

Seasons

Lesson Overview

In this lesson, students will use materials to investigate how the tilt of the Earth on its axis affects life on Earth.

Standards Addressed

SC 2014 8.E.4B.3 Develop and use models to explain how seasons, caused by the tilt of Earth's axis as it orbits the Sun, affects the length of the day and the amount of heating on Earth's surface.

NGSS MS-ESS 1-1 Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons.

Disciplinary Literacy Best Practices

Think-Ink-Pair-Share

Pairs Squared

Two Minute Paper

Read Aloud

Concept Map

Lesson Plan

Time Required – Two 55- minute class periods

Disciplinary Vocabulary: axis, direct and indirect solar radiation (sunlight), tilt, revolution, season, hemisphere, solstice, equinox

Materials needed: (per groups)

- Small containers (ex. Shoe box covers) – 2
- Thermometer – 2
- Sand or clean soil
- Book – 1
- Brick (or larger source for incline) - 1
- Flashlight – 1
- Graph paper – 1 sheet

Assessment: Cause-and-effect model (concept map) of how Earth's tilt results in varied daylight hours and unequal heating of Earth's hemispheres and seasonal change

Engage

- Students will watch one or both of the videos below as an introduction to the lesson:

Video #1 The Reasons for the Seasons:

<https://www.youtube.com/watch?v=PggOLThW7QA> (5 minutes 38 seconds)

Video #2 What Causes Seasons on Earth

<http://www.teachertube.com/video/what-causes-seasons-on-earth-657> (2 minutes 17seconds)

Have students **Think-Ink-Pair-Share** the answers to the following questions:

- What does the term axis mean?
- What is the angle of tilt for the earth's axis?
- How long does it take the earth to spin or rotate once on its axis?
- How long does it take the earth to orbit or revolve around the sun once?
- Many places on earth experience four different seasons. What are those seasons?
- Why is the angle of rays of sunlight so important in determining the amount of energy collected by the earth?

Explore

NOTE: This has been extracted from the Teachers' Guide of the ETV Streamline SC video The Reasons for the Seasons

Safety Note(s): Students should know and practice the procedures for fire, glass and chemical safety. Students should use care when performing this experiment, and be wearing the proper safety equipment including aprons and goggles. Students should know and practice safe disposal of materials in a laboratory setting.

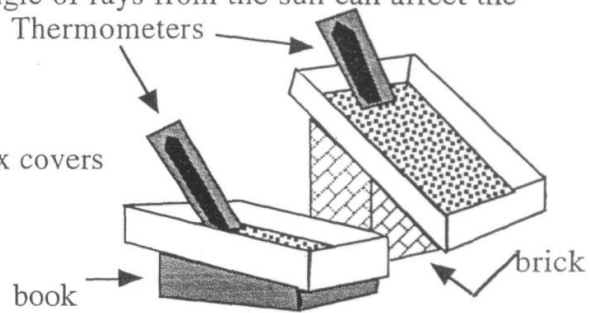
- If the class size is large or if time or materials are limited, then the teacher may decide to have half of the students complete Part A of the investigation and the other half of the students complete Part B of the investigation.
- The teacher will have students work in pairs to complete the investigation. After the investigation is complete, pairs of students will “square” or pair up with another group of students to share results and discuss their learning.

Part A: The Angle of Sunlight

I. Problem: To demonstrate how the angle of rays from the sun can affect the temperature of the earth.

II. Materials:

1. two small containers, such as shoe box covers
2. two thermometers
3. sand or clean soil
4. book
5. brick



III. Procedure:

1. Put an equal amount of sand in each box cover.
2. Go outside on a sunny day and pick a spot in direct sunlight.
3. Place the book on the ground and lay one box cover filled with sand in the box.
4. The other box cover should be angled so that it is facing directly into the sunlight. Use the brick to help aim the box cover at the sun.
5. Put a thermometer into each container so that the bulb of the thermometer is buried in the sand.
6. Record the temperatures of the two thermometers and then wait 15 minutes and record the new temperature in the data bar below.

IV. Observations:

	Starting Temp.	Ending Temp.
Flat Box		
Angled Box		

- The teacher will have students “**pair square**” to dialogue about their observations with another pair of students. Students should record data after listening to each other’s responses.

Groups should discuss the following questions:

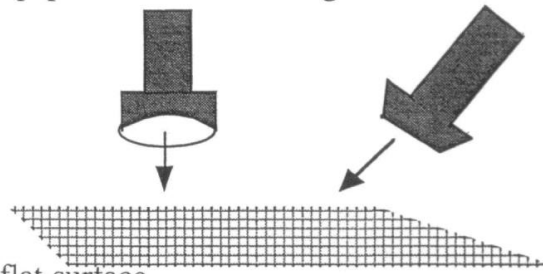
- What did you find out?
- How is the temperature affected by the angle?
- How does this compare to the tilt of the Earth on its axis?
- Based on your results, where on Earth would you expect the temperature to be hotter? Colder?

Part B: The Angle of Light

I. Problem: To compare the amount of light striking graph paper from a flashlight that is held straight above the paper and also at an angle.

II. Materials:

1. flashlight
2. graph paper
3. pencil



III. Procedure:

1. Place the graph paper on a flat surface.
2. Hold the flashlight thirty centimeters above the paper in such a way that it is shining straight down on the paper.
3. Observe the area lit brightly by the flashlight. Draw a circle around the squares that are in the light.
4. Repeat steps 2 and 3, but this time angle the flashlight at the paper.

IV. Observations:

Number of squares in the light

Flashlight straight above	
Flashlight at an angle	

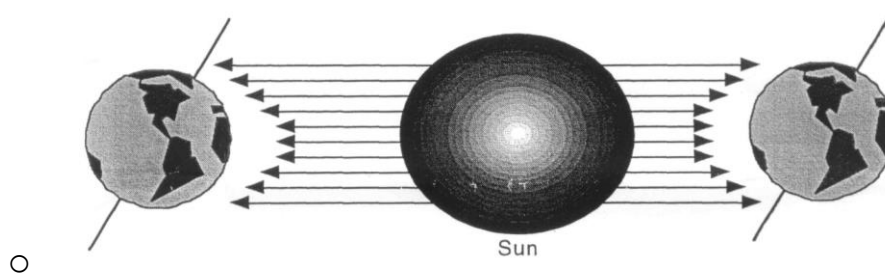
V. Conclusion: What did you find out?

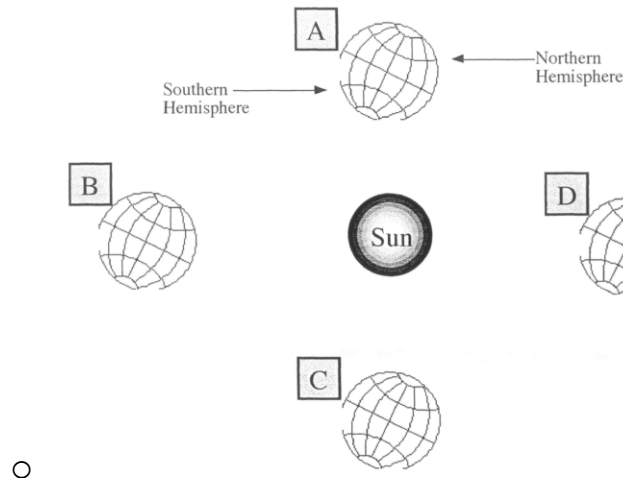
- The teacher will use the **Pairs Squared Strategy** to allow students to dialogue about their observations with a different pair of students.
 - What did you find out?
 - How is the amount of light affected by the angle?
 - How does this compare to the tilt of the Earth on its axis?
 - Based on your results, where on Earth would you expect the most light? The least?

- Assessment – Students complete a **Two Minute Paper**. The teacher provides each student with a half-sheet of paper three to five minutes before the end of the class period to record their thinking about the lesson. Tell the students they have two minutes to respond to the following questions:
 - What was the most important thing you learned today?
 - What did you learn today that you didn't know before class?

Explain

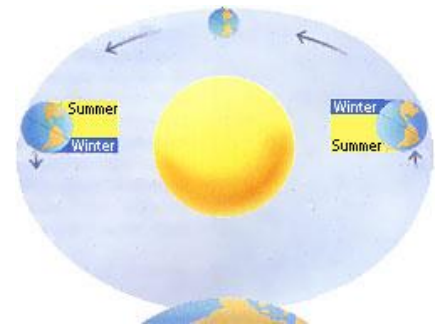
- Watch Exploring Weather: The Atmosphere in Motion video “The Sun and Weather” (6:48- 8:54) <https://www.youtube.com/watch?v=m7ieF7EklUA>
 - Why is the tilt of the earth the cause for seasons on our planet?
 - The North Pole and South Pole each have long periods of complete sunlight and complete darkness. Why?
- Access the article from <http://www.wrh.noaa.gov/fgz/science/season.php?wfo=fgz> . The teacher should Read Aloud the article and ask open ended questions while reading aloud to the students. The teacher should also have students examine the diagram so that they can develop a model at the end of the class period.
- Dialogue as a class about “How does the tilt of the Earth’s axis affect the length of the day and the amount of heating on Earth’s surface, thus causing the seasons of the year?” *The earth spins around an imaginary axis. A planet's axis is an imaginary line that goes through the North and South poles of the planet. It takes the earth 24 hours to spin around once on its axis. We call this a day. The earth's axis is tilted at 23.5 degrees. If the axis wasn't tilted, we would only have one season. Parts of the planet would receive the same amount of sunlight every day, so weather and climate would not change very much. Because the earth's axis is tilted, we have different seasons. As the earth orbits around the sun, the axis sometimes points toward the sun and sometimes away from the sun. When this happens, there are times when the Northern Hemisphere is receiving more light than the Southern Hemisphere. The Northern Hemisphere would be having spring or summer, while the Southern Hemisphere would be having fall or winter.*





- Seasons are the parts of the year called winter, spring, summer, and autumn, or fall. Each season lasts about three months. Each season brings changes in temperature, weather, and the length of daylight.

Image: The changing seasons are caused by the changing position of the Earth in relation to the sun. Credit: World Book illustration by Roberta Polfus



The changing seasons are caused by the changing position of the Earth in relation to the sun. Different parts of the Earth get different amounts of sunlight as the Earth travels around the sun. When the North Pole is slanted toward the sun, it is summer in the Northern Hemisphere -- the northern half of the Earth. The sun's rays shine on the Earth from a high angle, so northern areas get a lot of sunlight. At the same time, the South Pole is slanted away from the sun and it is winter in the Southern Hemisphere.

"Season." The World Book Student Discovery Encyclopedia. Chicago: World Book, Inc., 2005.

- http://www.nasa.gov/worldbook/wbkids/k_season.html

Assessment: Have students create a visual representation/**concept map** to explain how seasons caused by the Earth's tilt affects the length of the day and the amount of heating on the Earth's surface.

Extend

- Students make claims about how the tilt (small or large) of another planet in our solar system and that planet's orbit around the sun (closer to or further away than Earth) affect the seasons and provide evidence to support their claims.
Students research the length of seasons on other planets in our solar system to collect data.
Adapted from- http://education.nationalgeographic.com/education/activity/the-reason-for-the-seasons/?ar_a=1
- Sing a song about the seasons:
http://starchild.gsfc.nasa.gov/docs/StarChild/solar_system_level2/javascript/song.html
- Exploring Seasons:
http://www.classzone.com/books/ml_science_share/vis_sim/ssm05_pg41_seasons/ssm05_pg41_seasons.html

Teacher Reflections and Biographical Information

The biggest challenge is not implementing the strategies, but trying to choose the most appropriate strategy that will support the learning goal or objective. I have learned that choosing the right strategy can make or break a lesson. The more I used the strategies, the more confident I felt that I could select the best ones. There is no greater feeling of accomplishment than when your students are able to master a concept or standard. That's when you know that all your hard work and planning have made a difference.

Portions of this lesson originally appeared in the SC Standards Support System (S3) Curriculum. As a teacher in the IQ-MS project, I adapted it by supplementing additional disciplinary literacy strategies to support student understanding of the content.

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