A Teacher Planning Guide for

Elevate Science
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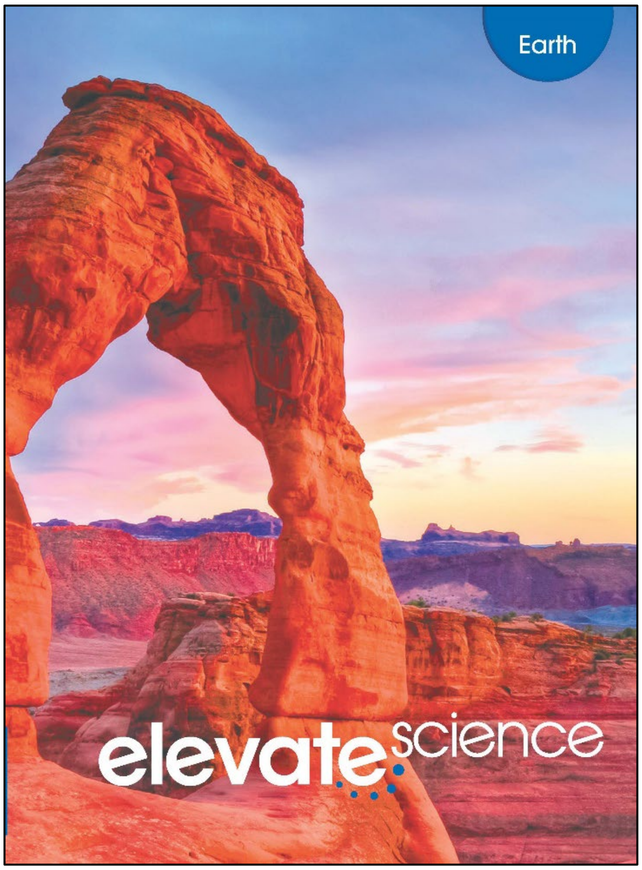

To the

Wisconsin Standards for Science
Earth Science, Grades 6-8

Prepared by Savvas Learning Company, formerly Pearson K12 Learning

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Introduction

The following document demonstrates how the ***Elevate Science ©2019*** program supports the Wisconsin Standards for Science.

Savvas Learning Company is proud to introduce ***Elevate Science: Life, Earth, and Physical*** for Middle Grades – where exploration is the heart of science! Designed to address the rigors of new science standards, students will experience science up close and personal, using real-world, relevant phenomena to solve project-based problems. Our newest program prepares students for the challenges of tomorrow, building strong reasoning skills and critical thinking strategies as they engage in explorations, formulate claims, and gather and analyze data that promote evidence-based arguments. The blended print and digital curriculum covers all Next Generation Science Standards at every grade level.

Elevate Science helps teachers transform learning, promote innovation, and manage their classroom.

Transform science classrooms by immersing students in active, three-dimensional learning.
Elevate Science engages students with real-world phenomena, open-ended Quests, uDemonstrate performance-based tasks, and in the engineering/design process with uEngineer It! investigations.

- A new 3-D learning model enhances best practices.
- Engineering-focused features infuse STEM learning.
- Phenomena-based activities put students at the heart of a Quest for knowledge.

Innovate learning by focusing on 21st century skills.
Students are encouraged to think, collaborate, and innovate! With ***Elevate Science***, students explore STEM careers, experience engineering activities, and discover our scientific and technological world. The content, strategies, and resources of Elevate Science equip the science classroom for scientific inquiry and science and engineering practices.

- Problem-based learning Quests put students on a journey of discovery.
- STEM connections help integrate curriculum.
- Coding and innovation engage students and build 21st century skills.

Manage the classroom with confidence.
Teachers will lead their class in asking questions and engaging in argumentation. Evidence-based assessments provide new options for monitoring student understanding.

- Professional development offers practical point-of-use support.
- Embedded standards in the program allow for easy integration.
- ELL and differentiated instruction strategies help instructors reach every learner.
- Interdisciplinary connections relate science to other subjects.

Designed for today's classroom, preparing students for tomorrow's world. ***Elevate Science*** promises to:

- Elevate thinking.
- Elevate learning.
- Elevate teaching.

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Science and Engineering Practices	**SCI.SEP2.A.m.5** Develop and use a model to predict and describe phenomena.
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Performance Indicators	**MS-ESS2-1:** Develop a model to describe the cycling of Earth's materials and the flow of energy that drives plate tectonics. **SCI.ESS2.C.m:** Water cycles among land, ocean, and atmosphere, and is propelled by sunlight and gravity. Density variations of sea water drive interconnected ocean currents. Water movement causes weathering and erosion, changing landscape features.
Science and Engineering Practices	**SCI.SEP4.A.m.2:** Use graphical displays (e.g., maps, charts, graphs, and tables) of large data sets to identify temporal and spatial relationships.
Crosscutting Concepts	**SCI.CC1.m:** Students recognize macroscopic patterns are related to the nature of microscopic and atomic-level structure. They identify patterns in rates of change and other numerical relationships that provide information about natural and human-designed systems. They use patterns to identify cause and effect relationships and use graphs and charts to identify patterns in data.

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Performance Indicators	**MS-ESS2-1:** Develop a model to describe the cycling of Earth's materials and the flow of energy that drives plate tectonics.
Science and Engineering Practices	**SCI.SEP2.A.m.5:** Develop and use a model to predict and describe phenomena.
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Science and Engineering Practices	**SCI.SEP1.A.m.4** Ask questions to clarify or refine a model, an explanation, or an engineering problem. **SCI.SEP3.A.m.4** Collect data under a range of conditions that serve as the basis for evidence to answer scientific questions or test design solutions.
Engineering, Technology, and the Application of Science	**MS-ETS1-1:** Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions. **SCI.ETS2.B.m.iii** Technology use varies over time and from region to region. **SCI.ETS3.A.m.i** Individuals and teams from many nations, cultures and backgrounds have contributed to advances in science and engineering. **SCI.ETS3.A.m.ii** Scientists and engineers are persistent, use creativity, reasoning, and skepticism, and remain open to new ideas.

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Science and Engineering Practices	**SCI.SEP8.A.m.1:** Critically read scientific texts adapted for classroom use to determine the central ideas, to obtain scientific and technical information, and to describe patterns in and evidence about the natural and designed world(s).
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Performance Indicators	**MS-ESS2-4** Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.
Crosscutting Concepts	**SCI.CC5.m** Students understand matter is conserved because atoms are conserved in physical and chemical processes. They also understand that within a natural or designed system the transfer of energy drives the motion and cycling of matter. Energy may take different forms (e.g., energy in fields, thermal energy, and energy of motion). The transfer of energy can be tracked as energy flows through a designed or natural system.
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Science and Engineering Practices	**SCI.SEP7.A.m.3:** Construct, use, and present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem.

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Performance Indicators	**MS-ESS2-5** Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions. **MS-ESS3-2:** Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects. **SCI.ESS2.D.m** Complex interactions determine local weather patterns and influence climate, including the role of the ocean.
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Performance Indicators	**MS-ESS2-4** Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity. **MS-ESS2-5** Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.
Science and Engineering Practices	**SCI.SEP2.A.m.5:** Develop and use a model to predict and describe phenomena.

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Lesson 1: The Atmosphere Around You, p. 48	
Performance Indicators	**MS-ESS2-5:** Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions. **MS-ESS2-6:** Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.
Science and Engineering Practices	**SCI.SEP2.A.m.5:** Develop and use a model to predict and describe phenomena.
Crosscutting Concepts	**SCI.CC2.m** Students classify relationships as causal or correlational, and recognize correlation does not necessarily imply causation. They use cause and effect relationships to predict phenomena in natural or designed systems. They also understand that phenomena may have more than one cause, and some cause and effect relationships in systems can only be explained using probability.
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Performance Indicators	**MS-ESS2-4:** Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity. **MS-ESS3-2** Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects. **SCI.ESS2.C.m:** Water cycles among land, ocean, and atmosphere, and is propelled by sunlight and gravity. Density variations of sea water drive interconnected ocean currents. Water movement causes weathering and erosion, changing landscape features. **SCI.ESS2.D.m** Complex interactions determine local weather patterns and influence climate, including the role of the ocean.

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Crosscutting Concepts	**SCI.CC2.m** Students classify relationships as causal or correlational, and recognize correlation does not necessarily imply causation. They use cause and effect relationships to predict phenomena in natural or designed systems. They also understand that phenomena may have more than one cause, and some cause and effect relationships in systems can only be explained using probability.
Science and Engineering Practices	**SCI.SEP8.A.m.1:** Critically read scientific texts adapted for classroom use to determine the central ideas, to obtain scientific and technical information, and to describe patterns in and evidence about the natural and designed world(s). **SCI.SEP2.A.m.5:** Develop and use a model to predict and describe phenomena.
uEngineer It!: Catching Water With a Net, p. 65	
Performance Indicators	**MS-ESS2-4:** Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.
Engineering, Technology, and the Application of Science	**SCI.ETS2.B.m.iii** Technology use varies over time and from region to region. **SCI.ETS3.A.m.i** Individuals and teams from many nations, cultures and backgrounds have contributed to advances in science and engineering. **SCI.ETS3.A.m.ii** Scientists and engineers are persistent, use creativity, reasoning, and skepticism, and remain open to new ideas. **SCI.ETS3.A.m.iii** Science and engineering are influenced by what is valued in society. **SCI.ETS3.B.m.ii** Engineering seeks solutions to human problems, including issues that arise due to human interaction with the environment. It uses some of the same practices as science and often applies scientific principles to solutions. **SCI.ETS3.C.m.iii** Engineers develop solutions using multiple approaches and evaluate their solutions against criteria such as cost, safety, time and performance. This evaluation often involves trade-offs between constraints to find the optimal solution.

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Lesson 3: Air Masses, p. 66	
Performance Indicators	**SCI.ESS2.D.m** Complex interactions determine local weather patterns and influence climate, including the role of the ocean. **MS-ESS2-5:** Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.
Science and Engineering Practices	**SCI.SEP4.A. m.2** Use graphical displays (e.g., maps, charts, graphs, and tables) of large data sets to identify temporal and spatial relationships.
Crosscutting Concepts	**SCI.CC2.m** Students classify relationships as causal or correlational, and recognize correlation does not necessarily imply causation. They use cause and effect relationships to predict phenomena in natural or designed systems. They also understand that phenomena may have more than one cause, and some cause and effect relationships in systems can only be explained using probability.
Quest Check-In, p. 73	
Performance Indicators	**MS-ESS2-5:** Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions. **SCI.ESS2.D.m** Complex interactions determine local weather patterns and influence climate, including the role of the ocean.
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Performance Indicators	**MS-ESS2-5:** Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions. **MS-ESS2-6:** Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates. **SCI.ESS2.D.m:** Complex interactions determine local weather patterns and influence climate, including the role of the ocean.

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Science and Engineering Practices	**SCI.SEP2.A.m.5:** Develop and use a model to predict and describe phenomena. **SCI.SEP8.A.m.1:** Critically read scientific texts adapted for classroom use to determine the central ideas, to obtain scientific and technical information, and to describe patterns in and evidence about the natural and designed world(s).
Crosscutting Concepts	**SCI.CC2.m** Students classify relationships as causal or correlational, and recognize correlation does not necessarily imply causation. They use cause and effect relationships to predict phenomena in natural or designed systems. They also understand that phenomena may have more than one cause, and some cause and effect relationships in systems can only be explained using probability.
Engineering, Technology, and the Application of Science	**SCI.ETS2.A.m.ii** Science and technology drive each other forward.
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Performance Indicators	**MS-ESS3-2:** Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects. **SCI.ESS3.B.m** Patterns can be seen through mapping the history of natural hazards in a region and understanding related geological forces.
Science and Engineering Practices	**SCI.SEP1.B.m** Students define a design problem that can be solved through the development of an object, tool, process, or system, and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions.
Crosscutting Concepts	**SCI.CC2.m:** Students classify relationships as causal or correlational, and recognize correlation does not necessarily imply causation. They use cause and effect relationships to predict phenomena in natural or designed systems. They also understand that phenomena may have more than one cause, and some cause and effect relationships in systems can only be explained using probability.

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Engineering, Technology, and the Application of Science	**SCI.ETS1.A.m** The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that are likely to limit possible solutions. **SCI.ETS1.B.m.ii** There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem.
Case Study: The Case of the Runaway Hurricane, pp. 92-93	
Performance Indicators	**MS-ESS2-5** Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions. **MS-ESS3-2** Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
Science and Engineering Practices	**SCI.SEP4.A. m.2** Use graphical displays (e.g., maps, charts, graphs, and tables) of large data sets to identify temporal and spatial relationships.
Evidence-Based Assessment, pp. 96-97	
Performance Indicators	**MS-ESS3-2** Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
Science and Engineering Practices	**SCI.SEP4.A.m.2:** Use graphical displays (e.g., maps, charts, graphs, and tables) of large data sets to identify temporal and spatial relationships. **SCI.SEP6.A.m.5** Apply scientific reasoning to show why the data or evidence is adequate for the explanation.

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uDemonstrate Lab: Water from Trees, pp. 98-101	
Performance Indicators	**MS-ESS2-4** Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.
Science and Engineering Practices	**SCI.SEP1.A.m.2:** Ask questions to identify and clarify evidence and the premise(s) of an argument. **SCI.SEP3.A.m.2:** Conduct an investigation. Evaluate and revise the experimental design to produce data that serve as the basis for evidence to meet the goals of the investigation.
Topic 3: Minerals and Rocks in the Geosphere	
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Performance Indicators	**MS-ESS2-1:** Develop a model to describe the cycling of Earth's materials and the flow of energy that drives plate tectonics.
Science and Engineering Practices	**SCI.SEP2.A.m.5:** Develop and use a model to predict and describe phenomena.
Crosscutting Concepts	**SCI.CC3.m:** Students observe time, space, and energy phenomena at various scales using models to study systems that are too large or too small. They understand phenomena observed at one scale may not be observable at another scale, and the function of natural and designed systems may change with scale. They use proportional relationships (e.g., speed as the ratio of distance traveled to time taken) to gather information about the magnitude of properties and processes. They represent scientific relationships through the use of algebraic expressions and equations.
Lesson 1: Earth's Interior, p. 106	
Performance Indicators	**MS-ESS2-1:** Develop a model to describe the cycling of Earth's materials and the flow of energy that drives plate tectonics.
Science and Engineering Practices	**SCI.SEP2.A.m.6:** Develop a model to describe unobservable mechanisms.

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Crosscutting Concepts	**SCI.CC1.m:** Students recognize macroscopic patterns are related to the nature of microscopic and atomic-level structure. They identify patterns in rates of change and other numerical relationships that provide information about natural and human-designed systems. They use patterns to identify cause and effect relationships and use graphs and charts to identify patterns in data.
Engineering, Technology, and the Application of Science	**SCI.ETS2.B.m.iii** Technology use varies over time and from region to region.
Quest Check-In, p. 116	
Performance Indicators	**MS-ESS2-1:** Develop a model to describe the cycling of Earth's materials and the flow of energy that drives plate tectonics.
Science and Engineering Practices	**SCI.SEP7.A.m.3:** Construct, use, and present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem.
Lesson 2: Minerals, p. 118	
Performance Indicators	**MS-ESS1-4** Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history. **MS-ESS3-1:** Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.
Science and Engineering Practices	**SCI.SEP2.A.m.5:** Develop and use a model to predict and describe phenomena. **SCI.SEP8.A.m.2:** Clarify claims and findings by integrating text-based qualitative and quantitative scientific information with information contained in media and visual displays.

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Engineering, Technology, and the Application of Science	**SCI.ETS3.B.m.iii** Science and engineering have direct impacts on the quality of life for all people. Therefore, scientists and engineers need to pursue their work in an ethical manner that requires honesty, fairness and dedication to public health, safety and welfare. **SCI.ETS3.C.m.iii** Engineers develop solutions using multiple approaches and evaluate their solutions against criteria such as cost, safety, time and performance. This evaluation often involves trade-offs between constraints to find the optimal solution.
Quest Check-In, p. 126	
Performance Indicators	**MS-ESS3-4:** Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.
Science and Engineering Practices	**SCI.SEP7.A.m.3:** Construct, use, and present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem.
Lesson 3: Rocks, p. 128	
Performance Indicators	**MS-ESS2-1:** Develop a model to describe the cycling of Earth's materials and the flow of energy that drives plate tectonics.
Science and Engineering Practices	**SCI.SEP2.A.m.5:** Develop and use a model to predict and describe phenomena.
Crosscutting Concepts	**SCI.CC7.m** Students explain stability and change in natural or designed systems by examining changes over time, and considering forces at different scales, including the atomic scale. They understand changes in one part of a system might cause large changes in another part, systems in dynamic equilibrium are stable due to a balance of feedback mechanisms, and stability might be disturbed by either sudden events or gradual changes that accumulate over time.

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Quest Check-In, p. 135	
Performance Indicators	**MS-ESS2-1:** Develop a model to describe the cycling of Earth's materials and the flow of energy that drives plate tectonics.
Science and Engineering Practices	**SCI.SEP7.A.m.3:** Construct, use, and present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem.
Crosscutting Concepts	**SCI.CC7.m** Students explain stability and change in natural or designed systems by examining changes over time, and considering forces at different scales, including the atomic scale. They understand changes in one part of a system might cause large changes in another part, systems in dynamic equilibrium are stable due to a balance of feedback mechanisms, and stability might be disturbed by either sudden events or gradual changes that accumulate over time.
Lesson 4: Cycling of Rocks, p.136	
	MS-ESS2-1: Develop a model to describe the cycling of Earth's materials and the flow of energy that drives plate tectonics. **SCI.ESS2.C.m:** Water cycles among land, ocean, and atmosphere, and is propelled by sunlight and gravity. Density variations of sea water drive interconnected ocean currents. Water movement causes weathering and erosion, changing landscape features.
Science and Engineering Practices	**SCI.SEP1.A.m.2:** Ask questions to identify and clarify evidence and the premise(s) of an argument.
Case Study: Might Mauna Loa, pp. 142-143	
Performance Indicators	**MS-ESS2-1:** Develop a model to describe the cycling of Earth's materials and the flow of energy that drives plate tectonics.
Evidence-Based Assessment, pp. 146-147	
Performance Indicators	**MS-ESS2-1:** Develop a model to describe the cycling of Earth's materials and the flow of energy that drives plate tectonics.
Science and Engineering Practices	**SCI.SEP4.A.m.4** Analyze and interpret data to provide evidence for explanations of phenomena.

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Crosscutting Concepts	**SCI.CC7.m** Students explain stability and change in natural or designed systems by examining changes over time, and considering forces at different scales, including the atomic scale. They understand changes in one part of a system might cause large changes in another part, systems in dynamic equilibrium are stable due to a balance of feedback mechanisms, and stability might be disturbed by either sudden events or gradual changes that accumulate over time.
uDemonstrate Lab: The Rock Cycle in Action, pp. 148-151	
Performance Indicators	**MS-ESS1-4** Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history. **MS-ESS2-1:** Develop a model to describe the cycling of Earth's materials and the flow of energy that drives plate tectonics.
Science and Engineering Practices	**SCI.SEP2.A.m.1** Evaluate limitations of a model for a proposed object or tool. **SCI.SEP3.A.m.5** Collect data about the performance of a proposed object, tool, process, or system under a range of conditions. **SCI.SEP6.B.m.2** Undertake a design project, engaging in the design cycle, to construct and implement a solution that meets specific design criteria and constraints.
Engineering, Technology, and the Application of Science	**MS-ETS1-3** Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
Topic 4: Plate Tectonics	
Quest Kickoff: How safe is it to hike around Mount Rainier?, pp. 154-155	
Performance Indicators	**MS-ESS3-2:** Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects. **SCI.ESS3.B.m:** Patterns can be seen through mapping the history of natural hazards in a region and understanding related geological forces.

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uConnect Lab: How Are Earth's Continents Linked Together?, pp. 155A-155B	
Performance Indicators	**MS-ESS2-3:** Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.
Science and Engineering Practices	**SCI.SEP7.A.m.3:** Construct, use, and present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem.
Lesson 1: Evidence of Plate Motions, p. 156	
Performance Indicators	**MS-ESS2-3:** Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions. **SCI.ESS2.B.m** Plate tectonics is the unifying theory that explains movements of rocks at Earth's surface and geological history. Maps are used to display evidence of plate movement.
Science and Engineering Practices	**SCI.SEP6.A.m.3** Construct a scientific explanation based on valid and reliable evidence obtained from sources, including the students' own experiments. Solutions should build on the following assumption: theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.
Crosscutting Concepts	**SCI.CC1.m** Students recognize macroscopic patterns are related to the nature of microscopic and atomic-level structure. They identify patterns in rates of change and other numerical relationships that provide information about natural and human-designed systems. They use patterns to identify cause and effect relationships and use graphs and charts to identify patterns in data.
Lesson 2: Plate Tectonics and Earth's Surface, p. 166	
Performance Indicators	**MS-ESS2-2:** Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales. **MS-ESS2-3:** Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.

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Science and Engineering Practices	**SCI.SEP6.A.m.3** Construct a scientific explanation based on valid and reliable evidence obtained from sources, including the students' own experiments. Solutions should build on the following assumption: theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.
Crosscutting Concepts	**SCI.CC2.m:** Students classify relationships as causal or correlational, and recognize correlation does not necessarily imply causation. They use cause and effect relationships to predict phenomena in natural or designed systems. They also understand that phenomena may have more than one cause, and some cause and effect relationships in systems can only be explained using probability. **SCI.CC3.m:** Students observe time, space, and energy phenomena at various scales using models to study systems that are too large or too small. They understand phenomena observed at one scale may not be observable at another scale, and the function of natural and designed systems may change with scale. They use proportional relationships (e.g., speed as the ratio of distance traveled to time taken) to gather information about the magnitude of properties and processes. They represent scientific relationships through the use of algebraic expressions and equations.
Case Study: Australia on the Move, pp. 176-177	
Performance Indicators	**MS-ESS2-2** Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.
Science and Engineering Practices	**SCI.SEP6.A.m.3** Construct a scientific explanation based on valid and reliable evidence obtained from sources, including the students' own experiments. Solutions should build on the following assumption: theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.

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Lesson 3: Earthquakes and Tsunami Hazards, p. 178	
Performance Indicators	**MS-ESS2-2:** Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales. **MS-ESS3-2** Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects. **SCI.ESS2.B.m:** Plate tectonics is the unifying theory that explains movements of rocks at Earth's surface and geological history. Maps are used to display evidence of plate movement.
Science and Engineering Practices	**SCI.SEP2.A.m.5:** Develop and use a model to predict and describe phenomena. **SCI.SEP4.A.m.7:** Analyze and interpret data to determine similarities and differences in findings.
Crosscutting Concepts	**SCI.CC1.m** Students recognize macroscopic patterns are related to the nature of microscopic and atomic-level structure. They identify patterns in rates of change and other numerical relationships that provide information about natural and human-designed systems. They use patterns to identify cause and effect relationships and use graphs and charts to identify patterns in data.
Quest Check-In, p. 88	
Performance Indicators	**MS-ESS2-2** Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.
Science and Engineering Practices	**SCI.SEP6.A.m.3** Construct a scientific explanation based on valid and reliable evidence obtained from sources, including the students' own experiments. Solutions should build on the following assumption: theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.

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Crosscutting Concepts	**SCI.CC2.m** Students classify relationships as causal or correlational, and recognize correlation does not necessarily imply causation. They use cause and effect relationships to predict phenomena in natural or designed systems. They also understand that phenomena may have more than one cause, and some cause and effect relationships in systems can only be explained using probability.
uEngineer It!: Designing to Prevent Destruction, p. 189	
Performance Indicators	**MS-ESS3-2:** Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects. **MS-ESS3-3:** Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
Science and Engineering Practices	**SCI.SEP1.A.m.4** Ask questions to clarify or refine a model, an explanation, or an engineering problem. **SCI.SEP3.A.m.4** Collect data under a range of conditions that serve as the basis for evidence to answer scientific questions or test design solutions.
Engineering, Technology, and the Application of Science	**SCI.ETS2.B.m.iii** Technology use varies over time and from region to region. **SCI.ETS3.A.m.i** Individuals and teams from many nations, cultures and backgrounds have contributed to advances in science and engineering. **SCI.ETS3.A.m.ii** Scientists and engineers are persistent, use creativity, reasoning, and skepticism, and remain open to new ideas. **SCI.ETS3.A.m.iii** Science and engineering are influenced by what is valued in society. **SCI.ETS3.B.m.ii** Engineering seeks solutions to human problems, including issues that arise due to human interaction with the environment. It uses some of the same practices as science and often applies scientific principles to solutions.

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Continued:	**Continued:** **SCI.ETS3.B.m.iii** Science and engineering have direct impacts on the quality of life for all people. Therefore, scientists and engineers need to pursue their work in an ethical manner that requires honesty, fairness and dedication to public health, safety and welfare. **SCI.ETS3.C.m.iii** Engineers develop solutions using multiple approaches and evaluate their solutions against criteria such as cost, safety, time and performance. This evaluation often involves trade-offs between constraints to find the optimal solution.
Lesson 4: Volcanoes and Earth's Surface, p. 190	
Performance Indicators	**MS-ESS2-2** Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales. **MS-ESS2-3** Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions. **SCI.ESS3.B.m** Patterns can be seen through mapping the history of natural hazards in a region and understanding related geological forces.
Science and Engineering Practices	**SCI.SEP4.A.m.7** Analyze and interpret data to determine similarities and differences in findings. **SCI.SEP6.A.m.3** Construct a scientific explanation based on valid and reliable evidence obtained from sources, including the students' own experiments. Solutions should build on the following assumption: theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.

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Crosscutting Concepts	**SCI.CC1.m** Students recognize macroscopic patterns are related to the nature of microscopic and atomic-level structure. They identify patterns in rates of change and other numerical relationships that provide information about natural and human-designed systems. They use patterns to identify cause and effect relationships and use graphs and charts to identify patterns in data. **SCI.CC3.m** Students observe time, space, and energy phenomena at various scales using models to study systems that are too large or too small. They understand phenomena observed at one scale may not be observable at another scale, and the function of natural and designed systems may change with scale. They use proportional relationships (e.g., speed as the ratio of distance traveled to time taken) to gather information about the magnitude of properties and processes. They represent scientific relationships through the use of algebraic expressions and equations.
Evidence-Based Assessment, pp. 202-203	
Performance Indicator	**MS-ESS2-2** Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales. **MS-ESS2-3** Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.
Science and Engineering Practices	**SCI.SEP6.A.m.3** Construct a scientific explanation based on valid and reliable evidence obtained from sources, including the students' own experiments. Solutions should build on the following assumption: theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.

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Crosscutting Concepts	**SCI.CC4.m:** Students understand systems may interact with other systems: they may have sub-systems and be a part of larger complex systems. They use models to represent systems and their interactions—such as inputs, processes, and outputs—and energy, matter, and information flows within systems. They also learn that models are limited in that they only represent certain aspects of the system under study.
uDemonstrate Lab: Modeling Sea-Floor Spreading, pp. 204-207	
Performance Indicator	**MS-ESS2-2** Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales. **MS-ESS3-2:** Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
Science and Engineering Practices	**SCI.SEP2.A.m.7** Develop and use a model to generate data to test ideas about phenomena in natural or designed systems, including those representing inputs and outputs, and those at unobservable scales. **SCI.SEP6.A.m.3** Construct a scientific explanation based on valid and reliable evidence obtained from sources, including the students' own experiments. Solutions should build on the following assumption: theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. **SCI.SEP6.B.m.3** Optimize performance of a design by prioritizing criteria, making trade-offs, testing, revising, and retesting.
Crosscutting Concepts	**SCI.CC7.m** Students explain stability and change in natural or designed systems by examining changes over time, and considering forces at different scales, including the atomic scale. They understand changes in one part of a system might cause large changes in another part, systems in dynamic equilibrium are stable due to a balance of feedback mechanisms, and stability might be disturbed by either sudden events or gradual changes that accumulate over time.

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Engineering, Technology, and the Application of Science	**MS-ETS1-2** Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. **MS-ETS1-3** Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success. **MS-ETS1-4** Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved. **SCI.ETS1.B.m.i** A solution needs to be tested and then modified on the basis of the test results in order to improve it.
Topic 5: Earth's Surface Systems	
Quest Kickoff: How can I design and build an artificial island?, pp. 210-211	
Performance Indicators	**SCI.ESS2.C.m:** Water cycles among land, ocean, and atmosphere, and is propelled by sunlight and gravity. Density variations of sea water drive interconnected ocean currents. Water movement causes weathering and erosion, changing landscape features.
Science and Engineering Practices	**SCI.SEP1.B.m** Students define a design problem that can be solved through the development of an object, tool, process, or system, and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions.
Engineering, Technology, and the Application of Science	**MS-ETS1-1** Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions. **SCI.ETS1.A.m** The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that are likely to limit possible solutions.

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uConnect Lab: How Does Gravity Affect Materials on a Slope?, pp. 211A-211B	
Performance Indicators	**MS-ESS3-2:** Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
Science and Engineering Practices	**SCI.SEP1.A.m.6** Ask questions that can be investigated within the scope of the classroom, outdoor environment, and museums and other public facilities with available resources and, when appropriate, frame a hypothesis based on observations and scientific principles. **SCI.SEP3.A.m** Students plan and carry out investigations that use multiple variables and provide evidence to support explanations or solutions. **SCI.SEP4.A.m.6** Consider limitations of data analysis (e.g., measurement error), and seek to improve precision and accuracy of data with better technological tools and methods (e.g., multiple trials).
Crosscutting Concepts	**SCI.CC2.m:** Students classify relationships as causal or correlational, and recognize correlation does not necessarily imply causation. They use cause and effect relationships to predict phenomena in natural or designed systems. They also understand that phenomena may have more than one cause, and some cause and effect relationships in systems can only be explained using probability.
Lesson 1: Weathering and Soil, p. 212	
Performance Indicators	**MS-ESS2-2** Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales. **SCI.ESS2.C.m** Water cycles among land, ocean, and atmosphere, and is propelled by sunlight and gravity. Density variations of sea water drive interconnected ocean currents. Water movement causes weathering and erosion, changing landscape features.

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Science and Engineering Practices	**SCI.SEP7.A.m.3:** Construct, use, and present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem.
Crosscutting Concepts	**SCI.CC2.m:** Students classify relationships as causal or correlational, and recognize correlation does not necessarily imply causation. They use cause and effect relationships to predict phenomena in natural or designed systems. They also understand that phenomena may have more than one cause, and some cause and effect relationships in systems can only be explained using probability. **SCI.CC3.m:** Students observe time, space, and energy phenomena at various scales using models to study systems that are too large or too small. They understand phenomena observed at one scale may not be observable at another scale, and the function of natural and designed systems may change with scale. They use proportional relationships (e.g., speed as the ratio of distance traveled to time taken) to gather information about the magnitude of properties and processes. They represent scientific relationships through the use of algebraic expressions and equations.
Quest Check-In, p. 220	
Performance Indicators	**SCI.ESS2.C.m:** Water cycles among land, ocean, and atmosphere, and is propelled by sunlight and gravity. Density variations of sea water drive interconnected ocean currents. Water movement causes weathering and erosion, changing landscape features. **MS-ESS2-2** Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.
Science and Engineering Practices	**SCI.SEP6.A.m.3** Construct a scientific explanation based on valid and reliable evidence obtained from sources, including the students' own experiments. Solutions should build on the following assumption: theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.

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Crosscutting Concepts	**SCI.CC7.m** Students explain stability and change in natural or designed systems by examining changes over time, and considering forces at different scales, including the atomic scale. They understand changes in one part of a system might cause large changes in another part, systems in dynamic equilibrium are stable due to a balance of feedback mechanisms, and stability might be disturbed by either sudden events or gradual changes that accumulate over time.
uEngineer It!: Ground Shifting Advances: Maps Help Predict, p. 221	
Performance Indicators	**MS-ESS3-2:** Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
Science and Engineering Practices	**SCI.SEP6.B.m.2:** Undertake a design project, engaging in the design cycle, to construct and implement a solution that meets specific design criteria and constraints.
Engineering, Technology, and the Application of Science	**SCI.ETS2.B.m.iii** Technology use varies over time and from region to region. **SCI.ETS3.A.m.i** Individuals and teams from many nations, cultures and backgrounds have contributed to advances in science and engineering. **SCI.ETS3.A.m.ii** Scientists and engineers are persistent, use creativity, reasoning, and skepticism, and remain open to new ideas. **SCI.ETS3.A.m.iii** Science and engineering are influenced by what is valued in society. **SCI.ETS3.B.m.ii** Engineering seeks solutions to human problems, including issues that arise due to human interaction with the environment. It uses some of the same practices as science and often applies scientific principles to solutions. **SCI.ETS3.B.m.iii** Science and engineering have direct impacts on the quality of life for all people. Therefore, scientists and engineers need to pursue their work in an ethical manner that requires honesty, fairness and dedication to public health, safety and welfare.

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Lesson 2: Erosion and Deposition, p. 222	
Performance Indicators	**MS-ESS2-2:** Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales. **SCI.ESS2.C.m:** Water cycles among land, ocean, and atmosphere, and is propelled by sunlight and gravity. Density variations of sea water drive interconnected ocean currents. Water movement causes weathering and erosion, changing landscape features.
Science and Engineering Practices	**SCI.SEP6.A.m.3** Construct a scientific explanation based on valid and reliable evidence obtained from sources, including the students' own experiments. Solutions should build on the following assumption: theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.
Crosscutting Concepts	**SCI.CC4.m** Students understand systems may interact with other systems: they may have sub-systems and be a part of larger complex systems. They use models to represent systems and their interactions—such as inputs, processes, and outputs—and energy, matter, and information flows within systems. They also learn that models are limited in that they only represent certain aspects of the system under study.
Quest Check-In, p. 228	
Performance Indicators	**MS-ESS3-2:** Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
Science and Engineering Practices	**SCI.SEP6.A.m.3** Construct a scientific explanation based on valid and reliable evidence obtained from sources, including the students' own experiments. Solutions should build on the following assumption: theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.

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Crosscutting Concepts	**SCI.CC1.m** Students recognize macroscopic patterns are related to the nature of microscopic and atomic-level structure. They identify patterns in rates of change and other numerical relationships that provide information about natural and human-designed systems. They use patterns to identify cause and effect relationships and use graphs and charts to identify patterns in data. **SCI.CC4.m** Students understand systems may interact with other systems: they may have sub-systems and be a part of larger complex systems. They use models to represent systems and their interactions—such as inputs, processes, and outputs—and energy, matter, and information flows within systems. They also learn that models are limited in that they only represent certain aspects of the system under study.
Lesson 3: Water Erosion, p. 230	
Performance Indicators	**MS-ESS2-2:** Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales. **SCI.ESS2.C.m:** Water cycles among land, ocean, and atmosphere, and is propelled by sunlight and gravity. Density variations of sea water drive interconnected ocean currents. Water movement causes weathering and erosion, changing landscape features.
Science and Engineering Practices	**SCI.SEP6.A.m.3** Construct a scientific explanation based on valid and reliable evidence obtained from sources, including the students' own experiments. Solutions should build on the following assumption: theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.
Crosscutting Concepts	**SCI.CC2.m:** Students classify relationships as causal or correlational, and recognize correlation does not necessarily imply causation. They use cause and effect relationships to predict phenomena in natural or designed systems. They also understand that phenomena may have more than one cause, and some cause and effect relationships in systems can only be explained using probability.

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Quest Check-In, p. 239	
Performance Indicators	**SCI.ESS2.C.m:** Water cycles among land, ocean, and atmosphere, and is propelled by sunlight and gravity. Density variations of sea water drive interconnected ocean currents. Water movement causes weathering and erosion, changing landscape features.
Crosscutting Concepts	**SCI.CC2.m** Students classify relationships as causal or correlational, and recognize correlation does not necessarily imply causation. They use cause and effect relationships to predict phenomena in natural or designed systems. They also understand that phenomena may have more than one cause, and some cause and effect relationships in systems can only be explained using probability. **SCI.CC7.m** Students explain stability and change in natural or designed systems by examining changes over time, and considering forces at different scales, including the atomic scale. They understand changes in one part of a system might cause large changes in another part, systems in dynamic equilibrium are stable due to a balance of feedback mechanisms, and stability might be disturbed by either sudden events or gradual changes that accumulate over time.
Case Study: Buyer Beware!, pp. 240-241	
Performance Indicators	**MS-ESS2-2** Construct an explanation based on evidence for how geoscience processes have changed Earth’s surface at varying time and spatial scales.
Lesson 4: Glacial and Wave Erosion, p. 242	
Performance Indicators	**MS-ESS2-2** Construct an explanation based on evidence for how geoscience processes have changed Earth’s surface at varying time and spatial scales. **SCI.ESS2.C.m:** Water cycles among land, ocean, and atmosphere, and is propelled by sunlight and gravity. Density variations of sea water drive interconnected ocean currents. Water movement causes weathering and erosion, changing landscape features.

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Science and Engineering Practices	**SCI.SEP6.A.m.3** Construct a scientific explanation based on valid and reliable evidence obtained from sources, including the students' own experiments. Solutions should build on the following assumption: theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.
Quest Check-In, p. 251	
Performance Indicators	**SCI.ESS2.C.m:** Water cycles among land, ocean, and atmosphere, and is propelled by sunlight and gravity. Density variations of sea water drive interconnected ocean currents. Water movement causes weathering and erosion, changing landscape features.
Crosscutting Concepts	**SCI.CC2.m** Students classify relationships as causal or correlational, and recognize correlation does not necessarily imply causation. They use cause and effect relationships to predict phenomena in natural or designed systems. They also understand that phenomena may have more than one cause, and some cause and effect relationships in systems can only be explained using probability. **SCI.CC7.m** Students explain stability and change in natural or designed systems by examining changes over time, and considering forces at different scales, including the atomic scale. They understand changes in one part of a system might cause large changes in another part, systems in dynamic equilibrium are stable due to a balance of feedback mechanisms, and stability might be disturbed by either sudden events or gradual changes that accumulate over time.
Evidence-Based Assessment, pp. 254-255	
Performance Indicators	**MS-ESS2-2** Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales. **MS-ESS3-2** Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.

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Science and Engineering Practices	**SCI.SEP4.A.m.7:** Analyze and interpret data to determine similarities and differences in findings. **SCI.SEP7.A.m.3:** Construct, use, and present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem.
Crosscutting Concepts	**SCI.CC2.m** Students classify relationships as causal or correlational, and recognize correlation does not necessarily imply causation. They use cause and effect relationships to predict phenomena in natural or designed systems. They also understand that phenomena may have more than one cause, and some cause and effect relationships in systems can only be explained using probability. **SCI.CC7.m** Students explain stability and change in natural or designed systems by examining changes over time, and considering forces at different scales, including the atomic scale. They understand changes in one part of a system might cause large changes in another part, systems in dynamic equilibrium are stable due to a balance of feedback mechanisms, and stability might be disturbed by either sudden events or gradual changes that accumulate over time.
uDemonstrate Lab: Materials on a Slope, pp. 256-259	
Performance Indicators	**MS-ESS3-2:** Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.

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Science and Engineering Practices	**SCI.SEP2.A.m.1** Evaluate limitations of a model for a proposed object or tool. **SCI.SEP2.A.m.7** Develop and use a model to generate data to test ideas about phenomena in natural or designed systems, including those representing inputs and outputs, and those at unobservable scales. **SCI.SEP3.A.m.1** Individually and collaboratively plan an investigation, identifying: independent and dependent variables and controls, tools needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim. **SCI.SEP3.A.m.4** Collect data under a range of conditions that serve as the basis for evidence to answer scientific questions or test design solutions. **SCI.SEP3.A.m.5** Collect data about the performance of a proposed object, tool, process, or system under a range of conditions. **SCI.SEP4.A.m.8** Analyze data to define an optimal operational range for a proposed object, tool, process, or system that best meets criteria for success.
Crosscutting Concepts	**SCI.CC3.m** Students observe time, space, and energy phenomena at various scales using models to study systems that are too large or too small. They understand phenomena observed at one scale may not be observable at another scale, and the function of natural and designed systems may change with scale. They use proportional relationships (e.g., speed as the ratio of distance traveled to time taken) to gather information about the magnitude of properties and processes. They represent scientific relationships through the use of algebraic expressions and equations. **SCI.CC7.m** Students explain stability and change in natural or designed systems by examining changes over time, and considering forces at different scales, including the atomic scale. They understand changes in one part of a system might cause large changes in another part, systems in dynamic equilibrium are stable due to a balance of feedback mechanisms, and stability might be disturbed by either sudden events or gradual changes that accumulate over time.

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Engineering, Technology, and the Application of Science	**MS-ETS1-3** Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success. **MS-ETS1-4** Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.
Topic 6: Distribution of Natural Resources	
Quest Kickoff: How could natural resources have saved a ghost town?, pp. 262-263	
Performance Indicators	**MS-ESS3-1:** Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.
Engineering, Technology, and the Application of Science	**MS-ETS1-1** Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions. **SCI.ETS1.A.m** The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that are likely to limit possible solutions. **SCI.ETS1.B.m.ii** There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem.
uConnect Lab: What's in a Piece of Coal?, pp. 263A-263B	
Performance Indicators	**MS-ESS3-1:** Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.

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Science and Engineering Practices	**SCI.SEP1.A.m.6** Ask questions that can be investigated within the scope of the classroom, outdoor environment, and museums and other public facilities with available resources and, when appropriate, frame a hypothesis based on observations and scientific principles. **SCI.SEP3.A.m.4** Collect data under a range of conditions that serve as the basis for evidence to answer scientific questions or test design solutions.
Lesson 1: Nonrenewable Energy Resources, p. 264	
Performance Indicators	**MS-ESS3-1:** Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes. **MS-ESS3-4:** Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems. **SCI.ESS3.A.m:** Humans depend on Earth's land, oceans, fresh water, atmosphere, and biosphere for different resources, many of which are limited or not renewable. Resources are distributed unevenly around the planet as a result of past geologic processes.
Science and Engineering Practices	**SCI.SEP3.A.m.1:** Individually and collaboratively plan an investigation, identifying: independent and dependent variables and controls, tools needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim. **SCI.SEP4.A.m.2:** Use graphical displays (e.g., maps, charts, graphs, and tables) of large data sets to identify temporal and spatial relationships.
Crosscutting Concepts	**SCI.CC1.m:** Students recognize macroscopic patterns are related to the nature of microscopic and atomic-level structure. They identify patterns in rates of change and other numerical relationships that provide information about natural and human-designed systems. They use patterns to identify cause and effect relationships and use graphs and charts to identify patterns in data.

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Lesson 2: Renewable Energy Resources, p. 274	
Performance Indicators	**MS-ESS3-1:** Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes. **MS-ESS3-3** Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
Science and Engineering Practices	**SCI.SEP6.B.m.1** Apply scientific ideas or principles to design, construct, and test a design of an object, tool, process, or system. **SCI.SEP7.A.m.3** Construct, use, and present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem.
Crosscutting Concepts	**SCI.CC2.m** Students classify relationships as causal or correlational, and recognize correlation does not necessarily imply causation. They use cause and effect relationships to predict phenomena in natural or designed systems. They also understand that phenomena may have more than one cause, and some cause and effect relationships in systems can only be explained using probability.
Quest Check-In, p. 280	
Performance Indicators	**MS-ESS3-4:** Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.
Science and Engineering Practices	**SCI.SEP7.A.m.3** Construct, use, and present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. **SCI.SEP7.A.m.3** Construct, use, and present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem.

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uEngineer It!: Micro-Hydro Power, p. 281	
Performance Indicators	**MS-ESS3-3:** Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
Science and Engineering Practices	**SCI.SEP1.A.m.4** Ask questions to clarify or refine a model, an explanation, or an engineering problem. **SCI.SEP3.A.m.4** Collect data under a range of conditions that serve as the basis for evidence to answer scientific questions or test design solutions. **SCI.SEP3.A.m.5** Collect data about the performance of a proposed object, tool, process, or system under a range of conditions. **SCI.SEP6.B.m.1** Apply scientific ideas or principles to design, construct, and test a design of an object, tool, process, or system.
Engineering, Technology, and the Application of Science	**SCI.ETS3.A.m.i** Individuals and teams from many nations, cultures and backgrounds have contributed to advances in science and engineering. **SCI.ETS3.A.m.ii** Scientists and engineers are persistent, use creativity, reasoning, and skepticism, and remain open to new ideas. **SCI.ETS3.A.m.iii** Science and engineering are influenced by what is valued in society. **SCI.ETS3.B.m.ii** Engineering seeks solutions to human problems, including issues that arise due to human interaction with the environment. It uses some of the same practices as science and often applies scientific principles to solutions. **SCI.ETS3.B.m.iii** Science and engineering have direct impacts on the quality of life for all people. Therefore, scientists and engineers need to pursue their work in an ethical manner that requires honesty, fairness and dedication to public health, safety and welfare. **SCI.ETS3.C.m.iii** Engineers develop solutions using multiple approaches and evaluate their solutions against criteria such as cost, safety, time and performance. This evaluation often involves trade-offs between constraints to find the optimal solution.

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Lesson 3: Mineral Resources, p. 282	
Performance Indicators	**MS-ESS3-1:** Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes. **SCI.ESS3.A.m:** Humans depend on Earth's land, oceans, fresh water, atmosphere, and biosphere for different resources, many of which are limited or not renewable. Resources are distributed unevenly around the planet as a result of past geologic processes.
Crosscutting Concepts	**SCI.CC2.m** Students classify relationships as causal or correlational, and recognize correlation does not necessarily imply causation. They use cause and effect relationships to predict phenomena in natural or designed systems. They also understand that phenomena may have more than one cause, and some cause and effect relationships in systems can only be explained using probability.
Quest Check-In, p. 289	
Performance Indicators	**SCI.ESS3.A.m:** Humans depend on Earth's land, oceans, fresh water, atmosphere, and biosphere for different resources, many of which are limited or not renewable. Resources are distributed unevenly around the planet as a result of past geologic processes.
Case Study: Phosphorus Fiasco, pp. 290-291	
Performance Indicators	**MS-ESS3-1** Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes. **MS-ESS3-4:** Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems. **SCI.ESS3.A.m** Humans depend on Earth's land, oceans, fresh water, atmosphere, and biosphere for different resources, many of which are limited or not renewable. Resources are distributed unevenly around the planet as a result of past geologic processes.

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Science and Engineering Practices	**SCI.SEP5.A.m.5** Apply mathematical concepts and processes (such as ratio, rate, percent, basic operations, and simple algebra) to scientific and engineering questions and problems.
Crosscutting Concepts	**SCI.CC3.m** Students observe time, space, and energy phenomena at various scales using models to study systems that are too large or too small. They understand phenomena observed at one scale may not be observable at another scale, and the function of natural and designed systems may change with scale. They use proportional relationships (e.g., speed as the ratio of distance traveled to time taken) to gather information about the magnitude of properties and processes. They represent scientific relationships through the use of algebraic expressions and equations.
Lesson 4: Water Resources, p. 292	
Performance Indicators	**MS-ESS3-4:** Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems. **SCI.ESS3.A.m:** Humans depend on Earth's land, oceans, fresh water, atmosphere, and biosphere for different resources, many of which are limited or not renewable. Resources are distributed unevenly around the planet as a result of past geologic processes.
Science and Engineering Practices	**SCI.SEP6.A.m.3** Construct a scientific explanation based on valid and reliable evidence obtained from sources, including the students' own experiments. Solutions should build on the following assumption: theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.
Quest Check-In, p. 298	
Performance Indicators	**MS-ESS3-1:** Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes. **SCI.ESS3.A.m:** Humans depend on Earth's land, oceans, fresh water, atmosphere, and biosphere for different resources, many of which are limited or not renewable. Resources are distributed unevenly around the planet as a result of past geologic processes.

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Evidence-Based Assessment, pp. 302-303	
Performance Indicators	**MS-ESS3-1:** Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes. **SCI.ESS3.A.m:** Humans depend on Earth's land, oceans, fresh water, atmosphere, and biosphere for different resources, many of which are limited or not renewable. Resources are distributed unevenly around the planet as a result of past geologic processes.
Engineering, Technology, and the Application of Science	**SCI.ETS2.B.m.i** All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment.
uDemonstrate Lab: To Drill or Not to Drill, pp. 304-307	
Performance Indicators	**MS-ESS3-1:** Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes. **SCI.ESS3.A.m** Humans depend on Earth's land, oceans, fresh water, atmosphere, and biosphere for different resources, many of which are limited or not renewable. Resources are distributed unevenly around the planet as a result of past geologic processes.
Science and Engineering Practices	**SCI.SEP2.A.m.1** Evaluate limitations of a model for a proposed object or tool.
Engineering, Technology, and the Application of Science	**SCI.ETS2.B.m.i** All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment.

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Topic 7: Human Impacts on the Environment	
Quest Kickoff: How can you help your school reduce its impact on Earth's systems?, pp. 310-311	
Performance Indicators	**MS-ESS3-4:** Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.
Engineering, Technology, and the Application of Science	**SCI.ETS2.B.m.i** All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment.
uConnect Lab: Finding a Solution for Your Pollution, pp. 311A-311B	
Performance Indicators	**MS-ESS3-4:** Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.
Science and Engineering Practices	**SCI.SEP5.A.m.4** Create algorithms (a series of ordered steps) to solve a problem.
Engineering, Technology, and the Application of Science	**SCI.ETS2.B.m.i** All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment.
Lesson 1: Population Growth and Resource Consumption, p. 312	
Performance Indicators	**MS-ESS3-4:** Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.
Science and Engineering Practices	**SCI.SEP7.A.m.3** Construct, use, and present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem.
Crosscutting Concepts	**SCI.CC2.m** Students classify relationships as causal or correlational, and recognize correlation does not necessarily imply causation. They use cause and effect relationships to predict phenomena in natural or designed systems. They also understand that phenomena may have more than one cause, and some cause and effect relationships in systems can only be explained using probability.

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Engineering, Technology, and the Application of Science	**SCI.ETS2.B.m.i** All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment.
Lesson 2: Air Pollution, p. 320	
Performance Indicators	**MS-ESS3-4:** Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems. **SCI.ESS3.C.m** Human activities have altered the hydrosphere, atmosphere, and lithosphere which in turn has altered the biosphere. Changes to the biosphere can have different impacts for different living things. Activities and technologies can be engineered to reduce people's impacts on Earth. **SCI.ESS3.D.m:** Evidence suggests human activities affect global warming. Decisions to reduce the impact of global warming depend on understanding climate science, engineering capabilities, and social dynamics.
Science and Engineering Practices	**SCI.SEP7.A.m.3:** Construct, use, and present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem.
Crosscutting Concepts	**SCI.CC2.m:** Students classify relationships as causal or correlational, and recognize correlation does not necessarily imply causation. They use cause and effect relationships to predict phenomena in natural or designed systems. They also understand that phenomena may have more than one cause, and some cause and effect relationships in systems can only be explained using probability.
Engineering, Technology, and the Application of Science	**SCI.ETS2.B.m.i** All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment.
Quest Check-In, p. 328	
Performance Indicators	**MS-ESS3-4:** Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.

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Lesson 3: Impacts on Land, p. 330	
Performance Indicators	**MS-ESS3-4:** Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems. **SCI.ESS3.A.m:** Humans depend on Earth's land, oceans, fresh water, atmosphere, and biosphere for different resources, many of which are limited or not renewable. Resources are distributed unevenly around the planet as a result of past geologic processes.
Science and Engineering Practices	**SCI.SEP2.A.m.7:** Develop and use a model to generate data to test ideas about phenomena in natural or designed systems, including those representing inputs and outputs, and those at unobservable scales. **SCI.SEP4.A.m.1:** Construct, analyze, or interpret graphical displays of data and large data sets to identify linear and nonlinear relationships.
Crosscutting Concepts	**SCI.CC2.m:** Students classify relationships as causal or correlational, and recognize correlation does not necessarily imply causation. They use cause and effect relationships to predict phenomena in natural or designed systems. They also understand that phenomena may have more than one cause, and some cause and effect relationships in systems can only be explained
Quest Check-In, p. 341	
Performance Indicators	**MS-ESS3-4:** Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems. **SCI.ESS3.A.m:** Humans depend on Earth's land, oceans, fresh water, atmosphere, and biosphere for different resources, many of which are limited or not renewable. Resources are distributed unevenly around the planet as a result of past geologic processes.
Science and Engineering Practices	**SCI.SEP7.A.m.3** Construct, use, and present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem.

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Engineering, Technology, and the Application of Science	**SCI.ETS2.B.m.i** All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment.
Case Study: Nothing Goes To Waste, pp. 342-343	
Performance Indicators	**MS-ESS3-4:** Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems. **SCI.ESS3.A.m:** Humans depend on Earth's land, oceans, fresh water, atmosphere, and biosphere for different resources, many of which are limited or not renewable. Resources are distributed unevenly around the planet as a result of past geologic processes.
Science and Engineering Practices	**SCI.SEP7.A.m.3** Construct, use, and present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem.
Crosscutting Concepts	**SCI.CC3.m** Students observe time, space, and energy phenomena at various scales using models to study systems that are too large or too small. They understand phenomena observed at one scale may not be observable at another scale, and the function of natural and designed systems may change with scale. They use proportional relationships (e.g., speed as the ratio of distance traveled to time taken) to gather information about the magnitude of properties and processes. They represent scientific relationships through the use of algebraic expressions and equations.
Engineering, Technology, and the Application of Science	**SCI.ETS2.B.m.i** All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment.

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Lesson 4: Water Pollution, p. 344	
Performance Indicators	**MS-ESS3-4:** Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems. **SCI.ESS3.C.m:** Human activities have altered the hydrosphere, atmosphere, and lithosphere which in turn has altered the biosphere. Changes to the biosphere can have different impacts for different living things. Activities and technologies can be engineered to reduce people's impacts on Earth.
Science and Engineering Practices	**SCI.SEP7.A.m.3:** Construct, use, and present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem.
Crosscutting Concepts	**SCI.CC2.m** Students classify relationships as causal or correlational, and recognize correlation does not necessarily imply causation. They use cause and effect relationships to predict phenomena in natural or designed systems. They also understand that phenomena may have more than one cause, and some cause and effect relationships in systems can only be explained using probability.
Quest Check-In, p. 352	
Performance Indicators	**MS-ESS3-4:** Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems. **SCI.ESS3.C.m:** Human activities have altered the hydrosphere, atmosphere, and lithosphere which in turn has altered the biosphere. Changes to the biosphere can have different impacts for different living things. Activities and technologies can be engineered to reduce people's impacts on Earth.
Science and Engineering Practices	**SCI.SEP7.A.m.3** Construct, use, and present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem.

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Engineering, Technology, and the Application of Science	**SCI.ETS2.B.m.i** All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment.
uEngineer It!: From Wastewater to Tap Water, p. 353	
Performance Indicators	**MS-ESS3-4:** Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.
Engineering, Technology, and the Application of Science	**SCI.ETS2.B.m.iii** Technology use varies over time and from region to region. **SCI.ETS3.A.m.i** Individuals and teams from many nations, cultures and backgrounds have contributed to advances in science and engineering. **SCI.ETS3.A.m.ii** Scientists and engineers are persistent, use creativity, reasoning, and skepticism, and remain open to new ideas. **SCI.ETS3.A.m.iii** Science and engineering are influenced by what is valued in society. **SCI.ETS3.B.m.ii** Engineering seeks solutions to human problems, including issues that arise due to human interaction with the environment. It uses some of the same practices as science and often applies scientific principles to solutions. **SCI.ETS3.B.m.iii** Science and engineering have direct impacts on the quality of life for all people. Therefore, scientists and engineers need to pursue their work in an ethical manner that requires honesty, fairness and dedication to public health, safety and welfare. **SCI.ETS3.C.m.iii** Engineers develop solutions using multiple approaches and evaluate their solutions against criteria such as cost, safety, time and performance. This evaluation often involves trade-offs between constraints to find the optimal solution.

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Evidence-Based Assessment, pp. 356-357	
Performance Indicators	**MS-ESS3-4:** Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.
Science and Engineering Practices	**SCI.SEP6.A.m.5** Apply scientific reasoning to show why the data or evidence is adequate for the explanation. **SCI.SEP7.A.m.3** Construct, use, and present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem.
Crosscutting Concepts	**SCI.CC2.m** Students classify relationships as causal or correlational, and recognize correlation does not necessarily imply causation. They use cause and effect relationships to predict phenomena in natural or designed systems. They also understand that phenomena may have more than one cause, and some cause and effect relationships in systems can only be explained using probability.
Engineering, Technology, and the Application of Science	**SCI.ETS2.B.m.i** All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment.
uDemonstrate Lab: Washing Away, pp. 358-361	
	MS-ESS3-4: Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.
Science and Engineering Practices	**SCI.SEP6.A.m.5** Apply scientific reasoning to show why the data or evidence is adequate for the explanation. **SCI.SEP7.A.m.3** Construct, use, and present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem.

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Engineering, Technology, and the Application of Science	**SCI.ETS2.B.m.i** All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment.
Topic 8: History of Earth	
Quest Kick Off: How do paleontologists know where to look for fossils?, pp. 364-365	
Performance Indicators	**MS-ESS1-4:** Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history. **SCI.ESS1.C.m** Rock strata and the fossil record can be used as evidence to organize the relative occurrence of major historical events in Earth's history.
uConnect Lab: Dividing History, pp. 365A-365B	
Performance Indicators	**MS-ESS1-4:** Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history.
Lesson 1: Determining Ages of Rocks, p. 366	
Performance Indicators	**MS-ESS1-4:** Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history. **SCI.ESS1.C.m** Rock strata and the fossil record can be used as evidence to organize the relative occurrence of major historical events in Earth's history.
Science and Engineering Practices	**SCI.SEP6.A.m.5:** Apply scientific reasoning to show why the data or evidence is adequate for the explanation.
Crosscutting Concepts	**SCI.CC3.m:** Students observe time, space, and energy phenomena at various scales using models to study systems that are too large or too small. They understand phenomena observed at one scale may not be observable at another scale, and the function of natural and designed systems may change with scale. They use proportional relationships (e.g., speed as the ratio of distance traveled to time taken) to gather information about the magnitude of properties and processes. They represent scientific relationships through the use of algebraic expressions and equations.

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Case Study: Rewriting the History of Your Foo, pp. 374-375	
Performance Indicators	**MS-ESS1-4:** Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history. **SCI.ESS1.C.m** Rock strata and the fossil record can be used as evidence to organize the relative occurrence of major historical events in Earth's history.
Science and Engineering Practices	**SCI.SEP7.A.m.3:** Construct, use, and present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem.
Lesson 2: Geologic Time Scale, p. 376	
Performance Indicators	**MS-ESS1-4:** Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history. **SCI.ESS1.C.m** Rock strata and the fossil record can be used as evidence to organize the relative occurrence of major historical events in Earth's history.
Science and Engineering Practices	**SCI.SEP6.A.m.5:** Apply scientific reasoning to show why the data or evidence is adequate for the explanation.
uEngineer It: Tiny Fossil, Big Accuracy, p. 383	
Performance Indicators	**MS-ESS1-4:** Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history.
Science and Engineering Practices	**SCI.SEP2.A.m.5:** Develop and use a model to predict and describe phenomena.

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Engineering, Technology, and the Application of Science	**SCI.ETS2.B.m.iii** Technology use varies over time and from region to region. **SCI.ETS3.A.m.i** Individuals and teams from many nations, cultures and backgrounds have contributed to advances in science and engineering. **SCI.ETS3.A.m.ii** Scientists and engineers are persistent, use creativity, reasoning, and skepticism, and remain open to new ideas. **SCI.ETS3.A.m.iii** Science and engineering are influenced by what is valued in society. **SCI.ETS3.B.m.ii** Engineering seeks solutions to human problems, including issues that arise due to human interaction with the environment. It uses some of the same practices as science and often applies scientific principles to solutions. **SCI.ETS3.B.m.iii** Science and engineering have direct impacts on the quality of life for all people. Therefore, scientists and engineers need to pursue their work in an ethical manner that requires honesty, fairness and dedication to public health, safety and welfare. **SCI.ETS3.C.m.iii** Engineers develop solutions using multiple approaches and evaluate their solutions against criteria such as cost, safety, time and performance. This evaluation often involves trade-offs between constraints to find the optimal solution.
Lesson 3: Major Events in Earth's History, p. 384	
Performance Indicators	**MS-ESS1-4:** Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history. **SCI.ESS1.C.m** Rock strata and the fossil record can be used as evidence to organize the relative occurrence of major historical events in Earth's history. **SCI.ESS2.E.m:** The fossil record documents the existence, diversity, extinction, and change of many life forms throughout history (linked to content in LS4.A).

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Science and Engineering Practices	**SCI.SEP2.A.m.5:** Develop and use a model to predict and describe phenomena. **SCI.SEP6.A.m.5:** Apply scientific reasoning to show why the data or evidence is adequate for the explanation.
Quest Check-In, p. 392	
Performance Indicators	**MS-ESS1-4:** Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history. **SCI.ESS1.C.m** Rock strata and the fossil record can be used as evidence to organize the relative occurrence of major historical events in Earth's history.
Global to Local: A New Mass Extinction?, p. 393	
Performance Indicators	**MS-ESS1-4** Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history. **SCI.ESS1.C.m** Rock strata and the fossil record can be used as evidence to organize the relative occurrence of major historical events in Earth's history.
Science and Engineering Practices	**SCI.SEP6.A.m.3:** Construct a scientific explanation based on valid and reliable evidence obtained from sources, including the students' own experiments. Solutions should build on the following assumption: theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.
Evidence-Based Assessment, pp. 396-397	
Performance Indicators	**MS-ESS1-4:** Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history. **SCI.ESS1.C.m** Rock strata and the fossil record can be used as evidence to organize the relative occurrence of major historical events in Earth's history.

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Continued:	**Continued:** **SCI.ESS3.C.m** Human activities have altered the hydrosphere, atmosphere, and lithosphere which in turn has altered the biosphere. Changes to the biosphere can have different impacts for different living things. Activities and technologies can be engineered to reduce people's impacts on Earth.
Science and Engineering Practices	**SCI.SEP6.A.m.5** Apply scientific reasoning to show why the data or evidence is adequate for the explanation.
uDemonstrate Lab: Core Sampling Through Time, pp. 398-401	
Performance Indicators	**MS-ESS1-4:** Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history. **SCI.ESS1.C.m** Rock strata and the fossil record can be used as evidence to organize the relative occurrence of major historical events in Earth's history.
Science and Engineering Practices	**SCI.SEP3.A.m.5** Collect data about the performance of a proposed object, tool, process, or system under a range of conditions. **SCI.SEP6.A.m.5:** Apply scientific reasoning to show why the data or evidence is adequate for the explanation.

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Topic 9: Energy in the Atmosphere and Ocean	
Quest Kickoff: What is the most efficient way for a container ship to cross the Atlantic?, pp. 404-405	
Performance Indicators	**MS-ESS2-6:** Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.
uConnect Lab: Does a Plastic Bag Trap Heat?, pp. 405A-405B	
Performance Indicators	**MS-ESS2-6:** Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.
Science and Engineering Practices	**SCI.SEP1.A.m.6** Ask questions that can be investigated within the scope of the classroom, outdoor environment, and museums and other public facilities with available resources and, when appropriate, frame a hypothesis based on observations and scientific principles. **SCI.SEP3.A.m.1** Individually and collaboratively plan an investigation, identifying: independent and dependent variables and controls, tools needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim. **SCI.SEP3.A.m.2** Conduct an investigation. Evaluate and revise the experimental design to produce data that serve as the basis for evidence to meet the goals of the investigation. **SCI.SEP3.A.m.4** Collect data under a range of conditions that serve as the basis for evidence to answer scientific questions or test design solutions.
Lesson 1: Energy in Earth's Atmosphere, p. 406	
Performance Indicators	**MS-ESS2-6:** Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates. **SCI.ESS2.C.m** Water cycles among land, ocean, and atmosphere, and is propelled by sunlight and gravity. Density variations of sea water drive interconnected ocean currents. Water movement causes weathering and erosion, changing landscape features.

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Science and Engineering Practices	**SCI.SEP8.A.m.1:** Critically read scientific texts adapted for classroom use to determine the central ideas, to obtain scientific and technical information, and to describe patterns in and evidence about the natural and designed world(s).
Crosscutting Concepts	**SCI.CC2.m:** Students classify relationships as causal or correlational, and recognize correlation does not necessarily imply causation. They use cause and effect relationships to predict phenomena in natural or designed systems. They also understand that phenomena may have more than one cause, and some cause and effect relationships in systems can only be explained using probability.
Lesson 2: Patterns of Circulation in the Atmosphere, p. 416	
Performance Indicators	**MS-ESS2-6:** Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.
Science and Engineering Practices	**SCI.SEP2.A.m.5:** Develop and use a model to predict and describe phenomena.
Crosscutting Concepts	**SCI.CC2.m** Students classify relationships as causal or correlational, and recognize correlation does not necessarily imply causation. They use cause and effect relationships to predict phenomena in natural or designed systems. They also understand that phenomena may have more than one cause, and some cause and effect relationships in systems can only be explained using probability.
uEngineer It!: Windmills of the Future, p. 425	
Performance Indicators	**MS-ESS2-5:** Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.
Engineering, Technology, and the Application of Science	**SCI.ETS2.B.m.iii** Technology use varies over time and from region to region. **SCI.ETS3.A.m.i** Individuals and teams from many nations, cultures and backgrounds have contributed to advances in science and engineering. **SCI.ETS3.A.m.ii** Scientists and engineers are persistent, use creativity, reasoning, and skepticism, and remain open to new ideas.

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Continued:	**Continued:** **SCI.ETS3.A.m.iii** Science and engineering are influenced by what is valued in society. **SCI.ETS3.B.m.ii** Engineering seeks solutions to human problems, including issues that arise due to human interaction with the environment. It uses some of the same practices as science and often applies scientific principles to solutions. **SCI.ETS3.B.m.iii** Science and engineering have direct impacts on the quality of life for all people. Therefore, scientists and engineers need to pursue their work in an ethical manner that requires honesty, fairness and dedication to public health, safety and welfare. **SCI.ETS3.C.m.iii** Engineers develop solutions using multiple approaches and evaluate their solutions against criteria such as cost, safety, time and performance. This evaluation often involves trade-offs between constraints to find the optimal solution.
Lesson 3: Patterns of Circulation in the Ocean, p. 426	
Performance Indicators	**MS-ESS2-6:** Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates. **SCI.ESS2.D.m:** Complex interactions determine local weather patterns and influence climate, including the role of the ocean.
Science and Engineering Practices	**SCI.SEP1.A.m.2:** Ask questions to identify and clarify evidence and the premise(s) of an argument. **SCI.SEP3.A.m.2:** Conduct an investigation. Evaluate and revise the experimental design to produce data that serve as the basis for evidence to meet the goals of the investigation. **SCI.SEP2.A.m.5** Develop and use a model to predict and describe phenomena.

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Case Study: Hurricanes in the Making, pp. 434-435	
Performance Indicators	**MS-ESS2-6** Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.
Science and Engineering Practices	**SCI.SEP2.A.m.5:** Develop and use a model to predict and describe phenomena. **SCI.SEP6.A.m.5:** Apply scientific reasoning to show why the data or evidence is adequate for the explanation.
Evidence-Based Assessment, pp. 438-439	
Performance Indicators	**MS-ESS2-6:** Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates. **SCI.ESS2.C.m** Water cycles among land, ocean, and atmosphere, and is propelled by sunlight and gravity. Density variations of sea water drive interconnected ocean currents. Water movement causes weathering and erosion, changing landscape features.
Crosscutting Concepts	**SCI.CC1.m:** Students recognize macroscopic patterns are related to the nature of microscopic and atomic-level structure. They identify patterns in rates of change and other numerical relationships that provide information about natural and human-designed systems. They use patterns to identify cause and effect relationships and use graphs and charts to identify patterns in data.
Engineering, Technology, and the Application of Science	**SCI.ETS3.B.m.i** Science asks questions to understand the natural world and assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. Science carefully considers and evaluates anomalies in data and evidence.

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uDemonstrate Lab: Not All Heating is Equal, pp. 440-443	
Performance Indicators	**MS-ESS2-6** Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates. **SCI.ESS2.C.m** Water cycles among land, ocean, and atmosphere, and is propelled by sunlight and gravity. Density variations of sea water drive interconnected ocean currents. Water movement causes weathering and erosion, changing landscape features.
Science and Engineering Practices	**SCI.SEP7.A.m.3:** Construct, use, and present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem.
Topic 10: Climate	
Quest Kickoff: How can I help reduce my school's carbon footprint, pp. 446-447	
Performance Indicators	**MS-ESS3-5** Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century. **SCI.ESS3.C.m** Human activities have altered the hydrosphere, atmosphere, and lithosphere which in turn has altered the biosphere. Changes to the biosphere can have different impacts for different living things. Activities and technologies can be engineered to reduce people's impacts on Earth. **SCI.ESS3.D.m** Evidence suggests human activities affect global warming. Decisions to reduce the impact of global warming depend on understanding climate science, engineering capabilities, and social dynamics.
uConnect Lab: How Do Climates Differ?, pp. 447A-447B	
	MS-ESS2-6: Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.
Science and Engineering Practices	**SCI.SEP6.A.m.3:** Construct a scientific explanation based on valid and reliable evidence obtained from sources, including the students' own experiments. Solutions should build on the following assumption: theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.

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Lesson 1: Climate Factors, p. 448	
Performance Indicators	**MS-ESS2-6:** Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates. **SCI.ESS2.D.m:** Complex interactions determine local weather patterns and influence climate, including the role of the ocean.
Science and Engineering Practices	**SCI.SEP2.A.m.5** Develop and use a model to predict and describe phenomena.
Crosscutting Concepts	**SCI.CC2.m** Students classify relationships as causal or correlational, and recognize correlation does not necessarily imply causation. They use cause and effect relationships to predict phenomena in natural or designed systems. They also understand that phenomena may have more than one cause, and some cause and effect relationships in systems can only be explained using probability.
Lesson 2: Climate Change, p. 458	
Performance Indicators	**MS-ESS3-5:** Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century. **SCI.ESS3.C.m** Human activities have altered the hydrosphere, atmosphere, and lithosphere which in turn has altered the biosphere. Changes to the biosphere can have different impacts for different living things. Activities and technologies can be engineered to reduce people's impacts on Earth. **SCI.ESS3.D.m** Evidence suggests human activities affect global warming. Decisions to reduce the impact of global warming depend on understanding climate science, engineering capabilities, and social dynamics.
Science and Engineering Practices	**SCI.SEP1.A.m.2** Ask questions to identify and clarify evidence and the premise(s) of an argument. **SCI.SEP1.B.m** Students define a design problem that can be solved through the development of an object, tool, process, or system, and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions.

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Crosscutting Concepts	**SCI.CC2.m** Students classify relationships as causal or correlational, and recognize correlation does not necessarily imply causation. They use cause and effect relationships to predict phenomena in natural or designed systems. They also understand that phenomena may have more than one cause, and some cause and effect relationships in systems can only be explained using probability.
Quest Check-In: 467	
Performance Indicators	**MS-ESS3-5** Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century. **SCI.ESS3.C.m** Human activities have altered the hydrosphere, atmosphere, and lithosphere which in turn has altered the biosphere. Changes to the biosphere can have different impacts for different living things. Activities and technologies can be engineered to reduce people's impacts on Earth. **SCI.ESS3.D.m** Evidence suggests human activities affect global warming. Decisions to reduce the impact of global warming depend on understanding climate science, engineering capabilities, and social dynamics.
Crosscutting Concepts	**SCI.CC7.m** Students explain stability and change in natural or designed systems by examining changes over time, and considering forces at different scales, including the atomic scale. They understand changes in one part of a system might cause large changes in another part, systems in dynamic equilibrium are stable due to a balance of feedback mechanisms, and stability might be disturbed by either sudden events or gradual changes that accumulate over time.
Case Study: The Carbon Cycle, pp. 468-469	
Performance Indicators	**MS-ESS3-5** Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.

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Lesson 3: Effects of a Changing Climate, p. 470	
Performance Indicators	**MS-ESS3-5** Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century. **SCI.ESS3.C.m** Human activities have altered the hydrosphere, atmosphere, and lithosphere which in turn has altered the biosphere. Changes to the biosphere can have different impacts for different living things. Activities and technologies can be engineered to reduce people's impacts on Earth. **SCI.ESS3.D.m** Evidence suggests human activities affect global warming. Decisions to reduce the impact of global warming depend on understanding climate science, engineering capabilities, and social dynamics.
Science and Engineering Practices	**SCI.SEP1.A.m.2** Ask questions to identify and clarify evidence and the premise(s) of an argument. **SCI.SEP7.A.m.3:** Construct, use, and present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem.
Crosscutting Concepts	**SCI.CC7.m** Students explain stability and change in natural or designed systems by examining changes over time, and considering forces at different scales, including the atomic scale. They understand changes in one part of a system might cause large changes in another part, systems in dynamic equilibrium are stable due to a balance of feedback mechanisms, and stability might be disturbed by either sudden events or gradual changes that accumulate over time.
uEngineer It!: Changing Climate Change, pp. 479	
Performance Indicators	**MS-ESS3-3:** Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment. **MS-ETS1-2** Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. **MS-ETS1-4** Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

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Evidence-Based Assessment, pp. 482-483	
Performance Indicators	**MS-ESS3-5** Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century. **SCI.ESS3.C.m** Human activities have altered the hydrosphere, atmosphere, and lithosphere which in turn has altered the biosphere. Changes to the biosphere can have different impacts for different living things. Activities and technologies can be engineered to reduce people's impacts on Earth. **SCI.ESS3.D.m** Evidence suggests human activities affect global warming. Decisions to reduce the impact of global warming depend on understanding climate science, engineering capabilities, and social dynamics.
Science and Engineering Practices	**SCI.SEP1.A.m.2** Ask questions to identify and clarify evidence and the premise(s) of an argument. **SCI.SEP7.A.m.3:** Construct, use, and present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem.
uDemonstrate Lab: An Ocean of a Problems, pp. 484-487	
Performance Indicators	**MS-ESS3-5** Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century. **SCI.ESS3.C.m** Human activities have altered the hydrosphere, atmosphere, and lithosphere which in turn has altered the biosphere. Changes to the biosphere can have different impacts for different living things. Activities and technologies can be engineered to reduce people's impacts on Earth. **SCI.ESS3.D.m** Evidence suggests human activities affect global warming. Decisions to reduce the impact of global warming depend on understanding climate science, engineering capabilities, and social dynamics.

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Science and Engineering Practices	**SCI.SEP3.A.m.1:** Individually and collaboratively plan an investigation, identifying: independent and dependent variables and controls, tools needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim. **SCI.SEP3.A.m.2:** Conduct an investigation. Evaluate and revise the experimental design to produce data that serve as the basis for evidence to meet the goals of the investigation. **SCI.SEP3.A.m.5:** Collect data about the performance of a proposed object, tool, process, or system under a range of conditions. **SCI.SEP4.A.m.7:** Analyze and interpret data to determine similarities and differences in findings. **SCI.SEP7.A.m.2** Respectfully provide and receive critiques about one's explanations, procedures, models, and questions by citing relevant evidence and posing and responding to questions that elicit pertinent elaboration and detail.
Topic 11: Earth-Sun-Moon System	
Quest Kickoff: How are tides related to our place in space?, pp. 490-491	
Performance Indicators	**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.
uConnect Lab: What Is at the Center?, pp. 491A-491B	
Performance Indicators	**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. **SCI.ESS1.B.m:** The solar system contains many varied objects held together by gravity. Solar system models explain and predict eclipses, lunar phases, and seasons.

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Science and Engineering Practices	**SCI.SEP1.A.m.6** Ask questions that can be investigated within the scope of the classroom, outdoor environment, and museums and other public facilities with available resources and, when appropriate, frame a hypothesis based on observations and scientific principles. **SCI.SEP2.A.m.1** Evaluate limitations of a model for a proposed object or tool. **SCI.SEP2.A.m.3** Use and develop a model of simple systems with uncertain and less predictable factors. **SCI.SEP2.A.m.5** Develop and use a model to predict and describe phenomena. **SCI.SEP3.A.m.4** Collect data under a range of conditions that serve as the basis for evidence to answer scientific questions or test design solutions. **SCI.SEP4.A. m.1** Construct, analyze, or interpret graphical displays of data and large data sets to identify linear and nonlinear relationships. **SCI.SEP6.A.m.2** Construct an explanation using models or representations.
Lesson 1: Movement in Space, p. 492	
Performance Indicators	**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.
Science and Engineering Practices	**SCI.SEP2.A.m.5** Develop and use a model to predict and describe phenomena. **SCI.SEP6.A.m.2** Construct an explanation using models or representations.
Crosscutting Concepts	**SCI.CC1.m** Students recognize macroscopic patterns are related to the nature of microscopic and atomic-level structure. They identify patterns in rates of change and other numerical relationships that provide information about natural and human-designed systems. They use patterns to identify cause and effect relationships and use graphs and charts to identify patterns in data.

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Case Study: The Ptolemaic Model, pp. 502-503	
Performance Indicators	**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.
Science and Engineering Practices	**SCI.SEP4.A. m.2** Use graphical displays (e.g., maps, charts, graphs, and tables) of large data sets to identify temporal and spatial relationships. **SCI.SEP6.A.m.2** Construct an explanation using models or representations.
Lesson 2: Earth's Movements in Space, p. 504	
Performance Indicators	**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. **SCI.ESS1.B.m:** The solar system contains many varied objects held together by gravity. Solar system models explain and predict eclipses, lunar phases, and seasons.
Science and Engineering Practices	**SCI.SEP2.A.m.5** Develop and use a model to predict and describe phenomena. **SCI.SEP8.A.m.1:** Critically read scientific texts adapted for classroom use to determine the central ideas, to obtain scientific and technical information, and to describe patterns in and evidence about the natural and designed world(s).
Crosscutting Concepts	**SCI.CC1.m:** Students recognize macroscopic patterns are related to the nature of microscopic and atomic-level structure. They identify patterns in rates of change and other numerical relationships that provide information about natural and human-designed systems. They use patterns to identify cause and effect relationships and use graphs and charts to identify patterns in data.

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Quest Check-In, p. 512	
Performance Indicators	**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.
Crosscutting Concepts	**SCI.CC1.m:** Students recognize macroscopic patterns are related to the nature of microscopic and atomic-level structure. They identify patterns in rates of change and other numerical relationships that provide information about natural and human-designed systems. They use patterns to identify cause and effect relationships and use graphs and charts to identify patterns in data.
Lesson 3: Phases and Eclipses, p. 514	
Performance Indicators	**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. **SCI.ESS1.B.m:** The solar system contains many varied objects held together by gravity. Solar system models explain and predict eclipses, lunar phases, and seasons.
Science and Engineering Practices	**SCI.SEP2.A.m.5:** Develop and use a model to predict and describe phenomena.
uEngineer It!: Power from the Tides, p. 523	
Performance Indicators	**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. **MS-ESS2-1:** Develop a model to describe the cycling of Earth's materials and the flow of energy that drives plate tectonics.
Science and Engineering Practices	**SCI.SEP2.A.m.5:** Develop and use a model to predict and describe phenomena.

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Engineering, Technology, and the Application of Science	**SCI.ETS2.B.m.iii** Technology use varies over time and from region to region. **SCI.ETS3.A.m.i** Individuals and teams from many nations, cultures and backgrounds have contributed to advances in science and engineering. **SCI.ETS3.A.m.ii** Scientists and engineers are persistent, use creativity, reasoning, and skepticism, and remain open to new ideas. **SCI.ETS3.A.m.iii** Science and engineering are influenced by what is valued in society. **SCI.ETS3.B.m.ii** Engineering seeks solutions to human problems, including issues that arise due to human interaction with the environment. It uses some of the same practices as science and often applies scientific principles to solutions. **SCI.ETS3.B.m.iii** Science and engineering have direct impacts on the quality of life for all people. Therefore, scientists and engineers need to pursue their work in an ethical manner that requires honesty, fairness and dedication to public health, safety and welfare. **SCI.ETS3.C.m.iii** Engineers develop solutions using multiple approaches and evaluate their solutions against criteria such as cost, safety, time and performance. This evaluation often involves trade-offs betwe.en constraints to find the optimal solution
Evidence-Based Assessment, pp. 526-527	
Performance Indicators	**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. **SCI.ESS1.B.m** The solar system contains many varied objects held together by gravity. Solar system models explain and predict eclipses, lunar phases, and seasons.

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Science and Engineering Practices	**SCI.SEP2.A.m.5** Develop and use a model to predict and describe phenomena. **SCI.SEP4.A. m.1** Construct, analyze, or interpret graphical displays of data and large data sets to identify linear and nonlinear relationships.
Crosscutting Concepts	**SCI.CC1.m** Students recognize macroscopic patterns are related to the nature of microscopic and atomic-level structure. They identify patterns in rates of change and other numerical relationships that provide information about natural and human-designed systems. They use patterns to identify cause and effect relationships and use graphs and charts to identify patterns in data.
uDemonstrate Lab: Modeling Lunar Phases, pp. 528-531	
Performance Indicators	**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. **SCI.ESS1.B.m:** The solar system contains many varied objects held together by gravity. Solar system models explain and predict eclipses, lunar phases, and seasons.
Science and Engineering Practices	**SCI.SEP2.A.m.5** Develop and use a model to predict and describe phenomena. **SCI.SEP6.A.m.5** Apply scientific reasoning to show why the data or evidence is adequate for the explanation..
Crosscutting Concepts	**SCI.CC1.m:** Students recognize macroscopic patterns are related to the nature of microscopic and atomic-level structure. They identify patterns in rates of change and other numerical relationships that provide information about natural and human-designed systems. They use patterns to identify cause and effect relationships and use graphs and charts to identify patterns in data.

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Topic 12: Solar System and the Universe	
Quest Kickoff: How do we look for things that can't be seen?, pp. 534-535	
Performance Indicators	**MS-ESS1-3:** Analyze and interpret data to determine scale properties of objects in the solar system.
uConnect Lab: Planetary Measures, pp. 535A-535B	
Performance Indicators	**MS-ESS1-3:** Analyze and interpret data to determine scale properties of objects in the solar system.
Science and Engineering Practices	**SCI.SEP4.A.m.4** Analyze and interpret data to provide evidence for explanations of phenomena.
Crosscutting Concepts	**SCI.CC3.m** Students observe time, space, and energy phenomena at various scales using models to study systems that are too large or too small. They understand phenomena observed at one scale may not be observable at another scale, and the function of natural and designed systems may change with scale. They use proportional relationships (e.g., speed as the ratio of distance traveled to time taken) to gather information about the magnitude of properties and processes. They represent scientific relationships through the use of algebraic expressions and equations. **SCI.CC4.m** Students understand systems may interact with other systems: they may have sub-systems and be a part of larger complex systems. They use models to represent systems and their interactions—such as inputs, processes, and outputs—and energy, matter, and information flows within systems. They also learn that models are limited in that they only represent certain aspects of the system under study.
Lesson 1: Solar System Objects, p. 536	
Performance Indicators	**MS-ESS1-2** Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system. **MS-ESS1-3** Analyze and interpret data to determine scale properties of objects in the solar system.

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Science and Engineering Practices	**SCI.SEP2.A.m.2** Develop or modify a model—based on evidence—to match what happens if a variable or component of a system is changed. **SCI.SEP2.A.m.4** Develop and/or revise a model to show the relationships among variables, including those that are not observable but predict observable phenomena. **SCI.SEP2.A.m.5** Develop and use a model to predict and describe phenomena. **SCI.SEP2.A.m.6** Develop a model to describe unobservable mechanisms. **SCI.SEP2.A.m.7** Develop and use a model to generate data to test ideas about phenomena in natural or designed systems, including those representing inputs and outputs, and those at unobservable scales. **SCI.SEP4.A.m.4** Analyze and interpret data to provide evidence for explanations of phenomena.
Engineering, Technology, and the Application of Science	**SCI.ETS2.A.m.i** 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. **SCI.ETS2.A.m.ii** Science and technology drive each other forward.
Case Study: Comparing Solar System Objects, pp. 548-549	
Performance Indicators	**MS-ESS1-2** Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system. **MS-ESS3-1:** Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.
Science and Engineering Practices	**SCI.SEP2.A.m.5** Develop and use a model to predict and describe phenomena. **SCI.SEP2.A.m.6** Develop a model to describe unobservable mechanisms.

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Crosscutting Concepts	**SCI.CC3.m:** Students observe time, space, and energy phenomena at various scales using models to study systems that are too large or too small. They understand phenomena observed at one scale may not be observable at another scale, and the function of natural and designed systems may change with scale. They use proportional relationships (e.g., speed as the ratio of distance traveled to time taken) to gather information about the magnitude of properties and processes. They represent scientific relationships through the use of algebraic expressions and technology equations.
Engineering, Technology, and the Application of Science	**SCI.ETS2.A.m.i** 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. **SCI.ETS2.A.m.ii** Science and drive each other forward.
Lesson 2: Learning About the Universe, p. 550	
Performance Indicators	**MS-ESS1-3** Analyze and interpret data to determine scale properties of objects in the solar system.
Science and Engineering Practices	**SCI.SEP2.A.m.5:** Develop and use a model to predict and describe phenomena. **SCI.SEP8.A.m.1:** Critically read scientific texts adapted for classroom use to determine the central ideas, to obtain scientific and technical information, and to describe patterns in and evidence about the natural and designed world(s).
Engineering, Technology, and the Application of Science	**SCI.ETS2.A.m.i** 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. **SCI.ETS2.A.m.ii** Science and technology drive each other forward.
Lesson 3: Stars, p. 560	
Performance Indicators	**MS-ESS1-2** Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system. **SCI.ESS1.A.m** The solar system is part of the Milky Way, which is one of many billions of galaxies.

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Science and Engineering Practices	**SCI.SEP2.A.m.5:** Develop and use a model to predict and describe phenomena. **SCI.SEP4.A.m.2:** Use graphical displays (e.g., maps, charts, graphs, and tables) of large data sets to identify temporal and spatial relationships. **SCI.SEP6.A.m.5:** Apply scientific reasoning to show why the data or evidence is adequate for the explanation.
Lesson 4: Galaxies, p. 570	
Performance Indicators	**MS-ESS1-2** Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system. **SCI.ESS1.A.m** The solar system is part of the Milky Way, which is one of many billions of galaxies.
Science and Engineering Practices	**SCI.SEP2.A.m.5:** Develop and use a model to predict and describe phenomena.
Evidence-Based Assessment, pp. 582-583	
Performance Indicators	**SCI.ESS1.B.m:** The solar system contains many varied objects held together by gravity. Solar system models explain and predict eclipses, lunar phases, and seasons.
Science and Engineering Practices	**SCI.SEP2.A.m.1** Evaluate limitations of a model for a proposed object or tool.
Crosscutting Concepts	**SCI.CC4.m:** Students understand systems may interact with other systems: they may have sub-systems and be a part of larger complex systems. They use models to represent systems and their interactions—such as inputs, processes, and outputs—and energy, matter, and information flows within systems. They also learn that models are limited in that they only represent certain aspects of the system under study.

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uDemonstrate Lab: Scaling Down the Solar System, pp. 584-587	
Performance Indicators	**MS-ESS1-3:** Analyze and interpret data to determine scale properties of objects in the solar system.
Science and Engineering Practices	**SCI.SEP1.A.m.3** Ask questions to determine relationships between independent and dependent variables and relationships in models. **SCI.SEP2.A.m.1** Evaluate limitations of a model for a proposed object or tool. **SCI.SEP4.A.m.4** Analyze and interpret data to provide evidence for explanations of phenomena.
Crosscutting Concepts	**SCI.CC3.m** Students observe time, space, and energy phenomena at various scales using models to study systems that are too large or too small. They understand phenomena observed at one scale may not be observable at another scale, and the function of natural and designed systems may change with scale. They use proportional relationships (e.g., speed as the ratio of distance traveled to time taken) to gather information about the magnitude of properties and processes. They represent scientific relationships through the use of algebraic expressions and equations.
Science and Engineering Practices Handbook, pp. 588-599	
Science and Engineering Practices	**SCI.SEP1.A.m.2** Ask questions to identify and clarify evidence and the premise(s) of an argument. **SCI.SEP1.A.m.4** Ask questions to clarify or refine a model, an explanation, or an engineering problem. **SCI.SEP1.A.m.7** Ask questions that challenge the premise(s) of an argument or the interpretation of a data set. **SCI.SEP1.B.m** Students define a design problem that can be solved through the development of an object, tool, process, or system, and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions. **SCI.SEP2.A.m.1** Evaluate limitations of a model for a proposed object or tool.

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Continued:	**Continued:** **SCI.SEP2.A.m.4** Develop and/or revise a model to show the relationships among variables, including those that are not observable but predict observable phenomena. **SCI.SEP2.A.m.7** Develop and use a model to generate data to test ideas about phenomena in natural or designed systems, including those representing inputs and outputs, and those at unobservable scales. **SCI.SEP3.A.m.1** Individually and collaboratively plan an investigation, identifying: independent and dependent variables and controls, tools needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim. **SCI.SEP3.A.m.3** Evaluate the accuracy of various methods for collecting data. **SCI.SEP3.A.m.4** Collect data under a range of conditions that serve as the basis for evidence to answer scientific questions or test design solutions. **SCI.SEP3.A.m.5** Collect data about the performance of a proposed object, tool, process, or system under a range of conditions. **SCI.SEP4.A.m.2** Use graphical displays (e.g., maps, charts, graphs, and tables) of large data sets to identify temporal and spatial relationships. **SCI.SEP6.A.m.3** Construct a scientific explanation based on valid and reliable evidence obtained from sources, including the students' own experiments. Solutions should build on the following assumption: theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. **SCI.SEP6.A.m.5** Apply scientific reasoning to show why the data or evidence is adequate for the explanation. **SCI.SEP6.B.m.1** Apply scientific ideas or principles to design, construct, and test a design of an object, tool, process, or system.

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Continued:	**SCI.SEP6.B.m.3** Optimize performance of a design by prioritizing criteria, making trade-offs, testing, revising, and retesting. **SCI.SEP7.A.m.1** Compare and critique two arguments on the same topic. Analyze whether they emphasize similar or different evidence and interpretations of facts. **SCI.SEP7.A.m.2** Respectfully provide and receive critiques about one's explanations, procedures, models, and questions by citing relevant evidence and posing and responding to questions that elicit pertinent elaboration and detail. **SCI.SEP7.A.m.5** Evaluate competing design solutions based on jointly developed and agreed-upon design criteria. **SCI.SEP8.A.m.3** Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication. Describe how they are supported or not supported by evidence and evaluate methods used. **SCI.SEP8.A.m.4** Evaluate data, hypotheses, and conclusions in scientific and technical texts in light of competing information or accounts.

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Engineering, Technology, and the Application of Science	**SCI.ETS1.A.m** The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that are likely to limit possible solutions. **SCI.ETS1.B.m.i** A solution needs to be tested and then modified on the basis of the test results in order to improve it. **SCI.ETS1.B.m.ii** There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. **SCI.ETS1.B.m.iii** Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. **SCI.ETS1.B.m.iv** Models of all kinds are important for testing solutions. **MS-ETS1-1** Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions. **MS-ETS1-2** Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. **SCI.ETS3.B.m.i** Science asks questions to understand the natural world and assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. Science carefully considers and evaluates anomalies in data and evidence. **SCI.ETS3.C.m.i** A theory is an explanation of some aspect of the natural world. Scientists develop theories by using multiple approaches. Validity of these theories and explanations is increased through a peer review process that tests and evaluates the evidence supporting scientific claims.