NGSS OVERVIEW

SOLAR SYSTEM AND BEYOND

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 and moon, and seasons.

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.

Performance Expectation MS-ESS1-3: Analyze and interpret data to determine scale properties of objects in the solar system.

Activity Description	Disciplinary Core Ideas	Science and Engineering Practices	Crosscutting Concepts	Common Core State Standards
1. **Talking It Over: Exploring Space** Students learn how space exploration has expanded our understanding of the Solar System and beyond. Students consider the challenges involved with space exploration. They learn how advances in engineering and technology have made space exploration possible.	MS-ESS1.A	Connections to Nature of Science: Science Knowledge Is Open to Revision in Light of New Evidence Analyzing and Interpreting Data	Connections to Engineering, Technology, and Applications of Science: Interdependence of Science, Engineering, and Technology	ELA/Literacy: RST.6-8.1 WHST.6-8.9
2. **Investigation: The Predictable Moon** Students start by ordering the phases of the Moon based on their own experiences and observations of the Moon. They then are challenged to figure out whether there is a predictable, and repeating, pattern in how the Moon's appearance changes over time. Using the pattern they discover, they analyze an incomplete moon phase calendar and determine which phases occur on the missing days.	MS-ESS1.A	Analyzing and Interpreting Data	Connections to Nature of Science: Science Knowledge Assumes an Order and Consistency in Natural Systems Patterns	
3. **Modeling: Explaining the Moon's Phases** Students use a physical model to understand how the interactions within the Earth-Sun-Moon system causes each phase of the Moon to have the appearance it has. To do this, students use a model to determine how light from the Sun makes different amounts of the Moon visible from Earth depending on where the Moon is relative to Earth and the Sun. They connect these observations with the pattern identified in the previous activity to build a better understanding of what causes the Moon's phases.	MS-ESS1.A MS-ESS1.B	Developing and Using Models	Connections to Nature of Science: Science Knowledge Assumes an Order and Consistency in Natural Systems Patterns Systems and System Models Cause and Effect	ELA/Literacy: WHST.6-8.2

SOLAR SYSTEM AND BEYOND (continued)

Activity Description	Disciplinary Core Ideas	Science and Engineering Practices	Crosscutting Concepts	Common Core State Standards
4. **Computer Simulation: Moon Phase Simulation** Students interact with a computer simulation that models the Moon's orbit around Earth. Students record data on how the Moon's appearance changes as its position in its orbit around Earth changes. They then analyze and interpret their data to identify the causes of the cyclic pattern of the Moon's phases.	MS-ESS1.A	Analyzing and Interpreting Data Developing and Using Models	Connections to Nature of Science: Science Knowledge Assumes an Order and Consistency in Natural Systems Patterns Systems and System Models Scale, Proportion, and Quantity Connections to Engineering, Technology, and Applications of Science: Interdependence of Science, Engineering, and Technology	
5. **Modeling: The Moon's Orbit** Students develop and use a three-dimensional model that illustrates how the Moon's orbital plane is not aligned with Earth's orbital plane around the Sun. This phenomenon explains why there are solar and lunar eclipses a few times a year but not each lunar cycle. This activity provides an assessment opportunity for the first part of Performance Expectation MS-ESS1-1 relating to the Earth–Moon–Sun system. The second part of Performance Expectation MS-ESS1-1 relating to Earth's tilt and seasons is assessed in the "Earth on the Move" activity.	MS-ESS1.A MS-ESS1.B	Analyzing and Interpreting Data Developing and Using Models	Connections to Nature of Science: Science Knowledge Assumes an Order and Consistency in Natural Systems Patterns	Mathematics: 6.RP.A.1 ELA/Literacy: WHST.6-8.2
6. **Investigation: Changing Sunlight** The previous sequence of activities focused on how the Moon's appearance changes over time. Students may recall from 5th grade NGSS Earth and Space Science that the Sun's position in the sky, and how long the Sun is up in the sky (above the horizon for a given location on a given day), also changes over time. This activity has students analyze and interpret 2 years of data related to the Sun's angle and the number of daylight hours in order to identify the patterns in these changes.	MS-ESS1.A MS-ESS1.B	Analyzing and Interpreting Data	Patterns Connections to Nature of Science: Science Knowledge Assumes an Order and Consistency in Natural Systems	

SOLAR SYSTEM AND BEYOND (continued)

Activity Description	Disciplinary Core Ideas	Science and Engineering Practices	Crosscutting Concepts	Common Core State Standards
7. **Computer Simulation: A Year Viewed from Space** Students use an interactive simulation to view Earth's orbit around the Sun. The scale used in this model allows students to observe what Earth's tilt is and how Earth's tilt is related to the number of hours the Sun is up during the different months of the year. Students analyze and interpret data to determine that Earth's distance from the Sun doesn't change much over the year and is actually closest to the Sun in early January.	MS-ESS1.A MS-ESS1.B	Developing and Using Models Analyzing and Interpreting Data	Patterns Connections to Nature of Science: Science Knowledge Assumes an Order and Consistency in Natural Systems Scale, Proportion, and Quantity Systems and System Models	ELA/Literacy: SL.8.5
8. **Modeling: Earth's Tilt** Students use a model to determine how the angle of the Sun relates to the amount of solar energy received at a given area on Earth's surface. Students model how Earth's tilt affects the interaction between solar energy and Earth's surface in the Earth-Sun system. To do this, students test how the angle of a solar cell, relative to the direction of incoming sunlight, affects the amount of electricity produced by the solar cell. This model allows students to observe why the angle of the Sun is related to the pattern of seasonal changes experienced on Earth.	MS-ESS1.B	Developing and Using Models	Patterns Connections to Nature of Science: Science Knowledge Assumes an Order and Consistency in Natural Systems Systems and System Models	Mathematics: 6.RP.A.3
9. **Reading: Earth on the Move** Students read about how Earth's tilt relative to its orbital plane is the reason for the seasonal changes we experience on Earth's surface. The reading prompts students to think about how both the amount and intensity of daylight are related to the temperature at Earth's surface and how changes in temperature relate to the seasons. This activity provides an assessment opportunity for the second part of Performance Expectation MS-ESS1-1 relating to Earth's tilt and seasons. The first part of Performance Expectation MS-ESS1-1 relating to the Earth, Moon, and Sun system is assessed in "The Moon's Orbit" activity.	MS-ESS1.A MS-ESS1.B	Developing and Using Models	Patterns Connections to Nature of Science: Science Knowledge Assumes an Order and Consistency in Natural Systems Connections to Engineering, Technology, and Applications of Science: Interdependence of Science, Engineering, and Technology	ELA/Literacy: RST.6-8.2 SL.8.5 WHST.6-8.2

SOLAR SYSTEM AND BEYOND (continued)

Activity Description	Disciplinary Core Ideas	Science and Engineering Practices	Crosscutting Concepts	Common Core State Standards
10. **Investigation: Observing Objects in Space** Now that students have experience with observing patterns to better understand phenomena, they are asked to think about objects that are much farther away and more difficult to observe. Students are first given images of space objects as viewed from Earth to help them recognize how difficult it is to tell how big or far something is based on just a picture. Then students are shown images that have been taken with advanced technologies so they can analyze data to categorize the different objects found in our Solar System and beyond.	MS-ESS1.A MS-ESS1.B	Analyzing and Interpreting Data Using Mathematics and Computational Thinking	Scale, Proportion, and Quantity Connections to Engineering, Technology, and Applications of Science: Interdependence of Science, Engineering, and Technology	Mathematics: 6.RP.A.1
11. **Modeling: Drawing the Solar System** To help students understand the size and scale of the Solar System, they are tasked with developing a scale model of the distances between the Sun and the different planets in our Solar System. To test whether their scale works, they are asked to draw the distances between the Sun and each of the planets on a single piece of paper, making sure their distances are scaled properly.	MS-ESS1.B	Developing and Using Models Analyzing and Interpreting Data	Systems and System Models Scale, Proportion, and Quantity	Mathematics: MP.2 6.RP.A.1
12. **Project: How Big Are the Planets?** While the scale used in the previous activity works for planetary distances, a different scale is needed to compare the sizes of planets. For this activity, students find different-sized objects in order to create a scale model of the size of the different planets in the Solar System. This model helps students describe the similarities and differences in the sizes of the planets.	MS-ESS1.B	Developing and Using Models Analyzing and Interpreting Data	Scale, Proportion, and Quantity	Mathematics: 6.RP.A.1 ELA/Literacy: SL.8.4 WHST.6-8.2
13. **Investigation: Identifying Planets** In this activity, students are given data corresponding to scaled properties of different planets in the Solar System. They then analyze and interpret the data to determine which planet each set of data corresponds to. Students are also introduced to different space missions that took place in order to collect the type of data analyzed in this activity. This activity provides an opportunity to assess Performance Expectation MS-ESS1-3.	MS-ESS1.B	Analyzing and Interpreting Data	Scale, Proportion, and Quantity Connections to Engineering, Technology, and Applications of Science: Interdependence of Science, Engineering, and Technology	Mathematics: MP.4 6.RP.A.3

SOLAR SYSTEM AND BEYOND (continued)

Activity Description	Disciplinary Core Ideas	Science and Engineering Practices	Crosscutting Concepts	Common Core State Standards
14. **Investigation: Gravitational Force** Students are introduced to the concept of gravity. To understand what gravity is, students are given data sets relating the gravitational force to the mass of two objects and the distance between two objects. Students look for patterns in the data. From this investigation, students analyze and interpret data to determine that the more massive two objects are or the closer two objects are, the larger the gravitational force between them.	MS-ESS1.B	Analyzing and Interpreting Data	Patterns Connections to Nature of Science: Science Knowledge Assumes an Order and Consistency in Natural Systems	Mathematics: 6.RP.A.3 6.SP.B.5
15. **Reading: The Effects of Gravity** Students are introduced to the concept that the objects in our Solar System orbit the Sun due to the gravitational interaction between each of the objects and the Sun. Students read about how gravity was responsible for the formation of our Solar System and Galaxy.	MS-ESS1.A MS-ESS1.B MS-PS2.A MS-PS2.B	Developing and Using Models	Systems and System Models Connections to Nature of Science: Science Knowledge Assumes an Order and Consistency in Natural Systems	ELA/Literacy: RST.6-8.1 WHST.6-8.2
16. **Computer Simulation: Modeling Gravity** This activity has students use a computer simulation to observe how gravity is responsible for the motions within our Solar System. By modifying the distance between objects and the mass of objects, students are able to observe how these variables affect the orbital periods of planets in our Solar System. Extending this concept, students are able to calculate the mass of the Sun. Students are then asked to develop and use a model to describe the role of gravity in the motions within galaxies and solar systems. This activity provides an opportunity to assess Performance Expectation MS-ESS1-2.	MS-ESS1.A MS-ESS1.B	Developing and Using Models	Systems and System Models Connections to Nature of Science: Science Knowledge Assumes an Order and Consistency in Natural Systems	Mathematics: MP.2 MP.4 6.RP.A.3
17. **Talking It Over: Choosing a Mission** In this culminating activity, students are tasked with determining which space mission to Titan should be funded as a future NASA endeavor. Students weigh the trade-offs between the new technology that might result from a mission and the amount of potential data and information that can be collected. This activity helps students understand how space missions are chosen and what type of information is still being learned about our Solar System.	MS-ESS1.B	Analyzing and Interpreting Data	Connections to Engineering, Technology, and Applications of Science: Interdependence of Science, Engineering, and Technology:	ELA/Literacy: WHST.6-8.2 WHST.6-8.9 SL.8.4 SL.8.5

PHENOMENA, DRIVING QUESTIONS AND SEPUP STORYLINE

SOLAR SYSTEM AND BEYOND

SOLAR SYSTEM AND BEYOND

Unit Issue: Choose a proposed space mission based on which missions have the most potential for technological advancements and better scientific understanding.

Anchoring Phenomenon: There are a variety of objects in space and they move over time. Technology plays a critical role in learning more about these objects. Examples explored include the fact that objects in space can be categorized based on their characteristics and apparent motion, phases of the moon, seasons and changes in the daynight cycle, solar and lunar eclipses, evidence gathered from telescopes and other instruments as well as from piloted and unpiloted space missions. Students generate and answer questions such as: What causes the patterns of motion of objects in space? What causes a solar or lunar eclipse? How can we use technology, either from Earth or space missions, to understand space objects and how they appear to move through space?

Investigative Phenomena	Driving Questions	Guiding Questions	Activities	PE	SEPUP Storyline
Space is vast and mysterious.	How can we learn more about space?	What have we learned from missions to space? (Activity 1) Which mission to Titan should we fund, and why? (Activity 17)	1, 17	MS-ESS1-3	Astronomers learn about objects in space by making observations. While we are able to learn a lot about space just from making observations with Earth-based technologies, sending spacecraft to collect data from out in space has been invaluable to helping us better understand our universe.
The Moon appears to change its shape over time.	How can we use observations and models to understand the Moon phases?	How can we predict changes in the Moon's appearance? (Activity 2) What causes the cycle of the Moon's phases that we observe from Earth? (Activity 3) How does the Moon's orbit around Earth cause the Moon's phases to repeat around every 29 days? (Activity 4) Why don't we see lunar and solar eclipses more often? (Activity 5)	2, 3, 4, 5	MS-ESS1-1	The earliest astronomers did not have any specialized technologies to help them observe the universe, but even they were able to observe and recognize naturally occurring astronomical patterns that allowed them to predict phenomena such as full moons and lunar eclipses. Without even traveling off of Earth's surface, we too can observe how the Moon's phases change over time and model why these phases have the appearances we observe from Earth. These observations can help us understand that the Moon orbits Earth and that its orbital plane around Earth is tilted relative to Earth's orbital plane around the Sun such that only at very specific times do the Sun, Earth, Moon align correctly to create solar or lunar eclipses.

PHENOMENA, DRIVING QUESTIONS AND SEPUP STORYLINE

SOLAR SYSTEM AND BEYOND (continued)

Investigative Phenomena	Driving Questions	Guiding Questions	Activities	PE	SEPUP Storyline
The Sun has a different path through the sky during different seasons.	Why does the Sun's path through the sky change over the year, and how does that change relate to seasons?	What do you observe about the length of daylight and the position of the Sun in the sky over the course of a year? (Activity 6)	6, 7, 8, 9	MS-ESS1-1	While it is easy to observe if you are watching the sky carefully, many people don't notice that the Sun's path through the sky changes over the course of the year. These changes correspond to the amount of daylight hours people experience at different places on Earth. To help understand why this is, we can model how Earth rotates on its axis while it orbits the Sun. By doing this, we can observe that Earth's axis is tilted relative to its orbital plane around the Sun. This tilt not only changes the Sun's apparent path through the sky over the course of the year, but it is also responsible for the differential heating of Earth's surfaces over that same period, which is what causes the seasons. If the Earth had no tilt, there would be no seasons.
		What does Earth's orbit around the Sun have to do with seasons? (Activity 7)			
		Why does Earth's tilt cause different places on Earth to receive different amounts of energy from the Sun? (Activity 8)			
		Why does Earth have seasons? (Activity 9)			

PHENOMENA, DRIVING QUESTIONS AND SEPUP STORYLINE

SOLAR SYSTEM AND BEYOND (continued)

Investigative Phenomena	Driving Questions	Guiding Questions	Activities	PE	SEPUP Storyline
There are other objects in the sky besides the Moon and the Sun.	What are the other objects in our universe, and how far away are they?	What types of objects are found in space? (Activity 10)	10, 11,12, 13	MS-ESS1-3	With an understanding of the Sun–Earth–Moon system, we can look out farther in our Solar System and see that there are other objects that appear to move relative to the background stars. Some of these objects are planets, some are asteroids, and some are moons of other planets. Advances in technology over time have allowed us to look more closely at these other bodies, especially those in our Solar System. Using mathematical techniques with these technologies has allowed scientists to determine how far away these planets are and how big they are. To get a better sense of the size and scale of these planets, we can analyze our collected data to make representations of the scale properties of these planets. We can look at both their sizes and their distances scaled down to more- understandable scales, thus allowing us to get a better sense of the magnitude of space.
		How can a scale model help us understand distances between objects in our Solar System? (Activity 11)			
		How can you make a scale model showing the sizes of all of the planets? (Activity 12)			
		What features make each planet in our Solar System unique? (Activity 13)			

PHENOMENA, DRIVING QUESTIONS AND SEPUP STORYLINE

SOLAR SYSTEM AND BEYOND (continued)

Investigative Phenomena	Driving Questions	Guiding Questions	Activities	PE	SEPUP Storyline
While many objects look the same from night to night, some objects appear to move.	What determines how objects move in space?	What determines the amount of gravitational force between objects? (Activity 14)	14, 15, 16	MS-ESS1-2	If we continue to watch the planets from night to night and year to year, we will notice that their movements follow certain patterns. What causes these predictable motions within our Solar System? Gravity! Anything with mass attracts other things to it because of its gravitational field. This gravitational field changes based on how massive the objects are and how far away they are from each other. More massive objects produce stronger gravitational fields, and if an object moves closer to another object, the gravitational pull between the two objects increases. This property not only allows planets to stay in motion around the Sun, but it is also responsible for the formation of our entire Solar System. Our Solar System is one of many in our Galaxy, the Milky Way. In fact, all of the individual stars we see in the night sky are in our Galaxy. A galaxy is a group of stars gravitationally orbiting a massive center. The motion of stars within our Galaxy and planets within our Solar System can be modeled and predicted through an understanding of gravity. Humans have been able to learn all of this because of technologies developed over the centuries and missions launched by space-interested agencies. So the question is left to students: What mission do they think should be funded to help us better understand our universe?
		How does gravity affect the motion of objects in space? (Activity 15)			
		How can models help us understand the role of gravity in the motion of space objects? (Activity 16)			

NGSS CORRELATIONS

SOLAR SYSTEM AND BEYOND

Crosscutting Concepts		Activity number
Cause and Effect	Cause-and-effect relationships may be used to predict phenomena in natural or designed systems.	3
Patterns	Patterns can be used to identify cause-and-effect relationships.	3, 4, 5, 6, 7, 8, 9, 14
	Graphs, charts, and images can be used to identify patterns in data.	2
Scale, Proportion, and Quantity	Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small.	4, 10, 11, 12, 13
Systems and System Models	Models can be used to represent systems and their interactions—such as inputs, processes and out-puts—and energy and matter flows within systems.	3, 4, 8, 11, 15, 16
	Models are limited in that they only represent certain aspects of the system under study.	8
Connections to Engineering, Technology, and Applications of Science	Engineering advances have led to important discoveries in virtually every field of science, and scientific discoveries have led to the development of entire industries and engineered systems	1, 4, 9, 10, 13, 17
Connections to the Nature of Science	Science assumes that objects and events in natural systems occur in consistent patterns and are understandable through measurement and observation.	2, 3, 4, 5, 6, 7, 8, 9, 14, 15, 16
Science and Engineering Practices		**Activity number**
Analyzing and Interpreting Data	Analyze and interpret data to determine similarities and differences in findings.	1, 2, 4, 5, 6, 7, 10, 11, 12, 13, 14, 17
	Construct and interpret graphical displays of data to identify linear and nonlinear relationships.	6
	Analyze and interpret data to provide evidence for phenomena.	9
Developing and Using Models	Develop a model to predict and/or describe phenomena.	3, 4, 5, 7, 8, 9, 11, 12, 15, 16
Constructing Explanations and Designing Solutions	Construct a scientific explanation based on valid and reliable evidence obtained from sources (in-cluding the students' own experiments) and the assumption that theories and laws that describe nature operate today as they did in the past and will continue to do so in the future.	7
	Apply scientific ideas to construct an explanation for real world phenomena, examples, or events.	3, 7, 8

Science and Engineering Practices		Activity number
Using Mathematics and Computational Thinking	Apply mathematical concepts and/or processes (e.g., ratio, rate, percent, basic operations, simple algebra) to scientific and engineering questions and problems.	10
Connections to the Nature of Science	Science findings are frequently revised and/or reinterpreted based on new evidence.	1
Disciplinary Core Ideas		**Activity number**
The Universe and Its Stars (ESS1.A)	Patterns of the apparent motion of the sun, the moon, and stars in the sky can be observed, described, predicted, and explained with models.	2, 3, 4, 5, 6, 7, 9, 16
	Earth and its solar system are part of the Milky Way galaxy, which is one of many galaxies in the universe.	1, 10, 15, 16
Earth and the Solar System (ESS1.B)	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.	10, 11, 12, 13, 14, 15, 16, 17
	This model of the solar system can explain eclipses of the sun and the moon. Earth's spin axis is fixed in direction over the short-term but tilted relative to its orbit around the sun. The seasons are a result of that tilt and are caused by the differential intensity of sunlight on different areas of Earth across the year.	3, 5, 6, 7, 8, 9
	The solar system appears to have formed from a disk of dust and gas, drawn together by gravity.	15, 16
Performance Expectations		**Activity number**
Earth's Place in the Universe (ESS1)	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. (MS-ESS1-1)	5, 9
	Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system. (MS-ESS1-2)	16
	Analyze and interpret data to determine scale properties of objects in the solar system. (MS-ESS1-3)	13

COMMON CORE STATE STANDARDS: CONNECTIONS AND CORRELATIONS

SOLAR SYSTEM AND BEYOND

Making Connections in ELA

As with all SEPUP instructional materials, this unit introduces multiple opportunities for students to engage in a range of ELA practices and skills that are important grade-specific goals of the common core state standards and are also essential to the sensemaking students are doing throughout the unit. Specifically, students engage with readings in order to advance their sensemaking about space, first in activity 1 to gather evidence about how space can be explored (RST.6-8.1), then in activity 9, reflecting and building on prior knowledge (RST.6-8.2) about the Earth's seasons and in activity 15, to use textual evidence to make sense of the role of gravity in our solar system (RST.6-8.1). Throughout the unit, students develop their own models of the solar system and document their developing ideas and models in writing (WHST.6-8.2) and in activity 12, share them with their peers through an oral presentation (SL.8.4). The unit culminates with a fictional scenario where students evaluate possible space exploration missions, drawing on the knowledge and evidence they have gathered throughout the unit in order to write a decision letter (WHST.6-8.2; WHST.6-8.9) and present their decision with their class (SL.8.4). Specific literacy strategies are embedded throughout the unit to support student development of these ELA skills and practices. In addition, Appendix E: Literacy Strategies in the Student Book contains optional resources to support reading, writing and oral communication.

Common Core State Standards – English Language Arts		Activity number
Reading in Science and Technical Subjects (RST)	Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. (RST.6-8.1)	1, 15
	Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions. (RST.6-8.2)	9
Speaking and Listening (SL)	Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound and valid reasoning, and well-chosen details: use appropriate eye contact, adequate volume, and clear pronunciation. (SL.8.4)	12, 17
	Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (SL.8.5)	7, 9, 17
Writing in History/ Social Studies, Science, and Technological Subjects (WHST)	Write informative/explanatory texts to examine and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. (WHST.6-8.2)	3, 5, 9, 12, 15, 17
	Draw evidence from informational texts to support analysis, reflection, and research. (WHST.6-8.9)	1, 17

Making Connections in Mathematics

This unit introduces multiple opportunities for students to engage in math practices and skills that are important grade-specific goals of the common core state standards and are also essential to the sensemaking students are doing throughout the unit. Specifically, in activities 3 and 4, students engage with mathematical reasoning (MP.2) as they explore physical and computer models of the solar system to make sense of moon phases and analyze and interpret data to identify the causes of moon phase cycles. Engagement with models and modeling continues throughout the unit and includes engagement with mathematical models of the solar system and its properties (MP.4). As the unit progresses, students apply proportional reasoning and the concept of ratios (6.RP.A.1) to make sense of orbits of solar system objects and size and scale of the solar system. In activity 12, students choose and apply their own scaling factor to create a scale model of the size of the planets. Later in activity 14, students explore and analyze gravitational force data to make sense of the relationship between gravitational pull and mass for various solar system objects (6.SP.B.5). The unit culminates with a fictional scenario where students consider possible space exploration mission proposals, where they apply the mathematical reasoning (MP.2; 6.RP.A.3) and modeling (MP.4) skills they engaged in earlier in the unit to evaluate each of the proposals in order to make an informed decision on the best proposal to recommend to NASA. To support students in creating and interpreting graphical displays of data in activities 7 and 14, an optional student sheet entitled "Scatterplot and Line Graphing Checklist" is provided in Appendix C: Science Skills in the Student Book.

Common Core State Standards – Mathematics		Activity number
Mathematical Practice (MP)	Reason abstractly and quantitatively. (MP.2)	3, 4, 11, 16
	Model with mathematics. (MP.4)	5, 6, 13, 16
Ratios and Proportional Reasoning (RP)	Understand the concept of a ratio, and use ratio language to describe a ratio between two quantities. (6.RP.A.1)	5, 10, 11, 12
	Use ratio and rate reasoning to solve real-world and mathematical problems. (6.RP.A.3)	8, 13, 14, 16
Statistics and Probability (SP)	Summarize numerical data sets in relation to their context. (6.SP.B.5)	14