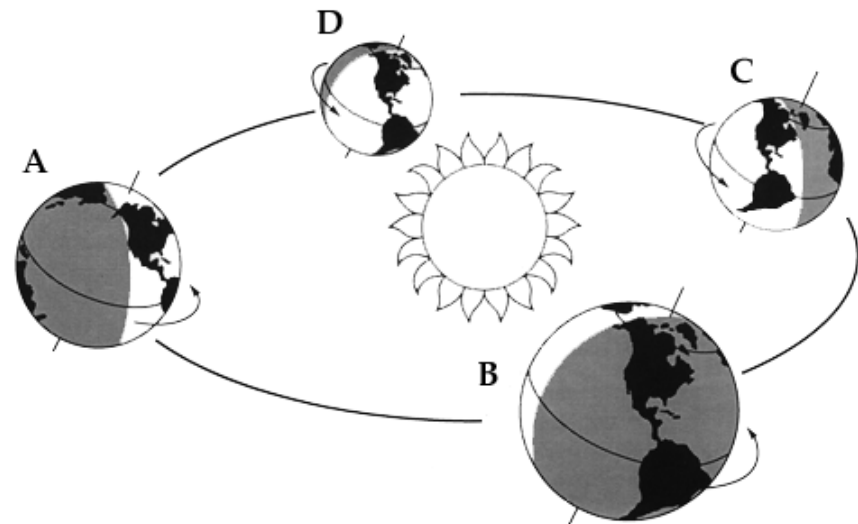
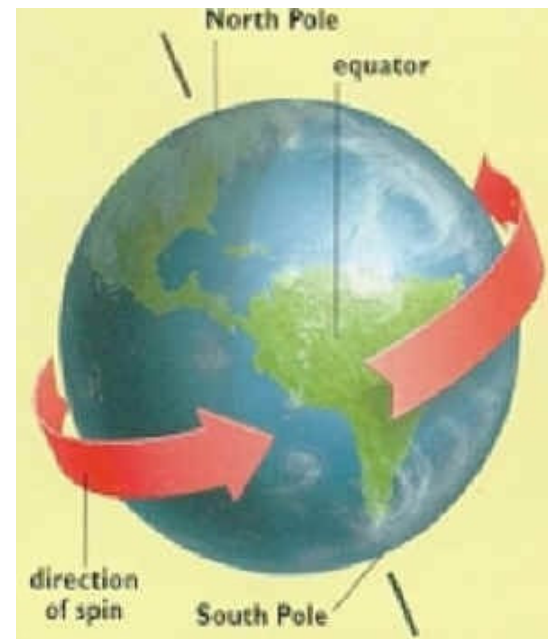


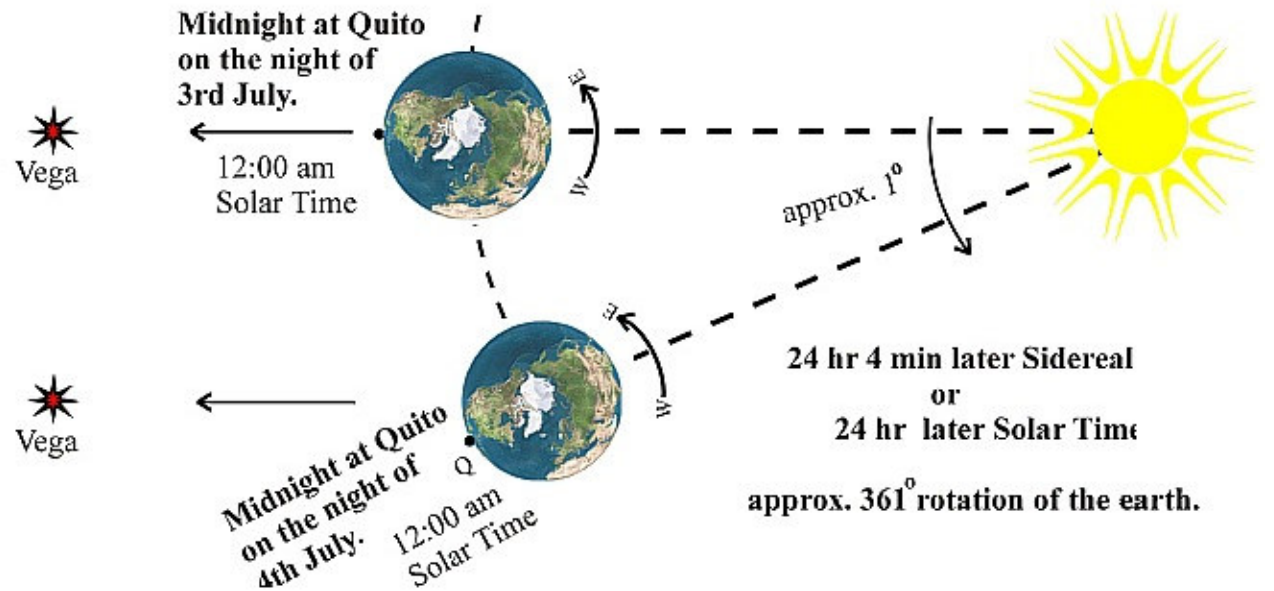
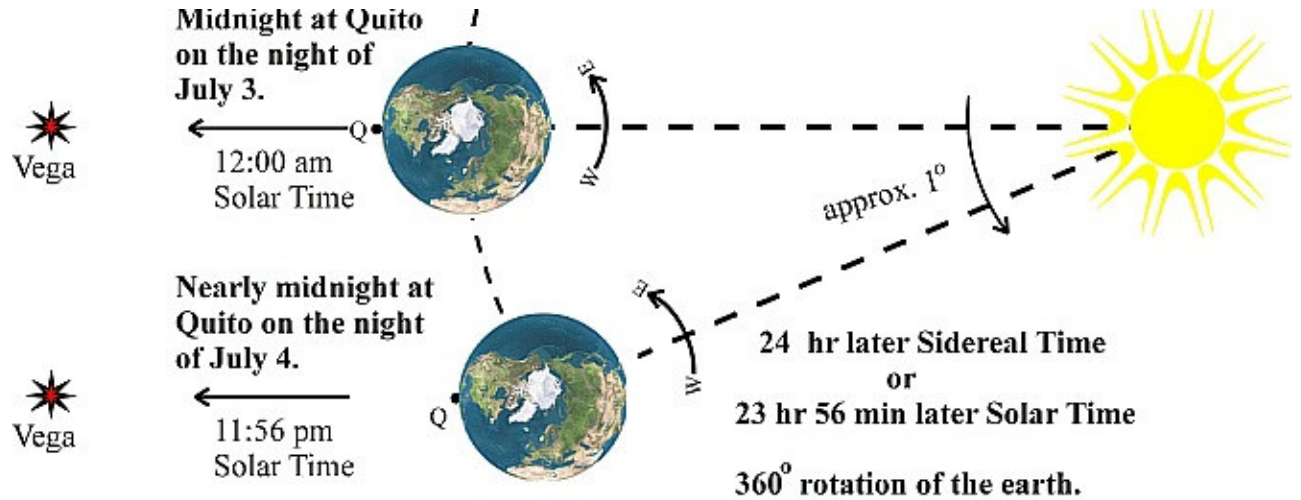
Ch 22.2 The Earth-Moon-Sun System

Motions of Earth

- The Earth has two main motions and a slow motion:
 - **Rotation** is the turning of the Earth on its axis giving night and day.
 - **Revolution** is the orbit of the Earth around the Sun or Moon around the Earth.
 - **Precession** occurs over very long time, 26,000 years, of the Earth's axis.



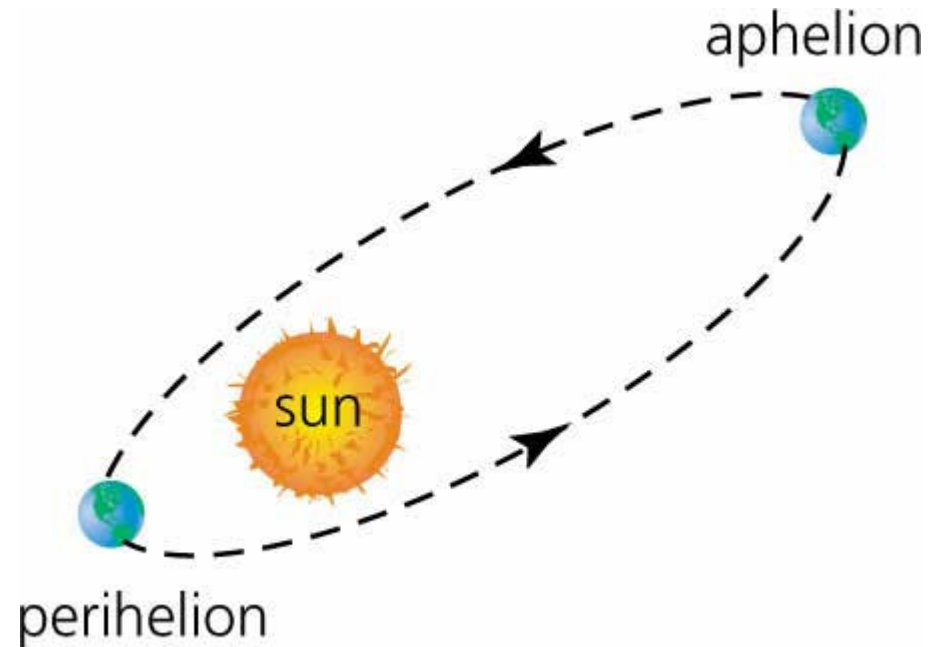
- **Solar day** - the time interval from one noon to the next. Each rotation of the Earth around its axis equals about 24 hours.
- A **sidereal day** is the time it takes for Earth to make one complete rotation with respect to a distant star, not our sun.
- The sidereal day is measured by the time required for a star to reappear at the identical position in the sky where it was observed the day before. It is almost 4 minutes shorter than a solar day.



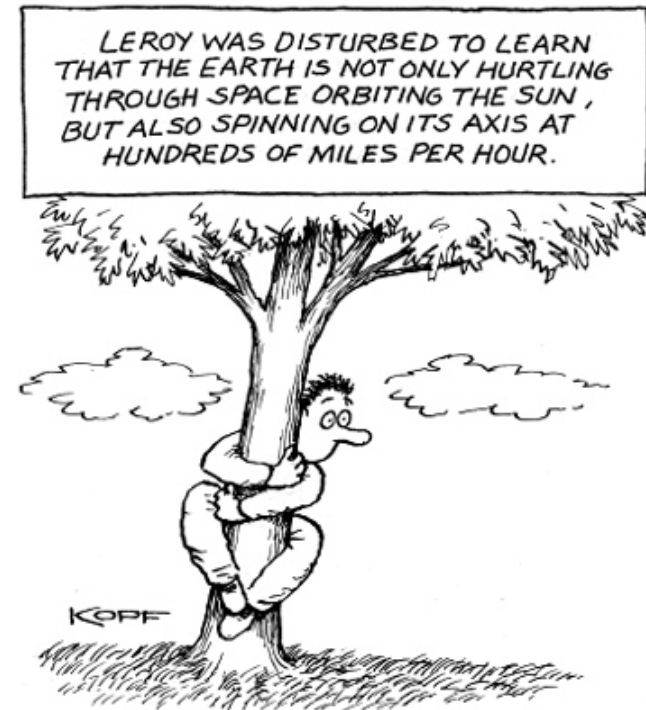
- Sidereal time is used by astronomers because the stars appear in the same position in the sky every 24 sidereal hours.

Revolution

- The Earth revolves around the sun in an elliptical orbit at an average speed of 107,000 kilometers per hour.
- The **perihelion** is the point of the elliptical orbit where the Earth is closest to the sun – about 147 million kilometers away. This occurs about January 3 each year.
- The **aphelion** is the point of the elliptical orbit where the Earth is farthest from the sun – about 152 million kilometers away. This occurs about July 4 each year.
- Generally, the planets and moon travel in nearly the same plane as Earth. So their paths on the celestial sphere lie near the ecliptic.

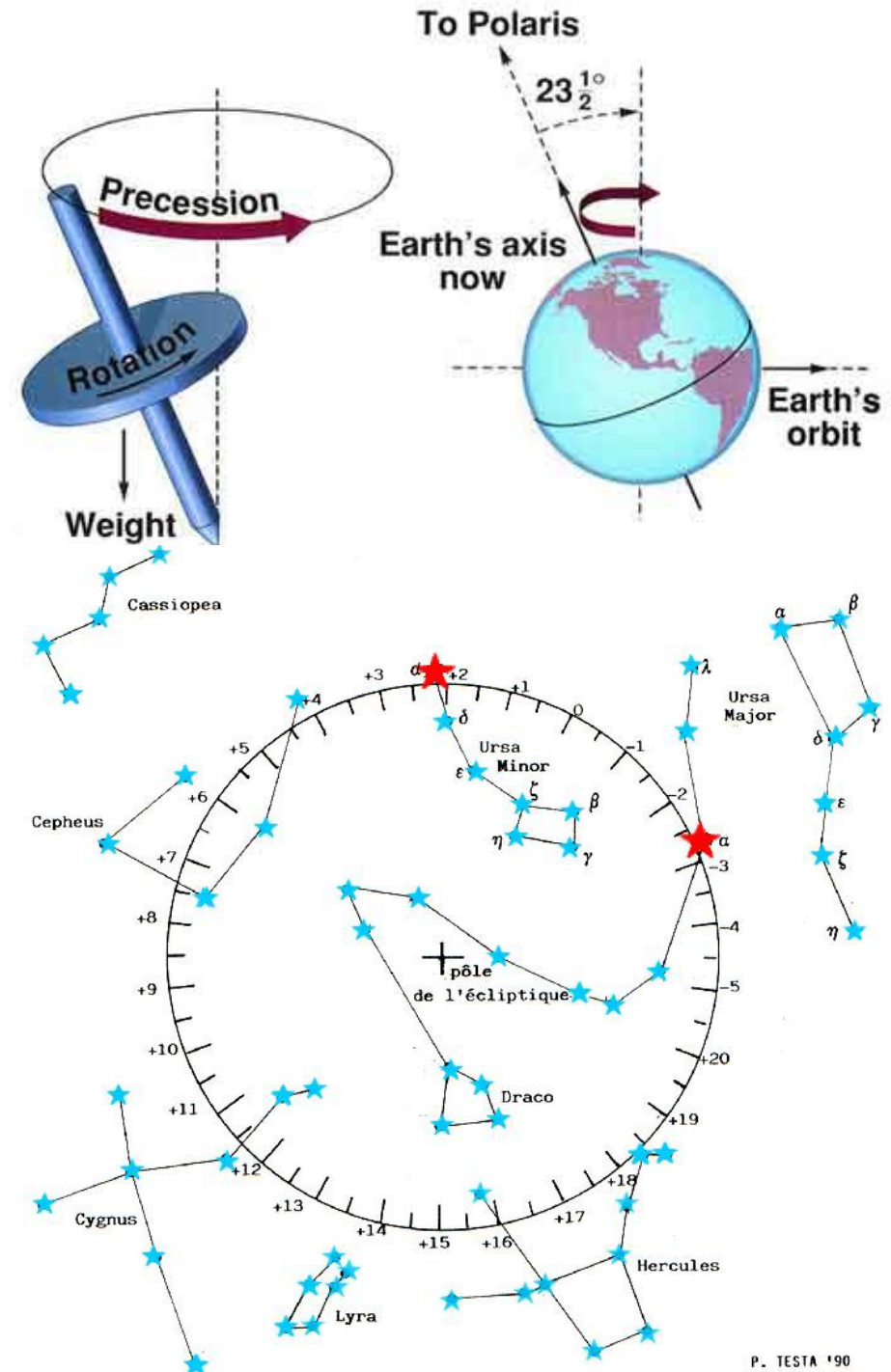


Academy Artworks



Precession

- **Precession** refers to a change in the direction of the axis of a rotating object.
- The Earth goes through one complete **precession** cycle in a period of approximately 25,800 years, during which the positions of stars will slowly change.
- The Earth's axis varies in tilt between 21.5 degrees and 24.5 degrees with a repeating period of 41,000 years.
- Currently, the axis points toward the star Polaris. In about 13,000 years it will point to the star Vega.
- The period of precession, or the amount of time for the axis to complete one circle is 26,000 years. By year 28,000, Polaris will once again be the North Star.



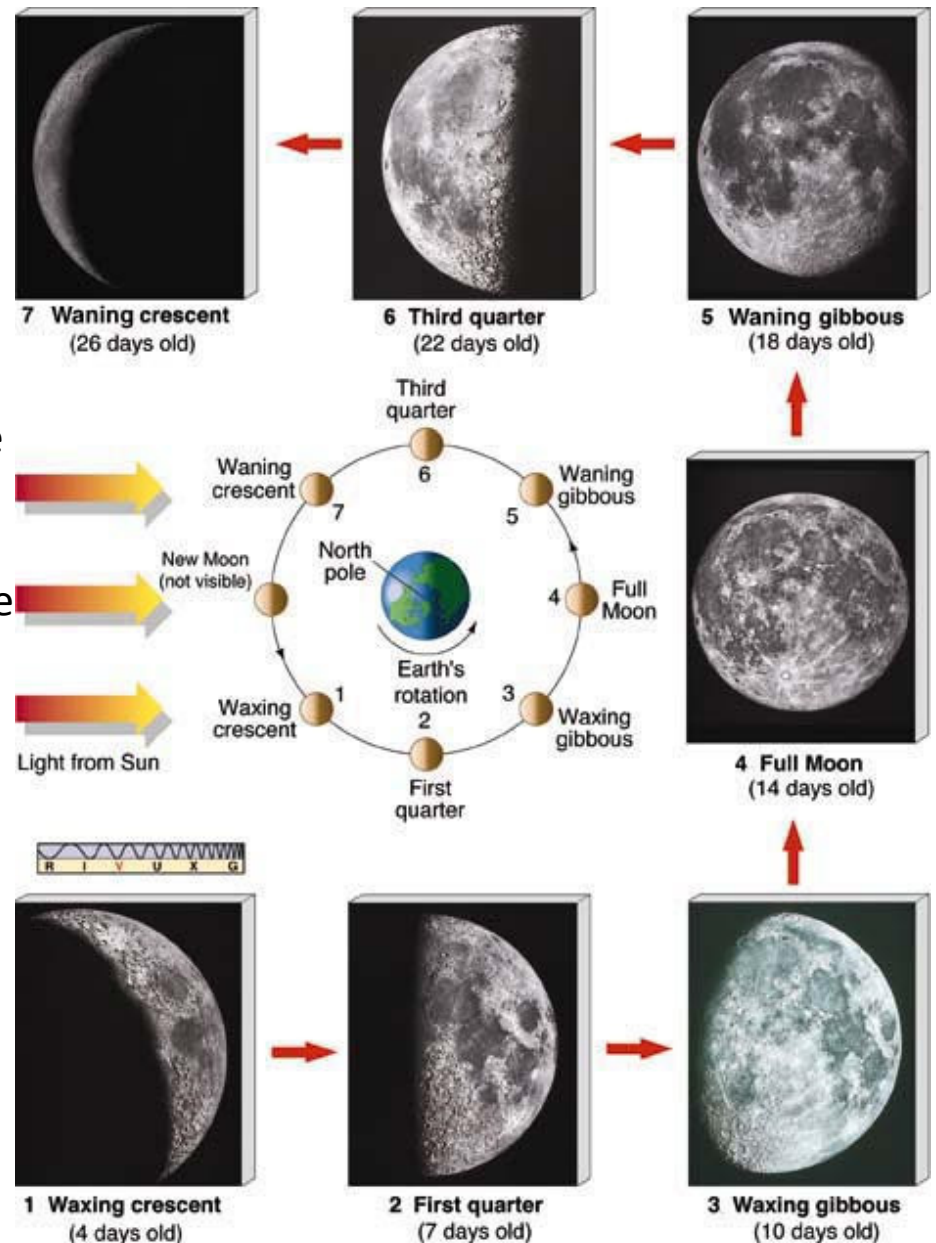
Motions of the Earth - Moon System

- The Earth has only one natural satellite, the Moon which orbits the Earth within a period of about one month.
- The Moon's orbit is elliptical of average distance of 384,401 kilometers. The point closest to the Earth is known as **perigee** and the point farthest from Earth is known as **apogee**.

Phases of the Moon

- On a monthly basis we observe the phases of the Moon as a change in the amount of the Moon that appears lit. The light that comes from the Moon is reflective light – it reflects Sun light – the Moon does not produce light.
- A thin sliver of the Moon is called **crescent**.
- Half of the Moon is lighted is a **quarter**.
- Moon increasing in lighted portion is **waxing**.
- A steadily decline of lighted portion is **waning**.
- **New-moon** phase is when the Moon disappears.

Just draw the Moon phases 1 through 7.

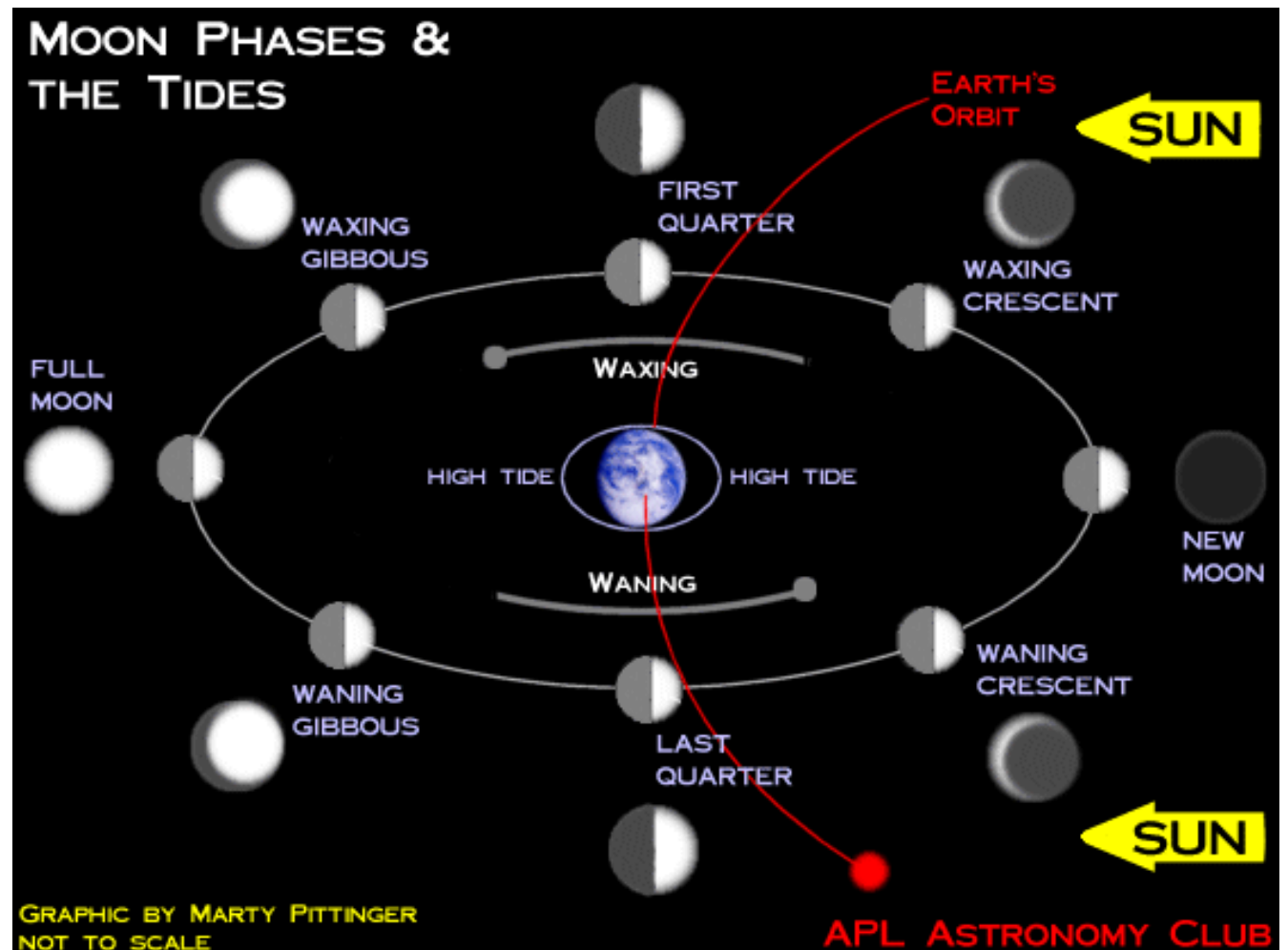


- The Moon is always illuminated (half of it) at all times but to an observer on Earth only see the visible part depending on the location of the Moon with respect to the Sun and Earth.
- When the Moon lies between the Sun and Earth, none of the lighted portion can be seen on the Earth.
- The cycle of the Moon through its phases requires 29 ½ days – the time span is

called the **synodic** month. This cycle was based for the first Roman calendar.

- However, this is not a true period, which takes only 27 1/3 days and is known as the sidereal month.

- Because of the Moon's period of rotation about its axis and its revolution around the Earth are the same, we only see one side of the Moon.



Eclipses

- An **eclipse** is an astronomical event that occurs when one celestial object moves into the shadow of another.
- When the Moon moves in a line directly between the Earth and Sun, it casts a dark shadow, this is called a **solar eclipse**.
- When the Moon moves within the shadow of the Earth, it is called a **lunar eclipse**.
- For a total solar eclipse to occur, the Moon must pass directly between the Earth and Sun, the Umbra creates a dark path across face of the Earth.
- For a full lunar eclipse, the Moon must completely pass into and through the Earth's Umbra causing a reddish color to come on to the face of the Moon.

