37.6	53.9	235°30.0	33.8	274°17.2	27.5			Alphecca	126°05.7	26°38.4
14	250°50.3	31°25.9	35.5	165°40.1	54.0	250°32.6	33.9	289°19.6	27.4			Antares	112°18.4	-26°28.9
15	265°52.8	46°25.3	.. 36.5	180°42.7	.. 54.1	265°35.2	.. 33.9	304°22.0	.. 27.4			Atria	107°14.7	-69°04.2
16	280°55.2	61°24.7	37.6	195°45.2	54.2	280°37.9	34.0	319°24.4	27.4			Sabik	102°05.2	-15°45.1
17	295°57.7	76°24.1	38.6	210°47.8	54.4	295°40.5	34.1	334°26.9	27.4			Shaula	96°13.2	-37°07.2
18	311°00.2	91°23.5	\$14°39.7	225°50.3	N23°54.5	310°43.1	\$01°34.1	349°29.3	S16°27.4			Rasalhague	96°00.5	12°32.8
19	326°02.6	106°23.0	40.7	240°52.9	54.6	325°45.8	34.2	4°31.7	27.4			Eltanin	90°43.4	51°29.4
20	341°05.1	121°22.4	41.7	255°55.5	54.7	340°48.4	34.3	19°34.1	27.3			Kaus Aust.	83°35.2	-34°22.5
21	356°07.6	136°21.8	.. 42.8	270°58.0	.. 54.8	355°51.1	.. 34.3	34°36.6	.. 27.3			Vega	80°34.7	38°48.5
22	11°10.0	151°21.2	43.8	286°00.6	54.9	10°53.7	34.4	49°39.0	27.3			Nunki	75°50.2	-26°16.1
23	26°12.5	166°20.6	44.9	301°03.1	55.0	25°56.3	34.5	64°41.4	27.3			Altair	62°01.8	8°55.8
Mer.pass. 21:15		ν -0.6° d -1.1' m -3.90		ν 2.5° d 0.1' m -1.24		ν 2.6° d -0.1' m -2.81		ν 2.4° d 0.0' m 0.68		Peacock			53°08.7	-56°39.9

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Stars	SHA	Dec
0	41°15.0	181°20.0	\$14°45.9	316°05.7	N23°55.2	40°59.0	\$01°34.5	79°43.8	S16°27.3			Fomalhaut	15°16.3	-29°30.2
1	56°17.4	196°19.4	46.9	331°08.3	55.3	56°01.6	34.6	94°46.3	27.3			Scheat	13°46.8	28°12.5
2	71°19.9	211°18.8	48.0	346°10.8	55.4	71°04.2	34.6	109°48.7	27.3			Markab	13°31.5	15°19.8
3	86°22.3	226°18.2	.. 49.0	1°13.4	.. 55.5	86°06.9	.. 34.7	124°51.1	.. 27.2			Oct 31 Mon	SHA	Mer.pass
4	101°24.8	241°17.6	50.0	16°16.0	55.6	101°09.5	34.8	139°53.5	27.2			Venus	142°31.3	11:53
5	116°27.3	256°17.0	51.1	31°18.5	55.7	116°12.1	34.8	154°55.9	27.2			Mars	274°47.8	03:03
6	131°29.7	271°16.4	\$14°52.1	46°21.1	N23°55.8	131°14.8	\$01°34.9	169°58.4	S16°27.2			Jupiter	359°35.5	21:21
7	146°32.2	286°15.8	53.1	61°23.7	56.0	146°17.4	35.0	185°00.8	27.2			Saturn	38°30.6	18:46
8	161°34.7	301°15.2	54.2	76°26.3	56.1	161°20.0	35.0	200°03.2	27.2			Nov 01 Tue	SHA	Mer.pass
9	176°37.1	316°14.6	.. 55.2	91°28.9	.. 56.2	176°22.7	.. 35.1	215°05.6	.. 27.1			Venus	141°18.3	11:54
10	191°39.6	331°14.0	56.2	106°31.4	56.3	191°25.3	35.2	230°08.1	27.1			Mars	274°48.8	02:59
11	206°42.1	346°13.4	57.3	121°34.0	56.4	206°27.9	35.2	245°10.5	27.1			Jupiter	359°39.8	21:17
12	221°44.5	1°12.8	\$14°58.3	136°36.6	N2									

DUT1 = UT1-UTC = -0.0094 sec  $\Delta T = TT-UT1 = +69.1934$  sec

2022 October 31 to Nov. 02 UT

h		Sun		Moon				
Mon		GHA	Dec	GHA	$\nu$	Dec	d	HP
0	184°05.4	S14°01.6	106°06.4	4.0'	S26°39.9	4.4'	59.3'	
1	199°05.5	02.4	120°29.3	4.0'	26°35.5	4.6'	59.3'	
2	214°05.5	03.2	134°52.4	4.1'	26°30.9	4.8'	59.3'	
3	229°05.5	.. 04.0	149°15.4	4.1'	26°26.1	5.0'	59.3'	
4	244°05.6	04.9	163°38.6	4.2'	26°21.1	5.1'	59.3'	
5	259°05.6	05.7	178°01.8	4.3'	26°16.0	5.3'	59.3'	
6	274°05.6	S14°06.5	192°25.1	4.4'	S26°10.6	5.5'	59.3'	
7	289°05.6	07.3	206°48.4	4.4'	26°05.2	5.7'	59.3'	
8	304°05.7	08.1	221°11.9	4.5'	25°59.5	5.8'	59.3'	
9	319°05.7	.. 08.9	235°35.4	4.6'	25°53.6	6.0'	59.3'	
10	334°05.7	09.7	249°58.9	4.7'	25°47.6	6.2'	59.3'	
11	349°05.7	10.5	264°22.6	4.7'	25°41.5	6.4'	59.3'	
12	4°05.8	S14°11.3	278°46.3	4.8'	S25°35.1	6.5'	59.3'	
13	19°05.8	12.1	293°10.2	4.9'	25°28.6	6.7'	59.2'	
14	34°05.8	12.9	307°34.1	5.0'	25°21.9	6.8'	59.2'	
15	49°05.8	.. 13.7	321°58.0	5.1'	25°15.0	7.0'	59.2'	
16	64°05.8	14.6	336°22.1	5.2'	25°08.0	7.2'	59.2'	
17	79°05.9	15.4	350°46.3	5.2'	25°00.9	7.3'	59.2'	
18	94°05.9	S14°16.2	5°10.5	5.3'	S24°53.5	7.5'	59.2'	
19	109°05.9	17.0	19°34.8	5.4'	24°46.0	7.7'	59.2'	
20	124°05.9	17.8	33°59.3	5.5'	24°38.4	7.8'	59.2'	
21	139°06.0	.. 18.6	48°23.8	5.6'	24°30.6	8.0'	59.2'	
22	154°06.0	19.4	62°48.4	5.7'	24°22.6	8.1'	59.2'	
23	169°06.0	20.2	77°13.1	5.8'	24°14.5	8.3'	59.2'	
			SD = 16.1'	d = -0.8'		SD = 16.2'		

Tue	GHA	Dec	GHA	$\nu$	Dec	d	HP	
0	184°06.0	S14°21.0	91°37.9	5.9'	S24°06.2	8.4'	59.1'	
1	199°06.0	21.8	106°02.8	6.0'	23°57.8	8.6'	59.1'	
2	214°06.1	22.6	120°27.8	6.1'	23°49.2	8.7'	59.1'	
3	229°06.1	.. 23.4	134°52.9	6.2'	23°40.5	8.9'	59.1'	
4	244°06.1	24.2	149°18.0	6.3'	23°31.6	9.0'	59.1'	
5	259°06.1	25.0	163°43.3	6.4'	23°22.6	9.2'	59.1'	
6	274°06.1	S14°25.8	178°08.7	6.5'	S23°13.5	9.3'	59.1'	
7	289°06.2	26.6	192°34.2	6.6'	23°04.2	9.4'	59.1'	
8	304°06.2	27.4	206°59.7	6.7'	22°54.8	9.6'	59.1'	
9	319°06.2	.. 28.2	221°25.4	6.8'	22°45.2	9.7'	59.0'	
10	334°06.2	29.0	235°51.2	6.9'	22°35.5	9.8'	59.0'	
11	349°06.2	29.8	250°17.0	7.0'	22°25.6	10.0'	59.0'	
12	4°06.2	S14°30.6	264°43.0	7.1'	S22°15.7	10.1'	59.0'	
13	19°06.3	31.4	279°09.1	7.2'	22°05.6	10.2'	59.0'	
14	34°06.3	32.2	293°35.3	7.3'	21°55.3	10.4'	59.0'	
15	49°06.3	.. 33.0	308°01.5	7.4'	21°45.0	10.5'	59.0'	
16	64°06.3	33.8	322°27.9	7.5'	21°34.5	10.6'	59.0'	
17	79°06.3	34.6	336°54.4	7.6'	21°23.8	10.7'	59.0'	
18	94°06.3	S14°35.4	351°21.0	7.7'	S21°13.1	10.9'	58.9'	
19	109°06.3	36.2	5°47.7	7.8'	21°02.2	11.0'	58.9'	
20	124°06.4	37.0	20°14.4	7.9'	20°51.3	11.1'	58.9'	
21	139°06.4	.. 37.8	34°41.3	8.0'	20°40.2	11.2'	58.9'	
22	154°06.4	38.6	49°08.3	8.1'	20°28.9	11.3'	58.9'	
23	169°06.4	39.4	63°35.4	8.2'	20°17.6	11.4'	58.9'	
			SD = 16.1'	d = -0.8'		SD = 16.1'		

Wed	GHA	Dec	GHA	$\nu$	Dec	d	HP	
0	184°06.4	S14°40.1	78°02.6	8.3'	S20°06.2	11.6'	58.9'	
1	199°06.4	40.9	92°29.9	8.4'	19°54.6	11.7'	58.9'	
2	214°06.4	41.7	106°57.3	8.5'	19°42.9	11.8'	58.8'	
3	229°06.4	.. 42.5	121°24.8	8.6'	19°31.2	11.9'	58.8'	
4	244°06.4	43.3	135°52.3	8.7'	19°19.3	12.0'	58.8'	
5	259°06.5	44.1	150°20.0	8.8'	19°07.3	12.1'	58.8'	
6	274°06.5	S14°44.9	164°47.8	8.9'	S18°55.2	12.2'	58.8'	
7	289°06.5	45.7	179°15.7	9.0'	18°43.0	12.3'	58.8'	
8	304°06.5	46.5	193°43.7	9.1'	18°30.7	12.4'	58.8'	
9	319°06.5	.. 47.3	208°11.8	9.2'	18°18.3	12.5'	58.8'	
10	334°06.5	48.1	222°39.9	9.3'	18°05.8	12.6'	58.7'	
11	349°06.5	48.8	237°08.2	9.4'	17°53.2	12.7'	58.7'	
12	4°06.5	S14°49.6	251°36.6	9.5'	S17°40.6	12.8'	58.7'	
13	19°06.5	50.4	266°05.0	9.6'	17°27.8	12.9'	58.7'	
14	34°06.5	51.2	280°33.6	9.6'	17°14.9	13.0'	58.7'	
15	49°06.5	.. 52.0	295°02.2	9.7'	17°02.0	13.0'	58.7'	
16	64°06.6	52.8	309°31.0	9.8'	16°48.9	13.1'	58.7'	
17	79°06.6	53.6	323°59.8	9.9'	16°35.8	13.2'	58.6'	
18	94°06.6	S14°54.4	338°28.7	10.0'	S16°22.6	13.3'	58.6'	
19	109°06.6	55.1	352°57.7	10.1'	16°09.3	13.4'	58.6'	
20	124°06.6	55.9	7°26.8	10.2'	15°55.9	13.5'	58.6'	
21	139°06.6	.. 56.7	21°56.0	10.3'	15°42.5	13.5'	58.6'	
22	154°06.6	57.5	36°25.3	10.4'	15°29.0	13.6'	58.6'	
23	169°06.6	58.3	50°54.7	10.5'	15°15.4	13.7'	58.6'	
			SD = 16.1'	d = -0.8'		SD = 16.1'		

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

Lat.	Mon	Moonrise		Monset	Moonset	
		Tue	Wed		Mon	Tue
N 72°		■	■	17:50	■	■
N 70°		■	■	17:07	■	■
68°		■	17:39	16:37	■	19:50
66°		■	16:43	16:15	■	20:45
64°		■	16:35	16:09	■	18:52
62°		■	15:45	15:24	■	21:42
60°		■	15:14	15:25	■	22:01
N 58°		■	14:50	15:08	■	20:36
56°		■	14:31	14:54	■	22:29
54°		■</				

November 03, 04, 05 UT (Thu., Fri., Sat.)

Aries			Venus			Mars		Jupiter		Saturn		Stars		
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	42°14.1	181°05.5	\$15°10.6	317°07.7	N23°57.9	42°02.1	\$01°36.0	80°41.9	\$16°26.9			Alpheratz	357°36.4	
1	57°16.6	196°04.9	11.6	332°10.3	58.0	57°04.7	36.1	95°44.4	26.9			Ankaa	353°08.6	
2	72°19.0	211°04.3	12.6	347°13.0	58.1	72°07.4	36.1	110°46.8	26.9			Schedar	349°32.6	
3	87°21.5	226°03.7	.. 13.6	2°15.6	.. 58.2	87°10.0	.. 36.2	125°49.2	.. 26.8			Diphda	348°48.8	
4	102°23.9	241°03.1	14.7	17°18.2	58.3	102°12.6	36.3	140°51.6	26.8			Achernar	335°21.0	
5	117°26.4	256°02.5	15.7	32°20.8	58.5	117°15.2	36.3	155°54.0	26.8			Hamal	327°52.9	
6	132°28.9	271°01.9	\$15°16.7	47°23.4	N23°58.6	132°17.9	\$01°36.4	170°56.4	\$16°26.8			Polaris	314°25.1	
7	147°31.3	286°01.3	17.7	62°26.0	58.7	147°20.5	36.4	185°58.9	26.8			Acamar	315°12.7	
8	162°33.8	301°00.7	18.7	77°28.6	58.8	162°23.1	36.5	201°01.3	26.8			Menkar	314°07.7	
9	177°36.3	316°00.1	.. 19.7	92°31.2	.. 58.9	177°25.8	.. 36.6	216°03.7	.. 26.7			Mirfak	308°30.4	
10	192°38.7	330°59.4	20.8	107°33.9	59.0	192°28.4	36.6	231°06.1	26.7			Aldebaran	290°41.4	
11	207°41.2	345°58.8	21.8	122°36.5	59.1	207°31.0	36.7	246°08.5	26.7			Rigel	281°05.4	
12	222°43.7	0°58.2	\$15°22.8	137°39.1	N23°59.3	222°33.6	\$01°36.7	261°11.0	\$16°26.7			Capella	280°24.2	
13	237°46.1	15°57.6	23.8	152°41.7	59.4	237°36.3	36.8	276°13.4	26.7			Bellatrix	278°24.6	
14	252°48.6	30°57.0	24.8	167°44.4	59.5	252°38.9	36.9	291°15.8	26.7			Elnath	278°03.9	
15	267°51.1	45°56.4	.. 25.8	182°47.0	.. 59.6	267°41.5	.. 36.9	306°18.2	.. 26.6			Alnilam	275°39.3	
16	282°53.5	60°55.8	26.8	197°49.6	59.7	282°44.1	37.0	321°20.6	26.6			Betelgeuse	270°53.8	
17	297°56.0	75°55.2	27.8	212°52.3	59.8	297°46.7	37.0	336°23.0	26.6			Canopus	263°52.9	
18	312°58.4	90°54.5	\$15°28.9	227°54.9	N23°59.9	312°49.4	\$01°37.1	351°25.4	\$16°26.6			Sirius	258°27.7	
19	328°00.9	105°53.9	29.9	242°57.5	24°00.1	327°52.0	37.2	6°27.9	26.6			Adhara	255°07.1	
20	343°03.4	120°53.3	30.9	258°00.2	00.2	342°54.6	37.2	21°30.3	26.5			Procyon	244°52.6	
21	358°05.8	135°52.7	.. 31.9	273°02.8	.. 00.3	357°52.2	.. 37.3	36°32.7	.. 26.5			Pollux	243°19.4	
22	13°08.3	150°52.1	32.9	288°05.4	00.4	12°59.9	37.3	51°35.1	26.5			Avior	234°15.4	
23	28°10.8	165°51.4	33.9	303°08.1	00.5	28°02.5	37.4	66°37.5	26.5			Suhail	222°47.7	
Mer.pass. 21:08			ν -0.6° d -1.0° m -3.90	ν 2.6° d 0.1° m -1.28			ν 2.6° d -0.1° m -2.80			ν 2.4° d 0.0° m 0.68				
Fri														
0	43°13.2	180°50.8	\$15°34.9	318°10.7	N24°00.6	43°05.1	\$01°37.4	81°39.9	\$16°26.5			Denebola	182°27.1	
1	58°15.7	195°50.2	35.9	333°13.4	00.7	58°07.7	37.5	96°42.4	26.5			Gienah	175°45.7	
2	73°18.2	210°49.6	36.9	348°16.0	00.9	73°10.3	37.6	111°44.8	26.4			Acrux	173°02.7	
3	88°20.6	225°49.0	.. 37.9	3°18.7	.. 01.0	88°13.0	.. 37.6	126°47.2	.. 26.4			Gacrux	171°54.2	
4	103°23.1	240°48.3	38.9	18°21.3	01.1	103°15.6	37.7	141°49.6	26.4			Alioth	166°15.1	
5	118°25.6	255°47.7	39.9	33°24.0	01.2	118°18.2	37.7	156°52.0	26.4			Spica	158°24.5	
6	133°28.0	270°47.1	\$15°40.9	48°26.6	N24°01.3	133°20.8	\$01°37.8	171°54.4	\$16°26.4			Alkaid	152°53.9	
7	148°30.5	285°46.5	41.9	63°29.3	01.4	148°23.4	37.8	186°56.8	26.3			Hadar	148°39.3	
8	163°32.9	300°45.9	42.9	78°31.9	01.5	163°26.1	37.9	201°59.3	26.3			Menkent	148°00.2	
9	178°35.4	315°45.2	.. 43.9	93°34.6	.. 01.7	178°28.7	.. 38.0	217°01.7	.. 26.3			Arcturus	145°49.9	
10	193°37.9	330°44.6	44.9	108°37.3	01.8	193°31.3	38.0	232°04.1	26.3			Rigel Kent.	139°43.5	
11	208°40.3	345°44.0	45.9	123°39.9	01.9	208°33.9	38.1	247°06.5	26.3			Kochab	137°21.0	
12	223°42.8	0°43.4	\$15°46.9	138°42.6	N24°02.0	223°36.5	\$01°38.1	262°08.9	\$16°26.3			Zuben'ubi	136°58.4	
13	238°45.3	15°42.7	47.9	153°45.3	02.1	238°39.1	38.2	277°11.3	26.2			Alphecca	126°05.7	
14	253°47.7	30°42.1	48.9	168°47.9	02.2	253°41.8	38.2	292°13.7	26.2			Antares	112°18.4	
15	268°50.2	45°41.5	.. 49.9	183°50.6	.. 02.3	268°44.4	.. 38.3	307°16.1	.. 26.2			Atria	107°14.8	
16	283°52.7	60°40.9	50.9	198°53.3	02.5	283°47.0	38.3	322°18.6	26.2			Sabik	102°05.2	
17	298°55.1	75°40.2	51.9	213°55.9	02.6	298°49.6	38.4	337°21.0	26.2			Shaula	96°13.2	
18	313°57.6	90°39.6	\$15°52.9	228°58.6	N24°02.7	313°52.2	\$01°38.5	352°23.4	\$16°26.1			Rasalhague	96°00.5	
19	329°00.0	105°39.0	53.9	244°01.3	02.8	328°54.8	38.5	7°25.8	26.1			Eltanin	90°43.4	
20	344°02.5	120°38.3	54.8	259°04.0	02.9	343°57.5	38.6	22°28.2	26.1			Kaus Aust.	83°35.2	
21	359°05.0	135°37.7	.. 55.8	274°06.6	.. 03.0	359°00.1	.. 38.6	37°30.6	.. 26.1			Vega	80°34.7	
22	14°07.4	150°37.1	56.8	289°09.3	03.1	14°02.7	38.7	52°33.0	26.1			Nunki	75°50.2	
23	29°09.9	165°36.5	57.8	304°12.0	03.2	29°05.3	38.7	67°35.4	26.0			Altair	62°01.8	
Mer.pass. 21:04			ν -0.6° d -1.0° m -3.90	ν 2.6° d 0.1° m -1.31			ν 2.6° d -0.1° m -2.79			ν 2.4° d 0.0° m 0.69				
Sat														
0	44°12.4	180°35.8	\$15°58.8	319°14.7	N24°03.4	44°07.9	\$01°38.8	82°37.8	\$16°26.0			Fomalhaut	15°16.3	
1	59°14.8	195°35.2	15°59.8	334°17.4	03.5	59°10.5	38.8	97°40.3	26.0			Scheat	13°46.8	
2	74°17.3	210°34.6	16°00.8	349°20.1	03.6	74°13.1	38.9	112°42.7	26.0			Markab	13°31.5	
3	89°19.8	225°33.9	.. 01.8	4°22.8	.. 03.7	89°15.8	.. 38.9	127°45.1	.. 26.0			Nov 03 Thu	SHA	Mer.pass
4	104°22.2	240°33.3	02.7	19°25.4	03.8	104°18.4	39.0	142°47.5	25.9			Venus	138°51.5	11:56
5	119°24.7	255°32.7	03.7	34°28.1	03.9	119°21.0	39.1	157°49.9	25.9			Mars	274°53.6	02:51
6	134°27.2	270°32.0	\$16°04.7	49°30.8	N24°04.0	134°23.6	\$01°39.1	172°52.3	\$16°25.9			Jupiter	359°48.0	21:08
7	149°29.6	285°31.4	05.7	64°33.5	04.2	149°26.2	39.2	187°54.7	25.9			Saturn	38°27.8	18:34
8	164°32.1	300°30.8	06.7	79°36.2	04.3	164°28.8	39.2	202°57.1	25.9			Nov 04 Fri	SHA	Mer.pass
9	179°34.5	315°30.1	.. 07.7	94°38.9	.. 04.4	179°31.4	.. 39.3	217°59.5	.. 25.8			Venus	137°37.6	11:57
10	194°37.0	330°29.5	08.6	109°41.6	04.5	194°34.0	39.3	233°01.9	25.8			Mars	274°57.5	02:47
11	209°39.5	345°28.8	09.6	124°44.3	04.6	209°36.7	39.4	248°04.3	25.8			Jupiter	359°51.9	21:04
12	224°41.9	0°28.2	\$16°10.6	139°47.0	N24°04.7	224°39.3	\$01°39.4	263°06.8	\$16°25.8			Saturn	38°26.7	18:30
13	239°44.4	15°27.6	11.6	154°49.7	04.8	239°41.9	39.5	278°09.2	25.8			Nov 05 Sat	SHA	Mer.pass
14	254°46.9	30°26.9	12.6	169°52.4	05.0	254°44.5	39.5	293°11.6	25.7			Venus	136°23.5	11:58
15	269°49.3	45°26.3	.. 13.5	184°55.2	.. 05.1	269°47.1	.. 39.6	308°14.0	.. 25.7			Mars	275°02.3	02:43
16	284°51.8	60°25.7	14.5	199°57.9	05.2	284°49.7	39.6	323°16.4	25.7			Jupiter	359°55.6	21:00
17	299°54.3	75°25.0	15.5	215°00.6	05.3	299°52.3	39.7	338°18.8	25.7			Saturn	38°25.5	18:27
18	314°56.7	90°24.4	\$16°16.5	230°03.3	N24°05.4	314°54.9	\$01°39.7	353°21.2	\$16°25.7			Horizontal parallax		
19	329°59.2	105°23.7	17.4	245°06.0	05.5	329°57.5	39.8	8°23.6	25.6			Venus:	0.1	
20	345°01.6	120°23.1	18.4	260°08.7	05.6</									

DUT1 = UT1-UTC = -0.0097 sec  $\Delta T = TT-UT1 = +69.1937$  sec

2022 November 03 to Nov. 05 UT

h		Sun		Moon				
Thu		GHA	Dec	GHA	$\nu$	Dec	d	HP
0	184°06.6	S14°59.1		65°24.1	10.5'	S15°01.7	13.8'	58.5'
1	199°06.6	14°59.8	79°53.7	10.6'	14°47.9	13.8'	58.5'	
2	214°06.6	15°00.6	94°23.3	10.7'	14°34.1	13.9'	58.5'	
3	229°06.6	.. 01.4	108°53.0	10.8'	14°20.2	14.0'	58.5'	
4	244°06.6	02.2	123°22.8	10.9'	14°06.2	14.0'	58.5'	
5	259°06.6	03.0	137°52.7	11.0'	13°52.2	14.1'	58.5'	
6	274°06.6	S15°03.7	152°22.6	11.0'	S13°38.1	14.2'	58.5'	
7	289°06.6	04.5	166°52.7	11.1'	13°24.0	14.2'	58.4'	
8	304°06.6	05.3	181°22.8	11.2'	13°09.7	14.3'	58.4'	
9	319°06.6	.. 06.1	195°53.0	11.3'	12°55.4	14.3'	58.4'	
10	334°06.6	06.9	210°23.2	11.3'	12°41.1	14.4'	58.4'	
11	349°06.6	07.6	224°53.6	11.4'	12°26.7	14.5'	58.4'	
12	4°06.6	S15°08.4	239°24.0	11.5'	S12°12.3	14.5'	58.4'	
13	19°06.6	09.2	253°54.5	11.6'	11°57.7	14.6'	58.3'	
14	34°06.6	10.0	268°25.0	11.6'	11°43.2	14.6'	58.3'	
15	49°06.6	.. 10.8	282°55.7	11.7'	11°28.6	14.7'	58.3'	
16	64°06.6	11.5	297°26.4	11.8'	11°13.9	14.7'	58.3'	
17	79°06.6	12.3	311°57.1	11.8'	10°59.2	14.8'	58.3'	
18	94°06.6	S15°13.1	326°28.0	11.9'	S10°44.4	14.8'	58.3'	
19	109°06.6	13.9	340°58.9	12.0'	10°29.6	14.9'	58.2'	
20	124°06.6	14.6	355°29.8	12.0'	10°14.8	14.9'	58.2'	
21	139°06.6	.. 15.4	10°00.9	12.1'	09°59.9	14.9'	58.2'	
22	154°06.6	16.2	24°32.0	12.2'	09°44.9	15.0'	58.2'	
23	169°06.6	17.0	39°03.1	12.2'	09°29.9	15.0'	58.2'	
			SD = 16.1'	d = -0.8'		SD = 16.0'		

Fri	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	184°06.6	S15°17.7	53°34.4	12.3'	S09°14.9	15.1'	58.2'
1	199°06.6	18.5	68°05.6	12.3'	08°59.9	15.1'	58.2'
2	214°06.6	19.3	82°37.0	12.4'	08°44.8	15.1'	58.1'
3	229°06.6	.. 20.0	97°08.4	12.5'	08°29.7	15.2'	58.1'
4	244°06.6	20.8	111°39.8	12.5'	08°14.5	15.2'	58.1'
5	259°06.6	21.6	126°11.3	12.6'	07°59.3	15.2'	58.1'
6	274°06.5	S15°22.4	140°42.9	12.6'	S07°44.1	15.3'	58.1'
7	289°06.5	23.1	155°14.5	12.7'	07°28.8	15.3'	58.1'
8	304°06.5	23.9	169°46.2	12.7'	07°13.5	15.3'	58.0'
9	319°06.5	.. 24.7	184°17.9	12.8'	06°58.2	15.3'	58.0'
10	334°06.5	25.4	198°49.7	12.8'	06°42.9	15.4'	58.0'
11	349°06.5	26.2	213°21.5	12.9'	06°27.6	15.4'	58.0'
12	4°06.5	S15°27.0	227°53.3	12.9'	S06°12.2	15.4'	58.0'
13	19°06.5	27.7	242°25.2	13.0'	05°56.8	15.4'	57.9'
14	34°06.5	28.5	256°57.2	13.0'	05°41.4	15.4'	57.9'
15	49°06.5	.. 29.3	271°29.2	13.0'	05°25.9	15.5'	57.9'
16	64°06.5	30.0	286°01.2	13.1'	05°10.5	15.5'	57.9'
17	79°06.5	30.8	300°33.3	13.1'	04°55.0	15.5'	57.9'
18	94°06.4	S15°31.6	315°05.4	13.2'	S04°39.5	15.5'	57.9'
19	109°06.4	32.3	329°37.6	13.2'	04°24.0	15.5'	57.8'
20	124°06.4	33.1	344°09.8	13.2'	04°08.5	15.5'	57.8'
21	139°06.4	.. 33.9	358°42.0	13.3'	03°53.0	15.5'	57.8'
22	154°06.4	34.6	13°14.3	13.3'	03°37.4	15.5'	57.8'
23	169°06.4	35.4	27°46.6	13.3'	03°21.9	15.5'	57.8'
			SD = 16.1'	d = -0.8'		SD = 15.9'	

Sat	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	184°06.4	S15°36.1	42°18.9	13.4'	S03°06.4	15.6'	57.8'
1	199°06.4	36.9	56°51.2	13.4'	02°50.8	15.6'	57.7'
2	214°06.3	37.7	71°23.6	13.4'	02°35.2	15.6'	57.7'
3	229°06.3	.. 38.4	85°56.1	13.4'	02°19.7	15.6'	57.7'
4	244°06.3	39.2	100°28.5	13.5'	02°04.1	15.6'	57.7'
5	259°06.3	39.9	115°01.0	13.5'	01°48.6	15.6'	57.7'
6	274°06.3	S15°40.7	129°33.5	13.5'	S01°33.0	15.6'	57.6'
7	289°06.3	41.5	144°06.0	13.5'	01°17.4	15.6'	57.6'
8	304°06.3	42.2	158°38.6	13.6'	01°01.9	15.6'	57.6'
9	319°06.2	.. 43.0	173°11.1	13.6'	00°46.3	15.5'	57.6'
10	334°06.2	43.7	187°43.7	13.6'	00°30.8	15.5'	57.6'
11	349°06.2	44.5	202°16.3	13.6'	S00°15.2	15.5'	57.5'
12	4°06.2	S15°45.3	216°49.0	13.6'	N00°00.3	15.5'	57.5'
13	19°06.2	46.0	231°21.6	13.7'	00°15.8	15.5'	57.5'
14	34°06.2	46.8	245°54.3	13.7'	00°31.3	15.5'	57.5'
15	49°06.1	.. 47.5	260°26.9	13.7'	00°46.8	15.5'	57.5'
16	64°06.1	48.3	274°59.6	13.7'	01°02.3	15.5'	57.5'
17	79°06.1	49.0	289°32.3	13.7'	01°17.8	15.5'	57.4'
18	94°06.1	S15°49.8	304°05.1	13.7'	N01°33.3	15.4'	57.4'
19	109°06.1	50.5	318°37.8	13.7'	01°48.7	15.4'	57.4'
20	124°06.0	51.3	333°10.5	13.7'	02°04.1	15.4'	57.4'
21	139°06.0	.. 52.0	347°43.3	13.8'	02°19.5	15.4'	57.4'
22	154°06.0	52.8	2°16.0	13.8'	02°34.9	15.4'	57.3'
23	169°06.0	53.5	16°48.8	13.8'	02°50.3	15.3'	57.3'
			SD = 16.1'	d = -0.8'		SD = 15.8'	

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

## November 06, 07, 08 UT (Sun., Mon., Tue.)

Aries			Venus			Mars			Jupiter			Saturn			Stars	
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	45°11.5	180°20.5	\$16°22.3	320°19.6	N24°06.1	45°10.6	S01°40.1	83°35.6	S16°25.5					Alpheratz	357°36.4	
1	60°14.0	195°19.9	23.3	335°22.3	06.2	60°13.2	40.1	98°38.1	25.5					Ankaa	353°08.6	
2	75°16.4	210°19.2	24.2	350°25.1	06.3	75°15.8	40.2	113°40.5	25.5					Schedar	349°32.6	
3	90°18.9	225°18.6	25.2	5°27.8	06.4	90°18.4	40.2	128°42.9	25.5					Diphda	348°48.9	
4	105°21.4	240°17.9	26.2	20°30.5	06.5	105°21.0	40.3	143°45.3	25.5					Achernar	335°21.0	
5	120°23.8	255°17.3	27.1	35°33.3	06.7	120°23.6	40.3	158°47.7	25.4					Hamal	327°52.9	
6	135°26.3	270°16.6	\$16°28.1	50°36.0	N24°06.8	135°26.2	S01°40.4	173°50.1	S16°25.4					Polaris	314°24.8	
7	150°28.8	285°16.0	29.1	65°38.7	06.9	150°28.8	40.4	188°52.5	25.4					Acamar	315°12.7	
8	165°31.2	300°15.4	30.0	80°41.5	07.0	165°31.4	40.5	203°54.9	25.4					Menkar	314°07.7	
9	180°33.7	315°14.7	31.0	95°44.2	07.1	180°34.0	40.5	218°57.3	25.3					Mirfak	308°30.4	
10	195°36.1	330°14.1	32.0	110°46.9	07.2	195°36.6	40.6	233°59.7	25.3					Aldebaran	290°41.4	
11	210°38.6	345°13.4	32.9	125°49.7	07.3	210°39.2	40.6	249°02.1	25.3					Rigel	281°05.3	
12	225°41.1	0°12.8	\$16°33.9	140°52.4	N24°07.5	225°41.8	S01°40.7	264°04.5	S16°25.3					Capella	280°24.2	
13	240°43.5	15°12.1	34.8	155°55.2	07.6	240°44.4	40.7	279°06.9	25.3					Bellatrix	278°24.6	
14	255°46.0	30°11.5	35.8	170°57.9	07.7	255°47.0	40.8	294°09.3	25.2					Elnath	278°03.9	
15	270°48.5	45°10.8	36.8	186°00.7	07.8	270°49.6	40.8	309°11.7	25.2					Alnilam	275°39.3	
16	285°50.9	60°10.2	37.7	201°03.4	07.9	285°52.2	40.9	324°14.1	25.2					Betelgeuse	270°53.8	
17	300°53.4	75°09.5	38.7	216°06.2	08.0	300°54.8	40.9	339°16.5	25.2					Canopus	263°52.8	
18	315°55.9	90°08.8	\$16°39.6	231°08.9	N24°08.1	315°57.4	S01°40.9	354°18.9	S16°25.2					Sirius	258°27.6	
19	330°58.3	105°08.2	40.6	246°11.7	08.2	331°00.0	41.0	9°21.3	25.1					Adhara	255°07.1	
20	346°00.8	120°07.5	41.5	261°14.4	08.4	346°02.6	41.0	24°23.7	25.1					Procyon	244°52.6	
21	1°03.3	135°06.9	42.5	276°17.2	08.5	1°05.2	41.1	39°26.1	25.1					Pollux	243°19.4	
22	16°05.7	150°06.2	43.5	291°20.0	08.6	16°07.8	41.1	54°28.5	25.1					Avor	234°15.3	
23	31°08.2	165°05.6	44.4	306°22.7	08.7	31°10.4	41.2	69°30.9	25.0					Suhail	222°47.7	
Mer.pass.		20:56	ν -0.6° d -1.0° m -3.90			ν 2.7° d 0.1° m -1.35			ν 2.6° d -0.1° m -2.77			ν 2.4° d 0.0° m 0.70				
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	46°10.6	180°04.9	\$16°45.4	321°25.5	N24°08.8	46°13.0	S01°41.2	84°33.3	S16°25.0					Denebola	193°43.6	
1	61°13.1	195°04.3	46.3	336°28.3	08.9	61°15.6	41.3	99°35.7	25.0					Gienah	175°45.7	
2	76°15.6	210°03.6	47.3	351°31.0	09.0	76°18.2	41.3	114°38.2	25.0					Acrux	173°02.7	
3	91°18.0	225°02.9	48.2	6°33.8	09.1	91°20.8	41.4	129°40.6	25.0					Gacrux	171°54.2	
4	106°20.5	240°02.3	49.2	21°36.6	09.3	106°23.4	41.4	144°43.0	24.9					Alioth	166°15.1	
5	121°23.0	255°01.6	50.1	36°39.3	09.4	121°26.0	41.5	159°45.4	24.9					Spica	158°24.5	
6	136°25.4	270°01.0	\$16°51.1	51°42.1	N24°09.5	136°28.6	S01°41.5	174°47.8	S16°24.9					Alkaid	152°53.9	
7	151°27.9	285°00.3	52.0	66°44.9	09.6	151°31.2	41.6	189°50.2	24.9					Hadar	148°39.2	
8	166°30.4	299°59.7	53.0	81°47.7	09.7	166°33.8	41.6	204°52.6	24.8					Menkent	148°00.2	
9	181°32.8	314°59.0	53.9	96°50.5	09.8	181°36.4	41.7	219°55.0	24.8					Arcturus	145°49.9	
10	196°35.3	329°58.3	54.8	111°53.2	09.9	196°39.0	41.7	234°57.4	24.8					Rigel Kent.	139°43.5	
11	211°37.7	344°57.7	55.8	126°56.0	10.1	211°41.6	41.8	249°59.8	24.8					Kochab	137°21.0	
12	226°40.2	359°57.0	\$16°56.7	141°58.8	N24°10.2	226°44.2	S01°41.8	265°02.2	S16°24.7					Zuben'ubi	136°58.4	
13	241°42.7	14°56.3	57.7	157°01.6	10.3	241°46.8	41.8	280°04.6	24.7					Alphecca	126°05.7	
14	256°45.1	29°55.7	58.6	172°04.4	10.4	256°49.4	41.9	295°07.0	24.7					Antares	112°18.4	
15	271°47.6	44°55.0	16°59.6	187°07.2	10.5	271°52.0	41.9	310°09.4	24.7					Atria	107°14.8	
16	286°50.1	59°54.4	17°00.5	202°10.0	10.6	286°54.6	42.0	325°11.8	24.7					Sabik	102°05.2	
17	301°52.5	74°53.7	01.4	217°12.8	10.7	301°57.2	42.0	340°14.2	24.6					Shaula	96°13.2	
18	316°55.0	89°53.0	\$17°02.4	232°15.5	N24°10.8	316°59.8	S01°42.1	355°16.6	S16°24.6					Rasalhague	96°00.5	
19	331°57.5	104°52.4	03.3	247°18.3	11.0	332°02.4	42.1	10°19.0	24.6					Eltanin	90°43.4	
20	346°59.9	119°51.7	04.3	262°21.1	11.1	347°05.0	42.2	25°21.4	24.6					Kaus Aust.	83°35.2	
21	2°02.4	134°51.0	05.2	277°23.9	11.2	2°07.6	42.2	40°23.8	24.5					Vega	80°34.7	
22	17°04.9	149°50.4	06.1	292°26.7	11.3	17°10.2	42.3	55°26.2	24.5					Nunki	75°50.2	
23	32°07.3	164°49.7	07.1	307°29.5	11.4	32°12.8	42.3	70°28.6	24.5					Altair	62°01.8	
Mer.pass.		20:52	ν -0.7° d -1.0° m -3.90			ν 2.8° d 0.1° m -1.37			ν 2.6° d -0.0° m -2.77			ν 2.4° d 0.0° m 0.70				
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	47°09.8	179°49.0	\$17°08.0	322°32.4	N24°11.5	47°15.3	S01°42.3	85°31.0	S16°24.5					Fomalhaut	15°16.4	
1	62°12.2	194°48.3	08.9	337°35.2	11.6	62°17.9	42.4	100°33.3	24.4					Scheat	13°46.8	
2	77°14.7	209°47.7	09.9	352°38.0	11.7	77°20.5	42.4	115°35.7	24.4					Markab	13°31.6	
3	92°17.2	224°47.0	10.8	7°40.8	11.9	92°23.1	42.5	130°38.1	24.4					Nov 06 Sun	135°09.0	
4	107°19.6	239°46.3	11.7	22°43.6	12.0	107°25.7	42.5	145°40.5	24.4					Venus	11:59	
5	122°22.1	254°45.7	12.7	37°46.4	12.1	122°28.3	42.6	160°42.9	24.4					Mars	02:38	
6	137°24.6	269°45.0	\$17°13.6	52°49.2	N24°12.2	137°30.9	S01°42.6	175°45.3	S16°24.3					Jupiter	20:56	
7	152°27.0	284°44.3	14.5	67°52.0	12.3	152°33.5	42.7	190°47.7	24.3					Saturn	18:23	
8	167°29.5	299°43.7	15.4	82°54.9	12.4	167°36.1	42.7	205°50.1	24.3					Nov 07 Mon	133°54.3	
9	182°32.0	314°43.0	16.4	97°57.7	12.5	182°38.7	42.7	220°52.5	24.3					Venus	12:00	
10	197°34.4	329°42.3	17.3	113°00.5	12.6	197°41.3	42.8	235°54.9	24.2					Mars	02:34	
11	212°36.9	344°41.6	18.2	128°03.3	12.8	212°43.8	42.8	250°57.3	24.2					Jupiter	20:52	
12	227°39.3	359°41.0	\$17°19.1	143°06.1	N24°12.9	227°46.4	S01°42.9	265°59.7	S16°24.2					Saturn	18:19	
13	242°41.8	14°40.3	20.1	158°09.0	13.0	242°49.0	42.9	281°02.1	24.2					Nov 08 Tue	132°39.2	
14	257°44.3	29°39.6	21.0	173°11.8	13.1	257°51.6	43.0	296°04.5	24.1					Venus	12:01	
15	272°46.7	44°38.9	21.9	188°14.6	13.2	272°54.2	43.0	311°06.9	24.1					Mars	02:29	
16	287°49.2	59°38.2	22.8	203°17.5	13.3	287°56.8	43.0	326°09.3	24.1					Jupiter	20:47	
17	302°51.7	74°37.6	23.8	218°20.3	13.4	302°59.4	43.1	341°11.7	24.1				</td			

DUT1 = UT1-UTC = -0.0116 sec  $\Delta T = TT-UT1 = +69.1956$  sec

2022 November 06 to Nov. 08 UT

h		Sun		Moon			
Sun	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	184°06.0	S15°54.3	31°21.5	13.8'	N03°05.6	15.3'	57.3'
1	199°05.9	55.0	45°54.3	13.8'	03°21.0	15.3'	57.3'
2	214°05.9	55.8	60°27.1	13.8'	03°36.3	15.3'	57.3'
3	229°05.9	.. 56.5	74°59.9	13.8'	03°51.5	15.2'	57.2'
4	244°05.9	57.3	89°32.6	13.8'	04°06.8	15.2'	57.2'
5	259°05.8	58.0	104°05.4	13.8'	04°22.0	15.2'	57.2'
6	274°05.8	S15°58.8	118°38.2	13.8'	N04°37.2	15.2'	57.2'
7	289°05.8	15°59.5	133°10.9	13.8'	04°52.3	15.1'	57.2'
8	304°05.8	16°00.3	147°43.7	13.8'	05°07.5	15.1'	57.1'
9	319°05.7	.. 01.0	162°16.5	13.8'	05°22.6	15.1'	57.1'
10	334°05.7	01.8	176°49.2	13.8'	05°37.6	15.0'	57.1'
11	349°05.7	02.5	191°22.0	13.7'	05°52.6	15.0'	57.1'
12	4°05.7	S16°03.3	205°54.7	13.7'	N06°07.6	15.0'	57.1'
13	19°05.6	04.0	220°27.5	13.7'	06°22.6	14.9'	57.0'
14	34°05.6	04.8	235°00.2	13.7'	06°37.5	14.9'	57.0'
15	49°05.6	.. 05.5	249°32.9	13.7'	06°52.4	14.8'	57.0'
16	64°05.6	06.3	264°05.6	13.7'	07°07.2	14.8'	57.0'
17	79°05.5	07.0	278°38.3	13.7'	07°22.0	14.7'	57.0'
18	94°05.5	S16°07.7	293°11.0	13.7'	N07°36.7	14.7'	56.9'
19	109°05.5	08.5	307°43.7	13.7'	07°51.5	14.7'	56.9'
20	124°05.5	09.2	322°16.3	13.6'	08°06.1	14.6'	56.9'
21	139°05.4	.. 10.0	336°48.9	13.6'	08°20.7	14.6'	56.9'
22	154°05.4	10.7	351°21.6	13.6'	08°35.3	14.5'	56.9'
23	169°05.4	11.4	5°54.2	13.6'	08°49.8	14.5'	56.8'
SD = 16.1'		SD = 15.6'					
Mon	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	184°05.3	S16°12.2	20°26.7	13.6'	N09°04.3	14.4'	56.8'
1	199°05.3	12.9	34°59.3	13.5'	09°18.7	14.4'	56.8'
2	214°05.3	13.7	49°31.8	13.5'	09°33.1	14.3'	56.8'
3	229°05.2	.. 14.4	64°04.4	13.5'	09°47.4	14.3'	56.7'
4	244°05.2	15.1	78°36.9	13.5'	10°01.6	14.2'	56.7'
5	259°05.2	15.9	93°09.3	13.5'	10°15.9	14.2'	56.7'
6	274°05.1	S16°16.6	107°41.8	13.4'	N10°30.0	14.1'	56.7'
7	289°05.1	17.4	122°14.2	13.4'	10°44.1	14.0'	56.7'
8	304°05.1	18.1	136°46.6	13.4'	10°58.1	14.0'	56.6'
9	319°05.0	.. 18.8	151°19.0	13.4'	11°12.1	13.9'	56.6'
10	334°05.0	19.6	165°51.4	13.3'	11°26.0	13.9'	56.6'
11	349°05.0	20.3	180°23.7	13.3'	11°39.9	13.8'	56.6'
12	4°04.9	S16°21.0	194°56.0	13.3'	N11°53.7	13.7'	56.6'
13	19°04.9	21.8	209°28.2	13.2'	12°07.4	13.7'	56.5'
14	34°04.9	22.5	224°00.5	13.2'	12°21.1	13.6'	56.5'
15	49°04.8	.. 23.2	238°32.7	13.2'	12°34.7	13.5'	56.5'
16	64°04.8	24.0	253°04.9	13.1'	12°48.2	13.5'	56.5'
17	79°04.8	24.7	267°37.0	13.1'	13°01.7	13.4'	56.4'
18	94°04.7	S16°25.4	282°09.1	13.1'	N13°15.1	13.3'	56.4'
19	109°04.7	26.2	296°41.2	13.0'	13°28.4	13.3'	56.4'
20	124°04.7	26.9	311°13.2	13.0'	13°41.6	13.2'	56.4'
21	139°04.6	.. 27.6	325°45.2	13.0'	13°54.8	13.1'	56.4'
22	154°04.6	28.4	340°17.2	12.9'	14°07.9	13.0'	56.3'
23	169°04.5	29.1	354°49.2	12.9'	14°21.0	13.0'	56.3'
SD = 16.1'		SD = 15.5'					
Tue	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	184°04.5	S16°29.8	9°21.1	12.9'	N14°33.9	12.9'	56.3'
1	199°04.5	30.5	23°52.9	12.8'	14°46.8	12.8'	56.3'
2	214°04.4	31.3	38°24.7	12.8'	14°59.6	12.7'	56.3'
3	229°04.4	.. 32.0	52°56.5	12.8'	15°12.4	12.7'	56.2'
4	244°04.3	32.7	67°28.3	12.7'	15°25.0	12.6'	56.2'
5	259°04.3	33.4	82°00.0	12.7'	15°37.6	12.5'	56.2'
6	274°04.3	S16°34.2	96°31.7	12.6'	N15°50.1	12.4'	56.2'
7	289°04.2	34.9	111°03.3	12.6'	16°02.5	12.3'	56.1'
8	304°04.2	35.6	125°34.9	12.6'	16°14.8	12.2'	56.1'
9	319°04.1	.. 36.3	140°06.5	12.5'	16°27.0	12.2'	56.1'
10	334°04.1	37.1	154°38.0	12.5'	16°39.2	12.1'	56.1'
11	349°04.1	37.8	169°09.4	12.4'	16°51.3	12.0'	56.1'
12	4°04.0	S16°38.5	183°40.9	12.4'	N17°03.3	11.9'	56.0'
13	19°04.0	39.2	198°12.3	12.3'	17°15.1	11.8'	56.0'
14	34°03.9	40.0	212°43.6	12.3'	17°27.0	11.7'	56.0'
15	49°03.9	.. 40.7	227°14.9	12.3'	17°38.7	11.6'	56.0'
16	64°03.8	41.4	241°46.2	12.2'	17°50.3	11.5'	56.0'
17	79°03.8	42.1	256°17.4	12.2'	18°01.8	11.4'	55.9'
18	94°03.7	S16°42.8	270°48.6	12.1'	N18°13.3	11.3'	55.9'
19	109°03.7	43.6	285°19.7	12.1'	18°24.6	11.3'	55.9'
20	124°03.7	44.3	299°50.8	12.0'	18°35.9	11.2'	55.9'
21	139°03.6	.. 45.0	314°21.8	12.0'	18°47.0	11.1'	55.8'
22	154°03.6	45.7	328°52.8	11.9'	18°58.1	11.0'	55.8'
23	169°03.5	46.4	343°23.7	11.9'	19°09.1	10.9'	55.8'
SD = 16.1'		SD = 15.4'					

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

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

November 09, 10, 11 UT (Wed., Thu., Fri.)

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	48°08.9	179°32.8	\$17°30.2	323°40.2	N24°14.2	48°17.5	S01°43.4	86°28.5	S16°23.9					Alpheratz	357°36.4	29°13.1	
1	63°11.4	194°32.1	31.1	338°43.0	14.3	63°20.1	43.4	101°30.8	23.9					Ankaa	353°08.6	-42°11.1	
2	78°13.8	209°31.4	32.0	353°45.9	14.4	78°22.6	43.5	116°33.2	23.8					Schedar	349°32.6	56°39.9	
3	93°16.3	224°30.8	.. 32.9	8°48.7	.. 14.5	93°25.2	.. 43.5	131°35.6	.. 23.8					Diphda	348°48.9	-17°51.7	
4	108°18.8	239°30.1	33.8	23°51.6	14.7	108°27.8	43.5	146°38.0	23.8					Achernar	335°21.0	-57°07.4	
5	123°21.2	254°29.4	34.7	38°54.4	14.8	123°30.4	43.6	161°40.4	23.8					Hamal	327°52.9	23°34.3	
6	138°23.7	269°28.7	\$17°35.6	53°57.3	N24°14.9	138°33.0	S01°43.6	176°42.8	S16°23.7					Polaris	314°24.4	89°21.6	
7	153°26.2	284°28.0	36.6	69°00.1	15.0	153°35.6	43.7	191°45.2	23.7					Acamar	315°12.7	-40°12.8	
8	168°28.6	299°27.3	37.5	84°03.0	15.1	168°38.1	43.7	206°47.6	23.7					Menkar	314°07.7	4°10.8	
9	183°31.1	314°26.7	.. 38.4	99°05.9	.. 15.2	183°40.7	.. 43.7	221°50.0	.. 23.7					Mirfak	308°30.3	49°56.5	
10	198°33.6	329°26.0	39.3	114°08.7	15.3	198°43.3	43.8	236°52.4	23.6					Aldebaran	290°41.4	16°33.3	
11	213°36.0	344°25.3	40.2	129°11.6	15.4	213°45.9	43.8	251°54.8	23.6					Rigel	281°05.3	-8°10.4	
12	228°38.5	359°24.6	\$17°41.1	144°14.5	N24°15.5	228°48.5	S01°43.9	266°57.2	S16°23.6					Capella	280°24.2	46°01.2	
13	243°41.0	14°23.9	42.0	159°17.3	15.7	243°51.1	43.9	281°59.6	23.6					Bellatrix	278°24.5	6°22.3	
14	258°43.4	29°23.2	42.9	174°20.2	15.8	258°53.6	43.9	297°02.0	23.5					Elnath	278°03.9	28°37.6	
15	273°45.9	44°22.5	.. 43.8	189°23.1	.. 15.9	273°56.2	.. 44.0	312°04.3	.. 23.5					Alnilam	275°39.3	-1°11.1	
16	288°48.3	59°21.8	44.7	204°25.9	16.0	288°58.8	44.0	327°06.7	23.5					Betelgeuse	270°53.8	7°24.7	
17	303°50.8	74°21.1	45.6	219°28.8	16.1	304°01.4	44.1	342°09.1	23.5					Canopus	263°52.8	-52°42.2	
18	318°53.3	89°20.5	\$17°46.5	234°31.7	N24°16.2	319°04.0	S01°44.1	357°11.5	S16°23.4					Sirius	258°27.6	-16°44.7	
19	333°55.7	104°19.8	47.4	249°34.6	16.3	334°06.5	44.1	12°13.9	23.4					Adhara	255°07.1	-28°59.9	
20	348°58.2	119°19.1	48.3	264°37.4	16.4	349°09.1	44.2	27°16.3	23.4					Procyon	244°52.6	5°10.1	
21	4°00.7	134°18.4	.. 49.2	279°40.3	.. 16.5	4°11.7	.. 44.2	42°18.7	.. 23.4					Pollux	243°19.4	27°58.2	
22	19°03.1	149°17.7	50.1	294°43.2	16.7	19°14.3	44.2	57°21.1	23.3					Avor	234°15.3	-59°34.6	
23	34°05.6	164°17.0	51.0	309°46.1	16.8	34°16.8	44.3	72°23.5	23.3					Suhail	222°47.6	-43°31.1	
Mer.pass.		20:44	ν -0.7° d -0.9° m -3.90	ν 2.8° d 0.1° m -1.42	ν 2.6° d -0.0° m -2.75	ν 2.4° d 0.0° m 0.71									Miaplacidus	221°38.6	-69°48.2
															Alphard	217°49.6	-8°45.2
															Regulus	207°36.5	11°51.4
															Dubhe	193°43.6	61°37.5
															Denebola	182°27.0	14°26.8
															Gienah	175°45.7	-17°39.9
															Acrux	173°02.7	-63°13.2
															Gacrux	171°54.1	-57°14.1
															Alioth	166°15.1	55°50.1
															Spica	158°24.5	-11°16.6
															Alkaid	152°53.9	49°12.0
															Hadar	148°39.2	-60°28.8
															Menkent	148°00.2	-36°28.7
															Arcturus	145°49.9	19°03.9
															Rigel Kent.	139°43.5	-60°55.6
															Kochab	137°21.0	74°03.7
															Zuben'ubi	136°58.4	-16°08.0
															Alphecca	126°05.7	26°38.4
															Antares	112°18.4	-26°28.9
															Atria	107°14.8	-69°04.1
															Sabik	102°05.2	-15°45.1
															Shaula	96°13.2	-37°07.2
															Rasalhague	96°00.5	12°32.7
															Eltanin	90°43.4	51°29.3
															Kaus Aust.	83°35.2	-34°22.5
															Vega	80°34.7	38°48.5
															Nunki	75°50.2	-26°16.1
															Altair	62°01.9	8°55.8
															Peacock	53°08.7	-56°39.9
															Deneb	49°27.1	45°21.9
															Enif	33°40.5	9°58.9
															Al Na'ir	27°35.1	-46°51.3
															Fomalhaut	15°16.4	-29°30.2
															Scheat	13°46.8	28°12.5
															Markab	13°31.6	15°19.8
Nov 09 Wed			SHA	Mer.pass													
			Venus	131°23.9													
			Mars	275°31.3													
			Jupiter	0°08.6													
			Saturn	38°19.5													
Nov 10 Thu			SHA	Mer.pass													
			Venus	130°08.2													
			Mars	275°40.9													
			Jupiter	0°11.4													
			Saturn	38°17.8													
Nov 11 Fri			SHA	Mer.pass													
			Venus	128°52.3													
			Mars	275°51.5													
			Jupiter	0°14.0													
			Saturn	38°16.0													
Horizontal parallax			Venus:	0.1													
			Mars:	0.3													

DUT1 = UT1-UTC = -0.0129 sec  $\Delta T = TT-UT1 = +69.1969$  sec

2022 November 09 to Nov. 11 UT

h		Sun		Moon			
Wed	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	184°03.5	S16°47.2	357°54.7	11.9'	N19°19.9	10.8'	55.8'
1	199°03.4	47.9	12°25.5	11.8'	19°30.7	10.7'	55.8'
2	214°03.4	48.6	26°56.3	11.8'	19°41.4	10.6'	55.7'
3	229°03.3	49.3	41°27.1	11.7'	19°51.9	10.5'	55.7'
4	244°03.3	50.0	55°57.8	11.7'	20°02.4	10.4'	55.7'
5	259°03.2	50.7	70°28.5	11.6'	20°12.8	10.3'	55.7'
6	274°03.2	S16°51.4	84°59.1	11.6'	N20°23.0	10.2'	55.7'
7	289°03.1	52.2	99°29.7	11.5'	20°33.2	10.0'	55.6'
8	304°03.1	52.9	114°00.3	11.5'	20°43.2	9.9'	55.6'
9	319°03.0	53.6	128°30.8	11.5'	20°53.2	9.8'	55.6'
10	334°03.0	54.3	143°01.2	11.4'	21°03.0	9.7'	55.6'
11	349°02.9	55.0	157°31.6	11.4'	21°12.7	9.6'	55.5'
12	4°02.9	S16°55.7	172°02.0	11.3'	N21°22.3	9.5'	55.5'
13	19°02.8	56.4	186°32.3	11.3'	21°31.8	9.4'	55.5'
14	34°02.8	57.1	201°02.6	11.2'	21°41.2	9.3'	55.5'
15	49°02.7	57.8	215°32.8	11.2'	21°50.5	9.2'	55.5'
16	64°02.7	58.6	230°03.0	11.1'	21°59.7	9.1'	55.4'
17	79°02.6	16°59.3	244°33.1	11.1'	22°08.8	9.0'	55.4'
18	94°02.5	S17°00.0	259°03.2	11.1'	N22°17.7	8.8'	55.4'
19	109°02.5	00.7	273°33.3	11.0'	22°26.6	8.7'	55.4'
20	124°02.4	01.4	288°03.3	11.0'	22°35.3	8.6'	55.4'
21	139°02.4	02.1	302°33.3	10.9'	22°43.9	8.5'	55.3'
22	154°02.3	02.8	317°03.2	10.9'	22°52.4	8.4'	55.3'
23	169°02.3	03.5	331°33.1	10.8'	23°00.8	8.3'	55.3'
SD = 16.1'		SD = 15.2'					

Thu	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	184°02.2	S17°04.2	346°02.9	10.8'	N23°09.0	8.1'	55.3'
1	199°02.2	04.9	0°32.7	10.8'	23°17.1	8.0'	55.3'
2	214°02.1	05.6	15°02.5	10.7'	23°25.2	7.9'	55.2'
3	229°02.0	06.3	29°32.2	10.7'	23°33.1	7.8'	55.2'
4	244°02.0	07.0	44°01.9	10.6'	23°40.8	7.7'	55.2'
5	259°01.9	07.7	58°31.5	10.6'	23°48.5	7.5'	55.2'
6	274°01.9	S17°08.4	73°01.1	10.6'	N23°56.0	7.4'	55.2'
7	289°01.8	09.1	87°30.7	10.5'	24°03.4	7.3'	55.1'
8	304°01.8	09.8	102°00.2	10.5'	24°10.7	7.2'	55.1'
9	319°01.7	10.5	116°29.7	10.4'	24°17.9	7.0'	55.1'
10	334°01.6	11.2	130°59.1	10.4'	24°24.9	6.9'	55.1'
11	349°01.6	11.9	145°28.6	10.4'	24°31.9	6.8'	55.1'
12	4°01.5	S17°12.6	159°57.9	10.3'	N24°38.6	6.7'	55.1'
13	19°01.4	13.3	174°27.3	10.3'	24°45.3	6.5'	55.0'
14	34°01.4	14.0	188°56.6	10.3'	24°51.9	6.4'	55.0'
15	49°01.3	14.7	203°25.9	10.2'	24°58.3	6.3'	55.0'
16	64°01.3	15.4	217°55.1	10.2'	25°04.6	6.2'	55.0'
17	79°01.2	16.1	232°24.3	10.2'	25°10.7	6.0'	55.0'
18	94°01.1	S17°16.8	246°53.5	10.1'	N25°16.7	5.9'	54.9'
19	109°01.1	17.5	261°22.7	10.1'	25°22.6	5.8'	54.9'
20	124°01.0	18.2	275°51.8	10.1'	25°28.4	5.6'	54.9'
21	139°00.9	18.9	290°20.9	10.1'	25°34.0	5.5'	54.9'
22	154°00.9	19.6	304°49.9	10.0'	25°39.6	5.4'	54.9'
23	169°00.8	20.3	319°19.0	10.0'	25°44.9	5.2'	54.9'
SD = 16.1'		SD = 15.1'					

Fri	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	184°00.8	S17°21.0	333°48.0	10.0'	N25°50.2	5.1'	54.8'
1	199°00.7	21.7	348°17.0	10.0'	25°55.3	5.0'	54.8'
2	214°00.6	22.4	2°45.9	9.9'	26°00.3	4.9'	54.8'
3	229°00.6	23.1	17°14.9	9.9'	26°05.1	4.7'	54.8'
4	244°00.5	23.7	31°43.8	9.9'	26°09.9	4.6'	54.8'
5	259°00.4	24.4	46°12.7	9.9'	26°14.5	4.5'	54.8'
6	274°00.4	S17°25.1	60°41.5	9.9'	N26°18.9	4.3'	54.7'
7	289°00.3	25.8	75°10.4	9.8'	26°23.2	4.2'	54.7'
8	304°00.2	26.5	89°39.2	9.8'	26°27.4	4.1'	54.7'
9	319°00.1	27.2	104°08.0	9.8'	26°31.5	3.9'	54.7'
10	334°00.1	27.9	118°36.8	9.8'	26°35.4	3.8'	54.7'
11	349°00.0	28.6	133°05.6	9.8'	26°39.2	3.6'	54.7'
12	3°59.9	S17°29.3	147°34.4	9.8'	N26°42.8	3.5'	54.6'
13	18°59.9	29.9	162°03.1	9.7'	26°46.3	3.4'	54.6'
14	33°59.8	30.6	176°31.9	9.7'	26°49.7	3.2'	54.6'
15	48°59.7	31.3	191°00.6	9.7'	26°53.0	3.1'	54.6'
16	63°59.7	32.0	205°29.3	9.7'	26°56.1	3.0'	54.6'
17	78°59.6	32.7	219°58.0	9.7'	26°59.0	2.8'	54.6'
18	93°59.5	S17°33.4	234°26.8	9.7'	N27°01.9	2.7'	54.6'
19	108°59.4	34.0	248°55.4	9.7'	27°04.6	2.6'	54.5'
20	123°59.4	34.7	263°24.1	9.7'	27°07.1	2.4'	54.5'
21	138°59.3	35.4	277°52.8	9.7'	27°09.6	2.3'	54.5'
22	153°59.2	36.1	292°21.5	9.7'	27°11.9	2.2'	54.5'
23	168°59.1	36.8	306°50.2	9.7'	27°14.0	2.0'	54.5'
SD = 16.1'		SD = 15.0'					

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

Lat.	Wed	Moonrise		Wed	Moonset	
		Thu	Fri		Thu	Fri
N 72°						
N 70°						
68°	13:26			11:25		
66°	14:24			10:27		
64°	14:59	14:39		09:54	11:58	
62°	15:24	15:24	15:29	09:30	11:14	12:55
60°	15:43	15:33	16:13	09:11	10:45	12:11
N 58°	16:00	16:16	16:43	08:55	10:22	11:42
56°	16:14	16:34	17:05	08:42	10:04	11:20
54°	16:26	16:5				

## November 12, 13, 14 UT (Sat., Sun., Mon.)

Aries		Venus		Mars		Jupiter		Saturn		Stars		
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	51°06.3	178°42.4	\$18°33.9	327°09.4	N24°22.1	51°22.8	\$01°46.0	89°20.4	S16°22.0	Alpheratz	357°36.4	
1	66°08.8	193°41.6	34.7	342°12.4	22.2	66°25.3	46.0	104°22.8	21.9	Ankaa	353°08.6	
2	81°11.3	208°40.9	35.6	357°15.4	22.3	81°27.9	46.0	119°25.1	21.9	Schedar	349°32.6	
3	96°13.7	223°40.2	.. 36.4	12°18.3	.. 22.5	96°30.5	.. 46.1	134°27.5	.. 21.9	Diphda	348°48.9	
4	111°16.2	238°39.5	37.3	27°21.3	22.6	111°33.0	46.1	149°29.9	21.8	Achernar	335°21.0	
5	126°18.7	253°38.7	38.1	42°24.3	22.7	126°35.6	46.1	164°32.3	21.8	Hamal	327°52.9	
6	141°21.1	268°38.0	\$18°39.0	57°27.2	N24°22.8	141°38.2	\$01°46.2	179°34.7	S16°21.8	Polaris	314°24.0	
7	156°23.6	283°37.3	39.8	72°30.2	22.9	156°40.7	46.2	194°37.0	21.8	Acamar	315°12.7	
8	171°26.1	298°36.6	40.7	87°33.2	23.0	171°43.3	46.2	209°39.4	21.7	Menkar	314°07.7	
9	186°28.5	313°35.9	.. 41.5	102°36.2	.. 23.1	186°45.8	.. 46.2	224°41.8	.. 21.7	Mirfak	308°30.3	
10	201°31.0	328°35.1	42.4	117°39.2	23.2	201°48.4	46.3	239°44.2	21.7	Aldebaran	290°41.4	
11	216°33.4	343°34.4	43.2	132°42.1	23.3	216°51.0	46.3	254°46.6	21.6	Rigel	281°05.3	
12	231°35.9	358°33.7	\$18°44.1	147°45.1	N24°23.4	231°53.5	\$01°46.3	269°48.9	S16°21.6	Capella	280°24.1	
13	246°38.4	13°32.9	44.9	162°48.1	23.5	246°56.1	46.4	284°51.3	21.6	Bellatrix	278°24.5	
14	261°40.8	28°32.2	45.8	177°51.1	23.6	261°58.6	46.4	299°53.7	21.6	Elnath	278°03.8	
15	276°43.3	43°31.5	.. 46.6	192°54.1	.. 23.7	277°01.2	.. 46.4	314°56.1	.. 21.5	Alnilam	275°39.3	
16	291°45.8	58°30.8	47.4	207°57.1	23.8	292°03.7	46.4	329°58.5	21.5	Betelgeuse	270°53.8	
17	306°48.2	73°30.0	48.3	223°00.1	24.0	307°06.3	46.5	345°00.8	21.5	Canopus	263°52.8	
18	321°50.7	88°29.3	\$18°49.1	238°03.1	N24°24.1	322°08.9	\$01°46.5	0°03.2	S16°21.4	Sirius	258°27.6	
19	336°53.2	103°28.6	50.0	253°06.1	24.2	337°11.4	46.5	15°05.6	21.4	Adhara	255°07.1	
20	351°55.6	118°27.8	50.8	268°09.1	24.3	352°14.0	46.6	30°08.0	21.4	Procyon	244°52.6	
21	6°58.1	133°27.1	.. 51.6	283°12.1	.. 24.4	7°16.5	.. 46.6	45°10.4	.. 21.3	Pollux	243°19.4	
22	22°00.6	148°26.4	52.5	298°15.1	24.5	22°19.1	46.6	60°12.7	21.3	Avior	234°15.3	
23	37°03.0	163°25.6	53.3	313°18.1	24.6	37°21.6	46.6	75°15.1	21.3	Suhail	222°47.6	
Mer.pass. 20:32		ν -0.7° d -0.9° m -3.90	ν 3.0° d 0.1° m -1.49		ν 2.6° d -0.0° m -2.73		ν 2.4° d 0.0° m 0.72					
Sun		GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec		
0	52°05.5	178°24.9	\$18°54.1	328°21.1	N24°24.7	52°24.2	\$01°46.7	90°17.5	S16°21.3	Denebola	182°27.0	
1	67°07.9	193°24.2	55.0	343°24.1	24.8	67°26.7	46.7	105°19.9	21.2	Gienah	175°45.7	
2	82°10.4	208°23.4	55.8	358°27.1	24.9	82°29.3	46.7	120°22.2	21.2	Acrux	173°02.6	
3	97°12.9	223°22.7	.. 56.6	13°30.1	.. 25.0	97°31.9	.. 46.8	135°24.6	.. 21.2	Gacrux	171°54.1	
4	112°15.3	238°22.0	57.5	28°33.1	25.1	112°34.4	46.8	150°27.0	21.1	Alioth	166°15.0	
5	127°17.8	253°21.2	58.3	43°36.1	25.2	127°37.0	46.8	165°29.4	21.1	Spica	158°24.5	
6	142°20.3	268°20.5	\$18°59.1	58°39.1	N24°25.3	142°39.5	\$01°46.8	180°31.8	S16°21.1	Alkaid	152°53.9	
7	157°22.7	283°19.8	18°59.9	73°42.1	25.4	157°42.1	46.9	195°34.1	21.0	Hadar	148°39.2	
8	172°25.2	298°19.0	19°00.8	88°45.2	25.5	172°44.6	46.9	210°36.5	21.0	Menkent	148°00.1	
9	187°27.7	313°18.3	.. 01.6	103°48.2	.. 25.7	187°47.2	.. 46.9	225°38.9	.. 21.0	Arcturus	145°49.9	
10	202°30.1	328°17.6	02.4	118°51.2	25.8	202°49.7	46.9	240°41.3	21.0	Rigel Kent.	139°43.5	
11	217°32.6	343°16.8	03.2	133°54.2	25.9	217°52.3	47.0	255°43.6	20.9	Kochab	137°21.0	
12	232°35.1	358°16.1	\$19°04.1	148°57.2	N24°26.0	232°54.8	\$01°47.0	270°46.0	S16°20.9	Zuben'ubi	136°58.4	
13	247°37.5	13°15.3	04.9	164°00.3	26.1	247°57.4	47.0	285°48.4	20.9	Alphecca	126°05.7	
14	262°40.0	28°14.6	05.7	179°03.3	26.2	262°59.9	47.0	300°50.8	20.8	Antares	112°18.4	
15	277°42.4	43°13.9	.. 06.5	194°06.3	.. 26.3	278°02.5	.. 47.1	315°53.1	.. 20.8	Atria	107°14.8	
16	292°44.9	58°13.1	07.3	209°09.4	26.4	293°05.0	47.1	330°55.5	20.8	Sabik	102°05.2	
17	307°47.4	73°12.4	08.2	224°12.4	26.5	308°07.6	47.1	345°57.9	20.7	Shaula	96°13.2	
18	322°49.8	88°11.6	\$19°09.0	239°15.4	N24°26.6	323°10.1	\$01°47.1	1°00.3	S16°20.7	Rasalhague	96°00.5	
19	337°52.3	103°10.9	09.8	254°18.5	26.7	338°12.7	47.2	16°02.6	20.7	Eltanin	90°43.5	
20	352°54.8	118°10.1	10.6	269°21.5	26.8	353°15.2	47.2	31°05.0	20.6	Kaus Aust.	83°35.2	
21	7°57.2	133°09.4	.. 11.4	284°24.5	.. 26.9	8°17.8	.. 47.2	46°07.4	.. 20.6	Vega	80°34.7	
22	22°59.7	148°08.7	12.2	299°27.6	27.0	23°20.3	47.2	61°09.8	20.6	Nunki	75°50.2	
23	38°02.2	163°07.9	13.0	314°30.6	27.1	38°22.9	47.3	76°12.1	20.5	Altair	62°01.9	
Mer.pass. 20:28		ν -0.7° d -0.8° m -3.90	ν 3.0° d 0.1° m -1.51		ν 2.6° d -0.0° m -2.72		ν 2.4° d 0.0° m 0.73					
Mon		GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec		
0	53°04.6	178°07.2	\$19°13.9	329°33.7	N24°27.2	53°25.4	\$01°47.3	91°14.5	S16°20.5	Nov 12 Sat	SHA	Mer.pass
1	68°07.1	193°06.4	14.7	344°36.7	27.3	68°28.0	47.3	106°16.9	20.5	Venus	127°36.0	12:06
2	83°09.5	208°05.7	15.5	359°39.7	27.4	83°30.5	47.3	121°19.3	20.5	Mars	276°03.1	02:11
3	98°12.0	223°04.9	.. 16.3	14°42.8	.. 27.5	98°33.1	.. 47.4	136°21.6	.. 20.4	Jupiter	0°16.4	20:31
4	113°14.5	238°04.2	17.1	29°45.8	27.6	113°35.6	47.4	151°24.0	20.4	Saturn	38°14.0	18:00
5	128°16.9	253°03.4	17.9	44°48.9	27.8	128°38.1	47.4	166°26.4	20.4			
6	143°19.4	268°02.7	\$19°18.7	59°51.9	N24°27.9	143°40.7	\$01°47.4	181°28.7	S16°20.3			
7	158°21.9	283°01.9	19.5	74°55.0	28.0	158°43.2	47.5	196°31.1	20.3			
8	173°24.3	298°01.2	20.3	89°58.1	28.1	173°45.8	47.5	211°33.5	20.3			
9	188°26.8	313°00.4	.. 21.1	105°01.1	.. 28.2	188°48.3	.. 47.5	226°35.9	.. 20.2			
10	203°29.3	327°59.7	21.9	120°04.2	28.3	203°50.9	47.5	241°38.2	20.2			
11	218°31.7	342°58.9	22.7	135°07.2	28.4	218°53.4	47.6	256°40.6	20.2			
12	233°34.2	357°58.2	\$19°23.5	150°10.3	N24°28.5	233°56.0	\$01°47.6	271°43.0	S16°20.1			
13	248°36.7	12°57.4	24.3	165°13.4	28.6	248°58.5	47.6	286°45.3	20.1			
14	263°39.1	27°56.7	25.1	180°16.4	28.7	264°01.0	47.6	301°47.7	20.1			
15	278°41.6	42°55.9	.. 25.9	195°19.5	.. 28.8	279°03.6	.. 47.6	316°50.1	.. 20.0			
16	293°44.0	57°55.2	26.7	210°22.6	28.9	294°06.1	47.7	331°52.5	20.0			
17	308°46.5	72°54.4	27.5	225°25.6	29.0	309°08.7	47.7	346°54.8	20.0			
18	323°49.0	87°53.7	\$19°28.3	240°28.7	N24°29.1	324°11.2	\$01°47.7	1°57.2	S16°19.9			
19	338°51.4	102°52.9	29.1	255°31.8	29.2	339°13.8	47.7	16°59.6	19.9			
20	353°53.9	117°52.1	29.9	270°34.8	29.3	354°16.3	47.8	32°01.9	19.9			
21	8°56.4	132°51.4	.. 30.7	285°37.9	.. 29.4	9°18.8	.. 47.8	47°04.3	.. 19.8			
22	23°58.8	147°50.6	31.5	300°41.0	29.5	24°21.4	47.8	62°06.7	19.8			
23	39°01.3	162°49.9	32.3	315°44.1	29.6	39°23.9	47.8	77°09.1	19.8			
Mer.pass. 20:24		ν -0.7° d -0.8° m -3.90	ν 3.0° d 0.1° m -1.									

DUT1 = UT1-UTC = -0.0122 sec  $\Delta T = TT-UT1 = +69.1962$  sec

2022 November 12 to Nov. 14 UT

h		Sun		Moon				
Sat		GHA	Dec	GHA	$\nu$	Dec	d	HP
0	183°59.1	S17°37.5	321°18.9	9.7'	N27°16.0	1.9'	54.5'	
1	198°59.0	38.1	335°47.5	9.7'	27°17.9	1.7'	54.5'	
2	213°58.9	38.8	350°16.2	9.7'	27°19.7	1.6'	54.4'	
3	228°58.8	.. 39.5	4°44.9	9.7'	27°21.3	1.5'	54.4'	
4	243°58.8	40.2	19°13.6	9.7'	27°22.7	1.3'	54.4'	
5	258°58.7	40.8	33°42.3	9.7'	27°24.1	1.2'	54.4'	
6	273°58.6	S17°41.5	48°11.0	9.7'	N27°25.3	1.1'	54.4'	
7	288°58.5	42.2	62°39.7	9.7'	27°26.3	0.9'	54.4'	
8	303°58.5	42.9	77°08.4	9.7'	27°27.3	0.8'	54.4'	
9	318°58.4	.. 43.6	91°37.1	9.7'	27°28.1	0.7'	54.4'	
10	333°58.3	44.2	106°05.8	9.7'	27°28.7	0.5'	54.3'	
11	348°58.2	44.9	120°34.5	9.7'	27°29.2	0.4'	54.3'	
12	3°58.2	S17°45.6	135°03.3	9.8'	N27°29.6	0.2'	54.3'	
13	18°58.1	46.3	149°32.0	9.8'	27°29.9	0.1'	54.3'	
14	33°58.0	46.9	164°00.8	9.8'	27°30.0	-0.0'	54.3'	
15	48°57.9	.. 47.6	178°29.6	9.8'	27°30.0	-0.2'	54.3'	
16	63°57.8	48.3	192°58.4	9.8'	27°29.8	-0.3'	54.3'	
17	78°57.8	48.9	207°27.2	9.8'	27°29.5	-0.4'	54.3'	
18	93°57.7	S17°49.6	221°56.1	9.9'	N27°29.1	-0.6'	54.3'	
19	108°57.6	50.3	236°24.9	9.9'	27°28.5	-0.7'	54.3'	
20	123°57.5	51.0	250°53.8	9.9'	27°27.8	-0.8'	54.2'	
21	138°57.4	.. 51.6	265°22.7	9.9'	27°27.0	-1.0'	54.2'	
22	153°57.3	52.3	279°51.7	10.0'	27°26.1	-1.1'	54.2'	
23	168°57.3	53.0	294°20.6	10.0'	27°25.0	-1.2'	54.2'	
		SD = 16.1'		d = -0.7'		SD = 14.9'		

Sun	GHA	Dec	GHA	$\nu$	Dec	d	HP	
0	183°57.2	S17°53.6	308°49.6	10.0'	N27°23.7	-1.4'	54.2'	
1	198°57.1	54.3	323°18.6	10.0'	27°22.4	-1.5'	54.2'	
2	213°57.0	55.0	337°47.6	10.1'	27°20.9	-1.6'	54.2'	
3	228°56.9	.. 55.6	352°16.7	10.1'	27°19.3	-1.8'	54.2'	
4	243°56.8	56.3	6°45.8	10.1'	27°17.5	-1.9'	54.2'	
5	258°56.8	57.0	21°14.9	10.1'	27°15.6	-2.0'	54.2'	
6	273°56.7	S17°57.6	35°44.0	10.2'	N27°13.6	-2.1'	54.2'	
7	288°56.6	58.3	50°13.2	10.2'	27°11.4	-2.3'	54.2'	
8	303°56.5	58.9	64°42.4	10.2'	27°09.2	-2.4'	54.2'	
9	318°56.4	17°59.6	79°11.7	10.3'	27°06.8	-2.5'	54.2'	
10	333°56.3	18°00.3	93°40.9	10.3'	27°04.2	-2.7'	54.1'	
11	348°56.2	00.9	108°10.3	10.4'	27°01.5	-2.8'	54.1'	
12	3°56.2	S18°01.6	122°39.6	10.4'	N26°58.8	-2.9'	54.1'	
13	18°56.1	02.3	137°09.0	10.4'	26°55.8	-3.1'	54.1'	
14	33°56.0	02.9	151°38.4	10.5'	26°52.8	-3.2'	54.1'	
15	48°55.9	.. 03.6	166°07.9	10.5'	26°49.6	-3.3'	54.1'	
16	63°55.8	04.2	180°37.4	10.5'	26°46.3	-3.4'	54.1'	
17	78°55.7	04.9	195°06.9	10.6'	26°42.9	-3.6'	54.1'	
18	93°55.6	S18°05.6	209°36.5	10.6'	N26°39.3	-3.7'	54.1'	
19	108°55.5	06.2	224°06.2	10.7'	26°35.6	-3.8'	54.1'	
20	123°55.4	06.9	238°35.8	10.7'	26°31.8	-3.9'	54.1'	
21	138°55.3	.. 07.5	253°05.5	10.8'	26°27.9	-4.1'	54.1'	
22	153°55.3	08.2	267°35.3	10.8'	26°23.8	-4.2'	54.1'	
23	168°55.2	08.8	282°05.1	10.8'	26°19.6	-4.3'	54.1'	
		SD = 16.2'		d = -0.7'		SD = 14.8'		

Mon	GHA	Dec	GHA	$\nu$	Dec	d	HP	
0	183°55.1	S18°09.5	296°34.9	10.9'	N26°15.3	-4.4'	54.1'	
1	198°55.0	10.1	311°04.8	10.9'	26°10.9	-4.5'	54.1'	
2	213°54.9	10.8	325°34.8	11.0'	26°06.4	-4.7'	54.1'	
3	228°54.8	.. 11.4	340°04.7	11.0'	26°01.7	-4.8'	54.1'	
4	243°54.7	12.1	354°34.8	11.1'	25°56.9	-4.9'	54.1'	
5	258°54.6	12.8	9°04.9	11.1'	25°52.0	-5.0'	54.1'	
6	273°54.5	S18°13.4	23°35.0	11.2'	N25°47.0	-5.1'	54.1'	
7	288°54.4	14.1	38°05.2	11.2'	25°41.8	-5.3'	54.1'	
8	303°54.3	14.7	52°35.4	11.3'	25°36.6	-5.4'	54.1'	
9	318°54.2	.. 15.4	67°05.7	11.3'	25°31.2	-5.5'	54.1'	
10	333°54.1	16.0	81°36.0	11.4'	25°25.7	-5.6'	54.1'	
11	348°54.0	16.7	96°06.3	11.4'	25°20.1	-5.7'	54.1'	
12	3°53.9	S18°17.3	110°36.8	11.5'	N25°14.4	-5.8'	54.1'	
13	18°53.8	17.9	125°07.3	11.5'	25°08.5	-6.0'	54.1'	
14	33°53.7	18.6	139°37.8	11.6'	25°02.6	-6.1'	54.1'	
15	48°53.6	.. 19.2	154°08.4	11.6'	24°56.5	-6.2'	54.1'	
16	63°53.5	19.9	168°39.0	11.7'	24°50.3	-6.3'	54.1'	
17	78°53.4	20.5	183°09.7	11.7'	24°44.0	-6.4'	54.1'	
18	93°53.3	S18°21.2	197°40.4	11.8'	N24°37.6	-6.5'	54.1'	
19	108°53.2	21.8	212°11.2	11.8'	24°31.1	-6.6'	54.1'	
20	123°53.1	22.5	226°42.0	11.9'	24°24.5	-6.7'	54.1'	
21	138°53.0	.. 23.1	241°12.9	11.9'	24°17.7	-6.8'	54.1'	
22	153°52.9	23.8	255°43.9	12.0'	24°10.9	-7.0'	54.1'	
23	168°52.8	24.4	270°14.9	12.1'	24°03.9	-7.1'	54.1'	
		SD = 16.2'		d = -0.7'		SD = 14.8'		

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

Day	Sun		Mer. Pass. Upper hh:mm	Moon		Age 18-20 88-73%
	Eqn. of Time 00 <sup>h</sup> mm:ss	Time 12 <sup>h</sup> mm:ss		Mer. Pass. Lower hh:mm		
12	15:56	15:53	11:44	02:40	15:06	
13	15:49	15:45	11:44	03:32	15:57	
14	15:40	15:36	11:44	04:22	16:47	

November 15, 16, 17 UT (Tue., Wed., Thu.)

Aries			Venus			Mars			Jupiter			Saturn			Stars	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	54°03.8	177°49.1	\$19°33.1	330°47.2	N24°29.7	54°26.5	\$01°47.8	92°11.4	S16°19.8					Alpheratz	357°36.4	29°13.1
1	69°06.2	192°48.4	33.9	345°50.2	29.8	69°29.0	47.9	107°13.8	19.7					Ankaa	353°08.6	-42°11.1
2	84°08.7	207°47.6	34.6	0°53.3	29.9	84°31.5	47.9	122°16.2	19.7					Schedar	349°32.7	56°39.9
3	99°11.2	222°46.8	35.4	15°56.4	30.0	99°34.1	47.9	137°18.5	19.7					Diphda	348°48.9	-17°51.7
4	114°13.6	237°46.1	36.2	30°59.5	30.1	114°36.6	47.9	152°20.9	19.6					Achernar	335°21.0	-57°07.4
5	129°16.1	252°45.3	37.0	46°02.6	30.2	129°39.1	47.9	167°23.3	19.6					Hamal	327°52.9	23°34.3
6	144°18.5	267°44.6	\$19°37.8	61°05.7	N24°30.3	144°41.7	\$01°48.0	182°25.6	S16°19.6					Polaris	314°23.9	89°21.6
7	159°21.0	282°43.8	38.6	76°08.8	30.4	159°44.2	48.0	197°28.0	19.5					Acamar	315°12.7	-40°12.8
8	174°23.5	297°43.0	39.3	91°11.9	30.5	174°46.8	48.0	212°30.4	19.5					Menkar	314°07.7	4°10.8
9	189°25.9	312°42.3	40.1	106°15.0	30.6	189°49.3	48.0	227°32.7	19.5					Mirfak	308°30.3	49°56.5
10	204°28.4	327°41.5	40.9	121°18.1	30.7	204°51.8	48.0	242°35.1	19.4					Aldebaran	290°41.3	16°33.3
11	219°30.9	342°40.7	41.7	136°21.2	30.8	219°54.4	48.1	257°37.5	19.4					Rigel	281°05.3	-8°10.4
12	234°33.3	357°40.0	\$19°42.5	151°24.3	N24°30.9	234°56.9	\$01°48.1	272°39.8	S16°19.4					Capella	280°24.1	46°01.2
13	249°35.8	12°39.2	43.2	166°27.4	31.0	249°59.4	48.1	287°42.2	19.3					Bellatrix	278°24.5	6°22.3
14	264°38.3	27°38.4	44.0	181°30.5	31.1	265°02.0	48.1	302°44.6	19.3					Elnath	278°03.8	28°37.6
15	279°40.7	42°37.7	44.8	196°33.6	31.2	280°04.5	48.1	317°47.0	19.3					Alnilam	275°39.3	-1°11.2
16	294°43.2	57°36.9	45.6	211°36.7	31.3	295°07.0	48.1	332°49.3	19.2					Betelgeuse	270°53.8	7°24.7
17	309°45.7	72°36.1	46.3	226°39.8	31.4	310°09.6	48.2	347°51.7	19.2					Canopus	263°52.8	-52°42.2
18	324°48.1	87°35.4	\$19°47.1	241°42.9	N24°31.5	325°12.1	\$01°48.2	2°54.1	S16°19.2					Sirius	258°27.6	-16°44.7
19	339°50.6	102°34.6	47.9	256°46.0	31.6	340°14.6	48.2	17°56.4	19.1					Adhara	255°07.0	-29°00.0
20	354°53.0	117°33.8	48.7	271°49.1	31.7	355°17.2	48.2	32°58.8	19.1					Procyon	244°52.5	5°10.1
21	9°55.5	132°33.1	49.4	286°52.2	31.8	10°19.7	48.2	48°01.2	19.1					Pollux	243°19.3	27°58.2
22	24°58.0	147°32.3	50.2	301°55.3	31.9	25°22.2	48.3	63°03.5	19.0					Avgor	234°15.2	-59°34.6
23	40°00.4	162°31.5	51.0	316°58.5	32.0	40°24.8	48.3	78°05.9	19.0					Suhail	222°47.6	-43°31.1
Mer.pass. 20:20		ν -0.8° d -0.8° m -3.91	ν 3.1° d 0.1° m -1.55		ν 2.5° d -0.0° m -2.71		ν 2.4° d 0.0° m 0.73									
Mer.pass. 20:16		ν -0.8° d -0.8° m -3.91	ν 3.1° d 0.1° m -1.57		ν 2.5° d -0.0° m -2.70		ν 2.4° d 0.0° m 0.74									
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	55°02.9	177°30.8	\$19°51.7	332°01.6	N24°32.1	55°27.3	\$01°48.3	93°08.2	S16°19.0					Denebola	182°27.0	14°26.7
1	70°05.4	192°30.0	52.5	347°04.7	32.2	70°29.8	48.3	108°10.6	18.9					Gienah	175°45.7	-17°39.9
2	85°07.8	207°29.2	53.3	2°07.8	32.3	85°32.4	48.3	123°13.0	18.9					Acrux	173°02.6	-63°13.2
3	100°10.3	222°28.4	54.0	17°10.9	32.4	100°34.9	48.3	138°15.3	18.9					Gacrux	171°54.1	-57°14.1
4	115°12.8	237°27.7	54.8	32°14.1	32.5	115°37.4	48.4	153°17.7	18.8					Alioth	166°15.0	55°50.1
5	130°15.2	252°26.9	55.5	47°17.2	32.6	130°40.0	48.4	168°20.1	18.8					Spica	158°24.5	-11°16.6
6	145°17.7	267°26.1	\$19°56.3	62°20.3	N24°32.7	145°42.5	\$01°48.4	183°22.4	S16°18.8					Alkaid	152°53.9	49°11.9
7	160°20.1	282°25.3	57.1	77°23.5	32.8	160°45.0	48.4	198°24.8	18.7					Hadar	148°39.2	-60°28.8
8	175°22.6	297°24.6	57.8	92°26.6	32.9	175°47.6	48.4	213°27.2	18.7					Menkent	148°00.1	-36°28.7
9	190°25.1	312°23.8	58.6	107°29.7	33.0	190°50.1	48.4	228°29.5	18.7					Arcturus	145°49.9	19°03.9
10	205°27.5	327°23.0	59.3	122°32.9	33.1	205°52.6	48.5	243°31.9	18.6					Rigel Kent.	139°43.4	-60°55.6
11	220°30.0	342°22.2	20°00.1	137°36.0	33.2	220°55.1	48.5	258°34.3	18.6					Kochab	137°21.0	74°03.6
12	235°32.5	357°21.5	\$20°00.9	152°39.1	N24°33.3	235°57.7	\$01°48.5	273°36.6	S16°18.5					Zuben'ubi	136°58.4	-16°08.0
13	250°34.9	12°20.7	01.6	167°42.3	33.4	251°00.2	48.5	288°39.0	18.5					Alphecca	126°05.6	26°38.4
14	265°37.4	27°19.9	02.4	182°45.4	33.5	266°02.7	48.5	303°41.4	18.5					Antares	112°18.4	-26°28.9
15	280°39.9	42°19.1	03.1	197°48.5	33.6	281°05.2	48.5	318°43.7	18.4					Atria	107°14.8	-69°04.1
16	295°42.3	57°18.3	03.9	212°51.7	33.7	296°07.8	48.5	333°46.1	18.4					Sabik	102°05.2	-15°45.1
17	310°44.8	72°17.6	04.6	227°54.8	33.8	311°10.3	48.6	348°48.4	18.4					Shaula	96°13.2	-37°07.2
18	325°47.3	87°16.8	\$20°05.4	242°58.0	N24°33.9	326°12.8	\$01°48.6	3°50.8	S16°18.3					Rasalhague	96°00.5	12°32.7
19	340°49.7	102°16.0	06.1	258°01.1	34.0	341°15.4	48.6	18°53.2	18.3					Eltanin	90°43.5	51°29.3
20	355°52.2	117°15.2	06.9	273°04.3	34.1	356°17.9	48.6	33°55.5	18.3					Kaus Aust.	83°35.2	-34°22.5
21	10°54.6	132°14.4	07.6	288°07.4	34.2	11°20.4	48.6	48°57.9	18.2					Vega	80°34.8	38°48.5
22	25°57.1	147°13.7	08.4	303°10.6	34.3	26°22.9	48.6	64°00.3	18.2					Nunki	75°50.2	-26°16.1
23	40°59.6	162°12.9	09.1	318°13.7	34.4	41°25.5	48.7	79°02.6	18.2					Altair	62°01.9	8°55.8
Mer.pass. 20:16		ν -0.8° d -0.8° m -3.91	ν 3.1° d 0.1° m -1.57		ν 2.5° d -0.0° m -2.70		ν 2.4° d 0.0° m 0.74									
Mer.pass. 20:13		ν -0.8° d -0.7° m -3.91	ν 3.2° d 0.1° m -1.60		ν 2.5° d -0.0° m -2.69		ν 2.4° d 0.0° m 0.74									
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	56°02.0	177°12.1	\$20°09.8	333°16.9	N24°34.5	56°28.0	\$01°48.7	94°05.0	S16°18.1					Nov 15 Tue	SHA	Mer.pass
1	71°04.5	192°11.3	10.6	348°20.0	34.6	71°30.5	48.7	109°07.3	18.1					Venus	123°45.4	12:09
2	86°07.0	207°10.5	11.3	3°23.2	34.7	86°33.0	48.7	124°09.7	18.1					Mars	276°43.4	01:56
3	101°09.4	222°09.7	12.1	18°26.4	34.8	101°35.5	48.7	139°12.1	18.0					Jupiter	0°22.7	20:19
4	116°11.9	237°08.9	12.8	33°29.5	34.9	116°38.1	48.7	154°14.4	18.0					Saturn	38°07.7	17:48
5	131°14.4	252°08.2	13.5	48°32.7	35.0	131°40.6	48.7	169°16.8	18.0					Nov 16 Wed	SHA	Mer.pass
6	146°16.8	267°07.4	\$20°14.3	63°35.8	N24°35.1	146°43.1	\$01°48.7	184°19.1	S16°17.9					Venus	122°27.9	12:11
7	161°19.3	282°06.6	15.0	78°39.0	35.2	161°45.6	48.8	199°21.5	17.9					Mars	276°58.7	01:52
8	176°21.8	297°05.8	15.8	93°42.2	35.3	176°48.2	48.8	214°23.9	17.8					Jupiter	0°24.4	20:15
9	191°24.2	312°05.0	16.5	108°45.4	35.4	191°50.7</										

DUT1 = UT1-UTC = -0.0109 sec  $\Delta T = TT-UT1 = +69.1949$  sec

2022 November 15 to Nov. 17 UT

h		Sun		Moon				
Tue		GHA	Dec	GHA	$\nu$	Dec	d	HP
0	183°52.7	S18°25.0	284°45.9	12.1'	N23°56.9	-7.2'	54.1'	
1	198°52.6	25.7	299°17.0	12.2'	23°49.7	-7.3'	54.1'	
2	213°52.5	26.3	313°48.2	12.2'	23°42.4	-7.4'	54.1'	
3	228°52.4	.. 27.0	328°19.4	12.3'	23°35.0	-7.5'	54.1'	
4	243°52.3	27.6	342°50.7	12.3'	23°27.5	-7.6'	54.2'	
5	258°52.2	28.2	357°22.0	12.4'	23°19.9	-7.7'	54.2'	
6	273°52.1	S18°28.9	11°53.4	12.4'	N23°12.2	-7.8'	54.2'	
7	288°52.0	29.5	26°24.8	12.5'	23°04.4	-7.9'	54.2'	
8	303°51.9	30.1	40°56.3	12.5'	22°56.5	-8.0'	54.2'	
9	318°51.8	.. 30.8	55°27.8	12.6'	22°48.5	-8.1'	54.2'	
10	333°51.7	31.4	69°59.4	12.6'	22°40.4	-8.2'	54.2'	
11	348°51.6	32.1	84°31.1	12.7'	22°32.2	-8.3'	54.2'	
12	3°51.5	S18°32.7	99°02.8	12.7'	N22°23.9	-8.4'	54.2'	
13	18°51.4	33.3	113°34.5	12.8'	22°15.5	-8.5'	54.2'	
14	33°51.3	34.0	128°06.3	12.9'	22°07.0	-8.6'	54.2'	
15	48°51.2	.. 34.6	142°38.2	12.9'	21°58.4	-8.7'	54.2'	
16	63°51.1	35.2	157°10.1	13.0'	21°49.7	-8.8'	54.3'	
17	78°51.0	35.9	171°42.0	13.0'	21°40.9	-8.9'	54.3'	
18	93°50.9	S18°36.5	186°14.1	13.1'	N21°32.0	-9.0'	54.3'	
19	108°50.8	37.1	200°46.1	13.1'	21°23.0	-9.1'	54.3'	
20	123°50.6	37.7	215°18.2	13.2'	21°13.9	-9.2'	54.3'	
21	138°50.5	.. 38.4	229°50.4	13.2'	21°04.7	-9.3'	54.3'	
22	153°50.4	39.0	244°22.6	13.3'	20°55.5	-9.4'	54.3'	
23	168°50.3	39.6	258°54.9	13.3'	20°46.1	-9.5'	54.3'	
		SD = 16.2' $d = -0.6'$		SD = 14.8'				
Wed		GHA	Dec	GHA	$\nu$	Dec	d	HP
0	183°50.2	S18°40.3	273°27.2	13.4'	N20°36.7	-9.5'	54.3'	
1	198°50.1	40.9	287°59.6	13.4'	20°27.1	-9.6'	54.4'	
2	213°50.0	41.5	302°32.0	13.5'	20°17.5	-9.7'	54.4'	
3	228°49.9	.. 42.1	317°04.4	13.5'	20°07.8	-9.8'	54.4'	
4	243°49.8	42.8	331°37.0	13.6'	19°57.9	-9.9'	54.4'	
5	258°49.7	43.4	346°09.5	13.6'	19°48.0	-10.0'	54.4'	
6	273°49.5	S18°44.0	0°42.1	13.7'	N19°38.0	-10.1'	54.4'	
7	288°49.4	44.6	15°14.8	13.7'	19°28.0	-10.2'	54.4'	
8	303°49.3	45.3	29°47.5	13.7'	19°17.8	-10.2'	54.4'	
9	318°49.2	.. 45.9	44°20.2	13.8'	19°07.6	-10.3'	54.5'	
10	333°49.1	46.5	58°53.0	13.8'	18°57.2	-10.4'	54.5'	
11	348°49.0	47.1	73°25.9	13.9'	18°46.8	-10.5'	54.5'	
12	3°48.9	S18°47.7	87°58.7	13.9'	N18°36.3	-10.6'	54.5'	
13	18°48.7	48.4	102°31.7	14.0'	18°25.7	-10.7'	54.5'	
14	33°48.6	49.0	117°04.6	14.0'	18°15.1	-10.7'	54.5'	
15	48°48.5	.. 49.6	131°37.7	14.1'	18°04.3	-10.8'	54.6'	
16	63°48.4	50.2	146°10.7	14.1'	17°53.5	-10.9'	54.6'	
17	78°48.3	50.8	160°43.8	14.1'	17°42.6	-11.0'	54.6'	
18	93°48.2	S18°51.5	175°16.9	14.2'	N17°31.6	-11.1'	54.6'	
19	108°48.0	52.1	189°50.1	14.2'	17°20.5	-11.1'	54.6'	
20	123°47.9	52.7	204°23.3	14.3'	17°09.4	-11.2'	54.6'	
21	138°47.8	.. 53.3	218°56.6	14.3'	16°58.1	-11.3'	54.7'	
22	153°47.7	53.9	233°29.9	14.3'	16°46.8	-11.4'	54.7'	
23	168°47.6	54.5	248°03.2	14.4'	16°35.5	-11.5'	54.7'	
		SD = 16.2' $d = -0.6'$		SD = 14.8'				
Thu		GHA	Dec	GHA	$\nu$	Dec	d	HP
0	183°47.5	S18°55.2	262°36.6	14.4'	N16°24.0	-11.5'	54.7'	
1	198°47.3	55.8	277°10.0	14.4'	16°12.5	-11.6'	54.7'	
2	213°47.2	56.4	291°43.4	14.5'	16°00.9	-11.7'	54.8'	
3	228°47.1	.. 57.0	306°16.9	14.5'	15°49.2	-11.7'	54.8'	
4	243°47.0	57.6	320°50.4	14.5'	15°37.4	-11.8'	54.8'	
5	258°46.9	58.2	335°24.0	14.6'	15°25.6	-11.9'	54.8'	
6	273°46.7	S18°58.8	349°57.5	14.6'	N15°13.7	-12.0'	54.8'	
7	288°46.6	18°59.4	4°31.1	14.6'	15°01.8	-12.0'	54.9'	
8	303°46.5	19°00.0	19°04.8	14.7'	14°49.7	-12.1'	54.9'	
9	318°46.4	.. 00.7	33°38.4	14.7'	14°37.6	-12.2'	54.9'	
10	333°46.2	01.3	48°12.1	14.7'	14°25.5	-12.2'	54.9'	
11	348°46.1	01.9	62°45.9	14.8'	14°13.2	-12.3'	55.0'	
12	3°46.0	S19°02.5	77°19.6	14.8'	N14°00.9	-12.4'	55.0'	
13	18°45.9	03.1	91°53.4	14.8'	13°48.5	-12.4'	55.0'	
14	33°45.7	03.7	106°27.2	14.8'	13°36.1	-12.5'	55.0'	
15	48°45.6	.. 04.3	121°01.0	14.9'	13°23.6	-12.6'	55.0'	
16	63°45.5	04.9	135°34.9	14.9'	13°11.0	-12.6'	55.1'	
17	78°45.4	05.5	150°08.8	14.9'	12°58.4	-12.7'	55.1'	
18	93°45.2	S19°06.1	164°42.7	14.9'	N12°45.7	-12.8'	55.1'	
19	108°45.1	06.7	179°16.6	14.9'	12°32.9	-12.8'	55.1'	
20	123°45.0	07.3	193°50.5	15.0'	12°20.1	-12.9'	55.2'	
21	138°44.9	.. 07.9	208°24.5	15.0'	12°07.2	-12.9'	55.2'	
22	153°44.7	08.5	222°58.5	15.0'	11°54.3	-13.0'	55.2'	
23	168°44.6	09.1	237°32.5	15.0'	11°41.3	-13.1'	55.2'	
		SD = 16.2' $d = -0.6'$		SD = 14.9'				

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

**November 18, 19, 20 UT (Fri., Sat., Sun.)**

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	
0	58°00.3	176°33.9	S20°44.4	335°50.1	N24°39.0	58°28.7	S01°49.2	95°58.1	S16°16.4	
1	73°02.8	191°33.0	45.1	350°53.3	39.1	73°31.3	49.2	111°00.5	16.4	
2	88°05.2	206°32.2	45.7	5°56.5	39.2	88°33.8	49.2	126°02.9	16.3	
3	103°07.7	221°31.4	.. 46.4	20°59.8	.. 39.3	103°36.3	.. 49.2	141°05.2	.. 16.3	
4	118°10.2	236°30.6	47.1	36°03.0	39.4	118°38.8	49.2	156°07.6	16.2	
5	133°12.6	251°29.8	47.8	51°06.2	39.5	133°41.3	49.2	171°09.9	16.2	
6	148°15.1	266°29.0	S20°48.5	66°09.5	N24°39.6	148°43.8	S01°49.2	186°12.3	S16°16.2	
7	163°17.6	281°28.2	49.2	81°12.7	39.6	163°46.3	49.2	201°14.6	16.1	
8	178°20.0	296°27.4	49.9	96°15.9	39.7	178°48.8	49.2	216°17.0	16.1	
9	193°22.5	311°26.6	.. 50.6	111°19.2	.. 39.8	193°51.3	.. 49.2	231°19.3	.. 16.0	
10	208°25.0	326°25.7	51.3	126°22.4	39.9	208°53.8	49.2	246°21.7	16.0	
11	223°27.4	341°24.9	51.9	141°25.7	40.0	223°56.3	49.2	261°24.0	16.0	
12	238°29.9	356°24.1	S20°52.6	156°28.9	N24°40.1	238°58.8	S01°49.2	276°26.4	S16°15.9	
13	253°32.3	11°23.3	53.3	171°32.1	40.2	254°01.3	49.2	291°28.7	15.9	
14	268°34.8	26°22.5	54.0	186°35.4	40.3	269°03.8	49.2	306°31.1	15.9	
15	283°37.3	41°21.7	.. 54.7	201°38.6	.. 40.4	284°06.3	.. 49.2	321°33.4	.. 15.8	
16	298°39.7	56°20.9	55.3	216°41.9	40.4	299°08.8	49.3	336°35.8	15.8	
17	313°42.2	71°20.0	56.0	231°45.1	40.5	314°11.3	49.3	351°38.1	15.7	
18	328°44.7	86°19.2	S20°56.7	246°48.4	N24°40.6	329°13.8	S01°49.3	6°40.5	S16°15.7	
19	343°47.1	101°18.4	57.4	261°51.6	40.7	344°16.3	49.3	21°42.8	15.7	
20	358°49.6	116°17.6	58.1	276°54.9	40.8	359°18.8	49.3	36°45.2	15.6	
21	13°52.1	131°16.8	.. 58.7	291°58.1	.. 40.9	14°21.3	.. 49.3	51°47.5	.. 15.6	
22	28°54.5	146°15.9	20°59.4	307°01.4	41.0	29°23.8	49.3	66°49.9	15.5	
23	43°57.0	161°15.1	21°00.1	322°04.7	41.1	44°26.3	49.3	81°52.2	15.5	
Mer.pass. 20:05		$\nu -0.8'$	$d -0.7'$	$m -3.91$	$\nu 3.2'$	$d 0.1'$	$m -1.64$	$\nu 2.5'$	$d -0.0'$	$m -2.68$
		$\nu -0.8'$	$d -0.7'$	$m -3.91$	$\nu 3.2'$	$d 0.1'$	$m -1.64$	$\nu 2.5'$	$d 0.0'$	$m 0.75$

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	58°59.5	176°14.3	S21°00.7	337°07.9	N24°41.2	59°28.8	S01°49.3	96°54.6	S16°15.5
1	74°01.9	191°13.5	01.4	352°11.2	41.2	74°31.3	49.3	111°56.9	15.4
2	89°04.4	206°12.7	02.1	7°14.4	41.3	89°33.8	49.3	126°59.3	15.4
3	104°06.8	221°11.8	.. 02.7	22°17.7	.. 41.4	104°36.3	.. 49.3	142°01.6	.. 15.4
4	119°09.3	236°11.0	03.4	37°21.0	41.5	119°38.8	49.3	157°04.0	15.3
5	134°11.8	251°10.2	04.1	52°24.2	41.6	134°41.3	49.3	172°06.3	15.3
6	149°14.2	266°09.4	S21°04.7	67°27.5	N24°41.7	149°43.8	S01°49.3	187°08.7	S16°15.2
7	164°16.7	281°08.5	05.4	82°30.8	41.8	164°46.3	49.3	202°11.0	15.2
8	179°19.2	296°07.7	06.1	97°34.0	41.8	179°48.8	49.3	217°13.4	15.2
9	194°21.6	311°06.9	.. 06.7	112°37.3	.. 41.9	194°51.3	.. 49.3	232°15.7	.. 15.1
10	209°24.1	326°06.1	07.4	127°40.6	42.0	209°53.8	49.3	247°18.1	15.1
11	224°26.6	341°05.2	08.0	142°43.8	42.1	224°56.3	49.3	262°20.4	15.0
12	239°29.0	356°04.4	S21°08.7	157°47.1	N24°42.2	239°58.8	S01°49.3	277°22.8	S16°15.0
13	254°31.5	11°03.6	09.4	172°50.4	42.3	255°01.3	49.3	292°25.1	15.0
14	269°33.9	26°02.8	10.0	187°53.7	42.4	270°03.8	49.3	307°27.5	14.9
15	284°36.4	41°01.9	.. 10.7	202°57.0	.. 42.4	285°06.3	.. 49.3	322°29.8	.. 14.9
16	299°38.9	56°01.1	11.3	218°00.2	42.5	300°08.8	49.3	337°32.2	14.8
17	314°41.3	71°00.3	12.0	233°03.5	42.6	315°11.3	49.3	352°34.5	14.8
18	329°43.8	85°59.4	S21°12.6	248°06.8	N24°42.7	330°13.8	S01°49.3	7°36.9	S16°14.8
19	344°46.3	100°58.6	13.3	263°10.1	42.8	345°16.3	49.3	22°39.2	14.7
20	359°48.7	115°57.8	13.9	278°13.4	42.9	0°18.8	49.3	37°41.6	14.7
21	14°51.2	130°57.0	.. 14.6	293°16.7	.. 42.9	15°21.3	.. 49.3	52°43.9	.. 14.6
22	29°53.7	145°56.1	15.2	308°19.9	43.0	30°23.8	49.3	67°46.2	14.6
23	44°56.1	160°55.3	15.9	323°23.2	43.1	45°26.3	49.3	82°48.6	14.6
Mer.pass. 20:01		ν -0.8° d -0.7° m -3.91		ν 3.3° d 0.1° m -1.66		ν 2.5° d -0.0° m -2.67		ν 2.3° d 0.0° m 0.75	

	SHA	Dec
Alpheratz	357°36.4	29°13.1
Ankaa	353°08.6	-42°11.1
Schedar	349°32.7	56°39.9
Diphda	348°48.9	-17°51.8
Achernar	335°21.0	-57°07.4
Hamal	327°52.9	23°34.3
Polaris	314°24.0	89°21.7
Acamar	315°12.7	-40°12.8
Menkar	314°07.7	4°10.8
Mirfak	308°30.3	49°56.6
Aldebaran	290°41.3	16°33.3
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°11.2
Betelgeuse	270°53.7	7°24.7
Canopus	263°52.7	-52°42.2
Sirius	258°27.6	-16°44.7
Adhara	255°07.0	-29°00.0
Procyon	244°52.5	5°10.1
Pollux	243°19.3	27°58.2
Avior	234°15.2	-59°34.6
Suhail	222°47.5	-43°31.1
Miaplacidus	221°38.4	-69°48.2
Alphard	217°49.5	-8°45.3
Regulus	207°36.4	11°51.4
Dubhe	193°43.4	61°37.5
Denebola	182°27.0	14°26.7
Gienah	175°45.6	-17°39.9
Acrux	173°02.6	-63°13.2
Gacrux	171°54.0	-57°14.1
Alioth	166°15.0	55°50.1
Spica	158°24.5	-11°16.7
Alkaid	152°53.9	49°11.9
Hadar	148°39.2	-60°28.7
Menkent	148°00.1	-36°28.7
Arcturus	145°49.9	19°03.9
Rigel Kent.	139°43.4	-60°55.6
Kochab	137°21.0	74°03.6
Zuben'ubri	136°58.3	-16°08.0
Alphecca	126°05.6	26°38.3
Antares	112°18.4	-26°28.9
Atria	107°14.8	-69°04.1
Sabik	102°05.2	-15°45.1
Shaula	96°13.2	-37°07.2
Rasalhague	96°00.5	12°32.7
Eltanin	90°43.5	51°29.3
Kaus Aust.	83°35.2	-34°22.5
Vega	80°34.8	38°48.4
Nunki	75°50.2	-26°16.1
Altair	62°01.9	8°55.8
Peacock	53°08.8	-56°39.9
Deneb	49°27.2	45°21.9
Enif	33°40.6	9°58.9
Al Na'ir	27°35.1	-46°51.3
Fomalhaut	15°16.4	-29°30.2
Scheat	13°46.8	28°12.5
Markab	13°31.6	15°19.8

Nov 18 Fri	SHA	Mer.pass
Venus	119° 51.9	12:13
Mars	277° 31.9	01:41
Jupiter	0° 27.3	20:07
Saturn	38° 00.4	17:37

Nov 19 Sat	SHA	Mer.pass
Venus	118° 33.5	12:14
Mars	277° 49.8	01:36
Jupiter	0° 28.4	20:03
Saturn	37° 57.8	17:33

Nov 20 Sun	SHA	Mer.pass
Venus	117° 14.9	12:16
Mars	278° 08.5	01:31
Jupiter	0° 29.4	19:59
Saturn	37° 55.1	17:30

Horizontal parallax

DUT1 = UT1-UTC = -0.0107 sec  $\Delta T = TT-UT1 = +69.1947$  sec

2022 November 18 to Nov. 20 UT

h	Sun			Moon			
Fri	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	183°44.5	S19°09.7	252°06.5	15.0'	N11°28.2	-13.1'	55.3'
1	198°44.4	10.3	266°40.5	15.0'	11°15.1	-13.2'	55.3'
2	213°44.2	10.9	281°14.6	15.1'	11°01.9	-13.2'	55.3'
3	228°44.1	11.5	295°48.6	15.1'	10°48.6	-13.3'	55.3'
4	243°44.0	12.1	310°22.7	15.1'	10°35.3	-13.4'	55.4'
5	258°43.8	12.7	324°56.8	15.1'	10°22.0	-13.4'	55.4'
6	273°43.7	S19°13.3	339°30.9	15.1'	N10°08.6	-13.5'	55.4'
7	288°43.6	13.9	354°05.0	15.1'	09°55.1	-13.5'	55.5'
8	303°43.4	14.5	8°39.1	15.1'	09°41.6	-13.6'	55.5'
9	318°43.3	15.1	23°13.2	15.1'	09°28.0	-13.6'	55.5'
10	333°43.2	15.7	37°47.3	15.1'	09°14.4	-13.7'	55.5'
11	348°43.1	16.3	52°21.5	15.1'	09°00.7	-13.7'	55.6'
12	3°42.9	S19°16.9	66°55.6	15.1'	N08°47.0	-13.8'	55.6'
13	18°42.8	17.5	81°29.7	15.1'	08°33.2	-13.8'	55.6'
14	33°42.7	18.1	96°03.9	15.1'	08°19.4	-13.9'	55.7'
15	48°42.5	18.6	110°38.0	15.1'	08°05.5	-13.9'	55.7'
16	63°42.4	19.2	125°12.2	15.1'	07°51.6	-14.0'	55.7'
17	78°42.3	19.8	139°46.3	15.1'	07°37.6	-14.0'	55.7'
18	93°42.1	S19°20.4	154°20.5	15.1'	N07°23.6	-14.1'	55.8'
19	108°42.0	21.0	168°54.6	15.1'	07°09.5	-14.1'	55.8'
20	123°41.8	21.6	183°28.8	15.1'	06°55.4	-14.2'	55.8'
21	138°41.7	22.2	198°02.9	15.1'	06°41.3	-14.2'	55.9'
22	153°41.6	22.8	212°37.0	15.1'	06°27.1	-14.2'	55.9'
23	168°41.4	23.3	227°11.2	15.1'	06°12.9	-14.3'	55.9'
	SD = 16.2'			SD = 15.1'			
	SD = 16.2'			SD = 15.1'			

Sat	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	183°41.3	S19°23.9	241°45.3	15.1'	N05°58.6	-14.3'	56.0'
1	198°41.2	24.5	256°19.4	15.1'	05°44.3	-14.4'	56.0'
2	213°41.0	25.1	270°53.5	15.1'	05°29.9	-14.4'	56.0'
3	228°40.9	25.7	285°27.6	15.1'	05°15.5	-14.4'	56.1'
4	243°40.8	26.3	300°01.6	15.1'	05°01.0	-14.5'	56.1'
5	258°40.6	26.9	314°35.7	15.0'	04°46.6	-14.5'	56.1'
6	273°40.5	S19°27.4	329°09.7	15.0'	N04°32.1	-14.6'	56.2'
7	288°40.3	28.0	343°43.7	15.0'	04°17.5	-14.6'	56.2'
8	303°40.2	28.6	358°17.8	15.0'	04°02.9	-14.6'	56.2'
9	318°40.1	29.2	12°51.7	15.0'	03°48.3	-14.7'	56.2'
10	333°39.9	29.8	27°25.7	15.0'	03°33.6	-14.7'	56.3'
11	348°39.8	30.3	41°59.7	14.9'	03°18.9	-14.7'	56.3'
12	3°39.6	S19°30.9	56°33.6	14.9'	N03°04.2	-14.8'	56.3'
13	18°39.5	31.5	71°07.5	14.9'	02°49.5	-14.8'	56.4'
14	33°39.4	32.1	85°41.4	14.9'	02°34.7	-14.8'	56.4'
15	48°39.2	32.6	100°15.2	14.8'	02°19.9	-14.8'	56.4'
16	63°39.1	33.2	114°49.1	14.8'	02°05.0	-14.9'	56.5'
17	78°38.9	33.8	129°22.9	14.8'	01°50.2	-14.9'	56.5'
18	93°38.8	S19°34.4	143°56.6	14.7'	N01°35.3	-14.9'	56.6'
19	108°38.6	34.9	158°30.4	14.7'	01°20.3	-14.9'	56.6'
20	123°38.5	35.5	173°04.1	14.7'	01°05.4	-15.0'	56.6'
21	138°38.3	36.1	187°37.8	14.6'	00°50.4	-15.0'	56.7'
22	153°38.2	36.7	202°11.4	14.6'	00°35.4	-15.0'	56.7'
23	168°38.1	37.2	216°45.0	14.6'	00°20.4	-15.0'	56.7'
	SD = 16.2'			SD = 15.3'			
	SD = 16.2'			SD = 15.3'			

Lat.	Twilight		Sunrise	Sunset	Twilight	
	Naut.	Civil			Civil	Naut.
N 72°	07:13	08:53	■	■	14:37	16:16
N 70°	07:02	08:27	10:18	13:12	15:03	16:28
68°	06:52	08:07	09:32	13:58	15:23	16:38
66°	06:44	07:51	09:02	14:28	15:39	16:46
64°	06:37	07:38	08:40	14:50	15:52	16:53
62°	06:30	07:27	08:22	15:08	16:03	17:00
60°	06:25	07:17	08:08	15:22	16:13	17:05
N 58°	06:20	07:09	07:55	15:35	16:21	17:10
56°	06:15	07:01	07:44	15:46	16:29	17:15
54°	06:11	06:55	07:35	15:55	16:35	17:19
52°	06:07	06:49	07:27	16:04	16:42	17:23
50°	06:03	06:43	07:19	16:11	16:47	17:27
48°	05:55	06:31	07:03	16:27	17:00	17:35
N 40°	05:47	06:20	06:50	16:41	17:10	17:43
35°	05:40	06:11	06:38	16:52	17:19	17:50
30°	05:34	06:03	06:28	17:02	17:28	17:57
20°	05:21	05:48	06:11	17:19	17:43	18:10
N 10°	05:08	05:34	05:56	17:35	17:57	18:23
0°	04:54	05:20	05:42	17:49	18:11	18:36
S 10°	04:39	05:05	05:27	18:03	18:26	18:52
20°	04:20	04:48	05:12	18:19	18:43	19:11
30°	03:56	04:28	04:54	18:37	19:03	19:35
35°	03:41	04:15	04:44	18:48	19:16	19:50
40°	03:22	04:01	04:32	19:00	19:31	20:09
45°	02:59	03:43	04:17	19:14	19:49	20:33
S 50°	02:26	03:20	04:00	19:32	20:12	21:06
52°	02:09	03:09	03:51	19:40	20:23	21:24
54°	01:48	02:56	03:42	19:50	20:36	21:45
56°	01:20	02:41	03:32	20:00	20:52	22:15
58°	00:32	02:23	03:20	20:13	21:10	23:08
S 60°	—	02:00	03:06	20:27	21:34	—
Lat.	Fri	Moonrise			Moonset	
	Sat	Sun	Fri	Sat	Sun	
N 72°	...	00:43	02:49	15:19	14:47	14:15
N 70°	...	00:51	02:48	15:08	14:44	14:20
68°	...	00:58	02:47	14:59	14:41	14:24
66°	...	01:04	02:46	14:51	14:39	14:27
64°	...	01:09	02:46	14:44	14:37	14:30
62°	...	01:13	02:45	14:39	14:36	14:33
60°	...	01:16	02:45	14:34	14:34	14:35
N 58°	...	01:20	02:44	14:29	14:33	14:37
56°	00:02	01:22	02:44	14:25	14:32	14:39
54°	00:08	01:25	02:44	14:22	14:31	14:40
52°	00:13	01:27	02:43	14:18	14:30	14:42
50°	00:17	01:29	02:43	14:15	14:29	14:43
45°	00:27	01:34	02:43	14:09	14:27	14:46
N 40°	00:34	01:38	02:42	14:03	14:26	14:48
35°	00:41	01:41	02:42	13:59	14:24	14:50
30°	00:47	01:44	02:41	13:55	14:23	14:52
20°	00:57	01:48	02:41	13:47	14:21	14:55
N 10°	01:06	01:53	02:40	13:41	14:19	14:58
0°	01:14	01:57	02:40	13:35	14:17	15:01
S 10°	01:22	02:01	02:40	13:28	14:15	15:04
20°	01:31	02:05	02:39	13:22	14:13	15:07
30°	01:41	02:10	02:39	13:14	14:11	15:10
35°	01:47	02:13	02:38	13:10	14:10	15:12
40°	01:53	02:16	02:38	13:05	14:08	15:14
45°	02:01	02:19	02:38	12:59	14:07	15:16
S 50°	02:10	02:42	02:37	12:52	14:04	15:19
52°	02:14	02:26	02:37	12:48	14:03	15:21
54°	02:18	02:28	02:37	12:45	14:02	15:22
56°	02:23	02:30	02:37	12:41	14:01	15:24
58°	02:29	02:33	02:37	12:36	14:00	15:26
S 60°	02:35	02:36	02:36	12:31	13:58	15:28
Day	Eqn.of Time	Mer.			Moon	
	00 <sup>h</sup> mm:ss	Pass. mm:ss			Mer.Pass. hh:mm	
					Upper hh:mm	Age 24-26 36-18%
18	14:58	14:52	11:45	07:24	19:46	
19	14:45	14:39	11:45	08:07	20:29	
20	14:32	14:25	11:46	08:50	21:13	
	SD = 16.2'	d = -0.6'	SD = 15.5'			

November 21, 22, 23 UT (Mon., Tue., Wed.)

Aries		Venus		Mars		Jupiter		Saturn		Stars		
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	59°58.6	175°54.5	\$21°16.5	338°26.5	N24°43.2	60°28.8	S01°49.3	97°50.9	S16°14.5	Alpheratz	357°36.4	
1	75°01.1	190°53.6	17.2	353°29.8	43.3	75°31.3	49.3	112°53.3	14.5	Ankaa	353°08.7	
2	90°03.5	205°52.8	17.8	8°33.1	43.4	90°33.7	49.3	127°55.6	14.4	Schedar	349°32.7	
3	105°06.0	220°52.0	18.5	23°36.4	43.4	105°36.2	49.3	142°58.0	14.4	Diphda	348°48.9	
4	120°08.4	235°51.1	19.1	38°39.7	43.5	120°38.7	49.3	158°00.3	14.4	Achernar	335°21.0	
5	135°10.9	250°50.3	19.7	53°43.0	43.6	135°41.2	49.3	173°02.7	14.3	Hamal	327°52.9	
6	150°13.4	265°49.5	\$21°20.4	68°46.3	N24°43.7	150°43.7	S01°49.3	188°05.0	S16°14.3	Polaris	314°24.1	
7	165°15.8	280°48.6	21.0	83°49.6	43.8	165°46.2	49.3	203°07.4	14.2	Acamar	315°12.7	
8	180°18.3	295°47.8	21.6	98°52.9	43.9	180°48.7	49.3	218°09.7	14.2	Menkar	314°07.7	
9	195°20.8	310°46.9	22.3	113°56.2	43.9	195°51.2	49.3	233°12.0	14.2	Mirfak	308°30.3	
10	210°23.2	325°46.1	22.9	128°59.5	44.0	210°53.7	49.3	248°14.4	14.1	Aldebaran	290°41.3	
11	225°25.7	340°45.3	23.6	144°02.8	44.1	225°56.2	49.3	263°16.7	14.1	Rigel	281°05.3	
12	240°28.2	355°44.4	\$21°24.2	159°06.1	N24°44.2	240°58.6	S01°49.3	278°19.1	S16°14.0	Capella	280°24.1	
13	255°30.6	10°43.6	24.8	174°09.4	44.3	256°01.1	49.3	293°21.4	14.0	Bellatrix	278°24.5	
14	270°33.1	25°42.8	25.4	189°12.7	44.3	271°03.6	49.3	308°23.8	14.0	Elnath	278°03.8	
15	285°35.6	40°41.9	26.1	204°16.0	44.4	286°06.1	49.3	323°26.1	13.9	Alnilam	275°39.2	
16	300°38.0	55°41.1	26.7	219°19.4	44.5	301°08.6	49.3	338°28.5	13.9	Betelgeuse	270°53.7	
17	315°40.5	70°40.2	27.3	234°22.7	44.6	316°11.1	49.3	353°30.8	13.8	Canopus	263°52.7	
18	330°42.9	85°39.4	\$21°28.0	249°26.0	N24°44.7	331°13.6	S01°49.3	8°33.1	S16°13.8	Sirius	258°27.5	
19	345°45.4	100°38.6	28.6	264°29.3	44.7	346°16.1	49.3	23°35.5	13.8	Adhara	255°07.0	
20	0°47.9	115°37.7	29.2	279°32.6	44.8	1°18.5	49.3	38°37.8	13.7	Procyon	244°52.5	
21	15°50.3	130°36.9	29.8	294°35.9	44.9	16°21.0	49.3	53°40.2	13.7	Pollux	243°19.3	
22	30°52.8	145°36.0	30.5	309°39.3	45.0	31°23.5	49.3	68°42.5	13.6	Avgor	234°15.2	
23	45°55.3	160°35.2	31.1	324°42.6	45.1	46°26.0	49.3	83°44.9	13.6	Suhail	222°47.5	
Mer.pass. 19:57		ν -0.8° d -0.6° m -3.91		ν 3.3° d 0.1° m -1.68		ν 2.5° d 0.0° m -2.66		ν 2.3° d 0.0° m 0.76		Miaplacidus		
Tue		GHA		GHA		GHA		GHA		GHA		
0	60°57.7	175°34.3	\$21°31.7	339°45.9	N24°45.1	61°28.5	S01°49.3	98°47.2	S16°13.5	Denebola	182°26.9	
1	76°00.2	190°33.5	32.3	354°49.2	45.2	76°31.0	49.3	113°49.5	13.5	Gienah	175°45.6	
2	91°02.7	205°32.6	32.9	9°52.5	45.3	91°33.5	49.3	128°51.9	13.5	Acrux	173°02.5	
3	106°05.1	220°31.8	33.5	24°55.9	45.4	106°35.9	49.3	143°54.2	13.4	Gacrux	171°54.0	
4	121°07.6	235°31.0	34.2	39°59.2	45.5	121°38.4	49.3	158°56.6	13.4	Alioth	166°15.0	
5	136°10.0	250°30.1	34.8	55°02.5	45.5	136°40.9	49.3	173°58.9	13.3	Spica	158°24.5	
6	151°12.5	265°29.3	\$21°35.4	70°05.9	N24°45.6	151°43.4	S01°49.3	180°01.2	S16°13.3	Alkaid	152°53.9	
7	166°15.0	280°28.4	36.0	85°09.2	45.7	166°45.9	49.3	204°03.6	13.3	Hadar	148°39.1	
8	181°17.4	295°27.6	36.6	100°12.5	45.8	181°48.3	49.2	219°05.9	13.2	Menkent	148°00.1	
9	196°19.9	310°26.7	37.2	115°15.8	45.9	196°50.8	49.2	234°08.3	13.2	Arcturus	145°49.9	
10	211°22.4	325°25.9	37.8	130°19.2	45.9	211°53.3	49.2	249°10.6	13.1	Rigil Kent.	139°43.4	
11	226°24.8	340°25.0	38.4	145°22.5	46.0	226°55.8	49.2	264°13.0	13.1	Kochab	137°20.9	
12	241°27.3	355°24.2	\$21°39.0	160°25.9	N24°46.1	241°58.3	S01°49.2	279°15.3	S16°13.0	Zuben'ubi	136°58.3	
13	256°29.8	10°23.3	39.7	175°29.2	46.2	257°00.8	49.2	294°17.6	13.0	Alphecca	126°05.6	
14	271°32.2	25°22.5	40.3	190°32.5	46.2	272°03.2	49.2	309°20.0	13.0	Antares	112°18.4	
15	286°34.7	40°21.6	40.9	205°35.9	46.3	287°05.7	49.2	324°22.3	12.9	Atria	107°14.8	
16	301°37.2	55°20.8	41.5	220°39.2	46.4	302°08.2	49.2	339°24.7	12.9	Sabik	102°05.2	
17	316°39.6	70°19.9	42.1	235°42.5	46.5	317°10.7	49.2	354°27.0	12.8	Shaula	96°13.2	
18	331°42.1	85°19.1	\$21°42.7	250°45.9	N24°46.5	332°13.1	S01°49.2	9°29.3	S16°12.8	Rasalhague	96°00.5	
19	346°44.5	100°18.2	43.3	265°49.2	46.6	347°15.6	49.2	24°31.7	12.8	Eltanin	90°43.5	
20	1°47.0	115°17.4	43.9	280°52.6	46.7	2°18.1	49.2	39°34.0	12.7	Kaus Aust.	83°35.2	
21	16°49.5	130°16.5	44.5	295°55.9	46.8	17°20.6	49.2	54°36.3	12.7	Vega	80°34.8	
22	31°51.9	145°15.7	45.1	310°59.3	46.8	32°23.1	49.2	69°38.7	12.6	Nunki	75°50.3	
23	46°54.4	160°14.8	45.7	326°02.6	46.9	47°25.5	49.2	84°41.0	12.6	Altair	62°01.9	
Mer.pass. 19:53		ν -0.8° d -0.6° m -3.91		ν 3.3° d 0.1° m -1.70		ν 2.5° d 0.0° m -2.65		ν 2.3° d 0.0° m 0.76		Peacock		
Wed		GHA		GHA		GHA		GHA		GHA		
0	61°56.9	175°13.9	\$21°46.2	341°06.0	N24°47.0	62°28.0	S01°49.2	99°43.4	S16°12.5	Fomalhaut	15°16.4	
1	76°59.3	190°13.1	46.8	356°09.3	47.1	77°30.5	49.1	114°45.7	12.5	Scheat	13°46.8	
2	92°01.8	205°12.2	47.4	11°12.7	47.1	92°33.0	49.1	129°48.0	12.5	Markab	13°31.6	
3	107°04.3	220°11.4	48.0	26°16.0	47.2	107°35.4	49.1	144°50.4	12.4	Nov 21 Mon	SHA	Mer.pass
4	122°06.7	235°10.5	48.6	41°19.4	47.3	122°37.9	49.1	159°52.7	12.4	Venus	115°55.9	12:17
5	137°09.2	250°09.7	49.2	56°22.7	47.4	137°40.4	49.1	174°55.1	12.3	Mars	278°27.9	01:26
6	152°11.7	265°08.8	\$21°49.8	71°26.1	N24°47.4	152°42.9	S01°49.1	189°57.4	S16°12.3	Jupiter	0°30.2	19:55
7	167°14.1	280°07.9	50.4	86°29.5	47.5	167°45.3	49.1	204°59.7	12.2	Saturn	37°52.4	17:26
8	182°16.6	295°07.1	51.0	101°32.8	47.6	182°47.8	49.1	220°02.1	12.2	Nov 22 Tue	SHA	Mer.pass
9	197°19.0	310°06.2	51.5	116°36.2	47.7	197°50.3	49.1	235°04.4	12.2	Venus	114°36.6	12:18
10	212°21.5	325°05.4	52.1	131°39.5	47.7	212°52.8	49.1	250°06.7	12.1	Mars	278°48.2	01:21
11	227°24.0	340°04.5	52.7	146°42.9	47.8	227°55.2	49.1	265°09.1	12.1	Jupiter	0°30.8	19:51
12	242°26.4	355°03.6	\$21°53.3	161°46.3	N24°47.9	242°57.7	S01°49.1	280°11.4	S16°12.0	Saturn	37°49.5	17:22
13	257°28.9	10°02.8	53.9	176°49.6	47.9	258°00.2	49.0	295°13.7	12.0	Nov 23 Wed	SHA	Mer.pass
14	272°31.4	25°01.9	54.4	191°53.0	48.0	273°02.6	49.0	310°16.1	11.9	Venus	113°17.1	12:20
15	287°33.8	40°01.1	55.0	206°56.4	48.1	288°05.1	49.0	325°18.4	11.9	Mars	279°09.1	01:15
16	302°36.3	55°00.2	55.6	221°59.7	48.2	303°07.6	49.0	340°20.8	11.9	Jupiter	0°31.1	19:47
17	317°38.8	69°59.3	56.2	237°03.1	48.2	318°10.1	49.0	355°23.1	11.8	Saturn	37°46.5	17:18
18	332°41.2	84°58.5	\$21°56.7	252°06.5	N24°48.3	333°12.5	S01°49.0	10°25.4	S16°11.8	Horizontal parallax		
19	347°43.7	99°57.6	57.3	267°09.9	48.4	348°15.0	49.0	25°27.8	11.7	Venus:	0.1	
20	2°46.2	114°56.7	57.9	282°13.2	48.5	3°17.5	49.0	40°30.1	11.7	Mars:	0.3	
21	17°48.6	129°55.9	58.5	297°16.6	48.5	18°19.9	49.0	55°32.4	11.6			
22	32°51.1	144°55.0	59.0	312°20.0	48.6	33°22.4	49.0	70°34.8	11.6			
23	47°53.5	159°54.1	59.6	327°23.4	48.7	48°24.9	48.9	85°37.1	11.6			
Mer.pass. 19:49		ν -0.9° d -0.6° m -3.91		ν 3.4° d 0.1° m -1.72		ν 2.5° d 0.0° m -2.64		ν 2.3° d 0.				

DUT1 = UT1-UTC = -0.0120 sec  $\Delta T = TT-UT1 = +69.1960$  sec

2022 November 21 to Nov. 23 UT

h		Sun		Moon				
Mon		GHA	Dec	GHA	$\nu$	Dec	d	HP
0	183°34.3	S19°51.3	220°30.1	13.2'	S05°59.1	-15.2'	57.6'	
1	198°34.2	51.9	235°02.3	13.2'	06°14.3	-15.2'	57.7'	
2	213°34.0	52.4	249°34.5	13.1'	06°29.5	-15.2'	57.7'	
3	228°33.9	.. 53.0	264°06.6	13.0'	06°44.7	-15.2'	57.7'	
4	243°33.7	53.5	278°38.6	13.0'	06°59.9	-15.2'	57.8'	
5	258°33.5	54.1	293°10.6	12.9'	07°15.1	-15.2'	57.8'	
6	273°33.4	S19°54.6	307°42.5	12.8'	S07°30.2	-15.1'	57.8'	
7	288°33.2	55.2	322°14.3	12.7'	07°45.4	-15.1'	57.9'	
8	303°33.1	55.7	336°46.0	12.7'	08°00.5	-15.1'	57.9'	
9	318°32.9	.. 56.3	351°17.7	12.6'	08°15.6	-15.1'	57.9'	
10	333°32.8	56.8	5°49.3	12.5'	08°30.7	-15.1'	58.0'	
11	348°32.6	57.4	20°20.8	12.4'	08°45.8	-15.0'	58.0'	
12	3°32.4	S19°57.9	34°52.2	12.3'	S09°00.8	-15.0'	58.0'	
13	18°32.3	58.5	49°23.5	12.2'	09°15.8	-15.0'	58.1'	
14	33°32.1	59.0	63°54.7	12.2'	09°30.8	-15.0'	58.1'	
15	48°32.0	19°59.6	78°25.9	12.1'	09°45.8	-14.9'	58.2'	
16	63°31.8	20°00.1	92°57.0	12.0'	10°00.7	-14.9'	58.2'	
17	78°31.6	00.7	107°27.9	11.9'	10°15.6	-14.9'	58.2'	
18	93°31.5	S20°01.2	121°58.8	11.8'	S10°30.5	-14.8'	58.3'	
19	108°31.3	01.8	136°29.6	11.7'	10°45.4	-14.8'	58.3'	
20	123°31.2	02.3	151°00.4	11.6'	11°00.2	-14.8'	58.3'	
21	138°31.0	.. 02.9	165°31.0	11.5'	11°14.9	-14.7'	58.4'	
22	153°30.8	03.4	180°01.5	11.4'	11°29.7	-14.7'	58.4'	
23	168°30.7	03.9	194°31.9	11.3'	11°44.4	-14.7'	58.4'	
	SD = 16.2'		SD = 15.7'					

Tue	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	183°30.5	S20°04.5	209°02.3	11.2'	S11°59.0	-14.6'	58.5'
1	198°30.4	05.0	223°32.5	11.1'	12°13.6	-14.6'	58.5'
2	213°30.2	05.6	238°02.6	11.0'	12°28.2	-14.5'	58.5'
3	228°30.0	.. 06.1	252°32.7	10.9'	12°42.7	-14.5'	58.6'
4	243°29.9	06.6	267°02.6	10.8'	12°57.2	-14.4'	58.6'
5	258°29.7	07.2	281°32.4	10.7'	13°11.6	-14.4'	58.6'
6	273°29.5	S20°07.7	296°02.1	10.6'	S13°25.9	-14.3'	58.7'
7	288°29.4	08.2	310°31.8	10.5'	13°40.2	-14.3'	58.7'
8	303°29.2	08.8	325°01.3	10.4'	13°54.5	-14.2'	58.7'
9	318°29.0	.. 09.3	339°30.7	10.3'	14°08.7	-14.1'	58.8'
10	333°28.9	09.8	354°00.0	10.2'	14°22.8	-14.1'	58.8'
11	348°28.7	10.4	8°29.2	10.1'	14°36.9	-14.0'	58.8'
12	3°28.5	S20°10.9	22°58.3	10.0'	S14°50.9	-13.9'	58.9'
13	18°28.4	11.4	37°27.3	9.9'	15°04.9	-13.9'	58.9'
14	33°28.2	12.0	51°56.1	9.8'	15°18.8	-13.8'	58.9'
15	48°28.0	.. 12.5	66°24.9	9.6'	15°32.6	-13.7'	59.0'
16	63°27.9	13.0	80°53.5	9.5'	15°46.3	-13.7'	59.0'
17	78°27.7	13.6	95°22.0	9.4'	16°00.0	-13.6'	59.0'
18	93°27.5	S20°14.1	109°50.5	9.3'	S16°13.6	-13.5'	59.1'
19	108°27.4	14.6	124°18.8	9.2'	16°27.1	-13.4'	59.1'
20	123°27.2	15.2	138°46.9	9.1'	16°40.6	-13.4'	59.1'
21	138°27.0	.. 15.7	153°15.0	8.9'	16°53.9	-13.3'	59.1'
22	153°26.8	16.2	167°43.0	8.8'	17°07.2	-13.2'	59.2'
23	168°26.7	16.7	182°10.8	8.7'	17°20.4	-13.1'	59.2'
	SD = 16.2'		SD = 15.9'				

Wed	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	183°26.5	S20°17.3	196°38.5	8.6'	S17°33.5	-13.0'	59.2'
1	198°26.3	17.8	211°06.1	8.5'	17°46.5	-12.9'	59.3'
2	213°26.2	18.3	225°33.6	8.4'	17°59.5	-12.8'	59.3'
3	228°26.0	.. 18.8	240°00.9	8.2'	18°12.3	-12.7'	59.3'
4	243°25.8	19.4	254°28.2	8.1'	18°25.0	-12.6'	59.3'
5	258°25.6	19.9	268°55.3	8.0'	18°37.7	-12.5'	59.4'
6	273°25.5	S20°20.4	283°22.3	7.9'	S18°50.2	-12.4'	59.4'
7	288°25.3	20.9	297°49.1	7.7'	19°02.7	-12.3'	59.4'
8	303°25.1	21.4	312°15.9	7.6'	19°15.0	-12.2'	59.5'
9	318°25.0	.. 22.0	326°42.5	7.5'	19°27.3	-12.1'	59.5'
10	333°24.8	22.5	341°09.0	7.4'	19°39.4	-12.0'	59.5'
11	348°24.6	23.0	355°35.4	7.3'	19°51.4	-11.9'	59.5'
12	3°24.4	S20°23.5	10°01.6	7.1'	S20°03.3	-11.8'	59.6'
13	18°24.3	24.0	24°27.8	7.0'	20°15.1	-11.7'	59.6'
14	33°24.1	24.6	38°53.8	6.9'	20°26.8	-11.6'	59.6'
15	48°23.9	.. 25.1	53°19.7	6.8'	20°38.4	-11.4'	59.6'
16	63°23.7	25.6	67°45.4	6.6'	20°49.8	-11.3'	59.7'
17	78°23.6	26.1	82°11.1	6.5'	21°01.2	-11.2'	59.7'
18	93°23.4	S20°26.6	96°36.6	6.4'	S21°12.4	-11.1'	59.7'
19	108°23.2	27.1	111°02.0	6.3'	21°23.4	-10.9'	59.7'
20	123°23.0	27.6	125°27.3	6.2'	21°34.4	-10.8'	59.7'
21	138°22.8	.. 28.1	139°52.5	6.0'	21°45.2	-10.7'	59.8'
22	153°22.7	28.7	154°17.5	5.9'	21°55.9	-10.6'	59.8'
23	168°22.5	29.2	168°42.4	5.8'	22°06.5	-10.4'	59.8'
	SD = 16.2'		SD = 16.2'				

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

Lat.	Mon	Monrise	Wed	Moonset		
	Tue	Wed		Mon	Tue	Wed
N 72°	05:02	07:39	■	13:39	12:43	■
N 70°	04:50	07:09	■	13:53	13:16	■
68°	04:41	06:47	09:23	14:05	13:40	12:54
66°	04:33	06:30	08:44	14:14	13:59	13:35
64°	04:27	06:16	08:17	14:22	14:14	14:03
62°	04:21	06:04	07:57	14:30	14:27	14:24
60°	04:17	05:55	07:40	14:36	14:38	14:42
N 58°	04:13	05:46	07:26	14:41	14:47	14:57
56°	04:09	05:39	07:14	14:46	14:56	15:10
54°	04:06	05:32	07:04	14:50	15:03	15:21
52°	04:03	05:26	06:54	14:54	15:10	15:31
50°	04:00	05:21	06:46	14:58	15:16	15:40
48°	03:54					

November 24, 25, 26 UT (Thu., Fri., Sat.)

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	62°56.0	174°53.3	S22°00.2	342°26.7	N24°48.7	63°27.4	S01°48.9	100°39.4	S16°11.5	Alpheratz	357°36.4	29°13.1					
1	77°58.5	189°52.4	00.7	357°30.1	48.8	78°29.8	48.9	115°41.8	11.5	Ankaa	353°08.7	-42°11.1					
2	93°00.9	204°51.5	01.3	12°33.5	48.9	93°32.3	48.9	130°44.1	11.4	Schedar	349°32.7	56°40.0					
3	108°03.4	219°50.7	· · 01.9	27°36.9	· · 48.9	108°34.8	· · 48.9	145°46.4	· · 11.4	Diphda	348°48.9	-17°51.8					
4	123°05.9	234°49.8	02.4	42°40.3	49.0	123°37.2	48.9	160°48.8	11.3	Achernar	335°21.1	-57°07.4					
5	138°08.3	249°48.9	03.0	57°43.6	49.1	138°39.7	48.9	175°51.1	11.3	Hamal	327°52.9	23°34.3					
6	153°10.8	264°48.1	S22°03.5	72°47.0	N24°49.2	153°42.2	S01°48.9	190°53.4	S16°11.2	Polaris	314°24.0	89°21.7					
7	168°13.3	279°47.2	04.1	87°50.4	49.2	168°44.6	48.9	205°55.8	11.2	Acamar	315°12.7	-40°12.8					
8	183°15.7	294°46.3	04.7	102°53.8	49.3	183°47.1	48.8	220°58.1	11.2	Menkar	314°07.7	4°10.8					
9	198°18.2	309°45.5	· · 05.2	117°57.2	· · 49.4	198°49.6	· · 48.8	236°00.4	· · 11.1	Mirfak	308°30.3	49°56.6					
10	213°20.6	324°44.6	05.8	133°00.6	49.4	213°52.0	48.8	251°02.8	11.1	Aldebaran	290°41.3	16°33.3					
11	228°23.1	339°43.7	06.3	148°04.0	49.5	228°54.5	48.8	266°05.1	11.0	Rigel	281°05.3	-8°10.4					
12	243°25.6	354°42.9	S22°06.9	163°07.3	N24°49.6	243°56.9	S01°48.8	281°07.4	S16°11.0	Capella	280°24.1	46°01.2					
13	258°28.0	9°42.0	07.4	178°10.7	49.6	258°59.4	48.8	296°09.8	10.9	Bellatrix	278°24.5	6°22.3					
14	273°30.5	24°41.1	08.0	193°14.1	49.7	274°01.9	48.8	311°12.1	10.9	Elnath	278°03.8	28°37.6					
15	288°33.0	39°40.2	· · 08.5	208°17.5	· · 49.8	289°04.3	· · 48.8	326°14.4	· · 10.8	Alnilam	275°39.2	-1°11.2					
16	303°35.4	54°39.4	09.1	223°20.9	49.8	304°06.8	48.7	341°16.8	10.8	Betelgeuse	270°53.7	7°24.7					
17	318°37.9	69°38.5	09.6	238°24.3	49.9	319°09.3	48.7	356°19.1	10.8	Canopus	263°52.7	-52°42.2					
18	333°40.4	84°37.6	S22°10.2	253°27.7	N24°50.0	334°11.7	S01°48.7	11°21.4	S16°10.7	Sirius	258°27.5	-16°44.7					
19	348°42.8	99°36.7	10.7	268°31.1	50.0	349°14.2	48.7	26°23.8	10.7	Adhara	255°07.0	-29°00.0					
20	3°45.3	114°35.9	11.3	283°34.5	50.1	4°16.7	48.7	41°26.1	10.6	Procyon	244°52.5	5°10.0					
21	18°47.8	129°35.0	· · 11.8	298°37.9	· · 50.2	19°19.1	· · 48.7	56°28.4	· · 10.6	Pollux	243°19.3	27°58.2					
22	33°50.2	144°34.1	12.4	313°41.3	50.2	34°21.6	48.7	71°30.8	10.5	Avior	234°15.1	-59°34.6					
23	48°52.7	159°33.2	12.9	328°44.7	50.3	49°24.0	48.7	86°33.1	10.5	Suhail	222°47.5	-43°31.2					
Mer.pass. 19:45		ν -0.9° d -0.6° m -3.91	ν 3.4° d 0.1° m -1.74	ν 2.5° d 0.0° m -2.64	ν 2.3° d 0.0° m 0.77												
Mer.pass. 19:45		ν -0.9° d -0.6° m -3.91	ν 3.4° d 0.1° m -1.74	ν 2.5° d 0.0° m -2.64	ν 2.3° d 0.0° m 0.77												
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	63°55.1	174°32.4	S22°13.4	343°48.1	N24°50.4	64°26.5	S01°48.6	101°35.4	S16°10.4	Denebola	182°26.9	14°26.7					
1	78°57.6	189°31.5	14.0	358°51.5	50.4	79°29.0	48.6	116°37.8	10.4	Gienah	175°45.6	-17°39.9					
2	94°00.1	204°30.6	14.5	13°54.9	50.5	94°31.4	48.6	131°40.1	10.4	Acrux	173°02.5	-63°13.2					
3	109°02.5	219°29.7	· · 15.1	28°58.3	· · 50.6	109°33.9	· · 48.6	146°42.4	· · 10.3	Gacrux	171°54.0	-57°14.1					
4	124°05.0	234°28.9	15.6	44°01.7	50.6	124°36.3	48.6	161°44.7	10.3	Alioth	166°14.9	55°50.0					
5	139°07.5	249°28.0	16.1	59°05.1	50.7	139°38.8	48.6	176°47.1	10.2	Spica	158°24.4	-11°16.7					
6	154°09.9	264°27.1	S22°16.7	74°08.5	N24°50.7	154°41.3	S01°48.6	191°49.4	S16°10.2	Alkaid	152°53.8	49°11.9					
7	169°12.4	279°26.2	17.2	89°12.0	50.8	169°43.7	48.5	206°51.7	10.1	Hadar	148°39.1	-60°28.7					
8	184°14.9	294°25.3	17.7	104°15.4	50.9	184°46.2	48.5	221°54.1	10.1	Menkent	148°00.1	-36°28.7					
9	199°17.3	309°24.5	· · 18.2	119°18.8	· · 50.9	199°48.6	· · 48.5	236°56.4	· · 10.0	Arcturus	145°49.9	19°03.9					
10	214°19.8	324°23.6	18.8	134°22.2	51.0	214°51.1	48.5	251°58.7	10.0	Rigel Kent.	139°43.4	-60°55.5					
11	229°22.3	339°22.7	19.3	149°25.6	51.1	229°53.5	48.5	267°01.1	09.9	Kochab	137°20.9	74°03.6					
12	244°24.7	354°21.8	S22°19.8	164°29.0	N24°51.1	244°56.0	S01°48.5	282°03.4	S16°09.9	Zuben 'ub	136°58.3	-16°08.1					
13	259°27.2	9°20.9	20.4	179°32.4	51.2	259°58.5	48.4	297°05.7	09.9	Alphecca	126°05.6	26°38.3					
14	274°29.6	24°20.0	20.9	194°35.9	51.3	275°09.9	48.4	312°08.0	09.8	Antares	112°18.4	-26°28.9					
15	289°32.1	39°19.2	· · 21.4	209°39.3	· · 51.3	290°03.4	· · 48.4	327°10.4	· · 09.8	Atria	107°14.8	-69°04.1					
16	304°34.6	54°18.3	21.9	224°42.7	51.4	305°05.8	48.4	342°12.7	09.7	Sabik	102°05.2	-15°45.1					
17	319°37.0	69°17.4	22.4	239°46.1	51.4	320°08.3	48.4	357°15.0	09.7	Shaula	96°13.2	-37°07.2					
18	334°39.5	84°16.5	S22°23.0	254°49.5	N24°51.5	335°10.7	S01°48.4	12°17.4	S16°09.6	Rasalhague	96°00.5	12°32.7					
19	349°42.0	99°15.6	23.5	269°53.0	51.6	350°13.2	48.3	27°19.7	09.6	Eltanin	90°43.5	51°29.3					
20	4°44.4	114°14.7	24.0	284°56.4	51.6	5°15.6	48.3	42°22.0	09.5	Kaus Aust.	83°35.2	-34°22.5					
21	19°46.9	129°13.9	· · 24.5	299°59.8	· · 51.7	20°18.1	· · 48.3	57°24.3	· · 09.5	Vega	80°34.8	38°48.4					
22	34°49.4	144°13.0	25.0	315°03.2	51.7	35°20.5	48.3	72°26.7	09.4	Nunki	75°50.3	-26°16.1					
23	49°51.8	159°12.1	25.5	330°06.6	51.8	50°23.0	48.3	87°29.0	09.4	Altair	62°01.9	8°55.8					
Mer.pass. 19:41		ν -0.9° d -0.5° m -3.91	ν 3.4° d 0.1° m -1.76	ν 2.5° d 0.0° m -2.63	ν 2.3° d 0.0° m 0.77												
Mer.pass. 19:41		ν -0.9° d -0.5° m -3.91	ν 3.4° d 0.1° m -1.76	ν 2.5° d 0.0° m -2.63	ν 2.3° d 0.0° m 0.77												
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	64°54.3	174°11.2	S22°26.1	345°10.1	N24°51.9	65°25.5	S01°48.3	102°31.3	S16°09.3	Fomalhaut	15°16.4	-29°30.2					
1	79°56.8	189°10.3	26.6	0°13.5	51.9	80°27.9	48.2	117°33.6	09.3	Scheat	13°46.9	28°12.5					
2	94°59.2	204°09.4	27.1	15°16.9	52.0	95°30.4	48.2	132°36.0	09.3	Markab	13°31.6	15°19.8					
3	110°01.7	219°08.5	· · 27.6	30°20.4	· · 52.1	110°32.8	· · 48.2	147°38.3	· · 09.2	Nov 24 Thu	SHA	Mer.pass					
4	125°04.1	234°07.6	28.1	45°23.8	52.1	125°35.3	48.2	162°40.6	09.2	Venus	111°57.3	12:21					
5	140°06.6	249°06.8	28.6	60°27.2	52.2	140°37.7	48.2	177°42.9	09.1	Mars	279°30.7	01:10					
6	155°09.1	264°05.9	S22°29.1	75°30.6	N24°52.2	155°40.2	S01°48.1	192°45.3	S16°09.1	Jupiter	0°31.3	19:43					
7	170°11.5	279°05.0	29.6	90°34.1	52.3	170°42.6	48.1	207°47.6	09.0	Saturn	37°43.4	17:15					
8	185°14.0	294°04.1	30.1	105°37.5	52.3	185°45.1	48.1	222°49.9	09.0	Nov 25 Fri	SHA	Mer.pass					
9	200°16.5	309°03.2	· · 30.6	120°40.9	· · 52.4	200°47.5	· · 48.1	237°52.3	· · 08.9	Venus	110°37.2	12:23					
10	215°18.9	324°02.3	31.1	135°44.4	52.5	215°50.0	48.1	252°54.6	08.9	Mars	279°53.0	01:05					
11	230°21.4	339°01.4	31.6	150°47.8	52.5	230°52.4	48.1	267°56.9	08.8	Jupiter	0°31.2	19:39					
12	245°23.9	354°00.5	S22°32.1	165°51.3	N24°52.6	245°54.9	S01°48.0	282°59.2	S16°08.8	Saturn	37°40.3	17:11					
13	260°26.3	8°59.6	32.6	180°54.7	52.6	260°57.3	48.0	298°01.6	08.7	Nov 26 Sat	SHA	Mer.pass					
14	275°28.8	23°58.7	33.1	195°58.1	52.7	275°59.8	48.0	313°03.9	08.7	Venus	109°16.9	12:24					
15	290°31.3	38°57.9	· · 33.6	211°01.6	· · 52.8	291°02.2	· · 48.0	328°06.2	· · 08.6	Mars	280°15.8	00:59					
16	305°33.7	53°57.															

DUT1 = UT1-UTC = -0.0131 sec  $\Delta T = TT-UT1 = +69.1971$  sec

2022 November 24 to Nov. 26 UT

h	Sun		Moon				
Thu	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	183°22.3	S20°29.7	183°07.2	5.7'	S22°16.9	-10.3'	59.8'
1	198°22.1	30.2	197°31.9	5.6'	22°27.2	-10.1'	59.9'
2	213°21.9	30.7	211°56.4	5.4'	22°37.3	-10.0'	59.9'
3	228°21.8	.. 31.2	226°20.9	5.3'	22°47.3	-9.9'	59.9'
4	243°21.6	31.7	240°45.2	5.2'	22°57.1	-9.7'	59.9'
5	258°21.4	32.2	255°09.4	5.1'	23°06.8	-9.6'	59.9'
6	273°21.2	S20°32.7	269°33.5	5.0'	S23°16.4	-9.4'	59.9'
7	288°21.0	33.2	283°57.5	4.9'	23°25.8	-9.3'	60.0'
8	303°20.9	33.7	298°21.3	4.7'	23°35.1	-9.1'	60.0'
9	318°20.7	.. 34.2	312°45.1	4.6'	23°44.2	-8.9'	60.0'
10	333°20.5	34.7	327°08.7	4.5'	23°53.1	-8.8'	60.0'
11	348°20.3	35.2	341°32.2	4.4'	24°01.9	-8.6'	60.0'
12	3°20.1	S20°35.7	355°55.7	4.3'	S24°10.5	-8.5'	60.1'
13	18°19.9	36.2	10°19.0	4.2'	24°19.0	-8.3'	60.1'
14	33°19.8	36.7	24°42.2	4.1'	24°27.3	-8.1'	60.1'
15	48°19.6	.. 37.2	39°05.3	4.0'	24°35.4	-8.0'	60.1'
16	63°19.4	37.7	53°28.3	3.9'	24°43.4	-7.8'	60.1'
17	78°19.2	38.2	67°51.2	3.8'	24°51.2	-7.6'	60.1'
18	93°19.0	S20°38.7	82°14.0	3.7'	S24°58.8	-7.5'	60.1'
19	108°18.8	39.2	96°36.7	3.6'	25°06.3	-7.3'	60.2'
20	123°18.7	39.7	110°59.3	3.5'	25°13.6	-7.1'	60.2'
21	138°18.5	.. 40.2	125°21.8	3.4'	25°20.7	-6.9'	60.2'
22	153°18.3	40.7	139°44.2	3.3'	25°27.6	-6.7'	60.2'
23	168°18.1	41.2	154°06.5	3.2'	25°34.3	-6.6'	60.2'
	SD = 16.2'		d = -0.5'				SD = 16.3'

Fri	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	183°17.9	S20°41.7	168°28.7	3.1'	S25°40.9	-6.4'	60.2'
1	198°17.7	42.2	182°50.9	3.1'	25°47.3	-6.2'	60.2'
2	213°17.5	42.7	197°12.9	3.0'	25°53.5	-6.0'	60.2'
3	228°17.3	.. 43.2	211°34.9	2.9'	25°59.5	-5.8'	60.2'
4	243°17.2	43.7	225°56.8	2.8'	26°05.3	-5.6'	60.3'
5	258°17.0	44.2	240°18.7	2.8'	26°11.0	-5.5'	60.3'
6	273°16.8	S20°44.7	254°40.4	2.7'	S26°16.4	-5.3'	60.3'
7	288°16.6	45.2	269°02.1	2.6'	26°21.7	-5.1'	60.3'
8	303°16.4	45.6	283°23.7	2.5'	26°26.8	-4.9'	60.3'
9	318°16.2	.. 46.1	297°45.2	2.5'	26°31.6	-4.7'	60.3'
10	333°16.0	46.6	312°06.7	2.4'	26°36.3	-4.5'	60.3'
11	348°15.8	47.1	326°28.1	2.4'	26°40.8	-4.3'	60.3'
12	3°15.6	S20°47.6	340°49.5	2.3'	S26°45.1	-4.1'	60.3'
13	18°15.4	48.1	355°10.8	2.2'	26°49.2	-3.9'	60.3'
14	33°15.3	48.6	9°32.0	2.2'	26°53.1	-3.7'	60.3'
15	48°15.1	.. 49.0	23°53.2	2.1'	26°56.8	-3.5'	60.3'
16	63°14.9	49.5	38°14.4	2.1'	27°00.3	-3.3'	60.3'
17	78°14.7	50.0	52°35.5	2.1'	27°03.6	-3.1'	60.3'
18	93°14.5	S20°50.5	66°56.5	2.0'	S27°06.7	-2.9'	60.3'
19	108°14.3	51.0	81°17.5	2.0'	27°09.6	-2.7'	60.3'
20	123°14.1	51.5	95°38.5	2.0'	27°12.3	-2.5'	60.3'
21	138°13.9	.. 51.9	109°59.5	1.9'	27°14.7	-2.3'	60.4'
22	153°13.7	52.4	124°20.4	1.9'	27°17.0	-2.1'	60.4'
23	168°13.5	52.9	138°41.3	1.9'	27°19.1	-1.9'	60.4'
	SD = 16.2'		d = -0.5'				SD = 16.4'

Sat	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	183°13.3	S20°53.4	153°02.2	1.9'	S27°21.0	-1.7'	60.4'
1	198°13.1	53.8	167°23.0	1.8'	27°22.6	-1.5'	60.4'
2	213°12.9	54.3	181°43.8	1.8'	27°24.1	-1.3'	60.4'
3	228°12.7	.. 54.8	196°04.7	1.8'	27°25.3	-1.0'	60.4'
4	243°12.5	55.3	210°25.5	1.8'	27°26.4	-0.8'	60.4'
5	258°12.3	55.7	224°46.3	1.8'	27°27.2	-0.6'	60.4'
6	273°12.2	S20°56.2	239°07.1	1.8'	S27°27.8	-0.4'	60.4'
7	288°12.0	56.7	253°27.9	1.8'	27°28.3	-0.2'	60.3'
8	303°11.8	57.2	267°48.7	1.8'	27°28.5	-0.0'	60.3'
9	318°11.6	.. 57.6	282°09.5	1.8'	27°28.5	0.2'	60.3'
10	333°11.4	58.1	296°30.3	1.8'	27°28.3	0.4'	60.3'
11	348°11.2	58.6	310°51.1	1.8'	27°27.9	0.6'	60.3'
12	3°11.0	S20°59.0	325°11.9	1.9'	S27°27.3	0.8'	60.3'
13	18°10.8	20°59.5	339°32.8	1.9'	27°26.5	1.0'	60.3'
14	33°10.6	21°00.0	353°53.7	1.9'	27°25.5	1.2'	60.3'
15	48°10.4	.. 00.5	8°14.6	1.9'	27°24.2	1.4'	60.3'
16	63°10.2	00.9	22°35.5	2.0'	27°22.8	1.6'	60.3'
17	78°10.0	01.4	36°56.5	2.0'	27°21.2	1.8'	60.3'
18	93°09.8	S21°01.8	51°17.4	2.0'	S27°19.3	2.0'	60.3'
19	108°09.6	02.3	65°38.5	2.1'	27°17.3	2.2'	60.3'
20	123°09.4	02.8	79°59.5	2.1'	27°15.0	2.4'	60.3'
21	138°09.2	.. 03.2	94°20.6	2.2'	27°12.6	2.7'	60.3'
22	153°09.0	03.7	108°41.8	2.2'	27°09.9	2.9'	60.3'
23	168°08.8	04.2	123°03.0	2.3'	27°07.1	3.1'	60.3'
	SD = 16.2'		d = -0.5'				SD = 16.5'

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

Day	Sun		Mer.	Moon	
	Eqn.of Time	00 <sup>h</sup> 12 <sup>h</sup>		Mer. Pass.	Age
	mm:ss	mm:ss	hh:mm	Upper	Lower
24	13:29	13:21	11:47	12:17	—
25	13:12	13:03	11:47	13:20	00:48
26	12:53	12:44	11:47	14:26	01:53

November 27, 28, 29 UT (Sun., Mon., Tue.)

Aries		Venus		Mars		Jupiter		Saturn		Stars		
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	65°53.4	173°49.8	\$22°38.0	346°32.6	N24°53.3	66°24.2	S01°47.8	103°27.1	S16°08.2	Alpheratz	357°36.4	
1	80°55.9	188°48.9	38.5	1°36.0	53.3	81°26.7	47.8	118°29.4	08.2	Ankaa	353°08.7	
2	95°58.4	203°48.0	39.0	16°39.5	53.4	96°29.1	47.7	133°31.8	08.1	Schedar	349°32.7	
3	111°00.8	218°47.1	39.5	31°42.9	53.4	111°31.5	47.7	148°34.1	08.1	Diphda	348°48.9	
4	126°03.3	233°46.2	39.9	46°46.4	53.5	126°34.0	47.7	163°36.4	08.0	Achernar	335°21.1	
5	141°05.8	248°45.3	40.4	61°49.8	53.5	141°36.4	47.7	178°38.7	08.0	Hamal	327°52.9	
6	156°08.2	263°44.4	\$22°40.9	76°53.3	N24°53.6	156°38.9	S01°47.7	193°41.1	S16°07.9	Polaris	314°24.0	
7	171°10.7	278°43.5	41.4	91°56.7	53.6	171°41.3	47.6	208°43.4	07.9	Acamar	315°12.7	
8	186°13.1	293°42.6	41.9	107°00.2	53.7	186°43.8	47.6	223°45.7	07.8	Menkar	314°07.7	
9	201°15.6	308°41.7	42.3	122°03.6	53.7	201°46.2	47.6	238°48.0	07.8	Mirfak	308°30.3	
10	216°18.1	323°40.8	42.8	137°07.1	53.8	216°48.6	47.6	253°50.3	07.7	Aldebaran	290°41.3	
11	231°20.5	338°39.9	43.3	152°10.5	53.9	231°51.1	47.5	268°52.7	07.7	Rigel	281°05.2	
12	246°23.0	353°39.0	\$22°43.7	167°14.0	N24°53.9	246°53.5	S01°47.5	283°55.0	S16°07.7	Capella	280°24.0	
13	261°25.5	8°38.1	44.2	182°17.5	54.0	261°56.0	47.5	298°57.3	07.6	Bellatrix	278°24.4	
14	276°27.9	23°37.2	44.7	197°20.9	54.0	276°58.4	47.5	313°59.6	07.6	Elnath	278°03.7	
15	291°30.4	38°36.3	45.2	212°24.4	54.1	292°00.8	47.5	329°02.0	07.5	Alnilam	275°39.2	
16	306°32.9	53°35.4	45.6	227°27.8	54.1	307°03.3	47.4	344°04.3	07.5	Betelgeuse	270°53.7	
17	321°35.3	68°34.5	46.1	242°31.3	54.2	322°05.7	47.4	359°06.6	07.4	Canopus	263°52.7	
18	336°37.8	83°33.6	\$22°46.6	257°34.8	N24°54.2	337°08.2	S01°47.4	14°08.9	S16°07.4	Sirius	258°27.5	
19	351°40.3	98°32.7	47.0	272°38.2	54.3	352°10.6	47.4	29°11.2	07.3	Adhara	255°06.9	
20	6°42.7	113°31.8	47.5	287°41.7	54.3	7°13.0	47.3	44°13.6	07.3	Procyon	244°52.5	
21	21°45.2	128°30.9	47.9	302°45.1	54.4	22°15.5	47.3	59°15.9	07.2	Pollux	243°19.2	
22	36°47.6	143°30.0	48.4	317°48.6	54.4	37°17.9	47.3	74°18.2	07.2	Avior	234°15.1	
23	51°50.1	158°29.1	48.9	332°52.1	54.5	52°20.4	47.3	89°20.5	07.1	Suhail	222°47.4	
Mer.pass. 19:33		ν -0.9° d -0.5° m -3.91	ν 3.4° d 0.1° m -1.80		ν 2.4° d 0.0° m -2.61	ν 2.3° d 0.0° m 0.78						
Mon		GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec		
0	66°52.6	173°28.2	\$22°49.3	347°55.5	N24°54.5	67°22.8	S01°47.2	104°22.8	S16°07.1	Denebola	182°26.9	
1	81°55.0	188°27.3	49.8	2°59.0	54.6	82°25.2	47.2	119°25.2	07.0	Gienah	175°45.6	
2	96°57.5	203°26.4	50.2	18°02.5	54.6	97°27.7	47.2	134°27.5	07.0	Acrux	173°02.4	
3	112°00.0	218°25.5	50.7	33°05.9	54.7	112°30.1	47.2	149°29.8	06.9	Gacrux	171°53.9	
4	127°02.4	233°24.5	51.1	48°09.4	54.7	127°32.5	47.1	164°32.1	06.9	Alioth	166°14.9	
5	142°04.9	248°23.6	51.6	63°12.9	54.8	142°35.0	47.1	179°34.4	06.8	Spica	158°24.4	
6	157°07.4	263°22.7	\$22°52.0	78°16.4	N24°54.8	157°37.4	S01°47.1	194°36.7	S16°06.8	Alkaid	152°53.8	
7	172°09.8	278°21.8	52.5	93°19.8	54.9	172°39.8	47.1	209°39.1	06.7	Hadar	148°39.1	
8	187°12.3	293°20.9	52.9	108°23.3	54.9	187°42.3	47.0	224°41.4	06.7	Menkent	148°00.0	
9	202°14.8	308°20.0	53.4	123°26.8	55.0	202°44.7	47.0	239°43.7	06.6	Arcturus	145°49.8	
10	217°17.2	323°19.1	53.8	138°30.2	55.0	217°47.1	47.0	254°46.0	06.6	Rigil Kent.	139°43.3	
11	232°19.7	338°18.2	54.3	153°33.7	55.1	232°49.6	47.0	269°48.3	06.5	Kochab	137°20.9	
12	247°22.1	353°17.3	\$22°54.7	168°37.2	N24°55.1	247°52.0	S01°46.9	284°50.7	S16°06.5	Zuben'ubi	136°58.3	
13	262°24.6	8°16.4	55.1	183°40.7	55.2	262°54.4	46.9	299°53.0	06.4	Alphecca	126°05.6	
14	277°27.1	23°15.5	55.6	198°44.1	55.2	277°56.9	46.9	314°55.3	06.4	Antares	112°18.4	
15	292°29.5	38°14.5	56.0	213°47.6	55.2	292°59.3	46.9	329°57.6	06.3	Atria	107°14.8	
16	307°32.0	53°13.6	56.5	228°51.1	55.3	308°01.7	46.8	344°59.9	06.3	Sabik	102°05.2	
17	322°34.5	68°12.7	56.9	243°54.6	55.3	323°04.2	46.8	0°02.2	06.2	Shaula	96°13.2	
18	337°36.9	83°11.8	\$22°57.3	258°58.1	N24°55.4	338°06.6	S01°46.8	15°04.6	S16°06.2	Rasalhague	96°00.5	
19	352°39.4	98°10.9	57.8	274°01.5	55.4	353°09.0	46.7	30°06.9	06.1	Eltanin	90°43.5	
20	7°41.9	113°10.0	58.2	289°05.0	55.5	8°11.5	46.7	45°09.2	06.1	Kaus Aust.	83°35.2	
21	22°44.3	128°09.1	58.6	304°08.5	55.5	23°13.9	46.7	60°11.5	06.0	Vega	80°34.8	
22	37°46.8	143°08.2	59.1	319°12.0	55.6	38°16.3	46.7	75°13.8	06.0	Nunki	75°50.3	
23	52°49.2	158°07.2	59.5	334°15.5	55.6	53°18.7	46.6	90°16.1	05.9	Altair	62°01.9	
Mer.pass. 19:29		ν -0.9° d -0.5° m -3.91	ν 3.5° d 0.0° m -1.82		ν 2.4° d 0.0° m -2.60	ν 2.3° d 0.0° m 0.78						
Tue		GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec		
0	67°51.7	173°06.3	\$22°59.9	349°18.9	N24°55.7	68°21.2	S01°46.6	105°18.5	S16°05.9	Fomalhaut	15°16.4	
1	82°54.2	188°05.4	23°00.3	4°22.4	55.7	83°23.6	46.6	120°20.8	05.8	Scheat	13°46.9	
2	97°56.6	203°04.5	00.8	19°25.9	55.7	98°26.0	46.5	135°23.1	05.8	Markab	13°31.6	
3	112°59.1	218°03.6	01.2	34°29.4	55.8	113°28.5	46.5	150°25.4	05.7	Nov 27 Sun	SHA	Mer.pass
4	128°01.6	233°02.7	01.6	49°32.9	55.8	128°30.9	46.5	165°27.7	05.7	Venus	107°56.4	12:25
5	143°04.0	248°01.8	02.0	64°36.4	55.9	143°33.3	46.5	180°30.0	05.6	Mars	280°39.1	00:54
6	158°06.5	263°00.8	\$23°02.5	79°39.8	N24°55.9	158°35.7	S01°46.4	195°32.4	S16°05.6	Jupiter	0°30.8	19:31
7	173°09.0	277°59.9	02.9	94°43.3	56.0	173°38.2	46.4	210°34.7	05.5	Saturn	37°33.7	17:04
8	188°11.4	292°59.0	03.3	109°46.8	56.0	188°40.6	46.4	225°37.0	05.5	Nov 28 Mon	SHA	Mer.pass
9	203°13.9	307°58.1	03.7	124°50.3	56.0	203°43.0	46.3	240°39.3	05.4	Venus	106°35.6	12:27
10	218°16.4	322°57.2	04.1	139°53.8	56.1	218°45.4	46.3	255°41.6	05.4	Mars	281°03.0	00:48
11	233°18.8	337°56.3	04.6	154°57.3	56.1	233°47.9	46.3	270°43.9	05.3	Jupiter	0°30.2	19:27
12	248°21.3	352°55.3	\$23°05.0	170°00.8	N24°56.2	248°50.3	S01°46.3	285°46.2	S16°05.3	Saturn	37°30.3	17:00
13	263°23.7	7°54.4	05.4	185°04.3	56.2	263°52.7	46.2	300°48.6	05.2	Nov 29 Tue	SHA	Mer.pass
14	278°26.2	22°53.5	05.8	200°07.8	56.3	278°55.1	46.2	315°50.9	05.2	Venus	105°14.6	12:28
15	293°28.7	37°52.6	06.2	215°11.3	56.3	293°57.6	46.2	330°53.2	05.1	Mars	281°27.2	00:43
16	308°31.1	52°51.7	06.6	230°14.7	56.3	309°00.0	46.1	345°55.5	05.1	Jupiter	0°29.5	19:23
17	323°33.6	67°50.7	07.0	245°18.2	56.4	324°02.4	46.1	0°57.8	05.0	Saturn	37°26.7	16:56
18	338°36.1	82°49.8	\$23°07.4	260°21.7	N24°56.4	339°04.8	S01°46.1	16°00.1	S16°05.0	Horizontal parallax		
19	353°38.5	97°48.9	07.8	275°25.2	56.5	354°07.3	46.0	31°02.4	04.9	Venus:	0.1	
20	8°41.0	112°48.0	08.2	290°28.7	56.5	9°09.7	46.0	46°04.8	04.9	Mars:	0.3	
21	23°43.5	127°47.1	08.6	305°32.2	56.5	24°12.1	46.0	61°07.1	04.8			
22	38°45.9	142°46.1	09.0	320°35.7	56.6	39°14.5	45.9	76°09.4	04.8			
23	53°48.4	157°45.2	09.4	335°39.2	56.6	54°16.9	45.9	91°11.7	04.7			
Mer.pass. 19:25		ν -0.9° d -0.4° m -3.91	ν 3.5° d 0.0° m -1.84		ν 2.4° d 0.0° m -2.60	ν 2.3° d 0.0° m 0.78						

DUT1 = UT1-UTC = -0.0124 sec  $\Delta T = TT-UT1 = +69.1964$  sec

2022 November 27 to Nov. 29 UT

h		Sun		Moon			
Sun	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	183°08.6	S21°04.6	137°24.3	2.3'	S27°04.0	3.2'	60.3'
1	198°08.4	05.1	151°45.6	2.4'	27°00.8	3.4'	60.2'
2	213°08.2	05.5	166°06.9	2.4'	26°57.3	3.6'	60.2'
3	228°07.9	.. 06.0	180°28.3	2.5'	26°53.7	3.8'	60.2'
4	243°07.7	06.5	194°49.8	2.5'	26°49.8	4.0'	60.2'
5	258°07.5	06.9	209°11.4	2.6'	26°45.8	4.2'	60.2'
6	273°07.3	S21°07.4	223°33.0	2.7'	S26°41.6	4.4'	60.2'
7	288°07.1	07.8	237°54.7	2.8'	26°37.2	4.6'	60.2'
8	303°06.9	08.3	252°16.4	2.8'	26°32.6	4.8'	60.2'
9	318°06.7	.. 08.7	266°38.3	2.9'	26°27.7	5.0'	60.2'
10	333°06.5	09.2	281°00.2	3.0'	26°22.8	5.2'	60.1'
11	348°06.3	09.7	295°22.2	3.1'	26°17.6	5.4'	60.1'
12	3°06.1	S21°10.1	309°44.2	3.2'	S26°12.2	5.6'	60.1'
13	18°05.9	10.6	324°06.4	3.2'	26°06.7	5.7'	60.1'
14	33°05.7	11.0	338°28.6	3.3'	26°00.9	5.9'	60.1'
15	48°05.5	.. 11.5	352°51.0	3.4'	25°55.0	6.1'	60.1'
16	63°05.3	11.9	7°13.4	3.5'	25°48.9	6.3'	60.1'
17	78°05.1	12.4	21°35.9	3.6'	25°42.6	6.5'	60.1'
18	93°04.9	S21°12.8	35°58.5	3.7'	S25°36.2	6.6'	60.0'
19	108°04.7	13.3	50°21.2	3.8'	25°29.5	6.8'	60.0'
20	123°04.4	13.7	64°44.0	3.9'	25°22.7	7.0'	60.0'
21	138°04.2	.. 14.2	79°06.9	4.0'	25°15.8	7.1'	60.0'
22	153°04.0	14.6	93°29.9	4.1'	25°08.6	7.3'	60.0'
23	168°03.8	15.0	107°53.0	4.2'	25°01.3	7.5'	60.0'
		SD = 16.2'	d = -0.5'	SD = 16.4'			

Mon	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	183°03.6	S21°15.5	122°16.2	4.3'	S24°53.8	7.7'	59.9'
1	198°03.4	15.9	136°39.5	4.4'	24°46.1	7.8'	59.9'
2	213°03.2	16.4	151°02.9	4.5'	24°38.3	8.0'	59.9'
3	228°03.0	.. 16.8	165°26.4	4.6'	24°30.4	8.1'	59.9'
4	243°02.8	17.3	179°50.0	4.7'	24°22.2	8.3'	59.9'
5	258°02.6	17.7	194°13.7	4.8'	24°13.9	8.5'	59.9'
6	273°02.3	S21°18.1	208°37.6	5.0'	S24°05.4	8.6'	59.8'
7	288°02.1	18.6	223°01.5	5.1'	23°56.8	8.8'	59.8'
8	303°01.9	19.0	237°25.6	5.2'	23°48.1	8.9'	59.8'
9	318°01.7	.. 19.5	251°49.8	5.3'	23°39.1	9.1'	59.8'
10	333°01.5	19.9	266°14.1	5.4'	23°30.1	9.2'	59.8'
11	348°01.3	20.3	280°38.5	5.5'	23°20.9	9.4'	59.7'
12	3°01.1	S21°20.8	295°03.0	5.6'	S23°11.5	9.5'	59.7'
13	18°00.9	21.2	309°27.7	5.8'	23°02.0	9.7'	59.7'
14	33°00.6	21.6	323°52.4	5.9'	22°52.3	9.8'	59.7'
15	48°00.4	.. 22.1	338°17.3	6.0'	22°42.5	9.9'	59.7'
16	63°00.2	22.5	352°42.3	6.1'	22°32.6	10.1'	59.6'
17	78°00.0	22.9	7°07.4	6.2'	22°22.5	10.2'	59.6'
18	92°59.8	S21°23.4	21°32.6	6.3'	S22°12.3	10.3'	59.6'
19	107°59.6	23.8	35°58.0	6.5'	22°02.0	10.5'	59.6'
20	122°59.4	24.2	50°23.4	6.6'	21°51.5	10.6'	59.6'
21	137°59.1	.. 24.7	64°49.0	6.7'	21°40.9	10.7'	59.5'
22	152°58.9	25.1	79°14.7	6.8'	21°30.2	10.8'	59.5'
23	167°58.7	25.5	93°40.5	6.9'	21°19.4	11.0'	59.5'
		SD = 16.2'	d = -0.4'	SD = 16.3'			

Tue	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	182°58.5	S21°26.0	108°06.5	7.1'	S21°08.4	11.1'	59.5'
1	197°58.3	26.4	122°32.6	7.2'	20°57.3	11.2'	59.5'
2	212°58.1	26.8	136°58.7	7.3'	20°46.1	11.3'	59.4'
3	227°57.8	.. 27.2	151°25.0	7.4'	20°34.8	11.4'	59.4'
4	242°57.6	27.7	165°51.5	7.5'	20°23.3	11.6'	59.4'
5	257°57.4	28.1	180°18.0	7.7'	20°11.8	11.7'	59.4'
6	272°57.2	S21°28.5	194°44.6	7.8'	S20°00.1	11.8'	59.3'
7	287°57.0	28.9	209°11.4	7.9'	19°48.3	11.9'	59.3'
8	302°56.7	29.3	223°38.3	8.0'	19°36.4	12.0'	59.3'
9	317°56.5	.. 29.8	238°05.3	8.1'	19°24.4	12.1'	59.3'
10	332°56.3	30.2	252°32.4	8.2'	19°12.3	12.2'	59.3'
11	347°56.1	30.6	266°59.7	8.4'	19°00.1	12.3'	59.2'
12	2°55.9	S21°31.0	281°27.0	8.5'	S18°47.8	12.4'	59.2'
13	17°55.6	31.4	295°54.5	8.6'	18°35.4	12.5'	59.2'
14	32°55.4	31.9	310°22.1	8.7'	18°22.9	12.6'	59.2'
15	47°55.2	.. 32.3	324°49.8	8.8'	18°10.3	12.7'	59.1'
16	62°55.0	32.7	339°17.6	8.9'	17°57.6	12.8'	59.1'
17	77°54.8	33.1	353°45.5	9.0'	17°44.8	12.9'	59.1'
18	92°54.5	S21°33.5	8°13.5	9.1'	S17°32.0	13.0'	59.1'
19	107°54.3	33.9	22°41.7	9.3'	17°19.0	13.0'	59.0'
20	122°54.1	34.4	37°09.9	9.4'	17°06.0	13.1'	59.0'
21	137°53.9	.. 34.8	51°38.3	9.5'	16°52.8	13.2'	59.0'
22	152°53.7	35.2	66°06.8	9.6'	16°39.6	13.3'	59.0'
23	167°53.4	35.6	80°35.3	9.7'	16°26.3	13.4'	58.9'
		SD = 16.2'	d = -0.4'	SD = 16.2'			

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

November 30, 01, 02 UT (Wed., Thu., Fri.)

Aries			Venus			Mars			Jupiter			Saturn			Stars	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	68°50.9	172°44.3	\$23°09.8	350°42.7	N24°56.7	69°19.4	S01°45.9	106°14.0	\$16°04.7							
1	83°53.3	187°43.4	10.2	5°46.2	56.7	84°21.8	45.9	121°16.3	04.6							
2	98°55.8	202°42.4	10.6	20°49.7	56.7	99°24.2	45.8	136°18.6	04.6							
3	113°58.2	217°41.5	.. 11.0	35°53.2	.. 56.8	114°26.6	.. 45.8	151°20.9	.. 04.5							
4	129°00.7	232°40.6	11.4	50°56.7	56.8	129°29.0	45.8	166°23.3	04.5							
5	144°03.2	247°39.7	11.8	66°00.2	56.8	144°31.5	45.7	181°25.6	04.4							
6	159°05.6	262°38.7	\$23°12.2	81°03.7	N24°56.9	159°33.9	S01°45.7	196°27.9	\$16°04.4							
7	174°08.1	277°37.8	12.6	96°07.2	56.9	174°36.3	45.7	211°30.2	04.3							
8	189°10.6	292°36.9	13.0	111°10.7	57.0	189°38.7	45.6	226°32.5	04.3							
9	204°13.0	307°36.0	.. 13.4	126°14.2	.. 57.0	204°41.1	.. 45.6	241°34.8	.. 04.2							
10	219°15.5	322°35.0	13.8	141°17.7	57.0	219°43.5	45.6	256°37.1	04.2							
11	234°18.0	337°34.1	14.2	156°21.2	57.1	234°46.0	45.5	271°39.4	04.1							
12	249°20.4	352°33.2	\$23°14.5	171°24.7	N24°57.1	249°48.4	S01°45.5	286°41.7	\$16°04.1							
13	264°22.9	7°32.3	14.9	186°28.2	57.1	264°50.8	45.5	301°44.1	04.0							
14	279°25.4	22°31.3	15.3	201°31.7	57.2	279°53.2	45.4	316°46.4	04.0							
15	294°27.8	37°30.4	.. 15.7	216°35.2	.. 57.2	294°55.6	.. 45.4	331°48.7	.. 03.9							
16	309°30.3	52°29.5	16.1	231°38.7	57.2	309°58.0	45.4	346°51.0	03.9							
17	324°32.7	67°28.6	16.4	246°42.2	57.3	325°00.5	45.3	1°53.3	03.8							
18	339°35.2	82°27.6	\$23°16.8	261°45.7	N24°57.3	340°02.9	S01°45.3	16°55.6	\$16°03.8							
19	354°37.7	97°26.7	17.2	276°49.3	57.3	355°05.3	45.3	31°57.9	03.7							
20	9°40.1	112°25.8	17.6	291°52.8	57.4	10°07.7	45.2	47°00.2	03.7							
21	24°42.6	127°24.8	.. 18.0	306°56.3	.. 57.4	25°10.1	.. 45.2	62°02.5	.. 03.6							
22	39°45.1	142°23.9	18.3	321°59.8	57.4	40°12.5	45.2	77°04.8	03.6							
23	54°47.5	157°23.0	18.7	337°03.3	57.5	55°14.9	45.1	92°07.2	03.5							
Mer.pass. 19:21		ν -0.9° d -0.4° m -3.91		ν 3.5° d 0.0° m -1.85		ν 2.4° d 0.0° m -2.59		ν 2.3° d 0.1° m 0.79								
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	69°50.0	172°22.1	\$23°19.1	352°06.8	N24°57.5	70°17.4	S01°45.1	107°09.5	\$16°03.5							
1	84°52.5	187°21.1	19.4	7°10.3	57.5	85°19.8	45.1	122°11.8	03.4							
2	99°54.9	202°20.2	19.8	22°13.8	57.6	100°22.2	45.0	137°14.1	03.4							
3	114°57.4	217°19.3	.. 20.2	37°17.3	.. 57.6	115°24.6	.. 45.0	152°16.4	.. 03.3							
4	129°59.8	232°18.3	20.5	52°20.8	57.6	130°27.0	44.9	167°18.7	03.2							
5	145°02.3	247°17.4	20.9	67°24.3	57.7	145°29.4	44.9	182°21.0	03.2							
6	160°04.8	262°16.5	\$23°21.3	82°27.9	N24°57.7	160°31.8	S01°44.9	197°23.3	\$16°03.1							
7	175°07.2	277°15.5	21.6	97°31.4	57.7	175°34.2	44.8	212°25.6	03.1							
8	190°09.7	292°14.6	22.0	112°34.9	57.8	190°36.7	44.8	227°27.9	03.0							
9	205°12.2	307°13.7	.. 22.3	127°38.4	.. 57.8	205°39.1	.. 44.8	242°30.2	.. 03.0							
10	220°14.6	322°12.7	22.7	142°41.9	57.8	220°41.5	44.7	257°32.5	02.9							
11	235°17.1	337°11.8	23.1	157°45.4	57.9	235°43.9	44.7	272°34.9	02.9							
12	250°19.6	352°10.9	\$23°23.4	172°48.9	N24°57.9	250°46.3	S01°44.7	287°37.2	\$16°02.8							
13	265°22.0	7°09.9	23.8	187°52.5	57.9	265°48.7	44.6	302°39.5	02.8							
14	280°24.5	22°09.0	24.1	202°56.0	58.0	280°51.1	44.6	317°41.8	02.7							
15	295°27.0	37°08.1	.. 24.5	217°59.5	.. 58.0	295°53.5	.. 44.5	332°44.1	.. 02.7							
16	310°29.4	52°07.1	24.8	233°03.0	58.0	310°55.9	44.5	347°46.4	02.6							
17	325°31.9	67°06.2	25.2	248°06.5	58.0	325°58.3	44.5	2°48.7	02.6							
18	340°34.3	82°05.3	\$23°25.5	263°10.0	N24°58.1	341°00.7	S01°44.4	17°51.0	\$16°02.5							
19	355°36.8	97°04.3	25.9	278°13.6	58.1	356°03.1	44.4	32°53.3	02.5							
20	10°39.3	112°03.4	26.2	293°17.1	58.1	11°05.5	44.4	47°55.6	02.4							
21	25°41.7	127°02.5	.. 26.6	308°20.6	.. 58.2	26°08.0	.. 44.3	62°57.9	.. 02.4							
22	40°44.2	142°01.5	26.9	323°24.1	58.2	41°10.4	44.3	78°00.2	02.3							
23	55°46.7	157°00.6	27.2	338°27.6	58.2	56°12.8	44.2	93°02.5	02.2							
Mer.pass. 19:17		ν -0.9° d -0.4° m -3.91		ν 3.5° d 0.0° m -1.87		ν 2.4° d 0.0° m -2.58		ν 2.3° d 0.1° m 0.79								
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	70°49.1	171°59.6	\$23°27.6	353°31.1	N24°58.2	71°15.2	S01°44.2	108°04.8	\$16°02.2							
1	85°51.6	186°58.7	27.9	8°34.7	58.3	86°17.6	44.2	123°07.1	02.1							
2	100°54.1	201°57.8	28.3	23°38.2	58.3	101°20.0	44.1	138°09.4	02.1							
3	115°56.5	216°56.8	.. 28.6	38°41.7	.. 58.3	116°22.4	.. 44.1	153°11.8	.. 02.0							
4	130°59.0	231°55.9	28.9	53°45.2	58.3	131°24.8	44.1	168°14.1	02.0							
5	146°01.5	246°55.0	29.3	68°48.7	58.4	146°27.2	44.0	183°16.4	01.9							
6	161°03.9	261°54.0	\$23°29.6	83°52.3	N24°58.4	161°29.6	S01°44.0	198°18.7	\$16°01.9							
7	176°06.4	276°53.1	29.9	98°55.8	58.4	176°32.0	43.9	213°21.0	01.8							
8	191°08.8	291°52.1	30.3	113°59.3	58.5	191°34.4	43.9	228°23.3	01.8							
9	206°11.3	306°51.2	.. 30.6	129°02.8	.. 58.5	206°36.8	.. 43.9	243°25.6	.. 01.7							
10	221°13.8	321°50.3	30.9	144°06.4	58.5	221°39.2	43.8	258°27.9	01.7							
11	236°16.2	336°49.3	31.3	159°09.9	58.5	236°41.6	43.8	273°30.2	01.6							
12	251°18.7	351°48.4	\$23°31.6	174°13.4	N24°58.6	251°44.0	S01°43.7	288°32.5	\$16°01.6							
13	266°21.2	6°47.4	31.9	189°16.9	58.6	266°46.4	43.7	303°34.8	01.5							
14	281°23.6	21°46.5	32.2	204°20.4	58.6	281°48.8	43.7	318°37.1	01.4							
15	296°26.1	36°45.6	.. 32.6	219°24.0	.. 58.6	296°51.2	.. 43.6	333°39.4	.. 01.4							
16	311°28.6	51°44.6	32.9	234°27.5	58.6	311°53.6	43.6	348°41.7	01.3							
17	326°31.0	66°43.7	33.2	249°31.0	58.7	326°56.0	43.5	3°44.0	01.3							
18	341°33.5	81°42.7	\$23°33.5	264°34.5	N24°58.7	341°58.4	S01°43.5	18°46.3	\$16°01.2							
19	356°35.9	96°41.8	33.8	279°38.1	58.7	357°00.8	43.5	33°48.6	01.2							
20	11°38.4	111°40.8	34.1	294°41.6	58.7	12°03.2	43.4	48°50.9	01.1							
21	26°40.9	126°39.9	.. 34.5	309°45.1	.. 58.8	27°05.6	.. 43.4	63°53.2	.. 01.1							
22	41°43.3	141°39.0	34.8	324°48.6	58.8	42°08.0	43.3	78°55.5	01.0							
23	56°45.8	156°38.0	35.1	339°52.2	58.8	57°10.4	43.3	93°57.8	01.0							
Mer.pass.																

DUT1 = UT1-UTC = -0.0122 sec  $\Delta T = TT-UT1 = +69.1962$  sec

2022 November 30 to Dec. 02 UT

h		Sun		Moon			
Wed	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	182°53.2	S21°36.0	95°04.0	9.8'	S16°13.0	13.4'	58.9'
1	197°53.0	36.4	109°32.8	9.9'	15°59.5	13.5'	58.9'
2	212°52.8	36.8	124°01.7	10.0'	15°46.0	13.6'	58.9'
3	227°52.5	.. 37.2	138°30.7	10.1'	15°32.4	13.7'	58.8'
4	242°52.3	37.6	152°59.8	10.2'	15°18.7	13.7'	58.8'
5	257°52.1	38.0	167°29.0	10.3'	15°05.0	13.8'	58.8'
6	272°51.9	S21°38.5	181°58.3	10.4'	S14°51.2	13.9'	58.8'
7	287°51.6	38.9	196°27.7	10.5'	14°37.3	13.9'	58.7'
8	302°51.4	39.3	210°57.2	10.6'	14°23.4	14.0'	58.7'
9	317°51.2	.. 39.7	225°26.8	10.7'	14°09.4	14.1'	58.7'
10	332°51.0	40.1	239°56.5	10.8'	13°55.3	14.1'	58.7'
11	347°50.7	40.5	254°26.3	10.9'	13°41.2	14.2'	58.6'
12	2°50.5	S21°40.9	268°56.1	11.0'	S13°27.0	14.2'	58.6'
13	17°50.3	41.3	283°26.1	11.1'	13°12.7	14.3'	58.6'
14	32°50.0	41.7	297°56.2	11.2'	12°58.4	14.4'	58.6'
15	47°49.8	.. 42.1	312°26.3	11.2'	12°44.1	14.4'	58.5'
16	62°49.6	42.5	326°56.6	11.3'	12°29.7	14.5'	58.5'
17	77°49.4	42.9	341°26.9	11.4'	12°15.2	14.5'	58.5'
18	92°49.1	S21°43.3	355°57.3	11.5'	S12°00.7	14.6'	58.5'
19	107°48.9	43.7	10°27.8	11.6'	11°46.1	14.6'	58.4'
20	122°48.7	44.1	24°58.4	11.7'	11°31.5	14.6'	58.4'
21	137°48.4	.. 44.5	39°29.1	11.7'	11°16.9	14.7'	58.4'
22	152°48.2	44.9	53°59.8	11.8'	11°02.2	14.7'	58.4'
23	167°48.0	45.3	68°30.6	11.9'	10°47.5	14.8'	58.3'
SD = 16.2'		SD = 16.1'					
Thu		SD = 16.1'					
Thu	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	182°47.8	S21°45.6	83°01.6	12.0'	S10°32.7	14.8'	58.3'
1	197°47.5	46.0	97°32.5	12.1'	10°17.9	14.9'	58.3'
2	212°47.3	46.4	112°03.6	12.1'	10°03.0	14.9'	58.3'
3	227°47.1	.. 46.8	126°34.7	12.2'	09°48.1	14.9'	58.2'
4	242°46.8	47.2	141°05.9	12.3'	09°33.2	15.0'	58.2'
5	257°46.6	47.6	155°37.2	12.4'	09°18.2	15.0'	58.2'
6	272°46.4	S21°48.0	170°08.6	12.4'	S09°03.3	15.0'	58.2'
7	287°46.1	48.4	184°40.0	12.5'	08°48.2	15.0'	58.1'
8	302°45.9	48.8	199°11.5	12.6'	08°33.2	15.1'	58.1'
9	317°45.7	.. 49.2	213°43.1	12.6'	08°18.1	15.1'	58.1'
10	332°45.4	49.5	228°14.7	12.7'	08°03.0	15.1'	58.1'
11	347°45.2	49.9	242°46.4	12.8'	07°47.9	15.2'	58.0'
12	2°45.0	S21°50.3	257°18.1	12.8'	S07°32.7	15.2'	58.0'
13	17°44.7	50.7	271°49.9	12.9'	07°17.5	15.2'	58.0'
14	32°44.5	51.1	286°21.8	12.9'	07°02.3	15.2'	58.0'
15	47°44.3	.. 51.5	300°53.7	13.0'	06°47.1	15.2'	57.9'
16	62°44.0	51.8	315°25.7	13.0'	06°31.9	15.3'	57.9'
17	77°43.8	52.2	329°57.8	13.1'	06°16.6	15.3'	57.9'
18	92°43.6	S21°52.6	344°29.9	13.2'	S06°01.4	15.3'	57.9'
19	107°43.3	53.0	359°02.0	13.2'	05°46.1	15.3'	57.8'
20	122°43.1	53.4	13°34.2	13.3'	05°30.8	15.3'	57.8'
21	137°42.9	.. 53.7	28°06.5	13.3'	05°15.5	15.3'	57.8'
22	152°42.6	54.1	42°38.8	13.4'	05°00.1	15.3'	57.8'
23	167°42.4	54.5	57°11.2	13.4'	04°44.8	15.3'	57.7'
SD = 16.2'		SD = 15.9'					
Fri		SD = 15.9'					
Fri	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	182°42.2	S21°54.9	71°43.6	13.4'	S04°29.5	15.4'	57.7'
1	197°41.9	55.2	86°16.0	13.5'	04°14.1	15.4'	57.7'
2	212°41.7	55.6	100°48.5	13.5'	03°58.7	15.4'	57.7'
3	227°41.4	.. 56.0	115°21.0	13.6'	03°43.4	15.4'	57.6'
4	242°41.2	56.4	129°53.6	13.6'	03°28.0	15.4'	57.6'
5	257°41.0	56.7	144°26.2	13.7'	03°12.6	15.4'	57.6'
6	272°40.7	S21°57.1	158°58.9	13.7'	S02°57.3	15.4'	57.6'
7	287°40.5	57.5	173°31.6	13.7'	02°41.9	15.4'	57.5'
8	302°40.2	57.9	188°04.3	13.8'	02°26.5	15.4'	57.5'
9	317°40.0	.. 58.2	202°37.1	13.8'	02°11.1	15.4'	57.5'
10	332°39.8	58.6	217°09.9	13.8'	01°55.8	15.4'	57.5'
11	347°39.5	59.0	231°42.7	13.9'	01°40.4	15.4'	57.4'
12	2°39.3	S21°59.3	246°15.6	13.9'	S01°25.0	15.4'	57.4'
13	17°39.1	21°59.7	260°48.5	13.9'	01°09.7	15.3'	57.4'
14	32°38.8	22°00.1	275°21.4	13.9'	00°54.3	15.3'	57.4'
15	47°38.6	.. 00.4	289°54.4	14.0'	00°39.0	15.3'	57.3'
16	62°38.3	00.8	304°27.3	14.0'	00°23.7	15.3'	57.3'
17	77°38.1	01.2	319°00.3	14.0'	S00°08.3	15.3'	57.3'
18	92°37.8	S22°01.5	333°33.4	14.0'	N00°07.0	15.3'	57.3'
19	107°37.6	01.9	348°06.4	14.1'	00°22.3	15.3'	57.2'
20	122°37.4	02.2	2°39.5	14.1'	00°37.5	15.3'	57.2'
21	137°37.1	.. 02.6	17°12.5	14.1'	00°52.8	15.3'	57.2'
22	152°36.9	03.0	31°45.7	14.1'	01°08.1	15.2'	57.2'
23	167°36.6	03.3	46°18.8	14.1'	01°23.3	15.2'	57.1'
SD = 16.2'		SD = 15.7'					

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

**December 03, 04, 05 UT (Sat., Sun., Mon.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	71°48.3	171°37.1	\$23°35.4	354°55.7	N24°58.8	72°12.8	S01°43.2	109°00.1	\$16°00.9					Alpheratz	357°36.5	29°13.1	
1	86°50.7	186°36.1	35.7	9°59.2	58.9	87°15.2	43.2	124°02.4	00.9					Ankaa	353°08.7	-42°11.1	
2	101°53.2	201°35.2	36.0	25°02.8	58.9	102°17.6	43.2	139°04.7	00.8					Schedar	349°32.7	56°40.0	
3	116°55.7	216°34.2	.. 36.3	40°06.3	.. 58.9	117°20.0	.. 43.1	154°07.0	.. 00.7					Diphda	348°48.9	-17°51.8	
4	131°58.1	231°33.3	36.6	55°09.8	58.9	132°22.4	43.1	169°09.3	00.7					Achernar	335°21.1	-57°07.5	
5	147°00.6	246°32.4	36.9	70°13.3	58.9	147°24.8	43.0	184°11.6	00.6					Hamal	327°52.9	23°34.3	
6	162°03.1	261°31.4	\$23°37.2	85°16.9	N24°59.0	162°27.2	S01°43.0	199°13.9	\$16°00.6					Polaris	314°24.9	89°21.8	
7	177°05.5	276°30.5	37.5	100°20.4	59.0	177°29.6	42.9	214°16.2	00.5					Acamar	315°12.7	-40°12.9	
8	192°08.0	291°29.5	37.8	115°23.9	59.0	192°32.0	42.9	229°18.5	00.5					Menkar	314°07.7	4°10.8	
9	207°10.4	306°28.6	.. 38.1	130°27.4	.. 59.0	207°34.4	.. 42.9	244°20.8	.. 00.4					Mirfak	308°30.3	49°56.6	
10	222°12.9	321°27.6	38.4	145°31.0	59.0	222°36.7	42.8	259°23.1	00.4					Aldebaran	290°41.3	16°33.3	
11	237°15.4	336°26.7	38.7	160°34.5	59.1	237°39.1	42.8	274°25.4	00.3					Rigel	281°05.2	-8°10.5	
12	252°17.8	351°25.7	\$23°39.0	175°38.0	N24°59.1	252°41.5	S01°42.7	289°27.7	\$16°00.3					Capella	280°24.0	46°01.2	
13	267°20.3	6°24.8	39.3	190°41.6	59.1	267°43.9	42.7	304°30.0	00.2					Bellatrix	278°24.4	6°22.2	
14	282°22.8	21°23.8	39.6	205°45.1	59.1	282°46.3	42.6	319°32.3	00.1					Elnath	278°03.7	28°37.6	
15	297°25.2	36°22.9	.. 39.9	220°48.6	.. 59.1	297°48.7	.. 42.6	334°34.6	.. 00.1					Alnilam	275°39.2	-1°11.2	
16	312°27.7	51°21.9	40.2	235°52.2	59.1	312°51.1	42.6	349°36.9	00.0					Betelgeuse	270°53.7	7°24.7	
17	327°30.2	66°21.0	40.5	250°55.7	59.2	327°53.5	42.5	4°39.2	16°00.0					Canopus	263°52.7	-52°42.3	
18	342°32.6	81°20.0	\$23°40.8	265°59.2	N24°59.2	342°55.9	S01°42.5	19°41.5	\$15°59.9					Sirius	258°27.5	-16°44.7	
19	357°35.1	96°19.1	41.1	281°02.7	59.2	357°58.3	42.4	34°43.8	59.9					Adhara	255°06.9	-29°00.0	
20	12°37.5	111°18.2	41.4	296°06.3	59.2	13°00.7	42.4	49°46.1	59.8					Procyon	244°52.4	5°10.0	
21	27°40.0	126°17.2	.. 41.6	311°09.8	.. 59.2	28°03.1	.. 42.3	64°48.4	.. 59.8					Pollux	243°19.2	27°58.2	
22	42°42.5	141°16.3	41.9	326°13.3	59.2	43°05.5	42.3	79°50.7	59.7					Avgor	234°15.0	-59°34.6	
23	57°44.9	156°15.3	42.2	341°16.9	59.3	58°07.8	42.2	94°53.0	59.6					Suhail	222°47.4	-43°31.2	
Mer.pass. 19:10		ν -0.9° d -0.3° m -3.91	ν 3.5° d 0.0° m -1.90	ν 2.4° d 0.0° m -2.56	ν 2.3° d 0.1° m 0.79									Miaplacidus	221°38.2	-69°48.3	
Mer.pass. 19:06		ν -0.9° d -0.3° m -3.91	ν 3.5° d 0.0° m -1.92	ν 2.4° d 0.0° m -2.56	ν 2.3° d 0.1° m 0.80									Alphard	217°49.4	-8°45.3	
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Regulus	207°36.3	11°51.4	
0	72°47.4	171°14.4	\$23°42.5	356°20.4	N24°59.3	73°10.2	S01°42.2	109°55.3	\$15°59.6					Dubhe	193°43.2	61°37.4	
1	87°49.9	186°13.4	42.8	11°23.9	59.3	88°12.6	42.2	124°57.6	59.5					Denebola	182°26.8	14°26.7	
2	102°52.3	201°12.5	43.0	26°27.5	59.3	103°15.0	42.1	139°59.9	59.5					Gienah	175°45.5	-17°39.9	
3	117°54.8	216°11.5	.. 43.3	41°31.0	.. 59.3	118°17.4	.. 42.1	155°02.2	.. 59.4					Acrux	173°02.4	-63°13.2	
4	132°57.3	231°10.6	43.6	56°34.5	59.3	133°19.8	42.0	170°04.5	59.4					Gacrux	171°53.9	-57°14.1	
5	147°59.7	246°09.6	43.9	71°38.1	59.4	148°22.2	42.0	185°06.8	59.3					Alioth	166°14.8	55°50.0	
6	163°02.2	261°08.7	\$23°44.2	86°41.6	N24°59.4	163°24.6	S01°41.9	200°09.1	\$15°59.3					Spica	158°24.4	-11°16.7	
7	178°04.7	276°07.7	44.4	101°45.1	59.4	178°26.9	41.9	215°11.4	59.2					Alkaid	152°53.8	49°11.8	
8	193°07.1	291°06.7	44.7	116°48.7	59.4	193°29.3	41.8	230°13.7	59.1					Hadar	148°39.0	-60°28.7	
9	208°09.6	306°05.8	.. 45.0	131°52.2	.. 59.4	208°31.7	.. 41.8	245°16.0	.. 59.1					Menkent	148°00.0	-36°28.7	
10	223°12.0	321°04.8	45.2	146°55.7	59.4	223°34.1	41.7	260°18.3	59.0					Arcturus	145°49.8	19°03.8	
11	238°14.5	336°03.9	45.5	161°59.3	59.4	238°36.5	41.7	275°20.6	59.0					Rigel Kent.	139°43.3	-60°55.5	
12	253°17.0	351°02.9	\$23°45.8	177°02.8	N24°59.5	253°38.9	S01°41.7	290°22.9	\$15°58.9					Kochab	137°20.9	74°03.5	
13	268°19.4	6°02.0	46.0	192°06.3	59.5	268°41.3	41.6	305°25.2	58.9					Zuben'ubi	136°58.3	-16°08.1	
14	283°21.9	21°01.0	46.3	207°09.9	59.5	283°43.6	41.6	320°27.5	58.8					Alphecca	126°05.6	26°38.3	
15	298°24.4	36°00.1	.. 46.6	222°13.4	.. 59.5	298°46.0	.. 41.5	335°29.8	.. 58.8					Antares	112°18.4	-26°28.9	
16	313°26.8	50°59.1	46.8	237°16.9	59.5	313°48.4	41.5	350°32.1	58.7					Atria	107°14.8	-69°04.0	
17	328°29.3	65°58.2	47.1	252°20.5	59.5	328°50.8	41.4	5°34.4	58.6					Sabik	102°05.2	-15°45.1	
18	343°31.8	80°57.2	\$23°47.3	267°24.0	N24°59.5	343°53.2	S01°41.4	20°36.7	\$15°58.6					Shaula	96°13.2	-37°07.2	
19	358°34.2	95°56.3	47.6	282°27.5	59.5	358°55.6	41.3	35°39.0	58.5					Rasalhague	96°00.5	12°32.7	
20	13°36.7	110°55.3	47.9	297°31.1	59.5	138°50.8	41.3	50°41.3	58.5					Eltanin	90°43.5	51°29.2	
21	28°39.2	125°54.4	.. 48.1	312°34.6	.. 59.6	29°00.3	.. 41.2	65°43.6	.. 58.4					Kaus Aust.	83°35.2	-34°22.5	
22	43°41.6	140°53.4	48.4	327°38.1	59.6	44°02.7	41.2	80°45.9	58.4					Vega	80°34.8	38°48.4	
23	58°44.1	155°52.5	48.6	342°41.7	59.6	59°05.1	41.1	95°48.2	58.3					Nunki	75°50.3	-26°16.1	
Mer.pass. 19:06		ν -0.9° d -0.3° m -3.91	ν 3.5° d 0.0° m -1.92	ν 2.4° d 0.0° m -2.56	ν 2.3° d 0.1° m 0.80									Altair	62°01.9	8°55.8	
Mer.pass. 19:02		ν -1.0° d -0.2° m -3.91	ν 3.5° d 0.0° m -1.93	ν 2.4° d 0.0° m -2.55	ν 2.3° d 0.1° m 0.80									Peacock	53°08.9	-56°39.9	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Mer.pass	49°27.3	45°21.9	
0	73°46.5	170°51.5	\$23°48.9	357°45.2	N24°59.6	74°07.5	S01°41.1	110°50.5	\$15°58.2					Enif	33°40.6	9°58.8	
1	88°49.0	185°50.5	49.1	12°48.7	59.6	89°09.9	41.0	125°52.8	58.2					Fomalhaut	27°35.2	-29°30.3	
2	103°51.5	200°49.6	49.4	27°52.3	59.6	104°12.2	41.0	140°55.1	58.1					Scheat	13°46.9	28°12.5	
3	118°53.9	215°48.6	.. 49.6	42°55.8	.. 59.6	119°14.6	.. 40.9	155°57.3	.. 58.1					Markab	13°31.6	15°19.8	
4	133°56.4	230°47.7	49.9	57°59.3	59.6	134°17.0	40.9	170°59.6	58.0					Dec 03 Sat	99°48.8	12:34	
5	148°58.9	245°46.7	50.1	73°02.9	59.6	149°19.4	40.8	186°01.9	58.0					Venus	283°07.4	00:20	
6	164°01.3	260°45.8	\$23°50.3	88°06.4	N24°59.6	164°21.8	S01°40.8	201°04.2	\$15°57.9					Jupiter	0°24.5	19:08	
7	179°03.8	275°44.8	50.6	103°09.9	59.7	179°24.1	40.7	216°06.5	57.9					Saturn	37°11.9	16:41	
8	194°06.3	290°43.8	50.8	118°13.5	59.7	194°26.5	40.7	231°08.8	57.8					Dec 04 Sun	98°26.9	12:36	
9	209°08.7	305°42.9	.. 51.1	133°17.0	.. 59.7	209°28.9	.. 40.6	246°11.1	.. 57.7					Venus	283°33.0	00:15	
10	224°11.2	320°41.9	51.3	148°20.5	59.7</												

DUT1 = UT1-UTC = -0.0136 sec  $\Delta T = TT-UT1 = +69.1976$  sec

2022 December 03 to Dec. 05 UT

h		Sun		Moon				
Sat		GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	182°36.4	S22°03.7	60°51.9	14.2'	N01°38.5	15.2'	57.1'	
1	197°36.1	04.0	75°25.1	14.2'	01°53.7	15.2'	57.1'	
2	212°35.9	04.4	89°58.2	14.2'	02°08.9	15.2'	57.1'	
3	227°35.7	.. 04.7	104°31.4	14.2'	02°24.1	15.1'	57.1'	
4	242°35.4	05.1	119°04.6	14.2'	02°39.2	15.1'	57.0'	
5	257°35.2	05.5	133°37.8	14.2'	02°54.3	15.1'	57.0'	
6	272°34.9	S22°05.8	148°11.0	14.2'	N03°09.4	15.1'	57.0'	
7	287°34.7	06.2	162°44.2	14.2'	03°24.5	15.0'	57.0'	
8	302°34.4	06.5	177°17.5	14.2'	03°39.5	15.0'	56.9'	
9	317°34.2	.. 06.9	191°50.7	14.2'	03°54.5	15.0'	56.9'	
10	332°33.9	07.2	206°23.9	14.2'	04°09.5	15.0'	56.9'	
11	347°33.7	07.6	220°57.1	14.2'	04°24.5	14.9'	56.9'	
12	2°33.5	S22°07.9	235°30.4	14.2'	N04°39.4	14.9'	56.8'	
13	17°33.2	08.3	250°03.6	14.2'	04°54.3	14.9'	56.8'	
14	32°33.0	08.6	264°36.9	14.2'	05°09.1	14.8'	56.8'	
15	47°32.7	.. 09.0	279°10.1	14.2'	05°24.0	14.8'	56.8'	
16	62°32.5	09.3	293°43.3	14.2'	05°38.8	14.8'	56.8'	
17	77°32.2	09.7	308°16.6	14.2'	05°53.5	14.7'	56.7'	
18	92°32.0	S22°10.0	322°49.8	14.2'	N06°08.3	14.7'	56.7'	
19	107°31.7	10.3	337°23.0	14.2'	06°22.9	14.6'	56.7'	
20	122°31.5	10.7	351°56.2	14.2'	06°37.6	14.6'	56.7'	
21	137°31.2	.. 11.0	6°29.4	14.2'	06°52.2	14.6'	56.6'	
22	152°31.0	11.4	21°02.6	14.2'	07°06.8	14.5'	56.6'	
23	167°30.7	11.7	35°35.8	14.2'	07°21.3	14.5'	56.6'	
		SD = 16.2' $d = -0.4'$		SD = 15.6'				

Sun	GHA	Dec	GHA	$\nu$	Dec	$d$	HP	
0	182°30.5	S22°12.1	50°09.0	14.2'	N07°35.8	14.4'	56.6'	
1	197°30.2	12.4	64°42.1	14.1'	07°50.2	14.4'	56.5'	
2	212°30.0	12.7	79°15.3	14.1'	08°04.6	14.4'	56.5'	
3	227°29.7	.. 13.1	93°48.4	14.1'	08°19.0	14.3'	56.5'	
4	242°29.5	13.4	108°21.5	14.1'	08°33.3	14.3'	56.5'	
5	257°29.2	13.7	122°54.6	14.1'	08°47.6	14.2'	56.5'	
6	272°29.0	S22°14.1	137°27.7	14.1'	N09°01.8	14.2'	56.4'	
7	287°28.7	14.4	152°00.7	14.0'	09°15.9	14.1'	56.4'	
8	302°28.5	14.7	166°33.8	14.0'	09°30.0	14.1'	56.4'	
9	317°28.2	.. 15.1	181°06.8	14.0'	09°44.1	14.0'	56.4'	
10	332°28.0	15.4	195°39.8	14.0'	09°58.1	14.0'	56.4'	
11	347°27.7	15.7	210°12.8	14.0'	10°12.1	13.9'	56.3'	
12	2°27.5	S22°16.1	224°45.7	13.9'	N10°26.0	13.9'	56.3'	
13	17°27.2	16.4	239°18.7	13.9'	10°39.8	13.8'	56.3'	
14	32°27.0	16.7	253°51.6	13.9'	10°53.6	13.7'	56.3'	
15	47°26.7	.. 17.1	268°24.5	13.9'	11°07.4	13.7'	56.2'	
16	62°26.5	17.4	282°57.3	13.8'	11°21.1	13.6'	56.2'	
17	77°26.2	17.7	297°30.2	13.8'	11°34.7	13.6'	56.2'	
18	92°26.0	S22°18.1	312°02.9	13.8'	N11°48.2	13.5'	56.2'	
19	107°25.7	18.4	326°35.7	13.7'	12°01.7	13.4'	56.2'	
20	122°25.5	18.7	341°08.5	13.7'	12°15.2	13.4'	56.1'	
21	137°25.2	.. 19.0	355°41.2	13.7'	12°28.6	13.3'	56.1'	
22	152°24.9	19.4	10°13.8	13.6'	12°41.9	13.3'	56.1'	
23	167°24.7	19.7	24°46.5	13.6'	12°55.1	13.2'	56.1'	
		SD = 16.2' $d = -0.3'$		SD = 15.4'				

Mon	GHA	Dec	GHA	$\nu$	Dec	$d$	HP	
0	182°24.4	S22°20.0	39°19.1	13.6'	N13°08.3	13.1'	56.1'	
1	197°24.2	20.3	53°51.7	13.5'	13°21.4	13.1'	56.0'	
2	212°23.9	20.6	68°24.2	13.5'	13°34.5	13.0'	56.0'	
3	227°23.7	.. 21.0	82°56.7	13.5'	13°47.5	12.9'	56.0'	
4	242°23.4	21.3	97°29.2	13.4'	14°00.4	12.8'	56.0'	
5	257°23.2	21.6	112°01.6	13.4'	14°13.2	12.8'	56.0'	
6	272°22.9	S22°21.9	126°34.0	13.4'	N14°26.0	12.7'	55.9'	
7	287°22.6	22.2	141°06.4	13.3'	14°38.7	12.6'	55.9'	
8	302°22.4	22.6	155°38.7	13.3'	14°51.4	12.6'	55.9'	
9	317°22.1	.. 22.9	170°11.0	13.2'	15°03.9	12.5'	55.9'	
10	332°21.9	23.2	184°43.2	13.2'	15°16.4	12.4'	55.9'	
11	347°21.6	23.5	199°15.4	13.2'	15°28.8	12.3'	55.8'	
12	2°21.4	S22°23.8	213°47.6	13.1'	N15°41.1	12.3'	55.8'	
13	17°21.1	24.1	228°19.7	13.1'	15°53.4	12.2'	55.8'	
14	32°20.8	24.4	242°51.8	13.0'	16°05.6	12.1'	55.8'	
15	47°20.6	.. 24.7	257°23.8	13.0'	16°17.7	12.0'	55.8'	
16	62°20.3	25.1	271°55.8	12.9'	16°29.7	11.9'	55.7'	
17	77°20.1	25.4	286°27.7	12.9'	16°41.6	11.9'	55.7'	
18	92°19.8	S22°25.7	300°59.6	12.9'	N16°53.4	11.8'	55.7'	
19	107°19.6	26.0	315°31.5	12.8'	17°05.2	11.7'	55.7'	
20	122°19.3	26.3	330°03.3	12.8'	17°16.9	11.6'	55.7'	
21	137°19.0	.. 26.6	344°35.0	12.7'	17°28.5	11.5'	55.6'	
22	152°18.8	26.9	359°06.7	12.7'	17°40.0	11.4'	55.6'	
23	167°18.5	27.2	13°38.4	12.6'	17°51.4	11.3'	55.6'	
		SD = 16.2' $d = -0.3'$		SD = 15.3'				

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

Lat.	Sat	Moonrise		Sat	Moonset	
		Sun	Mon		Sun	Mon
N 72°	13:20	12:43	11:49	02:27	04:38	07:08
N 70°	13:26	13:00	12:24	02:24	04:25	06:35
68°	13:32	13:13	12:49	02:22	04:14	06:11
66°	13:36	13:24	13:09	02:20	04:05	05:53
64°	13:40					

**December 06, 07, 08 UT (Tue., Wed., Thu.)**

Aries		Venus		Mars		Jupiter		Saturn		Stars	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec
0	74°45.7	170°28.5	\$23°54.5	359°10.0	N24°59.8	75°04.5	S01°39.9	111°45.5	\$15°56.9	Alpheratz	357°36.5
1	89°48.1	185°27.6	54.7	14°13.6	59.8	90°06.9	39.8	126°47.8	56.8	Ankaa	353°08.7
2	104°50.6	200°26.6	54.9	29°17.1	59.8	105°09.3	39.8	141°50.1	56.8	Schedar	349°32.8
3	119°53.1	215°25.6	.. 55.2	44°20.6	.. 59.8	120°11.7	.. 39.7	156°52.4	.. 56.7	Diphda	348°48.9
4	134°55.5	230°24.7	55.4	59°24.2	59.8	135°14.0	39.7	171°54.7	56.6	Achernar	335°21.1
5	149°58.0	245°23.7	55.6	74°27.7	59.8	150°16.4	39.6	186°57.0	56.6	Hamal	327°52.9
6	165°00.5	260°22.8	\$23°55.8	89°31.2	N24°59.8	165°18.8	S01°39.6	201°59.3	\$15°56.5	Polaris	314°25.2
7	180°02.9	275°21.8	56.0	104°34.8	59.8	180°21.2	39.5	217°01.5	56.5	Acamar	315°12.7
8	195°05.4	290°20.8	56.2	119°38.3	59.8	195°23.5	39.5	232°03.8	56.4	Menkar	314°07.7
9	210°07.9	305°19.9	.. 56.4	134°41.8	.. 59.8	210°25.9	.. 39.4	247°06.1	.. 56.4	Mirfak	308°30.3
10	225°10.3	320°18.9	56.6	149°45.4	59.8	225°28.3	39.3	262°08.4	56.3	Aldebaran	290°41.3
11	240°12.8	335°17.9	56.8	164°48.9	59.8	240°30.6	39.3	277°10.7	56.2	Rigel	281°05.2
12	255°15.3	350°17.0	\$23°57.1	179°52.4	N24°59.8	255°33.0	S01°39.2	292°13.0	\$15°56.2	Capella	280°24.0
13	270°17.7	5°16.0	57.3	194°56.0	59.8	270°35.4	39.2	307°15.3	56.1	Bellatrix	278°24.4
14	285°20.2	20°15.1	57.5	209°59.5	59.8	285°37.7	39.1	322°17.6	56.1	Elnath	278°03.7
15	300°22.6	35°14.1	.. 57.7	225°03.1	.. 59.8	300°40.1	.. 39.1	337°19.9	.. 56.0	Alnilam	275°39.2
16	315°25.1	50°13.1	57.9	240°06.6	59.8	315°42.5	39.0	352°22.2	56.0	Betelgeuse	270°53.6
17	330°27.6	65°12.2	58.1	255°10.1	59.8	330°44.9	39.0	7°24.5	55.9	Canopus	263°52.6
18	345°30.0	80°11.2	\$23°58.3	270°13.7	N24°59.8	345°47.2	S01°38.9	22°26.7	\$15°55.8	Sirius	258°27.5
19	0°32.5	95°10.2	58.5	285°17.2	59.8	0°49.6	38.9	37°29.0	55.8	Adhara	255°06.9
20	15°35.0	110°09.3	58.7	300°20.7	59.8	15°52.0	38.8	52°31.3	55.7	Procyon	244°52.4
21	30°37.4	125°08.3	.. 58.8	315°24.3	.. 59.8	30°54.3	.. 38.8	67°33.6	.. 55.7	Pollux	243°19.2
22	45°39.9	140°07.4	59.0	330°27.8	59.8	45°56.7	38.7	82°35.9	55.6	Avior	234°15.0
23	60°42.4	155°06.4	59.2	345°31.3	59.8	60°59.1	38.6	97°38.2	55.5	Suhail	222°47.4
Mer.pass. 18:58		ν -1.0° d -0.2° m -3.91	ν 3.5° d 0.0° m -1.94	ν 2.4° d 0.1° m -2.54	ν 2.3° d 0.1° m 0.80						
Wed		GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	
0	75°44.8	170°05.4	\$23°59.4	0°34.9	N24°59.8	76°01.4	S01°38.6	112°40.5	\$15°55.5	Denebola	182°26.8
1	90°47.3	185°04.5	59.6	15°38.4	59.8	91°03.8	38.5	127°42.8	55.4	Gienah	175°45.5
2	105°49.8	200°03.5	23°59.8	30°41.9	59.8	106°06.2	38.5	142°45.1	55.4	Acrux	173°02.3
3	120°52.2	215°02.5	24°00.0	45°45.4	.. 59.8	121°08.5	.. 38.4	157°47.3	.. 55.3	Gacrux	171°53.8
4	135°54.7	230°01.6	00.2	60°49.0	59.8	136°10.9	38.4	172°49.6	55.3	Alioth	166°14.8
5	150°57.1	245°00.6	00.4	75°52.5	59.8	151°13.3	38.3	187°51.9	55.2	Spica	158°24.4
6	165°59.6	259°59.6	\$24°00.5	90°56.0	N24°59.8	166°15.6	S01°38.3	202°54.2	\$15°55.1	Alkaid	152°53.7
7	181°02.1	274°58.7	00.7	105°59.6	59.8	181°18.0	38.2	217°56.5	55.1	Hadar	148°39.0
8	196°04.5	289°57.7	00.9	121°03.1	59.8	196°20.3	38.1	232°58.8	55.0	Menkent	148°00.0
9	211°07.0	304°56.7	.. 01.1	136°06.6	.. 59.8	211°22.7	.. 38.1	248°01.1	.. 55.0	Arcturus	145°49.8
10	226°09.5	319°55.8	01.2	151°10.2	59.8	226°25.1	38.0	263°03.4	54.9	Rigel Kent.	139°43.3
11	241°11.9	334°54.8	01.4	166°13.7	59.8	241°27.4	38.0	278°05.6	54.8	Kochab	137°20.8
12	256°14.4	349°53.8	\$24°01.6	181°17.2	N24°59.8	256°29.8	S01°37.9	293°07.9	\$15°54.8	Zuben'ubi	136°58.3
13	271°16.9	4°52.9	01.8	196°20.8	59.8	271°32.2	37.9	308°10.2	54.7	Alphecca	126°05.6
14	286°19.3	19°51.9	01.9	211°24.3	59.8	286°34.5	37.8	323°12.5	54.7	Antares	112°18.4
15	301°21.8	34°50.9	.. 02.1	226°27.8	.. 59.8	301°36.9	.. 37.7	338°14.8	.. 54.6	Atria	107°14.7
16	316°24.3	49°50.0	02.3	241°31.4	59.8	316°39.2	37.7	353°17.1	54.5	Sabik	102°05.1
17	331°26.7	64°49.0	02.5	256°34.9	59.8	331°41.6	37.6	8°19.4	54.5	Shaula	96°13.2
18	346°29.2	79°48.0	\$24°02.6	271°38.4	N24°59.8	346°44.0	S01°37.6	23°21.7	\$15°54.4	Rasalhague	96°00.5
19	1°31.6	94°47.1	02.8	286°41.9	59.7	1°46.3	37.5	38°23.9	54.4	Eltanin	90°43.5
20	16°34.1	109°46.1	03.0	301°45.5	59.7	16°48.7	37.5	53°26.2	54.3	Kaus Aust.	83°35.2
21	31°36.6	124°45.1	.. 03.1	316°49.0	.. 59.7	31°51.0	.. 37.4	68°28.5	.. 54.2	Vega	80°34.8
22	46°39.0	139°44.2	03.3	331°52.5	59.7	46°53.4	37.3	83°30.8	54.2	Nunki	75°50.3
23	61°41.5	154°43.2	03.4	346°56.1	59.7	61°55.8	37.3	98°33.1	54.1	Altair	62°01.9
Mer.pass. 18:54		ν -1.0° d -0.2° m -3.91	ν 3.5° d -0.0° m -1.95	ν 2.4° d 0.1° m -2.53	ν 2.3° d 0.1° m 0.81						
Thu		GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	
0	76°44.0	169°42.2	\$24°03.6	1°59.6	N24°59.7	76°58.1	S01°37.2	113°35.4	\$15°54.1	Dec 06 Tue	95°42.8
1	91°46.4	184°41.3	03.8	17°03.1	59.7	92°00.5	37.2	128°37.7	54.0	Venus	284°24.4
2	106°48.9	199°40.3	03.9	32°06.7	59.7	107°02.8	37.1	143°39.9	53.9	Mars	0°18.9
3	121°51.4	214°39.3	.. 04.1	47°10.2	.. 59.7	122°05.2	.. 37.1	158°42.2	.. 53.9	Jupiter	36°59.8
4	136°53.8	229°38.4	04.2	62°13.7	59.7	137°07.6	37.0	173°44.5	53.8	Saturn	16:30
5	151°56.3	244°37.4	04.4	77°17.2	59.7	152°09.9	36.9	188°46.8	53.8		
6	166°58.7	259°36.4	\$24°04.5	92°20.8	N24°59.7	167°12.3	S01°36.9	203°49.1	\$15°53.7	Dec 07 Wed	94°20.6
7	182°01.2	274°35.5	04.7	107°24.3	59.7	182°14.6	36.8	218°51.4	53.6	Venus	12:40
8	197°03.7	289°34.5	04.8	122°27.8	59.7	197°17.0	36.8	233°53.6	53.6	Mars	284°50.0
9	212°06.1	304°33.5	.. 05.0	137°31.3	.. 59.6	212°19.3	.. 36.7	248°55.9	.. 53.5	Jupiter	0°16.6
10	227°08.6	319°32.6	05.1	152°34.9	59.6	227°21.7	36.6	263°58.2	53.5	Saturn	18:53
11	242°11.1	334°31.6	05.3	167°38.4	59.6	242°24.0	36.6	279°00.5	53.4		
12	257°13.5	349°30.6	\$24°05.4	182°41.9	N24°59.6	257°26.4	S01°36.5	294°02.8	\$15°53.3	Dec 08 Thu	92°58.3
13	272°16.0	4°29.7	05.6	197°45.4	59.6	272°28.8	36.5	309°05.1	53.3	Venus	12:42
14	287°18.5	19°28.7	05.7	212°49.0	59.6	287°31.1	36.4	324°07.3	53.2	Mars	285°15.6
15	302°20.9	34°27.7	.. 05.8	227°52.5	.. 59.6	302°33.5	.. 36.3	339°09.6	.. 53.2	Jupiter	0°14.2
16	317°23.4	49°26.7	06.0	242°56.0	59.6	317°35.8	36.3	354°11.9	53.1	Saturn	16:23
17	332°25.9	64°25.8	06.1	257°59.5	59.6	332°38.2	36.2	9°14.2	53.0		
18	347°28.3	79°24.8	\$24°06.2	273°03.1	N24°59.6	347°40.5	S01°36.2	24°16.5	\$15°53.0	Horizontal parallax	
19	2°30.8	94°23.8	06.4	288°06.6	59.6	2°42.9	36.1	39°18.8	52.9	Venus:	0.1
20	17°33.2	109°22.9	06.5	303°10.1	59.5	17°45.2	36.0	54°21.0	52.9	Mars:	0.3
21	32°35.7	124°21.9	.. 06.6	318°13.6	.. 59.5	32°47.6	.. 36.0	69°23.3	.. 52.8		
22	47°38.2	139°20.9	06.8	333°17.2	59.5	47°49.9	35.9	84°25.6	52.7		
23	62°40.6	154°20.0	06.9	348°20.7	59.5	62°52.3	35.8	99°27.9	52.7		
Mer.pass. 18:50		ν -1.0° d -0.2° m -3.91	ν 3.5° d -0.0° m -1.94	ν 2.4° d 0.1° m -2.52	ν 2.3° d 0.1° m 0.81						

DUT1 = UT1-UTC = -0.0144 sec  $\Delta T = TT-UT1 = +69.1984$  sec

2022 December 06 to Dec. 08 UT

h		Sun		Moon			
Tue	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	182°18.3	S22°27.5	28°10.0	12.6'	N18°02.8	11.2'	55.6'
1	197°18.0	27.8	42°41.6	12.5'	18°14.0	11.2'	55.6'
2	212°17.7	28.1	57°13.1	12.5'	18°25.2	11.1'	55.6'
3	227°17.5	28.4	71°44.6	12.4'	18°36.2	11.0'	55.5'
4	242°17.2	28.7	86°16.0	12.4'	18°47.2	10.9'	55.5'
5	257°16.9	29.0	100°47.4	12.3'	18°58.1	10.8'	55.5'
6	272°16.7	S22°29.3	115°18.8	12.3'	N19°08.9	10.7'	55.5'
7	287°16.4	29.6	129°50.0	12.2'	19°19.6	10.6'	55.5'
8	302°16.2	29.9	144°21.3	12.2'	19°30.2	10.5'	55.4'
9	317°15.9	30.2	158°52.5	12.1'	19°40.7	10.4'	55.4'
10	332°15.6	30.5	173°23.6	12.1'	19°51.1	10.3'	55.4'
11	347°15.4	30.8	187°54.7	12.0'	20°01.4	10.2'	55.4'
12	2°15.1	S22°31.1	202°25.7	12.0'	N20°11.6	10.1'	55.4'
13	17°14.8	31.4	216°56.7	11.9'	20°21.7	10.0'	55.4'
14	32°14.6	31.7	231°27.6	11.9'	20°31.8	9.9'	55.3'
15	47°14.3	32.0	245°58.5	11.8'	20°41.7	9.8'	55.3'
16	62°14.1	32.3	260°29.4	11.8'	20°51.5	9.7'	55.3'
17	77°13.8	32.6	275°00.2	11.7'	21°01.2	9.6'	55.3'
18	92°13.5	S22°32.9	289°30.9	11.7'	N21°10.8	9.5'	55.3'
19	107°13.3	33.1	304°01.6	11.6'	21°20.3	9.4'	55.2'
20	122°13.0	33.4	318°32.2	11.6'	21°29.7	9.3'	55.2'
21	137°12.7	33.7	333°02.8	11.5'	21°39.0	9.2'	55.2'
22	152°12.5	34.0	347°33.3	11.5'	21°48.1	9.1'	55.2'
23	167°12.2	34.3	2°03.8	11.4'	21°57.2	9.0'	55.2'
SD = 16.2'		SD = 15.2'					
Wed	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	182°11.9	S22°34.6	16°34.3	11.4'	N22°06.2	8.9'	55.2'
1	197°11.7	34.9	31°04.7	11.3'	22°15.0	8.7'	55.1'
2	212°11.4	35.2	45°35.0	11.3'	22°23.8	8.6'	55.1'
3	227°11.1	35.4	60°05.3	11.2'	22°32.4	8.5'	55.1'
4	242°10.9	35.7	74°35.5	11.2'	22°40.9	8.4'	55.1'
5	257°10.6	36.0	89°05.7	11.1'	22°49.3	8.3'	55.1'
6	272°10.3	S22°36.3	103°35.9	11.1'	N22°57.6	8.2'	55.1'
7	287°10.1	36.6	118°06.0	11.1'	23°05.8	8.1'	55.0'
8	302°09.8	36.8	132°36.1	11.0'	23°13.9	7.9'	55.0'
9	317°09.5	37.1	147°06.1	11.0'	23°21.8	7.8'	55.0'
10	332°09.3	37.4	161°36.0	10.9'	23°29.7	7.7'	55.0'
11	347°09.0	37.7	176°05.9	10.9'	23°37.4	7.6'	55.0'
12	2°08.7	S22°38.0	190°35.8	10.8'	N23°45.0	7.5'	55.0'
13	17°08.5	38.2	205°05.6	10.8'	23°52.4	7.4'	54.9'
14	32°08.2	38.5	219°35.4	10.7'	23°59.8	7.2'	54.9'
15	47°07.9	38.8	234°05.2	10.7'	24°07.0	7.1'	54.9'
16	62°07.7	39.1	248°34.9	10.7'	24°14.2	7.0'	54.9'
17	77°07.4	39.3	263°04.5	10.6'	24°21.2	6.9'	54.9'
18	92°07.1	S22°39.6	277°34.1	10.6'	N24°28.0	6.8'	54.9'
19	107°06.8	39.9	292°03.7	10.5'	24°34.8	6.6'	54.9'
20	122°06.6	40.1	306°33.2	10.5'	24°41.4	6.5'	54.8'
21	137°06.3	40.4	321°02.7	10.4'	24°47.9	6.4'	54.8'
22	152°06.0	40.7	335°32.2	10.4'	24°54.3	6.3'	54.8'
23	167°05.8	41.0	350°01.6	10.4'	25°00.6	6.1'	54.8'
SD = 16.2'		SD = 15.0'					
Thu	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	182°05.5	S22°41.2	4°31.0	10.3'	N25°06.7	6.0'	54.8'
1	197°05.2	41.5	19°00.3	10.3'	25°12.7	5.9'	54.8'
2	212°04.9	41.8	33°29.6	10.3'	25°18.6	5.8'	54.7'
3	227°04.7	42.0	47°58.9	10.2'	25°24.3	5.6'	54.7'
4	242°04.4	42.3	62°28.1	10.2'	25°30.0	5.5'	54.7'
5	257°04.1	42.5	76°57.3	10.2'	25°35.5	5.4'	54.7'
6	272°03.9	S22°42.8	91°26.4	10.1'	N25°40.8	5.2'	54.7'
7	287°03.6	43.1	105°55.6	10.1'	25°46.1	5.1'	54.7'
8	302°03.3	43.3	120°24.7	10.1'	25°51.2	5.0'	54.7'
9	317°03.0	43.6	134°53.8	10.0'	25°56.1	4.8'	54.6'
10	332°02.8	43.9	149°22.8	10.0'	26°01.0	4.7'	54.6'
11	347°02.5	44.1	163°51.8	10.0'	26°05.7	4.6'	54.6'
12	2°02.2	S22°44.4	178°20.8	10.0'	N26°10.3	4.5'	54.6'
13	17°01.9	44.6	192°49.8	9.9'	26°14.8	4.3'	54.6'
14	32°01.7	44.9	207°18.7	9.9'	26°19.1	4.2'	54.6'
15	47°01.4	45.1	221°47.6	9.9'	26°23.3	4.1'	54.6'
16	62°01.1	45.4	236°16.5	9.9'	26°27.3	3.9'	54.6'
17	77°00.9	45.7	250°45.4	9.8'	26°31.2	3.8'	54.5'
18	92°00.6	S22°45.9	265°14.2	9.8'	N26°35.0	3.7'	54.5'
19	107°00.3	46.2	279°43.0	9.8'	26°38.7	3.5'	54.5'
20	122°00.0	46.4	294°11.8	9.8'	26°42.2	3.4'	54.5'
21	136°59.8	46.7	308°40.6	9.8'	26°45.6	3.3'	54.5'
22	151°59.5	46.9	323°09.4	9.8'	26°48.9	3.1'	54.5'
23	166°59.2	47.2	337°38.2	9.7'	26°52.0	3.0'	54.5'
SD = 16.2'		SD = 14.9'					

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

**December 09, 10, 11 UT (Fri., Sat., Sun.)**

Aries			Venus			Mars		Jupiter		Saturn		Stars		
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	77°43.1	169°19.0	\$24°07.0	3°24.2	N24°59.5	77°54.6	S01°35.8	114°30.2	\$15°52.6			Alpheratz	357°36.5	
1	92°45.6	184°18.0	07.2	18°27.7	59.5	92°57.0	35.7	129°32.5	52.6			Ankaa	353°08.7	
2	107°48.0	199°17.0	07.3	33°31.3	59.5	107°59.3	35.7	144°34.7	52.5			Schedar	349°32.8	
3	122°50.5	214°16.1	· · 07.4	48°34.8	· · 59.5	123°01.7	· · 35.6	159°37.0	· · 52.4			Diphda	348°48.9	
4	137°53.0	229°15.1	07.5	63°38.3	59.4	138°04.0	35.5	174°39.3	52.4			Achernar	335°21.1	
5	152°55.4	244°14.1	07.7	78°41.8	59.4	153°06.4	35.5	189°41.6	52.3			Hamal	327°52.9	
6	167°57.9	259°13.2	\$24°07.8	93°45.3	N24°59.4	168°08.7	S01°35.4	204°43.9	\$15°52.3			Polaris	314°25.5	
7	183°00.4	274°12.2	07.9	108°48.9	59.4	183°11.1	35.3	219°46.1	52.2			Acamar	315°12.7	
8	198°02.8	289°11.2	08.0	123°52.4	59.4	198°13.4	35.3	234°48.4	52.1			Menkar	314°07.7	
9	213°05.3	304°10.2	· · 08.1	138°55.9	· · 59.4	213°15.8	· · 35.2	249°50.7	· · 52.1			Mirfak	308°30.3	
10	228°07.7	319°09.3	08.2	153°59.4	59.4	228°18.1	35.2	264°53.0	52.0			Aldebaran	290°41.3	
11	243°10.2	334°08.3	08.4	169°02.9	59.4	243°20.5	35.1	279°55.3	51.9			Rigel	281°05.2	
12	258°12.7	349°07.3	\$24°08.5	184°06.5	N24°59.3	258°22.8	S01°35.0	294°57.6	\$15°51.9			Capella	280°24.0	
13	273°15.1	4°06.4	08.6	199°10.0	59.3	273°25.2	35.0	309°59.8	51.8			Bellatrix	278°24.4	
14	288°17.6	19°05.4	08.7	214°13.5	59.3	288°27.5	34.9	325°02.1	51.8			Elnath	278°03.7	
15	303°20.1	34°04.4	· · 08.8	229°17.0	· · 59.3	303°29.9	· · 34.8	340°04.4	· · 51.7			Alnilam	275°39.2	
16	318°22.5	49°03.4	08.9	244°20.5	59.3	318°32.2	34.8	355°06.7	51.6			Betelgeuse	270°53.6	
17	333°25.0	64°02.5	09.0	259°24.0	59.3	333°34.6	34.7	10°09.0	51.6			Canopus	263°52.6	
18	348°27.5	79°01.5	\$24°09.1	274°27.6	N24°59.3	348°36.9	S01°34.7	25°11.2	\$15°51.5			Sirius	258°27.4	
19	3°29.9	94°00.5	09.2	289°31.1	59.2	3°39.3	34.6	40°13.5	51.5			Adhara	255°06.9	
20	18°32.4	108°59.6	09.3	304°34.6	59.2	18°41.6	34.5	55°15.8	51.4			Procyon	244°52.4	
21	33°34.9	123°58.6	· · 09.4	319°38.1	· · 59.2	33°43.9	· · 34.5	70°18.1	· · 51.3			Pollux	243°19.1	
22	48°37.3	138°57.6	09.5	334°41.6	59.2	48°46.3	34.4	85°20.4	51.3			Avior	234°15.0	
23	63°39.8	153°56.6	09.6	349°45.1	59.2	63°48.6	34.3	100°22.6	51.2			Suhail	222°47.3	
Mer.pass. 18:46			ν -1.0' d -0.1' m -3.92	ν 3.5' d -0.0' m -1.93	ν 2.4' d 0.1' m -2.52	ν 2.3' d 0.1' m 0.81						Miaplacidus	221°38.1	
Mer.pass. 18:42			ν -1.0' d -0.1' m -3.92	ν 3.5' d -0.0' m -1.90	ν 2.3' d 0.1' m -2.51	ν 2.3' d 0.1' m 0.81						Alphard	217°49.3	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Regulus	207°36.2	
0	78°42.2	168°55.7	\$24°09.7	4°48.6	N24°59.2	78°51.0	S01°34.3	115°24.9	\$15°51.1			Dubhe	193°43.1	
1	93°44.7	183°54.7	09.8	19°52.2	59.1	93°53.3	34.2	130°27.2	51.1			Denebola	182°26.8	
2	108°47.2	198°53.7	09.9	34°55.7	59.1	108°55.7	34.1	145°29.5	51.0			Gienah	175°45.5	
3	123°49.6	213°52.7	· · 10.0	49°59.2	· · 59.1	123°58.0	· · 34.1	160°31.7	· · 51.0			Acrux	173°02.3	
4	138°52.1	228°51.8	10.1	65°02.7	59.1	139°00.3	34.0	175°34.0	50.9			Gacrux	171°53.8	
5	153°54.6	243°50.8	10.2	80°06.2	59.1	154°02.7	33.9	190°36.3	50.8			Alioth	166°14.8	
6	168°57.0	258°49.8	\$24°10.3	95°99.7	N24°59.0	169°05.0	S01°33.9	205°38.6	\$15°50.8			Spica	158°24.3	
7	183°59.5	273°48.8	10.4	110°13.2	59.0	184°07.4	33.8	220°40.9	50.7			Alkaid	152°53.7	
8	199°02.0	288°47.9	10.5	125°16.7	59.0	199°09.7	33.7	235°43.1	50.6			Hadar	148°38.9	
9	214°04.4	303°46.9	· · 10.5	140°20.2	· · 59.0	214°12.1	· · 33.7	250°45.4	· · 50.6			Menkent	148°00.0	
10	229°06.9	318°45.9	10.6	155°23.8	59.0	229°14.4	33.6	265°47.7	50.5			Arcturus	145°49.8	
11	244°09.4	333°45.0	10.7	170°27.3	59.0	244°16.7	33.5	280°50.0	50.5			Rigel Kent.	139°43.2	
12	259°11.8	348°44.0	\$24°10.8	185°30.8	N24°58.9	259°19.1	S01°33.5	295°52.3	\$15°50.4			Kochab	137°20.8	
13	274°14.3	3°43.0	10.9	200°34.3	58.9	274°21.4	33.4	310°54.5	50.3			Zuben'ubi	136°58.2	
14	289°16.7	18°42.0	11.0	215°37.8	58.9	289°23.8	33.3	325°56.8	50.3			Alphecca	126°05.6	
15	304°19.2	33°41.1	· · 11.0	230°41.3	· · 58.9	304°26.1	· · 33.3	340°59.1	· · 50.2			Antares	112°18.3	
16	319°21.7	48°40.1	11.1	245°44.8	58.9	319°28.4	33.2	356°01.4	50.2			Atria	107°14.7	
17	334°24.1	63°39.1	11.2	260°48.3	58.8	334°30.8	33.1	11°03.6	50.1			Sabik	102°05.1	
18	349°26.6	78°38.1	\$24°11.3	275°51.8	N24°58.8	349°33.1	S01°33.1	26°05.9	\$15°50.0			Shaula	96°13.2	
19	4°29.1	93°37.2	11.3	290°55.3	58.8	4°35.4	33.0	41°08.2	50.0			Rasalhague	96°00.5	
20	19°31.5	108°36.2	11.4	305°58.8	58.8	19°37.8	32.9	56°10.5	49.9			Eltanin	90°43.5	
21	34°34.0	123°35.2	· · 11.5	321°02.3	· · 58.8	34°40.1	· · 32.9	71°12.7	· · 49.8			Kaus Aust.	83°35.2	
22	49°36.5	138°34.2	11.5	336°05.8	58.7	49°42.5	32.8	86°15.0	49.8			Vega	80°34.8	
23	64°38.9	153°33.3	11.6	351°09.3	58.7	64°44.8	32.7	101°17.3	49.7			Nunki	75°50.3	
Mer.pass. 18:42			ν -1.0' d -0.1' m -3.92	ν 3.5' d -0.0' m -1.90	ν 2.3' d 0.1' m -2.51	ν 2.3' d 0.1' m 0.81						Altair	62°01.9	
Mer.pass. 18:38			ν -1.0' d -0.1' m -3.92	ν 3.5' d -0.0' m -1.88	ν 2.3' d 0.1' m -2.50	ν 2.3' d 0.1' m 0.82						Peacock	53°08.9	
Dec 09 Fri	SHA	Mer.pass										Deneb	49°27.3	
Venus	91°35.9	12:44										Markab	13°31.6	
Mars	285°41.1	23:41										Fomalhaut	15°16.5	
Jupiter	0°11.5	18:45										Scheat	13°46.9	
Saturn	36°47.1	16:20										Markab	13°31.6	
Dec 10 Sat	SHA	Mer.pass										Horizontal parallax		
Venus	90°13.4	12:45										Venus:	0.1	
Mars	286°06.4	23:35										Mars:	0.3	
Jupiter	0°08.7	18:42												
Saturn	36°42.7	16:16												
Dec 11 Sun	SHA	Mer.pass												
Venus	88°50.9	12:47												
Mars	286°31.5	23:30												
Jupiter	0°05.7	18:38												
Saturn	36°38.2	16:12												

DUT1 = UT1-UTC = -0.0134 sec  $\Delta T = TT-UT1 = +69.1974$  sec

2022 December 09 to Dec. 11 UT

h	Sun			Moon			
Fri	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	181°58.9	S22°47.4	352°06.9	9.7'	N26°55.0	2.8'	54.5'
1	196°58.7	47.7	6°35.6	9.7'	26°57.8	2.7'	54.4'
2	211°58.4	47.9	21°04.4	9.7'	27°00.5	2.6'	54.4'
3	226°58.1	48.2	35°33.1	9.7'	27°03.1	2.4'	54.4'
4	241°57.8	48.4	50°01.8	9.7'	27°05.5	2.3'	54.4'
5	256°57.5	48.6	64°30.5	9.7'	27°07.8	2.2'	54.4'
6	271°57.3	S22°48.9	78°59.1	9.7'	N27°10.0	2.0'	54.4'
7	286°57.0	49.1	93°27.8	9.7'	27°12.0	1.9'	54.4'
8	301°56.7	49.4	107°56.5	9.7'	27°13.9	1.8'	54.4'
9	316°56.4	49.6	122°25.2	9.7'	27°15.7	1.6'	54.3'
10	331°56.2	49.9	136°53.8	9.7'	27°17.3	1.5'	54.3'
11	346°55.9	50.1	151°22.5	9.7'	27°18.8	1.4'	54.3'
12	1°55.6	S22°50.3	165°51.2	9.7'	N27°20.2	1.2'	54.3'
13	16°55.3	50.6	180°19.9	9.7'	27°21.4	1.1'	54.3'
14	31°55.0	50.8	194°48.5	9.7'	27°22.5	0.9'	54.3'
15	46°54.8	51.1	209°17.2	9.7'	27°23.4	0.8'	54.3'
16	61°54.5	51.3	223°45.9	9.7'	27°24.2	0.7'	54.3'
17	76°54.2	51.5	238°14.6	9.7'	27°24.9	0.5'	54.3'
18	91°53.9	S22°51.8	252°43.3	9.7'	N27°25.4	0.4'	54.3'
19	106°53.6	52.0	267°12.0	9.7'	27°25.8	0.3'	54.2'
20	121°53.4	52.2	281°40.7	9.7'	27°26.1	0.1'	54.2'
21	136°53.1	52.5	296°09.5	9.7'	27°26.2	-0.0'	54.2'
22	151°52.8	52.7	310°38.2	9.8'	27°26.2	-0.1'	54.2'
23	166°52.5	52.9	325°07.0	9.8'	27°26.1	-0.3'	54.2'
	SD = 16.2'			SD = 14.9'			

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

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

Day	Sun		Moon		
	Eqn.of	Time	Mer.	Mer.	
	00 <sup>h</sup>	12 <sup>h</sup>	Pass.	Pass.	
	mm:ss	mm:ss	hh:mm	hh:mm	
09	07:56	07:42	11:52	00:33	12:59
10	07:29	07:15	11:53	01:25	13:50
11	07:02	06:48	11:53	02:16	14:41

**December 12, 13, 14 UT (Mon., Tue., Wed.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	80°40.5	168°08.9	\$24°12.9	7°36.8	N24°58.1	80°43.1	S01°31.0	117°14.2	S15°48.1							
1	95°43.0	183°07.9	12.9	22°40.2	58.1	95°45.4	30.9	132°16.4	48.1							
2	110°45.5	198°06.9	13.0	37°43.7	58.1	110°47.8	30.9	147°18.7	48.0							
3	125°47.9	213°06.0	.. 13.0	52°47.2	.. 58.0	125°50.1	.. 30.8	162°21.0	.. 47.9							
4	140°50.4	228°05.0	13.0	67°50.7	58.0	140°52.4	30.7	177°23.2	47.9							
5	155°52.8	243°04.0	13.0	82°54.2	58.0	155°54.7	30.6	192°25.5	47.8							
6	170°55.3	258°03.0	\$24°13.1	97°57.7	N24°58.0	170°57.1	S01°30.6	207°27.8	S15°47.7							
7	185°57.8	273°02.1	13.1	113°01.2	57.9	185°59.4	30.5	222°30.1	47.7							
8	201°00.2	288°01.1	13.1	128°04.7	57.9	201°01.7	30.4	237°32.3	47.6							
9	216°02.7	303°00.1	.. 13.1	143°08.1	.. 57.9	216°04.0	.. 30.3	252°34.6	.. 47.6							
10	231°05.2	317°59.1	13.2	158°11.6	57.8	231°06.4	30.3	267°36.9	47.5							
11	246°07.6	332°58.2	13.2	173°15.1	57.8	246°08.7	30.2	282°39.2	47.4							
12	261°10.1	347°57.2	\$24°13.2	188°18.6	N24°57.8	261°11.0	S01°30.1	297°41.4	S15°47.4							
13	276°12.6	2°56.2	13.2	203°22.1	57.8	276°13.3	30.1	312°43.7	47.3							
14	291°15.0	17°55.2	13.2	218°25.6	57.7	291°15.7	30.0	327°46.0	47.2							
15	306°17.5	32°54.3	.. 13.3	233°29.0	.. 57.7	306°18.0	.. 29.9	342°48.2	.. 47.2							
16	321°20.0	47°53.3	13.3	248°32.5	57.7	321°20.3	29.8	357°50.5	47.1							
17	336°22.4	62°52.3	13.3	263°36.0	57.6	336°22.6	29.8	12°52.8	47.0							
18	351°24.9	77°51.3	\$24°13.3	278°39.5	N24°57.6	351°25.0	S01°29.7	27°55.0	S15°47.0							
19	6°27.3	92°50.4	13.3	293°42.9	57.6	6°27.3	29.6	42°57.3	46.9							
20	21°29.8	107°49.4	13.3	308°46.4	57.6	21°29.6	29.5	57°59.6	46.8							
21	36°32.3	122°48.4	.. 13.3	323°49.9	.. 57.5	36°31.9	.. 29.5	73°01.9	.. 46.8							
22	51°34.7	137°47.4	13.3	338°53.4	57.5	51°34.3	29.4	88°04.1	46.7							
23	66°37.2	152°46.5	13.3	353°56.9	57.5	66°36.6	29.3	103°06.4	46.6							
Mer.pass. 18:34		ν -1.0° d -0.0' m -3.92	ν 3.5' d -0.0' m -1.85		ν 2.3' d 0.1' m -2.49	ν 2.3' d 0.1' m 0.82										
Tue		GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec		
0	81°39.7	167°45.5	\$24°13.3	9°00.3	N24°57.4	81°38.9	S01°29.2	118°08.7	S15°46.6							
1	96°42.1	182°44.5	13.3	24°03.8	57.4	96°41.2	29.2	133°10.9	46.5							
2	111°44.6	197°43.5	13.3	39°07.3	57.4	111°43.5	29.1	148°13.2	46.5							
3	126°47.1	212°42.6	.. 13.3	54°10.7	.. 57.3	126°45.9	.. 29.0	163°15.5	.. 46.4							
4	141°49.5	227°41.6	13.3	69°14.2	57.3	141°48.2	28.9	178°17.7	46.3							
5	156°52.0	242°40.6	13.3	84°17.7	57.3	156°50.5	28.9	193°20.0	46.3							
6	171°54.5	257°39.6	\$24°13.3	99°21.2	N24°57.2	171°52.8	S01°28.8	208°22.3	S15°46.2							
7	186°56.9	272°38.7	13.3	114°24.6	57.2	186°55.1	28.7	223°24.6	46.1							
8	201°59.4	287°37.7	13.3	129°28.1	57.2	201°57.5	28.6	238°26.8	46.1							
9	217°01.8	302°36.7	.. 13.3	144°31.6	.. 57.2	216°59.8	.. 28.6	253°29.1	.. 46.0							
10	232°04.3	317°35.7	13.3	159°35.0	57.1	232°02.1	28.5	268°31.4	45.9							
11	247°06.8	332°34.7	13.3	174°38.5	57.1	247°04.4	28.4	283°33.6	45.9							
12	262°09.2	347°33.8	\$24°13.3	189°42.0	N24°57.1	262°06.7	S01°28.3	298°35.9	S15°45.8							
13	277°11.7	2°32.8	13.3	204°45.4	57.0	277°09.1	28.3	313°38.2	45.7							
14	292°14.2	17°31.8	13.3	219°48.9	57.0	292°11.4	28.2	328°40.4	45.7							
15	307°16.6	32°30.8	.. 13.2	234°52.4	.. 57.0	307°13.7	.. 28.1	343°42.7	.. 45.6							
16	322°19.1	47°29.9	13.2	249°55.8	56.9	322°16.0	28.0	358°45.0	45.5							
17	337°21.6	62°28.9	13.2	264°59.3	56.9	337°18.3	28.0	13°47.2	45.5							
18	352°24.0	77°27.9	\$24°13.2	280°02.8	N24°56.9	352°20.6	S01°27.9	28°49.5	S15°45.4							
19	7°26.5	92°26.9	13.2	295°06.2	56.8	7°22.9	27.8	43°51.8	45.3							
20	22°29.0	107°26.0	13.2	310°09.7	56.8	22°25.3	27.7	58°54.0	45.3							
21	37°31.4	122°25.0	.. 13.1	325°13.1	.. 56.8	37°27.6	.. 27.7	73°56.3	.. 45.2							
22	52°33.9	137°24.0	13.1	340°16.6	56.7	52°29.9	27.6	88°58.6	45.1							
23	67°36.3	152°23.0	13.1	355°20.1	56.7	67°32.2	27.5	104°00.8	45.1							
Mer.pass. 18:30		ν -1.0° d -0.0' m -3.92	ν 3.5' d -0.0' m -1.82		ν 2.3' d 0.1' m -2.48	ν 2.3' d 0.1' m 0.82										
Wed		GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec		
0	82°38.8	167°22.1	\$24°13.0	10°23.5	N24°56.7	82°34.5	S01°27.4	119°03.1	S15°45.0							
1	97°41.3	182°21.1	13.0	25°27.0	56.6	97°36.8	27.3	134°05.4	44.9							
2	112°43.7	197°20.1	13.0	40°30.4	56.6	112°39.1	27.3	149°07.6	44.9							
3	127°46.2	212°19.1	.. 13.0	55°33.9	.. 56.5	127°41.5	.. 27.2	164°09.9	.. 44.8							
4	142°48.7	227°18.2	12.9	70°37.3	56.5	142°43.8	27.1	179°12.2	44.7							
5	157°51.1	242°17.2	12.9	85°40.8	56.5	157°46.1	27.0	194°14.4	44.7							
6	172°53.6	257°16.2	\$24°12.9	100°44.2	N24°56.4	172°48.4	S01°27.0	209°16.7	S15°44.6							
7	187°56.1	272°15.2	12.8	115°47.7	56.4	187°50.7	26.9	224°19.0	44.6							
8	202°58.5	287°14.3	12.8	130°51.2	56.4	202°53.0	26.8	239°21.2	44.5							
9	218°01.0	302°13.3	.. 12.7	145°54.6	.. 56.3	217°55.3	.. 26.7	254°23.5	.. 44.4							
10	233°03.4	317°12.3	12.7	160°58.1	56.3	232°57.6	26.6	269°25.8	44.4							
11	248°05.9	332°11.3	12.7	176°01.5	56.3	248°00.0	26.6	284°28.0	44.3							
12	263°08.4	347°10.4	\$24°12.6	191°04.9	N24°56.2	263°02.3	S01°26.5	299°30.3	S15°44.2							
13	278°10.8	2°09.4	12.6	206°08.4	56.2	278°04.6	26.4	314°32.6	44.2							
14	293°13.3	17°08.4	12.5	221°11.8	56.2	293°06.9	26.3	329°34.8	44.1							
15	308°15.8	32°07.4	.. 12.5	236°15.3	.. 56.1	308°09.2	.. 26.2	344°37.1	.. 44.0							
16	323°18.2	47°06.5	12.4	251°18.7	56.1	323°11.5	26.2	359°39.4	44.0							
17	338°20.7	62°05.5	12.4	266°22.2	56.0	338°13.8	26.1	14°41.6	43.9							
18	353°23.2	77°04.5	\$24°12.3	281°25.6	N24°56.0	353°16.1	S01°26.0	29°43.9	S15°43.8							
19	8°25.6	92°03.5	12.3	296°29.1	56.0	8°18.4	25.9	44°46.2	43.8							
20	23°28.1	107°02.6	12.2	311°32.5	55.9	23°20.7	25.8	59°48.4	43.7							
21	38°30.6	122°01.6	.. 12.2													

h		Sun		Moon				
Mon		GHA	Dec	GHA	$\nu$	Dec	d	HP
0	181°38.6	S23°03.3		315°16.3	11.8'	N24°40.5	-6.4'	54.0'
1	196°38.3	03.5		329°47.1	11.8'	24°34.1	-6.5'	54.0'
2	211°38.0	03.7		344°17.9	11.9'	24°27.6	-6.6'	54.0'
3	226°37.7	.. 03.9		358°48.8	11.9'	24°20.9	-6.7'	54.0'
4	241°37.4	04.1		13°19.7	12.0'	24°14.2	-6.8'	54.0'
5	256°37.1	04.2		27°50.7	12.0'	24°07.4	-6.9'	54.0'
6	271°36.8	S23°04.4		42°21.8	12.1'	N24°00.4	-7.0'	54.0'
7	286°36.6	04.6		56°52.9	12.2'	23°53.4	-7.2'	54.0'
8	301°36.3	04.8		71°24.0	12.2'	23°46.2	-7.3'	54.0'
9	316°36.0	.. 05.0		85°55.3	12.3'	23°39.0	-7.4'	54.0'
10	331°35.7	05.2		100°26.5	12.3'	23°31.6	-7.5'	54.0'
11	346°35.4	05.4		114°57.9	12.4'	23°24.2	-7.6'	54.0'
12	1°35.1	S23°05.5		129°29.3	12.5'	N23°16.6	-7.7'	54.0'
13	16°34.8	05.7		144°00.7	12.5'	23°08.9	-7.8'	54.0'
14	31°34.5	05.9		158°32.3	12.6'	23°01.2	-7.9'	54.0'
15	46°34.2	.. 06.1		173°03.8	12.6'	22°53.3	-8.0'	54.0'
16	61°33.9	06.3		187°35.5	12.7'	22°45.3	-8.1'	54.0'
17	76°33.6	06.4		202°07.2	12.8'	22°37.2	-8.2'	54.0'
18	91°33.4	S23°06.6		216°38.9	12.8'	N22°29.1	-8.3'	54.0'
19	106°33.1	06.8		231°10.8	12.9'	22°20.8	-8.4'	54.0'
20	121°32.8	07.0		245°42.6	12.9'	22°12.4	-8.5'	54.0'
21	136°32.5	.. 07.2		260°14.6	13.0'	22°04.0	-8.6'	54.0'
22	151°32.2	07.3		274°46.6	13.0'	21°55.4	-8.6'	54.0'
23	166°31.9	07.5		289°18.6	13.1'	21°46.8	-8.7'	54.0'
	SD = 16.2'		d = -0.2'		SD = 14.7'			

Tue		GHA		Dec				
Mon		GHA	Dec	GHA	$\nu$	Dec	d	HP
0	181°31.6	S23°07.7		303°50.7	13.2'	N21°38.0	-8.8'	54.0'
1	196°31.3	07.9		318°22.9	13.2'	21°29.2	-8.9'	54.0'
2	211°31.0	08.0		332°55.1	13.3'	21°20.3	-9.0'	54.0'
3	226°30.7	.. 08.2		347°27.4	13.3'	21°11.3	-9.1'	54.0'
4	241°30.4	08.4		1°59.7	13.4'	21°02.2	-9.2'	54.1'
5	256°30.1	08.5		16°32.1	13.5'	20°53.0	-9.3'	54.1'
6	271°29.8	S23°08.7		31°04.6	13.5'	N20°43.7	-9.4'	54.1'
7	286°29.5	08.9		45°37.1	13.6'	20°34.3	-9.5'	54.1'
8	301°29.3	09.0		60°09.6	13.6'	20°24.8	-9.6'	54.1'
9	316°29.0	.. 09.2		74°42.3	13.7'	20°15.3	-9.6'	54.1'
10	331°28.7	09.4		89°14.9	13.7'	20°05.6	-9.7'	54.1'
11	346°28.4	09.5		103°47.7	13.8'	19°55.9	-9.8'	54.1'
12	1°28.1	S23°09.7		118°20.4	13.8'	N19°46.1	-9.9'	54.1'
13	16°27.8	09.9		132°53.3	13.9'	19°36.2	-10.0'	54.1'
14	31°27.5	10.0		147°26.2	13.9'	19°26.3	-10.1'	54.1'
15	46°27.2	.. 10.2		161°59.1	14.0'	19°16.2	-10.1'	54.1'
16	61°26.9	10.3		176°32.1	14.1'	19°06.1	-10.2'	54.2'
17	76°26.6	10.5		191°05.2	14.1'	18°55.8	-10.3'	54.2'
18	91°26.3	S23°10.7		205°38.3	14.2'	N18°45.5	-10.4'	54.2'
19	106°26.0	10.8		220°11.4	14.2'	18°35.2	-10.5'	54.2'
20	121°25.7	11.0		234°44.6	14.3'	18°24.7	-10.5'	54.2'
21	136°25.4	.. 11.1		249°17.9	14.3'	18°14.2	-10.6'	54.2'
22	151°25.1	11.3		263°51.2	14.4'	18°03.6	-10.7'	54.2'
23	166°24.8	11.5		278°24.5	14.4'	17°52.9	-10.8'	54.2'
	SD = 16.2'		d = -0.2'		SD = 14.7'			

Wed		GHA		Dec				
Mon		GHA	Dec	GHA	$\nu$	Dec	d	HP
0	181°24.5	S23°11.6		292°57.9	14.4'	N17°42.1	-10.8'	54.2'
1	196°24.2	11.8		307°31.4	14.5'	17°31.3	-10.9'	54.3'
2	211°23.9	11.9		322°04.9	14.5'	17°20.3	-11.0'	54.3'
3	226°23.6	.. 12.1		336°38.4	14.6'	17°09.4	-11.1'	54.3'
4	241°23.3	12.2		351°12.0	14.6'	16°58.3	-11.1'	54.3'
5	256°23.1	12.4		5°45.6	14.7'	16°47.2	-11.2'	54.3'
6	271°22.8	S23°12.5		20°19.3	14.7'	N16°36.0	-11.3'	54.3'
7	286°22.5	12.7		34°53.0	14.8'	16°24.7	-11.3'	54.3'
8	301°22.2	12.8		49°26.8	14.8'	16°13.3	-11.4'	54.3'
9	316°21.9	.. 13.0		64°00.6	14.8'	16°01.9	-11.5'	54.4'
10	331°21.6	13.1		78°34.5	14.9'	15°50.4	-11.6'	54.4'
11	346°21.3	13.3		93°08.3	14.9'	15°38.9	-11.6'	54.4'
12	1°21.0	S23°13.4		107°42.3	15.0'	N15°27.3	-11.7'	54.4'
13	16°20.7	13.5		122°16.2	15.0'	15°15.6	-11.8'	54.4'
14	31°20.4	13.7		136°50.2	15.0'	15°03.8	-11.8'	54.4'
15	46°20.1	.. 13.8		151°24.3	15.1'	14°52.0	-11.9'	54.4'
16	61°19.8	14.0		165°58.4	15.1'	14°40.1	-11.9'	54.5'
17	76°19.5	14.1		180°32.5	15.1'	14°28.2	-12.0'	54.5'
18	91°19.2	S23°14.3		195°06.6	15.2'	N14°16.2	-12.1'	54.5'
19	106°18.9	14.4		209°40.8	15.2'	14°04.1	-12.1'	54.5'
20	121°18.6	14.5		224°15.0	15.2'	13°52.0	-12.2'	54.5'
21	136°18.3	.. 14.7		238°49.3	15.3'	13°39.8	-12.3'	54.6'
22	151°18.0	14.8		253°23.6	15.3'	13°27.5	-12.3'	54.6'
23	166°17.7	14.9		267°57.9	15.3'	13°15.2	-12.4'	54.6'
	SD = 16.2'		d = -0.2'		SD = 14.8'			

Lat.	Twilight		Sunrise	Sunset	Twilight	
	Naut.	Civil			Civil	Naut.
N 72°	08:17	10:40	■	■	13:08	15:31
N 70°	07:58	09:44	■	■	14:04	15:50
68°	07:42	09:10	■	■	14:38	16:06
66°	07:29	08:46	10:23	13:25	15:02	16:19
64°	07:19	08:27	09:43	14:05	15:21	16:29
62°	07:09	08:11	09:16	14:32	15:37	16:39
60°	07:01	07:58	08:55	14:53	15:50	16:47
N 58°	06:54	07:46	08:38	15:10	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
48°	06:24	07:06	07:30	16:18	16:52	17:29
N 40°	06:09	06:43	07:13	16:35	17:06	17:40
35°	05:59	06:31	06:59	16:49	17:17	17:49
30°	05:51	06:21	06:47	17:01	17:28	17:57
20°	05:34	06:02	06:26	17:22	17:46	18:14
N 10°	05:19	05:45	06:08	17:41	18:03	18:30
0°	05:02	05:28	05:50	17:58	18:20	18:47
S 10°	04:43	05:10	05:33	18:15	18:38	19:05
20°	04:21	04:50	05:14	18:34	18:59	19:28
30°	03:52	04:25	04:53	18:56	19:23	19:57
40°	03:11	03:52	04:25	19:24	19:56	20:38
45°	02:41	03:30	04:07	19:41	20:19	21:08
S 50°	01:56	03:01	03:45	20:04	20:48	21:53
52°	01:30	02:46	03:34	20:14	21:03	22:20
54°	00:48	02:28	03:22	20:26	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	03:22	21:17	22:57	—
Lat.	Mon	Moonrise	Tue	Wed	Mon	Tue
N 72°		■	19:46	■	■	14:33
N 70°		■	17:43	20:15	■	14:02
68°		■	18:33	20:36	■	14:11
66°		16:56	19:05	20:53	14:13	13:39
64°		17:41	19:28	21:07	13:27	13:15
62°		18:11	19:46	21:18	12:57	12:53
60°		1				

**December 15, 16, 17 UT (Thu., Fri., Sat.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	83°37.9	166°58.7	\$24°12.0	11°46.3	N24°55.8	83°30.0	\$01°25.5	119°57.5	\$15°43.4	Alpheratz	357°36.5	29°13.1					
1	98°40.4	181°57.7	11.9	26°49.7	55.7	98°32.3	25.4	134°59.7	43.4	Ankaa	353°08.8	-42°11.2					
2	113°42.9	196°56.7	11.9	41°53.1	55.7	113°34.6	25.4	150°02.0	43.3	Schedar	349°32.8	56°40.0					
3	128°45.3	211°55.8	.. 11.8	56°56.6	.. 55.7	128°36.9	.. 25.3	165°04.3	.. 43.2	Diphda	348°48.9	-17°51.8					
4	143°47.8	226°54.8	11.8	72°00.0	55.6	143°39.2	25.2	180°06.5	43.2	Achernar	335°21.2	-57°07.5					
5	158°50.3	241°53.8	11.7	87°03.4	55.6	158°41.5	25.1	195°08.8	43.1	Hamal	327°52.9	23°34.3					
6	173°52.7	256°52.8	\$24°11.6	102°06.9	N24°55.5	173°43.8	\$01°25.0	210°11.1	\$15°43.0	Polaris	314°26.9	89°21.8					
7	188°55.2	271°51.9	11.6	117°10.3	55.5	188°46.1	25.0	225°13.3	43.0	Acamar	315°12.7	-40°12.9					
8	203°57.7	286°50.9	11.5	132°13.7	55.5	203°48.4	24.9	240°15.6	42.9	Menkar	314°07.7	4°10.8					
9	219°00.1	301°49.9	.. 11.4	147°17.2	.. 55.4	218°50.7	.. 24.8	255°17.8	.. 42.8	Mirfak	308°30.3	49°56.6					
10	234°02.6	316°48.9	11.4	162°20.6	55.4	233°53.0	24.7	270°20.1	42.7	Aldebaran	290°41.2	16°33.3					
11	249°05.1	331°48.0	11.3	177°24.0	55.3	248°55.3	24.6	285°22.4	42.7	Rigel	281°05.2	-8°10.5					
12	264°07.5	346°47.0	\$24°11.2	192°27.5	N24°55.3	263°57.6	\$01°24.5	300°24.6	\$15°42.6	Capella	280°23.9	46°01.3					
13	279°10.0	1°46.0	11.1	207°30.9	55.3	278°59.9	24.5	315°26.9	42.5	Bellatrix	278°24.4	6°22.2					
14	294°12.4	16°45.0	11.1	222°34.3	55.2	294°02.2	24.4	330°29.2	42.5	Elnath	278°03.7	28°37.6					
15	309°14.9	31°44.1	.. 11.0	237°37.7	.. 55.2	309°04.5	.. 24.3	345°31.4	.. 42.4	Alnilam	275°39.1	-1°11.2					
16	324°17.4	46°43.1	10.9	252°41.2	55.1	324°06.8	24.2	0°33.7	42.3	Betelgeuse	270°53.6	7°24.7					
17	339°19.8	61°42.1	10.8	267°44.6	55.1	339°09.1	24.1	15°35.9	42.3	Canopus	263°52.6	-52°42.4					
18	354°22.3	76°41.2	\$24°10.7	282°48.0	N24°55.1	354°11.4	\$01°24.1	30°38.2	\$15°42.2	Sirius	258°27.4	-16°44.8					
19	9°24.8	91°40.2	10.7	297°51.4	55.0	9°13.7	24.0	45°40.5	42.1	Adhara	255°06.8	-29°00.1					
20	24°27.2	106°39.2	10.6	312°54.9	55.0	24°16.0	23.9	60°42.7	42.1	Procyon	244°52.3	5°10.0					
21	39°29.7	121°38.2	.. 10.5	327°58.3	.. 54.9	39°18.3	.. 23.8	75°45.0	.. 42.0	Pollux	243°19.1	27°58.2					
22	54°32.2	136°37.3	10.4	343°01.7	54.9	54°20.6	23.7	90°47.2	41.9	Avor	234°14.9	-59°34.7					
23	69°34.6	151°36.3	10.3	358°05.1	54.9	69°22.9	23.6	105°49.5	41.9	Suhail	222°47.3	-43°31.2					
Mer.pass.		18:22	ν -1.0' d 0.1' m -3.92	ν 3.4' d -0.0' m -1.76	ν 2.3' d 0.1' m -2.47	ν 2.3' d 0.1' m 0.83	Mer.pass.		18:19	ν -1.0' d 0.1' m -3.92	ν 3.4' d -0.0' m -1.73	ν 2.3' d 0.1' m -2.46	ν 2.3' d 0.1' m 0.83	Mer.pass.			
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	84°37.1	166°35.3	\$24°10.2	13°08.5	N24°54.8	84°25.2	\$01°23.6	120°51.8	\$15°41.8	Denebola	182°26.7	14°26.6					
1	99°39.5	181°34.3	10.1	28°12.0	54.8	99°27.5	23.5	135°54.0	41.7	Gienah	175°45.4	-17°40.0					
2	114°42.0	196°33.4	10.0	43°15.4	54.7	114°29.8	23.4	150°56.3	41.7	Acru	173°02.2	-63°13.2					
3	129°44.5	211°32.4	.. 09.9	58°18.8	.. 54.7	129°32.1	.. 23.3	165°58.6	.. 41.6	Gacrux	171°53.7	-57°14.1					
4	144°46.9	226°31.4	09.8	73°22.2	54.6	144°34.4	23.2	181°00.8	41.5	Alioth	166°14.7	55°49.9					
5	159°49.4	241°30.5	09.8	88°25.6	54.6	159°36.7	23.1	196°03.1	41.5	Spica	158°24.3	-11°16.7					
6	174°51.9	256°29.5	\$24°09.7	103°29.0	N24°54.6	174°39.0	\$01°23.0	211°05.3	\$15°41.4	Alkaid	152°53.7	49°11.8					
7	189°54.3	271°28.5	09.6	118°32.4	54.5	189°41.3	23.0	226°07.6	41.3	Hadar	148°38.9	-60°28.7					
8	204°56.8	286°27.5	09.5	133°35.8	54.5	204°43.6	22.9	241°09.9	41.3	Menkent	147°59.9	-36°28.7					
9	219°59.3	301°26.6	.. 09.4	148°39.3	.. 54.4	219°45.9	.. 22.8	256°12.1	.. 41.2	Arcturus	145°49.7	19°03.8					
10	235°01.7	316°25.6	09.3	163°42.7	54.4	234°48.2	22.7	271°14.4	41.1	Rigel Kent	139°43.2	-60°55.5					
11	250°04.2	331°24.6	09.1	178°46.1	54.3	249°50.5	22.6	286°16.6	41.1	Kochab	137°20.7	74°03.5					
12	265°06.7	346°23.7	\$24°09.0	193°49.5	N24°54.3	264°52.8	\$01°22.5	301°18.9	\$15°41.0	Zuben' ubi	136°58.2	-16°08.1					
13	280°09.1	1°22.7	08.9	208°52.9	54.3	279°55.1	22.5	316°21.1	40.9	Alphecca	126°05.5	26°38.2					
14	295°11.6	16°21.7	08.8	223°56.3	54.2	294°57.4	22.4	331°23.4	40.8	Antares	112°18.3	-26°28.9					
15	310°14.0	31°20.7	.. 08.7	238°59.7	.. 54.2	309°59.7	.. 22.3	346°25.7	.. 40.8	Atria	107°14.7	-69°04.0					
16	325°16.5	46°19.8	08.6	254°03.1	54.1	325°02.0	22.2	1°27.9	40.7	Sabik	102°05.1	-15°45.1					
17	340°19.0	61°18.8	08.5	269°06.5	54.1	340°04.3	22.1	16°30.2	40.6	Shaula	96°13.1	-37°07.2					
18	355°21.4	76°17.8	\$24°08.4	284°09.9	N24°54.0	355°06.6	\$01°22.0	31°32.4	\$15°40.6	Rasalhague	96°00.5	12°32.6					
19	10°23.9	91°16.9	08.3	299°13.3	54.0	10°08.9	21.9	46°34.7	40.5	Eltanin	90°43.5	51°29.1					
20	25°26.4	106°15.9	08.2	314°16.7	54.0	25°11.2	21.9	61°37.0	40.4	Kaus Aust.	83°35.2	-34°22.4					
21	40°28.8	121°14.9	.. 08.0	329°20.1	.. 53.9	40°13.5	.. 21.8	76°39.2	.. 40.4	Vega	80°34.8	38°48.3					
22	55°31.3	136°13.9	07.9	344°23.5	53.9	55°15.8	21.7	91°41.5	40.3	Nunki	75°50.3	-26°16.1					
23	70°33.8	151°13.0	07.8	359°26.9	53.8	70°18.0	21.6	106°43.7	40.2	Altair	62°01.9	8°55.7					
Mer.pass.		18:19	ν -1.0' d 0.1' m -3.92	ν 3.4' d -0.0' m -1.73	ν 2.3' d 0.1' m -2.46	ν 2.3' d 0.1' m 0.83	Mer.pass.		18:15	ν -1.0' d 0.1' m -3.92	ν 3.4' d -0.0' m -1.70	ν 2.3' d 0.1' m -2.45	ν 2.3' d 0.1' m 0.83	Mer.pass.			
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	85°36.2	166°12.0	\$24°07.7	14°30.3	N24°53.8	85°20.3	\$01°21.5	121°46.0	\$15°40.2	Dec 15 Thu	83°20.7	12:53					
1	100°38.7	181°11.0	07.6	29°33.7	53.7	100°22.6	21.4	136°48.3	40.1	Venus	288°08.3	23:08					
2	115°41.2	196°10.1	07.4	44°37.1	53.7	115°24.9	21.3	151°50.5	40.0	Mars	359°52.0	18:23					
3	130°43.6	211°09.1	.. 07.3	59°40.5	.. 53.6	130°27.2	.. 21.2	166°52.8	.. 40.0	Jupiter	36°19.5	15:58					
4	145°46.1	226°08.1	07.2	74°43.9	53.6	145°29.5	21.2	181°55.0	39.9	Saturn	36°14.7	15:54					
5	160°48.5	241°07.2	07.1	89°47.2	53.6	160°31.8	21.1	196°57.3	39.8	Dec 16 Fri	81°58.2	12:54					
6	175°51.0	256°06.2	\$24°06.9	104°50.6	N24°53.5	175°34.1	\$01°21.0	211°59.5	\$15°39.7	Venus	288°31.5	23:02					
7	190°53.5	271°05.2	06.8	119°54.0	53.5	190°36.4	20.9	227°01.8	39.7	Mars	359°48.2	18:20					
8	205°55.9	286°04.3	06.7	134°57.4	53.4	205°38.7	20.8	242°04.1	39.6	Jupiter	36°09.8	15:51					
9	220°58.4	301°03.3	.. 06.5	150°00.8	.. 53.4	220°41.0	.. 20.7	257°06.3	.. 39.5	Saturn	36°09.8	15:51					
10	236°00.9	316°02.3	06.4	165°04.2	53.3	235°43.2	20.6	272°08.6	39.5	Dec 17 Sat	80°35.8	12:56					
11	251°03.3	331°01.3	06.3	180°07.6	53.3	250°45.5	20.5	287°10.8	39.4	Venus	288°54.1	22:57					

DUT1 = UT1-UTC = -0.0104 sec  $\Delta T = TT-UT1 = +69.1944$  sec

2022 December 15 to Dec. 17 UT

h	Sun			Moon			
Thu	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	181°17.4	S23°15.1	282°32.2	15.4'	N13°02.8	-12.4'	54.6'
1	196°17.1	15.2	297°06.6	15.4'	12°50.4	-12.5'	54.6'
2	211°16.8	15.3	311°41.0	15.4'	12°37.9	-12.5'	54.6'
3	226°16.5	.. 15.5	326°15.4	15.5'	12°25.3	-12.6'	54.7'
4	241°16.2	15.6	340°49.9	15.5'	12°12.7	-12.7'	54.7'
5	256°15.9	15.7	355°24.3	15.5'	12°00.1	-12.7'	54.7'
6	271°15.6	S23°15.9	9°58.8	15.5'	N11°47.3	-12.8'	54.7'
7	286°15.3	16.0	24°33.4	15.5'	11°34.6	-12.8'	54.7'
8	301°15.0	16.1	39°07.9	15.6'	11°21.7	-12.9'	54.8'
9	316°14.7	.. 16.3	53°42.5	15.6'	11°08.9	-12.9'	54.8'
10	331°14.4	16.4	68°17.1	15.6'	10°55.9	-13.0'	54.8'
11	346°14.1	16.5	82°51.7	15.6'	10°43.0	-13.0'	54.8'
12	1°13.8	S23°16.6	97°26.3	15.6'	N10°29.9	-13.1'	54.9'
13	16°13.5	16.8	112°01.0	15.7'	10°16.8	-13.1'	54.9'
14	31°13.2	16.9	126°35.6	15.7'	10°03.7	-13.2'	54.9'
15	46°12.9	.. 17.0	141°10.3	15.7'	09°50.5	-13.2'	54.9'
16	61°12.6	17.1	155°45.0	15.7'	09°37.3	-13.3'	54.9'
17	76°12.3	17.2	170°19.7	15.7'	09°24.0	-13.3'	55.0'
18	91°12.0	S23°17.4	184°54.4	15.7'	N09°10.7	-13.4'	55.0'
19	106°11.7	17.5	199°29.1	15.7'	08°57.3	-13.4'	55.0'
20	121°11.4	17.6	214°03.9	15.7'	08°43.9	-13.5'	55.0'
21	136°11.1	.. 17.7	228°38.6	15.8'	08°30.4	-13.5'	55.1'
22	151°10.8	17.8	243°13.4	15.8'	08°16.9	-13.6'	55.1'
23	166°10.5	18.0	257°48.2	15.8'	08°03.3	-13.6'	55.1'
	SD = 16.2'			SD = 14.9'			
	SD = 16.2'			SD = 14.9'			
Fri	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	181°10.2	S23°18.1	272°22.9	15.8'	N07°49.7	-13.6'	55.1'
1	196°09.9	18.2	286°57.7	15.8'	07°36.1	-13.7'	55.2'
2	211°09.6	18.3	301°32.5	15.8'	07°22.4	-13.7'	55.2'
3	226°09.3	.. 18.4	316°07.3	15.8'	07°08.7	-13.8'	55.2'
4	241°09.0	18.5	330°42.0	15.8'	06°54.9	-13.8'	55.2'
5	256°08.7	18.6	345°16.8	15.8'	06°41.1	-13.8'	55.3'
6	271°08.4	S23°18.8	359°51.6	15.8'	N06°27.3	-13.9'	55.3'
7	286°08.1	18.9	14°26.4	15.8'	06°13.4	-13.9'	55.3'
8	301°07.8	19.0	29°01.2	15.8'	05°59.5	-14.0'	55.4'
9	316°07.4	.. 19.1	43°35.9	15.8'	05°45.5	-14.0'	55.4'
10	331°07.1	19.2	58°10.7	15.8'	05°31.5	-14.0'	55.4'
11	346°06.8	19.3	72°45.5	15.8'	05°17.5	-14.1'	55.4'
12	1°06.5	S23°19.4	87°20.2	15.7'	N05°03.4	-14.1'	55.5'
13	16°06.2	19.5	101°55.0	15.7'	04°49.3	-14.1'	55.5'
14	31°05.9	19.6	116°29.7	15.7'	04°35.2	-14.2'	55.5'
15	46°05.6	.. 19.7	131°04.4	15.7'	04°21.0	-14.2'	55.6'
16	61°05.3	19.8	145°39.1	15.7'	04°06.8	-14.2'	55.6'
17	76°05.0	19.9	160°13.8	15.7'	03°52.6	-14.3'	55.6'
18	91°04.7	S23°20.0	174°48.5	15.7'	N03°38.4	-14.3'	55.6'
19	106°04.4	20.1	189°23.2	15.6'	03°24.1	-14.3'	55.7'
20	121°04.1	20.2	203°57.8	15.6'	03°09.8	-14.3'	55.7'
21	136°03.8	.. 20.3	218°32.5	15.6'	02°55.4	-14.4'	55.7'
22	151°03.5	20.4	233°07.1	15.6'	02°41.0	-14.4'	55.8'
23	166°03.2	20.5	247°41.7	15.6'	02°26.6	-14.4'	55.8'
	SD = 16.2'			SD = 15.0'			
	SD = 16.2'			SD = 15.0'			
Sat	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	181°02.9	S23°20.6	262°16.2	15.5'	N02°12.2	-14.5'	55.8'
1	196°02.6	20.7	276°50.8	15.5'	01°57.7	-14.5'	55.9'
2	211°02.3	20.8	291°25.3	15.5'	01°43.3	-14.5'	55.9'
3	226°02.0	.. 20.9	305°59.8	15.5'	01°28.8	-14.5'	55.9'
4	241°01.7	21.0	320°34.3	15.4'	01°14.2	-14.5'	56.0'
5	256°01.4	21.1	335°08.7	15.4'	00°59.7	-14.6'	56.0'
6	271°01.1	S23°21.2	349°43.1	15.4'	N00°45.1	-14.6'	56.0'
7	286°00.8	21.3	4°17.5	15.3'	00°30.5	-14.6'	56.1'
8	301°00.5	21.4	18°51.8	15.3'	00°15.9	-14.6'	56.1'
9	316°00.1	.. 21.4	33°26.1	15.3'	N00°01.3	-14.6'	56.1'
10	330°59.8	21.5	48°00.4	15.2'	S00°13.3	-14.7'	56.2'
11	345°59.5	21.6	62°34.7	15.2'	00°28.0	-14.7'	56.2'
12	0°59.2	S23°21.7	77°08.9	15.2'	S00°42.7	-14.7'	56.2'
13	15°58.9	21.8	91°43.0	15.1'	00°57.4	-14.7'	56.3'
14	30°58.6	21.9	106°17.2	15.1'	01°12.1	-14.7'	56.3'
15	45°58.3	.. 22.0	120°51.2	15.0'	01°26.8	-14.7'	56.3'
16	60°58.0	22.1	135°25.3	15.0'	01°41.6	-14.8'	56.4'
17	75°57.7	22.1	149°59.3	14.9'	01°56.3	-14.8'	56.4'
18	90°57.4	S23°22.2	164°33.2	14.9'	S02°11.1	-14.8'	56.4'
19	105°57.1	22.3	179°07.1	14.9'	02°25.8	-14.8'	56.5'
20	120°56.8	22.4	193°41.0	14.8'	02°40.6	-14.8'	56.5'
21	135°56.5	.. 22.5	208°14.8	14.8'	02°55.4	-14.8'	56.6'
22	150°56.2	22.5	222°48.5	14.7'	03°10.2	-14.8'	56.6'
23	165°55.9	22.6	237°22.2	14.6'	03°25.0	-14.8'	56.6'
	SD = 16.2'			SD = 15.2'			
	SD = 16.2'			SD = 15.2'			

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

**December 18, 19, 20 UT (Sun., Mon., Tue.)**

Aries		Venus		Mars		Jupiter		Saturn		Stars	
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec
0	86°35.4	165°48.8	S24°04.4	15°51.5	N24°52.7	86°15.3	S01°19.4	122°40.2	S15°38.5	Alpheratz	357°36.5
1	101°37.8	180°47.8	04.2	30°54.8	52.6	101°17.5	19.3	137°42.4	38.4	Ankaa	353°08.8
2	116°40.3	195°46.8	04.1	45°58.2	52.6	116°19.8	19.2	152°44.7	38.4	Schedar	349°32.8
3	131°42.8	210°45.9	.. 03.9	61°01.6	.. 52.5	131°22.1	.. 19.1	167°46.9	.. 38.3	Diphda	348°48.9
4	146°45.2	225°44.9	03.8	76°04.9	52.5	146°24.4	19.0	182°49.2	38.2	Achnera	335°21.2
5	161°47.7	240°43.9	03.6	91°08.3	52.4	161°26.7	18.9	197°51.4	38.1	Hamal	327°52.9
6	176°50.1	255°43.0	S24°03.5	106°11.7	N24°52.4	176°29.0	S01°18.8	212°53.7	S15°38.1	Polaris	314°27.7
7	191°52.6	270°42.0	03.3	121°15.0	52.3	191°31.2	18.8	227°55.9	38.0	Acamar	315°12.8
8	206°55.1	285°41.0	03.1	136°18.4	52.3	206°33.5	18.7	242°58.2	37.9	Menkar	314°07.7
9	221°57.5	300°40.1	.. 03.0	151°21.7	.. 52.2	221°35.8	.. 18.6	258°00.4	.. 37.9	Mirfak	308°30.3
10	237°00.0	315°39.1	02.8	166°25.1	52.2	236°38.1	18.5	273°02.7	37.8	Aldebaran	290°41.2
11	252°02.5	330°38.1	02.6	181°28.5	52.1	251°40.4	18.4	288°04.9	37.7	Rigel	281°05.2
12	267°04.9	345°37.2	S24°02.5	196°31.8	N24°52.1	266°42.7	S01°18.3	303°07.2	S15°37.7	Capella	280°23.9
13	282°07.4	0°36.2	02.3	211°35.2	52.0	281°44.9	18.2	318°09.5	37.6	Bellatrix	278°24.4
14	297°09.9	15°35.2	02.1	226°38.5	52.0	296°47.2	18.1	333°11.7	37.5	Elnath	278°03.6
15	312°12.3	30°34.3	.. 02.0	241°41.9	.. 52.0	311°49.5	.. 18.0	348°14.0	.. 37.4	Alnilam	275°39.1
16	327°14.8	45°33.3	01.8	256°45.2	51.9	326°51.8	17.9	3°16.2	37.4	Betelgeuse	270°53.6
17	342°17.2	60°32.4	01.6	271°48.6	51.9	341°54.1	17.8	18°18.5	37.3	Canopus	263°52.6
18	357°19.7	75°31.4	S24°01.4	286°51.9	N24°51.8	356°56.3	S01°17.7	33°20.7	S15°37.2	Sirius	258°27.4
19	12°22.2	90°30.4	01.3	301°55.3	51.8	11°58.6	17.7	48°23.0	37.2	Adhara	255°06.8
20	27°24.6	105°29.5	01.1	316°58.6	51.7	27°00.9	17.6	63°25.2	37.1	Procyon	244°52.3
21	42°27.1	120°28.5	.. 00.9	332°02.0	.. 51.7	42°03.2	.. 17.5	78°27.5	.. 37.0	Pollux	243°19.1
22	57°29.6	135°27.5	00.7	347°05.3	51.6	57°05.5	17.4	93°29.7	37.0	Avior	234°14.9
23	72°32.0	150°26.6	00.5	2°08.7	51.6	72°07.7	17.3	108°32.0	36.9	Suhail	222°47.3
Mer.pass. 18:11		ν -1.0° d 0.2° m -3.92	ν 3.4° d -0.0° m -1.67	ν 2.3° d 0.1° m -2.45	ν 2.3° d 0.1° m 0.83	Miaplacidus					
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Dubhe	193°43.0
0	87°34.5	165°25.6	S24°00.4	17°12.0	N24°51.5	87°10.0	S01°17.2	123°34.2	S15°36.8	Denebola	182°26.7
1	102°37.0	180°24.6	00.2	32°15.4	51.5	102°12.3	17.1	138°36.5	36.7	Gienah	175°45.4
2	117°39.4	195°23.7	24°00.0	47°18.7	51.4	117°14.6	17.0	153°38.7	36.7	Acrux	173°02.1
3	132°41.9	210°22.7	23°59.8	62°22.1	.. 51.4	132°16.8	.. 16.9	168°41.0	.. 36.6	Gacrux	171°53.7
4	147°44.4	225°21.8	59.6	77°25.4	51.3	147°19.1	16.8	183°43.2	36.5	Alioth	166°14.7
5	162°46.8	240°20.8	59.4	92°28.7	51.3	162°21.4	16.7	198°45.5	36.5	Spica	158°24.3
6	177°49.3	255°19.8	S23°59.2	107°32.1	N24°51.2	177°23.7	S01°16.6	213°47.8	S15°36.4	Alkaid	152°53.6
7	192°51.7	270°18.9	59.0	122°35.4	51.2	192°26.0	16.5	228°50.0	36.3	Hadar	148°38.8
8	207°54.2	285°17.9	58.9	137°38.7	51.1	207°28.2	16.4	243°52.3	36.2	Menkent	147°59.9
9	222°56.7	300°16.9	.. 58.7	152°42.1	.. 51.1	222°30.5	.. 16.4	258°54.5	.. 36.2	Arcturus	145°49.7
10	237°59.1	315°16.0	58.5	167°45.4	51.0	237°32.8	16.3	273°56.8	36.1	Rigil Kent.	139°43.1
11	253°01.6	330°15.0	58.3	182°48.7	51.0	252°35.1	16.2	288°59.0	36.0	Kochab	137°20.7
12	268°04.1	345°14.1	S23°58.1	197°52.1	N24°50.9	267°37.3	S01°16.1	304°01.3	S15°36.0	Zuben' ubi	136°58.2
13	283°06.5	0°13.1	57.9	212°55.4	50.9	282°39.6	16.0	319°03.5	35.9	Alphecca	126°05.5
14	298°09.0	15°12.1	57.7	227°58.7	50.8	297°41.9	15.9	334°05.8	35.8	Antares	112°18.3
15	313°11.5	30°11.2	.. 57.5	243°02.1	.. 50.8	312°44.2	.. 15.8	349°08.0	.. 35.7	Atria	107°14.6
16	328°13.9	45°10.2	57.3	258°05.4	50.7	327°46.4	15.7	4°10.3	35.7	Sabik	102°05.1
17	343°16.4	60°09.3	57.1	273°08.7	50.7	342°48.7	15.6	19°12.5	35.6	Shaula	96°13.1
18	358°18.9	75°08.3	S23°56.9	288°12.0	N24°50.6	357°51.0	S01°15.5	34°14.8	S15°35.5	Rasalhague	96°00.5
19	13°21.3	90°07.3	56.6	303°15.4	50.5	12°53.2	15.4	49°17.0	35.5	Eltanin	90°43.5
20	28°23.8	105°06.4	56.4	318°18.7	50.5	27°55.5	15.3	64°19.3	35.4	Kaus Aust.	83°35.2
21	43°26.2	120°05.4	.. 56.2	333°22.0	.. 50.4	42°57.8	.. 15.2	79°21.5	.. 35.3	Vega	80°34.8
22	58°28.7	135°04.5	56.0	348°25.3	50.4	58°00.1	15.1	94°23.8	35.2	Nunki	75°50.3
23	73°31.2	150°03.5	55.8	3°28.6	50.3	73°02.3	15.0	109°26.0	35.2	Altair	62°01.9
Mer.pass. 18:07		ν -1.0° d 0.2° m -3.92	ν 3.3° d -0.0° m -1.64	ν 2.3° d 0.1° m -2.44	ν 2.3° d 0.1° m 0.84	Peacock					
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Fomalhaut	15°16.5
0	88°33.6	165°02.5	S23°55.6	18°31.9	N24°50.3	88°04.6	S01°14.9	124°28.3	S15°35.1	Scheat	13°46.9
1	103°36.1	180°01.6	55.4	33°35.3	50.2	103°06.9	14.8	139°30.5	35.0	Markab	13°31.7
2	118°38.6	195°06.6	55.2	48°38.6	50.2	118°09.1	14.7	154°32.8	35.0	Dec 18 Sun	79°13.4
3	133°41.0	209°59.7	.. 54.9	63°41.9	.. 50.1	133°11.4	.. 14.6	169°35.0	.. 34.9	Venus	289°16.1
4	148°43.5	224°58.7	54.7	78°45.2	50.1	148°13.7	14.5	184°37.3	34.8	Mars	359°39.9
5	163°46.0	239°57.8	54.5	93°48.5	50.0	163°16.0	14.4	199°39.5	34.7	Jupiter	36°04.8
6	178°48.4	254°56.8	S23°54.3	108°51.8	N24°50.0	178°18.2	S01°14.3	214°41.8	S15°34.7	Saturn	15:47
7	193°50.9	269°55.8	54.1	123°55.1	49.9	193°20.5	14.3	229°44.0	34.6	Dec 19 Mon	77°51.1
8	208°53.4	284°54.9	53.8	138°58.4	49.9	208°22.8	14.2	244°46.3	34.5	Venus	289°37.5
9	223°55.8	299°53.9	.. 53.6	154°01.7	.. 49.8	223°25.0	.. 14.1	259°48.5	.. 34.4	Mars	359°35.5
10	238°58.3	314°53.0	53.4	169°05.0	49.8	238°27.3	14.0	274°50.8	34.4	Jupiter	35°59.7
11	254°00.7	329°52.0	53.2	184°08.3	49.7	253°29.6	13.9	289°53.0	34.3	Saturn	15:43
12	269°03.2	344°51.1	S23°52.9	199°11.7	N24°49.7	268°31.8	S01°13.8	304°55.2	S15°34.2	Dec 20 Tue	76°28.9
13	284°05.7	359°50.1	52.7	214°15.0	49.6	283°34.1	13.7	319°57.5	34.2	Venus	289°58.3
14	299°08.1	14°49.1	52.5	229°18.3	49.6	298°36.4	13.6	334°59.7	34.1	Mars	359°31.0
15	314°10.6	29°48.2	.. 52.2	244°21.5	.. 49.5	313°38.6	.. 13.5	350°02.0	.. 34.0	Jupiter	35°54.6
16	329°13.1	44°47.2	52.0	259°24.8	49.5	328°40.9	13.4	5°04.2	33.9	Saturn	15:40
17	344°15.5	59°46.3	51.8	274°28.1	49.4	343°43.2	13.3	20°06.5	33.9	Horizontal parallax	
18	359°18.0	74°45.3	S23°51.5	289°31.4	N24°49.4	358°45.4	S01°13.2	35°08.7	S15°33.8	Venus:	0.1
19	14°20.5	89°44.4	51.3	304°34.7	49.3	13°47.7	13.1	50°11.0	33.7	Mars:	0.3
20	29°22.9	104°43.4	51.0	319°38.0	49.3	28°50.0	13.0	65°13.2	33.7		
21	44°25.4	119°42.5	.. 50.8	334°41.3	.. 49.2	43°52.2	.. 12.9	80°15.5	.. 33.6		
22	59°27.8	134°41.5	50.6	349°44.6	49.1	58°54.5	12.8	95°17.7	33.5		
23	74°30.3	149°40.6	50.3	4°47.9	49.1	73°56.8	12.7	110°20.0	33.4		
Mer.pass. 18:03		ν -1.0° d 0.2° m -3.92	ν 3.3° d -0.1° m -1.61	ν 2.3° d 0.1° m -2.43	ν 2.2° d 0.1° m 0.84	Stars					

DUT1 = UT1-UTC = -0.0107 sec  $\Delta T = TT-UT1 = +69.1947$  sec

2022 December 18 to Dec. 20 UT

h		Sun		Moon				
Sun		GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	180°55.6	S23°22.7	251°55.9	14.6'	S03°39.8	-14.8'	56.7'	
1	195°55.2	22.8	266°29.5	14.5'	03°54.6	-14.8'	56.7'	
2	210°54.9	22.8	281°03.0	14.5'	04°09.5	-14.8'	56.7'	
3	225°54.6	22.9	295°36.5	14.4'	04°24.3	-14.8'	56.8'	
4	240°54.3	23.0	310°09.9	14.4'	04°39.1	-14.8'	56.8'	
5	255°54.0	23.1	324°43.3	14.3'	04°53.9	-14.8'	56.8'	
6	270°53.7	S23°23.1	339°16.5	14.2'	S05°08.7	-14.8'	56.9'	
7	285°53.4	23.2	353°49.8	14.2'	05°23.6	-14.8'	56.9'	
8	300°53.1	23.3	8°22.9	14.1'	05°38.4	-14.8'	57.0'	
9	315°52.8	23.3	22°56.0	14.0'	05°53.2	-14.8'	57.0'	
10	330°52.5	23.4	37°29.1	14.0'	06°08.0	-14.8'	57.0'	
11	345°52.2	23.5	52°02.0	13.9'	06°22.8	-14.8'	57.1'	
12	0°51.9	S23°23.5	66°34.9	13.8'	S06°37.6	-14.8'	57.1'	
13	15°51.6	23.6	81°07.8	13.7'	06°52.4	-14.8'	57.2'	
14	30°51.3	23.7	95°40.5	13.7'	07°07.2	-14.8'	57.2'	
15	45°50.9	23.7	110°13.2	13.6'	07°21.9	-14.8'	57.2'	
16	60°50.6	23.8	124°45.8	13.5'	07°36.7	-14.7'	57.3'	
17	75°50.3	23.9	139°18.3	13.4'	07°51.4	-14.7'	57.3'	
18	90°50.0	S23°23.9	153°50.7	13.4'	S08°06.2	-14.7'	57.4'	
19	105°49.7	24.0	168°23.1	13.3'	08°20.9	-14.7'	57.4'	
20	120°49.4	24.1	182°55.4	13.2'	08°35.6	-14.7'	57.4'	
21	135°49.1	24.1	197°27.6	13.1'	08°50.2	-14.7'	57.5'	
22	150°48.8	24.2	211°59.7	13.0'	09°04.9	-14.6'	57.5'	
23	165°48.5	24.2	226°31.7	12.9'	09°19.5	-14.6'	57.5'	
	SD = 16.2'	d = -0.1'		SD = 15.5'				

Mon	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	180°48.2	S23°24.3	241°03.7	12.9'	S09°34.2	-14.6'	57.6'
1	195°47.9	24.3	255°35.5	12.8'	09°48.7	-14.6'	57.6'
2	210°47.6	24.4	270°07.3	12.7'	10°03.3	-14.5'	57.7'
3	225°47.2	24.5	284°38.9	12.6'	10°17.9	-14.5'	57.7'
4	240°46.9	24.5	299°10.5	12.5'	10°32.4	-14.5'	57.7'
5	255°46.6	24.6	313°42.0	12.4'	10°46.9	-14.5'	57.8'
6	270°46.3	S23°24.6	328°13.4	12.3'	S11°01.3	-14.4'	57.8'
7	285°46.0	24.7	342°44.7	12.2'	11°15.7	-14.4'	57.9'
8	300°45.7	24.7	357°15.9	12.1'	11°30.1	-14.4'	57.9'
9	315°45.4	24.8	11°47.0	12.0'	11°44.5	-14.3'	58.0'
10	330°45.1	24.8	26°18.0	11.9'	11°58.8	-14.3'	58.0'
11	345°44.8	24.9	40°48.9	11.8'	12°13.1	-14.2'	58.0'
12	0°44.5	S23°24.9	55°19.6	11.7'	S12°27.3	-14.2'	58.1'
13	15°44.2	25.0	69°50.3	11.6'	12°41.5	-14.2'	58.1'
14	30°43.8	25.0	84°20.9	11.5'	12°55.7	-14.1'	58.2'
15	45°43.5	25.1	98°51.4	11.4'	13°09.8	-14.1'	58.2'
16	60°43.2	25.1	113°21.7	11.3'	13°23.8	-14.0'	58.2'
17	75°42.9	25.1	127°52.0	11.1'	13°37.9	-14.0'	58.3'
18	90°42.6	S23°25.2	142°22.1	11.0'	S13°51.8	-13.9'	58.3'
19	105°42.3	25.2	156°52.2	10.9'	14°05.8	-13.9'	58.4'
20	120°42.0	25.3	171°22.1	10.8'	14°19.6	-13.8'	58.4'
21	135°41.7	25.3	185°51.9	10.7'	14°33.4	-13.8'	58.4'
22	150°41.4	25.4	200°21.5	10.6'	14°47.2	-13.7'	58.5'
23	165°41.1	25.4	214°51.1	10.4'	15°00.9	-13.6'	58.5'
	SD = 16.2'	d = -0.1'		SD = 15.7'			

Tue	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	180°40.7	S23°25.4	229°20.6	10.3'	S15°14.5	-13.6'	58.6'
1	195°40.4	25.5	243°49.9	10.2'	15°28.1	-13.5'	58.6'
2	210°40.1	25.5	258°19.1	10.1'	15°41.6	-13.5'	58.6'
3	225°39.8	25.5	272°48.2	10.0'	15°55.1	-13.4'	58.7'
4	240°39.5	25.6	287°17.2	9.8'	16°08.5	-13.3'	58.7'
5	255°39.2	25.6	301°46.0	9.7'	16°21.8	-13.2'	58.8'
6	270°38.9	S23°25.6	316°14.7	9.6'	S16°35.0	-13.2'	58.8'
7	285°38.6	25.7	330°43.3	9.5'	16°48.2	-13.1'	58.8'
8	300°38.3	25.7	345°11.8	9.3'	17°01.3	-13.0'	58.9'
9	315°38.0	25.7	359°40.1	9.2'	17°14.3	-12.9'	58.9'
10	330°37.6	25.8	14°08.3	9.1'	17°27.3	-12.9'	58.9'
11	345°37.3	25.8	28°36.4	8.9'	17°40.1	-12.8'	59.0'
12	0°37.0	S23°25.8	43°04.3	8.8'	S17°52.9	-12.7'	59.0'
13	15°36.7	25.8	57°32.2	8.7'	18°05.6	-12.6'	59.1'
14	30°36.4	25.9	71°59.8	8.6'	18°18.2	-12.5'	59.1'
15	45°36.1	25.9	86°27.4	8.4'	18°30.7	-12.4'	59.1'
16	60°35.8	25.9	100°54.8	8.3'	18°43.2	-12.3'	59.2'
17	75°35.5	25.9	115°22.1	8.2'	18°55.5	-12.2'	59.2'
18	90°35.2	S23°26.0	129°49.3	8.0'	S19°07.8	-12.1'	59.3'
19	105°34.8	26.0	144°16.3	7.9'	19°19.9	-12.1'	59.3'
20	120°34.5	26.0	158°43.2	7.7'	19°32.0	-11.9'	59.3'
21	135°34.2	26.0	173°09.9	7.6'	19°43.9	-11.8'	59.4'
22	150°33.9	26.1	187°36.5	7.5'	19°55.8	-11.7'	59.4'
23	165°33.6	26.1	202°03.0	7.3'	20°07.5	-11.6'	59.4'
	SD = 16.2'	d = -0.0'		SD = 16.0'			

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

**December 21, 22, 23 UT (Wed., Thu., Fri.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	89°32.8	164°39.6	\$23°50.1	19°51.2	N24°49.0	88°59.0	S01°12.6	125°22.2	\$15°33.4					Alpheratz	357°36.5	29°13.1	
1	104°35.2	179°38.6	49.8	34°54.5	49.0	104°01.3	12.5	140°24.5	33.3					Ankaa	353°08.8	-42°11.2	
2	119°37.7	194°37.7	49.6	49°57.8	48.9	119°03.5	12.4	155°26.7	33.2					Schedar	349°32.9	56°40.0	
3	134°40.2	209°36.7	· · 49.3	65°01.0	· · 48.9	134°05.8	· · 12.3	170°29.0	· · 33.1					Diphda	348°48.9	-17°51.8	
4	149°42.6	224°35.8	49.1	80°04.3	48.8	149°08.1	12.2	185°31.2	33.1					Achernar	335°21.2	-57°07.5	
5	164°45.1	239°34.8	48.8	95°07.6	48.8	164°10.3	12.1	200°33.5	33.0					Hamal	327°52.9	23°34.3	
6	179°47.6	254°33.9	\$23°48.6	110°10.9	N24°48.7	179°12.6	S01°12.0	215°35.7	\$15°32.9					Polaris	314°28.3	89°21.9	
7	194°50.0	269°32.9	48.3	125°14.2	48.7	194°14.9	11.9	230°37.9	32.9					Acamar	315°12.8	-40°13.0	
8	209°52.5	284°32.0	48.1	140°17.4	48.6	209°17.1	11.8	245°40.2	32.8					Menkar	314°07.7	4°10.8	
9	224°55.0	299°31.0	· · 47.8	155°20.7	· · 48.6	224°19.4	· · 11.7	260°42.4	· · 32.7					Mirfak	308°30.3	49°56.7	
10	239°57.4	314°30.1	47.6	170°24.0	48.5	239°21.6	11.6	275°44.7	32.6					Aldebaran	290°41.2	16°33.3	
11	254°59.9	329°29.1	47.3	185°27.3	48.5	254°23.9	11.5	290°46.9	32.6					Rigel	281°05.2	-8°10.5	
12	270°02.3	344°28.2	\$23°47.0	200°30.5	N24°48.4	269°26.2	S01°11.4	305°49.2	\$15°32.5					Capella	280°23.9	46°01.3	
13	285°04.8	359°27.2	46.8	215°33.8	48.3	284°28.4	11.3	320°51.4	32.4					Bellatrix	278°24.4	6°22.2	
14	300°07.3	14°26.3	46.5	230°37.1	48.3	299°30.7	11.2	335°53.7	32.3					Elnath	278°03.6	28°37.6	
15	315°09.7	29°25.3	· · 46.3	245°40.3	· · 48.2	314°32.9	· · 11.1	350°55.9	· · 32.3					Alnilam	275°39.1	-1°11.2	
16	330°12.2	44°24.4	46.0	260°43.6	48.2	329°35.2	11.0	5°58.2	32.2					Betelgeuse	270°53.6	7°24.7	
17	345°14.7	59°23.4	45.7	275°46.9	48.1	344°37.5	10.9	21°00.4	32.1					Canopus	263°52.6	-52°42.4	
18	0°17.1	74°22.5	\$23°45.5	290°50.1	N24°48.1	359°39.7	S01°10.8	36°02.6	\$15°32.0					Sirius	258°27.4	-16°44.8	
19	15°19.6	89°21.5	45.2	305°53.4	48.0	14°42.0	10.7	51°04.9	32.0					Adhara	255°06.8	-29°00.1	
20	30°22.1	104°20.6	44.9	320°56.7	48.0	29°44.2	10.6	66°07.1	31.9					Procyon	244°52.3	5°10.0	
21	45°24.5	119°19.6	· · 44.7	335°59.9	· · 47.9	44°46.5	· · 10.5	81°09.4	· · 31.8					Pollux	243°19.1	27°58.2	
22	60°27.0	134°18.7	44.4	351°03.2	47.9	59°48.8	10.4	96°11.6	31.8					Avior	234°14.9	-59°34.7	
23	75°29.5	149°17.7	44.1	6°06.4	47.8	74°51.0	10.3	111°13.9	31.7					Suhail	222°47.2	-43°31.3	
Mer.pass. 17:59			ν -1.0' d 0.2' m -3.92	ν 3.3' d -0.1' m -1.58	ν 2.3' d 0.1' m -2.43	ν 2.2' d 0.1' m 0.84								Miaplacidus	221°37.9	-69°48.4	
Mer.pass. 17:59			ν -0.9' d 0.3' m -3.92	ν 3.3' d -0.1' m -1.54	ν 2.3' d 0.1' m -2.42	ν 2.2' d 0.1' m 0.84								Alphard	217°49.2	-8°45.4	
Mer.pass. 17:59			ν -0.9' d 0.3' m -3.92	ν 3.3' d -0.1' m -1.54	ν 2.3' d 0.1' m -2.42	ν 2.2' d 0.1' m 0.84								Regulus	207°36.1	11°51.3	
Mer.pass. 17:59			ν -0.9' d 0.3' m -3.92	ν 3.3' d -0.1' m -1.54	ν 2.3' d 0.1' m -2.42	ν 2.2' d 0.1' m 0.84								Dubhe	193°43.0	61°37.4	
Mer.pass. 17:59			ν -0.9' d 0.3' m -3.92	ν 3.3' d -0.1' m -1.54	ν 2.3' d 0.1' m -2.42	ν 2.2' d 0.1' m 0.84								Denebola	182°26.7	14°26.6	
Mer.pass. 17:59			ν -0.9' d 0.3' m -3.92	ν 3.3' d -0.1' m -1.54	ν 2.3' d 0.1' m -2.42	ν 2.2' d 0.1' m 0.84								Gienah	175°45.4	-17°40.0	
Mer.pass. 17:59			ν -0.9' d 0.3' m -3.92	ν 3.3' d -0.1' m -1.54	ν 2.3' d 0.1' m -2.42	ν 2.2' d 0.1' m 0.84								Acrux	173°02.1	-63°13.2	
Mer.pass. 17:59			ν -0.9' d 0.3' m -3.92	ν 3.3' d -0.1' m -1.54	ν 2.3' d 0.1' m -2.42	ν 2.2' d 0.1' m 0.84								Gacrux	171°53.6	-57°14.1	
Mer.pass. 17:59			ν -0.9' d 0.3' m -3.92	ν 3.3' d -0.1' m -1.54	ν 2.3' d 0.1' m -2.42	ν 2.2' d 0.1' m 0.84								Alioth	166°14.6	55°49.9	
Mer.pass. 17:59			ν -0.9' d 0.3' m -3.92	ν 3.3' d -0.1' m -1.54	ν 2.3' d 0.1' m -2.42	ν 2.2' d 0.1' m 0.84								Spica	158°24.2	-11°16.7	
Mer.pass. 17:59			ν -0.9' d 0.3' m -3.92	ν 3.3' d -0.1' m -1.54	ν 2.3' d 0.1' m -2.42	ν 2.2' d 0.1' m 0.84								Alkaid	152°53.6	49°11.7	
Mer.pass. 17:59			ν -0.9' d 0.3' m -3.92	ν 3.3' d -0.1' m -1.54	ν 2.3' d 0.1' m -2.42	ν 2.2' d 0.1' m 0.84								Hadar	148°38.8	-60°28.7	
Mer.pass. 17:59			ν -0.9' d 0.3' m -3.92	ν 3.3' d -0.1' m -1.54	ν 2.3' d 0.1' m -2.42	ν 2.2' d 0.1' m 0.84								Menkent	147°59.9	-36°28.7	
Mer.pass. 17:59			ν -0.9' d 0.3' m -3.92	ν 3.3' d -0.1' m -1.54	ν 2.3' d 0.1' m -2.42	ν 2.2' d 0.1' m 0.84								Arcturus	145°49.7	19°03.7	
Mer.pass. 17:59			ν -0.9' d 0.3' m -3.92	ν 3.3' d -0.1' m -1.54	ν 2.3' d 0.1' m -2.42	ν 2.2' d 0.1' m 0.84								Rigel Kent.	139°43.1	-60°55.5	
Mer.pass. 17:59			ν -0.9' d 0.3' m -3.92	ν 3.3' d -0.1' m -1.54	ν 2.3' d 0.1' m -2.42	ν 2.2' d 0.1' m 0.84								Kochab	137°20.6	74°03.4	
Mer.pass. 17:59			ν -0.9' d 0.3' m -3.92	ν 3.3' d -0.1' m -1.54	ν 2.3' d 0.1' m -2.42	ν 2.2' d 0.1' m 0.84								Zuben'ubi	136°58.2	-16°08.1	
Mer.pass. 17:59			ν -0.9' d 0.3' m -3.92	ν 3.3' d -0.1' m -1.54	ν 2.3' d 0.1' m -2.42	ν 2.2' d 0.1' m 0.84								Alphecca	126°05.5	26°38.2	
Mer.pass. 17:59			ν -0.9' d 0.3' m -3.92	ν 3.3' d -0.1' m -1.54	ν 2.3' d 0.1' m -2.42	ν 2.2' d 0.1' m 0.84								Antares	112°18.3	-26°28.9	
Mer.pass. 17:59			ν -0.9' d 0.3' m -3.92	ν 3.3' d -0.1' m -1.54	ν 2.3' d 0.1' m -2.42	ν 2.2' d 0.1' m 0.84								Atria	107°14.6	-69°04.0	
Mer.pass. 17:59			ν -0.9' d 0.3' m -3.92	ν 3.3' d -0.1' m -1.54	ν 2.3' d 0.1' m -2.42	ν 2.2' d 0.1' m 0.84								Sabik	102°05.1	-15°45.2	
Mer.pass. 17:59			ν -0.9' d 0.3' m -3.92	ν 3.3' d -0.1' m -1.54	ν 2.3' d 0.1' m -2.42	ν 2.2' d 0.1' m 0.84								Shaula	96°13.1	-37°07.2	
Mer.pass. 17:59			ν -0.9' d 0.3' m -3.92	ν 3.3' d -0.1' m -1.54	ν 2.3' d 0.1' m -2.42	ν 2.2' d 0.1' m 0.84								Rasalhague	96°00.5	12°32.6	
Mer.pass. 17:59			ν -0.9' d 0.3' m -3.92	ν 3.3' d -0.1' m -1.54	ν 2.3' d 0.1' m -2.42	ν 2.2' d 0.1' m 0.84								Eltanin	90°43.5	51°29.1	
Mer.pass. 17:59			ν -0.9' d 0.3' m -3.92	ν 3.3' d -0.1' m -1.54	ν 2.3' d 0.1' m -2.42	ν 2.2' d 0.1' m 0.84								Kaus Aust.	83°35.2	-34°22.4	
Mer.pass. 17:59			ν -0.9' d 0.3' m -3.92	ν 3.3' d -0.1' m -1.54	ν 2.3' d 0.1' m -2.42	ν 2.2' d 0.1' m 0.84								Vega	80°34.8	38°48.3	
Mer.pass. 17:59			ν -0.9' d 0.3' m -3.92	ν 3.3' d -0.1' m -1.54	ν 2.3' d 0.1' m -2.42	ν 2.2' d 0.1' m 0.84								Nunki	75°50.2	-26°16.1	
Mer.pass. 17:59			ν -0.9' d 0.3' m -3.92	ν 3.3' d -0.1' m -1.54	ν 2.3' d 0.1' m -2.42	ν 2.2' d 0.1' m 0.84								Altair	62°01.9	8°55.7	
Mer.pass. 17:59			ν -0.9' d 0.3' m -3.92	ν 3.3' d -0.1' m -1.54	ν 2.3' d 0.1' m -2.42	ν 2.2' d 0.1' m 0.84								Peacock	53°08.9	-56°39.9	
Mer.pass. 17:59			ν -0.9' d 0.3' m -3.92	ν 3.3' d -0.1' m -1.54	ν 2.3' d 0.1' m -2.42	ν 2.2' d 0.1' m 0.84								Deneb	49°27.3	45°21.8	
Mer.pass. 17:59			ν -0.9' d 0.3' m -3.92	ν 3.3' d -0.1' m -1.54	ν 2.3' d 0.1' m -2.42	ν 2.2' d 0.1' m 0.84								Enif	33°40.7	9°58.8	
Mer.pass. 17:59			ν -0.9' d 0.3' m -3.92	ν 3.3' d -0.1' m -1.54	ν 2.3' d 0.1' m -2.42	ν 2.2' d 0.1' m 0.84								Al Nair	27°35.3	-46°51.3	
Mer.pass. 17:59			ν -0.9' d 0.3' m -3.92	ν 3.3' d -0.1' m -1.54	ν 2.3' d 0.1' m -2.42	ν 2.2' d 0.1' m 0.84								Fomalhaut	15°16.5	-29°30.3	
Mer.pass. 17:59			ν -0.9' d 0.3' m -3.92	ν 3.3'													

DUT1 = UT1-UTC = -0.0110 sec  $\Delta T = TT-UT1 = +69.1950$  sec

2022 December 21 to Dec. 23 UT

h		Sun		Moon				Lat.		Twilight		Sunrise		Sunset		Twilight	
Wed	GHA	Dec	GHA	$\nu$	Dec	$d$	HP	Naut.	Civil							Civil	Naut.
0	180°33.3	S23°26.1	216°29.3	7.2'	S20°19.1	-11.5'	59.5'	N 72°	08:26	10:58	■■■	■■■	12:59	15:31	12:59	15:31	
1	195°33.0	26.1	230°55.5	7.1'	20°30.7	-11.4'	59.5'	N 70°	08:06	09:55	■■■	■■■	14:02	15:51	14:02	15:51	
2	210°32.7	26.1	245°21.6	6.9'	20°42.1	-11.3'	59.6'	68°	07:50	09:20	■■■	■■■	14:38	16:07	14:38	16:07	
3	225°32.4	.. 26.1	259°47.5	6.8'	20°53.4	-11.2'	59.6'	66°	07:37	08:54	10:35	13:22	15:03	16:20	15:03	16:20	
4	240°32.1	26.2	274°13.3	6.6'	21°04.6	-11.1'	59.6'	64°	07:26	08:34	09:53	14:05	15:23	16:31	15:23	16:31	
5	255°31.7	26.2	288°38.9	6.5'	21°15.6	-10.9'	59.7'	62°	07:16	08:18	09:24	14:33	15:39	16:41	15:39	16:41	
6	270°31.4	S23°26.2	303°04.5	6.4'	S21°26.6	-10.8'	59.7'	60°	07:08	08:05	09:02	14:55	15:52	16:49	15:52	16:49	
7	285°31.1	26.2	317°29.8	6.2'	21°37.4	-10.7'	59.7'	N 58°	07:00	07:53	08:45	15:12	16:04	16:57	16:04	16:57	
8	300°30.8	26.2	331°55.1	6.1'	21°48.1	-10.6'	59.8'	56°	06:53	07:43	08:30	15:27	16:14	17:04	16:14	17:04	
9	315°30.5	.. 26.2	346°20.2	6.0'	21°58.7	-10.4'	59.8'	54°	06:47	07:33	08:17	15:40	16:24	17:10	16:24	17:10	
10	330°30.2	26.2	0°45.1	5.8'	22°09.1	-10.3'	59.8'	52°	06:42	07:25	08:06	15:51	16:32	17:16	16:32	17:16	
11	345°29.9	26.2	15°09.9	5.7'	22°19.4	-10.2'	59.9'	50°	06:36	07:18	07:56	16:01	16:39	17:21	16:39	17:21	
12	0°29.6	S23°26.2	29°34.6	5.5'	S22°29.6	-10.0'	59.9'	45°	06:24	07:02	07:36	16:22	16:55	17:33	16:55	17:33	
13	15°29.2	26.3	43°59.2	5.4'	22°39.6	-9.9'	59.9'	N 40°	06:14	06:48	07:19	16:38	17:09	17:43	16:38	17:43	
14	30°28.9	26.3	58°23.6	5.3'	22°49.5	-9.8'	60.0'	35°	06:05	06:36	07:04	16:53	17:21	17:52	17:21	17:52	
15	45°28.6	.. 26.3	72°47.9	5.1'	22°59.3	-9.6'	60.0'	30°	05:56	06:26	06:52	17:05	17:31	18:01	17:31	18:01	
16	60°28.3	26.3	87°12.0	5.0'	23°08.9	-9.5'	60.0'	20°	05:39	06:07	06:31	17:26	17:50	18:18	17:50	18:18	
17	75°28.0	26.3	101°36.0	4.9'	23°18.4	-9.3'	60.1'	N 10°	05:23	05:49	06:12	17:45	18:08	18:34	18:08	18:34	
18	90°27.7	S23°26.3	115°59.9	4.7'	S23°27.7	-9.2'	60.1'	0°	05:06	05:32	05:55	18:02	18:25	18:51	18:25	18:51	
19	105°27.4	26.3	130°23.6	4.6'	23°36.9	-9.0'	60.1'	S 10°	04:47	05:14	05:37	18:20	18:43	19:10	18:43	19:10	
20	120°27.1	26.3	144°47.3	4.5'	23°45.9	-8.9'	60.1'	20°	04:24	04:54	05:18	18:39	19:03	19:33	18:39	19:33	
21	135°26.8	.. 26.3	159°10.7	4.4'	23°54.8	-8.7'	60.2'	30°	03:55	04:29	04:56	19:01	19:28	20:02	19:28	20:02	
22	150°26.4	26.3	173°34.1	4.2'	24°03.5	-8.6'	60.2'	35°	03:37	04:13	04:43	19:14	19:44	20:21	19:44	20:21	
23	165°26.1	26.3	187°57.3	4.1'	24°12.1	-8.4'	60.2'	40°	03:13	03:55	04:28	19:29	20:02	20:44	19:29	20:44	
		SD = 16.2'	d = -0.0'		SD = 16.2'			45°	02:43	03:32	04:10	19:47	20:25	21:14	19:47	21:14	
Thu	GHA	Dec	GHA	$\nu$	Dec	$d$	HP	Naut.	Civil						Civil	Naut.	
0	180°25.8	S23°26.3	202°20.4	4.0'	S24°20.5	-8.2'	60.3'	N 50°	01:57	03:03	03:47	20:10	20:54	22:00	20:54	22:00	
1	195°25.5	26.3	216°43.4	3.8'	24°28.7	-8.1'	60.3'	52°	01:29	02:47	03:36	20:21	21:10	22:28	21:10	22:28	
2	210°25.2	26.3	231°06.2	3.7'	24°36.8	-7.9'	60.3'	54°	00:42	02:29	03:24	20:33	21:28	23:15	21:28	23:15	
3	225°24.9	.. 26.3	245°28.9	3.6'	24°44.7	-7.7'	60.4'	56°	—	02:07	03:10	20:47	21:50	—	20:47	—	
4	240°24.6	26.3	259°51.5	3.5'	24°52.5	-7.6'	60.4'	58°	—	01:37	02:53	21:04	22:20	—	21:04	—	
5	255°24.3	26.3	274°14.0	3.4'	25°00.0	-7.4'	60.4'	S 60°	—	00:46	02:32	21:25	23:11	—	23:11	—	
6	270°24.0	S23°26.3	288°36.4	3.2'	S25°07.4	-7.2'	60.4'										
7	285°23.6	26.3	302°58.6	3.1'	25°14.7	-7.1'	60.5'										
8	300°23.3	26.2	317°20.7	3.0'	25°21.7	-6.9'	60.5'										
9	315°23.0	.. 26.2	331°42.8	2.9'	25°28.6	-6.7'	60.5'										
10	330°22.7	26.2	346°04.7	2.8'	25°35.3	-6.5'	60.5'										
11	345°22.4	26.2	0°26.5	2.7'	25°41.8	-6.3'	60.6'										
12	0°22.1	S23°26.2	14°48.1	2.6'	S25°48.1	-6.1'	60.6'										
13	15°21.8	26.2	26.9	20.9	25°54.3	-6.0'	60.6'										
14	30°21.5	26.2	43°31.2	2.4'	26°00.2	-5.8'	60.6'										
15	45°21.1	.. 26.2	57°52.6	2.3'	26°06.0	-5.6'	60.7'										
16	60°20.8	26.2	72°13.9	2.2'	26°11.6	-5.4'	60.7'										
17	75°20.5	26.1	86°35.1	2.1'	26°17.0	-5.2'	60.7'										
18	90°20.2	S23°26.1	100°56.2	2.0'	S26°22.1	-5.0'	60.7'										
19	105°19.9	26.1	115°17.2	1.9'	26°27.1	-4.8'	60.7'										
20	120°19.6	26.1	129°38.1	1.8'	26°31.9	-4.6'	60.8'										
21	135°19.3	.. 26.1	143°58.9	1.7'	26°36.5	-4.4'	60.8'										
22	150°19.0	26.1	158°19.6	1.7'	26°40.9	-4.2'	60.8'										
23	165°18.6	26.0	172°40.3	1.6'	26°45.1	-4.0'	60.8'										
		SD = 16.3'	d = 0.0'		SD = 16.4'												
Fri	GHA	Dec	GHA	$\nu$	Dec	$d$	HP	Naut.	Civil						Civil	Naut.	
0	180°18.3	S23°26.0	187°00.9	1.5'	S26°49.1	-3.8'	60.8'	N 10°	03:59	05:03	06:10	15:53	16:53	17:58	16:53	17:58	
1	195°18.0	26.0	201°21.4	1.4'	26°52.9	-3.6'	60.9'	0°	03:43	04:43	05:48	16:11	17:13	18:20	17:13	18:20	
2	210°17.7	26.0	215°41.9	1.4'	26°56.5	-3.4'	60.9'	S 10°	03:27	04:23	05:26	16:29	17:34	18:42	17:34	18:42	
3	225°17.4	.. 25.9	230°02.3	1.3'	26°59.9	-3.2'	60.9'	20°	03:10	04:03	05:03	16:48	17:57	19:05	17:57	19:05	
4	240°17.1	25.9	244°22.6	1.3'	27°03.1	-3.0'	60.9'	30°	02:50	03:39	04:36	17:11	18:23	19:33	18:23	19:33	
5	255°16.8	25.9	258°42.8	1.2'	27°06.0	-2.8'	60.9'	35°	02:39	03:25	04:21	17:24	18:38	19:49	18:38	19:49	
6	270°16.5	S23°25.9	273°03.0	1.1'	S27°08.8	-2.5'	60.9'	40°	02:26	03:08	04:02	17:39	18:56	20:08	18:56	20:08	
7	285°16.2	25.8	287°23.2	1.1'	27°11.3	-2.3'	60.9'	45°	02:11	02:49	03:40	17:58	19:18	20:30	19:18	20:30	
8	300°15.8	25.8	301°43.3	1.0'	27°13.7	-2.1'	61.0'	S 50°	01:52	02:25	03:12	18:20	19:45	20:59	19:45	20:59	
9	315°15.5	.. 25.8	316°03.3	1.0'	27°15.8	-1.9'	61.0'	52°	01:44	02:14	02:59	18:31	19:59	21:13	19:59	21:13	
10	330°15.2	25.8	330°23.3	1.0'	27°17.7	-1.7'	61.0'	54°	01:34	02:01	02:43	18:44	20:14	21:29	20:14	21:29	
11	345°14.9	25.7	344°43.3	0.9'	27°19.4	-1.5'	61.0'	56°	01:23	01:46	02:24	18:58	20:32	21:49	20:32	21:49	
12	0°14.6	S23°25.7	359°03.2	0.9'	S27°20.9	-1.3'	61.0'	58°	01:11	01:28	02:02	19:15	20:55	22:13	20:55	22:13	
13	15°14.3	25.7	13°23.1	0.9'	27°22.2	-1.1'	61.0'	S 60°	00:56	01:07	01:33	19:36	21:23	22:44	19:36	22:44	
14	30°14.0	25.6	27°43.0	0.8'	27°23.2	-0.8'	61.0'										
15	45°13.7	.. 25.6	42°02.8	0.8'	27°24.1	-0.6'	61.0'										
16	60°13.3	25.6															

**December 24, 25, 26 UT (Sat., Sun., Mon.)**

Aries			Venus			Mars		Jupiter		Saturn		Stars			
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	92°30.2	163°31.6	<b>S23°29.2</b>	23°44.4	<b>N24°45.1</b>	91°41.3	<b>S01°05.2</b>	128°03.7	<b>S15°28.0</b>			Alpheratz	357°36.5	29°13.1	
1	107°32.7	178°30.7	28.8	38°47.6	45.1	106°43.5	05.0	143°05.9	28.0			Ankaa	353°08.8	-42°11.2	
2	122°35.1	193°29.7	28.5	53°50.8	45.0	121°45.8	04.9	158°08.2	27.9			Schedar	349°32.9	56°40.0	
3	137°37.6	208°28.8	.. 28.1	68°54.0	.. 45.0	136°48.0	.. 04.8	173°10.4	.. 27.8			Diphda	348°48.9	-17°51.8	
4	152°40.1	223°27.9	27.8	83°57.2	44.9	151°50.2	04.7	188°12.7	27.7			Achernar	335°21.2	-57°07.5	
5	167°42.5	238°26.9	27.5	99°00.4	44.9	166°52.5	04.6	203°14.9	27.6			Hamal	327°52.9	23°34.3	
6	182°45.0	253°26.0	<b>S23°27.1</b>	114°03.6	<b>N24°44.8</b>	181°54.7	<b>S01°04.5</b>	218°17.1	<b>S15°27.6</b>			Polaris	314°28.9	89°21.9	
7	197°47.5	268°25.1	26.8	129°06.7	44.8	196°57.0	04.4	233°19.4	27.5			Acamar	315°12.8	-40°13.0	
8	212°49.9	283°24.1	26.4	144°09.9	44.7	211°59.2	04.3	248°21.6	27.4			Menkar	314°07.7	4°10.7	
9	227°52.4	298°23.2	.. 26.1	159°13.1	.. 44.6	227°01.5	.. 04.2	263°23.8	.. 27.3			Mirfak	308°30.3	49°56.7	
10	242°54.8	313°22.3	25.7	174°16.3	44.6	242°03.7	04.1	278°26.1	27.3			Aldebaran	290°41.2	16°33.3	
11	257°57.3	328°21.3	25.4	189°19.5	44.5	257°05.9	04.0	293°28.3	27.2			Rigel	281°05.2	-8°10.5	
12	272°59.8	343°20.4	<b>S23°25.0</b>	204°22.6	<b>N24°44.5</b>	272°08.2	<b>S01°03.9</b>	308°30.6	<b>S15°27.1</b>			Capella	280°23.9	46°01.3	
13	288°02.2	358°19.5	24.7	219°25.8	44.4	287°10.4	03.7	323°32.8	27.0			Bellatrix	278°24.4	6°22.2	
14	303°04.7	13°18.6	24.3	234°29.0	44.4	302°12.7	03.6	338°35.0	27.0			Elnath	278°03.6	28°37.6	
15	318°07.2	28°17.6	.. 24.0	249°32.2	.. 44.3	317°14.9	.. 03.5	353°37.3	.. 26.9			Alnilam	275°39.1	-1°11.3	
16	333°09.6	43°16.7	23.6	264°35.3	44.3	332°17.1	03.4	8°39.5	26.8			Betelgeuse	270°53.6	7°24.7	
17	348°12.1	58°15.8	23.3	279°38.5	44.2	347°19.4	03.3	23°41.7	26.7			Canopus	263°52.6	-52°42.4	
18	3°14.6	73°14.8	<b>S23°22.9</b>	294°41.7	<b>N24°44.2</b>	2°21.6	<b>S01°03.2</b>	38°44.0	<b>S15°26.7</b>			Sirius	258°27.4	-16°44.8	
19	18°17.0	88°13.9	22.5	309°44.8	44.1	17°23.8	03.1	53°46.2	26.6			Adhara	255°06.8	-29°00.1	
20	33°19.5	103°13.0	22.2	324°48.0	44.0	32°26.1	03.0	68°48.5	26.5			Procyon	244°52.3	5°10.0	
21	48°22.0	118°12.1	.. 21.8	339°51.1	.. 44.0	47°28.3	.. 02.9	83°50.7	.. 26.4			Pollux	243°19.0	27°58.2	
22	63°24.4	133°11.1	21.5	354°54.3	43.9	62°30.6	02.8	98°52.9	26.4			Avior	234°14.8	-59°34.8	
23	78°26.9	148°10.2	21.1	9°57.5	43.9	77°32.8	02.6	113°55.2	26.3			Suhail	222°47.2	-43°31.3	
Mer.pass. 17:47		ν -0.9° d 0.3' m -3.92	ν 3.2' d -0.1' m -1.48	ν 2.2' d 0.1' m -2.40	ν 2.2' d 0.1' m 0.85										
Sun		GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec			
0	93°29.3	163°09.3	<b>S23°20.7</b>	25°00.6	<b>N24°43.8</b>	92°35.0	<b>S01°02.5</b>	128°57.4	<b>S15°26.2</b>			Denebola	182°26.6	14°26.6	
1	108°31.8	178°08.3	20.4	40°03.8	43.8	107°37.3	02.4	143°59.6	26.1			Gienah	175°45.3	-17°40.0	
2	123°34.3	193°07.4	20.0	55°06.9	43.7	122°39.5	02.3	159°01.9	26.1			Acrux	173°02.0	-63°13.2	
3	138°36.7	208°06.5	.. 19.6	70°10.1	.. 43.7	137°41.7	.. 02.2	174°04.1	.. 26.0			Gacrux	171°53.6	-57°14.2	
4	153°39.2	223°05.6	19.3	85°13.2	43.6	152°44.0	02.1	189°06.3	25.9			Alioth	166°14.6	55°49.9	
5	168°41.7	238°04.6	18.9	100°16.4	43.6	167°46.2	02.0	204°08.6	25.8			Spica	158°24.2	-11°16.8	
6	183°44.1	253°03.7	<b>S23°18.5</b>	115°19.5	<b>N24°43.5</b>	182°48.4	<b>S01°01.9</b>	219°10.8	<b>S15°25.7</b>			Alkaid	152°53.6	49°11.7	
7	198°46.6	268°02.8	18.1	130°22.7	43.4	197°50.7	01.8	234°13.1	25.7			Hadar	148°38.7	-60°28.7	
8	213°49.1	283°01.9	17.8	145°25.8	43.4	212°52.9	01.7	249°15.3	25.6			Menkent	147°59.8	-36°28.7	
9	228°51.5	298°00.9	.. 17.4	160°29.0	.. 43.3	227°55.1	.. 01.5	264°17.5	.. 25.5			Arcturus	145°49.7	19°03.7	
10	243°54.0	313°00.0	17.0	175°32.1	43.3	242°57.4	01.4	279°19.8	25.4			Rigel Kent.	139°43.0	-60°55.5	
11	258°56.5	327°59.1	16.6	190°35.3	43.2	257°59.6	01.3	294°22.0	25.4			Kochab	137°20.6	74°03.4	
12	273°58.9	342°58.2	<b>S23°16.3</b>	205°38.4	<b>N24°43.2</b>	273°01.8	<b>S01°01.2</b>	309°24.2	<b>S15°25.3</b>			Zuben 'ubi	136°58.1	-16°08.1	
13	289°01.4	357°57.3	15.9	220°41.5	43.1	288°04.1	01.1	324°26.5	25.2			Alphecca	126°05.5	26°38.2	
14	304°03.8	12°56.3	15.5	235°44.7	43.1	303°06.3	01.0	339°28.7	25.1			Antares	112°18.3	-26°28.9	
15	319°06.3	27°55.4	.. 15.1	250°47.8	.. 43.0	318°08.5	.. 00.9	354°30.9	.. 25.1			Atria	107°14.6	-69°04.0	
16	334°08.8	42°54.5	14.7	265°51.0	43.0	333°10.8	00.8	9°33.2	25.0			Sabik	102°05.1	-15°45.2	
17	349°11.2	57°53.6	14.3	280°54.1	42.9	348°13.0	00.6	24°35.4	24.9			Shaula	96°13.1	-37°07.2	
18	4°13.7	72°52.6	<b>S23°14.0</b>	295°57.2	<b>N24°42.8</b>	3°15.2	<b>S01°00.5</b>	39°37.6	<b>S15°24.8</b>			Rasalhague	96°00.5	12°32.6	
19	19°16.2	87°51.7	13.6	311°00.3	42.8	18°17.5	00.4	54°39.9	24.7			Eltanin	90°43.5	51°29.1	
20	34°18.6	102°50.8	13.2	326°03.5	42.7	33°19.7	00.3	69°42.1	24.7			Kaus Aust.	83°35.2	-34°22.4	
21	49°21.1	117°49.9	.. 12.8	341°06.6	.. 42.7	48°21.9	.. 00.2	84°44.3	.. 24.6			Vega	80°34.8	38°48.3	
22	64°23.6	132°49.0	12.4	356°09.7	42.6	63°24.2	00.1	99°46.6	24.5			Nunki	75°50.2	-26°16.1	
23	79°26.0	147°48.0	12.0	11°12.9	42.6	78°26.4	00.0	114°48.8	24.4			Altair	62°01.9	8°55.7	
Mer.pass. 17:43		ν -0.9° d 0.4' m -3.92	ν 3.2' d -0.1' m -1.44	ν 2.2' d 0.1' m -2.40	ν 2.2' d 0.1' m 0.85										
Mon		GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec			
0	94°28.5	162°47.1	<b>S23°11.6</b>	26°16.0	<b>N24°42.5</b>	93°28.6	<b>S00°59.9</b>	129°51.0	<b>S15°24.4</b>			Fomalhaut	15°16.5	-29°30.3	
1	109°31.0	177°46.2	11.2	41°19.1	42.5	108°30.9	59.7	144°53.3	24.3			Scheat	13°46.9	28°12.5	
2	124°33.4	192°45.3	10.8	56°22.2	42.4	123°33.1	59.6	159°55.5	24.2			Markab	13°31.7	15°19.7	
3	139°35.9	207°44.4	.. 10.4	71°25.3	.. 42.4	138°35.3	.. 59.5	174°57.7	.. 24.1			Dec 24 Sat	SHA	Mer.pass	
4	154°38.3	222°43.5	10.0	86°28.5	42.3	153°37.5	59.4	190°00.0	24.1			Venus	71°01.4	13:07	
5	169°40.8	237°42.5	09.6	101°31.6	42.2	168°39.8	59.3	205°02.2	24.0			Mars	291°14.2	22:20	
6	184°43.3	252°41.6	<b>S23°09.2</b>	116°34.7	<b>N24°42.2</b>	183°42.0	<b>S00°59.2</b>	220°04.4	<b>S15°23.9</b>			Jupiter	359°11.1	17:51	
7	199°45.7	267°40.7	08.8	131°37.8	42.1	198°44.2	59.1	235°06.7	23.8			Saturn	35°33.5	15:25	
8	214°48.2	282°39.8	08.4	146°40.9	42.1	213°46.5	58.9	250°08.9	23.7			Dec 25 Sun	SHA	Mer.pass	
9	229°50.7	297°38.9	.. 08.0	161°44.0	.. 42.0	228°48.7	.. 58.8	265°11.1	.. 23.7			Venus	69°39.9	13:08	
10	244°53.1	312°38.0	07.6	176°47.1	42.0	243°50.9	58.7	280°13.4	23.6			Mars	291°31.3	22:15	
11	259°55.6	327°37.0	07.2	191°50.2	41.9	258°53.1	58.6	295°15.6	23.5			Jupiter	359°05.7	17:47	
12	274°58.1	342°36.1	<b>S23°06.8</b>	206°53.3	<b>N24°41.9</b>	273°55.4	<b>S00°58.5</b>	310°17.8	<b>S15°23.4</b>			Saturn	35°28.1	15:22	
13	290°00.5	357°35.2	06.4	221°56.4	41.8	288°57.6	58.4	325°20.1	23.4			Dec 26 Mon	SHA	Mer.pass	
14	305°03.0	12°34.3	05.9	236°59.5	41.8	303°59.8	58.3	340°22.3	23.3			Venus	68°18.6	13:10	
15	320°05.4	27°33.4	.. 05.5	252°02.6	.. 41.7	319°02.									

DUT1 = UT1-UTC = -0.0095 sec  $\Delta T = TT-UT1 = +69.1935$  sec

2022 December 24 to Dec. 26 UT

h		Sun		Moon				
Sat		GHA	Dec	GHA	$\nu$	Dec	d	HP
0	180°10.9	S23°25.3	171°00.7	0.8'	S27°21.8	1.3'	61.1'	
1	195°10.5	25.2	185°20.5	0.8'	27°20.5	1.5'	61.1'	
2	210°10.2	25.2	199°40.3	0.8'	27°18.9	1.8'	61.1'	
3	225°09.9	.. 25.1	214°00.1	0.8'	27°17.2	2.0'	61.1'	
4	240°09.6	25.1	228°19.9	0.8'	27°15.2	2.2'	61.1'	
5	255°09.3	25.0	242°39.8	0.9'	27°13.0	2.4'	61.1'	
6	270°09.0	S23°25.0	256°59.7	0.9'	S27°10.6	2.6'	61.1'	
7	285°08.7	25.0	271°19.6	0.9'	27°08.0	2.8'	61.1'	
8	300°08.4	24.9	285°39.5	1.0'	27°05.1	3.1'	61.1'	
9	315°08.0	.. 24.9	299°59.5	1.0'	27°02.1	3.3'	61.1'	
10	330°07.7	24.8	314°19.5	1.1'	26°58.8	3.5'	61.1'	
11	345°07.4	24.8	328°39.6	1.1'	26°55.3	3.7'	61.1'	
12	0°07.1	S23°24.7	342°59.7	1.2'	S26°51.6	3.9'	61.1'	
13	15°06.8	24.7	357°19.9	1.2'	26°47.7	4.1'	61.1'	
14	30°06.5	24.6	11°40.1	1.3'	26°43.6	4.3'	61.1'	
15	45°06.2	.. 24.6	26°00.4	1.3'	26°39.3	4.5'	61.1'	
16	60°05.9	24.5	40°20.7	1.4'	26°34.8	4.7'	61.1'	
17	75°05.6	24.4	54°41.1	1.5'	26°30.0	4.9'	61.1'	
18	90°05.2	S23°24.4	69°01.6	1.5'	S26°25.1	5.1'	61.1'	
19	105°04.9	24.3	83°22.1	1.6'	26°20.0	5.3'	61.1'	
20	120°04.6	24.3	97°42.8	1.7'	26°14.6	5.5'	61.1'	
21	135°04.3	.. 24.2	112°03.5	1.8'	26°09.1	5.7'	61.1'	
22	150°04.0	24.2	126°24.2	1.9'	26°03.4	5.9'	61.1'	
23	165°03.7	24.1	140°45.1	1.9'	25°57.4	6.1'	61.1'	
	SD = 16.3'	d = 0.0'		SD = 16.7'		SD = 16.7'		

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

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

Day	Sun		Mer.	Moon	
	Eqn.of	Time		Mer. Pass.	Age
	00 <sup>h</sup>	12 <sup>h</sup>	Pass.	Upper	Lower
	mm:ss	mm:ss	hh:mm	hh:mm	hh:mm
24	00:43	00:28	12:00	13:11	00:38
25	00:14	00:01	12:00	14:16	01:44
26	00:16	00:31	12:01	15:16	02:47

**December 27, 28, 29 UT (Tue., Wed., Thu.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	95°27.6	162°25.2	\$23°01.8	27°30.5	N24°41.2	94°22.1	\$00°57.1	130°44.6	\$15°22.5								
1	110°30.1	177°24.3	01.3	42°33.6	41.2	109°24.3	57.0	145°46.9	22.4								
2	125°32.6	192°23.4	00.9	57°36.6	41.1	124°26.5	56.9	160°49.1	22.3								
3	140°35.0	207°22.5	.. 00.5	72°39.7	.. 41.1	139°28.7	.. 56.8	175°51.3	.. 22.3								
4	155°37.5	222°21.6	23°00.1	87°42.8	41.0	154°31.0	56.6	190°53.6	22.2								
5	170°39.9	237°20.7	22°59.6	102°45.9	41.0	169°33.2	56.5	205°55.8	22.1								
6	185°42.4	252°19.7	\$22°59.2	117°49.0	N24°40.9	184°35.4	\$00°56.4	220°58.0	\$15°22.0								
7	200°44.9	267°18.8	58.8	132°52.0	40.9	199°37.6	56.3	236°00.2	22.0								
8	215°47.3	282°17.9	58.3	147°55.1	40.8	214°39.8	56.2	251°02.5	21.9								
9	230°49.8	297°17.0	.. 57.9	162°58.2	.. 40.8	229°42.1	.. 56.1	266°04.7	.. 21.8								
10	245°52.3	312°16.1	57.5	178°01.3	40.7	244°44.3	55.9	281°06.9	21.7								
11	260°54.7	327°15.2	57.0	193°04.3	40.6	259°46.5	55.8	296°09.2	21.6								
12	275°57.2	342°14.3	\$22°56.6	208°07.4	N24°40.6	274°48.7	\$00°55.7	311°11.4	\$15°21.6								
13	290°59.7	357°13.4	56.1	223°10.5	40.5	289°50.9	55.6	326°13.6	21.5								
14	306°02.1	12°12.5	55.7	238°13.5	40.5	304°53.2	55.5	341°15.9	21.4								
15	321°04.6	27°11.6	.. 55.3	253°16.6	.. 40.4	319°55.4	.. 55.3	356°18.1	.. 21.3								
16	336°07.1	42°10.7	54.8	268°19.7	40.4	334°57.6	55.2	11°20.3	21.2								
17	351°09.5	57°09.8	54.4	283°22.7	40.3	349°59.8	55.1	26°22.5	21.2								
18	6°12.0	72°08.9	\$22°53.9	298°25.8	N24°40.3	5°02.0	\$00°55.0	41°24.8	\$15°21.1								
19	21°14.4	87°08.0	53.5	313°28.8	40.2	20°04.3	54.9	56°27.0	21.0								
20	36°16.9	102°07.1	53.0	328°31.9	40.2	35°06.5	54.8	71°29.2	20.9								
21	51°19.4	117°06.2	.. 52.6	343°35.0	.. 40.1	50°08.7	.. 54.6	86°31.5	.. 20.9								
22	66°21.8	132°05.3	52.1	358°38.0	40.1	65°10.9	54.5	101°33.7	20.8								
23	81°24.3	147°04.4	51.7	13°41.1	40.0	80°13.1	54.4	116°35.9	20.7								
Mer.pass. 17:35			ν -0.9° d 0.4' m -3.92	ν 3.1° d -0.1' m -1.38	ν 2.2° d 0.1' m -2.38	ν 2.2° d 0.1' m 0.85											
Mer.pass. 17:31			ν -0.9° d 0.5' m -3.92	ν 3.0° d -0.1' m -1.35	ν 2.2° d 0.1' m -2.38	ν 2.2° d 0.1' m 0.85											
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	96°26.8	162°03.5	\$22°51.2	28°44.1	N24°40.0	95°15.3	\$00°54.3	131°38.2	\$15°20.6								
1	111°29.2	177°02.6	50.8	43°47.2	39.9	110°17.6	54.2	146°40.4	20.5								
2	126°31.7	192°01.7	50.3	58°50.2	39.9	125°19.8	54.0	161°42.6	20.5								
3	141°34.2	207°00.8	.. 49.9	73°53.2	.. 39.8	140°22.0	.. 53.9	176°44.8	.. 20.4								
4	156°36.6	221°59.9	49.4	88°56.3	39.8	155°24.2	53.8	191°47.1	20.3								
5	171°39.1	236°59.0	48.9	103°59.3	39.7	170°26.4	53.7	206°49.3	20.2								
6	186°41.5	251°58.1	\$22°48.5	119°02.4	N24°39.7	185°28.6	\$00°53.6	221°51.5	\$15°20.1								
7	201°44.0	266°57.2	48.0	134°05.4	39.6	200°30.9	53.5	236°53.8	20.1								
8	216°46.5	281°56.3	47.6	149°08.5	39.6	215°33.1	53.3	251°56.0	20.0								
9	231°48.9	296°55.4	.. 47.1	164°11.5	.. 39.5	230°35.3	.. 53.2	266°58.2	.. 19.9								
10	246°51.4	311°54.5	46.6	179°14.5	39.4	245°37.5	53.1	282°00.4	19.8								
11	261°53.9	326°53.6	46.2	194°17.6	39.4	260°39.7	53.0	297°02.7	19.7								
12	276°56.3	341°52.7	\$22°45.7	209°20.6	N24°39.3	275°41.9	\$00°52.9	312°04.9	\$15°19.7								
13	291°58.8	356°51.8	45.2	224°23.6	39.3	290°44.1	52.7	327°07.1	19.6								
14	307°01.3	11°50.9	44.8	239°26.7	39.2	305°46.4	52.6	342°09.4	19.5								
15	322°03.7	26°50.0	.. 44.3	254°29.7	.. 39.2	320°48.6	.. 52.5	357°11.6	.. 19.4								
16	337°06.2	41°49.1	43.8	269°32.7	39.1	335°50.8	52.4	12°13.8	19.4								
17	352°08.7	56°48.2	43.3	284°35.7	39.1	350°53.0	52.3	27°16.0	19.3								
18	7°11.1	71°47.3	\$22°42.9	299°38.8	N24°39.0	5°55.2	\$00°52.1	42°18.3	\$15°19.2								
19	22°13.6	86°46.4	42.4	314°41.8	39.0	20°57.4	52.0	57°20.5	19.1								
20	37°16.0	101°45.6	41.9	329°44.8	38.9	35°59.6	51.9	72°22.7	19.0								
21	52°18.5	116°44.7	.. 41.4	344°47.8	.. 38.9	51°01.8	.. 51.8	87°24.9	.. 19.0								
22	67°21.0	131°43.8	40.9	359°50.8	38.8	66°04.1	51.6	102°27.2	18.9								
23	82°23.4	146°42.9	40.5	14°53.8	38.8	81°06.3	51.5	117°29.4	18.8								
Mer.pass. 17:31			ν -0.9° d 0.5' m -3.92	ν 3.0° d -0.1' m -1.35	ν 2.2° d 0.1' m -2.38	ν 2.2° d 0.1' m 0.85											
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	97°25.9	161°42.0	\$22°40.0	29°56.9	N24°38.7	96°08.5	\$00°51.4	132°31.6	\$15°18.7								
1	112°28.4	176°41.1	39.5	44°59.9	38.7	111°10.7	51.3	147°33.9	18.6								
2	127°30.8	191°40.2	39.0	60°02.9	38.6	126°12.9	51.2	162°36.1	18.6								
3	142°33.3	206°39.3	.. 38.5	75°05.9	.. 38.6	141°15.1	.. 51.0	177°38.3	.. 18.5								
4	157°35.8	221°38.4	38.0	90°08.9	38.5	156°17.3	50.9	192°40.5	18.4								
5	172°38.2	236°37.5	37.6	105°11.9	38.5	171°19.5	50.8	207°42.8	18.3								
6	187°40.7	251°36.7	\$22°37.1	120°14.9	N24°38.4	186°21.7	\$00°50.7	222°45.0	\$15°18.2								
7	202°43.2	266°35.8	36.6	135°17.9	38.4	201°23.9	50.6	237°47.2	18.2								
8	217°45.6	281°34.9	36.1	150°20.9	38.3	216°26.1	50.4	252°49.4	18.1								
9	232°48.1	296°34.0	.. 35.6	165°23.9	.. 38.3	231°28.4	.. 50.3	267°51.7	.. 18.0								
10	247°50.5	311°33.1	35.1	180°26.9	38.2	246°30.6	50.2	282°53.9	17.9								
11	262°53.0	326°32.2	34.6	195°29.9	38.2	261°32.8	50.1	297°56.1	17.8								
12	277°55.5	341°31.3	\$22°34.1	210°32.9	N24°38.1	276°35.0	\$00°49.9	312°58.3	\$15°17.8								
13	292°57.9	356°30.5	33.6	225°35.9	38.1	291°37.2	49.8	328°00.6	17.7								
14	308°00.4	11°29.6	33.1	240°38.9	38.0	306°39.4	49.7	343°02.8	17.6								
15	323°02.9	26°28.7	.. 32.6	255°41.9	.. 38.0	321°41.6	.. 49.6	358°05.0	.. 17.5								
16	338°05.3	41°27.8	32.1	270°44.9	37.9	336°43.8	49.4	13°07.2	17.4								
17	353°07.8	56°26.9	31.6	285°47.9	37.9	351°46.0	49.3	28°09.5	17.4								
18	8°10.3	71°26.0	\$22°31.1	300°50.8	N24°37.8	6°48.2	\$00°49.2	43°11.7	\$15°17.3								
19	23°12.7	86°25.2	30.6	315°53.8	37.8	21°50.4	49.1	58°13.9	17.2								
20	38°15.2	101°24.3	30.1	330°56.8	37.7	36°52.6	49.0	73°16.1	17.1								
21	53°17.6	116°23.4	.. 29.6	345°59.8	.. 37.7	51°54.8	.. 48.8	88°18.4	.. 17.0								
22	68°20.1	131°22.5	29.1	1°02.8	37.6												

DUT1 = UT1-UTC = -0.0082 sec  $\Delta T = TT-UT1 = +69.1922$  sec

2022 December 27 to Dec. 29 UT

h		Sun		Moon			
Tue	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	179°48.5	S23°20.2	126°03.0	7.8'	S17°43.3	13.3'	60.1'
1	194°48.2	20.1	140°29.8	7.9'	17°30.0	13.4'	60.1'
2	209°47.9	20.0	154°56.7	8.0'	17°16.6	13.5'	60.1'
3	224°47.6	.. 19.9	169°23.7	8.1'	17°03.1	13.6'	60.0'
4	239°47.3	19.8	183°50.8	8.2'	16°49.5	13.7'	60.0'
5	254°47.0	19.7	198°18.0	8.4'	16°35.8	13.8'	60.0'
6	269°46.6	S23°19.6	212°45.4	8.5'	S16°22.0	13.9'	59.9'
7	284°46.3	19.5	227°12.9	8.6'	16°08.2	13.9'	59.9'
8	299°46.0	19.4	241°40.5	8.7'	15°54.3	14.0'	59.9'
9	314°45.7	.. 19.3	256°08.2	8.8'	15°40.2	14.1'	59.8'
10	329°45.4	19.2	270°36.1	9.0'	15°26.2	14.2'	59.8'
11	344°45.1	19.0	285°04.0	9.1'	15°12.0	14.2'	59.8'
12	359°44.8	S23°18.9	299°32.1	9.2'	S14°57.8	14.3'	59.8'
13	14°44.5	18.8	314°00.3	9.3'	14°43.5	14.4'	59.7'
14	29°44.2	18.7	328°28.6	9.4'	14°29.1	14.4'	59.7'
15	44°43.9	.. 18.6	342°57.0	9.5'	14°14.7	14.5'	59.7'
16	59°43.6	18.5	357°25.5	9.6'	14°00.2	14.6'	59.6'
17	74°43.3	18.4	11°54.2	9.7'	13°45.6	14.6'	59.6'
18	89°43.0	S23°18.3	26°22.9	9.9'	S13°31.0	14.7'	59.6'
19	104°42.6	18.1	40°51.8	10.0'	13°16.3	14.7'	59.5'
20	119°42.3	18.0	55°20.7	10.1'	13°01.6	14.8'	59.5'
21	134°42.0	.. 17.9	69°49.8	10.2'	12°46.8	14.8'	59.5'
22	149°41.7	17.8	84°19.0	10.3'	12°32.0	14.9'	59.4'
23	164°41.4	17.7	98°48.3	10.4'	12°17.1	14.9'	59.4'
SD = 16.3'		SD = 16.4'					
Wed		SD = 16.4'					
Wed	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	179°41.1	S23°17.6	113°17.6	10.5'	S12°02.1	15.0'	59.4'
1	194°40.8	17.4	127°47.1	10.6'	11°47.2	15.0'	59.3'
2	209°40.5	17.3	142°16.7	10.7'	11°32.1	15.1'	59.3'
3	224°40.2	.. 17.2	156°46.4	10.8'	11°17.1	15.1'	59.3'
4	239°39.9	17.1	171°16.1	10.9'	11°01.9	15.2'	59.2'
5	254°39.6	17.0	185°46.0	11.0'	10°46.8	15.2'	59.2'
6	269°39.3	S23°16.8	200°16.0	11.1'	S10°31.6	15.2'	59.2'
7	284°39.0	16.7	214°46.0	11.1'	10°16.4	15.3'	59.1'
8	299°38.7	16.6	229°16.2	11.2'	10°01.1	15.3'	59.1'
9	314°38.4	.. 16.5	243°46.4	11.3'	09°45.8	15.3'	59.1'
10	329°38.1	16.3	258°16.7	11.4'	09°30.5	15.4'	59.0'
11	344°37.7	16.2	272°47.2	11.5'	09°15.1	15.4'	59.0'
12	359°37.4	S23°16.1	287°17.7	11.6'	S08°59.7	15.4'	59.0'
13	14°37.1	15.9	301°48.2	11.7'	08°44.3	15.4'	58.9'
14	29°36.8	15.8	316°18.9	11.7'	08°28.8	15.5'	58.9'
15	44°36.5	.. 15.7	330°49.6	11.8'	08°13.4	15.5'	58.9'
16	59°36.2	15.5	345°20.5	11.9'	07°57.9	15.5'	58.8'
17	74°35.9	15.4	359°51.4	12.0'	07°42.4	15.5'	58.8'
18	89°35.6	S23°15.3	14°22.4	12.1'	S07°26.8	15.5'	58.7'
19	104°35.3	15.1	28°53.4	12.1'	07°11.3	15.6'	58.7'
20	119°35.0	15.0	43°24.6	12.2'	06°55.7	15.6'	58.7'
21	134°34.7	.. 14.9	57°55.8	12.3'	06°40.1	15.6'	58.6'
22	149°34.4	14.7	72°27.0	12.3'	06°24.5	15.6'	58.6'
23	164°34.1	14.6	86°58.4	12.4'	06°08.9	15.6'	58.6'
SD = 16.3'		SD = 16.2'					
Thu		SD = 16.2'					
Thu	GHA	Dec	GHA	$\nu$	Dec	$d$	HP
0	179°33.8	S23°14.5	101°29.8	12.5'	S05°53.3	15.6'	58.5'
1	194°33.5	14.3	116°01.3	12.6'	05°37.7	15.6'	58.5'
2	209°33.2	14.2	130°32.9	12.6'	05°22.1	15.6'	58.5'
3	224°32.9	.. 14.0	145°04.5	12.7'	05°06.4	15.6'	58.4'
4	239°32.6	13.9	159°36.1	12.7'	04°50.8	15.6'	58.4'
5	254°32.3	13.8	174°07.9	12.8'	04°35.1	15.7'	58.4'
6	269°32.0	S23°13.6	188°39.7	12.9'	S04°19.5	15.7'	58.3'
7	284°31.6	13.5	203°11.6	12.9'	04°03.8	15.7'	58.3'
8	299°31.3	13.3	217°43.5	13.0'	03°48.2	15.7'	58.3'
9	314°31.0	.. 13.2	232°15.4	13.0'	03°32.5	15.7'	58.2'
10	329°30.7	13.0	246°47.5	13.1'	03°16.9	15.6'	58.2'
11	344°30.4	12.9	261°19.5	13.1'	03°01.2	15.6'	58.2'
12	359°30.1	S23°12.7	275°51.7	13.2'	S02°45.6	15.6'	58.1'
13	14°29.8	12.6	290°23.9	13.2'	02°29.9	15.6'	58.1'
14	29°29.5	12.4	304°56.1	13.3'	02°14.3	15.6'	58.0'
15	44°29.2	.. 12.3	319°28.4	13.3'	01°58.7	15.6'	58.0'
16	59°28.9	12.1	334°00.7	13.4'	01°43.1	15.6'	58.0'
17	74°28.6	12.0	348°33.1	13.4'	01°27.5	15.6'	57.9'
18	89°28.3	S23°11.8	3°05.5	13.5'	S01°11.9	15.6'	57.9'
19	104°28.0	11.7	17°37.9	13.5'	00°56.3	15.6'	57.9'
20	119°27.7	11.5	32°10.4	13.5'	00°40.8	15.5'	57.8'
21	134°27.4	.. 11.4	46°43.0	13.6'	00°25.2	15.5'	57.8'
22	149°27.1	11.2	61°15.5	13.6'	S00°09.7	15.5'	57.8'
23	164°26.8	11.1	75°48.1	13.6'	N00°05.8	15.5'	57.7'
SD = 16.3'		SD = 16.0'					

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

**December 30, 31, 01 UT (Fri., Sat., Sun.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	98°25.0	161°20.7	\$22°28.1	31°08.7	N24°37.5	97°01.4	\$00°48.5	133°25.0	S15°16.8	Alpheratz	357°36.5	29°13.1					
1	113°27.5	176°19.9	27.6	46°11.7	37.5	112°03.6	48.3	148°27.3	16.7	Ankaa	353°08.8	-42°11.2					
2	128°30.0	191°19.0	27.0	61°14.7	37.4	127°05.9	48.2	163°29.5	16.6	Schedar	349°32.9	56°40.0					
3	143°32.4	206°18.1	26.5	76°17.6	37.4	142°08.1	48.1	178°31.7	16.6	Diphda	348°49.0	-17°51.8					
4	158°34.9	221°17.2	26.0	91°20.6	37.3	157°10.3	48.0	193°33.9	16.5	Achernar	335°21.3	-57°07.5					
5	173°37.4	236°16.4	25.5	106°23.6	37.3	172°12.5	47.8	208°36.2	16.4	Hamal	327°52.9	23°34.3					
6	188°39.8	251°15.5	\$22°25.0	121°26.5	N24°37.3	187°14.7	\$00°47.7	223°38.4	S15°16.3	Polaris	314°31.1	89°21.9					
7	203°42.3	266°14.6	24.5	136°29.5	37.2	202°16.9	47.6	238°40.6	16.2	Acamar	315°12.8	-40°13.0					
8	218°44.8	281°13.7	23.9	151°32.5	37.2	217°19.1	47.5	253°42.8	16.1	Menkar	314°07.7	4°10.7					
9	233°47.2	296°12.8	23.4	166°35.4	37.1	232°21.3	47.3	268°45.1	16.1	Mirfak	308°30.3	49°56.7					
10	248°49.7	311°12.0	22.9	181°38.4	37.1	247°23.5	47.2	283°47.3	16.0	Aldebaran	290°41.2	16°33.3					
11	263°52.1	326°11.1	22.4	196°41.4	37.0	262°25.7	47.1	298°49.5	15.9	Rigel	281°05.2	-8°10.5					
12	278°54.6	341°10.2	\$22°21.9	211°44.3	N24°37.0	277°27.9	\$00°47.0	313°51.7	S15°15.8	Capella	280°23.9	46°01.3					
13	293°57.1	356°09.3	21.3	226°47.3	36.9	292°30.1	46.8	328°54.0	15.7	Bellatrix	278°24.3	6°22.2					
14	308°59.5	11°08.5	20.8	241°50.2	36.9	307°32.3	46.7	343°56.2	15.7	Elnath	278°03.6	28°37.6					
15	324°02.0	26°07.6	20.3	256°53.2	36.8	322°34.5	46.6	358°58.4	15.6	Alnilam	275°39.1	-1°11.3					
16	339°04.5	41°06.7	19.7	271°56.1	36.8	337°36.7	46.5	14°00.6	15.5	Betelgeuse	270°53.6	7°24.7					
17	354°06.9	56°05.9	19.2	286°59.1	36.7	352°38.9	46.3	29°02.8	15.4	Canopus	263°52.6	-52°42.4					
18	9°09.4	71°05.0	\$22°18.7	302°02.0	N24°36.7	7°41.1	\$00°46.2	44°05.1	S15°15.3	Sirius	258°27.4	-16°44.9					
19	24°11.9	86°04.1	18.2	317°05.0	36.6	22°43.3	46.1	59°07.3	15.3	Adhara	255°06.8	-29°00.2					
20	39°14.3	101°03.2	17.6	332°07.9	36.6	37°45.5	46.0	74°09.5	15.2	Procyon	244°52.3	5°10.0					
21	54°16.8	116°02.4	17.1	347°10.9	36.5	52°47.7	45.8	89°11.7	15.1	Pollux	243°19.0	27°58.2					
22	69°19.3	131°01.5	16.6	2°13.8	36.5	67°49.9	45.7	104°14.0	15.0	Avior	234°14.8	-59°34.8					
23	84°21.7	146°00.6	16.0	17°16.7	36.4	82°52.1	45.6	119°16.2	14.9	Suhail	222°47.2	-43°31.3					
Mer.pass. 17:23		ν -0.9' d 0.5' m -3.92	ν 3.0' d -0.0' m -1.28	ν 2.2' d 0.1' m -2.36	ν 2.2' d 0.1' m 0.85	Mer.pass. 17:20		ν -0.9' d 0.5' m -3.92	ν 2.9' d -0.0' m -1.25	ν 2.2' d 0.1' m -2.36	ν 2.2' d 0.1' m 0.86	Mer.pass. 17:20		ν -0.9' d 0.5' m -3.92	ν 2.9' d -0.0' m -1.25	ν 2.2' d 0.1' m -2.36	ν 2.2' d 0.1' m 0.86
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	99°24.2	160°59.8	\$22°15.5	32°19.7	N24°36.4	97°54.3	\$00°45.4	134°18.4	S15°14.9	Denebola	182°26.6	14°26.6					
1	114°26.6	175°58.9	14.9	47°22.6	36.3	112°56.5	45.3	149°20.6	14.8	Gienah	175°45.3	-17°40.0					
2	129°29.1	190°58.0	14.4	62°25.6	36.3	127°58.7	45.2	164°22.8	14.7	Acrua	173°01.9	-63°13.2					
3	144°31.6	205°57.2	13.9	77°28.5	36.3	143°00.9	45.1	179°25.1	14.6	Gacrux	171°53.5	-57°14.2					
4	159°34.0	220°56.3	13.3	92°31.4	36.2	158°03.1	44.9	194°27.3	14.5	Alioth	166°14.5	55°49.9					
5	174°36.5	235°55.4	12.8	107°34.4	36.2	173°05.3	44.8	209°29.5	14.4	Spica	158°24.2	-11°16.8					
6	189°39.0	250°54.6	\$22°12.2	122°37.3	N24°36.1	188°07.4	\$00°44.7	224°31.7	S15°14.4	Alkaid	152°53.5	49°11.7					
7	204°41.4	265°53.7	11.7	137°40.2	36.1	203°09.6	44.6	239°34.0	14.3	Hadar	148°38.7	-60°28.7					
8	219°43.9	280°52.8	11.1	152°43.1	36.0	218°11.8	44.4	254°36.2	14.2	Menkent	147°59.8	-36°28.7					
9	234°46.4	295°52.0	10.6	167°46.1	36.0	233°14.0	44.3	269°38.4	14.1	Arcturus	145°49.6	19°03.7					
10	249°48.8	310°51.1	10.0	182°49.0	35.9	248°16.2	44.2	284°40.6	14.0	Rigel Kent.	139°43.0	-60°55.5					
11	264°51.3	325°50.2	09.5	197°51.9	35.9	263°18.4	44.0	299°42.8	14.0	Kochab	137°20.5	74°03.4					
12	279°53.7	340°49.4	\$22°08.9	212°54.8	N24°35.8	278°20.6	\$00°43.9	314°45.1	S15°13.9	Zuben'ubi	136°58.1	-16°08.1					
13	294°56.2	355°48.5	08.4	227°57.7	35.8	293°22.8	43.8	329°47.3	13.8	Alphecca	126°05.4	26°38.1					
14	309°58.7	10°47.6	07.8	243°00.7	35.7	308°25.0	43.7	344°49.5	13.7	Antares	112°18.2	-26°28.9					
15	325°01.1	25°46.8	07.3	258°03.6	35.7	323°27.2	43.5	359°51.7	13.6	Atria	107°14.5	-69°03.9					
16	340°03.6	40°45.9	06.7	273°06.5	35.7	338°29.4	43.4	14°53.9	13.5	Sabik	102°05.0	-15°45.2					
17	355°06.1	55°45.0	06.2	288°09.4	35.6	353°31.6	43.3	29°56.2	13.5	Shaula	96°13.1	-37°07.2					
18	10°08.5	70°44.2	\$22°05.6	303°12.3	N24°35.6	8°33.8	\$00°43.1	44°58.4	S15°13.4	Rasalhague	96°00.4	12°32.6					
19	25°11.0	85°43.3	05.0	318°15.2	35.5	23°36.0	43.0	60°00.6	13.3	Eltanin	90°43.5	51°29.1					
20	40°13.5	100°42.5	04.5	333°18.1	35.5	38°38.2	42.9	75°02.8	13.2	Kaus Aust.	83°35.2	-34°22.4					
21	55°15.9	115°41.6	03.9	348°21.0	35.4	53°40.4	42.8	90°05.1	13.1	Vega	80°34.8	38°48.2					
22	70°18.4	130°40.7	03.3	3°23.9	35.4	68°42.6	42.6	105°07.3	13.1	Nunki	75°50.2	-26°16.1					
23	85°20.9	145°39.9	02.8	18°26.8	35.3	83°44.7	42.5	120°09.5	13.0	Altair	62°01.9	8°55.7					
Mer.pass. 17:20		ν -0.9' d 0.5' m -3.92	ν 2.9' d -0.0' m -1.25	ν 2.2' d 0.1' m -2.36	ν 2.2' d 0.1' m 0.86	Mer.pass. 17:20		ν -0.9' d 0.5' m -3.92	ν 2.9' d -0.0' m -1.25	ν 2.2' d 0.1' m -2.36	ν 2.2' d 0.1' m 0.86	Mer.pass. 17:20		ν -0.9' d 0.5' m -3.92	ν 2.9' d -0.0' m -1.25	ν 2.2' d 0.1' m -2.36	ν 2.2' d 0.1' m 0.86
Dec 30 Fri	SHA	Mer.pass															
Venus	62°55.7	13:15															
Mars	292°43.7	21:51															
Jupiter	358°36.4	17:29															
Saturn	35°00.0	15:04															
Dec 31 Sat	SHA	Mer.pass															
Venus	61°35.6	13:17															
Mars	292°55.5	21:46															
Jupiter	358°30.1	17:26															
Saturn	34°54.2	15:01															
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															
Horizontal parallax																	
Venus:	0.1																
Mars:	0.2																

DUT1 = UT1-UTC = -0.0085 sec  $\Delta T = TT-UT1 = +69.1925$  sec

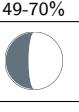
2022 December 30 to Jan. 01 UT

h	Sun			Moon			
Fri	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	179°26.5	S23°10.9	90°20.8	13.7'	N00°21.3	15.5'	57.7'
1	194°26.2	10.7	104°53.5	13.7'	00°36.8	15.4'	57.7'
2	209°25.9	10.6	119°26.2	13.7'	00°52.2	15.4'	57.6'
3	224°25.6	10.4	133°58.9	13.8'	01°07.6	15.4'	57.6'
4	239°25.3	10.3	148°31.7	13.8'	01°23.1	15.4'	57.6'
5	254°25.0	10.1	163°04.5	13.8'	01°38.4	15.4'	57.5'
6	269°24.7	S23°09.9	177°37.3	13.8'	N01°53.8	15.3'	57.5'
7	284°24.4	09.8	192°10.1	13.9'	02°09.1	15.3'	57.5'
8	299°24.1	09.6	206°43.0	13.9'	02°24.4	15.3'	57.4'
9	314°23.8	09.4	221°15.9	13.9'	02°39.7	15.2'	57.4'
10	329°23.5	09.3	235°48.8	13.9'	02°54.9	15.2'	57.4'
11	344°23.2	09.1	250°21.8	14.0'	03°10.2	15.2'	57.3'
12	359°22.9	S23°08.9	264°54.7	14.0'	N03°25.3	15.2'	57.3'
13	14°22.6	08.8	279°27.7	14.0'	03°40.5	15.1'	57.3'
14	29°22.3	08.6	294°00.7	14.0'	03°55.6	15.1'	57.2'
15	44°22.0	08.4	308°33.7	14.0'	04°10.7	15.0'	57.2'
16	59°21.7	08.3	323°06.7	14.0'	04°25.7	15.0'	57.2'
17	74°21.4	08.1	337°39.7	14.0'	04°40.7	15.0'	57.1'
18	89°21.1	S23°07.9	352°12.8	14.1'	N04°55.7	14.9'	57.1'
19	104°20.8	07.8	6°45.8	14.1'	05°10.7	14.9'	57.1'
20	119°20.5	07.6	21°18.9	14.1'	05°25.6	14.9'	57.0'
21	134°20.2	07.4	35°52.0	14.1'	05°40.4	14.8'	57.0'
22	149°19.9	07.2	50°25.0	14.1'	05°55.2	14.8'	57.0'
23	164°19.6	07.1	64°58.1	14.1'	06°10.0	14.7'	56.9'
	SD = 16.3'			SD = 15.7'			

Sat	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	179°19.3	S23°06.9	79°31.2	14.1'	N06°24.7	14.7'	56.9'
1	194°19.0	06.7	94°04.3	14.1'	06°39.4	14.6'	56.9'
2	209°18.7	06.5	108°37.4	14.1'	06°54.1	14.6'	56.9'
3	224°18.4	06.3	123°10.5	14.1'	07°08.7	14.6'	56.8'
4	239°18.1	06.2	137°43.6	14.1'	07°23.2	14.5'	56.8'
5	254°17.8	06.0	152°16.7	14.1'	07°37.7	14.5'	56.8'
6	269°17.5	S23°05.8	166°49.7	14.1'	N07°52.2	14.4'	56.7'
7	284°17.2	05.6	181°22.8	14.1'	08°06.6	14.4'	56.7'
8	299°16.9	05.4	195°55.9	14.1'	08°21.0	14.3'	56.7'
9	314°16.6	05.2	210°29.0	14.1'	08°35.3	14.3'	56.6'
10	329°16.3	05.1	225°02.0	14.1'	08°49.5	14.2'	56.6'
11	344°16.0	04.9	239°35.1	14.0'	09°03.7	14.2'	56.6'
12	359°15.7	S23°04.7	254°08.1	14.0'	N09°17.9	14.1'	56.6'
13	14°15.4	04.5	268°41.2	14.0'	09°32.0	14.0'	56.5'
14	29°15.1	04.3	283°14.2	14.0'	09°46.0	14.0'	56.5'
15	44°14.8	04.1	297°47.2	14.0'	10°00.0	13.9'	56.5'
16	59°14.5	03.9	312°20.2	14.0'	10°13.9	13.9'	56.4'
17	74°14.2	03.7	326°53.2	14.0'	10°27.8	13.8'	56.4'
18	89°13.9	S23°03.5	341°26.2	14.0'	N10°41.6	13.8'	56.4'
19	104°13.6	03.4	355°59.1	13.9'	10°55.4	13.7'	56.4'
20	119°13.3	03.2	10°32.0	13.9'	11°09.1	13.6'	56.3'
21	134°13.0	03.0	25°05.0	13.9'	11°22.7	13.6'	56.3'
22	149°12.7	02.8	39°37.9	13.9'	11°36.3	13.5'	56.3'
23	164°12.4	02.6	54°10.7	13.9'	11°49.8	13.4'	56.2'
	SD = 16.3'			SD = 15.5'			

Sun	GHA	Dec	GHA	$\nu$	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	13.2'	56.2'
3	224°11.3	01.8	112°22.0	13.8'	12°43.2	13.2'	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	13.0'	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	12.7'	55.9'
11	344°08.9	00.2	228°43.3	13.5'	14°26.6	12.6'	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°58.9	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	12.2'	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	11.8'	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'			SD = 15.3'			

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

Day	Sun		Mer.	Mer. Pass.	Moon	
	Eqn. of	Time			Pass.	Age
	00 <sup>h</sup>	12 <sup>h</sup>	mm:ss	mm:ss	hh:mm	7-9
30	02:14	02:28	12:02	18:32	06:10	
31	02:43	02:57	12:03	19:17	06:54	
01	03:11	03:26	12:03	20:02	07:39	

### Conversion of Arc to Time

0° - 59°			60° - 119°			120° - 179°			180° - 239°			240° - 299°			300° - 360°			0' - 59'			0" - 59"	
°	h	m	°	h	m	°	h	m	°	h	m	°	h	m	°	h	m	'	m	s	"	s
0	0	00	60	4	00	120	8	00	180	12	00	240	16	00	300	20	00	0	0	00	0	0.00
1	0	04	61	4	04	121	8	04	181	12	04	241	16	04	301	20	04	1	0	04	1	0.07
2	0	08	62	4	08	122	8	08	182	12	08	242	16	08	302	20	08	2	0	08	2	0.13
3	0	12	63	4	12	123	8	12	183	12	12	243	16	12	303	20	12	3	0	12	3	0.20
4	0	16	64	4	16	124	8	16	184	12	16	244	16	16	304	20	16	4	0	16	4	0.27
5	0	20	65	4	20	125	8	20	185	12	20	245	16	20	305	20	20	5	0	20	5	0.33
6	0	24	66	4	24	126	8	24	186	12	24	246	16	24	306	20	24	6	0	24	6	0.40
7	0	28	67	4	28	127	8	28	187	12	28	247	16	28	307	20	28	7	0	28	7	0.47
8	0	32	68	4	32	128	8	32	188	12	32	248	16	32	308	20	32	8	0	32	8	0.53
9	0	36	69	4	36	129	8	36	189	12	36	249	16	36	309	20	36	9	0	36	9	0.60
10	0	40	70	4	40	130	8	40	190	12	40	250	16	40	310	20	40	10	0	40	10	0.67
11	0	44	71	4	44	131	8	44	191	12	44	251	16	44	311	20	44	11	0	44	11	0.73
12	0	48	72	4	48	132	8	48	192	12	48	252	16	48	312	20	48	12	0	48	12	0.80
13	0	52	73	4	52	133	8	52	193	12	52	253	16	52	313	20	52	13	0	52	13	0.87
14	0	56	74	4	56	134	8	56	194	12	56	254	16	56	314	20	56	14	0	56	14	0.93
15	1	00	75	5	00	135	9	00	195	13	00	255	17	00	315	21	00	15	1	00	15	1.00
16	1	04	76	5	04	136	9	04	196	13	04	256	17	04	316	21	04	16	1	04	16	1.07
17	1	08	77	5	08	137	9	08	197	13	08	257	17	08	317	21	08	17	1	08	17	1.13
18	1	12	78	5	12	138	9	12	198	13	12	258	17	12	318	21	12	18	1	12	18	1.20
19	1	16	79	5	16	139	9	16	199	13	16	259	17	16	319	21	16	19	1	16	19	1.27
20	1	20	80	5	20	140	9	20	200	13	20	260	17	20	320	21	20	20	1	20	20	1.33
21	1	24	81	5	24	141	9	24	201	13	24	261	17	24	321	21	24	21	1	24	21	1.40
22	1	28	82	5	28	142	9	28	202	13	28	262	17	28	322	21	28	22	1	28	22	1.47
23	1	32	83	5	32	143	9	32	203	13	32	263	17	32	323	21	32	23	1	32	23	1.53
24	1	36	84	5	36	144	9	36	204	13	36	264	17	36	324	21	36	24	1	36	24	1.60
25	1	40	85	5	40	145	9	40	205	13	40	265	17	40	325	21	40	25	1	40	25	1.67
26	1	44	86	5	44	146	9	44	206	13	44	266	17	44	326	21	44	26	1	44	26	1.73
27	1	48	87	5	48	147	9	48	207	13	48	267	17	48	327	21	48	27	1	48	27	1.80
28	1	52	88	5	52	148	9	52	208	13	52	268	17	52	328	21	52	28	1	52	28	1.87
29	1	56	89	5	56	149	9	56	209	13	56	269	17	56	329	21	56	29	1	56	29	1.93
30	2	00	90	6	00	150	10	00	210	14	00	270	18	00	330	22	00	30	2	00	30	2.00
31	2	04	91	6	04	151	10	04	211	14	04	271	18	04	331	22	04	31	2	04	31	2.07
32	2	08	92	6	08	152	10	08	212	14	08	272	18	08	332	22	08	32	2	08	32	2.13
33	2	12	93	6	12	153	10	12	213	14	12	273	18	12	333	22	12	33	2	12	33	2.20
34	2	16	94	6	16	154	10	16	214	14	16	274	18	16	334	22	16	34	2	16	34	2.27
35	2	20	95	6	20	155	10	20	215	14	20	275	18	20	335	22	20	35	2	20	35	2.33
36	2	24	96	6	24	156	10	24	216	14	24	276	18	24	336	22	24	36	2	24	36	2.40
37	2	28	97	6	28	157	10	28	217	14	28	277	18	28	337	22	28	37	2	28	37	2.47
38	2	32	98	6	32	158	10	32	218	14	32	278	18	32	338	22	32	38	2	32	38	2.53
39	2	36	99	6	36	159	10	36	219	14	36	279	18	36	339	22	36	39	2	36	39	2.60
40	2	40	100	6	40	160	10	40	220	14	40	280	18	40	340	22	40	40	2	40	40	2.67
41	2	44	101	6	44	161	10	44	221	14	44	281	18	44	341	22	44	41	2	44	41	2.73
42	2	48	102	6	48	162	10	48	222	14	48	282	18	48	342	22	48	42	2	48	42	2.80
43	2	52	103	6	52	163	10	52	223	14	52	283	18	52	343	22	52	43	2	52	43	2.87
44	2	56	104	6	56	164	10	56	224	14	56	284	18	56	344	22	56	44	2	56	44	2.93
45	3	00	105	7	00	165	11	00	225	15	00	285	19	00	345	23	00	45	3	00	45	3.00
46	3	04	106	7	04	166	11	04	226	15	04	286	19	04	346	23	04	46	3	04	46	3.07
47	3	08	107	7	08	167	11	08	227	15	08	287	19	08	347	23	08	47	3	08	47	3.13
48	3	12	108	7	12	168	11	12	228	15	12	288	19	12	348	23	12	48	3	12	48	3.20
49	3	16	109	7	16	169	11	16	229	15	16	289	19	16	349	23	16	49	3	16	49	3.27
50	3	20	110	7	20	170	11	20	230	15	20	290	19	20	350	23	20	50	3	20	50	3.33
51	3	24	111	7	24	171	11	24	231	15	24	291	19	24	351	23	24	51	3	24	51	3.40
52	3	28	112	7	28	172	11	28	232	15	28	292	19	28	352	23	28	52	3	28	52	3.47
53	3	32	113	7	32	173	11	32	233	15	32	293	19	32	353	23	32	53	3	32	53	3.53
54	3	36	114	7	36	174	11	36	234	15	36	294	19	36	354	23	36	54	3	36	54	3.60
55	3	40	115	7	40	175	11	40	235	15	40	295	19	40	355	23	40	55	3	40	55	3.67
56	3	44	116	7	44	176	11	44	236	15	44	296	19	44	356	23	44	56	3	44	56	3.73
57	3	48	117	7	48	177	11	48	237	15	48	297	19	48	357	23	48	57	3	48	57	3.80
58	3	52	118	7	52	178	11	52	238	15	52	298	19	52	358	23	52	58	3	52	58	3.87
59	3	56	119	7	56	179	11	56	239	15	56	299	19	56	359	23	56	59	3	56	59	3.93
60	4	00	120	8	00	180	12	00	240	16	00	300	20	00	360	24	00	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			m 1	Sun Plan.	Aries	Moon	v and d corr			m 2	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	0	0°15.0	0°15.0	0°14.3	0.0 - 0.0	6.0 - 0.2	12.0 - 0.3	0	0°30.0	0°30.1	0°28.6	0.0 - 0.0	6.0 - 0.3	12.0 - 0.5
1	0°00.3	0°00.3	0°00.2	0.1 - 0.0	6.1 - 0.1	12.1 - 0.1	1	0°15.3	0°15.3	0°14.6	0.1 - 0.0	6.1 - 0.2	12.1 - 0.3	1	0°30.3	0°30.3	0°28.9	0.1 - 0.0	6.1 - 0.3	12.1 - 0.5
2	0°00.5	0°00.5	0°00.5	0.2 - 0.0	6.2 - 0.1	12.2 - 0.1	2	0°15.5	0°15.5	0°14.8	0.2 - 0.0	6.2 - 0.2	12.2 - 0.3	2	0°30.5	0°30.6	0°29.1	0.2 - 0.0	6.2 - 0.3	12.2 - 0.5
3	0°00.8	0°00.8	0°00.7	0.3 - 0.0	6.3 - 0.1	12.3 - 0.1	3	0°15.8	0°15.8	0°15.0	0.3 - 0.0	6.3 - 0.2	12.3 - 0.3	3	0°30.7	0°30.8	0°29.3	0.3 - 0.0	6.3 - 0.3	12.3 - 0.5
4	0°01.0	0°01.0	0°01.0	0.4 - 0.0	6.4 - 0.1	12.4 - 0.1	4	0°16.0	0°16.0	0°15.3	0.4 - 0.0	6.4 - 0.2	12.4 - 0.3	4	0°31.0	0°31.1	0°29.6	0.4 - 0.0	6.4 - 0.3	12.4 - 0.5
5	0°01.3	0°01.3	0°01.2	0.5 - 0.0	6.5 - 0.1	12.5 - 0.1	5	0°16.3	0°16.3	0°15.5	0.5 - 0.0	6.5 - 0.2	12.5 - 0.3	5	0°31.3	0°31.3	0°29.8	0.5 - 0.0	6.5 - 0.3	12.5 - 0.5
6	0°01.5	0°01.5	0°01.4	0.6 - 0.0	6.6 - 0.1	12.6 - 0.1	6	0°16.5	0°16.5	0°15.7	0.6 - 0.0	6.6 - 0.2	12.6 - 0.3	6	0°31.5	0°31.6	0°30.1	0.6 - 0.0	6.6 - 0.3	12.6 - 0.5
7	0°01.8	0°01.8	0°01.7	0.7 - 0.0	6.7 - 0.1	12.7 - 0.1	7	0°16.8	0°16.8	0°16.0	0.7 - 0.0	6.7 - 0.2	12.7 - 0.3	7	0°31.8	0°31.8	0°30.3	0.7 - 0.0	6.7 - 0.3	12.7 - 0.5
8	0°02.0	0°02.0	0°01.9	0.8 - 0.0	6.8 - 0.1	12.8 - 0.1	8	0°17.0	0°17.0	0°16.2	0.8 - 0.0	6.8 - 0.2	12.8 - 0.3	8	0°32.0	0°32.1	0°30.5	0.8 - 0.0	6.8 - 0.3	12.8 - 0.5
9	0°02.3	0°02.3	0°02.1	0.9 - 0.0	6.9 - 0.1	12.9 - 0.1	9	0°17.3	0°17.3	0°16.5	0.9 - 0.0	6.9 - 0.2	12.9 - 0.3	9	0°32.3	0°32.3	0°30.8	0.9 - 0.0	6.9 - 0.3	12.9 - 0.5
10	0°02.5	0°02.5	0°02.4	1.0 - 0.0	7.0 - 0.1	13.0 - 0.1	10	0°17.5	0°17.5	0°16.7	1.0 - 0.0	7.0 - 0.2	13.0 - 0.3	10	0°32.5	0°32.6	0°31.0	1.0 - 0.0	7.0 - 0.3	13.0 - 0.5
11	0°02.8	0°02.8	0°02.6	1.1 - 0.0	7.1 - 0.1	13.1 - 0.1	11	0°17.8	0°17.8	0°16.9	1.1 - 0.0	7.1 - 0.2	13.1 - 0.3	11	0°32.8	0°32.8	0°31.3	1.1 - 0.0	7.1 - 0.3	13.1 - 0.5
12	0°03.0	0°03.0	0°02.9	1.2 - 0.0	7.2 - 0.1	13.2 - 0.1	12	0°18.0	0°18.0	0°17.2	1.2 - 0.0	7.2 - 0.2	13.2 - 0.3	12	0°33.0	0°33.1	0°31.5	1.2 - 0.1	7.2 - 0.3	13.2 - 0.5
13	0°03.3	0°03.3	0°03.1	1.3 - 0.0	7.3 - 0.1	13.3 - 0.1	13	0°18.3	0°18.3	0°17.4	1.3 - 0.0	7.3 - 0.2	13.3 - 0.3	13	0°33.3	0°33.3	0°31.7	1.3 - 0.1	7.3 - 0.3	13.3 - 0.6
14	0°03.5	0°03.5	0°03.3	1.4 - 0.0	7.4 - 0.1	13.4 - 0.1	14	0°18.5	0°18.6	0°17.7	1.4 - 0.0	7.4 - 0.2	13.4 - 0.3	14	0°33.5	0°33.6	0°32.0	1.4 - 0.1	7.4 - 0.3	13.4 - 0.6
15	0°03.8	0°03.8	0°03.6	1.5 - 0.0	7.5 - 0.1	13.5 - 0.1	15	0°18.8	0°18.8	0°17.9	1.5 - 0.0	7.5 - 0.2	13.5 - 0.3	15	0°33.8	0°33.8	0°32.2	1.5 - 0.1	7.5 - 0.3	13.5 - 0.6
16	0°04.0	0°04.0	0°03.8	1.6 - 0.0	7.6 - 0.1	13.6 - 0.1	16	0°19.0	0°19.1	0°18.1	1.6 - 0.0	7.6 - 0.2	13.6 - 0.3	16	0°34.0	0°34.1	0°32.5	1.6 - 0.1	7.6 - 0.3	13.6 - 0.6
17	0°04.3	0°04.3	0°04.1	1.7 - 0.0	7.7 - 0.1	13.7 - 0.1	17	0°19.3	0°19.3	0°18.4	1.7 - 0.0	7.7 - 0.2	13.7 - 0.3	17	0°34.3	0°34.3	0°32.7	1.7 - 0.1	7.7 - 0.3	13.7 - 0.6
18	0°04.5	0°04.5	0°04.3	1.8 - 0.0	7.8 - 0.1	13.8 - 0.1	18	0°19.5	0°19.6	0°18.6	1.8 - 0.0	7.8 - 0.2	13.8 - 0.3	18	0°34.5	0°34.6	0°32.9	1.8 - 0.1	7.8 - 0.3	13.8 - 0.6
19	0°04.8	0°04.8	0°04.5	1.9 - 0.0	7.9 - 0.1	13.9 - 0.1	19	0°19.8	0°19.8	0°18.9	1.9 - 0.0	7.9 - 0.2	13.9 - 0.3	19	0°34.8	0°34.8	0°33.2	1.9 - 0.1	7.9 - 0.3	13.9 - 0.6
20	0°05.0	0°05.0	0°04.8	2.0 - 0.0	8.0 - 0.1	14.0 - 0.1	20	0°20.0	0°20.1	0°19.1	2.0 - 0.1	8.0 - 0.2	14.0 - 0.4	20	0°35.0	0°35.1	0°33.4	2.0 - 0.1	8.0 - 0.3	14.0 - 0.6
21	0°05.3	0°05.3	0°05.0	2.1 - 0.0	8.1 - 0.1	14.1 - 0.1	21	0°20.3	0°20.3	0°19.3	2.1 - 0.1	8.1 - 0.2	14.1 - 0.4	21	0°35.3	0°35.3	0°33.6	2.1 - 0.1	8.1 - 0.3	14.1 - 0.6
22	0°05.5	0°05.5	0°05.2	2.2 - 0.0	8.2 - 0.1	14.2 - 0.1	22	0°20.5	0°20.6	0°19.6	2.2 - 0.1	8.2 - 0.2	14.2 - 0.4	22	0°35.5	0°35.6	0°33.9	2.2 - 0.1	8.2 - 0.3	14.2 - 0.6
23	0°05.8	0°05.8	0°05.5	2.3 - 0.0	8.3 - 0.1	14.3 - 0.1	23	0°20.8	0°20.8	0°19.8	2.3 - 0.1	8.3 - 0.2	14.3 - 0.4	23	0°35.8	0°35.8	0°34.1	2.3 - 0.1	8.3 - 0.3	14.3 - 0.6
24	0°06.0	0°06.0	0°05.7	2.4 - 0.0	8.4 - 0.1	14.4 - 0.1	24	0°21.0	0°21.1	0°20.0	2.4 - 0.1	8.4 - 0.2	14.4 - 0.4	24	0°36.0	0°36.1	0°34.4	2.4 - 0.1	8.4 - 0.3	14.4 - 0.6
25	0°06.3	0°06.3	0°06.0	2.5 - 0.0	8.5 - 0.1	14.5 - 0.1	25	0°21.3	0°21.3	0°20.3	2.5 - 0.1	8.5 - 0.2	14.5 - 0.4	25	0°36.3	0°36.3	0°34.6	2.5 - 0.1	8.5 - 0.4	14.5 - 0.6
26	0°06.5	0°06.5	0°06.2	2.6 - 0.0	8.6 - 0.1	14.6 - 0.1	26	0°21.5	0°21.6	0°20.5	2.6 - 0.1	8.6 - 0.2	14.6 - 0.4	26	0°36.5	0°36.6	0°34.8	2.6 - 0.1	8.6 - 0.4	14.6 - 0.6
27	0°06.8	0°06.8	0°06.4	2.7 - 0.0	8.7 - 0.1	14.7 - 0.1	27	0°21.8	0°21.8	0°20.8	2.7 - 0.1	8.7 - 0.2	14.7 - 0.4	27	0°36.8	0°36.9	0°35.1	2.7 - 0.1	8.7 - 0.4	14.7 - 0.6
28	0°07.0	0°07.0	0°06.7	2.8 - 0.0	8.8 - 0.1	14.8 - 0.1	28	0°22.0	0°22.1	0°21.0	2.8 - 0.1	8.8 - 0.2	14.8 - 0.4	28	0°37.0	0°37.1	0°35.3	2.8 - 0.1	8.8 - 0.4	14.8 - 0.6
29	0°07.3	0°07.3	0°06.9	2.9 - 0.0	8.9 - 0.1	14.9 - 0.1	29	0°22.3	0°22.3	0°21.2	2.9 - 0.1	8.9 - 0.2	14.9 - 0.4	29	0°37.3	0°37.4	0°35.6	2.9 - 0.1	8.9 - 0.4	14.9 - 0.6
30	0°07.5	0°07.5	0°07.2	3.0 - 0.0	9.0 - 0.1	15.0 - 0.1	30	0°22.5	0°22.6	0°21.5	3.0 - 0.1	9.0 - 0.2	15.0 - 0.4	30	0°37.5	0°37.6	0°35.8	3.0 - 0.1	9.0 - 0.4	15.0 - 0.6
31	0°07.8	0°07.8	0°07.4	3.1 - 0.0	9.1 - 0.1	15.1 - 0.1	31	0°22.8	0°22.8	0°21.7	3.1 - 0.1	9.1 - 0.2	15.1 - 0.4	31	0°37.8	0°37.9	0°36.0	3.1 - 0.1	9.1 - 0.4	15.1 - 0.6
32	0°08.0	0°08.0	0°07.6	3.2 - 0.0	9.2 - 0.1	15.2 - 0.1	32	0°23.0	0°23.1	0°22.0	3.2 - 0.1	9.2 - 0.2	15.2 - 0.4	32	0°38.0	0°38.1	0°36.3	3.2 - 0.1	9.2 - 0.4	15.2 - 0.6
33	0°08.3	0°08.3	0°07.9	3.3 - 0.0	9.3 - 0.1	15.3 - 0.1	33	0°23.3	0°23.3	0°22.3	3.3 - 0.1	9.3 - 0.2	15.3 - 0.4	33	0°38.3	0°38.4	0°36.5	3.3 - 0.1	9.3 - 0.4	15.3 - 0.6
34	0°08.5	0°08.5	0°08.1	3.4 - 0.0	9.4 - 0.1	15.4 - 0.1	34	0°23.5	0°23.6	0°22.4	3.4 - 0.1	9.4 - 0.2	15.4 - 0.4	34	0°38.5	0°38.6	0°36.7	3.4 - 0.1	9.4 - 0.4	15.4 - 0.6
35	0°08.8	0°08.8	0°08.4	3.5 - 0.0	9.5 - 0.1	15.5 - 0.1	35	0°23.8	0°23.8	0°22.7	3.5 - 0.1	9.5 - 0.2	15.5 - 0.4	35	0°38.8	0°38.9	0°37.0	3.5 - 0.1	9.5 - 0.4	15.5 - 0.6
36	0°09.0	0°09.0	0°08.6	3.6 - 0.0	9.6 - 0.1	15.6 - 0.1	36	0°24.0	0°24.1	0°22.9	3.6 - 0.1	9.6 - 0.2	15.6 - 0.4	36	0°39.0	0°39.1	0°37.2	3.6 - 0.1	9.6 - 0.4	15.6 - 0.6
37	0°09.3	0°09.3	0°08.8	3.7 - 0.0	9.7 - 0.1	15.7 - 0.1	37	0°24.3	0°24.3	0°23.1	3.7 - 0.1	9.7 - 0.2	15.7 - 0.4	37	0°39.3	0°39.4	0°37.5	3.7 - 0.2	9.7 - 0.4	15.7 - 0.7
38	0°09.5	0°09.5	0°09.1	3.8 - 0.0	9.8 - 0.1	15.8 - 0.1	38	0°24.5	0°24.6	0°23.4	3.8 - 0.1	9.8 - 0.2	15.8 - 0.4	38	0°39.5	0°39.6	0°37.7	3.8 - 0.2	9.8 - 0.4	15.8 - 0.7
39	0°09.8	0°09.8	0°09.3	3.9 - 0.0	9.9 - 0.1	15.9 - 0.1	39	0°24.8	0°24.8	0°23.6	3.9 - 0.1	9.9 - 0.2	15.9 - 0.4	39	0°39.8	0°39.9	0°37.9	3.9 - 0.2	9.9 - 0.4	15.9 - 0.7
40	0°10.0	0°10.0	0°09.5	4.0 - 0.0	10.0 - 0.1	16.0 - 0.1	40	0°25.0	0°25.1	0°23.9	4.0 - 0.1	10.0 - 0.3	16.0 - 0.4	40	0°40.0	0°40.1	0°38.2	4.0 - 0.2	10.0 - 0.4	16.0 - 0.7
41	0°10.3	0°10.3	0°09.8	4.1 - 0.0	10.1 - 0.1	16.1 - 0.1	41	0°25.3	0°25.3	0°24.1	4.1 - 0.1	10.1 - 0.3	16.1 - 0.4	41	0°40.3	0°40.4	0°38.4	4.1 - 0.2	10.1 - 0.4	16.1 - 0.7
42	0°10.5	0°10.5	0°10.0	4.2 - 0.0	10.2 - 0.1	16.2 - 0.1	42	0°25.5	0°25.6	0°24.3	4.2 - 0.1	10.2 - 0.3	16.2 - 0.4	42	0°40.5	0°40.6	0°38.7	4.2 - 0.2	10.2 - 0.4	16.2 - 0.7
43	0°10.8	0°10.8	0°10.3	4.3 - 0.0	10.3 - 0.1	16.3 - 0.1	43	0°25.8	0°25.8											

## Increments and Corrections

m 3	Sun Plan.	Aries	Moon	v and d corr				m 4	Sun Plan.	Aries	Moon	v and d corr				m 5	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		0	1°00.0	1°00.2	0°57.3	0.0 - 0.0	6.0 - 0.4	12.0 - 0.9		0	1°15.0	1°15.2	1°11.6	0.0 - 0.0	6.0 - 0.5	12.0 - 1.1	
1	0°45.3	0°45.4	0°43.2	0.1 - 0.0	6.1 - 0.4	12.1 - 0.7		1	1°00.2	1°00.4	0°57.5	0.1 - 0.0	6.1 - 0.5	12.1 - 0.9		1	1°15.3	1°15.5	1°11.8	0.1 - 0.0	6.1 - 0.6	12.1 - 1.1	
2	0°45.5	0°45.6	0°43.4	0.2 - 0.0	6.2 - 0.4	12.2 - 0.7		2	1°00.5	1°00.7	0°57.7	0.2 - 0.0	6.2 - 0.5	12.2 - 0.9		2	1°15.5	1°15.7	1°12.1	0.2 - 0.0	6.2 - 0.6	12.2 - 1.1	
3	0°45.8	0°45.9	0°43.7	0.3 - 0.0	6.3 - 0.4	12.3 - 0.7		3	1°00.7	1°00.9	0°58.0	0.3 - 0.0	6.3 - 0.5	12.3 - 0.9		3	1°15.7	1°16.0	1°12.3	0.3 - 0.0	6.3 - 0.6	12.3 - 1.1	
4	0°46.0	0°46.1	0°43.9	0.4 - 0.0	6.4 - 0.4	12.4 - 0.7		4	1°01.0	1°01.2	0°58.2	0.4 - 0.0	6.4 - 0.5	12.4 - 0.9		4	1°16.0	1°16.2	1°12.5	0.4 - 0.0	6.4 - 0.6	12.4 - 1.1	
5	0°46.3	0°46.4	0°44.1	0.5 - 0.0	6.5 - 0.4	12.5 - 0.7		5	1°01.2	1°01.4	0°58.5	0.5 - 0.0	6.5 - 0.5	12.5 - 0.9		5	1°16.2	1°16.5	1°12.8	0.5 - 0.0	6.5 - 0.6	12.5 - 1.1	
6	0°46.5	0°46.6	0°44.4	0.6 - 0.0	6.6 - 0.4	12.6 - 0.7		6	1°01.5	1°01.7	0°58.7	0.6 - 0.0	6.6 - 0.5	12.6 - 0.9		6	1°16.5	1°16.7	1°13.0	0.6 - 0.1	6.6 - 0.6	12.6 - 1.2	
7	0°46.8	0°46.9	0°44.6	0.7 - 0.0	6.7 - 0.4	12.7 - 0.7		7	1°01.7	1°01.9	0°58.9	0.7 - 0.1	6.7 - 0.5	12.7 - 1.0		7	1°16.7	1°17.0	1°13.3	0.7 - 0.1	6.7 - 0.6	12.7 - 1.2	
8	0°47.0	0°47.1	0°44.9	0.8 - 0.0	6.8 - 0.4	12.8 - 0.7		8	1°02.0	1°02.2	0°59.2	0.8 - 0.1	6.8 - 0.5	12.8 - 1.0		8	1°17.0	1°17.2	1°13.5	0.8 - 0.1	6.8 - 0.6	12.8 - 1.2	
9	0°47.3	0°47.4	0°45.1	0.9 - 0.1	6.9 - 0.4	12.9 - 0.8		9	1°02.3	1°02.4	0°59.4	0.9 - 0.1	6.9 - 0.5	12.9 - 1.0		9	1°17.3	1°17.5	1°13.7	0.9 - 0.1	6.9 - 0.6	12.9 - 1.2	
10	0°47.5	0°47.6	0°45.3	1.0 - 0.1	7.0 - 0.4	13.0 - 0.8		10	1°02.5	1°02.7	0°59.7	1.0 - 0.1	7.0 - 0.5	13.0 - 1.0		10	1°17.5	1°17.7	1°14.0	1.0 - 0.1	7.0 - 0.6	13.0 - 1.2	
11	0°47.8	0°47.9	0°45.6	1.1 - 0.1	7.1 - 0.4	13.1 - 0.8		11	1°02.8	1°02.9	0°59.9	1.1 - 0.1	7.1 - 0.5	13.1 - 1.0		11	1°17.8	1°18.0	1°14.2	1.1 - 0.1	7.1 - 0.7	13.1 - 1.2	
12	0°48.0	0°48.1	0°45.8	1.2 - 0.1	7.2 - 0.4	13.2 - 0.8		12	1°03.0	1°03.2	1°00.1	1.2 - 0.1	7.2 - 0.5	13.2 - 1.0		12	1°18.0	1°18.2	1°14.4	1.2 - 0.1	7.2 - 0.7	13.2 - 1.2	
13	0°48.3	0°48.4	0°46.1	1.3 - 0.1	7.3 - 0.4	13.3 - 0.8		13	1°03.3	1°03.4	1°00.4	1.3 - 0.1	7.3 - 0.5	13.3 - 1.0		13	1°18.3	1°18.5	1°14.7	1.3 - 0.1	7.3 - 0.7	13.3 - 1.2	
14	0°48.5	0°48.6	0°46.3	1.4 - 0.1	7.4 - 0.4	13.4 - 0.8		14	1°03.5	1°03.7	1°00.6	1.4 - 0.1	7.4 - 0.6	13.4 - 1.0		14	1°18.5	1°18.7	1°14.9	1.4 - 0.1	7.4 - 0.7	13.4 - 1.2	
15	0°48.8	0°48.9	0°46.5	1.5 - 0.1	7.5 - 0.4	13.5 - 0.8		15	1°03.8	1°03.9	1°00.8	1.5 - 0.1	7.5 - 0.6	13.5 - 1.0		15	1°18.8	1°19.0	1°15.2	1.5 - 0.1	7.5 - 0.7	13.5 - 1.2	
16	0°49.0	0°49.1	0°46.8	1.6 - 0.1	7.6 - 0.4	13.6 - 0.8		16	1°04.0	1°04.2	1°01.1	1.6 - 0.1	7.6 - 0.6	13.6 - 1.0		16	1°19.0	1°19.2	1°15.4	1.6 - 0.1	7.6 - 0.7	13.6 - 1.2	
17	0°49.3	0°49.4	0°47.0	1.7 - 0.1	7.7 - 0.4	13.7 - 0.8		17	1°04.2	1°04.4	1°01.3	1.7 - 0.1	7.7 - 0.6	13.7 - 1.0		17	1°19.3	1°19.5	1°15.6	1.7 - 0.2	7.7 - 0.7	13.7 - 1.3	
18	0°49.5	0°49.6	0°47.2	1.8 - 0.1	7.8 - 0.5	13.8 - 0.8		18	1°04.5	1°04.7	1°01.6	1.8 - 0.1	7.8 - 0.6	13.8 - 1.0		18	1°19.5	1°19.7	1°15.9	1.8 - 0.2	7.8 - 0.7	13.8 - 1.3	
19	0°49.8	0°49.9	0°47.5	1.9 - 0.1	7.9 - 0.5	13.9 - 0.8		19	1°04.7	1°04.9	1°01.8	1.9 - 0.1	7.9 - 0.6	13.9 - 1.0		19	1°19.7	1°20.0	1°16.1	1.9 - 0.2	7.9 - 0.7	13.9 - 1.3	
20	0°50.0	0°50.1	0°47.7	2.0 - 0.1	8.0 - 0.5	14.0 - 0.8		20	1°05.0	1°05.2	1°02.0	2.0 - 0.1	8.0 - 0.6	14.0 - 1.1		20	1°20.0	1°20.2	1°16.4	2.0 - 0.2	8.0 - 0.7	14.0 - 1.3	
21	0°50.3	0°50.4	0°48.0	2.1 - 0.1	8.1 - 0.5	14.1 - 0.8		21	1°05.2	1°05.4	1°02.3	2.1 - 0.2	8.1 - 0.6	14.1 - 1.1		21	1°20.2	1°20.5	1°16.6	2.1 - 0.2	8.1 - 0.7	14.1 - 1.3	
22	0°50.5	0°50.6	0°48.2	2.2 - 0.1	8.2 - 0.5	14.2 - 0.8		22	1°05.5	1°05.7	1°02.5	2.2 - 0.2	8.2 - 0.6	14.2 - 1.1		22	1°20.5	1°20.7	1°16.8	2.2 - 0.2	8.2 - 0.8	14.2 - 1.3	
23	0°50.8	0°50.9	0°48.4	2.3 - 0.1	8.3 - 0.5	14.3 - 0.8		23	1°05.8	1°05.9	1°02.8	2.3 - 0.2	8.3 - 0.6	14.3 - 1.1		23	1°20.8	1°21.0	1°17.1	2.3 - 0.2	8.3 - 0.8	14.3 - 1.3	
24	0°51.0	0°51.1	0°48.7	2.4 - 0.1	8.4 - 0.5	14.4 - 0.8		24	1°06.0	1°06.2	1°03.0	2.4 - 0.2	8.4 - 0.6	14.4 - 1.1		24	1°21.0	1°21.2	1°17.3	2.4 - 0.2	8.4 - 0.8	14.4 - 1.3	
25	0°51.3	0°51.4	0°48.9	2.5 - 0.1	8.5 - 0.5	14.5 - 0.8		25	1°06.3	1°06.4	1°03.2	2.5 - 0.2	8.5 - 0.6	14.5 - 1.1		25	1°21.3	1°21.5	1°17.5	2.5 - 0.2	8.5 - 0.8	14.5 - 1.3	
26	0°51.5	0°51.6	0°49.2	2.6 - 0.2	8.6 - 0.5	14.6 - 0.9		26	1°06.5	1°06.7	1°03.5	2.6 - 0.2	8.6 - 0.6	14.6 - 1.1		26	1°21.5	1°21.7	1°17.8	2.6 - 0.2	8.6 - 0.8	14.6 - 1.3	
27	0°51.8	0°51.9	0°49.4	2.7 - 0.2	8.7 - 0.5	14.7 - 0.9		27	1°06.8	1°06.9	1°03.7	2.7 - 0.2	8.7 - 0.7	14.7 - 1.1		27	1°21.8	1°22.0	1°18.0	2.7 - 0.2	8.7 - 0.8	14.7 - 1.3	
28	0°52.0	0°52.1	0°49.6	2.8 - 0.2	8.8 - 0.5	14.8 - 0.9		28	1°07.0	1°07.2	1°03.9	2.8 - 0.2	8.8 - 0.7	14.8 - 1.1		28	1°22.0	1°22.2	1°18.3	2.8 - 0.3	8.8 - 0.8	14.8 - 1.4	
29	0°52.3	0°52.4	0°49.9	2.9 - 0.2	8.9 - 0.5	14.9 - 0.9		29	1°07.3	1°07.4	1°04.2	2.9 - 0.2	8.9 - 0.7	14.9 - 1.1		29	1°22.3	1°22.5	1°18.5	2.9 - 0.3	8.9 - 0.8	14.9 - 1.4	
30	0°52.5	0°52.6	0°50.1	3.0 - 0.2	9.0 - 0.5	15.0 - 0.9		30	1°07.5	1°07.7	1°04.4	3.0 - 0.2	9.0 - 0.7	15.0 - 1.1		30	1°22.5	1°22.7	1°18.7	3.0 - 0.3	9.0 - 0.8	15.0 - 1.4	
31	0°52.8	0°52.9	0°50.3	3.1 - 0.2	9.1 - 0.5	15.1 - 0.9		31	1°07.7	1°07.9	1°04.7	3.1 - 0.2	9.1 - 0.7	15.1 - 1.1		31	1°22.8	1°23.0	1°19.0	3.1 - 0.3	9.1 - 0.8	15.1 - 1.4	
32	0°53.0	0°53.1	0°50.6	3.2 - 0.2	9.2 - 0.5	15.2 - 0.9		32	1°08.0	1°08.2	1°04.9	3.2 - 0.2	9.2 - 0.7	15.2 - 1.1		32	1°23.0	1°23.2	1°19.2	3.2 - 0.3	9.2 - 0.8	15.2 - 1.4	
33	0°53.3	0°53.4	0°50.8	3.3 - 0.2	9.3 - 0.5	15.3 - 0.9		33	1°08.2	1°08.4	1°05.1	3.3 - 0.2	9.3 - 0.7	15.3 - 1.1		33	1°23.2	1°23.5	1°19.5	3.3 - 0.3	9.3 - 0.9	15.3 - 1.4	
34	0°53.5	0°53.6	0°51.1	3.4 - 0.2	9.4 - 0.5	15.4 - 0.9		34	1°08.5	1°08.7	1°05.4	3.4 - 0.3	9.4 - 0.7	15.4 - 1.2		34	1°23.5	1°23.7	1°19.7	3.4 - 0.3	9.4 - 0.9	15.4 - 1.4	
35	0°53.8	0°53.9	0°51.3	3.5 - 0.2	9.5 - 0.6	15.5 - 0.9		35	1°08.7	1°08.9	1°05.6	3.5 - 0.3	9.5 - 0.7	15.5 - 1.2		35	1°23.7	1°24.0	1°19.9	3.5 - 0.3	9.5 - 0.9	15.5 - 1.4	
36	0°54.0	0°54.1	0°51.5	3.6 - 0.2	9.6 - 0.6	15.6 - 0.9		36	1°09.0	1°09.2	1°05.9	3.6 - 0.3	9.6 - 0.7	15.6 - 1.2		36	1°24.0	1°24.2	1°20.2	3.6 - 0.3	9.6 - 0.9	15.6 - 1.4	
37	0°54.3	0°54.4	0°51.8	3.7 - 0.2	9.7 - 0.6	15.7 - 0.9		37	1°09.3	1°09.4	1°06.1	3.7 - 0.3	9.7 - 0.7	15.7 - 1.2		37	1°24.3	1°24.5	1°20.4	3.7 - 0.3	9.7 - 0.9	15.7 - 1.4	
38	0°54.5	0°54.6	0°52.0	3.8 - 0.2	9.8 - 0.6	15.8 - 0.9		38	1°09.5	1°09.7	1°06.3	3.8 - 0.3	9.8 - 0.7	15.8 - 1.2		38	1°24.5	1°24.7	1°20.7	3.8 - 0.3	9.8 - 0.9	15.8 - 1.4	
39	0°54.8	0°54.9	0°52.3	3.9 - 0.2	9.9 - 0.6	15.9 - 0.9		39	1°09.8	1°09.9	1°06.6	3.9 - 0.3	9.9 - 0.7	15.9 - 1.2		39	1°24.8	1°25.0	1°20.9	3.9 - 0.4	9.9 - 0.9	15.9 - 1.5	
40	0°55.0	0°55.2	0°52.5	4.0 - 0.2	10.0 - 0.6	16.0 - 0.9		40	1°10.0	1°10.2	1°06.8	4.0 - 0.3	10.0 - 0.8	16.0 - 1.2		40	1°25.0	1°25.2	1°21.1	4.0 - 0.4	10.0 - 0.9	16.0 - 1.5	
41	0°55.3	0°55.4	0°52.7	4.1 - 0.2	10.1 - 0.6	16.1 - 0.9		41	1°10.3	1°10.4	1°07.0	4.1 - 0.3	10.1 - 0.8	16.1 - 1.2		41	1°25.3	1°25.5	1°21.4	4.1 - 0.4	10.1 - 0.9	16.1 - 1.5	

## Increments and Corrections

m 6	Sun Plan.	Aries	Moon	v and d corr			m 7	Sun Plan.	Aries	Moon	v and d corr			m 8	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	0	1°45.0	1°45.3	1°40.2	0.0 - 0.0	6.0 - 0.8	12.0 - 1.5	0	2°00.0	2°00.3	1°54.5	0.0 - 0.0	6.0 - 0.8	12.0 - 1.7
1	1°30.3	1°30.5	1°26.1	0.1 - 0.0	6.1 - 0.7	12.1 - 1.3	1	1°45.3	1°45.5	1°40.5	0.1 - 0.0	6.1 - 0.8	12.1 - 1.5	1	2°00.3	2°00.6	1°54.8	0.1 - 0.0	6.1 - 0.9	12.1 - 1.7
2	1°30.5	1°30.7	1°26.4	0.2 - 0.0	6.2 - 0.7	12.2 - 1.3	2	1°45.5	1°45.8	1°40.7	0.2 - 0.0	6.2 - 0.8	12.2 - 1.5	2	2°00.5	2°00.8	1°55.0	0.2 - 0.0	6.2 - 0.9	12.2 - 1.7
3	1°30.7	1°31.0	1°26.6	0.3 - 0.0	6.3 - 0.7	12.3 - 1.3	3	1°45.8	1°46.0	1°40.9	0.3 - 0.0	6.3 - 0.8	12.3 - 1.5	3	2°00.8	2°01.1	1°55.2	0.3 - 0.0	6.3 - 0.9	12.3 - 1.7
4	1°31.0	1°31.2	1°26.9	0.4 - 0.0	6.4 - 0.7	12.4 - 1.3	4	1°46.0	1°46.3	1°41.2	0.4 - 0.1	6.4 - 0.8	12.4 - 1.6	4	2°01.0	2°01.3	1°55.5	0.4 - 0.1	6.4 - 0.9	12.4 - 1.8
5	1°31.2	1°31.5	1°27.1	0.5 - 0.1	6.5 - 0.7	12.5 - 1.4	5	1°46.2	1°46.5	1°41.4	0.5 - 0.1	6.5 - 0.8	12.5 - 1.6	5	2°01.3	2°01.6	1°55.7	0.5 - 0.1	6.5 - 0.9	12.5 - 1.8
6	1°31.5	1°31.8	1°27.3	0.6 - 0.1	6.6 - 0.7	12.6 - 1.4	6	1°46.5	1°46.8	1°41.6	0.6 - 0.1	6.6 - 0.8	12.6 - 1.6	6	2°01.5	2°01.8	1°56.0	0.6 - 0.1	6.6 - 0.9	12.6 - 1.8
7	1°31.7	1°32.0	1°27.6	0.7 - 0.1	6.7 - 0.7	12.7 - 1.4	7	1°46.7	1°47.0	1°41.9	0.7 - 0.1	6.7 - 0.8	12.7 - 1.6	7	2°01.8	2°02.1	1°56.2	0.7 - 0.1	6.7 - 0.9	12.7 - 1.8
8	1°32.0	1°32.3	1°27.8	0.8 - 0.1	6.8 - 0.7	12.8 - 1.4	8	1°47.0	1°47.3	1°42.1	0.8 - 0.1	6.8 - 0.8	12.8 - 1.6	8	2°02.0	2°02.3	1°56.4	0.8 - 0.1	6.8 - 1.0	12.8 - 1.8
9	1°32.3	1°32.5	1°28.0	0.9 - 0.1	6.9 - 0.7	12.9 - 1.4	9	1°47.3	1°47.5	1°42.4	0.9 - 0.1	6.9 - 0.9	12.9 - 1.6	9	2°02.3	2°02.6	1°56.7	0.9 - 0.1	6.9 - 1.0	12.9 - 1.8
10	1°32.5	1°32.8	1°28.3	1.0 - 0.1	7.0 - 0.8	13.0 - 1.4	10	1°47.5	1°47.8	1°42.6	1.0 - 0.1	7.0 - 0.9	13.0 - 1.6	10	2°02.5	2°02.8	1°56.9	1.0 - 0.1	7.0 - 1.0	13.0 - 1.8
11	1°32.8	1°33.0	1°28.5	1.1 - 0.1	7.1 - 0.8	13.1 - 1.4	11	1°47.8	1°48.0	1°42.8	1.1 - 0.1	7.1 - 0.9	13.1 - 1.6	11	2°02.8	2°03.1	1°57.2	1.1 - 0.2	7.1 - 1.0	13.1 - 1.9
12	1°33.0	1°33.3	1°28.8	1.2 - 0.1	7.2 - 0.8	13.2 - 1.4	12	1°48.0	1°48.3	1°43.1	1.2 - 0.2	7.2 - 0.9	13.2 - 1.6	12	2°03.0	2°03.3	1°57.4	1.2 - 0.2	7.2 - 1.0	13.2 - 1.9
13	1°33.3	1°33.5	1°29.0	1.3 - 0.1	7.3 - 0.8	13.3 - 1.4	13	1°48.3	1°48.5	1°43.3	1.3 - 0.2	7.3 - 0.9	13.3 - 1.7	13	2°03.3	2°03.6	1°57.6	1.3 - 0.2	7.3 - 1.0	13.3 - 1.9
14	1°33.5	1°33.8	1°29.2	1.4 - 0.2	7.4 - 0.8	13.4 - 1.5	14	1°48.5	1°48.8	1°43.6	1.4 - 0.2	7.4 - 0.9	13.4 - 1.7	14	2°03.5	2°03.8	1°57.9	1.4 - 0.2	7.4 - 1.0	13.4 - 1.9
15	1°33.8	1°34.0	1°29.5	1.5 - 0.2	7.5 - 0.8	13.5 - 1.5	15	1°48.8	1°49.0	1°43.8	1.5 - 0.2	7.5 - 0.9	13.5 - 1.7	15	2°03.8	2°04.1	1°58.1	1.5 - 0.2	7.5 - 1.1	13.5 - 1.9
16	1°34.0	1°34.3	1°29.7	1.6 - 0.2	7.6 - 0.8	13.6 - 1.5	16	1°49.0	1°49.3	1°44.0	1.6 - 0.2	7.6 - 0.9	13.6 - 1.7	16	2°04.0	2°04.3	1°58.4	1.6 - 0.2	7.6 - 1.1	13.6 - 1.9
17	1°34.3	1°34.5	1°30.0	1.7 - 0.2	7.7 - 0.8	13.7 - 1.5	17	1°49.3	1°49.5	1°44.3	1.7 - 0.2	7.7 - 1.0	13.7 - 1.7	17	2°04.2	2°04.6	1°58.6	1.7 - 0.2	7.7 - 1.1	13.7 - 1.9
18	1°34.5	1°34.8	1°30.2	1.8 - 0.2	7.8 - 0.8	13.8 - 1.5	18	1°49.5	1°49.8	1°44.5	1.8 - 0.2	7.8 - 1.0	13.8 - 1.7	18	2°04.5	2°04.8	1°58.8	1.8 - 0.3	7.8 - 1.1	13.8 - 2.0
19	1°34.8	1°35.0	1°30.4	1.9 - 0.2	7.9 - 0.9	13.9 - 1.5	19	1°49.8	1°50.0	1°44.8	1.9 - 0.2	7.9 - 1.0	13.9 - 1.7	19	2°04.7	2°05.1	1°59.1	1.9 - 0.3	7.9 - 1.1	13.9 - 2.0
20	1°35.0	1°35.3	1°30.7	2.0 - 0.2	8.0 - 0.9	14.0 - 1.5	20	1°50.0	1°50.3	1°45.0	2.0 - 0.3	8.0 - 1.0	14.0 - 1.8	20	2°05.0	2°05.3	1°59.3	2.0 - 0.3	8.0 - 1.1	14.0 - 2.0
21	1°35.2	1°35.5	1°30.9	2.1 - 0.2	8.1 - 0.9	14.1 - 1.5	21	1°50.2	1°50.6	1°45.2	2.1 - 0.3	8.1 - 1.0	14.1 - 1.8	21	2°05.2	2°05.6	1°59.5	2.1 - 0.3	8.1 - 1.1	14.1 - 2.0
22	1°35.5	1°35.8	1°31.1	2.2 - 0.2	8.2 - 0.9	14.2 - 1.5	22	1°50.5	1°50.8	1°45.5	2.2 - 0.3	8.2 - 1.0	14.2 - 1.8	22	2°05.5	2°05.8	1°59.8	2.2 - 0.3	8.2 - 1.2	14.2 - 2.0
23	1°35.8	1°36.0	1°31.4	2.3 - 0.2	8.3 - 0.9	14.3 - 1.5	23	1°50.8	1°51.1	1°45.7	2.3 - 0.3	8.3 - 1.0	14.3 - 1.8	23	2°05.7	2°06.1	2°00.0	2.3 - 0.3	8.3 - 1.2	14.3 - 2.0
24	1°36.0	1°36.3	1°31.6	2.4 - 0.3	8.4 - 0.9	14.4 - 1.6	24	1°51.0	1°51.3	1°45.9	2.4 - 0.3	8.4 - 1.1	14.4 - 1.8	24	2°06.0	2°06.3	2°00.3	2.4 - 0.3	8.4 - 1.2	14.4 - 2.0
25	1°36.3	1°36.5	1°31.9	2.5 - 0.3	8.5 - 0.9	14.5 - 1.6	25	1°51.3	1°51.6	1°46.2	2.5 - 0.3	8.5 - 1.1	14.5 - 1.8	25	2°06.2	2°06.6	2°00.5	2.5 - 0.4	8.5 - 1.2	14.5 - 2.1
26	1°36.5	1°36.8	1°32.1	2.6 - 0.3	8.6 - 0.9	14.6 - 1.6	26	1°51.5	1°51.8	1°46.4	2.6 - 0.3	8.6 - 1.1	14.6 - 1.8	26	2°06.5	2°06.8	2°00.7	2.6 - 0.4	8.6 - 1.2	14.6 - 2.1
27	1°36.8	1°37.0	1°32.3	2.7 - 0.3	8.7 - 0.9	14.7 - 1.6	27	1°51.8	1°52.1	1°46.7	2.7 - 0.3	8.7 - 1.1	14.7 - 1.8	27	2°06.7	2°07.1	2°01.0	2.7 - 0.4	8.7 - 1.2	14.7 - 2.1
28	1°37.0	1°37.3	1°32.6	2.8 - 0.3	8.8 - 1.0	14.8 - 1.6	28	1°52.0	1°52.3	1°46.9	2.8 - 0.4	8.8 - 1.1	14.8 - 1.9	28	2°07.0	2°07.3	2°01.2	2.8 - 0.4	8.8 - 1.2	14.8 - 2.1
29	1°37.3	1°37.5	1°32.8	2.9 - 0.3	8.9 - 1.0	14.9 - 1.6	29	1°52.3	1°52.6	1°47.1	2.9 - 0.4	8.9 - 1.1	14.9 - 1.9	29	2°07.2	2°07.6	2°01.5	2.9 - 0.4	8.9 - 1.3	14.9 - 2.1
30	1°37.5	1°37.8	1°33.1	3.0 - 0.3	9.0 - 1.0	15.0 - 1.6	30	1°52.5	1°52.8	1°47.4	3.0 - 0.4	9.0 - 1.1	15.0 - 1.9	30	2°07.5	2°07.8	2°01.7	3.0 - 0.4	9.0 - 1.3	15.0 - 2.1
31	1°37.8	1°38.0	1°33.3	3.1 - 0.3	9.1 - 1.0	15.1 - 1.6	31	1°52.7	1°53.1	1°47.6	3.1 - 0.4	9.1 - 1.1	15.1 - 1.9	31	2°07.8	2°08.1	2°01.9	3.1 - 0.4	9.1 - 1.3	15.1 - 2.1
32	1°38.0	1°38.3	1°33.5	3.2 - 0.3	9.2 - 1.0	15.2 - 1.6	32	1°53.0	1°53.3	1°47.9	3.2 - 0.4	9.2 - 1.1	15.2 - 1.9	32	2°08.0	2°08.3	2°02.2	3.2 - 0.5	9.2 - 1.3	15.2 - 2.2
33	1°38.3	1°38.5	1°33.8	3.3 - 0.4	9.3 - 1.0	15.3 - 1.7	33	1°53.3	1°53.6	1°48.1	3.3 - 0.4	9.3 - 1.2	15.3 - 1.9	33	2°08.3	2°08.6	2°02.4	3.3 - 0.5	9.3 - 1.3	15.3 - 2.2
34	1°38.5	1°38.8	1°34.0	3.4 - 0.4	9.4 - 1.0	15.4 - 1.7	34	1°53.5	1°53.8	1°48.3	3.4 - 0.4	9.4 - 1.2	15.4 - 1.9	34	2°08.5	2°08.9	2°02.6	3.4 - 0.5	9.4 - 1.3	15.4 - 2.2
35	1°38.7	1°39.0	1°34.3	3.5 - 0.4	9.5 - 1.0	15.5 - 1.7	35	1°53.7	1°54.1	1°48.6	3.5 - 0.4	9.5 - 1.2	15.5 - 1.9	35	2°08.8	2°09.1	2°02.9	3.5 - 0.5	9.5 - 1.3	15.5 - 2.2
36	1°39.0	1°39.3	1°34.5	3.6 - 0.4	9.6 - 1.0	15.6 - 1.7	36	1°54.0	1°54.3	1°48.8	3.6 - 0.5	9.6 - 1.2	15.6 - 1.9	36	2°09.0	2°09.4	2°03.1	3.6 - 0.5	9.6 - 1.4	15.6 - 2.2
37	1°39.3	1°39.5	1°34.7	3.7 - 0.4	9.7 - 1.1	15.7 - 1.7	37	1°54.2	1°54.6	1°49.0	3.7 - 0.5	9.7 - 1.2	15.7 - 2.0	37	2°09.3	2°09.6	2°03.4	3.7 - 0.5	9.7 - 1.4	15.7 - 2.2
38	1°39.5	1°39.8	1°35.0	3.8 - 0.4	9.8 - 1.1	15.8 - 1.7	38	1°54.5	1°54.8	1°49.3	3.8 - 0.5	9.8 - 1.2	15.8 - 2.0	38	2°09.5	2°09.9	2°03.6	3.8 - 0.5	9.8 - 1.4	15.8 - 2.2
39	1°39.8	1°40.0	1°35.2	3.9 - 0.4	9.9 - 1.1	15.9 - 1.7	39	1°54.8	1°55.1	1°49.5	3.9 - 0.5	9.9 - 1.2	15.9 - 2.0	39	2°09.8	2°10.1	2°03.8	3.9 - 0.6	9.9 - 1.4	15.9 - 2.3
40	1°40.0	1°40.3	1°35.4	4.0 - 0.4	10.0 - 1.1	16.0 - 1.7	40	1°55.0	1°55.3	1°49.8	4.0 - 0.5	10.0 - 1.3	16.0 - 2.0	40	2°10.0	2°10.4	2°04.1	4.0 - 0.6	10.0 - 1.4	16.0 - 2.3
41	1°40.3	1°40.5	1°35.7	4.1 - 0.4	10.1 - 1.1	16.1 - 1.7	41	1°55.3	1°55.6	1°50.0	4.1 - 0.5	10.1 - 1.3	16.1 - 2.0	41	2°10.3	2°10.6	2°04.3	4.1 - 0.6	10.1 - 1.4	16.1 - 2.3
42	1°40.5	1°40.8	1°35.9	4.2 - 0.5	10.2 - 1.1	16.2 - 1.8	42	1°55.5	1°55.8	1°50.2	4.2 - 0.5	10.2 - 1.3	16.2 - 2.0	42	2°10.5	2°10.9	2°04.6	4.2 - 0.6	10.2 - 1.4	16.2 - 2.3
43	1°40.8	1°41.0	1°36.2	4.3 - 0.5	10.3 - 1.1	16.3 - 1.8	43	1°55.8	1°56.1											

## Increments and Corrections

m 9	Sun Plan.	Aries	Moon	v and d corr			m 10	Sun Plan.	Aries	Moon	v and d corr			m 11	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	0	2°30.0	2°30.4	2°23.2	0.0 - 0.0	6.0 - 1.0	12.0 - 2.1	0	2°45.0	2°45.5	2°37.5	0.0 - 0.0	6.0 - 1.2	12.0 - 2.3
1	2°15.3	2°15.6	2°09.1	0.1 - 0.0	6.1 - 1.0	12.1 - 1.9	1	2°30.3	2°30.7	2°23.4	0.1 - 0.0	6.1 - 1.1	12.1 - 2.1	1	2°45.3	2°45.7	2°37.7	0.1 - 0.0	6.1 - 1.2	12.1 - 2.3
2	2°15.5	2°15.9	2°09.3	0.2 - 0.0	6.2 - 1.0	12.2 - 1.9	2	2°30.5	2°30.9	2°23.6	0.2 - 0.0	6.2 - 1.1	12.2 - 2.1	2	2°45.5	2°46.0	2°38.0	0.2 - 0.0	6.2 - 1.2	12.2 - 2.3
3	2°15.8	2°16.1	2°09.6	0.3 - 0.0	6.3 - 1.0	12.3 - 1.9	3	2°30.8	2°31.2	2°23.9	0.3 - 0.1	6.3 - 1.1	12.3 - 2.2	3	2°45.8	2°46.2	2°38.2	0.3 - 0.1	6.3 - 1.2	12.3 - 2.4
4	2°16.0	2°16.4	2°09.8	0.4 - 0.1	6.4 - 1.0	12.4 - 2.0	4	2°31.0	2°31.4	2°24.1	0.4 - 0.1	6.4 - 1.1	12.4 - 2.2	4	2°46.0	2°46.5	2°38.4	0.4 - 0.1	6.4 - 1.2	12.4 - 2.4
5	2°16.3	2°16.6	2°10.0	0.5 - 0.1	6.5 - 1.0	12.5 - 2.0	5	2°31.3	2°31.7	2°24.4	0.5 - 0.1	6.5 - 1.1	12.5 - 2.2	5	2°46.3	2°46.7	2°38.7	0.5 - 0.1	6.5 - 1.2	12.5 - 2.4
6	2°16.5	2°16.9	2°10.3	0.6 - 0.1	6.6 - 1.0	12.6 - 2.0	6	2°31.5	2°31.9	2°24.6	0.6 - 0.1	6.6 - 1.2	12.6 - 2.2	6	2°46.5	2°47.0	2°38.9	0.6 - 0.1	6.6 - 1.3	12.6 - 2.4
7	2°16.8	2°17.1	2°10.5	0.7 - 0.1	6.7 - 1.1	12.7 - 2.0	7	2°31.8	2°32.2	2°24.8	0.7 - 0.1	6.7 - 1.2	12.7 - 2.2	7	2°46.8	2°47.2	2°39.2	0.7 - 0.1	6.7 - 1.3	12.7 - 2.4
8	2°17.0	2°17.4	2°10.8	0.8 - 0.1	6.8 - 1.1	12.8 - 2.0	8	2°32.0	2°32.4	2°25.1	0.8 - 0.1	6.8 - 1.2	12.8 - 2.2	8	2°47.0	2°47.5	2°39.4	0.8 - 0.2	6.8 - 1.3	12.8 - 2.5
9	2°17.3	2°17.6	2°11.0	0.9 - 0.1	6.9 - 1.1	12.9 - 2.0	9	2°32.3	2°32.7	2°25.3	0.9 - 0.2	6.9 - 1.2	12.9 - 2.3	9	2°47.3	2°47.7	2°39.6	0.9 - 0.2	6.9 - 1.3	12.9 - 2.5
10	2°17.5	2°17.9	2°11.2	1.0 - 0.2	7.0 - 1.1	13.0 - 2.1	10	2°32.5	2°32.9	2°25.6	1.0 - 0.2	7.0 - 1.2	13.0 - 2.3	10	2°47.5	2°48.0	2°39.9	1.0 - 0.2	7.0 - 1.3	13.0 - 2.5
11	2°17.8	2°18.1	2°11.5	1.1 - 0.2	7.1 - 1.1	13.1 - 2.1	11	2°32.8	2°33.2	2°25.8	1.1 - 0.2	7.1 - 1.2	13.1 - 2.3	11	2°47.8	2°48.2	2°40.1	1.1 - 0.2	7.1 - 1.4	13.1 - 2.5
12	2°18.0	2°18.4	2°11.7	1.2 - 0.2	7.2 - 1.1	13.2 - 2.1	12	2°33.0	2°33.4	2°26.0	1.2 - 0.2	7.2 - 1.3	13.2 - 2.3	12	2°48.0	2°48.5	2°40.3	1.2 - 0.2	7.2 - 1.4	13.2 - 2.5
13	2°18.3	2°18.6	2°12.0	1.3 - 0.2	7.3 - 1.2	13.3 - 2.1	13	2°33.3	2°33.7	2°26.3	1.3 - 0.2	7.3 - 1.3	13.3 - 2.3	13	2°48.3	2°48.7	2°40.6	1.3 - 0.2	7.3 - 1.4	13.3 - 2.5
14	2°18.5	2°18.9	2°12.2	1.4 - 0.2	7.4 - 1.2	13.4 - 2.1	14	2°33.5	2°33.9	2°26.5	1.4 - 0.2	7.4 - 1.3	13.4 - 2.3	14	2°48.5	2°49.0	2°40.8	1.4 - 0.3	7.4 - 1.4	13.4 - 2.6
15	2°18.8	2°19.1	2°12.4	1.5 - 0.2	7.5 - 1.2	13.5 - 2.1	15	2°33.8	2°34.2	2°26.7	1.5 - 0.3	7.5 - 1.3	13.5 - 2.4	15	2°48.8	2°49.2	2°41.1	1.5 - 0.3	7.5 - 1.4	13.5 - 2.6
16	2°19.0	2°19.4	2°12.7	1.6 - 0.3	7.6 - 1.2	13.6 - 2.2	16	2°34.0	2°34.4	2°27.0	1.6 - 0.3	7.6 - 1.3	13.6 - 2.4	16	2°49.0	2°49.5	2°41.3	1.6 - 0.3	7.6 - 1.5	13.6 - 2.6
17	2°19.3	2°19.6	2°12.9	1.7 - 0.3	7.7 - 1.2	13.7 - 2.2	17	2°34.3	2°34.7	2°27.2	1.7 - 0.3	7.7 - 1.3	13.7 - 2.4	17	2°49.3	2°49.7	2°41.5	1.7 - 0.3	7.7 - 1.5	13.7 - 2.6
18	2°19.5	2°19.9	2°13.1	1.8 - 0.3	7.8 - 1.2	13.8 - 2.2	18	2°34.5	2°34.9	2°27.5	1.8 - 0.3	7.8 - 1.4	13.8 - 2.4	18	2°49.5	2°50.0	2°41.8	1.8 - 0.3	7.8 - 1.5	13.8 - 2.6
19	2°19.7	2°20.1	2°13.4	1.9 - 0.3	7.9 - 1.3	13.9 - 2.2	19	2°34.8	2°35.2	2°27.7	1.9 - 0.3	7.9 - 1.4	13.9 - 2.4	19	2°49.8	2°50.2	2°42.0	1.9 - 0.4	7.9 - 1.5	13.9 - 2.7
20	2°20.0	2°20.4	2°13.6	2.0 - 0.3	8.0 - 1.3	14.0 - 2.2	20	2°35.0	2°35.4	2°27.9	2.0 - 0.3	8.0 - 1.4	14.0 - 2.4	20	2°50.0	2°50.5	2°42.3	2.0 - 0.4	8.0 - 1.5	14.0 - 2.7
21	2°20.2	2°20.6	2°13.9	2.1 - 0.3	8.1 - 1.3	14.1 - 2.2	21	2°35.2	2°35.7	2°28.2	2.1 - 0.4	8.1 - 1.4	14.1 - 2.5	21	2°50.2	2°50.7	2°42.5	2.1 - 0.4	8.1 - 1.6	14.1 - 2.7
22	2°20.5	2°20.9	2°14.1	2.2 - 0.3	8.2 - 1.3	14.2 - 2.2	22	2°35.5	2°35.9	2°28.4	2.2 - 0.4	8.2 - 1.4	14.2 - 2.5	22	2°50.5	2°51.0	2°42.7	2.2 - 0.4	8.2 - 1.6	14.2 - 2.7
23	2°20.7	2°21.1	2°14.3	2.3 - 0.4	8.3 - 1.3	14.3 - 2.3	23	2°35.7	2°36.2	2°28.7	2.3 - 0.4	8.3 - 1.5	14.3 - 2.5	23	2°50.7	2°51.2	2°43.0	2.3 - 0.4	8.3 - 1.6	14.3 - 2.7
24	2°21.0	2°21.4	2°14.6	2.4 - 0.4	8.4 - 1.3	14.4 - 2.3	24	2°36.0	2°36.4	2°28.9	2.4 - 0.4	8.4 - 1.5	14.4 - 2.5	24	2°51.0	2°51.5	2°43.2	2.4 - 0.5	8.4 - 1.6	14.4 - 2.8
25	2°21.2	2°21.6	2°14.8	2.5 - 0.4	8.5 - 1.3	14.5 - 2.3	25	2°36.2	2°36.7	2°29.1	2.5 - 0.4	8.5 - 1.5	14.5 - 2.5	25	2°51.2	2°51.7	2°43.4	2.5 - 0.5	8.5 - 1.6	14.5 - 2.8
26	2°21.5	2°21.9	2°15.1	2.6 - 0.4	8.6 - 1.4	14.6 - 2.3	26	2°36.5	2°36.9	2°29.4	2.6 - 0.5	8.6 - 1.5	14.6 - 2.6	26	2°51.5	2°52.0	2°43.7	2.6 - 0.5	8.6 - 1.6	14.6 - 2.8
27	2°21.7	2°22.1	2°15.3	2.7 - 0.4	8.7 - 1.4	14.7 - 2.3	27	2°36.7	2°37.2	2°29.6	2.7 - 0.5	8.7 - 1.5	14.7 - 2.6	27	2°51.7	2°52.2	2°43.9	2.7 - 0.5	8.7 - 1.7	14.7 - 2.8
28	2°22.0	2°22.4	2°15.5	2.8 - 0.4	8.8 - 1.4	14.8 - 2.3	28	2°37.0	2°37.4	2°29.8	2.8 - 0.5	8.8 - 1.5	14.8 - 2.6	28	2°52.0	2°52.5	2°44.2	2.8 - 0.5	8.8 - 1.7	14.8 - 2.8
29	2°22.2	2°22.6	2°15.8	2.9 - 0.5	8.9 - 1.4	14.9 - 2.4	29	2°37.2	2°37.7	2°30.1	2.9 - 0.5	8.9 - 1.6	14.9 - 2.6	29	2°52.2	2°52.7	2°44.4	2.9 - 0.6	8.9 - 1.7	14.9 - 2.9
30	2°22.5	2°22.9	2°16.0	3.0 - 0.5	9.0 - 1.4	15.0 - 2.4	30	2°37.5	2°37.9	2°30.3	3.0 - 0.5	9.0 - 1.6	15.0 - 2.6	30	2°52.5	2°53.0	2°44.6	3.0 - 0.6	9.0 - 1.7	15.0 - 2.9
31	2°22.8	2°23.1	2°16.2	3.1 - 0.5	9.1 - 1.4	15.1 - 2.4	31	2°37.8	2°38.2	2°30.6	3.1 - 0.5	9.1 - 1.6	15.1 - 2.6	31	2°52.8	2°53.2	2°44.9	3.1 - 0.6	9.1 - 1.7	15.1 - 2.9
32	2°23.0	2°23.4	2°16.5	3.2 - 0.5	9.2 - 1.5	15.2 - 2.4	32	2°38.0	2°38.4	2°30.8	3.2 - 0.6	9.2 - 1.6	15.2 - 2.7	32	2°53.0	2°53.5	2°45.1	3.2 - 0.6	9.2 - 1.8	15.2 - 2.9
33	2°23.3	2°23.6	2°16.7	3.3 - 0.5	9.3 - 1.5	15.3 - 2.4	33	2°38.3	2°38.7	2°31.0	3.3 - 0.6	9.3 - 1.6	15.3 - 2.7	33	2°53.3	2°53.7	2°45.4	3.3 - 0.6	9.3 - 1.8	15.3 - 2.9
34	2°23.5	2°23.9	2°17.0	3.4 - 0.5	9.4 - 1.5	15.4 - 2.4	34	2°38.5	2°38.9	2°31.3	3.4 - 0.6	9.4 - 1.6	15.4 - 2.7	34	2°53.5	2°54.0	2°45.6	3.4 - 0.7	9.4 - 1.8	15.4 - 3.0
35	2°23.8	2°24.1	2°17.2	3.5 - 0.6	9.5 - 1.5	15.5 - 2.5	35	2°38.8	2°39.2	2°31.5	3.5 - 0.6	9.5 - 1.7	15.5 - 2.7	35	2°53.8	2°54.2	2°45.8	3.5 - 0.7	9.5 - 1.8	15.5 - 3.0
36	2°24.0	2°24.4	2°17.4	3.6 - 0.6	9.6 - 1.5	15.6 - 2.5	36	2°39.0	2°39.4	2°31.8	3.6 - 0.6	9.6 - 1.7	15.6 - 2.7	36	2°54.0	2°54.5	2°46.1	3.6 - 0.7	9.6 - 1.8	15.6 - 3.0
37	2°24.3	2°24.6	2°17.7	3.7 - 0.6	9.7 - 1.5	15.7 - 2.5	37	2°39.3	2°39.7	2°32.0	3.7 - 0.6	9.7 - 1.7	15.7 - 2.7	37	2°54.3	2°54.7	2°46.3	3.7 - 0.7	9.7 - 1.9	15.7 - 3.0
38	2°24.5	2°24.9	2°17.9	3.8 - 0.6	9.8 - 1.6	15.8 - 2.5	38	2°39.5	2°39.9	2°32.2	3.8 - 0.7	9.8 - 1.7	15.8 - 2.8	38	2°54.5	2°55.0	2°46.6	3.8 - 0.7	9.8 - 1.9	15.8 - 3.0
39	2°24.8	2°25.1	2°18.2	3.9 - 0.6	9.9 - 1.6	15.9 - 2.5	39	2°39.8	2°40.2	2°32.5	3.9 - 0.7	9.9 - 1.7	15.9 - 2.8	39	2°54.8	2°55.2	2°46.8	3.9 - 0.7	9.9 - 1.9	15.9 - 3.0
40	2°25.0	2°25.4	2°18.4	4.0 - 0.6	10.0 - 1.6	16.0 - 2.5	40	2°40.0	2°40.4	2°32.7	4.0 - 0.7	10.0 - 1.8	16.0 - 2.8	40	2°55.0	2°55.5	2°47.0	4.0 - 0.8	10.0 - 1.9	16.0 - 3.1
41	2°25.3	2°25.6	2°18.6	4.1 - 0.6	10.1 - 1.6	16.1 - 2.5	41	2°40.3	2°40.7	2°32.9	4.1 - 0.7	10.1 - 1.8	16.1 - 2.8	41	2°55.3	2°55.7	2°47.3	4.1 - 0.8	10.1 - 1.9	16.1 - 3.1
42	2°25.5	2°25.9	2°18.9	4.2 - 0.7	10.2 - 1.6	16.2 - 2.6	42	2°40.5	2°40.9	2°33.2	4.2 - 0.7	10.2 - 1.8	16.2 - 2.8	42	2°55.5	2°56.0	2°47.5	4.2 - 0.8	10.2 - 2.0	16.2 - 3.1
43	2°25.8	2°26.1	2°19.1	4.3 - 0.7	10.3 - 1.6	16.3 - 2.6	43	2°40.8	2°41.2											

## Increments and Corrections

m 12	Sun Plan.	Aries	Moon	v and d corr				m 13	Sun Plan.	Aries	Moon	v and d corr				m 14	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		0	3°15.0	3°15.5	3°06.1	0.0 - 0.0	6.0 - 1.4	12.0 - 2.7		0	3°30.0	3°30.6	3°20.4	0.0 - 0.0	6.0 - 1.4	12.0 - 2.9	
1	3°00.3	3°00.7	2°52.0	0.1 - 0.0	6.1 - 1.3	12.1 - 2.5		1	3°15.3	3°15.8	3°06.4	0.1 - 0.0	6.1 - 1.4	12.1 - 2.7		1	3°30.3	3°30.8	3°20.7	0.1 - 0.0	6.1 - 1.5	12.1 - 2.9	
2	3°00.5	3°01.0	2°52.3	0.2 - 0.0	6.2 - 1.3	12.2 - 2.5		2	3°15.5	3°16.0	3°06.6	0.2 - 0.0	6.2 - 1.4	12.2 - 2.7		2	3°30.5	3°31.1	3°20.9	0.2 - 0.0	6.2 - 1.5	12.2 - 2.9	
3	3°00.8	3°01.2	2°52.5	0.3 - 0.1	6.3 - 1.3	12.3 - 2.6		3	3°15.8	3°16.3	3°06.8	0.3 - 0.1	6.3 - 1.4	12.3 - 2.8		3	3°30.8	3°31.3	3°21.1	0.3 - 0.1	6.3 - 1.5	12.3 - 3.0	
4	3°01.0	3°01.5	2°52.8	0.4 - 0.1	6.4 - 1.3	12.4 - 2.6		4	3°16.0	3°16.5	3°07.1	0.4 - 0.1	6.4 - 1.4	12.4 - 2.8		4	3°31.0	3°31.6	3°21.4	0.4 - 0.1	6.4 - 1.5	12.4 - 3.0	
5	3°01.3	3°01.7	2°53.0	0.5 - 0.1	6.5 - 1.4	12.5 - 2.6		5	3°16.3	3°16.8	3°07.3	0.5 - 0.1	6.5 - 1.5	12.5 - 2.8		5	3°31.3	3°31.8	3°21.6	0.5 - 0.1	6.5 - 1.6	12.5 - 3.0	
6	3°01.5	3°02.0	2°53.2	0.6 - 0.1	6.6 - 1.4	12.6 - 2.6		6	3°16.5	3°17.0	3°07.5	0.6 - 0.1	6.6 - 1.5	12.6 - 2.8		6	3°31.5	3°32.1	3°21.9	0.6 - 0.1	6.6 - 1.6	12.6 - 3.0	
7	3°01.8	3°02.2	2°53.5	0.7 - 0.1	6.7 - 1.4	12.7 - 2.6		7	3°16.8	3°17.3	3°07.8	0.7 - 0.2	6.7 - 1.5	12.7 - 2.9		7	3°31.8	3°32.3	3°22.1	0.7 - 0.2	6.7 - 1.6	12.7 - 3.1	
8	3°02.0	3°02.5	2°53.7	0.8 - 0.2	6.8 - 1.4	12.8 - 2.7		8	3°17.0	3°17.5	3°08.0	0.8 - 0.2	6.8 - 1.5	12.8 - 2.9		8	3°32.0	3°32.6	3°22.3	0.8 - 0.2	6.8 - 1.6	12.8 - 3.1	
9	3°02.3	3°02.7	2°53.9	0.9 - 0.2	6.9 - 1.4	12.9 - 2.7		9	3°17.3	3°17.8	3°08.3	0.9 - 0.2	6.9 - 1.6	12.9 - 2.9		9	3°32.3	3°32.8	3°22.6	0.9 - 0.2	6.9 - 1.7	12.9 - 3.1	
10	3°02.5	3°03.0	2°54.2	1.0 - 0.2	7.0 - 1.5	13.0 - 2.7		10	3°17.5	3°18.0	3°08.5	1.0 - 0.2	7.0 - 1.6	13.0 - 2.9		10	3°32.5	3°33.1	3°22.8	1.0 - 0.2	7.0 - 1.7	13.0 - 3.1	
11	3°02.8	3°03.2	2°54.4	1.1 - 0.2	7.1 - 1.5	13.1 - 2.7		11	3°17.8	3°18.3	3°08.7	1.1 - 0.2	7.1 - 1.6	13.1 - 2.9		11	3°32.8	3°33.3	3°23.1	1.1 - 0.3	7.1 - 1.7	13.1 - 3.2	
12	3°03.0	3°03.5	2°54.7	1.2 - 0.3	7.2 - 1.5	13.2 - 2.8		12	3°18.0	3°18.5	3°09.0	1.2 - 0.3	7.2 - 1.6	13.2 - 3.0		12	3°33.0	3°33.6	3°23.3	1.2 - 0.3	7.2 - 1.7	13.2 - 3.2	
13	3°03.3	3°03.8	2°54.9	1.3 - 0.3	7.3 - 1.5	13.3 - 2.8		13	3°18.3	3°18.8	3°09.2	1.3 - 0.3	7.3 - 1.6	13.3 - 3.0		13	3°33.3	3°33.8	3°23.5	1.3 - 0.3	7.3 - 1.8	13.3 - 3.2	
14	3°03.5	3°04.0	2°55.1	1.4 - 0.3	7.4 - 1.5	13.4 - 2.8		14	3°18.5	3°19.0	3°09.5	1.4 - 0.3	7.4 - 1.7	13.4 - 3.0		14	3°33.5	3°34.1	3°23.8	1.4 - 0.3	7.4 - 1.8	13.4 - 3.2	
15	3°03.8	3°04.3	2°55.4	1.5 - 0.3	7.5 - 1.6	13.5 - 2.8		15	3°18.8	3°19.3	3°09.7	1.5 - 0.3	7.5 - 1.7	13.5 - 3.0		15	3°33.8	3°34.3	3°24.0	1.5 - 0.4	7.5 - 1.8	13.5 - 3.3	
16	3°04.0	3°04.5	2°55.6	1.6 - 0.3	7.6 - 1.6	13.6 - 2.8		16	3°19.0	3°19.5	3°09.9	1.6 - 0.4	7.6 - 1.7	13.6 - 3.1		16	3°34.0	3°34.6	3°24.3	1.6 - 0.4	7.6 - 1.8	13.6 - 3.3	
17	3°04.2	3°04.8	2°55.9	1.7 - 0.4	7.7 - 1.6	13.7 - 2.9		17	3°19.3	3°19.8	3°10.2	1.7 - 0.4	7.7 - 1.7	13.7 - 3.1		17	3°34.3	3°34.8	3°24.5	1.7 - 0.4	7.7 - 1.9	13.7 - 3.3	
18	3°04.5	3°05.0	2°56.1	1.8 - 0.4	7.8 - 1.6	13.8 - 2.9		18	3°19.5	3°20.0	3°10.4	1.8 - 0.4	7.8 - 1.8	13.8 - 3.1		18	3°34.5	3°35.1	3°24.7	1.8 - 0.4	7.8 - 1.9	13.8 - 3.3	
19	3°04.7	3°05.3	2°56.3	1.9 - 0.4	7.9 - 1.6	13.9 - 2.9		19	3°19.7	3°20.3	3°10.7	1.9 - 0.4	7.9 - 1.8	13.9 - 3.1		19	3°34.8	3°35.3	3°25.0	1.9 - 0.5	7.9 - 1.9	13.9 - 3.4	
20	3°05.0	3°05.5	2°56.6	2.0 - 0.4	8.0 - 1.7	14.0 - 2.9		20	3°20.0	3°20.5	3°10.9	2.0 - 0.5	8.0 - 1.8	14.0 - 3.1		20	3°35.0	3°35.6	3°25.2	2.0 - 0.5	8.0 - 1.9	14.0 - 3.4	
21	3°05.2	3°05.8	2°56.8	2.1 - 0.4	8.1 - 1.7	14.1 - 2.9		21	3°20.2	3°20.8	3°11.1	2.1 - 0.5	8.1 - 1.8	14.1 - 3.2		21	3°35.2	3°35.8	3°25.4	2.1 - 0.5	8.1 - 2.0	14.1 - 3.4	
22	3°05.5	3°06.0	2°57.0	2.2 - 0.5	8.2 - 1.7	14.2 - 3.0		22	3°20.5	3°21.0	3°11.4	2.2 - 0.5	8.2 - 1.8	14.2 - 3.2		22	3°35.5	3°36.1	3°25.7	2.2 - 0.5	8.2 - 2.0	14.2 - 3.4	
23	3°05.7	3°06.3	2°57.3	2.3 - 0.5	8.3 - 1.7	14.3 - 3.0		23	3°20.7	3°21.3	3°11.6	2.3 - 0.5	8.3 - 1.9	14.3 - 3.2		23	3°35.7	3°36.3	3°25.9	2.3 - 0.6	8.3 - 2.0	14.3 - 3.5	
24	3°06.0	3°06.5	2°57.5	2.4 - 0.5	8.4 - 1.8	14.4 - 3.0		24	3°21.0	3°21.5	3°11.8	2.4 - 0.5	8.4 - 1.9	14.4 - 3.2		24	3°36.0	3°36.6	3°26.2	2.4 - 0.6	8.4 - 2.0	14.4 - 3.5	
25	3°06.2	3°06.8	2°57.8	2.5 - 0.5	8.5 - 1.8	14.5 - 3.0		25	3°21.2	3°21.8	3°12.1	2.5 - 0.6	8.5 - 1.9	14.5 - 3.3		25	3°36.2	3°36.8	3°26.4	2.5 - 0.6	8.5 - 2.1	14.5 - 3.5	
26	3°06.5	3°07.0	2°58.0	2.6 - 0.5	8.6 - 1.8	14.6 - 3.0		26	3°21.5	3°22.1	3°12.3	2.6 - 0.6	8.6 - 1.9	14.6 - 3.3		26	3°36.5	3°37.1	3°26.6	2.6 - 0.6	8.6 - 2.1	14.6 - 3.5	
27	3°06.7	3°07.3	2°58.2	2.7 - 0.6	8.7 - 1.8	14.7 - 3.1		27	3°21.7	3°22.3	3°12.6	2.7 - 0.6	8.7 - 2.0	14.7 - 3.3		27	3°36.7	3°37.3	3°26.9	2.7 - 0.7	8.7 - 2.1	14.7 - 3.6	
28	3°07.0	3°07.5	2°58.5	2.8 - 0.6	8.8 - 1.8	14.8 - 3.1		28	3°22.0	3°22.6	3°12.8	2.8 - 0.6	8.8 - 2.0	14.8 - 3.3		28	3°37.0	3°37.6	3°27.1	2.8 - 0.7	8.8 - 2.1	14.8 - 3.6	
29	3°07.2	3°07.8	2°58.7	2.9 - 0.6	8.9 - 1.9	14.9 - 3.1		29	3°22.2	3°22.8	3°13.0	2.9 - 0.7	8.9 - 2.0	14.9 - 3.4		29	3°37.2	3°37.8	3°27.4	2.9 - 0.7	8.9 - 2.2	14.9 - 3.6	
30	3°07.5	3°08.0	2°59.0	3.0 - 0.6	9.0 - 1.9	15.0 - 3.1		30	3°22.5	3°23.1	3°13.3	3.0 - 0.7	9.0 - 2.0	15.0 - 3.4		30	3°37.5	3°38.1	3°27.6	3.0 - 0.7	9.0 - 2.2	15.0 - 3.6	
31	3°07.8	3°08.3	2°59.2	3.1 - 0.6	9.1 - 1.9	15.1 - 3.1		31	3°22.8	3°23.3	3°13.5	3.1 - 0.7	9.1 - 2.0	15.1 - 3.4		31	3°37.8	3°38.3	3°27.8	3.1 - 0.7	9.1 - 2.2	15.1 - 3.6	
32	3°08.0	3°08.5	2°59.4	3.2 - 0.7	9.2 - 1.9	15.2 - 3.2		32	3°23.0	3°23.6	3°13.8	3.2 - 0.7	9.2 - 2.1	15.2 - 3.4		32	3°38.0	3°38.6	3°28.1	3.2 - 0.8	9.2 - 2.2	15.2 - 3.7	
33	3°08.3	3°08.8	2°59.7	3.3 - 0.7	9.3 - 1.9	15.3 - 3.2		33	3°23.3	3°23.8	3°14.0	3.3 - 0.7	9.3 - 2.1	15.3 - 3.4		33	3°38.3	3°38.8	3°28.3	3.3 - 0.8	9.3 - 2.2	15.3 - 3.7	
34	3°08.5	3°09.0	2°59.9	3.4 - 0.7	9.4 - 2.0	15.4 - 3.2		34	3°23.5	3°24.1	3°14.2	3.4 - 0.8	9.4 - 2.1	15.4 - 3.5		34	3°38.5	3°39.1	3°28.5	3.4 - 0.8	9.4 - 2.3	15.4 - 3.7	
35	3°08.8	3°09.3	3°00.2	3.5 - 0.7	9.5 - 2.0	15.5 - 3.2		35	3°23.8	3°24.3	3°14.5	3.5 - 0.8	9.5 - 2.1	15.5 - 3.5		35	3°38.8	3°39.3	3°28.8	3.5 - 0.8	9.5 - 2.3	15.5 - 3.7	
36	3°09.0	3°09.5	3°00.4	3.6 - 0.8	9.6 - 2.0	15.6 - 3.3		36	3°24.0	3°24.6	3°14.7	3.6 - 0.8	9.6 - 2.2	15.6 - 3.5		36	3°39.0	3°39.6	3°29.0	3.6 - 0.9	9.6 - 2.3	15.6 - 3.8	
37	3°09.3	3°09.8	3°00.6	3.7 - 0.8	9.7 - 2.0	15.7 - 3.3		37	3°24.3	3°24.8	3°14.9	3.7 - 0.8	9.7 - 2.2	15.7 - 3.5		37	3°39.3	3°39.8	3°29.3	3.7 - 0.9	9.7 - 2.3	15.7 - 3.8	
38	3°09.5	3°10.0	3°00.9	3.8 - 0.8	9.8 - 2.0	15.8 - 3.3		38	3°24.5	3°25.1	3°15.2	3.8 - 0.9	9.8 - 2.2	15.8 - 3.6		38	3°39.5	3°40.1	3°29.5	3.8 - 0.9	9.8 - 2.4	15.8 - 3.8	
39	3°09.8	3°10.3	3°01.1	3.9 - 0.8	9.9 - 2.1	15.9 - 3.3		39	3°24.8	3°25.3	3°15.4	3.9 - 0.9	9.9 - 2.2	15.9 - 3.6		39	3°39.8	3°40.4	3°29.7	3.9 - 0.9	9.9 - 2.4	15.9 - 3.8	
40	3°10.0	3°10.5	3°01.3	4.0 - 0.8	10.0 - 2.1	16.0 - 3.3		40	3°25.0	3°25.6	3°15.7	4.0 - 0.9	10.0 - 2.3	16.0 - 3.6		40	3°40.0	3°40.6	3°30.0	4.0 - 1.0	10.0 - 2.4	16.0 - 3.9	
41	3°10.3	3°10.8	3°01.6	4.1 - 0.9	10.1 - 2.1	16.1 - 3.4		41	3°25.3	3°25.8	3°15.9	4.1 - 0.9	10.1 - 2.3	16.1 - 3.6		41	3°40.3	3°40.9	3°30.2	4.1 - 1.0	10.1 - 2.4	16.1 - 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				

## Increments and Corrections

m	Sun	Aries	Moon	v and d corr			m	Sun	Aries	Moon	v and d corr			m	Sun	Aries	Moon	v and d corr		
18	Plan.						19	Plan.						20	Plan.					
0	4°30.0	4°30.7	4°17.7	0.0 - 0.0	6.0 - 1.9	12.0 - 3.7	0	4°45.0	4°45.8	4°32.0	0.0 - 0.0	6.0 - 2.0	12.0 - 3.9	0	5°00.0	5°00.8	4°46.3	0.0 - 0.0	6.0 - 2.0	12.0 - 4.1
1	4°30.2	4°31.0	4°17.9	0.1 - 0.0	6.1 - 1.9	12.1 - 3.7	1	4°45.2	4°46.0	4°32.3	0.1 - 0.0	6.1 - 2.0	12.1 - 3.9	1	5°00.2	5°01.1	4°46.6	0.1 - 0.0	6.1 - 2.1	12.1 - 4.1
2	4°30.5	4°31.2	4°18.2	0.2 - 0.1	6.2 - 1.9	12.2 - 3.8	2	4°45.5	4°46.3	4°32.5	0.2 - 0.1	6.2 - 2.0	12.2 - 4.0	2	5°00.5	5°01.3	4°46.8	0.2 - 0.1	6.2 - 2.1	12.2 - 4.2
3	4°30.8	4°31.5	4°18.4	0.3 - 0.1	6.3 - 1.9	12.3 - 3.8	3	4°45.8	4°46.5	4°32.7	0.3 - 0.1	6.3 - 2.0	12.3 - 4.0	3	5°00.8	5°01.6	4°47.0	0.3 - 0.1	6.3 - 2.2	12.3 - 4.2
4	4°31.0	4°31.7	4°18.7	0.4 - 0.1	6.4 - 2.0	12.4 - 3.8	4	4°46.0	4°46.8	4°33.0	0.4 - 0.1	6.4 - 2.1	12.4 - 4.0	4	5°01.0	5°01.8	4°47.3	0.4 - 0.1	6.4 - 2.2	12.4 - 4.2
5	4°31.2	4°32.0	4°18.9	0.5 - 0.2	6.5 - 2.0	12.5 - 3.9	5	4°46.2	4°47.0	4°33.2	0.5 - 0.2	6.5 - 2.1	12.5 - 4.1	5	5°01.2	5°02.1	4°47.5	0.5 - 0.2	6.5 - 2.2	12.5 - 4.3
6	4°31.5	4°32.2	4°19.1	0.6 - 0.2	6.6 - 2.0	12.6 - 3.9	6	4°46.5	4°47.3	4°33.4	0.6 - 0.2	6.6 - 2.1	12.6 - 4.1	6	5°01.5	5°02.3	4°47.8	0.6 - 0.2	6.6 - 2.3	12.6 - 4.3
7	4°31.8	4°32.5	4°19.4	0.7 - 0.2	6.7 - 2.1	12.7 - 3.9	7	4°46.8	4°47.5	4°33.7	0.7 - 0.2	6.7 - 2.2	12.7 - 4.1	7	5°01.8	5°02.6	4°48.0	0.7 - 0.2	6.7 - 2.3	12.7 - 4.3
8	4°32.0	4°32.7	4°19.6	0.8 - 0.2	6.8 - 2.1	12.8 - 3.9	8	4°47.0	4°47.8	4°33.9	0.8 - 0.3	6.8 - 2.2	12.8 - 4.2	8	5°02.0	5°02.8	4°48.2	0.8 - 0.3	6.8 - 2.3	12.8 - 4.4
9	4°32.2	4°33.0	4°19.8	0.9 - 0.3	6.9 - 2.1	12.9 - 4.0	9	4°47.2	4°48.0	4°34.2	0.9 - 0.3	6.9 - 2.2	12.9 - 4.2	9	5°02.2	5°03.1	4°48.5	0.9 - 0.3	6.9 - 2.4	12.9 - 4.4
10	4°32.5	4°33.2	4°20.1	1.0 - 0.3	7.0 - 2.2	13.0 - 4.0	10	4°47.5	4°48.3	4°34.4	1.0 - 0.3	7.0 - 2.3	13.0 - 4.2	10	5°02.5	5°03.3	4°48.7	1.0 - 0.3	7.0 - 2.4	13.0 - 4.4
11	4°32.8	4°33.5	4°20.3	1.1 - 0.3	7.1 - 2.2	13.1 - 4.0	11	4°47.8	4°48.5	4°34.6	1.1 - 0.4	7.1 - 2.3	13.1 - 4.3	11	5°02.8	5°03.6	4°49.0	1.1 - 0.4	7.1 - 2.4	13.1 - 4.5
12	4°33.0	4°33.7	4°20.6	1.2 - 0.4	7.2 - 2.2	13.2 - 4.1	12	4°48.0	4°48.8	4°34.9	1.2 - 0.4	7.2 - 2.3	13.2 - 4.3	12	5°03.0	5°03.8	4°49.2	1.2 - 0.4	7.2 - 2.5	13.2 - 4.5
13	4°33.2	4°34.0	4°20.8	1.3 - 0.4	7.3 - 2.3	13.3 - 4.1	13	4°48.2	4°49.0	4°35.1	1.3 - 0.4	7.3 - 2.4	13.3 - 4.3	13	5°03.2	5°04.1	4°49.4	1.3 - 0.4	7.3 - 2.5	13.3 - 4.5
14	4°33.5	4°34.2	4°21.0	1.4 - 0.4	7.4 - 2.3	13.4 - 4.1	14	4°48.5	4°49.3	4°35.4	1.4 - 0.5	7.4 - 2.4	13.4 - 4.4	14	5°03.5	5°04.3	4°49.7	1.4 - 0.5	7.4 - 2.5	13.4 - 4.6
15	4°33.8	4°34.5	4°21.3	1.5 - 0.5	7.5 - 2.3	13.5 - 4.2	15	4°48.8	4°49.5	4°35.6	1.5 - 0.5	7.5 - 2.4	13.5 - 4.4	15	5°03.8	5°04.6	4°49.9	1.5 - 0.5	7.5 - 2.6	13.5 - 4.6
16	4°34.0	4°34.7	4°21.5	1.6 - 0.5	7.6 - 2.3	13.6 - 4.2	16	4°49.0	4°49.8	4°35.8	1.6 - 0.5	7.6 - 2.5	13.6 - 4.4	16	5°04.0	5°04.8	4°50.2	1.6 - 0.5	7.6 - 2.6	13.6 - 4.6
17	4°34.3	4°35.0	4°21.8	1.7 - 0.5	7.7 - 2.4	13.7 - 4.2	17	4°49.3	4°50.0	4°36.1	1.7 - 0.6	7.7 - 2.5	13.7 - 4.5	17	5°04.3	5°05.1	4°50.4	1.7 - 0.6	7.7 - 2.6	13.7 - 4.7
18	4°34.5	4°35.3	4°22.0	1.8 - 0.6	7.8 - 2.4	13.8 - 4.3	18	4°49.5	4°50.3	4°36.3	1.8 - 0.6	7.8 - 2.5	13.8 - 4.5	18	5°04.5	5°05.3	4°50.6	1.8 - 0.6	7.8 - 2.7	13.8 - 4.7
19	4°34.8	4°35.5	4°22.2	1.9 - 0.6	7.9 - 2.4	13.9 - 4.3	19	4°49.8	4°50.5	4°36.6	1.9 - 0.6	7.9 - 2.6	13.9 - 4.5	19	5°04.7	5°05.6	4°50.9	1.9 - 0.6	7.9 - 2.7	13.9 - 4.7
20	4°35.0	4°35.8	4°22.5	2.0 - 0.6	8.0 - 2.5	14.0 - 4.3	20	4°50.0	4°50.8	4°36.8	2.0 - 0.7	8.0 - 2.6	14.0 - 4.5	20	5°05.0	5°05.8	4°51.1	2.0 - 0.7	8.0 - 2.7	14.0 - 4.8
21	4°35.3	4°36.0	4°22.7	2.1 - 0.6	8.1 - 2.5	14.1 - 4.3	21	4°50.3	4°51.0	4°37.0	2.1 - 0.7	8.1 - 2.6	14.1 - 4.6	21	5°05.3	5°06.1	4°51.3	2.1 - 0.7	8.1 - 2.8	14.1 - 4.8
22	4°35.5	4°36.3	4°22.9	2.2 - 0.7	8.2 - 2.5	14.2 - 4.4	22	4°50.5	4°51.3	4°37.3	2.2 - 0.7	8.2 - 2.7	14.2 - 4.6	22	5°05.5	5°06.3	4°51.6	2.2 - 0.8	8.2 - 2.8	14.2 - 4.9
23	4°35.7	4°36.5	4°23.2	2.3 - 0.7	8.3 - 2.6	14.3 - 4.4	23	4°50.7	4°51.5	4°37.5	2.3 - 0.7	8.3 - 2.7	14.3 - 4.6	23	5°05.7	5°06.6	4°51.8	2.3 - 0.8	8.3 - 2.8	14.3 - 4.9
24	4°36.0	4°36.8	4°23.4	2.4 - 0.7	8.4 - 2.6	14.4 - 4.4	24	4°51.0	4°51.8	4°37.7	2.4 - 0.8	8.4 - 2.7	14.4 - 4.7	24	5°06.0	5°06.8	4°52.1	2.4 - 0.8	8.4 - 2.9	14.4 - 4.9
25	4°36.3	4°37.0	4°23.7	2.5 - 0.8	8.5 - 2.6	14.5 - 4.5	25	4°51.3	4°52.0	4°38.0	2.5 - 0.8	8.5 - 2.8	14.5 - 4.7	25	5°06.3	5°07.1	4°52.3	2.5 - 0.9	8.5 - 2.9	14.5 - 5.0
26	4°36.5	4°37.3	4°23.9	2.6 - 0.8	8.6 - 2.7	14.6 - 4.5	26	4°51.5	4°52.3	4°38.2	2.6 - 0.8	8.6 - 2.8	14.6 - 4.7	26	5°06.5	5°07.3	4°52.5	2.6 - 0.9	8.6 - 2.9	14.6 - 5.0
27	4°36.7	4°37.5	4°24.1	2.7 - 0.8	8.7 - 2.7	14.7 - 4.5	27	4°51.7	4°52.5	4°38.5	2.7 - 0.9	8.7 - 2.8	14.7 - 4.8	27	5°06.7	5°07.6	4°52.8	2.7 - 0.9	8.7 - 3.0	14.7 - 5.0
28	4°37.0	4°37.8	4°24.4	2.8 - 0.9	8.8 - 2.7	14.8 - 4.6	28	4°52.0	4°52.8	4°38.7	2.8 - 0.9	8.8 - 2.9	14.8 - 4.8	28	5°07.0	5°07.8	4°53.0	2.8 - 1.0	8.8 - 3.0	14.8 - 5.1
29	4°37.3	4°38.0	4°24.6	2.9 - 0.9	8.9 - 2.7	14.9 - 4.6	29	4°52.3	4°53.0	4°38.9	2.9 - 0.9	8.9 - 2.9	14.9 - 4.8	29	5°07.3	5°08.1	4°53.3	2.9 - 1.0	8.9 - 3.0	14.9 - 5.1
30	4°37.5	4°38.3	4°24.9	3.0 - 0.9	9.0 - 2.8	15.0 - 4.6	30	4°52.5	4°53.3	4°39.2	3.0 - 1.0	9.0 - 2.9	15.0 - 4.9	30	5°07.5	5°08.3	4°53.5	3.0 - 1.0	9.0 - 3.1	15.0 - 5.1
31	4°37.7	4°38.5	4°25.1	3.1 - 1.0	9.1 - 2.8	15.1 - 4.7	31	4°52.7	4°53.6	4°39.4	3.1 - 1.0	9.1 - 3.0	15.1 - 4.9	31	5°07.7	5°08.6	4°53.7	3.1 - 1.1	9.1 - 3.1	15.1 - 5.2
32	4°38.0	4°38.8	4°25.3	3.2 - 1.0	9.2 - 2.8	15.2 - 4.7	32	4°53.0	4°53.8	4°39.7	3.2 - 1.0	9.2 - 3.0	15.2 - 4.9	32	5°08.0	5°08.8	4°54.0	3.2 - 1.1	9.2 - 3.1	15.2 - 5.2
33	4°38.3	4°39.0	4°25.6	3.3 - 1.0	9.3 - 2.9	15.3 - 4.7	33	4°53.3	4°54.1	4°39.9	3.3 - 1.1	9.3 - 3.0	15.3 - 5.0	33	5°08.3	5°09.1	4°54.2	3.3 - 1.1	9.3 - 3.2	15.3 - 5.2
34	4°38.5	4°39.3	4°25.8	3.4 - 1.0	9.4 - 2.9	15.4 - 4.7	34	4°53.5	4°54.3	4°40.1	3.4 - 1.1	9.4 - 3.1	15.4 - 5.0	34	5°08.5	5°09.3	4°54.4	3.4 - 1.2	9.4 - 3.2	15.4 - 5.3
35	4°38.7	4°39.5	4°26.1	3.5 - 1.1	9.5 - 2.9	15.5 - 4.8	35	4°53.7	4°54.6	4°40.4	3.5 - 1.1	9.5 - 3.1	15.5 - 5.0	35	5°08.7	5°09.6	4°54.7	3.5 - 1.2	9.5 - 3.2	15.5 - 5.3
36	4°39.0	4°39.8	4°26.3	3.6 - 1.1	9.6 - 3.0	15.6 - 4.8	36	4°54.0	4°54.8	4°40.6	3.6 - 1.2	9.6 - 3.1	15.6 - 5.1	36	5°09.0	5°09.8	4°54.9	3.6 - 1.2	9.6 - 3.3	15.6 - 5.3
37	4°39.3	4°40.0	4°26.5	3.7 - 1.1	9.7 - 3.0	15.7 - 4.8	37	4°54.3	4°55.1	4°40.8	3.7 - 1.2	9.7 - 3.2	15.7 - 5.1	37	5°09.3	5°10.1	4°55.2	3.7 - 1.3	9.7 - 3.3	15.7 - 5.4
38	4°39.5	4°40.3	4°26.8	3.8 - 1.2	9.8 - 3.0	15.8 - 4.9	38	4°54.5	4°55.3	4°41.1	3.8 - 1.2	9.8 - 3.2	15.8 - 5.1	38	5°09.5	5°10.3	4°55.4	3.8 - 1.3	9.8 - 3.3	15.8 - 5.4
39	4°39.7	4°40.5	4°27.0	3.9 - 1.2	9.9 - 3.1	15.9 - 4.9	39	4°54.7	4°55.6	4°41.3	3.9 - 1.3	9.9 - 3.2	15.9 - 5.2	39	5°09.7	5°10.6	4°55.6	3.9 - 1.3	9.9 - 3.4	15.9 - 5.4
40	4°40.0	4°40.8	4°27.2	4.0 - 1.2	10.0 - 3.1	16.0 - 4.9	40	4°55.0	4°55.8	4°41.6	4.0 - 1.3	10.0 - 3.3	16.0 - 5.2	40	5°10.0	5°10.8	4°55.9	4.0 - 1.4	10.0 - 3.4	16.0 - 5.5
41	4°40.3	4°41.0	4°27.5	4.1 - 1.3	10.1 - 3.1	16.1 - 5.0	41	4°55.3	4°56.1	4°41.8	4.1 - 1.3	10.1 - 3.3	16.1 - 5.2	41	5°10.3	5°11.1	4°56.1	4.1 - 1.4	10.1 - 3.5	16.1 - 5.5
42	4°40.5	4°41.3	4°27.7	4.2 - 1.3	10.2 - 3.1	16.2 - 5.0	42	4°55.5	4°56.3	4°42.0	4.2 - 1.4	10.2 - 3.3								

## Increments and Corrections

m 21	Sun Plan.	Aries	Moon	v and d corr			m 22	Sun Plan.	Aries	Moon	v and d corr			m 23	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	0	5°30.0	5°30.9	5°15.0	0.0 - 0.0	6.0 - 2.3	12.0 - 4.5	0	5°45.0	5°45.9	5°29.3	0.0 - 0.0	6.0 - 2.4	12.0 - 4.7
1	5°15.2	5°16.1	5°00.9	0.1 - 0.0	6.1 - 2.2	12.1 - 4.3	1	5°30.2	5°31.2	5°15.2	0.1 - 0.0	6.1 - 2.3	12.1 - 4.5	1	5°45.2	5°46.2	5°29.5	0.1 - 0.0	6.1 - 2.4	12.1 - 4.7
2	5°15.5	5°16.4	5°01.1	0.2 - 0.1	6.2 - 2.2	12.2 - 4.4	2	5°30.5	5°31.4	5°15.4	0.2 - 0.1	6.2 - 2.3	12.2 - 4.6	2	5°45.5	5°46.4	5°29.8	0.2 - 0.1	6.2 - 2.4	12.2 - 4.8
3	5°15.8	5°16.6	5°01.4	0.3 - 0.1	6.3 - 2.3	12.3 - 4.4	3	5°30.8	5°31.7	5°15.7	0.3 - 0.1	6.3 - 2.4	12.3 - 4.6	3	5°45.8	5°46.7	5°30.0	0.3 - 0.1	6.3 - 2.5	12.3 - 4.8
4	5°16.0	5°16.9	5°01.6	0.4 - 0.1	6.4 - 2.3	12.4 - 4.4	4	5°31.0	5°31.9	5°15.9	0.4 - 0.2	6.4 - 2.4	12.4 - 4.7	4	5°46.0	5°46.9	5°30.2	0.4 - 0.2	6.4 - 2.5	12.4 - 4.9
5	5°16.2	5°17.1	5°01.8	0.5 - 0.2	6.5 - 2.3	12.5 - 4.5	5	5°31.2	5°32.2	5°16.2	0.5 - 0.2	6.5 - 2.4	12.5 - 4.7	5	5°46.2	5°47.2	5°30.5	0.5 - 0.2	6.5 - 2.5	12.5 - 4.9
6	5°16.5	5°17.4	5°02.1	0.6 - 0.2	6.6 - 2.4	12.6 - 4.5	6	5°31.5	5°32.4	5°16.4	0.6 - 0.2	6.6 - 2.5	12.6 - 4.7	6	5°46.5	5°47.4	5°30.7	0.6 - 0.2	6.6 - 2.6	12.6 - 4.9
7	5°16.8	5°17.6	5°02.3	0.7 - 0.3	6.7 - 2.4	12.7 - 4.6	7	5°31.8	5°32.7	5°16.6	0.7 - 0.3	6.7 - 2.5	12.7 - 4.8	7	5°46.8	5°47.7	5°31.0	0.7 - 0.3	6.7 - 2.6	12.7 - 5.0
8	5°17.0	5°17.9	5°02.6	0.8 - 0.3	6.8 - 2.4	12.8 - 4.6	8	5°32.0	5°32.9	5°16.9	0.8 - 0.3	6.8 - 2.5	12.8 - 4.8	8	5°47.0	5°47.9	5°31.2	0.8 - 0.3	6.8 - 2.7	12.8 - 5.0
9	5°17.2	5°18.1	5°02.8	0.9 - 0.3	6.9 - 2.5	12.9 - 4.6	9	5°32.2	5°33.2	5°17.1	0.9 - 0.3	6.9 - 2.6	12.9 - 4.8	9	5°47.2	5°48.2	5°31.4	0.9 - 0.4	6.9 - 2.7	12.9 - 5.1
10	5°17.5	5°18.4	5°03.0	1.0 - 0.4	7.0 - 2.5	13.0 - 4.7	10	5°32.5	5°33.4	5°17.4	1.0 - 0.4	7.0 - 2.6	13.0 - 4.9	10	5°47.5	5°48.4	5°31.7	1.0 - 0.4	7.0 - 2.7	13.0 - 5.1
11	5°17.8	5°18.6	5°03.3	1.1 - 0.4	7.1 - 2.5	13.1 - 4.7	11	5°32.8	5°33.7	5°17.6	1.1 - 0.4	7.1 - 2.7	13.1 - 4.9	11	5°47.8	5°48.7	5°31.9	1.1 - 0.4	7.1 - 2.8	13.1 - 5.1
12	5°18.0	5°18.9	5°03.5	1.2 - 0.4	7.2 - 2.6	13.2 - 4.7	12	5°33.0	5°33.9	5°17.8	1.2 - 0.5	7.2 - 2.7	13.2 - 4.9	12	5°48.0	5°49.0	5°32.1	1.2 - 0.5	7.2 - 2.8	13.2 - 5.2
13	5°18.2	5°19.1	5°03.8	1.3 - 0.5	7.3 - 2.6	13.3 - 4.8	13	5°33.2	5°34.2	5°18.1	1.3 - 0.5	7.3 - 2.7	13.3 - 5.0	13	5°48.2	5°49.2	5°32.4	1.3 - 0.5	7.3 - 2.9	13.3 - 5.2
14	5°18.5	5°19.4	5°04.0	1.4 - 0.5	7.4 - 2.7	13.4 - 4.8	14	5°33.5	5°34.4	5°18.3	1.4 - 0.5	7.4 - 2.8	13.4 - 5.0	14	5°48.5	5°49.5	5°32.6	1.4 - 0.5	7.4 - 2.9	13.4 - 5.2
15	5°18.8	5°19.6	5°04.2	1.5 - 0.5	7.5 - 2.7	13.5 - 4.8	15	5°33.8	5°34.7	5°18.5	1.5 - 0.6	7.5 - 2.8	13.5 - 5.1	15	5°48.8	5°49.7	5°32.9	1.5 - 0.6	7.5 - 2.9	13.5 - 5.3
16	5°19.0	5°19.9	5°04.5	1.6 - 0.6	7.6 - 2.7	13.6 - 4.9	16	5°34.0	5°34.9	5°18.8	1.6 - 0.6	7.6 - 2.8	13.6 - 5.1	16	5°49.0	5°50.0	5°33.1	1.6 - 0.6	7.6 - 3.0	13.6 - 5.3
17	5°19.3	5°20.1	5°04.7	1.7 - 0.6	7.7 - 2.8	13.7 - 4.9	17	5°34.3	5°35.2	5°19.0	1.7 - 0.6	7.7 - 2.9	13.7 - 5.1	17	5°49.3	5°50.2	5°33.3	1.7 - 0.7	7.7 - 3.0	13.7 - 5.4
18	5°19.5	5°20.4	5°04.9	1.8 - 0.6	7.8 - 2.8	13.8 - 4.9	18	5°34.5	5°35.4	5°19.3	1.8 - 0.7	7.8 - 2.9	13.8 - 5.2	18	5°49.5	5°50.5	5°33.6	1.8 - 0.7	7.8 - 3.1	13.8 - 5.4
19	5°19.7	5°20.6	5°05.2	1.9 - 0.7	7.9 - 2.8	13.9 - 5.0	19	5°34.8	5°35.7	5°19.5	1.9 - 0.7	7.9 - 3.0	13.9 - 5.2	19	5°49.8	5°50.7	5°33.8	1.9 - 0.7	7.9 - 3.1	13.9 - 5.4
20	5°20.0	5°20.9	5°05.4	2.0 - 0.7	8.0 - 2.9	14.0 - 5.0	20	5°35.0	5°35.9	5°19.7	2.0 - 0.8	8.0 - 3.0	14.0 - 5.3	20	5°50.0	5°51.0	5°34.1	2.0 - 0.8	8.0 - 3.1	14.0 - 5.5
21	5°20.3	5°21.1	5°05.7	2.1 - 0.8	8.1 - 2.9	14.1 - 5.1	21	5°35.3	5°36.2	5°20.0	2.1 - 0.8	8.1 - 3.0	14.1 - 5.3	21	5°50.3	5°51.2	5°34.3	2.1 - 0.8	8.1 - 3.2	14.1 - 5.5
22	5°20.5	5°21.4	5°05.9	2.2 - 0.8	8.2 - 2.9	14.2 - 5.1	22	5°35.5	5°36.4	5°20.2	2.2 - 0.8	8.2 - 3.1	14.2 - 5.3	22	5°50.5	5°51.5	5°34.5	2.2 - 0.9	8.2 - 3.2	14.2 - 5.6
23	5°20.7	5°21.6	5°06.1	2.3 - 0.8	8.3 - 3.0	14.3 - 5.1	23	5°35.7	5°36.7	5°20.5	2.3 - 0.9	8.3 - 3.1	14.3 - 5.4	23	5°50.7	5°51.7	5°34.8	2.3 - 0.9	8.3 - 3.3	14.3 - 5.6
24	5°21.0	5°21.9	5°06.4	2.4 - 0.9	8.4 - 3.0	14.4 - 5.2	24	5°36.0	5°36.9	5°20.7	2.4 - 0.9	8.4 - 3.2	14.4 - 5.4	24	5°51.0	5°52.0	5°35.0	2.4 - 0.9	8.4 - 3.3	14.4 - 5.6
25	5°21.3	5°22.1	5°06.6	2.5 - 0.9	8.5 - 3.0	14.5 - 5.2	25	5°36.3	5°37.2	5°20.9	2.5 - 0.9	8.5 - 3.2	14.5 - 5.4	25	5°51.3	5°52.2	5°35.2	2.5 - 1.0	8.5 - 3.3	14.5 - 5.7
26	5°21.5	5°22.4	5°06.9	2.6 - 0.9	8.6 - 3.1	14.6 - 5.2	26	5°36.5	5°37.4	5°21.2	2.6 - 1.0	8.6 - 3.2	14.6 - 5.5	26	5°51.5	5°52.5	5°35.5	2.6 - 1.0	8.6 - 3.4	14.6 - 5.7
27	5°21.7	5°22.6	5°07.1	2.7 - 1.0	8.7 - 3.1	14.7 - 5.3	27	5°36.7	5°37.7	5°21.4	2.7 - 1.0	8.7 - 3.3	14.7 - 5.5	27	5°51.7	5°52.7	5°35.7	2.7 - 1.1	8.7 - 3.4	14.7 - 5.8
28	5°22.0	5°22.9	5°07.3	2.8 - 1.0	8.8 - 3.2	14.8 - 5.3	28	5°37.0	5°37.9	5°21.6	2.8 - 1.1	8.8 - 3.3	14.8 - 5.6	28	5°52.0	5°53.0	5°36.0	2.8 - 1.1	8.8 - 3.4	14.8 - 5.8
29	5°22.3	5°23.1	5°07.6	2.9 - 1.0	8.9 - 3.2	14.9 - 5.3	29	5°37.3	5°38.2	5°21.9	2.9 - 1.1	8.9 - 3.3	14.9 - 5.6	29	5°52.3	5°53.2	5°36.2	2.9 - 1.1	8.9 - 3.5	14.9 - 5.8
30	5°22.5	5°23.4	5°07.8	3.0 - 1.1	9.0 - 3.2	15.0 - 5.4	30	5°37.5	5°38.4	5°22.1	3.0 - 1.1	9.0 - 3.4	15.0 - 5.6	30	5°52.5	5°53.5	5°36.4	3.0 - 1.2	9.0 - 3.5	15.0 - 5.9
31	5°22.7	5°23.6	5°08.0	3.1 - 1.1	9.1 - 3.3	15.1 - 5.4	31	5°37.7	5°38.7	5°22.4	3.1 - 1.2	9.1 - 3.4	15.1 - 5.7	31	5°52.7	5°53.7	5°36.7	3.1 - 1.2	9.1 - 3.6	15.1 - 5.9
32	5°23.0	5°23.9	5°08.3	3.2 - 1.1	9.2 - 3.3	15.2 - 5.4	32	5°38.0	5°38.9	5°22.6	3.2 - 1.2	9.2 - 3.4	15.2 - 5.7	32	5°53.0	5°54.0	5°36.9	3.2 - 1.3	9.2 - 3.6	15.2 - 6.0
33	5°23.3	5°24.1	5°08.5	3.3 - 1.2	9.3 - 3.3	15.3 - 5.5	33	5°38.3	5°39.3	5°22.8	3.3 - 1.2	9.3 - 3.5	15.3 - 5.7	33	5°53.3	5°54.2	5°37.2	3.3 - 1.3	9.3 - 3.6	15.3 - 6.0
34	5°23.5	5°24.4	5°08.8	3.4 - 1.2	9.4 - 3.4	15.4 - 5.5	34	5°38.5	5°39.4	5°23.1	3.4 - 1.3	9.4 - 3.5	15.4 - 5.8	34	5°53.5	5°54.5	5°37.4	3.4 - 1.3	9.4 - 3.7	15.4 - 6.0
35	5°23.7	5°24.6	5°09.0	3.5 - 1.3	9.5 - 3.4	15.5 - 5.6	35	5°38.7	5°39.7	5°23.3	3.5 - 1.3	9.5 - 3.6	15.5 - 5.8	35	5°53.7	5°54.7	5°37.6	3.5 - 1.4	9.5 - 3.7	15.5 - 6.1
36	5°24.0	5°24.9	5°09.2	3.6 - 1.3	9.6 - 3.4	15.6 - 5.6	36	5°39.0	5°39.9	5°23.6	3.6 - 1.4	9.6 - 3.6	15.6 - 5.8	36	5°54.0	5°55.0	5°37.9	3.6 - 1.4	9.6 - 3.8	15.6 - 6.1
37	5°24.3	5°25.1	5°09.5	3.7 - 1.3	9.7 - 3.5	15.7 - 5.6	37	5°39.3	5°40.2	5°23.8	3.7 - 1.4	9.7 - 3.6	15.7 - 5.9	37	5°54.3	5°55.2	5°38.1	3.7 - 1.4	9.7 - 3.8	15.7 - 6.1
38	5°24.5	5°25.4	5°09.7	3.8 - 1.4	9.8 - 3.5	15.8 - 5.7	38	5°39.5	5°40.4	5°24.0	3.8 - 1.4	9.8 - 3.7	15.8 - 5.9	38	5°54.5	5°55.5	5°38.4	3.8 - 1.5	9.8 - 3.8	15.8 - 6.2
39	5°24.7	5°25.6	5°10.0	3.9 - 1.4	9.9 - 3.5	15.9 - 5.7	39	5°39.7	5°40.7	5°24.3	3.9 - 1.5	9.9 - 3.7	15.9 - 6.0	39	5°54.7	5°55.7	5°38.6	3.9 - 1.5	9.9 - 3.9	15.9 - 6.2
40	5°25.0	5°25.9	5°10.2	4.0 - 1.4	10.0 - 3.6	16.0 - 5.7	40	5°40.0	5°40.9	5°24.5	4.0 - 1.5	10.0 - 3.8	16.0 - 6.0	40	5°55.0	5°56.0	5°38.8	4.0 - 1.6	10.0 - 3.9	16.0 - 6.3
41	5°25.3	5°26.1	5°10.4	4.1 - 1.5	10.1 - 3.6	16.1 - 5.8	41	5°40.3	5°41.2	5°24.7	4.1 - 1.5	10.1 - 3.8	16.1 - 6.0	41	5°55.3	5°56.2	5°39.1	4.1 - 1.6	10.1 - 4.0	16.1 - 6.3
42	5°25.5	5°26.4	5°10.7	4.2 - 1.5	10.2 - 3.7	16.2 - 5.8	42	5°40.5	5°41.4	5°25.0	4.2 - 1.6	10.2 - 3.8	16.2 - 6.1	42	5°55.5	5°56.5	5°39.3	4.2 - 1.6	10.2 - 4.0	16.2 - 6.3
43	5°25.7	5°26.6	5°10.9	4.3 - 1.5	10.3 - 3.7	16.3 - 5.8	43	5°40.7	5°41											

## Increments and Corrections

m 24	Sun Plan.	Aries	Moon	v and d corr			m 25	Sun Plan.	Aries	Moon	v and d corr			m 26	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	0	6°15.0	6°16.0	5°57.9	0.0 - 0.0	6.0 - 2.5	12.0 - 5.1	0	6°30.0	6°31.1	6°12.2	0.0 - 0.0	6.0 - 2.6	12.0 - 5.3
1	6°00.2	6°01.2	5°43.8	0.1 - 0.0	6.1 - 2.5	12.1 - 4.9	1	6°15.2	6°16.3	5°58.2	0.1 - 0.0	6.1 - 2.6	12.1 - 5.1	1	6°30.2	6°31.3	6°12.5	0.1 - 0.0	6.1 - 2.7	12.1 - 5.3
2	6°00.5	6°01.5	5°44.1	0.2 - 0.1	6.2 - 2.5	12.2 - 5.0	2	6°15.5	6°16.5	5°58.4	0.2 - 0.1	6.2 - 2.6	12.2 - 5.2	2	6°30.5	6°31.6	6°12.7	0.2 - 0.1	6.2 - 2.7	12.2 - 5.4
3	6°00.8	6°01.7	5°44.3	0.3 - 0.1	6.3 - 2.6	12.3 - 5.0	3	6°15.8	6°16.8	5°58.6	0.3 - 0.1	6.3 - 2.7	12.3 - 5.2	3	6°30.8	6°31.8	6°12.9	0.3 - 0.1	6.3 - 2.8	12.3 - 5.4
4	6°01.0	6°02.0	5°44.6	0.4 - 0.2	6.4 - 2.6	12.4 - 5.1	4	6°16.0	6°17.0	5°58.9	0.4 - 0.2	6.4 - 2.7	12.4 - 5.3	4	6°31.0	6°32.1	6°13.2	0.4 - 0.2	6.4 - 2.8	12.4 - 5.5
5	6°01.2	6°02.2	5°44.8	0.5 - 0.2	6.5 - 2.7	12.5 - 5.1	5	6°16.2	6°17.3	5°59.1	0.5 - 0.2	6.5 - 2.8	12.5 - 5.3	5	6°31.2	6°32.3	6°13.4	0.5 - 0.2	6.5 - 2.9	12.5 - 5.5
6	6°01.5	6°02.5	5°45.0	0.6 - 0.2	6.6 - 2.7	12.6 - 5.1	6	6°16.5	6°17.5	5°59.3	0.6 - 0.3	6.6 - 2.8	12.6 - 5.4	6	6°31.5	6°32.6	6°13.7	0.6 - 0.3	6.6 - 2.9	12.6 - 5.6
7	6°01.8	6°02.7	5°45.3	0.7 - 0.3	6.7 - 2.7	12.7 - 5.2	7	6°16.8	6°17.8	5°59.6	0.7 - 0.3	6.7 - 2.8	12.7 - 5.4	7	6°31.8	6°32.8	6°13.9	0.7 - 0.3	6.7 - 3.0	12.7 - 5.6
8	6°02.0	6°03.0	5°45.5	0.8 - 0.3	6.8 - 2.8	12.8 - 5.2	8	6°17.0	6°18.0	5°59.8	0.8 - 0.3	6.8 - 2.9	12.8 - 5.4	8	6°32.0	6°33.1	6°14.1	0.8 - 0.4	6.8 - 3.0	12.8 - 5.7
9	6°02.2	6°03.2	5°45.7	0.9 - 0.4	6.9 - 2.8	12.9 - 5.3	9	6°17.2	6°18.3	6°00.1	0.9 - 0.4	6.9 - 2.9	12.9 - 5.5	9	6°32.2	6°33.3	6°14.4	0.9 - 0.4	6.9 - 3.0	12.9 - 5.7
10	6°02.5	6°03.5	5°46.0	1.0 - 0.4	7.0 - 2.9	13.0 - 5.3	10	6°17.5	6°18.5	6°00.3	1.0 - 0.4	7.0 - 3.0	13.0 - 5.5	10	6°32.5	6°33.6	6°14.6	1.0 - 0.4	7.0 - 3.1	13.0 - 5.7
11	6°02.8	6°03.7	5°46.2	1.1 - 0.4	7.1 - 2.9	13.1 - 5.3	11	6°17.8	6°18.8	6°00.5	1.1 - 0.5	7.1 - 3.0	13.1 - 5.6	11	6°32.8	6°33.8	6°14.9	1.1 - 0.5	7.1 - 3.1	13.1 - 5.8
12	6°03.0	6°04.0	5°46.5	1.2 - 0.5	7.2 - 2.9	13.2 - 5.4	12	6°18.0	6°19.0	6°00.8	1.2 - 0.5	7.2 - 3.1	13.2 - 5.6	12	6°33.0	6°34.1	6°15.1	1.2 - 0.5	7.2 - 3.2	13.2 - 5.8
13	6°03.2	6°04.2	5°46.7	1.3 - 0.5	7.3 - 3.0	13.3 - 5.4	13	6°18.2	6°19.3	6°01.0	1.3 - 0.6	7.3 - 3.1	13.3 - 5.7	13	6°33.2	6°34.3	6°15.3	1.3 - 0.6	7.3 - 3.2	13.3 - 5.9
14	6°03.5	6°04.5	5°46.9	1.4 - 0.6	7.4 - 3.0	13.4 - 5.5	14	6°18.5	6°19.5	6°01.3	1.4 - 0.6	7.4 - 3.1	13.4 - 5.7	14	6°33.5	6°34.6	6°15.6	1.4 - 0.6	7.4 - 3.3	13.4 - 5.9
15	6°03.8	6°04.7	5°47.2	1.5 - 0.6	7.5 - 3.1	13.5 - 5.5	15	6°18.8	6°19.8	6°01.5	1.5 - 0.6	7.5 - 3.2	13.5 - 5.7	15	6°33.8	6°34.8	6°15.8	1.5 - 0.7	7.5 - 3.3	13.5 - 6.0
16	6°04.0	6°05.0	5°47.4	1.6 - 0.7	7.6 - 3.1	13.6 - 5.6	16	6°19.0	6°20.0	6°01.7	1.6 - 0.7	7.6 - 3.2	13.6 - 5.8	16	6°34.0	6°35.1	6°16.1	1.6 - 0.7	7.6 - 3.4	13.6 - 6.0
17	6°04.3	6°05.2	5°47.7	1.7 - 0.7	7.7 - 3.1	13.7 - 5.6	17	6°19.3	6°20.3	6°02.0	1.7 - 0.7	7.7 - 3.3	13.7 - 5.8	17	6°34.3	6°35.3	6°16.3	1.7 - 0.8	7.7 - 3.4	13.7 - 6.1
18	6°04.5	6°05.5	5°47.9	1.8 - 0.7	7.8 - 3.2	13.8 - 5.6	18	6°19.5	6°20.5	6°02.2	1.8 - 0.8	7.8 - 3.3	13.8 - 5.9	18	6°34.5	6°35.6	6°16.5	1.8 - 0.8	7.8 - 3.4	13.8 - 6.1
19	6°04.7	6°05.7	5°48.1	1.9 - 0.8	7.9 - 3.2	13.9 - 5.7	19	6°19.7	6°20.8	6°02.5	1.9 - 0.8	7.9 - 3.4	13.9 - 5.9	19	6°34.8	6°35.8	6°16.8	1.9 - 0.8	7.9 - 3.5	13.9 - 6.1
20	6°05.0	6°06.0	5°48.4	2.0 - 0.8	8.0 - 3.3	14.0 - 5.7	20	6°20.0	6°21.0	6°02.7	2.0 - 0.8	8.0 - 3.4	14.0 - 6.0	20	6°35.0	6°36.1	6°17.0	2.0 - 0.9	8.0 - 3.5	14.0 - 6.2
21	6°05.3	6°06.2	5°48.6	2.1 - 0.9	8.1 - 3.3	14.1 - 5.8	21	6°20.3	6°21.3	6°02.9	2.1 - 0.9	8.1 - 3.4	14.1 - 6.0	21	6°35.3	6°36.3	6°17.2	2.1 - 0.9	8.1 - 3.6	14.1 - 6.2
22	6°05.5	6°06.5	5°48.8	2.2 - 0.9	8.2 - 3.3	14.2 - 5.8	22	6°20.5	6°21.5	6°03.2	2.2 - 0.9	8.2 - 3.5	14.2 - 6.0	22	6°35.5	6°36.6	6°17.5	2.2 - 1.0	8.2 - 3.6	14.2 - 6.3
23	6°05.7	6°06.7	5°49.1	2.3 - 0.9	8.3 - 3.4	14.3 - 5.8	23	6°20.7	6°21.8	6°03.4	2.3 - 1.0	8.3 - 3.5	14.3 - 6.1	23	6°35.7	6°36.8	6°17.7	2.3 - 1.0	8.3 - 3.7	14.3 - 6.3
24	6°06.0	6°07.0	5°49.3	2.4 - 1.0	8.4 - 3.4	14.4 - 5.9	24	6°21.0	6°22.0	6°03.6	2.4 - 1.0	8.4 - 3.6	14.4 - 6.1	24	6°36.0	6°37.1	6°18.0	2.4 - 1.1	8.4 - 3.7	14.4 - 6.4
25	6°06.3	6°07.3	5°49.6	2.5 - 1.0	8.5 - 3.5	14.5 - 5.9	25	6°21.3	6°22.3	6°03.9	2.5 - 1.1	8.5 - 3.6	14.5 - 6.2	25	6°36.3	6°37.3	6°18.2	2.5 - 1.1	8.5 - 3.8	14.5 - 6.4
26	6°06.5	6°07.5	5°49.8	2.6 - 1.1	8.6 - 3.5	14.6 - 6.0	26	6°21.5	6°22.5	6°04.1	2.6 - 1.1	8.6 - 3.7	14.6 - 6.2	26	6°36.5	6°37.6	6°18.4	2.6 - 1.1	8.6 - 3.8	14.6 - 6.4
27	6°06.7	6°07.8	5°50.0	2.7 - 1.1	8.7 - 3.6	14.7 - 6.0	27	6°21.7	6°22.8	6°04.4	2.7 - 1.1	8.7 - 3.7	14.7 - 6.2	27	6°36.7	6°37.8	6°18.7	2.7 - 1.2	8.7 - 3.8	14.7 - 6.5
28	6°07.0	6°08.0	5°50.3	2.8 - 1.1	8.8 - 3.6	14.8 - 6.0	28	6°22.0	6°23.0	6°04.6	2.8 - 1.2	8.8 - 3.7	14.8 - 6.3	28	6°37.0	6°38.1	6°18.9	2.8 - 1.2	8.8 - 3.9	14.8 - 6.5
29	6°07.3	6°08.3	5°50.5	2.9 - 1.2	8.9 - 3.6	14.9 - 6.1	29	6°22.3	6°23.3	6°04.8	2.9 - 1.2	8.9 - 3.8	14.9 - 6.3	29	6°37.3	6°38.3	6°19.2	2.9 - 1.3	8.9 - 3.9	14.9 - 6.6
30	6°07.5	6°08.5	5°50.8	3.0 - 1.2	9.0 - 3.7	15.0 - 6.1	30	6°22.5	6°23.5	6°05.1	3.0 - 1.3	9.0 - 3.8	15.0 - 6.4	30	6°37.5	6°38.6	6°19.4	3.0 - 1.3	9.0 - 4.0	15.0 - 6.6
31	6°07.7	6°08.8	5°51.0	3.1 - 1.3	9.1 - 3.7	15.1 - 6.2	31	6°22.7	6°23.8	6°05.3	3.1 - 1.3	9.1 - 3.9	15.1 - 6.4	31	6°37.7	6°38.8	6°19.6	3.1 - 1.4	9.1 - 4.0	15.1 - 6.7
32	6°08.0	6°09.0	5°51.2	3.2 - 1.3	9.2 - 3.8	15.2 - 6.2	32	6°23.0	6°24.0	6°05.6	3.2 - 1.4	9.2 - 3.9	15.2 - 6.5	32	6°38.0	6°39.1	6°19.9	3.2 - 1.4	9.2 - 4.1	15.2 - 6.7
33	6°08.3	6°09.3	5°51.5	3.3 - 1.3	9.3 - 3.8	15.3 - 6.2	33	6°23.3	6°24.3	6°05.8	3.3 - 1.4	9.3 - 4.0	15.3 - 6.5	33	6°38.3	6°39.3	6°20.1	3.3 - 1.5	9.3 - 4.1	15.3 - 6.8
34	6°08.5	6°09.5	5°51.7	3.4 - 1.4	9.4 - 3.8	15.4 - 6.3	34	6°23.5	6°24.5	6°06.0	3.4 - 1.4	9.4 - 4.0	15.4 - 6.5	34	6°38.5	6°39.6	6°20.3	3.4 - 1.5	9.4 - 4.2	15.4 - 6.8
35	6°08.7	6°09.8	5°52.0	3.5 - 1.4	9.5 - 3.9	15.5 - 6.3	35	6°23.7	6°24.8	6°06.3	3.5 - 1.5	9.5 - 4.0	15.5 - 6.6	35	6°38.7	6°39.8	6°20.6	3.5 - 1.5	9.5 - 4.2	15.5 - 6.8
36	6°09.0	6°10.0	5°52.2	3.6 - 1.5	9.6 - 3.9	15.6 - 6.4	36	6°24.0	6°25.0	6°06.5	3.6 - 1.5	9.6 - 4.1	15.6 - 6.6	36	6°39.0	6°40.1	6°20.8	3.6 - 1.6	9.6 - 4.2	15.6 - 6.9
37	6°09.3	6°10.3	5°52.4	3.7 - 1.5	9.7 - 4.0	15.7 - 6.4	37	6°24.3	6°25.3	6°06.7	3.7 - 1.6	9.7 - 4.1	15.7 - 6.7	37	6°39.3	6°40.3	6°21.1	3.7 - 1.6	9.7 - 4.3	15.7 - 6.9
38	6°09.5	6°10.5	5°52.7	3.8 - 1.6	9.8 - 4.0	15.8 - 6.5	38	6°24.5	6°25.6	6°07.0	3.8 - 1.6	9.8 - 4.2	15.8 - 6.7	38	6°39.5	6°40.6	6°21.3	3.8 - 1.7	9.8 - 4.3	15.8 - 7.0
39	6°09.7	6°10.8	5°52.9	3.9 - 1.6	9.9 - 4.0	15.9 - 6.5	39	6°24.7	6°25.8	6°07.2	3.9 - 1.7	9.9 - 4.2	15.9 - 6.8	39	6°39.7	6°40.8	6°21.5	3.9 - 1.7	9.9 - 4.4	15.9 - 7.0
40	6°10.0	6°11.0	5°53.1	4.0 - 1.6	10.0 - 4.1	16.0 - 6.5	40	6°25.0	6°26.1	6°07.5	4.0 - 1.7	10.0 - 4.3	16.0 - 6.8	40	6°40.0	6°41.1	6°21.8	4.0 - 1.8	10.0 - 4.4	16.0 - 7.1
41	6°10.3	6°11.3	5°53.4	4.1 - 1.7	10.1 - 4.1	16.1 - 6.6	41	6°25.3	6°26.3	6°07.7	4.1 - 1.7	10.1 - 4.3	16.1 - 6.8	41	6°40.3	6°41.3	6°22.0	4.1 - 1.8	10.1 - 4.5	16.1 - 7.1
42	6°10.5	6°11.5	5°53.6	4.2 - 1.7	10.2 - 4.2	16.2 - 6.6	42	6°25.5	6°26.6	6°07.9	4.2 - 1.8	10.2 - 4.3	16.2 - 6.9	42	6°40.5	6°41.6	6°22.3	4.2 - 1.9	10.2 - 4.5	16.2 - 7.2
43	6°10.7	6°11.8	5°53.9	4.3 - 1.8	10.3 - 4.2	16.3 - 6.7	43	6°25.7	6°26											

## Increments and Corrections

m 27	Sun Plan.	Aries	Moon	v and d corr				m 28	Sun Plan.	Aries	Moon	v and d corr				m 29	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		0	7°00.0	7°01.1	6°40.9	0.0 - 0.0	6.0 - 2.8	12.0 - 5.7		0	7°15.0	7°16.2	6°55.2	0.0 - 0.0	6.0 - 2.9	12.0 - 5.9	
1	6°45.2	6°46.4	6°26.8	0.1 - 0.0	6.1 - 2.8	12.1 - 5.5		1	7°00.2	7°01.4	6°41.1	0.1 - 0.0	6.1 - 2.9	12.1 - 5.7		1	7°15.2	7°16.4	6°55.4	0.1 - 0.0	6.1 - 3.0	12.1 - 5.9	
2	6°45.5	6°46.6	6°27.0	0.2 - 0.1	6.2 - 2.8	12.2 - 5.6		2	7°00.5	7°01.6	6°41.3	0.2 - 0.1	6.2 - 2.9	12.2 - 5.8		2	7°15.5	7°16.7	6°55.7	0.2 - 0.1	6.2 - 3.0	12.2 - 6.0	
3	6°45.8	6°46.9	6°27.3	0.3 - 0.1	6.3 - 2.9	12.3 - 5.6		3	7°00.8	7°01.9	6°41.6	0.3 - 0.1	6.3 - 3.0	12.3 - 5.8		3	7°15.8	7°16.9	6°55.9	0.3 - 0.1	6.3 - 3.1	12.3 - 6.0	
4	6°46.0	6°47.1	6°27.5	0.4 - 0.2	6.4 - 2.9	12.4 - 5.7		4	7°01.0	7°02.2	6°41.8	0.4 - 0.2	6.4 - 3.0	12.4 - 5.9		4	7°16.0	7°17.2	6°56.1	0.4 - 0.2	6.4 - 3.1	12.4 - 6.1	
5	6°46.2	6°47.4	6°27.7	0.5 - 0.2	6.5 - 3.0	12.5 - 5.7		5	7°01.2	7°02.4	6°42.1	0.5 - 0.2	6.5 - 3.1	12.5 - 5.9		5	7°16.2	7°17.4	6°56.4	0.5 - 0.2	6.5 - 3.2	12.5 - 6.1	
6	6°46.5	6°47.6	6°28.0	0.6 - 0.3	6.6 - 3.0	12.6 - 5.8		6	7°01.5	7°02.7	6°42.3	0.6 - 0.3	6.6 - 3.1	12.6 - 6.0		6	7°16.5	7°17.7	6°56.6	0.6 - 0.3	6.6 - 3.2	12.6 - 6.2	
7	6°46.8	6°47.9	6°28.2	0.7 - 0.3	6.7 - 3.1	12.7 - 5.8		7	7°01.8	7°02.9	6°42.5	0.7 - 0.3	6.7 - 3.2	12.7 - 6.0		7	7°16.8	7°17.9	6°56.9	0.7 - 0.3	6.7 - 3.3	12.7 - 6.2	
8	6°47.0	6°48.1	6°28.5	0.8 - 0.4	6.8 - 3.1	12.8 - 5.9		8	7°02.0	7°03.2	6°42.8	0.8 - 0.4	6.8 - 3.2	12.8 - 6.1		8	7°17.0	7°18.2	6°57.1	0.8 - 0.4	6.8 - 3.3	12.8 - 6.3	
9	6°47.2	6°48.4	6°28.7	0.9 - 0.4	6.9 - 3.2	12.9 - 5.9		9	7°02.2	7°03.4	6°43.0	0.9 - 0.4	6.9 - 3.3	12.9 - 6.1		9	7°17.2	7°18.4	6°57.3	0.9 - 0.4	6.9 - 3.4	12.9 - 6.3	
10	6°47.5	6°48.6	6°28.9	1.0 - 0.5	7.0 - 3.2	13.0 - 6.0		10	7°02.5	7°03.7	6°43.3	1.0 - 0.5	7.0 - 3.3	13.0 - 6.2		10	7°17.5	7°18.7	6°57.6	1.0 - 0.5	7.0 - 3.4	13.0 - 6.4	
11	6°47.8	6°48.9	6°29.2	1.1 - 0.5	7.1 - 3.3	13.1 - 6.0		11	7°02.8	7°03.9	6°43.5	1.1 - 0.5	7.1 - 3.4	13.1 - 6.2		11	7°17.8	7°18.9	6°57.8	1.1 - 0.5	7.1 - 3.5	13.1 - 6.4	
12	6°48.0	6°49.1	6°29.4	1.2 - 0.6	7.2 - 3.3	13.2 - 6.0		12	7°03.0	7°04.2	6°43.7	1.2 - 0.6	7.2 - 3.4	13.2 - 6.3		12	7°18.0	7°19.2	6°58.0	1.2 - 0.6	7.2 - 3.5	13.2 - 6.5	
13	6°48.2	6°49.4	6°29.7	1.3 - 0.6	7.3 - 3.3	13.3 - 6.1		13	7°03.2	7°04.4	6°44.0	1.3 - 0.6	7.3 - 3.5	13.3 - 6.3		13	7°18.2	7°19.4	6°58.3	1.3 - 0.6	7.3 - 3.6	13.3 - 6.5	
14	6°48.5	6°49.6	6°29.9	1.4 - 0.6	7.4 - 3.4	13.4 - 6.1		14	7°03.5	7°04.7	6°44.2	1.4 - 0.7	7.4 - 3.5	13.4 - 6.4		14	7°18.5	7°19.7	6°58.5	1.4 - 0.7	7.4 - 3.6	13.4 - 6.6	
15	6°48.8	6°49.9	6°30.1	1.5 - 0.7	7.5 - 3.4	13.5 - 6.2		15	7°03.8	7°04.9	6°44.4	1.5 - 0.7	7.5 - 3.6	13.5 - 6.4		15	7°18.8	7°19.9	6°58.8	1.5 - 0.7	7.5 - 3.7	13.5 - 6.6	
16	6°49.0	6°50.1	6°30.4	1.6 - 0.7	7.6 - 3.5	13.6 - 6.2		16	7°04.0	7°05.2	6°44.7	1.6 - 0.8	7.6 - 3.6	13.6 - 6.5		16	7°19.0	7°20.2	6°59.0	1.6 - 0.8	7.6 - 3.7	13.6 - 6.7	
17	6°49.3	6°50.4	6°30.6	1.7 - 0.8	7.7 - 3.5	13.7 - 6.3		17	7°04.3	7°05.4	6°44.9	1.7 - 0.8	7.7 - 3.7	13.7 - 6.5		17	7°19.3	7°20.5	6°59.2	1.7 - 0.8	7.7 - 3.8	13.7 - 6.7	
18	6°49.5	6°50.6	6°30.8	1.8 - 0.8	7.8 - 3.6	13.8 - 6.3		18	7°04.5	7°05.7	6°45.2	1.8 - 0.9	7.8 - 3.7	13.8 - 6.6		18	7°19.5	7°20.7	6°59.5	1.8 - 0.9	7.8 - 3.8	13.8 - 6.8	
19	6°49.8	6°50.9	6°31.1	1.9 - 0.9	7.9 - 3.6	13.9 - 6.4		19	7°04.7	7°05.9	6°45.4	1.9 - 0.9	7.9 - 3.8	13.9 - 6.6		19	7°19.7	7°21.0	6°59.7	1.9 - 0.9	7.9 - 3.9	13.9 - 6.8	
20	6°50.0	6°51.1	6°31.3	2.0 - 0.9	8.0 - 3.7	14.0 - 6.4		20	7°05.0	7°06.2	6°45.6	2.0 - 0.9	8.0 - 3.8	14.0 - 6.6		20	7°20.0	7°21.2	7°00.0	2.0 - 1.0	8.0 - 3.9	14.0 - 6.9	
21	6°50.3	6°51.4	6°31.6	2.1 - 1.0	8.1 - 3.7	14.1 - 6.5		21	7°05.3	7°06.4	6°45.9	2.1 - 1.0	8.1 - 3.8	14.1 - 6.7		21	7°20.3	7°21.5	7°00.2	2.1 - 1.0	8.1 - 4.0	14.1 - 6.9	
22	6°50.5	6°51.6	6°31.8	2.2 - 1.0	8.2 - 3.8	14.2 - 6.5		22	7°05.5	7°06.7	6°46.1	2.2 - 1.0	8.2 - 3.9	14.2 - 6.7		22	7°20.5	7°21.7	7°00.4	2.2 - 1.1	8.2 - 4.0	14.2 - 7.0	
23	6°50.7	6°51.9	6°32.0	2.3 - 1.1	8.3 - 3.8	14.3 - 6.6		23	7°05.7	7°06.9	6°46.4	2.3 - 1.1	8.3 - 3.9	14.3 - 6.8		23	7°20.7	7°22.0	7°00.7	2.3 - 1.1	8.3 - 4.1	14.3 - 7.0	
24	6°51.0	6°52.1	6°32.3	2.4 - 1.1	8.4 - 3.9	14.4 - 6.6		24	7°06.0	7°07.2	6°46.6	2.4 - 1.1	8.4 - 4.0	14.4 - 6.8		24	7°21.0	7°22.2	7°00.9	2.4 - 1.2	8.4 - 4.1	14.4 - 7.1	
25	6°51.3	6°52.4	6°32.5	2.5 - 1.1	8.5 - 3.9	14.5 - 6.6		25	7°06.3	7°07.4	6°46.8	2.5 - 1.2	8.5 - 4.0	14.5 - 6.9		25	7°21.3	7°22.5	7°01.1	2.5 - 1.2	8.5 - 4.2	14.5 - 7.1	
26	6°51.5	6°52.6	6°32.8	2.6 - 1.2	8.6 - 3.9	14.6 - 6.7		26	7°06.5	7°07.7	6°47.1	2.6 - 1.2	8.6 - 4.1	14.6 - 6.9		26	7°21.5	7°22.7	7°01.4	2.6 - 1.3	8.6 - 4.2	14.6 - 7.2	
27	6°51.7	6°52.9	6°33.0	2.7 - 1.2	8.7 - 4.0	14.7 - 6.7		27	7°06.7	7°07.9	6°47.3	2.7 - 1.3	8.7 - 4.1	14.7 - 7.0		27	7°21.7	7°23.0	7°01.6	2.7 - 1.3	8.7 - 4.3	14.7 - 7.2	
28	6°52.0	6°53.1	6°33.2	2.8 - 1.3	8.8 - 4.0	14.8 - 6.8		28	7°07.0	7°08.2	6°47.5	2.8 - 1.3	8.8 - 4.2	14.8 - 7.0		28	7°22.0	7°23.2	7°01.9	2.8 - 1.4	8.8 - 4.3	14.8 - 7.3	
29	6°52.3	6°53.4	6°33.5	2.9 - 1.3	8.9 - 4.1	14.9 - 6.8		29	7°07.3	7°08.4	6°47.8	2.9 - 1.4	8.9 - 4.2	14.9 - 7.1		29	7°22.3	7°23.5	7°02.1	2.9 - 1.4	8.9 - 4.4	14.9 - 7.3	
30	6°52.5	6°53.6	6°33.7	3.0 - 1.4	9.0 - 4.1	15.0 - 6.9		30	7°07.5	7°08.7	6°48.0	3.0 - 1.4	9.0 - 4.3	15.0 - 7.1		30	7°22.5	7°23.7	7°02.3	3.0 - 1.5	9.0 - 4.4	15.0 - 7.4	
31	6°52.7	6°53.9	6°33.9	3.1 - 1.4	9.1 - 4.2	15.1 - 6.9		31	7°07.7	7°08.9	6°48.3	3.1 - 1.5	9.1 - 4.3	15.1 - 7.2		31	7°22.7	7°24.0	7°02.6	3.1 - 1.5	9.1 - 4.5	15.1 - 7.4	
32	6°53.0	6°54.1	6°34.2	3.2 - 1.5	9.2 - 4.2	15.2 - 7.0		32	7°08.0	7°09.2	6°48.5	3.2 - 1.5	9.2 - 4.4	15.2 - 7.2		32	7°23.0	7°24.2	7°02.8	3.2 - 1.6	9.2 - 4.5	15.2 - 7.5	
33	6°53.3	6°54.4	6°34.4	3.3 - 1.5	9.3 - 4.3	15.3 - 7.0		33	7°08.3	7°09.4	6°48.7	3.3 - 1.6	9.3 - 4.4	15.3 - 7.3		33	7°23.3	7°24.5	7°03.1	3.3 - 1.6	9.3 - 4.6	15.3 - 7.5	
34	6°53.5	6°54.6	6°34.7	3.4 - 1.6	9.4 - 4.3	15.4 - 7.1		34	7°08.5	7°09.7	6°49.0	3.4 - 1.6	9.4 - 4.5	15.4 - 7.3		34	7°23.5	7°24.7	7°03.3	3.4 - 1.7	9.4 - 4.6	15.4 - 7.6	
35	6°53.7	6°54.9	6°34.9	3.5 - 1.6	9.5 - 4.4	15.5 - 7.1		35	7°08.7	7°09.9	6°49.2	3.5 - 1.7	9.5 - 4.5	15.5 - 7.4		35	7°23.7	7°25.0	7°03.5	3.5 - 1.7	9.5 - 4.7	15.5 - 7.6	
36	6°54.0	6°55.1	6°35.1	3.6 - 1.6	9.6 - 4.4	15.6 - 7.1		36	7°09.0	7°10.2	6°49.5	3.6 - 1.7	9.6 - 4.6	15.6 - 7.4		36	7°24.0	7°25.2	7°03.8	3.6 - 1.8	9.6 - 4.7	15.6 - 7.7	
37	6°54.3	6°55.4	6°35.4	3.7 - 1.7	9.7 - 4.4	15.7 - 7.2		37	7°09.3	7°10.4	6°49.7	3.7 - 1.8	9.7 - 4.6	15.7 - 7.5		37	7°24.3	7°25.5	7°04.0	3.7 - 1.8	9.7 - 4.8	15.7 - 7.7	
38	6°54.5	6°55.6	6°35.6	3.8 - 1.7	9.8 - 4.5	15.8 - 7.2		38	7°09.5	7°10.7	6°49.9	3.8 - 1.8	9.8 - 4.7	15.8 - 7.5		38	7°24.5	7°25.7	7°04.3	3.8 - 1.9	9.8 - 4.8	15.8 - 7.8	
39	6°54.7	6°55.9	6°35.9	3.9 - 1.8	9.9 - 4.5	15.9 - 7.3		39	7°09.7	7°10.9	6°50.2	3.9 - 1.9	9.9 - 4.7	15.9 - 7.6		39	7°24.7	7°26.0	7°04.5	3.9 - 1.9	9.9 - 4.9	15.9 - 7.8	
40	6°55.0	6°56.1	6°36.1	4.0 - 1.8	10.0 - 4.6	16.0 - 7.3		40	7°10.0	7°11.2	6°50.4	4.0 - 1.9	10.0 - 4.8	16.0 - 7.6		40	7°25.0	7°26.2	7°04.7	4.0 - 2.0	10.0 - 4.9	16.0 - 7.9	
41	6°55.3	6°56.4	6°36.3	4.1 - 1.9	10.1 - 4.6	16.1 - 7.4		41	7°10.3	7°11.4	6°50.6	4.1 - 1.9	10.1 - 4.8	16.1 - 7.6		41	7°25.3	7°26.5	7°05.0	4.1 - 2.0	10.1 - 5.0	16.1 - 7.	

## Increments and Corrections

m 30	Sun Plan.	Aries	Moon	v and d corr			m 31	Sun Plan.	Aries	Moon	v and d corr			m 32	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	0	7°45.0	7°46.3	7°23.8	0.0 - 0.0	6.0 - 3.2	12.0 - 6.3	0	8°00.0	8°01.3	7°38.1	0.0 - 0.0	6.0 - 3.3	12.0 - 6.5
1	7°30.2	7°31.5	7°09.7	0.1 - 0.1	6.1 - 3.1	12.1 - 6.2	1	7°45.2	7°46.5	7°24.1	0.1 - 0.1	6.1 - 3.2	12.1 - 6.4	1	8°00.2	8°01.6	7°38.4	0.1 - 0.1	6.1 - 3.3	12.1 - 6.6
2	7°30.5	7°31.7	7°10.0	0.2 - 0.1	6.2 - 3.2	12.2 - 6.2	2	7°45.5	7°46.8	7°24.3	0.2 - 0.1	6.2 - 3.3	12.2 - 6.4	2	8°00.5	8°01.8	7°38.6	0.2 - 0.1	6.2 - 3.4	12.2 - 6.6
3	7°30.8	7°32.0	7°10.2	0.3 - 0.2	6.3 - 3.2	12.3 - 6.3	3	7°45.7	7°47.0	7°24.5	0.3 - 0.2	6.3 - 3.3	12.3 - 6.5	3	8°00.7	8°02.1	7°38.8	0.3 - 0.2	6.3 - 3.4	12.3 - 6.7
4	7°31.0	7°32.2	7°10.5	0.4 - 0.2	6.4 - 3.3	12.4 - 6.3	4	7°46.0	7°47.3	7°24.8	0.4 - 0.2	6.4 - 3.4	12.4 - 6.5	4	8°01.0	8°02.3	7°39.1	0.4 - 0.2	6.4 - 3.5	12.4 - 6.7
5	7°31.2	7°32.5	7°10.7	0.5 - 0.3	6.5 - 3.3	12.5 - 6.4	5	7°46.2	7°47.5	7°25.0	0.5 - 0.3	6.5 - 3.4	12.5 - 6.6	5	8°01.3	8°02.6	7°39.3	0.5 - 0.3	6.5 - 3.5	12.5 - 6.8
6	7°31.5	7°32.7	7°10.9	0.6 - 0.3	6.6 - 3.4	12.6 - 6.4	6	7°46.5	7°47.8	7°25.2	0.6 - 0.3	6.6 - 3.5	12.6 - 6.6	6	8°01.5	8°02.8	7°39.6	0.6 - 0.3	6.6 - 3.6	12.6 - 6.8
7	7°31.7	7°33.0	7°11.2	0.7 - 0.4	6.7 - 3.4	12.7 - 6.5	7	7°46.8	7°48.0	7°25.5	0.7 - 0.4	6.7 - 3.5	12.7 - 6.7	7	8°01.8	8°03.1	7°39.8	0.7 - 0.4	6.7 - 3.6	12.7 - 6.9
8	7°32.0	7°33.2	7°11.4	0.8 - 0.4	6.8 - 3.5	12.8 - 6.5	8	7°47.0	7°48.3	7°25.7	0.8 - 0.4	6.8 - 3.6	12.8 - 6.7	8	8°02.0	8°03.3	7°40.0	0.8 - 0.4	6.8 - 3.7	12.8 - 6.9
9	7°32.2	7°33.5	7°11.6	0.9 - 0.5	6.9 - 3.5	12.9 - 6.6	9	7°47.2	7°48.5	7°26.0	0.9 - 0.5	6.9 - 3.6	12.9 - 6.8	9	8°02.2	8°03.6	7°40.3	0.9 - 0.5	6.9 - 3.7	12.9 - 7.0
10	7°32.5	7°33.7	7°11.9	1.0 - 0.5	7.0 - 3.6	13.0 - 6.6	10	7°47.5	7°48.8	7°26.2	1.0 - 0.5	7.0 - 3.7	13.0 - 6.8	10	8°02.5	8°03.8	7°40.5	1.0 - 0.5	7.0 - 3.8	13.0 - 7.0
11	7°32.8	7°34.0	7°12.1	1.1 - 0.6	7.1 - 3.6	13.1 - 6.7	11	7°47.7	7°49.0	7°26.4	1.1 - 0.6	7.1 - 3.7	13.1 - 6.9	11	8°02.7	8°04.1	7°40.8	1.1 - 0.6	7.1 - 3.8	13.1 - 7.1
12	7°33.0	7°34.2	7°12.4	1.2 - 0.6	7.2 - 3.7	13.2 - 6.7	12	7°48.0	7°49.3	7°26.7	1.2 - 0.6	7.2 - 3.8	13.2 - 6.9	12	8°03.0	8°04.3	7°41.0	1.2 - 0.7	7.2 - 3.9	13.2 - 7.1
13	7°33.3	7°34.5	7°12.6	1.3 - 0.7	7.3 - 3.7	13.3 - 6.8	13	7°48.2	7°49.5	7°26.9	1.3 - 0.7	7.3 - 3.8	13.3 - 7.0	13	8°03.3	8°04.6	7°41.2	1.3 - 0.7	7.3 - 4.0	13.3 - 7.2
14	7°33.5	7°34.7	7°12.8	1.4 - 0.7	7.4 - 3.8	13.4 - 6.8	14	7°48.5	7°49.8	7°27.2	1.4 - 0.7	7.4 - 3.9	13.4 - 7.0	14	8°03.5	8°04.8	7°41.5	1.4 - 0.8	7.4 - 4.0	13.4 - 7.3
15	7°33.8	7°35.0	7°13.1	1.5 - 0.8	7.5 - 3.8	13.5 - 6.9	15	7°48.8	7°50.0	7°27.4	1.5 - 0.8	7.5 - 3.9	13.5 - 7.1	15	8°03.8	8°05.1	7°41.7	1.5 - 0.8	7.5 - 4.1	13.5 - 7.3
16	7°34.0	7°35.2	7°13.3	1.6 - 0.8	7.6 - 3.9	13.6 - 6.9	16	7°49.0	7°50.3	7°27.6	1.6 - 0.8	7.6 - 4.0	13.6 - 7.1	16	8°04.0	8°05.3	7°42.0	1.6 - 0.9	7.6 - 4.1	13.6 - 7.4
17	7°34.3	7°35.5	7°13.6	1.7 - 0.9	7.7 - 3.9	13.7 - 7.0	17	7°49.3	7°50.5	7°27.9	1.7 - 0.9	7.7 - 4.0	13.7 - 7.2	17	8°04.2	8°05.6	7°42.2	1.7 - 0.9	7.7 - 4.2	13.7 - 7.4
18	7°34.5	7°35.7	7°13.8	1.8 - 0.9	7.8 - 4.0	13.8 - 7.0	18	7°49.5	7°50.8	7°28.1	1.8 - 0.9	7.8 - 4.1	13.8 - 7.2	18	8°04.5	8°05.8	7°42.4	1.8 - 1.0	7.8 - 4.2	13.8 - 7.5
19	7°34.8	7°36.0	7°14.0	1.9 - 1.0	7.9 - 4.0	13.9 - 7.1	19	7°49.8	7°51.0	7°28.4	1.9 - 1.0	7.9 - 4.1	13.9 - 7.3	19	8°04.8	8°06.1	7°42.7	1.9 - 1.0	7.9 - 4.3	13.9 - 7.5
20	7°35.0	7°36.2	7°14.3	2.0 - 1.0	8.0 - 4.1	14.0 - 7.1	20	7°50.0	7°51.3	7°28.6	2.0 - 1.1	8.0 - 4.2	14.0 - 7.4	20	8°05.0	8°06.3	7°42.9	2.0 - 1.1	8.0 - 4.3	14.0 - 7.6
21	7°35.3	7°36.5	7°14.5	2.1 - 1.1	8.1 - 4.1	14.1 - 7.2	21	7°50.3	7°51.5	7°28.8	2.1 - 1.1	8.1 - 4.3	14.1 - 7.4	21	8°05.3	8°06.6	7°43.1	2.1 - 1.1	8.1 - 4.4	14.1 - 7.6
22	7°35.5	7°36.7	7°14.7	2.2 - 1.1	8.2 - 4.2	14.2 - 7.2	22	7°50.5	7°51.8	7°29.1	2.2 - 1.2	8.2 - 4.3	14.2 - 7.5	22	8°05.5	8°06.8	7°43.4	2.2 - 1.2	8.2 - 4.4	14.2 - 7.7
23	7°35.7	7°37.0	7°15.0	2.3 - 1.2	8.3 - 4.2	14.3 - 7.3	23	7°50.7	7°52.0	7°29.3	2.3 - 1.2	8.3 - 4.4	14.3 - 7.5	23	8°05.7	8°07.1	7°43.6	2.3 - 1.2	8.3 - 4.5	14.3 - 7.7
24	7°36.0	7°37.2	7°15.2	2.4 - 1.2	8.4 - 4.3	14.4 - 7.3	24	7°51.0	7°52.3	7°29.5	2.4 - 1.3	8.4 - 4.4	14.4 - 7.6	24	8°06.0	8°07.3	7°43.9	2.4 - 1.3	8.4 - 4.5	14.4 - 7.8
25	7°36.2	7°37.5	7°15.5	2.5 - 1.3	8.5 - 4.3	14.5 - 7.4	25	7°51.3	7°52.5	7°29.8	2.5 - 1.3	8.5 - 4.5	14.5 - 7.6	25	8°06.2	8°07.6	7°44.1	2.5 - 1.4	8.5 - 4.6	14.5 - 7.9
26	7°36.5	7°37.7	7°15.7	2.6 - 1.3	8.6 - 4.4	14.6 - 7.4	26	7°51.5	7°52.8	7°30.0	2.6 - 1.4	8.6 - 4.5	14.6 - 7.7	26	8°06.5	8°07.8	7°44.3	2.6 - 1.4	8.6 - 4.7	14.6 - 7.9
27	7°36.7	7°38.0	7°15.9	2.7 - 1.4	8.7 - 4.4	14.7 - 7.5	27	7°51.7	7°53.0	7°30.3	2.7 - 1.4	8.7 - 4.6	14.7 - 7.7	27	8°06.8	8°08.1	7°44.6	2.7 - 1.5	8.7 - 4.7	14.7 - 8.0
28	7°37.0	7°38.2	7°16.2	2.8 - 1.4	8.8 - 4.5	14.8 - 7.5	28	7°52.0	7°53.3	7°30.5	2.8 - 1.5	8.8 - 4.6	14.8 - 7.8	28	8°07.0	8°08.3	7°44.8	2.8 - 1.5	8.8 - 4.8	14.8 - 8.0
29	7°37.3	7°38.5	7°16.4	2.9 - 1.5	8.9 - 4.5	14.9 - 7.6	29	7°52.2	7°53.5	7°30.7	2.9 - 1.5	8.9 - 4.7	14.9 - 7.8	29	8°07.3	8°08.6	7°45.1	2.9 - 1.6	8.9 - 4.8	14.9 - 8.1
30	7°37.5	7°38.8	7°16.7	3.0 - 1.5	9.0 - 4.6	15.0 - 7.6	30	7°52.5	7°53.8	7°31.0	3.0 - 1.6	9.0 - 4.7	15.0 - 7.9	30	8°07.5	8°08.8	7°45.3	3.0 - 1.6	9.0 - 4.9	15.0 - 8.1
31	7°37.7	7°39.0	7°16.9	3.1 - 1.6	9.1 - 4.6	15.1 - 7.7	31	7°52.7	7°54.0	7°31.2	3.1 - 1.6	9.1 - 4.8	15.1 - 7.9	31	8°07.7	8°09.1	7°45.5	3.1 - 1.7	9.1 - 4.9	15.1 - 8.2
32	7°38.0	7°39.3	7°17.1	3.2 - 1.6	9.2 - 4.7	15.2 - 7.7	32	7°53.0	7°54.3	7°31.5	3.2 - 1.7	9.2 - 4.8	15.2 - 8.0	32	8°08.0	8°09.3	7°45.8	3.2 - 1.7	9.2 - 5.0	15.2 - 8.2
33	7°38.3	7°39.5	7°17.4	3.3 - 1.7	9.3 - 4.7	15.3 - 7.8	33	7°53.3	7°54.5	7°31.7	3.3 - 1.7	9.3 - 4.9	15.3 - 8.0	33	8°08.2	8°09.6	7°46.0	3.3 - 1.8	9.3 - 5.0	15.3 - 8.3
34	7°38.5	7°39.8	7°17.6	3.4 - 1.7	9.4 - 4.8	15.4 - 7.8	34	7°53.5	7°54.8	7°31.9	3.4 - 1.8	9.4 - 4.9	15.4 - 8.1	34	8°08.5	8°09.8	7°46.2	3.4 - 1.8	9.4 - 5.1	15.4 - 8.3
35	7°38.7	7°40.0	7°17.9	3.5 - 1.8	9.5 - 4.8	15.5 - 7.9	35	7°53.8	7°55.0	7°32.2	3.5 - 1.8	9.5 - 5.0	15.5 - 8.1	35	8°08.8	8°10.1	7°46.5	3.5 - 1.9	9.5 - 5.1	15.5 - 8.4
36	7°39.0	7°40.3	7°18.1	3.6 - 1.8	9.6 - 4.9	15.6 - 7.9	36	7°54.0	7°55.3	7°32.4	3.6 - 1.9	9.6 - 5.0	15.6 - 8.2	36	8°09.0	8°10.3	7°46.7	3.6 - 1.9	9.6 - 5.2	15.6 - 8.4
37	7°39.3	7°40.5	7°18.3	3.7 - 1.9	9.7 - 4.9	15.7 - 8.0	37	7°54.3	7°55.5	7°32.6	3.7 - 1.9	9.7 - 5.1	15.7 - 8.2	37	8°09.3	8°10.6	7°47.0	3.7 - 2.0	9.7 - 5.3	15.7 - 8.5
38	7°39.5	7°40.8	7°18.6	3.8 - 1.9	9.8 - 5.0	15.8 - 8.0	38	7°54.5	7°55.8	7°32.9	3.8 - 2.0	9.8 - 5.1	15.8 - 8.3	38	8°09.5	8°10.8	7°47.2	3.8 - 2.1	9.8 - 5.3	15.8 - 8.6
39	7°39.8	7°41.0	7°18.8	3.9 - 2.0	9.9 - 5.0	15.9 - 8.1	39	7°54.7	7°56.0	7°33.1	3.9 - 2.0	9.9 - 5.2	15.9 - 8.3	39	8°09.7	8°11.1	7°47.4	3.9 - 2.1	9.9 - 5.4	15.9 - 8.6
40	7°40.0	7°41.3	7°19.0	4.0 - 2.0	10.0 - 5.1	16.0 - 8.1	40	7°55.0	7°56.3	7°33.4	4.0 - 2.1	10.0 - 5.3	16.0 - 8.4	40	8°10.0	8°11.3	7°47.7	4.0 - 2.2	10.0 - 5.4	16.0 - 8.7
41	7°40.3	7°41.5	7°19.3	4.1 - 2.1	10.1 - 5.1	16.1 - 8.2	41	7°55.3	7°56.5	7°33.6	4.1 - 2.2	10.1 - 5.3	16.1 - 8.5	41	8°10.2	8°11.6	7°47.9	4.1 - 2.2	10.1 - 5.5	16.1 - 8.7
42	7°40.5	7°41.8	7°19.5	4.2 - 2.1	10.2 - 5.2	16.2 - 8.2	42	7°55.5	7°56.8	7°33.8	4.2 - 2.2	10.2 - 5.4	16.2 - 8.5	42	8°10.5	8°11.8	7°48.2	4.2 - 2.3	10.2 - 5.5	16.2 - 8.8
43	7°40.7	7°42.0	7°19.8	4.3 - 2.2	10.3 - 5.2	16.3 - 8.3	43	7°55.7	7°57											

## Increments and Corrections

m 33	Sun Plan.	Aries	Moon	v and d corr			m 34	Sun Plan.	Aries	Moon	v and d corr			m 35	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	0	8°30.0	8°31.4	8°06.8	0.0 - 0.0	6.0 - 3.4	12.0 - 6.9	0	8°45.0	8°46.4	8°21.1	0.0 - 0.0	6.0 - 3.5	12.0 - 7.1
1	8°15.2	8°16.6	7°52.7	0.1 - 0.1	6.1 - 3.4	12.1 - 6.8	1	8°30.2	8°31.6	8°07.0	0.1 - 0.1	6.1 - 3.5	12.1 - 7.0	1	8°45.2	8°46.7	8°21.3	0.1 - 0.1	6.1 - 3.6	12.1 - 7.2
2	8°15.5	8°16.9	7°52.9	0.2 - 0.1	6.2 - 3.5	12.2 - 6.8	2	8°30.5	8°31.9	8°07.2	0.2 - 0.1	6.2 - 3.6	12.2 - 7.0	2	8°45.5	8°46.9	8°21.6	0.2 - 0.1	6.2 - 3.7	12.2 - 7.2
3	8°15.7	8°17.1	7°53.2	0.3 - 0.2	6.3 - 3.5	12.3 - 6.9	3	8°30.7	8°32.1	8°07.5	0.3 - 0.2	6.3 - 3.6	12.3 - 7.1	3	8°45.7	8°47.2	8°21.8	0.3 - 0.2	6.3 - 3.7	12.3 - 7.3
4	8°16.0	8°17.4	7°53.4	0.4 - 0.2	6.4 - 3.6	12.4 - 6.9	4	8°31.0	8°32.4	8°07.7	0.4 - 0.2	6.4 - 3.7	12.4 - 7.1	4	8°46.0	8°47.4	8°22.0	0.4 - 0.2	6.4 - 3.8	12.4 - 7.3
5	8°16.3	8°17.6	7°53.6	0.5 - 0.3	6.5 - 3.6	12.5 - 7.0	5	8°31.3	8°32.6	8°08.0	0.5 - 0.3	6.5 - 3.7	12.5 - 7.2	5	8°46.3	8°47.7	8°22.3	0.5 - 0.3	6.5 - 3.8	12.5 - 7.4
6	8°16.5	8°17.9	7°53.9	0.6 - 0.3	6.6 - 3.7	12.6 - 7.0	6	8°31.5	8°32.9	8°08.2	0.6 - 0.3	6.6 - 3.8	12.6 - 7.2	6	8°46.5	8°47.9	8°22.5	0.6 - 0.4	6.6 - 3.9	12.6 - 7.5
7	8°16.8	8°18.1	7°54.1	0.7 - 0.4	6.7 - 3.7	12.7 - 7.1	7	8°31.8	8°33.1	8°08.4	0.7 - 0.4	6.7 - 3.9	12.7 - 7.3	7	8°46.8	8°48.2	8°22.8	0.7 - 0.4	6.7 - 4.0	12.7 - 7.5
8	8°17.0	8°18.4	7°54.4	0.8 - 0.4	6.8 - 3.8	12.8 - 7.1	8	8°32.0	8°33.4	8°08.7	0.8 - 0.5	6.8 - 3.9	12.8 - 7.4	8	8°47.0	8°48.4	8°23.0	0.8 - 0.5	6.8 - 4.0	12.8 - 7.6
9	8°17.2	8°18.6	7°54.6	0.9 - 0.5	6.9 - 3.9	12.9 - 7.2	9	8°32.2	8°33.7	8°08.9	0.9 - 0.5	6.9 - 4.0	12.9 - 7.4	9	8°47.2	8°48.7	8°23.2	0.9 - 0.5	6.9 - 4.1	12.9 - 7.6
10	8°17.5	8°18.9	7°54.8	1.0 - 0.6	7.0 - 3.9	13.0 - 7.3	10	8°32.5	8°33.9	8°09.2	1.0 - 0.6	7.0 - 4.0	13.0 - 7.5	10	8°47.5	8°48.9	8°23.5	1.0 - 0.6	7.0 - 4.1	13.0 - 7.7
11	8°17.7	8°19.1	7°55.1	1.1 - 0.6	7.1 - 4.0	13.1 - 7.3	11	8°32.7	8°34.2	8°09.4	1.1 - 0.6	7.1 - 4.1	13.1 - 7.5	11	8°47.7	8°49.2	8°23.7	1.1 - 0.7	7.1 - 4.2	13.1 - 7.8
12	8°18.0	8°19.4	7°55.3	1.2 - 0.7	7.2 - 4.0	13.2 - 7.4	12	8°33.0	8°34.4	8°09.6	1.2 - 0.7	7.2 - 4.1	13.2 - 7.6	12	8°48.0	8°49.4	8°23.9	1.2 - 0.7	7.2 - 4.3	13.2 - 7.8
13	8°18.3	8°19.6	7°55.6	1.3 - 0.7	7.3 - 4.1	13.3 - 7.4	13	8°33.3	8°34.7	8°09.9	1.3 - 0.7	7.3 - 4.2	13.3 - 7.6	13	8°48.3	8°49.7	8°24.2	1.3 - 0.8	7.3 - 4.3	13.3 - 7.9
14	8°18.5	8°19.9	7°55.8	1.4 - 0.8	7.4 - 4.1	13.4 - 7.5	14	8°33.5	8°34.9	8°10.1	1.4 - 0.8	7.4 - 4.3	13.4 - 7.7	14	8°48.5	8°49.9	8°24.4	1.4 - 0.8	7.4 - 4.4	13.4 - 7.9
15	8°18.8	8°20.1	7°56.0	1.5 - 0.8	7.5 - 4.2	13.5 - 7.5	15	8°33.8	8°35.2	8°10.3	1.5 - 0.9	7.5 - 4.3	13.5 - 7.8	15	8°48.8	8°50.2	8°24.7	1.5 - 0.9	7.5 - 4.4	13.5 - 8.0
16	8°19.0	8°20.4	7°56.3	1.6 - 0.9	7.6 - 4.2	13.6 - 7.6	16	8°34.0	8°35.4	8°10.6	1.6 - 0.9	7.6 - 4.4	13.6 - 7.8	16	8°49.0	8°50.4	8°24.9	1.6 - 0.9	7.6 - 4.5	13.6 - 8.0
17	8°19.2	8°20.6	7°56.5	1.7 - 0.9	7.7 - 4.3	13.7 - 7.6	17	8°34.2	8°35.7	8°10.8	1.7 - 1.0	7.7 - 4.4	13.7 - 7.9	17	8°49.2	8°50.7	8°25.1	1.7 - 1.0	7.7 - 4.6	13.7 - 8.1
18	8°19.5	8°20.9	7°56.7	1.8 - 1.0	7.8 - 4.4	13.8 - 7.7	18	8°34.5	8°35.9	8°11.1	1.8 - 1.0	7.8 - 4.5	13.8 - 7.9	18	8°49.5	8°50.9	8°25.4	1.8 - 1.1	7.8 - 4.6	13.8 - 8.2
19	8°19.8	8°21.1	7°57.0	1.9 - 1.1	7.9 - 4.4	13.9 - 7.8	19	8°34.8	8°36.2	8°11.3	1.9 - 1.1	7.9 - 4.5	13.9 - 8.0	19	8°49.8	8°51.2	8°25.6	1.9 - 1.1	7.9 - 4.7	13.9 - 8.2
20	8°20.0	8°21.4	7°57.2	2.0 - 1.1	8.0 - 4.5	14.0 - 7.8	20	8°35.0	8°36.4	8°11.5	2.0 - 1.1	8.0 - 4.6	14.0 - 8.0	20	8°50.0	8°51.4	8°25.9	2.0 - 1.2	8.0 - 4.7	14.0 - 8.3
21	8°20.3	8°21.6	7°57.5	2.1 - 1.2	8.1 - 4.5	14.1 - 7.9	21	8°35.3	8°36.7	8°11.8	2.1 - 1.2	8.1 - 4.7	14.1 - 8.1	21	8°50.3	8°51.7	8°26.1	2.1 - 1.2	8.1 - 4.8	14.1 - 8.3
22	8°20.5	8°21.9	7°57.7	2.2 - 1.2	8.2 - 4.6	14.2 - 7.9	22	8°35.5	8°36.9	8°12.0	2.2 - 1.3	8.2 - 4.7	14.2 - 8.2	22	8°50.5	8°52.0	8°26.3	2.2 - 1.3	8.2 - 4.9	14.2 - 8.4
23	8°20.7	8°22.1	7°57.9	2.3 - 1.3	8.3 - 4.6	14.3 - 8.0	23	8°35.7	8°37.2	8°12.3	2.3 - 1.3	8.3 - 4.8	14.3 - 8.2	23	8°50.7	8°52.2	8°26.6	2.3 - 1.4	8.3 - 4.9	14.3 - 8.5
24	8°21.0	8°22.4	7°58.2	2.4 - 1.3	8.4 - 4.7	14.4 - 8.0	24	8°36.0	8°37.4	8°12.5	2.4 - 1.4	8.4 - 4.8	14.4 - 8.3	24	8°51.0	8°52.5	8°26.8	2.4 - 1.4	8.4 - 5.0	14.4 - 8.5
25	8°21.2	8°22.6	7°58.4	2.5 - 1.4	8.5 - 4.7	14.5 - 8.1	25	8°36.2	8°37.7	8°12.7	2.5 - 1.4	8.5 - 4.9	14.5 - 8.3	25	8°51.2	8°52.7	8°27.0	2.5 - 1.5	8.5 - 5.0	14.5 - 8.6
26	8°21.5	8°22.9	7°58.7	2.6 - 1.5	8.6 - 4.8	14.6 - 8.2	26	8°36.5	8°37.9	8°13.0	2.6 - 1.5	8.6 - 4.9	14.6 - 8.4	26	8°51.5	8°53.0	8°27.3	2.6 - 1.5	8.6 - 5.1	14.6 - 8.6
27	8°21.8	8°23.1	7°58.9	2.7 - 1.5	8.7 - 4.9	14.7 - 8.2	27	8°36.8	8°38.2	8°13.2	2.7 - 1.6	8.7 - 5.0	14.7 - 8.5	27	8°51.8	8°53.2	8°27.5	2.7 - 1.6	8.7 - 5.1	14.7 - 8.7
28	8°22.0	8°23.4	7°59.1	2.8 - 1.6	8.8 - 4.9	14.8 - 8.3	28	8°37.0	8°38.4	8°13.4	2.8 - 1.6	8.8 - 5.1	14.8 - 8.5	28	8°52.0	8°53.5	8°27.8	2.8 - 1.7	8.8 - 5.2	14.8 - 8.8
29	8°22.3	8°23.6	7°59.4	2.9 - 1.6	8.9 - 5.0	14.9 - 8.3	29	8°37.3	8°38.7	8°13.7	2.9 - 1.7	8.9 - 5.1	14.9 - 8.6	29	8°52.3	8°53.7	8°28.0	2.9 - 1.7	8.9 - 5.3	14.9 - 8.8
30	8°22.5	8°23.9	7°59.6	3.0 - 1.7	9.0 - 5.0	15.0 - 8.4	30	8°37.5	8°38.9	8°13.9	3.0 - 1.7	9.0 - 5.2	15.0 - 8.6	30	8°52.5	8°54.0	8°28.2	3.0 - 1.8	9.0 - 5.3	15.0 - 8.9
31	8°22.7	8°24.1	7°59.8	3.1 - 1.7	9.1 - 5.1	15.1 - 8.4	31	8°37.7	8°39.2	8°14.2	3.1 - 1.8	9.1 - 5.2	15.1 - 8.7	31	8°52.7	8°54.2	8°28.5	3.1 - 1.8	9.1 - 5.4	15.1 - 8.9
32	8°23.0	8°24.4	8°00.1	3.2 - 1.8	9.2 - 5.1	15.2 - 8.5	32	8°38.0	8°39.4	8°14.4	3.2 - 1.8	9.2 - 5.3	15.2 - 8.7	32	8°53.0	8°54.5	8°28.7	3.2 - 1.9	9.2 - 5.4	15.2 - 9.0
33	8°23.2	8°24.6	8°00.3	3.3 - 1.8	9.3 - 5.2	15.3 - 8.5	33	8°38.2	8°39.7	8°14.6	3.3 - 1.9	9.3 - 5.3	15.3 - 8.8	33	8°53.2	8°54.7	8°29.0	3.3 - 2.0	9.3 - 5.5	15.3 - 9.1
34	8°23.5	8°24.9	8°00.6	3.4 - 1.9	9.4 - 5.2	15.4 - 8.6	34	8°38.5	8°39.9	8°14.9	3.4 - 2.0	9.4 - 5.4	15.4 - 8.9	34	8°53.5	8°55.0	8°29.2	3.4 - 2.0	9.4 - 5.6	15.4 - 9.1
35	8°23.8	8°25.1	8°00.8	3.5 - 2.0	9.5 - 5.3	15.5 - 8.7	35	8°38.8	8°40.2	8°15.1	3.5 - 2.0	9.5 - 5.5	15.5 - 8.9	35	8°53.8	8°55.2	8°29.4	3.5 - 2.1	9.5 - 5.6	15.5 - 9.2
36	8°24.0	8°25.4	8°01.0	3.6 - 2.0	9.6 - 5.4	15.6 - 8.7	36	8°39.0	8°40.4	8°15.4	3.6 - 2.1	9.6 - 5.5	15.6 - 9.0	36	8°54.0	8°55.5	8°29.7	3.6 - 2.1	9.6 - 5.7	15.6 - 9.2
37	8°24.3	8°25.6	8°01.3	3.7 - 2.1	9.7 - 5.4	15.7 - 8.8	37	8°39.3	8°40.7	8°15.6	3.7 - 2.1	9.7 - 5.6	15.7 - 9.0	37	8°54.3	8°55.7	8°29.9	3.7 - 2.2	9.7 - 5.7	15.7 - 9.3
38	8°24.5	8°25.9	8°01.5	3.8 - 2.1	9.8 - 5.5	15.8 - 8.8	38	8°39.5	8°40.9	8°15.8	3.8 - 2.2	9.8 - 5.6	15.8 - 9.1	38	8°54.5	8°56.0	8°30.2	3.8 - 2.2	9.8 - 5.8	15.8 - 9.3
39	8°24.7	8°26.1	8°01.8	3.9 - 2.2	9.9 - 5.5	15.9 - 8.9	39	8°39.7	8°41.2	8°16.1	3.9 - 2.2	9.9 - 5.7	15.9 - 9.1	39	8°54.7	8°56.2	8°30.4	3.9 - 2.3	9.9 - 5.9	15.9 - 9.4
40	8°25.0	8°26.4	8°02.0	4.0 - 2.2	10.0 - 5.6	16.0 - 8.9	40	8°40.0	8°41.4	8°16.3	4.0 - 2.3	10.0 - 5.8	16.0 - 9.2	40	8°55.0	8°56.5	8°30.6	4.0 - 2.4	10.0 - 5.9	16.0 - 9.5
41	8°25.2	8°26.6	8°02.2	4.1 - 2.3	10.1 - 5.6	16.1 - 9.0	41	8°40.2	8°41.7	8°16.5	4.1 - 2.4	10.1 - 5.8	16.1 - 9.3	41	8°55.2	8°56.7	8°30.9	4.1 - 2.4	10.1 - 6.0	16.1 - 9.5
42	8°25.5	8°26.9	8°02.5	4.2 - 2.3	10.2 - 5.7	16.2 - 9.0	42	8°40.5	8°41.9	8°16.8	4.2 - 2.4	10.2 - 5.9	16.2 - 9.3	42	8°55.5	8°57.0	8°31.1	4.2 - 2.5	10.2 - 6.0	16.2 - 9.6
43	8°25.8	8°27.1	8°02.7	4.3 - 2.4	10.3 - 5.8	16.3 - 9.1	43	8°40.8	8°42											

## Increments and Corrections

m 36	Sun Plan.	Aries	Moon	v and d corr				m 37	Sun Plan.	Aries	Moon	v and d corr				m 38	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		0	9°15.0	9°16.5	8°49.7	0.0 - 0.0	6.0 - 3.8	12.0 - 7.5		0	9°30.0	9°31.6	9°04.0	0.0 - 0.0	6.0 - 3.9	12.0 - 7.7	
1	9°00.2	9°01.7	8°35.6	0.1 - 0.1	6.1 - 3.7	12.1 - 7.4		1	9°15.2	9°16.8	8°50.0	0.1 - 0.1	6.1 - 3.8	12.1 - 7.6		1	9°30.2	9°31.8	9°04.3	0.1 - 0.1	6.1 - 3.9	12.1 - 7.8	
2	9°00.5	9°02.0	8°35.9	0.2 - 0.1	6.2 - 3.8	12.2 - 7.4		2	9°15.5	9°17.0	8°50.2	0.2 - 0.1	6.2 - 3.9	12.2 - 7.6		2	9°30.5	9°32.1	9°04.5	0.2 - 0.1	6.2 - 4.0	12.2 - 7.8	
3	9°00.7	9°02.2	8°36.1	0.3 - 0.2	6.3 - 3.8	12.3 - 7.5		3	9°15.7	9°17.3	8°50.4	0.3 - 0.2	6.3 - 3.9	12.3 - 7.7		3	9°30.7	9°32.3	9°04.7	0.3 - 0.2	6.3 - 4.0	12.3 - 7.9	
4	9°01.0	9°02.5	8°36.4	0.4 - 0.2	6.4 - 3.9	12.4 - 7.5		4	9°16.0	9°17.5	8°50.7	0.4 - 0.3	6.4 - 4.0	12.4 - 7.8		4	9°31.0	9°32.6	9°05.0	0.4 - 0.3	6.4 - 4.1	12.4 - 8.0	
5	9°01.3	9°02.7	8°36.6	0.5 - 0.3	6.5 - 4.0	12.5 - 7.6		5	9°16.3	9°17.8	8°50.9	0.5 - 0.3	6.5 - 4.1	12.5 - 7.8		5	9°31.3	9°32.8	9°05.2	0.5 - 0.3	6.5 - 4.2	12.5 - 8.0	
6	9°01.5	9°03.0	8°36.8	0.6 - 0.4	6.6 - 4.0	12.6 - 7.7		6	9°16.5	9°18.0	8°51.1	0.6 - 0.4	6.6 - 4.1	12.6 - 7.9		6	9°31.5	9°33.1	9°05.5	0.6 - 0.4	6.6 - 4.2	12.6 - 8.1	
7	9°01.8	9°03.2	8°37.1	0.7 - 0.4	6.7 - 4.1	12.7 - 7.7		7	9°16.8	9°18.3	8°51.4	0.7 - 0.4	6.7 - 4.2	12.7 - 7.9		7	9°31.8	9°33.3	9°05.7	0.7 - 0.4	6.7 - 4.3	12.7 - 8.1	
8	9°02.0	9°03.5	8°37.3	0.8 - 0.5	6.8 - 4.1	12.8 - 7.8		8	9°17.0	9°18.5	8°51.6	0.8 - 0.5	6.8 - 4.3	12.8 - 8.0		8	9°32.0	9°33.6	9°05.9	0.8 - 0.5	6.8 - 4.4	12.8 - 8.2	
9	9°02.2	9°03.7	8°37.5	0.9 - 0.5	6.9 - 4.2	12.9 - 7.8		9	9°17.2	9°18.8	8°51.9	0.9 - 0.6	6.9 - 4.3	12.9 - 8.1		9	9°32.2	9°33.8	9°06.2	0.9 - 0.6	6.9 - 4.4	12.9 - 8.3	
10	9°02.5	9°04.0	8°37.8	1.0 - 0.6	7.0 - 4.3	13.0 - 7.9		10	9°17.5	9°19.0	8°52.1	1.0 - 0.6	7.0 - 4.4	13.0 - 8.1		10	9°32.5	9°34.1	9°06.4	1.0 - 0.6	7.0 - 4.5	13.0 - 8.3	
11	9°02.7	9°04.2	8°38.0	1.1 - 0.7	7.1 - 4.3	13.1 - 8.0		11	9°17.7	9°19.3	8°52.3	1.1 - 0.7	7.1 - 4.4	13.1 - 8.2		11	9°32.7	9°34.3	9°06.7	1.1 - 0.7	7.1 - 4.6	13.1 - 8.4	
12	9°03.0	9°04.5	8°38.3	1.2 - 0.7	7.2 - 4.4	13.2 - 8.0		12	9°18.0	9°19.5	8°52.6	1.2 - 0.8	7.2 - 4.5	13.2 - 8.3		12	9°33.0	9°34.6	9°06.9	1.2 - 0.8	7.2 - 4.6	13.2 - 8.5	
13	9°03.3	9°04.7	8°38.5	1.3 - 0.8	7.3 - 4.4	13.3 - 8.1		13	9°18.3	9°19.8	8°52.8	1.3 - 0.8	7.3 - 4.6	13.3 - 8.3		13	9°33.3	9°34.8	9°07.1	1.3 - 0.8	7.3 - 4.7	13.3 - 8.5	
14	9°03.5	9°05.0	8°38.7	1.4 - 0.9	7.4 - 4.5	13.4 - 8.2		14	9°18.5	9°20.0	8°53.1	1.4 - 0.9	7.4 - 4.6	13.4 - 8.4		14	9°33.5	9°35.1	9°07.4	1.4 - 0.9	7.4 - 4.7	13.4 - 8.6	
15	9°03.8	9°05.2	8°39.0	1.5 - 0.9	7.5 - 4.6	13.5 - 8.2		15	9°18.8	9°20.3	8°53.3	1.5 - 0.9	7.5 - 4.7	13.5 - 8.4		15	9°33.8	9°35.3	9°07.6	1.5 - 1.0	7.5 - 4.8	13.5 - 8.7	
16	9°04.0	9°05.5	8°39.2	1.6 - 1.0	7.6 - 4.6	13.6 - 8.3		16	9°19.0	9°20.5	8°53.5	1.6 - 1.0	7.6 - 4.8	13.6 - 8.5		16	9°34.0	9°35.6	9°07.9	1.6 - 1.0	7.6 - 4.9	13.6 - 8.7	
17	9°04.2	9°05.7	8°39.5	1.7 - 1.0	7.7 - 4.7	13.7 - 8.3		17	9°19.2	9°20.8	8°53.8	1.7 - 1.1	7.7 - 4.8	13.7 - 8.6		17	9°34.2	9°35.8	9°08.1	1.7 - 1.1	7.7 - 4.9	13.7 - 8.8	
18	9°04.5	9°06.0	8°39.7	1.8 - 1.1	7.8 - 4.7	13.8 - 8.4		18	9°19.5	9°21.0	8°54.0	1.8 - 1.1	7.8 - 4.9	13.8 - 8.6		18	9°34.5	9°36.1	9°08.3	1.8 - 1.2	7.8 - 5.0	13.8 - 8.9	
19	9°04.8	9°06.2	8°39.9	1.9 - 1.2	7.9 - 4.8	13.9 - 8.5		19	9°19.8	9°21.3	8°54.3	1.9 - 1.2	7.9 - 4.9	13.9 - 8.7		19	9°34.8	9°36.3	9°08.6	1.9 - 1.2	7.9 - 5.1	13.9 - 8.9	
20	9°05.0	9°06.5	8°40.2	2.0 - 1.2	8.0 - 4.9	14.0 - 8.5		20	9°20.0	9°21.5	8°54.5	2.0 - 1.3	8.0 - 5.0	14.0 - 8.8		20	9°35.0	9°36.6	9°08.8	2.0 - 1.3	8.0 - 5.1	14.0 - 9.0	
21	9°05.3	9°06.7	8°40.4	2.1 - 1.3	8.1 - 4.9	14.1 - 8.6		21	9°20.3	9°21.8	8°54.7	2.1 - 1.3	8.1 - 5.1	14.1 - 8.8		21	9°35.3	9°36.8	9°09.0	2.1 - 1.3	8.1 - 5.2	14.1 - 9.0	
22	9°05.5	9°07.0	8°40.6	2.2 - 1.3	8.2 - 5.0	14.2 - 8.6		22	9°20.5	9°22.0	8°55.0	2.2 - 1.4	8.2 - 5.1	14.2 - 8.9		22	9°35.5	9°37.1	9°09.3	2.2 - 1.4	8.2 - 5.3	14.2 - 9.1	
23	9°05.7	9°07.2	8°40.9	2.3 - 1.4	8.3 - 5.0	14.3 - 8.7		23	9°20.7	9°22.3	8°55.2	2.3 - 1.4	8.3 - 5.2	14.3 - 8.9		23	9°35.7	9°37.3	9°09.5	2.3 - 1.5	8.3 - 5.3	14.3 - 9.2	
24	9°06.0	9°07.5	8°41.1	2.4 - 1.5	8.4 - 5.1	14.4 - 8.8		24	9°21.0	9°22.5	8°55.4	2.4 - 1.5	8.4 - 5.3	14.4 - 9.0		24	9°36.0	9°37.6	9°09.8	2.4 - 1.5	8.4 - 5.4	14.4 - 9.2	
25	9°06.2	9°07.7	8°41.4	2.5 - 1.5	8.5 - 5.2	14.5 - 8.8		25	9°21.2	9°22.8	8°55.7	2.5 - 1.6	8.5 - 5.3	14.5 - 9.1		25	9°36.2	9°37.8	9°10.0	2.5 - 1.6	8.5 - 5.5	14.5 - 9.3	
26	9°06.5	9°08.0	8°41.6	2.6 - 1.6	8.6 - 5.2	14.6 - 8.9		26	9°21.5	9°23.0	8°55.9	2.6 - 1.6	8.6 - 5.4	14.6 - 9.1		26	9°36.5	9°38.1	9°10.2	2.6 - 1.7	8.6 - 5.5	14.6 - 9.4	
27	9°06.8	9°08.2	8°41.8	2.7 - 1.6	8.7 - 5.3	14.7 - 8.9		27	9°21.8	9°23.3	8°56.2	2.7 - 1.7	8.7 - 5.4	14.7 - 9.2		27	9°36.8	9°38.3	9°10.5	2.7 - 1.7	8.7 - 5.6	14.7 - 9.4	
28	9°07.0	9°08.5	8°42.1	2.8 - 1.7	8.8 - 5.4	14.8 - 9.0		28	9°22.0	9°23.5	8°56.4	2.8 - 1.8	8.8 - 5.5	14.8 - 9.3		28	9°37.0	9°38.6	9°10.7	2.8 - 1.8	8.8 - 5.6	14.8 - 9.5	
29	9°07.3	9°08.7	8°42.3	2.9 - 1.8	8.9 - 5.4	14.9 - 9.1		29	9°22.3	9°23.8	8°56.6	2.9 - 1.8	8.9 - 5.6	14.9 - 9.3		29	9°37.3	9°38.8	9°11.0	2.9 - 1.9	8.9 - 5.7	14.9 - 9.6	
30	9°07.5	9°09.0	8°42.6	3.0 - 1.8	9.0 - 5.5	15.0 - 9.1		30	9°22.5	9°24.0	8°56.9	3.0 - 1.9	9.0 - 5.6	15.0 - 9.4		30	9°37.5	9°39.1	9°11.2	3.0 - 1.9	9.0 - 5.8	15.0 - 9.6	
31	9°07.7	9°09.2	8°42.8	3.1 - 1.9	9.1 - 5.5	15.1 - 9.2		31	9°22.7	9°24.3	8°57.1	3.1 - 1.9	9.1 - 5.7	15.1 - 9.4		31	9°37.7	9°39.3	9°11.4	3.1 - 2.0	9.1 - 5.8	15.1 - 9.7	
32	9°08.0	9°09.5	8°43.0	3.2 - 1.9	9.2 - 5.6	15.2 - 9.2		32	9°23.0	9°24.5	8°57.4	3.2 - 2.0	9.2 - 5.8	15.2 - 9.5		32	9°38.0	9°39.6	9°11.7	3.2 - 2.1	9.2 - 5.9	15.2 - 9.8	
33	9°08.2	9°09.7	8°43.3	3.3 - 2.0	9.3 - 5.7	15.3 - 9.3		33	9°23.2	9°24.8	8°57.6	3.3 - 2.1	9.3 - 5.8	15.3 - 9.6		33	9°38.2	9°39.8	9°11.9	3.3 - 2.1	9.3 - 6.0	15.3 - 9.8	
34	9°08.5	9°10.0	8°43.5	3.4 - 2.1	9.4 - 5.7	15.4 - 9.4		34	9°23.5	9°25.0	8°57.8	3.4 - 2.1	9.4 - 5.9	15.4 - 9.6		34	9°38.5	9°40.1	9°12.1	3.4 - 2.2	9.4 - 6.0	15.4 - 9.9	
35	9°08.8	9°10.2	8°43.8	3.5 - 2.1	9.5 - 5.8	15.5 - 9.4		35	9°23.8	9°25.3	8°58.1	3.5 - 2.2	9.5 - 5.9	15.5 - 9.7		35	9°38.8	9°40.3	9°12.4	3.5 - 2.2	9.5 - 6.1	15.5 - 9.9	
36	9°09.0	9°10.5	8°44.0	3.6 - 2.2	9.6 - 5.8	15.6 - 9.5		36	9°24.0	9°25.5	8°58.3	3.6 - 2.3	9.6 - 6.0	15.6 - 9.8		36	9°39.0	9°40.6	9°12.6	3.6 - 2.3	9.6 - 6.2	15.6 - 10.0	
37	9°09.3	9°10.8	8°44.2	3.7 - 2.3	9.7 - 5.9	15.7 - 9.6		37	9°24.3	9°25.8	8°58.5	3.7 - 2.3	9.7 - 6.1	15.7 - 9.8		37	9°39.3	9°40.8	9°12.9	3.7 - 2.4	9.7 - 6.2	15.7 - 10.1	
38	9°09.5	9°11.0	8°44.5	3.8 - 2.3	9.8 - 6.0	15.8 - 9.6		38	9°24.5	9°26.0	8°58.8	3.8 - 2.4	9.8 - 6.1	15.8 - 9.9		38	9°39.5	9°41.1	9°13.1	3.8 - 2.4	9.8 - 6.3	15.8 - 10.1	
39	9°09.7	9°11.3	8°44.7	3.9 - 2.4	9.9 - 6.0	15.9 - 9.7		39	9°24.7	9°26.3	8°59.0	3.9 - 2.4	9.9 - 6.2	15.9 - 9.9		39	9°39.7	9°41.3	9°13.3	3.9 - 2.5	9.9 - 6.4	15.9 - 10.2	
40	9°10.0	9°11.5	8°44.9	4.0 - 2.4	10.0 - 6.1	16.0 - 9.7		40	9°25.0	9°26.5	8°59.3	4.0 - 2.5	10.0 - 6.3	16.0 - 10.0		40	9°40.0	9°41.6	9°13.6	4.0 - 2.6	10.0 - 6.4	16.0 - 10.3	
41	9°10.2	9°11.8	8°45.2	4.1 - 2.5	10.1 - 6.1	16.1 - 9.8		41	9°25.2	9°26.8	8°59.5	4.1 - 2.6	10.1 - 6.3	16.1 - 10.1		41	9°40.2	9°41.8	9°13.8	4.1 - 2.6	10.1 - 6.5	1	

## Increments and Corrections

m 39	Sun Plan.	Aries	Moon	v and d corr			m 40	Sun Plan.	Aries	Moon	v and d corr			m 41	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	0	10°00.0	10°01.6	9°32.7	0.0 - 0.0	6.0 - 4.1	12.0 - 8.1	0	10°15.0	10°16.7	9°47.0	0.0 - 0.0	6.0 - 4.2	12.0 - 8.3
1	9°45.2	9°46.8	9°18.6	0.1 - 0.1	6.1 - 4.0	12.1 - 8.0	1	10°00.2	10°01.9	9°32.9	0.1 - 0.1	6.1 - 4.1	12.1 - 8.2	1	10°15.2	10°16.9	9°47.2	0.1 - 0.1	6.1 - 4.2	12.1 - 8.4
2	9°45.5	9°47.1	9°18.8	0.2 - 0.1	6.2 - 4.1	12.2 - 8.0	2	10°00.5	10°02.1	9°33.1	0.2 - 0.1	6.2 - 4.2	12.2 - 8.2	2	10°15.5	10°17.2	9°47.5	0.2 - 0.1	6.2 - 4.3	12.2 - 8.4
3	9°45.7	9°47.4	9°19.1	0.3 - 0.2	6.3 - 4.1	12.3 - 8.1	3	10°00.7	10°02.4	9°33.4	0.3 - 0.2	6.3 - 4.3	12.3 - 8.3	3	10°15.7	10°17.4	9°47.7	0.3 - 0.2	6.3 - 4.4	12.3 - 8.5
4	9°46.0	9°47.6	9°19.3	0.4 - 0.3	6.4 - 4.2	12.4 - 8.2	4	10°01.0	10°02.6	9°33.6	0.4 - 0.3	6.4 - 4.3	12.4 - 8.4	4	10°16.0	10°17.7	9°47.9	0.4 - 0.3	6.4 - 4.4	12.4 - 8.6
5	9°46.3	9°47.9	9°19.5	0.5 - 0.3	6.5 - 4.3	12.5 - 8.2	5	10°01.3	10°02.9	9°33.9	0.5 - 0.3	6.5 - 4.4	12.5 - 8.4	5	10°16.3	10°17.9	9°48.2	0.5 - 0.3	6.5 - 4.5	12.5 - 8.6
6	9°46.5	9°48.1	9°19.8	0.6 - 0.4	6.6 - 4.3	12.6 - 8.3	6	10°01.5	10°03.1	9°34.1	0.6 - 0.4	6.6 - 4.5	12.6 - 8.5	6	10°16.5	10°18.2	9°48.4	0.6 - 0.4	6.6 - 4.6	12.6 - 8.7
7	9°46.8	9°48.4	9°20.0	0.7 - 0.5	6.7 - 4.4	12.7 - 8.4	7	10°01.8	10°03.4	9°34.3	0.7 - 0.5	6.7 - 4.5	12.7 - 8.6	7	10°16.8	10°18.4	9°48.7	0.7 - 0.5	6.7 - 4.6	12.7 - 8.8
8	9°47.0	9°48.6	9°20.3	0.8 - 0.5	6.8 - 4.5	12.8 - 8.4	8	10°02.0	10°03.6	9°34.6	0.8 - 0.5	6.8 - 4.6	12.8 - 8.6	8	10°17.0	10°18.7	9°48.9	0.8 - 0.6	6.8 - 4.7	12.8 - 8.9
9	9°47.2	9°48.9	9°20.5	0.9 - 0.6	6.9 - 4.5	12.9 - 8.5	9	10°02.2	10°03.9	9°34.8	0.9 - 0.6	6.9 - 4.7	12.9 - 8.7	9	10°17.2	10°18.9	9°49.1	0.9 - 0.6	6.9 - 4.8	12.9 - 8.9
10	9°47.5	9°49.1	9°20.7	1.0 - 0.7	7.0 - 4.6	13.0 - 8.6	10	10°02.5	10°04.1	9°35.1	1.0 - 0.7	7.0 - 4.7	13.0 - 8.8	10	10°17.5	10°19.2	9°49.4	1.0 - 0.7	7.0 - 4.8	13.0 - 9.0
11	9°47.7	9°49.4	9°21.0	1.1 - 0.7	7.1 - 4.7	13.1 - 8.6	11	10°02.7	10°04.4	9°35.3	1.1 - 0.7	7.1 - 4.8	13.1 - 8.8	11	10°17.7	10°19.4	9°49.6	1.1 - 0.8	7.1 - 4.9	13.1 - 9.1
12	9°48.0	9°49.6	9°21.2	1.2 - 0.8	7.2 - 4.7	13.2 - 8.7	12	10°03.0	10°04.6	9°35.5	1.2 - 0.8	7.2 - 4.9	13.2 - 8.9	12	10°18.0	10°19.7	9°49.8	1.2 - 0.8	7.2 - 5.0	13.2 - 9.1
13	9°48.3	9°49.9	9°21.5	1.3 - 0.9	7.3 - 4.8	13.3 - 8.8	13	10°03.3	10°04.9	9°35.8	1.3 - 0.9	7.3 - 4.9	13.3 - 9.0	13	10°18.3	10°19.9	9°50.1	1.3 - 0.9	7.3 - 5.0	13.3 - 9.2
14	9°48.5	9°50.1	9°21.7	1.4 - 0.9	7.4 - 4.9	13.4 - 8.8	14	10°03.5	10°05.1	9°36.0	1.4 - 0.9	7.4 - 5.0	13.4 - 9.0	14	10°18.5	10°20.2	9°50.3	1.4 - 1.0	7.4 - 5.1	13.4 - 9.3
15	9°48.8	9°50.4	9°21.9	1.5 - 1.0	7.5 - 4.9	13.5 - 8.9	15	10°03.8	10°05.4	9°36.2	1.5 - 1.0	7.5 - 5.1	13.5 - 9.1	15	10°18.8	10°20.4	9°50.6	1.5 - 1.0	7.5 - 5.2	13.5 - 9.3
16	9°49.0	9°50.6	9°22.2	1.6 - 1.1	7.6 - 5.0	13.6 - 9.0	16	10°04.0	10°05.7	9°36.5	1.6 - 1.1	7.6 - 5.1	13.6 - 9.2	16	10°19.0	10°20.7	9°50.8	1.6 - 1.1	7.6 - 5.3	13.6 - 9.4
17	9°49.2	9°50.9	9°22.4	1.7 - 1.1	7.7 - 5.1	13.7 - 9.0	17	10°04.2	10°05.9	9°36.7	1.7 - 1.1	7.7 - 5.2	13.7 - 9.2	17	10°19.2	10°20.9	9°51.0	1.7 - 1.2	7.7 - 5.3	13.7 - 9.5
18	9°49.5	9°51.1	9°22.6	1.8 - 1.2	7.8 - 5.1	13.8 - 9.1	18	10°04.5	10°06.2	9°37.0	1.8 - 1.2	7.8 - 5.3	13.8 - 9.3	18	10°19.5	10°21.2	9°51.3	1.8 - 1.2	7.8 - 5.4	13.8 - 9.5
19	9°49.8	9°51.4	9°22.9	1.9 - 1.3	7.9 - 5.2	13.9 - 9.2	19	10°04.8	10°06.4	9°37.2	1.9 - 1.3	7.9 - 5.3	13.9 - 9.4	19	10°19.8	10°21.4	9°51.5	1.9 - 1.3	7.9 - 5.5	13.9 - 9.6
20	9°50.0	9°51.6	9°23.1	2.0 - 1.3	8.0 - 5.3	14.0 - 9.2	20	10°05.0	10°06.7	9°37.4	2.0 - 1.4	8.0 - 5.4	14.0 - 9.5	20	10°20.0	10°21.7	9°51.8	2.0 - 1.4	8.0 - 5.5	14.0 - 9.7
21	9°50.3	9°51.9	9°23.4	2.1 - 1.4	8.1 - 5.3	14.1 - 9.3	21	10°05.3	10°06.9	9°37.7	2.1 - 1.4	8.1 - 5.5	14.1 - 9.5	21	10°20.3	10°21.9	9°52.0	2.1 - 1.5	8.1 - 5.6	14.1 - 9.8
22	9°50.5	9°52.1	9°23.6	2.2 - 1.4	8.2 - 5.4	14.2 - 9.3	22	10°05.5	10°07.2	9°37.9	2.2 - 1.5	8.2 - 5.5	14.2 - 9.6	22	10°20.5	10°22.2	9°52.2	2.2 - 1.5	8.2 - 5.7	14.2 - 9.8
23	9°50.7	9°52.4	9°23.8	2.3 - 1.5	8.3 - 5.5	14.3 - 9.4	23	10°05.7	10°07.4	9°38.2	2.3 - 1.6	8.3 - 5.6	14.3 - 9.7	23	10°20.7	10°22.4	9°52.5	2.3 - 1.6	8.3 - 5.7	14.3 - 9.9
24	9°51.0	9°52.6	9°24.1	2.4 - 1.6	8.4 - 5.5	14.4 - 9.5	24	10°06.0	10°07.7	9°38.4	2.4 - 1.6	8.4 - 5.7	14.4 - 9.7	24	10°21.0	10°22.7	9°52.7	2.4 - 1.7	8.4 - 5.8	14.4 - 10.0
25	9°51.2	9°52.9	9°24.3	2.5 - 1.6	8.5 - 5.6	14.5 - 9.5	25	10°06.2	10°07.9	9°38.6	2.5 - 1.7	8.5 - 5.7	14.5 - 9.8	25	10°21.2	10°22.9	9°52.9	2.5 - 1.7	8.5 - 5.9	14.5 - 10.0
26	9°51.5	9°53.1	9°24.6	2.6 - 1.7	8.6 - 5.7	14.6 - 9.6	26	10°06.5	10°08.2	9°38.9	2.6 - 1.8	8.6 - 5.8	14.6 - 9.9	26	10°21.5	10°23.2	9°53.2	2.6 - 1.8	8.6 - 5.9	14.6 - 10.1
27	9°51.8	9°53.4	9°24.8	2.7 - 1.8	8.7 - 5.7	14.7 - 9.7	27	10°06.8	10°08.4	9°39.1	2.7 - 1.8	8.7 - 5.9	14.7 - 9.9	27	10°21.8	10°23.4	9°53.4	2.7 - 1.9	8.7 - 6.0	14.7 - 10.2
28	9°52.0	9°53.6	9°25.0	2.8 - 1.8	8.8 - 5.8	14.8 - 9.7	28	10°07.0	10°08.7	9°39.3	2.8 - 1.9	8.8 - 5.9	14.8 - 10.0	28	10°22.0	10°23.7	9°53.7	2.8 - 1.9	8.8 - 6.1	14.8 - 10.2
29	9°52.3	9°53.9	9°25.3	2.9 - 1.9	8.9 - 5.9	14.9 - 9.8	29	10°07.3	10°08.9	9°39.6	2.9 - 2.0	8.9 - 6.0	14.9 - 10.1	29	10°22.3	10°24.0	9°53.9	2.9 - 2.0	8.9 - 6.2	14.9 - 10.3
30	9°52.5	9°54.1	9°25.5	3.0 - 2.0	9.0 - 5.9	15.0 - 9.9	30	10°07.5	10°09.2	9°39.8	3.0 - 2.0	9.0 - 6.1	15.0 - 10.1	30	10°22.5	10°24.2	9°54.1	3.0 - 2.1	9.0 - 6.2	15.0 - 10.4
31	9°52.7	9°54.4	9°25.7	3.1 - 2.0	9.1 - 6.0	15.1 - 9.9	31	10°07.7	10°09.4	9°40.1	3.1 - 2.1	9.1 - 6.1	15.1 - 10.2	31	10°22.7	10°24.5	9°54.4	3.1 - 2.1	9.1 - 6.3	15.1 - 10.4
32	9°53.0	9°54.6	9°26.0	3.2 - 2.1	9.2 - 6.1	15.2 - 10.0	32	10°08.0	10°09.7	9°40.3	3.2 - 2.2	9.2 - 6.2	15.2 - 10.3	32	10°23.0	10°24.7	9°54.6	3.2 - 2.2	9.2 - 6.4	15.2 - 10.5
33	9°53.2	9°54.9	9°26.2	3.3 - 2.2	9.3 - 6.1	15.3 - 10.1	33	10°08.2	10°09.9	9°40.5	3.3 - 2.2	9.3 - 6.3	15.3 - 10.3	33	10°23.2	10°25.0	9°54.9	3.3 - 2.3	9.3 - 6.4	15.3 - 10.6
34	9°53.5	9°55.1	9°26.5	3.4 - 2.2	9.4 - 6.2	15.4 - 10.1	34	10°08.5	10°10.2	9°40.8	3.4 - 2.3	9.4 - 6.3	15.4 - 10.4	34	10°23.5	10°25.2	9°55.1	3.4 - 2.4	9.4 - 6.5	15.4 - 10.7
35	9°53.8	9°55.4	9°26.7	3.5 - 2.3	9.5 - 6.3	15.5 - 10.2	35	10°08.8	10°10.4	9°41.0	3.5 - 2.4	9.5 - 6.4	15.5 - 10.5	35	10°23.8	10°25.5	9°55.3	3.5 - 2.4	9.5 - 6.6	15.5 - 10.7
36	9°54.0	9°55.6	9°26.9	3.6 - 2.4	9.6 - 6.3	15.6 - 10.3	36	10°09.0	10°10.7	9°41.3	3.6 - 2.4	9.6 - 6.5	15.6 - 10.5	36	10°24.0	10°25.7	9°55.6	3.6 - 2.5	9.6 - 6.6	15.6 - 10.8
37	9°54.3	9°55.9	9°27.2	3.7 - 2.4	9.7 - 6.4	15.7 - 10.3	37	10°09.3	10°10.9	9°41.5	3.7 - 2.5	9.7 - 6.5	15.7 - 10.6	37	10°24.3	10°26.0	9°55.8	3.7 - 2.6	9.7 - 6.7	15.7 - 10.9
38	9°54.5	9°56.1	9°27.4	3.8 - 2.5	9.8 - 6.5	15.8 - 10.4	38	10°09.5	10°11.2	9°41.7	3.8 - 2.6	9.8 - 6.6	15.8 - 10.7	38	10°24.5	10°26.2	9°56.1	3.8 - 2.6	9.8 - 6.8	15.8 - 10.9
39	9°54.7	9°56.4	9°27.7	3.9 - 2.6	9.9 - 6.5	15.9 - 10.5	39	10°09.7	10°11.4	9°42.0	3.9 - 2.6	9.9 - 6.7	15.9 - 10.7	39	10°24.7	10°26.5	9°56.3	3.9 - 2.7	9.9 - 6.8	15.9 - 11.0
40	9°55.0	9°56.6	9°27.9	4.0 - 2.6	10.0 - 6.6	16.0 - 10.5	40	10°10.0	10°11.7	9°42.2	4.0 - 2.7	10.0 - 6.8	16.0 - 10.8	40	10°25.0	10°26.7	9°56.5	4.0 - 2.8	10.0 - 6.9	16.0 - 11.1
41	9°55.2	9°56.9	9°28.1	4.1 - 2.7	10.1 - 6.6	16.1 - 10.6	41	10°10.2	10°11.9	9°42.4	4.1 - 2.8	10.1 - 6.8	16.1 - 10.9	41	10°25.2	10°27.0	9°56.8	4.1 - 2.8	10.1 - 7.0	16.1 - 11.1
42	9°55.5	9°57.1	9°28.4	4.2 - 2.8	10.2 - 6.7	16.2 - 10.7	42	10°10.5	10°12.2	9°42.7	4.2 - 2.8	10.								

## Increments and Corrections

m 42	Sun Plan.	Aries	Moon	v and d corr			m 43	Sun Plan.	Aries	Moon	v and d corr			m 44	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	0	10°45.0	10°46.8	10°15.6	0.0 - 0.0	6.0 - 4.3	12.0 - 8.7	0	11°00.0	11°01.8	10°29.9	0.0 - 0.0	6.0 - 4.5	12.0 - 8.9
1	10°30.2	10°32.0	10°01.5	0.1 - 0.1	6.1 - 4.3	12.1 - 8.6	1	10°45.2	10°47.0	10°15.9	0.1 - 0.1	6.1 - 4.4	12.1 - 8.8	1	11°00.2	11°02.1	10°30.2	0.1 - 0.1	6.1 - 4.5	12.1 - 9.0
2	10°30.5	10°32.2	10°01.8	0.2 - 0.1	6.2 - 4.4	12.2 - 8.6	2	10°45.5	10°47.3	10°16.1	0.2 - 0.1	6.2 - 4.5	12.2 - 8.8	2	11°00.5	11°02.3	10°30.4	0.2 - 0.1	6.2 - 4.6	12.2 - 9.0
3	10°30.7	10°32.5	10°02.0	0.3 - 0.2	6.3 - 4.5	12.3 - 8.7	3	10°45.7	10°47.5	10°16.3	0.3 - 0.2	6.3 - 4.6	12.3 - 8.9	3	11°00.7	11°02.6	10°30.6	0.3 - 0.2	6.3 - 4.7	12.3 - 9.1
4	10°31.0	10°32.7	10°02.3	0.4 - 0.3	6.4 - 4.5	12.4 - 8.8	4	10°46.0	10°47.8	10°16.6	0.4 - 0.3	6.4 - 4.6	12.4 - 9.0	4	11°01.0	11°02.8	10°30.9	0.4 - 0.3	6.4 - 4.7	12.4 - 9.2
5	10°31.3	10°33.0	10°02.5	0.5 - 0.4	6.5 - 4.6	12.5 - 8.9	5	10°46.3	10°48.0	10°16.8	0.5 - 0.4	6.5 - 4.7	12.5 - 9.1	5	11°01.3	11°03.1	10°31.1	0.5 - 0.4	6.5 - 4.8	12.5 - 9.3
6	10°31.5	10°33.2	10°02.7	0.6 - 0.4	6.6 - 4.7	12.6 - 8.9	6	10°46.5	10°48.3	10°17.0	0.6 - 0.4	6.6 - 4.8	12.6 - 9.1	6	11°01.5	11°03.3	10°31.4	0.6 - 0.4	6.6 - 4.9	12.6 - 9.3
7	10°31.8	10°33.5	10°03.0	0.7 - 0.5	6.7 - 4.7	12.7 - 9.0	7	10°46.8	10°48.5	10°17.3	0.7 - 0.5	6.7 - 4.9	12.7 - 9.2	7	11°01.8	11°03.6	10°31.6	0.7 - 0.5	6.7 - 5.0	12.7 - 9.4
8	10°32.0	10°33.7	10°03.2	0.8 - 0.6	6.8 - 4.8	12.8 - 9.1	8	10°47.0	10°48.8	10°17.5	0.8 - 0.6	6.8 - 4.9	12.8 - 9.3	8	11°02.0	11°03.8	10°31.8	0.8 - 0.6	6.8 - 5.0	12.8 - 9.5
9	10°32.2	10°34.0	10°03.4	0.9 - 0.6	6.9 - 4.9	12.9 - 9.1	9	10°47.2	10°49.0	10°17.8	0.9 - 0.7	6.9 - 5.0	12.9 - 9.4	9	11°02.2	11°04.1	10°32.1	0.9 - 0.7	6.9 - 5.1	12.9 - 9.6
10	10°32.5	10°34.2	10°03.7	1.0 - 0.7	7.0 - 5.0	13.0 - 9.2	10	10°47.5	10°49.3	10°18.0	1.0 - 0.7	7.0 - 5.1	13.0 - 9.4	10	11°02.5	11°04.3	10°32.3	1.0 - 0.7	7.0 - 5.2	13.0 - 9.6
11	10°32.7	10°34.5	10°03.9	1.1 - 0.8	7.1 - 5.0	13.1 - 9.3	11	10°47.7	10°49.5	10°18.2	1.1 - 0.8	7.1 - 5.1	13.1 - 9.5	11	11°02.7	11°04.6	10°32.6	1.1 - 0.8	7.1 - 5.3	13.1 - 9.7
12	10°33.0	10°34.7	10°04.2	1.2 - 0.9	7.2 - 5.1	13.2 - 9.3	12	10°48.0	10°49.8	10°18.5	1.2 - 0.9	7.2 - 5.2	13.2 - 9.6	12	11°03.0	11°04.8	10°32.8	1.2 - 0.9	7.2 - 5.3	13.2 - 9.8
13	10°33.3	10°35.0	10°04.4	1.3 - 0.9	7.3 - 5.2	13.3 - 9.4	13	10°48.3	10°50.0	10°18.7	1.3 - 0.9	7.3 - 5.3	13.3 - 9.6	13	11°03.3	11°05.1	10°33.0	1.3 - 1.0	7.3 - 5.4	13.3 - 9.9
14	10°33.5	10°35.2	10°04.6	1.4 - 1.0	7.4 - 5.2	13.4 - 9.5	14	10°48.5	10°50.3	10°19.0	1.4 - 1.0	7.4 - 5.4	13.4 - 9.7	14	11°03.5	11°05.3	10°33.3	1.4 - 1.0	7.4 - 5.5	13.4 - 9.9
15	10°33.8	10°35.5	10°04.9	1.5 - 1.1	7.5 - 5.3	13.5 - 9.6	15	10°48.8	10°50.5	10°19.2	1.5 - 1.1	7.5 - 5.4	13.5 - 9.8	15	11°03.8	11°05.6	10°33.5	1.5 - 1.1	7.5 - 5.6	13.5 - 10.0
16	10°34.0	10°35.7	10°05.1	1.6 - 1.1	7.6 - 5.4	13.6 - 9.6	16	10°49.0	10°50.8	10°19.4	1.6 - 1.2	7.6 - 5.5	13.6 - 9.9	16	11°04.0	11°05.8	10°33.8	1.6 - 1.2	7.6 - 5.6	13.6 - 10.1
17	10°34.2	10°36.0	10°05.4	1.7 - 1.2	7.7 - 5.5	13.7 - 9.7	17	10°49.2	10°51.0	10°19.7	1.7 - 1.2	7.7 - 5.6	13.7 - 9.9	17	11°04.2	11°06.1	10°34.0	1.7 - 1.3	7.7 - 5.7	13.7 - 10.2
18	10°34.5	10°36.2	10°05.6	1.8 - 1.3	7.8 - 5.5	13.8 - 9.8	18	10°49.5	10°51.3	10°19.9	1.8 - 1.3	7.8 - 5.7	13.8 - 10.0	18	11°04.5	11°06.3	10°34.2	1.8 - 1.3	7.8 - 5.8	13.8 - 10.2
19	10°34.8	10°36.5	10°05.8	1.9 - 1.3	7.9 - 5.6	13.9 - 9.8	19	10°49.8	10°51.5	10°20.2	1.9 - 1.4	7.9 - 5.7	13.9 - 10.1	19	11°04.8	11°06.6	10°34.5	1.9 - 1.4	7.9 - 5.9	13.9 - 10.3
20	10°35.0	10°36.7	10°06.1	2.0 - 1.4	8.0 - 5.7	14.0 - 9.9	20	10°50.0	10°51.8	10°20.4	2.0 - 1.4	8.0 - 5.8	14.0 - 10.2	20	11°05.0	11°06.8	10°34.7	2.0 - 1.5	8.0 - 5.9	14.0 - 10.4
21	10°35.3	10°37.0	10°06.3	2.1 - 1.5	8.1 - 5.7	14.1 - 10.0	21	10°50.3	10°52.0	10°20.6	2.1 - 1.5	8.1 - 5.9	14.1 - 10.2	21	11°05.3	11°07.1	10°34.9	2.1 - 1.6	8.1 - 6.0	14.1 - 10.5
22	10°35.5	10°37.2	10°06.5	2.2 - 1.6	8.2 - 5.8	14.2 - 10.1	22	10°50.5	10°52.3	10°20.9	2.2 - 1.6	8.2 - 5.9	14.2 - 10.3	22	11°05.5	11°07.3	10°35.2	2.2 - 1.6	8.2 - 6.1	14.2 - 10.5
23	10°35.7	10°37.5	10°06.8	2.3 - 1.6	8.3 - 5.9	14.3 - 10.1	23	10°50.7	10°52.5	10°21.1	2.3 - 1.7	8.3 - 6.0	14.3 - 10.4	23	11°05.7	11°07.6	10°35.4	2.3 - 1.7	8.3 - 6.2	14.3 - 10.6
24	10°36.0	10°37.7	10°07.0	2.4 - 1.7	8.4 - 6.0	14.4 - 10.2	24	10°51.0	10°52.8	10°21.3	2.4 - 1.7	8.4 - 6.1	14.4 - 10.4	24	11°06.0	11°07.8	10°35.7	2.4 - 1.8	8.4 - 6.2	14.4 - 10.7
25	10°36.2	10°38.0	10°07.3	2.5 - 1.8	8.5 - 6.0	14.5 - 10.3	25	10°51.2	10°53.0	10°21.6	2.5 - 1.8	8.5 - 6.2	14.5 - 10.5	25	11°06.2	11°08.1	10°35.9	2.5 - 1.9	8.5 - 6.3	14.5 - 10.8
26	10°36.5	10°38.2	10°07.5	2.6 - 1.8	8.6 - 6.1	14.6 - 10.3	26	10°51.5	10°53.3	10°21.8	2.6 - 1.9	8.6 - 6.2	14.6 - 10.6	26	11°06.5	11°08.3	10°36.1	2.6 - 1.9	8.6 - 6.4	14.6 - 10.8
27	10°36.8	10°38.5	10°07.7	2.7 - 1.9	8.7 - 6.2	14.7 - 10.4	27	10°51.8	10°53.5	10°22.1	2.7 - 2.0	8.7 - 6.3	14.7 - 10.7	27	11°06.8	11°08.6	10°36.4	2.7 - 2.0	8.7 - 6.5	14.7 - 10.9
28	10°37.0	10°38.7	10°08.0	2.8 - 2.0	8.8 - 6.2	14.8 - 10.5	28	10°52.0	10°53.8	10°22.3	2.8 - 2.0	8.8 - 6.4	14.8 - 10.7	28	11°07.0	11°08.8	10°36.6	2.8 - 2.1	8.8 - 6.5	14.8 - 11.0
29	10°37.3	10°39.0	10°08.2	2.9 - 2.1	8.9 - 6.3	14.9 - 10.6	29	10°52.3	10°54.0	10°22.5	2.9 - 2.1	8.9 - 6.5	14.9 - 10.8	29	11°07.3	11°09.1	10°36.9	2.9 - 2.2	8.9 - 6.6	14.9 - 11.1
30	10°37.5	10°39.2	10°08.5	3.0 - 2.1	9.0 - 6.4	15.0 - 10.6	30	10°52.5	10°54.3	10°22.8	3.0 - 2.2	9.0 - 6.5	15.0 - 10.9	30	11°07.5	11°09.3	10°37.1	3.0 - 2.2	9.0 - 6.7	15.0 - 11.1
31	10°37.7	10°39.5	10°08.7	3.1 - 2.2	9.1 - 6.4	15.1 - 10.7	31	10°52.7	10°54.5	10°23.0	3.1 - 2.2	9.1 - 6.6	15.1 - 10.9	31	11°07.7	11°09.6	10°37.3	3.1 - 2.3	9.1 - 6.7	15.1 - 11.2
32	10°38.0	10°39.7	10°08.9	3.2 - 2.3	9.2 - 6.5	15.2 - 10.8	32	10°53.0	10°54.8	10°23.3	3.2 - 2.3	9.2 - 6.7	15.2 - 11.0	32	11°08.0	11°09.8	10°37.6	3.2 - 2.4	9.2 - 6.8	15.2 - 11.3
33	10°38.2	10°40.0	10°09.2	3.3 - 2.3	9.3 - 6.6	15.3 - 10.8	33	10°53.2	10°55.0	10°23.5	3.3 - 2.4	9.3 - 6.7	15.3 - 11.1	33	11°08.2	11°10.1	10°37.8	3.3 - 2.4	9.3 - 6.9	15.3 - 11.3
34	10°38.5	10°40.2	10°09.4	3.4 - 2.4	9.4 - 6.7	15.4 - 10.9	34	10°53.5	10°55.3	10°23.7	3.4 - 2.5	9.4 - 6.8	15.4 - 11.2	34	11°08.5	11°10.3	10°38.0	3.4 - 2.5	9.4 - 7.0	15.4 - 11.4
35	10°38.8	10°40.5	10°09.7	3.5 - 2.5	9.5 - 6.7	15.5 - 11.0	35	10°53.8	10°55.5	10°24.0	3.5 - 2.5	9.5 - 6.9	15.5 - 11.2	35	11°08.8	11°10.6	10°38.3	3.5 - 2.6	9.5 - 7.0	15.5 - 11.5
36	10°39.0	10°40.7	10°09.9	3.6 - 2.6	9.6 - 6.8	15.6 - 11.1	36	10°54.0	10°55.8	10°24.2	3.6 - 2.6	9.6 - 7.0	15.6 - 11.3	36	11°09.0	11°10.8	10°38.5	3.6 - 2.7	9.6 - 7.1	15.6 - 11.6
37	10°39.3	10°41.0	10°10.1	3.7 - 2.6	9.7 - 6.9	15.7 - 11.1	37	10°54.3	10°56.0	10°24.4	3.7 - 2.7	9.7 - 7.0	15.7 - 11.4	37	11°09.3	11°11.1	10°38.8	3.7 - 2.7	9.7 - 7.2	15.7 - 11.6
38	10°39.5	10°41.2	10°10.4	3.8 - 2.7	9.8 - 6.9	15.8 - 11.2	38	10°54.5	10°56.3	10°24.7	3.8 - 2.8	9.8 - 7.1	15.8 - 11.5	38	11°09.5	11°11.3	10°39.0	3.8 - 2.8	9.8 - 7.3	15.8 - 11.7
39	10°39.7	10°41.5	10°10.6	3.9 - 2.8	9.9 - 7.0	15.9 - 11.3	39	10°54.7	10°56.5	10°24.9	3.9 - 2.8	9.9 - 7.2	15.9 - 11.5	39	11°09.7	11°11.6	10°39.2	3.9 - 2.9	9.9 - 7.3	15.9 - 11.8
40	10°40.0	10°41.7	10°10.8	4.0 - 2.8	10.0 - 7.1	16.0 - 11.3	40	10°55.0	10°56.8	10°25.2	4.0 - 2.9	10.0 - 7.3	16.0 - 11.6	40	11°10.0	11°11.8	10°39.5	4.0 - 3.0	10.0 - 7.4	16.0 - 11.9
41	10°40.2	10°42.0	10°11.1	4.1 - 2.9	10.1 - 7.2	16.1 - 11.4	41	10°55.2	10°57.0	10°25.4	4.1 - 3.0	10.1 - 7.3	16.1							

## Increments and Corrections

m 45	Sun Plan.	Aries	Moon	v and d corr			m 46	Sun Plan.	Aries	Moon	v and d corr			m 47	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	0	11°30.0	11°31.9	10°58.6	0.0 - 0.0	6.0 - 4.7	12.0 - 9.3	0	11°45.0	11°46.9	11°12.9	0.0 - 0.0	6.0 - 4.8	12.0 - 9.5
1	11°15.2	11°17.1	10°44.5	0.1 - 0.1	6.1 - 4.6	12.1 - 9.2	1	11°30.2	11°32.1	10°58.8	0.1 - 0.1	6.1 - 4.7	12.1 - 9.4	1	11°45.2	11°47.2	11°13.1	0.1 - 0.1	6.1 - 4.8	12.1 - 9.6
2	11°15.5	11°17.3	10°44.7	0.2 - 0.2	6.2 - 4.7	12.2 - 9.3	2	11°30.5	11°32.4	10°59.0	0.2 - 0.2	6.2 - 4.8	12.2 - 9.5	2	11°45.5	11°47.4	11°13.4	0.2 - 0.2	6.2 - 4.9	12.2 - 9.7
3	11°15.7	11°17.6	10°45.0	0.3 - 0.2	6.3 - 4.8	12.3 - 9.3	3	11°30.7	11°32.6	10°59.3	0.3 - 0.2	6.3 - 4.9	12.3 - 9.5	3	11°45.7	11°47.7	11°13.6	0.3 - 0.2	6.3 - 5.0	12.3 - 9.7
4	11°16.0	11°17.8	10°45.2	0.4 - 0.3	6.4 - 4.9	12.4 - 9.4	4	11°31.0	11°32.9	10°59.5	0.4 - 0.3	6.4 - 5.0	12.4 - 9.6	4	11°46.0	11°47.9	11°13.8	0.4 - 0.3	6.4 - 5.1	12.4 - 9.8
5	11°16.3	11°18.1	10°45.4	0.5 - 0.4	6.5 - 4.9	12.5 - 9.5	5	11°31.3	11°33.1	10°59.8	0.5 - 0.4	6.5 - 5.0	12.5 - 9.7	5	11°46.3	11°48.2	11°14.1	0.5 - 0.4	6.5 - 5.1	12.5 - 9.9
6	11°16.5	11°18.3	10°45.7	0.6 - 0.5	6.6 - 5.0	12.6 - 9.6	6	11°31.5	11°33.4	11°00.0	0.6 - 0.5	6.6 - 5.1	12.6 - 9.8	6	11°46.5	11°48.4	11°14.3	0.6 - 0.5	6.6 - 5.2	12.6 - 10.0
7	11°16.8	11°18.6	10°45.9	0.7 - 0.5	6.7 - 5.1	12.7 - 9.6	7	11°31.8	11°33.6	11°00.2	0.7 - 0.5	6.7 - 5.2	12.7 - 9.8	7	11°46.8	11°48.7	11°14.6	0.7 - 0.6	6.7 - 5.3	12.7 - 10.1
8	11°17.0	11°18.9	10°46.2	0.8 - 0.6	6.8 - 5.2	12.8 - 9.7	8	11°32.0	11°33.9	11°00.5	0.8 - 0.6	6.8 - 5.3	12.8 - 9.9	8	11°47.0	11°48.9	11°14.8	0.8 - 0.6	6.8 - 5.4	12.8 - 10.1
9	11°17.2	11°19.1	10°46.4	0.9 - 0.7	6.9 - 5.2	12.9 - 9.8	9	11°32.2	11°34.1	11°00.7	0.9 - 0.7	6.9 - 5.3	12.9 - 10.0	9	11°47.2	11°49.2	11°15.0	0.9 - 0.7	6.9 - 5.5	12.9 - 10.2
10	11°17.5	11°19.4	10°46.6	1.0 - 0.8	7.0 - 5.3	13.0 - 9.9	10	11°32.5	11°34.4	11°01.0	1.0 - 0.8	7.0 - 5.4	13.0 - 10.1	10	11°47.5	11°49.4	11°15.3	1.0 - 0.8	7.0 - 5.5	13.0 - 10.3
11	11°17.7	11°19.6	10°46.9	1.1 - 0.8	7.1 - 5.4	13.1 - 9.9	11	11°32.7	11°34.6	11°01.2	1.1 - 0.9	7.1 - 5.5	13.1 - 10.2	11	11°47.7	11°49.7	11°15.5	1.1 - 0.9	7.1 - 5.6	13.1 - 10.4
12	11°18.0	11°19.9	10°47.1	1.2 - 0.9	7.2 - 5.5	13.2 - 10.0	12	11°33.0	11°34.9	11°01.4	1.2 - 0.9	7.2 - 5.6	13.2 - 10.2	12	11°48.0	11°49.9	11°15.7	1.2 - 1.0	7.2 - 5.7	13.2 - 10.4
13	11°18.3	11°20.1	10°47.4	1.3 - 1.0	7.3 - 5.5	13.3 - 10.1	13	11°33.3	11°35.1	11°01.7	1.3 - 1.0	7.3 - 5.7	13.3 - 10.3	13	11°48.3	11°50.2	11°16.0	1.3 - 1.0	7.3 - 5.8	13.3 - 10.5
14	11°18.5	11°20.4	10°47.6	1.4 - 1.1	7.4 - 5.6	13.4 - 10.2	14	11°33.5	11°35.4	11°01.9	1.4 - 1.1	7.4 - 5.7	13.4 - 10.4	14	11°48.5	11°50.4	11°16.2	1.4 - 1.1	7.4 - 5.9	13.4 - 10.6
15	11°18.8	11°20.6	10°47.8	1.5 - 1.1	7.5 - 5.7	13.5 - 10.2	15	11°33.8	11°35.6	11°02.1	1.5 - 1.2	7.5 - 5.8	13.5 - 10.5	15	11°48.8	11°50.7	11°16.5	1.5 - 1.2	7.5 - 5.9	13.5 - 10.7
16	11°19.0	11°20.9	10°48.1	1.6 - 1.2	7.6 - 5.8	13.6 - 10.3	16	11°34.0	11°35.9	11°02.4	1.6 - 1.2	7.6 - 5.9	13.6 - 10.5	16	11°49.0	11°50.9	11°16.7	1.6 - 1.3	7.6 - 6.0	13.6 - 10.8
17	11°19.2	11°21.1	10°48.3	1.7 - 1.3	7.7 - 5.8	13.7 - 10.4	17	11°34.2	11°36.1	11°02.6	1.7 - 1.3	7.7 - 6.0	13.7 - 10.6	17	11°49.2	11°51.2	11°16.9	1.7 - 1.3	7.7 - 6.1	13.7 - 10.8
18	11°19.5	11°21.4	10°48.5	1.8 - 1.4	7.8 - 5.9	13.8 - 10.5	18	11°34.5	11°36.4	11°02.9	1.8 - 1.4	7.8 - 6.0	13.8 - 10.7	18	11°49.5	11°51.4	11°17.2	1.8 - 1.4	7.8 - 6.2	13.8 - 10.9
19	11°19.8	11°21.6	10°48.8	1.9 - 1.4	7.9 - 6.0	13.9 - 10.5	19	11°34.8	11°36.6	11°03.1	1.9 - 1.5	7.9 - 6.1	13.9 - 10.8	19	11°49.8	11°51.7	11°17.4	1.9 - 1.5	7.9 - 6.3	13.9 - 11.0
20	11°20.0	11°21.9	10°49.0	2.0 - 1.5	8.0 - 6.1	14.0 - 10.6	20	11°35.0	11°36.9	11°03.3	2.0 - 1.6	8.0 - 6.2	14.0 - 10.8	20	11°50.0	11°51.9	11°17.7	2.0 - 1.6	8.0 - 6.3	14.0 - 11.1
21	11°20.3	11°22.1	10°49.3	2.1 - 1.6	8.1 - 6.1	14.1 - 10.7	21	11°35.3	11°37.2	11°03.6	2.1 - 1.6	8.1 - 6.3	14.1 - 10.9	21	11°50.3	11°52.2	11°17.9	2.1 - 1.7	8.1 - 6.4	14.1 - 11.2
22	11°20.5	11°22.4	10°49.5	2.2 - 1.7	8.2 - 6.2	14.2 - 10.8	22	11°35.5	11°37.4	11°03.8	2.2 - 1.7	8.2 - 6.4	14.2 - 11.0	22	11°50.5	11°52.4	11°18.1	2.2 - 1.7	8.2 - 6.5	14.2 - 11.2
23	11°20.7	11°22.6	10°49.7	2.3 - 1.7	8.3 - 6.3	14.3 - 10.8	23	11°35.7	11°37.7	11°04.1	2.3 - 1.8	8.3 - 6.4	14.3 - 11.1	23	11°50.7	11°52.7	11°18.4	2.3 - 1.8	8.3 - 6.6	14.3 - 11.3
24	11°21.0	11°22.9	10°50.0	2.4 - 1.8	8.4 - 6.4	14.4 - 10.9	24	11°36.0	11°37.9	11°04.3	2.4 - 1.9	8.4 - 6.5	14.4 - 11.2	24	11°51.0	11°52.9	11°18.6	2.4 - 1.9	8.4 - 6.7	14.4 - 11.4
25	11°21.2	11°23.1	10°50.2	2.5 - 1.9	8.5 - 6.4	14.5 - 11.0	25	11°36.2	11°38.2	11°04.5	2.5 - 1.9	8.5 - 6.6	14.5 - 11.2	25	11°51.2	11°53.2	11°18.8	2.5 - 2.0	8.5 - 6.7	14.5 - 11.5
26	11°21.5	11°23.4	10°50.5	2.6 - 2.0	8.6 - 6.5	14.6 - 11.1	26	11°36.5	11°38.4	11°04.8	2.6 - 2.0	8.6 - 6.7	14.6 - 11.3	26	11°51.5	11°53.4	11°19.1	2.6 - 2.1	8.6 - 6.8	14.6 - 11.6
27	11°21.8	11°23.6	10°50.7	2.7 - 2.0	8.7 - 6.6	14.7 - 11.1	27	11°36.8	11°38.7	11°05.0	2.7 - 2.1	8.7 - 6.7	14.7 - 11.4	27	11°51.8	11°53.7	11°19.3	2.7 - 2.1	8.7 - 6.9	14.7 - 11.6
28	11°22.0	11°23.9	10°50.9	2.8 - 2.1	8.8 - 6.7	14.8 - 11.2	28	11°37.0	11°38.9	11°05.2	2.8 - 2.2	8.8 - 6.8	14.8 - 11.5	28	11°52.0	11°53.9	11°19.6	2.8 - 2.2	8.8 - 7.0	14.8 - 11.7
29	11°22.3	11°24.1	10°51.2	2.9 - 2.2	8.9 - 6.7	14.9 - 11.3	29	11°37.3	11°39.2	11°05.5	2.9 - 2.2	8.9 - 6.9	14.9 - 11.5	29	11°52.3	11°54.2	11°19.8	2.9 - 2.3	8.9 - 7.0	14.9 - 11.8
30	11°22.5	11°24.4	10°51.4	3.0 - 2.3	9.0 - 6.8	15.0 - 11.4	30	11°37.5	11°39.4	11°05.7	3.0 - 2.3	9.0 - 7.0	15.0 - 11.6	30	11°52.5	11°54.4	11°20.0	3.0 - 2.4	9.0 - 7.1	15.0 - 11.9
31	11°22.7	11°24.6	10°51.6	3.1 - 2.4	9.1 - 6.9	15.1 - 11.5	31	11°37.7	11°39.7	11°06.0	3.1 - 2.4	9.1 - 7.1	15.1 - 11.7	31	11°52.7	11°54.7	11°20.3	3.1 - 2.5	9.1 - 7.2	15.1 - 12.0
32	11°23.0	11°24.9	10°51.9	3.2 - 2.4	9.2 - 7.0	15.2 - 11.5	32	11°38.0	11°39.9	11°06.2	3.2 - 2.5	9.2 - 7.1	15.2 - 11.8	32	11°53.0	11°54.9	11°20.5	3.2 - 2.5	9.2 - 7.3	15.2 - 12.0
33	11°23.2	11°25.1	10°52.1	3.3 - 2.5	9.3 - 7.1	15.3 - 11.6	33	11°38.2	11°40.2	11°06.4	3.3 - 2.6	9.3 - 7.2	15.3 - 11.9	33	11°53.2	11°55.2	11°20.8	3.3 - 2.6	9.3 - 7.4	15.3 - 12.1
34	11°23.5	11°25.4	10°52.4	3.4 - 2.6	9.4 - 7.1	15.4 - 11.7	34	11°38.5	11°40.4	11°06.7	3.4 - 2.6	9.4 - 7.3	15.4 - 11.9	34	11°53.5	11°55.5	11°21.0	3.4 - 2.7	9.4 - 7.4	15.4 - 12.2
35	11°23.8	11°25.6	10°52.6	3.5 - 2.7	9.5 - 7.2	15.5 - 11.8	35	11°38.8	11°40.7	11°06.9	3.5 - 2.7	9.5 - 7.4	15.5 - 12.0	35	11°53.8	11°55.7	11°21.2	3.5 - 2.8	9.5 - 7.5	15.5 - 12.3
36	11°24.0	11°25.9	10°52.8	3.6 - 2.7	9.6 - 7.3	15.6 - 11.8	36	11°39.0	11°40.9	11°07.2	3.6 - 2.8	9.6 - 7.4	15.6 - 12.1	36	11°54.0	11°56.0	11°21.5	3.6 - 2.9	9.6 - 7.6	15.6 - 12.3
37	11°24.3	11°26.1	10°53.1	3.7 - 2.8	9.7 - 7.4	15.7 - 11.9	37	11°39.3	11°41.2	11°07.4	3.7 - 2.9	9.7 - 7.5	15.7 - 12.2	37	11°54.3	11°56.2	11°21.7	3.7 - 2.9	9.7 - 7.7	15.7 - 12.4
38	11°24.5	11°26.4	10°53.3	3.8 - 2.9	9.8 - 7.4	15.8 - 12.0	38	11°39.5	11°41.4	11°07.6	3.8 - 2.9	9.8 - 7.6	15.8 - 12.2	38	11°54.5	11°56.5	11°22.0	3.8 - 3.0	9.8 - 7.8	15.8 - 12.5
39	11°24.7	11°26.6	10°53.6	3.9 - 3.0	9.9 - 7.5	15.9 - 12.1	39	11°39.7	11°41.7	11°07.9	3.9 - 3.0	9.9 - 7.7	15.9 - 12.3	39	11°54.7	11°56.7	11°22.2	3.9 - 3.1	9.9 - 7.8	15.9 - 12.6
40	11°25.0	11°26.9	10°53.8	4.0 - 3.0	10.0 - 7.6	16.0 - 12.1	40	11°40.0	11°41.9	11°08.1	4.0 - 3.1	10.0 - 7.8	16.0 - 12.4	40	11°55.0	11°57.0	11°22.4	4.0 - 3.2	10.0 - 7.9	16.0 - 12.7
41	11°25.2	11°27.1	10°54.0	4.1 - 3.1	10.1 - 7.7	16.1 - 12.2	41	11°40.2	11°42.2	11°08.3	4.1 -									

## Increments and Corrections

m 48	Sun Plan.	Aries	Moon	v and d corr			m 49	Sun Plan.	Aries	Moon	v and d corr			m 50	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	0	12°15.0	12°17.0	11°41.5	0.0 - 0.0	6.0 - 4.9	12.0 - 9.9	0	12°30.0	12°32.1	11°55.8	0.0 - 0.0	6.0 - 5.0	12.0 - 10.1
1	12°00.2	12°02.2	11°27.4	0.1 - 0.1	6.1 - 4.9	12.1 - 9.8	1	12°15.2	12°17.3	11°41.8	0.1 - 0.1	6.1 - 5.0	12.1 - 10.0	1	12°30.2	12°32.3	11°56.1	0.1 - 0.1	6.1 - 5.1	12.1 - 10.2
2	12°00.5	12°02.5	11°27.7	0.2 - 0.2	6.2 - 5.0	12.2 - 9.9	2	12°15.5	12°17.5	11°42.0	0.2 - 0.2	6.2 - 5.1	12.2 - 10.1	2	12°30.5	12°32.6	11°56.3	0.2 - 0.2	6.2 - 5.2	12.2 - 10.3
3	12°00.7	12°02.7	11°27.9	0.3 - 0.2	6.3 - 5.1	12.3 - 9.9	3	12°15.7	12°17.8	11°42.2	0.3 - 0.2	6.3 - 5.2	12.3 - 10.1	3	12°30.7	12°32.8	11°56.5	0.3 - 0.3	6.3 - 5.3	12.3 - 10.4
4	12°01.0	12°03.0	11°28.2	0.4 - 0.3	6.4 - 5.2	12.4 - 10.0	4	12°16.0	12°18.0	11°42.5	0.4 - 0.3	6.4 - 5.3	12.4 - 10.2	4	12°31.0	12°33.1	11°56.8	0.4 - 0.3	6.4 - 5.4	12.4 - 10.4
5	12°01.3	12°03.2	11°28.4	0.5 - 0.4	6.5 - 5.3	12.5 - 10.1	5	12°16.3	12°18.3	11°42.7	0.5 - 0.4	6.5 - 5.4	12.5 - 10.3	5	12°31.3	12°33.3	11°57.0	0.5 - 0.4	6.5 - 5.5	12.5 - 10.5
6	12°01.5	12°03.5	11°28.6	0.6 - 0.5	6.6 - 5.3	12.6 - 10.2	6	12°16.5	12°18.5	11°42.9	0.6 - 0.5	6.6 - 5.4	12.6 - 10.4	6	12°31.5	12°33.6	11°57.3	0.6 - 0.5	6.6 - 5.6	12.6 - 10.6
7	12°01.8	12°03.7	11°28.9	0.7 - 0.6	6.7 - 5.4	12.7 - 10.3	7	12°16.8	12°18.8	11°43.2	0.7 - 0.6	6.7 - 5.5	12.7 - 10.5	7	12°31.8	12°33.8	11°57.5	0.7 - 0.6	6.7 - 5.6	12.7 - 10.7
8	12°02.0	12°04.0	11°29.1	0.8 - 0.6	6.8 - 5.5	12.8 - 10.3	8	12°17.0	12°19.0	11°43.4	0.8 - 0.7	6.8 - 5.6	12.8 - 10.6	8	12°32.0	12°34.1	11°57.7	0.8 - 0.7	6.8 - 5.7	12.8 - 10.8
9	12°02.2	12°04.2	11°29.3	0.9 - 0.7	6.9 - 5.6	12.9 - 10.4	9	12°17.2	12°19.3	11°43.7	0.9 - 0.7	6.9 - 5.7	12.9 - 10.6	9	12°32.2	12°34.3	11°58.0	0.9 - 0.8	6.9 - 5.8	12.9 - 10.9
10	12°02.5	12°04.5	11°29.6	1.0 - 0.8	7.0 - 5.7	13.0 - 10.5	10	12°17.5	12°19.5	11°43.9	1.0 - 0.8	7.0 - 5.8	13.0 - 10.7	10	12°32.5	12°34.6	11°58.2	1.0 - 0.8	7.0 - 5.9	13.0 - 10.9
11	12°02.7	12°04.7	11°29.8	1.1 - 0.9	7.1 - 5.7	13.1 - 10.6	11	12°17.7	12°19.8	11°44.1	1.1 - 0.9	7.1 - 5.9	13.1 - 10.8	11	12°32.7	12°34.8	11°58.5	1.1 - 0.9	7.1 - 6.0	13.1 - 11.0
12	12°03.0	12°05.0	11°30.1	1.2 - 1.0	7.2 - 5.8	13.2 - 10.7	12	12°18.0	12°20.0	11°44.4	1.2 - 1.0	7.2 - 5.9	13.2 - 10.9	12	12°33.0	12°35.1	11°58.7	1.2 - 1.0	7.2 - 6.1	13.2 - 11.1
13	12°03.3	12°05.2	11°30.3	1.3 - 1.1	7.3 - 5.9	13.3 - 10.8	13	12°18.3	12°20.3	11°44.6	1.3 - 1.1	7.3 - 6.0	13.3 - 11.0	13	12°33.3	12°35.3	11°58.9	1.3 - 1.1	7.3 - 6.1	13.3 - 11.2
14	12°03.5	12°05.5	11°30.5	1.4 - 1.1	7.4 - 6.0	13.4 - 10.8	14	12°18.5	12°20.5	11°44.9	1.4 - 1.2	7.4 - 6.1	13.4 - 11.1	14	12°33.5	12°35.6	11°59.2	1.4 - 1.2	7.4 - 6.2	13.4 - 11.3
15	12°03.8	12°05.7	11°30.8	1.5 - 1.2	7.5 - 6.1	13.5 - 10.9	15	12°18.8	12°20.8	11°45.1	1.5 - 1.2	7.5 - 6.2	13.5 - 11.1	15	12°33.8	12°35.8	11°59.4	1.5 - 1.3	7.5 - 6.3	13.5 - 11.4
16	12°04.0	12°06.0	11°31.0	1.6 - 1.3	7.6 - 6.1	13.6 - 11.0	16	12°19.0	12°21.0	11°45.3	1.6 - 1.3	7.6 - 6.3	13.6 - 11.2	16	12°34.0	12°36.1	11°59.7	1.6 - 1.3	7.6 - 6.4	13.6 - 11.4
17	12°04.2	12°06.2	11°31.3	1.7 - 1.4	7.7 - 6.2	13.7 - 11.1	17	12°19.2	12°21.3	11°45.6	1.7 - 1.4	7.7 - 6.4	13.7 - 11.3	17	12°34.2	12°36.3	11°59.9	1.7 - 1.4	7.7 - 6.5	13.7 - 11.5
18	12°04.5	12°06.5	11°31.5	1.8 - 1.5	7.8 - 6.3	13.8 - 11.2	18	12°19.5	12°21.5	11°45.8	1.8 - 1.5	7.8 - 6.4	13.8 - 11.4	18	12°34.5	12°36.6	12°00.1	1.8 - 1.5	7.8 - 6.6	13.8 - 11.6
19	12°04.8	12°06.7	11°31.7	1.9 - 1.5	7.9 - 6.4	13.9 - 11.2	19	12°19.8	12°21.8	11°46.1	1.9 - 1.6	7.9 - 6.5	13.9 - 11.5	19	12°34.8	12°36.8	12°00.4	1.9 - 1.6	7.9 - 6.6	13.9 - 11.7
20	12°05.0	12°07.0	11°32.0	2.0 - 1.6	8.0 - 6.5	14.0 - 11.3	20	12°20.0	12°22.0	11°46.3	2.0 - 1.6	8.0 - 6.6	14.0 - 11.5	20	12°35.0	12°37.1	12°00.6	2.0 - 1.7	8.0 - 6.7	14.0 - 11.8
21	12°05.3	12°07.2	11°32.2	2.1 - 1.7	8.1 - 6.5	14.1 - 11.4	21	12°20.3	12°22.3	11°46.5	2.1 - 1.7	8.1 - 6.7	14.1 - 11.6	21	12°35.3	12°37.3	12°00.8	2.1 - 1.8	8.1 - 6.8	14.1 - 11.9
22	12°05.5	12°07.5	11°32.4	2.2 - 1.8	8.2 - 6.6	14.2 - 11.5	22	12°20.5	12°22.5	11°46.8	2.2 - 1.8	8.2 - 6.8	14.2 - 11.7	22	12°35.5	12°37.6	12°01.1	2.2 - 1.9	8.2 - 6.9	14.2 - 12.0
23	12°05.7	12°07.7	11°32.7	2.3 - 1.9	8.3 - 6.7	14.3 - 11.6	23	12°20.7	12°22.8	11°47.0	2.3 - 1.9	8.3 - 6.8	14.3 - 11.8	23	12°35.7	12°37.8	12°01.3	2.3 - 1.9	8.3 - 7.0	14.3 - 12.0
24	12°06.0	12°08.0	11°32.9	2.4 - 1.9	8.4 - 6.8	14.4 - 11.6	24	12°21.0	12°23.0	11°47.2	2.4 - 2.0	8.4 - 6.9	14.4 - 11.9	24	12°36.0	12°38.1	12°01.6	2.4 - 2.0	8.4 - 7.1	14.4 - 12.1
25	12°06.2	12°08.2	11°33.2	2.5 - 2.0	8.5 - 6.9	14.5 - 11.7	25	12°21.2	12°23.3	11°47.5	2.5 - 2.1	8.5 - 7.0	14.5 - 12.0	25	12°36.2	12°38.3	12°01.8	2.5 - 2.1	8.5 - 7.2	14.5 - 12.2
26	12°06.5	12°08.5	11°33.4	2.6 - 2.1	8.6 - 7.0	14.6 - 11.8	26	12°21.5	12°23.5	11°47.7	2.6 - 2.1	8.6 - 7.1	14.6 - 12.0	26	12°36.5	12°38.6	12°02.0	2.6 - 2.2	8.6 - 7.2	14.6 - 12.3
27	12°06.8	12°08.7	11°33.6	2.7 - 2.2	8.7 - 7.0	14.7 - 11.9	27	12°21.8	12°23.8	11°48.0	2.7 - 2.2	8.7 - 7.2	14.7 - 12.1	27	12°36.8	12°38.8	12°02.3	2.7 - 2.3	8.7 - 7.3	14.7 - 12.4
28	12°07.0	12°09.0	11°33.9	2.8 - 2.3	8.8 - 7.1	14.8 - 12.0	28	12°22.0	12°24.0	11°48.2	2.8 - 2.3	8.8 - 7.3	14.8 - 12.2	28	12°37.0	12°39.1	12°02.5	2.8 - 2.4	8.8 - 7.4	14.8 - 12.5
29	12°07.3	12°09.2	11°34.1	2.9 - 2.3	8.9 - 7.2	14.9 - 12.0	29	12°22.3	12°24.3	11°48.4	2.9 - 2.4	8.9 - 7.3	14.9 - 12.3	29	12°37.3	12°39.3	12°02.8	2.9 - 2.4	8.9 - 7.5	14.9 - 12.5
30	12°07.5	12°09.5	11°34.4	3.0 - 2.4	9.0 - 7.3	15.0 - 12.1	30	12°22.5	12°24.5	11°48.7	3.0 - 2.5	9.0 - 7.4	15.0 - 12.4	30	12°37.5	12°39.6	12°03.0	3.0 - 2.5	9.0 - 7.6	15.0 - 12.6
31	12°07.7	12°09.7	11°34.6	3.1 - 2.5	9.1 - 7.4	15.1 - 12.2	31	12°22.7	12°24.8	11°48.9	3.1 - 2.6	9.1 - 7.5	15.1 - 12.5	31	12°37.7	12°39.8	12°03.2	3.1 - 2.6	9.1 - 7.7	15.1 - 12.7
32	12°08.0	12°10.0	11°34.8	3.2 - 2.6	9.2 - 7.4	15.2 - 12.3	32	12°23.0	12°25.0	11°49.2	3.2 - 2.6	9.2 - 7.6	15.2 - 12.5	32	12°38.0	12°40.1	12°03.5	3.2 - 2.7	9.2 - 7.7	15.2 - 12.8
33	12°08.2	12°10.2	11°35.1	3.3 - 2.7	9.3 - 7.5	15.3 - 12.4	33	12°23.2	12°25.3	11°49.4	3.3 - 2.7	9.3 - 7.7	15.3 - 12.6	33	12°38.2	12°40.3	12°03.7	3.3 - 2.8	9.3 - 7.8	15.3 - 12.9
34	12°08.5	12°10.5	11°35.3	3.4 - 2.7	9.4 - 7.6	15.4 - 12.4	34	12°23.5	12°25.5	11°49.6	3.4 - 2.8	9.4 - 7.8	15.4 - 12.7	34	12°38.5	12°40.6	12°03.9	3.4 - 2.9	9.4 - 7.9	15.4 - 13.0
35	12°08.8	12°10.7	11°35.6	3.5 - 2.8	9.5 - 7.7	15.5 - 12.5	35	12°23.8	12°25.8	11°49.9	3.5 - 2.9	9.5 - 7.8	15.5 - 12.8	35	12°38.8	12°40.8	12°04.2	3.5 - 2.9	9.5 - 8.0	15.5 - 13.0
36	12°09.0	12°11.0	11°35.8	3.6 - 2.9	9.6 - 7.8	15.6 - 12.6	36	12°24.0	12°26.0	11°50.1	3.6 - 3.0	9.6 - 7.9	15.6 - 12.9	36	12°39.0	12°41.1	12°04.4	3.6 - 3.0	9.6 - 8.1	15.6 - 13.1
37	12°09.3	12°11.2	11°36.0	3.7 - 3.0	9.7 - 7.8	15.7 - 12.7	37	12°24.3	12°26.3	11°50.3	3.7 - 3.1	9.7 - 8.0	15.7 - 13.0	37	12°39.3	12°41.3	12°04.7	3.7 - 3.1	9.7 - 8.2	15.7 - 13.2
38	12°09.5	12°11.5	11°36.3	3.8 - 3.1	9.8 - 7.9	15.8 - 12.8	38	12°24.5	12°26.5	11°50.6	3.8 - 3.1	9.8 - 8.1	15.8 - 13.0	38	12°39.5	12°41.6	12°04.9	3.8 - 3.2	9.8 - 8.2	15.8 - 13.3
39	12°09.7	12°11.7	11°36.5	3.9 - 3.2	9.9 - 8.0	15.9 - 12.9	39	12°24.7	12°26.8	11°50.8	3.9 - 3.2	9.9 - 8.2	15.9 - 13.1	39	12°39.7	12°41.8	12°05.1	3.9 - 3.3	9.9 - 8.3	15.9 - 13.4
40	12°10.0	12°12.0	11°36.7	4.0 - 3.2	10.0 - 8.1	16.0 - 12.9	40	12°25.0	12°27.0	11°51.1	4.0 - 3.3	10.0 - 8.3	16.0 - 13.2	40	12°40.0	12°42.1	12°05.4	4.0 - 3.4	10.0 - 8.4	16.0 - 13.5
41	12°10.2	12°12.2	11°37.0	4.1 - 3.3	10.1 - 8.2	16.1 - 13.0	41	12°25.2	12°27.											

## 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</					

## Increments and Corrections

m 54	Sun Plan.	Aries	Moon	v and d corr			m 55	Sun Plan.	Aries	Moon	v and d corr			m 56	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	0	13°45.0	13°47.3	13°07.4	0.0 - 0.0	6.0 - 5.6	12.0 - 11.1	0	14°00.0	14°02.3	13°21.7	0.0 - 0.0	6.0 - 5.7	12.0 - 11.3
1	13°30.2	13°32.5	12°53.3	0.1 - 0.1	6.1 - 5.5	12.1 - 11.0	1	13°45.2	13°47.5	13°07.7	0.1 - 0.1	6.1 - 5.6	12.1 - 11.2	1	14°00.2	14°02.5	13°22.0	0.1 - 0.1	6.1 - 5.7	12.1 - 11.4
2	13°30.5	13°32.7	12°53.6	0.2 - 0.2	6.2 - 5.6	12.2 - 11.1	2	13°45.5	13°47.8	13°07.9	0.2 - 0.2	6.2 - 5.7	12.2 - 11.3	2	14°00.5	14°02.8	13°22.2	0.2 - 0.2	6.2 - 5.8	12.2 - 11.5
3	13°30.7	13°33.0	12°53.8	0.3 - 0.3	6.3 - 5.7	12.3 - 11.2	3	13°45.7	13°48.0	13°08.1	0.3 - 0.3	6.3 - 5.8	12.3 - 11.4	3	14°00.7	14°03.0	13°22.4	0.3 - 0.3	6.3 - 5.9	12.3 - 11.6
4	13°31.0	13°33.2	12°54.1	0.4 - 0.4	6.4 - 5.8	12.4 - 11.3	4	13°46.0	13°48.3	13°08.4	0.4 - 0.4	6.4 - 5.9	12.4 - 11.5	4	14°01.0	14°03.3	13°22.7	0.4 - 0.4	6.4 - 6.0	12.4 - 11.7
5	13°31.3	13°33.5	12°54.3	0.5 - 0.5	6.5 - 5.9	12.5 - 11.4	5	13°46.3	13°48.5	13°08.6	0.5 - 0.5	6.5 - 6.0	12.5 - 11.6	5	14°01.3	14°03.5	13°22.9	0.5 - 0.5	6.5 - 6.1	12.5 - 11.8
6	13°31.5	13°33.7	12°54.5	0.6 - 0.5	6.6 - 6.0	12.6 - 11.4	6	13°46.5	13°48.8	13°08.8	0.6 - 0.6	6.6 - 6.1	12.6 - 11.7	6	14°01.5	14°03.8	13°23.2	0.6 - 0.6	6.6 - 6.2	12.6 - 11.9
7	13°31.8	13°34.0	12°54.8	0.7 - 0.6	6.7 - 6.1	12.7 - 11.5	7	13°46.8	13°49.0	13°09.1	0.7 - 0.6	6.7 - 6.2	12.7 - 11.7	7	14°01.8	14°04.1	13°23.4	0.7 - 0.7	6.7 - 6.3	12.7 - 12.0
8	13°32.0	13°34.2	12°55.0	0.8 - 0.7	6.8 - 6.2	12.8 - 11.6	8	13°47.0	13°49.3	13°09.3	0.8 - 0.7	6.8 - 6.3	12.8 - 11.8	8	14°02.0	14°04.3	13°23.6	0.8 - 0.8	6.8 - 6.4	12.8 - 12.1
9	13°32.2	13°34.5	12°55.2	0.9 - 0.8	6.9 - 6.3	12.9 - 11.7	9	13°47.2	13°49.5	13°09.6	0.9 - 0.8	6.9 - 6.4	12.9 - 11.9	9	14°02.2	14°04.6	13°23.9	0.9 - 0.8	6.9 - 6.5	12.9 - 12.1
10	13°32.5	13°34.7	12°55.5	1.0 - 0.9	7.0 - 6.4	13.0 - 11.8	10	13°47.5	13°49.8	13°09.8	1.0 - 0.9	7.0 - 6.5	13.0 - 12.0	10	14°02.5	14°04.8	13°24.1	1.0 - 0.9	7.0 - 6.6	13.0 - 12.2
11	13°32.7	13°35.0	12°55.7	1.1 - 1.0	7.1 - 6.4	13.1 - 11.9	11	13°47.7	13°50.0	13°10.0	1.1 - 1.0	7.1 - 6.6	13.1 - 12.1	11	14°02.7	14°05.1	13°24.4	1.1 - 1.0	7.1 - 6.7	13.1 - 12.3
12	13°33.0	13°35.2	12°56.0	1.2 - 1.1	7.2 - 6.5	13.2 - 12.0	12	13°48.0	13°50.3	13°10.3	1.2 - 1.1	7.2 - 6.7	13.2 - 12.2	12	14°03.0	14°05.3	13°24.6	1.2 - 1.1	7.2 - 6.8	13.2 - 12.4
13	13°33.3	13°35.5	12°56.2	1.3 - 1.2	7.3 - 6.6	13.3 - 12.1	13	13°48.3	13°50.5	13°10.5	1.3 - 1.2	7.3 - 6.8	13.3 - 12.3	13	14°03.3	14°05.6	13°24.8	1.3 - 1.2	7.3 - 6.9	13.3 - 12.5
14	13°33.5	13°35.7	12°56.4	1.4 - 1.3	7.4 - 6.7	13.4 - 12.2	14	13°48.5	13°50.8	13°10.8	1.4 - 1.3	7.4 - 6.8	13.4 - 12.4	14	14°03.5	14°05.8	13°25.1	1.4 - 1.3	7.4 - 7.0	13.4 - 12.6
15	13°33.8	13°36.0	12°56.7	1.5 - 1.4	7.5 - 6.8	13.5 - 12.3	15	13°48.8	13°51.0	13°11.0	1.5 - 1.4	7.5 - 6.9	13.5 - 12.5	15	14°03.8	14°06.1	13°25.3	1.5 - 1.4	7.5 - 7.1	13.5 - 12.7
16	13°34.0	13°36.2	12°56.9	1.6 - 1.5	7.6 - 6.9	13.6 - 12.4	16	13°49.0	13°51.3	13°11.2	1.6 - 1.5	7.6 - 7.0	13.6 - 12.6	16	14°04.0	14°06.3	13°25.6	1.6 - 1.5	7.6 - 7.2	13.6 - 12.8
17	13°34.2	13°36.5	12°57.2	1.7 - 1.5	7.7 - 7.0	13.7 - 12.4	17	13°49.2	13°51.5	13°11.5	1.7 - 1.6	7.7 - 7.1	13.7 - 12.7	17	14°04.2	14°06.6	13°25.8	1.7 - 1.6	7.7 - 7.3	13.7 - 12.9
18	13°34.5	13°36.7	12°57.4	1.8 - 1.6	7.8 - 7.1	13.8 - 12.5	18	13°49.5	13°51.8	13°11.7	1.8 - 1.7	7.8 - 7.2	13.8 - 12.8	18	14°04.5	14°06.8	13°26.0	1.8 - 1.7	7.8 - 7.3	13.8 - 13.0
19	13°34.8	13°37.0	12°57.6	1.9 - 1.7	7.9 - 7.2	13.9 - 12.6	19	13°49.8	13°52.0	13°12.0	1.9 - 1.8	7.9 - 7.3	13.9 - 12.9	19	14°04.8	14°07.1	13°26.3	1.9 - 1.8	7.9 - 7.4	13.9 - 13.1
20	13°35.0	13°37.2	12°57.9	2.0 - 1.8	8.0 - 7.3	14.0 - 12.7	20	13°50.0	13°52.3	13°12.2	2.0 - 1.9	8.0 - 7.4	14.0 - 13.0	20	14°05.0	14°07.3	13°26.5	2.0 - 1.9	8.0 - 7.5	14.0 - 13.2
21	13°35.3	13°37.5	12°58.1	2.1 - 1.9	8.1 - 7.4	14.1 - 12.8	21	13°50.3	13°52.5	13°12.4	2.1 - 1.9	8.1 - 7.5	14.1 - 13.0	21	14°05.3	14°07.6	13°26.7	2.1 - 2.0	8.1 - 7.6	14.1 - 13.3
22	13°35.5	13°37.7	12°58.3	2.2 - 2.0	8.2 - 7.4	14.2 - 12.9	22	13°50.5	13°52.8	13°12.7	2.2 - 2.0	8.2 - 7.6	14.2 - 13.1	22	14°05.5	14°07.8	13°27.0	2.2 - 2.1	8.2 - 7.7	14.2 - 13.4
23	13°35.7	13°38.0	12°58.6	2.3 - 2.1	8.3 - 7.5	14.3 - 13.0	23	13°50.7	13°53.0	13°12.9	2.3 - 2.1	8.3 - 7.7	14.3 - 13.2	23	14°05.7	14°08.1	13°27.2	2.3 - 2.2	8.3 - 7.8	14.3 - 13.5
24	13°36.0	13°38.2	12°58.8	2.4 - 2.2	8.4 - 7.6	14.4 - 13.1	24	13°51.0	13°53.3	13°13.1	2.4 - 2.2	8.4 - 7.8	14.4 - 13.3	24	14°06.0	14°08.3	13°27.5	2.4 - 2.3	8.4 - 7.9	14.4 - 13.6
25	13°36.2	13°38.5	12°59.1	2.5 - 2.3	8.5 - 7.7	14.5 - 13.2	25	13°51.2	13°53.5	13°13.4	2.5 - 2.3	8.5 - 7.9	14.5 - 13.4	25	14°06.2	14°08.6	13°27.7	2.5 - 2.4	8.5 - 8.0	14.5 - 13.7
26	13°36.5	13°38.7	12°59.3	2.6 - 2.4	8.6 - 7.8	14.6 - 13.3	26	13°51.5	13°53.8	13°13.6	2.6 - 2.4	8.6 - 8.0	14.6 - 13.5	26	14°06.5	14°08.8	13°27.9	2.6 - 2.4	8.6 - 8.1	14.6 - 13.7
27	13°36.8	13°39.0	12°59.5	2.7 - 2.5	8.7 - 7.9	14.7 - 13.4	27	13°51.8	13°54.0	13°13.9	2.7 - 2.5	8.7 - 8.0	14.7 - 13.6	27	14°06.8	14°09.1	13°28.2	2.7 - 2.5	8.7 - 8.2	14.7 - 13.8
28	13°37.0	13°39.2	12°59.8	2.8 - 2.5	8.8 - 8.0	14.8 - 13.4	28	13°52.0	13°54.3	13°14.1	2.8 - 2.6	8.8 - 8.1	14.8 - 13.7	28	14°07.0	14°09.3	13°28.4	2.8 - 2.6	8.8 - 8.3	14.8 - 13.9
29	13°37.3	13°39.5	13°00.0	2.9 - 2.6	8.9 - 8.1	14.9 - 13.5	29	13°52.3	13°54.5	13°14.3	2.9 - 2.7	8.9 - 8.2	14.9 - 13.8	29	14°07.3	14°09.6	13°28.7	2.9 - 2.7	8.9 - 8.4	14.9 - 14.0
30	13°37.5	13°39.7	13°00.3	3.0 - 2.7	9.0 - 8.2	15.0 - 13.6	30	13°52.5	13°54.8	13°14.6	3.0 - 2.8	9.0 - 8.3	15.0 - 13.9	30	14°07.5	14°09.8	13°28.9	3.0 - 2.8	9.0 - 8.5	15.0 - 14.1
31	13°37.7	13°40.0	13°00.5	3.1 - 2.8	9.1 - 8.3	15.1 - 13.7	31	13°52.7	13°55.0	13°14.8	3.1 - 2.9	9.1 - 8.4	15.1 - 14.0	31	14°07.7	14°10.1	13°29.1	3.1 - 2.9	9.1 - 8.6	15.1 - 14.2
32	13°38.0	13°40.2	13°00.7	3.2 - 2.9	9.2 - 8.4	15.2 - 13.8	32	13°53.0	13°55.3	13°15.1	3.2 - 3.0	9.2 - 8.5	15.2 - 14.1	32	14°08.0	14°10.3	13°29.4	3.2 - 3.0	9.2 - 8.7	15.2 - 14.3
33	13°38.2	13°40.5	13°01.0	3.3 - 3.0	9.3 - 8.4	15.3 - 13.9	33	13°53.2	13°55.5	13°15.3	3.3 - 3.1	9.3 - 8.6	15.3 - 14.2	33	14°08.2	14°10.6	13°29.6	3.3 - 3.1	9.3 - 8.8	15.3 - 14.4
34	13°38.5	13°40.7	13°01.2	3.4 - 3.1	9.4 - 8.5	15.4 - 14.0	34	13°53.5	13°55.8	13°15.5	3.4 - 3.1	9.4 - 8.7	15.4 - 14.2	34	14°08.5	14°10.8	13°29.8	3.4 - 3.2	9.4 - 8.9	15.4 - 14.5
35	13°38.8	13°41.0	13°01.5	3.5 - 3.2	9.5 - 8.6	15.5 - 14.1	35	13°53.8	13°56.0	13°15.8	3.5 - 3.2	9.5 - 8.8	15.5 - 14.3	35	14°08.8	14°11.1	13°30.1	3.5 - 3.3	9.5 - 8.9	15.5 - 14.6
36	13°39.0	13°41.2	13°01.7	3.6 - 3.3	9.6 - 8.7	15.6 - 14.2	36	13°54.0	13°56.3	13°16.0	3.6 - 3.3	9.6 - 8.9	15.6 - 14.4	36	14°09.0	14°11.3	13°30.3	3.6 - 3.4	9.6 - 9.0	15.6 - 14.7
37	13°39.3	13°41.5	13°01.9	3.7 - 3.4	9.7 - 8.8	15.7 - 14.3	37	13°54.3	13°56.5	13°16.2	3.7 - 3.4	9.7 - 9.0	15.7 - 14.5	37	14°09.3	14°11.6	13°30.6	3.7 - 3.5	9.7 - 9.1	15.7 - 14.8
38	13°39.5	13°41.7	13°02.2	3.8 - 3.5	9.8 - 8.9	15.8 - 14.4	38	13°54.5	13°56.8	13°16.5	3.8 - 3.5	9.8 - 9.1	15.8 - 14.6	38	14°09.5	14°11.8	13°30.8	3.8 - 3.6	9.8 - 9.2	15.8 - 14.9
39	13°39.7	13°42.0	13°02.4	3.9 - 3.5	9.9 - 9.0	15.9 - 14.4	39	13°54.7	13°57.0	13°16.7	3.9 - 3.6	9.9 - 9.2	15.9 - 14.7	39	14°09.7	14°12.1	13°31.0	3.9 - 3.7	9.9 - 9.3	15.9 - 15.0
40	13°40.0	13°42.2	13°02.6	4.0 - 3.6	10.0 - 9.1	16.0 - 14.5	40	13°55.0	13°57.3	13°17.0	4.0 - 3.7	10.0 - 9.3	16.0 - 14.8	40	14°10.0	14°12.3	13°31.3	4.0 - 3.8	10.0 - 9.4	16.0 - 15.1
41	13°40.2	13°42.5	13°02.9	4.1 - 3.7	10.1 - 9.2	16.1 - 14.6	41	13°55.2	1											

## Increments and Corrections

m 57	Sun Plan.	Aries	Moon	v and d corr				m 58	Sun Plan.	Aries	Moon	v and d corr				m 59	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		0	14°30.0	14°32.4	13°50.4	0.0 - 0.0	6.0 - 5.8	12.0 - 11.7		0	14°45.0	14°47.4	14°04.7	0.0 - 0.0	6.0 - 6.0	12.0 - 11.9	
1	14°15.2	14°17.6	13°36.3	0.1 - 0.1	6.1 - 5.8	12.1 - 11.6		1	14°30.2	14°32.6	13°50.6	0.1 - 0.1	6.1 - 5.9	12.1 - 11.8		1	14°45.2	14°47.7	14°04.9	0.1 - 0.1	6.1 - 6.0	12.1 - 12.0	
2	14°15.5	14°17.8	13°36.5	0.2 - 0.2	6.2 - 5.9	12.2 - 11.7		2	14°30.5	14°32.9	13°50.8	0.2 - 0.2	6.2 - 6.0	12.2 - 11.9		2	14°45.5	14°47.9	14°05.2	0.2 - 0.2	6.2 - 6.1	12.2 - 12.1	
3	14°15.7	14°18.1	13°36.8	0.3 - 0.3	6.3 - 6.0	12.3 - 11.8		3	14°30.7	14°33.1	13°51.1	0.3 - 0.3	6.3 - 6.1	12.3 - 12.0		3	14°45.7	14°48.2	14°05.4	0.3 - 0.3	6.3 - 6.2	12.3 - 12.2	
4	14°16.0	14°18.3	13°37.0	0.4 - 0.4	6.4 - 6.1	12.4 - 11.9		4	14°31.0	14°33.4	13°51.3	0.4 - 0.4	6.4 - 6.2	12.4 - 12.1		4	14°46.0	14°48.4	14°05.6	0.4 - 0.4	6.4 - 6.3	12.4 - 12.3	
5	14°16.3	14°18.6	13°37.2	0.5 - 0.5	6.5 - 6.2	12.5 - 12.0		5	14°31.3	14°33.6	13°51.6	0.5 - 0.5	6.5 - 6.3	12.5 - 12.2		5	14°46.3	14°48.7	14°05.9	0.5 - 0.5	6.5 - 6.4	12.5 - 12.4	
6	14°16.5	14°18.8	13°37.5	0.6 - 0.6	6.6 - 6.3	12.6 - 12.1		6	14°31.5	14°33.9	13°51.8	0.6 - 0.6	6.6 - 6.4	12.6 - 12.3		6	14°46.5	14°48.9	14°06.1	0.6 - 0.6	6.6 - 6.5	12.6 - 12.5	
7	14°16.8	14°19.1	13°37.7	0.7 - 0.7	6.7 - 6.4	12.7 - 12.2		7	14°31.8	14°34.1	13°52.0	0.7 - 0.7	6.7 - 6.5	12.7 - 12.4		7	14°46.8	14°49.2	14°06.4	0.7 - 0.7	6.7 - 6.6	12.7 - 12.6	
8	14°17.0	14°19.3	13°38.0	0.8 - 0.8	6.8 - 6.5	12.8 - 12.3		8	14°32.0	14°34.4	13°52.3	0.8 - 0.8	6.8 - 6.6	12.8 - 12.5		8	14°47.0	14°49.4	14°06.6	0.8 - 0.8	6.8 - 6.7	12.8 - 12.7	
9	14°17.2	14°19.6	13°38.2	0.9 - 0.9	6.9 - 6.6	12.9 - 12.4		9	14°32.2	14°34.6	13°52.5	0.9 - 0.9	6.9 - 6.7	12.9 - 12.6		9	14°47.2	14°49.7	14°06.8	0.9 - 0.9	6.9 - 6.8	12.9 - 12.8	
10	14°17.5	14°19.8	13°38.4	1.0 - 1.0	7.0 - 6.7	13.0 - 12.5		10	14°32.5	14°34.9	13°52.8	1.0 - 1.0	7.0 - 6.8	13.0 - 12.7		10	14°47.5	14°49.9	14°07.1	1.0 - 1.0	7.0 - 6.9	13.0 - 12.9	
11	14°17.7	14°20.1	13°38.7	1.1 - 1.1	7.1 - 6.8	13.1 - 12.6		11	14°32.7	14°35.1	13°53.0	1.1 - 1.1	7.1 - 6.9	13.1 - 12.8		11	14°47.7	14°50.2	14°07.3	1.1 - 1.1	7.1 - 7.0	13.1 - 13.0	
12	14°18.0	14°20.3	13°38.9	1.2 - 1.2	7.2 - 6.9	13.2 - 12.7		12	14°33.0	14°35.4	13°53.2	1.2 - 1.2	7.2 - 7.0	13.2 - 12.9		12	14°48.0	14°50.4	14°07.5	1.2 - 1.2	7.2 - 7.1	13.2 - 13.1	
13	14°18.3	14°20.6	13°39.2	1.3 - 1.2	7.3 - 7.0	13.3 - 12.7		13	14°33.3	14°35.6	13°53.5	1.3 - 1.3	7.3 - 7.1	13.3 - 13.0		13	14°48.3	14°50.7	14°07.8	1.3 - 1.3	7.3 - 7.2	13.3 - 13.2	
14	14°18.5	14°20.8	13°39.4	1.4 - 1.3	7.4 - 7.1	13.4 - 12.8		14	14°33.5	14°35.9	13°53.7	1.4 - 1.4	7.4 - 7.2	13.4 - 13.1		14	14°48.5	14°50.9	14°08.0	1.4 - 1.4	7.4 - 7.3	13.4 - 13.3	
15	14°18.8	14°21.1	13°39.6	1.5 - 1.4	7.5 - 7.2	13.5 - 12.9		15	14°33.8	14°36.1	13°53.9	1.5 - 1.5	7.5 - 7.3	13.5 - 13.2		15	14°48.8	14°51.2	14°08.3	1.5 - 1.5	7.5 - 7.4	13.5 - 13.4	
16	14°19.0	14°21.3	13°39.9	1.6 - 1.5	7.6 - 7.3	13.6 - 13.0		16	14°34.0	14°36.4	13°54.2	1.6 - 1.6	7.6 - 7.4	13.6 - 13.3		16	14°49.0	14°51.4	14°08.5	1.6 - 1.6	7.6 - 7.5	13.6 - 13.5	
17	14°19.2	14°21.6	13°40.1	1.7 - 1.6	7.7 - 7.4	13.7 - 13.1		17	14°34.2	14°36.6	13°54.4	1.7 - 1.7	7.7 - 7.5	13.7 - 13.4		17	14°49.2	14°51.7	14°08.7	1.7 - 1.7	7.7 - 7.6	13.7 - 13.6	
18	14°19.5	14°21.8	13°40.3	1.8 - 1.7	7.8 - 7.5	13.8 - 13.2		18	14°34.5	14°36.9	13°54.7	1.8 - 1.8	7.8 - 7.6	13.8 - 13.5		18	14°49.5	14°51.9	14°09.0	1.8 - 1.8	7.8 - 7.7	13.8 - 13.7	
19	14°19.8	14°22.1	13°40.6	1.9 - 1.8	7.9 - 7.6	13.9 - 13.3		19	14°34.8	14°37.1	13°54.9	1.9 - 1.9	7.9 - 7.7	13.9 - 13.6		19	14°49.8	14°52.2	14°09.2	1.9 - 1.9	7.9 - 7.8	13.9 - 13.8	
20	14°20.0	14°22.4	13°40.8	2.0 - 1.9	8.0 - 7.7	14.0 - 13.4		20	14°35.0	14°37.4	13°55.1	2.0 - 1.9	8.0 - 7.8	14.0 - 13.7		20	14°50.0	14°52.4	14°09.5	2.0 - 2.0	8.0 - 7.9	14.0 - 13.9	
21	14°20.3	14°22.6	13°41.1	2.1 - 2.0	8.1 - 7.8	14.1 - 13.5		21	14°35.3	14°37.6	13°55.4	2.1 - 2.0	8.1 - 7.9	14.1 - 13.7		21	14°50.3	14°52.7	14°09.7	2.1 - 2.1	8.1 - 8.0	14.1 - 14.0	
22	14°20.5	14°22.9	13°41.3	2.2 - 2.1	8.2 - 7.9	14.2 - 13.6		22	14°35.5	14°37.9	13°55.6	2.2 - 2.1	8.2 - 8.0	14.2 - 13.8		22	14°50.5	14°52.9	14°09.9	2.2 - 2.2	8.2 - 8.1	14.2 - 14.1	
23	14°20.7	14°23.1	13°41.5	2.3 - 2.2	8.3 - 8.0	14.3 - 13.7		23	14°35.7	14°38.1	13°55.9	2.3 - 2.2	8.3 - 8.1	14.3 - 13.9		23	14°50.7	14°53.2	14°10.2	2.3 - 2.3	8.3 - 8.2	14.3 - 14.2	
24	14°21.0	14°23.4	13°41.8	2.4 - 2.3	8.4 - 8.1	14.4 - 13.8		24	14°36.0	14°38.4	13°56.1	2.4 - 2.3	8.4 - 8.2	14.4 - 14.0		24	14°51.0	14°53.4	14°10.4	2.4 - 2.4	8.4 - 8.3	14.4 - 14.3	
25	14°21.2	14°23.6	13°42.0	2.5 - 2.4	8.5 - 8.1	14.5 - 13.9		25	14°36.2	14°38.6	13°56.3	2.5 - 2.4	8.5 - 8.3	14.5 - 14.1		25	14°51.2	14°53.7	14°10.6	2.5 - 2.5	8.5 - 8.4	14.5 - 14.4	
26	14°21.5	14°23.9	13°42.3	2.6 - 2.5	8.6 - 8.2	14.6 - 14.0		26	14°36.5	14°38.9	13°56.6	2.6 - 2.5	8.6 - 8.4	14.6 - 14.2		26	14°51.5	14°53.9	14°10.9	2.6 - 2.6	8.6 - 8.5	14.6 - 14.5	
27	14°21.8	14°24.1	13°42.5	2.7 - 2.6	8.7 - 8.3	14.7 - 14.1		27	14°36.8	14°39.1	13°56.8	2.7 - 2.6	8.7 - 8.5	14.7 - 14.3		27	14°51.8	14°54.2	14°11.1	2.7 - 2.7	8.7 - 8.6	14.7 - 14.6	
28	14°22.0	14°24.4	13°42.7	2.8 - 2.7	8.8 - 8.4	14.8 - 14.2		28	14°37.0	14°39.4	13°57.0	2.8 - 2.7	8.8 - 8.6	14.8 - 14.4		28	14°52.0	14°54.4	14°11.4	2.8 - 2.8	8.8 - 8.7	14.8 - 14.7	
29	14°22.3	14°24.6	13°43.0	2.9 - 2.8	8.9 - 8.5	14.9 - 14.3		29	14°37.3	14°39.6	13°57.3	2.9 - 2.8	8.9 - 8.7	14.9 - 14.5		29	14°52.3	14°54.7	14°11.6	2.9 - 2.9	8.9 - 8.8	14.9 - 14.8	
30	14°22.5	14°24.9	13°43.2	3.0 - 2.9	9.0 - 8.6	15.0 - 14.4		30	14°37.5	14°39.9	13°57.5	3.0 - 2.9	9.0 - 8.8	15.0 - 14.6		30	14°52.5	14°54.9	14°11.8	3.0 - 3.0	9.0 - 8.9	15.0 - 14.9	
31	14°22.7	14°25.1	13°43.4	3.1 - 3.0	9.1 - 8.7	15.1 - 14.5		31	14°37.7	14°40.1	13°57.8	3.1 - 3.0	9.1 - 8.9	15.1 - 14.7		31	14°52.7	14°55.2	14°12.1	3.1 - 3.1	9.1 - 9.0	15.1 - 15.0	
32	14°23.0	14°25.4	13°43.7	3.2 - 3.1	9.2 - 8.8	15.2 - 14.6		32	14°38.0	14°40.4	13°58.0	3.2 - 3.1	9.2 - 9.0	15.2 - 14.8		32	14°53.0	14°55.4	14°12.3	3.2 - 3.2	9.2 - 9.1	15.2 - 15.1	
33	14°23.2	14°25.6	13°43.9	3.3 - 3.2	9.3 - 8.9	15.3 - 14.7		33	14°38.2	14°40.7	13°58.2	3.3 - 3.2	9.3 - 9.1	15.3 - 14.9		33	14°53.2	14°55.7	14°12.6	3.3 - 3.3	9.3 - 9.2	15.3 - 15.2	
34	14°23.5	14°25.9	13°44.2	3.4 - 3.3	9.4 - 9.0	15.4 - 14.8		34	14°38.5	14°40.9	13°58.5	3.4 - 3.3	9.4 - 9.2	15.4 - 15.0		34	14°53.5	14°55.9	14°12.8	3.4 - 3.4	9.4 - 9.3	15.4 - 15.3	
35	14°23.8	14°26.1	13°44.4	3.5 - 3.4	9.5 - 9.1	15.5 - 14.9		35	14°38.8	14°41.2	13°58.7	3.5 - 3.4	9.5 - 9.3	15.5 - 15.1		35	14°53.8	14°56.2	14°13.0	3.5 - 3.5	9.5 - 9.4	15.5 - 15.4	
36	14°24.0	14°26.4	13°44.6	3.6 - 3.5	9.6 - 9.2	15.6 - 15.0		36	14°39.0	14°41.4	13°59.0	3.6 - 3.5	9.6 - 9.4	15.6 - 15.2		36	14°54.0	14°56.4	14°13.3	3.6 - 3.6	9.6 - 9.5	15.6 - 15.5	
37	14°24.3	14°26.6	13°44.9	3.7 - 3.5	9.7 - 9.3	15.7 - 15.0		37	14°39.3	14°41.7	13°59.2	3.7 - 3.6	9.7 - 9.5	15.7 - 15.3		37	14°54.3	14°56.7	14°13.5	3.7 - 3.7	9.7 - 9.6	15.7 - 15.6	
38	14°24.5	14°26.9	13°45.1	3.8 - 3.6	9.8 - 9.4	15.8 - 15.1		38	14°39.5	14°41.9	13°59.4	3.8 - 3.7	9.8 - 9.6	15.8 - 15.4		38	14°54.5	14°56.9	14°13.8	3.8 - 3.8	9.8 - 9.7	15.8 - 15.7	
39	14°24.7	14°27.1	13°45.4	3.9 - 3.7	9.9 - 9.5	15.9 - 15.2		39	14°39.7	14°42.2	13°59.7	3.9 - 3.8	9.9 - 9.7	15.9 - 15.5		39	14°54.7	14°57.2	14°14.0	3.9 - 3.9	9.9 - 9.8	15.9 - 15.8	
40	14°25.0	1																					

**Altitude Correction Tables for 10° to 90° — Sun, Stars, Planets**

SUN			SUN			Stars & Planets		Additional Altitude Correction for Mars & Venus		Refraction		DIP always subtracted from Hs				
October – March			April – September			App. Alt.	Corr	°	'	App. Alt.	Corr	Ht. of Eye	Corr	Ht. of Eye	Corr	
App. Alt.	Lower Limb	Upper Limb	App. Alt.	Lower Limb	Upper Limb	App. Alt.	Corr	°	'	App. Alt.	Corr	meters	'	feet	meters	
°	'		°	'		°	'			°	'		'	feet		
9 33		'	9 39		'	9 55				5.5	- 9.1		2.4	- 2.8	8.0	1.0 - 1.8
9 45	+10.8	- 21.5	9 50	+10.6	- 21.2	10 07	- 5.3			6.0	- 8.5		2.6	- 2.9	8.6	1.5 - 2.2
9 56	+10.9	- 21.4	10 02	+10.7	- 21.1	10 20	- 5.2			6.5	- 7.9		2.8	- 3.0	9.2	2.0 - 2.5
10 08	+11.0	- 21.3	10 14	+10.8	- 21.0	10 32	- 5.1			7.0	- 7.5		3.0	- 3.1	9.8	2.5 - 2.8
10 20	+11.1	- 21.2	10 27	+10.9	- 20.9	10 46	- 5.0			7.5	- 7.0		3.2	- 3.2	10.5	3.0 - 3.0
10 33	+11.2	- 21.1	10 40	+11.0	- 20.8	10 59	- 4.9			8.0	- 6.6		3.4	- 3.3	11.2	
10 46	+11.3	- 21.0	10 53	+11.1	- 20.7	11 14	- 4.8			8.5	- 6.3		3.6	- 3.4	11.9	See table ←
11 00	+11.4	- 20.9	11 07	+11.2	- 20.6	11 29	- 4.7			9.0	- 5.9		3.8	- 3.5	12.6	
11 15	+11.5	- 20.8	11 22	+11.3	- 20.5	11 44	- 4.6			9.5	- 5.7		4.0	- 3.6	13.3	meters
11 30	+11.6	- 20.7	11 37	+11.4	- 20.4	12 00	- 4.5			10.0	- 5.4		4.3	- 3.7	14.1	20 - 7.9
11 45	+11.7	- 20.6	11 53	+11.5	- 20.3	12 17	- 4.4			10.5	- 5.1		4.5	- 3.8	14.9	22 - 8.3
12 01	+11.8	- 20.5	12 10	+11.6	- 20.2	12 35	- 4.3			11.0	- 4.9		4.7	- 3.9	15.7	24 - 8.6
12 18	+11.9	- 20.4	12 27	+11.7	- 20.1	12 53	- 4.2			11.5	- 4.7		5.0	- 4.0	16.5	26 - 9.0
12 36	+12.0	- 20.3	14 45	+11.8	- 20.0	13 12	- 4.1			12.0	- 4.5		5.2	- 4.1	17.4	28 - 9.3
12 54	+12.1	- 20.2	13 04	+11.9	- 19.9	13 32	- 4.0			12.5	- 4.4		5.5	- 4.2	18.3	
13 14	+12.2	- 20.1	13 24	+12.0	- 19.8	13 53	- 3.9			13.0	- 4.2		5.8	- 4.3	19.1	30 - 9.6
13 34	+12.3	- 20.0	13 44	+12.1	- 19.7	14 16	- 3.8			13.5	- 4.0		6.1	- 4.4	20.1	32 - 10.0
13 55	+12.4	- 19.9	14 06	+12.2	- 19.6	14 39	- 3.7			14.0	- 3.9		6.3	- 4.5	21.0	34 - 10.3
14 17	+12.5	- 19.8	14 29	+12.3	- 19.5	15 03	- 3.6			14.5	- 3.8		6.6	- 4.6	22.0	36 - 10.6
14 41	+12.6	- 19.7	14 53	+12.4	- 19.4	15 29	- 3.5			15.0	- 3.6		6.9	- 4.7	22.9	38 - 10.8
15 05	+12.7	- 19.6	15 18	+12.5	- 19.3	15 56	- 3.4			15.5	- 3.5		7.2	- 4.8	23.9	
15 31	+12.8	- 19.5	15 45	+12.6	- 19.2	16 25	- 3.3			16.0	- 3.4		7.5	- 4.9	24.9	40 - 11.1
15 59	+12.9	- 19.4	16 13	+12.7	- 19.1	16 55	- 3.2			16.5	- 3.3		7.9	- 5.0	26.0	42 - 11.4
16 27	+13.0	- 19.3	16 43	+12.8	- 19.0	17 27	- 3.1			17.0	- 3.2		8.2	- 5.1	27.1	44 - 11.7
16 58	+13.1	- 19.2	17 14	+12.9	- 18.9	18 01	- 3.0			17.5	- 3.1		8.5	- 5.2	28.1	46 - 11.9
17 30	+13.2	- 19.1	17 47	+13.0	- 18.8	18 37	- 2.9			18.0	- 3.0		8.8	- 5.3	29.2	48 - 12.2
18 05	+13.3	- 19.0	18 23	+13.1	- 18.7	19 16	- 2.8			18.5	- 2.9		9.2	- 5.4	30.4	feet
18 41	+13.4	- 18.9	19 00	+13.2	- 18.6	16 56	- 2.7			19.0	- 2.9		9.5	- 5.5	31.5	2 - 1.4
19 20	+13.5	- 18.8	19 41	+13.3	- 18.5	20 40	- 2.6			19.5	- 2.8		9.9	- 5.6	32.7	4 - 1.9
20 02	+13.6	- 18.7	20 24	+13.5	- 18.3	21 27	- 2.4			20.0	- 2.7		10.3	- 5.7	33.9	6 - 2.4
20 46	+13.7	- 18.6	21 10	+13.6	- 18.2	22 17	- 2.3			21.0	- 2.6		10.6	- 5.8	35.1	8 - 2.7
21 34	+13.8	- 18.5	21 59	+13.7	- 18.1	23 11	- 2.2			22.0	- 2.4		11.0	- 5.9	36.3	10 - 3.1
22 25	+13.9	- 18.4	22 52	+13.8	- 18.0	24 09	- 2.1			23.0	- 2.3		11.4	- 6.0	37.6	
23 20	+14.0	- 18.3	23 49	+13.9	- 17.9	25 12	- 2.0			24.0	- 2.2		11.8	- 6.1	38.9	See table ←
24 20	+14.1	- 18.2	24 51	+14.0	- 17.8	26 20	- 1.9			25.0	- 2.1		12.2	- 6.2	40.1	feet
25 24	+14.2	- 18.1	25 58	+14.1	- 17.7	27 34	- 1.8			26.0	- 2.0		12.6	- 6.3	41.5	70 - 8.1
26 34	+14.3	- 18.0	27 11	+14.2	- 17.6	28 54	- 1.7			27.0	- 1.9		13.0	- 6.4	45.0	75 - 8.4
27 50	+14.4	- 17.9	28 31	+14.3	- 17.5	30 22	- 1.6			28.0	- 1.9		13.4	- 6.5	44.2	80 - 8.7
29 13	+14.5	- 17.8	29 58	+14.4	- 17.4	31 58	- 1.5			29.0	- 1.8		13.8	- 6.6	45.5	85 - 8.9
30 44	+14.6	- 17.7	31 33	+14.5	- 17.3	33 43	- 1.4			30.0	- 1.7		14.2	- 6.7	46.9	90 - 9.2
32 24	+14.7	- 17.6	33 18	+14.6	- 17.2	35 38	- 1.3			31.0	- 1.7		14.7	- 6.8	48.4	95 - 9.5
34 15	+14.8	- 17.5	35 15	+14.7	- 17.1	37 45	- 1.2			32.0	- 1.6		15.1	- 6.9	49.8	100 - 9.7
36 17	+14.9	- 17.4	37 24	+14.8	- 17.0	40 06	- 1.1			33.0	- 1.5		15.5	- 7.0	51.3	105 - 9.9
38 34	+15.0	- 17.3	39 48	+14.9	- 16.9	42 42	- 1.0			34.0	- 1.5		16.0	- 7.1	52.8	110 - 10.2
41 06	+15.1	- 17.2	42 28	+15.0	- 16.8	45 34	- 0.9			35.0	- 1.4		16.5	- 7.2	54.3	115 - 10.4
43 56	+15.2	- 17.1	45 29	+15.1	- 16.7	48 45	- 0.8			36.0	- 1.4		16.9	- 7.3	55.8	120 - 10.6
47 07	+15.3	- 17.0	48 52	+15.2	- 16.6	52 16	- 0.7			37.0	- 1.3		17.4	- 7.4	57.4	125 - 10.8
50 43	+15.4	- 16.9	51 41	+15.3	- 16.5	56 09	- 0.6			38.0	- 1.3		17.9	- 7.5	58.9	130 - 11.1
54 46	+15.5	- 16.8	56 59	+15.4	- 16.4	60 26	- 0.5			39.0	- 1.2		18.4	- 7.6	60.5	135 - 11.3
59 21	+15.6	- 16.7	61 50	+15.5	- 16.3	65 06	- 0.4			40.0	- 1.2		18.8	- 7.7	62.1	140 - 11.5
64 28	+15.7	- 16.6	67 15	+15.6	- 16.2	70 09	- 0.3			45.0	- 1.0		19.3	- 7.8	63.8	145 - 11.7
70 10	+15.8	- 16.5	73 14	+15.7	- 16.1	75 32	- 0.2			50.0	- 0.8		60.0	- 0.6	19.8	150 - 11.9
76 24	+15.9	- 16.4	79 42	+15.8	- 16.0	81 12	- 0.1			55.0	- 0.7		65.0	- 0.5	20.4	155 - 12.1
83 05	+16.0	- 16.3	86 21	+15.9	- 15.9	87 03	0.0			60.0	- 0.6		70.0	- 0.4	20.9	
90 00	+16.1	- 16.2	90 00			90 00				75.0	- 0.3		80.0	- 0.2	21.4	

App. Alt. = Apparent altitude = Sextant altitude corrected for index error and dip.

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**Altitude Correction Tables for 0° to 10° — Sun, Stars, Planets**

App. Alt.	Sun		Stars & Planets	App. Alt.	Sun		Sun	Sun		Stars & Planets				
	October – March				April – September			April – September						
	Lower Limb	Upper Limb			Lower Limb	Upper Limb		Lower Limb	Upper Limb					
0 00	- 17.5	- 49.8	- 17.8	- 49.6	- 33.8	3 30	+ 3.4	- 28.9	+ 3.1	- 28.7	- 12.9			
0 03	16.9	49.2	17.2	49.0	33.2	3 35	3.6	28.7	3.3	28.5	12.7			
0 06	16.3	48.6	16.6	48.4	32.6	3 40	3.8	28.5	3.6	28.2	12.5			
0 09	15.7	48.0	16.0	47.8	32.0	3 45	4.0	28.3	3.8	28.0	12.3			
0 12	15.2	47.5	15.4	47.2	31.5	3 50	4.2	28.1	4.0	27.8	12.1			
0 15	14.6	46.9	14.8	46.6	30.9	3 55	4.4	27.9	4.1	27.7	11.9			
0 18	- 14.1	- 46.4	- 14.3	- 46.1	- 30.4	4 00	+ 4.6	- 27.7	+ 4.3	- 27.5	- 11.7			
0 21	13.5	45.8	13.8	33.8	29.8	4 05	4.8	27.5	4.5	27.3	11.5			
0 24	13.0	45.3	13.3	45.1	29.3	4 10	4.9	27.4	4.7	27.1	11.4			
0 27	12.5	44.8	12.8	44.6	28.8	4 15	5.1	27.2	4.9	26.9	11.2			
0 30	12.0	44.3	12.3	44.1	28.3	4 20	5.3	27.0	5.0	26.8	11.0			
0 33	11.6	43.9	11.8	43.6	27.9	4 25	5.4	26.9	5.2	26.6	10.9			
0 36	- 11.1	- 10.0	- 11.3	- 43.1	- 27.4	4 30	+ 5.6	- 26.7	+ 5.3	- 26.5	- 10.7			
0 39	10.6	42.9	10.9	42.7	26.9	4 35	5.7	26.6	5.5	26.3	10.6			
0 42	10.2	42.5	10.5	42.3	26.5	4 40	5.9	26.4	5.6	26.2	10.4			
0 45	9.8	42.1	10.0	41.8	26.1	4 45	6.0	26.3	5.8	26.0	10.3			
0 48	9.4	41.7	9.6	41.4	25.7	4 50	6.2	26.1	5.9	25.9	10.1			
0 51	9.0	41.3	9.2	41.0	25.3	4 55	6.3	26.0	6.1	25.7	10.0			
0 54	- 8.6	- 40.9	- 8.8	- 40.6	- 24.9	5 00	+ 6.4	- 25.9	+ 6.2	- 25.6	- 9.9			
0 57	8.2	40.5	8.4	40.2	24.5	5 05	6.6	25.7	6.3	25.5	9.7			
1 00	7.8	40.1	8.0	39.8	24.1	5 10	6.7	25.6	6.5	25.3	9.6			
1 03	7.4	39.7	7.7	39.5	23.7	5 15	6.8	25.5	6.6	25.2	9.5			
1 06	7.1	39.4	7.3	39.1	23.4	5 20	7.0	25.3	6.7	25.1	9.3			
1 09	6.7	39.0	7.0	38.8	23.0	5 25	7.1	25.2	6.8	25.0	9.2			
1 12	- 6.4	- 38.7	- 6.6	- 38.4	- 22.7	5 30	+ 7.2	- 25.1	+ 6.9	- 24.9	- 9.1			
1 15	6.0	38.3	6.3	38.1	22.3	5 35	7.3	25.0	7.1	24.7	9.0			
1 18	5.7	38.0	6.0	37.8	22.0	5 40	7.4	24.9	7.2	24.6	8.9			
1 21	5.4	37.7	5.7	37.5	21.7	5 45	7.5	24.8	7.3	24.5	8.8			
1 24	5.1	37.4	5.3	37.1	21.4	5 50	7.6	24.7	7.4	24.4	8.7			
1 27	4.8	37.1	5.0	33.8	21.1	5 55	7.7	24.6	7.5	24.3	8.6			
1 30	- 4.5	- 36.8	- 4.7	- 36.5	- 20.8	6 00	+ 7.8	- 24.5	+ 7.6	- 24.2	- 8.5			
1 35	4.0	36.3	4.3	36.1	20.3	6 10	8.0	24.3	7.8	24.0	8.3			
1 40	3.6	35.9	3.8	35.6	19.9	6 20	8.2	24.1	8.0	23.8	8.1			
1 45	3.1	35.4	3.4	35.2	19.4	6 30	8.4	23.9	8.2	23.6	7.9			
1 50	2.7	35.0	2.9	34.7	19.0	6 40	8.6	23.7	8.3	23.5	7.7			
1 55	2.3	34.6	2.5	34.3	18.6	6 50	8.7	23.6	8.5	23.3	7.6			
2 00	- 1.9	- 34.2	- 2.1	- 33.9	- 18.2	7 00	+ 8.9	- 23.4	+ 8.7	- 23.1	- 7.4			
2 05	1.5	33.8	1.7	33.5	17.8	7 10	9.1	23.2	8.8	23.0	7.2			
2 10	1.1	33.4	1.4	33.2	17.4	7 20	9.2	23.1	9.0	22.8	7.1			
2 15	0.8	33.1	1.0	32.8	17.1	7 30	9.3	23.0	9.1	22.7	6.9			
2 20	0.4	32.7	0.7	32.5	16.7	7 40	9.5	22.8	9.2	22.6	6.8			
2 25	- 0.1	32.4	- 0.3	32.1	16.4	7 50	9.6	22.7	9.4	22.4	6.7			
2 30	+ 0.2	- 32.1	0.0	- 31.8	- 16.1	8 00	+ 9.7	- 22.6	+ 9.5	- 22.3	- 6.6			
2 35	0.5	31.8	+ 0.3	31.5	15.8	8 10	9.9	22.4	9.6	22.2	6.4			
2 40	0.8	31.5	0.6	31.2	15.4	8 20	10.0	22.3	9.7	22.1	6.3			
2 45	1.1	31.2	0.9	30.9	15.2	8 30	10.1	22.2	9.9	21.9	6.2			
2 50	1.4	30.9	1.2	30.6	14.9	8 40	10.2	22.1	10.0	21.8	6.1			
2 55	1.7	30.6	1.4	30.4	14.9	8 50	10.3	22.0	10.1	21.7	6.0			
3 00	+ 2.0	- 30.3	+ 1.7	- 30.1	- 14.3	9 00	+ 10.4	- 21.9	+ 10.2	- 21.6	- 5.9			
3 05	2.2	30.1	2.0	29.8	14.1	9 10	10.5	21.8	10.3	21.5	5.8			
3 10	2.5	29.8	2.2	29.6	13.8	9 20	10.6	21.7	10.4	21.4	5.7			
3 15	2.7	29.6	2.5	29.3	13.6	9 30	10.7	21.6	10.5	21.3	5.6			
3 20	2.9	29.4	2.7	29.1	13.4	9 40	10.8	21.5	10.6	21.2	5.5			
3 25	3.2	29.1	2.9	28.9	13.4	9 50	10.9	21.4	10.6	21.2	5.4			
3 30	3.4	- 28.9	+ 3.1	- 28.7	- 12.9	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.
	Corr <sup>n</sup>														
0°	34.5	5°	58.2	10°	62.1	15°	62.8	20°	62.2	25°	60.8	30°	58.9	00	
10	36.5	5°	58.5	10°	62.2	15°	62.8	20°	62.2	25°	60.8	30°	58.8	10	
20	38.3	5°	58.7	10°	62.2	15°	62.8	20°	62.1	25°	60.7	30°	58.8	20	
30	40.0	5°	58.9	10°	62.3	15°	62.8	20°	62.1	25°	60.7	30°	58.7	30	
40	41.5	5°	59.1	10°	62.3	15°	62.8	20°	62.0	25°	60.6	30°	58.6	40	
50	42.9	5°	59.3	10°	62.4	15°	62.7	20°	62.0	25°	60.6	30°	58.5	50	
1°	44.2	6°	62.4	11°	62.7	16°	62.0	21°	60.5	26°	58.5	31°	00		
10	45.4	6°	62.4	11°	62.7	16°	61.9	21°	60.4	26°	58.4	31°	10		
20	46.5	6°	59.9	11°	62.5	16°	61.9	21°	60.4	26°	58.3	31°	20		
30	47.5	6°	60.0	11°	62.5	16°	61.9	21°	60.3	26°	58.2	31°	30		
40	48.4	6°	60.2	11°	62.5	16°	61.8	21°	60.3	26°	58.2	31°	40		
50	49.3	6°	60.3	11°	62.6	16°	61.8	21°	60.2	26°	58.1	31°	50		
2°	50.1	7°	60.5	12°	62.6	17°	62.7	22°	61.7	27°	60.1	32°	00		
10	50.8	7°	60.6	12°	62.6	17°	62.6	22°	61.7	27°	60.1	32°	10		
20	51.5	7°	60.7	12°	62.6	17°	62.6	22°	61.6	27°	60.0	32°	20		
30	52.2	7°	60.9	12°	62.7	17°	62.6	22°	61.6	27°	59.9	32°	30		
40	52.8	7°	61.0	12°	62.7	17°	62.6	22°	61.6	27°	59.9	32°	40		
50	53.4	7°	61.1	12°	62.7	17°	62.6	22°	61.5	27°	59.8	32°	50		
3°	53.9	8°	61.2	13°	62.7	18°	62.5	23°	61.5	28°	59.7	33°	00		
10	54.4	8°	61.3	13°	62.7	18°	62.5	23°	61.4	28°	59.7	33°	10		
20	54.9	8°	61.4	13°	62.7	18°	62.5	23°	61.4	28°	59.6	33°	20		
30	55.3	8°	61.5	13°	62.8	18°	62.5	23°	61.3	28°	59.5	33°	30		
40	55.7	8°	61.6	13°	62.8	18°	62.4	23°	61.3	28°	59.5	33°	40		
50	56.1	8°	61.6	13°	62.8	18°	62.4	23°	61.2	28°	59.4	33°	50		
4°	56.4	9°	61.7	14°	62.8	19°	62.4	24°	61.2	29°	59.3	34°	00		
10	56.8	9°	61.8	14°	62.8	19°	62.4	24°	61.1	29°	59.3	34°	10		
20	57.1	9°	61.9	14°	62.8	19°	62.3	24°	61.1	29°	59.2	34°	20		
30	57.4	9°	61.9	14°	62.8	19°	62.3	24°	61.0	29°	59.1	34°	30		
40	57.7	9°	62.0	14°	62.8	19°	62.3	24°	61.0	29°	59.1	34°	40		
50	58.0	9°	62.1	14°	62.8	19°	62.2	24°	60.9	29°	59.0	34°	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	2.0	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	3.4	4.6	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	3.6	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	Corr <sup>n</sup>	Ht. of Eye	Corr <sup>n</sup>	Ht. of Eye	Corr <sup>n</sup>
m	'	ft		m	'
2.4	-2.8	7.9		9.5	-5.5
2.6	-2.9	8.5		9.9	-5.6
2.8	-3.0	9.2		10.3	-5.7
3.0	-3.1	9.8		10.6	-5.8
3.2	-3.2	10.5		11.0	-5.9
3.4	-3.3	11.2		11.4	-6.0
3.6	-3.4	11.8		11.8	-6.1
3.8	-3.5	12.5		12.2	-6.2
4.0	-3.6	13.1		12.6	-6.3
4.3	-3.7	14.1		13.0	-6.4
4.5	-3.8	14.8		13.4	-6.5
4.7	-3.9	15.4		13.8	-6.6
5.0	-4.0	16.4		14.2	-6.7
5.2	-4.1	17.1		14.7	-6.8
5.5	-4.2	18.0		15.1	-6.9
5.8	-4.3	19.0		15.5	-7.0
6.1	-4.4	20.0		16.0	-7.1
6.3	-4.5	20.7		16.5	-7.2
6.6	-4.6	21.7		16.9	-7.3
6.9	-4.7	22.6		17.4	-7.4
7.2	-4.8	23.6		17.9	-7.5
7.5	-4.9	24.6		18.4	-7.6
7.9	-5.0	25.9		18.8	-7.7
8.2	-5.1	26.9		19.3	-7.8
8.5	-5.2	27.9		19.8	-7.9
8.8	-5.3	28.9		20.4	-8.0
9.2	-5.4	30.2		20.9	-8.1
9.5	-5.5	31.2		21.4	-7.0.2

## 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.

# 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 <sup>n</sup>					Corr <sup>n</sup>					Corr <sup>n</sup>					Corr <sup>n</sup>					Corr <sup>n</sup>					Corr <sup>n</sup>					Corr <sup>n</sup>					Corr <sup>n</sup>					Corr <sup>n</sup>					Corr <sup>n</sup>					Corr <sup>n</sup>					Corr <sup>n</sup>					Corr <sup>n</sup>																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
'	35°	40°	45°	50°	55°	60°	65°	70°	75°	80°	85°	86°	87°	88°	89°	90°	91°	92°	93°	94°	95°	96°	97°	98°	99°	100°	101°	102°	103°	104°	105°	106°	107°	108°	109°	110°	111°	112°	113°	114°	115°	116°	117°	118°	119°	120°	121°	122°	123°	124°	125°	126°	127°	128°	129°	130°	131°	132°	133°	134°	135°	136°	137°	138°	139°	140°	141°	142°	143°	144°	145°	146°	147°	148°	149°	150°	151°	152°	153°	154°	155°	156°	157°	158°	159°	160°	161°	162°	163°	164°	165°	166°	167°	168°	169°	170°	171°	172°	173°	174°	175°	176°	177°	178°	179°	180°	181°	182°	183°	184°	185°	186°	187°	188°	189°	190°	191°	192°	193°	194°	195°	196°	197°	198°	199°	200°	201°	202°	203°	204°	205°	206°	207°	208°	209°	210°	211°	212°	213°	214°	215°	216°	217°	218°	219°	220°	221°	222°	223°	224°	225°	226°	227°	228°	229°	230°	231°	232°	233°	234°	235°	236°	237°	238°	239°	240°	241°	242°	243°	244°	245°	246°	247°	248°	249°	250°	251°	252°	253°	254°	255°	256°	257°	258°	259°	260°	261°	262°	263°	264°	265°	266°	267°	268°	269°	270°	271°	272°	273°	274°	275°	276°	277°	278°	279°	280°	281°	282°	283°	284°	285°	286°	287°	288°	289°	290°	291°	292°	293°	294°	295°	296°	297°	298°	299°	300°	301°	302°	303°	304°	305°	306°	307°	308°	309°	310°	311°	312°	313°	314°	315°	316°	317°	318°	319°	320°	321°	322°	323°	324°	325°	326°	327°	328°	329°	330°	331°	332°	333°	334°	335°	336°	337°	338°	339°	340°	341°	342°	343°	344°	345°	346°	347°	348°	349°	350°	351°	352°	353°	354°	355°	356°	357°	358°	359°	360°	361°	362°	363°	364°	365°	366°	367°	368°	369°	370°	371°	372°	373°	374°	375°	376°	377°	378°	379°	380°	381°	382°	383°	384°	385°	386°	387°	388°	389°	390°	391°	392°	393°	394°	395°	396°	397°	398°	399°	400°	401°	402°	403°	404°	405°	406°	407°	408°	409°	410°	411°	412°	413°	414°	415°	416°	417°	418°	419°	420°	421°	422°	423°	424°	425°	426°	427°	428°	429°	430°	431°	432°	433°	434°	435°	436°	437°	438°	439°	440°	441°	442°	443°	444°	445°	446°	447°	448°	449°	450°	451°	452°	453°	454°	455°	456°	457°	458°	459°	460°	461°	462°	463°	464°	465°	466°	467°	468°	469°	470°	471°	472°	473°	474°	475°	476°	477°	478°	479°	480°	481°	482°	483°	484°	485°	486°	487°	488°	489°	490°	491°	492°	493°	494°	495°	496°	497°	498°	499°	500°	501°	502°	503°	504°	505°	506°	507°	508°	509°	510°	511°	512°	513°	514°	515°	516°	517°	518°	519°	520°	521°	522°	523°	524°	525°	526°	527°	528°	529°	530°	531°	532°	533°	534°	535°	536°	537°	538°	539°	540°	541°	542°	543°	544°	545°	546°	547°	548°	549°	550°	551°	552°	553°	554°	555°	556°	557°	558°	559°	560°	561°	562°	563°	564°	565°	566°	567°	568°	569°	570°	571°	572°	573°	574°	575°	576°	577°	578°	579°	580°	581°	582°	583°	584°	585°	586°	587°	588°	589°	590°	591°	592°	593°	594°	595°	596°	597°	598°	599°	600°	601°	602°	603°	604°	605°	606°	607°	608°	609°	610°	611°	612°	613°	614°	615°	616°	617°	618°	619°	620°	621°	622°	623°	624°	625°	626°	627°	628°	629°	630°	631°	632°	633°	634°	635°	636°	637°	638°	639°	640°	641°	642°	643°	644°	645°	646°	647°	648°	649°	650°	651°	652°	653°	654°	655°	656°	657°	658°	659°	660°	661°	662°	663°	664°	665°	666°	667°	668°	669°	670°	671°	672°	673°	674°	675°	676°	677°	678°	679°	680°	681°	682°	683°	684°	685°	686°	687°	688°	689°	690°	691°	692°	693°	694°	695°	696°	697°	698°	699°	700°	701°	702°	703°	704°	705°	706°	707°	708°	709°	710°	711°	712°	713°	714°	715°	716°	717°	718°	719°	720°	721°	722°	723°	724°	725°	726°	727°	728°	729°	730°	731°	732°	733°	734°	735°	736°	737°	738°	739°	740°	741°	742°	743°	744°	745°	746°	747°	748°	749°	750°	751°	752°	753°	754°	755°	756°	757°	758°	759°	760°	761°	762°	763°	764°	765°	766°	767°	768°	769°	770°	771°	772°	773°	774°	775°	776°	777°	778°	779°	780°	781°	782°	783°	784°	785°	786°	787°	788°	789°	790°	791°	792°	793°	794°	795°	796°	797°	798°	799°	800°	801°	802°	803°	804°	805°	806°	807°	808°	809°	810°	811°	812°	813°	814°	815°	816°	817°	818°	819°	820°	821°	822°	823°	824°	825°	826°	827°	828°	829°	830°	831°	832°	833°	834°	835°	836°	837°	838°	839°	840°	841°	842°	843°	844°	845°	846°	847°	848°	849°	850°	851°	852°	853°	854°	855°	856°	857°	858°	859°	860°	861°	862°	863°	864°	865°	866°	867°	868°	869°	870°	871°	872°	873°	874°	875°	876°	877°	878°	879°	880°	881°	882°	883°	884°	885°	886°	887°	888°	889°	890°	891°	892°	893°	894°	895°	896°	897°	898°	899°	900°	901°	902°	903°	904°	905°	906°	907°	908°	909°	910°	911°	912°	913°	914°	915°	916°	917°	918°	919°	920°	921°	922°	923°	924°	925°	926°	927°	928°	929°	930°	931°	932°	933°	934°	935°	936°	937°	938°	939°	940°	941°	942°	943°	944°	945°	946°	947°	948°	949°	950°	951°	952°	953°	954°	955°	956°	957°	958°	959°	960°	961°	962°	963°	964°	965°	966°	967°	968°	969°	970°	971°	972°	973°	974°	975°	976°	977°	978°	979°	980°	981°	982°	983°	984°	985°	986°	987°	988°	989°	990°	991°	992°	993°	994°	995°	996°	997°	998°	999°	1000°

# Total Lunar Eclipse of 2022 May 16

Ecliptic Conjunction = 04:15:18.8 TD (= 04:14:06.0 UT)

Greatest Eclipse = 04:12:41.6 TD (= 04:11:28.8 UT)

Penumbral Magnitude = 2.3726 P. Radius = 1.2854° Gamma = -0.2532

Umbral Magnitude = 1.4137 U. Radius = 0.7580° Axis = 0.2555°

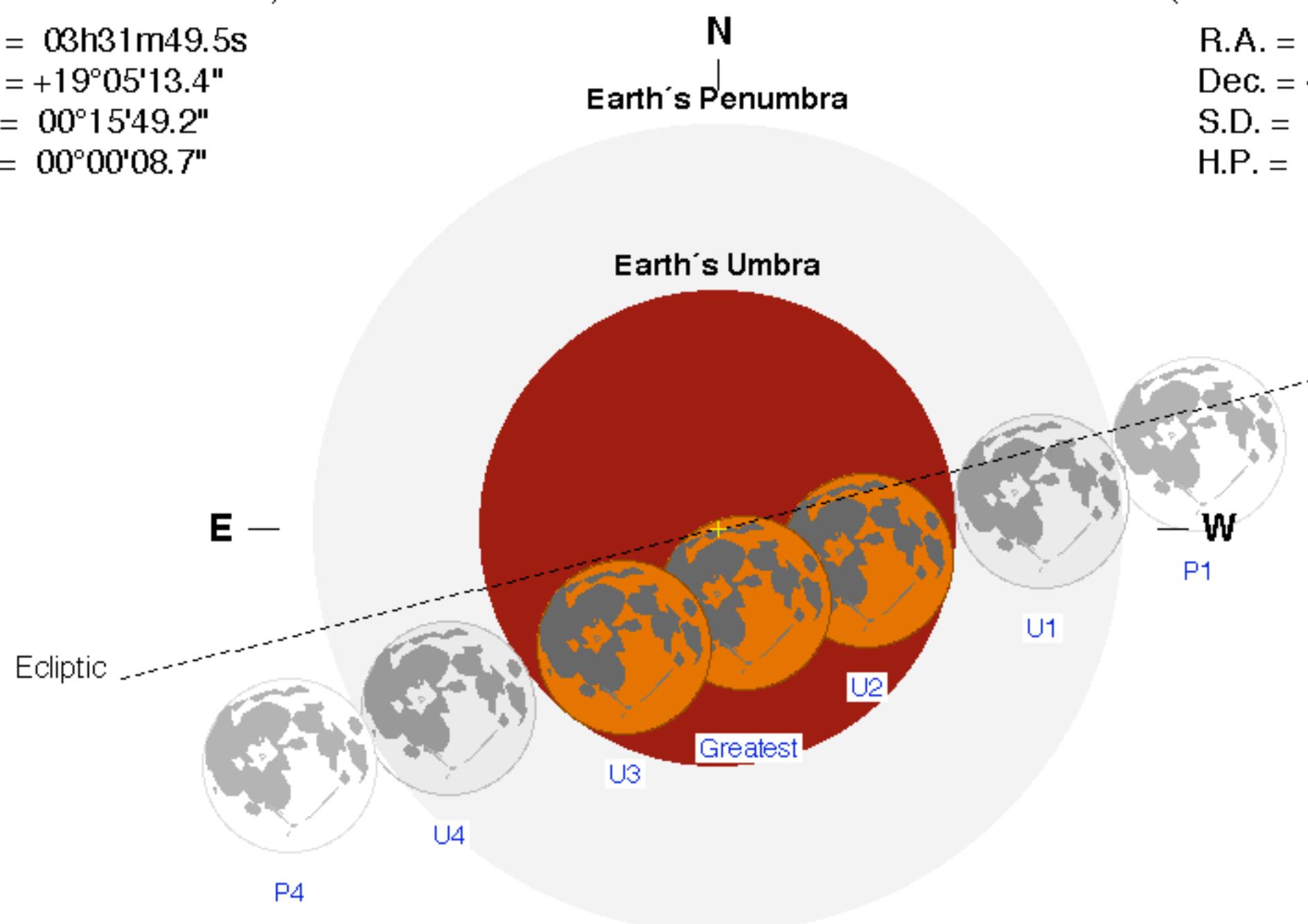
Saros Series = 131 Member = 34 of 72

## Sun at Greatest Eclipse (Geocentric Coordinates)

R.A. = 03h31m49.5s  
Dec. = +19°05'13.4"  
S.D. = 00°15'49.2"  
H.P. = 00°00'08.7"

## Moon at Greatest Eclipse (Geocentric Coordinates)

R.A. = 15h31m27.8s  
Dec. = -19°19'40.4"  
S.D. = 00°16'29.9"  
H.P. = 01°00'33.1"



## Eclipse Durations

Penumbral = 05h18m40s

Umbral = 03h27m14s

Total = 01h24m53s

ΔT = 73 s

Rule = CdT (Danjon)

Eph. = VSOP87/ELP2000-85

## Eclipse Contacts

P1 = 01:32:07 UT

U1 = 02:27:53 UT

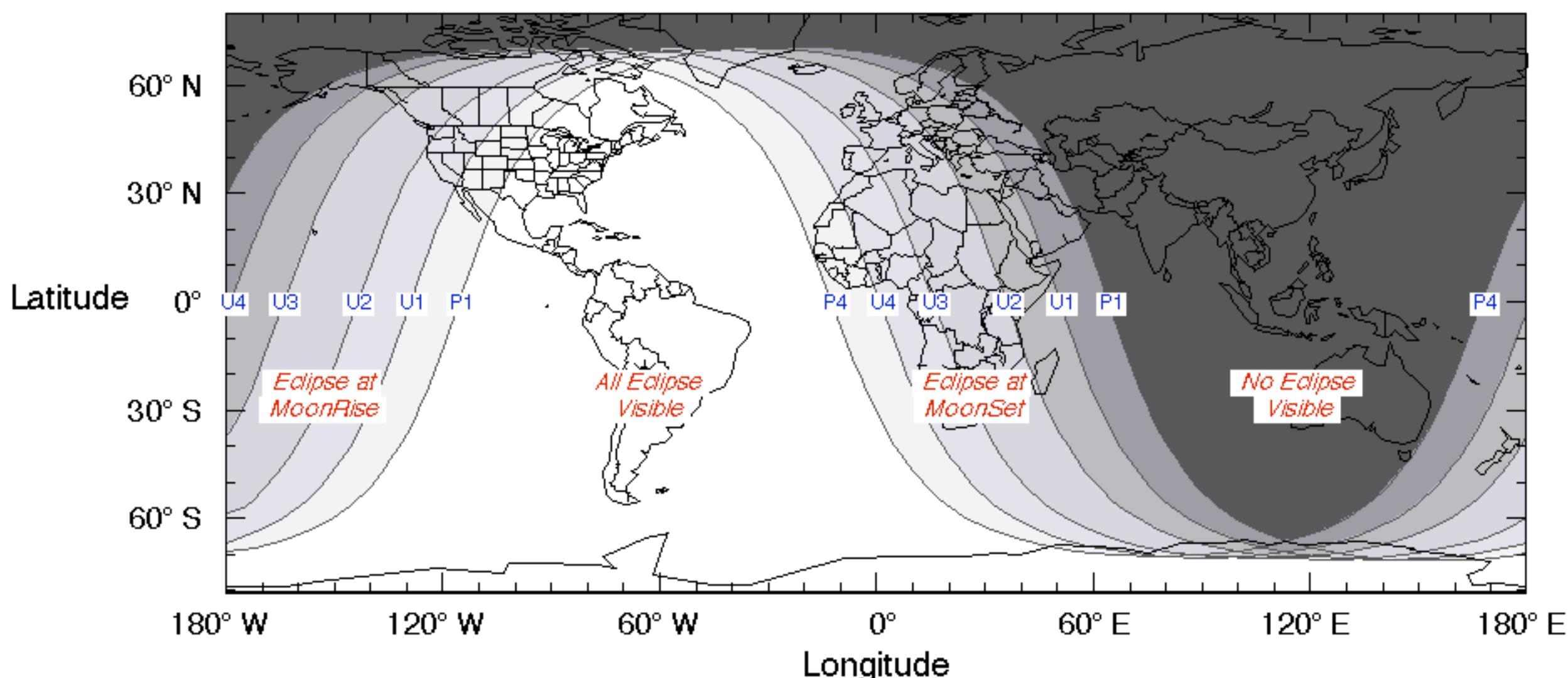
U2 = 03:29:03 UT

U3 = 04:53:56 UT

U4 = 05:55:07 UT

P4 = 06:50:48 UT

F. Espenak, NASA's GSFC  
[eclipse.gsfc.nasa.gov/eclipse.html](http://eclipse.gsfc.nasa.gov/eclipse.html)



# Total Lunar Eclipse of 2022 Nov 08

Ecliptic Conjunction = 11:03:18.4 TD (= 11:02:05.3 UT)

Greatest Eclipse = 11:00:22.0 TD (= 10:59:08.8 UT)

Penumbral Magnitude = 2.4143

P. Radius = 1.2164°

Gamma = 0.2570

Umbral Magnitude = 1.3589

U. Radius = 0.6783°

Axis = 0.2404°

Saros Series = 136 Member = 20 of 72

## Sun at Greatest Eclipse (Geocentric Coordinates)

R.A. = 14h54m11.2s

Dec. = -16°37'47.0"

S.D. = 00°16'08.5"

H.P. = 00°00'08.9"

N

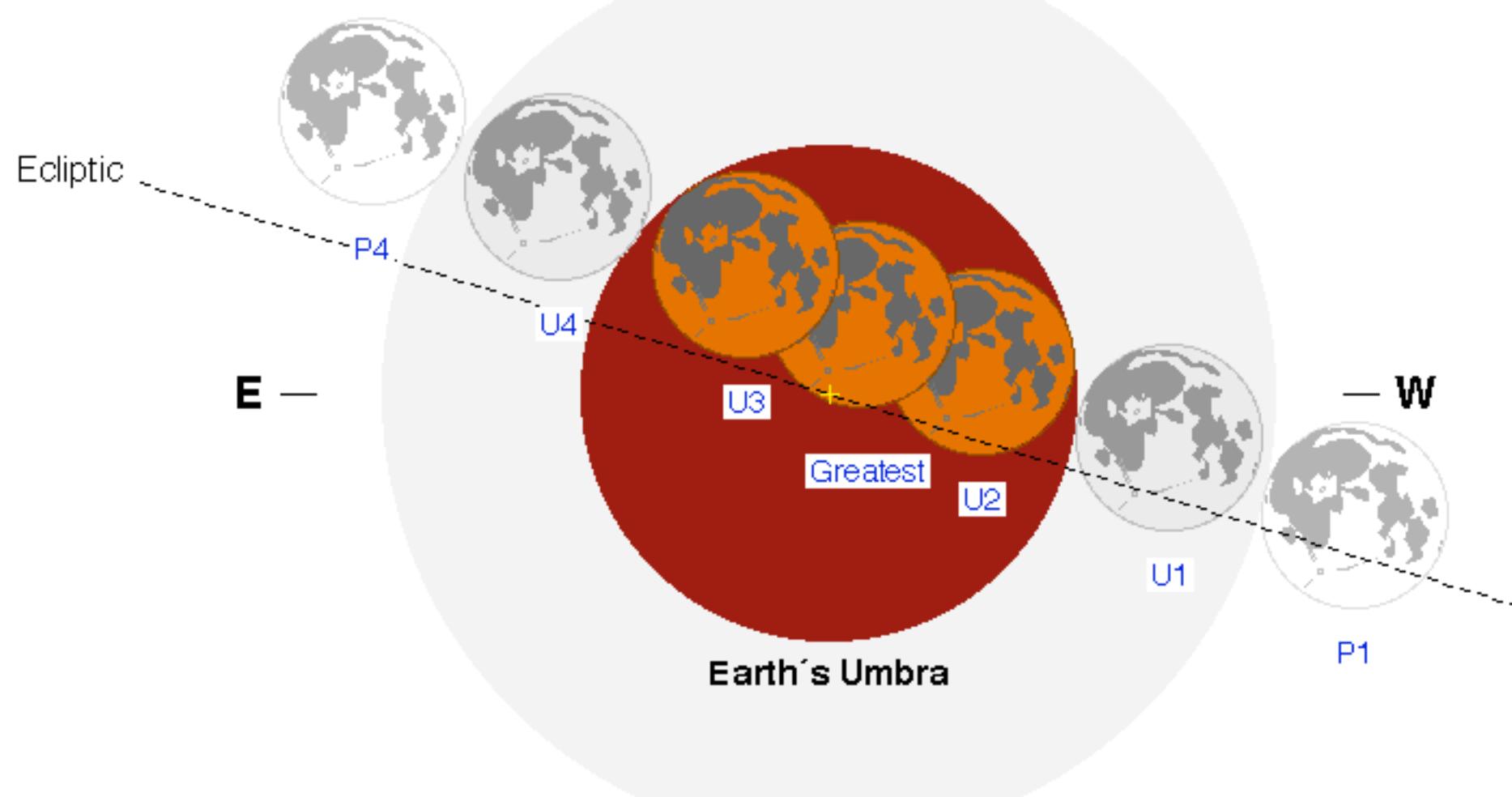
## Moon at Greatest Eclipse (Geocentric Coordinates)

R.A. = 02h53m48.1s

Dec. = +16°51'06.7"

S.D. = 00°15'17.7"

H.P. = 00°56'07.8"



## Eclipse Durations

Penumbral = 05h53m51s

Umbral = 03h39m50s

Total = 01h24m58s

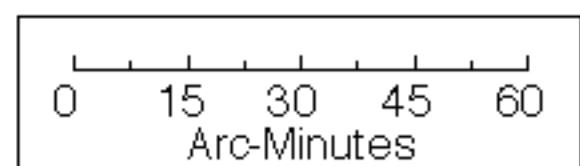
ΔT = 73 s

Rule = CdT (Danjon)

Eph. = VSOP87/ELP2000-85

## Earth's Penumbra

S



## Eclipse Contacts

P1 = 08:02:17 UT

U1 = 09:09:12 UT

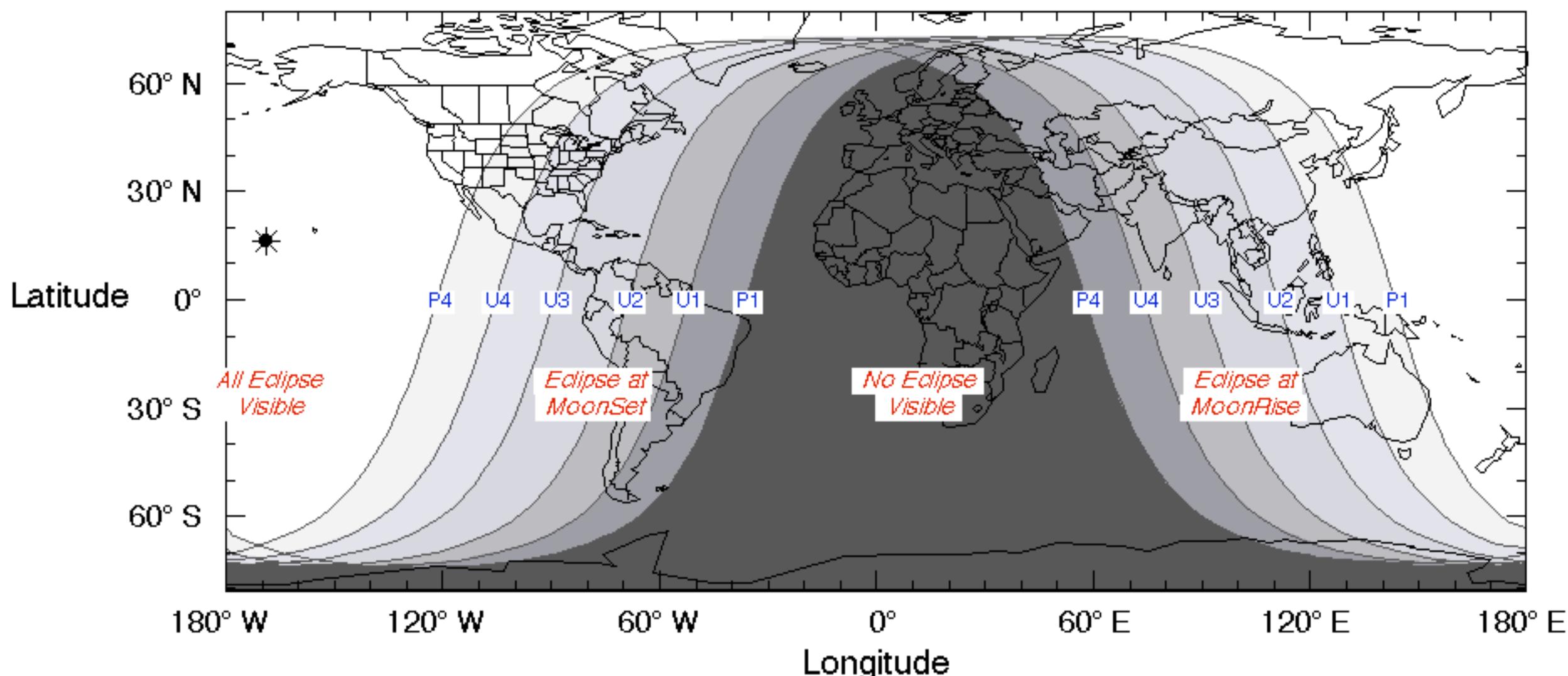
U2 = 10:16:39 UT

U3 = 11:41:37 UT

U4 = 12:49:03 UT

P4 = 13:56:08 UT

F. Espenak, NASA's GSFC  
[eclipse.gsfc.nasa.gov/eclipse.html](http://eclipse.gsfc.nasa.gov/eclipse.html)



## Partial Solar Eclipse of 2022 Apr 30

Geocentric Conjunction = 19:40:42.5 UT      J.D. = 2459700.319937  
 Greatest Eclipse = 20:41:20.2 UT      J.D. = 2459700.362039  
 Eclipse Magnitude = 0.6389      Gamma = -1.1900

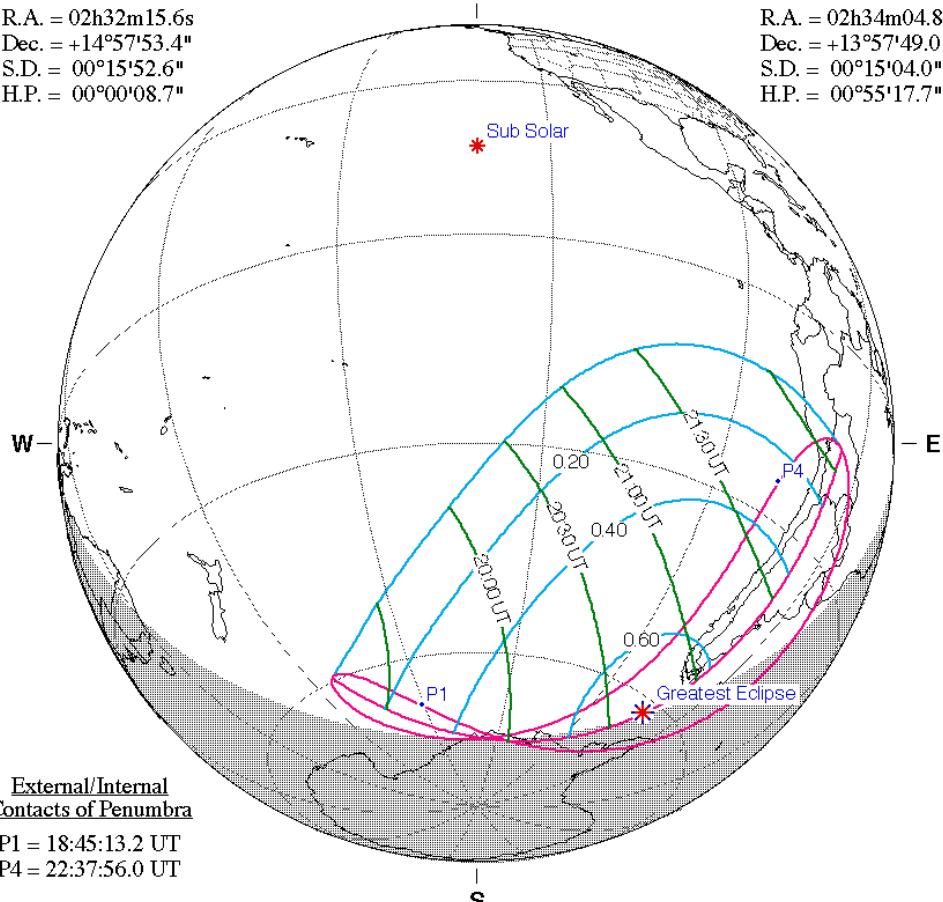
Saros Series = 119      Member = 66 of 71

Sun at Greatest Eclipse  
(Geocentric Coordinates)

R.A. = 02h32m15.6s  
 Dec. = +14°57'53.4"  
 S.D. = 00°15'52.6"  
 H.P. = 00°00'08.7"

Moon at Greatest Eclipse  
(Geocentric Coordinates)

R.A. = 02h34m04.8s  
 Dec. = +13°57'49.0"  
 S.D. = 00°15'04.0"  
 H.P. = 00°55'17.7"



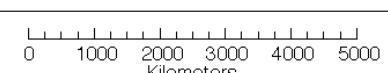
Ephemeris & Constants

Eph. = Newcomb/ILE  
 $\Delta T = 79.2$  s  
 $k_1 = 0.2724880$   
 $k_2 = 0.2722810$   
 $\Delta b = 0.0"$     $\Delta l = 0.0"$

Geocentric Libration  
(Optical + Physical)

$l = 4.01^\circ$   
 $b = 1.40^\circ$   
 $c = -16.62^\circ$

Brown Lun. No. = 1229



F. Espenak, NASA's GSFC - Fri, Jul 2,  
[sunearth.gsfc.nasa.gov/eclipse/eclipse.html](http://sunearth.gsfc.nasa.gov/eclipse/eclipse.html)

## Partial Solar Eclipse of 2022 Oct 25

Geocentric Conjunction = 10:03:36.7 UT      J.D. = 2459877.919175  
 Greatest Eclipse = 11:00:00.4 UT      J.D. = 2459877.958338  
 Eclipse Magnitude = 0.8611      Gamma = 1.0700

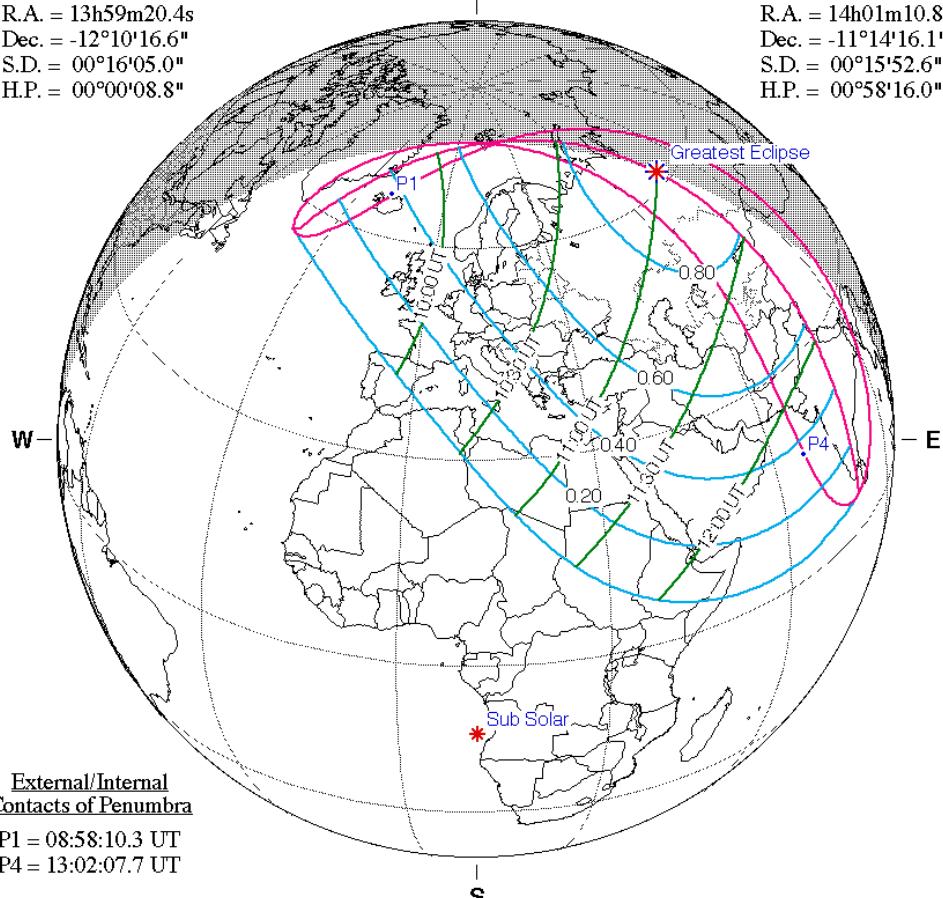
Saros Series = 124      Member = 55 of 73

Sun at Greatest Eclipse  
(Geocentric Coordinates)

R.A. = 13h59m20.4s  
 Dec. = -12°10'16.6"  
 S.D. = 00°16'05.0"  
 H.P. = 00°00'08.8"

Moon at Greatest Eclipse  
(Geocentric Coordinates)

R.A. = 14h01m10.8s  
 Dec. = -11°14'16.1"  
 S.D. = 00°15'52.6"  
 H.P. = 00°58'16.0"



External/Internal  
Contacts of Penumbra

P1 = 08:58:10.3 UT  
 P4 = 13:02:07.7 UT

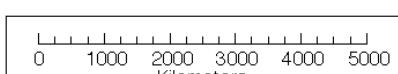
Ephemeris & Constants

Eph. = Newcomb/ILE  
 $\Delta T = 79.7$  s  
 $k_1 = 0.2724880$   
 $k_2 = 0.2722810$   
 $\Delta b = 0.0"$     $\Delta l = 0.0"$

Geocentric Libration  
(Optical + Physical)

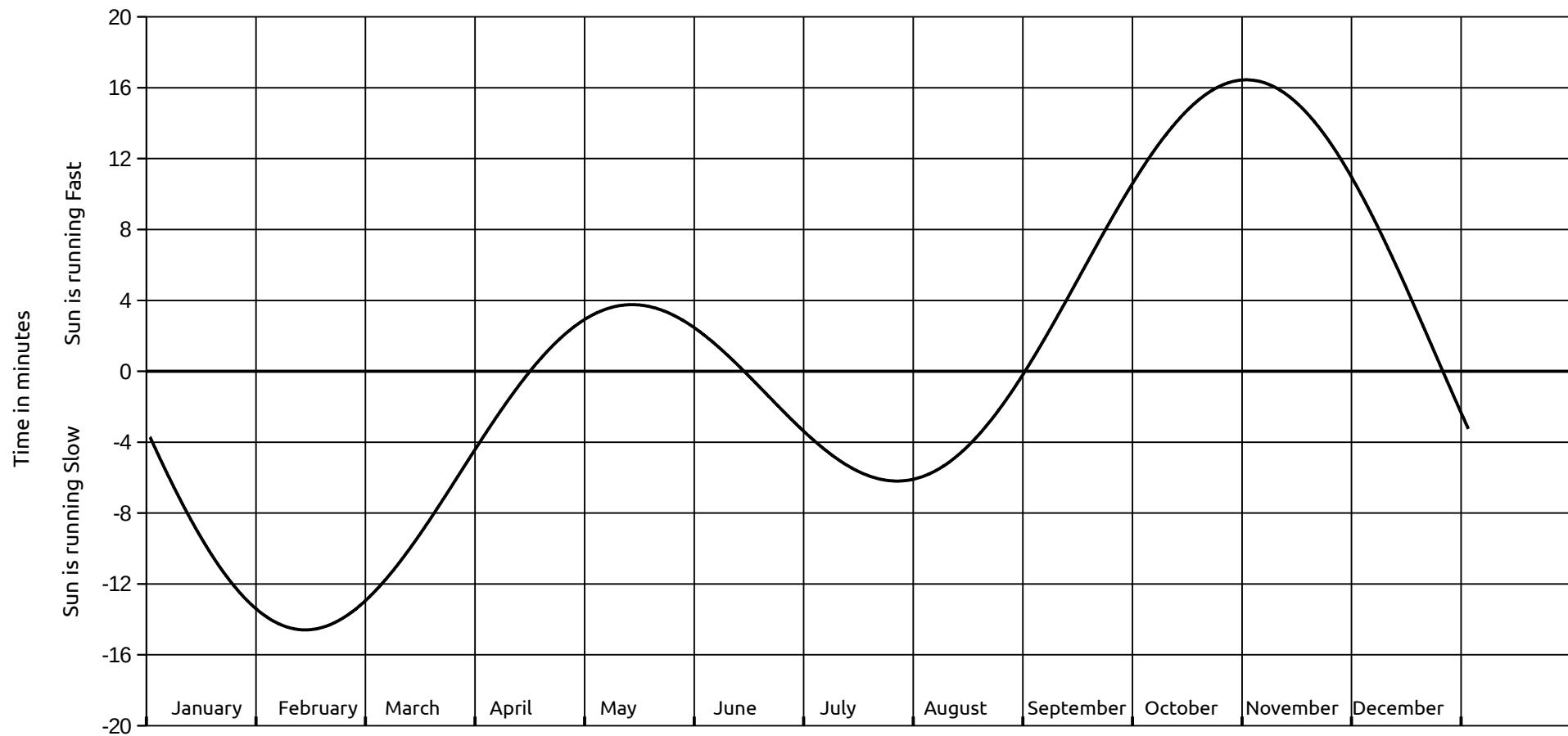
$l = -4.55^\circ$   
 $b = -1.38^\circ$   
 $c = 18.60^\circ$

Brown Lun. No. = 1235



F. Espenak, NASA's GSFC - Fri, Jul 2,  
[sunearth.gsfc.nasa.gov/eclipse/eclipse.html](http://sunearth.gsfc.nasa.gov/eclipse/eclipse.html)

## Equation of Time *for the Sun*



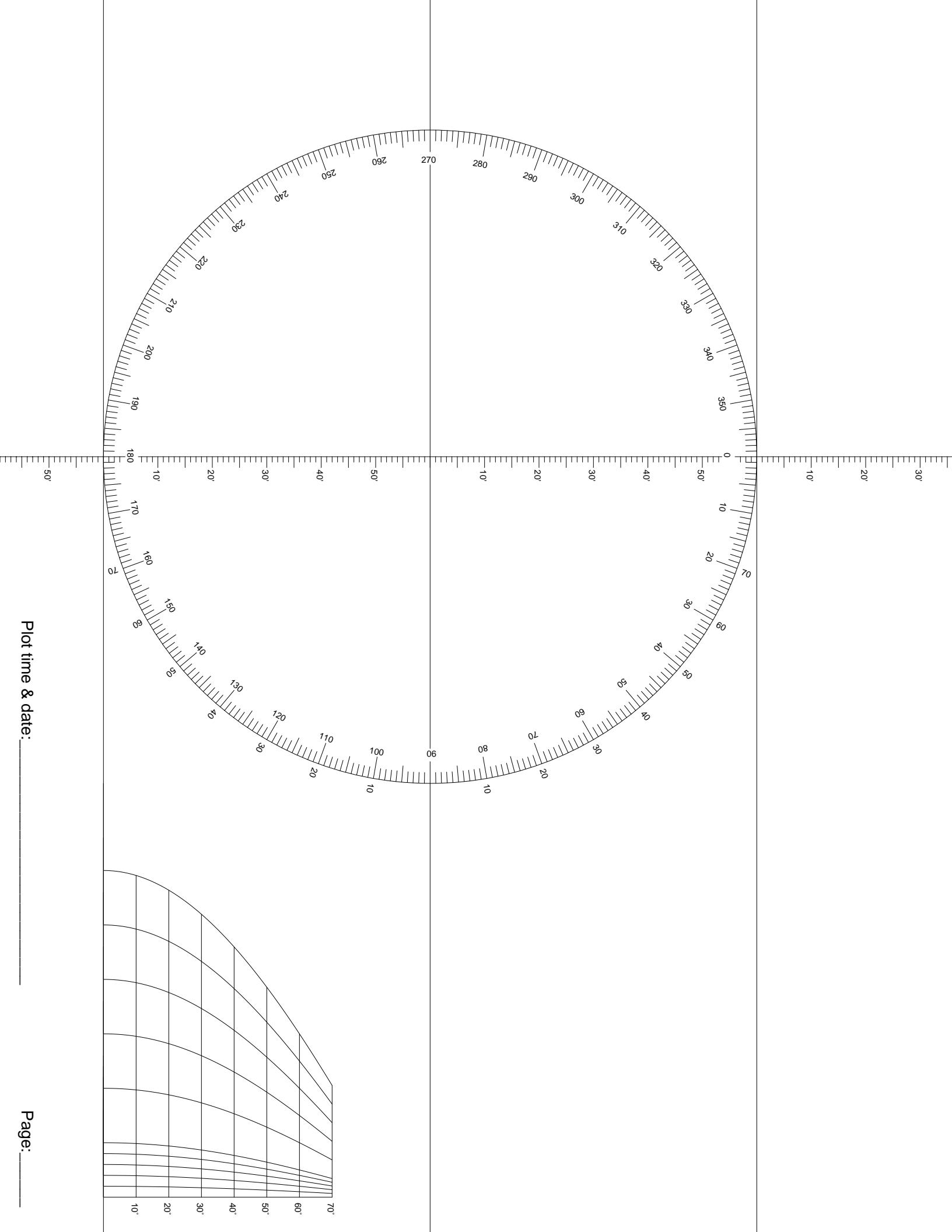
## 2022 Moon Phases

### Date and Time (GMT/Universal Time)

New Moon	First Quarter	Full Moon	Last Quarter
January 02 18:33	January 09 18:11	January 17 23:48	January 25 13:41
February 01 05:46	February 08 13:50	February 16 16:56	February 23 22:32
March 02 17:35	March 10 10:45	March 18 07:17	March 25 05:37
April 01 06:24	April 09 06:48	April 16 18:55	April 23 11:56
April 30 20:28	May 09 00:21	May 16 04:14	May 22 18:43
May 30 11:30	June 07 14:48	June 14 11:52	June 21 03:11
June 29 02:52	July 07 02:14	July 13 18:38	July 20 14:19
July 28 17:55	August 05 11:06	August 12 01:36	August 19 04:36
August 27 08:17	September 03 18:08	September 10 09:59	September 17 21:52
September 25 21:54	October 03 00:14	October 09 20:55	October 17 17:15
October 25 10:49	November 01 06:37	November 08 11:02	November 16 13:27
November 23 22:57	November 30 14:36	December 08 04:08	December 16 08:56
December 23 10:17	December 30 01:20	--	--

Add or subtract your time difference from Greenwich to determine local time and date of Moon phase.





Plot time & date: \_\_\_\_\_

Page: \_\_\_\_\_

# NAVIGATIONAL STAR CHART

U.S. Naval Observatory / Astronomical Applications Dept.

