**Lesson:** Earth-Sun Relationships

**Purpose:**

This lesson plan will help illustrate the general relationships of the earth. The lesson will explore latitude-longitude, how we describe day and night and define time zones as well as how the orbit of the earth and change in solar illumination affects seasonal changes.

**Approximate lesson time:** 30 minutes

**What you will need:**

* Globe on stand that can rotate
  + Globe should have an angled axis and preferably textured enough to feel the Latitude and Longitude lines
  + Optional:
    - 3-D printed globe with lines of longitude and latitude <http://www.thingiverse.com/thing:66228>
* Earth Orbit flat model
  + May need to be pre-made before lesson depending on materials used.
    - Can be created on a piece of paper with “puffy” paint, a 3-D pen, a hot glue gun, or any other texture creating material
  + Have a small dot/circle surrounded by an offset ellipse similar to the Earth’s orbit
  + Optional: add additional orbits of other planets to show full solar system model

**Latitude/Longitude and Time:**

* Using the globe have the student feel the small ridges representing the latitude and longitude. You can add the layers of a cake vs. orange wedge discussion for additional illustration.
* Spin the globe slowly while the student keeps their fingers on the same line of latitude. As they feel the lines longitude pass, explain the earth rotating to expose different portions to the sun (their fingers) to create each day.
* Discuss how the entirety of each line of longitude will pass the closest to the sun point at the same time each day, what we call solar noon. Discuss how sunrise and sunset will be different for each location on earth.
* Use the mathematic equation: 360 degrees / 24 hours = 15 degrees/hour
  + Shows the consistent rotation of the earth and how we approximate time zones
  + You can discuss changes in time across the country that they have heard of from relatives of television schedules/commercials.

**Earth’s Orbit:**

* Using the Orbit model created, describe the sun as the center of our solar system and the earth as revolving around the sun in an ecliptic pattern.
* Explain the differences in distance from the sun at different times of the year
  + Aphelion = July, Perihelion = January
  + Can also rotate the model to show that the ellipse changes apparent location on each revolution
* Bring the globe back and discuss the angle of inclination on the globe and how this differs from the plane of the ecliptic the earth is revolving around the sun on.

**Circle of Illumination and the Seasons:**

* Have the student feel the globe and observe how much of the globe they can feel without wrapping around the back side of the globe. Explain this as the circle of illumination.
  + Continue this exercise with the student imagining they are the sun. Rotate the globe to represent the different solstices and equinoxes relative to the student.
  + Discuss how the light varies and where the closest point of the globe is to the student for each location.
  + Discuss the Tropics of Cancer and Capricorn in relation to the angle of inclination
* Repeat this exercise, once again having the student imagine themselves as the sun, move the globe to their left and right to represent the solstices, and in front of them to represent the equinox, always keeping the angle of inclination pointing the same direction.
  + Have them make observations about where the circle of illumination will be at each location of the earth in its orbit.
  + Discuss how this difference in solar energy adjusts the seasons by changing the incoming solar energy.