# Earth's Motion

*Grade(s): 5*
*Lesson Duration: Class 45 min/ 5x per week (about two weeks)*
*Course Name(s): General Science*
*Lesson Author: Alyssa Zollinger/ NJ/ 5th grade*

## BIG IDEAS

In this lesson, students will explore shadows and the cause for day and night. They will complete various hands-on activities that allow them to develop information to construct their answer for the cause of day and night. Students will then use this information to develop graphical representations of the data to explain the patterns they observe about the amount of daylight throughout the year. Finally, students will be assessed on their ability to apply their knowledge to a new set of data. Students will receive data on the amount of daylight in the South Pole and will be asked to explain why they believe the South Pole goes through periods of darkness and full daylight.

## EDUCATION STANDARDS

NGSS Performance Expectation(s):

*5-ESS1-2 Represent data in graphical displays to reveal patterns of daily changes in the length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.*

| Science and Engineering Practices: | Disciplinary Core Ideas: | Crosscutting Concepts: |
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| **Analyzing and Interpreting Data**<br><br>Analyzing data in 3–5 builds on K–2 experiences and progresses to introducing quantitative approaches to collecting data and conducting multiple trials of qualitative observations. When possible and feasible, | **ESS1.B:** Earth and the Solar System  The orbits of Earth around the sun and of the moon around Earth, together with the rotation of Earth about an axis between its North and South poles, cause observable patterns. These include day and | **Patterns**<br><br>Similarities and differences in patterns can be used to sort, classify, communicate and analyze simple rates of change for natural phenomena. (5-ESS1-2) |

| digital tools should be used.<br><br>● Represent data in graphical displays (bar graphs, pictographs and/or pie charts) to reveal patterns that indicate relationships. (5-ESS1-2) | night; daily changes in the length and direction of shadows; and different positions of the sun, moon, and stars at different times of the day, month, and year. (5-ESS1-2) | |

**Common Core State Standards**:

**Math:**
• MP.2 Reason abstractly and quantitatively. (5-ESS1-1),(5-ESS1-2)
• MP.4 Model with mathematics. (5-ESS1-1),(5-ESS1-2)
  ● 5.G.A.2 Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation. (5-ESS1-2)

**ELA:**
• SL.5.5 Include multimedia components (e.g., graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes. (5-ESS1-2)

## MEASURABLE STUDENT LEARNING OBJECTIVES
Students will be able to use data to develop a graph to help explain patterns with shadows, day and night, and the seasonal appearance of stars.

## MATERIALS NEEDED
- Chromebooks
- Headphones
- *https://www.nasa.gov/analogs/nsf/sunrise_sunset*
- https://spaceplace.nasa.gov/
- https://www.scootle.edu.au/ec/viewing/L756/index.html?authuser=0
- https://drive.google.com/file/d/1QkjXa6pYxF3ha_ZrtkwFHLrIazkxsmlf/view?usp=sharing
- https://www.sunrisesunset.com/USA/
- *https://earthobservatory.nasa.gov/blogs/eokids/wp-content/uploads/sites/6/2019/04/16_SunSeasons-508.pdf*
- *https://www.youtube.com/watch?v=cDed5eXmngE*
- *https://www.youtube.com/watch?v=6SzjlsuyTdk*
- *https://www.readworks.org/article/The-Movement-of-the-Earth/9d51ea2a-8ddb-4d96-b252-c7*

## ENGAGING CONTEXT/PHENOMENON

Part of the introduction will include a picture of a tree at different times of the day. Students will observe the changes to the shadow and share with the class what they are now wondering. The next part will be showing a clip of the sun rising and setting. Students will share what they observed and are wondering. The last clips will be about Alaska in the Winter and in the Summer. This usually leads to the students asking "why is this happening?"

## DATA INTEGRATION

Students are collecting data at various points of the unit and using the data to develop their understanding of shadows and day and night. Students begin the unit analyzing their own shadows at different times throughout the day. By the end of the unit, students will be using the average monthly daylight hours data. They will take the data and develop a bar graph where they will look for patterns and use the information they learned to explain why the amount of daylight varies. The last part of the lesson will have students analyze the average amount of daylight at the South Pole. Students will use what they know to explain the patterns they observe.

## DIFFERENTIATION OF INSTRUCTION

Consider adding pictures to the directions to help support ELL and Dyslexic students who may have difficulty reading on their own. Allow students to use a calculator when doing math equations.

## POSSIBLE PRIOR or MISCONCEPTIONS

The Sun moves around us to create Day and Night
The Earth is straight up and down

## LESSON PROCEDURE

| 5E | Details of 5E Lesson Implementation (Visit BSCS to learn more about the 5E instructional model) |
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| **Engage** *45 mins* | **Lesson Objective:** Students will be able to use data to develop a graph to help explain patterns with shadows, day and night, and the seasonal appearance of stars. <br><br> **Procedure:** <br> 1. Show students the phenomenon video. Here students will be asked to observe a portion of the video and then jot down what they observe and what they are wondering. <br> 2. Allow students to generate their questions about the shadows and day and night. <br> 3. After discussion, tell students we will be learning about what causes shadows to change throughout the day and what causes day and night. <br><br> **Modifications** |

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| | Directions read a loud<br><br><br>**Standards Addressed**<br>● *5-ESS1-2 Represent data in graphical displays to reveal patterns of daily changes in the length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.*<br>●<br>**Formative Assessments**<br>Students worksheet<br>Class discussion<br><br>**Resources**<br>**Pheneonmenon Video** |
| **Explore**<br>*45 mins X2* | **Lesson Objective:** Students will be able to use data to develop a graph to help explain patterns with shadows, day and night, and the seasonal appearance of stars.<br><br>**Procedure:**<br>Day 1: Tracing Shadows<br>Today students will go outside to trace their shadows at various times throughout the day. Make sure that students stand in the same spot every time they go outside to ensure that they can see the changes in their shadows. Have students write down their observations about any changes that may occur. Consider picking a morning time between 8 am and 10 am, noon, then an afternoon around 2 pm. This will help to ensure that students will see that their shadow moves based on the location of the sun.<br><br>Have students share their observations and why they think these changes are occurring.<br><br><br>Day 2:<br>Today students will complete a computer simulation where they will explore shadows and what is causing them. Students will go to https://www.scootle.edu.au/ec/viewing/L756/index.html?authuser=0 To open up the interactive activity. Students will jot down important information as they learn new things. Students will explore how shadows move at various times throughout the day. Students will have to match the shadow with where the sun is located.<br><br>**Modifications**<br>Teacher prompting<br>Reading the directions aloud<br>Extra Time<br><br><br>**Standards Addressed**<br>● *5-ESS1-2 Represent data in graphical displays to reveal patterns of daily changes in the length and direction of shadows, day and* |

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| | *night, and the seasonal appearance of some stars in the night sky.*<br><br>**Formative Assessments:**<br>**Class discussions**<br>**Student predictions/ observations**<br><br><br>**Summative Assessments**<br>Lab sheet from Day 2<br><br>**Resources**<br>https://www.scootle.edu.au/ec/viewing/L756/index.html?authuser=0<br>https://drive.google.com/file/d/1QkjXa6pYxF3ha_ZrtkwFHLrlazkxsmlf/view?usp=sharing |
| **Explain**<br>*45 mins X2* | **Lesson Objective:** Students will be able to use data to develop a graph to help explain patterns with shadows, day and night, and the seasonal appearance of stars.<br><br><br>**Procedure:**<br><br>Students will be taking part in a Webquest activity where they will be watching videos, reading articles, and gathering information to help them understand shadow patterns and why we experience day and night.<br><br>Students will use various sources to answer the following questions:<br>1. Define revolution and rotation.<br>2. How long is one Earth rotation?<br>3. What does rotation cause?<br>4. How long is one Earth Revolution?<br>5. What does the revolution cause?<br><br>On their lab sheet, students will develop two models to help explain the causes of Day and Night.<br><br>6. Using the information you gathered what does day and night look like at the poles? Why is it different from what we experience?<br>7. Using what you learned about rotation and revolution, why does it seem that our shadows move throughout the day?<br><br>Students will also be able to utilize their textbooks to gather additional information about the tilt of Earth's axis and the causes of seasons.<br><br>**Modifications**<br>Mixed media (videos and reading)<br>Read text materials aloud (Teacher or partner)<br>Frequent check-ins<br>Small group support to help find the answers<br>Subtitles on videos |

**Standards Addressed**
- *5-ESS1-2 Represent data in graphical displays to reveal patterns of daily changes in the length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.*
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**Formative Assessments**
Class discussions
Small group discussions
Teacher observation

**Summative Assessments**
WebQuest Worksheet
Model of rotation and revolution

**Resources**
https://earthobservatory.nasa.gov/blogs/eokids/wp-content/uploads/sites/6/2019/04/16_SunSeasons-508.pdf
https://www.youtube.com/watch?v=cDed5eXmngE
https://www.youtube.com/watch?v=6SzjlsuyTdk
https://www.readworks.org/article/The-Movement-of-the-Earth/9d51ea2a-8ddb-4d96-b252-c7e5c12a2c4b#!articleTab:content/
https://spaceplace.nasa.gov/seasons/en/

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## Elaborate
*45 mins X1-2*

**Lesson Objective:** Students will be able to use data to develop a graph to help explain patterns with shadows, day and night, and the seasonal appearance of stars.

**Procedure:**
1 Students will go to https://www.sunrisesunset.com/USA/ . They will be asked to record the amount of daylight for each month. Students will be asked to convert hours into minutes. They will use this data to develop a bar graph. From here students will answer various questions about the data.
- How does the amount of daylight change throughout the day?
- Which months have the most daylight? Which months have the least daylight? Why do you think this is?
- Is there a relationship between the amount of daylight and the seasons?

**Modifications**
Read directions aloud
Use of a Calculator
Provide a visual example of converting hours into mins
Extra time
Assist with setting up the graph

**Standards Addressed**
- 5.G.A.2 Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the

situation. (5-ESS1-2)

- *5-ESS1-2 Represent data in graphical displays to reveal patterns of daily changes in the length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.*

**Formative Assessments**
**Teacher observations**
**Class discussions**

**Summative Assessments**
Daylight Graphing and Questions

**Resources**
https://www.sunrisesunset.com/USA/

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**Evaluate**
*45 mins*

**Lesson Objective:** Students will be able to use data to develop a graph to help explain patterns with shadows, day and night, and the seasonal appearance of stars.

**Procedure:**
- Teacher will go over the directions to their assessment.
- Students will be asked to analyze the South Pole Sunlight data from the website provided. They will then type up their answer to the following question.
    - Using what you know about day and night patterns, why do you think the South Pole would have such extreme daylight and night patterns? Why would the South Pole have such different daylight patterns than us in NJ?
- Students will be working independently and will have the entire class (40 mins) to construct their answer. Students will be expected to construct a detailed response about a paragraph in length that discusses rotation/ revolution, why daylight patterns are different from NJ
- EARLY FINISHERS: Students who finish the assignment early can explore NASA Space Kids.

**Modifications**
Teacher will need to help some students read the data in order for them to understand what they are observing.

**Standards Addressed**
- SL.5.5 Include multimedia components (e.g., graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes. (5-ESS1-2)

- *5-ESS1-2 Represent data in graphical displays to reveal patterns of daily changes in the length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.*

**Formative Assessments:**

|  | ● **Teacher observation**<br>● **Class discussions**<br>● **Student reflection of the objective**<br><br>**Summative Assessments**<br>● **Student completion on Lab Sheet**<br><br>**Resources**<br>*https://www.nasa.gov/analogs/nsf/sunrise_sunset*<br>*https://spaceplace.nasa.gov/* |
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# REFERENCES