

The Earth & its good friend, the Moon

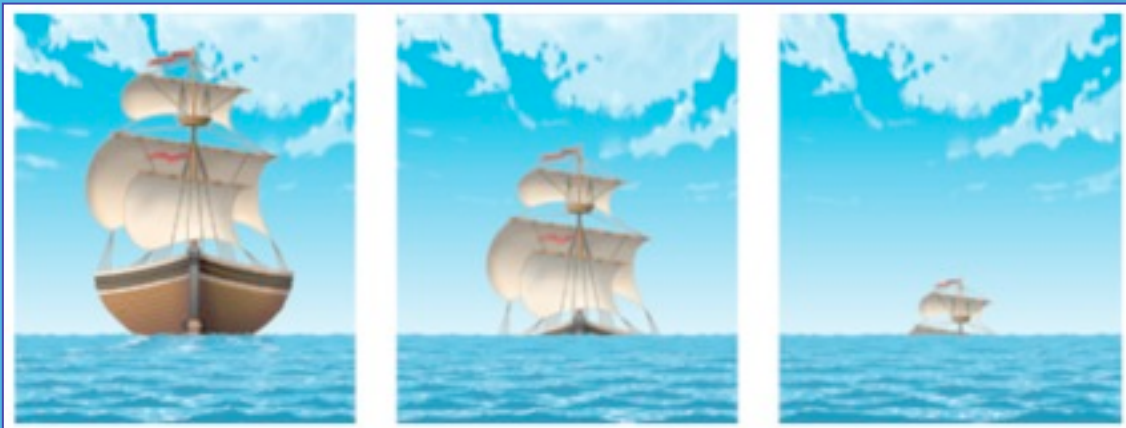
SNCID7 - Space

Key Questions!

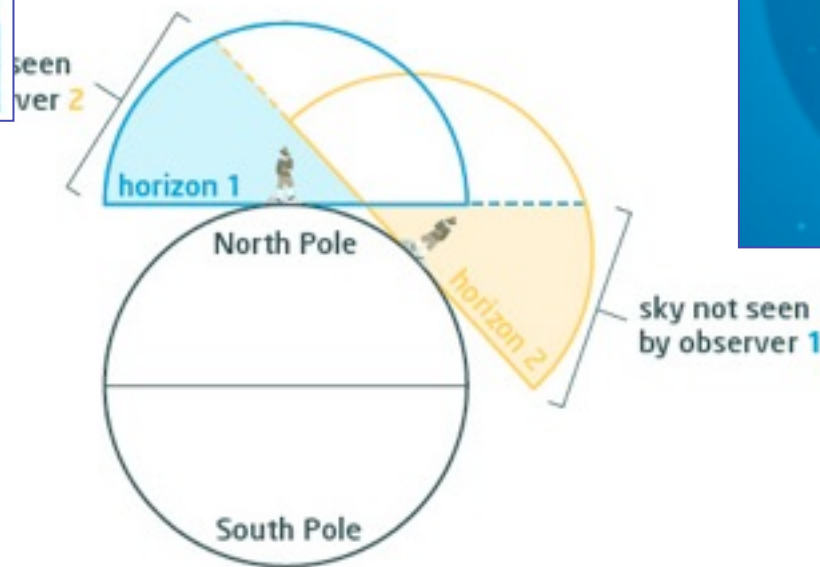
- What causes...
 - day and night?
 - the seasons?
 - the tides?
- What are eclipses?
- Let's eat some space oreos!

How do we know the Earth is round?

Most early peoples thought that Earth was flat. Two ancient Greek philosophers, **Eratosthenes** and **Aristarchus** (310-230 BCE) hypothesized that Earth was spherical. They based their hypothesis on three pieces of evidence.



1. The hull and then the masts of ships appeared to descend below the horizon as ships sailed away.



2. The appearance of the sky changed as travellers journeyed farther north or south.



3. During a lunar eclipse, the shadow of Earth on the moon was curved.

Astronomers, Years and Days

Astronomers are scientists who study astronomy, which is the study of the night sky. The first astronomers were the Mesopotamians, who kept detailed records of the sky as early as 6000 years ago.

Our year (365 days) is determined by counting the number of days it takes the Sun to return to exactly the same place in the sky with respect to background stars. This is the time it takes for Earth to make one **revolution** around the Sun.

Revolution is the time it takes an object to orbit another object.

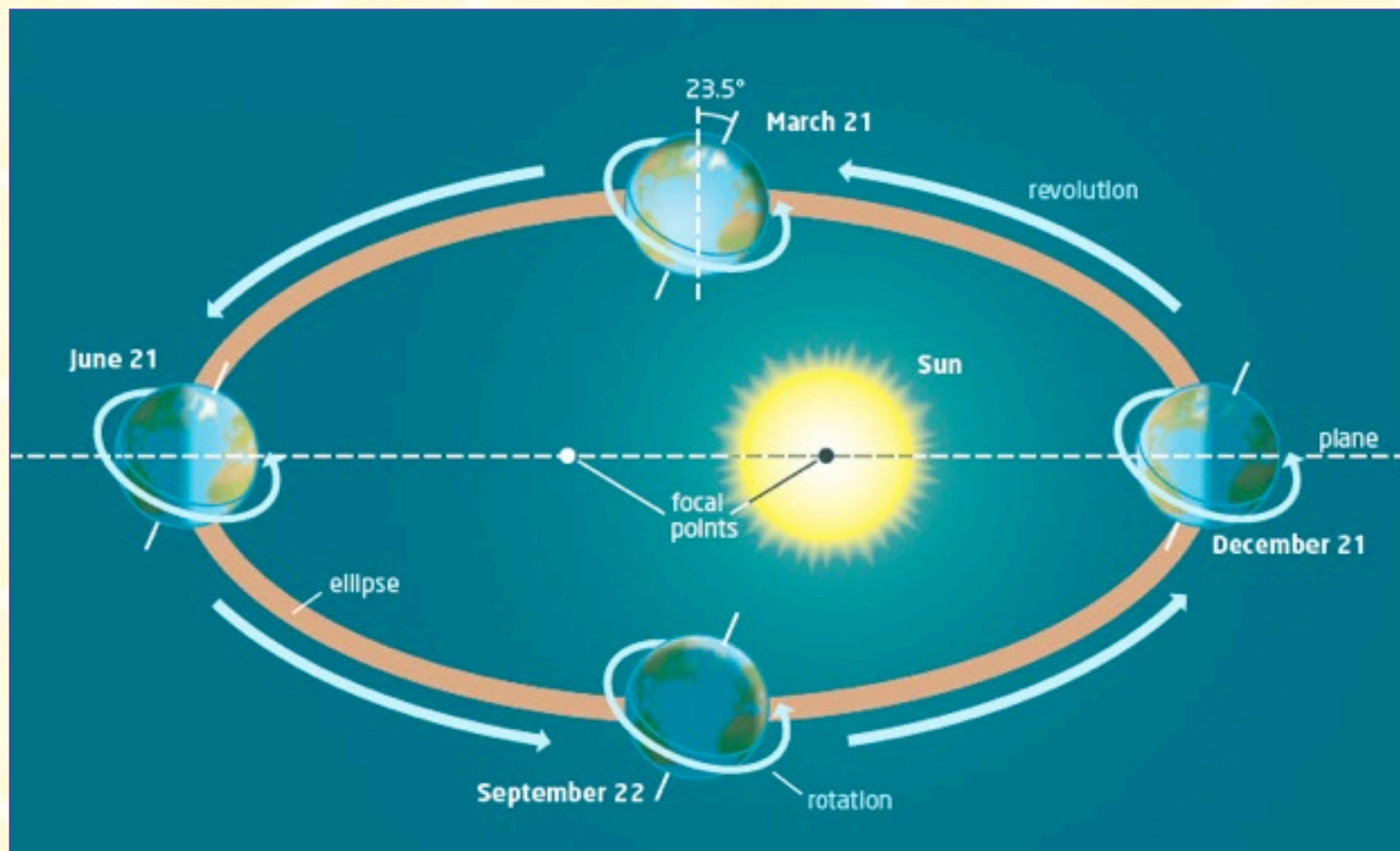
One **day** (24 hours) is the time it takes for Earth to make one **rotation**.



A **rotation** is the turning of an object around an imaginary axis running through it.

Movements of Earth and the Moon

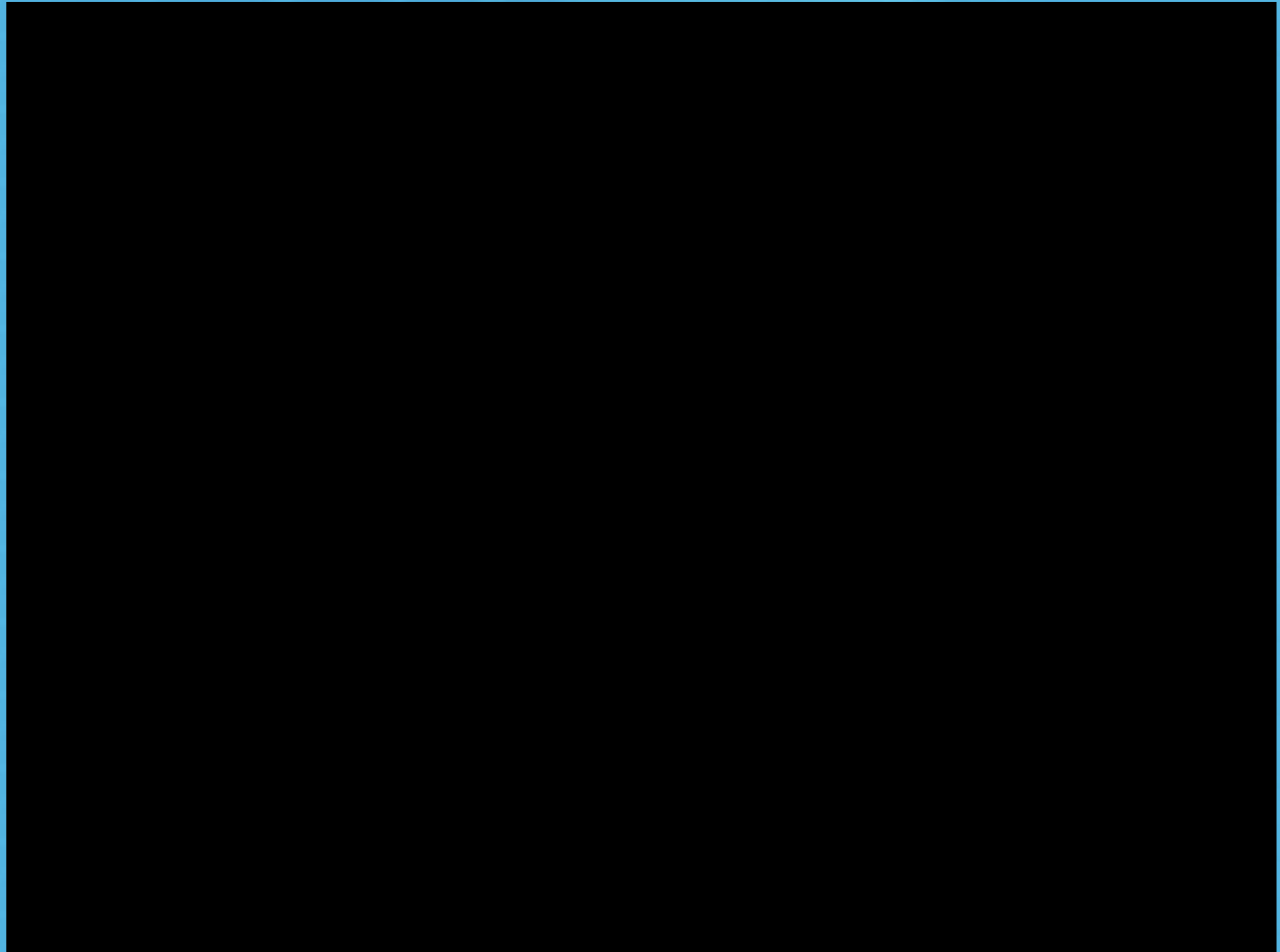
The study of the movement of Earth and Moon are important to understanding seasons, the cause of tides, the observed phases of the Moon, and eclipses.



Earth's orbit around the Sun is not a perfect circle. It is an **ellipse** (an oval or egg-like shape).

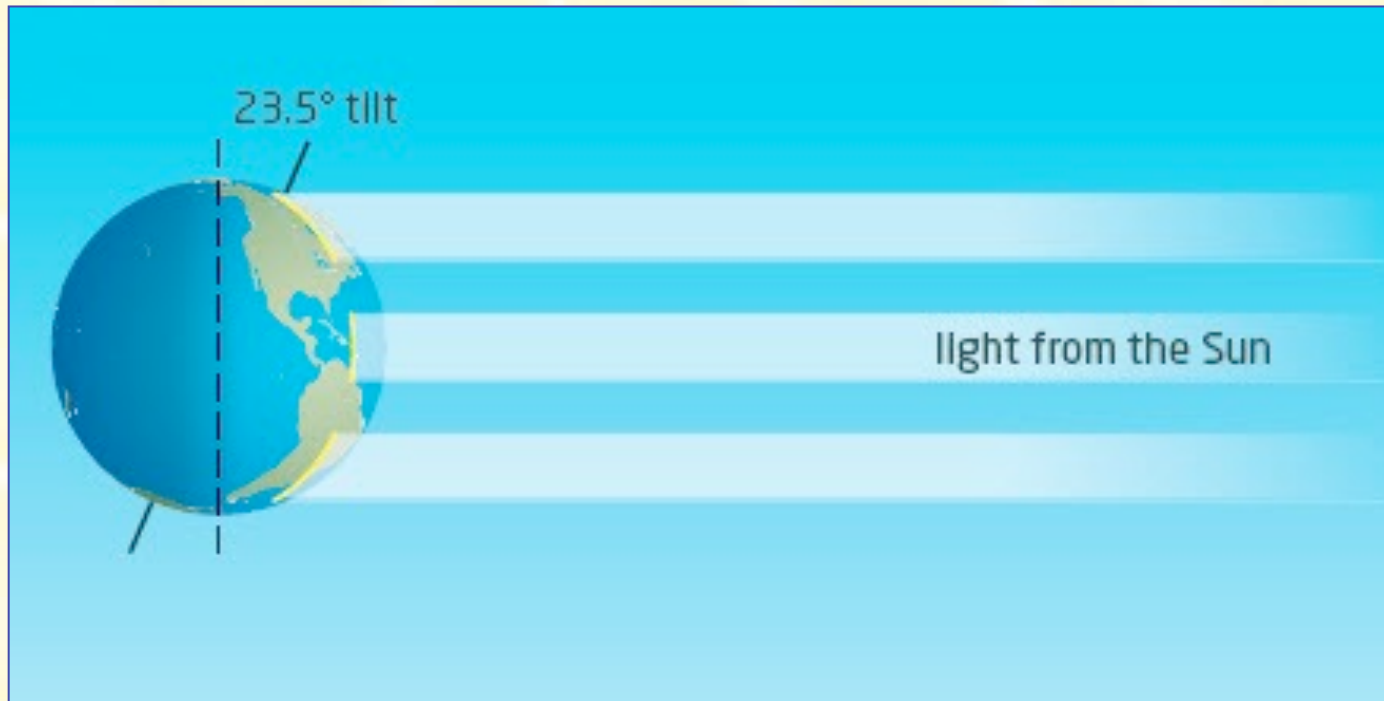
The Sun is found at one of the ellipse's two focal points.

Reviewing Rotation and Revolution



Why Do We Experience Seasons?

Earth rotates with its axis tilted 23.5° from its flat orbital plane.



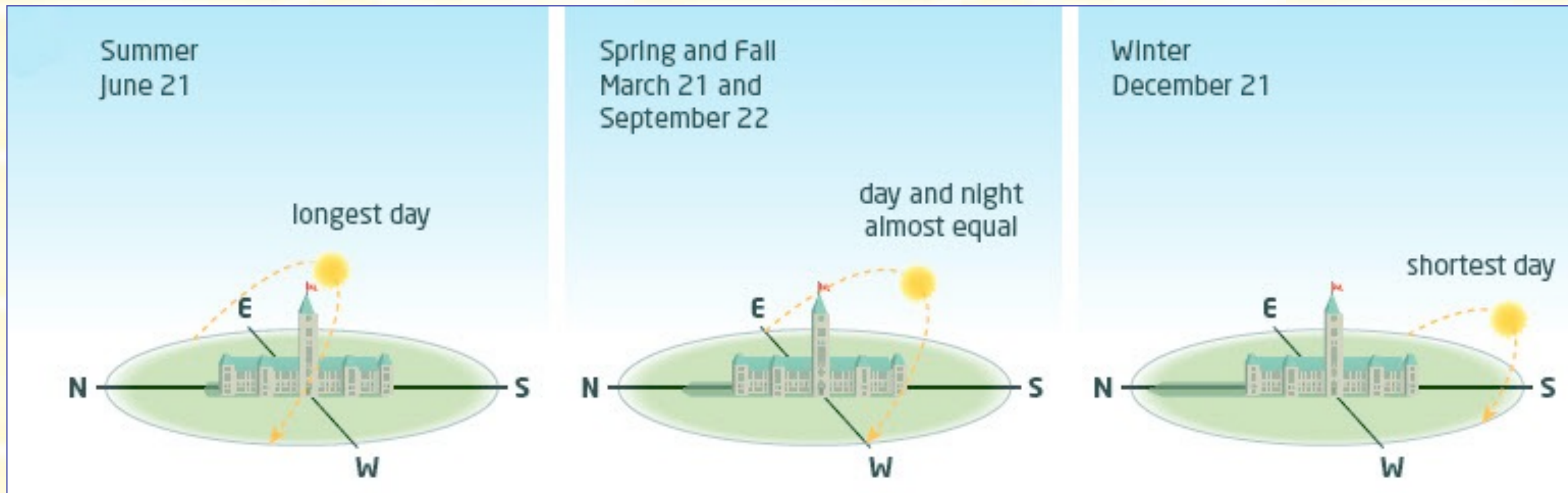
In the summer, the northern hemisphere is tilted towards the Sun, while in winter it is tilted away. It is this difference in tilt that causes the seasons.

As a result of these tilts, Earth receives sunlight at a larger angle for longer periods of time during the summer, and at a smaller angle for shorter periods of time in the winter.



Why Do We Experience Seasons?

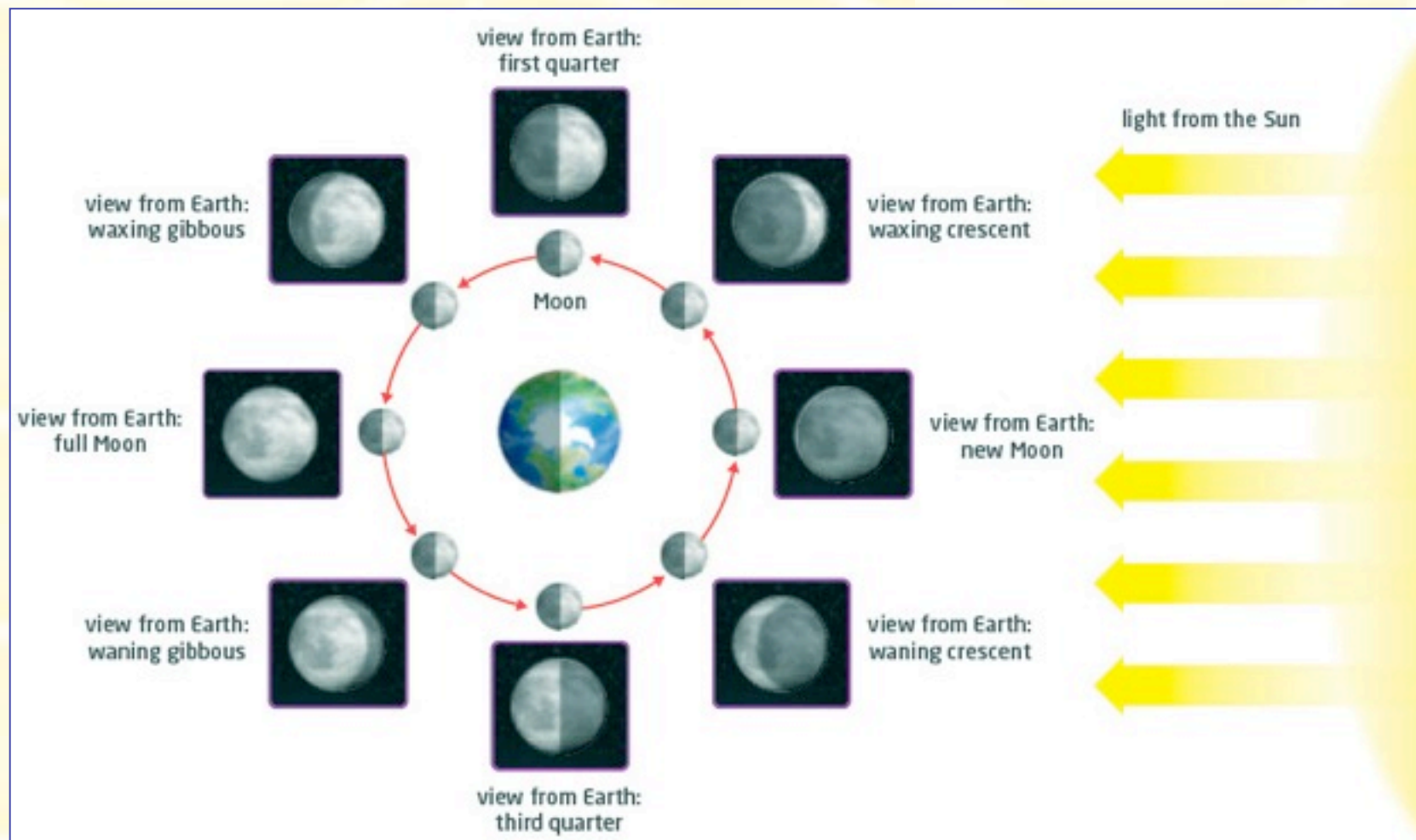
The approximate height of the Sun in the sky around the start of each season is shown in the diagram below.



The length of the day and how high the Sun rises in the sky is directly related to the tilt of Earth.

The Moon's Motion

The Moon makes a complete orbit around Earth in about 29.5 days. As the Moon completes one orbit, it rotates only once on its axis. As a result, you always see the same side of the Moon.



The **phases of the Moon**, which are the monthly progression of changes in the Moon's appearance, results from different portions of the Moon's sunlit side being visible from Earth.

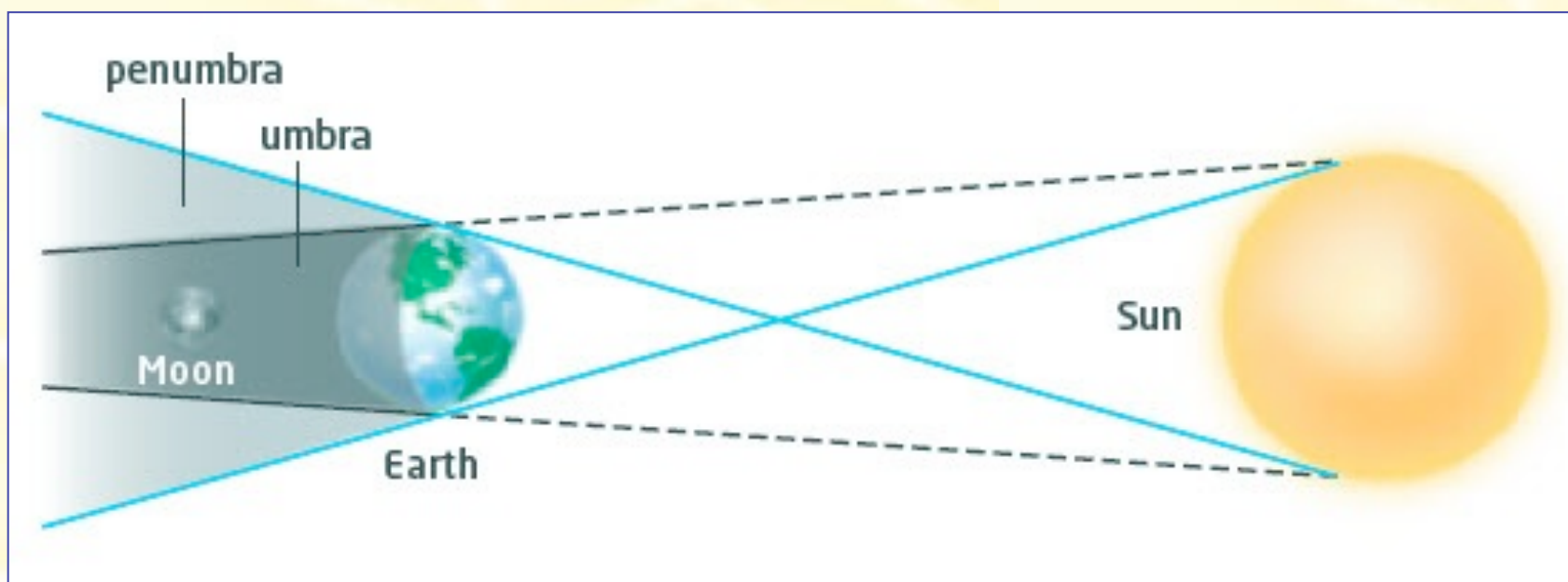
The “dark side of the moon” was not observed by humans until 1959, when a Russian spacecraft passed behind the Moon and took photos.

Phases of The Moon

http://aspire.cosmic-ray.org/labs/moon/lunar_phase3.swf

Lunar Eclipses

An **eclipse** is a phenomenon in which one celestial object moves directly in front of another celestial object.

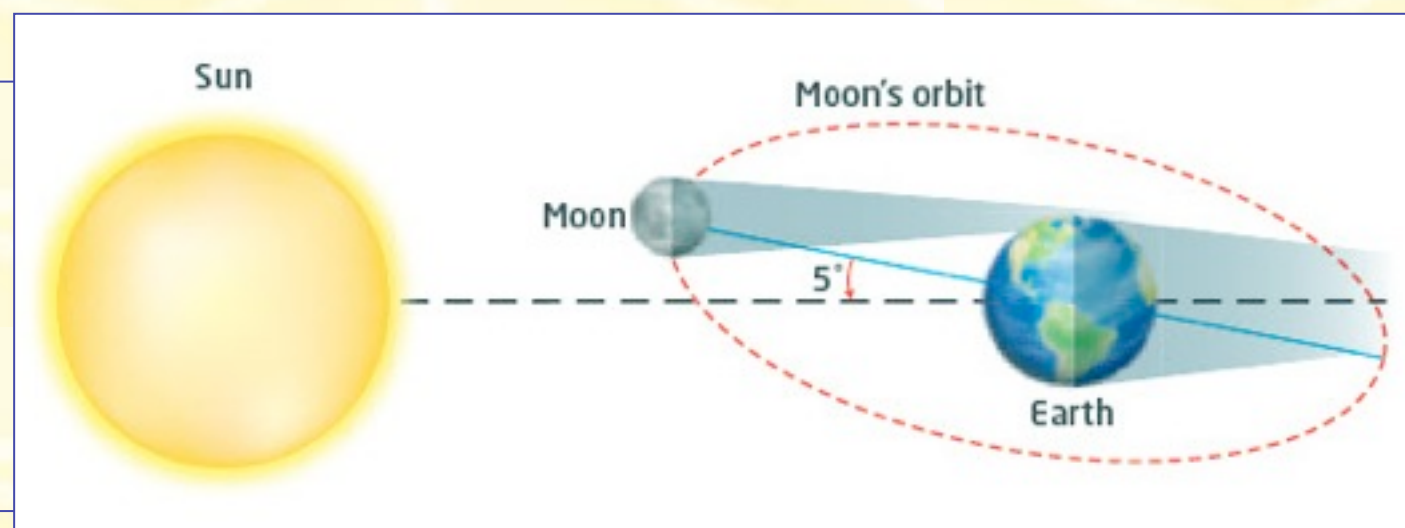


In a total **lunar eclipse**, the full Moon passes in Earth's shadow.

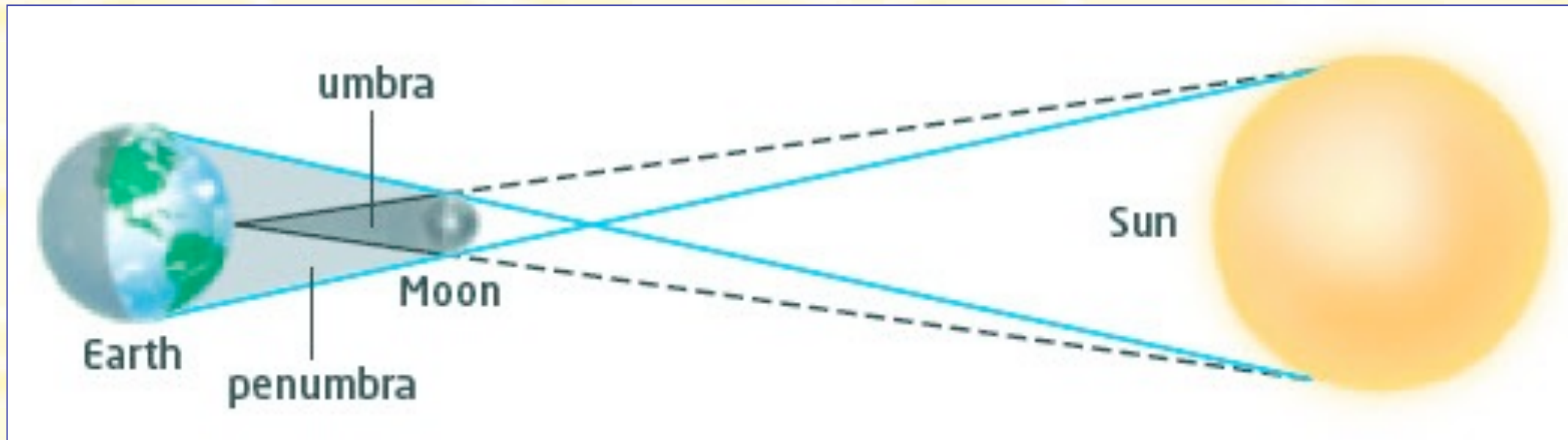


If the Moon passes through only the penumbra or part of the umbra, a **partial eclipse results**.

On average, lunar eclipses only occur about twice a year because the Moon's orbit is tilted about 5° to Earth's orbit.



In a **solar eclipse**, the shadow of the Moon falls on Earth.

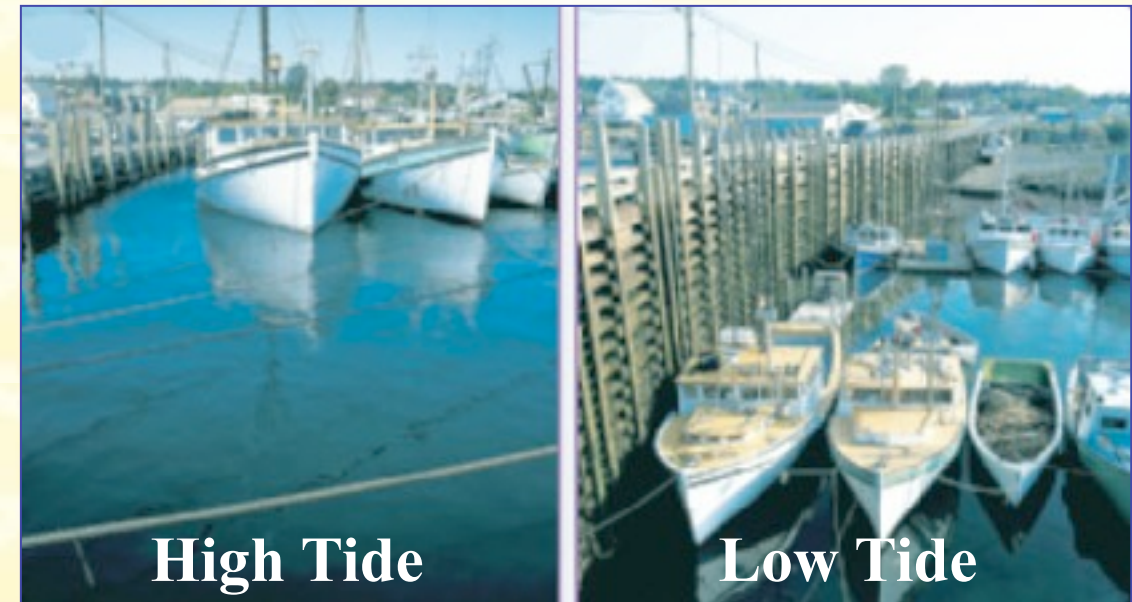
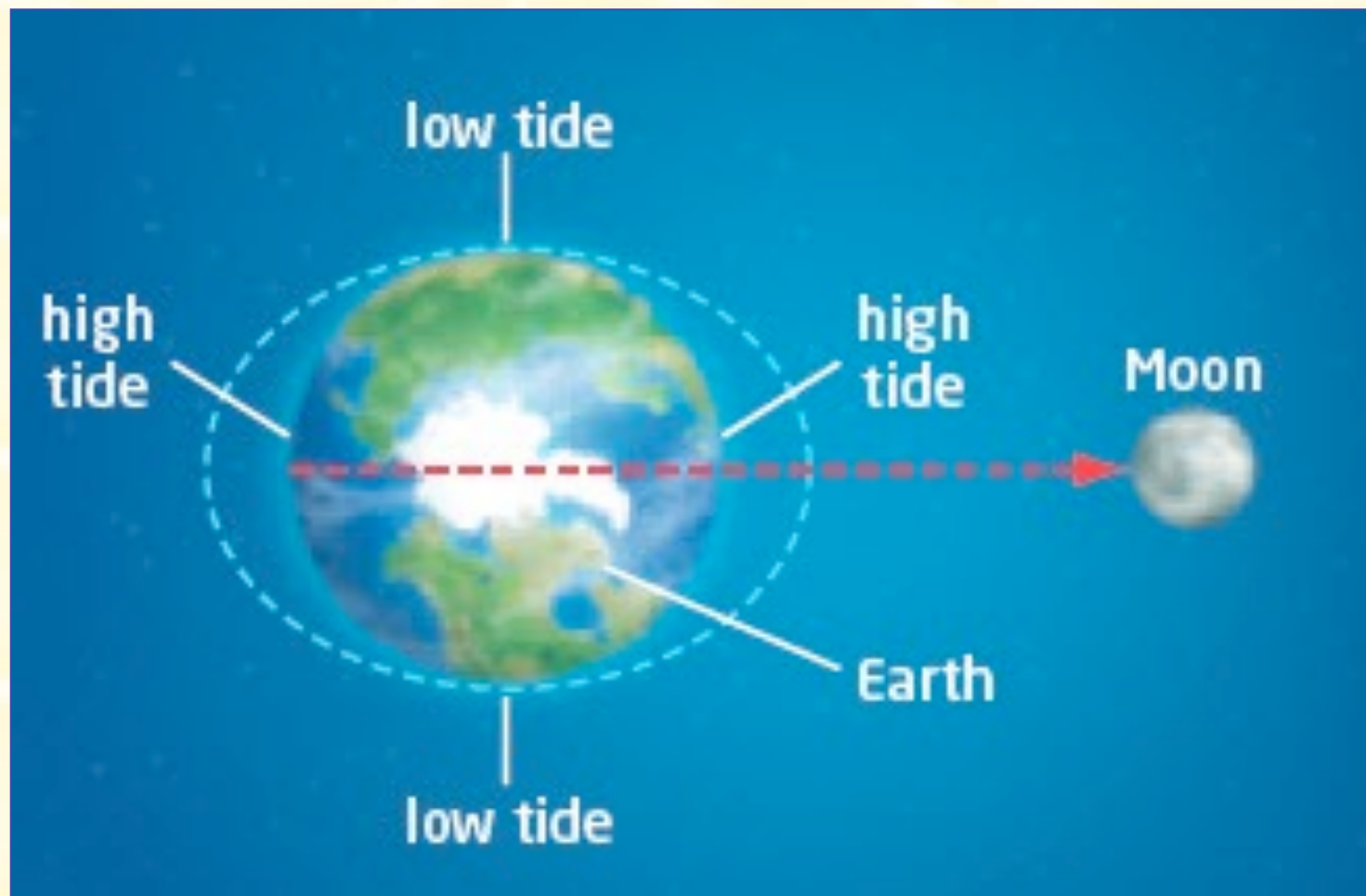


Solar eclipses also happen about twice a year, but only people living in a very small area can observe the phenomena.



Tides

The Moon's motion is responsible for the tides. The **gravitational force** (a force of attraction between all masses in the universe) exerted by the Moon and Earth pulling on each other causes tides.



The highest tides are on the side of Earth that faces the Moon.

The difference between the force of gravity on the side of Earth nearest the Moon and the force of gravity on the side of Earth farthest from the Moon results in a stretching effect called the **tidal force**.

Your homework!

Learning Check

1. Why do the stars appear to rise in the east and set in the west?
2. What is an ellipse, and what significance does it have regarding Earth's orbit?
3. Why are latitudes just above and below the equator always hot?
4. Why do you think it is important to understand Earth's motion through space?
5. Define the terms *umbra* and *penumbra*. Explain how they relate to solar eclipses or lunar eclipses.
6. Why does a lunar eclipse only happen when the Moon is full?
7. In your notebook, make a simple diagram that shows how a total solar eclipse happens.
8. Why do you always see the same side of the Moon?