Lesson

12 Earth in the Solar System

SC.8.E.5.9

Getting the Idea

Key Words
revolution
rotation
elliptical
Northern Hemisphere
Southern Hemisphere
solstice
equator
equinox

Objects in space often affect each other. You learned that all the planets of the solar system orbit the sun. In this lesson, you will examine some ways the sun affects Earth.

Gravity and Earth's Orbit

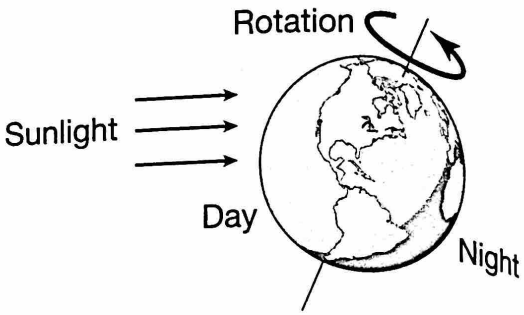
Recall that **revolution** is the movement of Earth or any other planet around the sun. The time it takes for a planet to complete one orbit around the sun determines the length of its year. For example, Earth takes 365.25 days to travel around the sun. Therefore, one year on Earth is equal to 365.25 days.

Recall from Lesson 9 that Earth's moon remains in orbit because of the gravitational attraction between Earth and its moon, as well as the moon's inertia. Gravity and inertia also keep Earth revolving around the sun. Earth's inertia causes it to travel in space at a constant speed along a straight path. However, gravity causes the sun and Earth to pull toward each other. The gravitational force between the sun and Earth balances with the movement of Earth caused by its inertia. This prevents Earth from moving off into space. Instead, Earth follows a regular, curved path around the sun.

Day, Night, and Rotation

Like other planets, Earth spins on an imaginary axis that runs through the center of the planet from its North Pole to its South Pole. The spinning of a planet on its axis is called **rotation**. The time required for a planet to make one full turn on its axis determines the length of its day. Earth takes 24 hours to complete one rotation, so the length of a day on Earth is 24 hours.

Day and Night



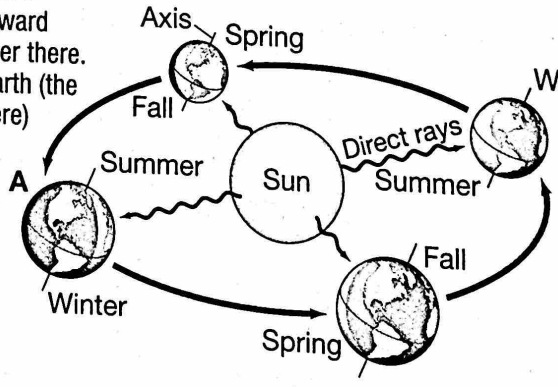
Earth rotates on its axis from west to east. As Earth rotates, only one half of Earth faces the sun. The side of Earth facing the sun experiences daylight. At the same time, the parts of Earth that face away from the sun experience night. Earth continues to rotate, and the area experiencing day and night shifts over a 24-hour period.

What Causes the Seasons?

The **elliptical** shape of Earth's orbit causes Earth's distance from the sun to vary at different times in its orbit. You may expect warm seasons to occur when Earth is closer to the sun. However, Earth's seasons do not result from our distance away from the sun. The seasons occur because of the tilt of Earth's axis.

Earth tilts on its axis in relation to its path around the Sun. Earth rotates on an axis tilted at a 23.5° angle. This tilt affects how much sunlight different areas of Earth receive at various times of the year. In many parts of Earth, the temperature changes with the seasons during the year. Earth's tilt on its axis and revolution around the sun cause Earth to experience seasons.

When Earth's Northern Hemisphere tilts toward the sun, it is summer there. The other half of Earth (the Southern Hemisphere) is having winter.



When it is winter in the Northern Hemisphere, the Southern Hemisphere tilts toward the sun and it is summer there.

The "top" half of Earth located north of the equator is the **Northern Hemisphere**. The "bottom" half, located south of the equator, is the **Southern Hemisphere**. Areas tilted toward the sun have a summer of longer days and higher temperatures because they receive more direct sunlight. Areas tilted away from the sun have a winter of shorter days and cooler temperatures because they receive less direct sunlight. If Earth were not tilted on its axis, there would be no seasons.

In summer in Florida, the Northern Hemisphere is tilted toward the sun. The tilt causes the sun's rays to shine more directly on Florida in summer. Think of the sun shining overhead on a hot summer day. The rays shine down on you directly. When the sun is shining on you from lower in the sky, such as on a winter day, the rays don't warm you as much. The rays come from a different angle. They are less direct, so less energy reaches you.

A **solstice** is a point in Earth's orbit when a hemisphere tilts most toward or away from the sun. There are two solstices in a year, a winter and a summer solstice. For the Northern Hemisphere, the winter solstice occurs on December 21 or 22, and marks the first day of winter. The summer solstice occurs on June 20 or 21, and marks the first day of summer.

Spring and fall occur when neither hemisphere tilts toward or away from the sun. At the beginning of these seasons, the sun heats both hemispheres equally. Since areas closer to the equator receive the most direct sunlight year round, these regions are hot year round. There is not as much of a difference between winter and summer in Florida as compared to areas farther north because those areas are farther from the equator. The equator is the part of Earth that gets direct sunlight throughout the year. The **equator** is an imaginary line that divides Earth horizontally into two halves, or hemispheres.

An **equinox** is a point in Earth's orbit when it tilts neither toward nor away from the sun. Earth experiences two equinoxes a year. The vernal equinox, or first day of spring, occurs in the Northern Hemisphere on March 20 or 21. The autumnal equinox, or first day of fall, occurs in the Northern Hemisphere on September 22 or 23. As with winter and summer, these seasons in the Southern Hemisphere are opposite those in the Northern Hemisphere.

The length of daylight each day also changes with the seasons. This has an effect on the temperature of the seasons. The period of daylight gets longer each day between December 21 and June 21. In summer, there are more hours of daylight than in winter. So not only are the sun's rays more direct, but the sun also heats Earth's surface for a longer period each day. Between June 21 and December 21, the period of daylight gets shorter each day. In winter, the sun's rays are less direct, and there are fewer hours of daylight. As a result, temperatures are lower in winter.

DISCUSSION QUESTION

Relative to its orbit, Mercury is not tilted on its axis. How do you think this affects the seasons on Mercury?

LESSON REVIEW

1. If the time it takes for Earth to rotate once on its axis increased, what would happen?

   A. A day would be longer.

   B. A day would be shorter.

   C. A year would be longer.

   D. A year would be shorter.

2. Which of these is the primary cause of Earth's seasons?

   A. Earth's gravitational attraction to the sun

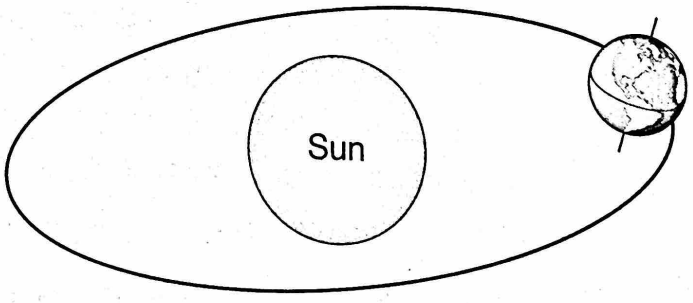
   B. the distance between Earth and the sun

   C. the tilt of Earth's axis as Earth revolves around the sun

   D. the moon's revolution around Earth

Use the following diagram and information to answer question 3.

3. The diagram below shows Earth in orbit around the sun.



What season would the position shown above cause in the Southern Hemisphere?

A. winter

B. spring

C. summer

D. fall