

Module 3: How does the Sun affect the Earth?

Activity A: Sun-Earth Interactions

Overview

Do you know what causes the seasons on Earth? If you live in the mid-latitudes on the planet, such as in the US, you experience four seasons each year. Why are the days longer and hotter in the summer and shorter and colder in the winter? What do equinoxes and solstices have to do with seasons? By gaining an accurate understanding of Earth's place in Space, you will gain knowledge as to why there are seasonal changes in temperature on Earth over the course of a year.

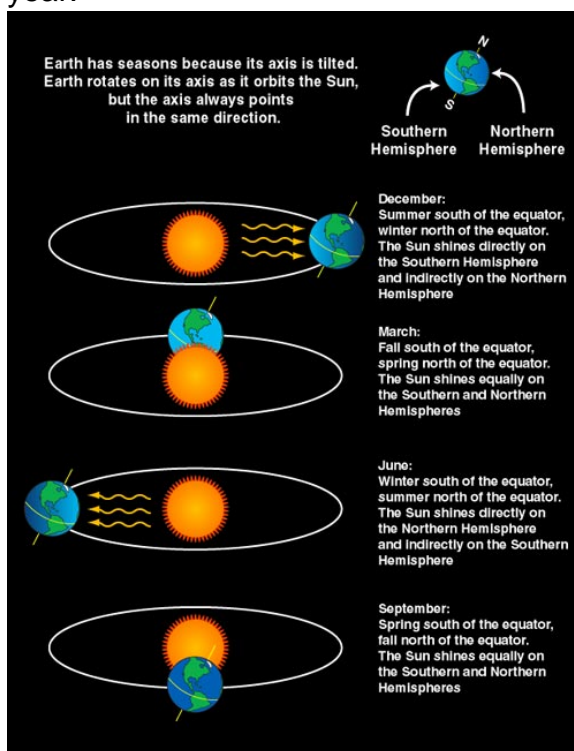
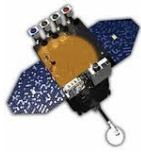


Image: NASA

First let's clear up a MAJOR misconception (false information) as to why there are seasons on Earth. Earth's seasons are NOT caused by changes in the distance the Earth is from the Sun during the year (the Earth is NOT closer to the Sun in summer and further from the Sun in winter)! The cause of Earth's seasons is due to the tilt of our planet on its axis. The Earth has an average tilt of 23.5 degrees from perpendicular. This means that the Earth's axis is not straight up and down, which explains why a globe (model of the Earth) is on an angle. Also, the tilt of Earth's axis always points in the same direction.

The four seasons – spring, summer, autumn, and winter – divide the year into four 3-month periods of time that are each approximately 91 days long (leap year every four years takes care of the extra quarter day per year). Latitude and the length of daylight affect seasonal temperatures. Daylight is longer during the summer months and at the Equator, and at lower latitudes sunlight is more concentrated, so temperatures are hotter. Daylight is shorter during the winter months, and at higher latitudes sunlight is spread over a wider area, so temperatures are colder. The Earth takes a day, 24 hours, to spin once on its axis (Earth rotates at 1000 miles/hour or about 1600 km/h!). While the Earth is rotating it is also orbiting (revolving) around the Sun. One orbit (revolution) of the Earth around the Sun equals a year (365.26 days to orbit means the Earth is revolving about 67,000 miles/hour or over 107,000 km/h!).



Team Goal

Your goal is to create a 3-D model that represents Earth's orbit around the Sun to explain the four seasons on Earth.

Materials

- 4 small Styrofoam globes
- Fine point Sharpie
- 1 large ball or index card labeled "The Sun"
- 9 index cards labeled "Spring Equinox", "Fall Equinox", "Summer Solstice", "Winter Solstice", "September 21", "June 21", "March 21", "December 21", and "North Star (Polaris)"
- 8 toothpicks
- Lump of modeling clay

Engage & Explore!

1. BUILD Knowledge:

Earth-Sun Interactions

As a team, watch these NASA eClips videos to see evidence of the Sun's effects on Earth. (Note: Click on the links below, type in the name of the video into the NASA eClips Search window, then scroll through the "Related Resources" to find and play your video.)

[Our World: Sunsets and Atmosphere](#)

[Launchpad: Aurora Lights](#)

[Real World: Monitoring Earth's Energy Budget](#)

2. APPLY Learning:

What Causes Earth's Seasons?

What effect does the invisible tilt of Earth's axis have on our planet? Everyone who experiences the four seasons knows from first hand observations that temperatures are colder in winter than in summer. What causes this difference in temperature and why are the daylight hours longer in summer than in winter? Click on these three Sun|Trek visualizations to learn about seasonal changes on Earth:

[What is the tilt of Earth's Axis?](#)

[Why are days longer in the summer?](#)

[Why are days hotter in the summer?](#)

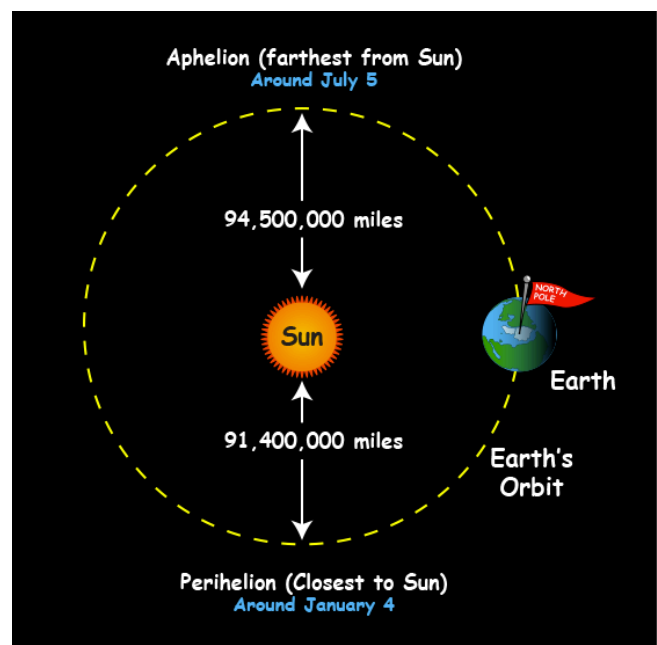


Image: NASA



3. DEMONSTRATE Ability:

Reason for Seasons 3-D Model

Procedure:

The latitude of the region where you live on Earth determines its length and intensity of sunlight, and thus your area's climate and seasonal patterns. If you live in the Northern Hemisphere, you notice each night that the North Star, Polaris, shines almost in the same place throughout the year but the constellations appear to move as the night and year progresses. This is due the Earth's constant tilt in the same direction, which is towards the North Star. This explains why Polaris remains in a relatively constant place in the night sky throughout the year. Your team's goal is to create a 3-D model that scientifically explains how the tilt of Earth's axis causes seasons on Earth. Read and follow the instructions for the "Reasons for Seasons" activity.

After your team completes the activity, check the scientific accuracy of your "Reason for Seasons" 3-D model and diagram. Click on the link to watch a visualization that explains why Earth has four seasons. Which direction is the North Star located in the visualization?

[Why are there four seasons on Earth?](#)

After your team has verified that your 3-D model and diagram of "Reasons for Seasons" is correct (or, if it is not correct, that your team has made changes to correct your activity diagram), you will film a short scientific "infomercial" to explain the reason for seasons on Earth. In your explanation, use your model to explain how the tilt of Earth's axis at each of the four equinox and solstice positions causes seasonal differences in temperature and daylight hours over the course of a year. Your team's 3-D "Reason for Seasons" model and this short video will be part of your Module 4 SDO Exploration Museum 3-D Solar Exhibit. Check out the NASA link below to reinforce your understanding of the reason for the seasons!

[What causes the seasons?](#)

Sensational, now you know about the relationship between the Earth and the Sun that causes seasons on our planet!