



# **Stackable Instructionally- embedded Portable Science (SIPS) Assessments Project**

**Grade 5 Science**

**Unit 4 Instructionally-embedded Assessment Task Specification Tool:**

**“How Does My Constellation Move?”**

**Earth and Its Gravitational Force and Motion**

**September 2023**

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<b>Grade 5</b>	<b>Unit 4</b>	<b>Instructional Segment 4</b>	<b>Task Title: How Does My Constellation Move?</b>
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**Unit 4 Title: Earth and Its Gravitational Force and Motion**

<b>Anchor Phenomenon</b>	<b>Problematization/Investigative Strategy for the Unit</b>
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In this unit, the anchor phenomenon is centered around observations of what is in the sky. As an example, the unit engages students with the astronomical studies of Indigenous cultures from around the world to encourage students to consider how different cultures engage with astronomy and the stars. The teacher can find a variety of resources online; one example of Indigenous astronomy can be found at [Native Skywatchers](#). The teacher may also want to consider contacting local tribal agencies, tribal cultural departments, or intertribal agencies for localized information. Links to additional resources are also included in the materials at the end of the instructional framework.

Alternative anchoring phenomena can be selected by the teacher, such as having students "look up" outside to start their thinking and generate observations about that day's sun, moon, and/or their evening's stars, moon, and satellites/space station.

Using constellations from diverse backgrounds as inspiration, students develop their own constellations and stories from their own local night sky. (Students may use a digital planetarium if they cannot go out after dark.) Students generate questions about their constellations, the sun, and the stars' apparent movements across the sky.

**Segment 4 Overview**

By engaging in the practices of engaging in argument from evidence, planning and carrying out investigations, and analyzing and interpreting data, students learn how the position of the sun and the orbit of the moon around the Earth explains its four phases. They also learn about how the Earth's tilt and rotation around the sun affect daily and seasonal patterns. Students are able to revisit the anchoring phenomenon of the observation of the sky and use the data they have gathered as evidence of why they see different stars at different times of the year.

Assessments for this segment focus on Big Idea 3 which has students engage in argument from evidence and analyze and interpret data to understand patterns in the sky throughout the year. Students are informally assessed on what causes sunrise and sunset and the role of Earth's rotation in daily observations of the sky. Students are formally assessed on their ability to analyze and interpret data and engage in arguments about how the length of day changes in a chosen location as well as the visibility of constellations throughout the year.

Lesson Title(s)	Lesson Description(s)
How Does My Constellation Move?	<p>In this activity, students conduct an investigation to gather data about how their star moves in the sky and how they can chart it out using <a href="#">Stellarium</a>. Students use the azimuthal grid to plot lines across the sky. The teacher shows students how in between each direction (N, S, E, W) there are 6 boxes in each row, with 4 rows up and 4 rows down (removing the landscape so students can see below the horizon). Students plot the location of stars on sheets of grid paper, connecting the dots to help show the movement of the stars around the sky.</p> <p>Students analyze the data they have collected and answer discussion questions that help to guide them to see that every year the constellations have returned to the same place.</p> <p>Next, the teacher places a basketball or other object in the center of the classroom, gymnasium, or open area to represent the sun. Then, students stand in a circle around the ball; they will represent Earth. The teacher asks students, “If we were observing the stars, where would the sun be?” (behind us). Students turn so the sun is at their back, with their hands left and right of their eyes (limits their peripheral view). Students draw a picture of what they see directly in front of them. Next, students turn to face the person to their right, so they are all facing the back of someone in a circle. (It may help to mark out a circle on the floor.) Students take several steps around the circle, about <math>\frac{1}{4}</math> of the way. Students turn with their back to the “sun” and make another observation and drawing. The class repeats these three more times, so the last observation is at the same location as the first.</p> <p>The teacher facilitates a class discussion about the evidence collected during this learning investigation. As students discuss, the teacher uses prompts to help students recognize that the constellations change over a year, but repeat, and that this is similar to what they saw when revolving around the “sun.”</p> <p><u>What Students Figure Out</u></p> <p>Students return to their model of the sun and Earth and modify their model and explanation to incorporate the evidence that the Earth revolves around the sun while rotating. Students make changes and share their thinking with peers who give them feedback before finalizing their model.</p>
Formal Assessment Title	Assessment Description
How Does My Constellation Move?	<p>In this task, students design an experiment to gather information on the movement and patterns of their constellation. Using a simulated sky, such as <i>Stellarium</i>, students gather data on the position of their constellations over several years, using tools within the simulation to measure the position. Students plot the position of their constellation over time and create representations to show how the constellation moves and eventually moves back to the same position in the sky. Students analyze their data and use their data to answer questions about the motion of celestial objects and make connections to the Earth revolving around the sun.</p>

## NGSS PE(s) Code(s) & Description(s)

**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. *[Clarification Statement: Examples of patterns could include the position and motion of Earth with respect to the sun and selected stars that are visible only in particular months.] [Assessment Boundary: Assessment does not include causes of seasons.]*

## AG(s) Code(s) & Description(s)

**A17.** Analyze and interpret data on the visible constellations at a location to determine if some constellations are visible throughout the year.

**A18.** Engage in argument from evidence on why some constellations are visible at a location only at some part of the year.

## Evidence Statement(s)

- Describe patterns in data to determine if some constellations are visible throughout the year.
- Represent data about the visibility of constellations to determine if some constellations are visible throughout the year.
- Use data to support conclusions about whether or not some constellations are visible throughout the year.
- Identify evidence that supports an explanation that some constellations are visible throughout the year.

## Phenomenon or Phenomenon-rooted Design Problem

- Students explore patterns in the visibility of constellations. They use data to identify patterns and make a prediction related to the appearance of some stars and/or constellations in the sky all year while others appear only at certain times of the year.

## General Scenario Description

Students explore patterns of movement of objects in the day and night sky and relate those observations to Earth's rotation on its axis, revolution around the sun, and position in the galaxy.

## Chain of Sensemaking

- Interpret the lyrics of an African-American folk song with regard to the positions of objects in the sky.
- Use the lyrics of the folk son and a Native American story about Ursa Major, which includes the Big Dipper, to complete a representation showing the seasonal pattern of the appearance of the Big Dipper in the night sky as viewed from the Northern Hemisphere.
- Use a bar graph showing the measured angle of a visible star over time to identify a pattern and make a prediction.
- Develop an explanation with evidence about why the patterns of movement of objects in the day and night sky can be predicted and explained by Earth's rotation on its axis, revolution around the sun, and position in the galaxy.

## Work Products

- Short Answer
- Constructed response
- Complete a model
- Interpretation of a graph
- Selected-response

## Application of Universal Design for Learning-based Guidelines to Promote Accessibility (<https://udlguidelines.cast.org/> )

Multiple Means of Engagement	Multiple Means of Representation	Multiple Means of Action & Expression
<ul style="list-style-type: none"><li><input checked="" type="checkbox"/> Context or content</li><li><input checked="" type="checkbox"/> Age appropriate</li><li><input checked="" type="checkbox"/> Appropriate for different groups</li><li><input checked="" type="checkbox"/> Makes sense of complex ideas in creative ways</li><li><input checked="" type="checkbox"/> Vary the degree of challenge or complexity within prompts</li></ul>	<ul style="list-style-type: none"><li><input checked="" type="checkbox"/> Provide visual diagrams and charts</li><li><input checked="" type="checkbox"/> Make explicit links between information provided in texts and any accompanying representation of that information in illustrations, equations, charts, or diagrams</li><li><input checked="" type="checkbox"/> Activate relevant prior knowledge</li><li><input type="checkbox"/> Bridge concepts with relevant and simple analogies and limited use of metaphors</li><li><input checked="" type="checkbox"/> Highlight or emphasize key elements in text, graphics, diagrams, formulas</li><li><input checked="" type="checkbox"/> Use outlines, graphic organizers, unit organizer routines, concept organizer routines, and concept mastery routines to emphasize key ideas and relationships</li><li><input checked="" type="checkbox"/> Give explicit prompts for each step in a sequential process</li></ul>	<ul style="list-style-type: none"><li><input checked="" type="checkbox"/> Solve problems using a variety of strategies</li><li><input checked="" type="checkbox"/> Sentence starters</li><li><input checked="" type="checkbox"/> Embed prompts to “show and explain your work”</li></ul>

## Targeted PE(s) Code(s) and Alternate Conception(s)

- **NGSS PE: 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. **[Clarification Statement: Examples of patterns could include the position and motion of Earth with respect to the sun and selected stars that are visible only in particular months.] [Assessment Boundary: Assessment does not include causes of seasons.]**
  - **Common Alternate Conceptions**
    - Celestial objects orbit around a stationary Earth.

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- The pattern of the visible stars does not change throughout the night.
  - Stars are only around at night and the Sun is only around during the day.
  - Everyone on Earth experiences day/noon/night at the same time.
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#### **Unit 4 Vocabulary**

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- Constellation
  - Orbit
  - Star
  - Big Dipper
  - Polaris
  - Axis
  - Rotation
  - Revolve
  - Gravity
  - Ursa Major
  - Ursa Minor
  - Dubhe
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