



Stackable Instructionally- embedded Portable Science (SIPS) Assessments Project

Grade 5 Science

Unit 4 Task 3 Specification Tool & Verification of Alignment

Earth and Its Gravitational Force and Motion

September 2023

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SIPS Grade 5 Unit 4 Task 3 Specification & Verification of Alignment

Grade: 5

Unit: 4

Task Number: 3

Task Title: Turn, Turn, Turn

NGSS Performance Expectations

5-ESS1-1 Support an argument that the apparent brightness of the sun and stars is due to their relative distances from the Earth. *[Assessment Boundary: Assessment is limited to relative distances, not sizes, of stars. Assessment does not include other factors that affect apparent brightness (such as stellar masses, age, stage).]*

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.]*

5-PS2-1 Support an argument that the gravitational force exerted by Earth on objects is directed down. *[Clarification Statement: “Down” is a local description of the direction that points toward the center of the spherical Earth.] [Assessment Boundary: Assessment does not include mathematical representation of gravitational force.]*

Phenomena or Phenomena-rooted Design Problem

- The task focuses on how people in ancient times used patterns in the motion of the moon, stars, and constellations to develop calendars and track time.

Scenario/Context/Situation/Boundaries

- The scenario is related to how ancient people used the patterns of constellations and the moon to develop the basis of the calendar we still use today.
- Task provides a description/list of the length of day for a U.S. city over the course of a year.
- Graphs, charts, and tables provide students with information from multiple sources in order to address questions.
- Task provides a description/list of lunar phases over a period of months.
- The task closes with a question about the force which maintains Earth’s spherical shape.

Variable Features to Shift Complexity or Focus

- Complexity of scientific concept(s).
- Domain-specific vocabulary and definitions.
- Graphic organizers presented may be diagrams, graphs, data tables, and/or drawings.
- Data sets addressed in the scenario, including but not limited to:
 - Hours of daylight.
 - Seasonal patterns in duration of daylight.
 - Presence or absence of stars and/or constellations.
 - Phases of the moon.
- Degree to which components of the model are provided.
- Patterns of change addressed in the scenario, including but not limited to:
 - The apparent motion of the sun across the daytime sky and the moon across the nighttime sky.
 - The changes in the appearance of the moon over a period of four weeks.

General Description of Task/Chain of Sensemaking

- Students complete a data table related to approximate sunrise and sunset times in a U.S. city. **[Prompt 1: 5-ESS1-2, KSA5]**
- Students use data that can be displayed graphically (pictures in a calendar, for example), which will allow them to describe the pattern of change that occurs in the appearance of the moon every four weeks. **[Prompt 2, Parts A & B: 5-ESS1-2, KSA6]**
- Students support or refute a claim related to observable patterns of lunar phases. **[Prompt 2, Part C: 5-ESS1-1 & 5-ESS1-2, KSA1]**
- Students support an argument related to the gravitational force maintaining the moon's orbit around Earth. **[Prompt 3: 5-PS2-1, KSA1]**

Targeted PE-related KSAs

5-ESS1-2, KSA5: Identify similarities and differences in the timing of observable changes in shadows, daylight, and the appearance of stars to describe how events occur at different rates (e.g., Earth rotates on its axis once a day, while its orbit around the sun takes a full year).

KSA6: Organizes data in a way to reveal patterns or relationships related to the orbits of Earth around the sun, of the moon around Earth, and/or the rotation of Earth about its axis, which makes predictions possible.

KSA1: Support an argument that the gravitational force exerted by Earth on objects is directed down.

Cross-performance Expectations Related KSAs to Target

5-ESS1-1 & 5-ESS1-2, KSA1: Support an argument that there are observable patterns in the lunar phases over a period of weeks or months that make predictions possible.

Student Demonstrations of Learning

- Uses graphical displays to organize data pertaining to daily and seasonal changes caused by Earth’s rotation and orbit around the sun.
- Sorts, classifies, communicates, and analyzes simple rates of change for natural phenomena using similarities and differences in patterns.
- Accurately uses reasoning to explain how relevant evidence/data can be used to explain a phenomenon related to the position and motion of objects in the Earth-moon-sun system.

Work Products

- Organize data in a table and/or graphical display (e.g., chart, graph).
- Interpretation of data.
- Complete a model.
- Constructed response.

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

Multiple Means of Engagement

- 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.

Multiple Means of Representation

- 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.
- Activate 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 mastery routines to emphasize key ideas and relationships.
- Give explicit prompts for each step in a sequential process.

Multiple Means of Action & Expression

- 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		X			X		X				X	
2 Parts A & B		X			X				X			X
2 Part C		X		X				X			X	
3		X		X					X			X

Rubric Considerations

- Accuracy of the model.
- Sophistication of the explanations.
- Completeness and accuracy of response.

Assessment Boundaries

- Assessment is limited to relative distances, not sizes, of stars. Assessment does not include other factors that affect apparent brightness (such as stellar masses, age, and stage).
- Assessment does not include causes of seasons.
- Assessment does not include mathematical representation of gravitational force.

Common Misconceptions

- **5-PS2-1**
 - Because Earth looks flat, it is flat.
 - Objects on the other side of the Earth fall up.
 - Gravity is its own force, not one caused by Earth itself.
 - Gravity only affects objects on or above the surface of Earth.
- **5-ESS1-1**
 - The sun is bigger and brighter than some other stars.

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- All stars are the same size.
 - **5-ESS1-2**
 - Celestial objects orbit around a stationary Earth.
 - 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.

Possible Technical Terms for Task

- orbit, sun, Earth, seasons, shadow, apparent position, seasonal, sundown, sunrise, new moon, first quarter, full moon, last quarter

Common Core State Standards for Literacy

Reading Informational

- **RI.5.1** Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text. **(5-PS2-1, 5-ESS1-1)**
- **RI.5.7** Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. **(5-ESS1-1)**
- **RI.5.8** Explain how an author uses reasons and evidence to support particular points in a text, identifying which reasons and evidence support which point(s). **(5-ESS1-1)**
- **RI.5.9** Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably. **(5-PS2-1, 5-ESS1-1)**

Writing

- **W.5.1** Write opinion pieces on topics or texts, supporting a point of view with reasons and information. **(5-PS2-1, 5-ESS1-1)**

Common Core State Standards for Mathematics

Mathematical Practice

- **MP.2** Reason abstractly and quantitatively. **(5-ESS1-1, 5-ESS1-2)**
- **MP.4** Model with mathematics. **(5-ESS1-1, 5-ESS1-2)**

Mathematics

- **5.NBT.A.2** Explain patterns in the number of zeros of the product when multiplying a number by powers of 10 and explain patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10. Use whole-number exponents to denote powers of 10. **(5-ESS1-1)**
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- **5.G.A.2** Represent real-world and mathematical problems by graphing points in the first quadrant of the coordinate plane and interpreting coordinate values of points in the context of the situation. **(5-ESS1-2)**
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Task Notes

SIPS Assessments Complexity Framework

Component	Complexity		
	Low	Moderate	High
Connections to Curriculum and Instruction	<p>A.1 Degree and nature of sense-making about phenomena or problems</p> <ul style="list-style-type: none"> Requires one or two dimensions One dimension may have a greater degree of emphasis than another Requires previously learned ideas or concepts 	<ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> 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	<p>B.1 Complexity of the presentation</p> <ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> 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
	<p>B.2 Cognitive demand of response development</p> <ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> 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
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