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## The Solar Terms And The Chinese Calendar

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Chinese astronomy divides the year into twenty-four parts, based on the longitude of the sun on the ecliptic, called "Solar Terms." As recounted in "Groundhog Day and Chinese Astronomy", the Chinese seasons begin at the midpoints between the solstices and equinoxes, not at the solstices and equinoxes themselves. The **Chinese New Year**, according to the rule of the T'ai-ch'u Era (104 BC) of the Emperor Wu Ti of the Former Han Dynasty, is the Second New Moon after the Winter Solstice, which amounts, roughly, to the Closest New Moon to the Solar Term "Spring Begins" (February 3/4). In 2006, the Chinese New Year falls on January 29, five days before Spring Begins on February 3. The twelve parts of the year corresponding to the signs of the Zodiac each consists of two Solar Terms, but four Zodiacal periods overlap two seasons. The seasons are of different lengths because, according to Kepler's Second Law, the Earth travels faster the closer it is to the Sun. Between January 2 and 4, the Earth reaches *Perihelion*, its closest approach to the sun, and travels the fastest. Thus, Chinese winter is only 89 days long, while Summer is 94 days long.

The Chinese New Year is often called the "lunar" new year, but it is no more "lunar" than the Babylonian, Jewish, or Islamic new years, which are also based on lunar months. Like the Babylonian and Jewish calendars, the Chinese is "luni-solar," with lunar months adjusted with intercalations for the solar year. The Vietnamese new year, *Tet*, is often also identified as "the lunar new year," but it is, indeed, just the Chinese New Year. The Chinese calendar was similarly used in Korea, Japan, and Mongolia, though I have had one Mongolian correspondent claiming that Chinese astronomy, attested from antiquity, was derived from the Mongols. Since the Mongols adopted writing only in the time of Chinggiz Khan, I don't think there is much doubt, from the historical evidence, that Chinese astronomy originated in China. Another confusion about the Chinese New Year is the phrase *gung hay fat choi*, which is often said to be "Happy New Year!" in Chinese. In 2004 I have actually seen a news report that this was the right phrase in *Mandarin* Chinese. But it is not. It is in one of the other Chinese languages (or "dialects"), **Yuè or Cantonese**, which is spoken in Guandong Province and Hong Kong. Cantonese syllables can end in *t*, *p*, or *k*, while Mandarin syllables cannot. The word *fat* thus shows that the phrase cannot be Mandarin. Its currency is probably due to the circumstance

that most Chinese immigrants to the United States before World War II were from Guandong Province, with Hong Kong itself contributing its influence since then.

THE SOLAR TERMS	Principal Terms	Chinese	Japanese	Length		Date	Zodiac
1. Spring Begins		Lìchun <sup>1</sup>	Risshun	15d	91d	February 4	Aquarius ♒
2. Rain Water	P-1	Yu <sup>3</sup> shui <sup>3</sup>	Usui	15d		February 19	Pisces ♓
3. Excited Insects		Jing <sup>1</sup> zhé	Keichitsu	15d		March 6	♈
4. <b>Vernal Equinox</b>	P-2	Chun <sup>1</sup> fen <sup>1</sup>	Shumbun	15d		March 21	Aries ♈
5. <u>Clear &amp; Bright</u>		Qing <sup>1</sup> míng	Seimei	15d		April 5	♉
6. Grain Rains	P-3	Gu <sup>3</sup> yu <sup>3</sup>	Kokuu	16d		April 20	Taurus ♉
7. Summer Begins		Lìxià	Rikka	15d	94d	May 6	♊
8. Grains Fills	P-4	Xiao <sup>3</sup> man <sup>3</sup>	Shôman	16d		May 21	Gemini ♊
9. Grain in Ear		Mángzhòng	Bôshoû	15d		June 6	♋
10. <b>Summer Solstice</b>	P-5	Xiàzhì	Geji	16d		June 21	Cancer ♋
11. Slight Heat		Xiao <sup>3</sup> shu <sup>3</sup>	Shôsho	16d		July 7	♌
12. Great Heat	P-6	Dàshu <sup>3</sup>	Daisho	16d		July 23	Leo ♌
13. Autumn Begins		Lìqiu <sup>1</sup>	Risshû	15d	91d	August 8	♍
14. Limit of Heat	P-7	Chu <sup>3</sup> shu <sup>3</sup> <sup>3&lt;/SUP&gt;YUW&lt; td&gt;</sup>	Shosho	16d		August 23	Virgo ♍
15. White Dew		Báilù	Hakuro	15d		September 8	♎

16. <b>Autumn Equinox</b>	P-8	Qiu <sup>1</sup> fen <sup>1</sup> n	Shûbun	15d		September 23	Libra
17. Cold Dew		Hánlù	Kanro	15d		October 8	♎
18. Hoar Frost	P-9	Shuang <sup>1</sup> jiàng	Sôkô	15d		October 23	Scorpius
19. Winter Begins		Lìdong <sup>1</sup>	Rittô	15d	89d	November 7	♏
20. Little Snow	P-10	Xiao <sup>3</sup> xue <sup>3</sup>	Shôsetsu	15d		November 22	Sagittarius
21. Great Snow		Dàxue <sup>3</sup>	Daisetsu	15d		December 7	♐
22. <b>Winter Solstice</b>	P-11	Dong <sup>1</sup> zhì	Tôji	15d		December 22	Capricorn
23. Little Cold		Xiao <sup>3</sup> hán	Shôkan	14d		January 6	♑
24. Great Cold	P-12	Dàhán	Daikan	15d		January 20	Aquarius
							♒

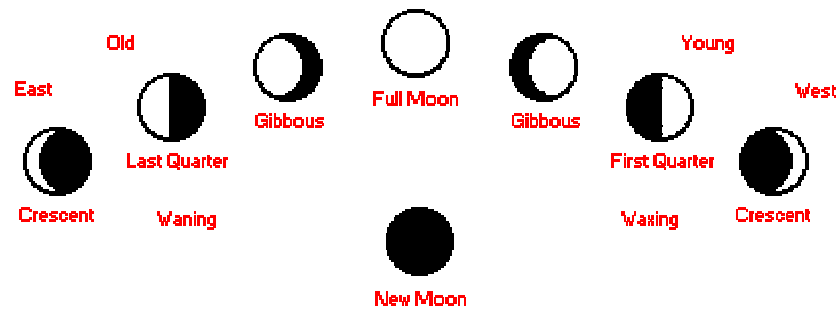
清  
Qīng

明  
Míng

Qing Ming (Qing<sup>1</sup>míng), "Clear and Bright," contains a major spring festival, used to visit the family tombs. These also happen to be the names of the last two Chinese Imperial Dynasties, the **Ming (1368-1644)** and the **Qing (1644-1912)**, chosen for their auspicious associations.

Since length of all terms may vary slightly from year to year, all dates may occur a day earlier.

The terms given "P" numbers are called "principal terms," *zhongqi*, correspond to the beginning of Zodiacal periods and are used to determine the numbering of the lunar months. Five rules determine the numbering of the months and the occurrence of intercalary months:



The first day of the month is the day on which the New Moon occurs.

Calculations of New Moons are based on the meridian 120° East. An ordinary year has twelve lunar months; an intercalary year has thirteen lunar months.

The Winter Solstice (term P-11) always falls in the 11th Month.

In an intercalary year, a month in which there is no Principal Term is the intercalary month. It is assigned the number of the preceding month, with the further designation of intercalary. If two months contain no Principal Term, only the first such month after the Winter Solstice is considered intercalary.

These rules, which may be found in the *Explanatory Supplement to the Astronomical Almanac* [prepared by The Nautical Almanac Office, U.S. Naval Observatory, edited by P. Kenneth Seidelmann, University Science Books, Mill Valley, California, 1992], do not provide a simple means for amateurs to construct a Chinese calendar. This was always done by Court Astronomers and still calls for precise astronomical data and special calculations, though it should be reliable enough to use the data for New Moons and for the ecliptic longitude of the sun in *The Astronomical Almanac* for the year in question [U.S. Government Printing Office, Washington, and Her Majesty's Stationery Office, London]. A table with the Chinese characters for all the Solar Terms may be found in *Mathews' Chinese-English Dictionary* [Harvard University Press, 1972], p. 1178. My original information about the Chinese calendar was from O.L. Harvey's pamphlet, "The Chinese Calendar and the Julian Day Number" [1977], which was based on *Chronological Tables of Chinese History*, by Tung Tso-pin [Hong Kong University Press, 1960], a rare work that I have never examined independently.



Chinese years are classified according to 10 "Heavenly Stems" and 12 "Earthy Branches." The succession of Stems and Branches produces a sixty year calendar cycle.

The Earthly Branches are more familiar, since one association is with 12 Zodiacal **animals**, which in Buddhist tradition are supposed to be the animals that responded when the Buddha called to them, like St. Francis, to hear him preach the Dharma. Most people hear about the Chinese New Year and know, for a while, that a year like 2000 is the "Year of the Dragon." The Chinese names, in Pinyin, are not the names of animals, but the proper names of the "Branches." The Japanese list gives the Japanese pronunciation of the Chinese name followed by the Japanese name of the corresponding animal. The Vietnamese names are the Vietnamese pronunciation of the Chinese names. The Mongolian names are the animal names.

### The Earthy Branches

China	Japan	Vietnam	Mongolia	associations
1. zi <sup>3</sup>	shi ne	tý	qulughana	1996 Rat 11 AM Aries
2. chou <sup>3</sup>	chu ushi	sù u	üker	1997 Ox 1 PM Taurus
3. yín	in tora	d'ân	bars	1998 Tiger 3 PM Gemini
4. mao <sup>3</sup>	bo u	mǎo	taulai	1999 Rabbit 5 PM Cancer
5. chén	shin tatsu	thìn	luu	<b>2000 <u>Dragon</u></b> 7 PM Leo
6. sì	shi mi	ty	moghai	2001 Snake 9 PM Virgo
7. wu <sup>3</sup>	go uma	ngo.	morin	2002 Horse 11 PM Libra
8. wèi	bi hitsuji	mùi	qonin	2003 Sheep 1 AM Scorpio
9. shen <sup>1</sup>	shin saru	thân	bechin	2004 Monkey 3 AM Sagittarius
10. yu <sup>3</sup>	yu tori	dâ.u	takiya	2005 Chicken 5 AM Capricorn
11. xu <sup>1</sup>	jutsu inu	tuât	noqai	2006 Dog 7 AM Aquarius
12. fù	gai i	ho: i	ghaqai	2007 Pig 9 AM Pisces

The primary association of the Heavenly Stems is with the five elements. These are divided into yang or "elder brother" and yin or "younger brother" forms. The Chinese names are not the element names, but the proper names of the "Stems." The Japanese and Mongolian lists give their pronunciation of the Chinese names followed by the elder/younger version of the element names. The Vietnamese list is just the pronunciation of the Chinese names.

The Heavenly Stems										
China	Japan		Vietnam	Mongolia		associations				
1. jia <sup>3</sup>	ko	ki-no-e	giáp	ga	ere modun	2004	yang	wood	fir	♃
2. yi <sup>1</sup>	otsu	ki-no-to	â't	yi	eme modun	2005	yin		bamboo	Jupiter blue/ green
3. bing <sup>3</sup>	hei	hi-no-e	bính	bing	ere ghal	2006	yang	fire	burning wood	♂
4. ding <sup>1</sup>	tei	hi-no-to	đinh	ding	eme ghal	2007	yin		lamp flame	Mars red
5. wù	bo	tsuchi- no-e	mâ.u	u	ere shiroi	1998	yang	earth	hill	♄
6. ji <sup>3</sup>	ki	tsuchi- no-to	ký	gi	eme shiroi	1999	yin		plain	Saturn yellow
7. geng <sup>1</sup>	kô	ka-no-e	canh	ging	ere temür	2000	yang	metal	weapons	♀
8. xin <sup>1</sup>	shin	ka-no-to	tân	sin	eme temür	2001	yin		kettle	Venus white
9. rén	jīn	mizu- no-e	nhâm	shim	ere usun	2002	yang	water	waves	♁
10. gui <sup>3</sup>	kǐ	mizu- no-to	quí	gūi	eme usun	2003	yin		brooks	Mercury black

A table with the Chinese characters for all the Earthly Branches and Celestial Stems may be found in *Mathews' Chinese-English Dictionary* [Harvard University Press, 1972], p. 1176. Treatments of the Japanese Branches and Stems, and other calendar features, may be found in the *Historical and Geographical Dictionary of Japan*, E. Papinot [Charles E. Tuttle Company, 1910, 1972], p. 836, and in *The Princeton Companion to Classical Japanese Literature*, Earl Miner, Hiroko Odagiri, and Robert E. Morrell [Princeton University Press, 1985], p. 399. The Vietnamese names here are taken from Nguyễn Đình-Hoà's *Vietnamese-English Dictionary* [Charles E. Tuttle Company, 1966, 1991], under listings for *chi* (the Earthly Branches, p. 62) and *can* (the Heavenly Stems, p. 31). Vietnamese diacritics cannot be rendered precisely in HTML.

## The Occurrence of the Solar Terms 1995-2006

This table shows the dates, in Universal Time (Greenwich Mean Time), on which the sun reaches the ecliptic longitudes for each of the solar terms, in the years 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006 according to the data for the sun in *The Astronomical Almanac for the Year 1995* and subsequent volumes for 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006 [U.S. Government Printing Office, Washington, and Her Majesty's Stationery Office, London, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004].

THE SOLAR TERMS	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	Long- itude of Sun
23. Little Cold	1/5	1/6	1/5	1/5	1/5	1/6	1/5	1/5	1/5	1/6	1/5	1/5	285°
24. Great Cold	1/20	1/20	1/20	1/20	1/20	1/20	1/20	1/20	1/20	1/20	1/19	1/20	300°
1. Spring Begins	2/4	2/4	2/3	2/4	2/4	2/4	2/3	2/4	2/4	2/4	2/3	2/3	315°
2. Rain Water	2/19	2/19	2/18	2/18	2/19	2/19	2/18	2/18	2/19	2/19	2/18	2/18	330°
3. Excited Insects	3/5	3/5											
	3/5	3/5	3/6	3/5	3/5	3/5	3/5	3/5	3/5	3/5	345°		

4. Vernal Equinox	3/21	3/20	3/20	3/20	3/21	3/20	3/20	3/20	3/21	3/20	3/20	3/20	0°
5. Clear & Bright	4/5	4/4	4/4	4/4	4/5	4/4	4/4	4/4	4/5	4/4	4/4	4/4	15°
6. Grain Rains	4/20	4/19	4/20	4/20	4/20	4/19	4/20	4/20	4/20	4/19	4/19	4/20	30°
7. Summer Begins	5/5	5/5	5/5	5/5	5/5	5/5	5/5	5/5	5/5	5/5	5/5	5/5	45°
8. Grains Fills	5/21	5/20	5/21	5/21	5/21	5/20	5/20	5/21	5/21	5/20	5/20	5/21	60°
9. Grain in Ear	6/6	6/5	6/5	6/5	6/6	6/5	6/5	6/5	6/6	6/5	6/5	6/5	75°
10. Summer Solstice	6/21	6/21	6/21	6/21	6/21	6/21	6/21	6/21	6/21	6/21	6/21	6/21	90°
11. Slight Heat	7/7	7/6	7/7	7/7	7/7	7/6	7/7	7/7	7/7	7/6	7/7	7/7	105°
12. Great Heat	7/23	7/22	7/22	7/23	7/23	7/22	7/22	7/23	7/23	7/23	7/22	7/22	120°
13. Autumn	8/7	8/7	8/7	8/7	8/7	8/7	8/7	8/7	8/7	8/7	8/7	8/7	135°

Begins														
14. Limit of Heat	8/23	8/22	8/23	8/23	8/23	8/22	8/23	8/23	8/23	8/22	8/23	8/23	150°	
15. White Dew	9/8	9/7	9/7	9/7	9/8	9/7	9/7	9/7	9/8	9/7	9/7	9/7	165°	
16. Autumn Equinox	9/23	9/22	9/22	9/23	9/23	9/22	9/22	9/23	9/23	9/22	9/22	9/23	180°	
17. Cold Dew	10/8	10/8	10/8	10/8	10/8	10/7	10/8	10/8	10/8	10/7	10/8	10/8	195°	
18. Hoar Frost	10/23	10/23	10/23	10/23	10/23	10/23	10/23	10/23	10/23	10/23	10/23	10/23	210°	
19. Winter Begins	11/7	11/7	11/7	11/7	11/7	11/7	11/7	11/7	11/7	11/7	11/7	11/7	225°	
20. Little Snow	11/22	11/22	11/22	11/22	11/22	11/22	11/22	11/22	11/22	11/21	11/22	11/22	240°	
21. Great Snow	12/7	12/6	12/7	12/7	12/7	12/6	12/7	12/7	12/7	12/6	12/7	12/7	255°	
22. Winter Solstice	12/22	12/21	12/21	12/22	12/22	12/21	12/21	12/22	12/22	12/21	12/21	12/22	270°	

The table begins in January with the calendar year. A true Chinese reckoning, of course, would time the events on a meridian in China, instead of on the Prime Meridian of Greenwich. However, this serves to universalize this aspect of Chinese astronomy, times for China can be obtained just by adding a few hours, and, after all, the UT data is what I have readily available. I don't think I would want to correct it anyway, since I like the universalization.