Stackable Instructionally-embedded Portable Science (SIPS) Assessments Project

Grade 8 Science
Unit 2 End of Unit Assessment Design Patterns
Gravity and Motion of Objects in the Solar System
August 2023

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SIPS Grade 8 Unit 2 End of Unit Assessment Design Patterns (MS-ESS1-1, MS-ESS1-2, MS-ESS1-3, MS-PS2-4)

Grade 8 SIPS Design Pattern for MS-ESS1-1

Element	Description
Knowledge and Practices (DCI, SEP, CCC)	In this task, students: • understand that patterns of motion of the sun, the moon, and stars in the sky can be observed, described, predicted, and explained with models. • understand that models can be used to explain eclipses of the sun and the moon. • understand that seasons are a result of Earth's tilt of its axis of rotation and are caused by differential intensity of sunlight on different areas of Earth across the year. • develop and use a model to describe phenomena. The crosscutting concept of using patterns to identify cause and effect is the organizing concept for these DCIs.
Performance Expectation	**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, moon, and seasons. [Clarification Statement: Examples of models can be physical, graphical, or conceptual.]
Knowledge, Skills, & Abilities (KSAs)	**KSA1:** Describe the cyclic patterns of the lunar phases based on a model. **KSA2:** Develop a model showing the lunar phases' cyclic pattern. **KSA3:** Use a model to describe the causes of the eclipses of the sun and/or moon. **KSA4:** Develop a model that shows the eclipses of the sun and/or moon. **KSA5:** Use a model to describe the seasonal patterns of Earth. **KSA6:** Develop a model that shows the changing of the seasons. **KSA7**: Use patterns to identify cause-and-effect relationships that exist in the apparent motion of the sun, moon, and stars in the sky. **KSA8**: Develop and/or use a model to make predictions of the cyclic patterns of lunar phases. **KSA9**: Develop and/or use a model to make predictions of the occurrence of a solar/lunar eclipse. **KSA10**: Develop and/or use a model to make predictions of the cyclic patterns of seasons.
Student Demonstration of Learning	• Accuracy of the description of 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. • Describe patterns of lunar phases, seasonal patterns, and causation of solar/lunar eclipses. • Identify relevant components of a model to explain the pattern of lunar phases. • Identify relevant components of a model to explain seasons on Earth. • Identify relevant components of a model to explain a solar/lunar eclipse. • Complete and/or correct a model related to moon phases. • Accurately depict all mechanistic features of the observable phenomena (seasons, lunar/solar eclipses, lunar phases). • Correctly identify and describe relevant relationships between components of the model. • Indicate scale limitations within an Earth-sun-moon system model. • Revise a given model of the Earth-sun-moon system to improve the accuracy of size and distance relationships in the model. • Use patterns to make predictions of observable phenomena in the Earth-sun-moon system.
Work Product	• Draw a model to describe the phenomena. • Complete a model. • Constructed response. • Selected response.
Task Features	• The task focuses on performances for which students' opportunity to learn has prepared them. • The task is based on the assessed KSA(s) and driven by a high-quality scenario that focuses on a phenomenon or design problem. • The task scenario is grounded in the phenomena and problems being addressed. • The task must prompt students to make connections between observed phenomena or evidence and reasoning underlying the observation/evidence. • The task provides ways for students to make connections of meaningful local, global, or universal relevance. • The task scenario is sufficient, engaging, relevant, and accessible to a wide range of students.

	● The task is accessible, appropriate, and cognitively demanding for all learners, including students with disabilities, English learners, or working below or above grade level. ● All prompts within a task are fair and equitable and include a range of presentation and response modes. ● The task requires students to use scientific reasoning and process skills to produce evidence that can be used by educators to make inferences about student learning. ● The task requires students to use reasoning and integrate multiple dimensions (i.e., SEP, DCI, CCC) to support sense-making about phenomena or problems. ● All tasks must elicit core ideas as defined in the PE. ● The task uses information that is scientifically accurate. ● The task must elicit core ideas as defined in the PE. ● The task uses active voice and present tense. ● The task is written at or below grade level. ● The task requires students to either use or develop a model. ● The task requires students to make observations about patterns of the movement of objects.

Variable Features - Aspects of an assessment task that <u>can be varied</u> to shift complexity or focus	● Complexity of scientific concept(s) to be modeled.
	● Phenomenon addressed in the scenario, including but not limited to:
	  ○ Phenomena associated with timing and appearance of eclipses.
	  ○ The differences in seasons in the Northern vs. Southern Hemispheres.
	  ○ The seasonal changes observed in the patterns of movement of the moon, Sun, and other objects in the sky (e.g., change in hours of daylight, change in visible constellations).
	  ○ 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.
	  ○ Models are used to compare the rates of rotation and revolution of the moon and Earth.
	  ○ Models used to illustrate why only one side of the moon is visible from Earth.
	● Domain-specific vocabulary and definitions.
	● Format of "real-world" phenomenon under investigation: image, data, text, combination.
	● Number, type, and complexity of representations of models, tables, graphs, and/or data sets.
	● 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. ● The degree to which components of the model are provided. ● The model may be provided for revision or one that is created from scratch. ● Representation of model. ● Use or purpose of the model. ● Type of model (e.g., physical/virtual). ● Amount and type of presented observations and/or measurements. ● Complexity in which values or relationships are predicted. ● Types of sources of evidence.
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.
Technical Terms	• Orbit, eclipse, galaxy, satellite, elliptical orbit, scale (and possible 'scale model'), axis, astronomical unit, tilt (in relation to an axis), rotation versus revolution, cyclic motion, Earth-sun-moon system, eclipse, lunar phase, universe, full moon, half moon, new moon

Grade 8 SIPS Design Pattern for MS-ESS1-2

Element	Description
Knowledge and Practices (DCI, SEP, CCC)	In this task, students: • understand that Earth and its solar systems are part of the Milky Way galaxy. • understand that the Milky Way galaxy is one of many galaxies in the universe. • understand that the solar system consists of the sun and a collection of objects held in orbit around the sun by the sun's gravitational pull on them. • recognizes that the solar system appears to have formed from a disk of dust and gas, drawn together by gravity. • develop and use a model to describe phenomena. The organizing concept for these DCIs is the crosscutting concept of systems and system models in which models can be used to represent systems and their interactions.
Performance Expectation	**MS-ESS1-2** Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system. [Clarification Statement: Emphasis for the model is on gravity as the force that holds together the solar system and Milky Way galaxy and controls orbital motions within them. Examples of models can be physical (such as the analogy of distance along a football field or computer visualizations of elliptical orbits) or conceptual (such as mathematical proportions relative to the size of familiar objects such as students' school or state).] [*Assessment Boundary: Assessment does not include Kepler's Laws of orbital motion, or the apparent retrograde motion of the planets as viewed from Earth.*]
Knowledge, Skills, & Abilities (KSAs)	**KSA1:** Describe how a model shows the role of gravity in the motions of objects within a galaxy and/or solar system. **KSA2:** Develop a model to show the role of gravity in the motions of objects within a galaxy and/or solar system. **KSA3:** Describe how a model shows the gravitational forces between two objects. **KSA4:** Develop a model to represent the gravitational forces between two objects. **KSA5**: Construct an argument, using evidence from a model, for how the solar system appeared to have formed. **KSA6**: Use a model to describe the components/sequences of events that resulted in the formation of our solar system from a dust cloud (nebula). **KSA7**: Manipulate the components of a model to demonstrate how the relationships among the sun, the Earth, the moon, planets in the solar system, and galaxies change the resulting gravitational force between/or motions of those bodies.

	KSA8: Make predictions about the effects of changes in mass/distance/how fast an object travels in a given model on other objects in the system. **KSA9**: Identify missing components, relationships, or other limitations of a model that can explain the role of gravity.
Student Demonstration of Learning	● Accuracy of the description of the interactions with a system shown in a model. ● Model accurately represents the gravitational interactions within a system. ● The scale of the model components is relevant to various objects, systems, and processes. ● Appropriateness of the description of how the solar system formed. ● Identify relevant components of a model to explain the role of gravity in the motions and interactions within galaxies and the solar system. ● Identify relevant components of a model to explain how the relationships among the sun, the Earth, the moon, planets in the solar system, and galaxies change the resulting gravitational force between/or motions of those bodies. ● Correctly identify and describe relevant relationships between components of the model. ● Indicate scale limitations within a model. ● Use patterns to make predictions about the effects of changes in mass/distance/how fast an object travels in a given model on other objects in the system. ● Complete and/or correct a model related to gravity as the attractive force that keeps solar systems and galaxies together.
Work Product	● Draw a model to describe the phenomena. ● Complete a model. ● Constructed response. ● Selected response.
Task Features	● The task focuses on performances for which students' opportunity to learn has prepared them. ● The task is based on the assessed KSA(s) and driven by a high-quality scenario that focuses on a phenomenon or design problem. ● The task scenario is grounded in the phenomena and problems being addressed. ● The task must prompt students to make connections between observed phenomena or evidence and reasoning underlying the observation/evidence. ● The task provides ways for students to make connections of meaningful local, global, or universal relevance.

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- The task scenario is sufficient, engaging, relevant, and accessible to a wide range of students.
- The task is accessible, appropriate, and cognitively demanding for all learners, including students with disabilities, English learners, or working below or above grade level.
- All prompts within a task are fair and equitable and include a range of presentation and response modes.
- The task requires students to use scientific reasoning and process skills to produce evidence that can be used by educators to make inferences about student learning.
- The task requires students to use reasoning and integrate multiple dimensions (i.e., SEP, DCI, CCC) to support sense-making about phenomena or problems.
- All tasks must elicit core ideas as defined in the PE.
- The task uses information that is scientifically accurate.
- The task must elicit core ideas as defined in the PE.
- The task uses active voice and present tense.
- The task is written at or below grade level.
- The task requires students to either use or develop a model.
- The task requires students to make observations about gravitational interactions between objects.

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<tr><td>Variable Features - Aspects of an assessment task that <u>can be varied</u> to shift complexity or focus</td><td>

- Complexity of scientific concept(s) to be modeled.
- Phenomenon addressed in the scenario, including but not limited to:
  - Satellites orbit Earth but can fall out of orbit (Skylab, UART satellite).
  - Halley’s Comet can be seen as it travels past Earth every 75–76 years.
  - Rings are present around some planets.
  - Mars has two moons, Phobos and Deimos, which orbit the planet.
  - The periodic nature of comets and other small-bodied solar orbiters.
  - Examples of potential phenomena/context for items that focus on the relationship between Earth, the solar system, and the Milky Way galaxy:
    - The relative size of Earth compared to the solar system and/or the relative size of the solar system compared to the Milky Way.
    - The relative motion of Earth, the objects in the solar system, and objects in the Milky Way Galaxy.
    - The differences in scale when measuring distances between planets, stars, galaxies, and other objects in the universe.

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	• Domain-specific vocabulary and definitions.
	• Format of "real-world" phenomenon under investigation: image, data, text, combination.
	• Number, type, and complexity of representations of models, tables, graphs, and/or data sets.
	• 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.
	• The degree to which components of the model are provided.
	• The model may be provided for revision or one that is created from scratch.
	• Representation of model.
	• Use or purpose of the model.
	• Type of model (e.g., physical/virtual).
	• Amount and type of presented observations and/or measurements.
	• Complexity in which values or relationships are predicted.
	• Types of sources of evidence.

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 specific facts about any planets or moons. • Focus should be on qualitative comparisons, not quantitative.
Technical Terms	• Orbit, eclipse, galaxy, satellite, elliptical orbit, scale (and possible ‘scale model’), axis astronomical unit, tilt (in relation to an axis), rotation versus revolution, inertia, force, mass, orbit,

Grade 8 SIPS Design Pattern for MS-ESS1-3

Element	Description
Knowledge and Practices (DCI, SEP, CCC)	In this task, students: • understand that the solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them. • Analyze data and/or make interpretations from data to draw conclusions, including finding similarities and differences, distinguishing between correlation and causation, and applying basic statistical techniques. The organizing concept for these DCIs is the crosscutting concept of scale, proportion, and quantity in which models can be used to represent time, space, and energy phenomena at various scales and to study systems that are too large or too small.
Performance Expectation	**MS-ESS1-3** Analyze and interpret data to determine scale properties of objects in the solar system. [Clarification Statement: Emphasis is on the analysis of data from Earth-based instruments, space-based telescopes, and spacecraft to determine similarities and differences among solar system objects. Examples of scale properties include the sizes of an object's layers (such as crust and atmosphere), surface features (such as volcanoes), and orbital radius. Examples of data include statistical information, drawings and photographs, and models.] [*Assessment Boundary: Assessment does not include recalling facts about properties of the planets and other solar system bodies.*]
Knowledge, Skills, & Abilities (KSAs)	**KSA1:** Identify information that relates to the similarities and differences among objects in the solar system. **KSA2:** Analyze data, applying appropriate scale and proportion, about objects in the solar system. **KSA3:** Develop graphical representations of data related to objects in the solar system. **KSA4:** Draw conclusions about the similarities and differences among solar system objects based on data. **KSA5**: Organize and interpret data to observe patterns and make inferences about scale properties of objects within the solar system. **KSA6**: Analyze and interpret data to determine similarities and differences between objects with different scales. **KSA7**: Use models and mathematical thinking to demonstrate an understanding of scale properties. **KSA8**: Make inferences about various bodies in our solar system based on scale properties and surface features. **KSA9**: Understand how relationships in advancement in technology and advancement in science have increased our knowledge of objects in our solar system.

	KSA10: Use a model to collect evidence to reason qualitatively or quantitatively about scale relationships represented in a model of objects in the solar system. (Combination of MS-ESS1-2 and MS-ESS1-3)
Student Demonstration of Learning	● Choose appropriate data related to similarities and differences among objects. ● Accurately apply basic statistical methods to data relating to objects in the solar systems. ● Generate appropriate representations of data related to objects in the solar system. ● Draw appropriate conclusions about similarities and/or differences among objects in the solar system. ● Create an accurate data table, chart, or graph with data about our solar system. ● Compare and contrast properties of objects within the solar system (i.e., size, distances, layers, surface features, orbital radius, density). ● Recognize differences in scales used in space and when to use each scale. ● Predict an outcome based on scale properties or surface features. ● Identify relevant relationships or meaningful patterns to describe patterns and surface features at different scales. ● Identify relationships in how advancement of science and technology impact each other.
Work Product	● Interpretation of data. ● Mathematical representation. ● Graph quantities. ● Constructed response. ● Selected response.
Task Features	● The task focuses on performances for which students' opportunity to learn has prepared them. ● The task is based on the assessed KSA(s) and driven by a high-quality scenario that focuses on a phenomenon or design problem. ● The task scenario is grounded in the phenomena and problems being addressed. ● The task must prompt students to make connections between observed phenomena or evidence and reasoning underlying the observation/evidence. ● The task provides ways for students to make connections of meaningful local, global, or universal relevance. ● The task scenario is sufficient, engaging, relevant, and accessible to a wide range of students. ● The task is accessible, appropriate, and cognitively demanding for all learners, including students with disabilities, English learners, or working below or above grade level. ● All prompts within a task are fair and equitable and include a range of presentation and response modes.

	- The task requires students to use scientific reasoning and process skills to produce evidence that can be used by educators to make inferences about student learning. - The task requires students to use reasoning and integrate multiple dimensions (i.e., SEP, DCI, CCC) to support sense-making about phenomena or problems. - All tasks must elicit core ideas as defined in the PE. - The task uses information that is scientifically accurate. - The task must elicit core ideas as defined in the PE. - The task uses active voice and present tense. - The task is written at or below grade level. - The task requires students to either use or develop a model. - The task requires students to consider scale of objects in the solar system.
Variable Features - Aspects of an assessment task that <u>can be varied</u> to shift complexity or focus	- Complexity of scientific concept(s) to be modeled. - Phenomenon addressed in the scenario, including but not limited to: - Orbital times of comets vs. planets. - Surface features of sun, rocky planets, and gas giants. - Impact of ground and space telescopes. - Impact of location in the solar system and mass on surface features of objects. - Gravity's role in the formation of the solar system. - Selecting an appropriate scale and distortion caused by using the wrong scale. - Comparing the angle of inclination of objects within the solar system. - Milestone advancements that impacted our understanding of the objects in the solar system. - Four of Jupiter's moons can be clearly seen through a small telescope under low magnification. These moons appear as tiny dots arranged around Jupiter. - Close-up pictures from the New Horizons mission provided new evidence about the dwarf planet, Pluto, which was not able to be gathered by distant observations and calculations (surface features, scale). - The sun and the moon appear approximately the same size in the sky, but the sun is vastly larger than the moon (scale). - Even though the moon is infinitesimally smaller than the sun, the entire sun is blocked from view on Earth during a solar eclipse (scale). - Domain-specific vocabulary and definitions.

	● Format of "real-world" phenomenon under investigation: image, data, text, combination.
	● Number, type, and complexity of representations of models, tables, graphs, and/or data sets.
	● Function of the model:
	  o To explain a mechanism underlying a phenomenon.
	  o To predict future outcomes.
	  o To describe a phenomenon.
	  o To generate data to inform how the world works.
	● The degree to which components of the model are provided.
	● The model may be provided for revision or one that is created from scratch.
	● Representation of model.
	● Use or purpose of the model.
	● Type of model (e.g., physical/virtual).
	● What scale property is the focus of the model?
	● Complexity of data to be analyzed and/or interpreted.
	● Degree to which components of the analysis are provided.
	● Measurement tools and units.
	● Mathematical representations.
	● Representation of data.
	● Use or purpose of the data representation.
	● Core idea targeted (e.g., orbital radius, surface features, orbital periods, radius of object, location, composition, angle of inclination, historical advancements, gravitational pull, mass, density).
	● Objects in the solar system being compared.
	● Examples of scale properties include the sizes of an object's layers (such as crust and atmosphere), surface features (such as volcanoes), and orbital radius.
	● Examples of data include statistical information, drawings and photographs, and models.

Assessment Boundaries	● Assessment does not include recalling facts about properties of the planets and other solar system bodies. ● Assessment does not include the use of scientific notation. ● Emphasis is on the analysis of data from Earth-based instruments, space-based telescopes, and spacecraft to determine similarities and differences among solar system objects.
Technical Terms	● Orbit, eclipse, galaxy, satellite, elliptical orbit, scale (and possible 'scale model'), axis astronomical unit, tilt (in relation to an axis), rotation versus revolution, terrestrial planet, gas giant, planetary rings, dwarf planet, inner planet, outer planet, comet

Grade 8 SIPS Design Pattern MS-PS2-4

Element	Description
Knowledge and Practices (DCI, SEP, CCC)	In this task, students: • demonstrate an understanding that gravitational interactions are always attractive and depend on the masses of interacting objects. • use the practices of engaging in argument from evidence to make sense of relationships between energy and forces. The organizing concept for these DCIs is the crosscutting concept of systems and system models in which models can be used to represent systems and their interactions and energy matter flows within systems.
Performance Expectation	**MS-PS2-4.** Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects. [Clarification Statement: Examples of evidence for arguments could include data generated from simulations or digital tools; and charts displaying mass, strength of interaction, distance from the Sun, and orbital periods of objects within the solar system.] [*Assessment Boundary: Assessment does not include Newton's Law of Gravitation or Kepler's Laws.*]
Knowledge, Skills, & Abilities (KSAs)	**KSA1:** Support a claim with evidence related to the idea that gravitational interactions are attractive and depend on the masses of interacting objects. **KSA2**: Use reasoning to explain how relevant evidence/data supports or refutes the claim related to the idea that gravitational interactions are attractive and depend on the masses of interacting objects. **KSA3:** Use a model to identify the variables associated with gravitational interactions. **KSA4:** Identify and represent, using models such as force diagrams, the relative magnitude, and direction of the force each object exerts on the other. **KSA5**: Identify proportional relationships of mass and gravitational force using data to construct an argument. **KSA6**: Use proportional relationships of mass and/or distance and gravitational force(s) using data to make a prediction.
Student Demonstration of Learning	• Correctly identifies evidence that supports a claim that gravitational interactions are attractive and depend on the masses of interacting objects. • Use reasoning to explain how some effects of gravitational interactions, which apply universally, may only be observable in interactions between very massive objects. • Correctly identifies variables in a model associated with gravitational interactions. • Constructs a sound argument that mass increases the magnitude of gravitational force.

Work Product	● Interpretation of data. ● Relationships are shown by a graph or data set. ● Constructed response. ● Selected response. ● Written arguments supported by empirical evidence and scientific reasoning to support the claim.
Task Features	● The task focuses on performances for which students' opportunity to learn has prepared them. ● The task is based on the assessed KSA(s) and driven by a high-quality scenario that focuses on a phenomenon or design problem. ● The task scenario is grounded in the phenomena and problems being addressed. ● The task must prompt students to make connections between observed phenomena or evidence and reasoning underlying the observation/evidence. ● The task provides ways for students to make connections of meaningful local, global, or universal relevance. ● The task scenario is sufficient, engaging, relevant, and accessible to a wide range of students. ● The task is accessible, appropriate, and cognitively demanding for all learners, including students with disabilities, English learners, or working below or above grade level. ● All prompts within a task are fair and equitable and include a range of presentation and response modes. ● The task requires students to use scientific reasoning and process skills to produce evidence that can be used by educators to make inferences about student learning. ● The task requires students to use reasoning and integrate multiple dimensions (i.e., SEP, DCI, CCC) to support sense-making about phenomena or problems. ● All tasks must elicit core ideas as defined in the PE. ● The task uses information that is scientifically accurate. ● The task must elicit core ideas as defined in the PE. ● The task uses active voice and present tense. ● The task is written at or below grade level. ● All tasks require evidence of qualitative and quantitative thinking. ● All tasks must prompt students to make connections between observed phenomena or evidence and reasoning underlying the observation/evidence. ● Students use scientific reasoning and process skills in observational (nonexperimental) investigations. ● All tasks must elicit core ideas as defined in the PE.

	- All tasks must include elements from at least two dimensions of the NGSS. - Students make observations and measurements. - The models used need to represent gravitational interactions between two masses within and between systems. - Data should provide enough evidence to support an explanation. - Task requires students to make observations and measurements to produce data that can serve as the basis for evidence.
Variable Features - Aspects of an assessment task that <u>can be varied</u> to shift complexity or focus	- Complexity of scientific concept(s) to be modeled. - Phenomenon addressed in the scenario, including but not limited to: - Patterns in data/graphs illustrating that as the mass of one or both of the interacting objects increases, the magnitude of gravitational force at a given distance increases. - Patterns in data/graphs illustrating that as distance between objects of given mass increases, the strength of the gravitational forces decreases. - Simulations in which students can observe patterns of movement in two or more objects interacting via gravity after altering the mass or relative distance between the objects. - Comparing data from orbital speeds of satellite objects around a massive object (like the Sun) to satellite objects around a comparably less massive object (like a planet or the Moon). - The moon orbits Earth. - Astronauts fall more slowly when jumping on the moon than on Earth. - A dropped apple falls toward Earth, but not toward the moon. - Rockets have to travel extremely fast when they leave Earth. - Domain-specific vocabulary and definitions. - Format of "real-world" phenomenon under investigation: image, data, text, combination. - Number, type, and complexity of representations of models, tables, graphs, and/or data sets. - Range of data provided. - Complexity of data provided. - Use or purpose of creating a graphical display. - Standard units used. - Type of graph. - Degree in which mathematical equations are used. - Complexity in which values or relationships are predicted. - Types of sources of evidence.

	• The models used need to represent gravitational interactions between two masses within and between systems. • Masses, distances, and strength of interactions of interacting objects (e.g., distance from the sun). • Format and type of data to determine the factors that affect the effect of gravitational forces. • Task provides data on masses, distances, and gravitational forces. • Evidence from several arguments related to gravitational forces may be provided in order to shore up the weaknesses of any one. • Convert among different-sized standard measurement units within a given measurement system and use these conversions to explain changes that occur. • Examples of evidence of arguments could include data generated from simulations or digital tools, and charts displaying mass, strength of interaction, distance from the sun, and orbital periods of objects within the solar system.
Assessment Boundaries	• The assessment does not require students to develop an actual equation. • Students do not need to know mathematical representations of gravity (values, units, etc.). • The assessment does not include Newton's Law of Gravitation or Kepler's Laws.
Technical Terms	• Orbit, ellipse, galaxy, satellite, elliptical orbit, scale (and possible 'scale model'), astronomical unit, solar system, galaxy, period, proportional relationships, force fields

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