Stackable Instructionally-embedded Portable Science (SIPS) Assessments Project

Grade 8 Science

Unit 2 Task 2 Specification Tool & Verification of Alignment

Gravity and Motion of Objects in the Solar System

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SIPS Grade 8 Unit 2 Task 2 Specification & Verification of Alignment

Grade: 8	Unit: 2	Task Number: 2	Task Title: Earth, Moon, and Sun

NGSS Performance Expectations

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.]

Phenomena or Phenomena-rooted Design Problem

- Phenomena associated with the timing and appearance of the patterns of movement of the Moon, Sun, and other objects in the sky. Such as changes that model the amount of the moon's surface that is illuminated over the lunar cycle based on the positions of the sun, moon, and Earth relative to each other.

Scenario/Context/Situation/Boundaries

- Scenario includes a situation in which students are to use a model to identify relationships between Earth's tilt on its axis of rotation and seasonal changes.
- Students are asked to identify and describe the role of Earth's axial tilt in causing seasons despite minimal change in the proximity to the sun.
- Scenario includes a situation in which students are to complete a model to identify the amount of the moon's surface that is illuminated over the lunar cycle based on the positions of the sun, moon, and Earth relative to each other.
- Students are asked to explain lunar phases in terms of the relative positions of the sun, Earth, and moon.

Variable Features to Shift Complexity or Focus

- Phenomenon addressed.
- Complexity of scientific concept(s) to be modeled.
- Format of "real-world" phenomenon under investigation: image, data, text, combination.
- Domain-specific vocabulary.
- Function of the model:
  - To explain a mechanism underlying a phenomenon.
  - To predict future outcomes.
  - To describe a phenomenon.
  - To generate data to inform how the world works.

General Description of Task / Chain of Sensemaking

- Students are asked to use a model to describe the spatial and temporal relationships in the Earth-sun system, including seasonal patterns of Earth. **[Prompt 1: MS-ESS1-1, KSA5]**
- Students are asked to complete a model that shows the cyclic pattern of the lunar phases. **[Prompt 2, Part A: MS-ESS1-1, KSA2]**
- Students are asked to explain cause-and-effect relationships that exist in the apparent motion of the sun and moon in the sky. **[Prompt 2, Part B: MS-ESS1-1, KSA8]**

Targeted PE-related KSAs

MS-ESS1-1, KSA5: Use a model to describe the seasonal patterns of Earth.

MS-ESS1-1, KSA2: Develop a model showing the lunar phases' cyclic pattern.

MS-ESS1-1, KSA8: Develop and/or use a model to make predictions of the cyclic patterns of lunar phases.

Cross-performance Expectations Related KSAs to Target

NA

Student Demonstrations of Learning

- Accurately depicts the pattern shown in the model.
- Model accurately represents the patterns of the phenomena.
- Model accurately displays the cause-and-effect relationship in the phenomena.
- Appropriateness of the description of the cause-and-effect relationship.

Work Products

- Complete a model.
- Constructed response.

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

Means of Engagement	Multiple Means of Representation	Multiple Means of Action & Expression
• Context or content. • Age appropriate. • Appropriate for different groups. • Makes sense of complex ideas in creative ways. • Vary the degree of challenge or complexity within prompts.	• Provide visual diagrams and charts. • Make explicit links between information provided in texts and any accompanying representation of that information in illustrations, equations, charts, or diagrams. • Activating relevant prior knowledge. • Highlight or emphasize key elements in text, graphics, diagrams, and formulas. • Use outlines, graphic organizers, unit organizer routines, concept organizer routines, and concept proficiency routines to emphasize key ideas and relationships. • Give explicit prompts for each step in a sequential process.	• Solve problems using a variety of strategies. • Sentence starters. • Embed prompts to "show and explain your work".

SIPS Assessments Complexity Framework Components

Prompt	**A.1** Degree and nature of sense-making about phenomena or problems			**B.1** Complexity of the presentation			**B.2** Cognitive demand of response development			**B.3** Cognitive demand of response production		
	Low	Moderate	High	Low	Moderate	High	Low	Moderate	High	Low	Moderate	High
1 Part A	**X**			**X**				**X**			**X**	
1 Part B	**X**			**X**			**X**			**X**		
1 Part C	**X**			**X**				**X**			**X**	
2 Part A		**X**			**X**		**X**			**X**		
2 Part B		**X**			**X**			**X**			**X**	

Rubric Considerations

- Correctness and/or appropriateness of the model.
- Sophistication of the explanations.

Assessment Boundaries

- Assessment does not include Kepler's Laws of orbital motion or the apparent retrograde motion of the planets as viewed from Earth.
- Assessment does not include phenomena that cause cycles of ice ages and other gradual climate changes.
- Students do not need to know Earth's exact tilt; sidereal and synodic periods; umbra and penumbra (the term "shadow" should be used); times of moonrise and moonset; precession; exact dates of equinoxes and solstices.

Common Misconceptions

- **MS-ESS1-1**
  - 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.

Possible Technical Terms for Task

- orbit, eclipse, tilt (in relation to an axis), rotation versus revolution, cyclic motion, Earth-sun-moon system, lunar phase, full moon, half moon, new moon

Common Core State Standards for Literacy

ELA/Literacy

- **SL.8. 5** Include multimedia components and visual displays in presentations to clarify claims and findings and emphasize salient points. **(MS-ESS1-1)**

Common Core State Standards for Mathematics

Mathematics

- **6.RP.A.1** Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. **(MS-ESS1-1}**
- **7.RP.A.2** Recognize and represent proportional relationships between quantities. **(MS-ESS1-1)**

Task Notes

SIPS Assessments Complexity Framework

	Component	Complexity		
		Low	Moderate	High
Connections to Curriculum and Instruction	**A.1 Degree and nature of sense-making about phenomena or problems**	• Requires one or two dimensions • One dimension may have a greater degree of emphasis than another • Requires previously learned ideas or concepts	• Requires integration of two dimensions in the service of sense-making • Requires integration of same or different combinations of dimensions as represented in the PE bundle • Requires a combination of previously learned ideas or concepts and newly presented information	• Requires integration of three dimensions in the service of sense-making • Requires integration of same or different combinations of dimensions as represented in the PE bundle • Requires a combination of previously learned ideas or concepts and newly presented information
Characteristics of the Tasks	**B.1 Complexity of the presentation**	• The amount and type of information provided in the scenario supports limited simple connections among ideas or concepts • Provides few, simple graphics/data/models • Includes definitions or examples • Phenomenon or problem presented in a concrete way with high level of certainty	• The amount and type of information provided in the scenario supports multiple evident connections among ideas or concepts • Provides graphics/data/models • Limited use of definitions or examples • Phenomenon or problem presented with some level of uncertainty	• The amount and type of information provided in the scenario supports multiple and varied complex connections among ideas or concepts • Provides complex graphics/data/models • Phenomenon or problem presented with high-degree of uncertainty
	B.2 Cognitive demand of response development	• Requires well-defined set of actions or procedures • Requires a connection or retrieval of factual information • Response requires a low level of sophistication with routinely encountered well-practiced applications	• Requires application of ideas and practices given cues and guidance • Requires drawing relationships and connecting ideas and practices • Response requires a moderate level of sophistication with typical but relatively complex representation of ideas and application of skills	• Requires selection and application of multiple complex ideas and practices • Requires high degree of sense-making, reasoning, and/or transfer • Response requires a high level of sophistication with non-routine or abstract representation of ideas and application of skills

B.3 Cognitive demand of response production	• Responses include selection from a small set of options presented as text (e.g., word, short phrase) or other formats (e.g., a simple graphic or process)	• Responses include one or more sentences or a paragraph, a moderately complex graphic, or multiple steps in a simple or moderately complex process	• Responses include multiple paragraphs, multiple graphics of at least moderate complexity, or multiple steps in a complex process