Phys 102 Astronomy

Name Key

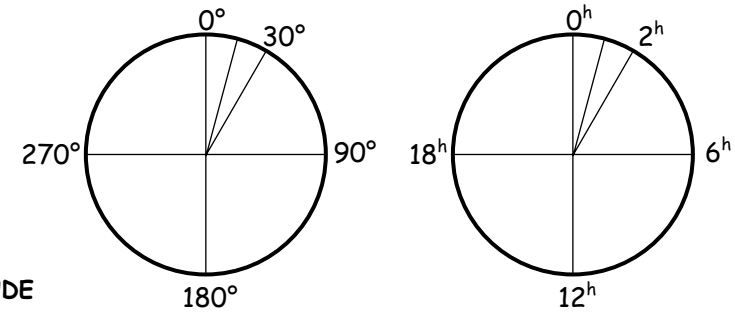
Time Zones

24 hours = 360 degrees

1 hour = 15 **degrees**

1 degree = 4 **minutes**

1 TIME ZONE = 15 **DEGREES OF LONGITUDE**



Starting at the Prime Meridian list the longitudes of the centers of N. American time zones:

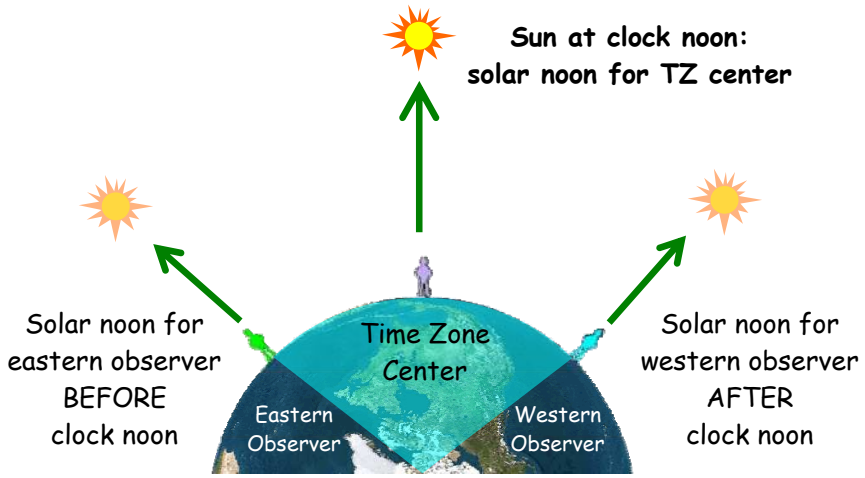
Name	Center Longitude
Atlantic	60°
Eastern	75°
Central	90°
Mountain	105°

Name	Center Longitude
Pacific	120°
Yukon	135° W
Alaska-Hawaiian	150°
Nome	165° W

Clock and Solar Noon

SOLAR NOON = SUN ON MERIDIAN (AT HIGHEST POINT DUE SOUTH)

On the time zone center longitude, clock noon corresponds (roughly) to solar noon. Each 1° of longitude requires 4 minutes of Earth rotation time. Find the clock times of solar noon at two cities in the Easter Time Zone.



City	Longitude of City	Longitude of TZ Center	Longitude Difference degrees	Longitude Difference E or W	Clock Time of Solar Noon
Portland, ME	70° 15′ W	75° W	4.75	E	11:41 am
Thunder Bay, Ontario	89° 15′ W	75° W	14.25	W	12:57 pm
Hamilton, Bermuda	E	75° W	4.75	E	10:59 am

Figure out the city at 32¼° N with solar noon occurring at 10:59 am on clocks set for Eastern Time.

ZULU TIME

The times of astronomical events is often given in **COORDINATED UNIVERSAL TIME (UT, UTC[1], OR ZULU)**, which is the time on the prime meridian at Greenwhich. Subtract 5 hours from UT for Eastern Standard Time and 4 hours for Eastern Daylight Time. In 2007, Daylight Saving Time is from March 11 to November 4.

EVENT	UT		LOCAL TIME (EDT OR EST)	
	Date	Time (24 hr)	Date	Time (AM/PM)
Full Moon	February 2, 2007	5:45	Feb. 2	12:45 am
Vernal Equinox	March 21, 2007	00:09	March 20	8:09 Pm
Summer Solstice	June 21, 2007	18:11	June 21	2:11 pm

THE SPEED OF NOON

The Speed of Noon at the Equator

As the Earth spins "beneath" the sun, the sun is directly over different points on Earth through the day. Thus "noon" travels all the way around the Earth in one day. On the equinoxes it travels along the equator where Earth's radius is 6.4 x 10^6m, so calculate the speed of noon (Just do the calculation at the end):

$$v_{\text{noon at equator}} = \frac{\text{distance}}{\text{time}} = \frac{2\pi R_{\text{equator}}}{24\,\text{hr}} = \frac{2\pi(6.4\times10^6\,\text{m})}{24(60)(60)\,\text{sec}} = \quad 465 \quad \text{m/s}$$

or, taking $1\ \text{m/s} = 2.24\ \text{mph}$, the speed of noon along the equator is $v_{\text{noon at equator}}$ = 1042 mph

$$465\ \text{m/s} \times \frac{2.24\ \text{mph}}{1\ \text{m/s}} = 1042\ \text{mph}$$

B. Terminator Speed in Canton

The terminator is the edge of the Earth's shadow on itself, that is, the edge of night or sunset and sunrise that occur when the terminator passes your position on Earth. Since we don't stand at the equator, the distance traveled by the terminator that passes over SLU is smaller than the distance traveled by the terminator at the equator. The rotational radius (the radius from the axis of rotation) of the Earth at Canton is $R_{\text{equator}}\cos(45°)$ since Canton is at a latitude of about 45°. Hence the speed of the terminator (or noon) at Canton is less than that at the equator. Calculate the speed of the terminator at Canton (Just do the calculation at the end):

$$v_{\text{noon in Canton}} = \frac{2\pi R_{\text{equator}}\cos(45^\circ)}{24\ \text{hr}} = \frac{2\pi(6.4\text{x}10^6\,\text{m})\cos(45^\circ)}{24(60)(60)\,\text{sec}} = \quad 329 \quad \text{m/s}$$

$$= \quad 737 \quad \text{mph}$$

[1] Replaced Greenwich Mean Time (GMT) as the World standard for time in 1986. Also known as "Zulu Time," it is based on atomic measurements rather than the Earth's rotation. Greenwich Mean Time (GMT) is still the standard time zone for the Prime Meridian (Zero Longitude). From http://wwp.greenwichmeantime.com/. See http://tycho.usno.navy.mil/what.html for conversion factors for UT.