



Stackable Instructionally- embedded Portable Science (SIPS) Assessments Project

Grade 8 Science

Unit 2 Instructionally-embedded Assessment Task Specification Tool:

“Comparing Our Model to Other Models”

Gravity and Motion of Objects in the Solar System

June 2023

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SIPS Grade 8 Unit 2 Instructionally-embedded Assessment Task Specification Tool

Grade 8	Unit 2	Instructional Segment 2	Task Title: Comparing Our Model to Other Models
Unit 2 Title: Gravity and Motion of Objects in the Solar System			
Anchor Phenomenon		Problematization/Investigative Strategy for the Unit	
In this unit, the anchor phenomenon is based on the shared experience that the class will have by viewing a video that introduces the James Webb Space Telescope (JWST). The teacher can problematize this for students by setting up the general questions of “What forces make it possible for the JWST to move as it did in the video?” and “Why can’t the JWST move in a straight-line path after launch?”		If we want to understand our solar system, we’ll need to research objects in our solar system and the Milky Way galaxy in the universe. We’ll need to understand the apparent motion and patterns of objects in the sky that can be observed. What are the connections between gravitational forces, masses of objects, and orbital motion of objects? What causes eclipses, the seasons, and lunar phases?	
Segment 2 Overview			
<p>By engaging in the practices of developing and using models, analyzing and interpreting data, obtaining, evaluating, and communicating information, and constructing arguments and explanations using evidence, students learn that cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons can be observed, described and predicted and that analysis and interpretation of data can be used to determine the scale properties of objects in the solar system. Students begin the segment by constructing a model of the solar system based on their current understanding and use it to attempt to explain phases, seasons, and eclipses. Students collect astronomical data using Stellarium – a tool to observe the position of the sun and moon on different days of the year to gather data to revise their model to better explain lunar phases and eclipses. Students explore climatological data and daylight hours, using this data to revise their model to better explain seasons. Finally, students compare their explanations to the “field” by researching other models, identifying the limitations of their model, and then considering any final modifications to their model.</p> <p>Assessments for this segment focus on students’ ability to use patterns, obtain and interpret data, and construct models and explanations to show how the tilt of the Earth causes different parts of the planet to receive varied amounts of energy over the course of the year, to identify relationships between the position of the Earth and the amount of sunlight received, and to explain seasonal cycling of temperatures and solar and lunar eclipses. Students are informally and formally assessed on their ability to obtain data and construct models to describe and construct explanations about patterns of the Earth-sun-moon system.</p>			
Lesson Title		Lesson Description	
Comparing Our Model to Other Models		Having worked on and refined their models, students shift to looking at others’ models and make comparisons between others’ models and their own. To find other models to consider, students can read core text, explore digital resources curated by the teacher, or conduct their research to find	

explanations of seasons, eclipses, phases of the moon, and the movement of the sun and moon across the sky.

Resources:

- [Why Do We Have Different Seasons? | California Academy of Sciences - YouTube](https://www.youtube.com/watch?v=WgHmqv_-UbQ)
[https://www.youtube.com/watch?v=WgHmqv_-UbQ]
- [Our World: Sun's Position - YouTube](https://www.youtube.com/watch?v=D0IrsXkz3I4)
[https://www.youtube.com/watch?v=D0IrsXkz3I4]
- [The Earths Tilt - YouTube](https://www.youtube.com/watch?v=e9MU4TouzII)
[https://www.youtube.com/watch?v=e9MU4TouzII]
- [Moon Phases: Crash Course Astronomy #4 - YouTube](https://www.youtube.com/watch?v=AQ5vty8f9Xc)
[https://www.youtube.com/watch?v=AQ5vty8f9Xc]

Students make additional revisions to their model after examining other models and explain any limitations to their model and how it does or does not explain natural phenomena related to the Earth-sun-moon system. Students use this opportunity as a last round of revisions before revisiting the list of questions at the start of the segment.

Formal Assessment Title	Assessment Description
Comparing Our Model to Other Models	This is the culminating assessment for Segment 2 in which students review and evaluate other models that provide explanations about the Earth-sun-moon system. Students revise their explanations about how changing amounts of solar energy result in the seasonal cycling of temperature.
NGSS PE(s) Code(s) & Description(s)	
MS-ESS1-1. 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. [Clarification Statement: Examples of models can be physical, graphical, or conceptual.]	
AG(s) Code(s) & Description(s)	
A7. Construct a model of Earth within the Earth-sun system that includes the tilt of Earth and that accounts for the seasonal variation in the amount of sunlight.	
A8. Construct an explanation of the relationship of the amount of solar energy in terms of Earth's position within its orbit around the sun.	
A10. 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.	

Evidence Statement(s)

- Use models to show how the change in season at a given place on Earth is directly related to the orientation of the tilted Earth and the position of Earth in its orbit around the sun.
 - Describe the relevant relationships between components shown in an Earth-sun model showing how the tilt of Earth accounts for the seasonal variation in the amount of sunlight.
 - Develop a model of Earth within the Earth-sun system that includes the tilt of Earth and accounts for the seasonal variation in the amount of sunlight.
 - Identify the evidence that supports a claim related to the relationship of the amount of solar energy reaching Earth in terms of Earth's position within its orbit around the sun.
 - Construct an explanation to support a claim related to the relationship of the amount of solar energy reaching Earth in terms of Earth's position within its orbit around the sun.
 - Develop and use a model to describe the cyclic patterns of lunar phases and eclipses of the sun and moon, and to describe the seasons.
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Phenomenon or Phenomenon-rooted Design Problem

- The Earth-sun System including the rotation of Earth around the sun, the Earth's tilt, seasonal variations in the amount of sunlight, and the angle of sunlight striking Earth's surface affects the amount of sunlight and solar radiation that specific locations on Earth receive.
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General Scenario Description

Students are taking on the role of an expert to locate and design solar farms. A city council is seeking recommendations to inform their decision about where and how to locate a solar farm and solar panels to ensure that sufficient electricity can be generated to meet the community's energy needs over a year.

Chain of Sensemaking

- Students are presented with a flawed Earth-sun system model prepared by the city council.
 - Students develop a correct model showing the Earth-sun system to represent each season in the Northern Hemisphere.
 - Students use provided science ideas with respect to Earth's tilt and its effect on the sunlight striking the ground directly or indirectly and the corrected model to explain the potential amount of electricity generated throughout the year vs summer to the city council.
 - Students explain to the city council the reason why their solar farm will likely generate the most electricity in summer.
 - Students used provided data to identify a pattern between the latitude and daily average solar insolation per year.
 - Students use provided data and knowledge of key science concepts to support an explanation about how the pattern between the latitude and the daily average per year of solar insolation is related to the shape of Earth.
 - Students recommend and explain to the city council how to best position (i.e., angle) their solar panels and explain their recommendation using their knowledge of the Earth-sun system.
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Work Products

- Model
- Short-constructed response
- Extended 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"><input checked="" type="checkbox"/> Context or content<input checked="" type="checkbox"/> Age appropriate<input checked="" type="checkbox"/> Appropriate for different groups<input checked="" type="checkbox"/> Makes sense of complex ideas in creative ways<input checked="" type="checkbox"/> Vary the degree of challenge or complexity within prompts	<ul style="list-style-type: none"><input type="checkbox"/> Provide visual diagrams and charts<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<input checked="" type="checkbox"/> Activate relevant prior knowledge<input type="checkbox"/> Bridge concepts with relevant and simple analogies and limited use of metaphors<input type="checkbox"/> Highlight or emphasize key elements in text, graphics, diagrams, formulas<input type="checkbox"/> Use outlines, graphic organizers, unit organizer routines, concept organizer routines, and concept mastery routines to emphasize key ideas and relationships<input checked="" type="checkbox"/> Give explicit prompts for each step in a sequential process	<ul style="list-style-type: none"><input checked="" type="checkbox"/> Solve problems using a variety of strategies<input checked="" type="checkbox"/> Sentence starters<input checked="" type="checkbox"/> Embed prompts to “show and explain your work”

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

- **NGSS PE: MS-ESS1-1.** 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. [Clarification Statement: Examples of models can be physical, graphical, or conceptual.]
 - **Common Alternate Conceptions**
 - The “dark side” (or far side) of the Moon does not receive light from the sun.
 - All objects within the solar system orbit on the same plane.
 - The distance between Earth and the sun is the primary cause of seasons.

Unit 2 Vocabulary

- Earth-sun system
 - Orbit
 - Elliptical orbit
 - Axis
 - Tilt (in relation to an axis)
 - Rotation versus revolution
 - Solar energy
 - Solar radiation
 - Solar insolation
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