Astronomy

History of Astronomy

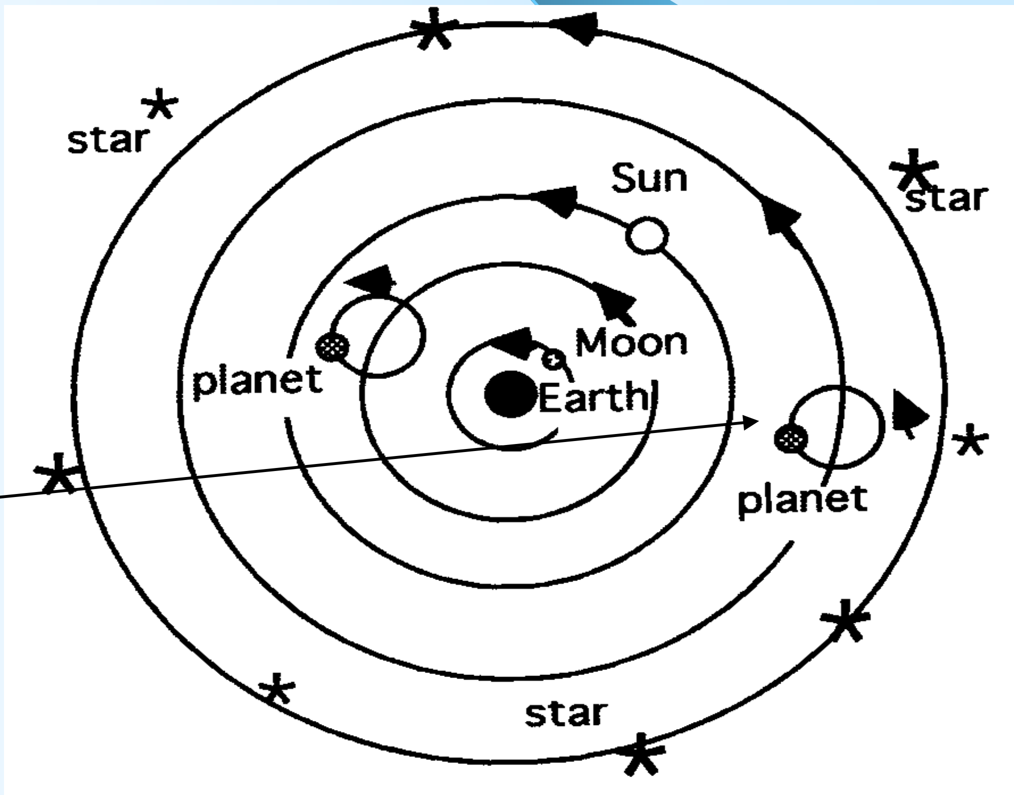
Geocentric Model of the Solar System

Geocentric: Theory that Earth was at the center of the solar system

Ptolemy: A Greek that created the geocentric theory

Dominated for more than 1000 years

Epicycles – small orbits within their own orbits.

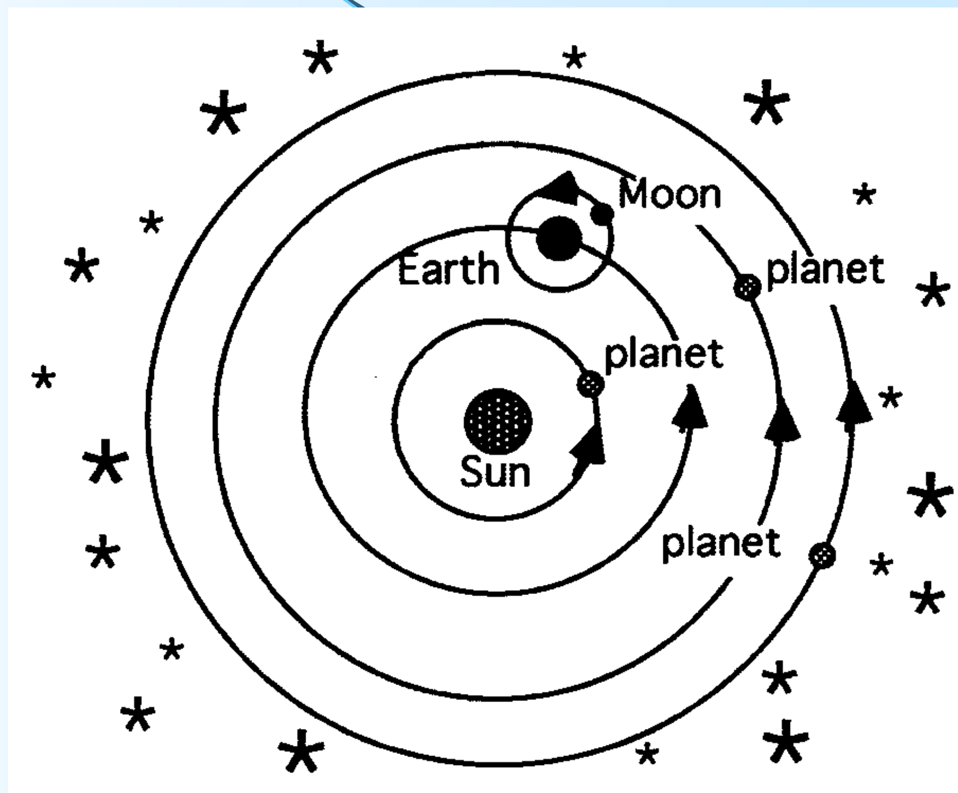


Heliocentric Model of the Solar System

Heliocentric: Theory that the sun is the center of the solar system

Copernicus: Created the heliocentric theory

- circular orbits
- Still used epicycles to explain retrograde motion



Why is the sun at the center of the solar system?

Densest object in the solar system

Tycho Brahe: Danish astronomer

Built the first observatory and created catalog of the stars

Galileo Galilei: First used the telescope to observe the sky

noticed that Jupiter had moons orbiting around it

- more evidence of the heliocentric theory
- named features on the moon (craters and mountains)
- first to observe sunspots (eventually blinded him)
- Observed that Venus has phases (like our Moon) which proves it orbits the Sun

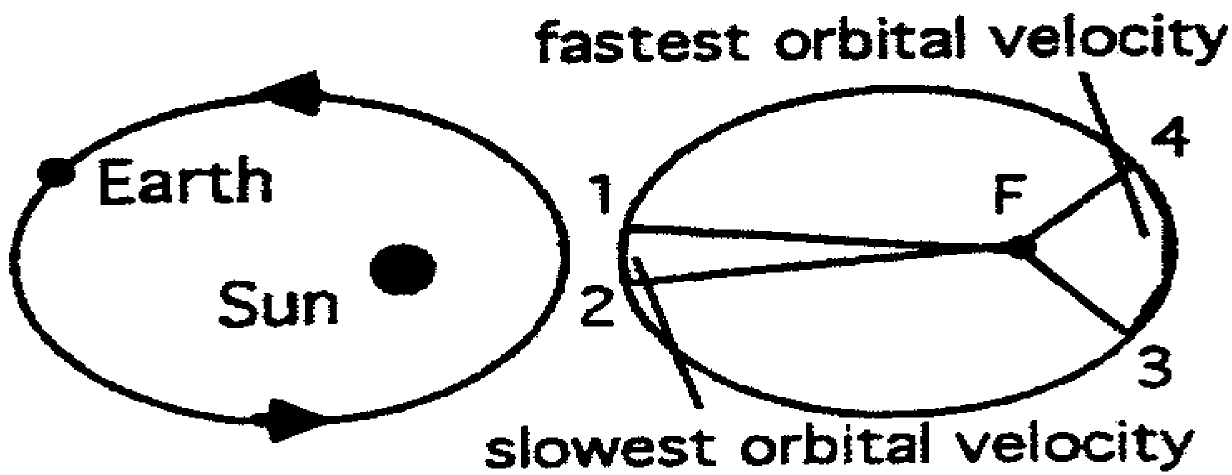
Kepler's Laws of Planetary Motion

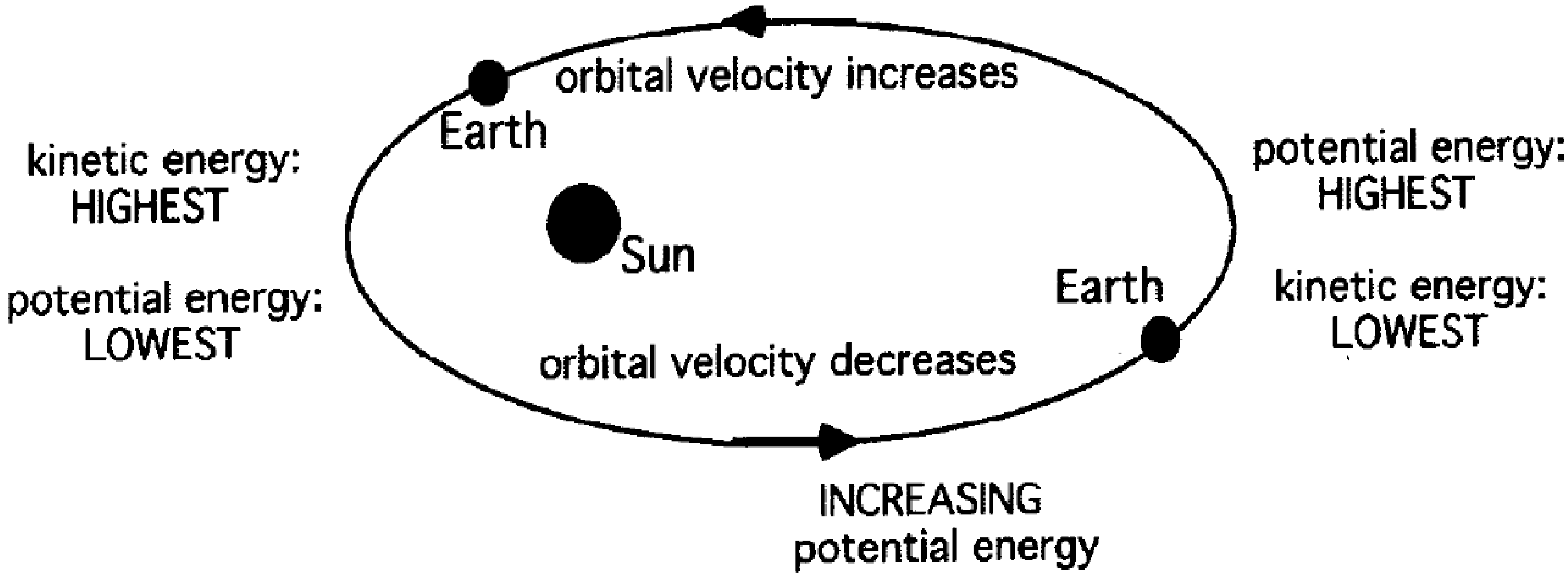
-Johannes Kepler, a German astronomer during the late 1500's to early 1600's, developed three laws of motion of objects in the sky to help better explain and predict their motions. Before Kepler, most astronomers agreed that planetary orbits were circular.

First Law: Planets move in an elliptical orbit

Second Law: A planet will cover equal areas in its orbit in an equal amount of time

Notice the sun is NOT directly at the center of the orbit





Third Law: The period of revolution around the sun is related to its distance from the sun. The farther a planet is from the sun, the longer it takes to go around the sun.

Earth's Orbit

1. **perihelion:** Point in a planet's orbit when it is Closest to the Sun
2. **aphelion:** Point in a planet's orbit when it is Farthest from the Sun

Isaac Newton: Created the Laws of Gravity after seeing an apple fall to the ground

Gravity: a force of attraction that exists between any two masses, bodies, or particles.

It is the attraction that exists between all objects.

Newton's Law of Gravity:

Objects of greater mass have a stronger pull of gravity

As distance increases, the force of gravity decreases.

The speed of a planet increases at perihelion due to an increase in the pull of gravity

What are the two main motions of Earth?

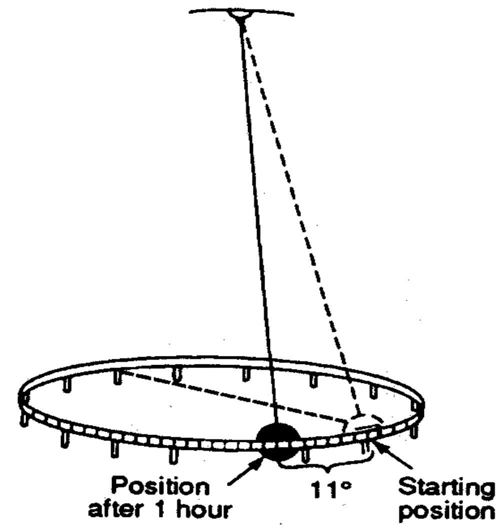
Rotation

Revolution

Evidence of Rotation:

(1) **Foucault's Pendulum**:

Every hour the pendulum shifts in a clockwise direction knocking over pins. The shifting is caused by the Earth's rotation.



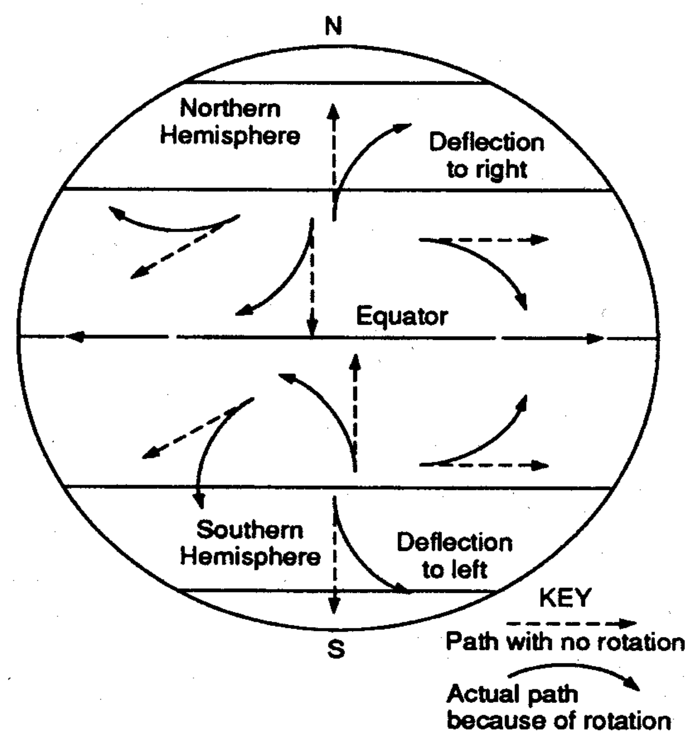
At the North Pole, apparent rotation would be a full circle of 360 degrees each 24 hours (15 degrees per hour).

The further South you go, the slower the rotation. At the equator, there is no rotation at all.

Below the equator, the rotation begins again but in a counterclockwise direction.

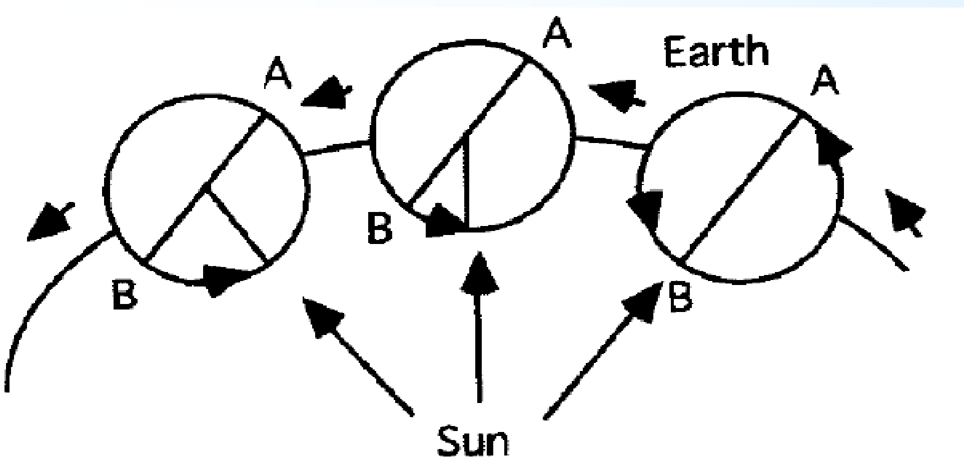
(2) **Coriolis Effect**:

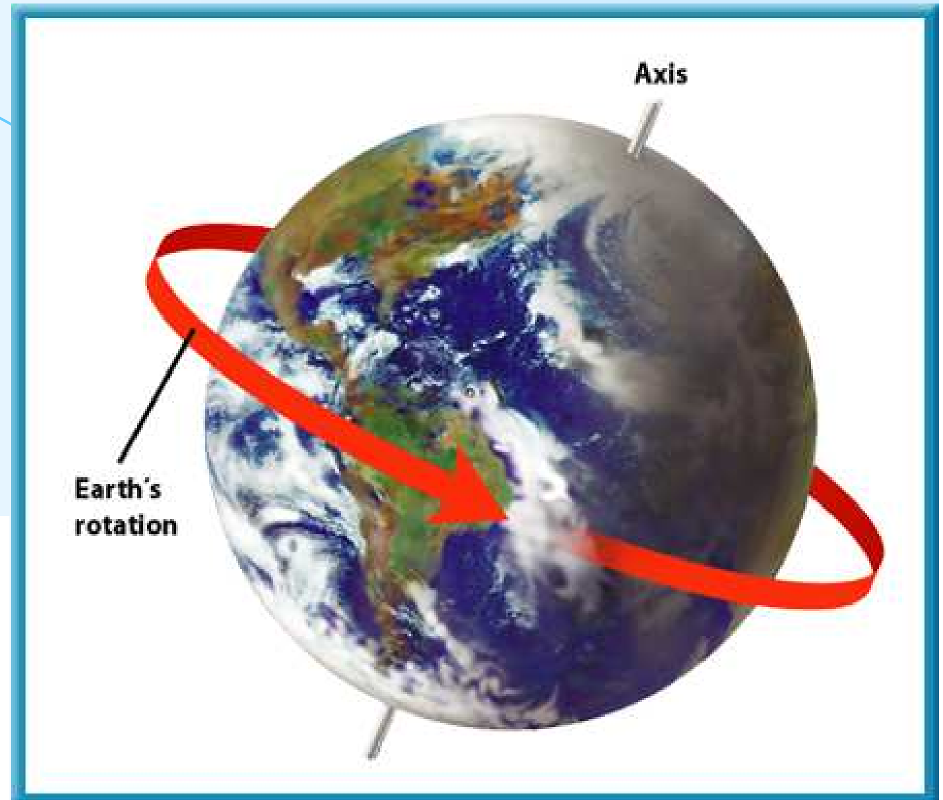
Earth's rotation causes winds and any other freely moving objects to curve in their path.



Terrestrial Observations

a.Rotation: ________________
__The spinning of a body on__
__its axis.__________________

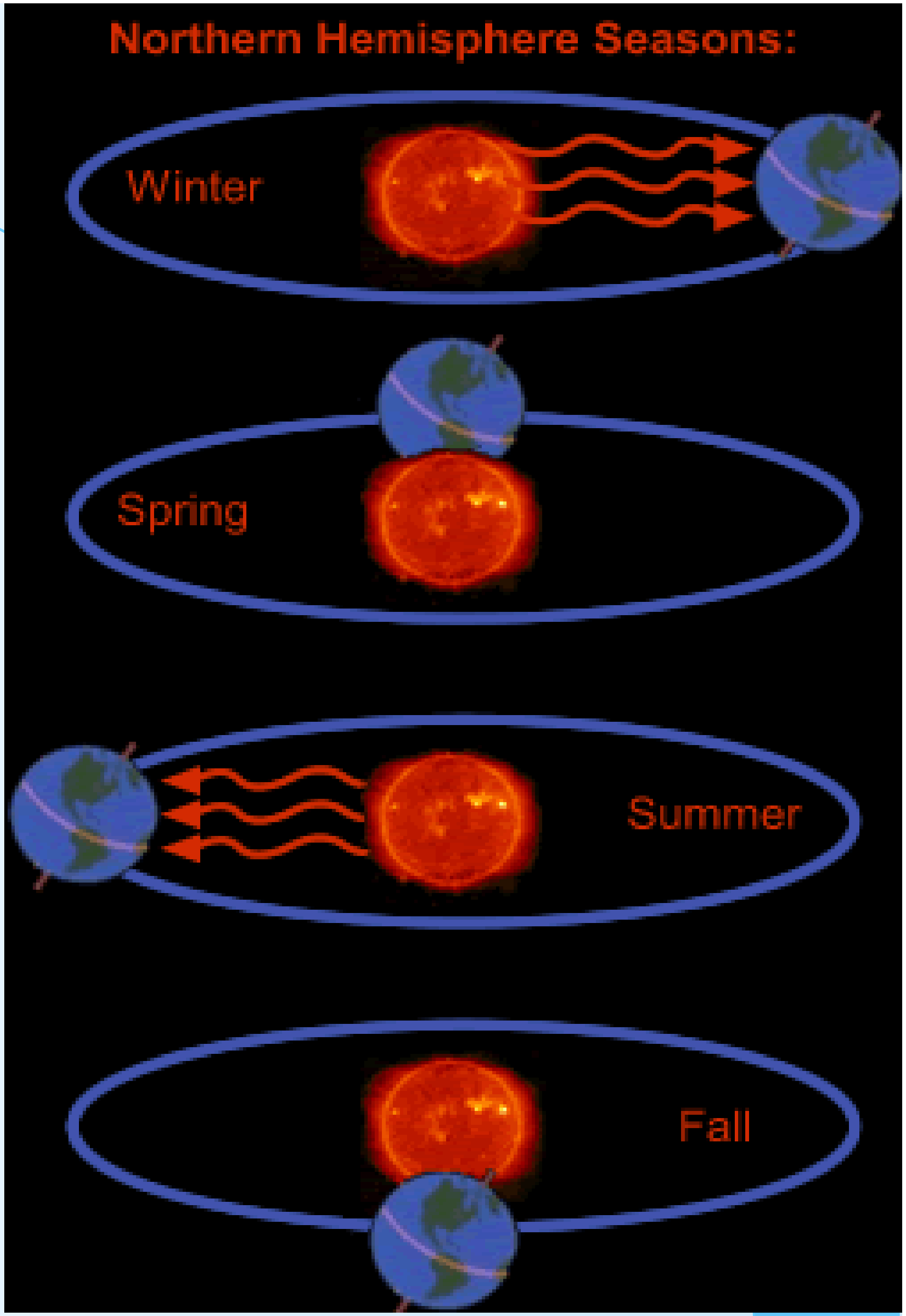




What does rotation cause on Earth?

Produces the daily cycle of daylight and darkness

Apparent Motion of the Sun: It changes with the seasons and latitude due to: __Earth's tilt______ Earth does not lie directly straight up and down. It is tilted __23.5 degrees



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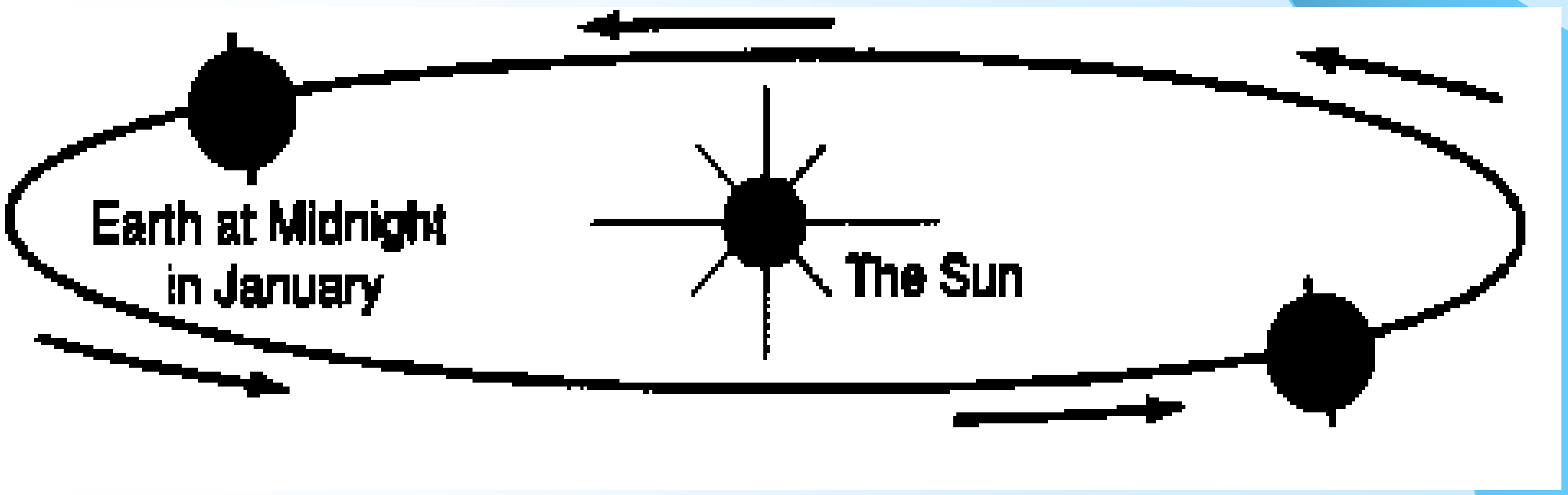
b. **Revolution**: The orbiting of one object around another.

Orbiting Equals revolution.
The Earth revolves around the sun, or the Earth orbits the sun.



Evidence of Revolution:

(1) Parallax Effect :

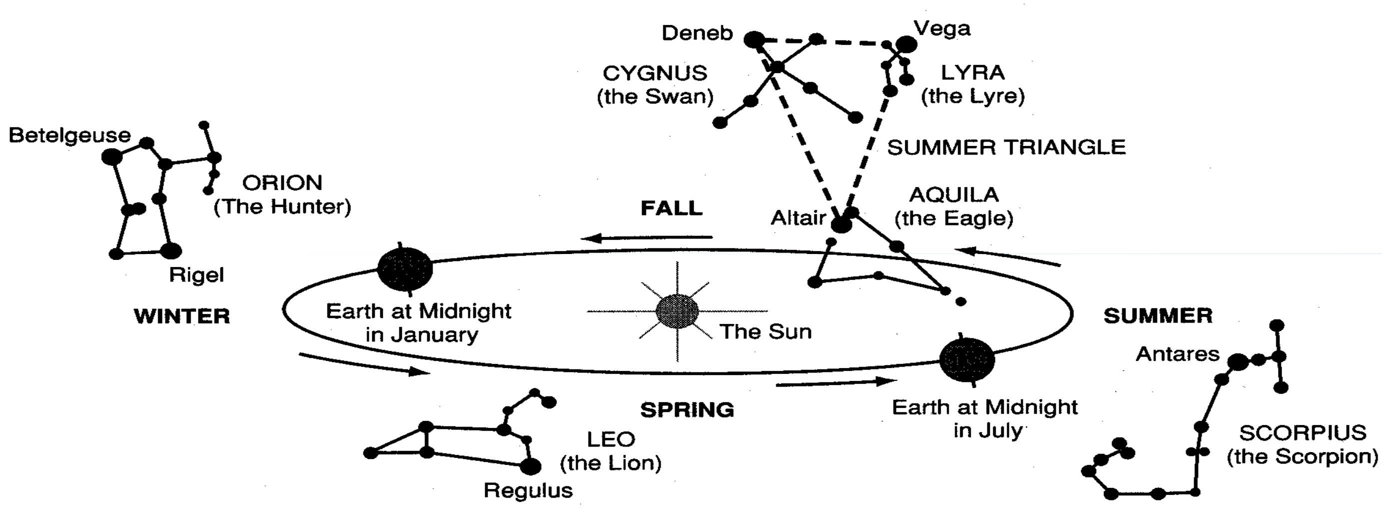
The apparent shift in a star's position that occurs because the Earth has moved in it's orbit. If you view the same object from two different angles, the perspective will change (Ex. Thumb and Eyes)

Astronomers view stars from one side of the Earth's orbit and then from the other side to attempt to detect parallax.

(2) Seasonal changes in constellation :

Different constellations appear in our night sky at different times of the year.

During the summer, certain constellations are visible in the nighttime sky. During the winter, when the Earth is on the other side of the Sun, the nighttime sky faces the Opposite side of the Earth, so we see different constellations.

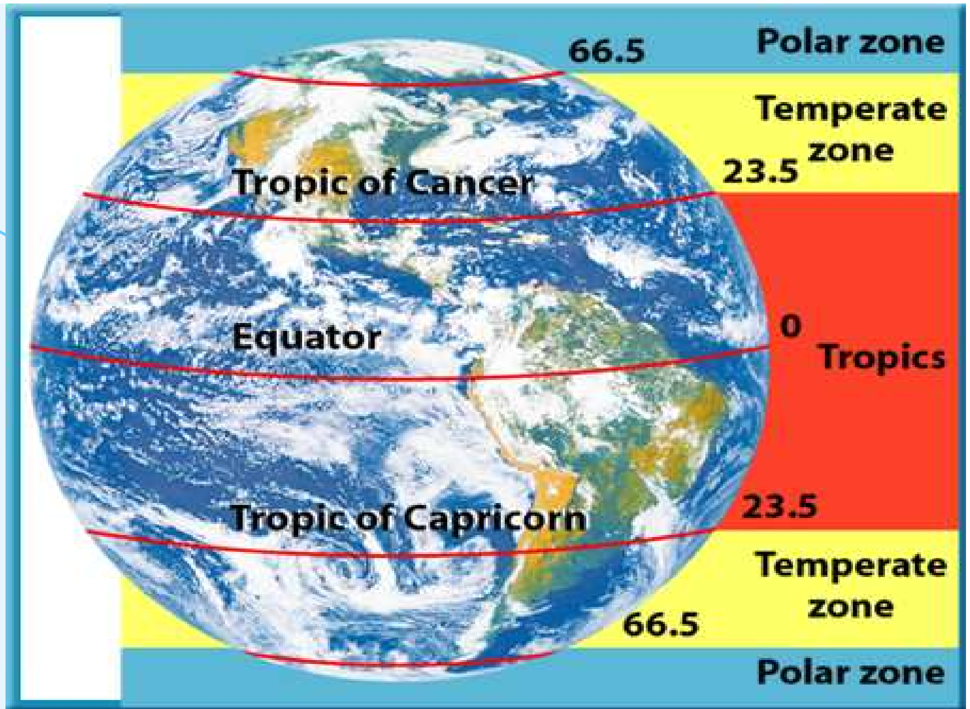


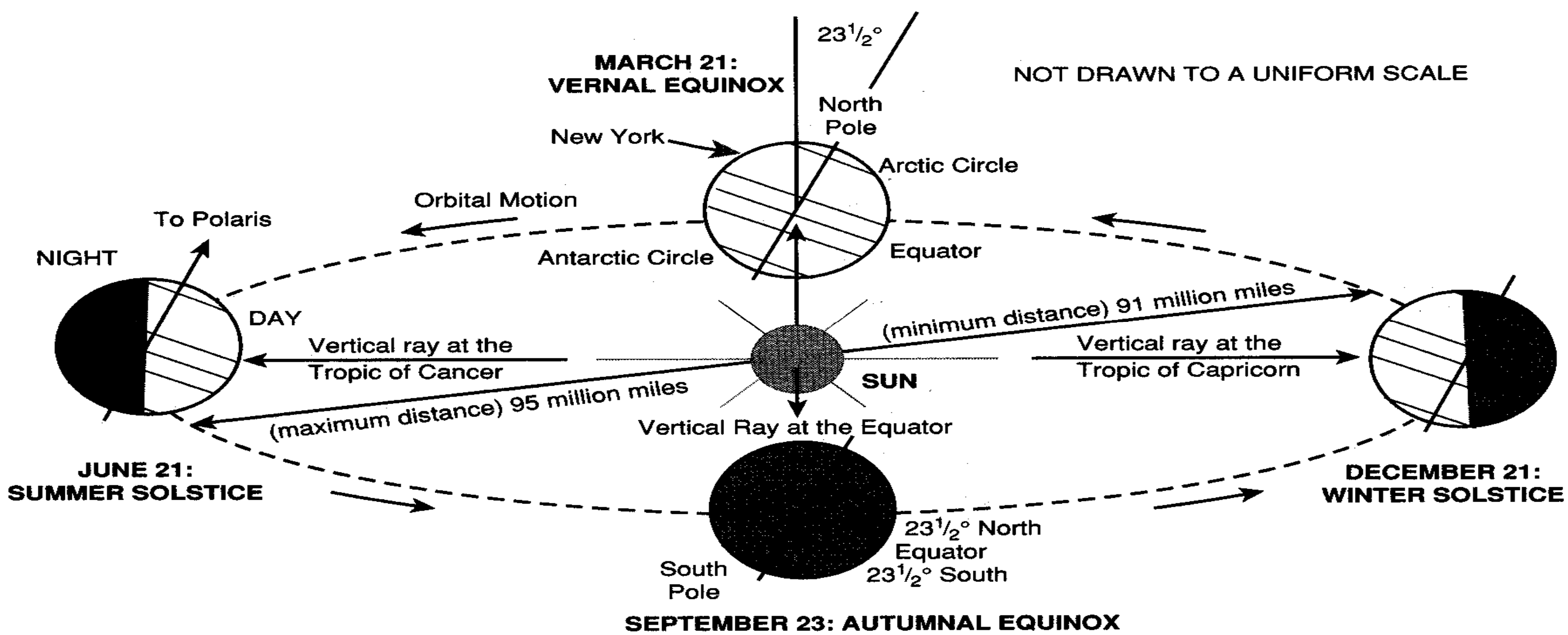
Tropics of Cancer and Capricorn:

23.5o north and south latitude.

Mark the furthest north and south travel of the direct rays of the sun.

Sun is directly over the Tropic of Cancer on June 21st and the Tropic of Capricorn on December 21st.

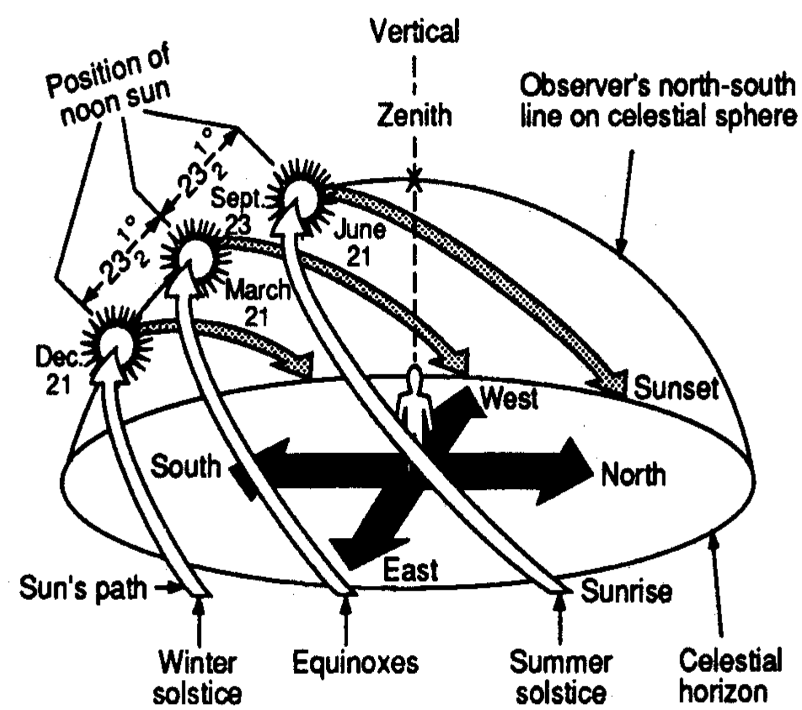


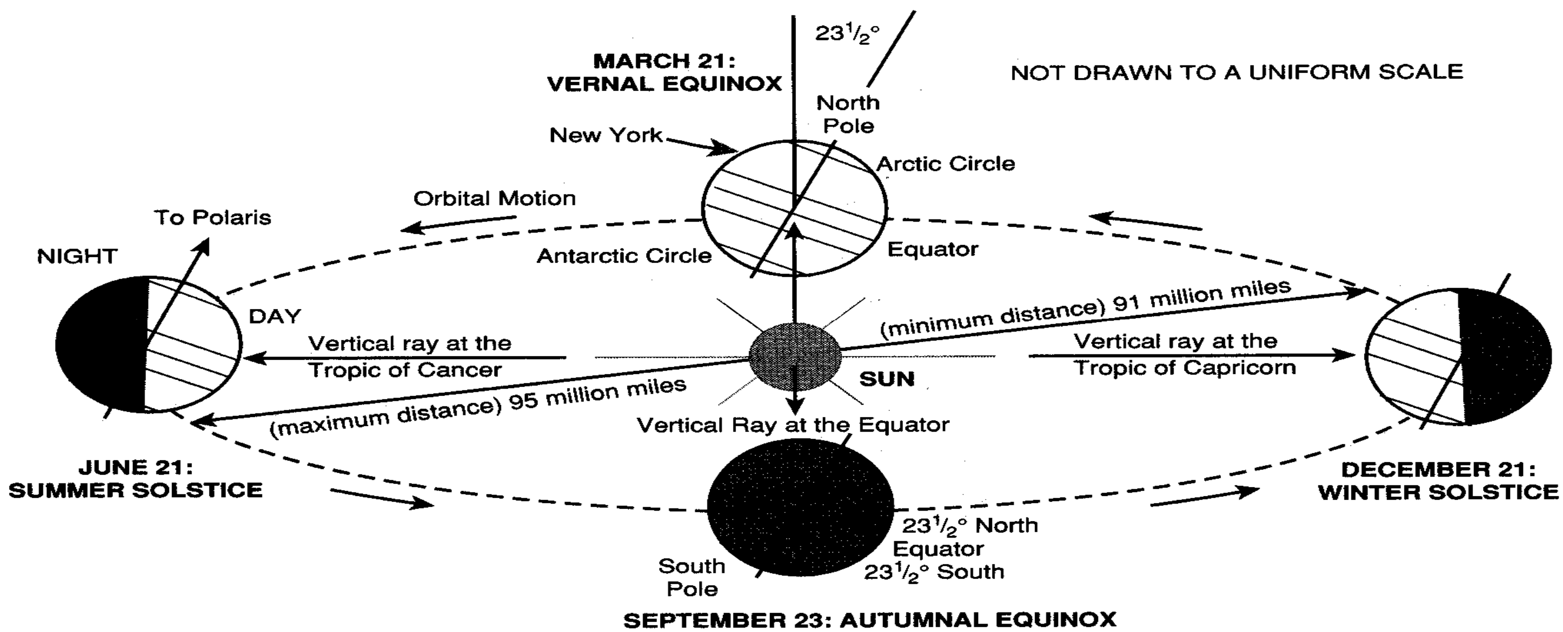


The hemisphere tilted _toward____ the sun receives more daylight hours than the hemisphere tilted ____away__ from the sun.

The __longer____period of sunlight is one reason summer is warmer than winter.

The sun appears _high_____ in the sky and the sun's radiation strikes the Earth more directly.

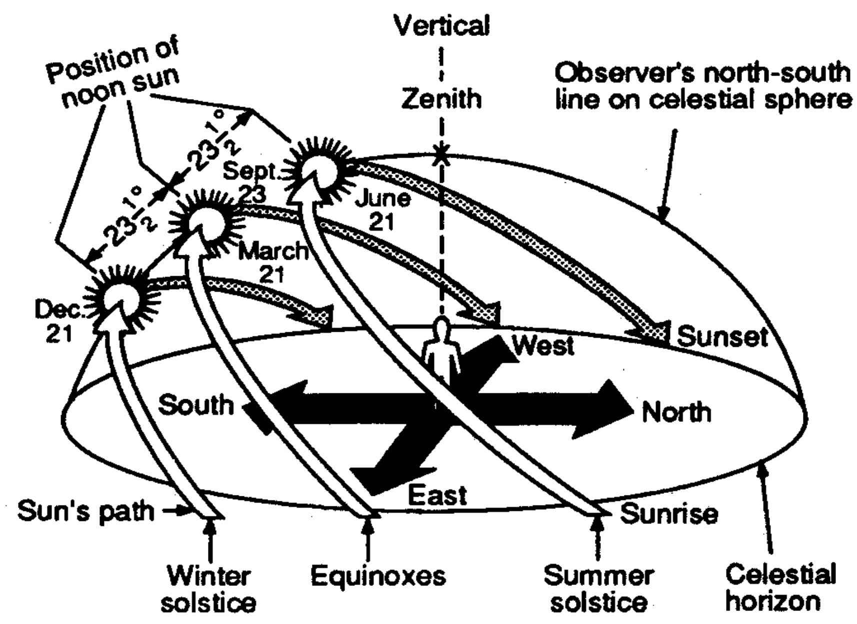




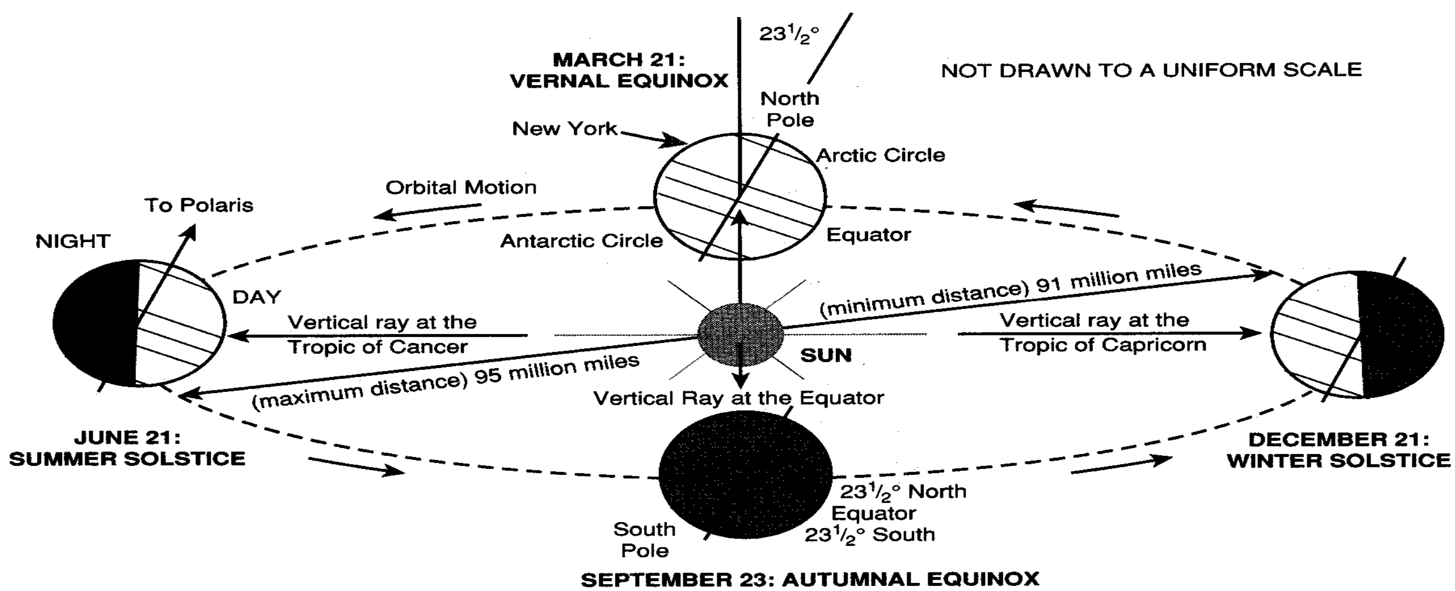
Summer: hemisphere tilted towards the Sun

but the sun is NEVER directly overhead for us! Because the path of the sun is longest in the summer, days are longest.

Summer Solstice: June 21 or 22

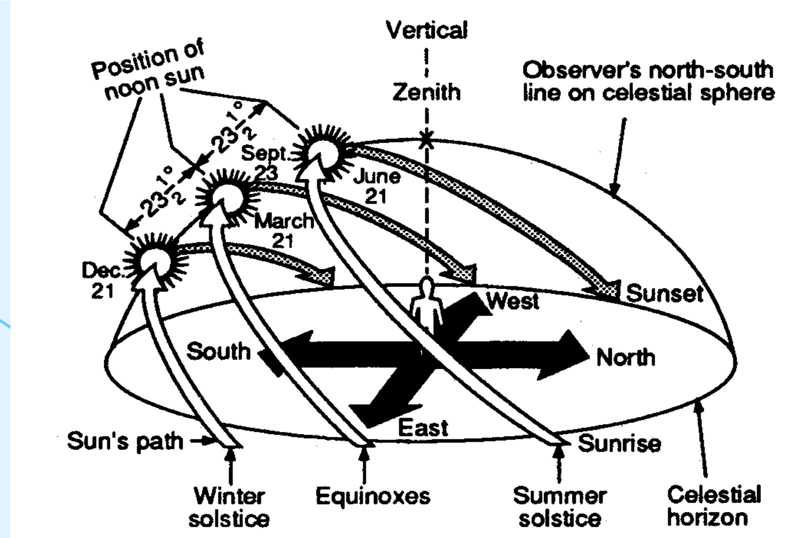


Northern Hemisphere is tilted towards the Sun receiving the most direct sunlight of the year during the longest day

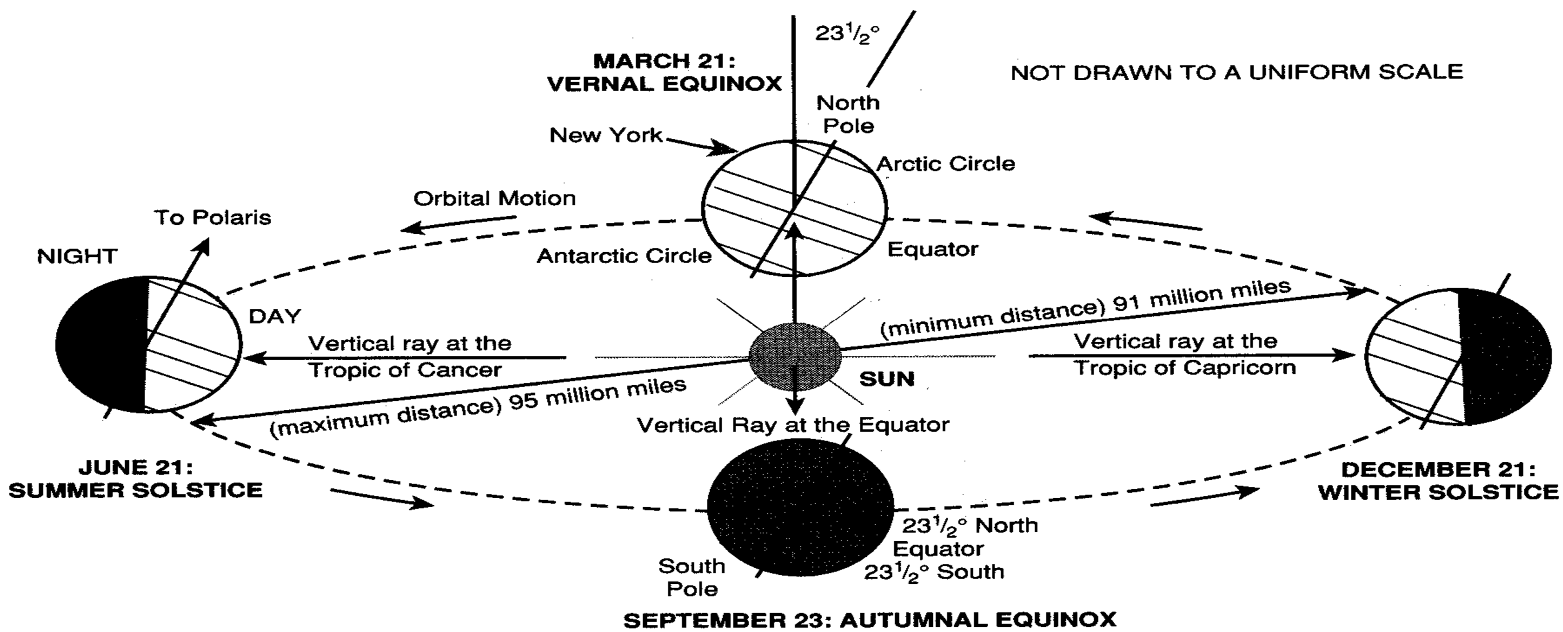


Winter: hemisphere tilted away from the Sun

Winter Solstice: December 21 or 22



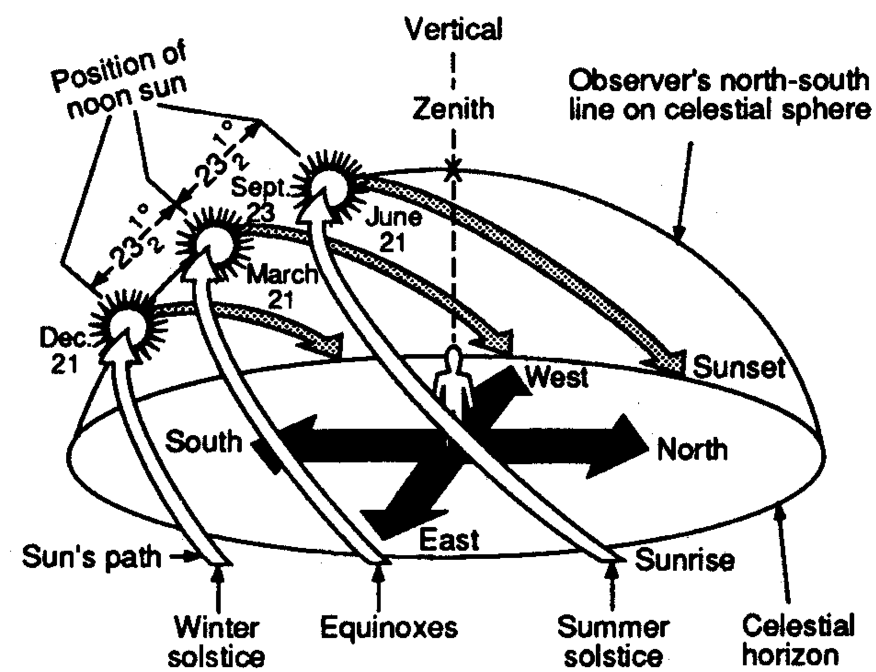
The Northern Hemisphere is tipped away from the Sun, producing the shortest day of the year and a low Sun angle

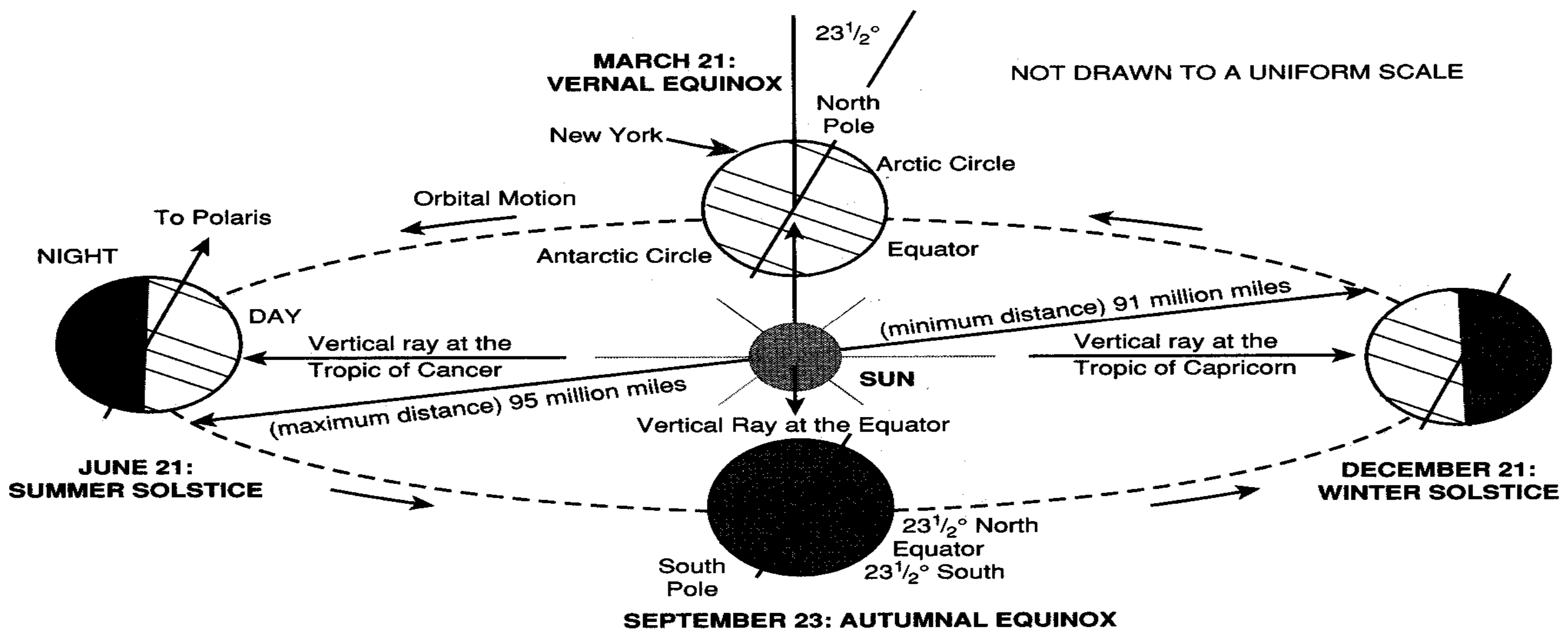


At the ___Equinox_______, day and night are 12 hours long **everywhere** on Earth. The sun is directly over Earth's equator.

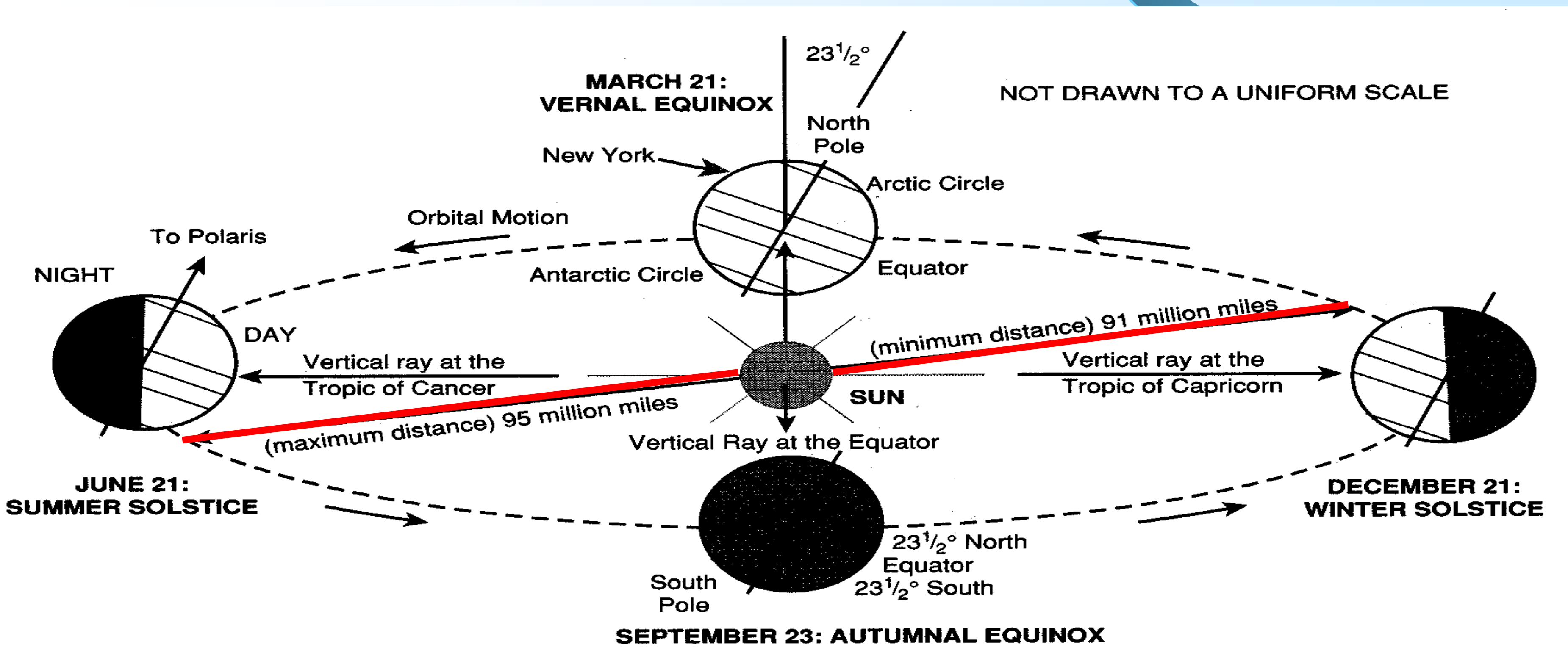
Vernal (Spring) Equinox:
___March 20 or 21

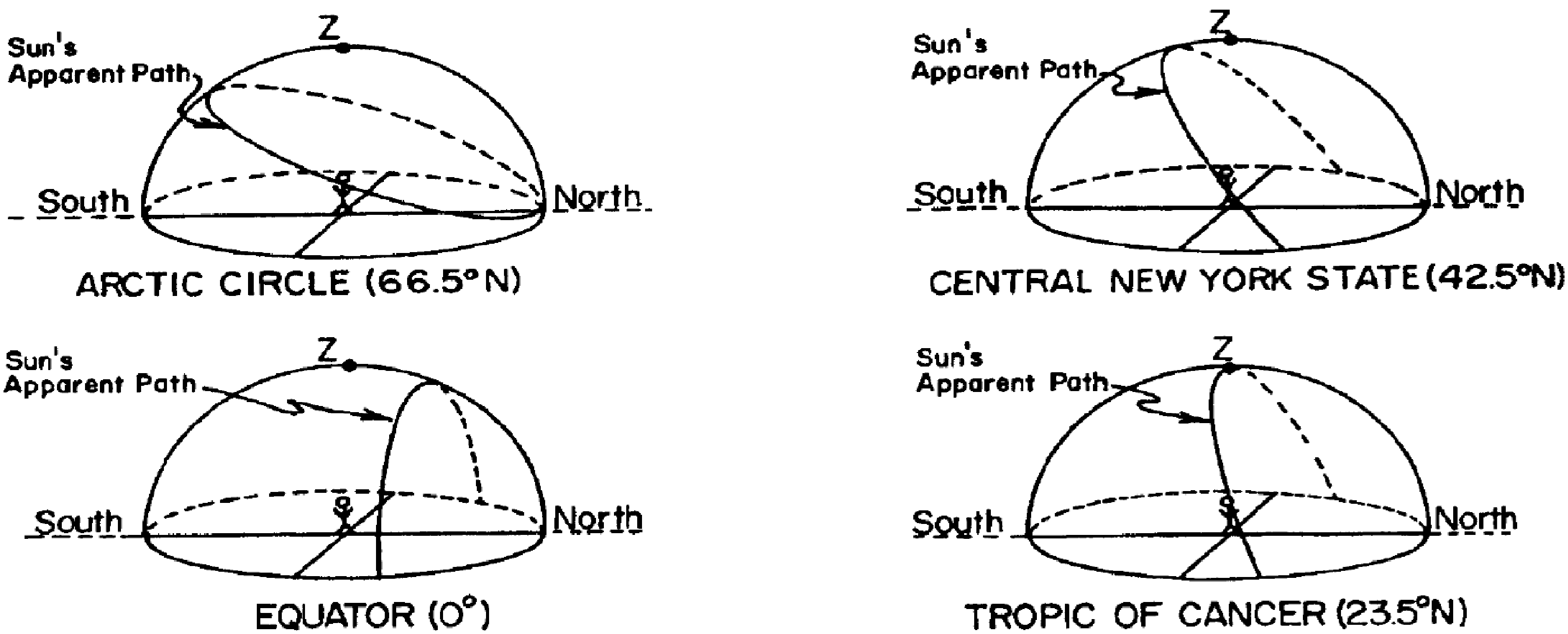
Autumnal (Fall) Equinox:
_September 22 or 23





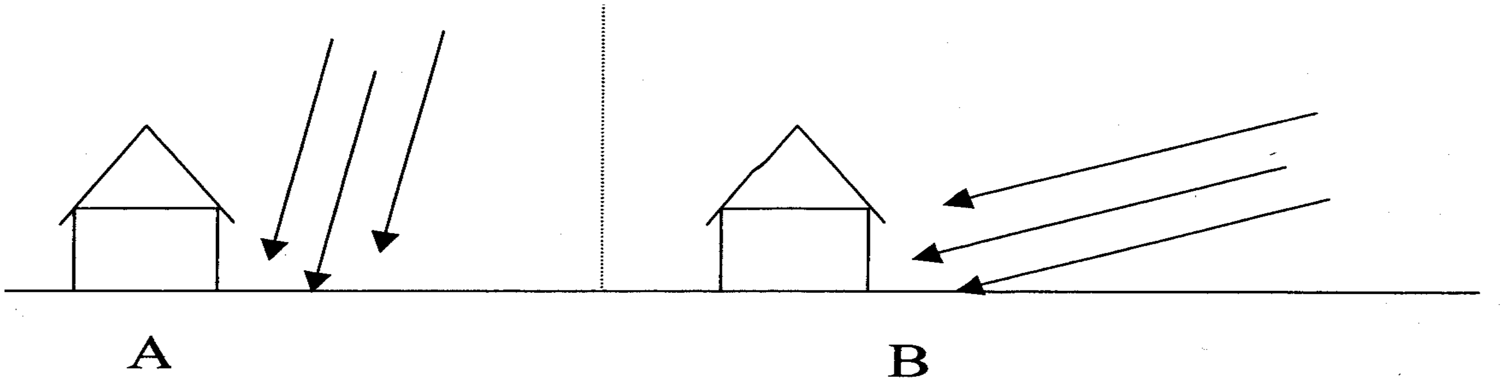
<u>Important Note</u>: We **do not** have summer in June because we are closer to the sun. We are actually closest to the sun in December, the beginning of winter.



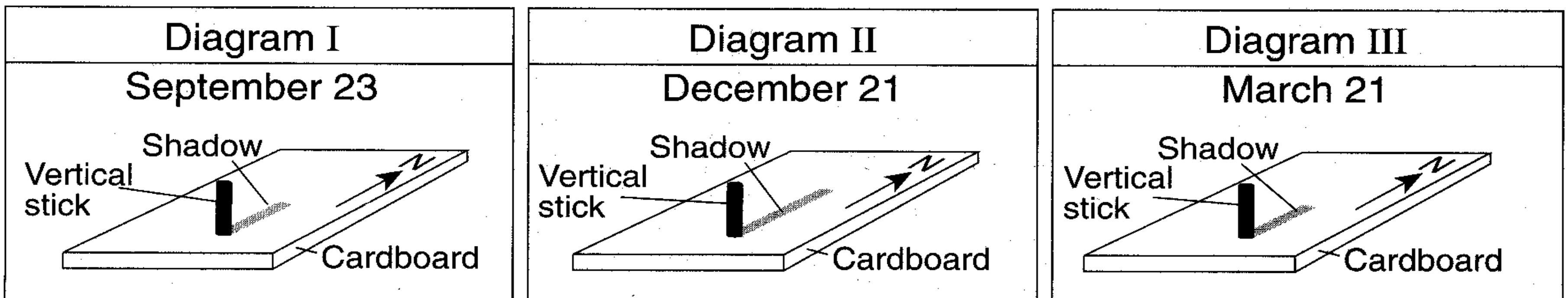


Sun's apparent path for four different observers on June 21st. Notice how the path and position of the noontime sun change for each location.

Latitude: The closer you are to the poles, the lower the noon time sun and the greater the difference between the winter and summer length of daylight. At the equator, day and night are 12 hours long all year.



Because the sun is higher in the sky in the summer, the rays of the sun shine down at a more direct angle.



The length of shadows cast by a stick are also affected by the height of the sun. In the summer, the sun is high in the sky, so the shadows it casts are _short_. Shadows cast in spring and fall are _equal______. In the winter, the sun is very low in the sky, so the shadow it casts is very _long_.