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A2 ALTITUDE CORRECTION TABLES 10°-90°—SUN, STARS, PLANETS

OCT.—MAR. SUN APR.—SEPT.					
App. Alt.	Lower Limb	Upper Limb	App. Alt.	Lower Limb	Upper Limb
° ′	′	′	° ′	′	′
9 34	+10·8	−21·5	9 39	+10·6	−21·2
9 45	+10·9	−21·4	9 51	+10·7	−21·1
9 56	+11·0	−21·3	10 03	+10·8	−21·0
10 08	+11·1	−21·2	10 15	+10·9	−20·9
10 21	+11·2	−21·1	10 27	+11·0	−20·8
10 34	+11·3	−21·0	10 40	+11·1	−20·7
10 47	+11·4	−20·9	10 54	+11·2	−20·6
11 01	+11·5	−20·8	11 08	+11·3	−20·5
11 15	+11·6	−20·7	11 23	+11·4	−20·4
11 30	+11·7	−20·6	11 38	+11·5	−20·3
11 46	+11·8	−20·5	11 54	+11·6	−20·2
12 02	+11·9	−20·4	12 10	+11·7	−20·1
12 19	+12·0	−20·3	12 28	+11·8	−20·0
12 37	+12·1	−20·2	12 46	+11·9	−19·9
12 55	+12·2	−20·1	13 05	+12·0	−19·8
13 14	+12·3	−20·0	13 24	+12·1	−19·7
13 35	+12·4	−19·9	13 45	+12·2	−19·6
13 56	+12·5	−19·8	14 07	+12·3	−19·5
14 18	+12·6	−19·7	14 30	+12·4	−19·4
14 42	+12·7	−19·6	14 54	+12·5	−19·3
15 06	+12·8	−19·5	15 19	+12·6	−19·2
15 32	+12·9	−19·4	15 46	+12·7	−19·1
15 59	+13·0	−19·3	16 14	+12·8	−19·0
16 28	+13·1	−19·2	16 44	+12·9	−18·9
16 59	+13·2	−19·1	17 15	+13·0	−18·8
17 32	+13·3	−19·0	17 48	+13·1	−18·7
18 06	+13·4	−18·9	18 24	+13·2	−18·6
18 42	+13·5	−18·8	19 01	+13·3	−18·5
19 21	+13·6	−18·7	19 42	+13·4	−18·4
20 03	+13·7	−18·6	20 25	+13·5	−18·3
20 48	+13·8	−18·5	21 11	+13·6	−18·2
21 35	+13·9	−18·4	22 00	+13·7	−18·1
22 26	+14·0	−18·3	22 54	+13·8	−18·0
23 22	+14·1	−18·2	23 51	+13·9	−17·9
24 21	+14·2	−18·1	24 53	+14·0	−17·8
25 26	+14·3	−18·0	26 00	+14·1	−17·7
26 36	+14·4	−17·9	27 13	+14·2	−17·6
27 52	+14·5	−17·8	28 33	+14·3	−17·5
29 15	+14·6	−17·7	30 00	+14·4	−17·4
30 46	+14·7	−17·6	31 35	+14·5	−17·3
32 26	+14·8	−17·5	33 20	+14·6	−17·2
34 17	+14·9	−17·4	35 17	+14·7	−17·1
36 20	+15·0	−17·3	37 26	+14·8	−17·0
38 36	+15·1	−17·2	39 50	+14·9	−16·9
41 08	+15·2	−17·1	42 31	+15·0	−16·8
43 59	+15·3	−17·0	45 31	+15·1	−16·7
47 10	+15·4	−16·9	48 55	+15·2	−16·6
50 46	+15·5	−16·8	52 44	+15·3	−16·5
54 49	+15·6	−16·7	57 02	+15·4	−16·4
59 23	+15·7	−16·6	61 51	+15·5	−16·3
64 30	+15·8	−16·5	67 17	+15·6	−16·2
70 12	+15·9	−16·4	73 16	+15·7	−16·1
76 26	+16·0	−16·3	79 43	+15·8	−16·0
83 05	+16·1	−16·2	86 32	+15·9	−15·9
90 00			90 00		

STARS AND PLANETS			
App. Alt.	Corrⁿ	App. Alt.	Additional Corrⁿ
° ′	′		1981
9 56	−5·3		VENUS
10 08	−5·2		Jan. 1-Sept. 27
10 20	−5·1	°	′
10 33	−5·0	42	+ 0·1
10 46	−4·9		Sept. 28-Nov. 13
11 00	−4·8	°	′
11 14	−4·7	47	+ 0·2
11 29	−4·6		Nov. 14-Dec. 10
11 45	−4·5	°	′
12 01	−4·4	46	+ 0·3
12 18	−4·3		Dec. 11-Dec. 26
12 35	−4·2	°	′
12 54	−4·1	0	+ 0·4
13 13	−4·0	41	+ 0·5
13 33	−3·9		Dec. 27-Dec. 31
13 54	−3·8	°	′
14 16	−3·7	6	+ 0·5
14 40	−3·6	20	+ 0·6
15 04	−3·5	31	+ 0·7
15 30	−3·4		
15 57	−3·3		MARS
16 26	−3·2		Jan. 1-Dec. 31
16 56	−3·1	°	′
17 28	−3·0	60	+ 0·1
18 02	−2·9		
18 38	−2·8		
19 17	−2·7		
19 58	−2·6		
20 42	−2·5		
21 28	−2·4		
22 19	−2·3		
23 13	−2·2		
24 11	−2·1		
25 14	−2·0		
26 22	−1·9		
27 36	−1·8		
28 56	−1·7		
30 24	−1·6		
32 00	−1·5		
33 45	−1·4		
35 40	−1·3		
37 48	−1·2		
40 08	−1·1		
42 44	−1·0		
45 36	−0·9		
48 47	−0·8		
52 18	−0·7		
56 11	−0·6		
60 28	−0·5		
65 08	−0·4		
70 11	−0·3		
75 34	−0·2		
81 13	−0·1		
87 03	0·0		
90 00			

DIP			
Ht. of Eye	Corrⁿ	Ht. of Eye	Corrⁿ
m		ft.	
2·4	−2·8	8·0	1·0 — 1·8
2·6	−2·9	8·6	1·5 — 2·2
2·8	−3·0	9·2	2·0 — 2·5
3·0	−3·1	9·8	2·5 — 2·8
3·2	−3·2	10·5	3·0 — 3·0
3·4	−3·3	11·2	See table
3·6	−3·4	11·9	←
3·8	−3·5	12·6	
4·0	−3·6	13·3	m
4·3	−3·7	14·1	20 — 7·9
4·5	−3·8	14·9	22 — 8·3
4·7	−3·9	15·7	24 — 8·6
5·0	−4·0	16·5	26 — 9·0
5·2	−4·1	17·4	28 — 9·3
5·5	−4·2	18·3	
5·8	−4·3	19·1	30 — 9·6
6·1	−4·4	20·1	32 — 10·0
6·3	−4·5	21·0	34 — 10·3
6·6	−4·6	22·0	36 — 10·6
6·9	−4·7	22·9	38 — 10·8
7·2	−4·8	23·9	
7·5	−4·9	24·9	40 — 11·1
7·9	−5·0	26·0	42 — 11·4
8·2	−5·1	27·1	44 — 11·7
8·5	−5·2	28·1	46 — 11·9
8·8	−5·3	29·2	48 — 12·2
9·2	−5·4	30·4	ft.
9·5	−5·5	31·5	2 — 1·4
9·9	−5·6	32·7	4 — 1·9
10·3	−5·7	33·9	6 — 2·4
10·6	−5·8	35·1	8 — 2·7
11·0	−5·9	36·3	10 — 3·1
11·4	−6·0	37·6	See table
11·8	−6·1	38·9	←
12·2	−6·2	40·1	
12·6	−6·3	41·5	ft.
13·0	−6·4	42·8	70 — 8·1
13·4	−6·5	44·2	75 — 8·4
13·8	−6·6	45·5	80 — 8·7
14·2	−6·7	46·9	85 — 8·9
14·7	−6·8	48·4	90 — 9·2
15·1	−6·9	49·8	95 — 9·5
15·5	−7·0	51·3	100 — 9·7
16·0	−7·1	52·8	105 — 9·9
16·5	−7·2	54·3	110 — 10·2
16·9	−7·3	55·8	115 — 10·4
17·4	−7·4	57·4	120 — 10·6
17·9	−7·5	58·9	125 — 10·8
18·4	−7·6	60·5	
18·8	−7·7	62·1	130 — 11·1
19·3	−7·8	63·8	135 — 11·3
19·8	−7·9	65·4	140 — 11·5
20·4	−8·0	67·1	145 — 11·7
20·9	−8·1	68·8	150 — 11·9
21·4		70·5	155 — 12·1

App. Alt. = Apparent altitude = Sextant altitude corrected for index error and dip.
For daylight observations of Venus, see page 260.

ALTITUDE CORRECTION TABLES 35°-90°—MOON

App. Alt.	35°–39°	40°–44°	45°–49°	50°–54°	55°–59°	60°–64°	65°–69°	70°–74°	75°–79°	80°–84°	85°–89°	App. Alt.
	Corrⁿ	Corrⁿ	Corrⁿ	Corrⁿ	Corrⁿ	Corrⁿ	Corrⁿ	Corrⁿ	Corrⁿ	Corrⁿ	Corrⁿ	
′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	′
00	35 56·5	40 53·7	45 50·5	50 46·9	55 43·1	60 38·9	65 34·6	70 30·1	75 25·3	80 20·5	85 15·6	00
10	56·4	53·6	50·4	46·8	42·9	38·8	34·4	29·9	25·2	20·4	15·5	10
20	56·3	53·5	50·2	46·7	42·8	38·7	34·3	29·7	25·0	20·2	15·3	20
30	56·2	53·4	50·1	46·5	42·7	38·5	34·1	29·6	24·9	20·0	15·1	30
40	56·2	53·3	50·0	46·4	42·5	38·4	34·0	29·4	24·7	19·9	15·0	40
50	56·1	53·2	49·9	46·3	42·4	38·2	33·8	29·3	24·5	19·7	14·8	50
00	36 56·0	41 53·1	46 49·8	51 46·2	56 42·3	61 38·1	66 33·7	71 29·1	76 24·4	81 19·6	86 14·6	00
10	55·9	53·0	49·7	46·0	42·1	37·9	33·5	29·0	24·2	19·4	14·5	10
20	55·8	52·8	49·5	45·9	42·0	37·8	33·4	28·8	24·1	19·2	14·3	20
30	55·7	52·7	49·4	45·8	41·8	37·7	33·2	28·7	23·9	19·1	14·1	30
40	55·6	52·6	49·3	45·7	41·7	37·5	33·1	28·5	23·8	18·9	14·0	40
50	55·5	52·5	49·2	45·5	41·6	37·4	32·9	28·3	23·6	18·7	13·8	50
00	37 55·4	42 52·4	47 49·1	52 45·4	57 41·4	62 37·2	67 32·8	72 28·2	77 23·4	82 18·6	87 13·7	00
10	55·3	52·3	49·0	45·3	41·3	37·1	32·6	28·0	23·3	18·4	13·5	10
20	55·2	52·2	48·8	45·2	41·2	36·9	32·5	27·9	23·1	18·2	13·3	20
30	55·1	52·1	48·7	45·0	41·0	36·8	32·3	27·7	22·9	18·1	13·2	30
40	55·0	52·0	48·6	44·9	40·9	36·6	32·2	27·6	22·8	17·9	13·0	40
50	55·0	51·9	48·5	44·8	40·8	36·5	32·0	27·4	22·6	17·8	12·8	50
00	38 54·9	43 51·8	48 48·4	53 44·6	58 40·6	63 36·4	68 31·9	73 27·2	78 22·5	83 17·6	88 12·7	00
10	54·8	51·7	48·2	44·5	40·5	36·2	31·7	27·1	22·3	17·4	12·5	10
20	54·7	51·6	48·1	44·4	40·3	36·1	31·6	26·9	22·1	17·3	12·3	20
30	54·6	51·5	48·0	44·2	40·2	35·9	31·4	26·8	22·0	17·1	12·2	30
40	54·5	51·4	47·9	44·1	40·1	35·8	31·3	26·6	21·8	16·9	12·0	40
50	54·4	51·2	47·8	44·0	39·9	35·6	31·1	26·5	21·7	16·8	11·8	50
00	39 54·3	44 51·1	49 47·6	54 43·9	59 39·8	64 35·5	69 31·0	74 26·3	79 21·5	84 16·6	89 11·7	00
10	54·2	51·0	47·5	43·7	39·6	35·3	30·8	26·1	21·3	16·5	11·5	10
20	54·1	50·9	47·4	43·6	39·5	35·2	30·7	26·0	21·2	16·3	11·4	20
30	54·0	50·8	47·3	43·5	39·4	35·0	30·5	25·8	21·0	16·1	11·2	30
40	53·9	50·7	47·2	43·3	39·2	34·9	30·4	25·7	20·9	16·0	11·0	40
50	53·8	50·6	47·0	43·2	39·1	34·7	30·2	25·5	20·7	15·8	10·9	50
H.P.	L U	L U	L U	L U	L U	L U	L U	L U	L U	L U	L U	H.P.
′	′ ′	′ ′	′ ′	′ ′	′ ′	′ ′	′ ′	′ ′	′ ′	′ ′	′ ′	′
54·0	1·1 1·7	1·3 1·9	1·5 2·1	1·7 2·4	2·0 2·6	2·3 2·9	2·6 3·2	2·9 3·5	3·2 3·8	3·5 4·1	3·8 4·5	54·0
54·3	1·4 1·8	1·6 2·0	1·8 2·2	2·0 2·5	2·3 2·7	2·5 3·0	2·8 3·2	3·0 3·5	3·3 3·8	3·6 4·1	3·9 4·4	54·3
54·6	1·7 2·0	1·9 2·2	2·1 2·4	2·3 2·6	2·5 2·8	2·7 3·0	3·0 3·3	3·2 3·5	3·5 3·8	3·7 4·1	4·0 4·3	54·6
54·9	2·0 2·2	2·2 2·3	2·3 2·5	2·5 2·7	2·7 2·9	2·9 3·1	3·2 3·3	3·4 3·5	3·6 3·8	3·9 4·0	4·1 4·3	54·9
55·2	2·3 2·3	2·5 2·4	2·6 2·6	2·8 2·8	3·0 2·9	3·2 3·1	3·4 3·3	3·6 3·5	3·8 3·7	4·0 4·0	4·2 4·2	55·2
55·5	2·7 2·5	2·8 2·6	2·9 2·7	3·1 2·9	3·2 3·0	3·4 3·2	3·6 3·4	3·7 3·5	3·9 3·7	4·1 3·9	4·3 4·1	55·5
55·8	3·0 2·6	3·1 2·7	3·2 2·8	3·3 3·0	3·5 3·1	3·6 3·3	3·8 3·4	3·9 3·6	4·1 3·7	4·2 3·9	4·4 4·0	55·8
56·1	3·3 2·8	3·4 2·9	3·5 3·0	3·6 3·1	3·7 3·2	3·8 3·3	4·0 3·4	4·1 3·6	4·2 3·7	4·4 3·8	4·5 4·0	56·1
56·4	3·6 2·9	3·7 3·0	3·8 3·1	3·9 3·2	3·9 3·3	4·0 3·4	4·1 3·5	4·3 3·6	4·4 3·7	4·5 3·8	4·6 3·9	56·4
56·7	3·9 3·1	4·0 3·1	4·1 3·2	4·1 3·3	4·2 3·3	4·3 3·4	4·3 3·5	4·4 3·6	4·5 3·7	4·6 3·8	4·7 3·8	56·7
57·0	4·3 3·2	4·3 3·3	4·3 3·3	4·4 3·4	4·4 3·4	4·5 3·5	4·5 3·5	4·6 3·6	4·7 3·6	4·7 3·7	4·8 3·8	57·0
57·3	4·6 3·4	4·6 3·4	4·6 3·4	4·6 3·5	4·7 3·5	4·7 3·5	4·7 3·6	4·8 3·6	4·8 3·6	4·8 3·7	4·9 3·7	57·3
57·6	4·9 3·6	4·9 3·6	4·9 3·6	4·9 3·6	4·9 3·6	4·9 3·6	4·9 3·6	4·9 3·6	5·0 3·6	5·0 3·6	5·0 3·6	57·6
57·9	5·2 3·7	5·2 3·7	5·2 3·7	5·2 3·7	5·2 3·7	5·1 3·6	5·1 3·6	5·1 3·6	5·1 3·6	5·1 3·6	5·1 3·6	57·9
58·2	5·5 3·9	5·5 3·8	5·5 3·8	5·4 3·8	5·4 3·7	5·4 3·7	5·3 3·7	5·3 3·6	5·2 3·6	5·2 3·5	5·2 3·5	58·2
58·5	5·9 4·0	5·8 4·0	5·8 3·9	5·7 3·9	5·6 3·8	5·6 3·8	5·5 3·7	5·5 3·6	5·4 3·6	5·3 3·5	5·3 3·4	58·5
58·8	6·2 4·2	6·1 4·1	6·0 4·1	6·0 4·0	5·9 3·9	5·8 3·8	5·7 3·7	5·6 3·6	5·5 3·5	5·4 3·5	5·3 3·4	58·8
59·1	6·5 4·3	6·4 4·3	6·3 4·2	6·2 4·1	6·1 4·0	6·0 3·9	5·9 3·8	5·8 3·6	5·7 3·5	5·6 3·4	5·4 3·3	59·1
59·4	6·8 4·5	6·7 4·4	6·6 4·3	6·5 4·2	6·4 4·1	6·2 3·9	6·1 3·8	6·0 3·7	5·8 3·5	5·7 3·4	5·5 3·2	59·4
59·7	7·1 4·6	7·0 4·5	6·9 4·4	6·8 4·3	6·6 4·1	6·5 4·0	6·3 3·8	6·2 3·7	6·0 3·5	5·8 3·3	5·6 3·2	59·7
60·0	7·5 4·8	7·3 4·7	7·2 4·5	7·0 4·4	6·9 4·2	6·7 4·0	6·5 3·9	6·3 3·7	6·1 3·5	5·9 3·3	5·7 3·1	60·0
60·3	7·8 5·0	7·6 4·8	7·5 4·7	7·3 4·5	7·1 4·3	6·9 4·1	6·7 3·9	6·5 3·7	6·3 3·5	6·0 3·2	5·8 3·0	60·3
60·6	8·1 5·1	7·9 5·0	7·7 4·8	7·6 4·6	7·3 4·4	7·1 4·2	6·9 3·9	6·7 3·7	6·4 3·4	6·2 3·2	5·9 2·9	60·6
60·9	8·4 5·3	8·2 5·1	8·0 4·9	7·8 4·7	7·6 4·5	7·3 4·2	7·1 4·0	6·8 3·7	6·6 3·4	6·3 3·2	6·0 2·9	60·9
61·2	8·7 5·4	8·5 5·2	8·3 5·0	8·1 4·8	7·8 4·5	7·6 4·3	7·3 4·0	7·0 3·7	6·7 3·4	6·4 3·1	6·1 2·8	61·2
61·5	9·1 5·6	8·8 5·4	8·6 5·1	8·3 4·9	8·1 4·6	7·8 4·3	7·5 4·0	7·2 3·7	6·9 3·4	6·5 3·1	6·2 2·7	61·5

ALTITUDE CORRECTION TABLES 0°–10°—SUN, STARS, PLANETS A3

App. Alt.	SUN OCT.–MAR. Lower Limb	SUN OCT.–MAR. Upper Limb	SUN APR.–SEPT. Lower Limb	SUN APR.–SEPT. Upper Limb	STARS PLANETS
° ′	′	′	′	′	′
0 00	−18·2	−50·5	−18·4	−50·2	−34·5
03	17·5	49·8	17·8	49·6	33·8
06	16·9	49·2	17·1	48·9	33·2
09	16·3	48·6	16·5	48·3	32·6
12	15·7	48·0	15·9	47·7	32·0
15	15·1	47·4	15·3	47·1	31·4
0 18	−14·5	−46·8	−14·8	−46·6	−30·8
21	14·0	46·3	14·2	46·0	30·3
24	13·5	45·8	13·7	45·5	29·8
27	12·9	45·2	13·2	45·0	29·2
30	12·4	44·7	12·7	44·5	28·7
33	11·9	44·2	12·2	44·0	28·2
0 36	−11·5	−43·8	−11·7	−43·5	−27·8
39	11·0	43·3	11·2	43·0	27·3
42	10·5	42·8	10·8	42·6	26·8
45	10·1	42·4	10·3	42·1	26·4
48	9·6	41·9	9·9	41·7	25·9
51	9·2	41·5	9·5	41·3	25·5
0 54	− 8·8	−41·1	− 9·1	−40·9	−25·1
0 57	8·4	40·7	8·7	40·5	24·7
1 00	8·0	40·3	8·3	40·1	24·3
03	7·7	40·0	7·9	39·7	24·0
06	7·3	39·6	7·5	39·3	23·6
09	6·9	39·2	7·2	39·0	23·2
1 12	− 6·6	−38·9	− 6·8	−38·6	−22·9
15	6·2	38·5	6·5	38·3	22·5
18	5·9	38·2	6·2	38·0	22·2
21	5·6	37·9	5·8	37·6	21·9
24	5·3	37·6	5·5	37·3	21·6
27	4·9	37·2	5·2	37·0	21·2
1 30	− 4·6	−36·9	− 4·9	−36·7	−20·9
35	4·2	36·5	4·4	36·2	20·5
40	3·7	36·0	4·0	35·8	20·0
45	3·2	35·5	3·5	35·3	19·5
50	2·8	35·1	3·1	34·9	19·1
1 55	2·4	34·7	2·6	34·4	18·7
2 00	− 2·0	−34·3	− 2·2	−34·0	−18·3
05	1·6	33·9	1·8	33·6	17·9
10	1·2	33·5	1·5	33·3	17·5
15	0·9	33·2	1·1	32·9	17·2
20	0·5	32·8	0·8	32·6	16·8
25	− 0·2	32·5	0·4	32·2	16·5
2 30	+ 0·2	−32·1	− 0·1	−31·9	−16·1
35	0·5	31·8	+ 0·2	31·6	15·8
40	0·8	31·5	0·5	31·3	15·5
45	1·1	31·2	0·8	31·0	15·2
50	1·4	30·9	1·1	30·7	14·9
2 55	1·6	30·7	1·4	30·4	14·7
3 00	+ 1·9	30·4	+ 1·7	−30·1	−14·4
05	2·2	30·1	1·9	29·9	14·1
10	2·4	29·9	2·1	29·7	13·9
15	2·6	29·7	2·4	29·4	13·7
20	2·9	29·4	2·6	29·2	13·4
25	3·1	29·2	2·9	28·9	13·2
3 30	+ 3·3	−29·0	+ 3·1	−28·7	−13·0

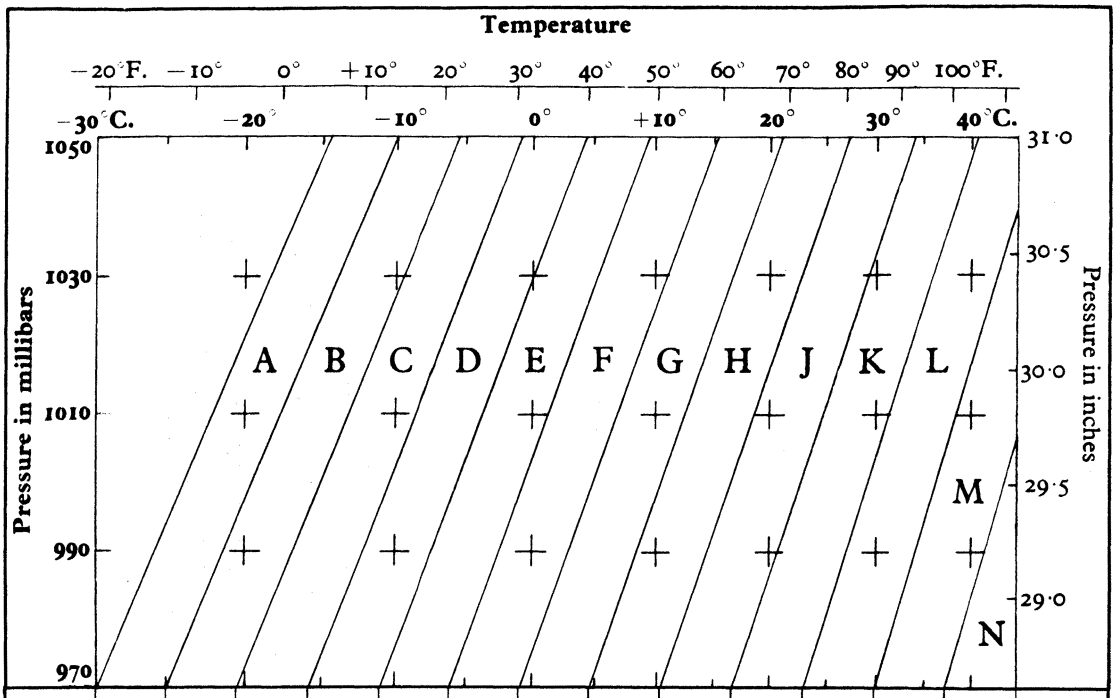
App. Alt.	SUN OCT.–MAR. Lower Limb	SUN OCT.–MAR. Upper Limb	SUN APR.–SEPT. Lower Limb	SUN APR.–SEPT. Upper Limb	STARS PLANETS
° ′	′	′	′	′	′
3 30	+ 3·3	−29·0	+ 3·1	−28·7	−13·0
35	3·6	28·7	3·3	28·5	12·7
40	3·8	28·5	3·5	28·3	12·5
45	4·0	28·3	3·7	28·1	12·3
50	4·2	28·1	3·9	27·9	12·1
3 55	4·4	27·9	4·1	27·7	11·9
4 00	+ 4·5	−27·8	+ 4·3	−27·5	−11·8
05	4·7	27·6	4·5	27·3	11·6
10	4·9	27·4	4·6	27·2	11·4
15	5·1	27·2	4·8	27·0	11·2
20	5·2	27·1	5·0	26·8	11·1
25	5·4	26·9	5·1	26·7	10·9
4 30	+ 5·6	−26·7	+ 5·3	−26·5	−10·7
35	5·7	26·6	5·5	26·3	10·6
40	5·9	26·4	5·6	26·2	10·4
45	6·0	26·3	5·8	26·0	10·3
50	6·2	26·1	5·9	25·9	10·1
4 55	6·3	26·0	6·0	25·8	10·0
5 00	+ 6·4	−25·9	+ 6·2	−25·6	− 9·9
05	6·6	25·7	6·3	25·5	9·7
10	6·7	25·6	6·4	25·4	9·6
15	6·8	25·5	6·6	25·2	9·5
20	6·9	25·4	6·7	25·1	9·4
25	7·1	25·2	6·8	25·0	9·2
5 30	+ 7·2	−25·1	+ 6·9	−24·9	− 9·1
35	7·3	25·0	7·0	24·8	9·0
40	7·4	24·9	7·2	24·6	8·9
45	7·5	24·8	7·3	24·5	8·8
50	7·6	24·7	7·4	24·4	8·7
5 55	7·7	24·6	7·5	24·3	8·6
6 00	+ 7·8	−24·5	+ 7·6	−24·2	− 8·5
10	8·0	24·3	7·8	24·0	8·3
20	8·2	24·1	8·0	23·8	8·1
30	8·4	23·9	8·1	23·7	7·9
40	8·6	23·7	8·3	23·5	7·7
6 50	8·7	23·6	8·5	23·3	7·6
7 00	+ 8·9	−23·4	+ 8·6	−23·2	7·4
10	9·1	23·2	8·8	23·0	7·2
20	9·2	23·1	9·0	22·8	7·1
30	9·3	23·0	9·1	22·7	7·0
40	9·5	22·8	9·2	22·6	6·8
7 50	9·6	22·7	9·4	22·4	6·7
8 00	+ 9·7	−22·6	+ 9·5	−22·3	− 6·6
10	9·9	22·4	9·6	22·2	6·4
20	10·0	22·3	9·7	22·1	6·3
30	10·1	22·2	9·8	22·0	6·2
40	10·2	22·1	10·0	21·8	6·1
8 50	10·3	22·0	10·1	21·7	6·0
9 00	+10·4	−21·9	+10·2	−21·6	− 5·9
10	10·5	21·8	10·3	21·5	5·8
20	10·6	21·7	10·4	21·4	5·7
30	10·7	21·6	10·5	21·3	5·6
40	10·8	21·5	10·6	21·2	5·5
9 50	10·9	21·4	10·6	21·2	5·4
10 00	+11·0	−21·3	+10·7	−21·1	− 5·3

Additional corrections for temperature and pressure are given on the following page.

For bubble sextant observations ignore dip and use the star corrections for Sun, planets, and stars.

A4 ALTITUDE CORRECTION TABLES—ADDITIONAL CORRECTIONS

ADDITIONAL REFRACTION CORRECTIONS FOR NON-STANDARD CONDITIONS



App. Alt.	A	B	C	D	E	F	G	H	J	K	L	M	N	App. Alt.
° ′	′	′	′	′	′	′	′	′	′	′	′	′	′	° ′
0 00	−6·9	−5·7	−4·6	−3·4	−2·3	−1·1	0·0	+1·1	+2·3	+3·4	+4·6	+5·7	+6·9	0 00
0 30	5·2	4·4	3·5	2·6	1·7	0·9	0·0	0·9	1·7	2·6	3·5	4·4	5·2	0 30
1 00	4·3	3·5	2·8	2·1	1·4	0·7	0·0	0·7	1·4	2·1	2·8	3·5	4·3	1 00
1 30	3·5	2·9	2·4	1·8	1·2	0·6	0·0	0·6	1·2	1·8	2·4	2·9	3·5	1 30
2 00	3·0	2·5	2·0	1·5	1·0	0·5	0·0	0·5	1·0	1·5	2·0	2·5	3·0	2 00
2 30	−2·5	−2·1	−1·6	−1·2	−0·8	−0·4	0·0	+0·4	+0·8	+1·2	+1·6	+2·1	+2·5	2 30
3 00	2·2	1·8	1·5	1·1	0·7	0·4	0·0	0·4	0·7	1·1	1·5	1·8	2·2	3 00
3 30	2·0	1·6	1·3	1·0	0·7	0·3	0·0	0·3	0·7	1·0	1·3	1·6	2·0	3 30
4 00	1·8	1·5	1·2	0·9	0·6	0·3	0·0	0·3	0·6	0·9	1·2	1·5	1·8	4 00
4 30	1·6	1·4	1·1	0·8	0·5	0·3	0·0	0·3	0·5	0·8	1·1	1·4	1·6	4 30
5 00	−1·5	−1·3	−1·0	−0·8	−0·5	−0·2	0·0	+0·2	+0·5	+0·8	+1·0	+1·3	+1·5	5 00
6	1·3	1·1	0·9	0·6	0·4	0·2	0·0	0·2	0·4	0·6	0·9	1·1	1·3	6
7	1·1	0·9	0·7	0·6	0·4	0·2	0·0	0·2	0·4	0·6	0·7	0·9	1·1	7
8	1·0	0·8	0·7	0·5	0·3	0·2	0·0	0·2	0·3	0·5	0·7	0·8	1·0	8
9	0·9	0·7	0·6	0·4	0·3	0·1	0·0	0·1	0·3	0·4	0·6	0·7	0·9	9
10 00	−0·8	−0·7	−0·5	−0·4	−0·3	−0·1	0·0	+0·1	+0·3	+0·4	+0·5	+0·7	+0·8	10 00
12	0·7	0·6	0·5	0·3	0·2	0·1	0·0	0·1	0·2	0·3	0·5	0·6	0·7	12
14	0·6	0·5	0·4	0·3	0·2	0·1	0·0	0·1	0·2	0·3	0·4	0·5	0·6	14
16	0·5	0·4	0·3	0·3	0·2	0·1	0·0	0·1	0·2	0·3	0·3	0·4	0·5	16
18	0·4	0·4	0·3	0·2	0·2	0·1	0·0	0·1	0·2	0·2	0·3	0·4	0·4	18
20 00	−0·4	−0·3	−0·3	−0·2	−0·1	−0·1	0·0	+0·1	+0·1	+0·2	+0·3	+0·3	+0·4	20 00
25	0·3	0·3	0·2	0·2	0·1	−0·1	0·0	+0·1	0·1	0·2	0·2	0·3	0·3	25
30	0·3	0·2	0·2	0·1	0·1	0·0	0·0	0·0	0·1	0·1	0·2	0·2	0·3	30
35	0·2	0·2	0·1	0·1	0·1	0·0	0·0	0·0	0·1	0·1	0·1	0·2	0·2	35
40	0·2	0·1	0·1	0·1	−0·1	0·0	0·0	0·0	+0·1	0·1	0·1	0·1	0·2	40
50 00	−0·1	−0·1	−0·1	−0·1	0·0	0·0	0·0	0·0	0·0	+0·1	+0·1	+0·1	+0·1	50 00

The graph is entered with arguments temperature and pressure to find a zone letter; using as arguments this zone letter and apparent altitude (sextant altitude corrected for dip), a correction is taken from the table. This correction is to be applied to the sextant altitude in addition to the corrections for standard conditions (for the Sun, stars and planets from page A2 and for the Moon from pages xxxiv and xxxv).

THE

NAUTICAL ALMANAC

FOR TRAINING PURPOSES ONLY

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PREFACE

The British and American editions of *The Nautical Almanac,* which are identical in content, are produced jointly by H. M. Nautical Almanac Office, Royal Greenwich Observatory, under the supervision of the Superintendent, and by the Nautical Almanac Office, United States Naval Observatory, under the supervision of P. K. Seidelmann and P. M. Janiczek, to the general requirements of the Royal Navy and of the United States Navy. The Almanac is printed separately in the United Kingdom and in the United States of America.

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RELIGIOUS CALENDARS

Epiphany	Jan. 6	Low Sunday	Apr. 26
Septuagesima Sunday	Feb. 15	Rogation Sunday	May 24
Quinquagesima Sunday	Mar. 1	Ascension Day—Holy Thursday	May 28
Ash Wednesday	Mar. 4	Whit Sunday—Pentecost	June 7
Quadragesima Sunday	Mar. 8	Trinity Sunday	June 14
Palm Sunday	Apr. 12	Corpus Christi	June 18
Good Friday	Apr. 17	First Sunday in Advent	Nov. 29
Easter Day	Apr. 19	Christmas Day	Dec. 25
Passover, First day of (Pesach)	Apr. 19	Day of Atonement (Yom Kippur)	Oct. 8
Feast of Weeks (Shebuoth)	June 8	Tabernacles, First day of (Succoth)	Oct. 13
Jewish New Year 5742 (Rosh Hashanah)	Sept. 29		
Islamic New Year (1402)	Oct. 30	Ramadân, First day of (tabular)	July 3

CIVIL CALENDAR—UNITED KINGDOM

Accession of Queen Elizabeth II	Feb. 6	Birthday of Prince Philip, Duke of Edinburgh	June 10
St. David (Wales)	Mar. 1	The Queen's Official Birthday	June 13
Commonwealth Day	Mar. 9	Remembrance Sunday	Nov. 8
St. Patrick (Ireland)	Mar. 17	Birthday of the Prince of Wales	Nov. 14
Birthday of Queen Elizabeth II	Apr. 21	St. Andrew (Scotland)	Nov. 30
St. George (England)	Apr. 23		
Coronation Day	June 2		

Bank Holidays in England and Wales—Jan. 1, Apr. 20, May 4, May 25, Aug. 31, Dec. 26
Northern Ireland—Jan. 1, Mar. 17, Apr. 20, May 4, May 25, July 13, Aug. 31, Dec. 26
Scotland—Jan. 1, Jan. 2, Apr. 17, May 4, May 25, Aug. 3, Dec. 25, Dec. 26

CIVIL CALENDAR—UNITED STATES OF AMERICA

New Year's Day	Jan. 1	Labor Day	Sept. 7
Lincoln's Birthday	Feb. 12	Columbus Day	Oct. 12
Washington's Birthday	Feb. 16	Election Day (in certain States)	Nov. 3
Memorial Day	May 25	Veterans Day	Nov. 11
Independence Day	July 4	Thanksgiving Day	Nov. 26

PHASES OF THE MOON

New Moon		First Quarter		Full Moon		Last Quarter	
	d h m		d h m		d h m		d h m
Jan.	6 07 24	Jan.	13 10 10	Jan.	20 07 39	Jan.	28 04 19
Feb.	4 22 14	Feb.	11 17 49	Feb.	18 22 58	Feb.	27 01 14
Mar.	6 10 31	Mar.	13 01 50	Mar.	20 15 22	Mar.	28 19 34
Apr.	4 20 19	Apr.	11 11 11	Apr.	19 07 59	Apr.	27 10 14
May	4 04 19	May	10 22 22	May	19 00 04	May	26 21 00
June	2 11 32	June	9 11 33	June	17 15 04	June	25 04 25
July	1 19 03	July	9 02 39	July	17 04 39	July	24 09 40
July	31 03 52	Aug.	7 19 26	Aug.	15 16 37	Aug.	22 14 16
Aug.	29 14 43	Sept.	6 13 26	Sept.	14 03 09	Sept.	20 19 47
Sept.	28 04 07	Oct.	6 07 45	Oct.	13 12 49	Oct.	20 03 40
Oct.	27 20 13	Nov.	5 01 09	Nov.	11 22 26	Nov.	18 14 54
Nov.	26 14 38	Dec.	4 16 22	Dec.	11 08 41	Dec.	18 05 47
Dec.	26 10 10						

DAYS OF THE WEEK AND DAYS OF THE YEAR

Day of Month	JAN.		FEB.		MAR.		APR.		MAY		JUNE		JULY		AUG.		SEPT.		OCT.		NOV.		DEC.	
	Week	Year	Week	Year	Week	Year	Week	Year	Week	Year	Week	Year	Week	Year	Week	Year	Week	Year	Week	Year	Week	Year	Week	Year
1	Th.	1	♑.	32	♑.	60	W.	91	F.	121	M.	152	W.	182	S.	213	Tu.	244	Th.	274	♑.	305	Tu.	335
2	F.	2	M.	33	M.	61	Th.	92	S.	122	Tu.	153	Th.	183	♑.	214	W.	245	F.	275	M.	306	W.	336
3	S.	3	Tu.	34	Tu.	62	F.	93	♑.	123	W.	154	F.	184	M.	215	Th.	246	S.	276	Tu.	307	Th.	337
4	♑.	4	W.	35	W.	63	S.	94	M.	124	Th.	155	S.	185	Tu.	216	F.	247	♑.	277	W.	308	F.	338
5	M.	5	Th.	36	Th.	64	♑.	95	Tu.	125	F.	156	♑.	186	W.	217	S.	248	M.	278	Th.	309	S.	339
6	Tu.	6	F.	37	F.	65	M.	96	W.	126	S.	157	M.	187	Th.	218	♑.	249	Tu.	279	F.	310	♑.	340
7	W.	7	S.	38	S.	66	Tu.	97	Th.	127	♑.	158	Tu.	188	F.	219	M.	250	W.	280	S.	311	M.	341
8	Th.	8	♑.	39	♑.	67	W.	98	F.	128	M.	159	W.	189	S.	220	Tu.	251	Th.	281	♑.	312	Tu.	342
9	F.	9	M.	40	M.	68	Th.	99	S.	129	Tu.	160	Th.	190	♑.	221	W.	252	F.	282	M.	313	W.	343
10	S.	10	Tu.	41	Tu.	69	F.	100	♑.	130	W.	161	F.	191	M.	222	Th.	253	S.	283	Tu.	314	Th.	344
11	♑.	11	W.	42	W.	70	S.	101	M.	131	Th.	162	S.	192	Tu.	223	F.	254	♑.	284	W.	315	F.	345
12	M.	12	Th.	43	Th.	71	♑.	102	Tu.	132	F.	163	♑.	193	W.	224	S.	255	M.	285	Th.	316	S.	346
13	Tu.	13	F.	44	F.	72	M.	103	W.	133	S.	164	M.	194	Th.	225	♑.	256	Tu.	286	F.	317	♑.	347
14	W.	14	S.	45	S.	73	Tu.	104	Th.	134	♑.	165	Tu.	195	F.	226	M.	257	W.	287	S.	318	M.	348
15	Th.	15	♑.	46	♑.	74	W.	105	F.	135	M.	166	W.	196	S.	227	Tu.	258	Th.	288	♑.	319	Tu.	349
16	F.	16	M.	47	M.	75	Th.	106	S.	136	Tu.	167	Th.	197	♑.	228	W.	259	F.	289	M.	320	W.	350
17	S.	17	Tu.	48	Tu.	76	F.	107	♑.	137	W.	168	F.	198	M.	229	Th.	260	S.	290	Tu.	321	Th.	351
18	♑.	18	W.	49	W.	77	S.	108	M.	138	Th.	169	S.	199	Tu.	230	F.	261	♑.	291	W.	322	F.	352
19	M.	19	Th.	50	Th.	78	♑.	109	Tu.	139	F.	170	♑.	200	W.	231	S.	262	M.	292	Th.	323	S.	353
20	Tu.	20	F.	51	F.	79	M.	110	W.	140	S.	171	M.	201	Th.	232	♑.	263	Tu.	293	F.	324	♑.	354
21	W.	21	S.	52	S.	80	Tu.	111	Th.	141	♑.	172	Tu.	202	F.	233	M.	264	W.	294	S.	325	M.	355
22	Th.	22	♑.	53	♑.	81	W.	112	F.	142	M.	173	W.	203	S.	234	Tu.	265	Th.	295	♑.	326	Tu.	356
23	F.	23	M.	54	M.	82	Th.	113	S.	143	Tu.	174	Th.	204	♑.	235	W.	266	F.	296	M.	327	W.	357
24	S.	24	Tu.	55	Tu.	83	F.	114	♑.	144	W.	175	F.	205	M.	236	Th.	267	S.	297	Tu.	328	Th.	358
25	♑.	25	W.	56	W.	84	S.	115	M.	145	Th.	176	S.	206	Tu.	237	F.	268	♑.	298	W.	329	F.	359
26	M.	26	Th.	57	Th.	85	♑.	116	Tu.	146	F.	177	♑.	207	W.	238	S.	269	M.	299	Th.	330	S.	360
27	Tu.	27	F.	58	F.	86	M.	117	W.	147	S.	178	M.	208	Th.	239	♑.	270	Tu.	300	F.	331	♑.	361
28	W.	28	S.	59	S.	87	Tu.	118	Th.	148	♑.	179	Tu.	209	F.	240	M.	271	W.	301	S.	332	M.	362
29	Th.	29			♑.	88	W.	119	F.	149	M.	180	W.	210	S.	241	Tu.	272	Th.	302	♑.	333	Tu.	363
30	F.	30			M.	89	Th.	120	S.	150	Tu.	181	Th.	211	♑.	242	W.	273	F.	303	M.	334	W.	364
31	S.	31			Tu.	90			♑.	151			F.	212	M.	243			S.	304			Th.	365

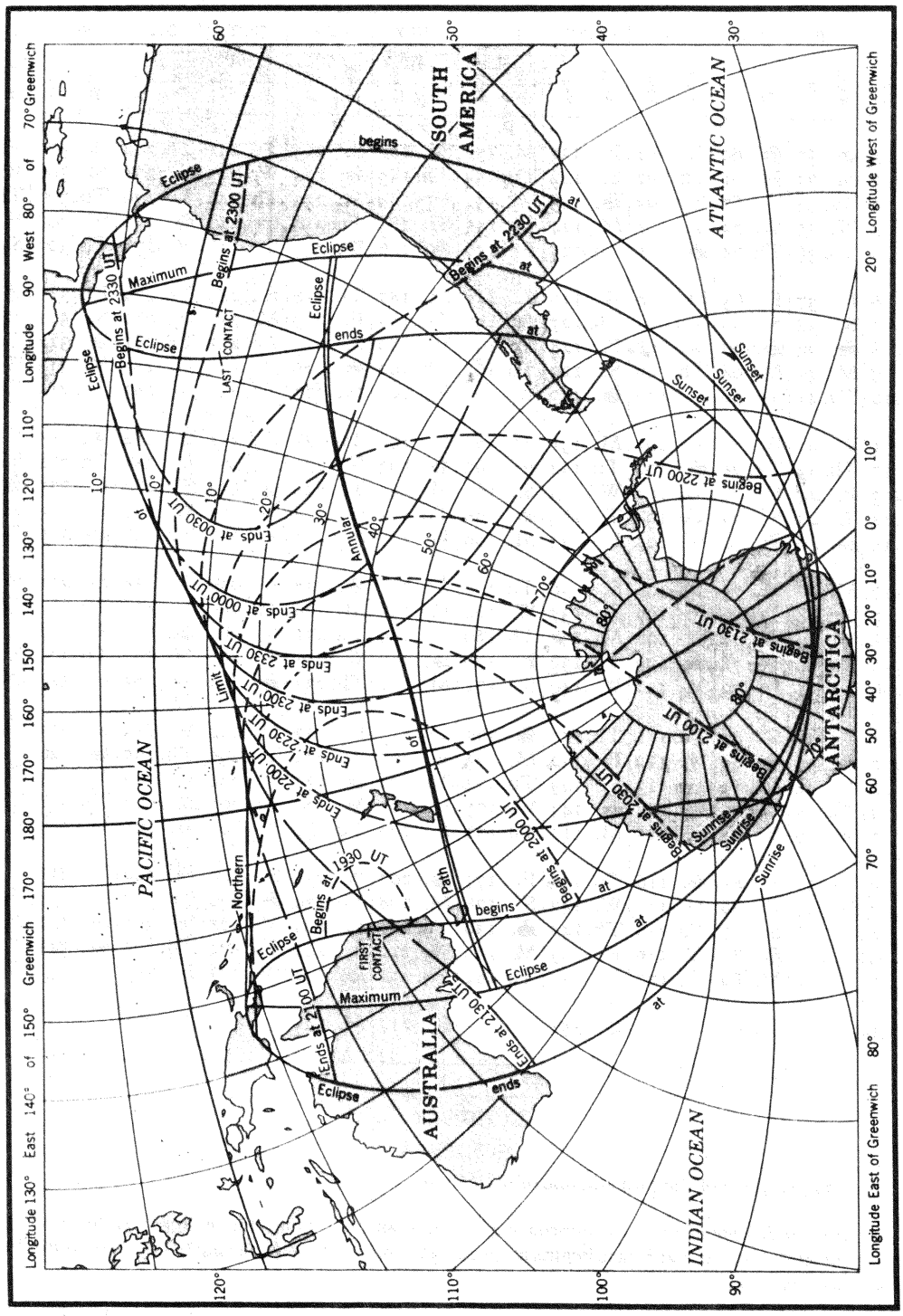
ECLIPSES

There are three eclipses, two of the Sun and one of the Moon.

1. *An Annular Eclipse of the Sun*, February 4-5. See map on page 6. The eclipse begins at $4^{d}\ 19^{h}\ 28^{m}$ and ends at $5^{d}\ 00^{h}\ 49^{m}$; the annular phase begins at $4^{d}\ 20^{h}\ 33^{m}$ and ends at $4^{d}\ 23^{h}\ 44^{m}$. The maximum duration of the annular phase is $1^{m}\ 11^{s}$.

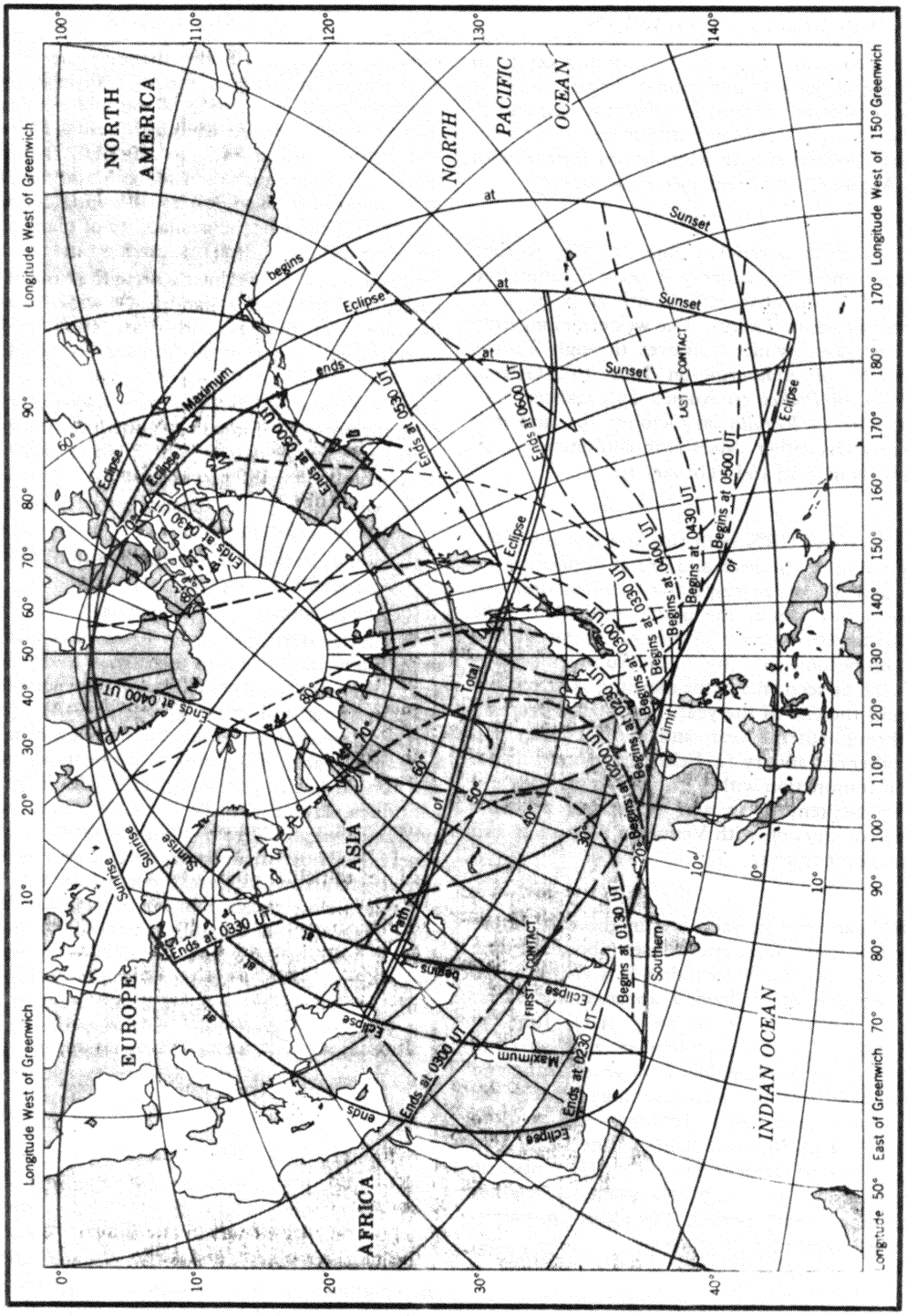
2. *A Partial Eclipse of the Moon*, July 17. The eclipse begins at $03^{h}\ 25^{m}$ and ends at $06^{h}\ 09^{m}$. It is visible from Africa except the north-eastern part, south-western Europe, the Atlantic Ocean, Antarctica, South America, North America except the north-western part, the eastern Pacific Ocean and New Zealand. At the time of maximum eclipse 0·55 of the Moon's diameter is obscured.

3. *A Total Eclipse of the Sun*, July 31. See map on page 7. The eclipse begins at $01^{h}\ 11^{m}$ and ends at $06^{h}\ 20^{m}$; the total phase begins at $02^{h}\ 18^{m}$ and ends at $05^{h}\ 14^{m}$. The maximum duration of the total phase is $2^{m}\ 02^{s}$.



SOLAR ECLIPSE DIAGRAMS

The principal features shown on the above diagrams are: the paths of total and annular eclipses; the northern and southern limits of partial eclipse; the sunrise and sunset curves; and contour lines showing the time of middle of eclipse and the semi-duration of partial eclipse. The times of beginning and end of partial eclipse at any place can be found by applying the semi-duration to the time of middle of the eclipse, both being interpolated for that place from the contour lines.



SOLAR ECLIPSE DIAGRAMS

For total and annular eclipses the mid-times of the total and annular phases are generally within 5 minutes of those given for the middle of eclipse ; but semi-durations, which depend on the precise position relative to the path, are not given. Further details of the paths and times of central eclipse are given in the *Astronomical Almanac*.

VISIBILITY OF PLANETS

VENUS is a brilliant object in the morning sky from the beginning of the year until mid-February (when it becomes too close to the Sun for observation), and in the evening sky from late May until the end of the year. Venus is in conjunction with Mercury on June 9, with Saturn on August 25 and Jupiter on August 28.

MARS is visible as a reddish object in Capricornus shortly after sunset in January; it then becomes too close to the Sun for observation until early in June, when it can be seen in Taurus. The western elongation gradually increases while it moves through Taurus (passing 6° N. of *Aldebaran* on June 19), Gemini (passing 6° S. of *Pollux* on August 23), Cancer, Leo (passing 1°·1 N. of *Regulus* on October 19), and into Virgo in early December. Mars is in conjunction with Mercury on January 23 and February 10.

JUPITER and SATURN both rise at about midnight at the beginning of the year and are at opposition on March 26 and March 27 respectively, when they can both be seen throughout the night. From late June until late September they are visible only in the evening sky, and then become too close to the Sun for observation. They can be seen only in the morning sky from late October until the end of the year. Both planets remain in Virgo throughout the year, and are in conjunction with each other on January 14, February 19 and July 30. Jupiter is in conjunction with Venus on August 28, and Mercury on September 13 and November 6, while Saturn is in conjunction with Venus on August 25 and Mercury on September 10.

MERCURY can only be seen low in the east before sunrise, or low in the west after sunset (about the time of beginning or end of civil twilight). It is visible in the mornings between the following approximate dates: February 23 (+1·9) to April 20 (−1·1), June 30 (+2·2) to August 2 (−1·4), October 25 (+1·1) to November 24 (−0·7); the planet is brighter at the end of each period. It is visible in the evenings between the following approximate dates: January 15 (−0·9) to February 12 (+1·5), May 5 (−1·4) to June 14 (+2·3), August 19 (−0·9) to October 13 (+1·7), December 26 (−0·7) to December 31 (−0·7); the planet is brighter at the beginning of each period. The figures in parentheses are the magnitudes.

PLANET DIAGRAM

General Description. The diagram on the opposite page shows, in graphical form for any date during the year, the local mean time of meridian passage of the Sun, of the five planets Mercury, Venus, Mars, Jupiter, and Saturn, and of each 30° of S.H.A.; intermediate lines, corresponding to particular stars, may be drawn in by the user if he so desires. It is intended to provide a general picture of the availability of planets and stars for observation.

On each side of the line marking the time of meridian passage of the Sun a band, 45^m wide, is shaded to indicate that planets and most stars crossing the meridian within 45^m of the Sun are too close to the Sun for observation.

Method of use and interpretation. For any date the diagram provides immediately the local mean times of meridian passage of the Sun, planets and stars, and thus the following information:

(a) whether a planet or star is too close to the Sun for observation;

(b) some indication of its position in the sky, especially during twilight;

(c) the proximity of other planets.

When the meridian passage of an outer planet occurs at midnight the body is in opposition to the Sun and is visible all night; a planet may then be observable during both morning and evening twilights. As the time of meridian passage decreases, the body eventually ceases to be observable in the morning, but its altitude above the eastern horizon at sunset gradually increases; this continues until the body is on the meridian during evening twilight. From then onwards the body is observable above the western horizon and its altitude at sunset gradually decreases; eventually the body becomes too close to the Sun for observation. When the body again becomes visible it is seen low in the east during morning twilight; its altitude at sunrise increases until meridian passage occurs during morning twilight. Then, as the time of meridian passage decreases to 0^h, the body is observable in the west during morning twilight with a gradually decreasing altitude, until it once again reaches opposition.

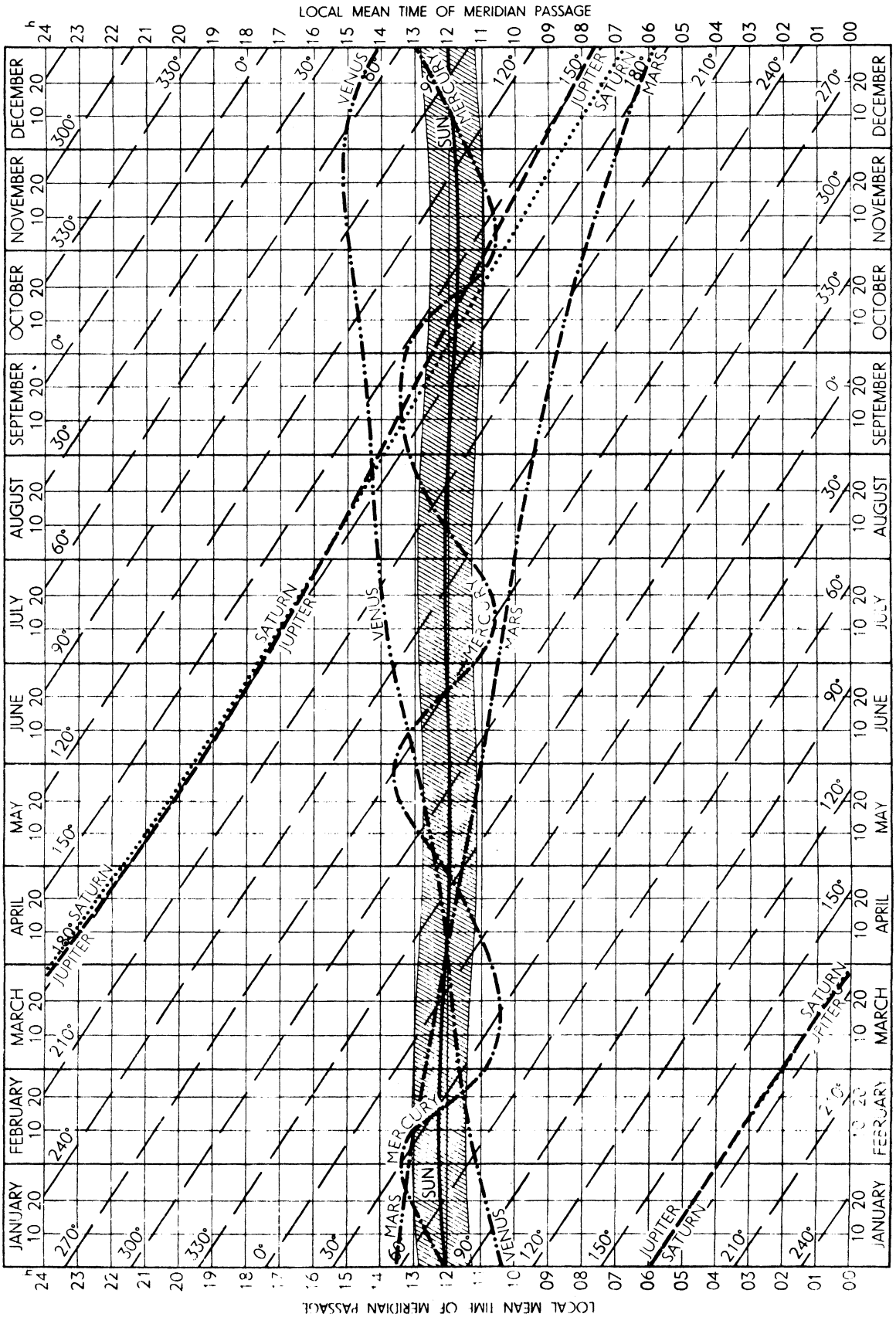
DO NOT CONFUSE

Jupiter with Saturn from the beginning of the year until mid-September; Jupiter is always the brighter object.

Mercury with Mars in late January when Mercury is the brighter object, and again in early February when it is only slightly brighter. The reddish tint of Mars should assist in its identification.

Venus with Mercury in early June, and with Saturn and Jupiter in late August; on all occasions Venus is the brighter object.

Mercury with Saturn in early September when Mercury is the brighter object, and with Jupiter in mid-September and early November; on both occasions Mercury is fainter than Jupiter.


LOCAL MEAN TIME OF MERIDIAN PASSAGE
JANUARY
FEBRUARY
MARCH
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
OCTOBER
NOVEMBER
DECEMBER
SUN
MERCURY
VENUS
MARS
JUPITER
SATURN

G.M.T.	ARIES	VENUS −3.4		MARS +1.4		JUPITER −1.6		SATURN +1.0	
	G.H.A.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
1 00	100 33.4	204 26.5	S21 57.7	157 14.8	S21 04.5	271 18.5	S 2 33.9	270 54.0	S 1 36.0
01	115 35.9	219 25.6	58.1	172 15.2	04.1	286 20.8	34.0	285 56.4	36.1
02	130 38.4	234 24.7	58.5	187 15.6	03.6	301 23.1	34.1	300 58.8	36.1
03	145 40.8	249 23.9	·· 58.9	202 16.1	·· 03.2	316 25.4	·· 34.1	316 01.2	·· 36.1
04	160 43.3	264 23.0	59.3	217 16.5	02.8	331 27.7	34.2	331 03.6	36.1
05	175 45.8	279 22.1	21 59.7	232 16.9	02.3	346 30.0	34.2	346 06.0	36.1
06	190 48.2	294 21.2	S22 00.1	247 17.3	S21 01.9	1 32.3	S 2 34.3	1 08.4	S 1 36.2
07	205 50.7	309 20.3	00.5	262 17.7	01.5	16 34.6	34.4	16 10.8	36.2
T 08	220 53.1	324 19.5	00.9	277 18.1	01.0	31 36.9	34.4	31 13.1	36.2
H 09	235 55.6	339 18.6	·· 01.2	292 18.5	·· 00.6	46 39.2	·· 34.5	46 15.5	·· 36.2
U 10	250 58.1	354 17.7	01.6	307 19.0	21 00.2	61 41.5	34.5	61 17.9	36.2
R 11	266 00.5	9 16.8	02.0	322 19.4	20 59.7	76 43.7	34.6	76 20.3	36.3
S 12	281 03.0	24 15.9	S22 02.4	337 19.8	S20 59.3	91 46.0	S 2 34.7	91 22.7	S 1 36.3
D 13	296 05.5	39 15.1	02.8	352 20.2	58.9	106 48.3	34.7	106 25.1	36.3
A 14	311 07.9	54 14.2	03.2	7 20.6	58.4	121 50.6	34.8	121 27.5	36.3
Y 15	326 10.4	69 13.3	·· 03.6	22 21.0	·· 58.0	136 52.9	·· 34.8	136 29.9	·· 36.3
16	341 12.9	84 12.4	03.9	37 21.4	57.6	151 55.2	34.9	151 32.3	36.4
17	356 15.3	99 11.5	04.3	52 21.9	57.1	166 57.5	35.0	166 34.6	36.4
18	11 17.8	114 10.6	S22 04.7	67 22.3	S20 56.7	181 59.8	S 2 35.0	181 37.0	S 1 36.4
19	26 20.3	129 09.8	05.1	82 22.7	56.3	197 02.1	35.1	196 39.4	36.4
20	41 22.7	144 08.9	05.5	97 23.1	55.8	212 04.4	35.1	211 41.8	36.4
21	56 25.2	159 08.0	·· 05.8	112 23.5	·· 55.4	227 06.7	·· 35.2	226 44.2	·· 36.4
22	71 27.6	174 07.1	06.2	127 23.9	54.9	242 09.0	35.3	241 46.6	36.5
23	86 30.1	189 06.2	06.6	142 24.4	54.5	257 11.3	35.3	256 49.0	36.5
2 00	101 32.6	204 05.3	S22 07.0	157 24.8	S20 54.1	272 13.6	S 2 35.4	271 51.4	S 1 36.5
01	116 35.0	219 04.4	07.3	172 25.2	53.6	287 15.9	35.4	286 53.8	36.5
02	131 37.5	234 03.5	07.7	187 25.6	53.2	302 18.2	35.5	301 56.2	36.5
03	146 40.0	249 02.7	·· 08.1	202 26.0	·· 52.7	317 20.5	·· 35.6	316 58.5	·· 36.6
04	161 42.4	264 01.8	08.4	217 26.4	52.3	332 22.8	35.6	332 00.9	36.6
05	176 44.9	279 00.9	08.8	232 26.9	51.9	347 25.1	35.7	347 03.3	36.6
06	191 47.4	294 00.0	S22 09.2	247 27.3	S20 51.4	2 27.4	S 2 35.7	2 05.7	S 1 36.6
07	206 49.8	308 59.1	09.5	262 27.7	51.0	17 29.7	35.8	17 08.1	36.6
08	221 52.3	323 58.2	09.9	277 28.1	50.5	32 32.0	35.8	32 10.5	36.6
F 09	236 54.7	338 57.3	·· 10.3	292 28.5	·· 50.1	47 34.3	·· 35.9	47 12.9	·· 36.7
R 10	251 57.2	353 56.4	10.6	307 29.0	49.6	62 36.6	36.0	62 15.3	36.7
I 11	266 59.7	8 55.6	11.0	322 29.4	49.2	77 38.9	36.0	77 17.7	36.7
D 12	282 02.1	23 54.7	S22 11.3	337 29.8	S20 48.8	92 41.2	S 2 36.1	92 20.1	S 1 36.7
A 13	297 04.6	38 53.8	11.7	352 30.2	48.3	107 43.5	36.1	107 22.5	36.7
Y 14	312 07.1	53 52.9	12.1	7 30.6	47.9	122 45.8	36.2	122 24.9	36.8
15	327 09.5	68 52.0	·· 12.4	22 31.1	·· 47.4	137 48.1	·· 36.2	137 27.3	·· 36.8
16	342 12.0	83 51.1	12.8	37 31.5	47.0	152 50.4	36.3	152 29.6	36.8
17	357 14.5	98 50.2	13.1	52 31.9	46.5	167 52.7	36.4	167 32.0	36.8
18	12 16.9	113 49.3	S22 13.5	67 32.3	S20 46.1	182 55.0	S 2 36.4	182 34.4	S 1 36.8
19	27 19.4	128 48.4	13.8	82 32.7	45.6	197 57.3	36.5	197 36.8	36.8
20	42 21.9	143 47.5	14.2	97 33.1	45.2	212 59.6	36.5	212 39.2	36.9
21	57 24.3	158 46.6	·· 14.5	112 33.6	·· 44.7	228 01.9	·· 36.6	227 41.6	·· 36.9
22	72 26.8	173 45.7	14.9	127 34.0	44.3	243 04.3	36.6	242 44.0	36.9
23	87 29.2	188 44.9	15.2	142 34.4	43.9	258 06.6	36.7	257 46.4	36.9
3 00	102 31.7	203 44.0	S22 15.6	157 34.8	S20 43.4	273 08.9	S 2 36.8	272 48.8	S 1 36.9
01	117 34.2	218 43.1	15.9	172 35.3	43.0	288 11.2	36.8	287 51.2	36.9
02	132 36.6	233 42.2	16.2	187 35.7	42.5	303 13.5	36.9	302 53.6	37.0
03	147 39.1	248 41.3	·· 16.6	202 36.1	·· 42.1	318 15.8	·· 36.9	317 56.0	·· 37.0
04	162 41.6	263 40.4	16.9	217 36.5	41.6	333 18.1	37.0	332 58.4	37.0
05	177 44.0	278 39.5	17.3	232 36.9	41.2	348 20.4	37.0	348 00.8	37.0
06	192 46.5	293 38.6	S22 17.6	247 37.4	S20 40.7	3 22.7	S 2 37.1	3 03.2	S 1 37.0
07	207 49.0	308 37.7	17.9	262 37.8	40.3	18 25.0	37.1	18 05.6	37.0
S 08	222 51.4	323 36.8	18.3	277 38.2	39.8	33 27.3	37.2	33 08.0	37.1
A 09	237 53.9	338 35.9	·· 18.6	292 38.6	·· 39.3	48 29.6	·· 37.2	48 10.4	·· 37.1
T 10	252 56.4	353 35.0	18.9	307 39.0	38.9	63 31.9	37.3	63 12.8	37.1
U 11	267 58.8	8 34.1	19.3	322 39.5	38.4	78 34.2	37.4	78 15.2	37.1
R 12	283 01.3	23 33.2	S22 19.6	337 39.9	S20 38.0	93 36.6	S 2 37.4	93 17.5	S 1 37.1
D 13	298 03.7	38 32.3	19.9	352 40.3	37.5	108 38.9	37.5	108 19.9	37.1
A 14	313 06.2	53 31.4	20.3	7 40.7	37.1	123 41.2	37.5	123 22.3	37.2
Y 15	328 08.7	68 30.5	·· 20.6	22 41.2	·· 36.6	138 43.5	·· 37.6	138 24.7	·· 37.2
16	343 11.1	83 29.6	20.9	37 41.6	36.2	153 45.8	37.6	153 27.1	37.2
17	358 13.6	98 28.7	21.3	52 42.0	35.7	168 48.1	37.7	168 29.5	37.2
18	13 16.1	113 27.8	S22 21.6	67 42.4	S20 35.3	183 50.4	S 2 37.7	183 31.9	S 1 37.2
19	28 18.5	128 26.9	21.9	82 42.9	34.8	198 52.7	37.8	198 34.3	37.2
20	43 21.0	143 26.0	22.2	97 43.3	34.3	213 55.0	37.8	213 36.7	37.2
21	58 23.5	158 25.1	·· 22.5	112 43.7	·· 33.9	228 57.3	·· 37.9	228 39.1	·· 37.3
22	73 25.9	173 24.2	22.9	127 44.1	33.4	243 59.7	37.9	243 41.5	37.3
23	88 28.4	188 23.3	23.2	142 44.5	33.0	259 02.0	38.0	258 43.9	37.3
	h m								
Mer. Pass.	17 11.0	v −0.9	d 0.4	v 0.4	d 0.4	v 2.3	d 0.1	v 2.4	d 0.0

STARS		
Name	S.H.A.	Dec.
	° ′	° ′
Acamar	315 36.9	S40 23.2
Achernar	335 45.0	S57 20.4
Acrux	173 36.9	S62 59.3
Adhara	255 31.6	S28 56.8
Aldebaran	291 17.5	N16 28.2
Alioth	166 42.4	N56 03.6
Alkaid	153 18.5	N49 24.3
Al Na'ir	28 15.0	S47 03.4
Alnilam	276 11.1	S 1 12.9
Alphard	218 20.1	S 8 34.5
Alphecca	126 32.2	N26 46.7
Alpheratz	358 09.2	N28 59.2
Altair	62 32.7	N 8 49.1
Ankaa	353 40.1	S42 24.9
Antares	112 56.9	S26 23.3
Arcturus	146 18.4	N19 16.9
Atria	108 21.5	S68 59.4
Avior	234 27.5	S59 26.8
Bellatrix	278 58.2	N 6 19.9
Betelgeuse	271 27.7	N 7 24.1
Canopus	264 06.6	S52 41.2
Capella	281 10.6	N45 58.8
Deneb	49 48.7	N45 12.9
Denebola	182 58.8	N14 40.7
Diphda	349 20.7	S18 05.7
Dubhe	194 21.6	N61 51.0
Elnath	278 43.5	N28 35.5
Eltanin	90 58.2	N51 29.5
Enif	34 11.6	N 9 47.3
Fomalhaut	15 51.4	S29 43.6
Gacrux	172 28.4	S57 00.0
Gienah	176 17.7	S17 26.0
Hadar	149 23.3	S60 16.5
Hamal	328 28.6	N23 22.4
Kaus Aust.	84 17.0	S34 23.6
Kochab	137 19.8	N74 13.8
Markab	14 03.1	N15 06.2
Menkar	314 40.7	N 4 00.8
Menkent	148 36.9	S36 16.3
Miaplacidus	221 44.1	S69 38.2
Mirfak	309 15.5	N49 47.7
Nunki	76 29.3	S26 19.2
Peacock	53 58.7	S56 47.9
Pollux	243 57.6	N28 04.3
Procyon	245 25.3	N 5 16.4
Rasalhague	96 29.7	N12 34.5
Regulus	208 09.6	N12 03.6
Rigel	281 35.5	S 8 13.5
Rigil Kent.	140 25.9	S60 45.0
Sabik	102 41.2	S15 42.0
Schedar	350 08.8	N56 26.2
Shaula	96 55.9	S37 05.3
Sirius	258 55.2	S16 41.5
Spica	158 57.4	S11 03.6
Suhail	223 10.2	S43 21.2
Vega	80 56.1	N38 46.0
Zuben'ubi	137 33.0	S15 57.6

	S.H.A.	Mer. Pass.
	° ′	h m
Venus	102 32.8	10 24
Mars	55 52.2	13 30
Jupiter	170 41.0	5 50
Saturn	170 18.8	5 52

G.M.T.	SUN G.H.A.	SUN Dec.	MOON G.H.A.	MOON v	MOON Dec.	MOON d	MOON H.P.
d h	° ′	° ′	° ′	′	° ′	′	′
1 00	179 08.9	S23 01.5	241 12.2	14.7	S 9 54.2	9.1	54.3
01	194 08.6	01.3	255 45.9	14.8	10 03.3	9.0	54.3
02	209 08.3	01.1	270 19.7	14.7	10 12.3	9.0	54.3
03	224 08.0	00.9	284 53.4	14.6	10 21.3	9.0	54.3
04	239 07.7	00.7	299 27.0	14.6	10 30.3	8.9	54.3
05	254 07.4	00.5	314 00.6	14.6	10 39.2	8.9	54.3
06	269 07.1	S23 00.3	328 34.2	14.6	S10 48.1	8.9	54.3
07	284 06.8	23 00.1	343 07.8	14.5	10 57.0	8.8	54.3
T 08	299 06.5	22 59.9	357 41.3	14.4	11 05.8	8.8	54.3
H 09	314 06.2	59.7	12 14.7	14.4	11 14.6	8.7	54.3
U 10	329 05.9	59.5	26 48.1	14.4	11 23.3	8.7	54.3
R 11	344 05.6	59.3	41 21.5	14.4	11 32.0	8.6	54.4
S 12	359 05.3	S22 59.1	55 54.9	14.2	S11 40.6	8.6	54.4
D 13	14 05.0	58.8	70 28.1	14.3	11 49.2	8.6	54.4
A 14	29 04.7	58.6	85 01.4	14.2	11 57.8	8.5	54.4
Y 15	44 04.4	58.4	99 34.6	14.1	12 06.3	8.4	54.4
16	59 04.1	58.2	114 07.7	14.1	12 14.7	8.5	54.4
17	74 03.8	58.0	128 40.8	14.1	12 23.2	8.3	54.4
18	89 03.5	S22 57.8	143 13.9	14.0	S12 31.5	8.3	54.4
19	104 03.2	57.6	157 46.9	14.0	12 39.8	8.3	54.4
20	119 02.9	57.3	172 19.9	13.9	12 48.1	8.2	54.5
21	134 02.7	57.1	186 52.8	13.9	12 56.3	8.2	54.5
22	149 02.4	56.9	201 25.7	13.8	13 04.5	8.1	54.5
23	164 02.1	56.7	215 58.5	13.8	13 12.6	8.0	54.5
2 00	179 01.8	S22 56.5	230 31.3	13.7	S13 20.6	8.0	54.5
01	194 01.5	56.3	245 04.0	13.7	13 28.6	8.0	54.5
02	209 01.2	56.0	259 36.7	13.6	13 36.6	7.9	54.5
03	224 00.9	55.8	274 09.3	13.6	13 44.5	7.8	54.5
04	239 00.6	55.6	288 41.9	13.5	13 52.3	7.8	54.6
05	254 00.3	55.4	303 14.4	13.5	14 00.1	7.7	54.6
06	269 00.0	S22 55.1	317 46.9	13.4	S14 07.8	7.7	54.6
07	283 59.7	54.9	332 19.3	13.4	14 15.5	7.6	54.6
08	298 59.4	54.7	346 51.7	13.3	14 23.1	7.6	54.6
F 09	313 59.1	54.5	1 24.0	13.2	14 30.7	7.5	54.6
R 10	328 58.8	54.2	15 56.2	13.2	14 38.2	7.4	54.6
I 11	343 58.6	54.0	30 28.4	13.2	14 45.6	7.4	54.7
D 12	358 58.3	S22 53.8	45 00.6	13.1	S14 53.0	7.3	54.7
A 13	13 58.0	53.6	59 32.7	13.0	15 00.3	7.2	54.7
Y 14	28 57.7	53.3	74 04.7	13.0	15 07.5	7.2	54.7
15	43 57.4	53.1	88 36.7	12.9	15 14.7	7.2	54.7
16	58 57.1	52.9	103 08.6	12.9	15 21.9	7.0	54.7
17	73 56.8	52.6	117 40.5	12.8	15 28.9	7.0	54.8
18	88 56.5	S22 52.4	132 12.3	12.8	S15 35.9	6.9	54.8
19	103 56.2	52.2	146 44.1	12.7	15 42.8	6.9	54.8
20	118 55.9	51.9	161 15.8	12.7	15 49.7	6.8	54.8
21	133 55.6	51.7	175 47.5	12.6	15 56.5	6.7	54.8
22	148 55.4	51.5	190 19.1	12.5	16 03.2	6.7	54.8
23	163 55.1	51.2	204 50.6	12.5	16 09.9	6.6	54.9
3 00	178 54.8	S22 51.0	219 22.1	12.4	S16 16.5	6.5	54.9
01	193 54.5	50.7	233 53.5	12.4	16 23.0	6.4	54.9
02	208 54.2	50.5	248 24.9	12.3	16 29.4	6.4	54.9
03	223 53.9	50.3	262 56.2	12.2	16 35.8	6.3	54.9
04	238 53.6	50.0	277 27.4	12.2	16 42.1	6.3	54.9
05	253 53.3	49.8	291 58.6	12.2	16 48.4	6.1	55.0
06	268 53.0	S22 49.5	306 29.8	12.0	S16 54.5	6.1	55.0
07	283 52.7	49.3	321 00.8	12.1	17 00.6	6.0	55.0
S 08	298 52.5	49.0	335 31.9	11.9	17 06.6	5.9	55.0
A 09	313 52.2	48.8	350 02.8	11.9	17 12.5	5.9	55.0
T 10	328 51.9	48.6	4 33.7	11.9	17 18.4	5.8	55.1
U 11	343 51.6	48.3	19 04.6	11.8	17 24.2	5.7	55.1
R 12	358 51.3	S22 48.1	33 35.4	11.7	S17 29.9	5.6	55.1
D 13	13 51.0	47.8	48 06.1	11.7	17 35.5	5.5	55.1
A 14	28 50.7	47.6	62 36.8	11.6	17 41.0	5.5	55.1
Y 15	43 50.4	47.3	77 07.4	11.6	17 46.5	5.3	55.2
16	58 50.2	47.1	91 38.0	11.5	17 51.8	5.3	55.2
17	73 49.9	46.8	106 08.5	11.4	17 57.1	5.3	55.2
18	88 49.6	S22 46.6	120 38.9	11.4	S18 02.4	5.1	55.2
19	103 49.3	46.3	135 09.3	11.3	18 07.5	5.0	55.2
20	118 49.0	46.0	149 39.6	11.3	18 12.5	5.0	55.3
21	133 48.7	45.8	164 09.9	11.2	18 17.5	4.9	55.3
22	148 48.4	45.5	178 40.1	11.2	18 22.4	4.7	55.3
23	163 48.1	45.3	193 10.3	11.1	18 27.1	4.7	55.3
	S.D. 16.3	d 0.2	S.D. 14.8		14.9		15.0

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 1	Moonrise 2	Moonrise 3	Moonrise 4
°	h m	h m	h m	h m	h m	h m	h m
N 72	08 23	10 40	▬	04 25	06 15	08 31	▬
N 70	08 04	09 48	▬	04 06	05 45	07 29	09 25
68	07 49	09 16	▬	03 52	05 22	06 54	08 25
66	07 37	08 52	10 26	03 41	05 05	06 29	07 51
64	07 26	08 34	09 49	03 31	04 51	06 10	07 26
62	07 17	08 18	09 22	03 23	04 39	05 54	07 07
60	07 09	08 05	09 02	03 16	04 29	05 41	06 51
N 58	07 02	07 54	08 45	03 10	04 20	05 30	06 37
56	06 56	07 44	08 31	03 04	04 12	05 20	06 26
54	06 50	07 36	08 19	02 59	04 06	05 12	06 16
52	06 44	07 28	08 08	02 55	04 00	05 04	06 07
50	06 39	07 20	07 59	02 51	03 54	04 57	05 59
45	06 28	07 05	07 38	02 42	03 42	04 42	05 42
N 40	06 18	06 52	07 22	02 35	03 33	04 30	05 28
35	06 09	06 40	07 08	02 29	03 24	04 20	05 16
30	06 00	06 30	06 56	02 24	03 17	04 11	05 06
20	05 44	06 12	06 36	02 15	03 04	03 56	04 48
N 10	05 28	05 55	06 17	02 07	02 53	03 42	04 33
0	05 12	05 38	06 00	01 59	02 43	03 30	04 18
S 10	04 53	05 20	05 43	01 52	02 33	03 17	04 04
20	04 31	05 00	05 25	01 44	02 22	03 04	03 49
30	04 03	04 36	05 03	01 35	02 10	02 49	03 32
35	03 44	04 21	04 50	01 30	02 03	02 40	03 21
40	03 22	04 03	04 36	01 24	01 55	02 30	03 10
45	02 52	03 41	04 18	01 17	01 46	02 19	02 56
S 50	02 09	03 12	03 56	01 09	01 35	02 04	02 40
52	01 43	02 58	03 46	01 05	01 29	01 58	02 32
54	01 03	02 41	03 34	01 01	01 24	01 51	02 24
56	////	02 19	03 20	00 57	01 17	01 43	02 14
58	////	01 52	03 04	00 52	01 10	01 34	02 03
S 60	////	01 09	02 45	00 46	01 03	01 23	01 51

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 1	Moonset 2	Moonset 3	Moonset 4
°	h m	h m	h m	h m	h m	h m	h m
N 72	▬	13 29	15 46	11 37	11 19	10 40	▬
N 70	▬	14 21	16 04	11 57	11 51	11 43	11 30
68	▬	14 53	16 19	12 12	12 14	12 19	12 30
66	13 42	15 16	16 32	12 25	12 32	12 44	13 05
64	14 20	15 35	16 42	12 35	12 47	13 04	13 30
62	14 46	15 50	16 51	12 44	13 00	13 20	13 49
60	15 07	16 03	16 59	12 52	13 10	13 34	14 06
N 58	15 23	16 14	17 06	12 59	13 20	13 46	14 19
56	15 37	16 24	17 13	13 05	13 28	13 56	14 31
54	15 50	16 33	17 19	13 11	13 35	14 05	14 41
52	16 00	16 41	17 24	13 16	13 42	14 13	14 51
50	16 10	16 48	17 29	13 20	13 48	14 20	14 59
45	16 30	17 04	17 41	13 30	14 00	14 35	15 16
N 40	16 46	17 17	17 51	13 38	14 11	14 48	15 31
35	17 00	17 28	18 00	13 45	14 20	14 59	15 43
30	17 12	17 38	18 08	13 51	14 28	15 09	15 54
20	17 33	17 57	18 24	14 02	14 42	15 25	16 12
N 10	17 51	18 14	18 40	14 11	14 54	15 39	16 28
0	18 08	18 30	18 56	14 20	15 05	15 53	16 43
S 10	18 25	18 48	19 15	14 29	15 17	16 06	16 58
20	18 43	19 08	19 37	14 38	15 29	16 21	17 14
30	19 05	19 32	20 05	14 49	15 43	16 37	17 32
35	19 18	19 47	20 23	14 56	15 51	16 47	17 43
40	19 32	20 05	20 46	15 03	16 00	16 58	17 55
45	19 50	20 27	21 15	15 11	16 11	17 11	18 09
S 50	20 12	20 55	21 59	15 21	16 24	17 27	18 27
52	20 22	21 10	22 24	15 26	16 30	17 34	18 35
54	20 34	21 27	23 03	15 31	16 37	17 42	18 45
56	20 47	21 48	////	15 37	16 45	17 52	18 55
58	21 03	22 15	////	15 43	16 53	18 02	19 07
S 60	21 23	22 57	////	15 51	17 03	18 14	19 21

Day	SUN Eqn. of Time 00ʰ	SUN Eqn. of Time 12ʰ	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
	m s	m s	h m	h m	h m	d	
1	03 24	03 38	12 04	08 10	20 32	25	
2	03 52	04 06	12 04	08 54	21 17	26	◑
3	04 20	04 34	12 05	09 41	22 06	27	

G.M.T.	ARIES	VENUS −3.4		MARS +1.4		JUPITER −1.6		SATURN +1.0		STARS		
	G.H.A.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.	Name	S.H.A.	Dec.
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	° ′
4 00	103 30.8	203 22.4	S22 23.5	157 45.0	S20 32.5	274 04.3	S 2 38.1	273 46.3	S 1 37.3	Acamar	315 36.9	S40 23.2
01	118 33.3	218 21.5	23.8	172 45.4	32.1	289 06.6	38.1	288 48.7	37.3	Achernar	335 45.0	S57 20.4
02	133 35.8	233 20.6	24.1	187 45.8	31.6	304 08.9	38.2	303 51.1	37.3	Acrux	173 36.8	S62 59.3
03	148 38.2	248 19.7	·· 24.4	202 46.2	·· 31.1	319 11.2	·· 38.2	318 53.5	·· 37.4	Adhara	255 31.6	S28 56.8
04	163 40.7	263 18.8	24.8	217 46.7	30.7	334 13.5	38.3	333 55.9	37.4	Aldebaran	291 17.5	N16 28.2
05	178 43.2	278 17.9	25.1	232 47.1	30.2	349 15.8	38.3	348 58.3	37.4			
06	193 45.6	293 17.0	S22 25.4	247 47.5	S20 29.8	4 18.2	S 2 38.4	4 00.7	S 1 37.4	Alioth	166 42.4	N56 03.6
07	208 48.1	308 16.1	25.7	262 47.9	29.3	19 20.5	38.4	19 03.1	37.4	Alkaid	153 18.5	N49 24.3
08	223 50.6	323 15.2	26.0	277 48.4	28.8	34 22.8	38.5	34 05.5	37.4	Al Na'ir	28 15.0	S47 03.4
S 09	238 53.0	338 14.3	·· 26.3	292 48.8	·· 28.4	49 25.1	·· 38.5	49 07.9	·· 37.4	Alnilam	276 11.1	S 1 12.9
U 10	253 55.5	353 13.4	26.6	307 49.2	27.9	64 27.4	38.6	64 10.3	37.5	Alphard	218 20.1	S 8 34.6
N 11	268 58.0	8 12.5	26.9	322 49.7	27.4	79 29.7	38.6	79 12.7	37.5			
D 12	284 00.4	23 11.6	S22 27.2	337 50.1	S20 27.0	94 32.0	S 2 38.7	94 15.1	S 1 37.5	Alphecca	126 32.2	N26 46.7
A 13	299 02.9	38 10.7	27.5	352 50.5	26.5	109 34.4	38.7	109 17.5	37.5	Alpheratz	358 09.2	N28 59.2
Y 14	314 05.3	53 09.8	27.8	7 50.9	26.1	124 36.7	38.8	124 19.9	37.5	Altair	62 32.7	N 8 49.1
15	329 07.8	68 08.9	·· 28.1	22 51.4	·· 25.6	139 39.0	·· 38.8	139 22.3	·· 37.5	Ankaa	353 40.1	S42 24.9
16	344 10.3	83 08.0	28.4	37 51.8	25.1	154 41.3	38.9	154 24.7	37.5	Antares	112 56.9	S26 23.3
17	359 12.7	98 07.1	28.7	52 52.2	24.7	169 43.6	38.9	169 27.1	37.6			
18	14 15.2	113 06.2	S22 29.0	67 52.6	S20 24.2	184 45.9	S 2 39.0	184 29.5	S 1 37.6	Arcturus	146 18.4	N19 16.8
19	29 17.7	128 05.3	29.3	82 53.1	23.7	199 48.3	39.0	199 31.9	37.6	Atria	108 21.5	S68 59.4
20	44 20.1	143 04.3	29.6	97 53.5	23.3	214 50.6	39.1	214 34.3	37.6	Avior	234 27.5	S59 26.8
21	59 22.6	158 03.4	·· 29.9	112 53.9	·· 22.8	229 52.9	·· 39.1	229 36.7	·· 37.6	Bellatrix	278 58.2	N 6 19.9
22	74 25.1	173 02.5	30.2	127 54.3	22.3	244 55.2	39.2	244 39.1	37.6	Betelgeuse	271 27.7	N 7 24.1
23	89 27.5	188 01.6	30.5	142 54.8	21.9	259 57.5	39.2	259 41.5	37.6			
5 00	104 30.0	203 00.7	S22 30.8	157 55.2	S20 21.4	274 59.9	S 2 39.3	274 43.9	S 1 37.6	Canopus	264 06.6	S52 41.3
01	119 32.5	217 59.8	31.1	172 55.6	20.9	290 02.2	39.3	289 46.3	37.7	Capella	281 10.5	N45 58.8
02	134 34.9	232 58.9	31.4	187 56.1	20.5	305 04.5	39.4	304 48.7	37.7	Deneb	49 48.7	N45 12.8
03	149 37.4	247 58.0	·· 31.6	202 56.5	·· 20.0	320 06.8	·· 39.4	319 51.1	·· 37.7	Denebola	182 58.8	N14 40.7
04	164 39.8	262 57.1	31.9	217 56.9	19.5	335 09.1	39.5	334 53.6	37.7	Diphda	349 20.7	S18 05.7
05	179 42.3	277 56.2	32.2	232 57.3	19.1	350 11.4	39.5	349 56.0	37.7			
06	194 44.8	292 55.3	S22 32.5	247 57.8	S20 18.6	5 13.8	S 2 39.6	4 58.4	S 1 37.7	Dubhe	194 21.6	N61 51.0
07	209 47.2	307 54.4	32.8	262 58.2	18.1	20 16.1	39.6	20 00.8	37.7	Elnath	278 43.5	N28 35.5
08	224 49.7	322 53.5	33.1	277 58.6	17.6	35 18.4	39.7	35 03.2	37.8	Eltanin	90 58.2	N51 29.5
M 09	239 52.2	337 52.5	·· 33.3	292 59.1	·· 17.2	50 20.7	·· 39.7	50 05.6	·· 37.8	Enif	34 11.6	N 9 47.2
O 10	254 54.6	352 51.6	33.6	307 59.5	16.7	65 23.1	39.8	65 08.0	37.8	Fomalhaut	15 51.4	S29 43.6
N 11	269 57.1	7 50.7	33.9	322 59.9	16.2	80 25.4	39.8	80 10.4	37.8			
D 12	284 59.6	22 49.8	S22 34.2	338 00.4	S20 15.8	95 27.7	S 2 39.9	95 12.8	S 1 37.8	Gacrux	172 28.4	S57 00.1
A 13	300 02.0	37 48.9	34.4	353 00.8	15.3	110 30.0	39.9	110 15.2	37.8	Gienah	176 17.7	S17 26.0
Y 14	315 04.5	52 48.0	34.7	8 01.2	14.8	125 32.3	40.0	125 17.6	37.8	Hadar	149 23.2	S60 16.5
15	330 07.0	67 47.1	·· 35.0	23 01.6	·· 14.3	140 34.7	·· 40.0	140 20.0	·· 37.8	Hamal	328 28.6	N23 22.4
16	345 09.4	82 46.2	35.3	38 02.1	13.9	155 37.0	40.1	155 22.4	37.9	Kaus Aust.	84 17.0	S34 23.6
17	0 11.9	97 45.3	35.5	53 02.5	13.4	170 39.3	40.1	170 24.8	37.9			
18	15 14.3	112 44.4	S22 35.8	68 02.9	S20 12.9	185 41.6	S 2 40.2	185 27.2	S 1 37.9	Kochab	137 19.7	N74 13.8
19	30 16.8	127 43.4	36.1	83 03.4	12.4	200 44.0	40.2	200 29.6	37.9	Markab	14 03.1	N15 06.2
20	45 19.3	142 42.5	36.3	98 03.8	12.0	215 46.3	40.3	215 32.0	37.9	Menkar	314 40.7	N 4 00.8
21	60 21.7	157 41.6	·· 36.6	113 04.2	·· 11.5	230 48.6	·· 40.3	230 34.4	·· 37.9	Menkent	148 36.9	S36 16.3
22	75 24.2	172 40.7	36.9	128 04.7	11.0	245 50.9	40.4	245 36.8	37.9	Miaplacidus	221 44.0	S69 38.2
23	90 26.7	187 39.8	37.1	143 05.1	10.5	260 53.3	40.4	260 39.2	37.9			
6 00	105 29.1	202 38.9	S22 37.4	158 05.5	S20 10.1	275 55.6	S 2 40.5	275 41.7	S 1 37.9	Mirfak	309 15.5	N49 47.7
01	120 31.6	217 38.0	37.6	173 06.0	09.6	290 57.9	40.5	290 44.1	38.0	Nunki	76 29.3	S26 19.2
02	135 34.1	232 37.1	37.9	188 06.4	09.1	306 00.2	40.5	305 46.5	38.0	Peacock	53 58.7	S56 47.9
03	150 36.5	247 36.1	·· 38.2	203 06.8	·· 08.6	321 02.6	·· 40.6	320 48.9	·· 38.0	Pollux	243 57.6	N28 04.3
04	165 39.0	262 35.2	38.4	218 07.3	08.1	336 04.9	40.6	335 51.3	38.0	Procyon	245 25.2	N 5 16.4
05	180 41.4	277 34.3	38.7	233 07.7	07.7	351 07.2	40.7	350 53.7	38.0			
06	195 43.9	292 33.4	S22 38.9	248 08.1	S20 07.2	6 09.5	S 2 40.7	5 56.1	S 1 38.0	Rasalhague	96 29.7	N12 34.4
07	210 46.4	307 32.5	39.2	263 08.6	06.7	21 11.9	40.8	20 58.5	38.0	Regulus	208 09.6	N12 03.6
08	225 48.8	322 31.6	39.4	278 09.0	06.2	36 14.2	40.8	36 00.9	38.0	Rigel	281 35.5	S 8 13.5
T 09	240 51.3	337 30.7	·· 39.7	293 09.4	·· 05.7	51 16.5	·· 40.9	51 03.3	·· 38.0	Rigil Kent.	140 25.8	S60 45.0
U 10	255 53.8	352 29.7	39.9	308 09.9	05.3	66 18.9	40.9	66 05.7	38.1	Sabik	102 41.2	S15 42.0
E 11	270 56.2	7 28.8	40.2	323 10.3	04.8	81 21.2	41.0	81 08.1	38.1			
S 12	285 58.7	22 27.9	S22 40.4	338 10.7	S20 04.3	96 23.5	S 2 41.0	96 10.6	S 1 38.1	Schedar	350 08.8	N56 26.2
D 13	301 01.2	37 27.0	40.7	353 11.2	03.8	111 25.8	41.1	111 13.0	38.1	Shaula	96 55.9	S37 05.3
A 14	316 03.6	52 26.1	40.9	8 11.6	03.3	126 28.2	41.1	126 15.4	38.1	Sirius	258 55.2	S16 41.5
Y 15	331 06.1	67 25.2	·· 41.2	23 12.0	·· 02.8	141 30.5	·· 41.1	141 17.8	·· 38.1	Spica	158 57.4	S11 03.6
16	346 08.6	82 24.2	41.4	38 12.5	02.4	156 32.8	41.2	156 20.2	38.1	Suhail	223 10.2	S43 21.2
17	1 11.0	97 23.3	41.6	53 12.9	01.9	171 35.2	41.2	171 22.6	38.1			
18	16 13.5	112 22.4	S22 41.9	68 13.3	S20 01.4	186 37.5	S 2 41.3	186 25.0	S 1 38.1	Vega	80 56.1	N38 46.0
19	31 15.9	127 21.5	42.1	83 13.8	00.9	201 39.8	41.3	201 27.4	38.2	Zuben'ubi	137 33.0	S15 57.6
20	46 18.4	142 20.6	42.4	98 14.2	20 00.4	216 42.2	41.4	216 29.8	38.2		S.H.A.	Mer. Pass.
21	61 20.9	157 19.7	·· 42.6	113 14.6	19 59.9	231 44.5	·· 41.4	231 32.2	·· 38.2		° ′	h m
22	76 23.3	172 18.7	42.8	128 15.1	59.5	246 46.8	41.5	246 34.7	38.2	Venus	98 30.7	10 29
23	91 25.8	187 17.8	43.1	143 15.5	59.0	261 49.1	41.5	261 37.1	38.2	Mars	53 25.2	13 28
	h m									Jupiter	170 29.9	5 39
Mer. Pass.	16 59.2	v −0.9	d 0.3	v 0.4	d 0.5	v 2.3	d 0.0	v 2.4	d 0.0	Saturn	170 14.0	5 40

G.M.T.	SUN G.H.A.	SUN Dec.	MOON G.H.A.	v	MOON Dec.	d	MOON H.P.
d h	° ′	° ′	° ′	′	° ′	′	′
4 00	178 47.9	S22 45.0	207 40.4	11.0	S18 31.8	4.7	55.3
01	193 47.6	44.8	222 10.4	11.0	18 36.5	4.5	55.4
02	208 47.3	44.5	236 40.4	10.9	18 41.0	4.4	55.4
03	223 47.0	44.2	251 10.3	10.9	18 45.4	4.3	55.4
04	238 46.7	44.0	265 40.2	10.8	18 49.7	4.3	55.4
05	253 46.4	43.7	280 10.0	10.8	18 54.0	4.2	55.4
06	268 46.2	S22 43.5	294 39.8	10.7	S18 58.2	4.0	55.5
07	283 45.9	43.2	309 09.5	10.7	19 02.2	4.0	55.5
08	298 45.6	42.9	323 39.2	10.6	19 06.2	3.9	55.5
S 09	313 45.3	42.7	338 08.8	10.5	19 10.1	3.8	55.5
U 10	328 45.0	42.4	352 38.3	10.5	19 13.9	3.7	55.6
N 11	343 44.7	42.1	7 07.8	10.5	19 17.6	3.6	55.6
D 12	358 44.4	S22 41.9	21 37.3	10.3	S19 21.2	3.5	55.6
A 13	13 44.2	41.6	36 06.6	10.4	19 24.7	3.4	55.6
Y 14	28 43.9	41.3	50 36.0	10.3	19 28.1	3.3	55.6
15	43 43.6	41.1	65 05.3	10.2	19 31.4	3.2	55.7
16	58 43.3	40.8	79 34.5	10.2	19 34.6	3.1	55.7
17	73 43.0	40.5	94 03.7	10.1	19 37.7	3.0	55.7
18	88 42.7	S22 40.3	108 32.8	10.1	S19 40.7	2.9	55.7
19	103 42.5	40.0	123 01.9	10.1	19 43.6	2.8	55.8
20	118 42.2	39.7	137 31.0	10.0	19 46.4	2.8	55.8
21	133 41.9	39.4	152 00.0	9.9	19 49.2	2.6	55.8
22	148 41.6	39.2	166 28.9	9.9	19 51.8	2.5	55.8
23	163 41.3	38.9	180 57.8	9.9	19 54.3	2.4	55.8
5 00	178 41.1	S22 38.6	195 26.7	9.8	S19 56.7	2.3	55.9
01	193 40.8	38.3	209 55.5	9.7	19 59.0	2.2	55.9
02	208 40.5	38.1	224 24.2	9.8	20 01.2	2.1	55.9
03	223 40.2	37.8	238 53.0	9.6	20 03.3	2.0	55.9
04	238 39.9	37.5	253 21.6	9.7	20 05.3	1.8	56.0
05	253 39.6	37.2	267 50.3	9.5	20 07.1	1.8	56.0
06	268 39.4	S22 37.0	282 18.8	9.6	S20 08.9	1.7	56.0
07	283 39.1	36.7	296 47.4	9.5	20 10.6	1.6	56.0
08	298 38.8	36.4	311 15.9	9.5	20 12.2	1.4	56.1
M 09	313 38.5	36.1	325 44.4	9.4	20 13.6	1.4	56.1
O 10	328 38.2	35.8	340 12.8	9.4	20 15.0	1.2	56.1
N 11	343 38.0	35.5	354 41.2	9.3	20 16.2	1.1	56.1
D 12	358 37.7	S22 35.3	9 09.5	9.3	S20 17.3	1.1	56.1
A 13	13 37.4	35.0	23 37.8	9.3	20 18.4	0.9	56.2
Y 14	28 37.1	34.7	38 06.1	9.3	20 19.3	0.8	56.2
15	43 36.9	34.4	52 34.4	9.2	20 20.1	0.7	56.2
16	58 36.6	34.1	67 02.6	9.1	20 20.8	0.5	56.2
17	73 36.3	33.8	81 30.7	9.2	20 21.3	0.5	56.3
18	88 36.0	S22 33.5	95 58.9	9.1	S20 21.8	0.4	56.3
19	103 35.7	33.2	110 27.0	9.1	20 22.2	0.2	56.3
20	118 35.5	32.9	124 55.1	9.0	20 22.4	0.2	56.3
21	133 35.2	32.7	139 23.1	9.0	20 22.6	0.0	56.4
22	148 34.9	32.4	153 51.1	9.0	20 22.6	0.1	56.4
23	163 34.6	32.1	168 19.1	9.0	20 22.5	0.2	56.4
6 00	178 34.4	S22 31.8	182 47.1	8.9	S20 22.3	0.3	56.4
01	193 34.1	31.5	197 15.0	8.9	20 22.0	0.4	56.4
02	208 33.8	31.2	211 42.9	8.9	20 21.6	0.6	56.5
03	223 33.5	30.9	226 10.8	8.8	20 21.0	0.6	56.5
04	238 33.2	30.6	240 38.6	8.9	20 20.4	0.8	56.5
05	253 33.0	30.3	255 06.5	8.8	20 19.6	0.9	56.5
06	268 32.7	S22 30.0	269 34.3	8.8	S20 18.7	1.0	56.6
07	283 32.4	29.7	284 02.1	8.7	20 17.7	1.1	56.6
08	298 32.1	29.4	298 29.8	8.8	20 16.6	1.2	56.6
T 09	313 31.9	29.1	312 57.6	8.7	20 15.4	1.4	56.6
U 10	328 31.6	28.8	327 25.3	8.7	20 14.0	1.4	56.7
E 11	343 31.3	28.5	341 53.0	8.7	20 12.6	1.6	56.7
S 12	358 31.0	S22 28.2	356 20.7	8.7	S20 11.0	1.7	56.7
D 13	13 30.8	27.9	10 48.4	8.7	20 09.3	1.8	56.7
A 14	28 30.5	27.6	25 16.1	8.6	20 07.5	1.9	56.7
Y 15	43 30.2	27.3	39 43.7	8.7	20 05.6	2.0	56.8
16	58 29.9	27.0	54 11.4	8.6	20 03.6	2.2	56.8
17	73 29.7	26.6	68 39.0	8.6	20 01.4	2.2	56.8
18	88 29.4	S22 26.3	83 06.6	8.6	S19 59.2	2.4	56.8
19	103 29.1	26.0	97 34.2	8.6	19 56.8	2.5	56.9
20	118 28.9	25.7	112 01.8	8.6	19 54.3	2.6	56.9
21	133 28.6	25.4	126 29.4	8.6	19 51.7	2.7	56.9
22	148 28.3	25.1	140 57.0	8.6	19 49.0	2.9	56.9
23	163 28.0	24.8	155 24.6	8.6	19 46.1	2.9	56.9
	S.D. 16.3	d 0.3	S.D. 15.1		15.3		15.4

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 4	Moonrise 5	Moonrise 6	Moonrise 7
°	h m	h m	h m	h m	h m	h m	h m
N 72	08 20	10 30	▬	▬	▬	▬	▬
N 70	08 02	09 43	▬	09 25	▬	▬	11 55
68	07 47	09 12	11 30	08 25	09 45	10 38	11 02
66	07 35	08 50	10 20	07 51	09 03	09 56	10 29
64	07 25	08 32	09 45	07 26	08 34	09 27	10 05
62	07 16	08 17	09 20	07 07	08 12	09 06	09 46
60	07 08	08 04	09 00	06 51	07 54	08 48	09 30
N 58	07 01	07 53	08 44	06 37	07 40	08 33	09 17
56	06 55	07 43	08 30	06 26	07 27	08 21	09 06
54	06 49	07 35	08 18	06 16	07 16	08 10	08 55
52	06 44	07 27	08 07	06 07	07 06	08 00	08 46
50	06 39	07 20	07 58	05 59	06 57	07 51	08 38
45	06 28	07 05	07 38	05 42	06 39	07 33	08 21
N 40	06 18	06 52	07 22	05 28	06 24	07 17	08 07
35	06 09	06 41	07 09	05 16	06 11	07 05	07 55
30	06 01	06 31	06 57	05 06	06 00	06 54	07 44
20	05 45	06 13	06 36	04 48	05 41	06 34	07 26
N 10	05 30	05 56	06 19	04 33	05 25	06 18	07 11
0	05 13	05 39	06 02	04 18	05 09	06 02	06 56
S 10	04 55	05 22	05 45	04 04	04 54	05 47	06 41
20	04 33	05 02	05 27	03 49	04 38	05 30	06 26
30	04 05	04 38	05 05	03 32	04 19	05 11	06 08
35	03 47	04 23	04 53	03 21	04 08	05 00	05 57
40	03 25	04 06	04 38	03 10	03 56	04 47	05 45
45	02 56	03 44	04 21	02 56	03 41	04 32	05 31
S 50	02 14	03 16	04 00	02 40	03 23	04 14	05 13
52	01 49	03 02	03 49	02 32	03 14	04 05	05 05
54	01 13	02 45	03 38	02 24	03 05	03 56	04 56
56	////	02 25	03 24	02 14	02 54	03 45	04 46
58	////	01 58	03 09	02 03	02 42	03 32	04 34
S 60	////	01 19	02 50	01 51	02 28	03 17	04 20

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 4	Moonset 5	Moonset 6	Moonset 7
°	h m	h m	h m	h m	h m	h m	h m
N 72	▬	13 42	15 52	▬	▬	▬	▬
N 70	▬	14 29	16 10	11 30	▬	▬	14 30
68	12 42	14 59	16 24	12 30	12 57	13 55	15 23
66	13 51	15 22	16 36	13 05	13 40	14 37	15 55
64	14 27	15 40	16 46	13 30	14 09	15 05	16 19
62	14 52	15 55	16 55	13 49	14 31	15 27	16 38
60	15 11	16 07	17 03	14 06	14 48	15 44	16 53
N 58	15 28	16 18	17 10	14 19	15 03	15 59	17 06
56	15 41	16 28	17 16	14 31	15 16	16 11	17 17
54	15 53	16 36	17 22	14 41	15 27	16 22	17 27
52	16 04	16 44	17 27	14 51	15 37	16 32	17 36
50	16 13	16 51	17 32	14 59	15 46	16 41	17 44
45	16 33	17 06	17 43	15 16	16 04	16 59	18 00
N 40	16 49	17 19	17 53	15 31	16 19	17 14	18 14
35	17 03	17 30	18 02	15 43	16 32	17 27	18 26
30	17 14	17 41	18 10	15 54	16 43	17 38	18 36
20	17 35	17 59	18 26	16 12	17 02	17 56	18 53
N 10	17 52	18 15	18 41	16 28	17 19	18 13	19 08
0	18 09	18 32	18 58	16 43	17 35	18 28	19 22
S 10	18 26	18 49	19 16	16 58	17 50	18 43	19 36
20	18 44	19 09	19 38	17 14	18 07	18 59	19 51
30	19 05	19 33	20 06	17 32	18 26	19 18	20 07
35	19 18	19 47	20 23	17 43	18 37	19 29	20 17
40	19 32	20 05	20 45	17 55	18 50	19 41	20 28
45	19 49	20 26	21 14	18 09	19 05	19 56	20 42
S 50	20 11	20 54	21 56	18 27	19 23	20 14	20 57
52	20 21	21 08	22 21	18 35	19 32	20 22	21 05
54	20 33	21 25	22 56	18 45	19 42	20 31	21 13
56	20 46	21 45	////	18 55	19 53	20 42	21 22
58	21 01	22 11	////	19 07	20 05	20 54	21 33
S 60	21 20	22 49	////	19 21	20 20	21 08	21 45

Day	SUN Eqn. of Time 00ʰ	SUN Eqn. of Time 12ʰ	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
	m s	m s	h m	h m	h m	d	
4	04 48	05 02	12 05	10 30	22 56	28	
5	05 15	05 29	12 05	11 22	23 48	29	●
6	05 42	05 55	12 06	12 15	24 42	00	

G.M.T.	ARIES	VENUS −3.4		MARS +1.4		JUPITER −1.7		SATURN +1.0	
	G.H.A.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
7 00	106 28.3	202 16.9	S22 43.3	158 16.0	S19 58.5	276 51.5	S 2 41.5	276 39.5	S 1 38.2
01	121 30.7	217 16.0	43.5	173 16.4	58.0	291 53.8	41.6	291 41.9	38.2
02	136 33.2	232 15.1	43.8	188 16.8	57.5	306 56.1	41.6	306 44.3	38.2
03	151 35.7	247 14.2	·· 44.0	203 17.3	·· 57.0	321 58.5	·· 41.7	321 46.7	·· 38.2
04	166 38.1	262 13.2	44.2	218 17.7	56.5	337 00.8	41.7	336 49.1	38.2
05	181 40.6	277 12.3	44.4	233 18.1	56.0	352 03.1	41.8	351 51.5	38.2
06	196 43.1	292 11.4	S22 44.7	248 18.6	S19 55.6	7 05.5	S 2 41.8	6 53.9	S 1 38.3
07	211 45.5	307 10.5	44.9	263 19.0	55.1	22 07.8	41.9	21 56.4	38.3
W 08	226 48.0	322 09.6	45.1	278 19.4	54.6	37 10.1	41.9	36 58.8	38.3
E 09	241 50.4	337 08.6	·· 45.3	293 19.9	·· 54.1	52 12.5	·· 41.9	52 01.2	·· 38.3
D 10	256 52.9	352 07.7	45.6	308 20.3	53.6	67 14.8	42.0	67 03.6	38.3
N 11	271 55.4	7 06.8	45.8	323 20.8	53.1	82 17.2	42.0	82 06.0	38.3
E 12	286 57.8	22 05.9	S22 46.0	338 21.2	S19 52.6	97 19.5	S 2 42.1	97 08.4	S 1 38.3
S 13	302 00.3	37 05.0	46.2	353 21.6	52.1	112 21.8	42.1	112 10.8	38.3
D 14	317 02.8	52 04.0	46.4	8 22.1	51.6	127 24.2	42.1	127 13.2	38.3
A 15	332 05.2	67 03.1	·· 46.7	23 22.5	·· 51.1	142 26.5	·· 42.2	142 15.7	·· 38.3
Y 16	347 07.7	82 02.2	46.9	38 23.0	50.7	157 28.8	42.2	157 18.1	38.3
17	2 10.2	97 01.3	47.1	53 23.4	50.2	172 31.2	42.3	172 20.5	38.4
18	17 12.6	112 00.4	S22 47.3	68 23.8	S19 49.7	187 33.5	S 2 42.3	187 22.9	S 1 38.4
19	32 15.1	126 59.4	47.5	83 24.3	49.2	202 35.8	42.4	202 25.3	38.4
20	47 17.5	141 58.5	47.7	98 24.7	48.7	217 38.2	42.4	217 27.7	38.4
21	62 20.0	156 57.6	·· 47.9	113 25.2	·· 48.2	232 40.5	·· 42.4	232 30.1	·· 38.4
22	77 22.5	171 56.7	48.1	128 25.6	47.7	247 42.9	42.5	247 32.6	38.4
23	92 24.9	186 55.7	48.3	143 26.0	47.2	262 45.2	42.5	262 35.0	38.4
8 00	107 27.4	201 54.8	S22 48.5	158 26.5	S19 46.7	277 47.5	S 2 42.6	277 37.4	S 1 38.4
01	122 29.9	216 53.9	48.7	173 26.9	46.2	292 49.9	42.6	292 39.8	38.4
02	137 32.3	231 53.0	48.9	188 27.4	45.7	307 52.2	42.6	307 42.2	38.4
03	152 34.8	246 52.0	·· 49.1	203 27.8	·· 45.2	322 54.6	·· 42.7	322 44.6	·· 38.4
04	167 37.3	261 51.1	49.3	218 28.2	44.7	337 56.9	42.7	337 47.0	38.4
05	182 39.7	276 50.2	49.5	233 28.7	44.2	352 59.2	42.8	352 49.5	38.4
06	197 42.2	291 49.3	S22 49.7	248 29.1	S19 43.7	8 01.6	S 2 42.8	7 51.9	S 1 38.5
07	212 44.7	306 48.4	49.9	263 29.6	43.2	23 03.9	42.9	22 54.3	38.5
T 08	227 47.1	321 47.4	50.1	278 30.0	42.7	38 06.3	42.9	37 56.7	38.5
H 09	242 49.6	336 46.5	·· 50.3	293 30.4	·· 42.2	53 08.6	·· 42.9	52 59.1	·· 38.5
U 10	257 52.0	351 45.6	50.5	308 30.9	41.7	68 10.9	43.0	68 01.5	38.5
R 11	272 54.5	6 44.7	50.7	323 31.3	41.2	83 13.3	43.0	83 04.0	38.5
S 12	287 57.0	21 43.7	S22 50.9	338 31.8	S19 40.7	98 15.6	S 2 43.1	98 06.4	S 1 38.5
D 13	302 59.4	36 42.8	51.1	353 32.2	40.2	113 18.0	43.1	113 08.8	38.5
A 14	318 01.9	51 41.9	51.3	8 32.7	39.7	128 20.3	43.1	128 11.2	38.5
Y 15	333 04.4	66 41.0	·· 51.5	23 33.1	·· 39.2	143 22.7	·· 43.2	143 13.6	·· 38.5
16	348 06.8	81 40.0	51.6	38 33.5	38.7	158 25.0	43.2	158 16.0	38.5
17	3 09.3	96 39.1	51.8	53 34.0	38.2	173 27.3	43.2	173 18.5	38.5
18	18 11.8	111 38.2	S22 52.0	68 34.4	S19 37.7	188 29.7	S 2 43.3	188 20.9	S 1 38.5
19	33 14.2	126 37.3	52.2	83 34.9	37.2	203 32.0	43.3	203 23.3	38.5
20	48 16.7	141 36.3	52.4	98 35.3	36.7	218 34.4	43.4	218 25.7	38.6
21	63 19.2	156 35.4	·· 52.6	113 35.8	·· 36.2	233 36.7	·· 43.4	233 28.1	·· 38.6
22	78 21.6	171 34.5	52.7	128 36.2	35.7	248 39.1	43.4	248 30.6	38.6
23	93 24.1	186 33.5	52.9	143 36.6	35.2	263 41.4	43.5	263 33.0	38.6
9 00	108 26.5	201 32.6	S22 53.1	158 37.1	S19 34.7	278 43.8	S 2 43.5	278 35.4	S 1 38.6
01	123 29.0	216 31.7	53.3	173 37.5	34.2	293 46.1	43.6	293 37.8	38.6
02	138 31.5	231 30.8	53.4	188 38.0	33.7	308 48.5	43.6	308 40.2	38.6
03	153 33.9	246 29.8	·· 53.6	203 38.4	·· 33.2	323 50.8	·· 43.6	323 42.7	·· 38.6
04	168 36.4	261 28.9	53.8	218 38.9	32.7	338 53.2	43.7	338 45.1	38.6
05	183 38.9	276 28.0	53.9	233 39.3	32.2	353 55.5	43.7	353 47.5	38.6
06	198 41.3	291 27.1	S22 54.1	248 39.8	S19 31.7	8 57.8	S 2 43.7	8 49.9	S 1 38.6
07	213 43.8	306 26.1	54.3	263 40.2	31.1	24 00.2	43.8	23 52.3	38.6
08	228 46.3	321 25.2	54.4	278 40.7	30.6	39 02.5	43.8	38 54.8	38.6
F 09	243 48.7	336 24.3	·· 54.6	293 41.1	·· 30.1	54 04.9	·· 43.9	53 57.2	·· 38.6
R 10	258 51.2	351 23.3	54.8	308 41.5	29.6	69 07.2	43.9	68 59.6	38.6
I 11	273 53.6	6 22.4	54.9	323 42.0	29.1	84 09.6	43.9	84 02.0	38.6
D 12	288 56.1	21 21.5	S22 55.1	338 42.4	S19 28.6	99 11.9	S 2 44.0	99 04.4	S 1 38.6
A 13	303 58.6	36 20.6	55.3	353 42.9	28.1	114 14.3	44.0	114 06.9	38.7
Y 14	319 01.0	51 19.6	55.4	8 43.3	27.6	129 16.6	44.0	129 09.3	38.7
15	334 03.5	66 18.7	·· 55.6	23 43.8	·· 27.1	144 19.0	·· 44.1	144 11.7	·· 38.7
16	349 06.0	81 17.8	55.7	38 44.2	26.6	159 21.3	44.1	159 14.1	38.7
17	4 08.4	96 16.8	55.9	53 44.7	26.1	174 23.7	44.1	174 16.5	38.7
18	19 10.9	111 15.9	S22 56.0	68 45.1	S19 25.5	189 26.0	S 2 44.2	189 19.0	S 1 38.7
19	34 13.4	126 15.0	56.2	83 45.6	25.0	204 28.4	44.2	204 21.4	38.7
20	49 15.8	141 14.1	56.3	98 46.0	24.5	219 30.7	44.3	219 23.8	38.7
21	64 18.3	156 13.1	·· 56.5	113 46.5	·· 24.0	234 33.1	·· 44.3	234 26.2	·· 38.7
22	79 20.8	171 12.2	56.6	128 46.9	23.5	249 35.5	44.3	249 28.7	38.7
23	94 23.2	186 11.3	56.8	143 47.4	23.0	264 37.8	44.4	264 31.1	38.7
Mer. Pass.	h m 16 47.4	v −0.9	d 0.2	v 0.4	d 0.5	v 2.3	d 0.0	v 2.4	d 0.0

STARS		
Name	S.H.A.	Dec.
	° ′	° ′
Acamar	315 36.9	S40 23.2
Achernar	335 45.1	S57 20.4
Acrux	173 36.8	S62 59.3
Adhara	255 31.6	S28 56.9
Aldebaran	291 17.5	N16 28.2
Alioth	166 42.3	N56 03.6
Alkaid	153 18.5	N49 24.3
Al Na'ir	28 15.1	S47 03.4
Alnilam	276 11.1	S 1 13.0
Alphard	218 20.1	S 8 34.6
Alphecca	126 32.2	N26 46.7
Alpheratz	358 09.2	N28 59.2
Altair	62 32.7	N 8 49.1
Ankaa	353 40.1	S42 24.9
Antares	112 56.9	S26 23.3
Arcturus	146 18.4	N19 16.8
Atria	108 21.4	S68 59.4
Avior	234 27.4	S59 26.9
Bellatrix	278 58.2	N 6 19.9
Betelgeuse	271 27.7	N 7 24.1
Canopus	264 06.6	S52 41.3
Capella	281 10.5	N45 58.8
Deneb	49 48.7	N45 12.8
Denebola	182 58.7	N14 40.6
Diphda	349 20.7	S18 05.7
Dubhe	194 21.6	N61 51.0
Elnath	278 43.5	N28 35.5
Eltanin	90 58.2	N51 29.4
Enif	34 11.6	N 9 47.2
Fomalhaut	15 51.4	S29 43.6
Gacrux	172 28.4	S57 00.1
Gienah	176 17.7	S17 26.1
Hadar	149 23.2	S60 16.5
Hamal	328 28.6	N23 22.4
Kaus Aust.	84 17.0	S34 23.6
Kochab	137 19.6	N74 13.8
Markab	14 03.1	N15 06.2
Menkar	314 40.7	N 4 00.8
Menkent	148 36.9	S36 16.3
Miaplacidus	221 44.0	S69 38.2
Mirfak	309 15.5	N49 47.7
Nunki	76 29.3	S26 19.2
Peacock	53 58.7	S56 47.9
Pollux	243 57.5	N28 04.3
Procyon	245 25.2	N 5 16.4
Rasalhague	96 29.7	N12 34.4
Regulus	208 09.5	N12 03.6
Rigel	281 35.5	S 8 13.6
Rigil Kent.	140 25.8	S60 45.0
Sabik	102 41.2	S15 42.0
Schedar	350 08.8	N56 26.2
Shaula	96 55.9	S37 05.3
Sirius	258 55.2	S16 41.5
Spica	158 57.3	S11 03.6
Suhail	223 10.2	S43 21.3
Vega	80 56.1	N38 46.0
Zuben'ubi	137 33.0	S15 57.6

	S.H.A.	Mer. Pass.
	° ′	h m
Venus	94 27.4	10 33
Mars	50 59.1	13 26
Jupiter	170 20.1	5 28
Saturn	170 10.0	5 29

G.M.T.	SUN G.H.A.	SUN Dec.	MOON G.H.A.	v	MOON Dec.	d	MOON H.P.
d h	° ′	° ′	° ′	′	° ′	′	′
7 00	178 27.8	S22 24.5	169 52.2	8.5	S19 43.2	3.1	57.0
01	193 27.5	24.2	184 19.7	8.6	19 40.1	3.2	57.0
02	208 27.2	23.8	198 47.3	8.5	19 36.9	3.3	57.0
03	223 26.9	·· 23.5	213 14.8	8.6	19 33.6	3.4	57.0
04	238 26.7	23.2	227 42.4	8.6	19 30.2	3.5	57.1
05	253 26.4	22.9	242 10.0	8.5	19 26.7	3.6	57.1
06	268 26.1	S22 22.6	256 37.5	8.6	S19 23.1	3.8	57.1
W 07	283 25.9	22.3	271 05.1	8.5	19 19.3	3.8	57.1
E 08	298 25.6	21.9	285 32.6	8.6	19 15.5	4.0	57.1
D 09	313 25.3	·· 21.6	300 00.2	8.6	19 11.5	4.1	57.2
N 10	328 25.1	21.3	314 27.8	8.5	19 07.4	4.2	57.2
E 11	343 24.8	21.0	328 55.3	8.6	19 03.2	4.3	57.2
S 12	358 24.5	S22 20.7	343 22.9	8.6	S18 58.9	4.4	57.2
D 13	13 24.2	20.3	357 50.5	8.6	18 54.5	4.6	57.3
A 14	28 24.0	20.0	12 18.1	8.6	18 49.9	4.6	57.3
Y 15	43 23.7	·· 19.7	26 45.7	8.6	18 45.3	4.8	57.3
16	58 23.4	19.4	41 13.3	8.6	18 40.5	4.9	57.3
17	73 23.2	19.0	55 40.9	8.6	18 35.6	4.9	57.3
18	88 22.9	S22 18.7	70 08.5	8.6	S18 30.7	5.1	57.4
19	103 22.6	18.4	84 36.1	8.7	18 25.6	5.2	57.4
20	118 22.4	18.1	99 03.8	8.6	18 20.4	5.3	57.4
21	133 22.1	·· 17.7	113 31.4	8.7	18 15.1	5.4	57.4
22	148 21.8	17.4	127 59.1	8.7	18 09.7	5.6	57.4
23	163 21.6	17.1	142 26.8	8.7	18 04.1	5.6	57.5
8 00	178 21.3	S22 16.7	156 54.5	8.7	S17 58.5	5.7	57.5
01	193 21.0	16.4	171 22.2	8.7	17 52.8	5.9	57.5
02	208 20.8	16.1	185 49.9	8.8	17 46.9	5.9	57.5
03	223 20.5	·· 15.7	200 17.7	8.7	17 41.0	6.1	57.5
04	238 20.2	15.4	214 45.4	8.8	17 34.9	6.1	57.6
05	253 20.0	15.1	229 13.2	8.8	17 28.8	6.3	57.6
06	268 19.7	S22 14.7	243 41.0	8.8	S17 22.5	6.3	57.6
07	283 19.4	14.4	258 08.8	8.8	17 16.2	6.5	57.6
T 08	298 19.2	14.1	272 36.6	8.9	17 09.7	6.6	57.6
H 09	313 18.9	·· 13.7	287 04.5	8.8	17 03.1	6.6	57.7
U 10	328 18.6	13.4	301 32.3	8.9	16 56.5	6.8	57.7
R 11	343 18.4	13.0	316 00.2	8.9	16 49.7	6.9	57.7
S 12	358 18.1	S22 12.7	330 28.1	9.0	S16 42.8	7.0	57.7
D 13	13 17.9	12.4	344 56.1	8.9	16 35.8	7.0	57.7
A 14	28 17.6	12.0	359 24.0	9.0	16 28.8	7.2	57.8
Y 15	43 17.3	·· 11.7	13 52.0	9.0	16 21.6	7.3	57.8
16	58 17.1	11.3	28 20.0	9.0	16 14.3	7.3	57.8
17	73 16.8	11.0	42 48.0	9.0	16 07.0	7.5	57.8
18	88 16.5	S22 10.6	57 16.0	9.1	S15 59.5	7.5	57.8
19	103 16.3	10.3	71 44.1	9.1	15 52.0	7.7	57.9
20	118 16.0	10.0	86 12.2	9.1	15 44.3	7.7	57.9
21	133 15.8	·· 09.6	100 40.3	9.2	15 36.6	7.9	57.9
22	148 15.5	09.3	115 08.5	9.1	15 28.7	7.9	57.9
23	163 15.2	08.9	129 36.6	9.2	15 20.8	8.0	57.9
9 00	178 15.0	S22 08.6	144 04.8	9.2	S15 12.8	8.1	57.9
01	193 14.7	08.2	158 33.0	9.3	15 04.7	8.2	58.0
02	208 14.4	07.9	173 01.3	9.2	14 56.5	8.3	58.0
03	223 14.2	·· 07.5	187 29.5	9.3	14 48.2	8.4	58.0
04	238 13.9	07.2	201 57.8	9.3	14 39.8	8.4	58.0
05	253 13.7	06.8	216 26.1	9.4	14 31.4	8.6	58.0
06	268 13.4	S22 06.4	230 54.5	9.3	S14 22.8	8.6	58.0
07	283 13.1	06.1	245 22.8	9.4	14 14.2	8.8	58.1
08	298 12.9	05.7	259 51.2	9.4	14 05.4	8.8	58.1
F 09	313 12.6	·· 05.4	274 19.6	9.5	13 56.6	8.8	58.1
R 10	328 12.4	05.0	288 48.1	9.5	13 47.8	9.0	58.1
I 11	343 12.1	04.7	303 16.6	9.5	13 38.8	9.1	58.1
D 12	358 11.9	S22 04.3	317 45.1	9.5	S13 29.7	9.1	58.1
A 13	13 11.6	03.9	332 13.6	9.6	13 20.6	9.2	58.2
Y 14	28 11.3	03.6	346 42.2	9.5	13 11.4	9.3	58.2
15	43 11.1	·· 03.2	1 10.7	9.6	13 02.1	9.4	58.2
16	58 10.8	02.9	15 39.3	9.7	12 52.7	9.4	58.2
17	73 10.6	02.5	30 08.0	9.6	12 43.3	9.5	58.2
18	88 10.3	S22 02.1	44 36.6	9.7	S12 33.8	9.6	58.2
19	103 10.1	01.8	59 05.3	9.7	12 24.2	9.7	58.3
20	118 09.8	01.4	73 34.0	9.8	12 14.5	9.7	58.3
21	133 09.5	·· 01.0	88 02.8	9.7	12 04.8	9.8	58.3
22	148 09.3	00.7	102 31.5	9.8	11 55.0	9.9	58.3
23	163 09.0	00.3	117 00.3	9.8	11 45.1	10.0	58.3
	S.D. 16.3	d 0.3	S.D. 15.6		15.7		15.8

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 7	Moonrise 8	Moonrise 9	Moonrise 10
°	h m	h m	h m	h m	h m	h m	h m
N 72	08 15	10 19	▬	▬	12 32	12 02	11 45
N 70	07 58	09 36	▬	11 55	11 43	11 36	11 31
68	07 44	09 08	11 10	11 02	11 12	11 17	11 19
66	07 33	08 46	10 13	10 29	10 49	11 01	11 09
64	07 23	08 29	09 40	10 05	10 30	10 48	11 00
62	07 14	08 14	09 16	09 46	10 15	10 37	10 53
60	07 07	08 02	08 57	09 30	10 03	10 27	10 47
N 58	07 00	07 51	08 41	09 17	09 52	10 19	10 41
56	06 54	07 42	08 28	09 06	09 42	10 11	10 36
54	06 48	07 34	08 16	08 55	09 33	10 05	10 32
52	06 43	07 26	08 06	08 46	09 26	09 59	10 28
50	06 38	07 19	07 57	08 38	09 19	09 54	10 24
45	06 28	07 04	07 38	08 21	09 04	09 42	10 16
N 40	06 18	06 52	07 22	08 07	08 52	09 32	10 09
35	06 09	06 41	07 09	07 55	08 41	09 24	10 04
30	06 01	06 31	06 57	07 44	08 32	09 17	09 58
20	05 46	06 13	06 37	07 26	08 17	09 04	09 50
N 10	05 31	05 57	06 20	07 11	08 03	08 53	09 42
0	05 15	05 41	06 03	06 56	07 50	08 43	09 34
S 10	04 57	05 24	05 46	06 41	07 37	08 32	09 27
20	04 35	05 04	05 29	06 26	07 23	08 21	09 19
30	04 08	04 41	05 08	06 08	07 07	08 08	09 10
35	03 50	04 26	04 55	05 57	06 58	08 01	09 05
40	03 28	04 09	04 41	05 45	06 47	07 52	08 59
45	03 00	03 48	04 24	05 31	06 35	07 42	08 52
S 50	02 19	03 20	04 03	05 13	06 20	07 30	08 44
52	01 56	03 07	03 53	05 05	06 12	07 25	08 40
54	01 22	02 50	03 42	04 56	06 04	07 19	08 36
56	////	02 31	03 29	04 46	05 56	07 12	08 31
58	////	02 06	03 14	04 34	05 46	07 04	08 26
S 60	////	01 30	02 56	04 20	05 34	06 55	08 20

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 7	Moonset 8	Moonset 9	Moonset 10
°	h m	h m	h m	h m	h m	h m	h m
N 72	▬	13 55	15 59	▬	15 46	18 06	20 11
N 70	▬	14 38	16 16	14 30	16 34	18 31	20 24
68	13 05	15 06	16 30	15 23	17 04	18 49	20 34
66	14 01	15 28	16 42	15 55	17 27	19 04	20 42
64	14 34	15 45	16 51	16 19	17 44	19 16	20 50
62	14 58	16 00	17 00	16 38	17 59	19 26	20 56
60	15 17	16 12	17 07	16 53	18 11	19 35	21 01
N 58	15 33	16 23	17 14	17 06	18 22	19 42	21 05
56	15 46	16 32	17 20	17 17	18 31	19 49	21 10
54	15 58	16 40	17 26	17 27	18 39	19 55	21 13
52	16 08	16 48	17 31	17 36	18 46	20 00	21 17
50	16 17	16 55	17 35	17 44	18 53	20 05	21 20
45	16 36	17 09	17 46	18 00	19 06	20 16	21 26
N 40	16 52	17 22	17 56	18 14	19 18	20 24	21 31
35	17 05	17 33	18 04	18 26	19 28	20 31	21 36
30	17 17	17 43	18 12	18 36	19 36	20 38	21 40
20	17 37	18 00	18 28	18 53	19 51	20 49	21 47
N 10	17 54	18 17	18 43	19 08	20 03	20 59	21 53
0	18 10	18 33	18 59	19 22	20 15	21 08	21 59
S 10	18 27	18 50	19 17	19 36	20 27	21 16	22 04
20	18 45	19 09	19 38	19 51	20 39	21 26	22 10
30	19 06	19 33	20 05	20 07	20 54	21 37	22 17
35	19 18	19 47	20 23	20 17	21 02	21 43	22 21
40	19 32	20 04	20 45	20 28	21 11	21 50	22 25
45	19 49	20 25	21 13	20 42	21 22	21 58	22 30
S 50	20 10	20 52	21 53	20 57	21 35	22 07	22 36
52	20 20	21 06	22 16	21 05	21 41	22 12	22 39
54	20 31	21 22	22 49	21 13	21 48	22 17	22 42
56	20 44	21 42	////	21 22	21 55	22 22	22 45
58	20 59	22 06	////	21 33	22 04	22 28	22 49
S 60	21 17	22 41	////	21 45	22 13	22 35	22 53

Day	SUN Eqn. of Time 00ʰ	SUN Eqn. of Time 12ʰ	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
	m s	m s	h m	h m	h m	d	
7	06 08	06 21	12 06	13 09	00 42	01	
8	06 34	06 47	12 07	14 02	01 36	02	●
9	07 00	07 12	12 07	14 55	02 29	03	

G.M.T.	ARIES	VENUS −3.3		MARS +1.4		JUPITER −1.7		SATURN +1.0	
	G.H.A.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
10 00	109 25.7	201 10.3	S22 56.9	158 47.8	S19 22.5	279 40.2	S 2 44.4	279 33.5	S 1 38.7
01	124 28.1	216 09.4	57.1	173 48.3	22.0	294 42.5	44.4	294 35.9	38.7
02	139 30.6	231 08.5	57.2	188 48.7	21.4	309 44.9	44.5	309 38.4	38.7
03	154 33.1	246 07.5	·· 57.4	203 49.2	·· 20.9	324 47.2	·· 44.5	324 40.8	·· 38.7
04	169 35.5	261 06.6	57.5	218 49.6	20.4	339 49.6	44.5	339 43.2	38.7
05	184 38.0	276 05.7	57.7	233 50.1	19.9	354 51.9	44.6	354 45.6	38.7
06	199 40.5	291 04.8	S22 57.8	248 50.5	S19 19.4	9 54.3	S 2 44.6	9 48.1	S 1 38.7
07	214 42.9	306 03.8	57.9	263 51.0	18.9	24 56.6	44.6	24 50.5	38.7
S 08	229 45.4	321 02.9	58.1	278 51.4	18.3	39 59.0	44.7	39 52.9	38.7
A 09	244 47.9	336 02.0	·· 58.2	293 51.9	·· 17.8	55 01.3	·· 44.7	54 55.3	·· 38.7
T 10	259 50.3	351 01.0	58.3	308 52.3	17.3	70 03.7	44.7	69 57.8	38.7
U 11	274 52.8	6 00.1	58.5	323 52.8	16.8	85 06.1	44.8	85 00.2	38.7
R 12	289 55.3	20 59.2	S22 58.6	338 53.2	S19 16.3	100 08.4	S 2 44.8	100 02.6	S 1 38.8
D 13	304 57.7	35 58.2	58.7	353 53.7	15.8	115 10.8	44.8	115 05.0	38.8
A 14	320 00.2	50 57.3	58.9	8 54.1	15.2	130 13.1	44.9	130 07.5	38.8
Y 15	335 02.6	65 56.4	·· 59.0	23 54.6	·· 14.7	145 15.5	·· 44.9	145 09.9	·· 38.8
16	350 05.1	80 55.4	59.1	38 55.0	14.2	160 17.8	44.9	160 12.3	38.8
17	5 07.6	95 54.5	59.2	53 55.5	13.7	175 20.2	45.0	175 14.7	38.8
18	20 10.0	110 53.6	S22 59.4	68 55.9	S19 13.2	190 22.6	S 2 45.0	190 17.2	S 1 38.8
19	35 12.5	125 52.6	59.5	83 56.4	12.6	205 24.9	45.0	205 19.6	38.8
20	50 15.0	140 51.7	59.6	98 56.8	12.1	220 27.3	45.1	220 22.0	38.8
21	65 17.4	155 50.8	·· 59.7	113 57.3	·· 11.6	235 29.6	·· 45.1	235 24.4	·· 38.8
22	80 19.9	170 49.8	22 59.9	128 57.7	11.1	250 32.0	45.1	250 26.9	38.8
23	95 22.4	185 48.9	23 00.0	143 58.2	10.6	265 34.4	45.2	265 29.3	38.8
11 00	110 24.8	200 48.0	S23 00.1	158 58.6	S19 10.0	280 36.7	S 2 45.2	280 31.7	S 1 38.8
01	125 27.3	215 47.0	00.2	173 59.1	09.5	295 39.1	45.2	295 34.1	38.8
02	140 29.7	230 46.1	00.3	188 59.5	09.0	310 41.4	45.3	310 36.6	38.8
03	155 32.2	245 45.2	·· 00.4	204 00.0	·· 08.5	325 43.8	·· 45.3	325 39.0	·· 38.8
04	170 34.7	260 44.2	00.5	219 00.4	07.9	340 46.2	45.3	340 41.4	38.8
05	185 37.1	275 43.3	00.7	234 00.9	07.4	355 48.5	45.4	355 43.9	38.8
06	200 39.6	290 42.4	S23 00.8	249 01.4	S19 06.9	10 50.9	S 2 45.4	10 46.3	S 1 38.8
07	215 42.1	305 41.4	00.9	264 01.8	06.4	25 53.2	45.4	25 48.7	38.8
08	230 44.5	320 40.5	01.0	279 02.3	05.8	40 55.6	45.5	40 51.1	38.8
S 09	245 47.0	335 39.6	·· 01.1	294 02.7	·· 05.3	55 58.0	·· 45.5	55 53.6	·· 38.8
U 10	260 49.5	350 38.6	01.2	309 03.2	04.8	71 00.3	45.5	70 56.0	38.8
N 11	275 51.9	5 37.7	01.3	324 03.6	04.3	86 02.7	45.5	85 58.4	38.8
D 12	290 54.4	20 36.8	S23 01.4	339 04.1	S19 03.7	101 05.1	S 2 45.6	101 00.9	S 1 38.8
A 13	305 56.9	35 35.8	01.5	354 04.5	03.2	116 07.4	45.6	116 03.3	38.8
Y 14	320 59.3	50 34.9	01.6	9 05.0	02.7	131 09.8	45.6	131 05.7	38.8
15	336 01.8	65 34.0	·· 01.7	24 05.4	·· 02.2	146 12.1	·· 45.7	146 08.2	·· 38.8
16	351 04.2	80 33.0	01.8	39 05.9	01.6	161 14.5	45.7	161 10.6	38.8
17	6 06.7	95 32.1	01.9	54 06.4	01.1	176 16.9	45.7	176 13.0	38.8
18	21 09.2	110 31.2	S23 02.0	69 06.8	S19 00.6	191 19.2	S 2 45.8	191 15.4	S 1 38.8
19	36 11.6	125 30.2	02.1	84 07.3	19 00.0	206 21.6	45.8	206 17.9	38.8
20	51 14.1	140 29.3	02.2	99 07.7	18 59.5	221 24.0	45.8	221 20.3	38.8
21	66 16.6	155 28.4	·· 02.3	114 08.2	·· 59.0	236 26.3	·· 45.8	236 22.7	·· 38.8
22	81 19.0	170 27.4	02.4	129 08.6	58.5	251 28.7	45.9	251 25.2	38.8
23	96 21.5	185 26.5	02.5	144 09.1	57.9	266 31.1	45.9	266 27.6	38.8
12 00	111 24.0	200 25.6	S23 02.5	159 09.6	S18 57.4	281 33.4	S 2 45.9	281 30.0	S 1 38.8
01	126 26.4	215 24.6	02.6	174 10.0	56.9	296 35.8	46.0	296 32.5	38.8
02	141 28.9	230 23.7	02.7	189 10.5	56.3	311 38.2	46.0	311 34.9	38.8
03	156 31.4	245 22.7	·· 02.8	204 10.9	·· 55.8	326 40.5	·· 46.0	326 37.3	·· 38.8
04	171 33.8	260 21.8	02.9	219 11.4	55.3	341 42.9	46.1	341 39.8	38.8
05	186 36.3	275 20.9	03.0	234 11.8	54.7	356 45.3	46.1	356 42.2	38.8
06	201 38.7	290 19.9	S23 03.1	249 12.3	S18 54.2	11 47.6	S 2 46.1	11 44.6	S 1 38.8
07	216 41.2	305 19.0	03.1	264 12.8	53.7	26 50.0	46.1	26 47.1	38.8
08	231 43.7	320 18.1	03.2	279 13.2	53.1	41 52.4	46.2	41 49.5	38.8
M 09	246 46.1	335 17.1	·· 03.3	294 13.7	·· 52.6	56 54.8	·· 46.2	56 51.9	·· 38.8
O 10	261 48.6	350 16.2	03.4	309 14.1	52.1	71 57.1	46.2	71 54.4	38.8
N 11	276 51.1	5 15.3	03.4	324 14.6	51.5	86 59.5	46.2	86 56.8	38.8
D 12	291 53.5	20 14.3	S23 03.5	339 15.1	S18 51.0	102 01.9	S 2 46.3	101 59.2	S 1 38.8
A 13	306 56.0	35 13.4	03.6	354 15.5	50.5	117 04.2	46.3	117 01.7	38.8
Y 14	321 58.5	50 12.5	03.7	9 16.0	49.9	132 06.6	46.3	132 04.1	38.8
15	337 00.9	65 11.5	·· 03.7	24 16.4	·· 49.4	147 09.0	·· 46.4	147 06.5	·· 38.8
16	352 03.4	80 10.6	03.8	39 16.9	48.8	162 11.4	46.4	162 09.0	38.8
17	7 05.8	95 09.6	03.9	54 17.4	48.3	177 13.7	46.4	177 11.4	38.8
18	22 08.3	110 08.7	S23 03.9	69 17.8	S18 47.8	192 16.1	S 2 46.4	192 13.8	S 1 38.8
19	37 10.8	125 07.8	04.0	84 18.3	47.2	207 18.5	46.5	207 16.3	38.8
20	52 13.2	140 06.8	04.1	99 18.7	46.7	222 20.8	46.5	222 18.7	38.8
21	67 15.7	155 05.9	·· 04.1	114 19.2	·· 46.2	237 23.2	·· 46.5	237 21.1	·· 38.8
22	82 18.2	170 05.0	04.2	129 19.7	45.6	252 25.6	46.5	252 23.6	38.8
23	97 20.6	185 04.0	04.2	144 20.1	45.1	267 28.0	46.6	267 26.0	38.8
Mer. Pass.	h m 16 35.6	v −0.9	d 0.1	v 0.5	d 0.5	v 2.4	d 0.0	v 2.4	d 0.0

STARS		
Name	S.H.A.	Dec.
	° ′	° ′
Acamar	315 36.9	S40 23.2
Achernar	335 45.1	S57 20.4
Acrux	173 36.8	S62 59.3
Adhara	255 31.6	S28 56.9
Aldebaran	291 17.5	N16 28.2
Alioth	166 42.3	N56 03.6
Alkaid	153 18.4	N49 24.3
Al Na'ir	28 15.1	S47 03.4
Alnilam	276 11.1	S 1 13.0
Alphard	218 20.1	S 8 34.6
Alphecca	126 32.2	N26 46.6
Alpheratz	358 09.2	N28 59.2
Altair	62 32.7	N 8 49.1
Ankaa	353 40.2	S42 24.9
Antares	112 56.9	S26 23.3
Arcturus	146 18.4	N19 16.8
Atria	108 21.4	S68 59.4
Avior	234 27.4	S59 26.9
Bellatrix	278 58.2	N 6 19.9
Betelgeuse	271 27.7	N 7 24.1
Canopus	264 06.6	S52 41.3
Capella	281 10.6	N45 58.8
Deneb	49 48.7	N45 12.8
Denebola	182 58.7	N14 40.6
Diphda	349 20.7	S18 05.7
Dubhe	194 21.5	N61 51.0
Elnath	278 43.5	N28 35.5
Eltanin	90 58.1	N51 29.4
Enif	34 11.6	N 9 47.2
Fomalhaut	15 51.4	S29 43.6
Gacrux	172 28.3	S57 00.1
Gienah	176 17.6	S17 26.1
Hadar	149 23.1	S60 16.5
Hamal	328 28.6	N23 22.4
Kaus Aust.	84 17.0	S34 23.6
Kochab	137 19.6	N74 13.8
Markab	14 03.1	N15 06.2
Menkar	314 40.8	N 4 00.8
Menkent	148 36.8	S36 16.4
Miaplacidus	221 44.0	S69 38.2
Mirfak	309 15.5	N49 47.7
Nunki	76 29.3	S26 19.2
Peacock	53 58.7	S56 47.9
Pollux	243 57.5	N28 04.3
Procyon	245 25.2	N 5 16.4
Rasalhague	96 29.7	N12 34.4
Regulus	208 09.5	N12 03.5
Rigel	281 35.5	S 8 13.6
Rigil Kent.	140 25.7	S60 45.0
Sabik	102 41.2	S15 42.0
Schedar	350 08.8	N56 26.2
Shaula	96 55.8	S37 05.3
Sirius	258 55.2	S16 41.5
Spica	158 57.3	S11 03.6
Suhail	223 10.2	S43 21.3
Vega	80 56.1	N38 45.9
Zuben'ubi	137 32.9	S15 57.6

	S.H.A.	Mer. Pass.
	° ′	h m
Venus	90 23.2	10 37
Mars	48 33.8	13 24
Jupiter	170 11.9	5 17
Saturn	170 06.9	5 17

G.M.T.	SUN G.H.A.	SUN Dec.	MOON G.H.A.	MOON v	MOON Dec.	MOON d	MOON H.P.
d h	° ′	° ′	° ′	′	° ′	′	′
10 00	178 08.8	S21 59.9	131 29.1	9.9	S11 35.1	10.0	58.3
01	193 08.5	59.6	145 58.0	9.8	11 25.1	10.1	58.3
02	208 08.3	59.2	160 26.8	9.9	11 15.0	10.2	58.4
03	223 08.0	·· 58.8	174 55.7	10.0	11 04.8	10.2	58.4
04	238 07.8	58.5	189 24.7	9.9	10 54.6	10.3	58.4
05	253 07.5	58.1	203 53.6	10.0	10 44.3	10.3	58.4
06	268 07.2	S21 57.7	218 22.6	9.9	S10 34.0	10.4	58.4
07	283 07.0	57.4	232 51.5	10.1	10 23.6	10.5	58.4
S 08	298 06.7	57.0	247 20.6	10.0	10 13.1	10.6	58.5
A 09	313 06.5	·· 56.6	261 49.6	10.1	10 02.5	10.6	58.5
T 10	328 06.2	56.2	276 18.7	10.0	9 51.9	10.6	58.5
U 11	343 06.0	55.9	290 47.7	10.1	9 41.3	10.7	58.5
R 12	358 05.7	S21 55.5	305 16.8	10.2	S 9 30.6	10.8	58.5
D 13	13 05.5	55.1	319 46.0	10.1	9 19.8	10.8	58.5
A 14	28 05.2	54.7	334 15.1	10.2	9 09.0	10.9	58.5
Y 15	43 05.0	·· 54.4	348 44.3	10.2	8 58.1	10.9	58.5
16	58 04.7	54.0	3 13.5	10.2	8 47.2	11.0	58.6
17	73 04.5	53.6	17 42.7	10.2	8 36.2	11.1	58.6
18	88 04.2	S21 53.2	32 11.9	10.3	S 8 25.1	11.1	58.6
19	103 04.0	52.8	46 41.2	10.2	8 14.0	11.1	58.6
20	118 03.7	52.4	61 10.4	10.3	8 02.9	11.2	58.6
21	133 03.5	·· 52.1	75 39.7	10.3	7 51.7	11.2	58.6
22	148 03.2	51.7	90 09.0	10.3	7 40.5	11.3	58.6
23	163 03.0	51.3	104 38.3	10.4	7 29.2	11.3	58.6
11 00	178 02.7	S21 50.9	119 07.7	10.3	S 7 17.9	11.4	58.7
01	193 02.5	50.5	133 37.0	10.4	7 06.5	11.4	58.7
02	208 02.2	50.1	148 06.4	10.4	6 55.1	11.5	58.7
03	223 02.0	·· 49.8	162 35.8	10.4	6 43.6	11.5	58.7
04	238 01.7	49.4	177 05.2	10.4	6 32.1	11.5	58.7
05	253 01.5	49.0	191 34.6	10.4	6 20.6	11.6	58.7
06	268 01.2	S21 48.6	206 04.0	10.5	S 6 09.0	11.6	58.7
07	283 01.0	48.2	220 33.5	10.4	5 57.4	11.6	58.7
08	298 00.7	47.8	235 02.9	10.5	5 45.8	11.7	58.8
S 09	313 00.5	·· 47.4	249 32.4	10.5	5 34.1	11.7	58.8
U 10	328 00.2	47.0	264 01.9	10.5	5 22.4	11.8	58.8
N 11	343 00.0	46.6	278 31.4	10.5	5 10.6	11.8	58.8
D 12	357 59.8	S21 46.2	293 00.9	10.5	S 4 58.8	11.8	58.8
A 13	12 59.5	45.8	307 30.4	10.5	4 47.0	11.8	58.8
Y 14	27 59.3	45.4	321 59.9	10.5	4 35.2	11.9	58.8
15	42 59.0	·· 45.0	336 29.4	10.5	4 23.3	11.9	58.8
16	57 58.8	44.6	350 58.9	10.6	4 11.4	11.9	58.8
17	72 58.5	44.3	5 28.5	10.5	3 59.5	12.0	58.9
18	87 58.3	S21 43.9	19 58.0	10.6	S 3 47.5	12.0	58.9
19	102 58.0	43.5	34 27.6	10.5	3 35.5	12.0	58.9
20	117 57.8	43.1	48 57.1	10.6	3 23.5	12.0	58.9
21	132 57.6	·· 42.7	63 26.7	10.5	3 11.5	12.0	58.9
22	147 57.3	42.3	77 56.2	10.6	2 59.5	12.1	58.9
23	162 57.1	41.8	92 25.8	10.6	2 47.4	12.1	58.9
12 00	177 56.8	S21 41.4	106 55.4	10.5	S 2 35.3	12.1	58.9
01	192 56.6	41.0	121 24.9	10.6	2 23.2	12.1	58.9
02	207 56.3	40.6	135 54.5	10.6	2 11.1	12.1	58.9
03	222 56.1	·· 40.2	150 24.1	10.5	1 59.0	12.2	59.0
04	237 55.9	39.8	164 53.6	10.6	1 46.8	12.1	59.0
05	252 55.6	39.4	179 23.2	10.6	1 34.7	12.2	59.0
06	267 55.4	S21 39.0	193 52.8	10.5	S 1 22.5	12.2	59.0
07	282 55.1	38.6	208 22.3	10.6	1 10.3	12.2	59.0
08	297 54.9	38.2	222 51.9	10.5	0 58.1	12.2	59.0
M 09	312 54.6	·· 37.8	237 21.4	10.6	0 45.9	12.2	59.0
O 10	327 54.4	37.4	251 51.0	10.5	0 33.7	12.2	59.0
N 11	342 54.2	37.0	266 20.5	10.6	0 21.5	12.2	59.0
D 12	357 53.9	S21 36.6	280 50.1	10.5	S 0 09.3	12.2	59.0
A 13	12 53.7	36.1	295 19.6	10.5	N 0 02.9	12.3	59.0
Y 14	27 53.5	35.7	309 49.1	10.5	0 15.2	12.2	59.1
15	42 53.2	·· 35.3	324 18.6	10.5	0 27.4	12.2	59.1
16	57 53.0	34.9	338 48.1	10.5	0 39.6	12.2	59.1
17	72 52.7	34.5	353 17.6	10.5	0 51.8	12.3	59.1
18	87 52.5	S21 34.1	7 47.1	10.4	N 1 04.1	12.2	59.1
19	102 52.3	33.7	22 16.5	10.5	1 16.3	12.2	59.1
20	117 52.0	33.2	36 46.0	10.4	1 28.5	12.2	59.1
21	132 51.8	·· 32.8	51 15.4	10.4	1 40.7	12.2	59.1
22	147 51.6	32.4	65 44.8	10.4	1 52.9	12.2	59.1
23	162 51.3	32.0	80 14.2	10.4	2 05.1	12.2	59.1
	S.D. 16.3	d 0.4	S.D. 15.9		16.0		16.1

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

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

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
	m s	m s	h m	h m	h m	d	
10	07 24	07 37	12 08	15 47	03 21	04	
11	07 49	08 01	12 08	16 37	04 12	05	◑
12	08 12	08 24	12 08	17 28	05 03	06	

GMT	ARIES	VENUS −3.3		MARS +1.4		JUPITER −1.7		SATURN +1.0	
d h	G.H.A.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.
	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
13 00	112 23.1	200 03.1	S23 04.3	159 20.6	S18 44.5	282 30.3	S 2 46.6	282 28.4	S 1 38.8
01	127 25.6	215 02.1	04.4	174 21.1	44.0	297 32.7	46.6	297 30.9	38.8
02	142 28.0	230 01.2	04.4	189 21.5	43.5	312 35.1	46.6	312 33.3	38.8
03	157 30.5	245 00.3	·· 04.5	204 22.0	·· 42.9	327 37.5	·· 46.7	327 35.7	·· 38.8
04	172 33.0	259 59.3	04.5	219 22.4	42.4	342 39.8	46.7	342 38.2	38.8
05	187 35.4	274 58.4	04.6	234 22.9	41.8	357 42.2	46.7	357 40.6	38.8
06	202 37.9	289 57.5	S23 04.6	249 23.4	S18 41.3	12 44.6	S 2 46.7	12 43.1	S 1 38.8
07	217 40.3	304 56.5	04.7	264 23.8	40.8	27 47.0	46.8	27 45.5	38.8
08	232 42.8	319 55.6	04.7	279 24.3	40.2	42 49.3	46.8	42 47.9	38.8
T 09	247 45.3	334 54.6	·· 04.8	294 24.8	·· 39.7	57 51.7	·· 46.8	57 50.4	·· 38.8
U 10	262 47.7	349 53.7	04.8	309 25.2	39.1	72 54.1	46.8	72 52.8	38.8
E 11	277 50.2	4 52.8	04.9	324 25.7	38.6	87 56.5	46.9	87 55.2	38.8
S 12	292 52.7	19 51.8	S23 04.9	339 26.1	S18 38.0	102 58.8	S 2 46.9	102 57.7	S 1 38.8
D 13	307 55.1	34 50.9	05.0	354 26.6	37.5	118 01.2	46.9	118 00.1	38.8
A 14	322 57.6	49 50.0	05.0	9 27.1	37.0	133 03.6	46.9	133 02.6	38.8
Y 15	338 00.1	64 49.0	·· 05.0	24 27.5	·· 36.4	148 06.0	·· 47.0	148 05.0	·· 38.8
16	353 02.5	79 48.1	05.1	39 28.0	35.9	163 08.4	47.0	163 07.4	38.8
17	8 05.0	94 47.1	05.1	54 28.5	35.3	178 10.7	47.0	178 09.9	38.8
18	23 07.5	109 46.2	S23 05.1	69 28.9	S18 34.8	193 13.1	S 2 47.0	193 12.3	S 1 38.8
19	38 09.9	124 45.3	05.2	84 29.4	34.2	208 15.5	47.1	208 14.8	38.8
20	53 12.4	139 44.3	05.2	99 29.9	33.7	223 17.9	47.1	223 17.2	38.8
21	68 14.8	154 43.4	·· 05.3	114 30.3	·· 33.1	238 20.3	·· 47.1	238 19.6	·· 38.8
22	83 17.3	169 42.5	05.3	129 30.8	32.6	253 22.6	47.1	253 22.1	38.8
23	98 19.8	184 41.5	05.3	144 31.3	32.0	268 25.0	47.2	268 24.5	38.8
14 00	113 22.2	199 40.6	S23 05.3	159 31.7	S18 31.5	283 27.4	S 2 47.2	283 26.9	S 1 38.8
01	128 24.7	214 39.6	05.4	174 32.2	30.9	298 29.8	47.2	298 29.4	38.8
02	143 27.2	229 38.7	05.4	189 32.7	30.4	313 32.2	47.2	313 31.8	38.8
03	158 29.6	244 37.8	·· 05.4	204 33.1	·· 29.8	328 34.5	·· 47.3	328 34.3	·· 38.8
04	173 32.1	259 36.8	05.4	219 33.6	29.3	343 36.9	47.3	343 36.7	38.8
05	188 34.6	274 35.9	05.5	234 34.1	28.7	358 39.3	47.3	358 39.2	38.8
06	203 37.0	289 35.0	S23 05.5	249 34.5	S18 28.2	13 41.7	S 2 47.3	13 41.6	S 1 38.8
07	218 39.5	304 34.0	05.5	264 35.0	27.6	28 44.1	47.3	28 44.0	38.8
W 08	233 42.0	319 33.1	05.5	279 35.5	27.1	43 46.5	47.4	43 46.5	38.8
E 09	248 44.4	334 32.1	·· 05.6	294 35.9	·· 26.5	58 48.8	·· 47.4	58 48.9	·· 38.8
D 10	263 46.9	349 31.2	05.6	309 36.4	26.0	73 51.2	47.4	73 51.4	38.8
N 11	278 49.3	4 30.3	05.6	324 36.9	25.4	88 53.6	47.4	88 53.8	38.7
E 12	293 51.8	19 29.3	S23 05.6	339 37.3	S18 24.9	103 56.0	S 2 47.4	103 56.2	S 1 38.7
S 13	308 54.3	34 28.4	05.6	354 37.8	24.3	118 58.4	47.5	118 58.7	38.7
D 14	323 56.7	49 27.4	05.6	9 38.3	23.8	134 00.8	47.5	134 01.1	38.7
A 15	338 59.2	64 26.5	·· 05.6	24 38.7	·· 23.2	149 03.2	·· 47.5	149 03.6	·· 38.7
Y 16	354 01.7	79 25.6	05.6	39 39.2	22.7	164 05.5	47.5	164 06.0	38.7
17	9 04.1	94 24.6	05.7	54 39.7	22.1	179 07.9	47.6	179 08.5	38.7
18	24 06.6	109 23.7	S23 05.7	69 40.2	S18 21.6	194 10.3	S 2 47.6	194 10.9	S 1 38.7
19	39 09.1	124 22.8	05.7	84 40.6	21.0	209 12.7	47.6	209 13.3	38.7
20	54 11.5	139 21.8	05.7	99 41.1	20.5	224 15.1	47.6	224 15.8	38.7
21	69 14.0	154 20.9	·· 05.7	114 41.6	·· 19.9	239 17.5	·· 47.6	239 18.2	·· 38.7
22	84 16.4	169 19.9	05.7	129 42.0	19.3	254 19.9	47.7	254 20.7	38.7
23	99 18.9	184 19.0	05.7	144 42.5	18.8	269 22.2	47.7	269 23.1	38.7
15 00	114 21.4	199 18.1	S23 05.7	159 43.0	S18 18.2	284 24.6	S 2 47.7	284 25.6	S 1 38.7
01	129 23.8	214 17.1	05.7	174 43.4	17.7	299 27.0	47.7	299 28.0	38.7
02	144 26.3	229 16.2	05.7	189 43.9	17.1	314 29.4	47.7	314 30.4	38.7
03	159 28.8	244 15.2	·· 05.7	204 44.4	·· 16.6	329 31.8	·· 47.8	329 32.9	·· 38.7
04	174 31.2	259 14.3	05.7	219 44.9	16.0	344 34.2	47.8	344 35.3	38.7
05	189 33.7	274 13.4	05.7	234 45.3	15.4	359 36.6	47.8	359 37.8	38.7
06	204 36.2	289 12.4	S23 05.7	249 45.8	S18 14.9	14 39.0	S 2 47.8	14 40.2	S 1 38.7
07	219 38.6	304 11.5	05.6	264 46.3	14.3	29 41.4	47.8	29 42.7	38.7
T 08	234 41.1	319 10.6	05.6	279 46.7	13.8	44 43.8	47.9	44 45.1	38.7
H 09	249 43.6	334 09.6	·· 05.6	294 47.2	·· 13.2	59 46.1	·· 47.9	59 47.6	·· 38.7
U 10	264 46.0	349 08.7	05.6	309 47.7	12.7	74 48.5	47.9	74 50.0	38.6
R 11	279 48.5	4 07.7	05.6	324 48.2	12.1	89 50.9	47.9	89 52.5	38.6
S 12	294 50.9	19 06.8	S23 05.6	339 48.6	S18 11.5	104 53.3	S 2 47.9	104 54.9	S 1 38.6
D 13	309 53.4	34 05.9	05.6	354 49.1	11.0	119 55.7	47.9	119 57.3	38.6
A 14	324 55.9	49 04.9	05.6	9 49.6	10.4	134 58.1	48.0	134 59.8	38.6
Y 15	339 58.3	64 04.0	·· 05.5	24 50.1	·· 09.9	150 00.5	·· 48.0	150 02.2	·· 38.6
16	355 00.8	79 03.0	05.5	39 50.5	09.3	165 02.9	48.0	165 04.7	38.6
17	10 03.3	94 02.1	05.5	54 51.0	08.7	180 05.3	48.0	180 07.1	38.6
18	25 05.7	109 01.2	S23 05.5	69 51.5	S18 08.2	195 07.7	S 2 48.0	195 09.6	S 1 38.6
19	40 08.2	124 00.2	05.4	84 52.0	07.6	210 10.1	48.1	210 12.0	38.6
20	55 10.7	138 59.3	05.4	99 52.4	07.0	225 12.5	48.1	225 14.5	38.6
21	70 13.1	153 58.4	·· 05.4	114 52.9	·· 06.5	240 14.9	·· 48.1	240 16.9	·· 38.6
22	85 15.6	168 57.4	05.4	129 53.4	05.9	255 17.3	48.1	255 19.4	38.6
23	100 18.1	183 56.5	05.3	144 53.8	05.3	270 19.6	48.1	270 21.8	38.6
Mer. Pass.	h m 16 23.8	v −0.9	d 0.0	v 0.5	d 0.6	v 2.4	d 0.0	v 2.4	d 0.0

STARS		
Name	S.H.A.	Dec.
	° ′	° ′
Acamar	315 36.9	S40 23.2
Achernar	335 45.1	S57 20.4
Acrux	173 36.7	S62 59.3
Adhara	255 31.6	S28 56.9
Aldebaran	291 17.5	N16 28.2
Alioth	166 42.3	N56 03.5
Alkaid	153 18.4	N49 24.3
Al Na'ir	28 15.1	S47 03.4
Alnilam	276 11.1	S 1 13.0
Alphard	218 20.0	S 8 34.6
Alphecca	126 32.1	N26 46.6
Alpheratz	358 09.2	N28 59.2
Altair	62 32.7	N 8 49.1
Ankaa	353 40.2	S42 24.9
Antares	112 56.8	S26 23.3
Arcturus	146 18.3	N19 16.8
Atria	108 21.3	S68 59.4
Avior	234 27.4	S59 26.9
Bellatrix	278 58.2	N 6 19.9
Betelgeuse	271 27.7	N 7 24.1
Canopus	264 06.6	S52 41.3
Capella	281 10.6	N45 58.8
Deneb	49 48.8	N45 12.8
Denebola	182 58.7	N14 40.6
Diphda	349 20.7	S18 05.7
Dubhe	194 21.5	N61 51.0
Elnath	278 43.5	N28 35.5
Eltanin	90 58.1	N51 29.4
Enif	34 11.6	N 9 47.2
Fomalhaut	15 51.4	S29 43.6
Gacrux	172 28.3	S57 00.1
Gienah	176 17.6	S17 26.1
Hadar	149 23.1	S60 16.5
Hamal	328 28.6	N23 22.4
Kaus Aust.	84 16.9	S34 23.6
Kochab	137 19.5	N74 13.8
Markab	14 03.1	N15 06.1
Menkar	314 40.8	N 4 00.8
Menkent	148 36.8	S36 16.4
Miaplacidus	221 44.0	S69 38.2
Mirfak	309 15.5	N49 47.7
Nunki	76 29.3	S26 19.2
Peacock	53 58.7	S56 47.9
Pollux	243 57.5	N28 04.3
Procyon	245 25.2	N 5 16.3
Rasalhague	96 29.7	N12 34.4
Regulus	208 09.5	N12 03.5
Rigel	281 35.5	S 8 13.6
Rigil Kent.	140 25.7	S60 45.0
Sabik	102 41.2	S15 42.0
Schedar	350 08.8	N56 26.2
Shaula	96 55.8	S37 05.3
Sirius	258 55.2	S16 41.6
Spica	158 57.3	S11 03.6
Suhail	223 10.2	S43 21.3
Vega	80 56.1	N38 45.9
Zuben'ubi	137 32.9	S15 57.7

	S.H.A.	Mer. Pass.
	° ′	h m
Venus	86 18.3	10 42
Mars	46 09.5	13 21
Jupiter	170 05.2	5 05
Saturn	170 04.7	5 05

G.M.T.	SUN G.H.A.	SUN Dec.	MOON G.H.A.	MOON v	MOON Dec.	MOON d	MOON H.P.
d h	° ′	° ′	° ′	′	° ′	′	′
13 00	177 51.1	S21 31.6	94 43.6	10.4	N 2 17.3	12.2	59.1
01	192 50.8	31.1	109 13.0	10.4	2 29.5	12.1	59.1
02	207 50.6	30.7	123 42.4	10.3	2 41.6	12.2	59.1
03	222 50.4	30.3	138 11.7	10.3	2 53.8	12.1	59.1
04	237 50.1	29.9	152 41.0	10.3	3 05.9	12.2	59.2
05	252 49.9	29.5	167 10.3	10.3	3 18.1	12.1	59.2
06	267 49.7	S21 29.0	181 39.6	10.2	N 3 30.2	12.1	59.2
07	282 49.4	28.6	196 08.8	10.3	3 42.3	12.0	59.2
08	297 49.2	28.2	210 38.1	10.2	3 54.3	12.1	59.2
09	312 49.0	27.7	225 07.3	10.2	4 06.4	12.0	59.2
10	327 48.7	27.3	239 36.5	10.1	4 18.4	12.1	59.2
11	342 48.5	26.9	254 05.6	10.2	4 30.5	11.9	59.2
12	357 48.3	S21 26.5	268 34.8	10.1	N 4 42.4	12.0	59.2
13	12 48.0	26.0	283 03.9	10.1	4 54.4	12.0	59.2
14	27 47.8	25.6	297 33.0	10.0	5 06.4	11.9	59.2
15	42 47.6	25.2	312 02.0	10.1	5 18.3	11.9	59.2
16	57 47.3	24.7	326 31.1	10.0	5 30.2	11.8	59.2
17	72 47.1	24.3	341 00.1	10.0	5 42.0	11.8	59.2
18	87 46.9	S21 23.9	355 29.1	9.9	N 5 53.8	11.8	59.2
19	102 46.6	23.4	9 58.0	9.9	6 05.6	11.8	59.2
20	117 46.4	23.0	24 26.9	9.9	6 17.4	11.7	59.2
21	132 46.2	22.6	38 55.8	9.9	6 29.1	11.7	59.2
22	147 46.0	22.1	53 24.7	9.8	6 40.8	11.7	59.3
23	162 45.7	21.7	67 53.5	9.8	6 52.5	11.6	59.3
14 00	177 45.5	S21 21.3	82 22.3	9.7	N 7 04.1	11.6	59.3
01	192 45.3	20.8	96 51.0	9.7	7 15.7	11.5	59.3
02	207 45.0	20.4	111 19.7	9.7	7 27.2	11.5	59.3
03	222 44.8	19.9	125 48.4	9.7	7 38.7	11.5	59.3
04	237 44.6	19.5	140 17.1	9.6	7 50.2	11.4	59.3
05	252 44.4	19.1	154 45.7	9.6	8 01.6	11.4	59.3
06	267 44.1	S21 18.6	169 14.3	9.5	N 8 13.0	11.3	59.3
07	282 43.9	18.2	183 42.8	9.5	8 24.3	11.3	59.3
08	297 43.7	17.7	198 11.3	9.5	8 35.6	11.2	59.3
09	312 43.4	17.3	212 39.8	9.4	8 46.8	11.2	59.3
10	327 43.2	16.8	227 08.2	9.4	8 58.0	11.2	59.3
11	342 43.0	16.4	241 36.6	9.3	9 09.2	11.0	59.3
12	357 42.8	S21 16.0	256 04.9	9.3	N 9 20.2	11.1	59.3
13	12 42.5	15.5	270 33.2	9.3	9 31.3	10.9	59.3
14	27 42.3	15.1	285 01.5	9.2	9 42.2	11.0	59.3
15	42 42.1	14.6	299 29.7	9.2	9 53.2	10.8	59.3
16	57 41.9	14.2	313 57.9	9.2	10 04.0	10.8	59.3
17	72 41.6	13.7	328 26.1	9.1	10 14.8	10.8	59.3
18	87 41.4	S21 13.3	342 54.2	9.0	N10 25.6	10.7	59.3
19	102 41.2	12.8	357 22.2	9.0	10 36.3	10.6	59.3
20	117 41.0	12.4	11 50.2	9.0	10 46.9	10.6	59.3
21	132 40.7	11.9	26 18.2	8.9	10 57.5	10.4	59.3
22	147 40.5	11.5	40 46.1	8.9	11 07.9	10.5	59.3
23	162 40.3	11.0	55 14.0	8.9	11 18.4	10.4	59.3
15 00	177 40.1	S21 10.5	69 41.9	8.7	N11 28.8	10.3	59.3
01	192 39.9	10.1	84 09.6	8.8	11 39.1	10.2	59.3
02	207 39.6	09.6	98 37.4	8.7	11 49.3	10.1	59.3
03	222 39.4	09.2	113 05.1	8.7	11 59.4	10.1	59.3
04	237 39.2	08.7	127 32.8	8.6	12 09.5	10.1	59.3
05	252 39.0	08.3	142 00.4	8.5	12 19.6	9.9	59.3
06	267 38.8	S21 07.8	156 27.9	8.5	N12 29.5	9.9	59.3
07	282 38.5	07.3	170 55.4	8.5	12 39.4	9.8	59.3
08	297 38.3	06.9	185 22.9	8.4	12 49.2	9.7	59.3
09	312 38.1	06.4	199 50.3	8.4	12 58.9	9.6	59.3
10	327 37.9	06.0	214 17.7	8.4	13 08.5	9.6	59.3
11	342 37.7	05.5	228 45.1	8.2	13 18.1	9.5	59.3
12	357 37.4	S21 05.0	243 12.3	8.3	N13 27.6	9.4	59.3
13	12 37.2	04.6	257 39.6	8.2	13 37.0	9.3	59.3
14	27 37.0	04.1	272 06.8	8.1	13 46.3	9.2	59.3
15	42 36.8	03.6	286 33.9	8.1	13 55.5	9.2	59.3
16	57 36.6	03.2	301 01.0	8.1	14 04.7	9.0	59.3
17	72 36.3	02.7	315 28.1	8.0	14 13.7	9.0	59.3
18	87 36.1	S21 02.2	329 55.1	7.9	N14 22.7	8.9	59.3
19	102 35.9	01.8	344 22.0	8.0	14 31.6	8.8	59.3
20	117 35.7	01.3	358 49.0	7.8	14 40.4	8.7	59.3
21	132 35.5	00.8	13 15.8	7.8	14 49.1	8.6	59.3
22	147 35.3	21 00.4	27 42.6	7.8	14 57.7	8.5	59.3
23	162 35.1	20 59.9	42 09.4	7.7	15 06.2	8.5	59.3
	S.D. 16.3	d 0.4	S.D.	16.1		16.2	16.2

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

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

Day	SUN Eqn. of Time 00ʰ	SUN Eqn. of Time 12ʰ	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
	m s	m s	h m	h m	h m	d	
13	08 35	08 46	12 09	18 19	05 53	07	
14	08 58	09 08	12 09	19 11	06 45	08	◐
15	09 19	09 30	12 09	20 05	07 38	09	

G.M.T.	ARIES	VENUS −3.3		MARS +1.4		JUPITER −1.7		SATURN +0.9		STARS		
	G.H.A.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.	Name	S.H.A.	Dec.
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	° ′
16 00	115 20.5	198 55.5	S23 05.3	159 54.3	S18 04.8	285 22.0	S 2 48.1	285 24.3	S 1 38.6	Acamar	315 36.9	S40 23.2
01	130 23.0	213 54.6	05.3	174 54.8	04.2	300 24.4	48.2	300 26.7	38.6	Achernar	335 45.1	S57 20.4
02	145 25.4	228 53.7	05.3	189 55.3	03.7	315 26.8	48.2	315 29.2	38.6	Acrux	173 36.7	S62 59.3
03	160 27.9	243 52.7	·· 05.2	204 55.8	·· 03.1	330 29.2	·· 48.2	330 31.6	·· 38.5	Adhara	255 31.5	S28 56.9
04	175 30.4	258 51.8	05.2	219 56.2	02.5	345 31.6	48.2	345 34.1	38.5	Aldebaran	291 17.5	N16 28.2
05	190 32.8	273 50.8	05.1	234 56.7	02.0	0 34.0	48.2	0 36.5	38.5			
06	205 35.3	288 49.9	S23 05.1	249 57.2	S18 01.4	15 36.4	S 2 48.2	15 39.0	S 1 38.5	Alioth	166 42.2	N56 03.5
07	220 37.8	303 49.0	05.1	264 57.7	00.8	30 38.8	48.3	30 41.4	38.5	Alkaid	153 18.4	N49 24.3
08	235 40.2	318 48.0	05.0	279 58.1	18 00.3	45 41.2	48.3	45 43.9	38.5	Al Na'ir	28 15.1	S47 03.4
F 09	250 42.7	333 47.1	·· 05.0	294 58.6	17 59.7	60 43.6	·· 48.3	60 46.3	·· 38.5	Alnilam	276 11.1	S 1 13.0
R 10	265 45.2	348 46.2	05.0	309 59.1	59.1	75 46.0	48.3	75 48.8	38.5	Alphard	218 20.0	S 8 34.6
I 11	280 47.6	3 45.2	04.9	324 59.6	58.6	90 48.4	48.3	90 51.2	38.5			
D 12	295 50.1	18 44.3	S23 04.9	340 00.0	S17 58.0	105 50.8	S 2 48.3	105 53.7	S 1 38.5	Alphecca	126 32.1	N26 46.6
A 13	310 52.5	33 43.3	04.8	355 00.5	57.4	120 53.2	48.3	120 56.1	38.5	Alpheratz	358 09.2	N28 59.2
Y 14	325 55.0	48 42.4	04.8	10 01.0	56.8	135 55.6	48.4	135 58.6	38.5	Altair	62 32.6	N 8 49.0
15	340 57.5	63 41.5	·· 04.7	25 01.5	·· 56.3	150 58.0	·· 48.4	151 01.0	·· 38.5	Ankaa	353 40.2	S42 24.9
16	355 59.9	78 40.5	04.7	40 02.0	55.7	166 00.4	48.4	166 03.5	38.5	Antares	112 56.8	S26 23.3
17	11 02.4	93 39.6	04.6	55 02.4	55.1	181 02.8	48.4	181 05.9	38.4			
18	26 04.9	108 38.7	S23 04.6	70 02.9	S17 54.6	196 05.2	S 2 48.4	196 08.4	S 1 38.4	Arcturus	146 18.3	N19 16.8
19	41 07.3	123 37.7	04.5	85 03.4	54.0	211 07.6	48.4	211 10.8	38.4	Atria	108 21.3	S68 59.4
20	56 09.8	138 36.8	04.5	100 03.9	53.4	226 10.0	48.4	226 13.3	38.4	Avior	234 27.4	S59 26.9
21	71 12.3	153 35.8	·· 04.4	115 04.3	·· 52.9	241 12.4	·· 48.5	241 15.7	·· 38.4	Bellatrix	278 58.2	N 6 19.8
22	86 14.7	168 34.9	04.4	130 04.8	52.3	256 14.8	48.5	256 18.2	38.4	Betelgeuse	271 27.7	N 7 24.1
23	101 17.2	183 34.0	04.3	145 05.3	51.7	271 17.2	48.5	271 20.6	38.4			
17 00	116 19.7	198 33.0	S23 04.2	160 05.8	S17 51.1	286 19.6	S 2 48.5	286 23.1	S 1 38.4	Canopus	264 06.6	S52 41.3
01	131 22.1	213 32.1	04.2	175 06.3	50.6	301 22.0	48.5	301 25.5	38.4	Capella	281 10.6	N45 58.8
02	146 24.6	228 31.2	04.1	190 06.7	50.0	316 24.4	48.5	316 28.0	38.4	Deneb	49 48.8	N45 12.8
03	161 27.0	243 30.2	·· 04.1	205 07.2	·· 49.4	331 26.8	·· 48.5	331 30.4	·· 38.4	Denebola	182 58.7	N14 40.6
04	176 29.5	258 29.3	04.0	220 07.7	48.8	346 29.2	48.6	346 32.9	38.4	Diphda	349 20.7	S18 05.7
05	191 32.0	273 28.3	03.9	235 08.2	48.3	1 31.6	48.6	1 35.3	38.4			
06	206 34.4	288 27.4	S23 03.9	250 08.7	S17 47.7	16 34.0	S 2 48.6	16 37.8	S 1 38.3	Dubhe	194 21.4	N61 51.0
07	221 36.9	303 26.5	03.8	265 09.2	47.1	31 36.5	48.6	31 40.3	38.3	Elnath	278 43.5	N28 35.5
S 08	236 39.4	318 25.5	03.7	280 09.6	46.5	46 38.9	48.6	46 42.7	38.3	Eltanin	90 58.1	N51 29.4
A 09	251 41.8	333 24.6	·· 03.7	295 10.1	·· 46.0	61 41.3	·· 48.6	61 45.2	·· 38.3	Enif	34 11.6	N 9 47.2
T 10	266 44.3	348 23.7	03.6	310 10.6	45.4	76 43.7	48.6	76 47.6	38.3	Fomalhaut	15 51.4	S29 43.6
U 11	281 46.8	3 22.7	03.5	325 11.1	44.8	91 46.1	48.6	91 50.1	38.3			
R 12	296 49.2	18 21.8	S23 03.4	340 11.6	S17 44.2	106 48.5	S 2 48.7	106 52.5	S 1 38.3	Gacrux	172 28.3	S57 00.1
D 13	311 51.7	33 20.8	03.4	355 12.0	43.7	121 50.9	48.7	121 55.0	38.3	Gienah	176 17.6	S17 26.1
A 14	326 54.2	48 19.9	03.3	10 12.5	43.1	136 53.3	48.7	136 57.4	38.3	Hadar	149 23.0	S60 16.5
Y 15	341 56.6	63 19.0	·· 03.2	25 13.0	·· 42.5	151 55.7	·· 48.7	151 59.9	·· 38.3	Hamal	328 28.6	N23 22.4
16	356 59.1	78 18.0	03.1	40 13.5	41.9	166 58.1	48.7	167 02.3	38.3	Kaus Aust.	84 16.9	S34 23.6
17	12 01.5	93 17.1	03.0	55 14.0	41.4	182 00.5	48.7	182 04.8	38.2			
18	27 04.0	108 16.2	S23 03.0	70 14.5	S17 40.8	197 02.9	S 2 48.7	197 07.3	S 1 38.2	Kochab	137 19.5	N74 13.8
19	42 06.5	123 15.2	02.9	85 14.9	40.2	212 05.3	48.7	212 09.7	38.2	Markab	14 03.2	N15 06.1
20	57 08.9	138 14.3	02.8	100 15.4	39.6	227 07.7	48.8	227 12.2	38.2	Menkar	314 40.8	N 4 00.8
21	72 11.4	153 13.4	·· 02.7	115 15.9	·· 39.0	242 10.1	·· 48.8	242 14.6	·· 38.2	Menkent	148 36.8	S36 16.4
22	87 13.9	168 12.4	02.6	130 16.4	38.5	257 12.6	48.8	257 17.1	38.2	Miaplacidus	221 43.9	S69 38.3
23	102 16.3	183 11.5	02.5	145 16.9	37.9	272 15.0	48.8	272 19.5	38.2			
18 00	117 18.8	198 10.5	S23 02.5	160 17.4	S17 37.3	287 17.4	S 2 48.8	287 22.0	S 1 38.2	Mirfak	309 15.5	N49 47.7
01	132 21.3	213 09.6	02.4	175 17.8	36.7	302 19.8	48.8	302 24.4	38.2	Nunki	76 29.3	S26 19.2
02	147 23.7	228 08.7	02.3	190 18.3	36.1	317 22.2	48.8	317 26.9	38.2	Peacock	53 58.7	S56 47.9
03	162 26.2	243 07.7	·· 02.2	205 18.8	·· 35.6	332 24.6	·· 48.8	332 29.4	·· 38.1	Pollux	243 57.5	N28 04.3
04	177 28.7	258 06.8	02.1	220 19.3	35.0	347 27.0	48.8	347 31.8	38.1	Procyon	245 25.2	N 5 16.3
05	192 31.1	273 05.9	02.0	235 19.8	34.4	2 29.4	48.8	2 34.3	38.1			
06	207 33.6	288 04.9	S23 01.9	250 20.3	S17 33.8	17 31.8	S 2 48.9	17 36.7	S 1 38.1	Rasalhague	96 29.7	N12 34.4
07	222 36.0	303 04.0	01.8	265 20.8	33.2	32 34.3	48.9	32 39.2	38.1	Regulus	208 09.5	N12 03.5
08	237 38.5	318 03.1	01.7	280 21.2	32.7	47 36.7	48.9	47 41.6	38.1	Rigel	281 35.5	S 8 13.6
S 09	252 41.0	333 02.1	·· 01.6	295 21.7	·· 32.1	62 39.1	·· 48.9	62 44.1	·· 38.1	Rigil Kent.	140 25.7	S60 45.0
U 10	267 43.4	348 01.2	01.5	310 22.2	31.5	77 41.5	48.9	77 46.6	38.1	Sabik	102 41.1	S15 42.0
N 11	282 45.9	3 00.3	01.4	325 22.7	30.9	92 43.9	48.9	92 49.0	38.1			
D 12	297 48.4	17 59.3	S23 01.3	340 23.2	S17 30.3	107 46.3	S 2 48.9	107 51.5	S 1 38.1	Schedar	350 08.9	N56 26.2
A 13	312 50.8	32 58.4	01.2	355 23.7	29.7	122 48.7	48.9	122 53.9	38.0	Shaula	96 55.8	S37 05.3
Y 14	327 53.3	47 57.4	01.1	10 24.2	29.1	137 51.1	48.9	137 56.4	38.0	Sirius	258 55.2	S16 41.6
15	342 55.8	62 56.5	·· 01.0	25 24.6	·· 28.6	152 53.6	·· 48.9	152 58.9	·· 38.0	Spica	158 57.3	S11 03.6
16	357 58.2	77 55.6	00.9	40 25.1	28.0	167 56.0	49.0	168 01.3	38.0	Suhail	223 10.2	S43 21.3
17	13 00.7	92 54.6	00.8	55 25.6	27.4	182 58.4	49.0	183 03.8	38.0			
18	28 03.1	107 53.7	S23 00.7	70 26.1	S17 26.8	198 00.8	S 2 49.0	198 06.2	S 1 38.0	Vega	80 56.1	N38 45.9
19	43 05.6	122 52.8	00.5	85 26.6	26.2	213 03.2	49.0	213 08.7	38.0	Zuben'ubi	137 32.9	S15 57.7
20	58 08.1	137 51.8	00.4	100 27.1	25.6	228 05.6	49.0	228 11.2	38.0			
21	73 10.5	152 50.9	·· 00.3	115 27.6	·· 25.0	243 08.1	·· 49.0	243 13.6	·· 38.0		S.H.A.	Mer. Pass.
22	88 13.0	167 50.0	00.2	130 28.1	24.5	258 10.5	49.0	258 16.1	37.9		° ′	h m
23	103 15.5	182 49.0	00.1	145 28.5	23.9	273 12.9	49.0	273 18.5	37.9	Venus	82 13.4	10 46
	h m									Mars	43 46.1	13 19
Mer. Pass.	16 12.0	v −0.9	d 0.1	v 0.5	d 0.6	v 2.4	d 0.0	v 2.5	d 0.0	Jupiter	170 00.0	4 54
										Saturn	170 03.4	4 54

G.M.T.	SUN G.H.A.	SUN Dec.	MOON G.H.A.	v	MOON Dec.	d	H.P.
d h	° ′	° ′	° ′	′	° ′	′	′
16 00	177 34.8	S20 59.4	56 36.1	7.7	N15 14.7	8.3	59.3
01	192 34.6	59.0	71 02.8	7.7	15 23.0	8.3	59.3
02	207 34.4	58.5	85 29.5	7.6	15 31.3	8.1	59.3
03	222 34.2	58.0	99 56.1	7.5	15 39.4	8.0	59.3
04	237 34.0	57.5	114 22.6	7.5	15 47.4	8.0	59.3
05	252 33.8	57.1	128 49.1	7.5	15 55.4	7.8	59.3
06	267 33.6	S20 56.6	143 15.6	7.4	N16 03.2	7.8	59.3
07	282 33.3	56.1	157 42.0	7.3	16 11.0	7.6	59.3
08	297 33.1	55.6	172 08.3	7.4	16 18.6	7.6	59.2
F 09	312 32.9	55.2	186 34.7	7.3	16 26.2	7.4	59.2
R 10	327 32.7	54.7	201 01.0	7.2	16 33.6	7.3	59.2
I 11	342 32.5	54.2	215 27.2	7.2	16 40.9	7.3	59.2
D 12	357 32.3	S20 53.7	229 53.4	7.2	N16 48.2	7.1	59.2
A 13	12 32.1	53.2	244 19.6	7.1	16 55.3	7.0	59.2
Y 14	27 31.9	52.8	258 45.7	7.1	17 02.3	6.9	59.2
15	42 31.6	52.3	273 11.8	7.0	17 09.2	6.8	59.2
16	57 31.4	51.8	287 37.8	7.0	17 16.0	6.7	59.2
17	72 31.2	51.3	302 03.8	7.0	17 22.7	6.5	59.2
18	87 31.0	S20 50.8	316 29.8	6.9	N17 29.2	6.5	59.2
19	102 30.8	50.3	330 55.7	6.9	17 35.7	6.3	59.2
20	117 30.6	49.9	345 21.6	6.8	17 42.0	6.3	59.2
21	132 30.4	49.4	359 47.4	6.9	17 48.3	6.1	59.2
22	147 30.2	48.9	14 13.3	6.7	17 54.4	6.0	59.2
23	162 30.0	48.4	28 39.0	6.8	18 00.4	5.9	59.1
17 00	177 29.8	S20 47.9	43 04.8	6.7	N18 06.3	5.8	59.1
01	192 29.6	47.4	57 30.5	6.7	18 12.1	5.6	59.1
02	207 29.4	46.9	71 56.2	6.7	18 17.7	5.5	59.1
03	222 29.1	46.4	86 21.9	6.6	18 23.2	5.5	59.1
04	237 28.9	46.0	100 47.5	6.6	18 28.7	5.2	59.1
05	252 28.7	45.5	115 13.1	6.5	18 33.9	5.2	59.1
06	267 28.5	S20 45.0	129 38.6	6.6	N18 39.1	5.1	59.1
07	282 28.3	44.5	144 04.2	6.5	18 44.2	4.9	59.1
S 08	297 28.1	44.0	158 29.7	6.5	18 49.1	4.8	59.1
A 09	312 27.9	43.5	172 55.2	6.4	18 53.9	4.7	59.1
T 10	327 27.7	43.0	187 20.6	6.5	18 58.6	4.5	59.0
U 11	342 27.5	42.5	201 46.1	6.4	19 03.1	4.5	59.0
R 12	357 27.3	S20 42.0	216 11.5	6.4	N19 07.6	4.3	59.0
D 13	12 27.1	41.5	230 36.9	6.4	19 11.9	4.2	59.0
A 14	27 26.9	41.0	245 02.3	6.3	19 16.1	4.0	59.0
Y 15	42 26.7	40.5	259 27.6	6.4	19 20.1	4.0	59.0
16	57 26.5	40.0	273 53.0	6.3	19 24.1	3.8	59.0
17	72 26.3	39.5	288 18.3	6.3	19 27.9	3.7	59.0
18	87 26.1	S20 39.0	302 43.6	6.3	N19 31.6	3.5	58.9
19	102 25.9	38.5	317 08.9	6.3	19 35.1	3.4	58.9
20	117 25.7	38.0	331 34.2	6.2	19 38.5	3.3	58.9
21	132 25.5	37.5	345 59.4	6.3	19 41.8	3.2	58.9
22	147 25.3	37.0	0 24.7	6.3	19 45.0	3.0	58.9
23	162 25.1	36.5	14 50.0	6.2	19 48.0	2.9	58.9
18 00	177 24.9	S20 36.0	29 15.2	6.2	N19 50.9	2.8	58.9
01	192 24.7	35.5	43 40.4	6.3	19 53.7	2.6	58.9
02	207 24.5	35.0	58 05.7	6.2	19 56.3	2.6	58.8
03	222 24.3	34.5	72 30.9	6.2	19 58.9	2.3	58.8
04	237 24.1	34.0	86 56.1	6.2	20 01.2	2.3	58.8
05	252 23.9	33.5	101 21.3	6.2	20 03.5	2.1	58.8
06	267 23.7	S20 33.0	115 46.5	6.2	N20 05.6	2.0	58.8
07	282 23.5	32.4	130 11.7	6.3	20 07.6	1.9	58.8
08	297 23.3	31.9	144 37.0	6.2	20 09.5	1.7	58.7
S 09	312 23.1	31.4	159 02.2	6.2	20 11.2	1.6	58.7
U 10	327 22.9	30.9	173 27.4	6.3	20 12.8	1.5	58.7
N 11	342 22.7	30.4	187 52.7	6.2	20 14.3	1.3	58.7
D 12	357 22.5	S20 29.9	202 17.9	6.2	N20 15.6	1.2	58.7
A 13	12 22.3	29.4	216 43.1	6.3	20 16.8	1.1	58.7
Y 14	27 22.1	28.9	231 08.4	6.3	20 17.9	0.9	58.6
15	42 21.9	28.4	245 33.7	6.3	20 18.8	0.8	58.6
16	57 21.7	27.8	259 59.0	6.3	20 19.6	0.7	58.6
17	72 21.5	27.3	274 24.3	6.3	20 20.3	0.6	58.6
18	87 21.3	S20 26.8	288 49.6	6.3	N20 20.9	0.4	58.6
19	102 21.1	26.3	303 14.9	6.4	20 21.3	0.3	58.6
20	117 20.9	25.8	317 40.3	6.3	20 21.6	0.1	58.5
21	132 20.8	25.3	332 05.6	6.4	20 21.7	0.1	58.5
22	147 20.6	24.7	346 31.0	6.4	20 21.8	0.2	58.5
23	162 20.4	24.2	0 56.4	6.5	20 21.6	0.2	58.5
	S.D. 16.3	d 0.5	S.D. 16.1		16.1		16.0

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

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

Day	SUN Eqn. of Time 00ʰ	SUN Eqn. of Time 12ʰ	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
	m s	m s	h m	h m	h m	d	
16	09 40	09 50	12 10	21 01	08 33	10	
17	10 01	10 10	12 10	21 58	09 29	11	◐
18	10 20	10 30	12 10	22 56	10 27	12	

G.M.T.	ARIES	VENUS −3.3		MARS +1.4		JUPITER −1.7		SATURN +0.9		STARS		
	G.H.A.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.	Name	S.H.A.	Dec.
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	° ′
19 00	118 17.9	197 48.1	S23 00.0	160 29.0	S17 23.3	288 15.3	S 2 49.0	288 21.0	S 1 37.9	Acamar	315 36.9	S40 23.2
01	133 20.4	212 47.2	22 59.8	175 29.5	22.7	303 17.7	49.0	303 23.5	37.9	Achernar	335 45.2	S57 20.4
02	148 22.9	227 46.2	59.7	190 30.0	22.1	318 20.1	49.0	318 25.9	37.9	Acrux	173 36.6	S62 59.3
03	163 25.3	242 45.3	·· 59.6	205 30.5	·· 21.5	333 22.6	·· 49.0	333 28.4	·· 37.9	Adhara	255 31.5	S28 56.9
04	178 27.8	257 44.4	59.5	220 31.0	20.9	348 25.0	49.0	348 30.8	37.9	Aldebaran	291 17.5	N16 28.2
05	193 30.3	272 43.4	59.4	235 31.5	20.3	3 27.4	49.1	3 33.3	37.9			
06	208 32.7	287 42.5	S22 59.2	250 32.0	S17 19.7	18 29.8	S 2 49.1	18 35.8	S 1 37.9	Alioth	166 42.2	N56 03.5
07	223 35.2	302 41.6	59.1	265 32.5	19.2	33 32.2	49.1	33 38.2	37.8	Alkaid	153 18.3	N49 24.3
08	238 37.6	317 40.6	59.0	280 33.0	18.6	48 34.7	49.1	48 40.7	37.8	Al Na'ir	28 15.1	S47 03.4
M 09	253 40.1	332 39.7	·· 58.8	295 33.4	·· 18.0	63 37.1	·· 49.1	63 43.2	·· 37.8	Alnilam	276 11.1	S 1 13.0
O 10	268 42.6	347 38.8	58.7	310 33.9	17.4	78 39.5	49.1	78 45.6	37.8	Alphard	218 20.0	S 8 34.6
N 11	283 45.0	2 37.8	58.6	325 34.4	16.8	93 41.9	49.1	93 48.1	37.8			
D 12	298 47.5	17 36.9	S22 58.5	340 34.9	S17 16.2	108 44.3	S 2 49.1	108 50.5	S 1 37.8	Alphecca	126 32.1	N26 46.6
A 13	313 50.0	32 36.0	58.3	355 35.4	15.6	123 46.8	49.1	123 53.0	37.8	Alpheratz	358 09.2	N28 59.2
Y 14	328 52.4	47 35.0	58.2	10 35.9	15.0	138 49.2	49.1	138 55.5	37.8	Altair	62 32.6	N 8 49.0
15	343 54.9	62 34.1	·· 58.0	25 36.4	·· 14.4	153 51.6	·· 49.1	153 57.9	·· 37.7	Ankaa	353 40.2	S42 24.9
16	358 57.4	77 33.2	57.9	40 36.9	13.8	168 54.0	49.1	169 00.4	37.7	Antares	112 56.8	S26 23.3
17	13 59.8	92 32.2	57.8	55 37.4	13.2	183 56.4	49.1	184 02.9	37.7			
18	29 02.3	107 31.3	S22 57.6	70 37.9	S17 12.6	198 58.9	S 2 49.1	199 05.3	S 1 37.7	Arcturus	146 18.3	N19 16.8
19	44 04.8	122 30.4	57.5	85 38.4	12.1	214 01.3	49.1	214 07.8	37.7	Atria	108 21.2	S68 59.4
20	59 07.2	137 29.4	57.3	100 38.9	11.5	229 03.7	49.1	229 10.2	37.7	Avior	234 27.4	S59 26.9
21	74 09.7	152 28.5	·· 57.2	115 39.3	·· 10.9	244 06.1	·· 49.1	244 12.7	·· 37.7	Bellatrix	278 58.2	N 6 19.8
22	89 12.1	167 27.6	57.1	130 39.8	10.3	259 08.6	49.2	259 15.2	37.7	Betelgeuse	271 27.7	N 7 24.1
23	104 14.6	182 26.6	56.9	145 40.3	09.7	274 11.0	49.2	274 17.6	37.6			
20 00	119 17.1	197 25.7	S22 56.8	160 40.8	S17 09.1	289 13.4	S 2 49.2	289 20.1	S 1 37.6	Canopus	264 06.6	S52 41.3
01	134 19.5	212 24.8	56.6	175 41.3	08.5	304 15.8	49.2	304 22.6	37.6	Capella	281 10.6	N45 58.8
02	149 22.0	227 23.8	56.5	190 41.8	07.9	319 18.3	49.2	319 25.0	37.6	Deneb	49 48.7	N45 12.8
03	164 24.5	242 22.9	·· 56.3	205 42.3	·· 07.3	334 20.7	·· 49.2	334 27.5	·· 37.6	Denebola	182 58.6	N14 40.6
04	179 26.9	257 22.0	56.2	220 42.8	06.7	349 23.1	49.2	349 30.0	37.6	Diphda	349 20.7	S18 05.7
05	194 29.4	272 21.1	56.0	235 43.3	06.1	4 25.5	49.2	4 32.4	37.6			
06	209 31.9	287 20.1	S22 55.9	250 43.8	S17 05.5	19 28.0	S 2 49.2	19 34.9	S 1 37.5	Dubhe	194 21.4	N61 51.0
07	224 34.3	302 19.2	55.7	265 44.3	04.9	34 30.4	49.2	34 37.4	37.5	Elnath	278 43.5	N28 35.5
08	239 36.8	317 18.3	55.5	280 44.8	04.3	49 32.8	49.2	49 39.8	37.5	Eltanin	90 58.1	N51 29.4
T 09	254 39.2	332 17.3	·· 55.4	295 45.3	·· 03.7	64 35.2	·· 49.2	64 42.3	·· 37.5	Enif	34 11.6	N 9 47.2
U 10	269 41.7	347 16.4	55.2	310 45.8	03.1	79 37.7	49.2	79 44.8	37.5	Fomalhaut	15 51.4	S29 43.6
E 11	284 44.2	2 15.5	55.1	325 46.3	02.5	94 40.1	49.2	94 47.2	37.5			
S 12	299 46.6	17 14.5	S22 54.9	340 46.8	S17 01.9	109 42.5	S 2 49.2	109 49.7	S 1 37.5	Gacrux	172 28.2	S57 00.1
D 13	314 49.1	32 13.6	54.7	355 47.3	01.3	124 45.0	49.2	124 52.2	37.4	Gienah	176 17.6	S17 26.1
A 14	329 51.6	47 12.7	54.6	10 47.8	00.7	139 47.4	49.2	139 54.6	37.4	Hadar	149 23.0	S60 16.6
Y 15	344 54.0	62 11.8	·· 54.4	25 48.3	17 00.1	154 49.8	·· 49.2	154 57.1	·· 37.4	Hamal	328 28.6	N23 22.4
16	359 56.5	77 10.8	54.2	40 48.7	16 59.5	169 52.2	49.2	169 59.6	37.4	Kaus Aust.	84 16.9	S34 23.6
17	14 59.0	92 09.9	54.1	55 49.2	58.9	184 54.7	49.2	185 02.0	37.4			
18	30 01.4	107 09.0	S22 53.9	70 49.7	S16 58.3	199 57.1	S 2 49.2	200 04.5	S 1 37.4	Kochab	137 19.4	N74 13.8
19	45 03.9	122 08.0	53.7	85 50.2	57.7	214 59.5	49.2	215 07.0	37.4	Markab	14 03.2	N15 06.1
20	60 06.4	137 07.1	53.6	100 50.7	57.1	230 02.0	49.2	230 09.4	37.3	Menkar	314 40.8	N 4 00.8
21	75 08.8	152 06.2	·· 53.4	115 51.2	·· 56.5	245 04.4	·· 49.2	245 11.9	·· 37.3	Menkent	148 36.7	S36 16.4
22	90 11.3	167 05.3	53.2	130 51.7	55.9	260 06.8	49.2	260 14.4	37.3	Miaplacidus	221 43.9	S69 38.3
23	105 13.7	182 04.3	53.0	145 52.2	55.3	275 09.3	49.2	275 16.8	37.3			
21 00	120 16.2	197 03.4	S22 52.9	160 52.7	S16 54.7	290 11.7	S 2 49.2	290 19.3	S 1 37.3	Mirfak	309 15.5	N49 47.8
01	135 18.7	212 02.5	52.7	175 53.2	54.1	305 14.1	49.2	305 21.8	37.3	Nunki	76 29.2	S26 19.2
02	150 21.1	227 01.5	52.5	190 53.7	53.5	320 16.6	49.2	320 24.3	37.3	Peacock	53 58.6	S56 47.9
03	165 23.6	242 00.6	·· 52.3	205 54.2	·· 52.9	335 19.0	·· 49.2	335 26.7	·· 37.2	Pollux	243 57.5	N28 04.3
04	180 26.1	256 59.7	52.1	220 54.7	52.3	350 21.4	49.2	350 29.2	37.2	Procyon	245 25.2	N 5 16.3
05	195 28.5	271 58.8	52.0	235 55.2	51.7	5 23.9	49.2	5 31.7	37.2			
06	210 31.0	286 57.8	S22 51.8	250 55.7	S16 51.1	20 26.3	S 2 49.2	20 34.1	S 1 37.2	Rasalhague	96 29.6	N12 34.4
07	225 33.5	301 56.9	51.6	265 56.2	50.5	35 28.7	49.2	35 36.6	37.2	Regulus	208 09.5	N12 03.5
W 08	240 35.9	316 56.0	51.4	280 56.7	49.9	50 31.2	49.2	50 39.1	37.2	Rigel	281 35.5	S 8 13.6
E 09	255 38.4	331 55.0	·· 51.2	295 57.2	·· 49.2	65 33.6	·· 49.2	65 41.5	·· 37.1	Rigil Kent.	140 25.6	S60 45.0
D 10	270 40.9	346 54.1	51.0	310 57.7	48.6	80 36.0	49.2	80 44.0	37.1	Sabik	102 41.1	S15 42.0
N 11	285 43.3	1 53.2	50.8	325 58.2	48.0	95 38.5	49.2	95 46.5	37.1			
E 12	300 45.8	16 52.3	S22 50.6	340 58.7	S16 47.4	110 40.9	S 2 49.2	110 49.0	S 1 37.1	Schedar	350 08.9	N56 26.2
S 13	315 48.2	31 51.3	50.5	355 59.2	46.8	125 43.3	49.2	125 51.4	37.1	Shaula	96 55.8	S37 05.3
D 14	330 50.7	46 50.4	50.3	10 59.7	46.2	140 45.8	49.2	140 53.9	37.1	Sirius	258 55.2	S16 41.6
A 15	345 53.2	61 49.5	·· 50.1	26 00.2	·· 45.6	155 48.2	·· 49.2	155 56.4	·· 37.0	Spica	158 57.2	S11 03.7
Y 16	0 55.6	76 48.6	49.9	41 00.7	45.0	170 50.6	49.2	170 58.8	37.0	Suhail	223 10.2	S43 21.3
17	15 58.1	91 47.6	49.7	56 01.2	44.4	185 53.1	49.2	186 01.3	37.0			
18	31 00.6	106 46.7	S22 49.5	71 01.7	S16 43.8	200 55.5	S 2 49.2	201 03.8	S 1 37.0	Vega	80 56.1	N38 45.9
19	46 03.0	121 45.8	49.3	86 02.2	43.2	215 57.9	49.2	216 06.3	37.0	Zuben'ubi	137 32.9	S15 57.7
20	61 05.5	136 44.9	49.1	101 02.7	42.6	231 00.4	49.2	231 08.7	37.0		S.H.A.	Mer. Pass
21	76 08.0	151 43.9	·· 48.9	116 03.2	·· 42.0	246 02.8	·· 49.2	246 11.2	·· 37.0		° ′	h m
22	91 10.4	166 43.0	48.7	131 03.7	41.3	261 05.3	49.2	261 13.7	36.9	Venus	78 08.6	10 51
23	106 12.9	181 42.1	48.5	146 04.2	40.7	276 07.7	49.2	276 16.2	36.9	Mars	41 23.8	13 17
	h m									Jupiter	169 56.3	4 42
Mer. Pass.	16 00.2	v −0.9	d 0.2	v 0.5	d 0.6	v 2.4	d 0.0	v 2.5	d 0.0	Saturn	170 03.0	4 42

G.M.T.	SUN G.H.A.	SUN Dec.	MOON G.H.A.	MOON v	MOON Dec.	MOON d	MOON H.P.
d h	° ′	° ′	° ′	′	° ′	′	′
19 00	177 20.2	S20 23.7	15 21.9	6.4	N20 21.4	0.4	58.5
01	192 20.0	23.2	29 47.3	6.5	20 21.0	0.4	58.4
02	207 19.8	22.7	44 12.8	6.6	20 20.6	0.7	58.4
03	222 19.6	·· 22.1	58 38.4	6.5	20 19.9	0.7	58.4
04	237 19.4	21.6	73 03.9	6.6	20 19.2	0.9	58.4
05	252 19.2	21.1	87 29.5	6.6	20 18.3	1.0	58.4
06	267 19.0	S20 20.6	101 55.1	6.6	N20 17.3	1.1	58.3
07	282 18.8	20.0	116 20.7	6.7	20 16.2	1.3	58.3
08	297 18.6	19.5	130 46.4	6.7	20 14.9	1.4	58.3
M 09	312 18.5	·· 19.0	145 12.1	6.8	20 13.5	1.5	58.3
O 10	327 18.3	18.5	159 37.9	6.8	20 12.0	1.7	58.3
N 11	342 18.1	17.9	174 03.7	6.8	20 10.3	1.7	58.2
D 12	357 17.9	S20 17.4	188 29.5	6.8	N20 08.6	1.9	58.2
A 13	12 17.7	16.9	202 55.3	7.0	20 06.7	2.0	58.2
Y 14	27 17.5	16.3	217 21.3	6.9	20 04.7	2.2	58.2
15	42 17.3	·· 15.8	231 47.2	7.0	20 02.5	2.2	58.2
16	57 17.1	15.3	246 13.2	7.0	20 00.3	2.4	58.1
17	72 16.9	14.7	260 39.2	7.1	19 57.9	2.5	58.1
18	87 16.8	S20 14.2	275 05.3	7.2	N19 55.4	2.6	58.1
19	102 16.6	13.7	289 31.5	7.1	19 52.8	2.8	58.1
20	117 16.4	13.1	303 57.6	7.3	19 50.0	2.9	58.0
21	132 16.2	·· 12.6	318 23.9	7.3	19 47.1	3.0	58.0
22	147 16.0	12.1	332 50.2	7.3	19 44.1	3.1	58.0
23	162 15.8	11.5	347 16.5	7.4	19 41.0	3.2	58.0
20 00	177 15.6	S20 11.0	1 42.9	7.4	N19 37.8	3.3	57.9
01	192 15.5	10.5	16 09.3	7.5	19 34.5	3.5	57.9
02	207 15.3	09.9	30 35.8	7.6	19 31.0	3.5	57.9
03	222 15.1	·· 09.4	45 02.4	7.6	19 27.5	3.7	57.9
04	237 14.9	08.9	59 29.0	7.6	19 23.8	3.8	57.9
05	252 14.7	08.3	73 55.6	7.7	19 20.0	3.9	57.8
06	267 14.5	S20 07.8	88 22.3	7.8	N19 16.1	4.1	57.8
07	282 14.4	07.2	102 49.1	7.9	19 12.0	4.1	57.8
08	297 14.2	06.7	117 16.0	7.9	19 07.9	4.3	57.8
T 09	312 14.0	·· 06.1	131 42.9	7.9	19 03.6	4.3	57.7
U 10	327 13.8	05.6	146 09.8	8.0	18 59.3	4.5	57.7
E 11	342 13.6	05.1	160 36.8	8.1	18 54.8	4.5	57.7
S 12	357 13.5	S20 04.5	175 03.9	8.2	N18 50.3	4.7	57.7
D 13	12 13.3	04.0	189 31.1	8.2	18 45.6	4.8	57.6
A 14	27 13.1	03.4	203 58.3	8.3	18 40.8	4.9	57.6
Y 15	42 12.9	·· 02.9	218 25.6	8.3	18 35.9	5.0	57.6
16	57 12.7	02.3	232 52.9	8.4	18 30.9	5.1	57.6
17	72 12.6	01.8	247 20.3	8.5	18 25.8	5.2	57.5
18	87 12.4	S20 01.2	261 47.8	8.6	N18 20.6	5.3	57.5
19	102 12.2	00.7	276 15.4	8.6	18 15.3	5.4	57.5
20	117 12.0	20 00.1	290 43.0	8.7	18 09.9	5.5	57.4
21	132 11.8	19 59.6	305 10.7	8.7	18 04.4	5.6	57.4
22	147 11.7	59.0	319 38.4	8.8	17 58.8	5.7	57.4
23	162 11.5	58.5	334 06.2	8.9	17 53.1	5.8	57.4
21 00	177 11.3	S19 57.9	348 34.1	9.0	N17 47.3	5.9	57.3
01	192 11.1	57.4	3 02.1	9.0	17 41.4	5.9	57.3
02	207 11.0	56.8	17 30.1	9.1	17 35.5	6.1	57.3
03	222 10.8	·· 56.3	31 58.2	9.2	17 29.4	6.2	57.3
04	237 10.6	55.7	46 26.4	9.3	17 23.2	6.2	57.2
05	252 10.4	55.2	60 54.7	9.3	17 17.0	6.4	57.2
06	267 10.3	S19 54.6	75 23.0	9.4	N17 10.6	6.4	57.2
W 07	282 10.1	54.1	89 51.4	9.4	17 04.2	6.6	57.2
E 08	297 09.9	53.5	104 19.8	9.6	16 57.6	6.6	57.1
D 09	312 09.7	·· 52.9	118 48.4	9.6	16 51.0	6.7	57.1
N 10	327 09.6	52.4	133 17.0	9.7	16 44.3	6.8	57.1
E 11	342 09.4	51.8	147 45.7	9.7	16 37.5	6.8	57.0
S 12	357 09.2	S19 51.3	162 14.4	9.9	N16 30.7	7.0	57.0
D 13	12 09.0	50.7	176 43.3	9.9	16 23.7	7.0	57.0
A 14	27 08.9	50.1	191 12.2	9.9	16 16.7	7.1	57.0
Y 15	42 08.7	·· 49.6	205 41.1	10.1	16 09.6	7.2	56.9
16	57 08.5	49.0	220 10.2	10.1	16 02.4	7.3	56.9
17	72 08.4	48.5	234 39.3	10.2	15 55.1	7.3	56.9
18	87 08.2	S19 47.9	249 08.5	10.3	N15 47.8	7.5	56.9
19	102 08.0	47.3	263 37.8	10.4	15 40.3	7.5	56.8
20	117 07.8	46.8	278 07.2	10.4	15 32.8	7.5	56.8
21	132 07.7	·· 46.2	292 36.6	10.5	15 25.3	7.7	56.8
22	147 07.5	45.6	307 06.1	10.6	15 17.6	7.7	56.7
23	162 07.3	45.1	321 35.7	10.6	15 09.9	7.8	56.7
	S.D. 16.3	d 0.5	S.D. 15.9		15.7		15.5

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

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

Day	SUN Eqn. of Time 00ʰ	SUN Eqn. of Time 12ʰ	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
	m s	m s	h m	h m	h m	d	
19	10 39	10 48	12 11	23 53	11 25	13	
20	10 57	11 06	12 11	24 47	12 20	14	○
21	11 14	11 23	12 11	00 47	13 14	15	

G.M.T.	ARIES	VENUS −3.3		MARS +1.4		JUPITER −1.8		SATURN +0.9		STARS		
	G.H.A.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.	Name	S.H.A.	Dec.
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	° ′
22 00	121 15.3	196 41.2	S22 48.3	161 04.7	S16 40.1	291 10.1	S 2 49.2	291 18.6	S 1 36.9	Acamar	315 37.0	S40 23.2
01	136 17.8	211 40.2	48.1	176 05.2	39.5	306 12.6	49.2	306 21.1	36.9	Achernar	335 45.2	S57 20.4
02	151 20.3	226 39.3	47.8	191 05.7	38.9	321 15.0	49.2	321 23.6	36.9	Acrux	173 36.6	S62 59.3
03	166 22.7	241 38.4	·· 47.6	206 06.2	·· 38.3	336 17.5	·· 49.2	336 26.0	·· 36.9	Adhara	255 31.5	S28 56.9
04	181 25.2	256 37.5	47.4	221 06.7	37.7	351 19.9	49.2	351 28.5	36.8	Aldebaran	291 17.5	N16 28.2
05	196 27.7	271 36.5	47.2	236 07.2	37.1	6 22.3	49.2	6 31.0	36.8			
06	211 30.1	286 35.6	S22 47.0	251 07.8	S16 36.5	21 24.8	S 2 49.2	21 33.5	S 1 36.8	Alioth	166 42.1	N56 03.5
07	226 32.6	301 34.7	46.8	266 08.3	35.8	36 27.2	49.2	36 35.9	36.8	Alkaid	153 18.3	N49 24.3
T 08	241 35.1	316 33.8	46.6	281 08.8	35.2	51 29.7	49.2	51 38.4	36.8	Al Na'ir	28 15.1	S47 03.4
H 09	256 37.5	331 32.8	·· 46.4	296 09.3	·· 34.6	66 32.1	·· 49.2	66 40.9	·· 36.7	Alnilam	276 11.1	S 1 13.0
U 10	271 40.0	346 31.9	46.1	311 09.8	34.0	81 34.5	49.2	81 43.4	36.7	Alphard	218 20.0	S 8 34.6
R 11	286 42.5	1 31.0	45.9	326 10.3	33.4	96 37.0	49.2	96 45.8	36.7			
S 12	301 44.9	16 30.1	S22 45.7	341 10.8	S16 32.8	111 39.4	S 2 49.2	111 48.3	S 1 36.7	Alphecca	126 32.1	N26 46.6
D 13	316 47.4	31 29.2	45.5	356 11.3	32.2	126 41.9	49.2	126 50.8	36.7	Alpheratz	358 09.2	N28 59.2
A 14	331 49.8	46 28.2	45.3	11 11.8	31.5	141 44.3	49.2	141 53.3	36.7	Altair	62 32.6	N 8 49.0
Y 15	346 52.3	61 27.3	·· 45.0	26 12.3	·· 30.9	156 46.8	·· 49.2	156 55.7	·· 36.6	Ankaa	353 40.2	S42 24.9
16	1 54.8	76 26.4	44.8	41 12.8	30.3	171 49.2	49.2	171 58.2	36.6	Antares	112 56.8	S26 23.3
17	16 57.2	91 25.5	44.6	56 13.3	29.7	186 51.7	49.2	187 00.7	36.6			
18	31 59.7	106 24.5	S22 44.3	71 13.8	S16 29.1	201 54.1	S 2 49.2	202 03.2	S 1 36.6	Arcturus	146 18.3	N19 16.8
19	47 02.2	121 23.6	44.1	86 14.3	28.5	216 56.5	49.2	217 05.6	36.6	Atria	108 21.2	S68 59.4
20	62 04.6	136 22.7	43.9	101 14.8	27.9	231 59.0	49.2	232 08.1	36.6	Avior	234 27.4	S59 26.9
21	77 07.1	151 21.8	·· 43.7	116 15.3	·· 27.2	247 01.4	·· 49.2	247 10.6	·· 36.5	Bellatrix	278 58.2	N 6 19.8
22	92 09.6	166 20.9	43.4	131 15.8	26.6	262 03.9	49.2	262 13.1	36.5	Betelgeuse	271 27.7	N 7 24.1
23	107 12.0	181 19.9	43.2	146 16.3	26.0	277 06.3	49.2	277 15.6	36.5			
23 00	122 14.5	196 19.0	S22 43.0	161 16.9	S16 25.4	292 08.8	S 2 49.1	292 18.0	S 1 36.5	Canopus	264 06.6	S52 41.3
01	137 17.0	211 18.1	42.7	176 17.4	24.8	307 11.2	49.1	307 20.5	36.5	Capella	281 10.6	N45 58.8
02	152 19.4	226 17.2	42.5	191 17.9	24.1	322 13.7	49.1	322 23.0	36.4	Deneb	49 48.7	N45 12.7
03	167 21.9	241 16.3	·· 42.2	206 18.4	·· 23.5	337 16.1	·· 49.1	337 25.5	·· 36.4	Denebola	182 58.6	N14 40.6
04	182 24.3	256 15.3	42.0	221 18.9	22.9	352 18.6	49.1	352 27.9	36.4	Diphda	349 20.8	S18 05.7
05	197 26.8	271 14.4	41.8	236 19.4	22.3	7 21.0	49.1	7 30.4	36.4			
06	212 29.3	286 13.5	S22 41.5	251 19.9	S16 21.7	22 23.5	S 2 49.1	22 32.9	S 1 36.4	Dubhe	194 21.4	N61 51.0
07	227 31.7	301 12.6	41.3	266 20.4	21.1	37 25.9	49.1	37 35.4	36.3	Elnath	278 43.5	N28 35.5
08	242 34.2	316 11.7	41.0	281 20.9	20.4	52 28.4	49.1	52 37.9	36.3	Eltanin	90 58.1	N51 29.4
F 09	257 36.7	331 10.7	·· 40.8	296 21.4	·· 19.8	67 30.8	·· 49.1	67 40.3	·· 36.3	Enif	34 11.6	N 9 47.2
R 10	272 39.1	346 09.8	40.5	311 21.9	19.2	82 33.3	49.1	82 42.8	36.3	Fomalhaut	15 51.4	S29 43.6
I 11	287 41.6	1 08.9	40.3	326 22.4	18.6	97 35.7	49.1	97 45.3	36.3			
D 12	302 44.1	16 08.0	S22 40.0	341 23.0	S16 17.9	112 38.2	S 2 49.1	112 47.8	S 1 36.3	Gacrux	172 28.2	S57 00.1
A 13	317 46.5	31 07.1	39.8	356 23.5	17.3	127 40.6	49.1	127 50.3	36.2	Gienah	176 17.5	S17 26.1
Y 14	332 49.0	46 06.2	39.5	11 24.0	16.7	142 43.1	49.1	142 52.7	36.2	Hadar	149 23.0	S60 16.6
15	347 51.4	61 05.2	·· 39.3	26 24.5	·· 16.1	157 45.5	·· 49.1	157 55.2	·· 36.2	Hamal	328 28.6	N23 22.4
16	2 53.9	76 04.3	39.0	41 25.0	15.5	172 48.0	49.1	172 57.7	36.2	Kaus Aust.	84 16.9	S34 23.6
17	17 56.4	91 03.4	38.8	56 25.5	14.8	187 50.4	49.0	188 00.2	36.2			
18	32 58.8	106 02.5	S22 38.5	71 26.0	S16 14.2	202 52.9	S 2 49.0	203 02.7	S 1 36.1	Kochab	137 19.3	N74 13.8
19	48 01.3	121 01.6	38.3	86 26.5	13.6	217 55.3	49.0	218 05.1	36.1	Markab	14 03.2	N15 06.1
20	63 03.8	136 00.7	38.0	101 27.0	13.0	232 57.8	49.0	233 07.6	36.1	Menkar	314 40.8	N 4 00.8
21	78 06.2	150 59.7	·· 37.7	116 27.5	·· 12.3	248 00.2	·· 49.0	248 10.1	·· 36.1	Menkent	148 36.7	S36 16.4
22	93 08.7	165 58.8	37.5	131 28.1	11.7	263 02.7	49.0	263 12.6	36.1	Miaplacidus	221 43.9	S69 38.3
23	108 11.2	180 57.9	37.2	146 28.6	11.1	278 05.1	49.0	278 15.1	36.0			
24 00	123 13.6	195 57.0	S22 37.0	161 29.1	S16 10.5	293 07.6	S 2 49.0	293 17.5	S 1 36.0	Mirfak	309 15.6	N49 47.8
01	138 16.1	210 56.1	36.7	176 29.6	09.8	308 10.0	49.0	308 20.0	36.0	Nunki	76 29.2	S26 19.2
02	153 18.6	225 55.2	36.4	191 30.1	09.2	323 12.5	49.0	323 22.5	36.0	Peacock	53 58.6	S56 47.8
03	168 21.0	240 54.2	·· 36.2	206 30.6	·· 08.6	338 14.9	·· 49.0	338 25.0	·· 36.0	Pollux	243 57.5	N28 04.3
04	183 23.5	255 53.3	35.9	221 31.1	08.0	353 17.4	49.0	353 27.5	35.9	Procyon	245 25.2	N 5 16.3
05	198 25.9	270 52.4	35.6	236 31.6	07.3	8 19.9	49.0	8 29.9	35.9			
06	213 28.4	285 51.5	S22 35.4	251 32.2	S16 06.7	23 22.3	S 2 48.9	23 32.4	S 1 35.9	Rasalhague	96 29.6	N12 34.4
07	228 30.9	300 50.6	35.1	266 32.7	06.1	38 24.8	48.9	38 34.9	35.9	Regulus	208 09.5	N12 03.5
S 08	243 33.3	315 49.7	34.8	281 33.2	05.5	53 27.2	48.9	53 37.4	35.8	Rigel	281 35.5	S 8 13.6
A 09	258 35.8	330 48.8	·· 34.5	296 33.7	·· 04.8	68 29.7	·· 48.9	68 39.9	·· 35.8	Rigil Kent.	140 25.6	S60 45.0
T 10	273 38.3	345 47.8	34.3	311 34.2	04.2	83 32.1	48.9	83 42.4	35.8	Sabik	102 41.1	S15 42.0
U 11	288 40.7	0 46.9	34.0	326 34.7	03.6	98 34.6	48.9	98 44.8	35.8			
R 12	303 43.2	15 46.0	S22 33.7	341 35.2	S16 03.0	113 37.0	S 2 48.9	113 47.3	S 1 35.8	Schedar	350 08.9	N56 26.1
D 13	318 45.7	30 45.1	33.4	356 35.7	02.3	128 39.5	48.9	128 49.8	35.7	Shaula	96 55.8	S37 05.3
A 14	333 48.1	45 44.2	33.1	11 36.3	01.7	143 42.0	48.9	143 52.3	35.7	Sirius	258 55.2	S16 41.6
Y 15	348 50.6	60 43.3	·· 32.9	26 36.8	·· 01.1	158 44.4	·· 48.9	158 54.8	·· 35.7	Spica	158 57.2	S11 03.7
16	3 53.1	75 42.4	32.6	41 37.3	16 00.4	173 46.9	48.8	173 57.3	35.7	Suhail	223 10.1	S43 21.3
17	18 55.5	90 41.5	32.3	56 37.8	15 59.8	188 49.3	48.8	188 59.8	35.7			
18	33 58.0	105 40.6	S22 32.0	71 38.3	S15 59.2	203 51.8	S 2 48.8	204 02.2	S 1 35.6	Vega	80 56.1	N38 45.9
19	49 00.4	120 39.6	31.7	86 38.8	58.5	218 54.3	48.8	219 04.7	35.6	Zuben'ubi	137 32.8	S15 57.7
20	64 02.9	135 38.7	31.4	101 39.4	57.9	233 56.7	48.8	234 07.2	35.6			
21	79 05.4	150 37.8	·· 31.1	116 39.9	·· 57.3	248 59.2	·· 48.8	249 09.7	·· 35.6		S.H.A.	Mer. Pass.
22	94 07.8	165 36.9	30.9	131 40.4	56.7	264 01.6	48.8	264 12.2	35.6		° ′	h m
23	109 10.3	180 36.0	30.6	146 40.9	56.0	279 04.1	48.8	279 14.7	35.5	Venus	74 04.5	10 55
	h m									Mars	39 02.4	13 14
Mer. Pass.	15 48.4	v −0.9	d 0.2	v 0.5	d 0.6	v 2.5	d 0.0	v 2.5	d 0.0	Jupiter	169 54.3	4 31
										Saturn	170 03.5	4 30

G.M.T.	SUN G.H.A.	SUN Dec.	MOON G.H.A.	MOON v	MOON Dec.	MOON d	MOON H.P.
d h	° ′	° ′	° ′	′	° ′	′	′
22 00	177 07.2	S19 44.5	336 05.3	10.7	N15 02.1	7.9	56.7
01	192 07.0	43.9	350 35.0	10.8	14 54.2	7.9	56.7
02	207 06.8	43.4	5 04.8	10.9	14 46.3	8.0	56.6
03	222 06.7	·· 42.8	19 34.7	10.9	14 38.3	8.1	56.6
04	237 06.5	42.2	34 04.6	11.1	14 30.2	8.1	56.6
05	252 06.3	41.6	48 34.7	11.0	14 22.1	8.2	56.5
06	267 06.2	S19 41.1	63 04.7	11.2	N14 13.9	8.3	56.5
07	282 06.0	40.5	77 34.9	11.2	14 05.6	8.3	56.5
T 08	297 05.8	39.9	92 05.1	11.3	13 57.3	8.4	56.5
H 09	312 05.7	·· 39.4	106 35.4	11.4	13 48.9	8.4	56.4
U 10	327 05.5	38.8	121 05.8	11.5	13 40.5	8.5	56.4
R 11	342 05.3	38.2	135 36.3	11.5	13 32.0	8.6	56.4
S 12	357 05.2	S19 37.6	150 06.8	11.6	N13 23.4	8.6	56.4
D 13	12 05.0	37.1	164 37.4	11.7	13 14.8	8.7	56.3
A 14	27 04.8	36.5	179 08.1	11.7	13 06.1	8.7	56.3
Y 15	42 04.7	·· 35.9	193 38.8	11.8	12 57.4	8.8	56.3
16	57 04.5	35.3	208 09.6	11.9	12 48.6	8.9	56.2
17	72 04.3	34.8	222 40.5	11.9	12 39.7	8.9	56.2
18	87 04.2	S19 34.2	237 11.4	12.0	N12 30.8	8.9	56.2
19	102 04.0	33.6	251 42.4	12.1	12 21.9	9.0	56.2
20	117 03.8	33.0	266 13.5	12.2	12 12.9	9.1	56.1
21	132 03.7	·· 32.4	280 44.7	12.2	12 03.8	9.0	56.1
22	147 03.5	31.9	295 15.9	12.3	11 54.8	9.2	56.1
23	162 03.4	31.3	309 47.2	12.3	11 45.6	9.2	56.1
23 00	177 03.2	S19 30.7	324 18.5	12.4	N11 36.4	9.2	56.0
01	192 03.0	30.1	338 49.9	12.5	11 27.2	9.3	56.0
02	207 02.9	29.5	353 21.4	12.6	11 17.9	9.3	56.0
03	222 02.7	·· 28.9	7 53.0	12.6	11 08.6	9.4	56.0
04	237 02.6	28.3	22 24.6	12.6	10 59.2	9.4	55.9
05	252 02.4	27.8	36 56.2	12.8	10 49.8	9.5	55.9
06	267 02.2	S19 27.2	51 28.0	12.8	N10 40.3	9.5	55.9
07	282 02.1	26.6	65 59.8	12.9	10 30.8	9.5	55.8
08	297 01.9	26.0	80 31.7	12.9	10 21.3	9.6	55.8
F 09	312 01.8	·· 25.4	95 03.6	13.0	10 11.7	9.6	55.8
R 10	327 01.6	24.8	109 35.6	13.0	10 02.1	9.6	55.8
I 11	342 01.5	24.2	124 07.6	13.1	9 52.5	9.7	55.7
D 12	357 01.3	S19 23.6	138 39.7	13.2	N 9 42.8	9.7	55.7
A 13	12 01.1	23.1	153 11.9	13.2	9 33.1	9.8	55.7
Y 14	27 01.0	22.5	167 44.1	13.3	9 23.3	9.7	55.7
15	42 00.8	·· 21.9	182 16.4	13.4	9 13.6	9.9	55.6
16	57 00.7	21.3	196 48.8	13.4	9 03.7	9.8	55.6
17	72 00.5	20.7	211 21.2	13.4	8 53.9	9.9	55.6
18	87 00.4	S19 20.1	225 53.6	13.5	N 8 44.0	9.9	55.6
19	102 00.2	19.5	240 26.1	13.6	8 34.1	9.9	55.5
20	117 00.1	18.9	254 58.7	13.6	8 24.2	10.0	55.5
21	131 59.9	·· 18.3	269 31.3	13.7	8 14.2	10.0	55.5
22	146 59.7	17.7	284 04.0	13.7	8 04.2	10.0	55.5
23	161 59.6	17.1	298 36.7	13.8	7 54.2	10.0	55.4
24 00	176 59.4	S19 16.5	313 09.5	13.8	N 7 44.2	10.1	55.4
01	191 59.3	15.9	327 42.3	13.9	7 34.1	10.1	55.4
02	206 59.1	15.3	342 15.2	14.0	7 24.0	10.1	55.4
03	221 59.0	·· 14.7	356 48.2	13.9	7 13.9	10.1	55.4
04	236 58.8	14.1	11 21.1	14.1	7 03.8	10.2	55.3
05	251 58.7	13.5	25 54.2	14.1	6 53.6	10.2	55.3
06	266 58.5	S19 12.9	40 27.3	14.1	N 6 43.4	10.1	55.3
07	281 58.4	12.3	55 00.4	14.2	6 33.3	10.3	55.3
S 08	296 58.2	11.7	69 33.6	14.2	6 23.0	10.2	55.2
A 09	311 58.1	·· 11.1	84 06.8	14.2	6 12.8	10.2	55.2
T 10	326 57.9	10.5	98 40.0	14.3	6 02.6	10.3	55.2
U 11	341 57.8	09.9	113 13.3	14.4	5 52.3	10.3	55.2
R 12	356 57.6	S19 09.3	127 46.7	14.4	N 5 42.0	10.3	55.2
D 13	11 57.5	08.7	142 20.1	14.4	5 31.7	10.3	55.1
A 14	26 57.3	08.1	156 53.5	14.5	5 21.4	10.3	55.1
Y 15	41 57.2	·· 07.5	171 27.0	14.5	5 11.1	10.4	55.1
16	56 57.0	06.9	186 00.5	14.6	5 00.7	10.3	55.1
17	71 56.9	06.3	200 34.1	14.6	4 50.4	10.4	55.0
18	86 56.7	S19 05.7	215 07.7	14.6	N 4 40.0	10.4	55.0
19	101 56.6	05.0	229 41.3	14.7	4 29.6	10.4	55.0
20	116 56.4	04.4	244 15.0	14.7	4 19.2	10.4	55.0
21	131 56.3	·· 03.8	258 48.7	14.7	4 08.8	10.4	55.0
22	146 56.2	03.2	273 22.4	14.8	3 58.4	10.4	54.9
23	161 56.0	02.6	287 56.2	14.8	3 48.0	10.4	54.9
	S.D. 16.3	d 0.6	S.D. 15.4		15.2		15.0

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

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

Day	SUN Eqn. of Time 00^h	SUN Eqn. of Time 12^h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
	m s	m s	h m	h m	h m	d	
22	11 31	11 39	12 12	01 39	14 04	16	
23	11 47	11 55	12 12	02 27	14 51	17	◑
24	12 02	12 09	12 12	03 13	15 35	18	

G.M.T.	ARIES	VENUS −3.3		MARS +1.4		JUPITER −1.8		SATURN +0.9	
	G.H.A.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
25 00	124 12.8	195 35.1	S22 30.3	161 41.4	S15 55.4	294 06.6	S 2 48.8	294 17.1	S 1 35.5
01	139 15.2	210 34.2	30.0	176 41.9	54.8	309 09.0	48.8	309 19.6	35.5
02	154 17.7	225 33.3	29.7	191 42.5	54.1	324 11.5	48.7	324 22.1	35.5
03	169 20.2	240 32.4	·· 29.4	206 43.0	·· 53.5	339 13.9	·· 48.7	339 24.6	·· 35.4
04	184 22.6	255 31.5	29.1	221 43.5	52.9	354 16.4	48.7	354 27.1	35.4
05	199 25.1	270 30.5	28.8	236 44.0	52.2	9 18.9	48.7	9 29.6	35.4
06	214 27.5	285 29.6	S22 28.5	251 44.5	S15 51.6	24 21.3	S 2 48.7	24 32.1	S 1 35.4
07	229 30.0	300 28.7	28.2	266 45.0	51.0	39 23.8	48.7	39 34.5	35.4
08	244 32.5	315 27.8	27.9	281 45.6	50.3	54 26.3	48.7	54 37.0	35.3
S 09	259 34.9	330 26.9	·· 27.6	296 46.1	·· 49.7	69 28.7	·· 48.7	69 39.5	·· 35.3
U 10	274 37.4	345 26.0	27.3	311 46.6	49.1	84 31.2	48.6	84 42.0	35.3
N 11	289 39.9	0 25.1	27.0	326 47.1	48.4	99 33.7	48.6	99 44.5	35.3
D 12	304 42.3	15 24.2	S22 26.7	341 47.6	S15 47.8	114 36.1	S 2 48.6	114 47.0	S 1 35.2
A 13	319 44.8	30 23.3	26.4	356 48.1	47.2	129 38.6	48.6	129 49.5	35.2
Y 14	334 47.3	45 22.4	26.1	11 48.7	46.5	144 41.0	48.6	144 52.0	35.2
15	349 49.7	60 21.5	·· 25.7	26 49.2	·· 45.9	159 43.5	·· 48.6	159 54.4	·· 35.2
16	4 52.2	75 20.6	25.4	41 49.7	45.2	174 46.0	48.6	174 56.9	35.1
17	19 54.7	90 19.7	25.1	56 50.2	44.6	189 48.4	48.6	189 59.4	35.1
18	34 57.1	105 18.7	S22 24.8	71 50.7	S15 44.0	204 50.9	S 2 48.5	205 01.9	S 1 35.1
19	49 59.6	120 17.8	24.5	86 51.3	43.3	219 53.4	48.5	220 04.4	35.1
20	65 02.0	135 16.9	24.2	101 51.8	42.7	234 55.8	48.5	235 06.9	35.1
21	80 04.5	150 16.0	·· 23.9	116 52.3	·· 42.1	249 58.3	·· 48.5	250 09.4	·· 35.0
22	95 07.0	165 15.1	23.5	131 52.8	41.4	265 00.8	48.5	265 11.9	35.0
23	110 09.4	180 14.2	23.2	146 53.3	40.8	280 03.3	48.5	280 14.4	35.0
26 00	125 11.9	195 13.3	S22 22.9	161 53.9	S15 40.1	295 05.7	S 2 48.5	295 16.9	S 1 35.0
01	140 14.4	210 12.4	22.6	176 54.4	39.5	310 08.2	48.4	310 19.3	34.9
02	155 16.8	225 11.5	22.3	191 54.9	38.9	325 10.7	48.4	325 21.8	34.9
03	170 19.3	240 10.6	·· 21.9	206 55.4	·· 38.2	340 13.1	·· 48.4	340 24.3	·· 34.9
04	185 21.8	255 09.7	21.6	221 55.9	37.6	355 15.6	48.4	355 26.8	34.9
05	200 24.2	270 08.8	21.3	236 56.5	37.0	10 18.1	48.4	10 29.3	34.8
06	215 26.7	285 07.9	S22 20.9	251 57.0	S15 36.3	25 20.5	S 2 48.4	25 31.8	S 1 34.8
07	230 29.2	300 07.0	20.6	266 57.5	35.7	40 23.0	48.4	40 34.3	34.8
08	245 31.6	315 06.1	20.3	281 58.0	35.0	55 25.5	48.3	55 36.8	34.8
M 09	260 34.1	330 05.2	·· 20.0	296 58.6	·· 34.4	70 28.0	·· 48.3	70 39.3	·· 34.7
O 10	275 36.5	345 04.3	19.6	311 59.1	33.8	85 30.4	48.3	85 41.8	34.7
N 11	290 39.0	0 03.4	19.3	326 59.6	33.1	100 32.9	48.3	100 44.2	34.7
D 12	305 41.5	15 02.5	S22 19.0	342 00.1	S15 32.5	115 35.4	S 2 48.3	115 46.7	S 1 34.7
A 13	320 43.9	30 01.6	18.6	357 00.7	31.8	130 37.8	48.3	130 49.2	34.6
Y 14	335 46.4	45 00.7	18.3	12 01.2	31.2	145 40.3	48.3	145 51.7	34.6
15	350 48.9	59 59.8	·· 17.9	27 01.7	·· 30.5	160 42.8	·· 48.2	160 54.2	·· 34.6
16	5 51.3	74 58.9	17.6	42 02.2	29.9	175 45.3	48.2	175 56.7	34.6
17	20 53.8	89 58.0	17.3	57 02.7	29.3	190 47.7	48.2	190 59.2	34.5
18	35 56.3	104 57.1	S22 16.9	72 03.3	S15 28.6	205 50.2	S 2 48.2	206 01.7	S 1 34.5
19	50 58.7	119 56.2	16.6	87 03.8	28.0	220 52.7	48.2	221 04.2	34.5
20	66 01.2	134 55.3	16.2	102 04.3	27.3	235 55.2	48.2	236 06.7	34.5
21	81 03.7	149 54.4	·· 15.9	117 04.8	·· 26.7	250 57.6	·· 48.1	251 09.2	·· 34.5
22	96 06.1	164 53.5	15.5	132 05.4	26.0	266 00.1	48.1	266 11.7	34.4
23	111 08.6	179 52.6	15.2	147 05.9	25.4	281 02.6	48.1	281 14.2	34.4
27 00	126 11.0	194 51.7	S22 14.8	162 06.4	S15 24.7	296 05.1	S 2 48.1	296 16.7	S 1 34.4
01	141 13.5	209 50.8	14.5	177 06.9	24.1	311 07.5	48.1	311 19.1	34.3
02	156 16.0	224 49.9	14.1	192 07.5	23.5	326 10.0	48.0	326 21.6	34.3
03	171 18.4	239 49.0	·· 13.8	207 08.0	·· 22.8	341 12.5	·· 48.0	341 24.1	·· 34.3
04	186 20.9	254 48.1	13.4	222 08.5	22.2	356 15.0	48.0	356 26.6	34.3
05	201 23.4	269 47.2	13.1	237 09.0	21.5	11 17.4	48.0	11 29.1	34.2
06	216 25.8	284 46.3	S22 12.7	252 09.6	S15 20.9	26 19.9	S 2 48.0	26 31.6	S 1 34.2
07	231 28.3	299 45.4	12.4	267 10.1	20.2	41 22.4	48.0	41 34.1	34.2
08	246 30.8	314 44.5	12.0	282 10.6	19.6	56 24.9	47.9	56 36.6	34.2
T 09	261 33.2	329 43.6	·· 11.6	297 11.2	·· 18.9	71 27.4	·· 47.9	71 39.1	·· 34.1
U 10	276 35.7	344 42.7	11.3	312 11.7	18.3	86 29.8	47.9	86 41.6	34.1
E 11	291 38.1	359 41.8	10.9	327 12.2	17.6	101 32.3	47.9	101 44.1	34.1
S 12	306 40.6	14 41.0	S22 10.6	342 12.7	S15 17.0	116 34.8	S 2 47.9	116 46.6	S 1 34.1
D 13	321 43.1	29 40.1	10.2	357 13.3	16.3	131 37.3	47.8	131 49.1	34.0
A 14	336 45.5	44 39.2	09.8	12 13.8	15.7	146 39.8	47.8	146 51.6	34.0
Y 15	351 48.0	59 38.3	·· 09.5	27 14.3	·· 15.0	161 42.2	·· 47.8	161 54.1	·· 34.0
16	6 50.5	74 37.4	09.1	42 14.9	14.4	176 44.7	47.8	176 56.6	34.0
17	21 52.9	89 36.5	08.7	57 15.4	13.7	191 47.2	47.8	191 59.1	33.9
18	36 55.4	104 35.6	S22 08.3	72 15.9	S15 13.1	206 49.7	S 2 47.8	207 01.6	S 1 33.9
19	51 57.9	119 34.7	08.0	87 16.4	12.4	221 52.2	47.7	222 04.1	33.9
20	67 00.3	134 33.8	07.6	102 17.0	11.8	236 54.6	47.7	237 06.6	33.9
21	82 02.8	149 32.9	·· 07.2	117 17.5	·· 11.1	251 57.1	·· 47.7	252 09.1	·· 33.8
22	97 05.3	164 32.0	06.9	132 18.0	10.5	266 59.6	47.7	267 11.6	33.8
23	112 07.7	179 31.1	06.5	147 18.6	09.8	282 02.1	47.7	282 14.1	33.8
Mer. Pass	h m 15 36.6	v 0.9	d 0.3	v 0.5	d 0.6	v 2.5	d 0.0	v 2.5	d 0.0

STARS		
Name	S.H.A.	Dec.
	° ′	° ′
Acamar	315 37.0	S40 23.2
Achernar	335 45.2	S57 20.4
Acrux	173 36.6	S62 59.3
Adhara	255 31.6	S28 56.9
Aldebaran	291 17.5	N16 28.2
Alioth	166 42.1	N56 03.5
Alkaid	153 18.3	N49 24.3
Al Na'ir	28 15.1	S47 03.4
Alnilam	276 11.2	S 1 13.0
Alphard	218 20.0	S 8 34.6
Alphecca	126 32.0	N26 46.6
Alpheratz	358 09.2	N28 59.1
Altair	62 32.6	N 8 49.0
Ankaa	353 40.2	S42 24.9
Antares	112 56.8	S26 23.3
Arcturus	146 18.2	N19 16.8
Atria	108 21.1	S68 59.3
Avior	234 27.4	S59 27.0
Bellatrix	278 58.2	N 6 19.8
Betelgeuse	271 27.7	N 7 24.1
Canopus	264 06.6	S52 41.4
Capella	281 10.6	N45 58.8
Deneb	49 48.7	N45 12.7
Denebola	182 58.6	N14 40.6
Diphda	349 20.8	S18 05.7
Dubhe	194 21.3	N61 51.0
Elnath	278 43.5	N28 35.5
Eltanin	90 58.1	N51 29.3
Enif	34 11.6	N 9 47.2
Fomalhaut	15 51.4	S29 43.6
Gacrux	172 28.2	S57 00.1
Gienah	176 17.5	S17 26.1
Hadar	149 22.9	S60 16.6
Hamal	328 28.6	N23 22.3
Kaus Aust.	84 16.9	S34 23.6
Kochab	137 19.3	N74 13.8
Markab	14 03.2	N15 06.1
Menkar	314 40.8	N 4 00.8
Menkent	148 36.7	S36 16.4
Miaplacidus	221 43.9	S69 38.3
Mirfak	309 15.6	N49 47.8
Nunki	76 29.2	S26 19.2
Peacock	53 58.6	S56 47.8
Pollux	243 57.5	N28 04.3
Procyon	245 25.2	N 5 16.3
Rasalhague	96 29.6	N12 34.4
Regulus	208 09.4	N12 03.5
Rigel	281 35.5	S 8 13.6
Rigil Kent.	140 25.5	S60 45.0
Sabik	102 41.1	S15 42.0
Schedar	350 08.9	N56 26.1
Shaula	96 55.7	S37 05.3
Sirius	258 55.2	S16 41.6
Spica	158 57.2	S11 03.7
Suhail	223 10.1	S43 21.4
Vega	80 56.0	N38 45.9
Zuben'ubi	137 32.8	S15 57.7

	S.H.A.	Mer. Pass.
	° ′	h m
Venus	70 01.4	11 00
Mars	36 42.0	13 12
Jupiter	169 53.8	4 19
Saturn	170 04.9	4 18

G.M.T.	SUN G.H.A.	SUN Dec.	MOON G.H.A.	MOON v	MOON Dec.	MOON d	MOON H.P.
d h	° ′	° ′	° ′	′	° ′	′	′
25 00	176 55.9	S19 02.0	302 30.0	14.9	N 3 37.6	10.4	54.9
01	191 55.7	01.4	317 03.9	14.9	3 27.2	10.5	54.9
02	206 55.6	00.8	331 37.8	14.9	3 16.7	10.4	54.9
03	221 55.4	19 00.2	346 11.7	14.9	3 06.3	10.4	54.9
04	236 55.3	18 59.5	0 45.6	15.0	2 55.9	10.5	54.8
05	251 55.1	58.9	15 19.6	15.0	2 45.4	10.4	54.8
06	266 55.0	S18 58.3	29 53.6	15.0	N 2 35.0	10.5	54.8
07	281 54.9	57.7	44 27.6	15.1	2 24.5	10.4	54.8
08	296 54.7	57.1	59 01.7	15.1	2 14.1	10.5	54.8
S 09	311 54.6	·· 56.5	73 35.8	15.1	2 03.6	10.5	54.7
U 10	326 54.4	55.8	88 09.9	15.1	1 53.1	10.4	54.7
N 11	341 54.3	55.2	102 44.0	15.2	1 42.7	10.5	54.7
D 12	356 54.2	S18 54.6	117 18.2	15.1	N 1 32.2	10.4	54.7
A 13	11 54.0	54.0	131 52.3	15.3	1 21.8	10.5	54.7
Y 14	26 53.9	53.4	146 26.6	15.2	1 11.3	10.5	54.7
15	41 53.7	·· 52.7	161 00.8	15.2	1 00.8	10.4	54.6
16	56 53.6	52.1	175 35.0	15.3	0 50.4	10.5	54.6
17	71 53.5	51.5	190 09.3	15.3	0 39.9	10.4	54.6
18	86 53.3	S18 50.9	204 43.6	15.3	N 0 29.5	10.5	54.6
19	101 53.2	50.2	219 17.9	15.3	0 19.0	10.4	54.6
20	116 53.0	49.6	233 52.2	15.4	N 0 08.6	10.4	54.6
21	131 52.9	·· 49.0	248 26.6	15.3	S 0 01.8	10.4	54.6
22	146 52.8	48.4	263 00.9	15.4	0 12.2	10.5	54.5
23	161 52.6	47.7	277 35.3	15.4	0 22.7	10.4	54.5
26 00	176 52.5	S18 47.1	292 09.7	15.4	S 0 33.1	10.4	54.5
01	191 52.3	46.5	306 44.1	15.4	0 43.5	10.4	54.5
02	206 52.2	45.9	321 18.5	15.4	0 53.9	10.4	54.5
03	221 52.1	·· 45.2	335 52.9	15.5	1 04.3	10.3	54.5
04	236 51.9	44.6	350 27.4	15.4	1 14.6	10.4	54.5
05	251 51.8	44.0	5 01.8	15.5	1 25.0	10.4	54.5
06	266 51.7	S18 43.3	19 36.3	15.5	S 1 35.4	10.3	54.4
07	281 51.5	42.7	34 10.8	15.4	1 45.7	10.3	54.4
08	296 51.4	42.1	48 45.2	15.5	1 56.0	10.3	54.4
M 09	311 51.3	·· 41.5	63 19.7	15.5	2 06.3	10.4	54.4
O 10	326 51.1	40.8	77 54.2	15.5	2 16.7	10.2	54.4
N 11	341 51.0	40.2	92 28.7	15.5	2 26.9	10.3	54.4
D 12	356 50.9	S18 39.6	107 03.2	15.5	S 2 37.2	10.3	54.4
A 13	11 50.7	38.9	121 37.7	15.5	2 47.5	10.2	54.4
Y 14	26 50.6	38.3	136 12.2	15.5	2 57.7	10.3	54.4
15	41 50.5	·· 37.6	150 46.7	15.5	3 08.0	10.2	54.4
16	56 50.3	37.0	165 21.2	15.6	3 18.2	10.2	54.3
17	71 50.2	36.4	179 55.8	15.5	3 28.4	10.2	54.3
18	86 50.1	S18 35.7	194 30.3	15.5	S 3 38.6	10.1	54.3
19	101 50.0	35.1	209 04.8	15.5	3 48.7	10.2	54.3
20	116 49.8	34.5	223 39.3	15.5	3 58.9	10.1	54.3
21	131 49.7	·· 33.8	238 13.8	15.5	4 09.0	10.1	54.3
22	146 49.6	33.2	252 48.3	15.5	4 19.1	10.1	54.3
23	161 49.4	32.5	267 22.8	15.5	4 29.2	10.1	54.3
27 00	176 49.3	S18 31.9	281 57.3	15.5	S 4 39.3	10.0	54.3
01	191 49.2	31.3	296 31.8	15.5	4 49.3	10.0	54.3
02	206 49.0	30.6	311 06.3	15.4	4 59.3	10.0	54.3
03	221 48.9	·· 30.0	325 40.7	15.5	5 09.3	10.0	54.3
04	236 48.8	29.3	340 15.2	15.5	5 19.3	10.0	54.3
05	251 48.7	28.7	354 49.7	15.4	5 29.3	9.9	54.3
06	266 48.5	S18 28.0	9 24.1	15.4	S 5 39.2	9.9	54.3
07	281 48.4	27.4	23 58.5	15.5	5 49.1	9.9	54.2
08	296 48.3	26.8	38 33.0	15.4	5 59.0	9.9	54.2
T 09	311 48.2	·· 26.1	53 07.4	15.4	6 08.9	9.8	54.2
U 10	326 48.0	25.5	67 41.8	15.4	6 18.7	9.8	54.2
E 11	341 47.9	24.8	82 16.2	15.3	6 28.5	9.8	54.2
S 12	356 47.8	S18 24.2	96 50.5	15.4	S 6 38.3	9.7	54.2
D 13	11 47.7	23.5	111 24.9	15.3	6 48.0	9.7	54.2
A 14	26 47.5	22.9	125 59.2	15.4	6 57.7	9.7	54.2
Y 15	41 47.4	·· 22.2	140 33.6	15.3	7 07.4	9.7	54.2
16	56 47.3	21.6	155 07.9	15.3	7 17.1	9.6	54.2
17	71 47.2	20.9	169 42.2	15.2	7 26.7	9.6	54.2
18	86 47.0	S18 20.3	184 16.4	15.3	S 7 36.3	9.6	54.2
19	101 46.9	19.6	198 50.7	15.2	7 45.9	9.6	54.2
20	116 46.8	19.0	213 24.9	15.2	7 55.5	9.5	54.2
21	131 46.7	·· 18.3	227 59.1	15.2	8 05.0	9.4	54.2
22	146 46.6	17.7	242 33.3	15.2	8 14.4	9.5	54.2
23	161 46.4	17.0	257 07.5	15.1	8 23.9	9.4	54.2
	S.D. 16.3	d 0.6	S.D. 14.9		14.8		14.8

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

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

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
	m s	m s	h m	h m	h m	d	
25	12 16	12 23	12 12	03 57	16 18	19	
26	12 30	12 36	12 13	04 39	17 00	20	◑
27	12 43	12 49	12 13	05 21	17 42	21	

G.M.T.	ARIES	VENUS −3.3		MARS +1.4		JUPITER −1.8		SATURN +0.9		STARS		
	G.H.A.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.	Name	S.H.A.	Dec.
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	° ′
28 00	127 10.2	194 30.3	S22 06.1	162 19.1	S15 09.2	297 04.6	S 2 47.6	297 16.6	S 1 33.7	Acamar	315 37.0	S40 23.2
01	142 12.6	209 29.4	05.7	177 19.6	08.5	312 07.1	47.6	312 19.1	33.7	Achernar	335 45.2	S57 20.4
02	157 15.1	224 28.5	05.3	192 20.1	07.9	327 09.5	47.6	327 21.5	33.7	Acrux	173 36.5	S62 59.4
03	172 17.6	239 27.6	05.0	207 20.7	07.2	342 12.0	47.6	342 24.0	33.7	Adhara	255 31.6	S28 57.0
04	187 20.0	254 26.7	04.6	222 21.2	06.6	357 14.5	47.6	357 26.5	33.6	Aldebaran	291 17.5	N16 28.2
05	202 22.5	269 25.8	04.2	237 21.7	05.9	12 17.0	47.5	12 29.0	33.6			
06	217 25.0	284 24.9	S22 03.8	252 22.3	S15 05.3	27 19.5	S 2 47.5	27 31.5	S 1 33.6	Alioth	166 42.1	N56 03.5
07	232 27.4	299 24.0	03.4	267 22.8	04.6	42 22.0	47.5	42 34.0	33.6	Alkaid	153 18.2	N49 24.3
W 08	247 29.9	314 23.1	03.0	282 23.3	04.0	57 24.4	47.5	57 36.5	33.5	Al Na'ir	28 15.1	S47 03.4
E 09	262 32.4	329 22.2	02.7	297 23.9	03.3	72 26.9	47.4	72 39.0	33.5	Alnilam	276 11.2	S 1 13.0
D 10	277 34.8	344 21.4	02.3	312 24.4	02.7	87 29.4	47.4	87 41.5	33.5	Alphard	218 20.0	S 8 34.6
N 11	292 37.3	359 20.5	01.9	327 24.9	02.0	102 31.9	47.4	102 44.0	33.4			
E 12	307 39.8	14 19.6	S22 01.5	342 25.5	S15 01.3	117 34.4	S 2 47.4	117 46.5	S 1 33.4	Alphecca	126 32.0	N26 46.6
S 13	322 42.2	29 18.7	01.1	357 26.0	00.7	132 36.9	47.4	132 49.0	33.4	Alpheratz	358 09.3	N28 59.1
D 14	337 44.7	44 17.8	00.7	12 26.5	15 00.0	147 39.4	47.3	147 51.5	33.4	Altair	62 32.6	N 8 49.0
A 15	352 47.1	59 16.9	22 00.3	27 27.1	14 59.4	162 41.9	47.3	162 54.0	33.3	Ankaa	353 40.2	S42 24.9
Y 16	7 49.6	74 16.0	21 59.9	42 27.6	58.7	177 44.3	47.3	177 56.5	33.3	Antares	112 56.7	S26 23.3
17	22 52.1	89 15.2	59.5	57 28.1	58.1	192 46.8	47.3	192 59.0	33.3			
18	37 54.5	104 14.3	S21 59.1	72 28.7	S14 57.4	207 49.3	S 2 47.2	208 01.5	S 1 33.3	Arcturus	146 18.2	N19 16.8
19	52 57.0	119 13.4	58.7	87 29.2	56.8	222 51.8	47.2	223 04.0	33.2	Atria	108 21.1	S68 59.3
20	67 59.5	134 12.5	58.3	102 29.7	56.1	237 54.3	47.2	238 06.5	33.2	Avior	234 27.4	S59 27.0
21	83 01.9	149 11.6	57.9	117 30.3	55.4	252 56.8	47.2	253 09.0	33.2	Bellatrix	278 58.2	N 6 19.8
22	98 04.4	164 10.7	57.5	132 30.8	54.8	267 59.3	47.2	268 11.5	33.1	Betelgeuse	271 27.7	N 7 24.1
23	113 06.9	179 09.9	57.1	147 31.3	54.1	283 01.8	47.1	283 14.0	33.1			
29 00	128 09.3	194 09.0	S21 56.7	162 31.9	S14 53.5	298 04.3	S 2 47.1	298 16.6	S 1 33.1	Canopus	264 06.6	S52 41.4
01	143 11.8	209 08.1	56.3	177 32.4	52.8	313 06.8	47.1	313 19.1	33.1	Capella	281 10.6	N45 58.8
02	158 14.2	224 07.2	55.9	192 32.9	52.2	328 09.2	47.1	328 21.6	33.0	Deneb	49 48.7	N45 12.7
03	173 16.7	239 06.3	55.5	207 33.5	51.5	343 11.7	47.0	343 24.1	33.0	Denebola	182 58.6	N14 40.6
04	188 19.2	254 05.4	55.1	222 34.0	50.8	358 14.2	47.0	358 26.6	33.0	Diphda	349 20.8	S18 05.7
05	203 21.6	269 04.6	54.7	237 34.5	50.2	13 16.7	47.0	13 29.1	32.9			
06	218 24.1	284 03.7	S21 54.2	252 35.1	S14 49.5	28 19.2	S 2 47.0	28 31.6	S 1 32.9	Dubhe	194 21.3	N61 51.0
07	233 26.6	299 02.8	53.8	267 35.6	48.9	43 21.7	46.9	43 34.1	32.9	Elnath	278 43.5	N28 35.5
T 08	248 29.0	314 01.9	53.4	282 36.1	48.2	58 24.2	46.9	58 36.6	32.8	Eltanin	90 58.0	N51 29.3
H 09	263 31.5	329 01.0	53.0	297 36.7	47.5	73 26.7	46.9	73 39.1	32.8	Enif	34 11.6	N 9 47.2
U 10	278 34.0	344 00.2	52.6	312 37.2	46.9	88 29.2	46.9	88 41.6	32.8	Fomalhaut	15 51.4	S29 43.6
R 11	293 36.4	358 59.3	52.2	327 37.7	46.2	103 31.7	46.8	103 44.1	32.8			
S 12	308 38.9	13 58.4	S21 51.7	342 38.3	S14 45.6	118 34.2	S 2 46.8	118 46.6	S 1 32.7	Gacrux	172 28.1	S57 00.2
D 13	323 41.4	28 57.5	51.3	357 38.8	44.9	133 36.7	46.8	133 49.1	32.7	Gienah	176 17.5	S17 26.1
A 14	338 43.8	43 56.6	50.9	12 39.4	44.2	148 39.2	46.8	148 51.6	32.7	Hadar	149 22.9	S60 16.6
Y 15	353 46.3	58 55.8	50.5	27 39.9	43.6	163 41.7	46.7	163 54.1	32.6	Hamal	328 28.7	N23 22.3
16	8 48.7	73 54.9	50.1	42 40.4	42.9	178 44.2	46.7	178 56.6	32.6	Kaus Aust.	84 16.9	S34 23.6
17	23 51.2	88 54.0	49.6	57 41.0	42.2	193 46.6	46.7	193 59.1	32.6			
18	38 53.7	103 53.1	S21 49.2	72 41.5	S14 41.6	208 49.1	S 2 46.7	209 01.6	S 1 32.6	Kochab	137 19.2	N74 13.8
19	53 56.1	118 52.3	48.8	87 42.0	40.9	223 51.6	46.6	224 04.1	32.5	Markab	14 03.2	N15 06.1
20	68 58.6	133 51.4	48.3	102 42.6	40.3	238 54.1	46.6	239 06.6	32.5	Menkar	314 40.8	N 4 00.8
21	84 01.1	148 50.5	47.9	117 43.1	39.6	253 56.6	46.6	254 09.1	32.5	Menkent	148 36.7	S36 16.4
22	99 03.5	163 49.6	47.5	132 43.7	38.9	268 59.1	46.6	269 11.6	32.4	Miaplacidus	221 43.9	S69 38.3
23	114 06.0	178 48.8	47.1	147 44.2	38.3	284 01.6	46.5	284 14.1	32.4			
30 00	129 08.5	193 47.9	S21 46.6	162 44.7	S14 37.6	299 04.1	S 2 46.5	299 16.6	S 1 32.4	Mirfak	309 15.6	N49 47.8
01	144 10.9	208 47.0	46.2	177 45.3	36.9	314 06.6	46.5	314 19.2	32.3	Nunki	76 29.2	S26 19.2
02	159 13.4	223 46.1	45.8	192 45.8	36.3	329 09.1	46.5	329 21.7	32.3	Peacock	53 58.6	S56 47.8
03	174 15.9	238 45.3	45.3	207 46.4	35.6	344 11.6	46.4	344 24.2	32.3	Pollux	243 57.5	N28 04.3
04	189 18.3	253 44.4	44.9	222 46.9	34.9	359 14.1	46.4	359 26.7	32.3	Procyon	245 25.2	N 5 16.3
05	204 20.8	268 43.5	44.4	237 47.4	34.3	14 16.6	46.4	14 29.2	32.2			
06	219 23.2	283 42.6	S21 44.0	252 48.0	S14 33.6	29 19.1	S 2 46.3	29 31.7	S 1 32.2	Rasalhague	96 29.6	N12 34.4
07	234 25.7	298 41.8	43.6	267 48.5	32.9	44 21.6	46.3	44 34.2	32.2	Regulus	208 09.4	N12 03.5
08	249 28.2	313 40.9	43.1	282 49.1	32.3	59 24.1	46.3	59 36.7	32.1	Rigel	281 35.6	S 8 13.6
F 09	264 30.6	328 40.0	42.7	297 49.6	31.6	74 26.6	46.3	74 39.2	32.1	Rigil Kent.	140 25.5	S60 45.0
R 10	279 33.1	343 39.1	42.2	312 50.1	30.9	89 29.1	46.2	89 41.7	32.1	Sabik	102 41.1	S15 42.0
I 11	294 35.6	358 38.3	41.8	327 50.7	30.3	104 31.6	46.2	104 44.2	32.0			
D 12	309 38.0	13 37.4	S21 41.3	342 51.2	S14 29.6	119 34.1	S 2 46.2	119 46.7	S 1 32.0	Schedar	350 09.0	N56 26.1
A 13	324 40.5	28 36.5	40.9	357 51.8	28.9	134 36.6	46.2	134 49.2	32.0	Shaula	96 55.7	S37 05.3
Y 14	339 43.0	43 35.7	40.4	12 52.3	28.3	149 39.1	46.1	149 51.7	31.9	Sirius	258 55.2	S16 41.6
15	354 45.4	58 34.8	40.0	27 52.8	27.6	164 41.6	46.1	164 54.3	31.9	Spica	158 57.2	S11 03.7
16	9 47.9	73 33.9	39.5	42 53.4	26.9	179 44.1	46.1	179 56.8	31.9	Suhail	223 10.1	S43 21.4
17	24 50.3	88 33.1	39.1	57 53.9	26.3	194 46.6	46.0	194 59.3	31.9			
18	39 52.8	103 32.2	S21 38.6	72 54.5	S14 25.6	209 49.1	S 2 46.0	210 01.8	S 1 31.8	Vega	80 56.0	N38 45.8
19	54 55.3	118 31.3	38.2	87 55.0	24.9	224 51.6	46.0	225 04.3	31.8	Zuben'ubi	137 32.8	S15 57.7
20	69 57.7	133 30.4	37.7	102 55.5	24.3	239 54.2	46.0	240 06.8	31.8			
21	85 00.2	148 29.6	37.3	117 56.1	23.6	254 56.7	45.9	255 09.3	31.7		S.H.A.	Mer. Pass.
22	100 02.7	163 28.7	36.8	132 56.6	22.9	269 59.2	45.9	270 11.8	31.7		° ′	h m
23	115 05.1	178 27.8	36.4	147 57.2	22.3	285 01.7	45.9	285 14.3	31.7	Venus	65 59.7	11 04
	h m									Mars	34 22.5	13 09
Mer. Pass.	15 24.8	v −0.9	d 0.4	v 0.5	d 0.7	v 2.5	d 0.0	v 2.5	d 0.0	Jupiter	169 54.9	4 07
										Saturn	170 07.2	4 06

G.M.T.	SUN G.H.A.	SUN Dec.	MOON G.H.A.	MOON v	MOON Dec.	MOON d	MOON H.P.
d h	° ′	° ′	° ′	′	° ′	′	′
28 00	176 46.3	S18 16.4	271 41.6	15.1	S 8 33.3	9.4	54.2
01	191 46.2	15.7	286 15.7	15.1	8 42.7	9.3	54.2
02	206 46.1	15.0	300 49.8	15.1	8 52.0	9.3	54.2
03	221 46.0	·· 14.4	315 23.9	15.0	9 01.3	9.3	54.2
04	236 45.8	13.7	329 57.9	15.0	9 10.6	9.2	54.2
05	251 45.7	13.1	344 31.9	15.0	9 19.8	9.2	54.2
06	266 45.6	S18 12.4	359 05.9	15.0	S 9 29.0	9.2	54.2
W 07	281 45.5	11.8	13 39.9	14.9	9 38.2	9.1	54.2
E 08	296 45.4	11.1	28 13.8	14.9	9 47.3	9.1	54.2
D 09	311 45.3	·· 10.4	42 47.7	14.9	9 56.4	9.1	54.2
N 10	326 45.1	09.8	57 21.6	14.8	10 05.5	9.0	54.2
E 11	341 45.0	09.1	71 55.4	14.8	10 14.5	8.9	54.3
S 12	356 44.9	S18 08.5	86 29.2	14.8	S10 23.4	9.0	54.3
D 13	11 44.8	07.8	101 03.0	14.7	10 32.4	8.8	54.3
A 14	26 44.7	07.1	115 36.7	14.7	10 41.2	8.9	54.3
Y 15	41 44.6	·· 06.5	130 10.4	14.7	10 50.1	8.8	54.3
16	56 44.4	05.8	144 44.1	14.6	10 58.9	8.7	54.3
17	71 44.3	05.1	159 17.7	14.6	11 07.6	8.8	54.3
18	86 44.2	S18 04.5	173 51.3	14.6	S11 16.4	8.6	54.3
19	101 44.1	03.8	188 24.9	14.5	11 25.0	8.6	54.3
20	116 44.0	03.1	202 58.4	14.5	11 33.6	8.6	54.3
21	131 43.9	·· 02.5	217 31.9	14.4	11 42.2	8.6	54.3
22	146 43.8	01.8	232 05.3	14.4	11 50.8	8.4	54.3
23	161 43.6	01.1	246 38.7	14.4	11 59.2	8.5	54.3
29 00	176 43.5	S18 00.5	261 12.1	14.3	S12 07.7	8.4	54.3
01	191 43.4	17 59.8	275 45.4	14.3	12 16.1	8.3	54.3
02	206 43.3	59.1	290 18.7	14.2	12 24.4	8.3	54.4
03	221 43.2	·· 58.5	304 51.9	14.2	12 32.7	8.3	54.4
04	236 43.1	57.8	319 25.1	14.2	12 41.0	8.1	54.4
05	251 43.0	57.1	333 58.3	14.1	12 49.1	8.2	54.4
06	266 42.9	S17 56.4	348 31.4	14.1	S12 57.3	8.1	54.4
07	281 42.8	55.8	3 04.5	14.0	13 05.4	8.0	54.4
T 08	296 42.7	55.1	17 37.5	14.0	13 13.4	8.0	54.4
H 09	311 42.5	·· 54.4	32 10.5	13.9	13 21.4	7.9	54.4
U 10	326 42.4	53.8	46 43.4	13.9	13 29.3	7.9	54.4
R 11	341 42.3	53.1	61 16.3	13.8	13 37.2	7.8	54.4
S 12	356 42.2	S17 52.4	75 49.1	13.8	S13 45.0	7.8	54.5
D 13	11 42.1	51.7	90 21.9	13.8	13 52.8	7.7	54.5
A 14	26 42.0	51.1	104 54.7	13.7	14 00.5	7.7	54.5
Y 15	41 41.9	·· 50.4	119 27.4	13.6	14 08.2	7.6	54.5
16	56 41.8	49.7	134 00.0	13.6	14 15.8	7.5	54.5
17	71 41.7	49.0	148 32.6	13.6	14 23.3	7.5	54.5
18	86 41.6	S17 48.3	163 05.2	13.5	S14 30.8	7.4	54.5
19	101 41.5	47.7	177 37.7	13.4	14 38.2	7.4	54.6
20	116 41.4	47.0	192 10.1	13.4	14 45.6	7.3	54.6
21	131 41.3	·· 46.3	206 42.5	13.3	14 52.9	7.3	54.6
22	146 41.2	45.6	221 14.8	13.3	15 00.2	7.1	54.6
23	161 41.1	44.9	235 47.1	13.3	15 07.3	7.2	54.6
30 00	176 40.9	S17 44.3	250 19.4	13.2	S15 14.5	7.0	54.6
01	191 40.8	43.6	264 51.6	13.1	15 21.5	7.0	54.6
02	206 40.7	42.9	279 23.7	13.1	15 28.5	6.9	54.7
03	221 40.6	·· 42.2	293 55.8	13.0	15 35.4	6.9	54.7
04	236 40.5	41.5	308 27.8	13.0	15 42.3	6.8	54.7
05	251 40.4	40.9	322 59.8	12.9	15 49.1	6.7	54.7
06	266 40.3	S17 40.2	337 31.7	12.9	S15 55.8	6.7	54.7
07	281 40.2	39.5	352 03.6	12.8	16 02.5	6.6	54.7
08	296 40.1	38.8	6 35.4	12.7	16 09.1	6.5	54.8
F 09	311 40.0	·· 38.1	21 07.1	12.7	16 15.6	6.5	54.8
R 10	326 39.9	37.4	35 38.8	12.7	16 22.1	6.4	54.8
I 11	341 39.8	36.7	50 10.5	12.5	16 28.5	6.3	54.8
D 12	356 39.7	S17 36.0	64 42.0	12.6	S16 34.8	6.2	54.8
A 13	11 39.6	35.4	79 13.6	12.4	16 41.0	6.2	54.8
Y 14	26 39.5	34.7	93 45.0	12.4	16 47.2	6.1	54.9
15	41 39.4	·· 34.0	108 16.4	12.4	16 53.3	6.0	54.9
16	56 39.3	33.3	122 47.8	12.3	16 59.3	6.0	54.9
17	71 39.2	32.6	137 19.1	12.2	17 05.3	5.9	54.9
18	86 39.1	S17 31.9	151 50.3	12.2	S17 11.2	5.8	54.9
19	101 39.0	31.2	166 21.5	12.1	17 17.0	5.7	55.0
20	116 38.9	30.5	180 52.6	12.1	17 22.7	5.6	55.0
21	131 38.8	·· 29.8	195 23.7	12.0	17 28.3	5.6	55.0
22	146 38.8	29.1	209 54.7	12.0	17 33.9	5.5	55.0
23	161 38.7	28.4	224 25.7	11.8	17 39.4	5.4	55.1
	S.D. 16.3	d 0.7	S.D. 14.8		14.8		14.9

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

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

Day	SUN Eqn. of Time 00ʰ	SUN Eqn. of Time 12ʰ	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
	m s	m s	h m	h m	h m	d	
28	12 54	13 00	12 13	06 04	18 25	22	
29	13 06	13 11	12 13	06 47	19 10	23	◑
30	13 16	13 21	12 13	07 33	19 56	24	

G.M.T.	ARIES	VENUS −3.3		MARS +1.4		JUPITER −1.8		SATURN +0.9	
	G.H.A.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
31 00	130 07.6	193 27.0	S21 35.9	162 57.7	S14 21.6	300 04.2	S 2 45.8	300 16.8	S 1 31.6
01	145 10.1	208 26.1	35.4	177 58.3	20.9	315 06.7	45.8	315 19.3	31.6
02	160 12.5	223 25.2	35.0	192 58.8	20.2	330 09.2	45.8	330 21.9	31.6
03	175 15.0	238 24.4	·· 34.5	207 59.4	·· 19.6	345 11.7	·· 45.7	345 24.4	·· 31.5
04	190 17.5	253 23.5	34.0	222 59.9	18.9	0 14.2	45.7	0 26.9	31.5
05	205 19.9	268 22.7	33.6	238 00.4	18.2	15 16.7	45.7	15 29.4	31.5
06	220 22.4	283 21.8	S21 33.1	253 01.0	S14 17.6	30 19.2	S 2 45.7	30 31.9	S 1 31.4
07	235 24.8	298 20.9	32.6	268 01.5	16.9	45 21.7	45.6	45 34.4	31.4
S 08	250 27.3	313 20.1	32.2	283 02.1	16.2	60 24.2	45.6	60 36.9	31.4
A 09	265 29.8	328 19.2	·· 31.7	298 02.6	·· 15.5	75 26.7	·· 45.6	75 39.4	·· 31.3
T 10	280 32.2	343 18.3	31.2	313 03.2	14.9	90 29.2	45.5	90 41.9	31.3
U 11	295 34.7	358 17.5	30.8	328 03.7	14.2	105 31.7	45.5	105 44.5	31.3
R 12	310 37.2	13 16.6	S21 30.3	343 04.3	S14 13.5	120 34.3	S 2 45.5	120 47.0	S 1 31.2
D 13	325 39.6	28 15.7	29.8	358 04.8	12.9	135 36.8	45.4	135 49.5	31.2
A 14	340 42.1	43 14.9	29.3	13 05.3	12.2	150 39.3	45.4	150 52.0	31.2
Y 15	355 44.6	58 14.0	·· 28.9	28 05.9	·· 11.5	165 41.8	·· 45.4	165 54.5	·· 31.1
16	10 47.0	73 13.2	28.4	43 06.4	10.8	180 44.3	45.3	180 57.0	31.1
17	25 49.5	88 12.3	27.9	58 07.0	10.2	195 46.8	45.3	195 59.5	31.1
18	40 52.0	103 11.4	S21 27.4	73 07.5	S14 09.5	210 49.3	S 2 45.3	211 02.0	S 1 31.0
19	55 54.4	118 10.6	26.9	88 08.1	08.8	225 51.8	45.3	226 04.6	31.0
20	70 56.9	133 09.7	26.5	103 08.6	08.1	240 54.3	45.2	241 07.1	31.0
21	85 59.3	148 08.9	·· 26.0	118 09.2	·· 07.5	255 56.9	·· 45.2	256 09.6	·· 30.9
22	101 01.8	163 08.0	25.5	133 09.7	06.8	270 59.4	45.2	271 12.1	30.9
23	116 04.3	178 07.1	25.0	148 10.3	06.1	286 01.9	45.1	286 14.6	30.9
1 00	131 06.7	193 06.3	S21 24.5	163 10.8	S14 05.4	301 04.4	S 2 45.1	301 17.1	S 1 30.8
01	146 09.2	208 05.4	24.0	178 11.4	04.8	316 06.9	45.1	316 19.6	30.8
02	161 11.7	223 04.6	23.5	193 11.9	04.1	331 09.4	45.0	331 22.2	30.8
03	176 14.1	238 03.7	·· 23.0	208 12.5	·· 03.4	346 11.9	·· 45.0	346 24.7	·· 30.7
04	191 16.6	253 02.9	22.6	223 13.0	02.7	1 14.4	45.0	1 27.2	30.7
05	206 19.1	268 02.0	22.1	238 13.6	02.1	16 17.0	44.9	16 29.7	30.7
06	221 21.5	283 01.2	S21 21.6	253 14.1	S14 01.4	31 19.5	S 2 44.9	31 32.2	S 1 30.6
07	236 24.0	298 00.3	21.1	268 14.7	00.7	46 22.0	44.9	46 34.7	30.6
08	251 26.4	312 59.4	20.6	283 15.2	14 00.0	61 24.5	44.8	61 37.2	30.6
S 09	266 28.9	327 58.6	·· 20.1	298 15.8	13 59.3	76 27.0	·· 44.8	76 39.8	·· 30.5
U 10	281 31.4	342 57.7	19.6	313 16.3	58.7	91 29.5	44.8	91 42.3	30.5
N 11	296 33.8	357 56.9	19.1	328 16.8	58.0	106 32.0	44.7	106 44.8	30.5
D 12	311 36.3	12 56.0	S21 18.6	343 17.4	S13 57.3	121 34.6	S 2 44.7	121 47.3	S 1 30.4
A 13	326 38.8	27 55.2	18.1	358 17.9	56.6	136 37.1	44.7	136 49.8	30.4
Y 14	341 41.2	42 54.3	17.6	13 18.5	55.9	151 39.6	44.6	151 52.3	30.4
15	356 43.7	57 53.5	·· 17.1	28 19.0	·· 55.3	166 42.1	·· 44.6	166 54.9	·· 30.3
16	11 46.2	72 52.6	16.6	43 19.6	54.6	181 44.6	44.6	181 57.4	30.3
17	26 48.6	87 51.8	16.1	58 20.2	53.9	196 47.1	44.5	196 59.9	30.3
18	41 51.1	102 50.9	S21 15.6	73 20.7	S13 53.2	211 49.7	S 2 44.5	212 02.4	S 1 30.2
19	56 53.6	117 50.1	15.1	88 21.3	52.5	226 52.2	44.4	227 04.9	30.2
20	71 56.0	132 49.2	14.5	103 21.8	51.9	241 54.7	44.4	242 07.4	30.2
21	86 58.5	147 48.4	·· 14.0	118 22.4	·· 51.2	256 57.2	·· 44.4	257 10.0	·· 30.1
22	102 00.9	162 47.5	13.5	133 22.9	50.5	271 59.7	44.3	272 12.5	30.1
23	117 03.4	177 46.7	13.0	148 23.5	49.8	287 02.3	44.3	287 15.0	30.1
2 00	132 05.9	192 45.8	S21 12.5	163 24.0	S13 49.1	302 04.8	S 2 44.3	302 17.5	S 1 30.0
01	147 08.3	207 45.0	12.0	178 24.6	48.5	317 07.3	44.2	317 20.0	30.0
02	162 10.8	222 44.1	11.5	193 25.1	47.8	332 09.8	44.2	332 22.5	30.0
03	177 13.3	237 43.3	·· 10.9	208 25.7	·· 47.1	347 12.3	·· 44.2	347 25.1	·· 29.9
04	192 15.7	252 42.4	10.4	223 26.2	46.4	2 14.9	44.1	2 27.6	29.9
05	207 18.2	267 41.6	09.9	238 26.8	45.7	17 17.4	44.1	17 30.1	29.8
06	222 20.7	282 40.7	S21 09.4	253 27.3	S13 45.0	32 19.9	S 2 44.1	32 32.6	S 1 29.8
07	237 23.1	297 39.9	08.9	268 27.9	44.4	47 22.4	44.0	47 35.1	29.8
08	252 25.6	312 39.0	08.3	283 28.4	43.7	62 25.0	44.0	62 37.7	29.7
M 09	267 28.1	327 38.2	·· 07.8	298 29.0	·· 43.0	77 27.5	·· 43.9	77 40.2	·· 29.7
O 10	282 30.5	342 37.4	07.3	313 29.5	42.3	92 30.0	43.9	92 42.7	29.7
N 11	297 33.0	357 36.5	06.8	328 30.1	41.6	107 32.5	43.9	107 45.2	29.6
D 12	312 35.4	12 35.7	S21 06.2	343 30.7	S13 40.9	122 35.0	S 2 43.8	122 47.7	S 1 29.6
A 13	327 37.9	27 34.8	05.7	358 31.2	40.3	137 37.6	43.8	137 50.3	29.6
Y 14	342 40.4	42 34.0	05.2	13 31.8	39.6	152 40.1	43.8	152 52.8	29.5
15	357 42.8	57 33.1	·· 04.7	28 32.3	·· 38.9	167 42.6	·· 43.7	167 55.3	·· 29.5
16	12 45.3	72 32.3	04.1	43 32.9	38.2	182 45.1	43.7	182 57.8	29.5
17	27 47.8	87 31.5	03.6	58 33.4	37.5	197 47.7	43.6	198 00.3	29.4
18	42 50.2	102 30.6	S21 03.1	73 34.0	S13 36.8	212 50.2	S 2 43.6	213 02.9	S 1 29.4
19	57 52.7	117 29.8	02.5	88 34.5	36.1	227 52.7	43.6	228 05.4	29.3
20	72 55.2	132 28.9	02.0	103 35.1	35.5	242 55.2	43.5	243 07.9	29.3
21	87 57.6	147 28.1	·· 01.5	118 35.6	·· 34.8	257 57.8	·· 43.5	258 10.4	·· 29.3
22	103 00.1	162 27.3	00.9	133 36.2	34.1	273 00.3	43.5	273 12.9	29.2
23	118 02.5	177 26.4	00.4	148 36.8	33.4	288 02.8	43.4	288 15.5	29.2
	h m								
Mer. Pass.	15 13.1	v −0.9	d 0.5	v 0.5	d 0.7	v 2.5	d 0.0	v 2.5	d 0.0

STARS		
Name	S.H.A.	Dec.
	° ′	° ′
Acamar	315 37.0	S40 23.2
Achernar	335 45.3	S57 20.4
Acrux	173 36.5	S62 59.4
Adhara	255 31.6	S28 57.0
Aldebaran	291 17.5	N16 28.2
Alioth	166 42.0	N56 03.5
Alkaid	153 18.2	N49 24.3
Al Na'ir	28 15.1	S47 03.4
Alnilam	276 11.2	S 1 13.0
Alphard	218 20.0	S 8 34.6
Alphecca	126 32.0	N26 46.6
Alpheratz	358 09.3	N28 59.1
Altair	62 32.6	N 8 49.0
Ankaa	353 40.2	S42 24.9
Antares	112 56.7	S26 23.3
Arcturus	146 18.2	N19 16.8
Atria	108 21.0	S68 59.3
Avior	234 27.4	S59 27.0
Bellatrix	278 58.2	N 6 19.8
Betelgeuse	271 27.7	N 7 24.1
Canopus	264 06.6	S52 41.4
Capella	281 10.6	N45 58.8
Deneb	49 48.7	N45 12.7
Denebola	182 58.6	N14 40.6
Diphda	349 20.8	S18 05.7
Dubhe	194 21.3	N61 51.0
Elnath	278 43.6	N28 35.5
Eltanin	90 58.0	N51 29.3
Enif	34 11.6	N 9 47.2
Fomalhaut	15 51.4	S29 43.6
Gacrux	172 28.1	S57 00.2
Gienah	176 17.5	S17 26.1
Hadar	149 22.8	S60 16.6
Hamal	328 28.7	N23 22.3
Kaus Aust.	84 16.8	S34 23.6
Kochab	137 19.1	N74 13.8
Markab	14 03.2	N15 06.1
Menkar	314 40.8	N 4 00.8
Menkent	148 36.6	S36 16.4
Miaplacidus	221 43.9	S69 38.3
Mirfak	309 15.6	N49 47.8
Nunki	76 29.2	S26 19.2
Peacock	53 58.6	S56 47.8
Pollux	243 57.5	N28 04.3
Procyon	245 25.2	N 5 16.3
Rasalhague	96 29.6	N12 34.3
Regulus	208 09.4	N12 03.5
Rigel	281 35.6	S 8 13.6
Rigil Kent.	140 25.4	S60 45.0
Sabik	102 41.0	S15 42.1
Schedar	350 09.8	N56 26.1
Shaula	96 55.7	S37 05.3
Sirius	258 55.2	S16 41.6
Spica	158 57.2	S11 03.7
Suhail	223 10.1	S43 21.4
Vega	80 56.0	N38 45.8
Zuben'ubi	137 32.8	S15 57.7

	S.H.A.	Mer. Pass.
	° ′	h m
Venus	61 59.6	11 08
Mars	32 04.1	13 07
Jupiter	169 57.7	3 55
Saturn	170 10.4	3 54

G.M.T.	SUN G.H.A.	SUN Dec.	MOON G.H.A.	v	MOON Dec.	d	MOON H.P.
d h	° ′	° ′	° ′	′	° ′	′	′
31 00	176 38.6	S17 27.7	238 56.5	11.9	S17 44.8	5.4	55.1
01	191 38.5	27.1	253 27.4	11.7	17 50.2	5.2	55.1
02	206 38.4	26.4	267 58.1	11.7	17 55.4	5.2	55.1
03	221 38.3	·· 25.7	282 28.8	11.7	18 00.6	5.1	55.1
04	236 38.2	25.0	296 59.5	11.6	18 05.7	5.0	55.2
05	251 38.1	24.3	311 30.1	11.5	18 10.7	4.9	55.2
06	266 38.0	S17 23.6	326 00.6	11.5	S18 15.6	4.9	55.2
07	281 37.9	22.9	340 31.1	11.4	18 20.5	4.7	55.2
S 08	296 37.8	22.2	355 01.5	11.4	18 25.2	4.7	55.3
A 09	311 37.7	·· 21.5	9 31.9	11.3	18 29.9	4.6	55.3
T 10	326 37.6	20.8	24 02.2	11.2	18 34.5	4.5	55.3
U 11	341 37.5	20.1	38 32.4	11.2	18 39.0	4.4	55.3
R 12	356 37.4	S17 19.4	53 02.6	11.1	S18 43.4	4.3	55.3
D 13	11 37.4	18.7	67 32.7	11.1	18 47.7	4.2	55.4
A 14	26 37.3	18.0	82 02.8	11.0	18 51.9	4.2	55.4
Y 15	41 37.2	·· 17.3	96 32.8	10.9	18 56.1	4.1	55.4
16	56 37.1	16.6	111 02.7	10.9	19 00.2	3.9	55.4
17	71 37.0	15.9	125 32.6	10.8	19 04.1	3.9	55.5
18	86 36.9	S17 15.2	140 02.4	10.8	S19 08.0	3.8	55.5
19	101 36.8	14.4	154 32.2	10.7	19 11.8	3.7	55.5
20	116 36.7	13.7	169 01.9	10.7	19 15.5	3.6	55.5
21	131 36.6	·· 13.0	183 31.6	10.6	19 19.1	3.5	55.6
22	146 36.6	12.3	198 01.2	10.5	19 22.6	3.4	55.6
23	161 36.5	11.6	212 30.7	10.5	19 26.0	3.3	55.6
1 00	176 36.4	S17 10.9	227 00.2	10.4	S19 29.3	3.2	55.6
01	191 36.3	10.2	241 29.6	10.4	19 32.5	3.1	55.7
02	206 36.2	09.5	255 59.0	10.3	19 35.6	3.0	55.7
03	221 36.1	·· 08.8	270 28.3	10.3	19 38.6	2.9	55.7
04	236 36.0	08.1	284 57.6	10.2	19 41.5	2.9	55.8
05	251 35.9	07.4	299 26.8	10.2	19 44.4	2.7	55.8
06	266 35.9	S17 06.7	313 56.0	10.1	S19 47.1	2.6	55.8
07	281 35.8	06.0	328 25.1	10.0	19 49.7	2.5	55.8
08	296 35.7	05.2	342 54.1	10.0	19 52.2	2.4	55.9
S 09	311 35.6	·· 04.5	357 23.1	9.9	19 54.6	2.4	55.9
U 10	326 35.5	03.8	11 52.0	9.9	19 57.0	2.2	55.9
N 11	341 35.4	03.1	26 20.9	9.9	19 59.2	2.1	55.9
D 12	356 35.4	S17 02.4	40 49.8	9.7	S20 01.3	2.0	56.0
A 13	11 35.3	01.7	55 18.5	9.8	20 03.3	1.9	56.0
Y 14	26 35.2	01.0	69 47.3	9.7	20 05.2	1.8	56.0
15	41 35.1	17 00.2	84 16.0	9.6	20 07.0	1.7	56.1
16	56 35.0	16 59.5	98 44.6	9.6	20 08.7	1.6	56.1
17	71 35.0	58.8	113 13.2	9.5	20 10.3	1.5	56.1
18	86 34.9	S16 58.1	127 41.7	9.5	S20 11.8	1.3	56.1
19	101 34.8	57.4	142 10.2	9.5	20 13.1	1.3	56.2
20	116 34.7	56.7	156 38.7	9.4	20 14.4	1.2	56.2
21	131 34.6	·· 55.9	171 07.1	9.3	20 15.6	1.0	56.2
22	146 34.6	55.2	185 35.4	9.3	20 16.6	0.9	56.3
23	161 34.5	54.5	200 03.7	9.3	20 17.5	0.9	56.3
2 00	176 34.4	S16 53.8	214 32.0	9.2	S20 18.4	0.7	56.3
01	191 34.3	53.1	229 00.2	9.2	20 19.1	0.6	56.3
02	206 34.2	52.3	243 28.4	9.1	20 19.7	0.5	56.4
03	221 34.2	·· 51.6	257 56.5	9.1	20 20.2	0.4	56.4
04	236 34.1	50.9	272 24.6	9.0	20 20.6	0.3	56.4
05	251 34.0	50.2	286 52.6	9.0	20 20.9	0.1	56.5
06	266 33.9	S16 49.5	301 20.6	9.0	S20 21.0	0.1	56.5
07	281 33.9	48.7	315 48.6	8.9	20 21.1	0.1	56.5
08	296 33.8	48.0	330 16.5	8.9	20 21.0	0.2	56.6
M 09	311 33.7	·· 47.3	344 44.4	8.9	20 20.8	0.2	56.6
O 10	326 33.6	46.6	359 12.3	8.8	20 20.6	0.4	56.6
N 11	341 33.6	45.8	13 40.1	8.8	20 20.2	0.6	56.6
D 12	356 33.5	S16 45.1	28 07.9	8.7	S20 19.6	0.6	56.7
A 13	11 33.4	44.4	42 35.6	8.7	20 19.0	0.7	56.7
Y 14	26 33.3	43.7	57 03.3	8.7	20 18.3	0.9	56.7
15	41 33.3	·· 42.9	71 31.0	8.6	20 17.4	1.0	56.8
16	56 33.2	42.2	85 58.6	8.7	20 16.4	1.1	56.8
17	71 33.1	41.5	100 26.3	8.5	20 15.3	1.2	56.8
18	86 33.0	S16 40.7	114 53.8	8.6	S20 14.1	1.3	56.9
19	101 33.0	40.0	129 21.4	8.5	20 12.8	1.5	56.9
20	116 32.9	39.3	143 48.9	8.5	20 11.3	1.5	56.9
21	131 32.8	·· 38.6	158 16.4	8.5	20 09.8	1.7	56.9
22	146 32.8	37.8	172 43.9	8.4	20 08.1	1.8	57.0
23	161 32.7	37.1	187 11.3	8.5	20 06.3	1.9	57.0
	S.D. 16.3	d 0.7	S.D. 15.1		15.3		15.4

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 31	Moonrise 1	Moonrise 2	Moonrise 3
°	h m	h m	h m	h m	h m	h m	h m
N 72	07 10	08 39	10 28	▬	▬	▬	▬
N 70	07 02	08 20	09 46	06 42	▬	▬	10 19
68	06 55	08 05	09 18	05 57	07 23	08 30	09 06
66	06 50	07 53	08 57	05 27	06 44	07 46	08 29
64	06 45	07 43	08 40	05 05	06 17	07 17	08 02
62	06 40	07 34	08 26	04 47	05 56	06 55	07 42
60	06 36	07 27	08 14	04 32	05 39	06 37	07 25
N 58	06 32	07 20	08 04	04 20	05 24	06 22	07 11
56	06 29	07 14	07 55	04 09	05 12	06 09	06 59
54	06 26	07 09	07 47	04 00	05 02	05 58	06 48
52	06 23	07 04	07 40	03 51	04 52	05 49	06 39
50	06 20	06 59	07 34	03 44	04 44	05 40	06 30
45	06 14	06 49	07 20	03 28	04 26	05 21	06 12
N 40	06 08	06 40	07 09	03 15	04 11	05 06	05 58
35	06 02	06 32	06 59	03 03	03 59	04 53	05 45
30	05 57	06 25	06 50	02 54	03 48	04 42	05 34
20	05 46	06 13	06 36	02 37	03 30	04 23	05 16
N 10	05 35	06 01	06 23	02 22	03 13	04 06	04 59
0	05 23	05 48	06 10	02 09	02 59	03 51	04 44
S 10	05 10	05 36	05 58	01 55	02 44	03 35	04 29
20	04 53	05 21	05 44	01 41	02 28	03 18	04 13
30	04 32	05 03	05 29	01 25	02 09	02 59	03 54
35	04 18	04 52	05 19	01 15	01 59	02 48	03 43
40	04 02	04 39	05 09	01 04	01 47	02 36	03 31
45	03 41	04 23	04 57	00 52	01 33	02 21	03 16
S 50	03 14	04 04	04 42	00 36	01 15	02 02	02 58
52	03 00	03 54	04 34	00 29	01 07	01 54	02 50
54	02 43	03 43	04 27	00 21	00 58	01 44	02 40
56	02 22	03 31	04 18	00 12	00 48	01 33	02 29
58	01 54	03 16	04 08	00 02	00 36	01 20	02 17
S 60	01 10	02 58	03 56	24 23	00 23	01 06	02 03

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 31	Moonset 1	Moonset 2	Moonset 3
°	h m	h m	h m	h m	h m	h m	h m
N 72	14 01	15 50	17 19	▬	▬	▬	▬
N 70	14 43	16 08	17 27	09 51	▬	▬	11 41
68	15 11	16 23	17 33	10 37	10 55	11 37	12 54
66	15 32	16 35	17 39	11 07	11 34	12 21	13 31
64	15 48	16 45	17 44	11 30	12 02	12 50	13 57
62	16 02	16 54	17 48	11 48	12 23	13 12	14 17
60	16 14	17 01	17 52	12 03	12 40	13 30	14 34
N 58	16 24	17 08	17 56	12 16	12 55	13 45	14 47
56	16 33	17 14	17 59	12 27	13 07	13 58	14 59
54	16 41	17 19	18 02	12 37	13 18	14 09	15 10
52	16 48	17 24	18 05	12 45	13 27	14 18	15 19
50	16 54	17 29	18 08	12 53	13 36	14 27	15 27
45	17 08	17 39	18 14	13 10	13 54	14 46	15 45
N 40	17 19	17 48	18 20	13 24	14 09	15 01	15 59
35	17 29	17 55	18 26	13 35	14 22	15 14	16 11
30	17 37	18 02	18 31	13 45	14 33	15 25	16 22
20	17 52	18 15	18 41	14 03	14 51	15 44	16 40
N 10	18 05	18 27	18 52	14 18	15 08	16 01	16 56
0	18 17	18 39	19 04	14 32	15 23	16 16	17 10
S 10	18 30	18 52	19 17	14 47	15 39	16 32	17 25
20	18 43	19 06	19 34	15 02	15 55	16 48	17 41
30	18 58	19 24	19 55	15 20	16 14	17 07	17 58
35	19 07	19 35	20 08	15 30	16 25	17 18	18 09
40	19 18	19 48	20 24	15 42	16 37	17 31	18 20
45	19 30	20 03	20 45	15 56	16 52	17 46	18 34
S 50	19 45	20 23	21 12	16 12	17 11	18 04	18 51
52	19 52	20 32	21 25	16 20	17 19	18 12	18 59
54	19 59	20 43	21 42	16 29	17 29	18 22	19 08
56	20 08	20 55	22 02	16 39	17 40	18 33	19 18
58	20 18	21 09	22 29	16 51	17 52	18 45	19 29
S 60	20 29	21 27	23 10	17 04	18 07	19 00	19 42

Day	SUN Eqn. of Time 00ʰ	SUN Eqn. of Time 12ʰ	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
	m s	m s	h m	h m	h m	d	
31	13 26	13 30	12 14	08 21	20 45	25	
1	13 34	13 38	12 14	09 11	21 37	26	
2	13 42	13 46	12 14	10 03	22 30	27	

G.M.T.	ARIES	VENUS −3.3		MARS +1.4		JUPITER −1.8		SATURN +0.9		STARS		
	G.H.A.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.	Name	S.H.A.	Dec.
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	° ′
3 00	133 05.0	192 25.6	S20 59.8	163 37.3	S13 32.7	303 05.4	S 2 43.4	303 18.0	S 1 29.2	Acamar	315 37.0	S40 23.2
01	148 07.5	207 24.7	59.3	178 37.9	32.0	318 07.9	43.3	318 20.5	29.1	Achernar	335 45.3	S57 20.4
02	163 09.9	222 23.9	58.8	193 38.4	31.3	333 10.4	43.3	333 23.0	29.1	Acrux	173 36.5	S62 59.4
03	178 12.4	237 23.1	·· 58.2	208 39.0	·· 30.6	348 12.9	·· 43.3	348 25.5	·· 29.1	Adhara	255 31.6	S28 57.0
04	193 14.9	252 22.2	57.7	223 39.5	30.0	3 15.5	43.2	3 28.1	29.0	Aldebaran	291 17.5	N16 28.2
05	208 17.3	267 21.4	57.1	238 40.1	29.3	18 18.0	43.2	18 30.6	29.0			
06	223 19.8	282 20.6	S20 56.6	253 40.7	S13 28.6	33 20.5	S 2 43.1	33 33.1	S 1 28.9	Alioth	166 42.0	N56 03.5
07	238 22.3	297 19.7	56.0	268 41.2	27.9	48 23.1	43.1	48 35.6	28.9	Alkaid	153 18.2	N49 24.2
08	253 24.7	312 18.9	55.5	283 41.8	27.2	63 25.6	43.1	63 38.2	28.9	Al Na'ir	28 15.1	S47 03.4
T 09	268 27.2	327 18.0	·· 54.9	298 42.3	·· 26.5	78 28.1	·· 43.0	78 40.7	·· 28.8	Alnilam	276 11.2	S 1 13.0
U 10	283 29.7	342 17.2	54.4	313 42.9	25.8	93 30.6	43.0	93 43.2	28.8	Alphard	218 20.0	S 8 34.7
E 11	298 32.1	357 16.4	53.8	328 43.4	25.1	108 33.2	42.9	108 45.7	28.8			
S 12	313 34.6	12 15.5	S20 53.3	343 44.0	S13 24.4	123 35.7	S 2 42.9	123 48.3	S 1 28.7	Alphecca	126 32.0	N26 46.6
D 13	328 37.0	27 14.7	52.7	358 44.6	23.7	138 38.2	42.9	138 50.8	28.7	Alpheratz	358 09.3	N28 59.1
A 14	343 39.5	42 13.9	52.2	13 45.1	23.1	153 40.8	42.8	153 53.3	28.6	Altair	62 32.6	N 8 49.0
Y 15	358 42.0	57 13.0	·· 51.6	28 45.7	·· 22.4	168 43.3	·· 42.8	168 55.8	·· 28.6	Ankaa	353 40.3	S42 24.9
16	13 44.4	72 12.2	51.0	43 46.2	21.7	183 45.8	42.7	183 58.4	28.6	Antares	112 56.7	S26 23.3
17	28 46.9	87 11.4	50.5	58 46.8	21.0	198 48.4	42.7	199 00.9	28.5			
18	43 49.4	102 10.5	S20 49.9	73 47.4	S13 20.3	213 50.9	S 2 42.7	214 03.4	S 1 28.5	Arcturus	146 18.2	N19 16.7
19	58 51.8	117 09.7	49.4	88 47.9	19.6	228 53.4	42.6	229 05.9	28.5	Atria	108 20.9	S68 59.3
20	73 54.3	132 08.9	48.8	103 48.5	18.9	243 56.0	42.6	244 08.5	28.4	Avior	234 27.4	S59 27.0
21	88 56.8	147 08.1	·· 48.2	118 49.0	·· 18.2	258 58.5	·· 42.5	259 11.0	·· 28.4	Bellatrix	278 58.3	N 6 19.8
22	103 59.2	162 07.2	47.7	133 49.6	17.5	274 01.0	42.5	274 13.5	28.3	Betelgeuse	271 27.7	N 7 24.1
23	119 01.7	177 06.4	47.1	148 50.2	16.8	289 03.6	42.5	289 16.0	28.3			
4 00	134 04.2	192 05.6	S20 46.5	163 50.7	S13 16.1	304 06.1	S 2 42.4	304 18.6	S 1 28.3	Canopus	264 06.6	S52 41.4
01	149 06.6	207 04.7	46.0	178 51.3	15.4	319 08.6	42.4	319 21.1	28.2	Capella	281 10.6	N45 58.8
02	164 09.1	222 03.9	45.4	193 51.8	14.8	334 11.2	42.3	334 23.6	28.2	Deneb	49 48.7	N45 12.7
03	179 11.5	237 03.1	·· 44.8	208 52.4	·· 14.1	349 13.7	·· 42.3	349 26.1	·· 28.1	Denebola	182 58.5	N14 40.6
04	194 14.0	252 02.3	44.3	223 53.0	13.4	4 16.2	42.2	4 28.7	28.1	Diphda	349 20.8	S18 05.7
05	209 16.5	267 01.4	43.7	238 53.5	12.7	19 18.8	42.2	19 31.2	28.1			
06	224 18.9	282 00.6	S20 43.1	253 54.1	S13 12.0	34 21.3	S 2 42.2	34 33.7	S 1 28.0	Dubhe	194 21.2	N61 51.0
07	239 21.4	296 59.8	42.6	268 54.7	11.3	49 23.8	42.1	49 36.2	28.0	Elnath	278 43.6	N28 35.5
W 08	254 23.9	311 59.0	42.0	283 55.2	10.6	64 26.4	42.1	64 38.8	28.0	Eltanin	90 58.0	N51 29.3
E 09	269 26.3	326 58.1	·· 41.4	298 55.8	·· 09.9	79 28.9	·· 42.0	79 41.3	·· 27.9	Enif	34 11.6	N 9 47.2
D 10	284 28.8	341 57.3	40.8	313 56.3	09.2	94 31.5	42.0	94 43.8	27.9	Fomalhaut	15 51.4	S29 43.6
N 11	299 31.3	356 56.5	40.3	328 56.9	08.5	109 34.0	41.9	109 46.3	27.8			
E 12	314 33.7	11 55.7	S20 39.7	343 57.5	S13 07.8	124 36.5	S 2 41.9	124 48.9	S 1 27.8	Gacrux	172 28.1	S57 00.2
S 13	329 36.2	26 54.8	39.1	358 58.0	07.1	139 39.1	41.9	139 51.4	27.8	Gienah	176 17.5	S17 26.2
D 14	344 38.6	41 54.0	38.5	13 58.6	06.4	154 41.6	41.8	154 53.9	27.7	Hadar	149 22.8	S60 16.6
A 15	359 41.1	56 53.2	·· 37.9	28 59.2	·· 05.7	169 44.1	·· 41.8	169 56.5	·· 27.7	Hamal	328 28.7	N23 22.3
Y 16	14 43.6	71 52.4	37.3	43 59.7	05.0	184 46.7	41.7	184 59.0	27.6	Kaus Aust.	84 16.8	S34 23.6
17	29 46.0	86 51.5	36.8	59 00.3	04.3	199 49.2	41.7	200 01.5	27.6			
18	44 48.5	101 50.7	S20 36.2	74 00.9	S13 03.6	214 51.8	S 2 41.6	215 04.0	S 1 27.6	Kochab	137 19.1	N74 13.7
19	59 51.0	116 49.9	35.6	89 01.4	02.9	229 54.3	41.6	230 06.6	27.5	Markab	14 03.2	N15 06.1
20	74 53.4	131 49.1	35.0	104 02.0	02.2	244 56.8	41.6	245 09.1	27.5	Menkar	314 40.8	N 4 00.8
21	89 55.9	146 48.3	·· 34.4	119 02.5	·· 01.5	259 59.4	·· 41.5	260 11.6	·· 27.4	Menkent	148 36.6	S36 16.4
22	104 58.4	161 47.4	33.8	134 03.1	00.8	275 01.9	41.5	275 14.2	27.4	Miaplacidus	221 43.9	S69 38.4
23	120 00.8	176 46.6	33.2	149 03.7	13 00.1	290 04.5	41.4	290 16.7	27.4			
5 00	135 03.3	191 45.8	S20 32.6	164 04.2	S12 59.4	305 07.0	S 2 41.4	305 19.2	S 1 27.3	Mirfak	309 15.6	N49 47.8
01	150 05.8	206 45.0	32.1	179 04.8	58.7	320 09.6	41.3	320 21.7	27.3	Nunki	76 29.2	S26 19.2
02	165 08.2	221 44.2	31.5	194 05.4	58.0	335 12.1	41.3	335 24.3	27.2	Peacock	53 58.6	S56 47.8
03	180 10.7	236 43.4	·· 30.9	209 05.9	·· 57.3	350 14.6	·· 41.2	350 26.8	·· 27.2	Pollux	243 57.5	N28 04.3
04	195 13.1	251 42.5	30.3	224 06.5	56.6	5 17.2	41.2	5 29.3	27.2	Procyon	245 25.2	N 5 16.3
05	210 15.6	266 41.7	29.7	239 07.1	55.9	20 19.7	41.2	20 31.9	27.1			
06	225 18.1	281 40.9	S20 29.1	254 07.6	S12 55.2	35 22.3	S 2 41.1	35 34.4	S 1 27.1	Rasalhague	96 29.6	N12 34.3
07	240 20.5	296 40.1	28.5	269 08.2	54.5	50 24.8	41.1	50 36.9	27.0	Regulus	208 09.4	N12 03.5
T 08	255 23.0	311 39.3	27.9	284 08.8	53.8	65 27.4	41.0	65 39.5	27.0	Rigel	281 35.6	S 8 13.6
H 09	270 25.5	326 38.5	·· 27.3	299 09.3	·· 53.1	80 29.9	·· 41.0	80 42.0	·· 27.0	Rigil Kent.	140 25.4	S60 45.1
U 10	285 27.9	341 37.6	26.7	314 09.9	52.4	95 32.4	40.9	95 44.5	26.9	Sabik	102 41.0	S15 42.1
R 11	300 30.4	356 36.8	26.1	329 10.5	51.7	110 35.0	40.9	110 47.1	26.9			
S 12	315 32.9	11 36.0	S20 25.5	344 11.0	S12 51.0	125 37.5	S 2 40.8	125 49.6	S 1 26.8	Schedar	350 09.0	N56 26.1
D 13	330 35.3	26 35.2	24.9	359 11.6	50.3	140 40.1	40.8	140 52.1	26.8	Shaula	96 55.7	S37 05.3
A 14	345 37.8	41 34.4	24.3	14 12.2	49.6	155 42.6	40.7	155 54.6	26.8	Sirius	258 55.2	S16 41.6
Y 15	0 40.3	56 33.6	·· 23.6	29 12.7	·· 48.9	170 45.2	·· 40.7	170 57.2	·· 26.7	Spica	158 57.1	S11 03.7
16	15 42.7	71 32.8	23.0	44 13.3	48.2	185 47.7	40.6	185 59.7	26.7	Suhail	223 10.1	S43 21.4
17	30 45.2	86 32.0	22.4	59 13.9	47.5	200 50.3	40.6	201 02.2	26.6			
18	45 47.6	101 31.2	S20 21.8	74 14.4	S12 46.8	215 52.8	S 2 40.6	216 04.8	S 1 26.6	Vega	80 56.0	N38 45.8
19	60 50.1	116 30.3	21.2	89 15.0	46.1	230 55.4	40.5	231 07.3	26.6	Zuben'ubi	137 32.7	S15 57.7
20	75 52.6	131 29.5	20.6	104 15.6	45.4	245 57.9	40.5	246 09.8	26.5			
21	90 55.0	146 28.7	·· 20.0	119 16.1	·· 44.7	261 00.5	·· 40.4	261 12.4	·· 26.5		S.H.A.	Mer. Pass.
22	105 57.5	161 27.9	19.4	134 16.7	44.0	276 03.0	40.4	276 14.9	26.4		° ′	h m
23	121 00.0	176 27.1	18.8	149 17.3	43.3	291 05.5	40.3	291 17.4	26.4	Venus	58 01.4	11 12
	h m									Mars	29 46.6	13 04
Mer. Pass	15 01.3	v −0.8	d 0.6	v 0.6	d 0.7	v 2.5	d 0.0	v 2.5	d 0.0	Jupiter	170 01.9	3 43
										Saturn	170 14.4	3 42

G.M.T.	SUN G.H.A.	SUN Dec.	MOON G.H.A.	v	MOON Dec.	d	H.P.
d h	° ′	° ′	° ′	′	° ′	′	′
3 00	176 32.6	S16 36.4	201 38.8	8.4	S20 04.4	2.0	57.0
01	191 32.5	35.6	216 06.2	8.3	20 02.4	2.2	57.1
02	206 32.5	34.9	230 33.5	8.4	20 00.2	2.2	57.1
03	221 32.4	·· 34.2	245 00.9	8.3	19 58.0	2.4	57.1
04	236 32.3	33.4	259 28.2	8.3	19 55.6	2.5	57.2
05	251 32.3	32.7	273 55.5	8.3	19 53.1	2.7	57.2
06	266 32.2	S16 32.0	288 22.8	8.3	S19 50.4	2.7	57.2
07	281 32.1	31.2	302 50.1	8.2	19 47.7	2.8	57.2
08	296 32.1	30.5	317 17.3	8.3	19 44.9	3.0	57.3
T 09	311 32.0	·· 29.7	331 44.6	8.2	19 41.9	3.1	57.3
U 10	326 31.9	29.0	346 11.8	8.2	19 38.8	3.2	57.3
E 11	341 31.9	28.3	0 39.0	8.2	19 35.6	3.3	57.4
S 12	356 31.8	S16 27.5	15 06.2	8.1	S19 32.3	3.5	57.4
D 13	11 31.7	26.8	29 33.3	8.2	19 28.8	3.5	57.4
A 14	26 31.7	26.1	44 00.5	8.2	19 25.3	3.7	57.4
Y 15	41 31.6	·· 25.3	58 27.7	8.1	19 21.6	3.8	57.5
16	56 31.5	24.6	72 54.8	8.1	19 17.8	3.9	57.5
17	71 31.5	23.8	87 21.9	8.2	19 13.9	4.1	57.5
18	86 31.4	S16 23.1	101 49.1	8.1	S19 09.8	4.1	57.6
19	101 31.3	22.4	116 16.2	8.1	19 05.7	4.3	57.6
20	116 31.3	21.6	130 43.3	8.1	19 01.4	4.4	57.6
21	131 31.2	·· 20.9	145 10.4	8.1	18 57.0	4.4	57.6
22	146 31.2	20.1	159 37.5	8.1	18 52.6	4.7	57.7
23	161 31.1	19.4	174 04.6	8.1	18 47.9	4.7	57.7
4 00	176 31.0	S16 18.6	188 31.7	8.1	S18 43.2	4.8	57.7
01	191 31.0	17.9	202 58.8	8.0	18 38.4	5.0	57.8
02	206 30.9	17.2	217 25.8	8.1	18 33.4	5.1	57.8
03	221 30.8	·· 16.4	231 52.9	8.1	18 28.3	5.2	57.8
04	236 30.8	15.7	246 20.0	8.1	18 23.1	5.3	57.8
05	251 30.7	14.9	260 47.1	8.1	18 17.8	5.4	57.9
06	266 30.7	S16 14.2	275 14.2	8.1	S18 12.4	5.5	57.9
W 07	281 30.6	13.4	289 41.3	8.1	18 06.9	5.7	57.9
E 08	296 30.5	12.7	304 08.4	8.1	18 01.2	5.7	58.0
D 09	311 30.5	·· 11.9	318 35.5	8.1	17 55.5	5.9	58.0
N 10	326 30.4	11.2	333 02.6	8.1	17 49.6	6.0	58.0
E 11	341 30.4	10.4	347 29.7	8.1	17 43.6	6.1	58.0
S 12	356 30.3	S16 09.7	1 56.8	8.1	S17 37.5	6.2	58.1
D 13	11 30.3	08.9	16 23.9	8.2	17 31.3	6.3	58.1
A 14	26 30.2	08.2	30 51.1	8.1	17 25.0	6.4	58.1
Y 15	41 30.1	·· 07.4	45 18.2	8.2	17 18.6	6.5	58.1
16	56 30.1	06.7	59 45.4	8.1	17 12.1	6.7	58.2
17	71 30.0	05.9	74 12.5	8.2	17 05.4	6.7	58.2
18	86 30.0	S16 05.2					
19	101 29.9	04.4					
20	116 29.9	03.7					
21	131 29.8	·· 02.9					
22	146 29.8	02.2					
23	161 29.7	01.4					
5 00	176 29.7	S16 00.6	175 23.0	8.2	S16 16.0	7.5	58.4
01	191 29.6	15 59.9	189 50.2	8.3	16 08.5	7.6	58.4
02	206 29.5	59.1	204 17.5	8.3	16 00.9	7.7	58.4
03	221 29.5	·· 58.4	218 44.8	8.3	15 53.2	7.8	58.4
04	236 29.4	57.6	233 12.1	8.3	15 45.4	7.9	58.5
05	251 29.4	56.9	247 39.4	8.4	15 37.5	7.9	58.5
06	266 29.3	S15 56.1	262 06.8	8.4	S15 29.6	8.1	58.5
07	281 29.3	55.3	276 34.2	8.3	15 21.5	8.2	58.5
T 08	296 29.2	54.6	291 01.5	8.4	15 13.3	8.3	58.6
H 09	311 29.2	·· 53.8	305 28.9	8.5	15 05.0	8.4	58.6
U 10	326 29.1	53.1	319 56.4	8.4	14 56.6	8.4	58.6
R 11	341 29.1	52.3	334 23.8	8.5	14 48.2	8.6	58.6
S 12	356 29.0	S15 51.5	348 51.3	8.4	S14 39.6	8.7	58.7
D 13	11 29.0	50.8	3 18.7	8.5	14 30.9	8.7	58.7
A 14	26 28.9	50.0	17 46.2	8.6	14 22.2	8.9	58.7
Y 15	41 28.9	·· 49.3	32 13.8	8.5	14 13.3	8.9	58.7
16	56 28.8	48.5	46 41.3	8.6	14 04.4	9.0	58.7
17	71 28.8	47.7	61 08.9	8.6	13 55.4	9.2	58.8
18	86 28.8	S15 47.0	75 36.5	8.6	S13 46.2	9.2	58.8
19	101 28.7	46.2	90 04.1	8.6	13 37.0	9.2	58.8
20	116 28.7	45.4	104 31.7	8.7	13 27.8	9.4	58.8
21	131 28.6	·· 44.7	118 59.4	8.6	13 18.4	9.5	58.8
22	146 28.6	43.9	133 27.0	8.7	13 08.9	9.5	58.9
23	161 28.5	43.1	147 54.7	8.8	12 59.4	9.7	58.9
	S.D. 16.2	d 0.7	S.D. 15.6		15.8		16.0

An Annular Eclipse of the Sun occurs on this date. See page 5.

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 3	Moonrise 4	Moonrise 5	Moonrise 6
°	h m	h m	h m	h m	h m	h m	h m
N 72	06 59	08 25	10 04	▬	11 18	10 24	10 04
N 70	06 52	08 09	09 30	10 19	10 00	09 52	09 45
68	06 47	07 56	09 05	09 06	09 21	09 28	09 31
66	06 42	07 45	08 46	08 29	08 54	09 09	09 19
64	06 38	07 35	08 31	08 02	08 33	08 54	09 08
62	06 34	07 27	08 18	07 42	08 16	08 41	09 00
60	06 30	07 20	08 07	07 25	08 02	08 30	08 52
N 58	06 27	07 14	07 58	07 11	07 50	08 21	08 46
56	06 24	07 09	07 49	06 59	07 39	08 12	08 40
54	06 21	07 04	07 42	06 48	07 30	08 05	08 34
52	06 19	06 59	07 35	06 39	07 22	07 58	08 30
50	06 16	06 55	07 29	06 30	07 14	07 52	08 25
45	06 10	06 45	07 16	06 12	06 58	07 39	08 16
N 40	06 05	06 37	07 06	05 58	06 45	07 29	08 08
35	06 00	06 30	06 57	05 45	06 34	07 19	08 01
30	05 55	06 24	06 49	05 34	06 24	07 11	07 55
20	05 45	06 12	06 35	05 16	06 07	06 57	07 45
N 10	05 35	06 00	06 22	04 59	05 53	06 45	07 36
0	05 24	05 49	06 10	04 44	05 39	06 33	07 27
S 10	05 11	05 37	05 59	04 29	05 25	06 22	07 18
20	04 55	05 23	05 46	04 13	05 10	06 09	07 09
30	04 35	05 06	05 31	03 54	04 53	05 55	06 59
35	04 22	04 55	05 23	03 43	04 43	05 47	06 53
40	04 07	04 43	05 13	03 31	04 32	05 38	06 46
45	03 47	04 28	05 01	03 16	04 19	05 27	06 38
S 50	03 21	04 09	04 47	02 58	04 02	05 13	06 28
52	03 08	04 00	04 40	02 50	03 55	05 07	06 23
54	02 52	03 50	04 33	02 40	03 46	05 00	06 18
56	02 33	03 39	04 25	02 29	03 37	04 52	06 13
58	02 09	03 25	04 15	02 17	03 26	04 43	06 07
S 60	01 34	03 09	04 04	02 03	03 13	04 33	06 00

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 3	Moonset 4	Moonset 5	Moonset 6
°	h m	h m	h m	h m	h m	h m	h m
N 72	14 25	16 04	17 31	▬	12 37	15 25	17 37
N 70	15 00	16 20	17 37	11 41	13 55	15 56	17 54
68	15 24	16 34	17 43	12 54	14 33	16 19	18 07
66	15 43	16 44	17 47	13 31	14 59	16 37	18 18
64	15 58	16 54	17 52	13 57	15 19	16 51	18 27
62	16 11	17 02	17 55	14 17	15 36	17 03	18 34
60	16 22	17 08	17 59	14 34	15 49	17 13	18 41
N 58	16 31	17 15	18 02	14 47	16 01	17 22	18 47
56	16 39	17 20	18 05	14 59	16 11	17 30	18 52
54	16 47	17 25	18 07	15 10	16 20	17 36	18 56
52	16 53	17 30	18 10	15 19	16 28	17 43	19 00
50	16 59	17 34	18 12	15 27	16 35	17 48	19 04
45	17 12	17 43	18 18	15 45	16 50	18 00	19 12
N 40	17 23	17 51	18 23	15 59	17 03	18 10	19 19
35	17 32	17 58	18 28	16 11	17 13	18 18	19 24
30	17 40	18 05	18 33	16 22	17 23	18 25	19 29
20	17 54	18 16	18 43	16 40	17 38	18 38	19 38
N 10	18 06	18 28	18 53	16 56	17 52	18 49	19 45
0	18 17	18 39	19 04	17 10	18 05	18 59	19 52
S 10	18 29	18 51	19 17	17 25	18 18	19 09	19 59
20	18 42	19 05	19 32	17 41	18 31	19 20	20 07
30	18 56	19 22	19 52	17 58	18 47	19 32	20 15
35	19 05	19 32	20 05	18 09	18 56	19 39	20 19
40	19 15	19 44	20 20	18 20	19 06	19 47	20 25
45	19 26	19 59	20 40	18 34	19 18	19 56	20 31
S 50	19 40	20 17	21 05	18 51	19 32	20 07	20 38
52	19 47	20 26	21 18	18 59	19 39	20 12	20 42
54	19 54	20 36	21 33	19 08	19 46	20 18	20 45
56	20 02	20 48	21 52	19 18	19 54	20 24	20 49
58	20 11	21 01	22 15	19 29	20 04	20 31	20 54
S 60	20 22	21 17	22 48	19 42	20 14	20 39	20 59

Day	SUN Eqn. of Time 00ʰ	SUN Eqn. of Time 12ʰ	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
	m s	m s	h m	h m	h m	d	
3	13 49	13 53	12 14	10 57	23 25	28	
4	13 56	13 59	12 14	11 52	24 19	29	●
5	14 01	14 04	12 14	12 46	00 19	01	

G.M.T.	ARIES	VENUS −3.4		MARS +1.4		JUPITER −1.9		SATURN +0.8	
	G.H.A.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
6 00	136 02.4	191 26.3	S20 18.1	164 17.9	S12 42.6	306 08.1	S 2 40.3	306 20.0	S 1 26.4
01	151 04.9	206 25.5	17.5	179 18.4	41.9	321 10.6	40.2	321 22.5	26.3
02	166 07.4	221 24.7	16.9	194 19.0	41.2	336 13.2	40.2	336 25.0	26.3
03	181 09.8	236 23.9	·· 16.3	209 19.6	·· 40.5	351 15.7	·· 40.1	351 27.6	·· 26.2
04	196 12.3	251 23.1	15.7	224 20.1	39.8	6 18.3	40.1	6 30.1	26.2
05	211 14.8	266 22.3	15.0	239 20.7	39.1	21 20.8	40.0	21 32.6	26.1
06	226 17.2	281 21.5	S20 14.4	254 21.3	S12 38.4	36 23.4	S 2 40.0	36 35.2	S 1 26.1
07	241 19.7	296 20.7	13.8	269 21.8	37.7	51 25.9	39.9	51 37.7	26.1
08	256 22.1	311 19.9	13.2	284 22.4	37.0	66 28.5	39.9	66 40.2	26.0
F 09	271 24.6	326 19.1	·· 12.5	299 23.0	·· 36.3	81 31.1	·· 39.8	81 42.8	·· 26.0
R 10	286 27.1	341 18.2	11.9	314 23.6	35.6	96 33.6	39.8	96 45.3	25.9
I 11	301 29.5	356 17.4	11.3	329 24.1	34.9	111 36.2	39.7	111 47.8	25.9
D 12	316 32.0	11 16.6	S20 10.7	344 24.7	S12 34.2	126 38.7	S 2 39.7	126 50.4	S 1 25.9
A 13	331 34.5	26 15.8	10.0	359 25.3	33.5	141 41.3	39.6	141 52.9	25.8
Y 14	346 36.9	41 15.0	09.4	14 25.8	32.8	156 43.8	39.6	156 55.5	25.8
15	1 39.4	56 14.2	·· 08.8	29 26.4	·· 32.0	171 46.4	·· 39.5	171 58.0	·· 25.7
16	16 41.9	71 13.4	08.1	44 27.0	31.3	186 48.9	39.5	187 00.5	25.7
17	31 44.3	86 12.6	07.5	59 27.6	30.6	201 51.5	39.4	202 03.1	25.6
18	46 46.8	101 11.8	S20 06.9	74 28.1	S12 29.9	216 54.0	S 2 39.4	217 05.6	S 1 25.6
19	61 49.2	116 11.0	06.2	89 28.7	29.2	231 56.6	39.3	232 08.1	25.6
20	76 51.7	131 10.2	05.6	104 29.3	28.5	246 59.1	39.3	247 10.7	25.5
21	91 54.2	146 09.4	·· 04.9	119 29.9	·· 27.8	262 01.7	·· 39.2	262 13.2	·· 25.5
22	106 56.6	161 08.6	04.3	134 30.4	27.1	277 04.2	39.2	277 15.7	25.4
23	121 59.1	176 07.8	03.7	149 31.0	26.4	292 06.8	39.1	292 18.3	25.4
7 00	137 01.6	191 07.1	S20 03.0	164 31.6	S12 25.7	307 09.4	S 2 39.1	307 20.8	S 1 25.3
01	152 04.0	206 06.3	02.4	179 32.2	25.0	322 11.9	39.0	322 23.4	25.3
02	167 06.5	221 05.5	01.7	194 32.7	24.3	337 14.5	39.0	337 25.9	25.3
03	182 09.0	236 04.7	·· 01.1	209 33.3	·· 23.6	352 17.0	·· 38.9	352 28.4	·· 25.2
04	197 11.4	251 03.9	20 00.4	224 33.9	22.8	7 19.6	38.9	7 31.0	25.2
05	212 13.9	266 03.1	19 59.8	239 34.4	22.1	22 22.1	38.8	22 33.5	25.1
06	227 16.4	281 02.3	S19 59.2	254 35.0	S12 21.4	37 24.7	S 2 38.8	37 36.0	S 1 25.1
07	242 18.8	296 01.5	58.5	269 35.6	20.7	52 27.3	38.7	52 38.6	25.0
S 08	257 21.3	311 00.7	57.9	284 36.2	20.0	67 29.8	38.7	67 41.1	25.0
A 09	272 23.7	325 59.9	·· 57.2	299 36.7	·· 19.3	82 32.4	·· 38.6	82 43.7	·· 25.0
T 10	287 26.2	340 59.1	56.6	314 37.3	18.6	97 34.9	38.6	97 46.2	24.9
U 11	302 28.7	355 58.3	55.9	329 37.9	17.9	112 37.5	38.5	112 48.7	24.9
R 12	317 31.1	10 57.5	S19 55.2	344 38.5	S12 17.2	127 40.1	S 2 38.5	127 51.3	S 1 24.8
D 13	332 33.6	25 56.7	54.6	359 39.1	16.4	142 42.6	38.4	142 53.8	24.8
A 14	347 36.1	40 55.9	53.9	14 39.6	15.7	157 45.2	38.4	157 56.4	24.7
Y 15	2 38.5	55 55.2	·· 53.3	29 40.2	·· 15.0	172 47.7	·· 38.3	172 58.9	·· 24.7
16	17 41.0	70 54.4	52.6	44 40.8	14.3	187 50.3	38.3	188 01.4	24.7
17	32 43.5	85 53.6	52.0	59 41.4	13.6	202 52.9	38.2	203 04.0	24.6
18	47 45.9	100 52.8	S19 51.3	74 41.9	S12 12.9	217 55.4	S 2 38.2	218 06.5	S 1 24.6
19	62 48.4	115 52.0	50.6	89 42.5	12.2	232 58.0	38.1	233 09.1	24.5
20	77 50.9	130 51.2	50.0	104 43.1	11.5	248 00.5	38.1	248 11.6	24.5
21	92 53.3	145 50.4	·· 49.3	119 43.7	·· 10.8	263 03.1	·· 38.0	263 14.1	·· 24.4
22	107 55.8	160 49.6	48.7	134 44.2	10.0	278 05.7	38.0	278 16.7	24.4
23	122 58.2	175 48.9	48.0	149 44.8	09.3	293 08.2	37.9	293 19.2	24.3
8 00	138 00.7	190 48.1	S19 47.3	164 45.4	S12 08.6	308 10.8	S 2 37.8	308 21.8	S 1 24.3
01	153 03.2	205 47.3	46.7	179 46.0	07.9	323 13.4	37.8	323 24.3	24.3
02	168 05.6	220 46.5	46.0	194 46.6	07.2	338 15.9	37.7	338 26.8	24.2
03	183 08.1	235 45.7	·· 45.3	209 47.1	·· 06.5	353 18.5	·· 37.7	353 29.4	·· 24.2
04	198 10.6	250 44.9	44.6	224 47.7	05.8	8 21.0	37.6	8 31.9	24.1
05	213 13.0	265 44.2	44.0	239 48.3	05.0	23 23.6	37.6	23 34.5	24.1
06	228 15.5	280 43.4	S19 43.3	254 48.9	S12 04.3	38 26.2	S 2 37.5	38 37.0	S 1 24.0
07	243 18.0	295 42.6	42.6	269 49.5	03.6	53 28.7	37.5	53 39.5	24.0
08	258 20.4	310 41.8	42.0	284 50.0	02.9	68 31.3	37.4	68 42.1	23.9
S 09	273 22.9	325 41.0	·· 41.3	299 50.6	·· 02.2	83 33.9	·· 37.4	83 44.6	·· 23.9
U 10	288 25.3	340 40.2	40.6	314 51.2	01.5	98 36.4	37.3	98 47.2	23.9
N 11	303 27.8	355 39.5	39.9	329 51.8	00.8	113 39.0	37.2	113 49.7	23.8
D 12	318 30.3	10 38.7	S19 39.3	344 52.3	S12 00.0	128 41.6	S 2 37.2	128 52.3	S 1 23.8
A 13	333 32.7	25 37.9	38.6	359 52.9	11 59.3	143 44.1	37.1	143 54.8	23.7
Y 14	348 35.2	40 37.1	37.9	14 53.5	58.6	158 46.7	37.1	158 57.3	23.7
15	3 37.7	55 36.3	·· 37.2	29 54.1	·· 57.9	173 49.3	·· 37.0	173 59.9	·· 23.6
16	18 40.1	70 35.6	36.5	44 54.7	57.2	188 51.8	37.0	189 02.4	23.6
17	33 42.6	85 34.8	35.8	59 55.3	56.5	203 54.4	36.9	204 05.0	23.5
18	48 45.1	100 34.0	S19 35.2	74 55.8	S11 55.7	218 57.0	S 2 36.9	219 07.5	S 1 23.5
19	63 47.5	115 33.2	34.5	89 56.4	55.0	233 59.5	36.8	234 10.1	23.4
20	78 50.0	130 32.5	33.8	104 57.0	54.3	249 02.1	36.8	249 12.6	23.4
21	93 52.5	145 31.7	·· 33.1	119 57.6	·· 53.6	264 04.7	·· 36.7	264 15.2	·· 23.4
22	108 54.9	160 30.9	32.4	134 58.2	52.9	279 07.2	36.6	279 17.7	23.3
23	123 57.4	175 30.1	31.7	149 58.7	52.2	294 09.8	36.6	294 20.2	23.3
	h m								
Mer. Pass.	14 49.5	v −0.8	d 0.7	v 0.6	d 0.7	v 2.6	d 0.1	v 2.5	d 0.0

STARS		
Name	S.H.A.	Dec.
	° ′	° ′
Acamar	315 37.0	S40 23.2
Achernar	335 45.3	S57 20.4
Acrux	173 36.4	S62 59.4
Adhara	255 31.6	S28 57.0
Aldebaran	291 17.6	N16 28.2
Alioth	166 42.0	N56 03.5
Alkaid	153 18.1	N49 24.2
Al Na'ir	28 15.1	S47 03.3
Alnilam	276 11.2	S 1 13.0
Alphard	218 20.0	S 8 34.7
Alphecca	126 31.9	N26 46.5
Alpheratz	358 09.3	N28 59.1
Altair	62 32.6	N 8 49.0
Ankaa	353 40.3	S42 24.8
Antares	112 56.6	S26 23.3
Arcturus	146 18.2	N19 16.7
Atria	108 20.9	S68 59.3
Avior	234 27.4	S59 27.0
Bellatrix	278 58.3	N 6 19.8
Betelgeuse	271 27.8	N 7 24.1
Canopus	264 06.7	S52 41.4
Capella	281 10.6	N45 58.8
Deneb	49 48.7	N45 12.7
Denebola	182 58.5	N14 40.6
Diphda	349 20.8	S18 05.7
Dubhe	194 21.2	N61 51.1
Elnath	278 43.6	N28 35.5
Eltanin	90 58.0	N51 29.3
Enif	34 11.6	N 9 47.2
Fomalhaut	15 51.4	S29 43.6
Gacrux	172 28.0	S57 00.2
Gienah	176 17.5	S17 26.2
Hadar	149 22.8	S60 16.6
Hamal	328 28.7	N23 22.3
Kaus Aust.	84 16.8	S34 23.6
Kochab	137 19.0	N74 13.7
Markab	14 03.2	N15 06.1
Menkar	314 40.8	N 4 00.8
Menkent	148 36.6	S36 16.4
Miaplacidus	221 43.9	S69 38.4
Mirfak	309 15.6	N49 47.8
Nunki	76 29.1	S26 19.2
Peacock	53 58.6	S56 47.8
Pollux	243 57.5	N28 04.3
Procyon	245 25.2	N 5 16.3
Rasalhague	96 29.5	N12 34.3
Regulus	208 09.4	N12 03.5
Rigel	281 35.6	S 8 13.6
Rigil Kent.	140 25.4	S60 45.1
Sabik	102 41.0	S15 42.1
Schedar	350 09.0	N56 26.1
Shaula	96 55.6	S37 05.3
Sirius	258 55.2	S16 41.6
Spica	158 57.1	S11 03.7
Suhail	223 10.1	S43 21.4
Vega	80 56.0	N38 45.8
Zuben'ubi	137 32.7	S15 57.7

	S.H.A.	Mer. Pass.
	° ′	h m
Venus	54 05.5	11 16
Mars	27 30.0	13 01
Jupiter	170 07.8	3 31
Saturn	170 19.3	3 30

G.M.T.	SUN G.H.A.	SUN Dec.	MOON G.H.A.	MOON v	MOON Dec.	MOON d	MOON H.P.
d h	° ′	° ′	° ′	′	° ′	′	′
6 00	176 28.5	S15 42.4	162 22.5	8.7	S12 49.7	9.7	58.9
01	191 28.4	41.6	176 50.2	8.8	12 40.0	9.8	58.9
02	206 28.4	40.8	191 18.0	8.8	12 30.2	9.8	58.9
03	221 28.3	·· 40.1	205 45.8	8.8	12 20.4	10.0	59.0
04	236 28.3	39.3	220 13.6	8.8	12 10.4	10.0	59.0
05	251 28.3	38.5	234 41.4	8.9	12 00.4	10.1	59.0
06	266 28.2	S15 37.8	249 09.3	8.9	S11 50.3	10.2	59.0
07	281 28.2	37.0	263 37.2	8.9	11 40.1	10.2	59.0
08	296 28.1	36.2	278 05.1	9.0	11 29.9	10.4	59.0
F 09	311 28.1	·· 35.4	292 33.1	8.9	11 19.5	10.4	59.1
R 10	326 28.0	34.7	307 01.0	9.0	11 09.1	10.4	59.1
I 11	341 28.0	33.9	321 29.0	9.0	10 58.7	10.6	59.1
D 12	356 28.0	S15 33.1	335 57.0	9.1	S10 48.1	10.6	59.1
A 13	11 27.9	32.4	350 25.1	9.0	10 37.5	10.7	59.1
Y 14	26 27.9	31.6	4 53.1	9.1	10 26.8	10.7	59.1
15	41 27.8	·· 30.8	19 21.2	9.1	10 16.1	10.8	59.2
16	56 27.8	30.0	33 49.3	9.1	10 05.3	10.9	59.2
17	71 27.8	29.3	48 17.4	9.2	9 54.4	10.9	59.2
18	86 27.7	S15 28.5	62 45.6	9.2	S 9 43.5	11.0	59.2
19	101 27.7	27.7	77 13.8	9.2	9 32.5	11.1	59.2
20	116 27.7	26.9	91 42.0	9.2	9 21.4	11.1	59.2
21	131 27.6	·· 26.2	106 10.2	9.2	9 10.3	11.1	59.2
22	146 27.6	25.4	120 38.4	9.3	8 59.2	11.3	59.2
23	161 27.5	24.6	135 06.7	9.3	8 47.9	11.3	59.3
7 00	176 27.5	S15 23.8	149 35.0	9.3	S 8 36.6	11.3	59.3
01	191 27.5	23.0	164 03.3	9.3	8 25.3	11.4	59.3
02	206 27.4	22.3	178 31.6	9.4	8 13.9	11.4	59.3
03	221 27.4	·· 21.5	193 00.0	9.4	8 02.5	11.5	59.3
04	236 27.4	20.7	207 28.4	9.4	7 51.0	11.6	59.3
05	251 27.3	19.9	221 56.8	9.4	7 39.4	11.6	59.3
06	266 27.3	S15 19.1	236 25.2	9.4	S 7 27.8	11.6	59.3
07	281 27.3	18.4	250 53.6	9.5	7 16.2	11.7	59.4
S 08	296 27.2	17.6	265 22.1	9.4	7 04.5	11.7	59.4
A 09	311 27.2	·· 16.8	279 50.5	9.5	6 52.8	11.8	59.4
T 10	326 27.2	16.0	294 19.0	9.5	6 41.0	11.8	59.4
U 11	341 27.1	15.2	308 47.5	9.6	6 29.2	11.9	59.4
R 12	356 27.1	S15 14.5	323 16.1	9.5	S 6 17.3	11.9	59.4
D 13	11 27.1	13.7	337 44.6	9.6	6 05.4	11.9	59.4
A 14	26 27.0	12.9	352 13.2	9.6	5 53.5	12.0	59.4
Y 15	41 27.0	·· 12.1	6 41.8	9.6	5 41.5	12.0	59.4
16	56 27.0	11.3	21 10.4	9.6	5 29.5	12.0	59.4
17	71 26.9	10.5	35 39.0	9.6	5 17.5	12.1	59.4
18	86 26.9	S15 09.7	50 07.6	9.7	S 5 05.4	12.1	59.5
19	101 26.9	09.0	64 36.3	9.6	4 53.3	12.1	59.5
20	116 26.8	08.2	79 04.9	9.7	4 41.2	12.2	59.5
21	131 26.8	·· 07.4	93 33.6	9.7	4 29.0	12.2	59.5
22	146 26.8	06.6	108 02.3	9.7	4 16.8	12.2	59.5
23	161 26.8	05.8	122 31.0	9.7	4 04.6	12.2	59.5
8 00	176 26.7	S15 05.0	136 59.7	9.8	S 3 52.4	12.3	59.5
01	191 26.7	04.2	151 28.5	9.7	3 40.1	12.3	59.5
02	206 26.7	03.4	165 57.2	9.8	3 27.8	12.3	59.5
03	221 26.7	·· 02.7	180 26.0	9.7	3 15.5	12.3	59.5
04	236 26.6	01.9	194 54.7	9.8	3 03.2	12.3	59.5
05	251 26.6	01.1	209 23.5	9.8	2 50.9	12.4	59.5
06	266 26.6	S15 00.3	223 52.3	9.8	S 2 38.5	12.4	59.5
07	281 26.5	14 59.5	238 21.1	9.8	2 26.1	12.4	59.5
08	296 26.5	58.7	252 49.9	9.8	2 13.7	12.4	59.5
S 09	311 26.5	·· 57.9	267 18.7	9.8	2 01.3	12.4	59.5
U 10	326 26.5	57.1	281 47.5	9.8	1 48.9	12.5	59.5
N 11	341 26.4	56.3	296 16.3	9.9	1 36.4	12.4	59.5
D 12	356 26.4	S14 55.5	310 45.2	9.8	S 1 24.0	12.4	59.5
A 13	11 26.4	54.7	325 14.0	9.8	1 11.6	12.5	59.5
Y 14	26 26.4	53.9	339 42.8	9.9	0 59.1	12.5	59.5
15	41 26.4	·· 53.1	354 11.7	9.8	0 46.6	12.4	59.5
16	56 26.3	52.3	8 40.5	9.9	0 34.2	12.5	59.5
17	71 26.3	51.5	23 09.4	9.8	0 21.7	12.5	59.6
18	86 26.3	S14 50.8	37 38.2	9.9	S 0 09.2	12.4	59.6
19	101 26.3	50.0	52 07.1	9.8	N 0 03.2	12.5	59.6
20	116 26.2	49.2	66 35.9	9.9	0 15.7	12.5	59.6
21	131 26.2	·· 48.4	81 04.8	9.9	0 28.2	12.4	59.6
22	146 26.2	47.6	95 33.7	9.8	0 40.6	12.5	59.6
23	161 26.2	46.8	110 02.5	9.9	0 53.1	12.5	59.6
	S.D. 16.2	d 0.8	S.D. 16.1		16.2		16.2

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 6	Moonrise 7	Moonrise 8	Moonrise 9
°	h m	h m	h m	h m	h m	h m	h m
N 72	06 48	08 12	09 43	10 04	09 50	09 37	09 26
N 70	06 42	07 57	09 14	09 45	09 40	09 35	09 30
68	06 38	07 45	08 52	09 31	09 32	09 32	09 33
66	06 34	07 36	08 35	09 19	09 25	09 31	09 36
64	06 30	07 27	08 21	09 08	09 20	09 29	09 38
62	06 27	07 20	08 09	09 00	09 15	09 28	09 40
60	06 24	07 14	07 59	08 52	09 10	09 26	09 42
N 58	06 21	07 08	07 51	08 46	09 06	09 25	09 43
56	06 19	07 03	07 43	08 40	09 03	09 24	09 45
54	06 17	06 59	07 36	08 34	09 00	09 23	09 46
52	06 14	06 54	07 30	08 30	08 57	09 23	09 47
50	06 12	06 50	07 25	08 25	08 55	09 22	09 48
45	06 07	06 42	07 13	08 16	08 49	09 20	09 51
N 40	06 02	06 34	07 03	08 08	08 44	09 19	09 53
35	05 58	06 28	06 54	08 01	08 40	09 18	09 54
30	05 53	06 22	06 47	07 55	08 37	09 17	09 56
20	05 44	06 11	06 33	07 45	08 30	09 15	09 59
N 10	05 35	06 00	06 22	07 36	08 25	09 13	10 01
0	05 24	05 49	06 11	07 27	08 20	09 12	10 03
S 10	05 12	05 38	06 00	07 18	08 15	09 10	10 06
20	04 57	05 24	05 48	07 09	08 09	09 09	10 08
30	04 38	05 08	05 34	06 59	08 03	09 07	10 11
35	04 26	04 58	05 26	06 53	07 59	09 06	10 13
40	04 11	04 47	05 16	06 46	07 55	09 05	10 15
45	03 53	04 33	05 05	06 38	07 50	09 04	10 17
S 50	03 28	04 15	04 52	06 28	07 45	09 02	10 20
52	03 16	04 07	04 46	06 23	07 42	09 01	10 21
54	03 02	03 57	04 39	06 18	07 39	09 01	10 22
56	02 44	03 46	04 31	06 13	07 36	09 00	10 24
58	02 23	03 34	04 23	06 07	07 32	08 59	10 26
S 60	01 54	03 19	04 13	06 00	07 28	08 58	10 27

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 6	Moonset 7	Moonset 8	Moonset 9
°	h m	h m	h m	h m	h m	h m	h m
N 72	14 46	16 18	17 43	17 37	19 42	21 43	23 44
N 70	15 16	16 33	17 48	17 54	19 49	21 42	23 35
68	15 37	16 44	17 52	18 07	19 55	21 42	23 28
66	15 54	16 54	17 56	18 18	20 00	21 41	23 22
64	16 08	17 02	17 59	18 27	20 04	21 41	23 17
62	16 20	17 09	18 03	18 34	20 07	21 40	23 13
60	16 30	17 16	18 05	18 41	20 10	21 40	23 10
N 58	16 38	17 21	18 08	18 47	20 13	21 40	23 06
56	16 46	17 26	18 10	18 52	20 15	21 40	23 03
54	16 53	17 31	18 13	18 56	20 18	21 39	23 01
52	16 59	17 35	18 15	19 00	20 20	21 39	22 59
50	17 04	17 39	18 17	19 04	20 21	21 39	22 56
45	17 16	17 47	18 22	19 12	20 25	21 39	22 52
N 40	17 26	17 54	18 27	19 19	20 28	21 38	22 48
35	17 35	18 01	18 31	19 24	20 31	21 38	22 45
30	17 42	18 07	18 35	19 29	20 34	21 38	22 42
20	17 55	18 18	18 44	19 38	20 38	21 37	22 37
N 10	18 07	18 28	18 54	19 45	20 41	21 37	22 32
0	18 18	18 39	19 04	19 52	20 45	21 36	22 28
S 10	18 29	18 51	19 16	19 59	20 48	21 36	22 24
20	18 41	19 04	19 31	20 07	20 51	21 35	22 19
30	18 54	19 20	19 50	20 15	20 55	21 35	22 14
35	19 02	19 29	20 02	20 19	20 58	21 34	22 11
40	19 11	19 41	20 16	20 25	21 00	21 34	22 08
45	19 22	19 54	20 35	20 31	21 03	21 34	22 04
S 50	19 37	20 12	20 59	20 38	21 06	21 33	22 00
52	19 41	20 20	21 11	20 42	21 08	21 33	21 58
54	19 48	20 29	21 25	20 45	21 10	21 33	21 56
56	19 56	20 40	21 41	20 49	21 12	21 32	21 53
58	20 04	20 52	22 02	20 54	21 14	21 32	21 50
S 60	20 14	21 07	22 30	20 59	21 16	21 32	21 47

Day	SUN Eqn. of Time 00ʰ	SUN Eqn. of Time 12ʰ	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
	m s	m s	h m	h m	h m	d	
6	14 06	14 08	12 14	13 40	01 13	02	
7	14 10	14 12	12 14	14 32	02 06	03	
8	14 13	14 14	12 14	15 24	02 58	04	

G.M.T.	ARIES	VENUS −3.4		MARS +1.4		JUPITER −1.9		SATURN +0.8	
	G.H.A.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
9 00	138 59.8	190 29.4	S19 31.0	164 59.3	S11 51.4	309 12.4	S 2 36.5	309 22.8	S 1 23.2
01	154 02.3	205 28.6	30.3	179 59.9	50.7	324 15.0	36.5	324 25.3	23.2
02	169 04.8	220 27.8	29.7	195 00.5	50.0	339 17.5	36.4	339 27.9	23.1
03	184 07.2	235 27.0	·· 29.0	210 01.1	·· 49.3	354 20.1	·· 36.4	354 30.4	·· 23.1
04	199 09.7	250 26.3	28.3	225 01.7	48.6	9 22.7	36.3	9 33.0	23.0
05	214 12.2	265 25.5	27.6	240 02.2	47.8	24 25.2	36.2	24 35.5	23.0
06	229 14.6	280 24.7	S19 26.9	255 02.8	S11 47.1	39 27.8	S 2 36.2	39 38.1	S 1 22.9
07	244 17.1	295 24.0	26.2	270 03.4	46.4	54 30.4	36.1	54 40.6	22.9
08	259 19.6	310 23.2	25.5	285 04.0	45.7	69 33.0	36.1	69 43.1	22.9
M 09	274 22.0	325 22.4	·· 24.8	300 04.6	·· 45.0	84 35.5	·· 36.0	84 45.7	·· 22.8
O 10	289 24.5	340 21.7	24.1	315 05.2	44.2	99 38.1	36.0	99 48.2	22.8
N 11	304 27.0	355 20.9	23.4	330 05.7	43.5	114 40.7	35.9	114 50.8	22.7
D 12	319 29.4	10 20.1	S19 22.7	345 06.3	S11 42.8	129 43.3	S 2 35.8	129 53.3	S 1 22.7
A 13	334 31.9	25 19.3	22.0	0 06.9	42.1	144 45.8	35.8	144 55.9	22.6
Y 14	349 34.3	40 18.6	21.3	15 07.5	41.4	159 48.4	35.7	159 58.4	22.6
15	4 36.8	55 17.8	·· 20.6	30 08.1	·· 40.6	174 51.0	·· 35.7	175 01.0	·· 22.5
16	19 39.3	70 17.0	19.9	45 08.7	39.9	189 53.5	35.6	190 03.5	22.5
17	34 41.7	85 16.3	19.2	60 09.2	39.2	204 56.1	35.6	205 06.1	22.4
18	49 44.2	100 15.5	S19 18.5	75 09.8	S11 38.5	219 58.7	S 2 35.5	220 08.6	S 1 22.4
19	64 46.7	115 14.8	17.7	90 10.4	37.8	235 01.3	35.4	235 11.2	22.3
20	79 49.1	130 14.0	17.0	105 11.0	37.0	250 03.9	35.4	250 13.7	22.3
21	94 51.6	145 13.2	·· 16.3	120 11.6	·· 36.3	265 06.4	·· 35.3	265 16.3	·· 22.2
22	109 54.1	160 12.5	15.6	135 12.2	35.6	280 09.0	35.3	280 18.8	22.2
23	124 56.5	175 11.7	14.9	150 12.8	34.9	295 11.6	35.2	295 21.4	22.2
10 00	139 59.0	190 10.9	S19 14.2	165 13.3	S11 34.1	310 14.2	S 2 35.1	310 23.9	S 1 22.1
01	155 01.4	205 10.2	13.5	180 13.9	33.4	325 16.7	35.1	325 26.5	22.1
02	170 03.9	220 09.4	12.8	195 14.5	32.7	340 19.3	35.0	340 29.0	22.0
03	185 06.4	235 08.7	·· 12.0	210 15.1	·· 32.0	355 21.9	·· 35.0	355 31.5	·· 22.0
04	200 08.8	250 07.9	11.3	225 15.7	31.3	10 24.5	34.9	10 34.1	21.9
05	215 11.3	265 07.1	10.6	240 16.3	30.5	25 27.0	34.8	25 36.6	21.9
06	230 13.8	280 06.4	S19 09.9	255 16.9	S11 29.8	40 29.6	S 2 34.8	40 39.2	S 1 21.8
07	245 16.2	295 05.6	09.2	270 17.5	29.1	55 32.2	34.7	55 41.7	21.8
08	260 18.7	310 04.9	08.4	285 18.0	28.4	70 34.8	34.7	70 44.3	21.7
T 09	275 21.2	325 04.1	·· 07.7	300 18.6	·· 27.6	85 37.4	·· 34.6	85 46.8	·· 21.7
U 10	290 23.6	340 03.3	07.0	315 19.2	26.9	100 39.9	34.5	100 49.4	21.6
E 11	305 26.1	355 02.6	06.3	330 19.8	26.2	115 42.5	34.5	115 51.9	21.6
S 12	320 28.6	10 01.8	S19 05.6	345 20.4	S11 25.5	130 45.1	S 2 34.4	130 54.5	S 1 21.5
D 13	335 31.0	25 01.1	04.8	0 21.0	24.7	145 47.7	34.4	145 57.0	21.5
A 14	350 33.5	40 00.3	04.1	15 21.6	24.0	160 50.3	34.3	160 59.6	21.4
Y 15	5 35.9	54 59.6	·· 03.4	30 22.2	·· 23.3	175 52.8	·· 34.2	176 02.1	·· 21.4
16	20 38.4	69 58.8	02.6	45 22.8	22.6	190 55.4	34.2	191 04.7	21.3
17	35 40.9	84 58.1	01.9	60 23.3	21.8	205 58.0	34.1	206 07.2	21.3
18	50 43.3	99 57.3	S19 01.2	75 23.9	S11 21.1	221 00.6	S 2 34.1	221 09.8	S 1 21.2
19	65 45.8	114 56.5	19 00.5	90 24.5	20.4	236 03.2	34.0	236 12.3	21.2
20	80 48.3	129 55.8	18 59.7	105 25.1	19.7	251 05.8	33.9	251 14.9	21.1
21	95 50.7	144 55.0	·· 59.0	120 25.7	·· 18.9	266 08.3	·· 33.9	266 17.5	·· 21.1
22	110 53.2	159 54.3	58.3	135 26.3	18.2	281 10.9	33.8	281 20.0	21.1
23	125 55.7	174 53.5	57.5	150 26.9	17.5	296 13.5	33.7	296 22.6	21.0
11 00	140 58.1	189 52.8	S18 56.8	165 27.5	S11 16.7	311 16.1	S 2 33.7	311 25.1	S 1 21.0
01	156 00.6	204 52.0	56.0	180 28.1	16.0	326 18.7	33.6	326 27.7	20.9
02	171 03.1	219 51.3	55.3	195 28.6	15.3	341 21.3	33.6	341 30.2	20.9
03	186 05.5	234 50.5	·· 54.6	210 29.2	·· 14.6	356 23.8	·· 33.5	356 32.8	·· 20.8
04	201 08.0	249 49.8	53.8	225 29.8	13.8	11 26.4	33.4	11 35.3	20.8
05	216 10.4	264 49.0	53.1	240 30.4	13.1	26 29.0	33.4	26 37.9	20.7
06	231 12.9	279 48.3	S18 52.3	255 31.0	S11 12.4	41 31.6	S 2 33.3	41 40.4	S 1 20.7
W 07	246 15.4	294 47.6	51.6	270 31.6	11.7	56 34.2	33.2	56 43.0	20.6
E 08	261 17.8	309 46.8	50.9	285 32.2	10.9	71 36.8	33.2	71 45.5	20.6
D 09	276 20.3	324 46.1	·· 50.1	300 32.8	·· 10.2	86 39.4	·· 33.1	86 48.1	·· 20.5
N 10	291 22.8	339 45.3	49.4	315 33.4	09.5	101 41.9	33.1	101 50.6	20.5
E 11	306 25.2	354 44.6	48.6	330 34.0	08.7	116 44.5	33.0	116 53.2	20.4
S 12	321 27.7	9 43.8	S18 47.9	345 34.6	S11 08.0	131 47.1	S 2 32.9	131 55.7	S 1 20.4
D 13	336 30.2	24 43.1	47.1	0 35.2	07.3	146 49.7	32.9	146 58.3	20.3
A 14	351 32.6	39 42.3	46.4	15 35.8	06.5	161 52.3	32.8	162 00.8	20.3
Y 15	6 35.1	54 41.6	·· 45.6	30 36.3	·· 05.8	176 54.9	·· 32.7	177 03.4	·· 20.2
16	21 37.6	69 40.9	44.9	45 36.9	05.1	191 57.5	32.7	192 06.0	20.2
17	36 40.0	84 40.1	44.1	60 37.5	04.4	207 00.1	32.6	207 08.5	20.1
18	51 42.5	99 39.4	S18 43.4	75 38.1	S11 03.6	222 02.7	S 2 32.5	222 11.1	S 1 20.1
19	66 44.9	114 38.6	42.6	90 38.7	02.9	237 05.2	32.5	237 13.6	20.0
20	81 47.4	129 37.9	41.9	105 39.3	02.2	252 07.8	32.4	252 16.2	20.0
21	96 49.9	144 37.1	·· 41.1	120 39.9	·· 01.4	267 10.4	·· 32.4	267 18.7	·· 19.9
22	111 52.3	159 36.4	40.3	135 40.5	00.7	282 13.0	32.3	282 21.3	19.9
23	126 54.8	174 35.7	39.6	150 41.1	00.0	297 15.6	32.2	297 23.8	19.8
	h m								
Mer. Pass.	14 37.7	*v* −0.8	*d* 0.7	*v* 0.6	*d* 0.7	*v* 2.6	*d* 0.1	*v* 2.6	*d* 0.0

STARS		
Name	S.H.A.	Dec.
	° ′	° ′
Acamar	315 37.1	S40 23.2
Achernar	335 45.3	S57 20.4
Acrux	173 36.4	S62 59.4
Adhara	255 31.6	S28 57.0
Aldebaran	291 17.6	N16 28.2
Alioth	166 41.9	N56 03.6
Alkaid	153 18.1	N49 24.3
Al Na'ir	28 15.1	S47 03.3
Alnilam	276 11.2	S 1 13.0
Alphard	218 20.0	S 8 34.7
Alphecca	126 31.9	N26 46.5
Alpheratz	358 09.3	N28 59.1
Altair	62 32.6	N 8 49.0
Ankaa	353 40.3	S42 24.8
Antares	112 56.6	S26 23.3
Arcturus	146 18.1	N19 16.7
Atria	108 20.8	S68 59.3
Avior	234 27.4	S59 27.1
Bellatrix	278 58.3	N 6 19.8
Betelgeuse	271 27.8	N 7 24.1
Canopus	264 06.7	S52 41.4
Capella	281 10.7	N45 58.8
Deneb	49 48.7	N45 12.7
Denebola	182 58.5	N14 40.6
Diphda	349 20.8	S18 05.7
Dubhe	194 21.2	N61 51.1
Elnath	278 43.6	N28 35.5
Eltanin	90 57.9	N51 29.3
Enif	34 11.6	N 9 47.2
Fomalhaut	15 51.5	S29 43.6
Gacrux	172 28.0	S57 00.2
Gienah	176 17.4	S17 26.2
Hadar	149 22.7	S60 16.6
Hamal	328 28.7	N23 22.3
Kaus Aust.	84 16.8	S34 23.6
Kochab	137 18.9	N74 13.7
Markab	14 03.2	N15 06.1
Menkar	314 40.9	N 4 00.8
Menkent	148 36.6	S36 16.4
Miaplacidus	221 43.9	S69 38.4
Mirfak	309 15.7	N49 47.8
Nunki	76 29.1	S26 19.2
Peacock	53 58.5	S56 47.8
Pollux	243 57.5	N28 04.3
Procyon	245 25.2	N 5 16.3
Rasalhague	96 29.5	N12 34.3
Regulus	208 09.4	N12 03.5
Rigel	281 35.6	S 8 13.6
Rigil Kent.	140 25.3	S60 45.1
Sabik	102 41.0	S15 42.1
Schedar	350 09.0	N56 26.1
Shaula	96 55.6	S37 05.3
Sirius	258 55.2	S16 41.6
Spica	158 57.1	S11 03.7
Suhail	223 10.1	S43 21.4
Vega	80 56.0	N38 45.8
Zuben'ubi	137 32.7	S15 57.7

	S.H.A.	Mer. Pass.
	° ′	h m
Venus	50 12.0	11 20
Mars	25 14.4	12 59
Jupiter	170 15.2	3 18
Saturn	170 24.9	3 18

G.M.T.	SUN G.H.A.	SUN Dec.	MOON G.H.A.	MOON v	MOON Dec.	MOON d	MOON H.P.
d h	° ′	° ′	° ′	′	° ′	′	′
9 00	176 26.2	S14 46.0	124 31.4	9.8	N 1 05.6	12.4	59.6
01	191 26.1	45.2	139 00.2	9.9	1 18.0	12.4	59.6
02	206 26.1	44.4	153 29.1	9.8	1 30.4	12.5	59.6
03	221 26.1	43.6	167 57.9	9.9	1 42.9	12.4	59.6
04	236 26.1	42.8	182 26.8	9.8	1 55.3	12.4	59.6
05	251 26.1	42.0	196 55.6	9.9	2 07.7	12.4	59.5
06	266 26.1	S14 41.2	211 24.5	9.8	N 2 20.1	12.4	59.5
07	281 26.0	40.4	225 53.3	9.8	2 32.5	12.3	59.5
08	296 26.0	39.6	240 22.1	9.8	2 44.8	12.4	59.5
M 09	311 26.0	38.8	254 50.9	9.9	2 57.2	12.3	59.5
O 10	326 26.0	37.9	269 19.8	9.8	3 09.5	12.3	59.5
N 11	341 26.0	37.1	283 48.6	9.8	3 21.8	12.3	59.5
D 12	356 26.0	S14 36.3	298 17.4	9.7	N 3 34.1	12.2	59.5
A 13	11 25.9	35.5	312 46.1	9.8	3 46.3	12.3	59.5
Y 14	26 25.9	34.7	327 14.9	9.8	3 58.6	12.2	59.5
15	41 25.9	33.9	341 43.7	9.7	4 10.8	12.2	59.5
16	56 25.9	33.1	356 12.4	9.8	4 23.0	12.1	59.5
17	71 25.9	32.3	10 41.2	9.7	4 35.1	12.2	59.5
18	86 25.9	S14 31.5	25 09.9	9.7	N 4 47.3	12.1	59.5
19	101 25.9	30.7	39 38.6	9.7	4 59.4	12.0	59.5
20	116 25.8	29.9	54 07.3	9.7	5 11.4	12.1	59.5
21	131 25.8	29.1	68 36.0	9.7	5 23.5	12.0	59.5
22	146 25.8	28.3	83 04.7	9.6	5 35.5	11.9	59.5
23	161 25.8	27.5	97 33.3	9.7	5 47.4	12.0	59.5
10 00	176 25.8	S14 26.7	112 02.0	9.6	N 5 59.4	11.8	59.5
01	191 25.8	25.8	126 30.6	9.6	6 11.2	11.9	59.5
02	206 25.8	25.0	140 59.2	9.6	6 23.1	11.8	59.5
03	221 25.8	24.2	155 27.8	9.6	6 34.9	11.8	59.5
04	236 25.8	23.4	169 56.4	9.5	6 46.7	11.7	59.5
05	251 25.7	22.6	184 24.9	9.6	6 58.4	11.7	59.5
06	266 25.7	S14 21.8	198 53.5	9.5	N 7 10.1	11.7	59.4
07	281 25.7	21.0	213 22.0	9.5	7 21.8	11.6	59.4
08	296 25.7	20.2	227 50.5	9.4	7 33.4	11.5	59.4
T 09	311 25.7	19.4	242 18.9	9.5	7 44.9	11.5	59.4
U 10	326 25.7	18.5	256 47.4	9.4	7 56.4	11.5	59.4
E 11	341 25.7	17.7	271 15.8	9.4	8 07.9	11.4	59.4
S 12	356 25.7	S14 16.9	285 44.2	9.4	N 8 19.3	11.3	59.4
D 13	11 25.7	16.1	300 12.6	9.4	8 30.6	11.3	59.4
A 14	26 25.7	15.3	314 41.0	9.3	8 41.9	11.3	59.4
Y 15	41 25.7	14.5	329 09.3	9.3	8 53.2	11.2	59.4
16	56 25.7	13.7	343 37.6	9.3	9 04.4	11.1	59.4
17	71 25.7	12.8	358 05.9	9.3	9 15.5	11.1	59.4
18	86 25.7	S14 12.0	12 34.2	9.2	N 9 26.6	11.0	59.4
19	101 25.6	11.2	27 02.4	9.2	9 37.6	10.9	59.4
20	116 25.6	10.4	41 30.6	9.2	9 48.5	10.9	59.3
21	131 25.6	09.6	55 58.8	9.1	9 59.4	10.9	59.3
22	146 25.6	08.7	70 26.9	9.2	10 10.3	10.7	59.3
23	161 25.6	07.9	84 55.1	9.1	10 21.0	10.8	59.3
11 00	176 25.6	S14 07.1	99 23.2	9.0	N10 31.8	10.6	59.3
01	191 25.6	06.3	113 51.2	9.1	10 42.4	10.6	59.3
02	206 25.6	05.5	128 19.3	9.0	10 53.0	10.5	59.3
03	221 25.6	04.6	142 47.3	9.0	11 03.5	10.4	59.3
04	236 25.6	03.8	157 15.3	8.9	11 13.9	10.4	59.3
05	251 25.6	03.0	171 43.2	9.0	11 24.3	10.3	59.3
06	266 25.6	S14 02.2	186 11.2	8.8	N11 34.6	10.2	59.2
W 07	281 25.6	01.4	200 39.0	8.9	11 44.8	10.2	59.2
E 08	296 25.6	14 00.5	215 06.9	8.8	11 55.0	10.1	59.2
D 09	311 25.6	13 59.7	229 34.7	8.9	12 05.1	10.0	59.2
N 10	326 25.6	58.9	244 02.6	8.7	12 15.1	9.9	59.2
E 11	341 25.6	58.1	258 30.3	8.8	12 25.0	9.8	59.2
S 12	356 25.6	S13 57.2	272 58.1	8.7	N12 34.8	9.8	59.2
D 13	11 25.6	56.4	287 25.8	8.7	12 44.6	9.7	59.2
A 14	26 25.6	55.6	301 53.5	8.6	12 54.3	9.6	59.2
Y 15	41 25.6	54.8	316 21.1	8.6	13 03.9	9.6	59.2
16	56 25.6	53.9	330 48.7	8.6	13 13.5	9.4	59.1
17	71 25.6	53.1	345 16.3	8.6	13 22.9	9.4	59.1
18	86 25.6	S13 52.3	359 43.9	8.5	N13 32.3	9.3	59.1
19	101 25.6	51.5	14 11.4	8.5	13 41.6	9.2	59.1
20	116 25.6	50.6	28 38.9	8.4	13 50.8	9.1	59.1
21	131 25.6	49.8	43 06.3	8.4	13 59.9	9.0	59.1
22	146 25.6	49.0	57 33.7	8.4	14 08.9	8.9	59.1
23	161 25.6	48.2	72 01.1	8.4	14 17.8	8.9	59.1
	S.D. 16.2	d 0.8	S.D. 16.2		16.2		16.1

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 9	Moonrise 10	Moonrise 11	Moonrise 12
°	h m	h m	h m	h m	h m	h m	h m
N 72	06 36	07 58	09 24	09 26	09 14	08 59	08 39
N 70	06 32	07 45	08 59	09 30	09 25	09 20	09 14
68	06 28	07 35	08 40	09 33	09 34	09 36	09 40
66	06 25	07 26	08 24	09 36	09 41	09 49	10 00
64	06 22	07 19	08 12	09 38	09 48	10 00	10 16
62	06 20	07 12	08 01	09 40	09 53	10 09	10 29
60	06 18	07 07	07 52	09 42	09 58	10 17	10 40
N 58	06 15	07 02	07 44	09 43	10 02	10 24	10 50
56	06 13	06 57	07 37	09 45	10 06	10 30	10 59
54	06 11	06 53	07 30	09 46	10 10	10 36	11 07
52	06 09	06 49	07 25	09 47	10 13	10 41	11 14
50	06 08	06 46	07 20	09 48	10 16	10 46	11 20
45	06 03	06 38	07 09	09 51	10 22	10 56	11 34
N 40	05 59	06 31	06 59	09 53	10 27	11 04	11 45
35	05 55	06 25	06 51	09 54	10 32	11 12	11 54
30	05 51	06 20	06 44	09 56	10 36	11 18	12 03
20	05 43	06 09	06 32	09 59	10 43	11 29	12 18
N 10	05 34	06 00	06 21	10 01	10 49	11 39	12 30
0	05 25	05 50	06 11	10 03	10 55	11 48	12 43
S 10	05 13	05 39	06 00	10 06	11 01	11 58	12 55
20	04 59	05 26	05 49	10 08	11 08	12 08	13 08
30	04 41	05 11	05 36	10 11	11 15	12 19	13 23
35	04 29	05 02	05 29	10 13	11 20	12 26	13 32
40	04 15	04 51	05 20	10 15	11 24	12 34	13 42
45	03 58	04 38	05 10	10 17	11 30	12 43	13 54
S 50	03 35	04 21	04 57	10 20	11 37	12 53	14 08
52	03 24	04 13	04 52	10 21	11 40	12 59	14 15
54	03 11	04 04	04 45	10 22	11 44	13 04	14 22
56	02 55	03 54	04 38	10 24	11 48	13 10	14 31
58	02 35	03 43	04 30	10 26	11 52	13 17	14 40
S 60	02 10	03 29	04 21	10 27	11 57	13 25	14 51

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 9	Moonset 10	Moonset 11	Moonset 12
°	h m	h m	h m	h m	h m	h m	h m
N 72	15 06	16 32	17 55	23 44	25 48	01 48	04 02
N 70	15 31	16 45	17 59	23 35	25 30	01 30	03 28
68	15 50	16 55	18 02	23 28	25 15	01 15	03 03
66	16 06	17 04	18 05	23 22	25 04	01 04	02 44
64	16 18	17 11	18 08	23 17	24 54	00 54	02 29
62	16 29	17 17	18 10	23 13	24 46	00 46	02 16
60	16 38	17 23	18 12	23 10	24 38	00 38	02 06
N 58	16 46	17 28	18 14	23 06	24 32	00 32	01 57
56	16 53	17 32	18 16	23 03	24 27	00 27	01 48
54	16 59	17 36	18 18	23 01	24 22	00 22	01 41
52	17 05	17 40	18 20	22 59	24 17	00 17	01 35
50	17 10	17 44	18 22	22 56	24 13	00 13	01 29
45	17 21	17 51	18 26	22 52	24 05	00 05	01 17
N 40	17 30	17 58	18 30	22 48	23 57	25 06	01 06
35	17 38	18 04	18 34	22 45	23 51	24 57	00 57
30	17 45	18 09	18 38	22 42	23 46	24 50	00 50
20	17 57	18 19	18 46	22 37	23 36	24 36	00 36
N 10	18 08	18 29	18 54	22 32	23 28	24 25	00 25
0	18 18	18 39	19 04	22 28	23 20	24 14	00 14
S 10	18 28	18 50	19 15	22 24	23 13	24 03	00 03
20	18 39	19 02	19 29	22 19	23 05	23 52	24 41
30	18 52	19 17	19 47	22 14	22 55	23 39	24 25
35	18 59	19 26	19 58	22 11	22 50	23 31	24 16
40	19 08	19 37	20 12	22 08	22 44	23 22	24 05
45	19 18	19 50	20 29	22 04	22 37	23 12	23 52
S 50	19 30	20 06	20 52	22 00	22 28	23 00	23 37
52	19 36	20 14	21 03	21 58	22 25	22 55	23 30
54	19 42	20 23	21 16	21 56	22 20	22 48	23 22
56	19 49	20 32	21 31	21 53	22 16	22 42	23 13
58	19 57	20 44	21 50	21 50	22 10	22 34	23 03
S 60	20 06	20 57	22 14	21 47	22 05	22 25	22 52

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
	m s	m s	h m	h m	h m	d	
9	14 15	14 16	12 14	16 16	03 50	05	
10	14 17	14 17	12 14	17 08	04 42	06	
11	14 17	14 18	12 14	18 01	05 34	07	

G.M.T.	ARIES	VENUS −3.4		MARS +1.4		JUPITER −1.9		SATURN +0.8		STARS		
	G.H.A.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.	Name	S.H.A.	Dec.
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	° ′
12 00	141 57.3	189 34.9	S18 38.8	165 41.7	S10 59.2	312 18.2	S 2 32.2	312 26.4	S 1 19.8	Acamar	315 37.1	S40 23.2
01	156 59.7	204 34.2	38.1	180 42.3	58.5	327 20.8	32.1	327 29.0	19.7	Achernar	335 45.4	S57 20.4
02	172 02.2	219 33.5	37.3	195 42.9	57.8	342 23.4	32.0	342 31.5	19.7	Acrux	173 36.4	S62 59.4
03	187 04.7	234 32.7	·· 36.5	210 43.5	·· 57.0	357 26.0	·· 32.0	357 34.1	·· 19.6	Adhara	255 31.6	S28 57.0
04	202 07.1	249 32.0	35.8	225 44.1	56.3	12 28.6	31.9	12 36.6	19.6	Aldebaran	291 17.6	N16 28.2
05	217 09.6	264 31.2	35.0	240 44.7	55.6	27 31.1	31.8	27 39.2	19.5			
06	232 12.0	279 30.5	S18 34.2	255 45.3	S10 54.9	42 33.7	S 2 31.8	42 41.7	S 1 19.5	Alioth	166 41.9	N56 03.6
07	247 14.5	294 29.8	33.5	270 45.9	54.1	57 36.3	31.7	57 44.3	19.4	Alkaid	153 18.1	N49 24.3
T 08	262 17.0	309 29.0	32.7	285 46.5	53.4	72 38.9	31.6	72 46.8	19.4	Al Na'ir	28 15.1	S47 03.3
H 09	277 19.4	324 28.3	·· 31.9	300 47.0	·· 52.7	87 41.5	·· 31.6	87 49.4	·· 19.3	Alnilam	276 11.2	S 1 13.0
U 10	292 21.9	339 27.6	31.2	315 47.6	51.9	102 44.1	31.5	102 52.0	19.3	Alphard	218 20.0	S 8 34.7
R 11	307 24.4	354 26.8	30.4	330 48.2	51.2	117 46.7	31.4	117 54.5	19.2			
S 12	322 26.8	9 26.1	S18 29.6	345 48.8	S10 50.5	132 49.3	S 2 31.4	132 57.1	S 1 19.2	Alphecca	126 31.9	N26 46.5
D 13	337 29.3	24 25.4	28.9	0 49.4	49.7	147 51.9	31.3	147 59.6	19.1	Alpheratz	358 09.3	N28 59.1
A 14	352 31.8	39 24.6	28.1	15 50.0	49.0	162 54.5	31.2	163 02.2	19.1	Altair	62 32.5	N 8 49.0
Y 15	7 34.2	54 23.9	·· 27.3	30 50.6	·· 48.3	177 57.1	·· 31.2	178 04.7	·· 19.0	Ankaa	353 40.3	S42 24.8
16	22 36.7	69 23.2	26.5	45 51.2	47.5	192 59.7	31.1	193 07.3	19.0	Antares	112 56.6	S26 23.3
17	37 39.2	84 22.5	25.8	60 51.8	46.8	208 02.3	31.0	208 09.9	18.9			
18	52 41.6	99 21.7	S18 25.0	75 52.4	S10 46.0	223 04.9	S 2 31.0	223 12.4	S 1 18.9	Arcturus	146 18.1	N19 16.7
19	67 44.1	114 21.0	24.2	90 53.0	45.3	238 07.5	30.9	238 15.0	18.8	Atria	108 20.8	S68 59.3
20	82 46.5	129 20.3	23.4	105 53.6	44.6	253 10.1	30.8	253 17.5	18.8	Avior	234 27.5	S59 27.1
21	97 49.0	144 19.5	·· 22.7	120 54.2	·· 43.8	268 12.7	·· 30.8	268 20.1	·· 18.7	Bellatrix	278 58.3	N 6 19.8
22	112 51.5	159 18.8	21.9	135 54.8	43.1	283 15.3	30.7	283 22.7	18.7	Betelgeuse	271 27.8	N 7 24.1
23	127 53.9	174 18.1	21.1	150 55.4	42.4	298 17.9	30.6	298 25.2	18.6			
13 00	142 56.4	189 17.4	S18 20.3	165 56.0	S10 41.6	313 20.5	S 2 30.6	313 27.8	S 1 18.6	Canopus	264 06.7	S52 41.4
01	157 58.9	204 16.6	19.5	180 56.6	40.9	328 23.1	30.5	328 30.3	18.5	Capella	281 10.7	N45 58.8
02	173 01.3	219 15.9	18.8	195 57.2	40.2	343 25.6	30.4	343 32.9	18.5	Deneb	49 48.7	N45 12.6
03	188 03.8	234 15.2	·· 18.0	210 57.8	·· 39.4	358 28.2	·· 30.4	358 35.5	·· 18.4	Denebola	182 58.5	N14 40.6
04	203 06.3	249 14.5	17.2	225 58.4	38.7	13 30.8	30.3	13 38.0	18.4	Diphda	349 20.8	S18 05.7
05	218 08.7	264 13.7	16.4	240 59.0	38.0	28 33.4	30.2	28 40.6	18.3			
06	233 11.2	279 13.0	S18 15.6	255 59.6	S10 37.2	43 36.0	S 2 30.2	43 43.1	S 1 18.2	Dubhe	194 21.2	N61 51.1
07	248 13.7	294 12.3	14.8	271 00.2	36.5	58 38.6	30.1	58 45.7	18.2	Elnath	278 43.6	N28 35.5
08	263 16.1	309 11.6	14.0	286 00.8	35.7	73 41.2	30.0	73 48.3	18.1	Eltanin	90 57.9	N51 29.3
F 09	278 18.6	324 10.9	·· 13.3	301 01.4	·· 35.0	88 43.8	·· 30.0	88 50.8	·· 18.1	Enif	34 11.6	N 9 47.2
R 10	293 21.0	339 10.1	12.5	316 02.0	34.3	103 46.4	29.9	103 53.4	18.0	Fomalhaut	15 51.5	S29 43.6
I 11	308 23.5	354 09.4	11.7	331 02.6	33.5	118 49.0	29.8	118 55.9	18.0			
D 12	323 26.0	9 08.7	S18 10.9	346 03.2	S10 32.8	133 51.6	S 2 29.7	133 58.5	S 1 17.9	Gacrux	172 28.0	S57 00.2
A 13	338 28.4	24 08.0	10.1	1 03.8	32.1	148 54.2	29.7	149 01.1	17.9	Gienah	176 17.4	S17 26.2
Y 14	353 30.9	39 07.2	09.3	16 04.4	31.3	163 56.8	29.6	164 03.6	17.8	Hadar	149 22.7	S60 16.6
15	8 33.4	54 06.5	·· 08.5	31 05.0	·· 30.6	178 59.5	·· 29.5	179 06.2	·· 17.8	Hamal	328 28.7	N23 22.3
16	23 35.8	69 05.8	07.7	46 05.6	29.8	194 02.1	29.5	194 08.7	17.7	Kaus Aust.	84 16.7	S34 23.6
17	38 38.3	84 05.1	06.9	61 06.2	29.1	209 04.7	29.4	209 11.3	17.7			
18	53 40.8	99 04.4	S18 06.1	76 06.8	S10 28.4	224 07.3	S 2 29.3	224 13.9	S 1 17.6	Kochab	137 18.9	N74 13.7
19	68 43.2	114 03.7	05.3	91 07.4	27.6	239 09.9	29.3	239 16.4	17.6	Markab	14 03.2	N15 06.1
20	83 45.7	129 02.9	04.5	106 08.0	26.9	254 12.5	29.2	254 19.0	17.5	Menkar	314 40.9	N 4 00.8
21	98 48.1	144 02.2	·· 03.7	121 08.6	·· 26.2	269 15.1	·· 29.1	269 21.6	·· 17.5	Menkent	148 36.5	S36 16.5
22	113 50.6	159 01.5	02.9	136 09.2	25.4	284 17.7	29.1	284 24.1	17.4	Miaplacidus	221 43.9	S69 38.4
23	128 53.1	174 00.8	02.1	151 09.8	24.7	299 20.3	29.0	299 26.7	17.4			
14 00	143 55.5	189 00.1	S18 01.3	166 10.4	S10 23.9	314 22.9	S 2 28.9	314 29.2	S 1 17.3	Mirfak	309 15.7	N49 47.8
01	158 58.0	203 59.4	18 00.5	181 11.0	23.2	329 25.5	28.8	329 31.8	17.3	Nunki	76 29.1	S26 19.2
02	174 00.5	218 58.7	17 59.7	196 11.6	22.5	344 28.1	28.8	344 34.4	17.2	Peacock	53 58.5	S56 47.8
03	189 02.9	233 57.9	·· 58.9	211 12.2	·· 21.7	359 30.7	·· 28.7	359 36.9	·· 17.1	Pollux	243 57.5	N28 04.3
04	204 05.4	248 57.2	58.1	226 12.8	21.0	14 33.3	28.6	14 39.5	17.1	Procyon	245 25.2	N 5 16.3
05	219 07.9	263 56.5	57.3	241 13.4	20.2	29 35.9	28.6	29 42.1	17.0			
06	234 10.3	278 55.8	S17 56.5	256 14.0	S10 19.5	44 38.5	S 2 28.5	44 44.6	S 1 17.0	Rasalhague	96 29.5	N12 34.3
07	249 12.8	293 55.1	55.7	271 14.6	18.8	59 41.1	28.4	59 47.2	16.9	Regulus	208 09.4	N12 03.5
S 08	264 15.3	308 54.4	54.8	286 15.2	18.0	74 43.7	28.3	74 49.7	16.9	Rigel	281 35.6	S 8 13.6
A 09	279 17.7	323 53.7	·· 54.0	301 15.8	·· 17.3	89 46.3	·· 28.3	89 52.3	·· 16.8	Rigil Kent.	140 25.3	S60 45.1
T 10	294 20.2	338 53.0	53.2	316 16.5	16.5	104 48.9	28.2	104 54.9	16.8	Sabik	102 41.0	S15 42.1
U 11	309 22.6	353 52.3	52.4	331 17.1	15.8	119 51.5	28.1	119 57.4	16.7			
R 12	324 25.1	8 51.6	S17 51.6	346 17.7	S10 15.0	134 54.2	S 2 28.1	135 00.0	S 1 16.7	Schedar	350 09.1	N56 26.1
D 13	339 27.6	23 50.9	50.8	1 18.3	14.3	149 56.8	28.0	150 02.6	16.6	Shaula	96 55.6	S37 05.3
A 14	354 30.0	38 50.1	50.0	16 18.9	13.6	164 59.4	27.9	165 05.1	16.6	Sirius	258 55.2	S16 41.6
Y 15	9 32.5	53 49.4	·· 49.1	31 19.5	·· 12.8	180 02.0	·· 27.8	180 07.7	·· 16.5	Spica	158 57.1	S11 03.7
16	24 35.0	68 48.7	48.3	46 20.1	12.1	195 04.6	27.8	195 10.3	16.5	Suhail	223 10.1	S43 21.5
17	39 37.4	83 48.0	47.5	61 20.7	11.3	210 07.2	27.7	210 12.8	16.4			
18	54 39.9	98 47.3	S17 46.7	76 21.3	S10 10.6	225 09.8	S 2 27.6	225 15.4	S 1 16.3	Vega	80 55.9	N38 45.8
19	69 42.4	113 46.6	45.9	91 21.9	09.9	240 12.4	27.6	240 18.0	16.3	Zuben'ubi	137 32.7	S15 57.7
20	84 44.8	128 45.9	45.1	106 22.5	09.1	255 15.0	27.5	255 20.5	16.2			
21	99 47.3	143 45.2	·· 44.2	121 23.1	·· 08.4	270 17.6	·· 27.4	270 23.1	·· 16.2		S.H.A.	Mer. Pass.
22	114 49.8	158 44.5	43.4	136 23.7	07.6	285 20.2	27.3	285 25.7	16.1		° ′	h m
23	129 52.2	173 43.8	42.6	151 24.3	06.9	300 22.9	27.3	300 28.2	16.1	Venus	46 21.0	11 23
	h m									Mars	22 59.6	12 56
Mer. Pass.	14 25.9	v −0.7	d 0.8	v 0.6	d 0.7	v 2.6	d 0.1	v 2.6	d 0.1	Jupiter	170 24.1	3 06
										Saturn	170 31.4	3 06

G.M.T.	SUN G.H.A.	SUN Dec.	MOON G.H.A.	MOON v	MOON Dec.	MOON d	MOON H.P.
d h	° ′	° ′	° ′	′	° ′	′	′
12 00	176 25.7	S13 47.3	86 28.5	8.3	N14 26.7	8.7	59.0
01	191 25.7	46.5	100 55.8	8.3	14 35.4	8.7	59.0
02	206 25.7	45.7	115 23.1	8.3	14 44.1	8.6	59.0
03	221 25.7	·· 44.8	129 50.4	8.2	14 52.7	8.4	59.0
04	236 25.7	44.0	144 17.6	8.2	15 01.1	8.4	59.0
05	251 25.7	43.2	158 44.8	8.2	15 09.5	8.3	59.0
06	266 25.7	S13 42.3	173 12.0	8.1	N15 17.8	8.2	59.0
07	281 25.7	41.5	187 39.1	8.1	15 26.0	8.1	59.0
T 08	296 25.7	40.7	202 06.2	8.1	15 34.1	8.0	59.0
H 09	311 25.7	·· 39.9	216 33.3	8.0	15 42.1	7.9	58.9
U 10	326 25.7	39.0	231 00.3	8.0	15 50.0	7.8	58.9
R 11	341 25.7	38.2	245 27.3	8.0	15 57.8	7.7	58.9
S 12	356 25.7	S13 37.4	259 54.3	7.9	N16 05.5	7.6	58.9
D 13	11 25.7	36.5	274 21.2	7.9	16 13.1	7.5	58.9
A 14	26 25.8	35.7	288 48.1	7.9	16 20.6	7.4	58.9
Y 15	41 25.8	·· 34.9	303 15.0	7.9	16 28.0	7.3	58.9
16	56 25.8	34.0	317 41.9	7.8	16 35.3	7.2	58.8
17	71 25.8	33.2	332 08.7	7.8	16 42.5	7.1	58.8
18	86 25.8	S13 32.3	346 35.5	7.8	N16 49.6	7.0	58.8
19	101 25.8	31.5	1 02.3	7.7	16 56.6	6.9	58.8
20	116 25.8	30.7	15 29.0	7.7	17 03.5	6.7	58.8
21	131 25.8	·· 29.8	29 55.7	7.7	17 10.2	6.7	58.8
22	146 25.8	29.0	44 22.4	7.7	17 16.9	6.5	58.8
23	161 25.9	28.2	58 49.1	7.6	17 23.4	6.5	58.7
13 00	176 25.9	S13 27.3	73 15.7	7.6	N17 29.9	6.3	58.7
01	191 25.9	26.5	87 42.3	7.6	17 36.2	6.2	58.7
02	206 25.9	25.6	102 08.9	7.5	17 42.4	6.1	58.7
03	221 25.9	·· 24.8	116 35.4	7.5	17 48.5	6.0	58.7
04	236 25.9	24.0	131 01.9	7.5	17 54.5	5.9	58.7
05	251 25.9	23.1	145 28.4	7.5	18 00.4	5.8	58.7
06	266 26.0	S13 22.3	159 54.9	7.5	N18 06.2	5.7	58.6
07	281 26.0	21.4	174 21.4	7.4	18 11.9	5.5	58.6
08	296 26.0	20.6	188 47.8	7.4	18 17.4	5.4	58.6
F 09	311 26.0	·· 19.8	203 14.2	7.4	18 22.8	5.3	58.6
R 10	326 26.0	18.9	217 40.6	7.4	18 28.1	5.2	58.6
I 11	341 26.0	18.1	232 07.0	7.3	18 33.3	5.1	58.6
D 12	356 26.1	S13 17.2	246 33.3	7.4	N18 38.4	5.0	58.6
A 13	11 26.1	16.4	260 59.7	7.3	18 43.4	4.8	58.5
Y 14	26 26.1	15.5	275 26.0	7.3	18 48.2	4.7	58.5
15	41 26.1	·· 14.7	289 52.3	7.3	18 52.9	4.6	58.5
16	56 26.1	13.9	304 18.6	7.2	18 57.5	4.5	58.5
17	71 26.1	13.0	318 44.8	7.3	19 02.0	4.4	58.5
18	86 26.2	S13 12.2	333 11.1	7.2	N19 06.4	4.2	58.5
19	101 26.2	11.3	347 37.3	7.2	19 10.6	4.2	58.5
20	116 26.2	10.5	2 03.5	7.2	19 14.8	4.0	58.4
21	131 26.2	·· 09.6	16 29.7	7.2	19 18.8	3.9	58.4
22	146 26.2	08.8	30 55.9	7.2	19 22.7	3.7	58.4
23	161 26.3	07.9	45 22.1	7.2	19 26.4	3.7	58.4
14 00	176 26.3	S13 07.1	59 48.3	7.1	N19 30.1	3.5	58.4
01	191 26.3	06.2	74 14.4	7.2	19 33.6	3.4	58.4
02	206 26.3	05.4	88 40.6	7.1	19 37.0	3.3	58.3
03	221 26.4	·· 04.6	103 06.7	7.2	19 40.3	3.1	58.3
04	236 26.4	03.7	117 32.9	7.1	19 43.4	3.0	58.3
05	251 26.4	02.9	131 59.0	7.1	19 46.4	2.9	58.3
06	266 26.4	S13 02.0	146 25.1	7.2	N19 49.3	2.8	58.3
07	281 26.4	01.2	160 51.3	7.1	19 52.1	2.7	58.3
S 08	296 26.5	13 00.3	175 17.4	7.1	19 54.8	2.5	58.2
A 09	311 26.5	12 59.5	189 43.5	7.1	19 57.3	2.4	58.2
T 10	326 26.5	58.6	204 09.6	7.1	19 59.7	2.3	58.2
U 11	341 26.5	57.8	218 35.7	7.2	20 02.0	2.1	58.2
R 12	356 26.6	S12 56.9	233 01.9	7.1	N20 04.1	2.1	58.2
D 13	11 26.6	56.1	247 28.0	7.1	20 06.2	1.9	58.2
A 14	26 26.6	55.2	261 54.1	7.1	20 08.1	1.8	58.1
Y 15	41 26.6	·· 54.3	276 20.2	7.2	20 09.9	1.6	58.1
16	56 26.7	53.5	290 46.4	7.1	20 11.5	1.5	58.1
17	71 26.7	52.6	305 12.5	7.2	20 13.0	1.5	58.1
18	86 26.7	S12 51.8	319 38.7	7.1	N20 14.5	1.2	58.1
19	101 26.7	50.9	334 04.8	7.2	20 15.7	1.2	58.1
20	116 26.8	50.1	348 31.0	7.2	20 16.9	1.0	58.0
21	131 26.8	·· 49.2	2 57.2	7.1	20 17.9	0.9	58.0
22	146 26.8	48.4	17 23.3	7.2	20 18.8	0.8	58.0
23	161 26.9	47.5	31 49.5	7.3	20 19.6	0.7	58.0
	S.D. 16.2	d 0.8	S.D. 16.0		16.0		15.9

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

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

Day	SUN Eqn. of Time 00ʰ	SUN Eqn. of Time 12ʰ	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
	m s	m s	h m	h m	h m	d	
12	14 17	14 17	12 14	18 56	06 28	08	
13	14 17	14 16	12 14	19 51	07 23	09	◐
14	14 15	14 14	12 14	20 48	08 20	10	

G.M.T.	ARIES	VENUS −3.4		MARS +1.4		JUPITER −1.9		SATURN +0.8		STARS		
	G.H.A.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.	Name	S.H.A.	Dec.
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	° ′
15 00	144 54.7	188 43.1	S17 41.8	166 24.9	S10 06.1	315 25.5	S 2 27.2	315 30.8	S 1 16.0	Acamar	315 37.1	S40 23.2
01	159 57.1	203 42.4	40.9	181 25.5	05.4	330 28.1	27.1	330 33.3	16.0	Achernar	335 45.4	S57 20.3
02	174 59.6	218 41.7	40.1	196 26.1	04.7	345 30.7	27.0	345 35.9	15.9	Acrux	173 36.3	S62 59.5
03	190 02.1	233 41.0	·· 39.3	211 26.7	·· 03.9	0 33.3	·· 27.0	0 38.5	·· 15.9	Adhara	255 31.6	S28 57.0
04	205 04.5	248 40.3	38.5	226 27.4	03.2	15 35.9	26.9	15 41.0	15.8	Aldebaran	291 17.6	N16 28.2
05	220 07.0	263 39.6	37.6	241 28.0	02.4	30 38.5	26.8	30 43.6	15.8			
06	235 09.5	278 38.9	S17 36.8	256 28.6	S10 01.7	45 41.1	S 2 26.7	45 46.2	S 1 15.7	Alioth	166 41.9	N56 03.6
07	250 11.9	293 38.2	36.0	271 29.2	00.9	60 43.7	26.7	60 48.7	15.6	Alkaid	153 18.0	N49 24.3
08	265 14.4	308 37.5	35.1	286 29.8	10 00.2	75 46.4	26.6	75 51.3	15.6	Al Na'ir	28 15.1	S47 03.3
S 09	280 16.9	323 36.8	·· 34.3	301 30.4	9 59.4	90 49.0	·· 26.5	90 53.9	·· 15.5	Alnilam	276 11.2	S 1 13.0
U 10	295 19.3	338 36.1	33.5	316 31.0	58.7	105 51.6	26.5	105 56.5	15.5	Alphard	218 20.0	S 8 34.7
N 11	310 21.8	353 35.4	32.6	331 31.6	58.0	120 54.2	26.4	120 59.0	15.4			
D 12	325 24.2	8 34.7	S17 31.8	346 32.2	S 9 57.2	135 56.8	S 2 26.3	136 01.6	S 1 15.4	Alphecca	126 31.9	N26 46.5
A 13	340 26.7	23 34.0	31.0	1 32.8	56.5	150 59.4	26.2	151 04.2	15.3	Alpheratz	358 09.3	N28 59.1
Y 14	355 29.2	38 33.3	30.1	16 33.4	55.7	166 02.0	26.2	166 06.7	15.3	Altair	62 32.5	N 8 49.0
15	10 31.6	53 32.6	·· 29.3	31 34.0	·· 55.0	181 04.7	·· 26.1	181 09.3	·· 15.2	Ankaa	353 40.3	S42 24.8
16	25 34.1	68 31.9	28.5	46 34.7	54.2	196 07.3	26.0	196 11.9	15.2	Antares	112 56.6	S26 23.3
17	40 36.6	83 31.3	27.6	61 35.3	53.5	211 09.9	25.9	211 14.4	15.1			
18	55 39.0	98 30.6	S17 26.8	76 35.9	S 9 52.7	226 12.5	S 2 25.9	226 17.0	S 1 15.0	Arcturus	146 18.1	N19 16.7
19	70 41.5	113 29,9	25.9	91 36.5	52.0	241 15.1	25.8	241 19.6	15.0	Atria	108 20.7	S68 59.3
20	85 44.0	128 29.2	25.1	106 37.1	51.2	256 17.7	25.7	256 22.1	14.9	Avior	234 27.5	S59 27.1
21	100 46.4	143 28.5	·· 24.3	121 37.7	·· 50.5	271 20.4	·· 25.6	271 24.7	·· 14.9	Bellatrix	278 58.3	N 6 19.8
22	115 48.9	158 27.8	23.4	136 38.3	49.7	286 23.0	25.6	286 27.3	14.8	Betelgeuse	271 27.8	N 7 24.1
23	130 51.4	173 27.1	22.6	151 38.9	49.0	301 25.6	25.5	301 29.8	14.8			
16 00	145 53.8	188 26.4	S17 21.7	166 39.5	S 9 48.3	316 28.2	S 2 25.4	316 32.4	S 1 14.7	Canopus	264 06.7	S52 41.4
01	160 56.3	203 25.7	20.9	181 40.1	47.5	331 30.8	25.3	331 35.0	14.7	Capella	281 10.7	N45 58.8
02	175 58.7	218 25.0	20.0	196 40.7	46.8	346 33.4	25.2	346 37.5	14.6	Deneb	49 48.7	N45 12.6
03	191 01.2	233 24.4	·· 19.2	211 41.4	·· 46.0	1 36.1	·· 25.2	1 40.1	·· 14.5	Denebola	182 58.5	N14 40.6
04	206 03.7	248 23.7	18.3	226 42.0	45.3	16 38.7	25.1	16 42.7	14.5	Diphda	349 20.8	S18 05.7
05	221 06.1	263 23.0	17.5	241 42.6	44.5	31 41.3	25.0	31 45.3	14.4			
06	236 08.6	278 22.3	S17 16.6	256 43.2	S 9 43.8	46 43.9	S 2 24.9	46 47.8	S 1 14.4	Dubhe	194 21.2	N61 51.1
07	251 11.1	293 21.6	15.8	271 43.8	43.0	61 46.5	24.9	61 50.4	14.3	Elnath	278 43.6	N28 35.5
08	266 13.5	308 20.9	14.9	286 44.4	42.3	76 49.2	24.8	76 53.0	14.3	Eltanin	90 57.9	N51 29.3
M 09	281 16.0	323 20.2	·· 14.1	301 45.0	·· 41.5	91 51.8	·· 24.7	91 55.5	·· 14.2	Enif	34 11.6	N 9 47.2
O 10	296 18.5	338 19.6	13.2	316 45.6	40.8	106 54.4	24.6	106 58.1	14.2	Fomalhaut	15 51.4	S29 43.6
N 11	311 20.9	353 18.9	12.4	331 46.2	40.0	121 57.0	24.6	122 00.7	14.1			
D 12	326 23.4	8 18.2	S17 11.5	346 46.9	S 9 39.3	136 59.6	S 2 24.5	137 03.3	S 1 14.0	Gacrux	172 28.0	S57 00.2
A 13	341 25.9	23 17.5	10.7	1 47.5	38.5	152 02.3	24.4	152 05.8	14.0	Gienah	176 17.4	S17 26.2
Y 14	356 28.3	38 16.8	09.8	16 48.1	37.8	167 04.9	24.3	167 08.4	13.9	Hadar	149 22.6	S60 16.6
15	11 30.8	53 16.1	·· 08.9	31 48.7	·· 37.0	182 07.5	·· 24.3	182 11.0	·· 13.9	Hamal	328 28.7	N23 22.3
16	26 33.2	68 15.5	08.1	46 49.3	36.3	197 10.1	24.2	197 13.5	13.8	Kaus Aust.	84 16.7	S34 23.6
17	41 35.7	83 14.8	07.2	61 49.9	35.5	212 12.7	24.1	212 16.1	13.8			
18	56 38.2	98 14.1	S17 06.4	76 50.5	S 9 34.8	227 15.4	S 2 24.0	227 18.7	S 1 13.7	Kochab	137 18.8	N74 13.7
19	71 40.6	113 13.4	05.5	91 51.2	34.0	242 18.0	23.9	242 21.3	13.7	Markab	14 03.2	N15 06.1
20	86 43.1	128 12.7	04.6	106 51.8	33.3	257 20.6	23.9	257 23.8	13.6	Menkar	314 40.9	N 4 00.8
21	101 45.6	143 12.1	·· 03.8	121 52.4	·· 32.5	272 23.2	·· 23.8	272 26.4	·· 13.5	Menkent	148 36.5	S36 16.5
22	116 48.0	158 11.4	02.9	136 53.0	31.8	287 25.9	23.7	287 29.0	13.5	Miaplacidus	221 43.9	S69 38.4
23	131 50.5	173 10.7	02.1	151 53.6	31.0	302 28.5	23.6	302 31.5	13.4			
17 00	146 53.0	188 10.0	S17 01.2	166 54.2	S 9 30.3	317 31.1	S 2 23.6	317 34.1	S 1 13.4	Mirfak	309 15.7	N49 47.8
01	161 55.4	203 09.3	17 00.3	181 54.8	29.5	332 33.7	23.5	332 36.7	13.3	Nunki	76 29.1	S26 19.2
02	176 57.9	218 08.7	16 59.5	196 55.4	28.8	347 36.4	23.4	347 39.3	13.3	Peacock	53 58.5	S56 47.7
03	192 00.3	233 08.0	·· 58.6	211 56.1	·· 28.0	2 39.0	·· 23.3	2 41.8	·· 13.2	Pollux	243 57.5	N28 04.3
04	207 02.8	248 07.3	57.7	226 56.7	27.3	17 41.6	23.2	17 44.4	13.1	Procyon	245 25.2	N 5 16.3
05	222 05.3	263 06.6	56.9	241 57.3	26.5	32 44.2	23.2	32 47.0	13.1			
06	237 07.7	278 06.0	S16 56.0	256 57.9	S 9 25.8	47 46.9	S 2 23.1	47 49.6	S 1 13.0	Rasalhague	96 29.5	N12 34.3
07	252 10.2	293 05.3	55.1	271 58.5	25.0	62 49.5	23.0	62 52.1	13.0	Regulus	208 09.4	N12 03.5
T 08	267 12.7	308 04.6	54.2	286 59.1	24.3	77 52.1	22.9	77 54.7	12.9	Rigel	281 35.6	S 8 13.6
U 09	282 15.1	323 04.0	·· 53.4	301 59.8	·· 23.5	92 54.7	·· 22.8	92 57.3	·· 12.9	Rigil Kent.	140 25.2	S60 45.1
E 10	297 17.6	338 03.3	52.5	317 00.4	22.8	107 57.4	22.8	107 59.9	12.8	Sabik	102 40.9	S15 42.1
S 11	312 20.1	353 02.6	51.6	332 01.0	22.0	123 00.0	22.7	123 02.4	12.7			
D 12	327 22.5	8 01.9	S16 50.7	347 01.6	S 9 21.3	138 02.6	S 2 22.6	138 05.0	S 1 12.7	Schedar	350 09.1	N56 26.1
A 13	342 25.0	23 01.3	49.9	2 02.2	20.5	153 05.2	22.5	153 07.6	12.6	Shaula	96 55.5	S37 05.3
Y 14	357 27.5	38 00.6	49.0	17 02.8	19.8	168 07.9	22.4	168 10.2	12.6	Sirius	258 55.2	S16 41.7
15	12 29.9	52 59.9	·· 48.1	32 03.4	·· 19.0	183 10.5	·· 22.4	183 12.7	·· 12.5	Spica	158 57.0	S11 03.7
16	27 32.4	67 59.3	47.2	47 04.1	18.2	198 13.1	22.3	198 15.3	12.5	Suhail	223 10.1	S43 21.5
17	42 34.8	82 58.6	46.4	62 04.7	17.5	213 15.8	22.2	213 17.9	12.4			
18	57 37.3	97 57.9	S16 45.5	77 05.3	S 9 16.7	228 18.4	S 2 22.1	228 20.5	S 1 12.3	Vega	80 55.9	N38 45.8
19	72 39.8	112 57.3	44.6	92 05.9	16.0	243 21.0	22.0	243 23.0	12.3	Zuben'ubi	137 32.6	S15 57.7
20	87 42.2	127 56.6	43.7	107 06.5	15.2	258 23.6	22.0	258 25.6	12.2		S.H.A.	Mer. Pass.
21	102 44.7	142 55.9	·· 42.8	122 07.1	·· 14.5	273 26.3	·· 21.9	273 28.2	·· 12.2		° ′	h m
22	117 47.2	157 55.3	41.9	137 07.8	13.7	288 28.9	21.8	288 30.8	12.1	Venus	42 32.6	11 27
23	132 49.6	172 54.6	41.1	152 08.4	13.0	303 31.5	21.7	303 33.3	12.1	Mars	20 45.7	12 53
	h m									Jupiter	170 34.4	2 54
Mer. Pass.	14 14.1	v −0.7	d 0.9	v 0.6	d 0.7	v 2.6	d 0.1	v 2.6	d 0.1	Saturn	170 38.6	2 53

G.M.T.	SUN G.H.A.	SUN Dec.	MOON G.H.A.	MOON v	MOON Dec.	MOON d	MOON H.P.
d h	° ′	° ′	° ′	′	° ′	′	′
15 00	176 26.9	S12 46.7	46 15.8	7.2	N20 20.3	0.5	58.0
01	191 26.9	45.8	60 42.0	7.2	20 20.8	0.4	58.0
02	206 26.9	44.9	75 08.2	7.3	20 21.2	0.3	57.9
03	221 27.0	·· 44.1	89 34.5	7.3	20 21.5	0.1	57.9
04	236 27.0	43.2	104 00.8	7.2	20 21.6	0.1	57.9
05	251 27.0	42.4	118 27.0	7.4	20 21.7	0.1	57.9
06	266 27.1	S12 41.5	132 53.4	7.3	N20 21.6	0.3	57.9
07	281 27.1	40.7	147 19.7	7.3	20 21.3	0.3	57.8
08	296 27.1	39.8	161 46.0	7.4	20 21.0	0.5	57.8
S 09	311 27.2	·· 38.9	176 12.4	7.4	20 20.5	0.6	57.8
U 10	326 27.2	38.1	190 38.8	7.5	20 19.9	0.7	57.8
N 11	341 27.2	37.2	205 05.3	7.4	20 19.2	0.8	57.8
D 12	356 27.3	S12 36.4	219 31.7	7.5	N20 18.4	1.0	57.8
A 13	11 27.3	35.5	233 58.2	7.5	20 17.4	1.0	57.7
Y 14	26 27.3	34.6	248 24.7	7.5	20 16.4	1.2	57.7
15	41 27.4	·· 33.8	262 51.2	7.6	20 15.2	1.3	57.7
16	56 27.4	32.9	277 17.8	7.6	20 13.9	1.5	57.7
17	71 27.4	32.1	291 44.4	7.6	20 12.4	1.6	57.7
18	86 27.5	S12 31.2	306 11.0	7.7	N20 10.8	1.6	57.6
19	101 27.5	30.3	320 37.7	7.7	20 09.2	1.8	57.6
20	116 27.5	29.5	335 04.4	7.7	20 07.4	2.0	57.6
21	131 27.6	·· 28.6	349 31.1	7.8	20 05.4	2.0	57.6
22	146 27.6	27.7	3 57.9	7.8	20 03.4	2.2	57.6
23	161 27.6	26.9	18 24.7	7.8	20 01.2	2.2	57.6
16 00	176 27.7	S12 26.0	32 51.5	7.9	N19 59.0	2.4	57.5
01	191 27.7	25.1	47 18.4	7.9	19 56.6	2.5	57.5
02	206 27.8	24.3	61 45.3	8.0	19 54.1	2.7	57.5
03	221 27.8	·· 23.4	76 12.3	8.0	19 51.4	2.7	57.5
04	236 27.8	22.5	90 39.3	8.0	19 48.7	2.8	57.5
05	251 27.9	21.7	105 06.3	8.1	19 45.9	3.0	57.4
06	266 27.9	S12 20.8	119 33.4	8.1	N19 42.9	3.1	57.4
07	281 27.9	20.0	134 00.5	8.2	19 39.8	3.2	57.4
08	296 28.0	19.1	148 27.7	8.2	19 36.6	3.3	57.4
M 09	311 28.0	·· 18.2	162 54.9	8.3	19 33.3	3.4	57.4
O 10	326 28.1	17.3	177 22.2	8.3	19 29.9	3.6	57.3
N 11	341 28.1	16.5	191 49.5	8.3	19 26.3	3.6	57.3
D 12	356 28.1	S12 15.6	206 16.8	8.4	N19 22.7	3.8	57.3
A 13	11 28.2	14.7	220 44.2	8.5	19 18.9	3.8	57.3
Y 14	26 28.2	13.9	235 11.7	8.5	19 15.1	4.0	57.3
15	41 28.3	·· 13.0	249 39.2	8.5	19 11.1	4.1	57.2
16	56 28.3	12.1	264 06.7	8.6	19 07.0	4.2	57.2
17	71 28.3	11.3	278 34.3	8.7	19 02.8	4.2	57.2
18	86 28.4	S12 10.4	293 02.0	8.7	N18 58.6	4.4	57.2
19	101 28.4	09.5	307 29.7	8.8	18 54.2	4.6	57.2
20	116 28.5	08.7	321 57.5	8.8	18 49.6	4.6	57.1
21	131 28.5	·· 07.8	336 25.3	8.8	18 45.0	4.7	57.1
22	146 28.6	06.9	350 53.1	9.0	18 40.3	4.8	57.1
23	161 28.6	06.0	5 21.1	8.9	18 35.5	4.9	57.1
17 00	176 28.6	S12 05.2	19 49.0	9.1	N18 30.6	5.0	57.1
01	191 28.7	04.3	34 17.1	9.1	18 25.6	5.1	57.0
02	206 28.7	03.4	48 45.2	9.1	18 20.5	5.2	57.0
03	221 28.8	·· 02.5	63 13.3	9.2	18 15.3	5.4	57.0
04	236 28.8	01.7	77 41.5	9.3	18 09.9	5.4	57.0
05	251 28.9	12 00.8	92 09.8	9.3	18 04.5	5.5	57.0
06	266 28.9	S11 59.9	106 38.1	9.4	N17 59.0	5.6	56.9
07	281 29.0	59.0	121 06.5	9.4	17 53.4	5.7	56.9
08	296 29.0	58.2	135 34.9	9.5	17 47.7	5.8	56.9
T 09	311 29.1	·· 57.3	150 03.4	9.6	17 41.9	5.8	56.9
U 10	326 29.1	56.4	164 32.0	9.6	17 36.1	6.0	56.9
E 11	341 29.2	55.5	179 00.6	9.7	17 30.1	6.1	56.8
S 12	356 29.2	S11 54.7	193 29.3	9.7	N17 24.0	6.2	56.8
D 13	11 29.2	53.8	207 58.0	9.8	17 17.8	6.2	56.8
A 14	26 29.3	52.9	222 26.8	9.9	17 11.6	6.3	56.8
Y 15	41 29.3	·· 52.0	236 55.7	9.9	17 05.3	6.5	56.8
16	56 29.4	51.2	251 24.6	10.0	16 58.8	6.5	56.7
17	71 29.4	50.3	265 53.6	10.0	16 52.3	6.6	56.7
18	86 29.5	S11 49.4	280 22.6	10.1	N16 45.7	6.7	56.7
19	101 29.5	48.5	294 51.7	10.2	16 39.0	6.7	56.7
20	116 29.6	47.6	309 20.9	10.3	16 32.3	6.9	56.6
21	131 29.6	·· 46.8	323 50.2	10.3	16 25.4	6.9	56.6
22	146 29.7	45.9	338 19.5	10.3	16 18.5	7.0	56.6
23	161 29.7	45.0	352 48.8	10.4	16 11.5	7.1	56.6
	S.D. 16.2	d 0.9	S.D. 15.7		15.6		15.5

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

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

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
	m s	m s	h m	h m	h m	d	
15	14 13	14 11	12 14	21 44	09 16	11	
16	14 09	14 08	12 14	22 38	10 11	12	○
17	14 05	14 03	12 14	23 30	11 04	13	

G.M.T.	ARIES	VENUS −3.4		MARS +1.4		JUPITER −1.9		SATURN +0.8		STARS		
	G.H.A.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.	Name	S.H.A.	Dec.
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	° ′
18 00	147 52.1	187 53.9	S16 40.2	167 09.0	S 9 12.2	318 34.2	S 2 21.6	318 35.9	S 1 12.0	Acamar	315 37.1	S40 23.2
01	162 54.6	202 53.3	39.3	182 09.6	11.5	333 36.8	21.6	333 38.5	11.9	Achernar	335 45.4	S57 20.3
02	177 57.0	217 52.6	38.4	197 10.2	10.7	348 39.4	21.5	348 41.1	11.9	Acrux	173 36.3	S62 59.5
03	192 59.5	232 51.9	·· 37.5	212 10.9	·· 10.0	3 42.1	·· 21.4	3 43.6	·· 11.8	Adhara	255 31.6	S28 57.0
04	208 02.0	247 51.3	36.6	227 11.5	09.2	18 44.7	21.3	18 46.2	11.8	Aldebaran	291 17.6	N16 28.2
05	223 04.4	262 50.6	35.7	242 12.1	08.4	33 47.3	21.2	33 48.8	11.7			
06	238 06.9	277 50.0	S16 34.9	257 12.7	S 9 07.7	48 49.9	S 2 21.2	48 51.4	S 1 11.6	Alioth	166 41.9	N56 03.6
07	253 09.3	292 49.3	34.0	272 13.3	06.9	63 52.6	21.1	63 53.9	11.6	Alkaid	153 18.0	N49 24.3
W 08	268 11.8	307 48.6	33.1	287 13.9	06.2	78 55.2	21.0	78 56.5	11.5	Al Na'ir	28 15.0	S47 03.3
E 09	283 14.3	322 48.0	·· 32.2	302 14.6	·· 05.4	93 57.8	·· 20.9	93 59.1	·· 11.5	Alnilam	276 11.2	S 1 13.0
D 10	298 16.7	337 47.3	31.3	317 15.2	04.7	109 00.5	20.8	109 01.7	11.4	Alphard	218 20.0	S 8 34.7
N 11	313 19.2	352 46.6	30.4	332 15.8	03.9	124 03.1	20.7	124 04.3	11.4			
E 12	328 21.7	7 46.0	S16 29.5	347 16.4	S 9 03.2	139 05.7	S 2 20.7	139 06.8	S 1 11.3	Alphecca	126 31.8	N26 46.5
S 13	343 24.1	22 45.3	28.6	2 17.0	02.4	154 08.4	20.6	154 09.4	11.2	Alpheratz	358 09.3	N28 59.1
D 14	358 26.6	37 44.7	27.7	17 17.7	01.6	169 11.0	20.5	169 12.0	11.2	Altair	62 32.5	N 8 49.0
A 15	13 29.1	52 44.0	·· 26.8	32 18.3	·· 00.9	184 13.6	·· 20.4	184 14.6	·· 11.1	Ankaa	353 40.3	S42 24.8
Y 16	28 31.5	67 43.4	25.9	47 18.9	9 00.1	199 16.3	20.3	199 17.1	11.1	Antares	112 56.5	S26 23.3
17	43 34.0	82 42.7	25.0	62 19.5	8 59.4	214 18.9	20.2	214 19.7	11.0			
18	58 36.4	97 42.0	S16 24.1	77 20.1	S 8 58.6	229 21.6	S 2 20.2	229 22.3	S 1 10.9	Arcturus	146 18.1	N19 16.7
19	73 38.9	112 41.4	23.2	92 20.8	57.9	244 24.2	20.1	244 24.9	10.9	Atria	108 20.7	S68 59.3
20	88 41.4	127 40.7	22.3	107 21.4	57.1	259 26.8	20.0	259 27.5	10.8	Avior	234 27.5	S59 27.1
21	103 43.8	142 40.1	·· 21.4	122 22.0	·· 56.4	274 29.5	·· 19.9	274 30.0	·· 10.8	Bellatrix	278 58.3	N 6 19.8
22	118 46.3	157 39.4	20.5	137 22.6	55.6	289 32.1	19.8	289 32.6	10.7	Betelgeuse	271 27.8	N 7 24.1
23	133 48.8	172 38.8	19.6	152 23.2	54.8	304 34.7	19.7	304 35.2	10.7			
19 00	148 51.2	187 38.1	S16 18.7	167 23.9	S 8 54.1	319 37.4	S 2 19.7	319 37.8	S 1 10.6	Canopus	264 06.7	S52 41.5
01	163 53.7	202 37.5	17.8	182 24.5	53.3	334 40.0	19.6	334 40.4	10.5	Capella	281 10.7	N45 58.8
02	178 56.2	217 36.8	16.9	197 25.1	52.6	349 42.6	19.5	349 42.9	10.5	Deneb	49 48.7	N45 12.6
03	193 58.6	232 36.2	·· 16.0	212 25.7	·· 51.8	4 45.3	·· 19.4	4 45.5	·· 10.4	Denebola	182 58.5	N14 40.6
04	209 01.1	247 35.5	15.1	227 26.4	51.0	19 47.9	19.3	19 48.1	10.4	Diphda	349 20.8	S18 05.7
05	224 03.6	262 34.9	14.2	242 27.0	50.3	34 50.6	19.2	34 50.7	10.3			
06	239 06.0	277 34.2	S16 13.3	257 27.6	S 8 49.5	49 53.2	S 2 19.2	49 53.2	S 1 10.2	Dubhe	194 21.1	N61 51.1
07	254 08.5	292 33.6	12.3	272 28.2	48.8	64 55.8	19.1	64 55.8	10.2	Elnath	278 43.6	N28 35.5
T 08	269 10.9	307 32.9	11.4	287 28.8	48.0	79 58.5	19.0	79 58.4	10.1	Eltanin	90 57.9	N51 29.2
H 09	284 13.4	322 32.3	·· 10.5	302 29.5	·· 47.3	95 01.1	·· 18.9	95 01.0	·· 10.1	Enif	34 11.6	N 9 47.1
U 10	299 15.9	337 31.6	09.6	317 30.1	46.5	110 03.7	18.8	110 03.6	10.0	Fomalhaut	15 51.4	S29 43.5
R 11	314 18.3	352 31.0	08.7	332 30.7	45.7	125 06.4	18.7	125 06.2	09.9			
S 12	329 20.8	7 30.3	S16 07.8	347 31.3	S 8 45.0	140 09.0	S 2 18.7	140 08.7	S 1 09.9	Gacrux	172 27.9	S57 00.3
D 13	344 23.3	22 29.7	06.9	2 32.0	44.2	155 11.7	18.6	155 11.3	09.8	Gienah	176 17.4	S17 26.2
A 14	359 25.7	37 29.0	06.0	17 32.6	43.5	170 14.3	18.5	170 13.9	09.8	Hadar	149 22.6	S60 16.7
Y 15	14 28.2	52 28.4	·· 05.0	32 33.2	·· 42.7	185 16.9	·· 18.4	185 16.5	·· 09.7	Hamal	328 28.7	N23 22.3
16	29 30.7	67 27.8	04.1	47 33.8	41.9	200 19.6	18.3	200 19.1	09.6	Kaus Aust.	84 16.7	S34 23.6
17	44 33.1	82 27.1	03.2	62 34.5	41.2	215 22.2	18.2	215 21.6	09.6			
18	59 35.6	97 26.5	S16 02.3	77 35.1	S 8 40.4	230 24.9	S 2 18.1	230 24.2	S 1 09.5	Kochab	137 18.7	N74 13.7
19	74 38.1	112 25.8	01.4	92 35.7	39.7	245 27.5	18.1	245 26.8	09.5	Markab	14 03.2	N15 06.1
20	89 40.5	127 25.2	16 00.4	107 36.3	38.9	260 30.2	18.0	260 29.4	09.4	Menkar	314 40.9	N 4 00.8
21	104 43.0	142 24.5	15 59.5	122 36.9	·· 38.1	275 32.8	·· 17.9	275 32.0	·· 09.3	Menkent	148 36.5	S36 16.5
22	119 45.4	157 23.9	58.6	137 37.6	37.4	290 35.4	17.8	290 34.5	09.3	Miaplacidus	221 43.9	S69 38.5
23	134 47.9	172 23.3	57.7	152 38.2	36.6	305 38.1	17.7	305 37.1	09.2			
20 00	149 50.4	187 22.6	S15 56.8	167 38.8	S 8 35.9	320 40.7	S 2 17.6	320 39.7	S 1 09.2	Mirfak	309 15.7	N49 47.8
01	164 52.8	202 22.0	55.8	182 39.4	35.1	335 43.4	17.5	335 42.3	09.1	Nunki	76 29.1	S26 19.2
02	179 55.3	217 21.3	54.9	197 40.1	34.3	350 46.0	17.5	350 44.9	09.0	Peacock	53 58.5	S56 47.7
03	194 57.8	232 20.7	·· 54.0	212 40.7	·· 33.6	5 48.7	·· 17.4	5 47.5	·· 09.0	Pollux	243 57.5	N28 04.3
04	210 00.2	247 20.1	53.1	227 41.3	32.8	20 51.3	17.3	20 50.0	08.9	Procyon	245 25.2	N 5 16.3
05	225 02.7	262 19.4	52.1	242 41.9	32.1	35 53.9	17.2	35 52.6	08.9			
06	240 05.2	277 18.8	S15 51.2	257 42.6	S 8 31.3	50 56.6	S 2 17.1	50 55.2	S 1 08.8	Rasalhague	96 29.5	N12 34.3
07	255 07.6	292 18.1	50.3	272 43.2	30.5	65 59.2	17.0	65 57.8	08.7	Regulus	208 09.4	N12 03.5
08	270 10.1	307 17.5	49.3	287 43.8	29.8	81 01.9	16.9	81 00.4	08.7	Rigel	281 35.6	S 8 13.6
F 09	285 12.5	322 16.9	·· 48.4	302 44.5	·· 29.0	96 04.5	·· 16.9	96 03.0	·· 08.6	Rigil Kent.	140 25.2	S60 45.1
R 10	300 15.0	337 16.2	47.5	317 45.1	28.3	111 07.2	16.8	111 05.5	08.6	Sabik	102 40.9	S15 42.1
I 11	315 17.5	352 15.6	46.6	332 45.7	27.5	126 09.8	16.7	126 08.1	08.5			
D 12	330 19.9	7 15.0	S15 45.6	347 46.3	S 8 26.7	141 12.5	S 2 16.6	141 10.7	S 1 08.4	Schedar	350 09.1	N56 26.1
A 13	345 22.4	22 14.3	44.7	2 47.0	26.0	156 15.1	16.5	156 13.3	08.4	Shaula	96 55.5	S37 05.3
Y 14	0 24.9	37 13.7	43.8	17 47.6	25.2	171 17.7	16.4	171 15.9	08.3	Sirius	258 55.2	S16 41.7
15	15 27.3	52 13.1	·· 42.8	32 48.2	·· 24.4	186 20.4	·· 16.3	186 18.5	·· 08.3	Spica	158 57.0	S11 03.8
16	30 29.8	67 12.4	41.9	47 48.8	23.7	201 23.0	16.2	201 21.1	08.2	Suhail	223 10.1	S43 21.5
17	45 32.3	82 11.8	41.0	62 49.5	22.9	216 25.7	16.2	216 23.6	08.1			
18	60 34.7	97 11.2	S15 40.0	77 50.1	S 8 22.2	231 28.3	S 2 16.1	231 26.2	S 1 08.1	Vega	80 55.9	N38 45.8
19	75 37.2	112 10.5	39.1	92 50.7	21.4	246 31.0	16.0	246 28.8	08.0	Zuben'ubi	137 32.6	S15 57.8
20	90 39.7	127 09.9	38.1	107 51.3	20.6	261 33.6	15.9	261 31.4	07.9		S.H.A.	Mer. Pass.
21	105 42.1	142 09.3	·· 37.2	122 52.0	·· 19.9	276 36.3	·· 15.8	276 34.0	·· 07.9		° ′	h m
22	120 44.6	157 08.7	36.3	137 52.6	19.1	291 38.9	15.7	291 36.6	07.8	Venus	38 46.9	11 30
23	135 47.0	172 08.0	35.3	152 53.2	18.3	306 41.6	15.6	306 39.1	07.8	Mars	18 32.6	12 50
	h m									Jupiter	170 46.1	2 41
Mer. Pass	14 02.3	v 0.6	d 0.9	v 0.6	d 0.8	v 2.6	d 0.1	v 2.6	d 0.1	Saturn	170 46.5	2 41

G.M.T.	SUN G.H.A.	SUN Dec.	MOON G.H.A.	MOON v	MOON Dec.	MOON d	MOON H.P.
d h	° ′	° ′	° ′	′	° ′	′	′
18 00	176 29.8	S11 44.1	7 18.2	10.5	N16 04.4	7.2	56.6
01	191 29.8	43.2	21 47.7	10.6	15 57.2	7.2	56.5
02	206 29.9	42.4	36 17.3	10.6	15 50.0	7.4	56.5
03	221 30.0	·· 41.5	50 46.9	10.7	15 42.6	7.4	56.5
04	236 30.0	40.6	65 16.6	10.7	15 35.2	7.5	56.5
05	251 30.1	39.7	79 46.3	10.8	15 27.7	7.5	56.5
06	266 30.1	S11 38.8	94 16.1	10.9	N15 20.2	7.6	56.4
07	281 30.2	38.0	108 46.0	10.9	15 12.6	7.7	56.4
W 08	296 30.2	37.1	123 15.9	11.0	15 04.9	7.8	56.4
E 09	311 30.3	·· 36.2	137 45.9	11.1	14 57.1	7.9	56.4
D 10	326 30.3	35.3	152 16.0	11.1	14 49.2	7.9	56.3
N 11	341 30.4	34.4	166 46.1	11.2	14 41.3	8.0	56.3
E 12	356 30.4	S11 33.5	181 16.3	11.2	N14 33.3	8.0	56.3
S 13	11 30.5	32.7	195 46.5	11.3	14 25.3	8.1	56.3
D 14	26 30.5	31.8	210 16.8	11.4	14 17.2	8.2	56.3
A 15	41 30.6	·· 30.9	224 47.2	11.4	14 09.0	8.3	56.2
Y 16	56 30.7	30.0	239 17.6	11.5	14 00.7	8.3	56.2
17	71 30.7	29.1	253 48.1	11.6	13 52.4	8.3	56.2
18	86 30.8	S11 28.2	268 18.7	11.6	N13 44.1	8.5	56.2
19	101 30.8	27.3	282 49.3	11.7	13 35.6	8.5	56.2
20	116 30.9	26.5	297 20.0	11.7	13 27.1	8.5	56.1
21	131 30.9	·· 25.6	311 50.7	11.9	13 18.6	8.7	56.1
22	146 31.0	24.7	326 21.6	11.8	13 09.9	8.6	56.1
23	161 31.1	23.8	340 52.4	11.9	13 01.3	8.8	56.1
19 00	176 31.1	S11 22.9	355 23.3	12.0	N12 52.5	8.8	56.1
01	191 31.2	22.0	9 54.3	12.1	12 43.7	8.8	56.0
02	206 31.2	21.1	24 25.4	12.1	12 34.9	8.9	56.0
03	221 31.3	·· 20.2	38 56.5	12.2	12 26.0	8.9	56.0
04	236 31.4	19.4	53 27.7	12.2	12 17.1	9.1	56.0
05	251 31.4	18.5	67 58.9	12.3	12 08.0	9.0	55.9
06	266 31.5	S11 17.6	82 30.2	12.3	N11 59.0	9.1	55.9
07	281 31.5	16.7	97 01.5	12.5	11 49.9	9.2	55.9
T 08	296 31.6	15.8	111 33.0	12.4	11 40.7	9.2	55.9
H 09	311 31.7	·· 14.9	126 04.4	12.5	11 31.5	9.2	55.9
U 10	326 31.7	14.0	140 35.9	12.6	11 22.3	9.3	55.8
R 11	341 31.8	13.1	155 07.5	12.7	11 13.0	9.4	55.8
S 12	356 31.8	S11 12.2	169 39.2	12.7	N11 03.6	9.4	55.8
D 13	11 31.9	11.3	184 10.9	12.7	10 54.2	9.4	55.8
A 14	26 32.0	10.4	198 42.6	12.8	10 44.8	9.5	55.8
Y 15	41 32.0	·· 09.6	213 14.4	12.9	10 35.3	9.5	55.7
16	56 32.1	08.7	227 46.3	12.9	10 25.8	9.5	55.7
17	71 32.2	07.8	242 18.2	13.0	10 16.3	9.6	55.7
18	86 32.2	S11 06.9	256 50.2	13.0	N10 06.7	9.7	55.7
19	101 32.3	06.0	271 22.2	13.1	9 57.0	9.7	55.7
20	116 32.4	05.1	285 54.3	13.1	9 47.3	9.7	55.6
21	131 32.4	·· 04.2	300 26.4	13.2	9 37.6	9.7	55.6
22	146 32.5	03.3	314 58.6	13.2	9 27.9	9.8	55.6
23	161 32.5	02.4	329 30.8	13.3	9 18.1	9.8	55.6
20 00	176 32.6	S11 01.5	344 03.1	13.3	N 9 08.3	9.9	55.5
01	191 32.7	11 00.6	358 35.4	13.4	8 58.4	9.9	55.5
02	206 32.7	10 59.7	13 07.8	13.5	8 48.5	9.9	55.5
03	221 32.8	·· 58.8	27 40.3	13.5	8 38.6	10.0	55.5
04	236 32.9	57.9	42 12.8	13.5	8 28.6	9.9	55.5
05	251 32.9	57.0	56 45.3	13.6	8 18.7	10.1	55.4
06	266 33.0	S10 56.1	71 17.9	13.6	N 8 08.6	10.0	55.4
07	281 33.1	55.2	85 50.5	13.7	7 58.6	10.1	55.4
08	296 33.1	54.3	100 23.2	13.7	7 48.5	10.1	55.4
F 09	311 33.2	·· 53.4	114 55.9	13.8	7 38.4	10.1	55.4
R 10	326 33.3	52.5	129 28.7	13.8	7 28.3	10.1	55.3
I 11	341 33.4	51.6	144 01.5	13.9	7 18.2	10.2	55.3
D 12	356 33.4	S10 50.7	158 34.4	13.9	N 7 08.0	10.2	55.3
A 13	11 33.5	49.8	173 07.3	13.9	6 57.8	10.2	55.3
Y 14	26 33.6	48.9	187 40.2	14.0	6 47.6	10.3	55.3
15	41 33.6	·· 48.0	202 13.2	14.1	6 37.3	10.2	55.2
16	56 33.7	47.1	216 46.3	14.1	6 27.1	10.3	55.2
17	71 33.8	46.2	231 19.4	14.1	6 16.8	10.3	55.2
18	86 33.8	S10 45.3	245 52.5	14.1	N 6 06.5	10.4	55.2
19	101 33.9	44.4	260 25.6	14.3	5 56.1	10.3	55.2
20	116 34.0	43.5	274 58.9	14.2	5 45.8	10.4	55.2
21	131 34.1	·· 42.6	289 32.1	14.3	5 35.4	10.3	55.1
22	146 34.1	41.7	304 05.4	14.3	5 25.1	10.4	55.1
23	161 34.2	40.8	318 38.7	14.3	5 14.7	10.4	55.1
	S.D. 16.2	d 0.9	S.D. 15.3		15.2		15.1

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

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

Day	SUN Eqn. of Time 00ʰ	SUN Eqn. of Time 12ʰ	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
	m s	m s	h m	h m	h m	d	
18	14 01	13 58	12 14	24 19	11 55	14	
19	13 56	13 53	12 14	00 19	12 43	15	○
20	13 50	13 46	12 14	01 06	13 28	16	

G.M.T.	ARIES	VENUS −3.4		MARS +1.4		JUPITER −1.9		SATURN +0.8		STARS		
	G.H.A.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.	Name	S.H.A.	Dec.
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	° ′
21 00	150 49.5	187 07.4	S15 34.4	167 53.9	S 8 17.6	321 44.2	S 2 15.5	321 41.7	S 1 07.7	Acamar	315 37.1	S40 23.2
01	165 52.0	202 06.8	33.4	182 54.5	16.8	336 46.9	15.4	336 44.3	07.6	Achernar	335 45.4	S57 20.3
02	180 54.4	217 06.1	32.5	197 55.1	16.0	351 49.5	15.4	351 46.9	07.6	Acrux	173 36.3	S62 59.5
03	195 56.9	232 05.5	·· 31.6	212 55.7	·· 15.3	6 52.2	·· 15.3	6 49.5	·· 07.5	Adhara	255 31.6	S28 57.0
04	210 59.4	247 04.9	30.6	227 56.4	14.5	21 54.8	15.2	21 52.1	07.5	Aldebaran	291 17.6	N16 28.2
05	226 01.8	262 04.3	29.7	242 57.0	13.8	36 57.5	15.1	36 54.7	07.4			
06	241 04.3	277 03.6	S15 28.7	257 57.6	S 8 13.0	52 00.1	S 2 15.0	51 57.2	S 1 07.3	Alioth	166 41.8	N56 03.6
07	256 06.8	292 03.0	27.8	272 58.3	12.2	67 02.8	14.9	66 59.8	07.3	Alkaid	153 18.0	N49 24.3
S 08	271 09.2	307 02.4	26.8	287 58.9	11.5	82 05.4	14.8	82 02.4	07.2	Al Na'ir	28 15.0	S47 03.3
A 09	286 11.7	322 01.8	·· 25.9	302 59.5	·· 10.7	97 08.1	·· 14.7	97 05.0	·· 07.1	Alnilam	276 11.2	S 1 13.0
T 10	301 14.2	337 01.1	24.9	318 00.2	09.9	112 10.7	14.6	112 07.6	07.1	Alphard	218 20.0	S 8 34.7
U 11	316 16.6	352 00.5	24.0	333 00.8	09.2	127 13.4	14.6	127 10.2	07.0			
R 12	331 19.1	6 59.9	S15 23.0	348 01.4	S 8 08.4	142 16.0	S 2 14.5	142 12.8	S 1 07.0	Alphecca	126 31.8	N26 46.5
D 13	346 21.5	21 59.3	22.1	3 02.0	07.6	157 18.7	14.4	157 15.4	06.9	Alpheratz	358 09.3	N28 59.1
A 14	1 24.0	36 58.7	21.1	18 02.7	06.9	172 21.3	14.3	172 17.9	06.8	Altair	62 32.5	N 8 49.0
Y 15	16 26.5	51 58.0	·· 20.2	33 03.3	·· 06.1	187 24.0	·· 14.2	187 20.5	·· 06.8	Ankaa	353 40.3	S42 24.8
16	31 28.9	66 57.4	19.2	48 03.9	05.3	202 26.6	14.1	202 23.1	06.7	Antares	112 56.5	S26 23.3
17	46 31.4	81 56.8	18.3	63 04.6	04.6	217 29.3	14.0	217 25.7	06.7			
18	61 33.9	96 56.2	S15 17.3	78 05.2	S 8 03.8	232 31.9	S 2 13.9	232 28.3	S 1 06.6	Arcturus	146 18.0	N19 16.7
19	76 36.3	111 55.6	16.4	93 05.8	03.0	247 34.6	13.8	247 30.9	06.5	Atria	108 20.6	S68 59.3
20	91 38.8	126 54.9	15.4	108 06.5	02.3	262 37.3	13.7	262 33.5	06.5	Avior	234 27.5	S59 27.1
21	106 41.3	141 54.3	·· 14.4	123 07.1	·· 01.5	277 39.9	·· 13.7	277 36.1	·· 06.4	Bellatrix	278 58.3	N 6 19.8
22	121 43.7	156 53.7	13.5	138 07.7	00.7	292 42.6	13.6	292 38.6	06.3	Betelgeuse	271 27.8	N 7 24.1
23	136 46.2	171 53.1	12.5	153 08.3	8 00.0	307 45.2	13.5	307 41.2	06.3			
22 00	151 48.6	186 52.5	S15 11.6	168 09.0	S 7 59.2	322 47.9	S 2 13.4	322 43.8	S 1 06.2	Canopus	264 06.8	S52 41.5
01	166 51.1	201 51.8	10.6	183 09.6	58.4	337 50.5	13.3	337 46.4	06.2	Capella	281 10.7	N45 58.8
02	181 53.6	216 51.2	09.6	198 10.2	57.7	352 53.2	13.2	352 49.0	06.1	Deneb	49 48.7	N45 12.6
03	196 56.0	231 50.6	·· 08.7	213 10.9	·· 56.9	7 55.8	·· 13.1	7 51.6	·· 06.0	Denebola	182 58.4	N14 40.6
04	211 58.5	246 50.0	07.7	228 11.5	56.1	22 58.5	13.0	22 54.2	06.0	Diphda	349 20.8	S18 05.7
05	227 01.0	261 49.4	06.8	243 12.1	55.4	38 01.1	12.9	37 56.8	05.9			
06	242 03.4	276 48.8	S15 05.8	258 12.8	S 7 54.6	53 03.8	S 2 12.8	52 59.4	S 1 05.8	Dubhe	194 21.1	N61 51.1
07	257 05.9	291 48.2	04.8	273 13.4	53.8	68 06.5	12.7	68 01.9	05.8	Elnath	278 43.6	N28 35.5
08	272 08.4	306 47.6	03.9	288 14.0	53.1	83 09.1	12.7	83 04.5	05.7	Eltanin	90 57.8	N51 29.2
S 09	287 10.8	321 46.9	·· 02.9	303 14.7	·· 52.3	98 11.8	·· 12.6	98 07.1	·· 05.7	Enif	34 11.6	N 9 47.1
U 10	302 13.3	336 46.3	01.9	318 15.3	51.5	113 14.4	12.5	113 09.7	05.6	Fomalhaut	15 51.4	S29 43.5
N 11	317 15.8	351 45.7	01.0	333 15.9	50.8	128 17.1	12.4	128 12.3	05.5			
D 12	332 18.2	6 45.1	S15 00.0	348 16.6	S 7 50.0	143 19.7	S 2 12.3	143 14.9	S 1 05.5	Gacrux	172 27.9	S57 00.3
A 13	347 20.7	21 44.5	14 59.0	3 17.2	49.2	158 22.4	12.2	158 17.5	05.4	Gienah	176 17.4	S17 26.2
Y 14	2 23.1	36 43.9	58.1	18 17.8	48.5	173 25.1	12.1	173 20.1	05.3	Hadar	149 22.6	S60 16.7
15	17 25.6	51 43.3	·· 57.1	33 18.5	·· 47.7	188 27.7	·· 12.0	188 22.7	·· 05.3	Hamal	328 28.8	N23 22.3
16	32 28.1	66 42.7	56.1	48 19.1	46.9	203 30.4	11.9	203 25.3	05.2	Kaus Aust.	84 16.7	S34 23.6
17	47 30.5	81 42.1	55.2	63 19.7	46.2	218 33.0	11.8	218 27.9	05.1			
18	62 33.0	96 41.5	S14 54.2	78 20.4	S 7 45.4	233 35.7	S 2 11.7	233 30.4	S 1 05.1	Kochab	137 18.7	N74 13.8
19	77 35.5	111 40.8	53.2	93 21.0	44.6	248 38.4	11.6	248 33.0	05.0	Markab	14 03.2	N15 06.1
20	92 37.9	126 40.2	52.2	108 21.6	43.9	263 41.0	11.5	263 35.6	05.0	Menkar	314 40.9	N 4 00.8
21	107 40.4	141 39.6	·· 51.3	123 22.3	·· 43.1	278 43.7	·· 11.5	278 38.2	·· 04.9	Menkent	148 36.5	S36 16.5
22	122 42.9	156 39.0	50.3	138 22.9	42.3	293 46.3	11.4	293 40.8	04.8	Miaplacidus	221 44.0	S69 38.5
23	137 45.3	171 38.4	49.3	153 23.5	41.6	308 49.0	11.3	308 43.4	04.8			
23 00	152 47.8	186 37.8	S14 48.3	168 24.2	S 7 40.8	323 51.7	S 2 11.2	323 46.0	S 1 04.7	Mirfak	309 15.8	N49 47.7
01	167 50.3	201 37.2	47.4	183 24.8	40.0	338 54.3	11.1	338 48.6	04.6	Nunki	76 29.0	S26 19.2
02	182 52.7	216 36.6	46.4	198 25.5	39.3	353 57.0	11.0	353 51.2	04.6	Peacock	53 58.5	S56 47.7
03	197 55.2	231 36.0	·· 45.4	213 26.1	·· 38.5	8 59.6	·· 10.9	8 53.8	·· 04.5	Pollux	243 57.5	N28 04.3
04	212 57.6	246 35.4	44.4	228 26.7	37.7	24 02.3	10.8	23 56.4	04.4	Procyon	245 25.2	N 5 16.3
05	228 00.1	261 34.8	43.4	243 27.4	36.9	39 05.0	10.7	38 58.9	04.4			
06	243 02.6	276 34.2	S14 42.5	258 28.0	S 7 36.2	54 07.6	S 2 10.6	54 01.5	S 1 04.3	Rasalhague	96 29.4	N12 34.3
07	258 05.0	291 33.6	41.5	273 28.6	35.4	69 10.3	10.5	69 04.1	04.3	Regulus	208 09.4	N12 03.5
08	273 07.5	306 33.0	40.5	288 29.3	34.6	84 13.0	10.4	84 06.7	04.2	Rigel	281 35.6	S 8 13.6
M 09	288 10.0	321 32.4	·· 39.5	303 29.9	·· 33.9	99 15.6	·· 10.3	99 09.3	·· 04.1	Rigil Kent.	140 25.2	S60 45.1
O 10	303 12.4	336 31.8	38.5	318 30.5	33.1	114 18.3	10.2	114 11.9	04.1	Sabik	102 40.9	S15 42.1
N 11	318 14.9	351 31.2	37.6	333 31.2	32.3	129 20.9	10.1	129 14.5	04.0			
D 12	333 17.4	6 30.6	S14 36.6	348 31.8	S 7 31.6	144 23.6	S 2 10.1	144 17.1	S 1 03.9	Schedar	350 09.1	N56 26.1
A 13	348 19.8	21 30.0	35.6	3 32.4	30.8	159 26.3	10.0	159 19.7	03.9	Shaula	96 55.5	S37 05.3
Y 14	3 22.3	36 29.4	34.6	18 33.1	30.0	174 28.9	09.9	174 22.3	03.8	Sirius	258 55.2	S16 41.7
15	18 24.8	51 28.8	·· 33.6	33 33.7	·· 29.2	189 31.6	·· 09.8	189 24.9	·· 03.7	Spica	158 57.0	S11 03.8
16	33 27.2	66 28.2	32.6	48 34.4	28.5	204 34.3	09.7	204 27.5	03.7	Suhail	223 10.1	S43 21.5
17	48 29.7	81 27.6	31.6	63 35.0	27.7	219 36.9	09.6	219 30.1	03.6			
18	63 32.1	96 27.0	S14 30.6	78 35.6	S 7 26.9	234 39.6	S 2 09.5	234 32.7	S 1 03.5	Vega	80 55.9	N38 45.7
19	78 34.6	111 26.4	29.7	93 36.3	26.2	249 42.3	09.4	249 35.3	03.5	Zuben'ubi	137 32.6	S15 57.8
20	93 37.1	126 25.8	28.7	108 36.9	25.4	264 44.9	09.3	264 37.8	03.4			
21	108 39.5	141 25.2	·· 27.7	123 37.5	·· 24.6	279 47.6	·· 09.2	279 40.4	·· 03.4		S.H.A.	Mer. Pass.
22	123 42.0	156 24.6	26.7	138 38.2	23.8	294 50.3	09.1	294 43.0	03.3		° ′	h m
23	138 44.5	171 24.0	25.7	153 38.8	23.1	309 52.9	09.0	309 45.6	03.2	Venus	35 03.8	11 33
	h m									Mars	16 20.3	12 47
Mer. Pass	13 50.5	v −0.6	d 1.0	v 0.6	d 0.8	v 2.7	d 0.1	v 2.6	d 0.1	Jupiter	170 59.2	2 28
										Saturn	170 55.2	2 29

G.M.T.	SUN G.H.A.	SUN Dec.	MOON G.H.A.	MOON v	MOON Dec.	MOON d	MOON H.P.
d h	° ′	° ′	° ′	′	° ′	′	′
21 00	176 34.3	S10 39.9	333 12.0	14.4	N 5 04.3	10.5	55.1
01	191 34.3	39.0	347 45.4	14.5	4 53.8	10.4	55.1
02	206 34.4	38.1	2 18.9	14.4	4 43.4	10.4	55.0
03	221 34.5	·· 37.2	16 52.3	14.5	4 33.0	10.5	55.0
04	236 34.6	36.3	31 25.8	14.6	4 22.5	10.5	55.0
05	251 34.6	35.4	45 59.4	14.5	4 12.0	10.5	55.0
06	266 34.7	S10 34.5	60 32.9	14.6	N 4 01.5	10.4	55.0
07	281 34.8	33.6	75 06.5	14.7	3 51.1	10.5	55.0
S 08	296 34.9	32.7	89 40.2	14.6	3 40.6	10.6	54.9
A 09	311 34.9	·· 31.8	104 13.8	14.7	3 30.0	10.5	54.9
T 10	326 35.0	30.9	118 47.5	14.8	3 19.5	10.5	54.9
U 11	341 35.1	30.0	133 21.3	14.7	3 09.0	10.5	54.9
R 12	356 35.2	S10 29.1	147 55.0	14.8	N 2 58.5	10.5	54.9
D 13	11 35.2	28.2	162 28.8	14.8	2 48.0	10.6	54.9
A 14	26 35.3	27.3	177 02.6	14.8	2 37.4	10.5	54.8
Y 15	41 35.4	·· 26.4	191 36.4	14.9	2 26.9	10.6	54.8
16	56 35.5	25.5	206 10.3	14.9	2 16.3	10.5	54.8
17	71 35.5	24.6	220 44.2	14.9	2 05.8	10.6	54.8
18	86 35.6	S10 23.6	235 18.1	15.0	N 1 55.2	10.5	54.8
19	101 35.7	22.7	249 52.1	14.9	1 44.7	10.6	54.8
20	116 35.8	21.8	264 26.0	15.0	1 34.1	10.5	54.7
21	131 35.9	·· 20.9	279 00.0	15.0	1 23.6	10.6	54.7
22	146 35.9	20.0	293 34.0	15.1	1 13.0	10.5	54.7
23	161 36.0	19.1	308 08.1	15.0	1 02.5	10.6	54.7
22 00	176 36.1	S10 18.2	322 42.1	15.1	N 0 51.9	10.5	54.7
01	191 36.2	17.3	337 16.2	15.1	0 41.4	10.6	54.7
02	206 36.2	16.4	351 50.3	15.1	0 30.8	10.5	54.7
03	221 36.3	·· 15.5	6 24.4	15.1	0 20.3	10.5	54.6
04	236 36.4	14.6	20 58.5	15.2	N 0 09.8	10.5	54.6
05	251 36.5	13.6	35 32.7	15.2	S 0 00.7	10.6	54.6
06	266 36.6	S10 12.7	50 06.9	15.2	S 0 11.3	10.5	54.6
07	281 36.6	11.8	64 41.1	15.2	0 21.8	10.5	54.6
08	296 36.7	10.9	79 15.3	15.2	0 32.3	10.5	54.6
S 09	311 36.8	·· 10.0	93 49.5	15.2	0 42.8	10.5	54.6
U 10	326 36.9	09.1	108 23.7	15.2	0 53.3	10.4	54.5
N 11	341 37.0	08.2	122 57.9	15.3	1 03.7	10.5	54.5
D 12	356 37.1	S10 07.3	137 32.2	15.3	S 1 14.2	10.5	54.5
A 13	11 37.1	06.4	152 06.5	15.2	1 24.7	10.4	54.5
Y 14	26 37.2	05.4	166 40.7	15.3	1 35.1	10.4	54.5
15	41 37.3	·· 04.5	181 15.0	15.3	1 45.5	10.5	54.5
16	56 37.4	03.6	195 49.3	15.3	1 56.0	10.4	54.5
17	71 37.5	02.7	210 23.6	15.4	2 06.4	10.4	54.5
18	86 37.6	S10 01.8	224 58.0	15.3	S 2 16.8	10.4	54.4
19	101 37.6	00.9	239 32.3	15.3	2 27.2	10.3	54.4
20	116 37.7	10 00.0	254 06.6	15.3	2 37.5	10.4	54.4
21	131 37.8	9 59.0	268 40.9	15.4	2 47.9	10.3	54.4
22	146 37.9	58.1	283 15.3	15.3	2 58.2	10.3	54.4
23	161 38.0	57.2	297 49.6	15.4	3 08.5	10.3	54.4
23 00	176 38.1	S 9 56.3	312 24.0	15.3	S 3 18.8	10.3	54.4
01	191 38.1	55.4	326 58.3	15.4	3 29.1	10.3	54.4
02	206 38.2	54.5	341 32.7	15.4	3 39.4	10.2	54.4
03	221 38.3	·· 53.6	356 07.1	15.3	3 49.6	10.2	54.3
04	236 38.4	52.6	10 41.4	15.4	3 59.8	10.2	54.3
05	251 38.5	51.7	25 15.8	15.3	4 10.0	10.2	54.3
06	266 38.6	S 9 50.8	39 50.1	15.4	S 4 20.2	10.2	54.3
07	281 38.7	49.9	54 24.5	15.4	4 30.4	10.1	54.3
08	296 38.8	49.0	68 58.9	15.3	4 40.5	10.1	54.3
M 09	311 38.8	·· 48.1	83 33.2	15.4	4 50.6	10.1	54.3
O 10	326 38.9	47.1	98 07.6	15.3	5 00.7	10.1	54.3
N 11	341 39.0	46.2	112 41.9	15.4	5 10.8	10.0	54.3
D 12	356 39.1	S 9 45.3	127 16.3	15.3	S 5 20.8	10.1	54.3
A 13	11 39.2	44.4	141 50.6	15.4	5 30.9	10.0	54.3
Y 14	26 39.3	43.5	156 25.0	15.3	5 40.9	9.9	54.3
15	41 39.4	·· 42.5	170 59.3	15.3	5 50.8	10.0	54.3
16	56 39.5	41.6	185 33.6	15.3	6 00.8	9.9	54.2
17	71 39.6	40.7	200 07.9	15.3	6 10.7	9.9	54.2
18	86 39.6	S 9 39.8	214 42.2	15.3	S 6 20.6	9.8	54.2
19	101 39.7	38.9	229 16.5	15.3	6 30.4	9.9	54.2
20	116 39.8	37.9	243 50.8	15.3	6 40.3	9.8	54.2
21	131 39.9	·· 37.0	258 25.1	15.3	6 50.1	9.7	54.2
22	146 40.0	36.1	272 59.4	15.2	6 59.8	9.8	54.2
23	161 40.1	35.2	287 33.6	15.2	7 09.6	9.7	54.2
	S.D. 16.2	d 0.9	S.D. 15.0		14.9		14.8

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

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

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
	m s	m s	h m	h m	h m	d	
21	13 43	13 40	12 14	01 50	14 12	17	
22	13 36	13 32	12 14	02 34	14 55	18	◑
23	13 28	13 24	12 13	03 16	15 37	19	

G.M.T.	ARIES	VENUS −3.4		MARS +1.4		JUPITER −1.9		SATURN +0.8	
	G.H.A.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
24 00	153 46.9	186 23.5	S14 24.7	168 39.5	S 7 22.3	324 55.6	S 2 08.9	324 48.2	S 1 03.2
01	168 49.4	201 22.9	23.7	183 40.1	21.5	339 58.3	08.8	339 50.8	03.1
02	183 51.9	216 22.3	22.7	198 40.7	20.8	355 00.9	08.7	354 53.4	03.0
03	198 54.3	231 21.7	·· 21.7	213 41.4	·· 20.0	10 03.6	·· 08.6	9 56.0	·· 03.0
04	213 56.8	246 21.1	20.7	228 42.0	19.2	25 06.3	08.5	24 58.6	02.9
05	228 59.2	261 20.5	19.7	243 42.7	18.4	40 08.9	08.4	40 01.2	02.8
06	244 01.7	276 19.9	S14 18.7	258 43.3	S 7 17.7	55 11.6	S 2 08.3	55 03.8	S 1 02.8
07	259 04.2	291 19.3	17.7	273 43.9	16.9	70 14.3	08.2	70 06.4	02.7
08	274 06.6	306 18.7	16.7	288 44.6	16.1	85 16.9	08.1	85 09.0	02.6
T 09	289 09.1	321 18.1	·· 15.7	303 45.2	·· 15.4	100 19.6	·· 08.1	100 11.6	·· 02.6
U 10	304 11.6	336 17.5	14.7	318 45.8	14.6	115 22.3	08.0	115 14.2	02.5
E 11	319 14.0	351 17.0	13.7	333 46.5	13.8	130 24.9	07.9	130 16.8	02.4
S 12	334 16.5	6 16.4	S14 12.7	348 47.1	S 7 13.0	145 27.6	S 2 07.8	145 19.4	S 1 02.4
D 13	349 19.0	21 15.8	11.7	3 47.8	12.3	160 30.3	07.7	160 22.0	02.3
A 14	4 21.4	36 15.2	10.7	18 48.4	11.5	175 32.9	07.6	175 24.6	02.3
Y 15	19 23.9	51 14.6	·· 09.7	33 49.0	·· 10.7	190 35.6	·· 07.5	190 27.2	·· 02.2
16	34 26.4	66 14.0	08.7	48 49.7	09.9	205 38.3	07.4	205 29.8	02.1
17	49 28.8	81 13.4	07.7	63 50.3	09.2	220 40.9	07.3	220 32.3	02.1
18	64 31.3	96 12.9	S14 06.7	78 51.0	S 7 08.4	235 43.6	S 2 07.2	235 34.9	S 1 02.0
19	79 33.7	111 12.3	05.7	93 51.6	07.6	250 46.3	07.1	250 37.5	01.9
20	94 36.2	126 11.7	04.7	108 52.2	06.9	265 49.0	07.0	265 40.1	01.9
21	109 38.7	141 11.1	·· 03.7	123 52.9	·· 06.1	280 51.6	·· 06.9	280 42.7	·· 01.8
22	124 41.1	156 10.5	02.7	138 53.5	05.3	295 54.3	06.8	295 45.3	01.7
23	139 43.6	171 09.9	01.7	153 54.2	04.5	310 57.0	06.7	310 47.9	01.7
25 00	154 46.1	186 09.4	S14 00.7	168 54.8	S 7 03.8	325 59.6	S 2 06.6	325 50.5	S 1 01.6
01	169 48.5	201 08.8	13 59.7	183 55.5	03.0	341 02.3	06.5	340 53.1	01.5
02	184 51.0	216 08.2	58.6	198 56.1	02.2	356 05.0	06.4	355 55.7	01.5
03	199 53.5	231 07.6	·· 57.6	213 56.7	·· 01.4	11 07.7	·· 06.3	10 58.3	·· 01.4
04	214 55.9	246 07.0	56.6	228 57.4	7 00.7	26 10.3	06.2	26 00.9	01.3
05	229 58.4	261 06.5	55.6	243 58.0	6 59.9	41 13.0	06.1	41 03.5	01.3
06	245 00.9	276 05.9	S13 54.6	258 58.7	S 6 59.1	56 15.7	S 2 06.0	56 06.1	S 1 01.2
07	260 03.3	291 05.3	53.6	273 59.3	58.3	71 18.4	05.9	71 08.7	01.1
W 08	275 05.8	306 04.7	52.6	288 59.9	57.6	86 21.0	05.8	86 11.3	01.1
E 09	290 08.2	321 04.1	·· 51.5	304 00.6	·· 56.8	101 23.7	·· 05.7	101 13.9	·· 01.0
D 10	305 10.7	336 03.6	50.5	319 01.2	56.0	116 26.4	05.6	116 16.5	00.9
N 11	320 13.2	351 03.0	49.5	334 01.9	55.2	131 29.1	05.5	131 19.1	00.9
E 12	335 15.6	6 02.4	S13 48.5	349 02.5	S 6 54.5	146 31.7	S 2 05.4	146 21.7	S 1 00.8
S 13	350 18.1	21 01.8	47.5	4 03.2	53.7	161 34.4	05.3	161 24.3	00.7
D 14	5 20.6	36 01.3	46.5	19 03.8	52.9	176 37.1	05.2	176 26.9	00.7
A 15	20 23.0	51 00.7	·· 45.4	34 04.4	·· 52.1	191 39.8	·· 05.1	191 29.5	·· 00.6
Y 16	35 25.5	66 00.1	44.4	49 05.1	51.4	206 42.4	05.0	206 32.1	00.5
17	50 28.0	80 59.5	43.4	64 05.7	50.6	221 45.1	04.9	221 34.7	00.5
18	65 30.4	95 59.0	S13 42.4	79 06.4	S 6 49.8	236 47.8	S 2 04.8	236 37.3	S 1 00.4
19	80 32.9	110 58.4	41.4	94 07.0	49.0	251 50.5	04.7	251 39.9	00.3
20	95 35.3	125 57.8	40.3	109 07.7	48.3	266 53.1	04.6	266 42.5	00.3
21	110 37.8	140 57.3	·· 39.3	124 08.3	·· 47.5	281 55.8	·· 04.5	281 45.1	·· 00.2
22	125 40.3	155 56.7	38.3	139 09.0	46.7	296 58.5	04.4	296 47.7	00.1
23	140 42.7	170 56.1	37.3	154 09.6	45.9	312 01.2	04.3	311 50.3	00.1
26 00	155 45.2	185 55.5	S13 36.2	169 10.2	S 6 45.2	327 03.8	S 2 04.2	326 52.9	S 1 00.0
01	170 47.7	200 55.0	35.2	184 10.9	44.4	342 06.5	04.1	341 55.5	0 59.9
02	185 50.1	215 54.4	34.2	199 11.5	43.6	357 09.2	04.0	356 58.1	59.9
03	200 52.6	230 53.8	·· 33.2	214 12.2	·· 42.8	12 11.9	·· 03.9	12 00.7	·· 59.8
04	215 55.1	245 53.3	32.1	229 12.8	42.0	27 14.6	03.8	27 03.3	59.7
05	230 57.5	260 52.7	31.1	244 13.5	41.3	42 17.2	03.7	42 05.9	59.7
06	246 00.0	275 52.1	S13 30.1	259 14.1	S 6 40.5	57 19.9	S 2 03.6	57 08.5	S 0 59.6
07	261 02.5	290 51.6	29.1	274 14.8	39.7	72 22.6	03.5	72 11.1	59.5
T 08	276 04.9	305 51.0	28.0	289 15.4	38.9	87 25.3	03.4	87 13.7	59.5
H 09	291 07.4	320 50.4	·· 27.0	304 16.0	·· 38.2	102 28.0	·· 03.3	102 16.3	·· 59.4
U 10	306 09.8	335 49.9	26.0	319 16.7	37.4	117 30.6	03.2	117 18.9	59.3
R 11	321 12.3	350 49.3	24.9	334 17.3	36.6	132 33.3	03.1	132 21.5	59.3
S 12	336 14.8	5 48.7	S13 23.9	349 18.0	S 6 35.8	147 36.0	S 2 03.0	147 24.1	S 0 59.2
D 13	351 17.2	20 48.2	22.9	4 18.6	35.1	162 38.7	02.9	162 26.7	59.1
A 14	6 19.7	35 47.6	21.8	19 19.3	34.3	177 41.4	02.8	177 29.3	59.1
Y 15	21 22.2	50 47.0	·· 20.8	34 19.9	·· 33.5	192 44.0	·· 02.7	192 31.9	·· 59.0
16	36 24.6	65 46.5	19.8	49 20.6	32.7	207 46.7	02.6	207 34.5	58.9
17	51 27.1	80 45.9	18.7	64 21.2	31.9	222 49.4	02.5	222 37.1	58.9
18	66 29.6	95 45.4	S13 17.7	79 21.9	S 6 31.2	237 52.1	S 2 02.4	237 39.7	S 0 58.8
19	81 32.0	110 44.8	16.7	94 22.5	30.4	252 54.8	02.3	252 42.3	58.7
20	96 34.5	125 44.2	15.6	109 23.1	29.6	267 57.4	02.2	267 44.9	58.7
21	111 37.0	140 43.7	·· 14.6	124 23.8	·· 28.8	283 00.1	·· 02.1	282 47.5	·· 58.6
22	126 39.4	155 43.1	13.5	139 24.4	28.1	298 02.8	02.0	297 50.1	58.5
23	141 41.9	170 42.6	12.5	154 25.1	27.3	313 05.5	01.9	312 52.7	58.5
Mer. Pass.	h m 13 38.7	v −0.6	d 1.0	v 0.6	d 0.8	v 2.7	d 0.1	v 2.6	d 0.1

STARS		
Name	S.H.A.	Dec.
	° ′	° ′
Acamar	315 37.2	S40 23.2
Achernar	335 45.4	S57 20.3
Acrux	173 36.3	S62 59.5
Adhara	255 31.6	S28 57.0
Aldebaran	291 17.6	N16 28.2
Alioth	166 41.8	N56 03.6
Alkaid	153 18.0	N49 24.3
Al Na'ir	28 15.0	S47 03.3
Alnilam	276 11.3	S 1 13.0
Alphard	218 20.0	S 8 34.7
Alphecca	126 31.8	N26 46.5
Alpheratz	358 09.3	N28 59.1
Altair	62 32.5	N 8 49.0
Ankaa	353 40.3	S42 24.8
Antares	112 56.5	S26 23.3
Arcturus	146 18.0	N19 16.7
Atria	108 20.6	S68 59.3
Avior	234 27.5	S59 27.1
Bellatrix	278 58.3	N 6 19.8
Betelgeuse	271 27.8	N 7 24.1
Canopus	264 06.8	S52 41.5
Capella	281 10.7	N45 58.8
Deneb	49 48.7	N45 12.6
Denebola	182 58.4	N14 40.6
Diphda	349 20.8	S18 05.7
Dubhe	194 21.1	N61 51.1
Elnath	278 43.7	N28 35.5
Eltanin	90 57.8	N51 29.2
Enif	34 11.6	N 9 47.1
Fomalhaut	15 51.4	S29 43.5
Gacrux	172 27.9	S57 00.3
Gienah	176 17.4	S17 26.2
Hadar	149 22.5	S60 16.7
Hamal	328 28.8	N23 22.3
Kaus Aust.	84 16.6	S34 23.6
Kochab	137 18.6	N74 13.8
Markab	14 03.2	N15 06.1
Menkar	314 40.9	N 4 00.8
Menkent	148 36.4	S36 16.5
Miaplacidus	221 44.0	S69 38.5
Mirfak	309 15.8	N49 47.7
Nunki	76 29.0	S26 19.2
Peacock	53 58.4	S56 47.7
Pollux	243 57.5	N28 04.3
Procyon	245 25.2	N 5 16.3
Rasalhague	96 29.4	N12 34.3
Regulus	208 09.4	N12 03.5
Rigel	281 35.7	S 8 13.6
Rigil Kent.	140 25.1	S60 45.1
Sabik	102 40.9	S15 42.1
Schedar	350 09.1	N56 26.0
Shaula	96 55.5	S37 05.3
Sirius	258 55.2	S16 41.7
Spica	158 57.0	S11 03.8
Suhail	223 10.1	S43 21.5
Vega	80 55.9	N38 45.7
Zuben'ubi	137 32.6	S15 57.8

	S.H.A.	Mer. Pass.
	° ′	h m
Venus	31 23.3	11 36
Mars	14 08.7	12 44
Jupiter	171 13.6	2 16
Saturn	171 04.5	2 16

G.M.T.	SUN G.H.A.	SUN Dec.	MOON G.H.A.	MOON v	MOON Dec.	MOON d	MOON H.P.
d h	° ′	° ′	° ′	′	° ′	′	′
24 00	176 40.2	S 9 34.3	302 07.8	15.3	S 7 19.3	9.7	54.2
01	191 40.3	33.3	316 42.1	15.2	7 29.0	9.6	54.2
02	206 40.4	32.4	331 16.3	15.2	7 38.6	9.6	54.2
03	221 40.5	·· 31.5	345 50.5	15.2	7 48.2	9.6	54.2
04	236 40.6	30.6	0 24.7	15.1	7 57.8	9.6	54.2
05	251 40.6	29.6	14 58.8	15.2	8 07.4	9.5	54.2
06	266 40.7	S 9 28.7	29 33.0	15.1	S 8 16.9	9.5	54.2
07	281 40.8	27.8	44 07.1	15.1	8 26.4	9.4	54.2
08	296 40.9	26.9	58 41.2	15.1	8 35.8	9.4	54.2
T 09	311 41.0	·· 26.0	73 15.3	15.1	8 45.2	9.4	54.2
U 10	326 41.1	25.0	87 49.4	15.1	8 54.6	9.3	54.2
E 11	341 41.2	24.1	102 23.5	15.0	9 03.9	9.3	54.2
S 12	356 41.3	S 9 23.2	116 57.5	15.0	S 9 13.2	9.3	54.2
D 13	11 41.4	22.3	131 31.5	15.0	9 22.5	9.2	54.2
A 14	26 41.5	21.3	146 05.5	15.0	9 31.7	9.1	54.2
Y 15	41 41.6	·· 20.4	160 39.5	14.9	9 40.8	9.2	54.2
16	56 41.7	19.5	175 13.4	14.9	9 50.0	9.1	54.2
17	71 41.8	18.6	189 47.3	14.9	9 59.1	9.0	54.2
18	86 41.9	S 9 17.6	204 21.2	14.9	S10 08.1	9.1	54.2
19	101 42.0	16.7	218 55.1	14.9	10 17.2	8.9	54.2
20	116 42.1	15.8	233 29.0	14.8	10 26.1	9.0	54.2
21	131 42.2	·· 14.8	248 02.8	14.8	10 35.1	8.8	54.2
22	146 42.3	13.9	262 36.6	14.7	10 43.9	8.9	54.2
23	161 42.4	13.0	277 10.3	14.8	10 52.8	8.8	54.2
25 00	176 42.5	S 9 12.1	291 44.1	14.7	S11 01.6	8.7	54.2
01	191 42.6	11.1	306 17.8	14.7	11 10.3	8.7	54.2
02	206 42.7	10.2	320 51.5	14.6	11 19.0	8.7	54.2
03	221 42.7	·· 09.3	335 25.1	14.6	11 27.7	8.6	54.2
04	236 42.8	08.4	349 58.7	14.6	11 36.3	8.6	54.2
05	251 42.9	07.4	4 32.3	14.6	11 44.9	8.5	54.2
06	266 43.0	S 9 06.5	19 05.9	14.5	S11 53.4	8.5	54.2
W 07	281 43.1	05.6	33 39.4	14.5	12 01.9	8.4	54.2
E 08	296 43.2	04.6	48 12.9	14.4	12 10.3	8.4	54.2
D 09	311 43.3	·· 03.7	62 46.3	14.5	12 18.7	8.3	54.2
N 10	326 43.4	02.8	77 19.8	14.3	12 27.0	8.3	54.2
E 11	341 43.5	01.8	91 53.1	14.4	12 35.3	8.2	54.2
S 12	356 43.6	S 9 00.9	106 26.5	14.3	S12 43.5	8.2	54.2
D 13	11 43.7	9 00.0	120 59.8	14.3	12 51.7	8.1	54.2
A 14	26 43.8	8 59.1	135 33.1	14.2	12 59.8	8.0	54.2
Y 15	41 43.9	·· 58.1	150 06.3	14.2	13 07.8	8.1	54.2
16	56 44.0	57.2	164 39.5	14.2	13 15.9	7.9	54.2
17	71 44.1	56.3	179 12.7	14.1	13 23.8	7.9	54.2
18	86 44.3	S 8 55.3	193 45.8	14.1	S13 31.7	7.9	54.3
19	101 44.4	54.4	208 18.9	14.1	13 39.6	7.8	54.3
20	116 44.5	53.5	222 52.0	14.0	13 47.4	7.7	54.3
21	131 44.6	·· 52.5	237 25.0	14.0	13 55.1	7.7	54.3
22	146 44.7	51.6	251 58.0	13.9	14 02.8	7.6	54.3
23	161 44.8	50.7	266 30.9	13.9	14 10.4	7.6	54.3
26 00	176 44.9	S 8 49.7	281 03.8	13.8	S14 18.0	7.5	54.3
01	191 45.0	48.8	295 36.6	13.8	14 25.5	7.4	54.3
02	206 45.1	47.9	310 09.4	13.8	14 32.9	7.4	54.3
03	221 45.2	·· 46.9	324 42.2	13.7	14 40.3	7.3	54.3
04	236 45.3	46.0	339 14.9	13.7	14 47.6	7.3	54.3
05	251 45.4	45.1	353 47.6	13.6	14 54.9	7.2	54.4
06	266 45.5	S 8 44.1	8 20.2	13.6	S15 02.1	7.1	54.4
07	281 45.6	43.2	22 52.8	13.5	15 09.2	7.1	54.4
T 08	296 45.7	42.3	37 25.3	13.5	15 16.3	7.0	54.4
H 09	311 45.8	·· 41.3	51 57.8	13.5	15 23.3	7.0	54.4
U 10	326 45.9	40.4	66 30.3	13.4	15 30.3	6.8	54.4
R 11	341 46.0	39.5	81 02.7	13.3	15 37.1	6.9	54.4
S 12	356 46.1	S 8 38.5	95 35.0	13.4	S15 44.0	6.7	54.4
D 13	11 46.2	37.6	110 07.4	13.2	15 50.7	6.7	54.4
A 14	26 46.3	36.6	124 39.6	13.2	15 57.4	6.6	54.5
Y 15	41 46.4	·· 35.7	139 11.8	13.2	16 04.0	6.6	54.5
16	56 46.5	34.8	153 44.0	13.1	16 10.6	6.5	54.5
17	71 46.7	33.8	168 16.1	13.1	16 17.1	6.4	54.5
18	86 46.8	S 8 32.9	182 48.2	13.0	S16 23.5	6.3	54.5
19	101 46.9	32.0	197 20.2	13.0	16 29.8	6.3	54.5
20	116 47.0	31.0	211 52.2	12.9	16 36.1	6.2	54.5
21	131 47.1	·· 30.1	226 24.1	12.9	16 42.3	6.1	54.6
22	146 47.2	29.1	240 56.0	12.8	16 48.4	6.1	54.6
23	161 47.3	28.2	255 27.8	12.8	16 54.5	6.0	54.6
	S.D. 16.2	d 0.9	S.D. 14.8		14.8		14.8

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

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

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
	m s	m s	h m	h m	h m	d	
24	13 19	13 15	12 13	03 58	16 20	20	
25	13 10	13 06	12 13	04 41	17 03	21	
26	13 01	12 56	12 13	05 26	17 48	22	◑

	GMT	ARIES	VENUS −3.4		MARS +1.4		JUPITER −2.0		SATURN +0.7	
		G.H.A.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.
	d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
27	00	156 44.3	185 42.0	S13 11.5	169 25.7	S 6 26.5	328 08.2	S 2 01.8	327 55.3	S 0 58.4
	01	171 46.8	200 41.4	10.4	184 26.4	25.7	343 10.9	01.7	342 57.9	58.3
	02	186 49.3	215 40.9	09.4	199 27.0	24.9	358 13.5	01.6	358 00.5	58.3
	03	201 51.7	230 40.3	·· 08.3	214 27.7	·· 24.2	13 16.2	·· 01.5	13 03.1	·· 58.2
	04	216 54.2	245 39.8	07.3	229 28.3	23.4	28 18.9	01.4	28 05.8	58.1
	05	231 56.7	260 39.2	06.2	244 29.0	22.6	43 21.6	01.3	43 08.4	58.1
	06	246 59.1	275 38.6	S13 05.2	259 29.6	S 6 21.8	58 24.3	S 2 01.2	58 11.0	S 0 58.0
	07	262 01.6	290 38.1	04.2	274 30.3	21.0	73 27.0	01.1	73 13.6	57.9
	08	277 04.1	305 37.5	03.1	289 30.9	20.3	88 29.6	01.0	88 16.2	57.9
F	09	292 06.5	320 37.0	·· 02.1	304 31.6	·· 19.5	103 32.3	·· 00.9	103 18.8	·· 57.8
R	10	307 09.0	335 36.4	01.0	319 32.2	18.7	118 35.0	00.8	118 21.4	57.7
I	11	322 11.4	350 35.9	13 00.0	334 32.9	17.9	133 37.7	00.7	133 24.0	57.6
D	12	337 13.9	5 35.3	S12 58.9	349 33.5	S 6 17.2	148 40.4	S 2 00.6	148 26.6	S 0 57.6
A	13	352 16.4	20 34.8	57.9	4 34.2	16.4	163 43.1	00.5	163 29.2	57.5
Y	14	7 18.8	35 34.2	56.8	19 34.8	15.6	178 45.7	00.4	178 31.8	57.4
	15	22 21.3	50 33.7	·· 55.8	34 35.5	·· 14.8	193 48.4	·· 00.3	193 34.4	·· 57.4
	16	37 23.8	65 33.1	54.7	49 36.1	14.0	208 51.1	00.2	208 37.0	57.3
	17	52 26.2	80 32.6	53.7	64 36.8	13.3	223 53.8	00.1	223 39.6	57.2
	18	67 28.7	95 32.0	S12 52.6	79 37.4	S 6 12.5	238 56.5	S 2 00.0	238 42.2	S 0 57.2
	19	82 31.2	110 31.5	51.6	94 38.1	11.7	253 59.2	1 59.9	253 44.8	57.1
	20	97 33.6	125 30.9	50.5	109 38.7	10.9	269 01.9	59.7	268 47.4	57.0
	21	112 36.1	140 30.4	·· 49.5	124 39.4	·· 10.1	284 04.6	·· 59.6	283 50.0	·· 57.0
	22	127 38.6	155 29.8	48.4	139 40.0	09.4	299 07.2	59.5	298 52.6	56.9
	23	142 41.0	170 29.3	47.4	154 40.7	08.6	314 09.9	59.4	313 55.2	56.8
28	00	157 43.5	185 28.7	S12 46.3	169 41.3	S 6 07.8	329 12.6	S 1 59.3	328 57.8	S 0 56.8
	01	172 45.9	200 28.2	45.3	184 42.0	07.0	344 15.3	59.2	344 00.4	56.7
	02	187 48.4	215 27.6	44.2	199 42.6	06.2	359 18.0	59.1	359 03.0	56.6
	03	202 50.9	230 27.1	·· 43.1	214 43.3	·· 05.5	14 20.7	·· 59.0	14 05.7	·· 56.6
	04	217 53.3	245 26.5	42.1	229 43.9	04.7	29 23.4	58.9	29 08.3	56.5
	05	232 55.8	260 26.0	41.0	244 44.6	03.9	44 26.1	58.8	44 10.9	56.4
	06	247 58.3	275 25.4	S12 40.0	259 45.2	S 6 03.1	59 28.8	S 1 58.7	59 13.5	S 0 56.3
	07	263 00.7	290 24.9	38.9	274 45.9	02.3	74 31.4	58.6	74 16.1	56.3
S	08	278 03.2	305 24.3	37.9	289 46.5	01.5	89 34.1	58.5	89 18.7	56.2
A	09	293 05.7	320 23.8	·· 36.8	304 47.2	·· 00.8	104 36.8	·· 58.4	104 21.3	·· 56.1
T	10	308 08.1	335 23.2	35.7	319 47.8	6 00.0	119 39.5	58.3	119 23.9	56.1
U	11	323 10.6	350 22.7	34.7	334 48.5	5 59.2	134 42.2	58.2	134 26.5	56.0
R	12	338 13.1	5 22.2	S12 33.6	349 49.1	S 5 58.4	149 44.9	S 1 58.1	149 29.1	S 0 55.9
D	13	353 15.5	20 21.6	32.5	4 49.8	57.6	164 47.6	58.0	164 31.7	55.9
A	14	8 18.0	35 21.1	31.5	19 50.4	56.9	179 50.3	57.9	179 34.3	55.8
Y	15	23 20.4	50 20.5	·· 30.4	34 51.1	·· 56.1	194 53.0	·· 57.8	194 36.9	·· 55.7
	16	38 22.9	65 20.0	29.4	49 51.7	55.3	209 55.7	57.7	209 39.5	55.7
	17	53 25.4	80 19.4	28.3	64 52.4	54.5	224 58.3	57.6	224 42.1	55.6
	18	68 27.8	95 18.9	S12 27.2	79 53.0	S 5 53.7	240 01.0	S 1 57.4	239 44.8	S 0 55.5
	19	83 30.3	110 18.4	26.2	94 53.7	53.0	255 03.7	57.3	254 47.4	55.4
	20	98 32.8	125 17.8	25.1	109 54.3	52.2	270 06.4	57.2	269 50.0	55.4
	21	113 35.2	140 17.3	·· 24.0	124 55.0	·· 51.4	285 09.1	·· 57.1	284 52.6	·· 55.3
	22	128 37.7	155 16.8	23.0	139 55.6	50.6	300 11.8	57.0	299 55.2	55.2
	23	143 40.2	170 16.2	21.9	154 56.3	49.8	315 14.5	56.9	314 57.8	55.2
1	00	158 42.6	185 15.7	S12 20.8	169 56.9	S 5 49.0	330 17.2	S 1 56.8	330 00.4	S 0 55.1
	01	173 45.1	200 15.1	19.7	184 57.6	48.3	345 19.9	56.7	345 03.0	55.0
	02	188 47.5	215 14.6	18.7	199 58.2	47.5	0 22.6	56.6	0 05.6	55.0
	03	203 50.0	230 14.1	·· 17.6	214 58.9	·· 46.7	15 25.3	·· 56.5	15 08.2	·· 54.9
	04	218 52.5	245 13.5	16.5	229 59.6	45.9	30 28.0	56.4	30 10.8	54.8
	05	233 54.9	260 13.0	15.5	245 00.2	45.1	45 30.7	56.3	45 13.4	54.8
	06	248 57.4	275 12.5	S12 14.4	260 00.9	S 5 44.4	60 33.4	S 1 56.2	60 16.1	S 0 54.7
	07	263 59.9	290 11.9	13.3	275 01.5	43.6	75 36.1	56.1	75 18.7	54.6
	08	279 02.3	305 11.4	12.2	290 02.2	42.8	90 38.7	56.0	90 21.3	54.5
S	09	294 04.8	320 10.9	·· 11.2	305 02.8	·· 42.0	105 41.4	·· 55.9	105 23.9	·· 54.5
U	10	309 07.3	335 10.3	10.1	320 03.5	41.2	120 44.1	55.8	120 26.5	54.4
N	11	324 09.7	350 09.8	09.0	335 04.1	40.4	135 46.8	55.6	135 29.1	54.3
D	12	339 12.2	5 09.3	S12 07.9	350 04.8	S 5 39.7	150 49.5	S 1 55.5	150 31.7	S 0 54.3
A	13	354 14.7	20 08.7	06.9	5 05.4	38.9	165 52.2	55.4	165 34.3	54.2
Y	14	9 17.1	35 08.2	05.8	20 06.1	38.1	180 54.9	55.3	180 36.9	54.1
	15	24 19.6	50 07.7	·· 04.7	35 06.7	·· 37.3	195 57.6	·· 55.2	195 39.5	·· 54.1
	16	39 22.0	65 07.1	03.6	50 07.4	36.5	211 00.3	55.1	210 42.1	54.0
	17	54 24.5	80 06.6	02.6	65 08.1	35.7	226 03.0	55.0	225 44.8	53.9
	18	69 27.0	95 06.1	S12 01.5	80 08.7	S 5 35.0	241 05.7	S 1 54.9	240 47.4	S 0 53.8
	19	84 29.4	110 05.5	12 00.4	95 09.4	34.2	256 08.4	54.8	255 50.0	53.8
	20	99 31.9	125 05.0	11 59.3	110 10.0	33.4	271 11.1	54.7	270 52.6	53.7
	21	114 34.4	140 04.5	·· 58.2	125 10.7	·· 32.6	286 13.8	·· 54.6	285 55.2	·· 53.6
	22	129 36.8	155 04.0	57.2	140 11.3	31.8	301 16.5	54.5	300 57.8	53.6
	23	144 39.3	170 03.4	56.1	155 12.0	31.0	316 19.2	54.4	316 00.4	53.5
		h m								
Mer. Pass.		13 26.9	v −0.5	d 1.1	v 0.7	d 0.8	v 2.7	d 0.1	v 2.6	d 0.1

STARS

Name	S.H.A.	Dec.
	° ′	° ′
Acamar	315 37.2	S40 23.2
Achernar	335 45.5	S57 20.3
Acrux	173 36.2	S62 59.5
Adhara	255 31.7	S28 57.0
Aldebaran	291 17.6	N16 28.2
Alioth	166 41.8	N56 03.6
Alkaid	153 17.9	N49 24.3
Al Na'ir	28 15.0	S47 03.3
Alnilam	276 11.3	S 1 13.0
Alphard	218 20.0	S 8 34.7
Alphecca	126 31.8	N26 46.5
Alpheratz	358 09.3	N28 59.1
Altair	62 32.5	N 8 49.0
Ankaa	353 40.3	S42 24.8
Antares	112 56.5	S26 23.3
Arcturus	146 18.0	N19 16.7
Atria	108 20.5	S68 59.3
Avior	234 27.5	S59 27.1
Bellatrix	278 58.3	N 6 19.8
Betelgeuse	271 27.8	N 7 24.1
Canopus	264 06.8	S52 41.5
Capella	281 10.8	N45 58.8
Deneb	49 48.6	N45 12.6
Denebola	182 58.4	N14 40.6
Diphda	349 20.8	S18 05.7
Dubhe	194 21.1	N61 51.1
Elnath	278 43.7	N28 35.5
Eltanin	90 57.8	N51 29.2
Enif	34 11.6	N 9 47.1
Fomalhaut	15 51.4	S29 43.5
Gacrux	172 27.9	S57 00.3
Gienah	176 17.4	S17 26.2
Hadar	149 22.5	S60 16.7
Hamal	328 28.8	N23 22.3
Kaus Aust.	84 16.6	S34 23.6
Kochab	137 18.5	N74 13.8
Markab	14 03.2	N15 06.0
Menkar	314 40.9	N 4 00.8
Menkent	148 36.4	S36 16.5
Miaplacidus	221 44.0	S69 38.5
Mirfak	309 15.8	N49 47.7
Nunki	76 29.0	S26 19.2
Peacock	53 58.4	S56 47.7
Pollux	243 57.5	N28 04.3
Procyon	245 25.2	N 5 16.3
Rasalhague	96 29.4	N12 34.3
Regulus	208 09.4	N12 03.5
Rigel	281 35.7	S 8 13.6
Rigil Kent.	140 25.1	S60 45.1
Sabik	102 40.8	S15 42.1
Schedar	350 09.1	N56 26.0
Shaula	96 55.4	S37 05.3
Sirius	258 55.3	S16 41.7
Spica	158 57.0	S11 03.8
Suhail	223 10.1	S43 21.5
Vega	80 55.8	N38 45.7
Zuben'ubi	137 32.6	S15 57.8

	S.H.A.	Mer. Pass.
	° ′	h m
Venus	27 45.2	11 39
Mars	11 57.8	12 41
Jupiter	171 29.1	2 03
Saturn	171 14.4	2 04

G.M.T.	SUN G.H.A.	SUN Dec.	MOON G.H.A.	MOON v	MOON Dec.	MOON d	MOON H.P.
d h	° ′	° ′	° ′	′	° ′	′	′
27 00	176 47.4	S 8 27.3	269 59.6	12.7	S17 00.5	5.9	54.6
01	191 47.5	26.3	284 31.3	12.6	17 06.4	5.8	54.6
02	206 47.6	25.4	299 02.9	12.7	17 12.2	5.8	54.6
03	221 47.7	·· 24.5	313 34.6	12.5	17 18.0	5.7	54.7
04	236 47.9	23.5	328 06.1	12.5	17 23.7	5.6	54.7
05	251 48.0	22.6	342 37.6	12.5	17 29.3	5.6	54.7
06	266 48.1	S 8 21.6	357 09.1	12.4	S17 34.9	5.4	54.7
07	281 48.2	20.7	11 40.5	12.4	17 40.3	5.4	54.7
08	296 48.3	19.8	26 11.9	12.3	17 45.7	5.3	54.7
F 09	311 48.4	·· 18.8	40 43.2	12.2	17 51.0	5.2	54.8
R 10	326 48.5	17.9	55 14.4	12.2	17 56.2	5.2	54.8
I 11	341 48.6	16.9	69 45.6	12.2	18 01.4	5.1	54.8
D 12	356 48.7	S 8 16.0	84 16.8	12.0	S18 06.5	4.9	54.8
A 13	11 48.8	15.1	98 47.8	12.1	18 11.4	5.0	54.8
Y 14	26 49.0	14.1	113 18.9	12.0	18 16.4	4.8	54.9
15	41 49.1	·· 13.2	127 49.9	11.9	18 21.2	4.7	54.9
16	56 49.2	12.2	142 20.8	11.9	18 25.9	4.7	54.9
17	71 49.3	11.3	156 51.7	11.8	18 30.6	4.6	54.9
18	86 49.4	S 8 10.3	171 22.5	11.8	S18 35.2	4.4	54.9
19	101 49.5	09.4	185 53.3	11.7	18 39.6	4.5	55.0
20	116 49.6	08.5	200 24.0	11.7	18 44.1	4.3	55.0
21	131 49.8	·· 07.5	214 54.7	11.6	18 48.4	4.2	55.0
22	146 49.9	06.6	229 25.3	11.5	18 52.6	4.2	55.0
23	161 50.0	05.6	243 55.8	11.5	18 56.8	4.0	55.1
28 00	176 50.1	S 8 04.7	258 26.3	11.5	S19 00.8	4.0	55.1
01	191 50.2	03.7	272 56.8	11.4	19 04.8	3.9	55.1
02	206 50.3	02.8	287 27.2	11.3	19 08.7	3.8	55.1
03	221 50.4	·· 01.9	301 57.5	11.3	19 12.5	3.7	55.2
04	236 50.6	00.9	316 27.8	11.2	19 16.2	3.6	55.2
05	251 50.7	8 00.0	330 58.0	11.2	19 19.8	3.5	55.2
06	266 50.8	S 7 59.0	345 28.2	11.1	S19 23.3	3.4	55.2
07	281 50.9	58.1	359 58.3	11.1	19 26.7	3.4	55.3
S 08	296 51.0	57.1	14 28.4	11.0	19 30.1	3.2	55.3
A 09	311 51.1	·· 56.2	28 58.4	11.0	19 33.3	3.1	55.3
T 10	326 51.2	55.2	43 28.4	10.9	19 36.4	3.1	55.3
U 11	341 51.4	54.3	57 58.3	10.9	19 39.5	3.0	55.4
R 12	356 51.5	S 7 53.3	72 28.2	10.8	S19 42.5	2.8	55.4
D 13	11 51.6	52.4	86 58.0	10.7	19 45.3	2.8	55.4
A 14	26 51.7	51.5	101 27.7	10.7	19 48.1	2.7	55.4
Y 15	41 51.8	·· 50.5	115 57.4	10.7	19 50.8	2.5	55.5
16	56 51.9	49.6	130 27.1	10.6	19 53.3	2.5	55.5
17	71 52.1	48.6	144 56.7	10.5	19 55.8	2.4	55.5
18	86 52.2	S 7 47.7	159 26.2	10.5	S19 58.2	2.3	55.5
19	101 52.3	46.7	173 55.7	10.5	20 00.5	2.2	55.6
20	116 52.4	45.8	188 25.2	10.4	20 02.7	2.0	55.6
21	131 52.5	·· 44.8	202 54.6	10.3	20 04.7	2.0	55.6
22	146 52.7	43.9	217 23.9	10.3	20 06.7	1.9	55.7
23	161 52.8	42.9	231 53.2	10.3	20 08.6	1.8	55.7
1 00	176 52.9	S 7 42.0	246 22.5	10.2	S20 10.4	1.6	55.7
01	191 53.0	41.0	260 51.7	10.1	20 12.0	1.6	55.7
02	206 53.1	40.1	275 20.8	10.1	20 13.6	1.5	55.8
03	221 53.3	·· 39.1	289 49.9	10.1	20 15.1	1.3	55.8
04	236 53.4	38.2	304 19.0	10.0	20 16.4	1.3	55.8
05	251 53.5	37.2	318 48.0	10.0	20 17.7	1.2	55.9
06	266 53.6	S 7 36.3	333 17.0	9.9	S20 18.9	1.0	55.9
07	281 53.7	35.3	347 45.9	9.8	20 19.9	1.0	55.9
08	296 53.9	34.4	2 14.7	9.9	20 20.9	0.8	56.0
S 09	311 54.0	·· 33.4	16 43.6	9.7	20 21.7	0.7	56.0
U 10	326 54.1	32.5	31 12.3	9.8	20 22.4	0.7	56.0
N 11	341 54.2	31.5	45 41.1	9.6	20 23.1	0.5	56.1
D 12	356 54.3	S 7 30.6	60 09.7	9.7	S20 23.6	0.4	56.1
A 13	11 54.5	29.6	74 38.4	9.6	20 24.0	0.3	56.1
Y 14	26 54.6	28.7	89 07.0	9.5	20 24.3	0.2	56.1
15	41 54.7	·· 27.7	103 35.5	9.5	20 24.5	0.0	56.2
16	56 54.8	26.8	118 04.0	9.5	20 24.5	0.0	56.2
17	71 55.0	25.8	132 32.5	9.4	20 24.5	0.1	56.2
18	86 55.1	S 7 24.9	147 00.9	9.4	S20 24.4	0.3	56.3
19	101 55.2	23.9	161 29.3	9.4	20 24.1	0.3	56.3
20	116 55.3	23.0	175 57.7	9.3	20 23.8	0.5	56.3
21	131 55.5	·· 22.0	190 26.0	9.3	20 23.3	0.6	56.4
22	146 55.6	21.1	204 54.3	9.2	20 22.7	0.7	56.4
23	161 55.7	20.1	219 22.5	9.2	20 22.0	0.8	56.4
	S.D. 16.2	d 0.9	S.D. 14.9		15.1		15.3

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 27	Moonrise 28	Moonrise 1	Moonrise 2
°	h m	h m	h m	h m	h m	h m	h m
N 72	05 15	06 33	07 43	05 21	▬	▬	▬
N 70	05 20	06 30	07 32	04 08	06 05	▬	▬
68	05 23	06 28	07 24	03 31	04 59	06 16	07 06
66	05 26	06 25	07 17	03 05	04 24	05 33	06 24
64	05 29	06 23	07 11	02 45	03 59	05 04	05 55
62	05 30	06 22	07 06	02 29	03 39	04 42	05 34
60	05 32	06 20	07 02	02 15	03 23	04 24	05 16
N 58	05 33	06 18	06 58	02 04	03 09	04 09	05 01
56	05 34	06 17	06 54	01 54	02 57	03 56	04 49
54	05 35	06 16	06 51	01 45	02 47	03 45	04 38
52	05 35	06 14	06 48	01 37	02 38	03 36	04 28
50	05 36	06 13	06 46	01 30	02 30	03 27	04 19
45	05 37	06 11	06 40	01 15	02 13	03 08	04 01
N 40	05 37	06 08	06 35	01 02	01 58	02 53	03 46
35	05 36	06 06	06 31	00 52	01 47	02 40	03 33
30	05 35	06 03	06 27	00 43	01 36	02 29	03 22
20	05 33	05 59	06 21	00 27	01 18	02 10	03 03
N 10	05 29	05 54	06 15	00 13	01 03	01 54	02 46
0	05 24	05 48	06 09	00 00	00 48	01 38	02 30
S 10	05 18	05 42	06 04	24 34	00 34	01 23	02 15
20	05 09	05 35	05 57	24 18	00 18	01 06	01 58
30	04 57	05 26	05 50	24 01	00 01	00 48	01 39
35	04 50	05 20	05 46	23 51	24 37	00 37	01 28
40	04 40	05 13	05 41	23 39	24 24	00 24	01 16
45	04 29	05 05	05 36	23 25	24 09	00 09	01 01
S 50	04 14	04 55	05 29	23 09	23 51	24 42	00 42
52	04 07	04 50	05 26	23 01	23 43	24 33	00 33
54	03 59	04 45	05 22	22 52	23 33	24 24	00 24
56	03 50	04 39	05 18	22 42	23 22	24 13	00 13
58	03 39	04 32	05 14	22 31	23 10	24 00	00 00
S 60	03 26	04 24	05 09	22 19	22 56	23 45	24 49

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 27	Moonset 28	Moonset 1	Moonset 2
°	h m	h m	h m	h m	h m	h m	h m
N 72	16 44	17 54	19 13	06 52	▬	▬	▬
N 70	16 54	17 57	19 08	08 06	07 50	▬	▬
68	17 03	17 59	19 04	08 44	08 55	09 24	10 24
66	17 09	18 02	19 01	09 10	09 31	10 07	11 05
64	17 15	18 03	18 58	09 31	09 57	10 36	11 34
62	17 20	18 05	18 56	09 48	10 17	10 58	11 55
60	17 25	18 07	18 55	10 02	10 33	11 16	12 13
N 58	17 28	18 08	18 53	10 14	10 47	11 31	12 27
56	17 32	18 09	18 52	10 24	10 59	11 44	12 40
54	17 35	18 10	18 51	10 33	11 10	11 55	12 51
52	17 38	18 12	18 51	10 41	11 19	12 05	13 00
50	17 40	18 13	18 50	10 49	11 27	12 14	13 09
45	17 46	18 15	18 49	11 05	11 45	12 32	13 27
N 40	17 51	18 18	18 49	11 17	12 00	12 48	13 42
35	17 55	18 20	18 49	11 29	12 12	13 00	13 55
30	17 58	18 22	18 50	11 38	12 23	13 12	14 06
20	18 05	18 27	18 53	11 55	12 41	13 31	14 24
N 10	18 10	18 32	18 56	12 10	12 57	13 48	14 41
0	18 16	18 37	19 01	12 23	13 12	14 03	14 56
S 10	18 21	18 43	19 07	12 37	13 27	14 19	15 11
20	18 28	18 50	19 16	12 52	13 43	14 35	15 27
30	18 35	18 59	19 27	13 08	14 02	14 54	15 46
35	18 39	19 04	19 35	13 18	14 12	15 06	15 57
40	18 43	19 11	19 44	13 29	14 25	15 18	16 09
45	18 49	19 19	19 55	13 43	14 39	15 33	16 24
S 50	18 55	19 29	20 10	13 59	14 57	15 52	16 41
52	18 58	19 33	20 17	14 06	15 06	16 01	16 50
54	19 02	19 39	20 24	14 15	15 15	16 10	16 59
56	19 05	19 45	20 33	14 24	15 26	16 21	17 09
58	19 10	19 51	20 44	14 35	15 38	16 34	17 21
S 60	19 14	19 59	20 56	14 47	15 52	16 49	17 35

Day	SUN Eqn. of Time 00ʰ	SUN Eqn. of Time 12ʰ	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
	m s	m s	h m	h m	h m	d	
27	12 51	12 45	12 13	06 12	18 36	23	
28	12 40	12 34	12 13	07 00	19 25	24	
1	12 29	12 23	12 12	07 51	20 17	25	

	G.M.T.	ARIES	VENUS −3.4		MARS +1.4		JUPITER −2.0		SATURN +0.7	
		G.H.A.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.
	d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
	2 00	159 41.8	185 02.9	S11 55.0	170 12.6	S 5 30.3	331 21.9	S 1 54.2	331 03.0	S 0 53.4
	01	174 44.2	200 02.4	53.9	185 13.3	29.5	346 24.6	54.1	346 05.6	53.4
	02	189 46.7	215 01.8	52.8	200 13.9	28.7	1 27.3	54.0	1 08.2	53.3
	03	204 49.2	230 01.3	·· 51.7	215 14.6	·· 27.9	16 30.0	·· 53.9	16 10.9	·· 53.2
	04	219 51.6	245 00.8	50.7	230 15.3	27.1	31 32.7	53.8	31 13.5	53.1
	05	234 54.1	260 00.3	49.6	245 15.9	26.3	46 35.4	53.7	46 16.1	53.1
	06	249 56.5	274 59.7	S11 48.5	260 16.6	S 5 25.5	61 38.1	S 1 53.6	61 18.7	S 0 53.0
	07	264 59.0	289 59.2	47.4	275 17.2	24.8	76 40.8	53.5	76 21.3	52.9
	08	280 01.5	304 58.7	46.3	290 17.9	24.0	91 43.5	53.4	91 23.9	52.9
M	09	295 03.9	319 58.2	·· 45.2	305 18.5	·· 23.2	106 46.2	·· 53.3	106 26.5	·· 52.8
O	10	310 06.4	334 57.6	44.1	320 19.2	22.4	121 48.9	53.2	121 29.1	52.7
N	11	325 08.9	349 57.1	43.0	335 19.9	21.6	136 51.6	53.1	136 31.7	52.6
D	12	340 11.3	4 56.6	S11 42.0	350 20.5	S 5 20.8	151 54.3	S 1 52.9	151 34.4	S 0 52.6
A	13	355 13.8	19 56.1	40.9	5 21.2	20.1	166 57.0	52.8	166 37.0	52.5
Y	14	10 16.3	34 55.6	39.8	20 21.8	19.3	181 59.7	52.7	181 39.6	52.4
	15	25 18.7	49 55.0	·· 38.7	35 22.5	·· 18.5	197 02.4	·· 52.6	196 42.2	·· 52.4
	16	40 21.2	64 54.5	37.6	50 23.1	17.7	212 05.1	52.5	211 44.8	52.3
	17	55 23.6	79 54.0	36.5	65 23.8	16.9	227 07.8	52.4	226 47.4	52.2
	18	70 26.1	94 53.5	S11 35.4	80 24.5	S 5 16.1	242 10.5	S 1 52.3	241 50.0	S 0 52.2
	19	85 28.6	109 53.0	34.3	95 25.1	15.3	257 13.2	52.2	256 52.6	52.1
	20	100 31.0	124 52.4	33.2	110 25.8	14.6	272 15.9	52.1	271 55.3	52.0
	21	115 33.5	139 51.9	·· 32.1	125 26.4	·· 13.8	287 18.6	·· 52.0	286 57.9	·· 51.9
	22	130 36.0	154 51.4	31.0	140 27.1	13.0	302 21.3	51.9	302 00.5	51.9
	23	145 38.4	169 50.9	29.9	155 27.7	12.2	317 24.0	51.7	317 03.1	51.8
	3 00	160 40.9	184 50.4	S11 28.8	170 28.4	S 5 11.4	332 26.7	S 1 51.6	332 05.7	S 0 51.7
	01	175 43.4	199 49.8	27.7	185 29.1	10.6	347 29.4	51.5	347 08.3	51.7
	02	190 45.8	214 49.3	26.7	200 29.7	09.8	2 32.1	51.4	2 10.9	51.6
	03	205 48.3	229 48.8	·· 25.6	215 30.4	·· 09.1	17 34.8	·· 51.3	17 13.5	·· 51.5
	04	220 50.8	244 48.3	24.5	230 31.0	08.3	32 37.5	51.2	32 16.2	51.4
	05	235 53.2	259 47.8	23.4	245 31.7	07.5	47 40.2	51.1	47 18.8	51.4
	06	250 55.7	274 47.3	S11 22.3	260 32.3	S 5 06.7	62 42.9	S 1 51.0	62 21.4	S 0 51.3
	07	265 58.1	289 46.7	21.2	275 33.0	05.9	77 45.6	50.9	77 24.0	51.2
	08	281 00.6	304 46.2	20.1	290 33.7	05.1	92 48.3	50.8	92 26.6	51.2
T	09	296 03.1	319 45.7	·· 19.0	305 34.3	·· 04.3	107 51.0	·· 50.6	107 29.2	·· 51.1
U	10	311 05.5	334 45.2	17.9	320 35.0	03.6	122 53.7	50.5	122 31.8	51.0
E	11	326 08.0	349 44.7	16.8	335 35.6	02.8	137 56.4	50.4	137 34.5	50.9
S	12	341 10.5	4 44.2	S11 15.7	350 36.3	S 5 02.0	152 59.1	S 1 50.3	152 37.1	S 0 50.9
D	13	356 12.9	19 43.7	14.6	5 37.0	01.2	168 01.9	50.2	167 39.7	50.8
A	14	11 15.4	34 43.2	13.4	20 37.6	5 00.4	183 04.6	50.1	182 42.3	50.7
Y	15	26 17.9	49 42.6	·· 12.3	35 38.3	4 59.6	198 07.3	·· 50.0	197 44.9	·· 50.7
	16	41 20.3	64 42.1	11.2	50 38.9	58.8	213 10.0	49.9	212 47.5	50.6
	17	56 22.8	79 41.6	10.1	65 39.6	58.1	228 12.7	49.8	227 50.1	50.5
	18	71 25.3	94 41.1	S11 09.0	80 40.3	S 4 57.3	243 15.4	S 1 49.7	242 52.8	S 0 50.4
	19	86 27.7	109 40.6	07.9	95 40.9	56.5	258 18.1	49.5	257 55.4	50.4
	20	101 30.2	124 40.1	06.8	110 41.6	55.7	273 20.8	49.4	272 58.0	50.3
	21	116 32.6	139 39.6	·· 05.7	125 42.2	·· 54.9	288 23.5	·· 49.3	288 00.6	·· 50.2
	22	131 35.1	154 39.1	04.6	140 42.9	54.1	303 26.2	49.2	303 03.2	50.2
	23	146 37.6	169 38.6	03.5	155 43.6	53.3	318 28.9	49.1	318 05.8	50.1
	4 00	161 40.0	184 38.1	S11 02.4	170 44.2	S 4 52.6	333 31.6	S 1 49.0	333 08.4	S 0 50.0
	01	176 42.5	199 37.6	01.3	185 44.9	51.8	348 34.3	48.9	348 11.1	49.9
	02	191 45.0	214 37.1	11 00.2	200 45.5	51.0	3 37.0	48.8	3 13.7	49.9
	03	206 47.4	229 36.5	10 59.1	215 46.2	·· 50.2	18 39.7	·· 48.7	18 16.3	·· 49.8
	04	221 49.9	244 36.0	58.0	230 46.9	49.4	33 42.5	48.5	33 18.9	49.7
	05	236 52.4	259 35.5	56.8	245 47.5	48.6	48 45.2	48.4	48 21.5	49.6
	06	251 54.8	274 35.0	S10 55.7	260 48.2	S 4 47.8	63 47.9	S 1 48.3	63 24.1	S 0 49.6
W	07	266 57.3	289 34.5	54.6	275 48.8	47.0	78 50.6	48.2	78 26.8	49.5
E	08	281 59.7	304 34.0	53.5	290 49.5	46.3	93 53.3	48.1	93 29.4	49.4
D	09	297 02.2	319 33.5	·· 52.4	305 50.2	·· 45.5	108 56.0	·· 48.0	108 32.0	·· 49.4
N	10	312 04.7	334 33.0	51.3	320 50.8	44.7	123 58.7	47.9	123 34.6	49.3
E	11	327 07.1	349 32.5	50.2	335 51.5	43.9	139 01.4	47.8	138 37.2	49.2
S	12	342 09.6	4 32.0	S10 49.0	350 52.2	S 4 43.1	154 04.1	S 1 47.6	153 39.8	S 0 49.1
D	13	357 12.1	19 31.5	47.9	5 52.8	42.3	169 06.8	47.5	168 42.5	49.1
A	14	12 14.5	34 31.0	46.8	20 53.5	41.5	184 09.5	47.4	183 45.1	49.0
Y	15	27 17.0	49 30.5	·· 45.7	35 54.1	·· 40.7	199 12.2	·· 47.3	198 47.7	·· 48.9
	16	42 19.5	64 30.0	44.6	50 54.8	40.0	214 15.0	47.2	213 50.3	48.9
	17	57 21.9	79 29.5	43.5	65 55.5	39.2	229 17.7	47.1	228 52.9	48.8
	18	72 24.4	94 29.0	S10 42.4	80 56.1	S 4 38.4	244 20.4	S 1 47.0	243 55.5	S 0 48.7
	19	87 26.9	109 28.5	41.2	95 56.8	37.6	259 23.1	46.9	258 58.2	48.6
	20	102 29.3	124 28.0	40.1	110 57.5	36.8	274 25.8	46.7	274 00.8	48.6
	21	117 31.8	139 27.5	·· 39.0	125 58.1	·· 36.0	289 28.5	·· 46.6	289 03.4	·· 48.5
	22	132 34.2	154 27.0	37.9	140 58.8	35.2	304 31.2	46.5	304 06.0	48.4
	23	147 36.7	169 26.5	36.8	155 59.4	34.4	319 33.9	46.4	319 08.6	48.3
	Mer. Pass.	h m 13 15.1	v −0.5	d 1.1	v 0.7	d 0.8	v 2.7	d 0.1	v 2.6	d 0.1

STARS		
Name	S.H.A.	Dec.
	° ′	° ′
Acamar	315 37.2	S40 23.2
Achernar	335 45.5	S57 20.3
Acrux	173 36.2	S62 59.5
Adhara	255 31.7	S28 57.1
Aldebaran	291 17.7	N16 28.2
Alioth	166 41.8	N56 03.6
Alkaid	153 17.9	N49 24.3
Al Na'ir	28 15.0	S47 03.2
Alnilam	276 11.3	S 1 13.0
Alphard	218 20.0	S 8 34.7
Alphecca	126 31.7	N26 46.5
Alpheratz	358 09.3	N28 59.0
Altair	62 32.5	N 8 48.9
Ankaa	353 40.3	S42 24.8
Antares	112 56.4	S26 23.3
Arcturus	146 18.0	N19 16.7
Atria	108 20.4	S68 59.3
Avior	234 27.6	S59 27.2
Bellatrix	278 58.4	N 6 19.8
Betelgeuse	271 27.8	N 7 24.1
Canopus	264 06.8	S52 41.5
Capella	281 10.8	N45 58.8
Deneb	49 48.6	N45 12.6
Denebola	182 58.4	N14 40.6
Diphda	349 20.8	S18 05.7
Dubhe	194 21.1	N61 51.1
Elnath	278 43.7	N28 35.5
Eltanin	90 57.7	N51 29.2
Enif	34 11.6	N 9 47.1
Fomalhaut	15 51.4	S29 43.5
Gacrux	172 27.9	S57 00.3
Gienah	176 17.3	S17 26.2
Hadar	149 22.5	S60 16.7
Hamal	328 28.8	N23 22.3
Kaus Aust.	84 16.6	S34 23.6
Kochab	137 18.5	N74 13.8
Markab	14 03.2	N15 06.0
Menkar	314 40.9	N 4 00.8
Menkent	148 36.4	S36 16.5
Miaplacidus	221 44.0	S69 38.5
Mirfak	309 15.8	N49 47.7
Nunki	76 29.0	S26 19.2
Peacock	53 58.4	S56 47.7
Pollux	243 57.5	N28 04.3
Procyon	245 25.2	N 5 16.3
Rasalhague	96 29.4	N12 34.3
Regulus	208 09.4	N12 03.5
Rigel	281 35.7	S 8 13.6
Rigil Kent.	140 25.1	S60 45.1
Sabik	102 40.8	S15 42.1
Schedar	350 09.1	N56 26.0
Shaula	96 55.4	S37 05.3
Sirius	258 55.3	S16 41.7
Spica	158 57.0	S11 03.8
Suhail	223 10.1	S43 21.5
Vega	80 55.8	N38 45.7
Zuben'ubi	137 32.5	S15 57.8

	S.H.A.	Mer. Pass.
	° ′	h m
Venus	24 09.5	11 41
Mars	9 47.5	12 38
Jupiter	171 45.8	1 50
Saturn	171 24.8	1 51

G.M.T.	SUN G.H.A.	SUN Dec.	MOON G.H.A.	MOON v	MOON Dec.	MOON d	MOON H.P.
d h	° ′	° ′	° ′	′	° ′	′	′
2 00	176 55.8	S 7 19.2	233 50.7	9.1	S20 21.2	0.9	56.5
01	191 56.0	18.2	248 18.8	9.2	20 20.3	1.0	56.5
02	206 56.1	17.3	262 47.0	9.0	20 19.3	1.2	56.5
03	221 56.2	·· 16.3	277 15.0	9.1	20 18.1	1.2	56.6
04	236 56.3	15.4	291 43.1	9.0	20 16.9	1.4	56.6
05	251 56.5	14.4	306 11.1	9.0	20 15.5	1.5	56.6
06	266 56.6	S 7 13.4	320 39.1	8.9	S20 14.0	1.6	56.7
07	281 56.7	12.5	335 07.0	8.9	20 12.4	1.7	56.7
08	296 56.8	11.5	349 34.9	8.9	20 10.7	1.9	56.8
M 09	311 57.0	·· 10.6	4 02.8	8.9	20 08.8	1.9	56.8
O 10	326 57.1	09.6	18 30.7	8.8	20 06.9	2.1	56.8
N 11	341 57.2	08.7	32 58.5	8.8	20 04.8	2.2	56.9
D 12	356 57.3	S 7 07.7	47 26.3	8.7	S20 02.6	2.3	56.9
A 13	11 57.5	06.8	61 54.0	8.8	20 00.3	2.4	56.9
Y 14	26 57.6	05.8	76 21.8	8.7	19 57.9	2.5	57.0
15	41 57.7	·· 04.9	90 49.5	8.6	19 55.4	2.6	57.0
16	56 57.8	03.9	105 17.1	8.7	19 52.8	2.8	57.0
17	71 58.0	02.9	119 44.8	8.6	19 50.0	2.9	57.1
18	86 58.1	S 7 02.0	134 12.4	8.6	S19 47.1	3.0	57.1
19	101 58.2	01.0	148 40.0	8.6	19 44.1	3.1	57.1
20	116 58.4	7 00.1	163 07.6	8.5	19 41.0	3.2	57.2
21	131 58.5	6 59.1	177 35.1	8.5	19 37.8	3.4	57.2
22	146 58.6	58.2	192 02.6	8.5	19 34.4	3.4	57.2
23	161 58.7	57.2	206 30.1	8.5	19 31.0	3.6	57.3
3 00	176 58.9	S 6 56.2	220 57.6	8.5	S19 27.4	3.7	57.3
01	191 59.0	55.3	235 25.1	8.4	19 23.7	3.8	57.4
02	206 59.1	54.3	249 52.5	8.5	19 19.9	3.9	57.4
03	221 59.3	·· 53.4	264 20.0	8.4	19 16.0	4.1	57.4
04	236 59.4	52.4	278 47.4	8.4	19 11.9	4.1	57.5
05	251 59.5	51.5	293 14.8	8.3	19 07.8	4.3	57.5
06	266 59.7	S 6 50.5	307 42.1	8.4	S19 03.5	4.4	57.5
07	281 59.8	49.5	322 09.5	8.3	18 59.1	4.5	57.6
08	296 59.9	48.6	336 36.8	8.3	18 54.6	4.6	57.6
T 09	312 00.1	·· 47.6	351 04.1	8.3	18 50.0	4.8	57.6
U 10	327 00.2	46.7	5 31.4	8.3	18 45.2	4.9	57.7
E 11	342 00.3	45.7	19 58.7	8.3	18 40.3	4.9	57.7
S 12	357 00.4	S 6 44.7	34 26.0	8.3	S18 35.4	5.1	57.8
D 13	12 00.6	43.8	48 53.3	8.2	18 30.3	5.2	57.8
A 14	27 00.7	42.8	63 20.5	8.3	18 25.1	5.4	57.8
Y 15	42 00.8	·· 41.9	77 47.8	8.2	18 19.7	5.4	57.9
16	57 01.0	40.9	92 15.0	8.3	18 14.3	5.5	57.9
17	72 01.1	39.9	106 42.3	8.2	18 08.8	5.7	57.9
18	87 01.2	S 6 39.0	121 09.5	8.2	S18 03.1	5.8	58.0
19	102 01.4	38.0	135 36.7	8.2	17 57.3	5.9	58.0
20	117 01.5	37.1	150 03.9	8.2	17 51.4	6.0	58.0
21	132 01.6	·· 36.1	164 31.1	8.2	17 45.4	6.1	58.1
22	147 01.8	35.1	178 58.3	8.2	17 39.3	6.3	58.1
23	162 01.9	34.2	193 25.5	8.2	17 33.0	6.3	58.1
4 00	177 02.0	S 6 33.2	207 52.7	8.1	S17 26.7	6.5	58.2
01	192 02.2	32.3	222 19.8	8.2	17 20.2	6.5	58.2
02	207 02.3	31.3	236 47.0	8.2	17 13.7	6.7	58.3
03	222 02.4	·· 30.3	251 14.2	8.1	17 07.0	6.8	58.3
04	237 02.6	29.4	265 41.3	8.2	17 00.2	6.9	58.3
05	252 02.7	28.4	280 08.5	8.2	16 53.3	7.0	58.4
06	267 02.9	S 6 27.5	294 35.7	8.1	S16 46.3	7.2	58.4
W 07	282 03.0	26.5	309 02.8	8.2	16 39.1	7.2	58.4
E 08	297 03.1	25.5	323 30.0	8.2	16 31.9	7.3	58.5
D 09	312 03.3	·· 24.6	337 57.2	8.1	16 24.6	7.5	58.5
N 10	327 03.4	23.6	352 24.3	8.2	16 17.1	7.5	58.5
E 11	342 03.5	22.6	6 51.5	8.2	16 09.6	7.7	58.6
S 12	357 03.7	S 6 21.7	21 18.7	8.1	S16 01.9	7.8	58.6
D 13	12 03.8	20.7	35 45.8	8.2	15 54.1	7.8	58.6
A 14	27 03.9	19.8	50 13.0	8.2	15 46.3	8.0	58.7
Y 15	42 04.1	·· 18.8	64 40.2	8.2	15 38.3	8.1	58.7
16	57 04.2	17.8	79 07.4	8.2	15 30.2	8.2	58.7
17	72 04.4	16.9	93 34.6	8.2	15 22.0	8.3	58.8
18	87 04.5	S 6 15.9	108 01.8	8.1	S15 13.7	8.3	58.8
19	102 04.6	14.9	122 28.9	8.2	15 05.4	8.5	58.8
20	117 04.8	14.0	136 56.1	8.3	14 56.9	8.6	58.9
21	132 04.9	·· 13.0	151 23.4	8.2	14 48.3	8.7	58.9
22	147 05.0	12.0	165 50.6	8.2	14 39.6	8.8	58.9
23	162 05.2	11.1	180 17.8	8.2	14 30.8	8.9	59.0
	S.D. 16.2	d 1.0	S.D. 15.5		15.7		16.0

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 2	Moonrise 3	Moonrise 4	Moonrise 5
°	h m	h m	h m	h m	h m	h m	h m
N 72	05 00	06 19	07 27	▬	▬	08 53	08 24
N 70	05 07	06 17	07 18	▬	08 19	08 08	08 00
68	05 11	06 16	07 12	07 06	07 28	07 37	07 41
66	05 15	06 14	07 06	06 24	06 56	07 15	07 26
64	05 19	06 13	07 01	05 55	06 32	06 57	07 14
62	05 21	06 12	06 57	05 34	06 13	06 42	07 03
60	05 23	06 11	06 53	05 16	05 58	06 29	06 54
N 58	05 25	06 10	06 50	05 01	05 44	06 19	06 46
56	05 27	06 10	06 47	04 49	05 33	06 09	06 39
54	05 28	06 09	06 44	04 38	05 23	06 01	06 33
52	05 29	06 08	06 42	04 28	05 14	05 53	06 27
50	05 30	06 07	06 40	04 19	05 06	05 46	06 22
45	05 31	06 05	06 35	04 01	04 49	05 32	06 11
N 40	05 32	06 04	06 31	03 46	04 35	05 20	06 01
35	05 33	06 02	06 27	03 33	04 23	05 10	05 53
30	05 32	06 00	06 24	03 22	04 12	05 01	05 46
20	05 31	05 56	06 18	03 03	03 54	04 45	05 34
N 10	05 28	05 52	06 13	02 46	03 39	04 31	05 23
0	05 24	05 48	06 09	02 30	03 24	04 19	05 13
S 10	05 18	05 43	06 04	02 15	03 09	04 06	05 03
20	05 10	05 36	05 58	01 58	02 54	03 52	04 52
30	04 59	05 28	05 52	01 39	02 36	03 36	04 40
35	04 53	05 23	05 49	01 28	02 25	03 27	04 32
40	04 44	05 17	05 44	01 16	02 13	03 17	04 24
45	04 34	05 10	05 40	01 01	01 59	03 04	04 15
S 50	04 20	05 00	05 34	00 42	01 42	02 49	04 03
52	04 14	04 56	05 31	00 33	01 34	02 42	03 58
54	04 06	04 51	05 28	00 24	01 25	02 35	03 52
56	03 58	04 46	05 25	00 13	01 14	02 26	03 45
58	03 48	04 40	05 21	00 00	01 03	02 16	03 37
S 60	03 36	04 33	05 17	24 49	00 49	02 05	03 29

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 2	Moonset 3	Moonset 4	Moonset 5
°	h m	h m	h m	h m	h m	h m	h m
N 72	16 59	18 08	19 27	▬	▬	12 24	14 47
N 70	17 07	18 09	19 20	▬	11 03	13 09	15 10
68	17 14	18 10	19 15	10 24	11 54	13 38	15 27
66	17 20	18 11	19 11	11 05	12 25	14 00	15 41
64	17 24	18 12	19 07	11 34	12 49	14 17	15 52
62	17 28	18 13	19 04	11 55	13 07	14 31	16 02
60	17 32	18 14	19 02	12 13	13 22	14 43	16 10
N 58	17 35	18 15	19 00	12 27	13 35	14 53	16 18
56	17 38	18 15	18 59	12 40	13 46	15 02	16 24
54	17 41	18 16	18 57	12 51	13 56	15 10	16 30
52	17 43	18 17	18 56	13 00	14 05	15 17	16 35
50	17 45	18 18	18 55	13 09	14 13	15 24	16 39
45	17 50	18 19	18 53	13 27	14 29	15 37	16 49
N 40	17 54	18 21	18 52	13 42	14 43	15 48	16 57
35	17 57	18 23	18 52	13 55	14 54	15 58	17 04
30	18 00	18 24	18 52	14 06	15 04	16 06	17 11
20	18 06	18 28	18 53	14 24	15 21	16 21	17 21
N 10	18 11	18 32	18 56	14 41	15 36	16 33	17 30
0	18 15	18 36	19 00	14 56	15 50	16 45	17 39
S 10	18 20	18 41	19 06	15 11	16 04	16 56	17 47
20	18 25	18 47	19 13	15 27	16 19	17 08	17 56
30	18 31	18 55	19 24	15 46	16 35	17 22	18 07
35	18 35	19 00	19 31	15 57	16 45	17 30	18 12
40	18 39	19 06	19 39	16 09	16 56	17 39	18 19
45	18 43	19 13	19 49	16 24	17 09	17 50	18 27
S 50	18 49	19 22	20 02	16 41	17 25	18 03	18 36
52	18 52	19 26	20 09	16 50	17 32	18 09	18 40
54	18 55	19 31	20 16	16 59	17 40	18 15	18 45
56	18 58	19 36	20 24	17 09	17 50	18 22	18 50
58	19 01	19 42	20 34	17 21	18 00	18 30	18 55
S 60	19 05	19 49	20 45	17 35	18 12	18 40	19 02

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
	m s	m s	h m	h m	h m	d	
2	12 17	12 11	12 12	08 43	21 10	26	
3	12 05	11 58	12 12	09 37	22 04	27	◑
4	11 52	11 46	12 12	10 32	22 59	28	

G.M.T.	ARIES	VENUS −3.4		MARS +1.4		JUPITER −2.0		SATURN +0.7	
	G.H.A.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
5 00	162 39.2	184 26.0	S10 35.6	171 00.1	S 4 33.7	334 36.6	S 1 46.3	334 11.2	S 0 48.3
01	177 41.6	199 25.5	34.5	186 00.8	32.9	349 39.4	46.2	349 13.9	48.2
02	192 44.1	214 25.0	33.4	201 01.4	32.1	4 42.1	46.1	4 16.5	48.1
03	207 46.6	229 24.5	·· 32.3	216 02.1	·· 31.3	19 44.8	·· 46.0	19 19.1	·· 48.1
04	222 49.0	244 24.0	31.2	231 02.8	30.5	34 47.5	45.8	34 21.7	48.0
05	237 51.5	259 23.5	30.0	246 03.4	29.7	49 50.2	45.7	49 24.3	47.9
06	252 54.0	274 23.0	S10 28.9	261 04.1	S 4 28.9	64 52.9	S 1 45.6	64 26.9	S 0 47.8
07	267 56.4	289 22.5	27.8	276 04.7	28.1	79 55.6	45.5	79 29.6	47.8
T 08	282 58.9	304 22.0	26.7	291 05.4	27.3	94 58.3	45.4	94 32.2	47.7
H 09	298 01.4	319 21.5	·· 25.5	306 06.1	·· 26.6	110 01.1	·· 45.3	109 34.8	·· 47.6
U 10	313 03.8	334 21.0	24.4	321 06.7	25.8	125 03.8	45.2	124 37.4	47.5
R 11	328 06.3	349 20.6	23.3	336 07.4	25.0	140 06.5	45.0	139 40.0	47.5
S 12	343 08.7	4 20.1	S10 22.2	351 08.1	S 4 24.2	155 09.2	S 1 44.9	154 42.7	S 0 47.4
D 13	358 11.2	19 19.6	21.0	6 08.7	23.4	170 11.9	44.8	169 45.3	47.3
A 14	13 13.7	34 19.1	19.9	21 09.4	22.6	185 14.6	44.7	184 47.9	47.2
Y 15	28 16.1	49 18.6	·· 18.8	36 10.1	·· 21.8	200 17.3	·· 44.6	199 50.5	·· 47.2
16	43 18.6	64 18.1	17.6	51 10.7	21.0	215 20.1	44.5	214 53.1	47.1
17	58 21.1	79 17.6	16.5	66 11.4	20.2	230 22.8	44.4	229 55.7	47.0
18	73 23.5	94 17.1	S10 15.4	81 12.1	S 4 19.5	245 25.5	S 1 44.2	244 58.4	S 0 47.0
19	88 26.0	109 16.6	14.3	96 12.7	18.7	260 28.2	44.1	260 01.0	46.9
20	103 28.5	124 16.1	13.1	111 13.4	17.9	275 30.9	44.0	275 03.6	46.8
21	118 30.9	139 15.6	·· 12.0	126 14.0	·· 17.1	290 33.6	·· 43.9	290 06.2	·· 46.7
22	133 33.4	154 15.1	10.9	141 14.7	16.3	305 36.4	43.8	305 08.8	46.7
23	148 35.9	169 14.7	09.7	156 15.4	15.5	320 39.1	43.7	320 11.5	46.6
6 00	163 38.3	184 14.2	S10 08.6	171 16.0	S 4 14.7	335 41.8	S 1 43.6	335 14.1	S 0 46.5
01	178 40.8	199 13.7	07.5	186 16.7	13.9	350 44.5	43.4	350 16.7	46.4
02	193 43.2	214 13.2	06.3	201 17.4	13.1	5 47.2	43.3	5 19.3	46.4
03	208 45.7	229 12.7	·· 05.2	216 18.0	·· 12.4	20 49.9	·· 43.2	20 21.9	·· 46.3
04	223 48.2	244 12.2	04.1	231 18.7	11.6	35 52.6	43.1	35 24.6	46.2
05	238 50.6	259 11.7	02.9	246 19.4	10.8	50 55.4	43.0	50 27.2	46.1
06	253 53.1	274 11.2	S10 01.8	261 20.0	S 4 10.0	65 58.1	S 1 42.9	65 29.8	S 0 46.1
07	268 55.6	289 10.8	10 00.7	276 20.7	09.2	81 00.8	42.8	80 32.4	46.0
08	283 58.0	304 10.3	9 59.5	291 21.4	08.4	96 03.5	42.6	95 35.0	45.9
F 09	299 00.5	319 09.8	·· 58.4	306 22.0	·· 07.6	111 06.2	·· 42.5	110 37.7	·· 45.9
R 10	314 03.0	334 09.3	57.3	321 22.7	06.8	126 09.0	42.4	125 40.3	45.8
I 11	329 05.4	349 08.8	56.1	336 23.4	06.0	141 11.7	42.3	140 42.9	45.7
D 12	344 07.9	4 08.3	S 9 55.0	351 24.0	S 4 05.2	156 14.4	S 1 42.2	155 45.5	S 0 45.6
A 13	359 10.3	19 07.9	53.8	6 24.7	04.5	171 17.1	42.1	170 48.1	45.6
Y 14	14 12.8	34 07.4	52.7	21 25.4	03.7	186 19.8	41.9	185 50.8	45.5
15	29 15.3	49 06.9	·· 51.6	36 26.0	·· 02.9	201 22.5	·· 41.8	200 53.4	·· 45.4
16	44 17.7	64 06.4	50.4	51 26.7	02.1	216 25.3	41.7	215 56.0	45.3
17	59 20.2	79 05.9	49.3	66 27.4	01.3	231 28.0	41.6	230 58.6	45.3
18	74 22.7	94 05.4	S 9 48.1	81 28.0	S 4 00.5	246 30.7	S 1 41.5	246 01.2	S 0 45.2
19	89 25.1	109 05.0	47.0	96 28.7	3 59.7	261 33.4	41.4	261 03.9	45.1
20	104 27.6	124 04.5	45.9	111 29.4	58.9	276 36.1	41.3	276 06.5	45.0
21	119 30.1	139 04.0	·· 44.7	126 30.0	·· 58.1	291 38.9	·· 41.1	291 09.1	·· 45.0
22	134 32.5	154 03.5	43.6	141 30.7	57.3	306 41.6	41.0	306 11.7	44.9
23	149 35.0	169 03.0	42.4	156 31.4	56.6	321 44.3	40.9	321 14.4	44.8
7 00	164 37.5	184 02.6	S 9 41.3	171 32.0	S 3 55.8	336 47.0	S 1 40.8	336 17.0	S 0 44.7
01	179 39.9	199 02.1	40.2	186 32.7	55.0	351 49.7	40.7	351 19.6	44.7
02	194 42.4	214 01.6	39.0	201 33.4	54.2	6 52.5	40.6	6 22.2	44.6
03	209 44.8	229 01.1	·· 37.9	216 34.0	·· 53.4	21 55.2	·· 40.4	21 24.8	·· 44.5
04	224 47.3	244 00.6	36.7	231 34.7	52.6	36 57.9	40.3	36 27.5	44.4
05	239 49.8	259 00.2	35.6	246 35.4	51.8	52 00.6	40.2	51 30.1	44.4
06	254 52.2	273 59.7	S 9 34.4	261 36.0	S 3 51.0	67 03.3	S 1 40.1	66 32.7	S 0 44.3
07	269 54.7	288 59.2	33.3	276 36.7	50.2	82 06.1	40.0	81 35.3	44.2
S 08	284 57.2	303 58.7	32.1	291 37.4	49.4	97 08.8	39.9	96 37.9	44.2
A 09	299 59.6	318 58.3	·· 31.0	306 38.1	·· 48.7	112 11.5	·· 39.7	111 40.6	·· 44.1
T 10	315 02.1	333 57.8	29.8	321 38.7	47.9	127 14.2	39.6	126 43.2	44.0
U 11	330 04.6	348 57.3	28.7	336 39.4	47.1	142 16.9	39.5	141 45.8	43.9
R 12	345 07.0	3 56.8	S 9 27.5	351 40.1	S 3 46.3	157 19.7	S 1 39.4	156 48.4	S 0 43.9
D 13	0 09.5	18 56.4	26.4	6 40.7	45.5	172 22.4	39.3	171 51.1	43.8
A 14	15 12.0	33 55.9	25.2	21 41.4	44.7	187 25.1	39.2	186 53.7	43.7
Y 15	30 14.4	48 55.4	·· 24.1	36 42.1	·· 43.9	202 27.8	·· 39.0	201 56.3	·· 43.6
16	45 16.9	63 54.9	22.9	51 42.7	43.1	217 30.6	38.9	216 58.9	43.6
17	60 19.3	78 54.5	21.8	66 43.4	42.3	232 33.3	38.8	232 01.6	43.5
18	75 21.8	93 54.0	S 9 20.6	81 44.1	S 3 41.5	247 36.0	S 1 38.7	247 04.2	S 0 43.4
19	90 24.3	108 53.5	19.5	96 44.7	40.7	262 38.7	38.6	262 06.8	43.3
20	105 26.7	123 53.0	18.3	111 45.4	40.0	277 41.4	38.5	277 09.4	43.3
21	120 29.2	138 52.6	·· 17.2	126 46.1	·· 39.2	292 44.2	·· 38.3	292 12.0	·· 43.2
22	135 31.7	153 52.1	16.0	141 46.8	38.4	307 46.9	38.2	307 14.7	43.1
23	150 34.1	168 51.6	14.9	156 47.4	37.6	322 49.6	38.1	322 17.3	43.0
Mer. Pass.	h m 13 03.3	v −0.5	d 1.1	v 0.7	d 0.8	v 2.7	d 0.1	v 2.6	d 0.1

STARS		
Name	S.H.A.	Dec.
	° ′	° ′
Acamar	315 37.2	S40 23.2
Achernar	335 45.5	S57 20.3
Acrux	173 36.2	S62 59.6
Adhara	255 31.7	S28 57.1
Aldebaran	291 17.7	N16 28.2
Alioth	166 41.7	N56 03.6
Alkaid	153 17.9	N49 24.3
Al Na'ir	28 15.0	S47 03.2
Alnilam	276 11.3	S 1 13.0
Alphard	218 20.0	S 8 34.7
Alphecca	126 31.7	N26 46.5
Alpheratz	358 09.3	N28 59.0
Altair	62 32.4	N 8 48.9
Ankaa	353 40.3	S42 24.8
Antares	112 56.4	S26 23.3
Arcturus	146 18.0	N19 16.7
Atria	108 20.4	S68 59.3
Avior	234 27.6	S59 27.2
Bellatrix	278 58.4	N 6 19.8
Betelgeuse	271 27.9	N 7 24.1
Canopus	264 06.9	S52 41.5
Capella	281 10.8	N45 58.8
Deneb	49 48.6	N45 12.6
Denebola	182 58.4	N14 40.6
Diphda	349 20.9	S18 05.7
Dubhe	194 21.1	N61 51.2
Elnath	278 43.7	N28 35.5
Eltanin	90 57.7	N51 29.2
Enif	34 11.6	N 9 47.1
Fomalhaut	15 51.4	S29 43.5
Gacrux	172 27.8	S57 00.3
Gienah	176 17.3	S17 26.3
Hadar	149 22.4	S60 16.7
Hamal	328 28.8	N23 22.3
Kaus Aust.	84 16.6	S34 23.6
Kochab	137 18.4	N74 13.8
Markab	14 03.2	N15 06.0
Menkar	314 41.0	N 4 00.8
Menkent	148 36.4	S36 16.5
Miaplacidus	221 44.0	S69 38.5
Mirfak	309 15.8	N49 47.7
Nunki	76 29.0	S26 19.2
Peacock	53 58.3	S56 47.7
Pollux	243 57.5	N28 04.3
Procyon	245 25.3	N 5 16.3
Rasalhague	96 29.3	N12 34.3
Regulus	208 09.4	N12 03.5
Rigel	281 35.7	S 8 13.6
Rigil Kent.	140 25.0	S60 45.2
Sabik	102 40.8	S15 42.1
Schedar	350 09.1	N56 26.0
Shaula	96 55.4	S37 05.3
Sirius	258 55.3	S16 41.7
Spica	158 56.9	S11 03.8
Suhail	223 10.2	S43 21.6
Vega	80 55.8	N38 45.7
Zuben'ubi	137 32.5	S15 57.8

	S.H.A.	Mer. Pass.
	° ′	h m
Venus	20 35.9	11 43
Mars	7 37.7	12 34
Jupiter	172 03.5	1 37
Saturn	171 35.8	1 39

G.M.T.	SUN G.H.A.	SUN Dec.	MOON G.H.A.	MOON v	MOON Dec.	MOON d	MOON H.P.
d h	° ′	° ′	° ′	′	° ′	′	′
5 00	177 05.3	S 6 10.1	194 45.0	8.2	S14 21.9	9.0	59.0
01	192 05.5	09.1	209 12.2	8.3	14 12.9	9.0	59.0
02	207 05.6	08.2	223 39.5	8.2	14 03.9	9.2	59.1
03	222 05.7	·· 07.2	238 06.7	8.3	13 54.7	9.3	59.1
04	237 05.9	06.3	252 34.0	8.3	13 45.4	9.4	59.1
05	252 06.0	05.3	267 01.3	8.2	13 36.0	9.4	59.2
06	267 06.2	S 6 04.3	281 28.5	8.3	S13 26.6	9.6	59.2
07	282 06.3	03.4	295 55.8	8.3	13 17.0	9.6	59.2
T 08	297 06.4	02.4	310 23.1	8.3	13 07.4	9.7	59.2
H 09	312 06.6	·· 01.4	324 50.4	8.3	12 57.7	9.8	59.3
U 10	327 06.7	6 00.5	339 17.7	8.4	12 47.9	9.9	59.3
R 11	342 06.9	5 59.5	353 45.1	8.3	12 38.0	10.0	59.3
S 12	357 07.0	S 5 58.5	8 12.4	8.3	S12 28.0	10.1	59.4
D 13	12 07.1	57.6	22 39.7	8.4	12 17.9	10.2	59.4
A 14	27 07.3	56.6	37 07.1	8.4	12 07.7	10.2	59.4
Y 15	42 07.4	·· 55.6	51 34.5	8.3	11 57.5	10.3	59.4
16	57 07.6	54.7	66 01.8	8.4	11 47.2	10.5	59.5
17	72 07.7	53.7	80 29.2	8.4	11 36.7	10.4	59.5
18	87 07.9	S 5 52.7	94 56.6	8.4	S11 26.3	10.6	59.5
19	102 08.0	51.8	109 24.0	8.5	11 15.7	10.7	59.6
20	117 08.1	50.8	123 51.5	8.4	11 05.0	10.7	59.6
21	132 08.3	·· 49.8	138 18.9	8.4	10 54.3	10.8	59.6
22	147 08.4	48.8	152 46.3	8.5	10 43.5	10.9	59.6
23	162 08.6	47.9	167 13.8	8.4	10 32.6	10.9	59.7
6 00	177 08.7	S 5 46.9	181 41.2	8.5	S10 21.7	11.0	59.7
01	192 08.9	45.9	196 08.7	8.5	10 10.7	11.1	59.7
02	207 09.0	45.0	210 36.2	8.5	9 59.6	11.2	59.7
03	222 09.1	·· 44.0	225 03.7	8.5	9 48.4	11.2	59.8
04	237 09.3	43.0	239 31.2	8.5	9 37.2	11.3	59.8
05	252 09.4	42.1	253 58.7	8.6	9 25.9	11.4	59.8
06	267 09.6	S 5 41.1	268 26.3	8.5	S 9 14.5	11.4	59.8
07	282 09.7	40.1	282 53.8	8.6	9 03.1	11.5	59.8
08	297 09.9	39.2	297 21.4	8.5	8 51.6	11.6	59.9
F 09	312 10.0	·· 38.2	311 48.9	8.6	8 40.0	11.6	59.9
R 10	327 10.2	37.2	326 16.5	8.6	8 28.4	11.7	59.9
I 11	342 10.3	36.3	340 44.1	8.6	8 16.7	11.7	59.9
D 12	357 10.4	S 5 35.3	355 11.7	8.6	S 8 05.0	11.8	60.0
A 13	12 10.6	34.3	9 39.3	8.6	7 53.2	11.9	60.0
Y 14	27 10.7	33.3	24 06.9	8.6	7 41.3	11.9	60.0
15	42 10.9	·· 32.4	38 34.5	8.7	7 29.4	12.0	60.0
16	57 11.0	31.4	53 02.2	8.6	7 17.4	12.0	60.0
17	72 11.2	30.4	67 29.8	8.7	7 05.4	12.1	60.1
18	87 11.3	S 5 29.5	81 57.5	8.6	S 6 53.3	12.1	60.1
19	102 11.5	28.5	96 25.1	8.7	6 41.2	12.1	60.1
20	117 11.6	27.5	110 52.8	8.7	6 29.1	12.2	60.1
21	132 11.8	·· 26.5	125 20.5	8.7	6 16.9	12.3	60.1
22	147 11.9	25.6	139 48.2	8.7	6 04.6	12.3	60.1
23	162 12.1	24.6	154 15.9	8.7	5 52.3	12.3	60.2
7 00	177 12.2	S 5 23.6	168 43.6	8.7	S 5 40.0	12.4	60.2
01	192 12.3	22.7	183 11.3	8.7	5 27.6	12.4	60.2
02	207 12.5	21.7	197 39.0	8.8	5 15.2	12.5	60.2
03	222 12.6	·· 20.7	212 06.8	8.7	5 02.7	12.5	60.2
04	237 12.8	19.7	226 34.5	8.7	4 50.2	12.5	60.2
05	252 12.9	18.8	241 02.2	8.8	4 37.7	12.6	60.2
06	267 13.1	S 5 17.8	255 30.0	8.7	S 4 25.1	12.6	60.3
07	282 13.2	16.8	269 57.7	8.8	4 12.5	12.6	60.3
S 08	297 13.4	15.9	284 25.5	8.7	3 59.9	12.7	60.3
A 09	312 13.5	·· 14.9	298 53.2	8.8	3 47.2	12.7	60.3
T 10	327 13.7	13.9	313 21.0	8.8	3 34.5	12.7	60.3
U 11	342 13.8	12.9	327 48.8	8.7	3 21.8	12.7	60.3
R 12	357 14.0	S 5 12.0	342 16.5	8.8	S 3 09.1	12.8	60.3
D 13	12 14.1	11.0	356 44.3	8.8	2 56.3	12.8	60.3
A 14	27 14.3	10.0	11 12.1	8.8	2 43.5	12.8	60.4
Y 15	42 14.4	·· 09.0	25 39.9	8.8	2 30.7	12.8	60.4
16	57 14.6	08.1	40 07.7	8.8	2 17.9	12.8	60.4
17	72 14.7	07.1	54 35.5	8.8	2 05.1	12.9	60.4
18	87 14.9	S 5 06.1	69 03.3	8.7	S 1 52.2	12.9	60.4
19	102 15.0	05.2	83 31.0	8.8	1 39.3	12.8	60.4
20	117 15.2	04.2	97 58.8	8.8	1 26.5	12.9	60.4
21	132 15.3	·· 03.2	112 26.6	8.8	1 13.6	12.9	60.4
22	147 15.5	02.2	126 54.4	8.8	1 00.7	13.0	60.4
23	162 15.6	01.3	141 22.2	8.8	0 47.7	12.9	60.4
	S.D. 16.1	d 1.0	S.D. 16.2		16.3		16.4

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 5	Moonrise 6	Moonrise 7	Moonrise 8
°	h m	h m	h m	h m	h m	h m	h m
N 72	04 45	06 04	07 11	08 24	08 08	07 54	07 42
N 70	04 53	06 04	07 05	08 00	07 54	07 49	07 43
68	04 59	06 04	06 59	07 41	07 43	07 44	07 44
66	05 04	06 03	06 54	07 26	07 34	07 40	07 45
64	05 08	06 03	06 51	07 14	07 26	07 37	07 46
62	05 12	06 03	06 47	07 03	07 20	07 34	07 47
60	05 15	06 03	06 44	06 54	07 14	07 31	07 47
N 58	05 17	06 02	06 42	06 46	07 09	07 29	07 48
56	05 19	06 02	06 39	06 39	07 04	07 27	07 48
54	05 21	06 02	06 37	06 33	07 00	07 25	07 49
52	05 22	06 01	06 35	06 27	06 56	07 23	07 49
50	05 24	06 01	06 33	06 22	06 53	07 22	07 49
45	05 26	06 00	06 29	06 11	06 46	07 18	07 50
N 40	05 28	05 59	06 26	06 01	06 39	07 16	07 51
35	05 29	05 58	06 23	05 53	06 34	07 13	07 51
30	05 29	05 57	06 21	05 46	06 29	07 11	07 52
20	05 28	05 54	06 16	05 34	06 21	07 07	07 53
N 10	05 26	05 51	06 12	05 23	06 14	07 04	07 54
0	05 23	05 47	06 08	05 13	06 07	07 01	07 54
S 10	05 18	05 43	06 04	05 03	06 00	06 58	07 55
20	05 11	05 37	05 59	04 52	05 53	06 54	07 56
30	05 02	05 30	05 54	04 40	05 45	06 51	07 57
35	04 56	05 26	05 51	04 32	05 40	06 49	07 58
40	04 48	05 20	05 48	04 24	05 35	06 46	07 58
45	04 38	05 14	05 44	04 15	05 28	06 43	07 59
S 50	04 26	05 06	05 39	04 03	05 20	06 40	08 00
52	04 20	05 02	05 37	03 58	05 17	06 38	08 01
54	04 13	04 58	05 34	03 52	05 13	06 37	08 01
56	04 06	04 53	05 31	03 45	05 09	06 35	08 02
58	03 57	04 47	05 28	03 37	05 04	06 33	08 03
S 60	03 46	04 41	05 25	03 29	04 58	06 30	08 03

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 5	Moonset 6	Moonset 7	Moonset 8
°	h m	h m	h m	h m	h m	h m	h m
N 72	17 14	18 21	19 41	14 47	16 57	19 04	21 09
N 70	17 20	18 21	19 33	15 10	17 09	19 06	21 04
68	17 25	18 21	19 26	15 27	17 18	19 08	20 59
66	17 30	18 21	19 21	15 41	17 25	19 10	20 55
64	17 33	18 21	19 16	15 52	17 31	19 12	20 52
62	17 37	18 21	19 13	16 02	17 37	19 13	20 49
60	17 40	18 21	19 10	16 10	17 41	19 14	20 47
N 58	17 42	18 21	19 07	16 18	17 45	19 15	20 45
56	17 44	18 22	19 05	16 24	17 49	19 16	20 43
54	17 47	18 22	19 03	16 30	17 52	19 17	20 41
52	17 48	18 22	19 01	16 35	17 55	19 17	20 40
50	17 50	18 22	19 00	16 39	17 58	19 18	20 38
45	17 54	18 23	18 57	16 49	18 04	19 19	20 35
N 40	17 57	18 24	18 56	16 57	18 08	19 20	20 33
35	18 00	18 25	18 55	17 04	18 13	19 21	20 31
30	18 02	18 26	18 54	17 11	18 16	19 22	20 29
20	18 07	18 29	18 54	17 21	18 22	19 24	20 25
N 10	18 11	18 32	18 56	17 30	18 28	19 25	20 22
0	18 15	18 35	18 59	17 39	18 33	19 26	20 20
S 10	18 19	18 40	19 04	17 47	18 38	19 27	20 17
20	18 23	18 45	19 11	17 56	18 43	19 29	20 14
30	18 28	18 52	19 20	18 07	18 49	19 30	20 11
35	18 31	18 56	19 26	18 12	18 52	19 31	20 09
40	18 34	19 01	19 34	18 19	18 56	19 31	20 06
45	18 38	19 08	19 43	18 27	19 00	19 32	20 04
S 50	18 43	19 16	19 55	18 36	19 06	19 33	20 01
52	18 45	19 19	20 01	18 40	19 08	19 34	20 00
54	18 47	19 24	20 08	18 45	19 11	19 34	19 58
56	18 50	19 28	20 15	18 50	19 13	19 35	19 56
58	18 53	19 33	20 24	18 55	19 17	19 36	19 55
S 60	18 56	19 40	20 34	19 02	19 20	19 36	19 52

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
	m s	m s	h m	h m	h m	d	
5	11 39	11 32	12 12	11 26	23 53	29	
6	11 25	11 19	12 11	12 20	24 47	00	●
7	11 11	11 04	12 11	13 14	00 47	01	

G.M.T.	ARIES	VENUS −3.4		MARS +1.4		JUPITER −2.0		SATURN +0.7		STARS		
	G.H.A.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.	Name	S.H.A.	Dec.
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	° ′
8 00	165 36.6	183 51.2	S 9 13.7	171 48.1	S 3 36.8	337 52.3	S 1 38.0	337 19.9	S 0 43.0	Acamar	315 37.2	S40 23.2
01	180 39.1	198 50.7	12.6	186 48.8	36.0	352 55.1	37.9	352 22.5	42.9	Achernar	335 45.5	S57 20.3
02	195 41.5	213 50.2	11.4	201 49.4	35.2	7 57.8	37.7	7 25.2	42.8	Acrux	173 36.2	S62 59.6
03	210 44.0	228 49.7	·· 10.3	216 50.1	·· 34.4	23 00.5	·· 37.6	22 27.8	·· 42.7	Adhara	255 31.7	S28 57.1
04	225 46.4	243 49.3	09.1	231 50.8	33.6	38 03.2	37.5	37 30.4	42.7	Aldebaran	291 17.7	N16 28.2
05	240 48.9	258 48.8	08.0	246 51.4	32.8	53 06.0	37.4	52 33.0	42.6			
06	255 51.4	273 48.3	S 9 06.8	261 52.1	S 3 32.0	68 08.7	S 1 37.3	67 35.7	S 0 42.5	Alioth	166 41.7	N56 03.6
07	270 53.8	288 47.9	05.6	276 52.8	31.3	83 11.4	37.2	82 38.3	42.4	Alkaid	153 17.9	N49 24.3
08	285 56.3	303 47.4	04.5	291 53.5	30.5	98 14.1	37.0	97 40.9	42.4	Al Na'ir	28 15.0	S47 03.2
S 09	300 58.8	318 46.9	·· 03.3	306 54.1	·· 29.7	113 16.9	·· 36.9	112 43.5	·· 42.3	Alnilam	276 11.3	S 1 13.0
U 10	316 01.2	333 46.5	02.2	321 54.8	28.9	128 19.6	36.8	127 46.2	42.2	Alphard	218 20.0	S 8 34.7
N 11	331 03.7	348 46.0	9 01.0	336 55.5	28.1	143 22.3	36.7	142 48.8	42.1			
D 12	346 06.2	3 45.5	S 8 59.9	351 56.1	S 3 27.3	158 25.0	S 1 36.6	157 51.4	S 0 42.1	Alphecca	126 31.7	N26 46.5
A 13	1 08.6	18 45.1	58.7	6 56.8	26.5	173 27.8	36.4	172 54.0	42.0	Alpheratz	358 09.3	N28 59.0
Y 14	16 11.1	33 44.6	57.5	21 57.5	25.7	188 30.5	36.3	187 56.6	41.9	Altair	62 32.4	N 8 48.9
15	31 13.6	48 44.1	·· 56.4	36 58.1	·· 24.9	203 33.2	·· 36.2	202 59.3	·· 41.8	Ankaa	353 40.3	S42 24.8
16	46 16.0	63 43.7	55.2	51 58.8	24.1	218 35.9	36.1	218 01.9	41.8	Antares	112 56.4	S26 23.3
17	61 18.5	78 43.2	54.1	66 59.5	23.3	233 38.7	36.0	233 04.5	41.7			
18	76 20.9	93 42.7	S 8 52.9	82 00.2	S 3 22.5	248 41.4	S 1 35.9	248 07.1	S 0 41.6	Arcturus	146 18.0	N19 16.7
19	91 23.4	108 42.3	51.7	97 00.8	21.8	263 44.1	35.7	263 09.8	41.5	Atria	108 20.3	S68 59.3
20	106 25.9	123 41.8	50.6	112 01.5	21.0	278 46.9	35.6	278 12.4	41.5	Avior	234 27.6	S59 27.2
21	121 28.3	138 41.4	·· 49.4	127 02.2	·· 20.2	293 49.6	·· 35.5	293 15.0	·· 41.4	Bellatrix	278 58.4	N 6 19.8
22	136 30.8	153 40.9	48.2	142 02.8	19.4	308 52.3	35.4	308 17.6	41.3	Betelgeuse	271 27.9	N 7 24.1
23	151 33.3	168 40.4	47.1	157 03.5	18.6	323 55.0	35.3	323 20.3	41.2			
9 00	166 35.7	183 40.0	S 8 45.9	172 04.2	S 3 17.8	338 57.8	S 1 35.1	338 22.9	S 0 41.2	Canopus	264 06.9	S52 41.5
01	181 38.2	198 39.5	44.8	187 04.9	17.0	354 00.5	35.0	353 25.5	41.1	Capella	281 10.8	N45 58.8
02	196 40.7	213 39.0	43.6	202 05.5	16.2	9 03.2	34.9	8 28.2	41.0	Deneb	49 48.6	N45 12.5
03	211 43.1	228 38.6	·· 42.4	217 06.2	·· 15.4	24 05.9	·· 34.8	23 30.8	·· 40.9	Denebola	182 58.4	N14 40.6
04	226 45.6	243 38.1	41.3	232 06.9	14.6	39 08.7	34.7	38 33.4	40.9	Diphda	349 20.9	S18 05.6
05	241 48.1	258 37.7	40.1	247 07.6	13.8	54 11.4	34.5	53 36.0	40.8			
06	256 50.5	273 37.2	S 8 38.9	262 08.2	S 3 13.0	69 14.1	S 1 34.4	68 38.7	S 0 40.7	Dubhe	194 21.1	N61 51.2
07	271 53.0	288 36.7	37.8	277 08.9	12.3	84 16.9	34.3	83 41.3	40.6	Elnath	278 43.7	N28 35.5
08	286 55.4	303 36.3	36.6	292 09.6	11.5	99 19.6	34.2	98 43.9	40.6	Eltanin	90 57.7	N51 29.2
M 09	301 57.9	318 35.8	·· 35.4	307 10.2	·· 10.7	114 22.3	·· 34.1	113 46.5	·· 40.5	Enif	34 11.6	N 9 47.1
O 10	317 00.4	333 35.4	34.3	322 10.9	09.9	129 25.0	34.0	128 49.2	40.4	Fomalhaut	15 51.4	S29 43.5
N 11	332 02.8	348 34.9	33.1	337 11.6	09.1	144 27.8	33.8	143 51.8	40.3			
D 12	347 05.3	3 34.4	S 8 31.9	352 12.3	S 3 08.3	159 30.5	S 1 33.7	158 54.4	S 0 40.3	Gacrux	172 27.8	S57 00.4
A 13	2 07.8	18 34.0	30.8	7 12.9	07.5	174 33.2	33.6	173 57.0	40.2	Gienah	176 17.3	S17 26.3
Y 14	17 10.2	33 33.5	29.6	22 13.6	06.7	189 36.0	33.5	188 59.7	40.1	Hadar	149 22.4	S60 16.7
15	32 12.7	48 33.1	·· 28.4	37 14.3	·· 05.9	204 38.7	·· 33.4	204 02.3	·· 40.0	Hamal	328 28.8	N23 22.3
16	47 15.2	63 32.6	27.2	52 15.0	05.1	219 41.4	33.2	219 04.9	40.0	Kaus Aust.	84 16.5	S34 23.6
17	62 17.6	78 32.2	26.1	67 15.6	04.3	234 44.2	33.1	234 07.5	39.9			
18	77 20.1	93 31.7	S 8 24.9	82 16.3	S 3 03.5	249 46.9	S 1 33.0	249 10.2	S 0 39.8	Kochab	137 18.4	N74 13.8
19	92 22.5	108 31.2	23.7	97 17.0	02.7	264 49.6	32.9	264 12.8	39.7	Markab	14 03.2	N15 06.0
20	107 25.0	123 30.8	22.6	112 17.7	02.0	279 52.3	32.8	279 15.4	39.6	Menkar	314 41.0	N 4 00.8
21	122 27.5	138 30.3	·· 21.4	127 18.3	·· 01.2	294 55.1	·· 32.6	294 18.0	·· 39.6	Menkent	148 36.4	S36 16.5
22	137 29.9	153 29.9	20.2	142 19.0	3 00.4	309 57.8	32.5	309 20.7	39.5	Miaplacidus	221 44.1	S69 38.6
23	152 32.4	168 29.4	19.0	157 19.7	2 59.6	325 00.5	32.4	324 23.3	39.4			
10 00	167 34.9	183 29.0	S 8 17.9	172 20.3	S 2 58.8	340 03.3	S 1 32.3	339 25.9	S 0 39.3	Mirfak	309 15.9	N49 47.7
01	182 37.3	198 28.5	16.7	187 21.0	58.0	355 06.0	32.2	354 28.6	39.3	Nunki	76 28.9	S26 19.2
02	197 39.8	213 28.1	15.5	202 21.7	57.2	10 08.7	32.0	9 31.2	39.2	Peacock	53 58.3	S56 47.7
03	212 42.3	228 27.6	·· 14.3	217 22.4	·· 56.4	25 11.5	·· 31.9	24 33.8	·· 39.1	Pollux	243 57.6	N28 04.3
04	227 44.7	243 27.2	13.2	232 23.0	55.6	40 14.2	31.8	39 36.4	39.0	Procyon	245 25.3	N 5 16.3
05	242 47.2	258 26.7	12.0	247 23.7	54.8	55 16.9	31.7	54 39.1	39.0			
06	257 49.7	273 26.3	S 8 10.8	262 24.4	S 2 54.0	70 19.7	S 1 31.6	69 41.7	S 0 38.9	Rasalhague	96 29.3	N12 34.3
07	272 52.1	288 25.8	09.6	277 25.1	53.2	85 22.4	31.4	84 44.3	38.8	Regulus	208 09.4	N12 03.5
08	287 54.6	303 25.3	08.5	292 25.7	52.4	100 25.1	31.3	99 46.9	38.7	Rigel	281 35.7	S 8 13.6
T 09	302 57.0	318 24.9	·· 07.3	307 26.4	·· 51.7	115 27.9	·· 31.2	114 49.6	·· 38.7	Rigil Kent.	140 25.0	S60 45.2
U 10	317 59.5	333 24.4	06.1	322 27.1	50.9	130 30.6	31.1	129 52.2	38.6	Sabik	102 40.8	S15 42.1
E 11	333 02.0	348 24.0	04.9	337 27.8	50.1	145 33.3	30.9	144 54.8	38.5			
S 12	348 04.4	3 23.5	S 8 03.8	352 28.4	S 2 49.3	160 36.1	S 1 30.8	159 57.5	S 0 38.4	Schedar	350 09.2	N56 26.0
D 13	3 06.9	18 23.1	02.6	7 29.1	48.5	175 38.8	30.7	175 00.1	38.4	Shaula	96 55.4	S37 05.3
A 14	18 09.4	33 22.6	01.4	22 29.8	47.7	190 41.5	30.6	190 02.7	38.3	Sirius	258 55.3	S16 41.7
Y 15	33 11.8	48 22.2	8 00.2	37 30.5	·· 46.9	205 44.3	·· 30.5	205 05.3	·· 38.2	Spica	158 56.9	S11 03.8
16	48 14.3	63 21.7	7 59.0	52 31.1	46.1	220 47.0	30.3	220 08.0	38.1	Suhail	223 10.2	S43 21.6
17	63 16.8	78 21.3	57.9	67 31.8	45.3	235 49.7	30.2	235 10.6	38.1			
18	78 19.2	93 20.9	S 7 56.7	82 32.5	S 2 44.5	250 52.5	S 1 30.1	250 13.2	S 0 38.0	Vega	80 55.8	N38 45.7
19	93 21.7	108 20.4	55.5	97 33.2	43.7	265 55.2	30.0	265 15.9	37.9	Zuben'ubi	137 32.5	S15 57.8
20	108 24.2	123 20.0	54.3	112 33.8	42.9	280 57.9	29.9	280 18.5	37.8			
21	123 26.6	138 19.5	·· 53.1	127 34.5	·· 42.1	296 00.7	·· 29.7	295 21.1	·· 37.7		S.H.A.	Mer. Pass.
22	138 29.1	153 19.1	52.0	142 35.2	41.3	311 03.4	29.6	310 23.7	37.7		° ′	h m
23	153 31.5	168 18.6	50.8	157 35.9	40.6	326 06.1	29.5	325 26.4	37.6	Venus	17 04.2	11 46
	h m									Mars	5 28.5	12 31
Mer. Pass.	12 51.5	v −0.5	d 1.2	v 0.7	d 0.8	v 2.7	d 0.1	v 2.6	d 0.1	Jupiter	172 22.0	1 24
										Saturn	171 47.2	1 26

G.M.T.	SUN G.H.A.	SUN Dec.	MOON G.H.A.	MOON v	MOON Dec.	MOON d	MOON H.P.
d h	° ′	° ′	° ′	′	° ′	′	′
8 00	177 15.8	S 5 00.3	155 50.0	8.8	S 0 34.8	12.9	60.4
01	192 15.9	4 59.3	170 17.8	8.8	0 21.9	12.9	60.4
02	207 16.1	58.3	184 45.6	8.7	S 0 09.0	13.0	60.4
03	222 16.2	·· 57.4	199 13.3	8.8	N 0 04.0	12.9	60.4
04	237 16.4	56.4	213 41.1	8.8	0 16.9	12.9	60.4
05	252 16.6	55.4	228 08.9	8.8	0 29.8	13.0	60.4
06	267 16.7	S 4 54.4	242 36.7	8.7	N 0 42.8	12.9	60.4
07	282 16.9	53.5	257 04.4	8.8	0 55.7	12.9	60.5
08	297 17.0	52.5	271 32.2	8.8	1 08.6	12.9	60.5
S 09	312 17.2	·· 51.5	286 00.0	8.7	1 21.5	12.9	60.5
U 10	327 17.3	50.5	300 27.7	8.8	1 34.4	12.9	60.5
N 11	342 17.5	49.6	314 55.5	8.7	1 47.3	12.9	60.5
D 12	357 17.6	S 4 48.6	329 23.2	8.7	N 2 00.2	12.9	60.5
A 13	12 17.8	47.6	343 50.9	8.8	2 13.1	12.8	60.5
Y 14	27 17.9	46.6	358 18.7	8.7	2 25.9	12.9	60.5
15	42 18.1	·· 45.7	12 46.4	8.7	2 38.8	12.8	60.5
16	57 18.2	44.7	27 14.1	8.7	2 51.6	12.8	60.5
17	72 18.4	43.7	41 41.8	8.7	3 04.4	12.8	60.5
18	87 18.6	S 4 42.7	56 09.5	8.7	N 3 17.2	12.8	60.5
19	102 18.7	41.8	70 37.2	8.6	3 30.0	12.7	60.4
20	117 18.9	40.8	85 04.8	8.7	3 42.7	12.7	60.4
21	132 19.0	·· 39.8	99 32.5	8.6	3 55.4	12.7	60.4
22	147 19.2	38.8	114 00.1	8.7	4 08.1	12.7	60.4
23	162 19.3	37.8	128 27.8	8.6	4 20.8	12.6	60.4
9 00	177 19.5	S 4 36.9	142 55.4	8.6	N 4 33.4	12.6	60.4
01	192 19.6	35.9	157 23.0	8.6	4 46.0	12.6	60.4
02	207 19.8	34.9	171 50.6	8.6	4 58.6	12.5	60.4
03	222 20.0	·· 33.9	186 18.2	8.6	5 11.1	12.5	60.4
04	237 20.1	33.0	200 45.8	8.5	5 23.6	12.5	60.4
05	252 20.3	32.0	215 13.3	8.6	5 36.1	12.4	60.4
06	267 20.4	S 4 31.0	229 40.9	8.5	N 5 48.5	12.4	60.4
07	282 20.6	30.0	244 08.4	8.5	6 00.9	12.3	60.4
08	297 20.7	29.1	258 35.9	8.5	6 13.2	12.3	60.4
M 09	312 20.9	·· 28.1	273 03.4	8.5	6 25.5	12.3	60.4
O 10	327 21.1	27.1	287 30.9	8.5	6 37.8	12.2	60.4
N 11	342 21.2	26.1	301 58.4	8.5	6 50.0	12.2	60.4
D 12	357 21.4	S 4 25.1	316 25.9	8.4	N 7 02.2	12.1	60.3
A 13	12 21.5	24.2	330 53.3	8.4	7 14.3	12.1	60.3
Y 14	27 21.7	23.2	345 20.7	8.4	7 26.4	12.0	60.3
15	42 21.8	·· 22.2	359 48.1	8.4	7 38.4	12.0	60.3
16	57 22.0	21.2	14 15.5	8.4	7 50.4	11.9	60.3
17	72 22.2	20.2	28 42.9	8.3	8 02.3	11.9	60.3
18	87 22.3	S 4 19.3	43 10.2	8.3	N 8 14.2	11.8	60.3
19	102 22.5	18.3	57 37.5	8.3	8 26.0	11.7	60.3
20	117 22.6	17.3	72 04.8	8.3	8 37.7	11.7	60.3
21	132 22.8	·· 16.3	86 32.1	8.3	8 49.4	11.6	60.2
22	147 23.0	15.4	100 59.4	8.3	9 01.0	11.6	60.2
23	162 23.1	14.4	115 26.7	8.2	9 12.6	11.5	60.2
10 00	177 23.3	S 4 13.4	129 53.9	8.2	N 9 24.1	11.4	60.2
01	192 23.4	12.4	144 21.1	8.2	9 35.5	11.4	60.2
02	207 23.6	11.4	158 48.3	8.2	9 46.9	11.3	60.2
03	222 23.7	·· 10.5	173 15.5	8.1	9 58.2	11.3	60.2
04	237 23.9	09.5	187 42.6	8.1	10 09.5	11.1	60.1
05	252 24.1	08.5	202 09.7	8.1	10 20.6	11.1	60.1
06	267 24.2	S 4 07.5	216 36.8	8.1	N10 31.7	11.1	60.1
07	282 24.4	06.5	231 03.9	8.1	10 42.8	10.9	60.1
08	297 24.6	05.6	245 31.0	8.0	10 53.7	10.9	60.1
T 09	312 24.7	·· 04.6	259 58.0	8.0	11 04.6	10.8	60.1
U 10	327 24.9	03.6	274 25.0	8.0	11 15.4	10.7	60.1
E 11	342 25.0	02.6	288 52.0	8.0	11 26.1	10.7	60.0
S 12	357 25.2	S 4 01.6	303 19.0	7.9	N11 36.8	10.6	60.0
D 13	12 25.4	4 00.7	317 45.9	8.0	11 47.4	10.5	60.0
A 14	27 25.5	3 59.7	332 12.9	7.9	11 57.9	10.4	60.0
Y 15	42 25.7	·· 58.7	346 39.8	7.9	12 08.3	10.3	60.0
16	57 25.8	57.7	1 06.7	7.8	12 18.6	10.3	59.9
17	72 26.0	56.7	15 33.5	7.9	12 28.9	10.1	59.9
18	87 26.2	S 3 55.8	30 00.4	7.8	N12 39.0	10.1	59.9
19	102 26.3	54.8	44 27.2	7.8	12 49.1	10.0	59.9
20	117 26.5	53.8	58 54.0	7.7	12 59.1	9.9	59.9
21	132 26.7	·· 52.8	73 20.7	7.8	13 09.0	9.8	59.9
22	147 26.8	51.8	87 47.5	7.7	13 18.8	9.7	59.8
23	162 27.0	50.8	102 14.2	7.7	13 28.5	9.7	59.8
	S.D. 16.1	d 1.0	S.D. 16.5		16.4		16.4

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 8	Moonrise 9	Moonrise 10	Moonrise 11
°	h m	h m	h m	h m	h m	h m	h m
N 72	04 29	05 49	06 56	07 42	07 30	07 16	06 57
N 70	04 38	05 50	06 51	07 43	07 38	07 33	07 27
68	04 46	05 51	06 47	07 44	07 45	07 46	07 49
66	04 52	05 52	06 43	07 45	07 51	07 57	08 07
64	04 58	05 53	06 40	07 46	07 55	08 07	08 21
62	05 02	05 54	06 38	07 47	08 00	08 15	08 33
60	05 06	05 54	06 35	07 47	08 03	08 22	08 44
N 58	05 09	05 54	06 33	07 48	08 07	08 28	08 53
56	05 11	05 55	06 31	07 48	08 10	08 33	09 01
54	05 14	05 55	06 30	07 49	08 12	08 38	09 08
52	05 16	05 55	06 28	07 49	08 15	08 43	09 14
50	05 17	05 55	06 27	07 49	08 17	08 47	09 20
45	05 21	05 55	06 24	07 50	08 22	08 56	09 33
N 40	05 23	05 54	06 21	07 51	08 26	09 03	09 43
35	05 25	05 54	06 19	07 51	08 30	09 10	09 52
30	05 26	05 53	06 17	07 52	08 33	09 15	10 00
20	05 26	05 52	06 14	07 53	08 38	09 25	10 14
N 10	05 25	05 49	06 10	07 54	08 43	09 34	10 26
0	05 22	05 47	06 07	07 54	08 48	09 42	10 38
S 10	05 18	05 43	06 04	07 55	08 53	09 51	10 49
20	05 13	05 38	06 00	07 56	08 58	10 00	11 01
30	05 04	05 32	05 56	07 57	09 04	10 10	11 16
35	04 58	05 28	05 54	07 58	09 07	10 16	11 24
40	04 51	05 24	05 51	07 58	09 11	10 23	11 33
45	04 43	05 18	05 48	07 59	09 15	10 31	11 44
S 50	04 32	05 11	05 44	08 00	09 21	10 40	11 58
52	04 26	05 08	05 42	08 01	09 23	10 45	12 04
54	04 20	05 04	05 40	08 01	09 26	10 50	12 11
56	04 13	05 00	05 38	08 02	09 29	10 55	12 19
58	04 05	04 55	05 35	08 03	09 32	11 01	12 28
S 60	03 56	04 49	05 32	08 03	09 36	11 08	12 38

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 8	Moonset 9	Moonset 10	Moonset 11
°	h m	h m	h m	h m	h m	h m	h m
N 72	17 28	18 35	19 56	21 09	23 17	25 31	01 31
N 70	17 32	18 33	19 46	21 04	23 02	25 03	01 03
68	17 36	18 32	19 38	20 59	22 50	24 42	00 42
66	17 40	18 31	19 31	20 55	22 41	24 25	00 25
64	17 43	18 30	19 26	20 52	22 33	24 12	00 12
62	17 45	18 29	19 21	20 49	22 26	24 00	00 00
60	17 47	18 29	19 17	20 47	22 20	23 51	25 18
N 58	17 49	18 28	19 14	20 45	22 14	23 42	25 06
56	17 51	18 28	19 11	20 43	22 10	23 35	24 56
54	17 52	18 28	19 09	20 41	22 06	23 28	24 48
52	17 54	18 27	19 07	20 40	22 02	23 23	24 40
50	17 55	18 27	19 05	20 38	21 59	23 17	24 33
45	17 58	18 27	19 01	20 35	21 51	23 06	24 18
N 40	18 00	18 27	18 59	20 33	21 45	22 56	24 06
35	18 02	18 28	18 57	20 31	21 40	22 48	23 55
30	18 04	18 28	18 56	20 29	21 35	22 41	23 46
20	18 08	18 30	18 55	20 25	21 27	22 29	23 31
N 10	18 11	18 32	18 56	20 22	21 20	22 18	23 17
0	18 14	18 35	18 59	20 20	21 14	22 08	23 04
S 10	18 17	18 38	19 03	20 17	21 07	21 59	22 52
20	18 20	18 42	19 08	20 14	21 00	21 48	22 38
30	18 24	18 48	19 17	20 11	20 52	21 36	22 22
35	18 27	18 52	19 22	20 09	20 48	21 29	22 13
40	18 29	18 57	19 29	20 06	20 43	21 21	22 03
45	18 33	19 02	19 37	20 04	20 37	21 12	21 51
S 50	18 36	19 09	19 48	20 01	20 30	21 01	21 37
52	18 38	19 12	19 54	20 00	20 26	20 56	21 30
54	18 40	19 16	20 00	19 58	20 23	20 50	21 22
56	18 42	19 20	20 06	19 56	20 19	20 44	21 14
58	18 45	19 25	20 14	19 55	20 14	20 37	21 05
S 60	18 47	19 30	20 23	19 52	20 09	20 29	20 54

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
	m s	m s	h m	h m	h m	d	
8	10 57	10 50	12 11	14 07	01 40	02	
9	10 42	10 35	12 11	15 01	02 34	03	
10	10 27	10 20	12 10	15 55	03 28	04	

	G.M.T.	ARIES	VENUS −3.4		MARS +1.3		JUPITER −2.0		SATURN +0.7	
		G.H.A.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.
	d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
	11 00	168 34.0	183 18.2	S 7 49.6	172 36.6	S 2 39.8	341 08.9	S 1 29.4	340 29.0	S 0 37.5
	01	183 36.5	198 17.7	48.4	187 37.2	39.0	356 11.6	29.3	355 31.6	37.4
	02	198 38.9	213 17.3	47.2	202 37.9	38.2	11 14.3	29.1	10 34.3	37.4
	03	213 41.4	228 16.8	·· 46.1	217 38.6	·· 37.4	26 17.1	·· 29.0	25 36.9	·· 37.3
	04	228 43.9	243 16.4	44.9	232 39.3	36.6	41 19.8	28.9	40 39.5	37.2
	05	243 46.3	258 15.9	43.7	247 39.9	35.8	56 22.5	28.8	55 42.1	37.1
	06	258 48.8	273 15.5	S 7 42.5	262 40.6	S 2 35.0	71 25.3	S 1 28.6	70 44.8	S 0 37.1
	07	273 51.3	288 15.1	41.3	277 41.3	34.2	86 28.0	28.5	85 47.4	37.0
W	08	288 53.7	303 14.6	40.1	292 42.0	33.4	101 30.7	28.4	100 50.0	36.9
E	09	303 56.2	318 14.2	·· 38.9	307 42.6	·· 32.6	116 33.5	·· 28.3	115 52.7	·· 36.8
D	10	318 58.6	333 13.7	37.8	322 43.3	31.8	131 36.2	28.2	130 55.3	36.8
N	11	334 01.1	348 13.3	36.6	337 44.0	31.0	146 38.9	28.0	145 57.9	36.7
E	12	349 03.6	3 12.8	S 7 35.4	352 44.7	S 2 30.2	161 41.7	S 1 27.9	161 00.5	S 0 36.6
S	13	4 06.0	18 12.4	34.2	7 45.4	29.4	176 44.4	27.8	176 03.2	36.5
D	14	19 08.5	33 12.0	33.0	22 46.0	28.7	191 47.2	27.7	191 05.8	36.4
A	15	34 11.0	48 11.5	·· 31.8	37 46.7	·· 27.9	206 49.9	·· 27.5	206 08.4	·· 36.4
Y	16	49 13.4	63 11.1	30.6	52 47.4	27.1	221 52.6	27.4	221 11.1	36.3
	17	64 15.9	78 10.6	29.5	67 48.1	26.3	236 55.4	27.3	236 13.7	36.2
	18	79 18.4	93 10.2	S 7 28.3	82 48.7	S 2 25.5	251 58.1	S 1 27.2	251 16.3	S 0 36.1
	19	94 20.8	108 09.8	27.1	97 49.4	24.7	267 00.8	27.1	266 19.0	36.1
	20	109 23.3	123 09.3	25.9	112 50.1	23.9	282 03.6	26.9	281 21.6	36.0
	21	124 25.8	138 08.9	·· 24.7	127 50.8	·· 23.1	297 06.3	·· 26.8	296 24.2	·· 35.9
	22	139 28.2	153 08.4	23.5	142 51.5	22.3	312 09.0	26.7	311 26.8	35.8
	23	154 30.7	168 08.0	22.3	157 52.1	21.5	327 11.8	26.6	326 29.5	35.8
	12 00	169 33.1	183 07.6	S 7 21.1	172 52.8	S 2 20.7	342 14.5	S 1 26.4	341 32.1	S 0 35.7
	01	184 35.6	198 07.1	19.9	187 53.5	19.9	357 17.3	26.3	356 34.7	35.6
	02	199 38.1	213 06.7	18.7	202 54.2	19.1	12 20.0	26.2	11 37.4	35.5
	03	214 40.5	228 06.2	·· 17.6	217 54.8	·· 18.3	27 22.7	·· 26.1	26 40.0	·· 35.4
	04	229 43.0	243 05.8	16.4	232 55.5	17.6	42 25.5	26.0	41 42.6	35.4
	05	244 45.5	258 05.4	15.2	247 56.2	16.8	57 28.2	25.8	56 45.3	35.3
	06	259 47.9	273 04.9	S 7 14.0	262 56.9	S 2 16.0	72 31.0	S 1 25.7	71 47.9	S 0 35.2
	07	274 50.4	288 04.5	12.8	277 57.6	15.2	87 33.7	25.6	86 50.5	35.1
T	08	289 52.9	303 04.1	11.6	292 58.2	14.4	102 36.4	25.5	101 53.2	35.1
H	09	304 55.3	318 03.6	·· 10.4	307 58.9	·· 13.6	117 39.2	·· 25.3	116 55.8	·· 35.0
U	10	319 57.8	333 03.2	09.2	322 59.6	12.8	132 41.9	25.2	131 58.4	34.9
R	11	335 00.3	348 02.7	08.0	338 00.3	12.0	147 44.6	25.1	147 01.0	34.8
S	12	350 02.7	3 02.3	S 7 06.8	353 01.0	S 2 11.2	162 47.4	S 1 25.0	162 03.7	S 0 34.8
D	13	5 05.2	18 01.9	05.6	8 01.6	10.4	177 50.1	24.9	177 06.3	34.7
A	14	20 07.6	33 01.4	04.4	23 02.3	09.6	192 52.9	24.7	192 08.9	34.6
Y	15	35 10.1	48 01.0	·· 03.2	38 03.0	·· 08.8	207 55.6	·· 24.6	207 11.6	·· 34.5
	16	50 12.6	63 00.6	02.0	53 03.7	08.0	222 58.3	24.5	222 14.2	34.4
	17	65 15.0	78 00.1	7 00.8	68 04.3	07.2	238 01.1	24.4	237 16.8	34.4
	18	80 17.5	92 59.7	S 6 59.6	83 05.0	S 2 06.4	253 03.8	S 1 24.2	252 19.5	S 0 34.3
	19	95 20.0	107 59.3	58.4	98 05.7	05.6	268 06.6	24.1	267 22.1	34.2
	20	110 22.4	122 58.8	57.2	113 06.4	04.9	283 09.3	24.0	282 24.7	34.1
	21	125 24.9	137 58.4	·· 56.1	128 07.1	·· 04.1	298 12.0	·· 23.9	297 27.4	·· 34.1
	22	140 27.4	152 58.0	54.9	143 07.7	03.3	313 14.8	23.7	312 30.0	34.0
	23	155 29.8	167 57.5	53.7	158 08.4	02.5	328 17.5	23.6	327 32.6	33.9
	13 00	170 32.3	182 57.1	S 6 52.5	173 09.1	S 2 01.7	343 20.3	S 1 23.5	342 35.3	S 0 33.8
	01	185 34.7	197 56.7	51.3	188 09.8	00.9	358 23.0	23.4	357 37.9	33.8
	02	200 37.2	212 56.3	50.1	203 10.5	2 00.1	13 25.7	23.3	12 40.5	33.7
	03	215 39.7	227 55.8	·· 48.9	218 11.1	1 59.3	28 28.5	·· 23.1	27 43.1	·· 33.6
	04	230 42.1	242 55.4	47.7	233 11.8	58.5	43 31.2	23.0	42 45.8	33.5
	05	245 44.6	257 55.0	46.5	248 12.5	57.7	58 34.0	22.9	57 48.4	33.4
	06	260 47.1	272 54.5	S 6 45.3	263 13.2	S 1 56.9	73 36.7	S 1 22.8	72 51.0	S 0 33.4
	07	275 49.5	287 54.1	44.1	278 13.9	56.1	88 39.4	22.6	87 53.7	33.3
	08	290 52.0	302 53.7	42.9	293 14.6	55.3	103 42.2	22.5	102 56.3	33.2
F	09	305 54.5	317 53.2	·· 41.7	308 15.2	·· 54.5	118 44.9	·· 22.4	117 58.9	·· 33.1
R	10	320 56.9	332 52.8	40.5	323 15.9	53.7	133 47.7	22.3	133 01.6	33.1
I	11	335 59.4	347 52.4	39.3	338 16.6	53.0	148 50.4	22.1	148 04.2	33.0
D	12	351 01.9	2 52.0	S 6 38.1	353 17.3	S 1 52.2	163 53.2	S 1 22.0	163 06.8	S 0 32.9
A	13	6 04.3	17 51.5	36.9	8 18.0	51.4	178 55.9	21.9	178 09.5	32.8
Y	14	21 06.8	32 51.1	35.7	23 18.6	50.6	193 58.6	21.8	193 12.1	32.7
	15	36 09.2	47 50.7	·· 34.4	38 19.3	·· 49.8	209 01.4	·· 21.6	208 14.7	·· 32.7
	16	51 11.7	62 50.2	33.2	53 20.0	49.0	224 04.1	21.5	223 17.4	32.6
	17	66 14.2	77 49.8	32.0	68 20.7	48.2	239 06.9	21.4	238 20.0	32.5
	18	81 16.6	92 49.4	S 6 30.8	83 21.4	S 1 47.4	254 09.6	S 1 21.3	253 22.6	S 0 32.4
	19	96 19.1	107 49.0	29.6	98 22.0	46.6	269 12.4	21.1	268 25.3	32.4
	20	111 21.6	122 48.5	28.4	113 22.7	45.8	284 15.1	21.0	283 27.9	32.3
	21	126 24.0	137 48.1	·· 27.2	128 23.4	·· 45.0	299 17.8	·· 20.9	298 30.5	·· 32.2
	22	141 26.5	152 47.7	26.0	143 24.1	44.2	314 20.6	20.8	313 33.2	32.1
	23	156 29.0	167 47.3	24.8	158 24.8	43.4	329 23.3	20.7	328 35.8	32.0
	Mer. Pass.	h m 12 39.7	v −0.4	d 1.2	v 0.7	d 0.8	v 2.7	d 0.1	v 2.6	d 0.1

STARS		
Name	S.H.A.	Dec.
	° ′	° ′
Acamar	315 37.2	S40 23.2
Achernar	335 45.5	S57 20.3
Acrux	173 36.2	S62 59.6
Adhara	255 31.7	S28 57.1
Aldebaran	291 17.7	N16 28.2
Alioth	166 41.7	N56 03.6
Alkaid	153 17.9	N49 24.3
Al Na'ir	28 15.0	S47 03.2
Alnilam	276 11.3	S 1 13.0
Alphard	218 20.0	S 8 34.7
Alphecca	126 31.7	N26 46.5
Alpheratz	358 09.3	N28 59.0
Altair	62 32.4	N 8 48.9
Ankaa	353 40.3	S42 24.7
Antares	112 56.4	S26 23.3
Arcturus	146 17.9	N19 16.7
Atria	108 20.3	S68 59.3
Avior	234 27.6	S59 27.2
Bellatrix	278 58.4	N 6 19.8
Betelgeuse	271 27.9	N 7 24.1
Canopus	264 06.9	S52 41.5
Capella	281 10.8	N45 58.8
Deneb	49 48.6	N45 12.5
Denebola	182 58.4	N14 40.6
Diphda	349 20.9	S18 05.6
Dubhe	194 21.1	N61 51.2
Elnath	278 43.7	N28 35.5
Eltanin	90 57.7	N51 29.2
Enif	34 11.6	N 9 47.1
Fomalhaut	15 51.4	S29 43.5
Gacrux	172 27.8	S57 00.4
Gienah	176 17.3	S17 26.3
Hadar	149 22.4	S60 16.7
Hamal	328 28.8	N23 22.3
Kaus Aust.	84 16.5	S34 23.5
Kochab	137 18.3	N74 13.8
Markab	14 03.2	N15 06.0
Menkar	314 41.0	N 4 00.8
Menkent	148 36.3	S36 16.5
Miaplacidus	221 44.1	S69 38.6
Mirfak	309 15.9	N49 47.7
Nunki	76 28.9	S26 19.2
Peacock	53 58.3	S56 47.7
Pollux	243 57.6	N28 04.3
Procyon	245 25.3	N 5 16.3
Rasalhague	96 29.3	N12 34.3
Regulus	208 09.4	N12 03.5
Rigel	281 35.7	S 8 13.6
Rigil Kent.	140 25.0	S60 45.2
Sabik	102 40.7	S15 42.1
Schedar	350 09.2	N56 26.0
Shaula	96 55.3	S37 05.3
Sirius	258 55.3	S16 41.7
Spica	158 56.9	S11 03.8
Suhail	223 10.2	S43 21.6
Vega	80 55.7	N38 45.7
Zuben'ubi	137 32.5	S15 57.8

	S.H.A.	Mer. Pass
	° ′	h m
Venus	13 34.4	11 48
Mars	3 19.7	12 28
Jupiter	172 41.4	1 11
Saturn	171 59.0	1 14

G.M.T.	SUN G.H.A.	SUN Dec.	MOON G.H.A.	MOON v	MOON Dec.	MOON d	MOON H.P.
d h	° ′	° ′	° ′	′	° ′	′	′
11 00	177 27.1	S 3 49.9	116 40.9	7.7	N13 38.2	9.5	59.8
01	192 27.3	48.9	131 07.6	7.6	13 47.7	9.4	59.8
02	207 27.5	47.9	145 34.2	7.7	13 57.1	9.4	59.8
03	222 27.6	·· 46.9	160 00.9	7.6	14 06.5	9.3	59.7
04	237 27.8	45.9	174 27.5	7.6	14 15.8	9.1	59.7
05	252 28.0	45.0	188 54.1	7.5	14 24.9	9.1	59.7
06	267 28.1	S 3 44.0	203 20.6	7.6	N14 34.0	9.0	59.7
07	282 28.3	43.0	217 47.2	7.5	14 43.0	8.8	59.7
W 08	297 28.5	42.0	232 13.7	7.5	14 51.8	8.8	59.6
E 09	312 28.6	·· 41.0	246 40.2	7.5	15 00.6	8.7	59.6
D 10	327 28.8	40.0	261 06.7	7.5	15 09.3	8.5	59.6
N 11	342 28.9	39.1	275 33.2	7.4	15 17.8	8.5	59.6
E 12	357 29.1	S 3 38.1	289 59.6	7.4	N15 26.3	8.3	59.5
S 13	12 29.3	37.1	304 26.0	7.5	15 34.6	8.3	59.5
D 14	27 29.4	36.1	318 52.5	7.3	15 42.9	8.1	59.5
A 15	42 29.6	·· 35.1	333 18.8	7.4	15 51.0	8.1	59.5
Y 16	57 29.8	34.2	347 45.2	7.4	15 59.1	7.9	59.5
17	72 29.9	33.2	2 11.6	7.3	16 07.0	7.8	59.4
18	87 30.1	S 3 32.2	16 37.9	7.3	N16 14.8	7.8	59.4
19	102 30.3	31.2	31 04.2	7.3	16 22.6	7.6	59.4
20	117 30.4	30.2	45 30.5	7.3	16 30.2	7.5	59.4
21	132 30.6	·· 29.2	59 56.8	7.2	16 37.7	7.4	59.3
22	147 30.8	28.3	74 23.0	7.3	16 45.1	7.3	59.3
23	162 30.9	27.3	88 49.3	7.2	16 52.4	7.1	59.3
12 00	177 31.1	S 3 26.3	103 15.5	7.2	N16 59.5	7.1	59.3
01	192 31.3	25.3	117 41.7	7.2	17 06.6	6.9	59.2
02	207 31.4	24.3	132 07.9	7.2	17 13.5	6.8	59.2
03	222 31.6	·· 23.3	146 34.1	7.2	17 20.3	6.8	59.2
04	237 31.8	22.4	161 00.3	7.1	17 27.1	6.6	59.2
05	252 31.9	21.4	175 26.4	7.2	17 33.7	6.4	59.1
06	267 32.1	S 3 20.4	189 52.6	7.1	N17 40.1	6.4	59.1
07	282 32.3	19.4	204 18.7	7.1	17 46.5	6.3	59.1
T 08	297 32.4	18.4	218 44.8	7.1	17 52.8	6.1	59.1
H 09	312 32.6	·· 17.4	233 10.9	7.1	17 58.9	6.0	59.0
U 10	327 32.8	16.5	247 37.0	7.1	18 04.9	5.9	59.0
R 11	342 32.9	15.5	262 03.1	7.1	18 10.8	5.8	59.0
S 12	357 33.1	S 3 14.5	276 29.2	7.1	N18 16.6	5.6	59.0
D 13	12 33.3	13.5	290 55.3	7.0	18 22.2	5.6	58.9
A 14	27 33.4	12.5	305 21.3	7.1	18 27.8	5.4	58.9
Y 15	42 33.6	·· 11.5	319 47.4	7.0	18 33.2	5.3	58.9
16	57 33.8	10.6	334 13.4	7.1	18 38.5	5.1	58.9
17	72 34.0	09.6	348 39.5	7.0	18 43.6	5.1	58.8
18	87 34.1	S 3 08.6	3 05.5	7.0	N18 48.7	4.9	58.8
19	102 34.3	07.6	17 31.5	7.1	18 53.6	4.8	58.8
20	117 34.5	06.6	31 57.6	7.0	18 58.4	4.7	58.8
21	132 34.6	·· 05.6	46 23.6	7.0	19 03.1	4.6	58.7
22	147 34.8	04.6	60 49.6	7.1	19 07.7	4.4	58.7
23	162 35.0	03.7	75 15.7	7.0	19 12.1	4.3	58.7
13 00	177 35.1	S 3 02.7	89 41.7	7.0	N19 16.4	4.2	58.7
01	192 35.3	01.7	104 07.7	7.0	19 20.6	4.1	58.6
02	207 35.5	3 00.7	118 33.7	7.1	19 24.7	3.9	58.6
03	222 35.6	2 59.7	132 59.8	7.0	19 28.6	3.8	58.6
04	237 35.8	58.7	147 25.8	7.0	19 32.4	3.7	58.6
05	252 36.0	57.8	161 51.8	7.1	19 36.1	3.6	58.5
06	267 36.2	S 2 56.8	176 17.9	7.0	N19 39.7	3.4	58.5
07	282 36.3	55.8	190 43.9	7.1	19 43.1	3.3	58.5
08	297 36.5	54.8	205 10.0	7.0	19 46.4	3.2	58.5
F 09	312 36.7	·· 53.8	219 36.0	7.1	19 49.6	3.1	58.4
R 10	327 36.8	52.8	234 02.1	7.1	19 52.7	2.9	58.4
I 11	342 37.0	51.8	248 28.2	7.0	19 55.6	2.8	58.4
D 12	357 37.2	S 2 50.9	262 54.2	7.1	N19 58.4	2.7	58.4
A 13	12 37.4	49.9	277 20.3	7.1	20 01.1	2.6	58.3
Y 14	27 37.5	48.9	291 46.4	7.2	20 03.7	2.4	58.3
15	42 37.7	·· 47.9	306 12.6	7.1	20 06.1	2.3	58.3
16	57 37.9	46.9	320 38.7	7.1	20 08.4	2.2	58.3
17	72 38.0	45.9	335 04.8	7.2	20 10.6	2.0	58.2
18	87 38.2	S 2 44.9	349 31.0	7.2	N20 12.6	2.0	58.2
19	102 38.4	44.0	3 57.2	7.2	20 14.6	1.8	58.2
20	117 38.6	43.0	18 23.4	7.2	20 16.4	1.6	58.2
21	132 38.7	·· 42.0	32 49.6	7.2	20 18.0	1.6	58.1
22	147 38.9	41.0	47 15.8	7.3	20 19.6	1.4	58.1
23	162 39.1	40.0	61 42.1	7.2	20 21.0	1.3	58.1
	S.D. 16.1	d 1.0	S.D. 16.2		16.1		15.9

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

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

Day	SUN Eqn. of Time 00ʰ	SUN Eqn. of Time 12ʰ	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
	m s	m s	h m	h m	h m	d	
11	10 12	10 04	12 10	16 51	04 23	05	
12	09 56	09 48	12 10	17 47	05 19	06	◐
13	09 40	09 32	12 10	18 44	06 15	07	

G.M.T.	ARIES	VENUS −3.4		MARS +1.3		JUPITER −2.0		SATURN +0.7		STARS		
	G.H.A.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.	Name	S.H.A.	Dec.
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	° ′
14 00	171 31.4	182 46.8	S 6 23.6	173 25.5	S 1 42.6	344 26.1	S 1 20.5	343 38.4	S 0 32.0	Acamar	315 37.3	S40 23.2
01	186 33.9	197 46.4	22.4	188 26.1	41.8	359 28.8	20.4	358 41.1	31.9	Achernar	335 45.5	S57 20.2
02	201 36.4	212 46.0	21.2	203 26.8	41.1	14 31.6	20.3	13 43.7	31.8	Acrux	173 36.2	S62 59.6
03	216 38.8	227 45.6	·· 20.0	218 27.5	·· 40.3	29 34.3	·· 20.2	28 46.3	·· 31.7	Adhara	255 31.7	S28 57.1
04	231 41.3	242 45.1	18.8	233 28.2	39.5	44 37.0	20.0	43 49.0	31.7	Aldebaran	291 17.7	N16 28.2
05	246 43.7	257 44.7	17.6	248 28.9	38.7	59 39.8	19.9	58 51.6	31.6			
06	261 46.2	272 44.3	S 6 16.4	263 29.5	S 1 37.9	74 42.5	S 1 19.8	73 54.2	S 0 31.5	Alioth	166 41.7	N56 03.6
07	276 48.7	287 43.9	15.2	278 30.2	37.1	89 45.3	19.7	88 56.9	31.4	Alkaid	153 17.8	N49 24.3
S 08	291 51.1	302 43.4	14.0	293 30.9	36.3	104 48.0	19.5	103 59.5	31.3	Al Na'ir	28 15.0	S47 03.2
A 09	306 53.6	317 43.0	·· 12.7	308 31.6	·· 35.5	119 50.8	·· 19.4	119 02.1	·· 31.3	Alnilam	276 11.3	S 1 13.0
T 10	321 56.1	332 42.6	11.5	323 32.3	34.7	134 53.5	19.3	134 04.8	31.2	Alphard	218 20.0	S 8 34.7
U 11	336 58.5	347 42.2	10.3	338 33.0	33.9	149 56.2	19.2	149 07.4	31.1			
R 12	352 01.0	2 41.8	S 6 09.1	353 33.6	S 1 33.1	164 59.0	S 1 19.0	164 10.0	S 0 31.0	Alphecca	126 31.7	N26 46.5
D 13	7 03.5	17 41.3	07.9	8 34.3	32.3	180 01.7	18.9	179 12.7	31.0	Alpheratz	358 09.3	N28 59.0
A 14	22 05.9	32 40.9	06.7	23 35.0	31.5	195 04.5	18.8	194 15.3	30.9	Altair	62 32.4	N 8 48.9
Y 15	37 08.4	47 40.5	·· 05.5	38 35.7	·· 30.7	210 07.2	·· 18.7	209 17.9	·· 30.8	Ankaa	353 40.3	S42 24.7
16	52 10.9	62 40.1	04.3	53 36.4	29.9	225 10.0	18.5	224 20.6	30.7	Antares	112 56.3	S26 23.4
17	67 13.3	77 39.7	03.1	68 37.1	29.1	240 12.7	18.4	239 23.2	30.6			
18	82 15.8	92 39.2	S 6 01.9	83 37.7	S 1 28.4	255 15.5	S 1 18.3	254 25.8	S 0 30.6	Arcturus	146 17.9	N19 16.7
19	97 18.2	107 38.8	6 00.7	98 38.4	27.6	270 18.2	18.2	269 28.5	30.5	Atria	108 20.2	S68 59.4
20	112 20.7	122 38.4	5 59.4	113 39.1	26.8	285 20.9	18.0	284 31.1	30.4	Avior	234 27.6	S59 27.2
21	127 23.2	137 38.0	·· 58.2	128 39.8	·· 26.0	300 23.7	·· 17.9	299 33.7	·· 30.3	Bellatrix	278 58.4	N 6 19.8
22	142 25.6	152 37.6	57.0	143 40.5	25.2	315 26.4	17.8	314 36.4	30.3	Betelgeuse	271 27.9	N 7 24.1
23	157 28.1	167 37.1	55.8	158 41.2	24.4	330 29.2	17.7	329 39.0	30.2			
15 00	172 30.6	182 36.7	S 5 54.6	173 41.8	S 1 23.6	345 31.9	S 1 17.5	344 41.6	S 0 30.1	Canopus	264 07.0	S52 41.5
01	187 33.0	197 36.3	53.4	188 42.5	22.8	0 34.7	17.4	359 44.3	30.0	Capella	281 10.8	N45 58.8
02	202 35.5	212 35.9	52.2	203 43.2	22.0	15 37.4	17.3	14 46.9	29.9	Deneb	49 48.6	N45 12.5
03	217 38.0	227 35.5	·· 51.0	218 43.9	·· 21.2	30 40.2	·· 17.2	29 49.5	·· 29.9	Denebola	182 58.4	N14 40.6
04	232 40.4	242 35.0	49.7	233 44.6	20.4	45 42.9	17.0	44 52.2	29.8	Diphda	349 20.9	S18 05.6
05	247 42.9	257 34.6	48.5	248 45.3	19.6	60 45.7	16.9	59 54.8	29.7			
06	262 45.3	272 34.2	S 5 47.3	263 45.9	S 1 18.8	75 48.4	S 1 16.8	74 57.4	S 0 29.6	Dubhe	194 21.1	N61 51.2
07	277 47.8	287 33.8	46.1	278 46.6	18.0	90 51.2	16.7	90 00.1	29.6	Elnath	278 43.7	N28 35.5
08	292 50.3	302 33.4	44.9	293 47.3	17.2	105 53.9	16.5	105 02.7	29.5	Eltanin	90 57.6	N51 29.2
S 09	307 52.7	317 33.0	·· 43.7	308 48.0	·· 16.5	120 56.6	·· 16.4	120 05.3	·· 29.4	Enif	34 11.5	N 9 47.1
U 10	322 55.2	332 32.5	42.5	323 48.7	15.7	135 59.4	16.3	135 08.0	29.3	Fomalhaut	15 51.4	S29 43.5
N 11	337 57.7	347 32.1	41.2	338 49.4	14.9	151 02.1	16.2	150 10.6	29.2			
D 12	353 00.1	2 31.7	S 5 40.0	353 50.1	S 1 14.1	166 04.9	S 1 16.0	165 13.3	S 0 29.2	Gacrux	172 27.8	S57 00.4
A 13	8 02.6	17 31.3	38.8	8 50.7	13.3	181 07.6	15.9	180 15.9	29.1	Gienah	176 17.3	S17 26.3
Y 14	23 05.1	32 30.9	37.6	23 51.4	12.5	196 10.4	15.8	195 18.5	29.0	Hadar	149 22.4	S60 16.8
15	38 07.5	47 30.5	·· 36.4	38 52.1	·· 11.7	211 13.1	·· 15.7	210 21.2	·· 28.9	Hamal	328 28.8	N23 22.3
16	53 10.0	62 30.0	35.2	53 52.8	10.9	226 15.9	15.5	225 23.8	28.9	Kaus Aust.	84 16.5	S34 23.5
17	68 12.5	77 29.6	33.9	68 53.5	10.1	241 18.6	15.4	240 26.4	28.8			
18	83 14.9	92 29.2	S 5 32.7	83 54.2	S 1 09.3	256 21.4	S 1 15.3	255 29.1	S 0 28.7	Kochab	137 18.3	N74 13.8
19	98 17.4	107 28.8	31.5	98 54.9	08.5	271 24.1	15.2	270 31.7	28.6	Markab	14 03.2	N15 06.0
20	113 19.8	122 28.4	30.3	113 55.5	07.7	286 26.9	15.0	285 34.3	28.5	Menkar	314 41.0	N 4 00.8
21	128 22.3	137 28.0	·· 29.1	128 56.2	·· 06.9	301 29.6	·· 14.9	300 37.0	·· 28.5	Menkent	148 36.3	S36 16.6
22	143 24.8	152 27.6	27.9	143 56.9	06.1	316 32.4	14.8	315 39.6	28.4	Miaplacidus	221 44.1	S69 38.6
23	158 27.2	167 27.1	26.6	158 57.6	05.3	331 35.1	14.7	330 42.2	28.3			
16 00	173 29.7	182 26.7	S 5 25.4	173 58.3	S 1 04.6	346 37.9	S 1 14.5	345 44.9	S 0 28.2	Mirfak	309 15.9	N49 47.7
01	188 32.2	197 26.3	24.2	188 59.0	03.8	1 40.6	14.4	0 47.5	28.2	Nunki	76 28.9	S26 19.2
02	203 34.6	212 25.9	23.0	203 59.6	03.0	16 43.4	14.3	15 50.1	28.1	Peacock	53 58.3	S56 47.6
03	218 37.1	227 25.5	·· 21.8	219 00.3	·· 02.2	31 46.1	·· 14.2	30 52.8	·· 28.0	Pollux	243 57.6	N28 04.3
04	233 39.6	242 25.1	20.5	234 01.0	01.4	46 48.8	14.0	45 55.4	27.9	Procyon	245 25.3	N 5 16.3
05	248 42.0	257 24.7	19.3	249 01.7	1 00.6	61 51.6	13.9	60 58.0	27.8			
06	263 44.5	272 24.3	S 5 18.1	264 02.4	S 0 59.8	76 54.3	S 1 13.8	76 00.7	S 0 27.8	Rasalhague	96 29.3	N12 34.3
07	278 47.0	287 23.8	16.9	279 03.1	59.0	91 57.1	13.6	91 03.3	27.7	Regulus	208 09.4	N12 03.5
08	293 49.4	302 23.4	15.7	294 03.8	58.2	106 59.8	13.5	106 06.0	27.6	Rigel	281 35.7	S 8 13.6
M 09	308 51.9	317 23.0	·· 14.4	309 04.4	·· 57.4	122 02.6	·· 13.4	121 08.6	·· 27.5	Rigil Kent.	140 24.9	S60 45.2
O 10	323 54.3	332 22.6	13.2	324 05.1	56.6	137 05.3	13.3	136 11.2	27.4	Sabik	102 40.7	S15 42.1
N 11	338 56.8	347 22.2	12.0	339 05.8	55.8	152 08.1	13.1	151 13.9	27.4			
D 12	353 59.3	2 21.8	S 5 10.8	354 06.5	S 0 55.0	167 10.8	S 1 13.0	166 16.5	S 0 27.3	Schedar	350 09.2	N56 26.0
A 13	9 01.7	17 21.4	09.6	9 07.2	54.2	182 13.6	12.9	181 19.1	27.2	Shaula	96 55.3	S37 05.3
Y 14	24 04.2	32 21.0	08.3	24 07.9	53.4	197 16.3	12.8	196 21.8	27.1	Sirius	258 55.3	S16 41.7
15	39 06.7	47 20.6	·· 07.1	39 08.6	·· 52.7	212 19.1	·· 12.6	211 24.4	·· 27.1	Spica	158 56.9	S11 03.8
16	54 09.1	62 20.1	05.9	54 09.3	51.9	227 21.8	12.5	226 27.0	27.0	Suhail	223 10.2	S43 21.6
17	69 11.6	77 19.7	04.7	69 09.9	51.1	242 24.6	12.4	241 29.7	26.9			
18	84 14.1	92 19.3	S 5 03.5	84 10.6	S 0 50.3	257 27.3	S 1 12.3	256 32.3	S 0 26.8	Vega	80 55.7	N38 45.7
19	99 16.5	107 18.9	02.2	99 11.3	49.5	272 30.1	12.1	271 35.0	26.7	Zuben'ubi	137 32.5	S15 57.8
20	114 19.0	122 18.5	5 01.0	114 12.0	48.7	287 32.8	12.0	286 37.6	26.7			
21	129 21.4	137 18.1	4 59.8	129 12.7	·· 47.9	302 35.6	·· 11.9	301 40.2	·· 26.6		S.H.A.	Mer. Pass.
22	144 23.9	152 17.7	58.6	144 13.4	47.1	317 38.3	11.8	316 42.9	26.5		° ′	h m
23	159 26.4	167 17.3	57.3	159 14.1	46.3	332 41.1	11.6	331 45.5	26.4	Venus	10 06.2	11 50
	h m									Mars	1 11.3	12 25
Mer. Pass.	12 27.9	v −0.4	d 1.2	v 0.7	d 0.8	v 2.7	d 0.1	v 2.6	d 0.1	Jupiter	173 01.4	0 58
										Saturn	172 11.1	1 01

G.M.T.	SUN G.H.A.	SUN Dec.	MOON G.H.A.	MOON v	MOON Dec.	MOON d	MOON H.P.
d h	° ′	° ′	° ′	′	° ′	′	′
14 00	177 39.2	S 2 39.0	76 08.3	7.3	N20 22.3	1.2	58.0
01	192 39.4	38.0	90 34.6	7.3	20 23.5	1.0	58.0
02	207 39.6	37.1	105 00.9	7.4	20 24.5	1.0	58.0
03	222 39.8	·· 36.1	119 27.3	7.3	20 25.5	0.8	58.0
04	237 39.9	35.1	133 53.6	7.4	20 26.3	0.6	57.9
05	252 40.1	34.1	148 20.0	7.4	20 26.9	0.6	57.9
06	267 40.3	S 2 33.1	162 46.4	7.5	N20 27.5	0.4	57.9
07	282 40.5	32.1	177 12.9	7.4	20 27.9	0.3	57.9
S 08	297 40.6	31.1	191 39.3	7.5	20 28.2	0.2	57.8
A 09	312 40.8	·· 30.2	206 05.8	7.5	20 28.4	0.1	57.8
T 10	327 41.0	29.2	220 32.3	7.6	20 28.5	0.1	57.8
U 11	342 41.2	28.2	234 58.9	7.6	20 28.4	0.2	57.8
R 12	357 41.3	S 2 27.2	249 25.5	7.6	N20 28.2	0.3	57.7
D 13	12 41.5	26.2	263 52.1	7.6	20 27.9	0.5	57.7
A 14	27 41.7	25.2	278 18.7	7.7	20 27.4	0.5	57.7
Y 15	42 41.9	·· 24.2	292 45.4	7.7	20 26.9	0.7	57.7
16	57 42.0	23.3	307 12.1	7.8	20 26.2	0.8	57.6
17	72 42.2	22.3	321 38.9	7.8	20 25.4	0.9	57.6
18	87 42.4	S 2 21.3	336 05.7	7.8	N20 24.5	1.1	57.6
19	102 42.6	20.3	350 32.5	7.8	20 23.4	1.1	57.6
20	117 42.7	19.3	4 59.3	7.9	20 22.3	1.3	57.5
21	132 42.9	·· 18.3	19 26.2	8.0	20 21.0	1.4	57.5
22	147 43.1	17.3	33 53.2	8.0	20 19.6	1.5	57.5
23	162 43.3	16.3	48 20.2	8.0	20 18.1	1.6	57.5
15 00	177 43.4	S 2 15.4	62 47.2	8.0	N20 16.5	1.8	57.4
01	192 43.6	14.4	77 14.2	8.1	20 14.7	1.9	57.4
02	207 43.8	13.4	91 41.3	8.2	20 12.8	2.0	57.4
03	222 44.0	·· 12.4	106 08.5	8.2	20 10.8	2.1	57.4
04	237 44.1	11.4	120 35.7	8.2	20 08.7	2.2	57.3
05	252 44.3	10.4	135 02.9	8.3	20 06.5	2.3	57.3
06	267 44.5	S 2 09.4	149 30.2	8.3	N20 04.2	2.5	57.3
07	282 44.7	08.4	163 57.5	8.4	20 01.7	2.5	57.3
08	297 44.8	07.5	178 24.9	8.4	19 59.2	2.7	57.2
S 09	312 45.0	·· 06.5	192 52.3	8.4	19 56.5	2.8	57.2
U 10	327 45.2	05.5	207 19.7	8.5	19 53.7	2.9	57.2
N 11	342 45.4	04.5	221 47.2	8.6	19 50.8	3.0	57.2
D 12	357 45.5	S 2 03.5	236 14.8	8.6	N19 47.8	3.1	57.2
A 13	12 45.7	02.5	250 42.4	8.7	19 44.7	3.2	57.1
Y 14	27 45.9	01.5	265 10.1	8.7	19 41.5	3.4	57.1
15	42 46.1	2 00.6	279 37.8	8.7	19 38.1	3.4	57.1
16	57 46.3	1 59.6	294 05.5	8.8	19 34.7	3.6	57.1
17	72 46.4	58.6	308 33.3	8.9	19 31.1	3.6	57.0
18	87 46.6	S 1 57.6	323 01.2	8.9	N19 27.5	3.8	57.0
19	102 46.8	56.6	337 29.1	9.0	19 23.7	3.9	57.0
20	117 47.0	55.6	351 57.1	9.0	19 19.8	4.0	57.0
21	132 47.1	·· 54.6	6 25.1	9.1	19 15.8	4.0	56.9
22	147 47.3	53.6	20 53.2	9.1	19 11.8	4.2	56.9
23	162 47.5	52.7	35 21.3	9.2	19 07.6	4.3	56.9
16 00	177 47.7	S 1 51.7	49 49.5	9.2	N19 03.3	4.4	56.9
01	192 47.9	50.7	64 17.7	9.3	18 58.9	4.5	56.8
02	207 48.0	49.7	78 46.0	9.4	18 54.4	4.6	56.8
03	222 48.2	·· 48.7	93 14.4	9.4	18 49.8	4.7	56.8
04	237 48.4	47.7	107 42.8	9.4	18 45.1	4.8	56.8
05	252 48.6	46.7	122 11.2	9.6	18 40.3	4.9	56.8
06	267 48.7	S 1 45.7	136 39.8	9.5	N18 35.4	5.0	56.7
07	282 48.9	44.8	151 08.3	9.7	18 30.4	5.1	56.7
08	297 49.1	43.8	165 37.0	9.7	18 25.3	5.2	56.7
M 09	312 49.3	·· 42.8	180 05.7	9.7	18 20.1	5.2	56.7
O 10	327 49.5	41.8	194 34.4	9.8	18 14.9	5.4	56.6
N 11	342 49.6	40.8	209 03.2	9.9	18 09.5	5.5	56.6
D 12	357 49.8	S 1 39.8	223 32.1	9.9	N18 04.0	5.5	56.6
A 13	12 50.0	38.8	238 01.0	10.0	17 58.5	5.7	56.6
Y 14	27 50.2	37.8	252 30.0	10.1	17 52.8	5.7	56.5
15	42 50.4	·· 36.9	266 59.1	10.1	17 47.1	5.9	56.5
16	57 50.5	35.9	281 28.2	10.1	17 41.2	5.9	56.5
17	72 50.7	34.9	295 57.3	10.2	17 35.3	6.0	56.5
18	87 50.9	S 1 33.9	310 26.5	10.3	N17 29.3	6.1	56.5
19	102 51.1	32.9	324 55.8	10.4	17 23.2	6.2	56.4
20	117 51.3	31.9	339 25.2	10.4	17 17.0	6.3	56.4
21	132 51.4	·· 30.9	353 54.6	10.4	17 10.7	6.4	56.4
22	147 51.6	29.9	8 24.0	10.6	17 04.3	6.4	56.4
23	162 51.8	29.0	22 53.6	10.6	16 57.9	6.5	56.4
	S.D. 16.1	d 1.0	S.D. 15.7		15.6		15.4

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

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

Day	SUN Eqn. of Time 00ʰ	SUN Eqn. of Time 12ʰ	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
	m s	m s	h m	h m	h m	d	
14	09 23	09 15	12 09	19 39	07 12	08	
15	09 07	08 58	12 09	20 33	08 07	09	
16	08 50	08 41	12 09	21 25	09 00	10	◐

G.M.T.	ARIES	VENUS −3.4		MARS +1.3		JUPITER −2.0		SATURN +0.7		STARS		
	G.H.A.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.	Name	S.H.A.	Dec.
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	° ′
17 00	174 28.8	182 16.9	S 4 56.1	174 14.8	S 0 45.5	347 43.8	S 1 11.5	346 48.2	S 0 26.3	Acamar	315 37.3	S40 23.1
01	189 31.3	197 16.5	54.9	189 15.4	44.7	2 46.6	11.4	1 50.8	26.3	Achernar	335 45.5	S57 20.2
02	204 33.8	212 16.1	53.6	204 16.1	43.9	17 49.3	11.2	16 53.4	26.2	Acrux	173 36.2	S62 59.6
03	219 36.2	227 15.7	·· 52.4	219 16.8	·· 43.1	32 52.1	·· 11.1	31 56.1	·· 26.1	Adhara	255 31.7	S28 57.1
04	234 38.7	242 15.3	51.2	234 17.5	42.4	47 54.8	11.0	46 58.7	26.0	Aldebaran	291 17.7	N16 28.2
05	249 41.2	257 14.8	50.0	249 18.2	41.6	62 57.6	10.9	62 01.3	26.0			
06	264 43.6	272 14.4	S 4 48.7	264 18.9	S 0 40.8	78 00.3	S 1 10.7	77 04.0	S 0 25.9	Alioth	166 41.7	N56 03.7
07	279 46.1	287 14.0	47.5	279 19.6	40.0	93 03.1	10.6	92 06.6	25.8	Alkaid	153 17.8	N49 24.3
08	294 48.6	302 13.6	46.3	294 20.2	39.2	108 05.8	10.5	107 09.2	25.7	Al Na'ir	28 14.9	S47 03.2
T 09	309 51.0	317 13.2	·· 45.1	309 20.9	·· 38.4	123 08.6	·· 10.3	122 11.9	·· 25.6	Alnilam	276 11.3	S 1 13.0
U 10	324 53.5	332 12.8	43.8	324 21.6	37.6	138 11.3	10.2	137 14.5	25.6	Alphard	218 20.0	S 8 34.7
E 11	339 55.9	347 12.4	42.6	339 22.3	36.8	153 14.1	10.1	152 17.2	25.5			
S 12	354 58.4	2 12.0	S 4 41.4	354 23.0	S 0 36.0	168 16.8	S 1 10.0	167 19.8	S 0 25.4	Alphecca	126 31.6	N26 46.5
D 13	10 00.9	17 11.6	40.2	9 23.7	35.2	183 19.6	09.8	182 22.4	25.3	Alpheratz	358 09.3	N28 59.0
A 14	25 03.3	32 11.2	38.9	24 24.4	34.4	198 22.3	09.7	197 25.1	25.3	Altair	62 32.4	N 8 48.9
Y 15	40 05.8	47 10.8	·· 37.7	39 25.1	·· 33.6	213 25.1	·· 09.6	212 27.7	·· 25.2	Ankaa	353 40.3	S42 24.7
16	55 08.3	62 10.4	36.5	54 25.7	32.8	228 27.8	09.5	227 30.3	25.1	Antares	112 56.3	S26 23.4
17	70 10.7	77 10.0	35.2	69 26.4	32.1	243 30.6	09.3	242 33.0	25.0			
18	85 13.2	92 09.6	S 4 34.0	84 27.1	S 0 31.3	258 33.4	S 1 09.2	257 35.6	S 0 24.9	Arcturus	146 17.9	N19 16.7
19	100 15.7	107 09.2	32.8	99 27.8	30.5	273 36.1	09.1	272 38.3	24.9	Atria	108 20.2	S68 59.4
20	115 18.1	122 08.8	31.6	114 28.5	29.7	288 38.9	09.0	287 40.9	24.8	Avior	234 27.7	S59 27.2
21	130 20.6	137 08.4	·· 30.3	129 29.2	·· 28.9	303 41.6	·· 08.8	302 43.5	·· 24.7	Bellatrix	278 58.4	N 6 19.8
22	145 23.1	152 08.0	29.1	144 29.9	28.1	318 44.4	08.7	317 46.2	24.6	Betelgeuse	271 27.9	N 7 24.1
23	160 25.5	167 07.6	27.9	159 30.6	27.3	333 47.1	08.6	332 48.8	24.5			
18 00	175 28.0	182 07.2	S 4 26.6	174 31.2	S 0 26.5	348 49.9	S 1 08.4	347 51.4	S 0 24.5	Canopus	264 07.0	S52 41.5
01	190 30.4	197 06.8	25.4	189 31.9	25.7	3 52.6	08.3	2 54.1	24.4	Capella	281 10.9	N45 58.8
02	205 32.9	212 06.4	24.2	204 32.6	24.9	18 55.4	08.2	17 56.7	24.3	Deneb	49 48.5	N45 12.5
03	220 35.4	227 06.0	·· 23.0	219 33.3	·· 24.1	33 58.1	·· 08.1	32 59.4	·· 24.2	Denebola	182 58.4	N14 40.6
04	235 37.8	242 05.6	21.7	234 34.0	23.3	49 00.9	07.9	48 02.0	24.2	Diphda	349 20.9	S18 05.6
05	250 40.3	257 05.2	20.5	249 34.7	22.5	64 03.6	07.8	63 04.6	24.1			
06	265 42.8	272 04.8	S 4 19.3	264 35.4	S 0 21.8	79 06.4	S 1 07.7	78 07.3	S 0 24.0	Dubhe	194 21.1	N61 51.2
07	280 45.2	287 04.4	18.0	279 36.1	21.0	94 09.1	07.6	93 09.9	23.9	Elnath	278 43.7	N28 35.5
W 08	295 47.7	302 04.0	16.8	294 36.7	20.2	109 11.9	07.4	108 12.5	23.8	Eltanin	90 57.6	N51 29.2
E 09	310 50.2	317 03.6	·· 15.6	309 37.4	·· 19.4	124 14.6	·· 07.3	123 15.2	·· 23.8	Enif	34 11.5	N 9 47.1
D 10	325 52.6	332 03.2	14.3	324 38.1	18.6	139 17.4	07.2	138 17.8	23.7	Fomalhaut	15 51.4	S29 43.5
N 11	340 55.1	347 02.7	13.1	339 38.8	17.8	154 20.1	07.0	153 20.5	23.6			
E 12	355 57.5	2 02.3	S 4 11.9	354 39.5	S 0 17.0	169 22.9	S 1 06.9	168 23.1	S 0 23.5	Gacrux	172 27.8	S57 00.4
S 13	11 00.0	17 02.0	10.6	9 40.2	16.2	184 25.6	06.8	183 25.7	23.5	Gienah	176 17.3	S17 26.3
D 14	26 02.5	32 01.5	09.4	24 40.9	15.4	199 28.4	06.7	198 28.4	23.4	Hadar	149 22.3	S60 16.8
A 15	41 04.9	47 01.2	·· 08.2	39 41.6	·· 14.6	214 31.1	·· 06.5	213 31.0	·· 23.3	Hamal	328 28.8	N23 22.3
Y 16	56 07.4	62 00.8	06.9	54 42.3	13.8	229 33.9	06.4	228 33.7	23.2	Kaus Aust.	84 16.5	S34 23.5
17	71 09.9	77 00.4	05.7	69 42.9	13.0	244 36.7	06.3	243 36.3	23.1			
18	86 12.3	92 00.0	S 4 04.5	84 43.6	S 0 12.3	259 39.4	S 1 06.2	258 38.9	S 0 23.1	Kochab	137 18.2	N74 13.8
19	101 14.8	106 59.6	03.2	99 44.3	11.5	274 42.2	06.0	273 41.6	23.0	Markab	14 03.1	N15 06.0
20	116 17.3	121 59.2	02.0	114 45.0	10.7	289 44.9	05.9	288 44.2	22.9	Menkar	314 41.0	N 4 00.8
21	131 19.7	136 58.8	4 00.8	129 45.7	·· 09.9	304 47.7	·· 05.8	303 46.8	·· 22.8	Menkent	148 36.3	S36 16.6
22	146 22.2	151 58.4	3 59.5	144 46.4	09.1	319 50.4	05.6	318 49.5	22.7	Miaplacidus	221 44.2	S69 38.6
23	161 24.7	166 58.0	58.3	159 47.1	08.3	334 53.2	05.5	333 52.1	22.7			
19 00	176 27.1	181 57.6	S 3 57.1	174 47.8	S 0 07.5	349 55.9	S 1 05.4	348 54.8	S 0 22.6	Mirfak	309 15.9	N49 47.7
01	191 29.6	196 57.2	55.8	189 48.5	06.7	4 58.7	05.3	3 57.4	22.5	Nunki	76 28.9	S26 19.2
02	206 32.0	211 56.8	54.6	204 49.2	05.9	20 01.4	05.1	19 00.0	22.4	Peacock	53 58.2	S56 47.6
03	221 34.5	226 56.4	·· 53.4	219 49.8	·· 05.1	35 04.2	·· 05.0	34 02.7	·· 22.4	Pollux	243 57.6	N28 04.3
04	236 37.0	241 56.0	52.1	234 50.5	04.3	50 06.9	04.9	49 05.3	22.3	Procyon	245 25.3	N 5 16.3
05	251 39.4	256 55.6	50.9	249 51.2	03.5	65 09.7	04.8	64 08.0	22.2			
06	266 41.9	271 55.2	S 3 49.7	264 51.9	S 0 02.8	80 12.5	S 1 04.6	79 10.6	S 0 22.1	Rasalhague	96 29.3	N12 34.3
07	281 44.4	286 54.8	48.4	279 52.6	02.0	95 15.2	04.5	94 13.2	22.0	Regulus	208 09.4	N12 03.5
T 08	296 46.8	301 54.4	47.2	294 53.3	01.2	110 18.0	04.4	109 15.9	22.0	Rigel	281 35.7	S 8 13.6
H 09	311 49.3	316 54.0	·· 45.9	309 54.0	S 0 00.4	125 20.7	·· 04.2	124 18.5	·· 21.9	Rigil Kent.	140 24.9	S60 45.2
U 10	326 51.8	331 53.6	44.7	324 54.7	N 0 00.4	140 23.5	04.1	139 21.2	21.8	Sabik	102 40.7	S15 42.1
R 11	341 54.2	346 53.2	43.5	339 55.4	01.2	155 26.2	04.0	154 23.8	21.7			
S 12	356 56.7	1 52.8	S 3 42.2	354 56.1	N 0 02.0	170 29.0	S 1 03.9	169 26.4	S 0 21.6	Schedar	350 09.2	N56 26.0
D 13	11 59.2	16 52.4	41.0	9 56.7	02.8	185 31.7	03.7	184 29.1	21.6	Shaula	96 55.3	S37 05.3
A 14	27 01.6	31 52.0	39.8	24 57.4	03.6	200 34.5	03.6	199 31.7	21.5	Sirius	258 55.3	S16 41.7
Y 15	42 04.1	46 51.6	·· 38.5	39 58.1	·· 04.4	215 37.2	·· 03.5	214 34.3	·· 21.4	Spica	158 56.9	S11 03.8
16	57 06.5	61 51.2	37.3	54 58.8	05.2	230 40.0	03.3	229 37.0	21.3	Suhail	223 10.2	S43 21.6
17	72 09.0	76 50.8	36.1	69 59.5	05.9	245 42.8	03.2	244 39.6	21.3			
18	87 11.5	91 50.4	S 3 34.8	85 00.2	N 0 06.7	260 45.5	S 1 03.1	259 42.3	S 0 21.2	Vega	80 55.7	N38 45.7
19	102 13.9	106 50.0	33.6	100 00.9	07.5	275 48.3	03.0	274 44.9	21.1	Zuben'ubi	137 32.4	S15 57.8
20	117 16.4	121 49.6	32.3	115 01.6	08.3	290 51.0	02.8	289 47.5	21.0			
21	132 18.9	136 49.2	·· 31.1	130 02.3	·· 09.1	305 53.8	·· 02.7	304 50.2	·· 20.9		S.H.A.	Mer. Pass.
22	147 21.3	151 48.8	29.9	145 03.0	09.9	320 56.5	02.6	319 52.8	20.9		° ′	h m
23	162 23.8	166 48.5	28.6	160 03.7	10.7	335 59.3	02.5	334 55.5	20.8	Venus	6 39.2	11 52
	h m									Mars	359 03.3	12 21
Mer. Pass.	12 16.1	v 0.4	d 1.2	v 0.7	d 0.8	v 2.8	d 0.1	v 2.6	d 0.1	Jupiter	173 21.9	0 45
										Saturn	172 23.5	0 48

G.M.T.	SUN G.H.A.	SUN Dec.	MOON G.H.A.	MOON v	MOON Dec.	MOON d	MOON H.P.
d h	° ′	° ′	° ′	′	° ′	′	′
17 00	177 52.0	S 1 28.0	37 23.2	10.6	N16 51.4	6.6	56.3
01	192 52.2	27.0	51 52.8	10.7	16 44.8	6.7	56.3
02	207 52.3	26.0	66 22.5	10.8	16 38.1	6.8	56.3
03	222 52.5	·· 25.0	80 52.3	10.8	16 31.3	6.9	56.3
04	237 52.7	24.0	95 22.1	10.9	16 24.4	6.9	56.2
05	252 52.9	23.0	109 52.0	10.9	16 17.5	7.0	56.2
06	267 53.1	S 1 22.0	124 21.9	11.1	N16 10.5	7.1	56.2
07	282 53.2	21.1	138 52.0	11.0	16 03.4	7.2	56.2
08	297 53.4	20.1	153 22.0	11.2	15 56.2	7.2	56.2
T 09	312 53.6	·· 19.1	167 52.2	11.1	15 49.0	7.3	56.1
U 10	327 53.8	18.1	182 22.3	11.3	15 41.7	7.4	56.1
E 11	342 54.0	17.1	196 52.6	11.3	15 34.3	7.5	56.1
S 12	357 54.2	S 1 16.1	211 22.9	11.4	N15 26.8	7.5	56.1
D 13	12 54.3	15.1	225 53.3	11.4	15 19.3	7.7	56.1
A 14	27 54.5	14.1	240 23.7	11.5	15 11.6	7.6	56.0
Y 15	42 54.7	·· 13.1	254 54.2	11.5	15 04.0	7.8	56.0
16	57 54.9	12.2	269 24.7	11.6	14 56.2	7.8	56.0
17	72 55.1	11.2	283 55.3	11.7	14 48.4	7.9	56.0
18	87 55.2	S 1 10.2	298 26.0	11.7	N14 40.5	7.9	56.0
19	102 55.4	09.2	312 56.7	11.8	14 32.6	8.1	55.9
20	117 55.6	08.2	327 27.5	11.9	14 24.5	8.1	55.9
21	132 55.8	·· 07.2	341 58.4	11.9	14 16.4	8.1	55.9
22	147 56.0	06.2	356 29.3	11.9	14 08.3	8.2	55.9
23	162 56.2	05.2	11 00.2	12.0	14 00.1	8.3	55.9
18 00	177 56.3	S 1 04.2	25 31.2	12.1	N13 51.8	8.3	55.8
01	192 56.5	03.3	40 02.3	12.1	13 43.5	8.4	55.8
02	207 56.7	02.3	54 33.4	12.2	13 35.1	8.5	55.8
03	222 56.9	·· 01.3	69 04.6	12.3	13 26.6	8.5	55.8
04	237 57.1	1 00.3	83 35.9	12.3	13 18.1	8.6	55.8
05	252 57.3	0 59.3	98 07.2	12.3	13 09.5	8.6	55.7
06	267 57.4	S 0 58.3	112 38.5	12.4	N13 00.9	8.7	55.7
W 07	282 57.6	57.3	127 09.9	12.5	12 52.2	8.8	55.7
E 08	297 57.8	56.3	141 41.4	12.5	12 43.4	8.8	55.7
D 09	312 58.0	·· 55.4	156 12.9	12.6	12 34.6	8.8	55.7
N 10	327 58.2	54.4	170 44.5	12.6	12 25.8	8.9	55.6
E 11	342 58.4	53.4	185 16.1	12.7	12 16.9	9.0	55.6
S 12	357 58.5	S 0 52.4	199 47.8	12.8	N12 07.9	9.0	55.6
D 13	12 58.7	51.4	214 19.6	12.7	11 58.9	9.1	55.6
A 14	27 58.9	50.4	228 51.3	12.9	11 49.8	9.1	55.6
Y 15	42 59.1	·· 49.4	243 23.2	12.9	11 40.7	9.2	55.6
16	57 59.3	48.4	257 55.1	12.9	11 31.5	9.2	55.5
17	72 59.5	47.4	272 27.0	13.0	11 22.3	9.2	55.5
18	87 59.6	S 0 46.5	286 59.0	13.1	N11 13.1	9.3	55.5
19	102 59.8	45.5	301 31.1	13.1	11 03.8	9.4	55.5
20	118 00.0	44.5	316 03.2	13.1	10 54.4	9.4	55.5
21	133 00.2	·· 43.5	330 35.3	13.2	10 45.0	9.4	55.4
22	148 00.4	42.5	345 07.5	13.3	10 35.6	9.5	55.4
23	163 00.6	41.5	359 39.8	13.3	10 26.1	9.5	55.4
19 00	178 00.7	S 0 40.5	14 12.1	13.3	N10 16.6	9.6	55.4
01	193 00.9	39.5	28 44.4	13.4	10 07.0	9.6	55.4
02	208 01.1	38.6	43 16.8	13.4	9 57.4	9.6	55.4
03	223 01.3	·· 37.6	57 49.2	13.5	9 47.8	9.7	55.3
04	238 01.5	36.6	72 21.7	13.6	9 38.1	9.7	55.3
05	253 01.7	35.6	86 54.3	13.5	9 28.4	9.8	55.3
06	268 01.8	S 0 34.6	101 26.8	13.7	N 9 18.6	9.8	55.3
07	283 02.0	33.6	115 59.5	13.6	9 08.8	9.8	55.3
T 08	298 02.2	32.6	130 32.1	13.8	8 59.0	9.9	55.2
H 09	313 02.4	·· 31.6	145 04.9	13.7	8 49.1	9.9	55.2
U 10	328 02.6	30.7	159 37.6	13.8	8 39.2	9.9	55.2
R 11	343 02.8	29.7	174 10.4	13.9	8 29.3	9.9	55.2
S 12	358 03.0	S 0 28.7	188 43.3	13.8	N 8 19.4	10.0	55.2
D 13	13 03.1	27.7	203 16.1	14.0	8 09.4	10.1	55.2
A 14	28 03.3	26.7	217 49.1	13.9	7 59.3	10.0	55.1
Y 15	43 03.5	·· 25.7	232 22.0	14.0	7 49.3	10.1	55.1
16	58 03.7	24.7	246 55.0	14.1	7 39.2	10.1	55.1
17	73 03.9	23.7	261 28.1	14.1	7 29.1	10.1	55.1
18	88 04.1	S 0 22.8	276 01.2	14.1	N 7 19.0	10.2	55.1
19	103 04.3	21.8	290 34.3	14.2	7 08.8	10.2	55.1
20	118 04.4	20.8	305 07.5	14.2	6 58.6	10.2	55.0
21	133 04.6	·· 19.8	319 40.7	14.2	6 48.4	10.2	55.0
22	148 04.8	18.8	334 13.9	14.3	6 38.2	10.3	55.0
23	163 05.0	17.8	348 47.2	14.3	6 27.9	10.3	55.0
	S.D. 16.1	d 1.0	S.D. 15.3		15.2		15.0

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

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

Day	SUN Eqn. of Time 00ʰ	SUN Eqn. of Time 12ʰ	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
	m s	m s	h m	h m	h m	d	
17	08 32	08 24	12 08	22 15	09 50	11	
18	08 15	08 06	12 08	23 01	10 38	12	○
19	07 57	07 49	12 08	23 46	11 24	13	

G.M.T.	ARIES	VENUS −3.4		MARS +1.3		JUPITER −2.0		SATURN +0.7	
	G.H.A.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
20 00	177 26.3	181 48.1	S 3 27.4	175 04.3	N 0 11.5	351 02.0	S 1 02.3	349 58.1	S 0 20.7
01	192 28.7	196 47.7	26.1	190 05.0	12.3	6 04.8	02.2	5 00.7	20.6
02	207 31.2	211 47.3	24.9	205 05.7	13.1	21 07.5	02.1	20 03.4	20.5
03	222 33.6	226 46.9	·· 23.7	220 06.4	·· 13.9	36 10.3	·· 01.9	35 06.0	·· 20.5
04	237 36.1	241 46.5	22.4	235 07.1	14.6	51 13.1	01.8	50 08.7	20.4
05	252 38.6	256 46.1	21.2	250 07.8	15.4	66 15.8	01.7	65 11.3	20.3
06	267 41.0	271 45.7	S 3 19.9	265 08.5	N 0 16.2	81 18.6	S 1 01.6	80 13.9	S 0 20.2
07	282 43.5	286 45.3	18.7	280 09.2	17.0	96 21.3	01.4	95 16.6	20.2
08	297 46.0	301 44.9	17.5	295 09.9	17.8	111 24.1	01.3	110 19.2	20.1
F 09	312 48.4	316 44.5	·· 16.2	310 10.6	·· 18.6	126 26.8	·· 01.2	125 21.9	·· 20.0
R 10	327 50.9	331 44.1	15.0	325 11.3	19.4	141 29.6	01.0	140 24.5	19.9
I 11	342 53.4	346 43.7	13.7	340 12.0	20.2	156 32.3	00.9	155 27.1	19.8
D 12	357 55.8	1 43.3	S 3 12.5	355 12.6	N 0 21.0	171 35.1	S 1 00.8	170 29.8	S 0 19.8
A 13	12 58.3	16 43.0	11.3	10 13.3	21.8	186 37.9	00.7	185 32.4	19.7
Y 14	28 00.8	31 42.6	10.0	25 14.0	22.6	201 40.6	00.5	200 35.1	19.6
15	43 03.2	46 42.2	·· 08.8	40 14.7	·· 23.3	216 43.4	·· 00.4	215 37.7	·· 19.5
16	58 05.7	61 41.8	07.5	55 15.4	24.1	231 46.1	00.3	230 40.3	19.4
17	73 08.1	76 41.4	06.3	70 16.1	24.9	246 48.9	00.1	245 43.0	19.4
18	88 10.6	91 41.0	S 3 05.1	85 16.8	N 0 25.7	261 51.6	S 1 00.0	260 45.6	S 0 19.3
19	103 13.1	106 40.6	03.8	100 17.5	26.5	276 54.4	0 59.9	275 48.3	19.2
20	118 15.5	121 40.2	02.6	115 18.2	27.3	291 57.2	59.8	290 50.9	19.1
21	133 18.0	136 39.8	·· 01.3	130 18.9	·· 28.1	306 59.9	·· 59.6	305 53.5	·· 19.0
22	148 20.5	151 39.4	3 00.1	145 19.6	28.9	322 02.7	59.5	320 56.2	19.0
23	163 22.9	166 39.0	2 58.8	160 20.3	29.7	337 05.4	59.4	335 58.8	18.9
21 00	178 25.4	181 38.7	S 2 57.6	175 21.0	N 0 30.5	352 08.2	S 0 59.2	351 01.5	S 0 18.8
01	193 27.9	196 38.3	56.4	190 21.6	31.2	7 10.9	59.1	6 04.1	18.7
02	208 30.3	211 37.9	55.1	205 22.3	32.0	22 13.7	59.0	21 06.7	18.7
03	223 32.8	226 37.5	·· 53.9	220 23.0	·· 32.8	37 16.5	·· 58.9	36 09.4	·· 18.6
04	238 35.3	241 37.1	52.6	235 23.7	33.6	52 19.2	58.7	51 12.0	18.5
05	253 37.7	256 36.7	51.4	250 24.4	34.4	67 22.0	58.6	66 14.7	18.4
06	268 40.2	271 36.3	S 2 50.1	265 25.1	N 0 35.2	82 24.7	S 0 58.5	81 17.3	S 0 18.3
07	283 42.6	286 35.9	48.9	280 25.8	36.0	97 27.5	58.3	96 19.9	18.3
S 08	298 45.1	301 35.5	47.6	295 26.5	36.8	112 30.2	58.2	111 22.6	18.2
A 09	313 47.6	316 35.1	·· 46.4	310 27.2	·· 37.6	127 33.0	·· 58.1	126 25.2	·· 18.1
T 10	328 50.0	331 34.8	45.2	325 27.9	38.4	142 35.8	58.0	141 27.9	18.0
U 11	343 52.5	346 34.4	43.9	340 28.6	39.1	157 38.5	57.8	156 30.5	17.9
R 12	358 55.0	1 34.0	S 2 42.7	355 29.3	N 0 39.9	172 41.3	S 0 57.7	171 33.2	S 0 17.9
D 13	13 57.4	16 33.6	41.4	10 30.0	40.7	187 44.0	57.6	186 35.8	17.8
A 14	28 59.9	31 33.2	40.2	25 30.7	41.5	202 46.8	57.5	201 38.4	17.7
Y 15	44 02.4	46 32.8	·· 38.9	40 31.3	·· 42.3	217 49.5	·· 57.3	216 41.1	·· 17.6
16	59 04.8	61 32.4	37.7	55 32.0	43.1	232 52.3	57.2	231 43.7	17.6
17	74 07.3	76 32.0	36.4	70 32.7	43.9	247 55.1	57.1	246 46.4	17.5
18	89 09.7	91 31.7	S 2 35.2	85 33.4	N 0 44.7	262 57.8	S 0 56.9	261 49.0	S 0 17.4
19	104 12.2	106 31.3	34.0	100 34.1	45.5	278 00.6	56.8	276 51.6	17.3
20	119 14.7	121 30.9	32.7	115 34.8	46.2	293 03.3	56.7	291 54.3	17.2
21	134 17.1	136 30.5	·· 31.5	130 35.5	·· 47.0	308 06.1	·· 56.6	306 56.9	·· 17.2
22	149 19.6	151 30.1	30.2	145 36.2	47.8	323 08.8	56.4	321 59.6	17.1
23	164 22.1	166 29.7	29.0	160 36.9	48.6	338 11.6	56.3	337 02.2	17.0
22 00	179 24.5	181 29.3	S 2 27.7	175 37.6	N 0 49.4	353 14.4	S 0 56.2	352 04.8	S 0 16.9
01	194 27.0	196 28.9	26.5	190 38.3	50.2	8 17.1	56.0	7 07.5	16.8
02	209 29.5	211 28.6	25.2	205 39.0	51.0	23 19.9	55.9	22 10.1	16.8
03	224 31.9	226 28.2	·· 24.0	220 39.7	·· 51.8	38 22.6	·· 55.8	37 12.8	·· 16.7
04	239 34.4	241 27.8	22.7	235 40.4	52.6	53 25.4	55.7	52 15.4	16.6
05	254 36.9	256 27.4	21.5	250 41.1	53.3	68 28.1	55.5	67 18.0	16.5
06	269 39.3	271 27.0	S 2 20.2	265 41.7	N 0 54.1	83 30.9	S 0 55.4	82 20.7	S 0 16.4
07	284 41.8	286 26.6	19.0	280 42.4	54.9	98 33.7	55.3	97 23.3	16.4
08	299 44.2	301 26.2	17.7	295 43.1	55.7	113 36.4	55.1	112 26.0	16.3
S 09	314 46.7	316 25.8	·· 16.5	310 43.8	·· 56.5	128 39.2	·· 55.0	127 28.6	·· 16.2
U 10	329 49.2	331 25.5	15.3	325 44.5	57.3	143 41.9	54.9	142 31.3	16.1
N 11	344 51.6	346 25.1	14.0	340 45.2	58.1	158 44.7	54.7	157 33.9	16.1
D 12	359 54.1	1 24.7	S 2 12.8	355 45.9	N 0 58.9	173 47.5	S 0 54.6	172 36.5	S 0 16.0
A 13	14 56.6	16 24.3	11.5	10 46.6	0 59.7	188 50.2	54.5	187 39.2	15.9
Y 14	29 59.0	31 23.9	10.3	25 47.3	1 00.4	203 53.0	54.4	202 41.8	15.8
15	45 01.5	46 23.5	·· 09.0	40 48.0	·· 01.2	218 55.7	·· 54.2	217 44.5	·· 15.7
16	60 04.0	61 23.2	07.8	55 48.7	02.0	233 58.5	54.1	232 47.1	15.7
17	75 06.4	76 22.8	06.5	70 49.4	02.8	249 01.3	54.0	247 49.7	15.6
18	90 08.9	91 22.4	S 2 05.3	85 50.1	N 1 03.6	264 04.0	S 0 53.8	262 52.4	S 0 15.5
19	105 11.4	106 22.0	04.0	100 50.8	04.4	279 06.8	53.7	277 55.0	15.4
20	120 13.8	121 21.6	02.8	115 51.5	05.2	294 09.5	53.6	292 57.7	15.3
21	135 16.3	136 21.2	·· 01.5	130 52.2	·· 06.0	309 12.3	·· 53.5	308 00.3	·· 15.3
22	150 18.7	151 20.8	2 00.3	145 52.9	06.7	324 15.0	53.3	323 03.0	15.2
23	165 21.2	166 20.5	1 59.0	160 53.5	07.5	339 17.8	53.2	338 05.6	15.1
Mer. Pass.	h m 12 04.3	v −0.4	d 1.2	v 0.7	d 0.8	v 2.8	d 0.1	v 2.6	d 0.1

STARS		
Name	S.H.A.	Dec.
	° ′	° ′
Acamar	315 37.3	S40 23.1
Achernar	335 45.5	S57 20.2
Acrux	173 36.2	S62 59.6
Adhara	255 31.8	S28 57.1
Aldebaran	291 17.7	N16 28.2
Alioth	166 41.7	N56 03.7
Alkaid	153 17.8	N49 24.3
Al Na'ir	28 14.9	S47 03.2
Alnilam	276 11.4	S 1 13.0
Alphard	218 20.0	S 8 34.7
Alphecca	126 31.6	N26 46.5
Alpheratz	358 09.3	N28 59.0
Altair	62 32.3	N 8 48.9
Ankaa	353 40.3	S42 24.7
Antares	112 56.3	S26 23.4
Arcturus	146 17.9	N19 16.7
Atria	108 20.1	S68 59.4
Avior	234 27.7	S59 27.2
Bellatrix	278 58.4	N 6 19.8
Betelgeuse	271 27.9	N 7 24.1
Canopus	264 07.0	S52 41.5
Capella	281 10.9	N45 58.8
Deneb	49 48.5	N45 12.5
Denebola	182 58.4	N14 40.6
Diphda	349 20.9	S18 05.6
Dubhe	194 21.1	N61 51.2
Elnath	278 43.8	N28 35.5
Eltanin	90 57.6	N51 29.2
Enif	34 11.5	N 9 47.1
Fomalhaut	15 51.4	S29 43.5
Gacrux	172 27.8	S57 00.4
Gienah	176 17.3	S17 26.3
Hadar	149 22.3	S60 16.8
Hamal	328 28.8	N23 22.3
Kaus Aust.	84 16.4	S34 23.5
Kochab	137 18.2	N74 13.8
Markab	14 03.1	N15 06.0
Menkar	314 41.0	N 4 00.8
Menkent	148 36.3	S36 16.6
Miaplacidus	221 44.2	S69 38.6
Mirfak	309 15.9	N49 47.7
Nunki	76 28.8	S26 19.2
Peacock	53 58.2	S56 47.6
Pollux	243 57.6	N28 04.3
Procyon	245 25.3	N 5 16.3
Rasalhague	96 29.2	N12 34.3
Regulus	208 09.4	N12 03.5
Rigel	281 35.8	S 8 13.6
Rigil Kent.	140 24.9	S60 45.2
Sabik	102 40.7	S15 42.1
Schedar	350 09.2	N56 25.9
Shaula	96 55.3	S37 05.3
Sirius	258 55.3	S16 41.7
Spica	158 56.9	S11 03.8
Suhail	223 10.2	S43 21.6
Vega	80 55.7	N38 45.7
Zuben'ubi	137 32.4	S15 57.8

	S.H.A.	Mer. Pass.
	° ′	h m
Venus	3 13.3	11 54
Mars	356 55.6	12 18
Jupiter	173 42.8	0 31
Saturn	172 36.1	0 36

G.M.T.	SUN G.H.A.	SUN Dec.	MOON G.H.A.	MOON v	MOON Dec.	MOON d	MOON H.P.
d h	° ′	° ′	° ′	′	° ′	′	′
20 00	178 05.2	S 0 16.8	3 20.5	14.4	N 6 17.6	10.3	55.0
01	193 05.4	15.8	17 53.9	14.3	6 07.3	10.3	55.0
02	208 05.6	14.8	32 27.2	14.5	5 57.0	10.3	55.0
03	223 05.7	·· 13.9	47 00.7	14.4	5 46.7	10.4	54.9
04	238 05.9	12.9	61 34.1	14.5	5 36.3	10.4	54.9
05	253 06.1	11.9	76 07.6	14.5	5 25.9	10.4	54.9
06	268 06.3	S 0 10.9	90 41.1	14.5	N 5 15.5	10.4	54.9
07	283 06.5	09.9	105 14.6	14.6	5 05.1	10.4	54.9
08	298 06.7	08.9	119 48.2	14.6	4 54.7	10.5	54.9
F 09	313 06.9	·· 07.9	134 21.8	14.7	4 44.2	10.4	54.8
R 10	328 07.0	06.9	148 55.5	14.6	4 33.8	10.5	54.8
I 11	343 07.2	06.0	163 29.1	14.7	4 23.3	10.5	54.8
D 12	358 07.4	S 0 05.0	178 02.8	14.8	N 4 12.8	10.5	54.8
A 13	13 07.6	04.0	192 36.6	14.7	4 02.3	10.5	54.8
Y 14	28 07.8	03.0	207 10.3	14.8	3 51.8	10.5	54.8
15	43 08.0	·· 02.0	221 44.1	14.8	3 41.3	10.6	54.8
16	58 08.2	S 0 01.0	236 17.9	14.8	3 30.7	10.5	54.7
17	73 08.4	0 00.0	250 51.7	14.9	3 20.2	10.6	54.7
18	88 08.5	N 0 00.9	265 25.6	14.9	N 3 09.6	10.5	54.7
19	103 08.7	01.9	279 59.5	14.9	2 59.1	10.6	54.7
20	118 08.9	02.9	294 33.4	14.9	2 48.5	10.6	54.7
21	133 09.1	·· 03.9	309 07.3	15.0	2 37.9	10.5	54.7
22	148 09.3	04.9	323 41.3	14.9	2 27.4	10.6	54.7
23	163 09.5	05.9	338 15.2	15.0	2 16.8	10.6	54.7
21 00	178 09.7	N 0 06.9	352 49.2	15.0	N 2 06.2	10.6	54.6
01	193 09.8	07.9	7 23.2	15.1	1 55.6	10.6	54.6
02	208 10.0	08.8	21 57.3	15.0	1 45.0	10.6	54.6
03	223 10.2	·· 09.8	36 31.3	15.1	1 34.4	10.6	54.6
04	238 10.4	10.8	51 05.4	15.1	1 23.8	10.6	54.6
05	253 10.6	11.8	65 39.5	15.1	1 13.2	10.6	54.6
06	268 10.8	N 0 12.8	80 13.6	15.1	N 1 02.6	10.6	54.6
07	283 11.0	13.8	94 47.7	15.2	0 52.0	10.6	54.5
S 08	298 11.2	14.8	109 21.9	15.1	0 41.4	10.6	54.5
A 09	313 11.3	·· 15.8	123 56.0	15.2	0 30.8	10.6	54.5
T 10	328 11.5	16.7	138 30.2	15.2	0 20.2	10.6	54.5
U 11	343 11.7	17.7	153 04.4	15.2	N 0 09.6	10.6	54.5
R 12	358 11.9	N 0 18.7	167 38.6	15.2	S 0 01.0	10.6	54.5
D 13	13 12.1	19.7	182 12.8	15.2	0 11.6	10.6	54.5
A 14	28 12.3	20.7	196 47.0	15.3	0 22.2	10.5	54.5
Y 15	43 12.5	·· 21.7	211 21.3	15.2	0 32.7	10.6	54.5
16	58 12.7	22.7	225 55.5	15.3	0 43.3	10.6	54.4
17	73 12.9	23.6	240 29.8	15.2	0 53.9	10.5	54.4
18	88 13.0	N 0 24.6	255 04.0	15.3	S 1 04.4	10.5	54.4
19	103 13.2	25.6	269 38.3	15.3	1 14.9	10.6	54.4
20	118 13.4	26.6	284 12.6	15.3	1 25.5	10.5	54.4
21	133 13.6	·· 27.6	298 46.9	15.3	1 36.0	10.5	54.4
22	148 13.8	28.6	313 21.2	15.3	1 46.5	10.5	54.4
23	163 14.0	29.6	327 55.5	15.3	1 57.0	10.5	54.4
22 00	178 14.2	N 0 30.6	342 29.8	15.4	S 2 07.5	10.5	54.4
01	193 14.4	31.5	357 04.2	15.3	2 18.0	10.4	54.3
02	208 14.5	32.5	11 38.5	15.3	2 28.4	10.5	54.3
03	223 14.7	·· 33.5	26 12.8	15.4	2 38.9	10.4	54.3
04	238 14.9	34.5	40 47.2	15.3	2 49.3	10.4	54.3
05	253 15.1	35.5	55 21.5	15.3	2 59.7	10.4	54.3
06	268 15.3	N 0 36.5	69 55.8	15.4	S 3 10.1	10.4	54.3
07	283 15.5	37.5	84 30.2	15.3	3 20.5	10.4	54.3
08	298 15.7	38.4	99 04.5	15.4	3 30.9	10.4	54.3
S 09	313 15.9	·· 39.4	113 38.9	15.3	3 41.3	10.3	54.3
U 10	328 16.1	40.4	128 13.2	15.4	3 51.6	10.3	54.3
N 11	343 16.2	41.4	142 47.6	15.3	4 01.9	10.3	54.3
D 12	358 16.4	N 0 42.4	157 21.9	15.3	S 4 12.2	10.3	54.2
A 13	13 16.6	43.4	171 56.2	15.4	4 22.5	10.2	54.2
Y 14	28 16.8	44.4	186 30.6	15.3	4 32.7	10.3	54.2
15	43 17.0	·· 45.3	201 04.9	15.3	4 43.0	10.2	54.2
16	58 17.2	46.3	215 39.2	15.4	4 53.2	10.2	54.2
17	73 17.4	47.3	230 13.6	15.3	5 03.4	10.1	54.2
18	88 17.6	N 0 48.3	244 47.9	15.3	S 5 13.5	10.2	54.2
19	103 17.8	49.3	259 22.2	15.3	5 23.7	10.1	54.2
20	118 17.9	50.3	273 56.5	15.3	5 33.8	10.1	54.2
21	133 18.1	·· 51.3	288 30.8	15.3	5 43.9	10.0	54.2
22	148 18.3	52.2	303 05.1	15.3	5 53.9	10.1	54.2
23	163 18.5	53.2	317 39.4	15.3	6 04.0	10.0	54.2
	S.D. 16.1	d 1.0	S.D. 14.9		14.8		14.8

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

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

Day	SUN Eqn. of Time 00ʰ	SUN Eqn. of Time 12ʰ	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
	m s	m s	h m	h m	h m	d	
20	07 40	07 31	12 08	24 30	12 08	14	
21	07 22	07 13	12 07	00 30	12 51	15	○
22	07 04	06 55	12 07	01 12	13 33	16	

G.M.T.	ARIES	VENUS −3.4		MARS +1.3		JUPITER −2.0		SATURN +0.7		STARS		
	G.H.A.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.	Name	S.H.A.	Dec.
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	° ′
23 00	180 23.7	181 20.1	S 1 57.8	175 54.2	N 1 08.3	354 20.6	S 0 53.1	353 08.2	S 0 15.0	Acamar	315 37.3	S40 23.1
01	195 26.1	196 19.7	56.5	190 54.9	09.1	9 23.3	52.9	8 10.9	14.9	Achernar	335 45.6	S57 20.2
02	210 28.6	211 19.3	55.3	205 55.6	09.9	24 26.1	52.8	23 13.5	14.9	Acrux	173 36.2	S62 59.7
03	225 31.1	226 18.9	·· 54.0	220 56.3	·· 10.7	39 28.8	·· 52.7	38 16.2	·· 14.8	Adhara	255 31.8	S28 57.1
04	240 33.5	241 18.5	52.8	235 57.0	11.5	54 31.6	52.6	53 18.8	14.7	Aldebaran	291 17.8	N16 28.2
05	255 36.0	256 18.2	51.5	250 57.7	12.3	69 34.4	52.4	68 21.4	14.6			
06	270 38.5	271 17.8	S 1 50.3	265 58.4	N 1 13.1	84 37.1	S 0 52.3	83 24.1	S 0 14.6	Alioth	166 41.7	N56 03.7
07	285 40.9	286 17.4	49.0	280 59.1	13.8	99 39.9	52.2	98 26.7	14.5	Alkaid	153 17.8	N49 24.3
08	300 43.4	301 17.0	47.8	295 59.8	14.6	114 42.6	52.0	113 29.4	14.4	Al Na'ir	28 14.9	S47 03.2
M 09	315 45.8	316 16.6	·· 46.5	311 00.5	·· 15.4	129 45.4	·· 51.9	128 32.0	·· 14.3	Alnilam	276 11.4	S 1 13.0
O 10	330 48.3	331 16.2	45.3	326 01.2	16.2	144 48.2	51.8	143 34.7	14.2	Alphard	218 20.0	S 8 34.7
N 11	345 50.8	346 15.9	44.0	341 01.9	17.0	159 50.9	51.7	158 37.3	14.2			
D 12	0 53.2	1 15.5	S 1 42.8	356 02.6	N 1 17.8	174 53.7	S 0 51.5	173 39.9	S 0 14.1	Alphecca	126 31.6	N26 46.5
A 13	15 55.7	16 15.1	41.5	11 03.3	18.6	189 56.4	51.4	188 42.6	14.0	Alpheratz	358 09.3	N28 59.0
Y 14	30 58.2	31 14.7	40.3	26 04.0	19.4	204 59.2	51.3	203 45.2	13.9	Altair	62 32.3	N 8 48.9
15	46 00.6	46 14.3	·· 39.0	41 04.7	·· 20.1	220 01.9	·· 51.1	218 47.9	·· 13.8	Ankaa	353 40.3	S42 24.7
16	61 03.1	61 13.9	37.8	56 05.4	20.9	235 04.7	51.0	233 50.5	13.8	Antares	112 56.3	S26 23.4
17	76 05.6	76 13.6	36.5	71 06.1	21.7	250 07.5	50.9	248 53.1	13.7			
18	91 08.0	91 13.2	S 1 35.3	86 06.7	N 1 22.5	265 10.2	S 0 50.8	263 55.8	S 0 13.6	Arcturus	146 17.9	N19 16.7
19	106 10.5	106 12.8	34.0	101 07.4	23.3	280 13.0	50.6	278 58.4	13.5	Atria	108 20.1	S68 59.4
20	121 13.0	121 12.4	32.8	116 08.1	24.1	295 15.7	50.5	294 01.1	13.4	Avior	234 27.7	S59 27.2
21	136 15.4	136 12.0	·· 31.5	131 08.8	·· 24.9	310 18.5	·· 50.4	309 03.7	·· 13.4	Bellatrix	278 58.5	N 6 19.8
22	151 17.9	151 11.7	30.3	146 09.5	25.6	325 21.3	50.2	324 06.4	13.3	Betelgeuse	271 27.9	N 7 24.1
23	166 20.3	166 11.3	29.0	161 10.2	26.4	340 24.0	50.1	339 09.0	13.2			
24 00	181 22.8	181 10.9	S 1 27.8	176 10.9	N 1 27.2	355 26.8	S 0 50.0	354 11.6	S 0 13.1	Canopus	264 07.0	S52 41.5
01	196 25.3	196 10.5	26.5	191 11.6	28.0	10 29.5	49.9	9 14.3	13.1	Capella	281 10.9	N45 58.8
02	211 27.7	211 10.1	25.3	206 12.3	28.8	25 32.3	49.7	24 16.9	13.0	Deneb	49 48.5	N45 12.5
03	226 30.2	226 09.7	·· 24.0	221 13.0	·· 29.6	40 35.1	·· 49.6	39 19.6	·· 12.9	Denebola	182 58.4	N14 40.6
04	241 32.7	241 09.4	22.8	236 13.7	30.4	55 37.8	49.5	54 22.2	12.8	Diphda	349 20.9	S18 05.6
05	256 35.1	256 09.0	21.5	251 14.4	31.2	70 40.6	49.3	69 24.9	12.7			
06	271 37.6	271 08.6	S 1 20.3	266 15.1	N 1 31.9	85 43.3	S 0 49.2	84 27.5	S 0 12.7	Dubhe	194 21.1	N61 51.2
07	286 40.1	286 08.2	19.0	281 15.8	32.7	100 46.1	49.1	99 30.1	12.6	Elnath	278 43.8	N28 35.5
08	301 42.5	301 07.8	17.7	296 16.5	33.5	115 48.9	49.0	114 32.8	12.5	Eltanin	90 57.5	N51 29.2
T 09	316 45.0	316 07.5	·· 16.5	311 17.2	·· 34.3	130 51.6	·· 48.8	129 35.4	·· 12.4	Enif	34 11.5	N 9 47.1
U 10	331 47.5	331 07.1	15.2	326 17.9	35.1	145 54.4	48.7	144 38.1	12.3	Fomalhaut	15 51.4	S29 43.5
E 11	346 49.9	346 06.7	14.0	341 18.6	35.9	160 57.1	48.6	159 40.7	12.3			
S 12	1 52.4	1 06.3	S 1 12.7	356 19.3	N 1 36.7	175 59.9	S 0 48.4	174 43.3	S 0 12.2	Gacrux	172 27.8	S57 00.4
D 13	16 54.8	16 05.9	11.5	11 20.0	37.4	191 02.7	48.3	189 46.0	12.1	Gienah	176 17.3	S17 26.3
A 14	31 57.3	31 05.6	10.2	26 20.7	38.2	206 05.4	48.2	204 48.6	12.0	Hadar	149 22.3	S60 16.8
Y 15	46 59.8	46 05.2	·· 09.0	41 21.3	·· 39.0	221 08.2	·· 48.1	219 51.3	·· 11.9	Hamal	328 28.8	N23 22.3
16	62 02.2	61 04.8	07.7	56 22.0	39.8	236 10.9	47.9	234 53.9	11.9	Kaus Aust.	84 16.4	S34 23.5
17	77 04.7	76 04.4	06.5	71 22.7	40.6	251 13.7	47.8	249 56.6	11.8			
18	92 07.2	91 04.0	S 1 05.2	86 23.4	N 1 41.4	266 16.5	S 0 47.7	264 59.2	S 0 11.7	Kochab	137 18.1	N74 13.8
19	107 09.6	106 03.7	04.0	101 24.1	42.2	281 19.2	47.5	280 01.8	11.6	Markab	14 03.1	N15 06.0
20	122 12.1	121 03.3	02.7	116 24.8	42.9	296 22.0	47.4	295 04.5	11.6	Menkar	314 41.0	N 4 00.8
21	137 14.6	136 02.9	·· 01.5	131 25.5	·· 43.7	311 24.7	·· 47.3	310 07.1	·· 11.5	Menkent	148 36.3	S36 16.6
22	152 17.0	151 02.5	1 00.2	146 26.2	44.5	326 27.5	47.1	325 09.8	11.4	Miaplacidus	221 44.2	S69 38.6
23	167 19.5	166 02.1	0 59.0	161 26.9	45.3	341 30.3	47.0	340 12.4	11.3			
25 00	182 21.9	181 01.8	S 0 57.7	176 27.6	N 1 46.1	356 33.0	S 0 46.9	355 15.1	S 0 11.2	Mirfak	309 15.9	N49 47.7
01	197 24.4	196 01.4	56.4	191 28.3	46.9	11 35.8	46.8	10 17.7	11.2	Nunki	76 28.8	S26 19.2
02	212 26.9	211 01.0	55.2	206 29.0	47.7	26 38.5	46.6	25 20.3	11.1	Peacock	53 58.2	S56 47.6
03	227 29.3	226 00.6	·· 53.9	221 29.7	·· 48.4	41 41.3	·· 46.5	40 23.0	·· 11.0	Pollux	243 57.6	N28 04.3
04	242 31.8	241 00.2	52.7	236 30.4	49.2	56 44.1	46.4	55 25.6	10.9	Procyon	245 25.3	N 5 16.3
05	257 34.3	255 59.9	51.4	251 31.1	50.0	71 46.8	46.2	70 28.3	10.8			
06	272 36.7	270 59.5	S 0 50.2	266 31.8	N 1 50.8	86 49.6	S 0 46.1	85 30.9	S 0 10.8	Rasalhague	96 29.2	N12 34.3
W 07	287 39.2	285 59.1	48.9	281 32.5	51.6	101 52.3	46.0	100 33.6	10.7	Regulus	208 09.4	N12 03.5
E 08	302 41.7	300 58.7	47.7	296 33.2	52.4	116 55.1	45.9	115 36.2	10.6	Rigel	281 35.8	S 8 13.6
D 09	317 44.1	315 58.3	·· 46.4	311 33.9	·· 53.1	131 57.9	·· 45.7	130 38.8	·· 10.5	Rigil Kent.	140 24.9	S60 45.2
N 10	332 46.6	330 58.0	45.2	326 34.6	53.9	147 00.6	45.6	145 41.5	10.4	Sabik	102 40.7	S15 42.1
E 11	347 49.1	345 57.6	43.9	341 35.3	54.7	162 03.4	45.5	160 44.1	10.4			
S 12	2 51.5	0 57.2	S 0 42.7	356 36.0	N 1 55.5	177 06.1	S 0 45.3	175 46.8	S 0 10.3	Schedar	350 09.2	N56 25.9
D 13	17 54.0	15 56.8	41.4	11 36.7	56.3	192 08.9	45.2	190 49.4	10.2	Shaula	96 55.2	S37 05.3
A 14	32 56.4	30 56.4	40.1	26 37.4	57.1	207 11.7	45.1	205 52.1	10.1	Sirius	258 55.4	S16 41.7
Y 15	47 58.9	45 56.1	·· 38.9	41 38.0	·· 57.9	222 14.4	·· 45.0	220 54.7	·· 10.1	Spica	158 56.9	S11 03.8
16	63 01.4	60 55.7	37.6	56 38.7	58.6	237 17.2	44.8	235 57.3	10.0	Suhail	223 10.2	S43 21.6
17	78 03.8	75 55.3	36.4	71 39.4	1 59.4	252 19.9	44.7	251 00.0	09.9			
18	93 06.3	90 54.9	S 0 35.1	86 40.1	N 2 00.2	267 22.7	S 0 44.6	266 02.6	S 0 09.8	Vega	80 55.6	N38 45.7
19	108 08.8	105 54.6	33.9	101 40.8	01.0	282 25.5	44.4	281 05.3	09.7	Zuben'ubi	137 32.4	S15 57.8
20	123 11.2	120 54.2	32.6	116 41.5	01.8	297 28.2	44.3	296 07.9	09.7			
21	138 13.7	135 53.8	·· 31.4	131 42.2	·· 02.6	312 31.0	·· 44.2	311 10.6	·· 09.6		S.H.A.	Mer. Pass.
22	153 16.2	150 53.4	30.1	146 42.9	03.3	327 33.8	44.1	326 13.2	09.5		° ′	h m
23	168 18.6	165 53.0	28.9	161 43.6	04.1	342 36.5	43.9	341 15.8	09.4	Venus	359 48.1	11 56
	h m									Mars	354 48.1	12 15
Mer. Pass.	11 52.5	v −0.4	d 1.3	v 0.7	d 0.8	v 2.8	d 0.1	v 2.6	d 0.1	Jupiter	174 04.0	0 18
										Saturn	172 48.8	0 23

G.M.T.	SUN G.H.A.	SUN Dec.	MOON G.H.A.	MOON v	MOON Dec.	MOON d	MOON H.P.
d h	° ′	° ′	° ′	′	° ′	′	′
23 00	178 18.7	N 0 54.2	332 13.7	15.3	S 6 14.0	10.0	54.2
01	193 18.9	55.2	346 48.0	15.2	6 24.0	9.9	54.1
02	208 19.1	56.2	1 22.2	15.3	6 33.9	9.9	54.1
03	223 19.3	·· 57.2	15 56.5	15.2	6 43.8	9.9	54.1
04	238 19.5	58.2	30 30.7	15.2	6 53.7	9.9	54.1
05	253 19.7	0 59.1	45 04.9	15.2	7 03.6	9.8	54.1
06	268 19.8	N 1 00.1	59 39.1	15.3	S 7 13.4	9.8	54.1
07	283 20.0	01.1	74 13.4	15.1	7 23.2	9.8	54.1
08	298 20.2	02.1	88 47.5	15.2	7 33.0	9.8	54.1
M 09	313 20.4	·· 03.1	103 21.7	15.2	7 42.8	9.7	54.1
O 10	328 20.6	04.1	117 55.9	15.1	7 52.5	9.6	54.1
N 11	343 20.8	05.1	132 30.0	15.2	8 02.1	9.7	54.1
D 12	358 21.0	N 1 06.0	147 04.2	15.1	S 8 11.8	9.6	54.1
A 13	13 21.2	07.0	161 38.3	15.1	8 21.4	9.5	54.1
Y 14	28 21.4	08.0	176 12.4	15.1	8 30.9	9.6	54.1
15	43 21.5	·· 09.0	190 46.5	15.0	8 40.5	9.5	54.1
16	58 21.7	10.0	205 20.5	15.1	8 50.0	9.4	54.1
17	73 21.9	11.0	219 54.6	15.0	8 59.4	9.4	54.1
18	88 22.1	N 1 11.9	234 28.6	15.0	S 9 08.8	9.4	54.1
19	103 22.3	12.9	249 02.6	15.0	9 18.2	9.4	54.1
20	118 22.5	13.9	263 36.6	15.0	9 27.6	9.3	54.1
21	133 22.7	·· 14.9	278 10.6	14.9	9 36.9	9.2	54.1
22	148 22.9	15.9	292 44.5	14.9	9 46.1	9.3	54.1
23	163 23.1	16.9	307 18.4	14.9	9 55.4	9.1	54.1
24 00	178 23.3	N 1 17.8	321 52.3	14.9	S10 04.5	9.2	54.1
01	193 23.4	18.8	336 26.2	14.9	10 13.7	9.1	54.1
02	208 23.6	19.8	351 00.1	14.8	10 22.8	9.0	54.1
03	223 23.8	·· 20.8	5 33.9	14.8	10 31.8	9.0	54.1
04	238 24.0	21.8	20 07.7	14.8	10 40.8	9.0	54.0
05	253 24.2	22.8	34 41.5	14.8	10 49.8	8.9	54.0
06	268 24.4	N 1 23.8	49 15.3	14.7	S10 58.7	8.9	54.0
07	283 24.6	24.7	63 49.0	14.7	11 07.6	8.8	54.0
08	298 24.8	25.7	78 22.7	14.7	11 16.4	8.8	54.0
T 09	313 25.0	·· 26.7	92 56.4	14.7	11 25.2	8.7	54.0
U 10	328 25.2	27.7	107 30.1	14.6	11 33.9	8.7	54.0
E 11	343 25.3	28.7	122 03.7	14.6	11 42.6	8.6	54.0
S 12	358 25.5	N 1 29.7	136 37.3	14.6	S11 51.2	8.6	54.0
D 13	13 25.7	30.6	151 10.9	14.5	11 59.8	8.6	54.0
A 14	28 25.9	31.6	165 44.4	14.5	12 08.4	8.5	54.0
Y 15	43 26.1	·· 32.6	180 17.9	14.5	12 16.9	8.4	54.1
16	58 26.3	33.6	194 51.4	14.4	12 25.3	8.4	54.1
17	73 26.5	34.6	209 24.8	14.5	12 33.7	8.3	54.1
18	88 26.7	N 1 35.6	223 58.3	14.4	S12 42.0	8.3	54.1
19	103 26.9	36.5	238 31.7	14.3	12 50.3	8.2	54.1
20	118 27.1	37.5	253 05.0	14.3	12 58.5	8.2	54.1
21	133 27.2	·· 38.5	267 38.3	14.3	13 06.7	8.1	54.1
22	148 27.4	39.5	282 11.6	14.3	13 14.8	8.1	54.1
23	163 27.6	40.5	296 44.9	14.2	13 22.9	8.0	54.1
25 00	178 27.8	N 1 41.5	311 18.1	14.2	S13 30.9	7.9	54.1
01	193 28.0	42.4	325 51.3	14.2	13 38.8	7.9	54.1
02	208 28.2	43.4	340 24.5	14.1	13 46.7	7.9	54.1
03	223 28.4	·· 44.4	354 57.6	14.1	13 54.6	7.8	54.1
04	238 28.6	45.4	9 30.7	14.1	14 02.4	7.7	54.1
05	253 28.8	46.4	24 03.8	14.0	14 10.1	7.7	54.1
06	268 29.0	N 1 47.3	38 36.8	14.0	S14 17.8	7.6	54.1
W 07	283 29.1	48.3	53 09.8	13.9	14 25.4	7.5	54.1
E 08	298 29.3	49.3	67 42.7	13.9	14 32.9	7.5	54.1
D 09	313 29.5	·· 50.3	82 15.6	13.9	14 40.4	7.4	54.1
N 10	328 29.7	51.3	96 48.5	13.8	14 47.8	7.4	54.1
E 11	343 29.9	52.3	111 21.3	13.8	14 55.2	7.3	54.1
S 12	358 30.1	N 1 53.2	125 54.1	13.8	S15 02.5	7.2	54.1
D 13	13 30.3	54.2	140 26.9	13.7	15 09.7	7.2	54.1
A 14	28 30.5	55.2	154 59.6	13.7	15 16.9	7.1	54.1
Y 15	43 30.7	·· 56.2	169 32.3	13.7	15 24.0	7.0	54.2
16	58 30.9	57.2	184 05.0	13.6	15 31.0	7.0	54.2
17	73 31.1	58.2	198 37.6	13.5	15 38.0	6.9	54.2
18	88 31.2	N 1 59.1	213 10.1	13.5	S15 44.9	6.9	54.2
19	103 31.4	2 00.1	227 42.6	13.5	15 51.8	6.8	54.2
20	118 31.6	01.1	242 15.1	13.5	15 58.6	6.7	54.2
21	133 31.8	·· 02.1	256 47.6	13.4	16 05.3	6.6	54.2
22	148 32.0	03.1	271 20.0	13.3	16 11.9	6.6	54.2
23	163 32.2	04.0	285 52.3	13.4	16 18.5	6.5	54.2
	S.D. 16.1	d 1.0	S.D. 14.7		14.7		14.7

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

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

Day	SUN Eqn. of Time 00ʰ	SUN Eqn. of Time 12ʰ	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
	m s	m s	h m	h m	h m	d	
23	06 46	06 36	12 07	01 54	14 16	17	
24	06 27	06 18	12 06	02 37	14 59	18	◑
25	06 09	06 00	12 06	03 21	15 43	19	

G.M.T.	ARIES	VENUS −3.5		MARS +1.3		JUPITER −2.0		SATURN +0.6	
	G.H.A.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
26 00	183 21.1	180 52.7	S 0 27.6	176 44.3	N 2 04.9	357 39.3	S 0 43.8	356 18.5	S 0 09.3
01	198 23.6	195 52.3	26.3	191 45.0	05.7	12 42.0	43.7	11 21.1	09.3
02	213 26.0	210 51.9	25.1	206 45.7	06.5	27 44.8	43.5	26 23.8	09.2
03	228 28.5	225 51.5	·· 23.8	221 46.4	·· 07.3	42 47.6	·· 43.4	41 26.4	·· 09.1
04	243 30.9	240 51.1	22.6	236 47.1	08.0	57 50.3	43.3	56 29.1	09.0
05	258 33.4	255 50.8	21.3	251 47.8	08.8	72 53.1	43.2	71 31.7	09.0
06	273 35.9	270 50.4	S 0 20.1	266 48.5	N 2 09.6	87 55.8	S 0 43.0	86 34.3	S 0 08.9
07	288 38.3	285 50.0	18.8	281 49.2	10.4	102 58.6	42.9	101 37.0	08.8
T 08	303 40.8	300 49.6	17.6	296 49.9	11.2	118 01.4	42.8	116 39.6	08.7
H 09	318 43.3	315 49.3	·· 16.3	311 50.6	·· 12.0	133 04.1	·· 42.6	131 42.3	·· 08.6
U 10	333 45.7	330 48.9	15.1	326 51.3	12.7	148 06.9	42.5	146 44.9	08.6
R 11	348 48.2	345 48.5	13.8	341 52.0	13.5	163 09.6	42.4	161 47.5	08.5
S 12	3 50.7	0 48.1	S 0 12.5	356 52.7	N 2 14.3	178 12.4	S 0 42.3	176 50.2	S 0 08.4
D 13	18 53.1	15 47.7	11.3	11 53.4	15.1	193 15.2	42.1	191 52.8	08.3
A 14	33 55.6	30 47.4	10.0	26 54.1	15.9	208 17.9	42.0	206 55.5	08.2
Y 15	48 58.0	45 47.0	·· 08.8	41 54.8	·· 16.7	223 20.7	·· 41.9	221 58.1	·· 08.2
16	64 00.5	60 46.6	07.5	56 55.5	17.4	238 23.4	41.7	237 00.8	08.1
17	79 03.0	75 46.2	06.3	71 56.2	18.2	253 26.2	41.6	252 03.4	08.0
18	94 05.4	90 45.9	S 0 05.0	86 56.8	N 2 19.0	268 29.0	S 0 41.5	267 06.1	S 0 07.9
19	109 07.9	105 45.5	03.8	101 57.5	19.8	283 31.7	41.4	282 08.7	07.9
20	124 10.4	120 45.1	02.5	116 58.2	20.6	298 34.5	41.2	297 11.3	07.8
21	139 12.8	135 44.7	S 0 01.2	131 58.9	·· 21.4	313 37.2	·· 41.1	312 14.0	·· 07.7
22	154 15.3	150 44.4	0 00.0	146 59.6	22.1	328 40.0	41.0	327 16.6	07.6
23	169 17.8	165 44.0	N 0 01.3	162 00.3	22.9	343 42.8	40.8	342 19.3	07.5
27 00	184 20.2	180 43.6	N 0 02.5	177 01.0	N 2 23.7	358 45.5	S 0 40.7	357 21.9	S 0 07.5
01	199 22.7	195 43.2	03.8	192 01.7	24.5	13 48.3	40.6	12 24.6	07.4
02	214 25.2	210 42.8	05.0	207 02.4	25.3	28 51.0	40.5	27 27.2	07.3
03	229 27.6	225 42.5	·· 06.3	222 03.1	·· 26.1	43 53.8	·· 40.3	42 29.8	·· 07.2
04	244 30.1	240 42.1	07.5	237 03.8	26.8	58 56.6	40.2	57 32.5	07.1
05	259 32.5	255 41.7	08.8	252 04.5	27.6	73 59.3	40.1	72 35.1	07.1
06	274 35.0	270 41.3	N 0 10.1	267 05.2	N 2 28.4	89 02.1	S 0 39.9	87 37.8	S 0 07.0
07	289 37.5	285 41.0	11.3	282 05.9	29.2	104 04.9	39.8	102 40.4	06.9
08	304 39.9	300 40.6	12.6	297 06.6	30.0	119 07.6	39.7	117 43.1	06.8
F 09	319 42.4	315 40.2	·· 13.8	312 07.3	·· 30.7	134 10.4	·· 39.6	132 45.7	·· 06.8
R 10	334 44.9	330 39.8	15.1	327 08.0	31.5	149 13.1	39.4	147 48.3	06.7
I 11	349 47.3	345 39.4	16.3	342 08.7	32.3	164 15.9	39.3	162 51.0	06.6
D 12	4 49.8	0 39.1	N 0 17.6	357 09.4	N 2 33.1	179 18.7	S 0 39.2	177 53.6	S 0 06.5
A 13	19 52.3	15 38.7	18.9	12 10.1	33.9	194 21.4	39.0	192 56.3	06.4
Y 14	34 54.7	30 38.3	20.1	27 10.8	34.7	209 24.2	38.9	207 58.9	06.4
15	49 57.2	45 37.9	·· 21.4	42 11.5	·· 35.4	224 26.9	·· 38.8	223 01.6	·· 06.3
16	64 59.7	60 37.6	22.6	57 12.2	36.2	239 29.7	38.7	238 04.2	06.2
17	80 02.1	75 37.2	23.9	72 12.9	37.0	254 32.5	38.5	253 06.8	06.1
18	95 04.6	90 36.8	N 0 25.1	87 13.6	N 2 37.8	269 35.2	S 0 38.4	268 09.5	S 0 06.0
19	110 07.0	105 36.4	26.4	102 14.3	38.6	284 38.0	38.3	283 12.1	06.0
20	125 09.5	120 36.1	27.6	117 15.0	39.3	299 40.7	38.2	298 14.8	05.9
21	140 12.0	135 35.7	·· 28.9	132 15.7	·· 40.1	314 43.5	·· 38.0	313 17.4	·· 05.8
22	155 14.4	150 35.3	30.2	147 16.4	40.9	329 46.3	37.9	328 20.1	05.7
23	170 16.9	165 34.9	31.4	162 17.1	41.7	344 49.0	37.8	343 22.7	05.7
28 00	185 19.4	180 34.5	N 0 32.7	177 17.8	N 2 42.5	359 51.8	S 0 37.6	358 25.3	S 0 05.6
01	200 21.8	195 34.2	33.9	192 18.5	43.2	14 54.5	37.5	13 28.0	05.5
02	215 24.3	210 33.8	35.2	207 19.1	44.0	29 57.3	37.4	28 30.6	05.4
03	230 26.8	225 33.4	·· 36.4	222 19.8	·· 44.8	45 00.1	·· 37.3	43 33.3	·· 05.3
04	245 29.2	240 33.0	37.7	237 20.5	45.6	60 02.8	37.1	58 35.9	05.3
05	260 31.7	255 32.7	38.9	252 21.2	46.4	75 05.6	37.0	73 38.6	05.2
06	275 34.2	270 32.3	N 0 40.2	267 21.9	N 2 47.1	90 08.3	S 0 36.9	88 41.2	S 0 05.1
07	290 36.6	285 31.9	41.5	282 22.6	47.9	105 11.1	36.7	103 43.8	05.0
S 08	305 39.1	300 31.5	42.7	297 23.3	48.7	120 13.9	36.6	118 46.5	04.9
A 09	320 41.5	315 31.2	·· 44.0	312 24.0	·· 49.5	135 16.6	·· 36.5	133 49.1	·· 04.9
T 10	335 44.0	330 30.8	45.2	327 24.7	50.3	150 19.4	36.4	148 51.8	04.8
U 11	350 46.5	345 30.4	46.5	342 25.4	51.0	165 22.1	36.2	163 54.4	04.7
R 12	5 48.9	0 30.0	N 0 47.7	357 26.1	N 2 51.8	180 24.9	S 0 36.1	178 57.1	S 0 04.6
D 13	20 51.4	15 29.7	49.0	12 26.8	52.6	195 27.7	36.0	193 59.7	04.6
A 14	35 53.9	30 29.3	50.3	27 27.5	53.4	210 30.4	35.8	209 02.3	04.5
Y 15	50 56.3	45 28.9	·· 51.5	42 28.2	·· 54.2	225 33.2	·· 35.7	224 05.0	·· 04.4
16	65 58.8	60 28.5	52.8	57 28.9	54.9	240 35.9	35.6	239 07.6	04.3
17	81 01.3	75 28.1	54.0	72 29.6	55.7	255 38.7	35.5	254 10.3	04.2
18	96 03.7	90 27.8	N 0 55.3	87 30.3	N 2 56.5	270 41.5	S 0 35.3	269 12.9	S 0 04.2
19	111 06.2	105 27.4	56.5	102 31.0	57.3	285 44.2	35.2	284 15.6	04.1
20	126 08.6	120 27.0	57.8	117 31.7	58.1	300 47.0	35.1	299 18.2	04.0
21	141 11.1	135 26.6	0 59.0	132 32.4	·· 58.8	315 49.7	·· 35.0	314 20.8	·· 03.9
22	156 13.6	150 26.3	1 00.3	147 33.1	2 59.6	330 52.5	34.8	329 23.5	03.9
23	171 16.0	165 25.9	01.6	162 33.8	3 00.4	345 55.3	34.7	344 26.1	03.8
Mer Pass.	h m 11 40.7	v −0.4	d 1.3	v 0.7	d 0.8	v 2.8	d 0.1	v 2.6	d 0.1

STARS		
Name	S.H.A.	Dec.
	° ′	° ′
Acamar	315 37.3	S40 23.1
Achernar	335 45.6	S57 20.2
Acrux	173 36.1	S62 59.7
Adhara	255 31.8	S28 57.1
Aldebaran	291 17.8	N16 28.2
Alioth	166 41.7	N56 03.7
Alkaid	153 17.8	N49 24.4
Al Na'ir	28 14.9	S47 03.1
Alnilam	276 11.4	S 1 13.0
Alphard	218 20.0	S 8 34.8
Alphecca	126 31.6	N26 46.5
Alpheratz	358 09.3	N28 59.0
Altair	62 32.3	N 8 48.9
Ankaa	353 40.3	S42 24.7
Antares	112 56.3	S26 23.4
Arcturus	146 17.9	N19 16.7
Atria	108 20.0	S68 59.4
Avior	234 27.8	S59 27.2
Bellatrix	278 58.5	N 6 19.8
Betelgeuse	271 28.0	N 7 24.1
Canopus	264 07.1	S52 41.5
Capella	281 10.9	N45 58.8
Deneb	49 48.5	N45 12.5
Denebola	182 58.4	N14 40.6
Diphda	349 20.9	S18 05.6
Dubhe	194 21.1	N61 51.3
Elnath	278 43.8	N28 35.5
Eltanin	90 57.5	N51 29.2
Enif	34 11.5	N 9 47.1
Fomalhaut	15 51.4	S29 43.4
Gacrux	172 27.8	S57 00.5
Gienah	176 17.3	S17 26.3
Hadar	149 22.3	S60 16.8
Hamal	328 28.8	N23 22.3
Kaus Aust.	84 16.4	S34 23.5
Kochab	137 18.1	N74 13.8
Markab	14 03.1	N15 06.0
Menkar	314 41.0	N 4 00.8
Menkent	148 36.3	S36 16.6
Miaplacidus	221 44.3	S69 38.6
Mirfak	309 16.0	N49 47.7
Nunki	76 28.8	S26 19.2
Peacock	53 58.1	S56 47.6
Pollux	243 57.6	N28 04.3
Procyon	245 25.3	N 5 16.3
Rasalhague	96 29.2	N12 34.3
Regulus	208 09.4	N12 03.5
Rigel	281 35.8	S 8 13.6
Rigil Kent.	140 24.8	S60 45.2
Sabik	102 40.6	S15 42.1
Schedar	350 09.2	N56 25.9
Shaula	96 55.2	S37 05.3
Sirius	258 55.4	S16 41.7
Spica	158 56.9	S11 03.8
Suhail	223 10.3	S43 21.6
Vega	80 55.6	N38 45.7
Zuben'ubi	137 32.4	S15 57.8

	S.H.A.	Mer. Pass.
	° ′	h m
Venus	356 23.4	11 57
Mars	352 40.8	12 11
Jupiter	174 25.3	0 05
Saturn	173 01.7	0 11

G.M.T.	SUN G.H.A.	SUN Dec.	MOON G.H.A.	MOON v	MOON Dec.	MOON d	MOON H.P.
d h	° ′	° ′	° ′	′	° ′	′	′
26 00	178 32.4	N 2 05.0	300 24.7	13.2	S16 25.0	6.4	54.2
01	193 32.6	06.0	314 56.9	13.3	16 31.4	6.4	54.2
02	208 32.8	07.0	329 29.2	13.2	16 37.8	6.3	54.2
03	223 33.0	·· 08.0	344 01.4	13.1	16 44.1	6.2	54.3
04	238 33.1	08.9	358 33.5	13.1	16 50.3	6.2	54.3
05	253 33.3	09.9	13 05.6	13.1	16 56.5	6.1	54.3
06	268 33.5	N 2 10.9	27 37.7	13.0	S17 02.6	6.0	54.3
07	283 33.7	11.9	42 09.7	13.0	17 08.6	5.9	54.3
T 08	298 33.9	12.9	56 41.7	13.0	17 14.5	5.9	54.3
H 09	313 34.1	·· 13.8	71 13.7	12.8	17 20.4	5.7	54.3
U 10	328 34.3	14.8	85 45.5	12.9	17 26.1	5.7	54.3
R 11	343 34.5	15.8	100 17.4	12.8	17 31.8	5.7	54.3
S 12	358 34.7	N 2 16.8	114 49.2	12.8	S17 37.5	5.5	54.4
D 13	13 34.9	17.8	129 21.0	12.7	17 43.0	5.5	54.4
A 14	28 35.0	18.7	143 52.7	12.7	17 48.5	5.4	54.4
Y 15	43 35.2	·· 19.7	158 24.4	12.6	17 53.9	5.3	54.4
16	58 35.4	20.7	172 56.0	12.6	17 59.2	5.3	54.4
17	73 35.6	21.7	187 27.6	12.5	18 04.5	5.1	54.4
18	88 35.8	N 2 22.7	201 59.1	12.5	S18 09.6	5.1	54.4
19	103 36.0	23.6	216 30.6	12.5	18 14.7	5.0	54.5
20	118 36.2	24.6	231 02.1	12.4	18 19.7	5.0	54.5
21	133 36.4	·· 25.6	245 33.5	12.3	18 24.7	4.8	54.5
22	148 36.6	26.6	260 04.8	12.4	18 29.5	4.8	54.5
23	163 36.8	27.6	274 36.2	12.2	18 34.3	4.6	54.5
27 00	178 37.0	N 2 28.5	289 07.4	12.3	S18 38.9	4.6	54.5
01	193 37.1	29.5	303 38.7	12.2	18 43.5	4.5	54.5
02	208 37.3	30.5	318 09.9	12.1	18 48.0	4.5	54.6
03	223 37.5	·· 31.5	332 41.0	12.1	18 52.5	4.3	54.6
04	238 37.7	32.5	347 12.1	12.0	18 56.8	4.2	54.6
05	253 37.9	33.4	1 43.1	12.0	19 01.0	4.2	54.6
06	268 38.1	N 2 34.4	16 14.1	12.0	S19 05.2	4.1	54.6
07	283 38.3	35.4	30 45.1	11.9	19 09.3	4.0	54.7
08	298 38.5	36.4	45 16.0	11.9	19 13.3	3.9	54.7
F 09	313 38.7	·· 37.4	59 46.9	11.8	19 17.2	3.8	54.7
R 10	328 38.9	38.3	74 17.7	11.8	19 21.0	3.7	54.7
I 11	343 39.0	39.3	88 48.5	11.7	19 24.7	3.7	54.7
D 12	358 39.2	N 2 40.3	103 19.2	11.7	S19 28.4	3.5	54.7
A 13	13 39.4	41.3	117 49.9	11.6	19 31.9	3.5	54.8
Y 14	28 39.6	42.2	132 20.5	11.6	19 35.4	3.4	54.8
15	43 39.8	·· 43.2	146 51.1	11.6	19 38.8	3.3	54.8
16	58 40.0	44.2	161 21.7	11.5	19 42.1	3.1	54.8
17	73 40.2	45.2	175 52.2	11.5	19 45.2	3.1	54.8
18	88 40.4	N 2 46.2	190 22.7	11.4	S19 48.3	3.0	54.9
19	103 40.6	47.1	204 53.1	11.4	19 51.3	2.9	54.9
20	118 40.8	48.1	219 23.5	11.3	19 54.2	2.9	54.9
21	133 40.9	·· 49.1	233 53.8	11.3	19 57.1	2.7	54.9
22	148 41.1	50.1	248 24.1	11.3	19 59.8	2.6	55.0
23	163 41.3	51.0	262 54.4	11.2	20 02.4	2.5	55.0
28 00	178 41.5	N 2 52.0	277 24.6	11.1	S20 04.9	2.5	55.0
01	193 41.7	53.0	291 54.7	11.2	20 07.4	2.3	55.0
02	208 41.9	54.0	306 24.9	11.0	20 09.7	2.3	55.0
03	223 42.1	·· 55.0	320 54.9	11.1	20 12.0	2.1	55.1
04	238 42.3	55.9	335 25.0	11.0	20 14.1	2.1	55.1
05	253 42.5	56.9	349 55.0	10.9	20 16.2	1.9	55.1
06	268 42.7	N 2 57.9	4 24.9	10.9	S20 18.1	1.9	55.1
07	283 42.8	58.9	18 54.8	10.9	20 20.0	1.7	55.2
S 08	298 43.0	2 59.8	33 24.7	10.8	20 21.7	1.7	55.2
A 09	313 43.2	3 00.8	47 54.5	10.8	20 23.4	1.5	55.2
T 10	328 43.4	01.8	62 24.3	10.8	20 24.9	1.5	55.2
U 11	343 43.6	02.8	76 54.1	10.7	20 26.4	1.3	55.3
R 12	358 43.8	N 3 03.7	91 23.8	10.6	S20 27.7	1.3	55.3
D 13	13 44.0	04.7	105 53.4	10.7	20 29.0	1.1	55.3
A 14	28 44.2	05.7	120 23.1	10.6	20 30.1	1.1	55.3
Y 15	43 44.4	·· 06.7	134 52.7	10.5	20 31.2	0.9	55.4
16	58 44.5	07.6	149 22.2	10.5	20 32.1	0.9	55.4
17	73 44.7	08.6	163 51.7	10.5	20 33.0	0.7	55.4
18	88 44.9	N 3 09.6	178 21.2	10.4	S20 33.7	0.6	55.5
19	103 45.1	10.6	192 50.6	10.4	20 34.3	0.6	55.5
20	118 45.3	11.5	207 20.0	10.4	20 34.9	0.4	55.5
21	133 45.5	·· 12.5	221 49.4	10.3	20 35.3	0.3	55.5
22	148 45.7	13.5	236 18.7	10.3	20 35.6	0.2	55.6
23	163 45.9	14.5	250 48.0	10.2	20 35.8	0.2	55.6
	S.D. 16.1	d 1.0	S.D. 14.8		14.9		15.1

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

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

Day	SUN Eqn. of Time 00ʰ	SUN Eqn. of Time 12ʰ	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
	m s	m s	h m	h m	h m	d	
26	05 51	05 42	12 06	04 06	16 29	20	
27	05 33	05 23	12 05	04 53	17 17	21	◑
28	05 14	05 05	12 05	05 42	18 07	22	

G.M.T.	ARIES	VENUS −3.5		MARS +1.4		JUPITER −2.0		SATURN +0.7	
	G.H.A.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
29 00	186 18.5	180 25.5	N 1 02.8	177 34.5	N 3 01.2	0 58.0	S 0 34.6	359 28.8	S 0 03.7
01	201 21.0	195 25.1	04.1	192 35.2	01.9	16 00.8	34.4	14 31.4	03.6
02	216 23.4	210 24.8	05.3	207 35.9	02.7	31 03.5	34.3	29 34.1	03.5
03	231 25.9	225 24.4	·· 06.6	222 36.6	·· 03.5	46 06.3	·· 34.2	44 36.7	·· 03.5
04	246 28.4	240 24.0	07.8	237 37.3	04.3	61 09.1	34.1	59 39.3	03.4
05	261 30.8	255 23.6	09.1	252 38.0	05.1	76 11.8	33.9	74 42.0	03.3
06	276 33.3	270 23.3	N 1 10.3	267 38.7	N 3 05.8	91 14.6	S 0 33.8	89 44.6	S 0 03.2
07	291 35.8	285 22.9	11.6	282 39.4	06.6	106 17.3	33.7	104 47.3	03.1
08	306 38.2	300 22.5	12.9	297 40.1	07.4	121 20.1	33.5	119 49.9	03.1
S 09	321 40.7	315 22.1	·· 14.1	312 40.8	·· 08.2	136 22.9	·· 33.4	134 52.6	·· 03.0
U 10	336 43.1	330 21.7	15.4	327 41.5	09.0	151 25.6	33.3	149 55.2	02.9
N 11	351 45.6	345 21.4	16.6	342 42.2	09.7	166 28.4	33.2	164 57.8	02.8
D 12	6 48.1	0 21.0	N 1 17.9	357 42.9	N 3 10.5	181 31.1	S 0 33.0	180 00.5	S 0 02.8
A 13	21 50.5	15 20.6	19.1	12 43.6	11.3	196 33.9	32.9	195 03.1	02.7
Y 14	36 53.0	30 20.2	20.4	27 44.3	12.1	211 36.7	32.8	210 05.8	02.6
15	51 55.5	45 19.9	·· 21.6	42 45.0	·· 12.8	226 39.4	·· 32.7	225 08.4	·· 02.5
16	66 57.9	60 19.5	22.9	57 45.7	13.6	241 42.2	32.5	240 11.1	02.4
17	82 00.4	75 19.1	24.2	72 46.4	14.4	256 44.9	32.4	255 13.7	02.4
18	97 02.9	90 18.7	N 1 25.4	87 47.0	N 3 15.2	271 47.7	S 0 32.3	270 16.3	S 0 02.3
19	112 05.3	105 18.4	26.7	102 47.7	15.9	286 50.5	32.1	285 19.0	02.2
20	127 07.8	120 18.0	27.9	117 48.4	16.7	301 53.2	32.0	300 21.6	02.1
21	142 10.3	135 17.6	·· 29.2	132 49.1	·· 17.5	316 56.0	·· 31.9	315 24.3	·· 02.1
22	157 12.7	150 17.2	30.4	147 49.8	18.3	331 58.7	31.8	330 26.9	02.0
23	172 15.2	165 16.8	31.7	162 50.5	19.1	347 01.5	31.6	345 29.6	01.9
30 00	187 17.6	180 16.5	N 1 32.9	177 51.2	N 3 19.8	2 04.3	S 0 31.5	0 32.2	S 0 01.8
01	202 20.1	195 16.1	34.2	192 51.9	20.6	17 07.0	31.4	15 34.8	01.7
02	217 22.6	210 15.7	35.5	207 52.6	21.4	32 09.8	31.3	30 37.5	01.7
03	232 25.0	225 15.3	·· 36.7	222 53.3	·· 22.2	47 12.5	·· 31.1	45 40.1	·· 01.6
04	247 27.5	240 15.0	38.0	237 54.0	22.9	62 15.3	31.0	60 42.8	01.5
05	262 30.0	255 14.6	39.2	252 54.7	23.7	77 18.1	30.9	75 45.4	01.4
06	277 32.4	270 14.2	N 1 40.5	267 55.4	N 3 24.5	92 20.8	S 0 30.7	90 48.1	S 0 01.4
07	292 34.9	285 13.8	41.7	282 56.1	25.3	107 23.6	30.6	105 50.7	01.3
08	307 37.4	300 13.5	43.0	297 56.8	26.0	122 26.3	30.5	120 53.3	01.2
M 09	322 39.8	315 13.1	·· 44.2	312 57.5	·· 26.8	137 29.1	·· 30.4	135 56.0	·· 01.1
O 10	337 42.3	330 12.7	45.5	327 58.2	27.6	152 31.9	30.2	150 58.6	01.0
N 11	352 44.7	345 12.3	46.7	342 58.9	28.4	167 34.6	30.1	166 01.3	01.0
D 12	7 47.2	0 11.9	N 1 48.0	357 59.6	N 3 29.1	182 37.4	S 0 30.0	181 03.9	S 0 00.9
A 13	22 49.7	15 11.6	49.3	13 00.3	29.9	197 40.1	29.9	196 06.6	00.8
Y 14	37 52.1	30 11.2	50.5	28 01.0	30.7	212 42.9	29.7	211 09.2	00.7
15	52 54.6	45 10.8	·· 51.8	43 01.7	·· 31.5	227 45.7	·· 29.6	226 11.8	·· 00.7
16	67 57.1	60 10.4	53.0	58 02.4	32.2	242 48.4	29.5	241 14.5	00.6
17	82 59.5	75 10.1	54.3	73 03.1	33.0	257 51.2	29.4	256 17.1	00.5
18	98 02.0	90 09.7	N 1 55.5	88 03.8	N 3 33.8	272 53.9	S 0 29.2	271 19.8	S 0 00.4
19	113 04.5	105 09.3	56.8	103 04.5	34.6	287 56.7	29.1	286 22.4	00.3
20	128 06.9	120 08.9	58.0	118 05.2	35.3	302 59.4	29.0	301 25.1	00.3
21	143 09.4	135 08.6	1 59.3	133 05.9	·· 36.1	318 02.2	·· 28.8	316 27.7	·· 00.2
22	158 11.9	150 08.2	2 00.5	148 06.6	36.9	333 05.0	28.7	331 30.3	S 0 00.1
23	173 14.3	165 07.8	01.8	163 07.3	37.7	348 07.7	28.6	346 33.0	0 00.0
31 00	188 16.8	180 07.4	N 2 03.1	178 08.0	N 3 38.4	3 10.5	S 0 28.5	1 35.6	0 00.0
01	203 19.2	195 07.0	04.3	193 08.7	39.2	18 13.2	28.3	16 38.3	N 0 00.1
02	218 21.7	210 06.7	05.6	208 09.4	40.0	33 16.0	28.2	31 40.9	00.2
03	233 24.2	225 06.3	·· 06.8	223 10.1	·· 40.8	48 18.8	·· 28.1	46 43.6	·· 00.3
04	248 26.6	240 05.9	08.1	238 10.8	41.5	63 21.5	28.0	61 46.2	00.3
05	263 29.1	255 05.5	09.3	253 11.5	42.3	78 24.3	27.8	76 48.8	00.4
06	278 31.6	270 05.2	N 2 10.6	268 12.2	N 3 43.1	93 27.0	S 0 27.7	91 51.5	N 0 00.5
07	293 34.0	285 04.8	11.8	283 12.9	43.9	108 29.8	27.6	106 54.1	00.6
08	308 36.5	300 04.4	13.1	298 13.6	44.6	123 32.6	27.5	121 56.8	00.7
T 09	323 39.0	315 04.0	·· 14.3	313 14.3	·· 45.4	138 35.3	·· 27.3	136 59.4	·· 00.7
U 10	338 41.4	330 03.6	15.6	328 15.0	46.2	153 38.1	27.2	152 02.1	00.8
E 11	353 43.9	345 03.3	16.8	343 15.7	47.0	168 40.8	27.1	167 04.7	00.9
S 12	8 46.4	0 02.9	N 2 18.1	358 16.4	N 3 47.7	183 43.6	S 0 27.0	182 07.3	N 0 01.0
D 13	23 48.8	15 02.5	19.4	13 17.1	48.5	198 46.3	26.8	197 10.0	01.0
A 14	38 51.3	30 02.1	20.6	28 17.8	49.3	213 49.1	26.7	212 12.6	01.1
Y 15	53 53.7	45 01.7	·· 21.9	43 18.5	·· 50.1	228 51.9	·· 26.6	227 15.3	·· 01.2
16	68 56.2	60 01.4	23.1	58 19.2	50.8	243 54.6	26.4	242 17.9	01.3
17	83 58.7	75 01.0	24.4	73 19.9	51.6	258 57.4	26.3	257 20.5	01.4
18	99 01.1	90 00.6	N 2 25.6	88 20.6	N 3 52.4	274 00.1	S 0 26.2	272 23.2	N 0 01.4
19	114 03.6	105 00.2	26.9	103 21.3	53.1	289 02.9	26.1	287 25.8	01.5
20	129 06.1	119 59.9	28.1	118 21.9	53.9	304 05.7	25.9	302 28.5	01.6
21	144 08.5	134 59.5	·· 29.4	133 22.6	·· 54.7	319 08.4	·· 25.8	317 31.1	·· 01.7
22	159 11.0	149 59.1	30.6	148 23.3	55.5	334 11.2	25.7	332 33.8	01.7
23	174 13.5	164 58.7	31.9	163 24.0	56.2	349 13.9	25.6	347 36.4	01.8
Mer. Pass.	h m 11 28.9	v −0.4	d 1.3	v 0.7	d 0.8	v 2.8	d 0.1	v 2.6	d 0.1

STARS		
Name	S.H.A.	Dec.
	° ′	° ′
Acamar	315 37.3	S40 23.1
Achernar	335 45.6	S57 20.2
Acrux	173 36.1	S62 59.7
Adhara	255 31.8	S28 57.1
Aldebaran	291 17.8	N16 28.2
Alioth	166 41.6	N56 03.7
Alkaid	153 17.8	N49 24.4
Al Na'ir	28 14.9	S47 03.1
Alnilam	276 11.4	S 1 13.0
Alphard	218 20.0	S 8 34.8
Alphecca	126 31.6	N26 46.5
Alpheratz	358 09.3	N28 59.0
Altair	62 32.3	N 8 48.9
Ankaa	353 40.3	S42 24.7
Antares	112 56.2	S26 23.4
Arcturus	146 17.9	N19 16.7
Atria	108 19.9	S68 59.4
Avior	234 27.8	S59 27.3
Bellatrix	278 58.5	N 6 19.8
Betelgeuse	271 28.0	N 7 24.1
Canopus	264 07.1	S52 41.5
Capella	281 10.9	N45 58.8
Deneb	49 48.4	N45 12.5
Denebola	182 58.4	N14 40.6
Diphda	349 20.9	S18 05.6
Dubhe	194 21.1	N61 51.3
Elnath	278 43.8	N28 35.5
Eltanin	90 57.5	N51 29.2
Enif	34 11.5	N 9 47.1
Fomalhaut	15 51.4	S29 43.4
Gacrux	172 27.8	S57 00.5
Gienah	176 17.3	S17 26.3
Hadar	149 22.3	S60 16.8
Hamal	328 28.8	N23 22.3
Kaus Aust.	84 16.4	S34 23.5
Kochab	137 18.1	N74 13.9
Markab	14 03.1	N15 06.0
Menkar	314 41.0	N 4 00.8
Menkent	148 36.2	S36 16.6
Miaplacidus	221 44.3	S69 38.7
Mirfak	309 16.0	N49 47.7
Nunki	76 28.8	S26 19.2
Peacock	53 58.1	S56 47.6
Pollux	243 57.6	N28 04.3
Procyon	245 25.3	N 5 16.3
Rasalhague	96 29.2	N12 34.3
Regulus	208 09.4	N12 03.5
Rigel	281 35.8	S 8 13.6
Rigil Kent.	140 24.8	S60 45.3
Sabik	102 40.6	S15 42.1
Schedar	350 09.2	N56 25.9
Shaula	96 55.2	S37 05.3
Sirius	258 55.4	S16 41.7
Spica	158 56.9	S11 03.8
Suhail	223 10.3	S43 21.6
Vega	80 55.6	N38 45.7
Zuben'ubi	137 32.4	S15 57.8

	S.H.A.	Mer. Pass.
	° ′	h m
Venus	352 58.8	11 59
Mars	350 33.6	12 08
Jupiter	174 46.6	23 47
Saturn	173 14.6	23 54

G.M.T.	SUN G.H.A.	SUN Dec.	MOON G.H.A.	MOON v	MOON Dec.	MOON d	MOON H.P.
d h	° ′	° ′	° ′	′	° ′	′	′
29 00	178 46.1	N 3 15.4	265 17.2	10.3	S20 36.0	0.0	55.6
01	193 46.3	16.4	279 46.5	10.1	20 36.0	0.1	55.7
02	208 46.4	17.4	294 15.6	10.2	20 35.9	0.2	55.7
03	223 46.6	·· 18.4	308 44.8	10.1	20 35.7	0.4	55.7
04	238 46.8	19.3	323 13.9	10.1	20 35.3	0.4	55.7
05	253 47.0	20.3	337 43.0	10.0	20 34.9	0.5	55.8
06	268 47.2	N 3 21.3	352 12.0	10.0	S20 34.4	0.6	55.8
07	283 47.4	22.3	6 41.0	10.0	20 33.8	0.8	55.8
08	298 47.6	23.2	21 10.0	10.0	20 33.2	0.8	55.9
S 09	313 47.8	·· 24.2	35 39.0	9.9	20 32.2	1.0	55.9
U 10	328 48.0	25.2	50 07.9	9.9	20 31.2	1.1	55.9
N 11	343 48.1	26.2	64 36.8	9.8	20 30.1	1.1	56.0
D 12	358 48.3	N 3 27.1	79 05.6	9.8	S20 29.0	1.3	56.0
A 13	13 48.5	28.1	93 34.4	9.8	20 27.7	1.4	56.0
Y 14	28 48.7	29.1	108 03.2	9.8	20 26.3	1.5	56.1
15	43 48.9	·· 30.1	122 32.0	9.7	20 24.8	1.6	56.1
16	58 49.1	31.0	137 00.7	9.7	20 23.2	1.8	56.1
17	73 49.3	32.0	151 29.4	9.7	20 21.4	1.8	56.2
18	88 49.5	N 3 33.0	165 58.1	9.7	S20 19.6	1.9	56.2
19	103 49.7	33.9	180 26.8	9.6	20 17.7	2.1	56.2
20	118 49.8	34.9	194 55.4	9.6	20 15.6	2.2	56.3
21	133 50.0	·· 35.9	209 24.0	9.5	20 13.4	2.3	56.3
22	148 50.2	36.9	223 52.5	9.6	20 11.1	2.3	56.3
23	163 50.4	37.8	238 21.1	9.5	20 08.8	2.5	56.4
30 00	178 50.6	N 3 38.8	252 49.6	9.5	S20 06.3	2.7	56.4
01	193 50.8	39.8	267 18.1	9.5	20 03.6	2.7	56.4
02	208 51.0	40.7	281 46.6	9.4	20 00.9	2.8	56.5
03	223 51.2	·· 41.7	296 15.0	9.4	19 58.1	3.0	56.5
04	238 51.3	42.7	310 43.4	9.5	19 55.1	3.0	56.5
05	253 51.5	43.7	325 11.9	9.3	19 52.1	3.2	56.6
06	268 51.7	N 3 44.6	339 40.2	9.4	S19 48.9	3.3	56.6
07	283 51.9	45.6	354 08.6	9.3	19 45.6	3.4	56.6
08	298 52.1	46.6	8 36.9	9.3	19 42.2	3.5	56.7
M 09	313 52.3	·· 47.5	23 05.2	9.3	19 38.7	3.6	56.7
O 10	328 52.5	48.5	37 33.5	9.3	19 35.1	3.8	56.8
N 11	343 52.7	49.5	52 01.8	9.3	19 31.3	3.8	56.8
D 12	358 52.9	N 3 50.5	66 30.1	9.2	S19 27.5	4.0	56.8
A 13	13 53.0	51.4	80 58.3	9.2	19 23.5	4.0	56.9
Y 14	28 53.2	52.4	95 26.5	9.2	19 19.5	4.2	56.9
15	43 53.4	·· 53.4	109 54.7	9.2	19 15.3	4.3	56.9
16	58 53.6	54.3	124 22.9	9.2	19 11.0	4.4	57.0
17	73 53.8	55.3	138 51.1	9.1	19 06.6	4.6	57.0
18	88 54.0	N 3 56.3	153 19.2	9.2	S19 02.0	4.6	57.1
19	103 54.2	57.3	167 47.4	9.1	18 57.4	4.7	57.1
20	118 54.4	58.2	182 15.5	9.1	18 52.7	4.9	57.1
21	133 54.5	3 59.2	196 43.6	9.1	18 47.8	5.0	57.2
22	148 54.7	4 00.2	211 11.7	9.1	18 42.8	5.0	57.2
23	163 54.9	01.1	225 39.8	9.0	18 37.8	5.2	57.2
31 00	178 55.1	N 4 02.1	240 07.8	9.1	S18 32.6	5.3	57.3
01	193 55.3	03.1	254 35.9	9.0	18 27.3	5.5	57.3
02	208 55.5	04.0	269 03.9	9.0	18 21.8	5.5	57.4
03	223 55.7	·· 05.0	283 31.9	9.0	18 16.3	5.6	57.4
04	238 55.9	06.0	297 59.9	9.0	18 10.7	5.8	57.4
05	253 56.0	06.9	312 27.9	9.0	18 04.9	5.8	57.5
06	268 56.2	N 4 07.9	326 55.9	9.0	S17 59.1	6.0	57.5
07	283 56.4	08.9	341 23.9	9.0	17 53.1	6.1	57.6
08	298 56.6	09.8	355 51.9	8.9	17 47.0	6.2	57.6
T 09	313 56.8	·· 10.8	10 19.8	9.0	17 40.8	6.3	57.6
U 10	328 57.0	11.8	24 47.8	8.9	17 34.5	6.4	57.7
E 11	343 57.2	12.8	39 15.7	8.9	17 28.1	6.5	57.7
S 12	358 57.4	N 4 13.7	53 43.6	9.0	S17 21.6	6.6	57.8
D 13	13 57.5	14.7	68 11.6	8.9	17 15.0	6.7	57.8
A 14	28 57.7	15.7	82 39.5	8.9	17 08.3	6.9	57.8
Y 15	43 57.9	·· 16.6	97 07.4	8.9	17 01.4	6.9	57.9
16	58 58.1	17.6	111 35.3	8.9	16 54.5	7.1	57.9
17	73 58.3	18.6	126 03.2	8.9	16 47.4	7.1	57.9
18	88 58.5	N 4 19.5	140 31.1	8.8	S16 40.3	7.3	58.0
19	103 58.7	20.5	154 58.9	8.9	16 33.0	7.4	58.0
20	118 58.8	21.5	169 26.8	8.9	16 25.6	7.5	58.1
21	133 59.0	·· 22.4	183 54.7	8.8	16 18.1	7.6	58.1
22	148 59.2	23.4	198 22.5	8.9	16 10.5	7.6	58.1
23	163 59.4	24.4	212 50.4	8.8	16 02.9	7.8	58.2
	S.D. 16.0	d 1.0	S.D. 15.3		15.5		15.7

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

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

Day	SUN Eqn. of Time 00ʰ	SUN Eqn. of Time 12ʰ	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
	m s	m s	h m	h m	h m	d	
29	04 56	04 47	12 05	06 32	18 58	23	
30	04 38	04 29	12 04	07 24	19 51	24	
31	04 20	04 11	12 04	08 17	20 44	25	

G.M.T.	ARIES	VENUS −3.5		MARS +1.4		JUPITER −2.0		SATURN +0.7	
	G.H.A.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
1 00	189 15.9	179 58.3	N 2 33.1	178 24.7	N 3 57.0	4 16.7	S 0 25.4	2 39.0	N 0 01.9
01	204 18.4	194 58.0	34.4	193 25.4	57.8	19 19.4	25.3	17 41.7	02.0
02	219 20.8	209 57.6	35.6	208 26.1	58.6	34 22.2	25.2	32 44.3	02.0
03	234 23.3	224 57.2	·· 36.9	223 26.8	3 59.3	49 25.0	·· 25.1	47 47.0	·· 02.1
04	249 25.8	239 56.8	38.1	238 27.5	4 00.1	64 27.7	24.9	62 49.6	02.2
05	264 28.2	254 56.4	39.4	253 28.2	00.9	79 30.5	24.8	77 52.3	02.3
06	279 30.7	269 56.1	N 2 40.6	268 28.9	N 4 01.6	94 33.2	S 0 24.7	92 54.9	N 0 02.4
07	294 33.2	284 55.7	41.9	283 29.6	02.4	109 36.0	24.6	107 57.5	02.4
W 08	309 35.6	299 55.3	43.2	298 30.3	03.2	124 38.7	24.4	123 00.2	02.5
E 09	324 38.1	314 54.9	·· 44.4	313 31.0	·· 04.0	139 41.5	·· 24.3	138 02.8	·· 02.6
D 10	339 40.6	329 54.6	45.7	328 31.7	04.7	154 44.3	24.2	153 05.5	02.7
N 11	354 43.0	344 54.2	46.9	343 32.4	05.5	169 47.0	24.1	168 08.1	02.7
E 12	9 45.5	359 53.8	N 2 48.2	358 33.1	N 4 06.3	184 49.8	S 0 23.9	183 10.8	N 0 02.8
S 13	24 48.0	14 53.4	49.4	13 33.8	07.0	199 52.5	23.8	198 13.4	02.9
D 14	39 50.4	29 53.0	50.7	28 34.5	07.8	214 55.3	23.7	213 16.0	03.0
A 15	54 52.9	44 52.7	·· 51.9	43 35.2	·· 08.6	229 58.0	·· 23.6	228 18.7	·· 03.0
Y 16	69 55.3	59 52.3	53.2	58 35.9	09.4	245 00.8	23.4	243 21.3	03.1
17	84 57.8	74 51.9	54.4	73 36.6	10.1	260 03.6	23.3	258 24.0	03.2
18	100 00.3	89 51.5	N 2 55.7	88 37.3	N 4 10.9	275 06.3	S 0 23.2	273 26.6	N 0 03.3
19	115 02.7	104 51.1	56.9	103 38.0	11.7	290 09.1	23.1	288 29.2	03.4
20	130 05.2	119 50.8	58.2	118 38.7	12.4	305 11.8	22.9	303 31.9	03.4
21	145 07.7	134 50.4	2 59.4	133 39.4	·· 13.2	320 14.6	·· 22.8	318 34.5	·· 03.5
22	160 10.1	149 50.0	3 00.7	148 40.1	14.0	335 17.3	22.7	333 37.2	03.6
23	175 12.6	164 49.6	01.9	163 40.8	14.7	350 20.1	22.6	348 39.8	03.7
2 00	190 15.1	179 49.2	N 3 03.2	178 41.5	N 4 15.5	5 22.9	S 0 22.4	3 42.5	N 0 03.7
01	205 17.5	194 48.9	04.4	193 42.2	16.3	20 25.6	22.3	18 45.1	03.8
02	220 20.0	209 48.5	05.7	208 42.9	17.1	35 28.4	22.2	33 47.7	03.9
03	235 22.5	224 48.1	·· 06.9	223 43.6	·· 17.8	50 31.1	·· 22.1	48 50.4	·· 04.0
04	250 24.9	239 47.7	08.2	238 44.3	18.6	65 33.9	21.9	63 53.0	04.0
05	265 27.4	254 47.3	09.4	253 45.0	19.4	80 36.6	21.8	78 55.7	04.1
06	280 29.8	269 46.9	N 3 10.7	268 45.7	N 4 20.1	95 39.4	S 0 21.7	93 58.3	N 0 04.2
07	295 32.3	284 46.6	11.9	283 46.4	20.9	110 42.2	21.6	109 01.0	04.3
T 08	310 34.8	299 46.2	13.2	298 47.1	21.7	125 44.9	21.4	124 03.6	04.3
H 09	325 37.2	314 45.8	·· 14.4	313 47.8	·· 22.4	140 47.7	·· 21.3	139 06.2	·· 04.4
U 10	340 39.7	329 45.4	15.7	328 48.5	23.2	155 50.4	21.2	154 08.9	04.5
R 11	355 42.2	344 45.0	16.9	343 49.2	24.0	170 53.2	21.1	169 11.5	04.6
S 12	10 44.6	359 44.7	N 3 18.2	358 49.9	N 4 24.7	185 55.9	S 0 20.9	184 14.2	N 0 04.7
D 13	25 47.1	14 44.3	19.4	13 50.6	25.5	200 58.7	20.8	199 16.8	04.7
A 14	40 49.6	29 43.9	20.7	28 51.3	26.3	216 01.4	20.7	214 19.4	04.8
Y 15	55 52.0	44 43.5	·· 21.9	43 52.0	·· 27.1	231 04.2	·· 20.6	229 22.1	·· 04.9
16	70 54.5	59 43.1	23.2	58 52.7	27.8	246 07.0	20.4	244 24.7	05.0
17	85 56.9	74 42.8	24.4	73 53.4	28.6	261 09.7	20.3	259 27.4	05.0
18	100 59.4	89 42.4	N 3 25.7	88 54.1	N 4 29.4	276 12.5	S 0 20.2	274 30.0	N 0 05.1
19	116 01.9	104 42.0	26.9	103 54.8	30.1	291 15.2	20.1	289 32.6	05.2
20	131 04.3	119 41.6	28.1	118 55.5	30.9	306 18.0	19.9	304 35.3	05.3
21	146 06.8	134 41.2	·· 29.4	133 56.2	·· 31.7	321 20.7	·· 19.8	319 37.9	·· 05.3
22	161 09.3	149 40.8	30.6	148 56.9	32.4	336 23.5	19.7	334 40.6	05.4
23	176 11.7	164 40.5	31.9	163 57.6	33.2	351 26.2	19.6	349 43.2	05.5
3 00	191 14.2	179 40.1	N 3 33.1	178 58.3	N 4 34.0	6 29.0	S 0 19.4	4 45.9	N 0 05.6
01	206 16.7	194 39.7	34.4	193 59.0	34.7	21 31.8	19.3	19 48.5	05.6
02	221 19.1	209 39.3	35.6	208 59.7	35.5	36 34.5	19.2	34 51.1	05.7
03	236 21.6	224 38.9	·· 36.9	224 00.4	·· 36.3	51 37.3	·· 19.1	49 53.8	·· 05.8
04	251 24.1	239 38.6	38.1	239 01.1	37.0	66 40.0	18.9	64 56.4	05.9
05	266 26.5	254 38.2	39.4	254 01.8	37.8	81 42.8	18.8	79 59.1	06.0
06	281 29.0	269 37.8	N 3 40.6	269 02.5	N 4 38.6	96 45.5	S 0 18.7	95 01.7	N 0 06.0
07	296 31.4	284 37.4	41.9	284 03.2	39.3	111 48.3	18.6	110 04.3	06.1
08	311 33.9	299 37.0	43.1	299 03.9	40.1	126 51.0	18.4	125 07.0	06.2
F 09	326 36.4	314 36.6	·· 44.4	314 04.6	·· 40.9	141 53.8	·· 18.3	140 09.6	·· 06.3
R 10	341 38.8	329 36.3	45.6	329 05.3	41.6	156 56.6	18.2	155 12.3	06.3
I 11	356 41.3	344 35.9	46.9	344 05.9	42.4	171 59.3	18.1	170 14.9	06.4
D 12	11 43.8	359 35.5	N 3 48.1	359 06.6	N 4 43.2	187 02.1	S 0 17.9	185 17.6	N 0 06.5
A 13	26 46.2	14 35.1	49.3	14 07.3	43.9	202 04.8	17.8	200 20.2	06.6
Y 14	41 48.7	29 34.7	50.6	29 08.0	44.7	217 07.6	17.7	215 22.8	06.6
15	56 51.2	44 34.3	·· 51.8	44 08.7	·· 45.5	232 10.3	·· 17.6	230 25.5	·· 06.7
16	71 53.6	59 34.0	53.1	59 09.4	46.2	247 13.1	17.5	245 28.1	06.8
17	86 56.1	74 33.6	54.3	74 10.1	47.0	262 15.8	17.3	260 30.8	06.9
18	101 58.6	89 33.2	N 3 55.6	89 10.8	N 4 47.8	277 18.6	S 0 17.2	275 33.4	N 0 06.9
19	117 01.0	104 32.8	56.8	104 11.5	48.5	292 21.3	17.1	290 36.0	07.0
20	132 03.5	119 32.4	58.1	119 12.2	49.3	307 24.1	17.0	305 38.7	07.1
21	147 05.9	134 32.0	3 59.3	134 12.9	·· 50.1	322 26.8	·· 16.8	320 41.3	·· 07.2
22	162 08.4	149 31.6	4 00.6	149 13.6	50.8	337 29.6	16.7	335 44.0	07.2
23	177 10.9	164 31.3	01.8	164 14.3	51.6	352 32.4	16.6	350 46.6	07.3
Mer. Pass.	h m 11 17.1	*v* −0.4	*d* 1.2	*v* 0.7	*d* 0.8	*v* 2.8	*d* 0.1	*v* 2.6	*d* 0.1

STARS

Name	S.H.A.	Dec.
	° ′	° ′
Acamar	315 37.3	S40 23.1
Achernar	335 45.6	S57 20.1
Acrux	173 36.1	S62 59.7
Adhara	255 31.8	S28 57.1
Aldebaran	291 17.8	N16 28.2
Alioth	166 41.6	N56 03.7
Alkaid	153 17.8	N49 24.4
Al Na'ir	28 14.8	S47 03.1
Alnilam	276 11.4	S 1 13.0
Alphard	218 20.0	S 8 34.8
Alphecca	126 31.5	N26 46.5
Alpheratz	358 09.3	N28 59.0
Altair	62 32.3	N 8 48.9
Ankaa	353 40.3	S42 24.6
Antares	112 56.2	S26 23.4
Arcturus	146 17.8	N19 16.7
Atria	108 19.9	S68 59.4
Avior	234 27.8	S59 27.3
Bellatrix	278 58.5	N 6 19.8
Betelgeuse	271 28.0	N 7 24.1
Canopus	264 07.1	S52 41.5
Capella	281 11.0	N45 58.8
Deneb	49 48.4	N45 12.5
Denebola	182 58.4	N14 40.6
Diphda	349 20.8	S18 05.6
Dubhe	194 21.1	N61 51.3
Elnath	278 43.8	N28 35.5
Eltanin	90 57.4	N51 29.2
Enif	34 11.5	N 9 47.1
Fomalhaut	15 51.3	S29 43.4
Gacrux	172 27.8	S57 00.5
Gienah	176 17.3	S17 26.3
Hadar	149 22.2	S60 16.9
Hamal	328 28.8	N23 22.3
Kaus Aust.	84 16.3	S34 23.5
Kochab	137 18.0	N74 13.9
Markab	14 03.1	N15 06.0
Menkar	314 41.0	N 4 00.8
Menkent	148 36.2	S36 16.6
Miaplacidus	221 44.3	S69 38.7
Mirfak	309 16.0	N49 47.7
Nunki	76 28.7	S26 19.2
Peacock	53 58.1	S56 47.6
Pollux	243 57.7	N28 04.3
Procyon	245 25.4	N 5 16.3
Rasalhague	96 29.2	N12 34.3
Regulus	208 09.4	N12 03.5
Rigel	281 35.8	S 8 13.6
Rigil Kent.	140 24.8	S60 45.3
Sabik	102 40.6	S15 42.1
Schedar	350 09.2	N56 25.9
Shaula	96 55.1	S37 05.3
Sirius	258 55.4	S16 41.7
Spica	158 56.9	S11 03.8
Suhail	223 10.3	S43 21.6
Vega	80 55.6	N38 45.7
Zuben'ubi	137 32.4	S15 57.8

	S.H.A.	Mer. Pass.
	° ′	h m
Venus	349 34.2	12 01
Mars	348 26.4	12 05
Jupiter	175 07.8	23 34
Saturn	173 27.4	23 41

G.M.T.	SUN G.H.A.	SUN Dec.	MOON G.H.A.	MOON v	MOON Dec.	MOON d	MOON H.P.
d h	° ′	° ′	° ′	′	° ′	′	′
1 00	178 59.6	N 4 25.3	227 18.2	8.9	S15 55.1	7.9	58.2
01	193 59.8	26.3	241 46.1	8.8	15 47.2	8.0	58.3
02	209 00.0	27.3	256 13.9	8.9	15 39.2	8.1	58.3
03	224 00.1	·· 28.2	270 41.8	8.8	15 31.1	8.2	58.3
04	239 00.3	29.2	285 09.6	8.8	15 22.9	8.3	58.4
05	254 00.5	30.1	299 37.4	8.8	15 14.6	8.4	58.4
06	269 00.7	N 4 31.1	314 05.2	8.9	S15 06.2	8.6	58.5
W 07	284 00.9	32.1	328 33.1	8.8	14 57.6	8.6	58.5
E 08	299 01.1	33.0	343 00.9	8.8	14 49.0	8.7	58.5
D 09	314 01.3	·· 34.0	357 28.7	8.8	14 40.3	8.8	58.6
N 10	329 01.4	35.0	11 56.5	8.8	14 31.5	8.9	58.6
E 11	344 01.6	35.9	26 24.3	8.8	14 22.6	9.0	58.7
S 12	359 01.8	N 4 36.9	40 52.1	8.8	S14 13.6	9.1	58.7
D 13	14 02.0	37.9	55 19.9	8.8	14 04.5	9.1	58.7
A 14	29 02.2	38.8	69 47.7	8.8	13 55.4	9.3	58.8
Y 15	44 02.4	·· 39.8	84 15.5	8.8	13 46.1	9.4	58.8
16	59 02.6	40.8	98 43.3	8.8	13 36.7	9.5	58.9
17	74 02.7	41.7	113 11.1	8.8	13 27.2	9.6	58.9
18	89 02.9	N 4 42.7	127 38.9	8.8	S13 17.6	9.6	58.9
19	104 03.1	43.6	142 06.7	8.7	13 08.0	9.8	59.0
20	119 03.3	44.6	156 34.4	8.8	12 58.2	9.8	59.0
21	134 03.5	·· 45.6	171 02.2	8.8	12 48.4	9.9	59.1
22	149 03.7	46.5	185 30.0	8.8	12 38.5	10.0	59.1
23	164 03.9	47.5	199 57.8	8.8	12 28.5	10.1	59.1
2 00	179 04.0	N 4 48.5	214 25.6	8.7	S12 18.4	10.2	59.2
01	194 04.2	49.4	228 53.3	8.8	12 08.2	10.3	59.2
02	209 04.4	50.4	243 21.1	8.8	11 57.9	10.4	59.2
03	224 04.6	·· 51.3	257 48.9	8.7	11 47.5	10.4	59.3
04	239 04.8	52.3	272 16.6	8.8	11 37.1	10.6	59.3
05	254 05.0	53.3	286 44.4	8.8	11 26.5	10.6	59.4
06	269 05.2	N 4 54.2	301 12.2	8.7	S11 15.9	10.7	59.4
07	284 05.3	55.2	315 39.9	8.8	11 05.2	10.7	59.4
T 08	299 05.5	56.2	330 07.7	8.7	10 54.5	10.9	59.5
H 09	314 05.7	·· 57.1	344 35.4	8.8	10 43.6	10.9	59.5
U 10	329 05.9	58.1	359 03.2	8.7	10 32.7	11.0	59.5
R 11	344 06.1	4 59.0	13 30.9	8.8	10 21.7	11.1	59.6
S 12	359 06.3	N 5 00.0	27 58.7	8.7	S10 10.6	11.2	59.6
D 13	14 06.4	01.0	42 26.4	8.8	9 59.4	11.2	59.6
A 14	29 06.6	01.9	56 54.2	8.7	9 48.2	11.3	59.7
Y 15	44 06.8	·· 02.9	71 21.9	8.7	9 36.9	11.4	59.7
16	59 07.0	03.8	85 49.6	8.8	9 25.5	11.4	59.7
17	74 07.2	04.8	100 17.4	8.7	9 14.1	11.6	59.8
18	89 07.4	N 5 05.8	114 45.1	8.7	S 9 02.5	11.6	59.8
19	104 07.6	06.7	129 12.8	8.7	8 50.9	11.6	59.9
20	119 07.7	07.7	143 40.5	8.7	8 39.3	11.7	59.9
21	134 07.9	·· 08.6	158 08.2	8.7	8 27.6	11.8	59.9
22	149 08.1	09.6	172 35.9	8.7	8 15.8	11.9	59.9
23	164 08.3	10.6	187 03.6	8.7	8 03.9	11.9	60.0
3 00	179 08.5	N 5 11.5	201 31.3	8.7	S 7 52.0	12.0	60.0
01	194 08.7	12.5	215 59.0	8.7	7 40.0	12.0	60.0
02	209 08.8	13.4	230 26.7	8.7	7 28.0	12.1	60.1
03	224 09.0	·· 14.4	244 54.4	8.7	7 15.9	12.2	60.1
04	239 09.2	15.3	259 22.1	8.6	7 03.7	12.2	60.1
05	254 09.4	16.3	273 49.7	8.7	6 51.5	12.2	60.2
06	269 09.6	N 5 17.3	288 17.4	8.7	S 6 39.3	12.3	60.2
07	284 09.8	18.2	302 45.1	8.6	6 27.0	12.4	60.2
08	299 09.9	19.2	317 12.7	8.6	6 14.6	12.4	60.3
F 09	314 10.1	·· 20.1	331 40.3	8.7	6 02.2	12.5	60.3
R 10	329 10.3	21.1	346 08.0	8.6	5 49.7	12.5	60.3
I 11	344 10.5	22.1	0 35.6	8.6	5 37.2	12.6	60.3
D 12	359 10.7	N 5 23.0	15 03.2	8.6	S 5 24.6	12.6	60.4
A 13	14 10.9	24.0	29 30.8	8.6	5 12.0	12.7	60.4
Y 14	29 11.0	24.9	43 58.4	8.6	4 59.3	12.7	60.4
15	44 11.2	·· 25.9	58 26.0	8.6	4 46.6	12.7	60.5
16	59 11.4	26.8	72 53.6	8.5	4 33.9	12.8	60.5
17	74 11.6	27.8	87 21.1	8.6	4 21.1	12.8	60.5
18	89 11.8	N 5 28.7	101 48.7	8.5	S 4 08.3	12.9	60.5
19	104 11.9	29.7	116 16.2	8.5	3 55.4	12.9	60.6
20	119 12.1	30.7	130 43.7	8.6	3 42.5	12.9	60.6
21	134 12.3	·· 31.6	145 11.3	8.5	3 29.6	12.9	60.6
22	149 12.5	32.6	159 38.8	8.5	3 16.7	13.0	60.6
23	164 12.7	33.5	174 06.3	8.4	3 03.7	13.0	60.7
	S.D. 16.0	d 1.0	S.D. 16.0		16.2		16.4

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 1	Moonrise 2	Moonrise 3	Moonrise 4
°	h m	h m	h m	h m	h m	h m	h m
N 72	01 27	03 36	04 51	06 51	06 29	06 13	06 00
N 70	02 14	03 53	04 59	06 18	06 10	06 04	05 58
68	02 43	04 06	05 06	05 53	05 55	05 56	05 56
66	03 05	04 17	05 11	05 35	05 43	05 49	05 54
64	03 21	04 26	05 15	05 19	05 33	05 44	05 53
62	03 35	04 33	05 19	05 06	05 24	05 39	05 52
60	03 46	04 40	05 23	04 55	05 17	05 35	05 51
N 58	03 56	04 45	05 26	04 46	05 10	05 31	05 50
56	04 04	04 50	05 28	04 38	05 04	05 27	05 49
54	04 11	04 55	05 31	04 30	04 59	05 24	05 48
52	04 17	04 59	05 33	04 23	04 54	05 22	05 48
50	04 23	05 02	05 35	04 17	04 50	05 19	05 47
45	04 34	05 10	05 39	04 04	04 40	05 14	05 46
N 40	04 43	05 15	05 43	03 53	04 32	05 09	05 44
35	04 50	05 20	05 46	03 44	04 25	05 05	05 43
30	04 56	05 24	05 48	03 36	04 19	05 01	05 43
20	05 05	05 31	05 53	03 22	04 09	04 55	05 41
N 10	05 11	05 36	05 57	03 09	04 00	04 50	05 40
0	05 15	05 40	06 00	02 58	03 51	04 45	05 39
S 10	05 18	05 43	06 04	02 46	03 43	04 40	05 38
20	05 20	05 45	06 07	02 34	03 33	04 34	05 36
30	05 20	05 47	06 11	02 19	03 23	04 28	05 35
35	05 19	05 48	06 13	02 11	03 17	04 25	05 34
40	05 17	05 49	06 16	02 02	03 10	04 20	05 33
45	05 15	05 49	06 19	01 50	03 02	04 16	05 32
S 50	05 12	05 50	06 22	01 37	02 52	04 10	05 31
52	05 11	05 50	06 23	01 31	02 47	04 08	05 30
54	05 09	05 50	06 25	01 24	02 42	04 05	05 30
56	05 07	05 50	06 27	01 16	02 37	04 01	05 29
58	05 04	05 50	06 29	01 07	02 30	03 58	05 28
S 60	05 01	05 50	06 31	00 57	02 23	03 54	05 28

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 1	Moonset 2	Moonset 3	Moonset 4
°	h m	h m	h m	h m	h m	h m	h m
N 72	19 19	20 36	22 54	11 47	14 02	16 10	18 18
N 70	19 11	20 18	22 00	12 19	14 18	16 17	18 16
68	19 04	20 04	21 29	12 42	14 31	16 23	18 15
66	18 58	19 53	21 06	13 00	14 42	16 27	18 14
64	18 54	19 44	20 49	13 14	14 51	16 31	18 13
62	18 49	19 36	20 35	13 26	14 59	16 35	18 13
60	18 46	19 29	20 23	13 36	15 05	16 38	18 12
N 58	18 43	19 23	20 14	13 45	15 11	16 40	18 11
56	18 40	19 18	20 05	13 53	15 16	16 42	18 11
54	18 38	19 14	19 58	14 00	15 21	16 45	18 11
52	18 35	19 10	19 51	14 06	15 25	16 46	18 10
50	18 33	19 06	19 46	14 12	15 28	16 48	18 10
45	18 29	18 59	19 34	14 24	15 36	16 52	18 09
N 40	18 25	18 52	19 25	14 34	15 43	16 55	18 08
35	18 22	18 47	19 18	14 42	15 49	16 57	18 08
30	18 19	18 43	19 12	14 49	15 54	17 00	18 07
20	18 15	18 37	19 03	15 02	16 02	17 04	18 06
N 10	18 11	18 32	18 56	15 13	16 10	17 07	18 05
0	18 07	18 28	18 52	15 23	16 17	17 10	18 04
S 10	18 03	18 24	18 49	15 33	16 24	17 13	18 04
20	18 00	18 22	18 47	15 44	16 31	17 17	18 03
30	17 56	18 19	18 47	15 56	16 39	17 20	18 02
35	17 53	18 19	18 48	16 04	16 44	17 23	18 01
40	17 51	18 18	18 49	16 11	16 49	17 25	18 00
45	17 48	18 17	18 51	16 21	16 55	17 28	17 59
S 50	17 44	18 17	18 54	16 32	17 03	17 31	17 59
52	17 43	18 16	18 55	16 37	17 06	17 32	17 58
54	17 41	18 16	18 57	16 43	17 10	17 34	17 58
56	17 39	18 16	18 59	16 49	17 14	17 36	17 57
58	17 37	18 16	19 02	16 56	17 18	17 38	17 56
S 60	17 35	18 16	19 04	17 04	17 23	17 40	17 56

Day	SUN Eqn. of Time 00ʰ	SUN Eqn. of Time 12ʰ	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
	m s	m s	h m	h m	h m	d	
1	04 02	03 53	12 04	09 10	21 37	26	
2	03 44	03 35	12 04	10 04	22 31	27	
3	03 26	03 18	12 03	10 58	23 24	28	

G.M.T.	ARIES	VENUS −3.5		MARS +1.4		JUPITER −2.0		SATURN +0.7	
	G.H.A.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
4 00	192 13.3	179 30.9	N 4 03.0	179 15.0	N 4 52.4	7 35.1	S 0 16.5	5 49.2	N 0 07.4
01	207 15.8	194 30.5	04.3	194 15.7	53.1	22 37.9	16.3	20 51.9	07.5
02	222 18.3	209 30.1	05.5	209 16.4	53.9	37 40.6	16.2	35 54.5	07.5
03	237 20.7	224 29.7	·· 06.8	224 17.1	·· 54.6	52 43.4	·· 16.1	50 57.2	·· 07.6
04	252 23.2	239 29.3	08.0	239 17.8	55.4	67 46.1	16.0	65 59.8	07.7
05	267 25.7	254 29.0	09.3	254 18.5	56.2	82 48.9	15.9	81 02.4	07.8
06	282 28.1	269 28.6	N 4 10.5	269 19.2	N 4 56.9	97 51.6	S 0 15.7	96 05.1	N 0 07.8
07	297 30.6	284 28.2	11.7	284 19.9	57.7	112 54.4	15.6	111 07.7	07.9
S 08	312 33.0	299 27.8	13.0	299 20.6	58.5	127 57.1	15.5	126 10.4	08.0
A 09	327 35.5	314 27.4	·· 14.2	314 21.3	4 59.2	142 59.9	·· 15.4	141 13.0	·· 08.1
T 10	342 38.0	329 27.0	15.5	329 22.0	5 00.0	158 02.6	15.2	156 15.6	08.1
U 11	357 40.4	344 26.6	16.7	344 22.7	00.8	173 05.4	15.1	171 18.3	08.2
R 12	12 42.9	359 26.3	N 4 18.0	359 23.4	N 5 01.5	188 08.1	S 0 15.0	186 20.9	N 0 08.3
D 13	27 45.4	14 25.9	19.2	14 24.1	02.3	203 10.9	14.9	201 23.6	08.4
A 14	42 47.8	29 25.5	20.4	29 24.8	03.1	218 13.7	14.7	216 26.2	08.4
Y 15	57 50.3	44 25.1	·· 21.7	44 25.5	·· 03.8	233 16.4	·· 14.6	231 28.8	·· 08.5
16	72 52.8	59 24.7	22.9	59 26.2	04.6	248 19.2	14.5	246 31.5	08.6
17	87 55.2	74 24.3	24.2	74 26.9	05.3	263 21.9	14.4	261 34.1	08.7
18	102 57.7	89 23.9	N 4 25.4	89 27.6	N 5 06.1	278 24.7	S 0 14.3	276 36.8	N 0 08.8
19	118 00.2	104 23.5	26.7	104 28.3	06.9	293 27.4	14.1	291 39.4	08.8
20	133 02.6	119 23.2	27.9	119 29.0	07.6	308 30.2	14.0	306 42.1	08.9
21	148 05.1	134 22.8	·· 29.1	134 29.7	·· 08.4	323 32.9	·· 13.9	321 44.7	·· 09.0
22	163 07.5	149 22.4	30.4	149 30.4	09.2	338 35.7	13.8	336 47.3	09.1
23	178 10.0	164 22.0	31.6	164 31.1	09.9	353 38.4	13.6	351 50.0	09.1
5 00	193 12.5	179 21.6	N 4 32.9	179 31.8	N 5 10.7	8 41.2	S 0 13.5	6 52.6	N 0 09.2
01	208 14.9	194 21.2	34.1	194 32.5	11.4	23 43.9	13.4	21 55.3	09.3
02	223 17.4	209 20.8	35.3	209 33.2	12.2	38 46.7	13.3	36 57.9	09.4
03	238 19.9	224 20.4	·· 36.6	224 33.9	·· 13.0	53 49.4	·· 13.2	52 00.5	·· 09.4
04	253 22.3	239 20.1	37.8	239 34.6	13.7	68 52.2	13.0	67 03.2	09.5
05	268 24.8	254 19.7	39.1	254 35.3	14.5	83 54.9	12.9	82 05.8	09.6
06	283 27.3	269 19.3	N 4 40.3	269 36.0	N 5 15.3	98 57.7	S 0 12.8	97 08.5	N 0 09.7
07	298 29.7	284 18.9	41.5	284 36.7	16.0	114 00.4	12.7	112 11.1	09.7
08	313 32.2	299 18.5	42.8	299 37.4	16.8	129 03.2	12.5	127 13.7	09.8
S 09	328 34.7	314 18.1	·· 44.0	314 38.1	·· 17.5	144 05.9	·· 12.4	142 16.4	·· 09.9
U 10	343 37.1	329 17.7	45.3	329 38.8	18.3	159 08.7	12.3	157 19.0	10.0
N 11	358 39.6	344 17.3	46.5	344 39.5	19.1	174 11.4	12.2	172 21.6	10.0
D 12	13 42.0	359 17.0	N 4 47.7	359 40.2	N 5 19.8	189 14.2	S 0 12.1	187 24.3	N 0 10.1
A 13	28 44.5	14 16.6	49.0	14 40.9	20.6	204 16.9	11.9	202 26.9	10.2
Y 14	43 47.0	29 16.2	50.2	29 41.6	21.3	219 19.7	11.8	217 29.6	10.3
15	58 49.4	44 15.8	·· 51.5	44 42.3	·· 22.1	234 22.4	·· 11.7	232 32.2	·· 10.3
16	73 51.9	59 15.4	52.7	59 43.0	22.9	249 25.2	11.6	247 34.8	10.4
17	88 54.4	74 15.0	53.9	74 43.7	23.6	264 27.9	11.5	262 37.5	10.5
18	103 56.8	89 14.6	N 4 55.2	89 44.4	N 5 24.4	279 30.7	S 0 11.3	277 40.1	N 0 10.5
19	118 59.3	104 14.2	56.4	104 45.1	25.1	294 33.4	11.2	292 42.8	10.6
20	134 01.8	119 13.8	57.6	119 45.8	25.9	309 36.2	11.1	307 45.4	10.7
21	149 04.2	134 13.4	4 58.9	134 46.5	·· 26.7	324 38.9	·· 11.0	322 48.0	·· 10.8
22	164 06.7	149 13.1	5 00.1	149 47.2	27.4	339 41.7	10.8	337 50.7	10.8
23	179 09.1	164 12.7	01.4	164 47.9	28.2	354 44.4	10.7	352 53.3	10.9
6 00	194 11.6	179 12.3	N 5 02.6	179 48.6	N 5 28.9	9 47.2	S 0 10.6	7 56.0	N 0 11.0
01	209 14.1	194 11.9	03.8	194 49.3	29.7	24 49.9	10.5	22 58.6	11.1
02	224 16.5	209 11.5	05.1	209 50.0	30.5	39 52.7	10.4	38 01.2	11.1
03	239 19.0	224 11.1	·· 06.3	224 50.7	·· 31.2	54 55.4	·· 10.2	53 03.9	·· 11.2
04	254 21.5	239 10.7	07.5	239 51.4	32.0	69 58.2	10.1	68 06.5	11.3
05	269 23.9	254 10.3	08.8	254 52.1	32.7	85 00.9	10.0	83 09.2	11.4
06	284 26.4	269 09.9	N 5 10.0	269 52.8	N 5 33.5	100 03.7	S 0 09.9	98 11.8	N 0 11.4
07	299 28.9	284 09.5	11.2	284 53.4	34.3	115 06.4	09.8	113 14.4	11.5
08	314 31.3	299 09.1	12.5	299 54.1	35.0	130 09.2	09.6	128 17.1	11.6
M 09	329 33.8	314 08.8	·· 13.7	314 54.8	·· 35.8	145 11.9	·· 09.5	143 19.7	·· 11.7
O 10	344 36.3	329 08.4	14.9	329 55.5	36.5	160 14.7	09.4	158 22.4	11.7
N 11	359 38.7	344 08.0	16.2	344 56.2	37.3	175 17.4	09.3	173 25.0	11.8
D 12	14 41.2	359 07.6	N 5 17.4	359 56.9	N 5 38.0	190 20.2	S 0 09.2	188 27.6	N 0 11.9
A 13	29 43.6	14 07.2	18.6	14 57.6	38.8	205 22.9	09.0	203 30.3	12.0
Y 14	44 46.1	29 06.8	19.9	29 58.3	39.6	220 25.7	08.9	218 32.9	12.0
15	59 48.6	44 06.4	·· 21.1	44 59.0	·· 40.3	235 28.4	·· 08.8	233 35.5	·· 12.1
16	74 51.0	59 06.0	22.3	59 59.7	41.1	250 31.2	08.7	248 38.2	12.2
17	89 53.5	74 05.6	23.6	75 00.4	41.8	265 33.9	08.6	263 40.8	12.3
18	104 56.0	89 05.2	N 5 24.8	90 01.1	N 5 42.6	280 36.7	S 0 08.4	278 43.5	N 0 12.3
19	119 58.4	104 04.8	26.0	105 01.8	43.3	295 39.4	08.3	293 46.1	12.4
20	135 00.9	119 04.4	27.3	120 02.5	44.1	310 42.2	08.2	308 48.7	12.5
21	150 03.4	134 04.0	·· 28.5	135 03.2	·· 44.9	325 44.9	·· 08.1	323 51.4	·· 12.6
22	165 05.8	149 03.6	29..	150 03.9	45.6	340 47.7	08.0	338 54.0	12.6
23	180 08.3	164 03.2	31.0	165 04.6	46.4	355 50.4	07.8	353 56.7	12.7
	h m								
Mer. Pass.	11 05.3	v −0.4	d 1.2	v 0.7	d 0.8	v 2.8	d 0.1	v 2.6	d 0.1

STARS		
Name	S.H.A.	Dec.
	° ′	° ′
Acamar	315 37.3	S40 23.1
Achernar	335 45.6	S57 20.1
Acrux	173 36.1	S62 59.7
Adhara	255 31.8	S28 57.1
Aldebaran	291 17.8	N16 28.2
Alioth	166 41.6	N56 03.7
Alkaid	153 17.8	N49 24.4
Al Na'ir	28 14.8	S47 03.1
Alnilam	276 11.4	S 1 13.0
Alphard	218 20.0	S 8 34.8
Alphecca	126 31.5	N26 46.5
Alpheratz	358 09.3	N28 59.0
Altair	62 32.2	N 8 48.9
Ankaa	353 40.3	S42 24.6
Antares	112 56.2	S26 23.4
Arcturus	146 17.8	N19 16.7
Atria	108 19.8	S68 59.4
Avior	234 27.9	S59 27.3
Bellatrix	278 58.5	N 6 19.8
Betelgeuse	271 28.0	N 7 24.1
Canopus	264 07.1	S52 41.5
Capella	281 11.0	N45 58.8
Deneb	49 48.4	N45 12.5
Denebola	182 58.4	N14 40.6
Diphda	349 20.8	S18 05.6
Dubhe	194 21.1	N61 51.3
Elnath	278 43.8	N28 35.5
Eltanin	90 57.4	N51 29.2
Enif	34 11.4	N 9 47.1
Fomalhaut	15 51.3	S29 43.4
Gacrux	172 27.8	S57 00.5
Gienah	176 17.3	S17 26.3
Hadar	149 22.2	S60 16.9
Hamal	328 28.9	N23 22.2
Kaus Aust.	84 16.3	S34 23.5
Kochab	137 18.0	N74 13.9
Markab	14 03.1	N15 06.0
Menkar	314 41.0	N 4 00.8
Menkent	148 36.2	S36 16.6
Miaplacidus	221 44.4	S69 38.7
Mirfak	309 16.0	N49 47.7
Nunki	76 28.7	S26 19.2
Peacock	53 58.0	S56 47.6
Pollux	243 57.7	N28 04.3
Procyon	245 25.4	N 5 16.3
Rasalhague	96 29.1	N12 34.3
Regulus	208 09.4	N12 03.5
Rigel	281 35.8	S 8 13.6
Rigil Kent.	140 24.8	S60 45.3
Sabik	102 40.6	S15 42.1
Schedar	350 09.2	N56 25.9
Shaula	96 55.1	S37 05.3
Sirius	258 55.4	S16 41.7
Spica	158 56.9	S11 03.8
Suhail	223 10.3	S43 21.7
Vega	80 55.5	N38 45.7
Zuben'ubi	137 32.4	S15 57.8

	S.H.A.	Mer. Pass.
	° ′	h m
Venus	346 09.1	12 03
Mars	346 19.3	12 01
Jupiter	175 28.7	23 21
Saturn	173 40.1	23 28

G.M.T.	SUN G.H.A.	SUN Dec.	MOON G.H.A.	MOON v	MOON Dec.	MOON d	MOON H.P.
d h	° ′	° ′	° ′	′	° ′	′	′
4 00	179 12.9	N 5 34.5	188 33.7	8.5	S 2 50.7	13.1	60.7
01	194 13.0	35.4	203 01.2	8.5	2 37.6	13.1	60.7
02	209 13.2	36.4	217 28.7	8.4	2 24.5	13.1	60.7
03	224 13.4	·· 37.3	231 56.1	8.4	2 11.4	13.1	60.7
04	239 13.6	38.3	246 23.5	8.4	1 58.3	13.1	60.8
05	254 13.8	39.3	260 50.9	8.4	1 45.2	13.2	60.8
06	269 13.9	N 5 40.2	275 18.3	8.4	S 1 32.0	13.2	60.8
07	284 14.1	41.2	289 45.7	8.4	1 18.8	13.2	60.8
S 08	299 14.3	42.1	304 13.1	8.3	1 05.6	13.2	60.8
A 09	314 14.5	·· 43.1	318 40.4	8.3	0 52.4	13.2	60.9
T 10	329 14.7	44.0	333 07.7	8.3	0 39.2	13.3	60.9
U 11	344 14.9	45.0	347 35.0	8.3	0 25.9	13.2	60.9
R 12	359 15.0	N 5 45.9	2 02.3	8.3	S 0 12.7	13.3	60.9
D 13	14 15.2	46.9	16 29.6	8.3	N 0 00.6	13.2	60.9
A 14	29 15.4	47.8	30 56.9	8.2	0 13.8	13.3	60.9
Y 15	44 15.6	·· 48.8	45 24.1	8.2	0 27.1	13.3	61.0
16	59 15.8	49.7	59 51.3	8.2	0 40.4	13.3	61.0
17	74 15.9	50.7	74 18.5	8.2	0 53.7	13.3	61.0
18	89 16.1	N 5 51.6	88 45.7	8.1	N 1 07.0	13.2	61.0
19	104 16.3	52.6	103 12.8	8.2	1 20.2	13.3	61.0
20	119 16.5	53.5	117 40.0	8.1	1 33.5	13.3	61.0
21	134 16.7	·· 54.5	132 07.1	8.1	1 46.8	13.3	61.0
22	149 16.8	55.4	146 34.2	8.0	2 00.1	13.2	61.0
23	164 17.0	56.4	161 01.2	8.1	2 13.3	13.3	61.1
5 00	179 17.2	N 5 57.3	175 28.3	8.0	N 2 26.6	13.2	61.1
01	194 17.4	58.3	189 55.3	8.0	2 39.8	13.3	61.1
02	209 17.6	5 59.2	204 22.3	8.0	2 53.1	13.2	61.1
03	224 17.7	6 00.2	218 49.3	7.9	3 06.3	13.2	61.1
04	239 17.9	01.1	233 16.2	7.9	3 19.5	13.2	61.1
05	254 18.1	02.1	247 43.1	7.9	3 32.7	13.1	61.1
06	269 18.3	N 6 03.0	262 10.0	7.9	N 3 45.8	13.2	61.1
07	284 18.5	04.0	276 36.9	7.8	3 59.0	13.1	61.1
08	299 18.6	04.9	291 03.7	7.9	4 12.1	13.1	61.1
S 09	314 18.8	·· 05.9	305 30.6	7.8	4 25.2	13.0	61.1
U 10	329 19.0	06.8	319 57.4	7.7	4 38.2	13.1	61.1
N 11	344 19.2	07.8	334 24.1	7.8	4 51.3	13.0	61.1
D 12	359 19.4	N 6 08.7	348 50.9	7.7	N 5 04.3	13.0	61.2
A 13	14 19.5	09.7	3 17.6	7.7	5 17.3	12.9	61.2
Y 14	29 19.7	10.6	17 44.3	7.6	5 30.2	12.9	61.2
15	44 19.9	·· 11.6	32 10.9	7.7	5 43.1	12.9	61.2
16	59 20.1	12.5	46 37.6	7.6	5 56.0	12.9	61.2
17	74 20.3	13.5	61 04.2	7.5	6 08.9	12.8	61.2
18	89 20.4	N 6 14.4	75 30.7	7.6	N 6 21.7	12.7	61.2
19	104 20.6	15.4	89 57.3	7.5	6 34.4	12.7	61.2
20	119 20.8	16.3	104 23.8	7.5	6 47.1	12.7	61.2
21	134 21.0	·· 17.3	118 50.3	7.4	6 59.8	12.6	61.2
22	149 21.2	18.2	133 16.7	7.5	7 12.4	12.6	61.2
23	164 21.3	19.2	147 43.2	7.4	7 25.0	12.5	61.2
6 00	179 21.5	N 6 20.1	162 09.6	7.3	N 7 37.5	12.5	61.2
01	194 21.7	21.1	176 35.9	7.4	7 50.0	12.5	61.2
02	209 21.9	22.0	191 02.3	7.3	8 02.5	12.3	61.2
03	224 22.0	·· 22.9	205 28.6	7.2	8 14.8	12.3	61.1
04	239 22.2	23.9	219 54.8	7.3	8 27.1	12.3	61.1
05	254 22.4	24.8	234 21.1	7.2	8 39.4	12.2	61.1
06	269 22.6	N 6 25.8	248 47.3	7.2	N 8 51.6	12.1	61.1
07	284 22.8	26.7	263 13.5	7.1	9 03.7	12.1	61.1
08	299 22.9	27.7	277 39.6	7.1	9 15.8	12.0	61.1
M 09	314 23.1	·· 28.6	292 05.7	7.1	9 27.8	12.0	61.1
O 10	329 23.3	29.6	306 31.8	7.1	9 39.8	11.8	61.1
N 11	344 23.5	30.5	320 57.9	7.0	9 51.6	11.8	61.1
D 12	359 23.6	N 6 31.4	335 23.9	7.0	N10 03.4	11.8	61.1
A 13	14 23.8	32.4	349 49.9	7.0	10 15.2	11.7	61.1
Y 14	29 24.0	33.3	4 15.9	6.9	10 26.9	11.5	61.1
15	44 24.2	·· 34.3	18 41.8	6.9	10 38.4	11.6	61.1
16	59 24.4	35.2	33 07.7	6.9	10 50.0	11.4	61.0
17	74 24.5	36.2	47 33.6	6.8	11 01.4	11.4	61.0
18	89 24.7	N 6 37.1	61 59.4	6.8	N11 12.8	11.3	61.0
19	104 24.9	38.0	76 25.2	6.8	11 24.1	11.2	61.0
20	119 25.1	39.0	90 51.0	6.8	11 35.3	11.1	61.0
21	134 25.2	·· 39.9	105 16.8	6.7	11 46.4	11.0	61.0
22	149 25.4	40.9	119 42.5	6.7	11 57.4	11.0	61.0
23	164 25.6	41.8	134 08.2	6.6	12 08.4	10.8	61.0
	S.D. 16.0	d 0.9	S.D. 16.6		16.7		16.6

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 4	Moonrise 5	Moonrise 6	Moonrise 7
°	h m	h m	h m	h m	h m	h m	h m
N 72	00 18	03 16	04 35	06 00	05 47	05 33	05 15
N 70	01 47	03 36	04 45	05 58	05 52	05 46	05 39
68	02 23	03 52	04 53	05 56	05 56	05 56	05 58
66	02 48	04 04	04 59	05 54	05 59	06 05	06 13
64	03 07	04 14	05 05	05 53	06 02	06 12	06 25
62	03 23	04 23	05 10	05 52	06 04	06 18	06 35
60	03 35	04 30	05 14	05 51	06 07	06 24	06 44
N 58	03 46	04 37	05 17	05 50	06 09	06 29	06 52
56	03 55	04 42	05 21	05 49	06 10	06 33	06 59
54	04 03	04 47	05 24	05 48	06 12	06 37	07 06
52	04 09	04 52	05 26	05 48	06 13	06 41	07 11
50	04 16	04 55	05 29	05 47	06 15	06 44	07 17
45	04 28	05 04	05 34	05 46	06 18	06 51	07 28
N 40	04 38	05 11	05 38	05 44	06 20	06 57	07 37
35	04 46	05 16	05 42	05 43	06 22	07 02	07 45
30	04 52	05 21	05 45	05 43	06 24	07 07	07 52
20	05 02	05 28	05 50	05 41	06 27	07 15	08 05
N 10	05 09	05 34	05 55	05 40	06 30	07 22	08 16
0	05 15	05 39	05 59	05 39	06 33	07 29	08 26
S 10	05 18	05 43	06 04	05 38	06 36	07 36	08 36
20	05 20	05 46	06 08	05 36	06 39	07 43	08 47
30	05 21	05 49	06 13	05 35	06 43	07 51	09 00
35	05 21	05 50	06 16	05 34	06 45	07 56	09 08
40	05 20	05 52	06 19	05 33	06 47	08 02	09 16
45	05 19	05 53	06 22	05 32	06 50	08 08	09 26
S 50	05 17	05 54	06 27	05 31	06 53	08 16	09 38
52	05 16	05 55	06 29	05 30	06 55	08 20	09 44
54	05 14	05 55	06 31	05 30	06 57	08 24	09 50
56	05 13	05 56	06 33	05 29	06 58	08 28	09 57
58	05 11	05 56	06 36	05 28	07 00	08 33	10 05
S 60	05 08	05 57	06 38	05 28	07 03	08 39	10 14

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 4	Moonset 5	Moonset 6	Moonset 7
°	h m	h m	h m	h m	h m	h m	h m
N 72	19 33	20 54	////	18 18	20 28	22 45	25 18
N 70	19 23	20 33	22 28	18 16	20 18	22 23	24 32
68	19 15	20 17	21 48	18 15	20 10	22 06	24 02
66	19 08	20 04	21 21	18 14	20 03	21 52	23 40
64	19 02	19 54	21 01	18 13	19 57	21 41	23 23
62	18 58	19 45	20 46	18 13	19 52	21 32	23 09
60	18 53	19 37	20 33	18 12	19 48	21 23	22 57
N 58	18 49	19 31	20 22	18 11	19 44	21 16	22 46
56	18 46	19 25	20 13	18 11	19 41	21 10	22 37
54	18 43	19 20	20 05	18 11	19 38	21 05	22 29
52	18 40	19 15	19 57	18 10	19 35	21 00	22 22
50	18 38	19 11	19 51	18 10	19 32	20 55	22 16
45	18 33	19 03	19 38	18 09	19 27	20 45	22 02
N 40	18 28	18 56	19 28	18 08	19 23	20 37	21 50
35	18 24	18 50	19 20	18 08	19 19	20 30	21 41
30	18 21	18 45	19 14	18 07	19 15	20 24	21 32
20	18 15	18 38	19 04	18 06	19 09	20 14	21 18
N 10	18 10	18 32	18 56	18 05	19 04	20 04	21 05
0	18 06	18 27	18 51	18 04	18 59	19 56	20 53
S 10	18 02	18 23	18 47	18 04	18 55	19 47	20 41
20	17 57	18 19	18 45	18 03	18 49	19 38	20 29
30	17 52	18 16	18 44	18 02	18 44	19 28	20 14
35	17 49	18 15	18 44	18 01	18 40	19 22	20 06
40	17 46	18 13	18 44	18 00	18 36	19 15	19 57
45	17 42	18 12	18 46	17 59	18 32	19 07	19 46
S 50	17 38	18 10	18 48	17 59	18 27	18 58	19 32
52	17 36	18 10	18 49	17 58	18 24	18 53	19 26
54	17 34	18 09	18 50	17 58	18 22	18 48	19 19
56	17 31	18 09	18 51	17 57	18 19	18 43	19 12
58	17 29	18 08	18 53	17 56	18 16	18 37	19 03
S 60	17 26	18 07	18 55	17 56	18 12	18 31	18 53

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
	m s	m s	h m	h m	h m	d	
4	03 09	03 00	12 03	11 52	24 19	29	
5	02 52	02 43	12 03	12 46	00 19	01	●
6	02 34	02 26	12 02	13 42	01 14	02	