REASONS FOR THE SEASONS

BENCHMARK and TASKS

SC.E.1.2.1 The student knows that the tilt of the Earth on its own axis as it rotates and revolves around the Sun causes changes in season, length of day, and energy available.

- The student simulates the rotation of the earth on its axis every 24 hours to produce the night and day cycle.
- The student simulates the tilt of the earth on its axis and the revolution of the earth around the sun to demonstrate the cause for the changes in seasons, length of day, and the amount of energy available.
- The student observes and records that days and nights change in length throughout the year.
- The student relates the angle at which the rays of the sun strike the surface of the earth to the amount of energy received and thus the season of the year.

KEY QUESTION

What causes the earth to have seasonal changes?

BACKGROUND INFORMATION

The earth rotates once each day around an imaginary line called an **axis.** The earth's axis tilts about 23.5 degrees. The tilt changes the way sunlight strikes the earth at different times of the year. The north end of the axis always points toward the North Star as the earth revolves around the **sun.**

When the Northern Hemisphere is tilted towards the sun, we have summer. At this time the sun shines more directly on that part of the earth, heating the ground and air. Three months after the beginning of summer, the Northern Hemisphere is not pointing in the direction of the sun and neither is the Southern Hemisphere. Days and nights are equal in length. As the earth continues to move, the northern hemisphere points away from the sun and the sun's rays shine less directly on its surface. The sun's rays are slanted covering a larger area, so the ground and air are heated less. Another three months go by and again neither the northern nor southern hemisphere points in the direction of the sun. Days and nights are once again equal in length.

A Common Misconception: Many people believe that it is warmer in the summer than in the winter because the earth is closer to the sun in the summer. However, the earth's orbit is almost a perfect circle, and we remain nearly a constant distance from the sun throughout the year. Therefore, the earth's distance from the sun cannot account for seasonal changes.

MATERIALS

Per student

1 sheet of drawing paper

Teacher

The Reasons for Seasons, Gail Gibbons

Per class

1 globe
small lump of clay
1 small lamp
1 extension cord (if needed)
1 toothpick
1 measuring tape
1 planetarium model (optional)
1 label for *North*

TEACHING TIPS

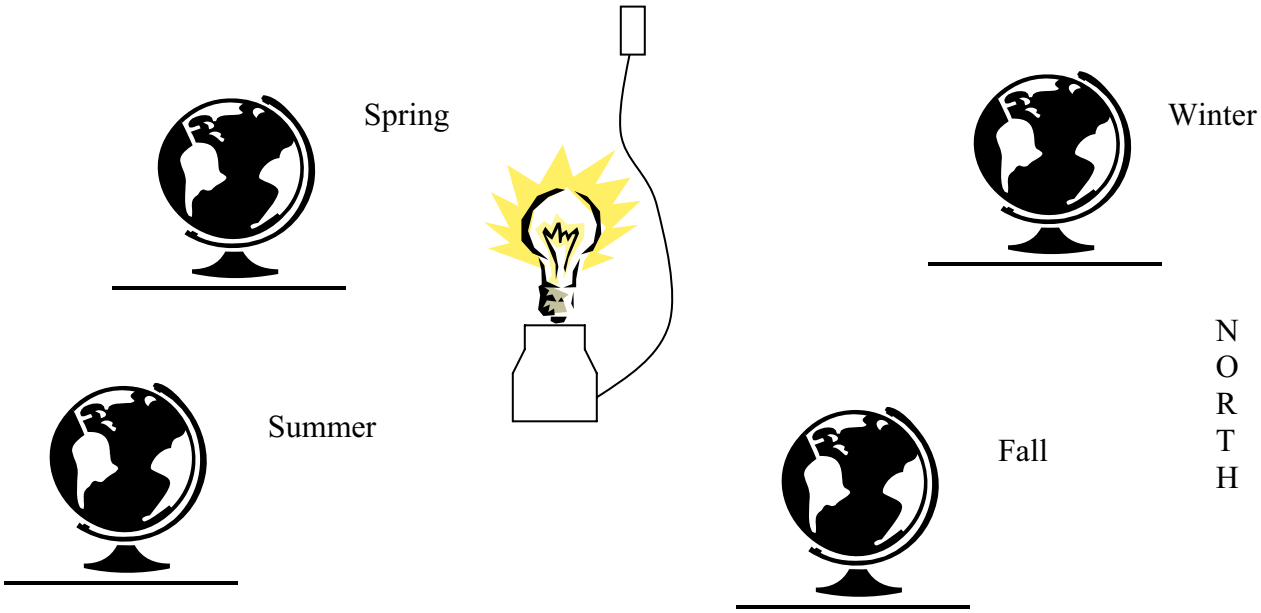
1. Suggested activities may take more than one class period.
2. After presenting these activities, assess student knowledge of the concept of why the earth has seasonal changes. If students do not display a working knowledge in this area, continue to reinforce this concept.

ENGAGE

1. Ask: *Why is it warmer in the summer than in the winter?*
2. Ask students to explain their answers by drawing a picture to show their thinking about why we have seasons. (Save the drawings for future reference.)

EXPLORE (Part 1)

1. Remove the shade from a small table lamp. Place the lamp in the middle of the classroom and turn it on. The lamp will represent the sun.
2. Make a label for "North" and place it in position on the floor.
3. Display the globe and ask students to demonstrate one way the earth moves. The students may demonstrate rotation and/or revolution. Explain that the earth is always turning and review the terms rotation and revolution.
4. On the globe, mark Florida with a small lump of clay and a toothpick.
5. Rotate the globe, showing the students that one rotation equals one day (24 hours). Observe that for part of one rotation, the toothpick is in the light (day) and for the remainder of the rotation, it is in darkness (night). The earth rotates on its axis as it revolves around the sun.
6. Place the globe on the floor about 1.5 m from the lamp on the side opposite north. The light bulb should be at the same height as the middle of the globe. Adjust the lamp, if necessary. The globe's axis should tilt toward the north. This is the summer position for the northern hemisphere. Have students locate Florida and observe the light striking the surface. Measure and record on a class chart the length of the shadow created by the toothpick.
7. Ask students to move the globe to each of the other positions - fall, winter, and spring - showing Earth's revolution around the sun. Make sure the globe's axis is always pointed towards north. Stop at each position and have the students observe the light hitting the Florida marker. At each position, measure and record the shadow created by the light. (Note: As you do this activity, you will only be able to move the globe so far before the toothpick hits the globe arm. You will have to remove the toothpick and clay and replace it after you turn the globe past the arm.)



EXPLAIN (Part 1)

During which season was the toothpick's shadow longest? Why?
During which season was the toothpick's shadow shortest? Why?
(A short shadow in the summer indicates strong, direct sunlight; a long shadow in the winter indicates weaker, indirect sunlight striking the earth at an angle.)
During which season do we get the most daylight? (summer)
During which seasons do we have about the same amounts of daylight and darkness? (spring and fall)
How would conditions change if the earth were not tilted on its axis?
Have students watch as the globe is held upright with no tilt and moved around the lamp. (If the earth were not tilted on its axis, there would be no seasons.)
How long does it take for the earth to make one complete revolution around the sun? (one year)

EXPLORE (Part 2)

1. Have students record the changes in the length of day over a period of two weeks by recording sunrise and sunset times as reported in the newspaper. (Have students do this early in the fall and again in the spring so they can compare the patterns in two different seasons.)
2. Once students have collected the data, ask them to create a line graph to show the sunrise and sunset pattern that occurred during the two-week period.

EXPLAIN (Part 2)

Discuss:
Did you notice any patterns in the sunrise and sunset times?
How were the sunrise and sunset times you recorded in the spring different from those you recorded during the fall?

EXTEND/APPLY

Read *The Reasons for Seasons* by Gail Gibbons.

ASSESSMENT

Ask the students the same question you asked in the Engage part of the activity and again have them draw a picture to explain their answer:

Why is it warmer in summer than in winter?

Compare this drawing to the one done earlier. Ask students to explain anything about their thinking that may have changed.