

**U.S. Naval Observatory  
Astronomical Applications Department**

**Note: In the tables, d, h, m indicate day, hour, minute, respectively, of Universal Time.**

**2004 Phases of the Moon  
Universal Time**

NEW MOON			FIRST QUARTER			FULL MOON			LAST QUARTER						
d	h	m	d	h	m	d	h	m	d	h	m				
						JAN.	7	15	40	JAN.	15	4	46		
JAN.	21	21	05	JAN.	29	6	03	FEB.	6	8	47	FEB.	13	13	40
FEB.	20	9	18	FEB.	28	3	24	MAR.	6	23	14	MAR.	13	21	01
MAR.	20	22	41	MAR.	28	23	48	APR.	5	11	03	APR.	12	3	46
APR.	19	13	21	APR.	27	17	32	MAY	4	20	33	MAY	11	11	04
MAY	19	4	52	MAY	27	7	57	JUNE	3	4	20	JUNE	9	20	02
JUNE	17	20	27	JUNE	25	19	08	JULY	2	11	09	JULY	9	7	34
JULY	17	11	24	JULY	25	3	37	JULY	31	18	05	AUG.	7	22	01
AUG.	16	1	24	AUG.	23	10	12	AUG.	30	2	22	SEPT.	6	15	11
SEPT.	14	14	29	SEPT.	21	15	54	SEPT.	28	13	09	OCT.	6	10	12
OCT.	14	2	48	OCT.	20	21	59	OCT.	28	3	07	NOV.	5	5	53
NOV.	12	14	27	NOV.	19	5	50	NOV.	26	20	07	DEC.	5	0	53
DEC.	12	1	29	DEC.	18	16	40	DEC.	26	15	06				

**2005 Phases of the Moon  
Universal Time**

NEW MOON			FIRST QUARTER			FULL MOON			LAST QUARTER						
d	h	m	d	h	m	d	h	m	d	h	m				
									JAN.	3	17	46			
JAN.	10	12	03	JAN.	17	6	57	JAN.	25	10	32	FEB.	2	7	27
FEB.	8	22	28	FEB.	16	0	16	FEB.	24	4	54	MAR.	3	17	36
MAR.	10	9	10	MAR.	17	19	19	MAR.	25	20	58	APR.	2	0	50
APR.	8	20	32	APR.	16	14	37	APR.	24	10	06	MAY	1	6	24
MAY	8	8	45	MAY	16	8	56	MAY	23	20	18	MAY	30	11	47
JUNE	6	21	55	JUNE	15	1	22	JUNE	22	4	14	JUNE	28	18	23
JULY	6	12	02	JULY	14	15	20	JULY	21	11	00	JULY	28	3	19
AUG.	5	3	05	AUG.	13	2	38	AUG.	19	17	53	AUG.	26	15	18
SEPT.	3	18	45	SEPT.	11	11	37	SEPT.	18	2	01	SEPT.	25	6	41
OCT.	3	10	28	OCT.	10	19	01	OCT.	17	12	14	OCT.	25	1	17
NOV.	2	1	24	NOV.	9	1	57	NOV.	16	0	57	NOV.	23	22	11
DEC.	1	15	01	DEC.	8	9	36	DEC.	15	16	15	DEC.	23	19	36
DEC.	31	3	12												

## 2006 Phases of the Moon

### Universal Time

New Moon			First Quarter			Full Moon			Last Quarter		
d	h	m	d	h	m	d	h	m	d	h	m
			Jan 6	18	56	Jan 14	9	48	Jan 22	15	14
Jan 29	14	15	Feb 5	6	29	Feb 13	4	44	Feb 21	7	17
Feb 28	0	31	Mar 6	20	16	Mar 14	23	35	Mar 22	19	10
Mar 29	10	15	Apr 5	12	01	Apr 13	16	40	Apr 21	3	28
Apr 27	19	44	May 5	5	13	May 13	6	51	May 20	9	21
May 27	5	26	Jun 3	23	06	Jun 11	18	03	Jun 18	14	08
Jun 25	16	05	Jul 3	16	37	Jul 11	3	02	Jul 17	19	13
Jul 25	4	31	Aug 2	8	46	Aug 9	10	54	Aug 16	1	51
Aug 23	19	10	Aug 31	22	56	Sep 7	18	42	Sep 14	11	15
Sep 22	11	45	Sep 30	11	04	Oct 7	3	13	Oct 14	0	26
Oct 22	5	14	Oct 29	21	25	Nov 5	12	58	Nov 12	17	45
Nov 20	22	18	Nov 28	6	29	Dec 5	0	25	Dec 12	14	32
Dec 20	14	01	Dec 27	14	48						

## 2007 Phases of the Moon

### Universal Time

New Moon			First Quarter			Full Moon			Last Quarter		
d	h	m	d	h	m	d	h	m	d	h	m
						Jan 3	13	57	Jan 11	12	45
Jan 19	4	01	Jan 25	23	01	Feb 2	5	45	Feb 10	9	51
Feb 17	16	14	Feb 24	7	56	Mar 3	23	17	Mar 12	3	54
Mar 19	2	43	Mar 25	18	16	Apr 2	17	15	Apr 10	18	04
Apr 17	11	36	Apr 24	6	35	May 2	10	09	May 10	4	27
May 16	19	27	May 23	21	02	Jun 1	1	04	Jun 8	11	43
Jun 15	3	13	Jun 22	13	15	Jun 30	13	49	Jul 7	16	54
Jul 14	12	04	Jul 22	6	29	Jul 30	0	48	Aug 5	21	20
Aug 12	23	02	Aug 20	23	54	Aug 28	10	35	Sep 4	2	32
Sep 11	12	44	Sep 19	16	48	Sep 26	19	45	Oct 3	10	06
Oct 11	5	01	Oct 19	8	33	Oct 26	4	52	Nov 1	21	18
Nov 9	23	03	Nov 17	22	33	Nov 24	14	30	Dec 1	12	44
Dec 9	17	40	Dec 17	10	17	Dec 24	1	16	Dec 31	7	51

## 2008 Phases of the Moon

### Universal Time

	New Moon			First Quarter			Full Moon			Last Quarter					
	d	h	m	d	h	m	d	h	m	d	h	m			
Jan	8	11	37	Jan	15	19	46	Jan	22	13	35	Jan	30	5	03
Feb	7	3	44	Feb	14	3	33	Feb	21	3	30	Feb	29	2	18
Mar	7	17	14	Mar	14	10	46	Mar	21	18	40	Mar	29	21	47
Apr	6	3	55	Apr	12	18	32	Apr	20	10	25	Apr	28	14	12
May	5	12	18	May	12	3	47	May	20	2	11	May	28	2	57
Jun	3	19	23	Jun	10	15	04	Jun	18	17	30	Jun	26	12	10
Jul	3	2	19	Jul	10	4	35	Jul	18	7	59	Jul	25	18	42
Aug	1	10	13	Aug	8	20	20	Aug	16	21	16	Aug	23	23	50
Aug	30	19	58	Sep	7	14	04	Sep	15	9	13	Sep	22	5	04
Sep	29	8	12	Oct	7	9	04	Oct	14	20	02	Oct	21	11	55
Oct	28	23	14	Nov	6	4	03	Nov	13	6	17	Nov	19	21	31
Nov	27	16	55	Dec	5	21	26	Dec	12	16	37	Dec	19	10	29
Dec	27	12	22												

## What is Universal Time?

The times of various events, particularly astronomical and weather phenomena, are often given in "Universal Time" (abbreviated **UT**) which is sometimes referred to, now colloquially, as "Greenwich Mean Time" (abbreviated **GMT**). The two terms are often used loosely to refer to time kept on the Greenwich meridian (longitude zero), five hours ahead of Eastern Standard Time. Times given in UT are almost always given in terms of a 24-hour clock. Thus, 14:42 (often written simply 1442) is 2:42 p.m., and 21:17 (2117) is 9:17 p.m. Sometimes a Z is appended to a time to indicate UT, as in 0935Z.

When a precision of one second or better is needed, however, it is necessary to be more specific about the exact meaning of UT. For that purpose different designations of Universal Time have been adopted. In astronomical and navigational usage, UT often refers to a specific time called UT1, which is a measure of the rotation angle of the Earth as observed astronomically. It is affected by small variations in the rotation of the Earth, and can differ slightly from the civil time on the Greenwich meridian. Times which may be labeled "Universal Time" or "UT" in data provided by the Astronomical Applications Department of the U.S. Naval Observatory (for example, in the annual almanacs) conform to this definition.

However, in the most common civil usage, UT refers to a time scale called "Coordinated Universal Time" (abbreviated **UTC**), which is the basis for the worldwide system of civil time. This time scale is kept by time laboratories around the world, including the U.S. Naval Observatory, and is determined using highly precise atomic clocks. The International Bureau of Weights and Measures makes use of data from the timing laboratories to provide the international standard UTC which is accurate to approximately a nanosecond (billionth of a second) per day. The length of a UTC second is defined in terms of an atomic transition of the element cesium under specific conditions, and is not directly related to any astronomical phenomena.

UTC is the time distributed by standard radio stations that broadcast time, such as WWV and WWVH. It can also be obtained readily from the Global Positioning System (GPS) satellites. The difference between UTC and UT1 is made available electronically and broadcast so that navigators can obtain UT1. UTC is the basis for civil standard time in the U.S. and its territories. Standard time within [U.S. time zones](#) is an integral number of hours offset from UTC.

UTC is equivalent to the civil time for Iceland, Liberia, Morocco, Senegal, Ghana, Mali, Mauritania, and several other countries. During the winter months, UTC is also the civil time scale for the United Kingdom and Ireland.

One can think of UT1 as being a time determined by the rotation of the Earth, over which we have no control, whereas UTC is a human invention. It is relatively easy to manufacture highly precise clocks that keep UTC, while the only "clock" keeping UT1 precisely is the Earth itself. Nevertheless, it is desirable that our civil time scale not be very different from the Earth's time, so, by international agreement, UTC is not permitted to differ from UT1 by more than 0.9 second. When it appears that the difference between the two kinds of time may approach this limit, a one-second change called a "[leap second](#)" is introduced into UTC. This occurs on average about once every year to a year and a half.

For more information on time, time scales, and accurate clocks, see the U.S. Naval Observatory [Time Service Department](#) web pages. Related information can be found on the pages of the [National Institute of Standards and Technology](#) (NIST).

## Historical Note

Greenwich Mean Time is a widely used historical term, but one that has been used in several ways. Because of the ambiguity, its use is no longer recommended in technical contexts.

Prior to 1925, in astronomical and nautical almanacs, a day of Greenwich Mean Time began at *noon*. This reckoning of Greenwich Mean Time is now called Greenwich Mean Astronomical Time, and is no longer used. Persons using old editions of the almanacs for historical research should be aware of the previous convention.