

Tracking Shadows

Sun's Position in the Sky

High in the sky = short shadows = direct sunlight = heat

Low in the sky = long shadows = less direct sunlight = cooler

Using the Analemma as a calendar and predict seasons

Track the Sun across the sky by displaying the following dates in Uniview:

March 20

June 21

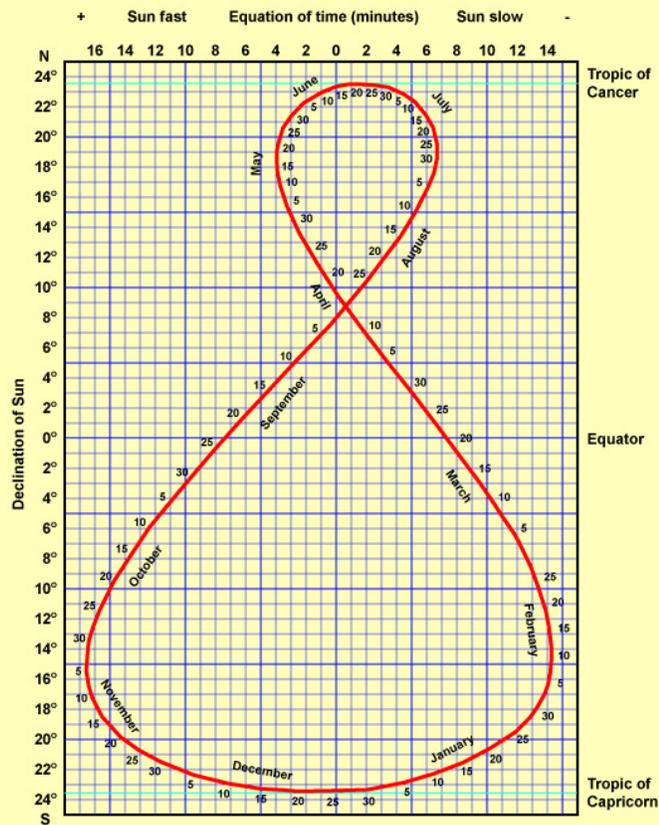
Sept 22

Dec 21

Restart sequence to show the analemma: Uniview 1 sec = 7 days
Scrub ahead to display path

Direct

Analemma



The analemma (redrawn using data from the U.S. Coast and Geodetic Survey)

Seasons

Nearly every place on Earth has four distinct **seasons**: winter, spring, summer, and fall.

Seasons in the hemispheres differ. When the northern **hemisphere** is in summer, the southern hemisphere is experiencing winter.

The shape and tilt of the Earth on its axis affects the angle at which the Sun's rays pass through the **atmosphere**, and the length of daylight that an area experiences.

The Reason for the Seasons**What do you think causes the seasons?**

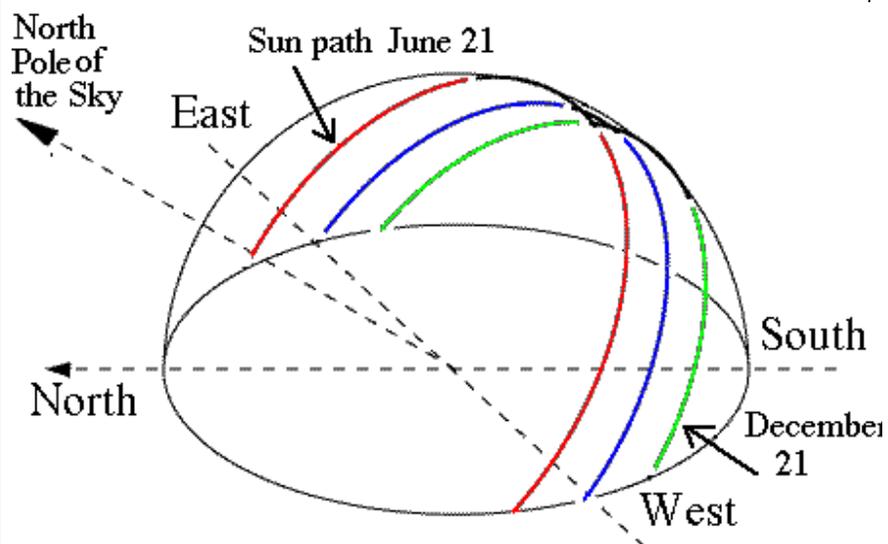
The seasons *do not depend on the distance* of the Earth from the Sun. The Earth is at a closer distance to the Sun during December, when the northern hemisphere is experiencing winter.

Angle of Separation

The higher the **angle**, the more intense the solar radiation.

Because of the **curvature** of the Earth, sunlight strikes the poles at a low angle. Rays striking Earth at a low angle must pass through more **atmosphere**. Earth's atmosphere **absorbs** and **reflects** solar energy. The more atmosphere the rays have to pass through, the less **solar energy** reaches Earth's surface.

When a hemisphere of the Earth is experiencing winter the angle of the Sun is lower, and when summer occurs the angle is much higher.



Sun High in the Sky = Summer
Sun Low in the Sky = Winter

Rays of Sun and Surface Temperature

Length of Day (Uneven Heating of Earth's Surface)

The tilt of the Earth in combination with the latitude of location affects the length of the day.

Those living on the equator have 12 hours of daylight and 12 hours of darkness every day of the year.

If you lived at the North Pole, you would have 6 months of constant daylight from spring to fall. Unfortunately, you would encounter 24 hours of night for six months from fall to spring.

With more time to absorb energy from the Sun, the Earth **retains** varying amounts of heat. This uneven heating of the Earth's surface has an effect on the seasons.

Long Day = Warmer

Equal Day = Moderate

Short Day = Colder

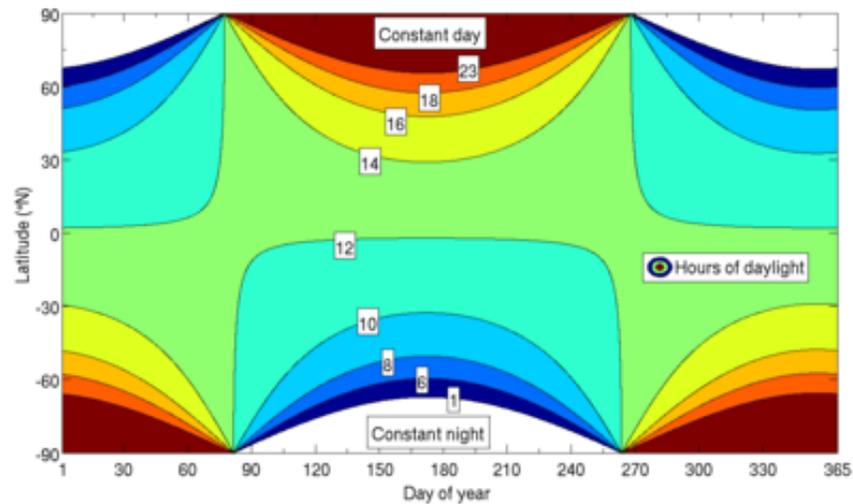
Louisville, KY: 2013 Length of Daylight

March 20 = (Spring) Vernal Equinox = 12 hours and 11 min

June 21 = Summer Solstice = 14 hours and 49 min

September 22 = (Fall) Autumnal Equinox = 12 hours and 8 m

December 21 = Winter Solstice = 9 hours and 30 min



5

Seasons on other Planets

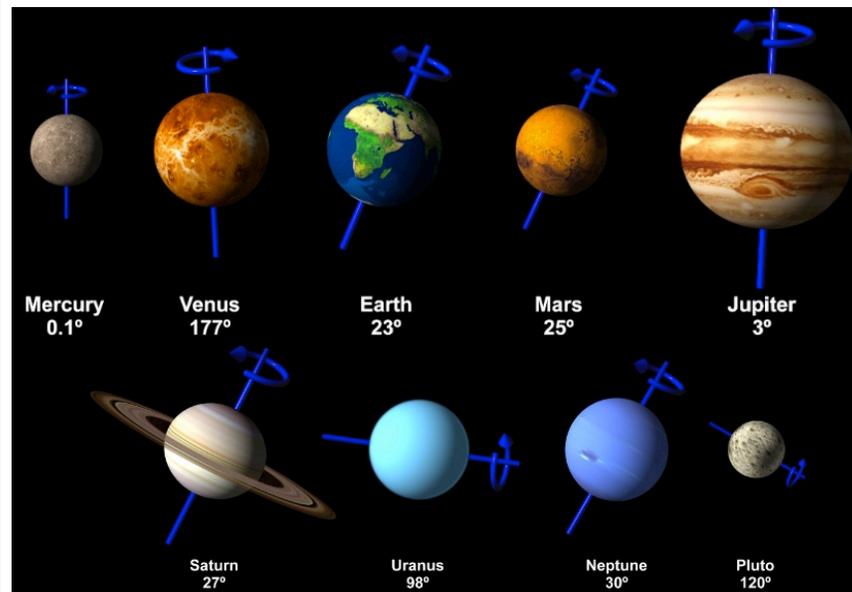
All of the planets have tilted axes, curved surfaces, and revolutionary paths around the Sun, which gives each the opportunity to experience seasons.

Uranus is tilted almost on its side, meaning one hemisphere always has summer during half of its orbit, while the other half of it is in winter for 42 years (half of its 84 year orbit around the Sun).

Even Triton, Neptune's moon, experiences summer and winter, each lasting 40 years with only a few degrees of fluctuation.

Though the Sun has the greatest impact on the planets to which it is closest, The Earth is the only planet to display four distinct seasons.

Lesson 4



Obliquity of the Nine Planets

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