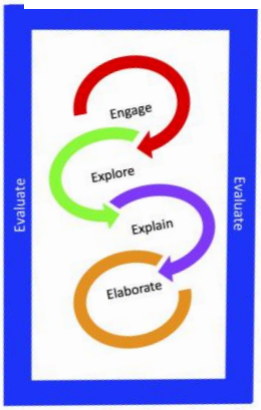
National Aeronautics and Space Administration

Guide Lites

Interactive Lesson: Seasons
Grades 3-5

NASA eClips™ Guide Lites are individual supplemental activities that are developed for formal and informal educational settings. Currently there are two types of Guide Lites:
1) excerpts from approved NASA eClips™ Educator Guides; and
2) targeted vocabulary lessons that help students confront science misconceptions addressed within NASA Spotlites, student-produced videos.

NASA eClips Guides use the "Five E" constructivist model developed by Roger Bybee. Constructivism is an educational philosophy that promotes student-centered learning where students build their own understanding of new ideas. The 5E instructional model consists of five sequential stages for teaching and learning: Engage, Explore, Explain, Extend (or Elaborate), and Evaluate.



- The ENGAGE stage piques student interest and gets them personally involved in the lesson, while pre-assessing prior understanding.
- The EXPLORE stage gets students involved in the topic, providing them with the opportunity to build their own understanding.
- The EXPLAIN stage provides students with an opportunity to communicate what they have learned so far and understand what it means. This lesson introduces vocabulary in context and confronts misconceptions.
- The EXTEND stage allows students to use their new knowledge and continue to explore its implications.
- The EVALUATION stage is for both students and teachers to determine how much learning and understanding has taken place.

This NASA eClips™ Guide Lites Interactive Lesson Plan is designed to support existing curriculum. The goal of this lesson is to correct a science misconception through watching a video (**Engage**), learning new vocabulary collectively, and participating in discussions (**Explore** and **Explain**). The suggested **Extend** activities are included to deepen conceptual understanding and can be used at the discretion of the teacher. The **Extend** activities will require additional instructional time.

The hyperlinks included in this document open PDFs or webpages and may perform differently based on the device being used. Links may have to be cut and pasted into a web browser to open. PDFs and other documents may need to be downloaded to view.

National Standards

Next Generation Science Standards

- Earth's Systems 3-ESS-2
  - Obtain and combine information to describe climates in different regions of the world.
- Space Systems 5-ESS1-2
  - Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.

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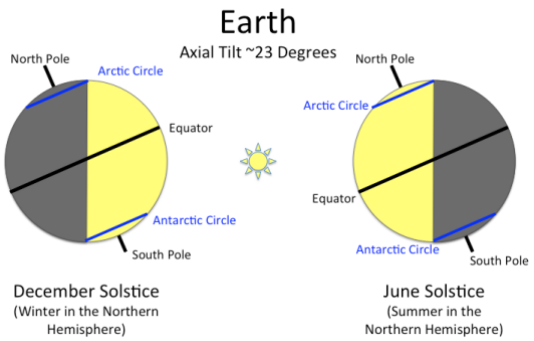
Student Misconception
Students incorrectly think Earth's seasons are caused by Earth's distance from the sun.

Objective
In this activity, students explain that Earth's seasons are caused by the tilt of Earth's axis combined with the position of Earth in its orbit around the sun as a result of watching the Spotlite video, learning the vocabulary collaboratively, and discussing the sun-Earth relationship.

Time Frame
Approximately 45 minutes (pretest, video review and discussion (20 minutes), collaborative vocabulary with Frayer Model (25 minutes), posttest. Additional time needed for completion of extension activities.

Materials:
Per student: copy of pretest and posttest (alternatively, these can be completed online)
Per small group: copy of Frayer Model (alternatively, these can be completed online)
Per classroom: chart paper for posting final vocabulary definitions

Background information:
- Earth's axis is tilted slightly at an angle that measures around 23 degrees.
- Seasons are caused by the tilt of Earth's axis.
- Sometimes the North Pole is tilted toward the sun allowing the sun's rays to directly strike the northern hemisphere.
- When the sun's rays hit Earth directly more heat and light energy are received on Earth than when the rays hit Earth at an angle.



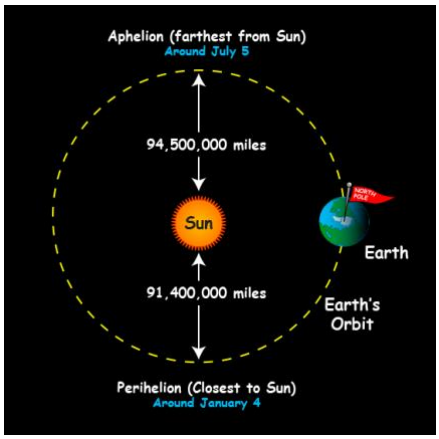


Image credit: https://blogs.nasa.gov/pluto/2015/10/23/a-planet-for-all-seasons/

Pre-Assessment
Probe for students' prior knowledge using one or both of these pre-assessments.

1. **Seasons** Pre / Post Test include in packet. For an electronic version use this link to view to the NASA Spotlite Interactive Lesson Plan – **Seasons** Pre / Post Test at ClassFlow: https://prod.classflow.com/classflow/#!/product/itemId=8f44f7b335d5482789593b651e396386

2. Discussion questions:
   - What causes the seasons on Earth?
   - What role does the tilt of Earth play in the changing seasons?

- What are solstices and equinoxes? How are they related to the seasons
- How are the amounts of heat and light received on Earth related to the angle of the sun's rays?

Engage

1. Ask students to watch the Spotlite video on seasons that can be found at the following link, https://youtu.be/nKTB9hFH6nc . After viewing the video, lead a discussion with students to identify the misconception addressed in the video.
   (Misconception: Seasons are caused by Earth's distance from the sun.)
2. Identify key vocabulary words and phrases in the video.
   (Examples: axis, tilt, revolution, orbit, season, Additional words should be added as needed.)

**These words, and other key vocabulary terms, can be found in the NASA eClips™ Virtual Vocabulary, https://nasaeclips.arc.nasa.gov/teachertoolbox/vocab.

Explore and Explain

Use the Frayer Model to help students develop a conceptual understanding of key vocabulary.

Using a digital interactive Frayer Model enables students to work collaboratively and simultaneously on the same digital document. Several digital Frayer models can be found at:

- ClassFlow: http://tinyurl.com/FrayerModelClassFlow
- PDF Filler: http://tinyurl.com/FrayeronPDFfiller
- Google Slides https://docs.google.com/presentation/d/1a8RaLcmOmSwlYxZBFPWHgbkoEZrJnnp5gicNeElXzjc/edit?usp=sharing

Implementation Note

Within the Frayer Model, students EXPLORE concepts through brainstorming and researching AND EXPLAIN and synthesize their understanding.

Example: Place the word ***axis*** in the center of the graphic organizer.

1. Facilitate a discussion with students exploring why this word is key vocabulary to this study.
2. **(EXPLORE):** Ask students to brainstorm *characteristics of* ***axis*** and add responses to the area with the corresponding heading on the graphic organizer.
3. Ask students to continue their exploration as they research the topic using a variety of resources including their textbook and notes.
4. **(EXPLAIN):** Next, ask students to add *examples* and *non-examples* in the Frayer model. *(Emphasize the higher-level thinking skill of comparing and contrasting. How are the examples alike/different than the non-examples?)*
5. Using the information provided, ask students to develop their own definition of the word ***axis*** that is clear and concise. An example to guide work is started below.
6. After completing the example together, assign a new vocabulary word to each group of students to work on collaboratively.
7. Groups will share their Frayer Models and lead discussions to check for understanding of each vocabulary word.
8. Compile final definitions and post so all students have access for later work.

Implementation Note

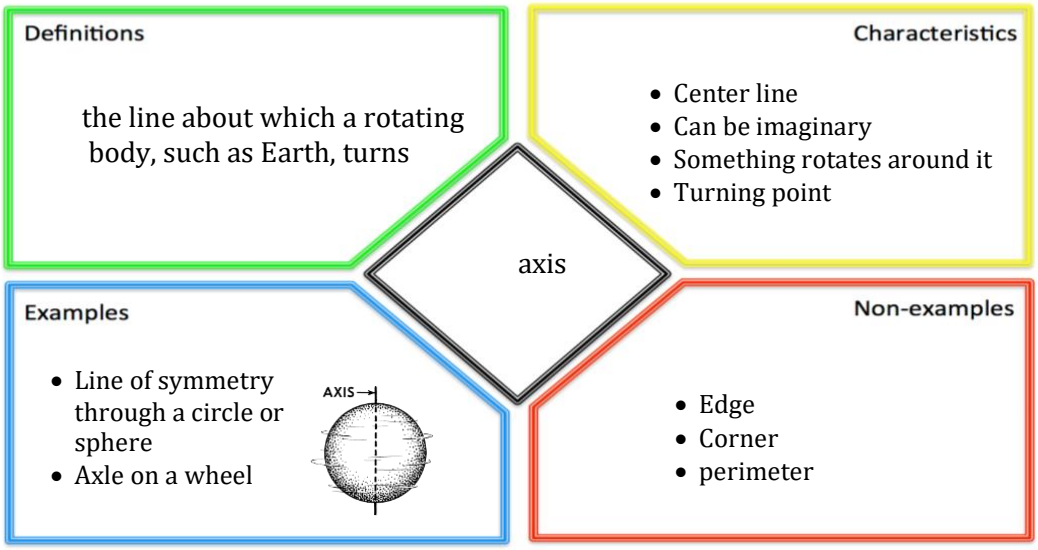
Doing this activity in pairs or teams builds students' collaboration skills.

Implementation Note

Developing their own definitions helps students build conceptual understanding.

Frayer Model for Vocabulary Development

Use the graphic organizer to write definitions, characteristics, examples and non-examples for a vocabulary word. You can include drawings, graphics, and diagrams.



Evaluate

Return to these discussion questions:

- What causes the seasons on Earth?
- What role does the tilt of Earth play in the changing seasons?
- What are solstices and equinoxes? How are they related to the seasons?
- How are the amounts of heat and light received on Earth related to the angle of the sun's rays?

Compare student responses to Pre-assessment and Evaluate questions to determine if students have a clear understanding of the vocabulary.

Use the *NASA Spotlite Interactive Lesson Plan – **Seasons** Pre / Post Test.*
https://prod.classflow.com/classflow/#!/product/itemId=8f44f7b335d5482789593b651e396386

Explore

For additional videos and activities to reinforce content and develop student understanding, visit the related web site linked to the NASA eClips™ video **Our World: Sun's Position.**
https://nasaeclips.arc.nasa.gov/video/ourworld/our-world-suns-position

Students learn that Earth heats more when the Sun is in the sky longer by comparing the temperature on thermometers left under a lamp for different lengths of time. Students collect data during the lab, then graph and analyze it. See the ***Adventures in the Attic*** **Educator Guide** lab activity on page 49.
https://sdo.gsfc.nasa.gov/assets/docs/Book2_resources.pdf

Extend

To extend students' understanding of the effects seasons have on animal migration and develop students' ability to construct explanations use the Globe Program storybook and activity *The Mystery of the Missing Hummingbirds.*
https://www.globe.gov/web/elementary-globe/overview/seasons/story-book

In this data analysis activity, students connect the idea of the tilt and orbit of the earth (changing of seasons) with monthly snow/ice data.
MY NASA DATA Lesson: Seasons
https://mynasadata.larc.nasa.gov/lesson-plans/my-nasa-data-lesson/?passid=114

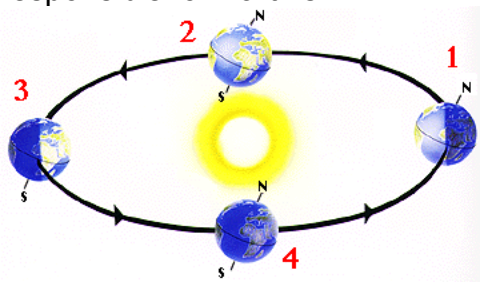
Frayer Model for Vocabulary Development

Use the graphic organizer to write definitions, characteristics, examples and non-examples for a vocabulary word. You can include drawings, graphics, and diagrams.

Seasons Grades 3-5 Pre / Post Test
NASA Spotlite Interactive Lesson

This assessment was designed for the interactive lesson plan featuring the student produced NASA Spotlite video Seasons. https://youtu.be/nKTB9hFH6nc

1. Study the diagram below. It shows the tilt of Earth and how Earth revolves around the sun. The tilt of Earth is responsible for Earth's –



A. revolution
B. seasons
C. eclipse
D. rotation

2. When the North Pole is tilted toward the sun, what are the sun's rays doing?

A. The sun's rays are **not** reaching the northern hemisphere.
B. The sun's rays are striking the northern hemisphere **indirectly** causing it to have summer.
C. The sun's rays are striking the northern hemisphere **directly** causing it to have summer.
D. The sun's rays are striking the northern hemisphere **directly** causing it to have winter.

3. More heat is produced when the sun's rays hit Earth _____, than when they hit at an angle.
A. Randomly
B. Directly
C. Indirectly
D. Occasionally

4. What is important in determining Earth's seasons?

A. The tilt of Earth's axis and revolution around the sun.
B. Only Earth's revolution around the sun
C. Earth's rotation and distance to the sun
D. Only Earth's distance to the sun

5. The picture below shows Earth spinning on its axis. This is called-

A. revolution
B. orbit
C. rotation
D. seasons

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https://prod.classflow.com/classflow/#!/product/itemId=8f44f7b335d5482789593b651e396386

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NASA Spotlite Interactive Lesson

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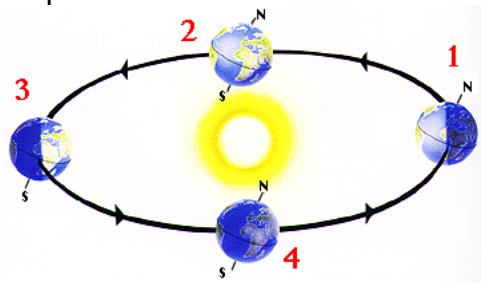

A. revolution
B. seasons
C. eclipse
D. rotation

2. When the North Pole is tilted toward the sun, what are the sun's rays doing?

A. The sun's rays are not reaching the northern hemisphere.
B. The sun's rays are striking the northern hemisphere indirectly causing it to have summer.
C. The sun's rays are striking the northern hemisphere directly causing it to have summer.
D. The sun's rays are striking the northern hemisphere directly causing it to have winter.

3. More heat is produced when the sun's rays hit Earth _____, than when they hit at an angle.
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4. What is important in determining Earth's seasons?

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A. revolution
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D. seasons