ASTRONOMY

By the time this unit is over, you will be able to:

- Develop and use a model of the Earth-sun-moon system to describe the patterns of lunar phases, eclipses of the sun and moon, and seasons.
- Identify several visible features on the moon.

Key vocabulary terms in this unit:

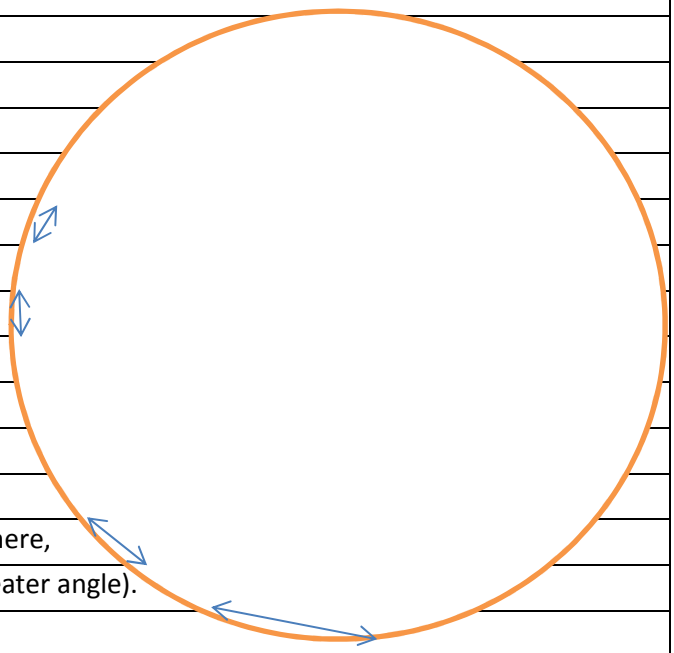
VOCAB	DEFINITION
Astronomy	the branch of science that deals with celestial objects, space, and the physical universe as a whole
Axis	the imaginary line that passes through Earth's center & North and South Poles. The Earth spins around this line.
Rotation	the spinning of the Earth around its axis, causing night and day.
Revolution	the movement of one object around another (for example, the motion of the Earth & the other planets in their path around the Sun)
Orbit	the path an object takes as it revolves (for example, the path the Earth takes as it revolves around the Sun)
Solstice	one of the two times in the year when the Sun reaches its highest or lowest point in the sky at noon, marked by the longest and shortest days.
Equinox	one of the two times in the year when the Sun is directly overhead at the equator, causing day and night to be about 12 hours long everywhere on Earth.
Day	the period of time when your part of the Earth is facing the Sun.
Night	the period of time when your part of the Earth is facing away from the Sun.
Force	a push or a pull.
Gravity	the force that attracts a body toward the center of the Earth, or toward any other physical body having mass (for example, towards the Sun)
Matter	anything made of atoms and molecules and takes up space.
Mass	the amount of matter in an object.
Weight	a downward force caused by gravity acting on an object.

Inertia	a resistance in changes to an object's motion.
Phases	the different shapes of the moon we see from Earth
Eclipse	when our view of one object in the sky is blocked by either another object or the Earth's shadow.
Solar Eclipse	as seen from Earth, it's when the moon blocks out the Sun.
Lunar Eclipse	as seen from Earth, it's when Earth blocks sunlight from reaching the moon.
Umbra	the fully shaded inner area of a shadow
Penumbra	the partially shaded outer area of a shadow
Tide	the rise and fall of the sea.
Spring Tide	a tide just after a new or full moon, when there is the greatest difference between high and low water
Neap Tide	a tide just after the first or third quarters of the moon when there is the least difference between high and low water
Crater	a large, bowl-shaped cavity in the ground or on the surface of a planet or the moon, typically one caused by an explosion or the impact of a meteorite or other celestial body.
Regolith	a layer of very fine debris covering the moon's surface.
Mare (singular) Maria (plural)	the dark areas on the moon.
Highlands	the bright, heavily cratered region on the moon.
Rays	streaks of fine debris thrown out during the formation of an impact crater.

Sun's Energy (Light & Heat) Hitting the Earth's Surface

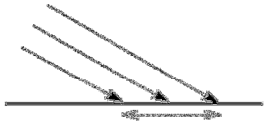
SUN

Because the Sun is so far away, its rays are parallel to each other. Each ray has equal amount of light & heat energy.



Near the middle of the sphere, the Sun's energy strike more directly (closer to perpendicular). The more concentrated energy means greater heating and more light.

As you move closer to the top and bottom of the sphere, the same Sun's energy is more spread out (hits at greater angle). This means less heating and less light over the area.

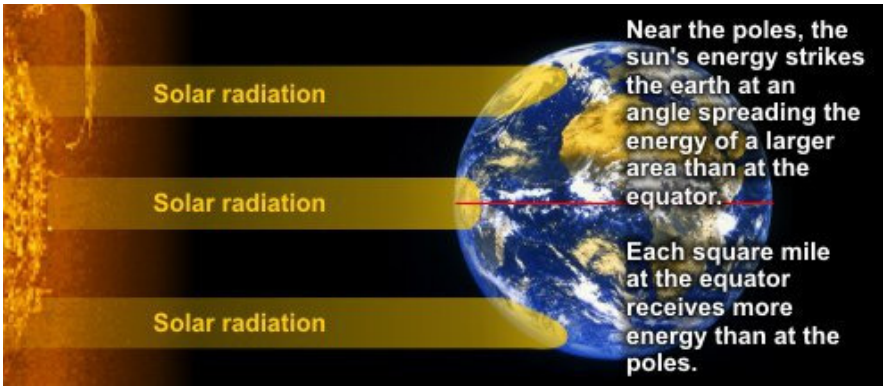


Same energy but more spread out, means less heating.

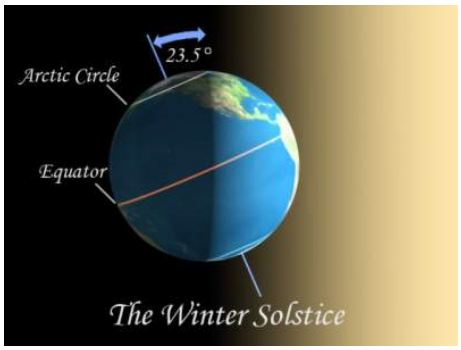
Same energy but more concentrated, means greater heating.

Because the Earth's axis is tilted, the hemispheres are not heated evenly – one hemisphere generally receives more of the Sun's energy than the other.

Uneven heating of hemispheres + revolving around the Sun → Seasons



Characteristics of Winter (in either hemisphere)

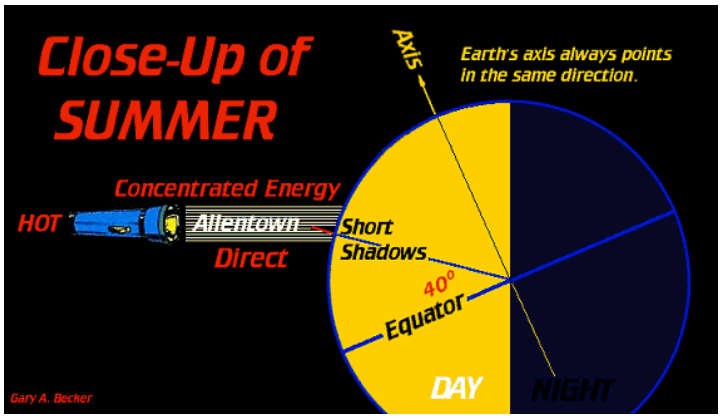


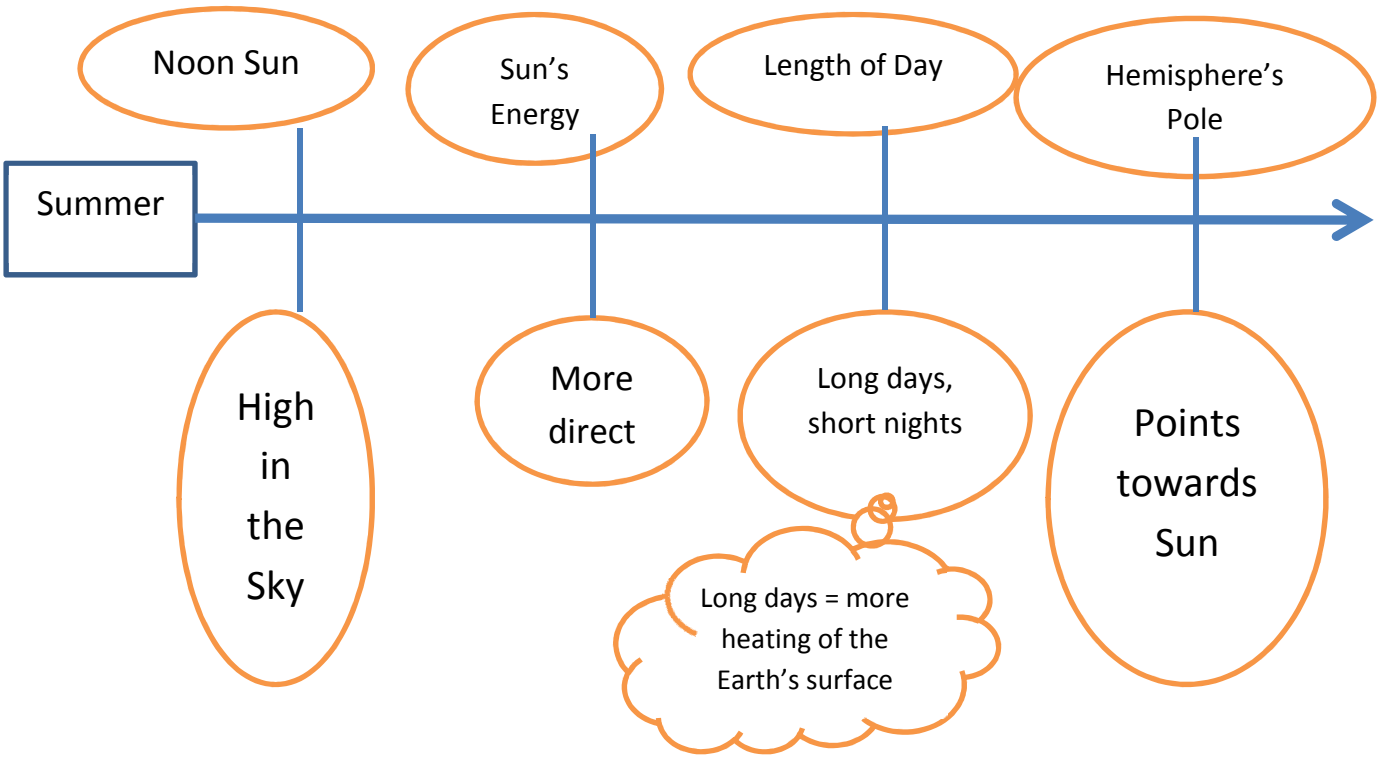
Winter

- Noon Sun
  - Low in the Sky
- Sun's Energy
  - Spread over larger area
- Length of Day
  - Short days; long nights
    - Short days = less heating of the Earth's surface
- Hemisphere's Pole
  - Points away from Sun

First Day = Winter Solstice

Characteristics of Summer (in either hemisphere)

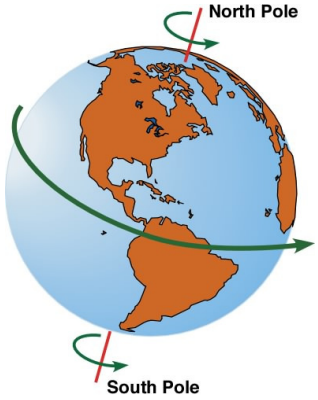




Earth's Motion

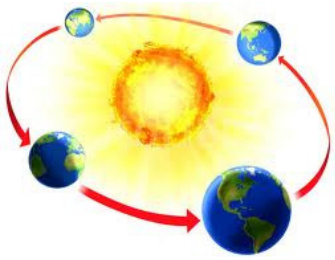
Earth ROTATES around its axis

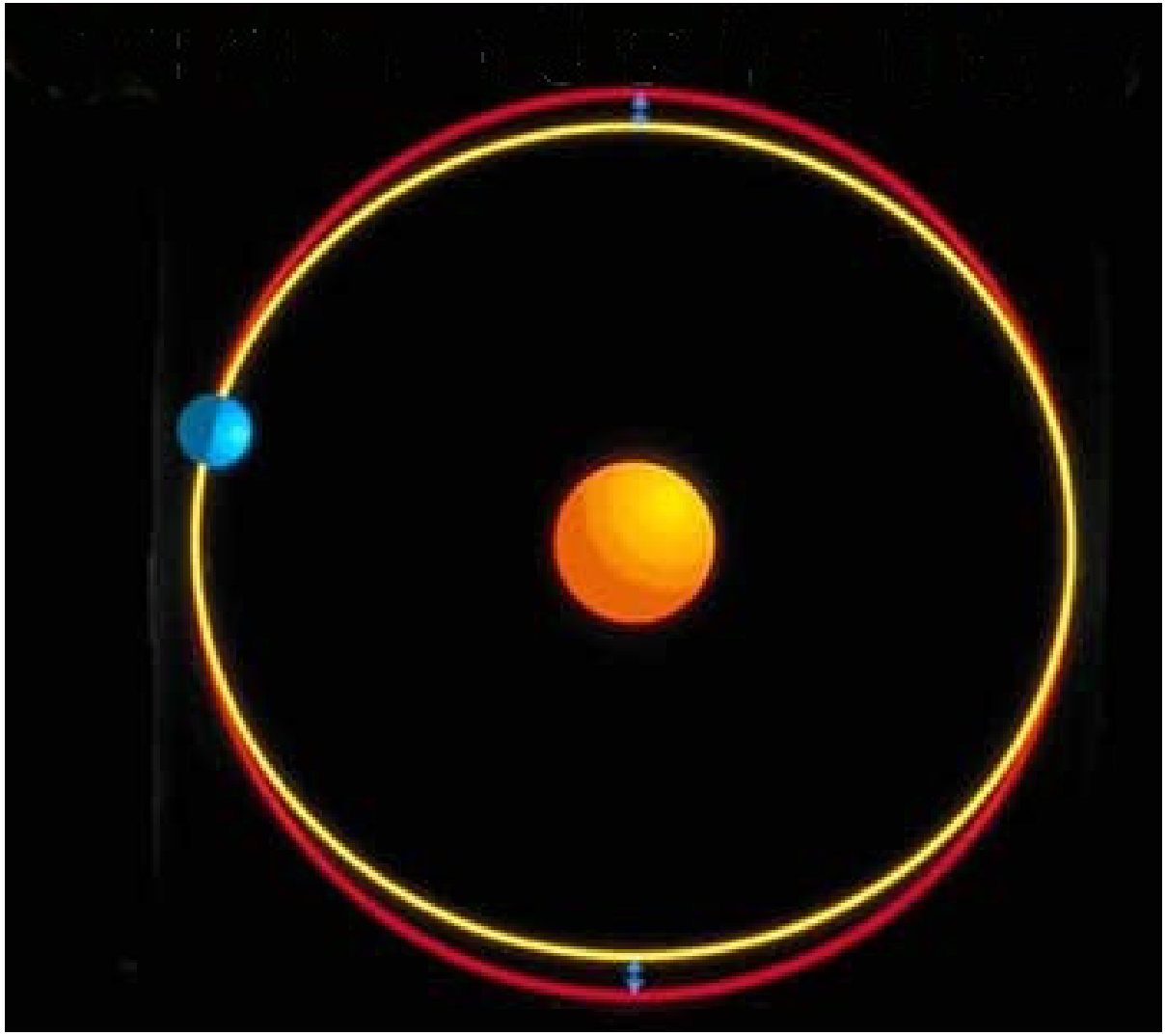
- This causes DAY and NIGHT
- 50% of Earth is always in day; 50% of Earth is always in night
- At Equator, you will rotate @ a speed of approx. 1,041 mi/hr
- In Franklin, MA, you will rotate @ a speed of approx. 774 mi/hr



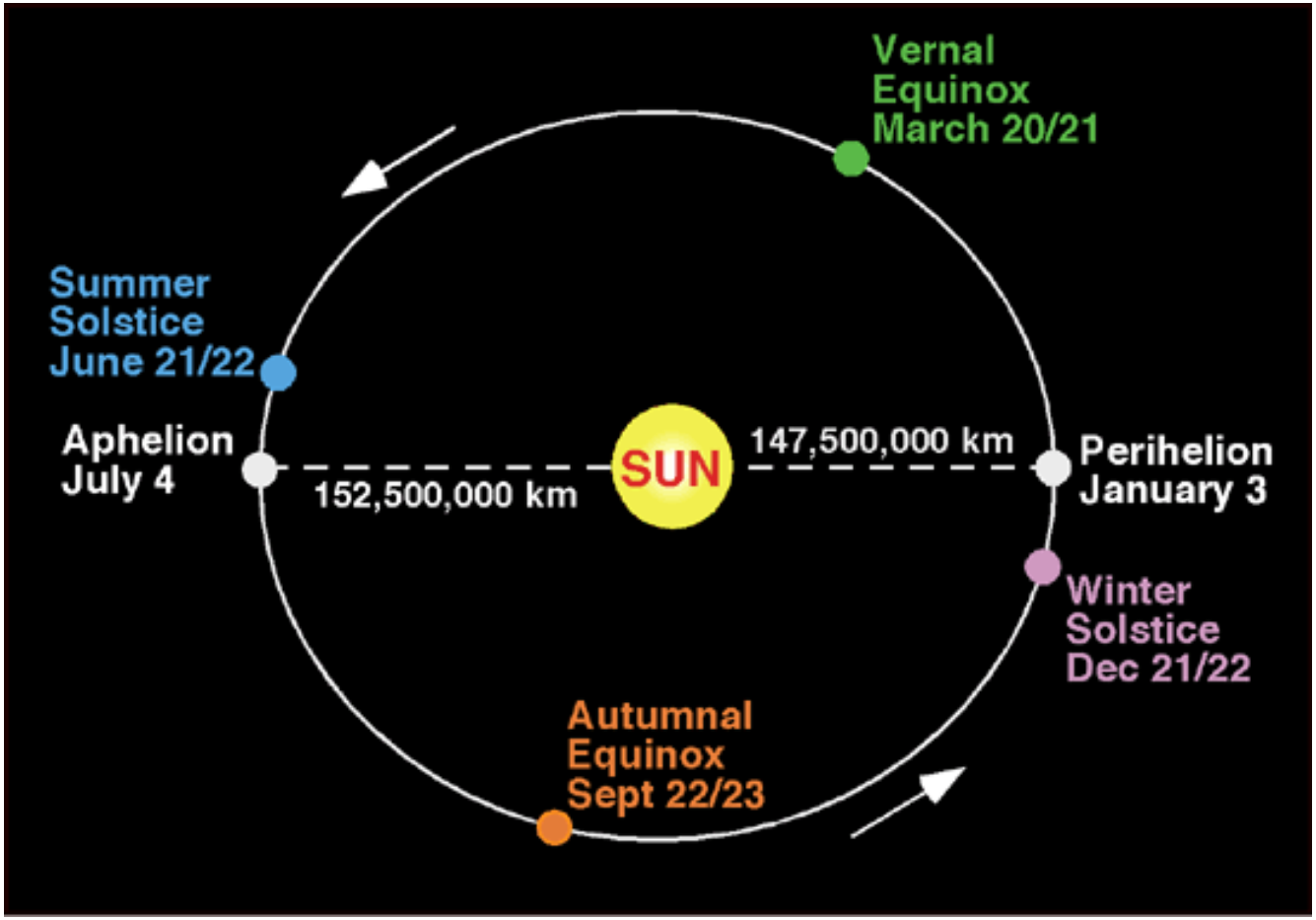
Earth REVOLVES around the Sun

- 1 revolution = 1 year
- Earth follows a path (orbit) around the Sun
- Orbit is an ellipse (ALMOST a perfect circle)
- Earth's orbit is about 584 million miles (about 940 million km) in length.
- Earth's orbital speed is about 66,500 mi/hr





A comparison of the Earth's orbit around the Sun (in the shape of an ellipse) and a perfect circle.

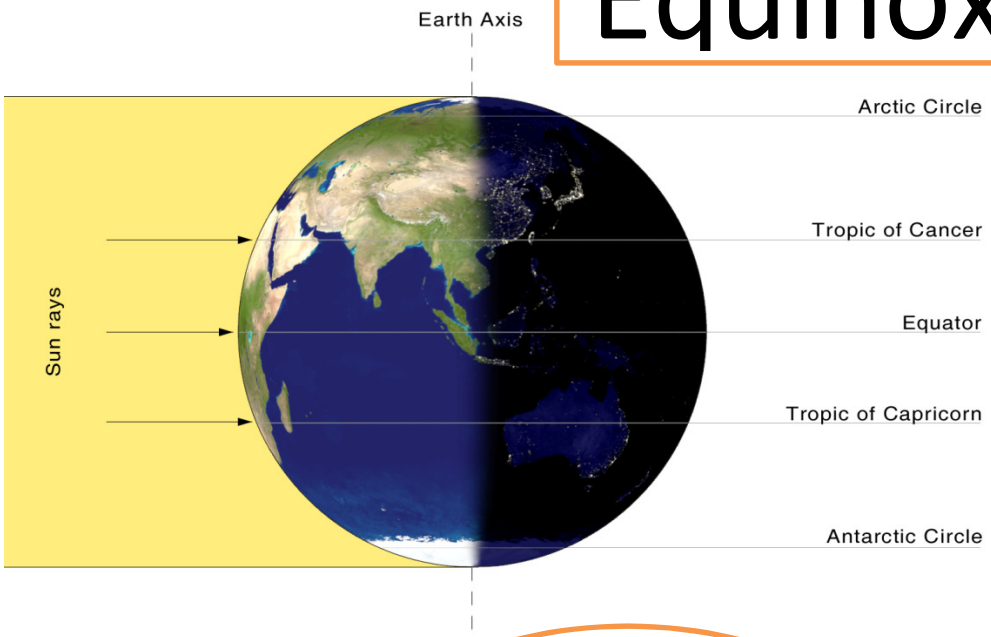

Vernal
Equinox
March 20/21
Summer
Solstice
June 21/22
Aphelion
July 4
152,500,000 km
SUN
147,500,000 km
Perihelion
January 3
Winter
Solstice
Dec 21/22
Autumnal
Equinox
Sept 22/23

Equinox

Latin word meaning "equal night"

Length of day & night is approx. 12 hours long everywhere

Occur halfway between the solstices; mark the beginnings of spring & fall



Vernal (Spring) Equinox = 1st day of spring

N. Hemisphere ≈ March 21
S. Hemisphere ≈ September 22

Neither hemisphere is tilted towards the sun; both hemispheres receive <u>equal</u> amount of energy

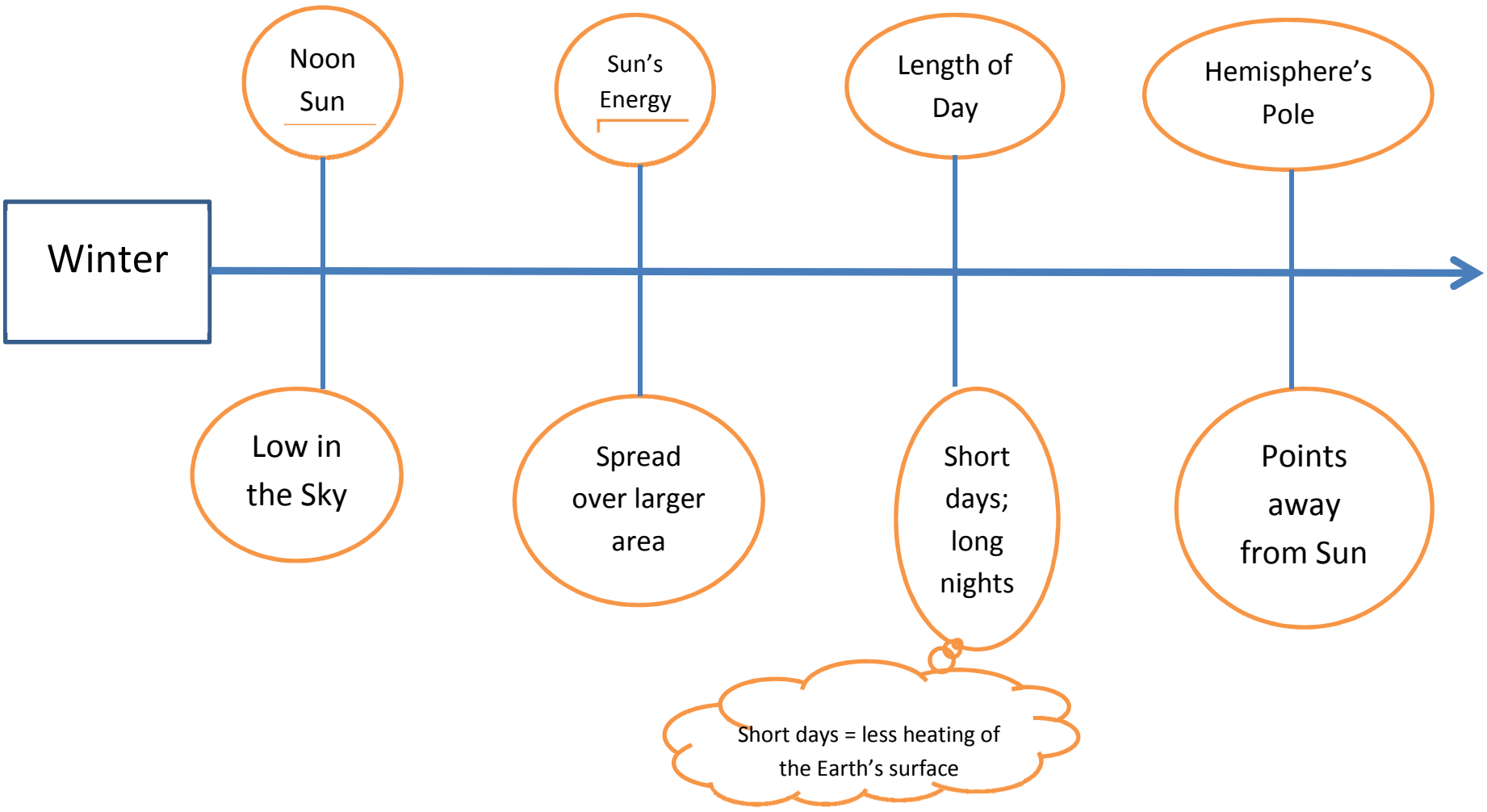
Noon sun is directly overhead at the equator

Occurs two times a year, around March 21 & September 22

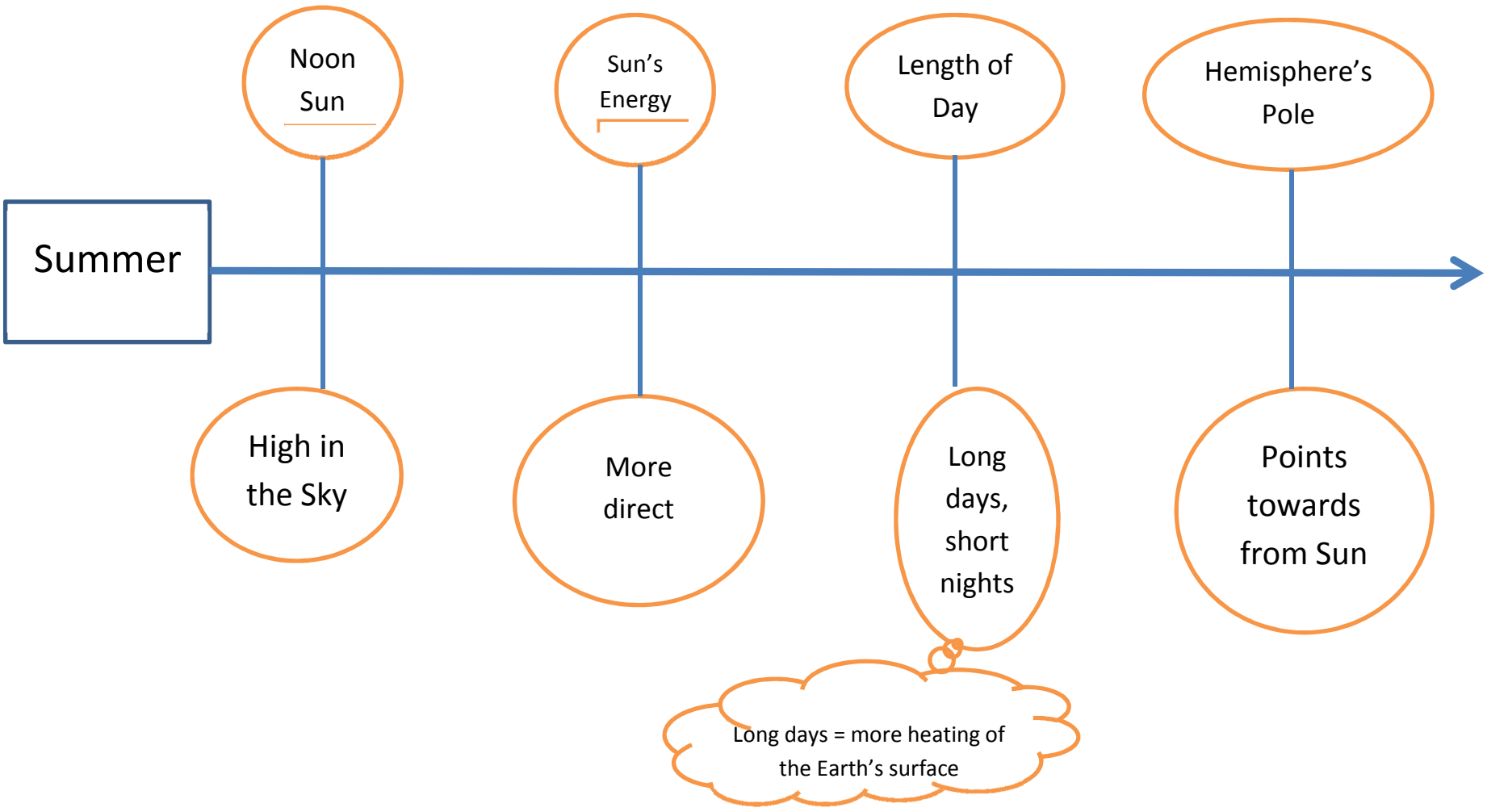
Autumnal (Fall) Equinox = 1st day of fall

N. Hemisphere ≈ September 22
S. Hemisphere ≈ March 21

What happens during…



What happens during…



Solstice

Noon – when the Sun stops rising and starts to set. **NOT 12:00pm**

Mark the beginning of winter and summer.

Occurs June 21/22 and December 21/22

One of the two times in the year when the sun reaches its highest or lowest point in the sky at noon.

Summer Solstice = longest day & shortest night of the year

At equator, about 12hrs of day & night. The amount of daylight increases as you move away from the equator.

At equator, about 12hrs of day & night. The amount of night increases as you move away from equator.

Winter Solstice = longest night & shortest day of

Sun is directly overhead at one of the tropics at noon

<u>Tropic of Cancer</u>

23.5°N

The highest north of the Equator where the Sun will ever be directly overhead.

<u>Tropic of Capricorn</u>

23.5°S

The highest south of the Equator where the Sun will ever be directly overhead.

If sun is overhead @ Tropic of Cancer

- N.Hemisphere begins summer & S.Hemisphere begins winter

If sun is overhead @ Tropic of Capricorn

- N. Hemisphere begins winter & S. Hemisphere begins

The Seasons

Winter,
Spring,
Summer,
Fall

The start of each season is marked by a solstice OR equinox

Uneven heating of the surface is due to the tilt of the Earth's axis

Caused by the uneven heating of the Earth's surface as it revolves around the Sun

Due to the tilt, one hemisphere USUALLY receives more of the Sun's rays than the other. This has to do with which way the poles are pointing (towards Sun, away from Sun, neither towards nor away)