NGSS UNIT OVERVIEW

GEOLOGICAL PROCESSES

Performance Expectation MS-ESS2-1: Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.

Performance Expectation MS-ESS2-2: Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.

Performance Expectation 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.

Performance Expectation 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.

Performance Expectation 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.

Activity Description	Disciplinary Core Ideas	Science and Engineering Practices	Crosscutting Concepts	Common Core State Standards
1. **Talking it Over: Storing Nuclear Waste** Students are introduced to the compelling issue of determining a central location to store nuclear waste in the United States. In the activity, they learn about nuclear waste and begin to consider the challenges associated with storing radioactive material. The activity elicits students' initial ideas about natural hazards, which could have an impact on safety of a nuclear waste storage site. The crosscutting concept of patterns helps students make sense of the data presented in this activity.	MS-ESS3.B	Analyzing and Interpreting Data Asking Questions and Defining Problems	Patterns Connections to Engineering, Technology, and Applications of Science: Influence of Science, Engineering, and Technology on Society and the Natural World Connections to Nature of Science: Science Addresses Questions about the Natural and Material World	Mathematics: MP.2 ELA/Literacy: RST.6-8.1
2. **Investigation: Investigating Groundwater** Students carry out an investigation to learn how water enters and flows through earth materials. They analyze and interpret the data they collect as they compare two different earth materials. In doing so, they learn that aquifers form in locations with certain geological features. Students then reconsider the issue of where to store nuclear waste as they examine a map showing the uneven distribution of aquifers across the contiguous United States.	MS-ESS2.A MS-ESS2.C MS-ESS3.A	Analyzing and Interpreting Data Developing and Using Models Planning and Carrying Out Investigations	Structure and Function Systems and System Models	ELA/Literacy: RST.6-8.3

GEOLOGICAL PROCESSES (continued)

Activity Description	Disciplinary Core Ideas	Science and Engineering Practices	Crosscutting Concepts	Common Core State Standards
3. **View and Reflect: Modeling Landslides** Students learn how scientists use models and technology to develop an understanding of the phenomenon of landslides. They watch and discuss a video showing a team of scientists using a model to investigate how and why landslides happen.	MS-ESS2.A MS-ESS2.C MS-ESS3.B	Developing and Using Models Constructing Explanations and Designing Solutions	Cause and Effect Systems and System Models Scale, Proportion, and Quantity Stability and Change	
4. **Reading: Natural Hazards Caused by Earthquakes and Volcanoes** Students obtain and evaluate information by reading cases of real geological events. In doing so, they learn about natural hazards caused by earthquakes and volcanoes, as well as how these natural hazards are monitored and the destruction caused by them can be mitigated.	MS-ESS2.A MS-ESS3.B	Constructing Explanations and Designing Solutions Obtaining, Evaluating, and Communicating Information Engaging in Argument from Evidence	Cause and Effect Connections to Engineering, Technology, and Applications of Science: Influence of Science, Engineering, and Technology on Society and the Natural World	ELA/Literacy: RST.6-8.1 RST.6-8.2 WHST.6-8.9
5. **Modeling: Modeling Volcanic Eruptions** Students use a model to understand what happens during a volcanic eruption. By analyzing and interpreting the data from the model, students learn how the amount of gas in the magma that feeds a volcano can result in more- or less-explosive eruptions. Students consider how the type of eruption might affect the type of igneous rock formed.	MS-ESS2.A	Constructing Explanations and Designing Solutions Developing and Using Models Planning and Carrying Out Investigations Analyzing and Interpreting Data	Cause and Effect Scale, Proportion, and Quantity Systems and System Models	ELA/Literacy: RST.6-8.3
6. **Investigation: Mapping Locations of Earthquakes and Volcanoes** In previous activities, students learned about hazards associated with earthquakes and volcanoes. In this activity, students use the science and engineering practice of analyzing and interpreting data as they map the locations of significant earthquakes and major volcanoes around the world. They look for patterns in the distribution of earthquakes and volcanoes as a first step in discovering that Earth's surface is broken into plates. In subsequent activities, students build on this knowledge as they learn about plate movement, its causes, and the effects.	MS-ESS2.A MS-ESS3.B	Analyzing and Interpreting Data Asking Questions and Defining Problems Using Mathematics and Computational Thinking	Patterns Systems and System Models Connections to Nature of Science; Scientific Knowledge Assumes an Order and Consistency in Natural Systems	ELA/Literacy: SL.8.1

GEOLOGICAL PROCESSES (continued)

Activity Description	Disciplinary Core Ideas	Science and Engineering Practices	Crosscutting Concepts	Common Core State Standards
7. **Problem Solving: Observing Earth's Moving Surface** In this activity, students learn how to analyze and interpret data from GPS measurements over time, which they use to determine the rate and direction of tectonic plate movement. They work collaboratively in groups and then share their findings. While students do not provide explanations for the motions shown in the GPS data in this activity, the analyzed data display the types of plate boundary interactions students will encounter in subsequent activities.	MS-ESS2.A MS-ESS3.B	Analyzing and Interpreting Data Constructing Explanations and Designing Solutions	Patterns Scale, Proportion, and Quantity Stability and Change Connections to Engineering, Technology, and Applications of Science: Interdependence of Science, Engineering, and Technology Connections to Engineering, Technology, and Applications of Science: Influence of Science, Engineering, and Technology on Society and the Natural World	Mathematics: MP.4 6.NS.C.5 ELA/Literacy: SL.8.1
8. **Reading: Beneath Earth's Surface** Through a reading about the structure of Earth's interior, students obtain information about how Earth's surface is broken into lithospheric plates that move. They integrate information from the reading and a table of data about Earth's layers to create a scale model of Earth's interior.	MS-ESS2.A MS-ESS2.B	Developing and Using Models Analyzing and Interpreting Data Using Mathematics and Computational Thinking Connections to Nature of Science: Scientific Knowledge Is Open to Revision in Light of New Evidence	Patterns Scale, Proportion, and Quantity Structure and Function Connections to Engineering, Technology, and Applications of Science: Influence of Science, Engineering, and Technology on Society and the Natural World Connections to Nature of Science: Science Is a Human Endeavor	Mathematics: 6.RP.A.1 ELA/Literacy: RST.6-8.3 RST.6-8.4

GEOLOGICAL PROCESSES (continued)

Activity Description	Disciplinary Core Ideas	Science and Engineering Practices	Crosscutting Concepts	Common Core State Standards
9. **Modeling: Modeling Earthquakes** In previous activities, students have learned that earthquakes occur at plate boundaries, and that some plates move apart, some move towards each other, and move past each other. In this activity, students plan and carry out an investigation using a model to simulate the buildup and release of energy in an earthquake. They investigate cause-and-effect relationships as they choose variables to change in the model.	MS-ESS2.A	Asking Questions and Defining Problems Developing and Using Models Planning and Carrying Out Investigations Analyzing and Interpreting Data Construction Explanations and Designing Solutions	Cause and Effect Scale, Proportion, and Quantity Systems and System Models Energy and Matter Stability and Change	ELA/Literacy: RST.6-8.3
10. **Computer Simulation: Plate Boundaries** Students use a model to observe the changes to Earth's lithosphere at plate boundaries. By carefully observing a computer simulation, students investigate how Earth's surface changes over time due to geological processes caused by plate motion. Students analyze and interpret data from the computer simulation to identify the similarities and differences between the geological processes that happen at the three plate boundaries.	MS-ESS2.A MS-ESS2.B MS-ESS1.C	Developing and Using Models Planning and Carrying Out Investigations Analyzing and Interpreting Data Constructing Explanations and Designing Solutions	Patterns Cause and Effect Scale, Proportion, and Quantity Systems and System Models Stability and Change	ELA/Literacy: SL.8.1
11. **Reading: Understanding Plate Boundaries** Students read about the geological processes that shape Earth's surface near plate boundaries. They consider how these geological processes have changed Earth's surface at varying time and spatial scales. They apply their understanding of the geological processes happening at plate boundaries and their associated natural hazards to the nuclear waste issue.	MS-ESS2.A MS-ESS1.C MS-ESS3.B	Analyzing and Interpreting data Engaging in Argument from Evidence	Cause and Effect Stability and Change	ELA/Literacy: RST.6-8.2 WHST.6-8.1

GEOLOGICAL PROCESSES (continued)

Activity Description	Disciplinary Core Ideas	Science and Engineering Practices	Crosscutting Concepts	Common Core State Standards
12. **Investigation: The Continent Puzzle** Students analyze and interpret data about continent shapes, as well as fossil and rock information from different continents. Students use the patterns found in this data as evidence to explain that the continents have moved great distances, collided, and spread apart over geological time.	MS-ESS1.C MS-ESS2.A MS-ESS2.B	Developing and Using Models Analyzing and Interpreting Data Using Mathematics and Computational Thinking Constructing Explanations Engaging in Argument from Evidence Connections to Nature of Science: Scientific Knowledge Is Based on Empirical Evidence	Patterns Scale, Proportion, and Quantity Stability and Change Connections to Nature of Science: Science Is a Human Endeavor Connections to Nature of Science: Scientific Knowledge Assumes an Order and Consistency in Natural Systems	Mathematics: 6.RP.A.1 7.RP.A.2 ELA/Literacy: SL.8.1 WHST.6-8.1
13. **View and Reflect: The Theory of Plate Tectonics** Students learn about the development of the theory of plate tectonics, beginning with a review of the fossil and geological evidence that led to Alfred Wegener's ideas about continental drift. Through watching and discussing a video, students see that scientific knowledge is based on empirical evidence and that scientific findings are subject to revision as new evidence becomes available. Finally, students use the evidence they've collected throughout the unit to construct an explanation about how plate tectonic processes have shaped Earth's surface at different spatial and time scales. This activity provides an assessment opportunity for Performance Expectation MS-ESS2-2.	MS-ESS1.C MS-ESS2.A MS-ESS2.B	Analyzing and Interpreting Data Constructing Explanations and Designing Solutions Obtaining, Evaluating, and Communicating Information Connections to Nature of Science: Scientific Knowledge Is Based on Empirical Evidence Connections to Nature of Science: Scientific Knowledge Is Open to Revision in Light of New Evidence	Patterns Scale, Proportion, and Quantity Stability and Change Connections to Nature of Science: Science Is a Human Endeavor Connections to Nature of Science: Scientific Knowledge Assumes an Order and Consistency in Natural Systems	ELA/Literacy: WHST.6-8.2

GEOLOGICAL PROCESSES (continued)

Activity Description	Disciplinary Core Ideas	Science and Engineering Practices	Crosscutting Concepts	Common Core State Standards
14. **Laboratory: What Makes the Plates Move?** Students learn about the flow of energy and the forces that are thought to drive the movement of Earth's lithospheric plates. They use a model to discover the conditions necessary for convection to take place, and relate their findings to the flow of energy and resulting movement in Earth's interior. Students also use a model to learn about the role of gravity in plate motion. This activity provides a formal assessment opportunity for Performance Expectation MS-ESS2-3.	MS-ESS1.C MS-ESS2.A MS-ESS2.B	Developing and Using Models Planning and Carrying Out Investigations Analyzing and Interpreting Data Constructing Explanations Connections to Nature of Science: Scientific Knowledge Is Based on Empirical Evidence Connections to Nature of Science: Scientific Knowledge Is Open to Revision in Light of New Evidence	Patterns Cause and Effect Scale, Proportion, and Quantity Systems and System Models Energy and Matter Structure and Function Stability and Change Connections to Nature of Science: Science Is a Human Endeavor Connections to Nature of Science: Scientific Knowledge Assumes an Order and Consistency in Natural Systems	Mathematics: MP.2 ELA/Literacy: WHST.6-8.2
15. **Investigation: The Rock Cycle** Throughout the unit, students have learned about many geological processes that have changed Earth's surface at varying time and spatial scales. In this activity, students use a model to connect the cycling of earth materials to the geological processes that result in the formation of different kinds of rock. Students also consider how the flow of energy drives various geological processes that form rock. Finally, students develop a model that describes the cause-and-effect relationships between geological processes and the cycling of Earth's materials. This activity provides a formal assessment opportunity for Performance Expectation MS-ESS2-1.	MS-ESS2.A MS-ESS2.C	Developing and Using Models Analyzing and Interpreting Data Constructing Explanations and Designing Solutions Connections to Nature of Science: Scientific Knowledge Is Based on Empirical Evidence	Cause and Effect Scale, Proportion, and Quantity Systems and System Models Patterns Energy and Matter Stability and Change Structure and Function Connections to Nature of Science: Scientific Knowledge Assumes an Order and Consistency in Natural Systems	ELA/Literacy: SL.8.1

GEOLOGICAL PROCESSES (continued)

Activity Description	Disciplinary Core Ideas	Science and Engineering Practices	Crosscutting Concepts	Common Core State Standards
16. **Reading: Rocks as a Resource** Students learn about the geological processes that result in the formation of three different natural resources. They connect those processes to maps showing the uneven distribution of these natural resources to make inferences about the past geological processes in those locations. This activity provides a formal assessment opportunity for Performance Expectation MS-ESS3-1, with a focus on mineral and energy resources.	MS-ESS2.A MS-ESS3.A	Constructing Explanations and Designing Solutions Analyzing and Interpreting Data Obtaining, Evaluating, and Communicating Information Connections to Nature of Science: Scientific Knowledge Is Based on Empirical Evidence	Patterns Cause and Effect Scale, Proportion, and Quantity Stability and Change Connections to Engineering, Technology, and Applications of Science: Influence of Science, Engineering, and Technology on Society and the Natural World Connections to Nature of Science: Scientific Knowledge Assumes an Order and Consistency in Natural Systems Connections to Nature of Science: Science Addresses Questions about the Natural and Material World	ELA/Literacy: RST.6-8.2 RST.6-8.7 WHST.6-8.1

GEOLOGICAL PROCESSES (continued)

Activity Description	Disciplinary Core Ideas	Science and Engineering Practices	Crosscutting Concepts	Common Core State Standards
17. **Investigation: Enough Resources for All** Students continue to learn about the limited nature of some natural resources due to the geological processes that create them. In this activity, they model aquifer inputs and outputs, and monitor water levels in aquifers over time. Students then construct an explanation of why aquifers are a limited but renewable resource. This activity provides a formal assessment opportunity for Performance Expectation MS-ESS3-1, with a focus on groundwater resources.	MS-ESS3.A	Developing and Using Models Planning and Carrying Out Investigations Analyzing and Interpreting Data Constructing Explanations and Designing Solutions Connections to Nature of Science: Scientific Knowledge Is Based on Empirical Evidence	Patterns Cause and Effect Systems and System Models Structure and Function Stability and Change Connections to Engineering, Technology, and Application of Science: Influence of Science, Engineering, and Technology on Society and the Natural World Connections to Nature of Science: Science Addresses Questions about the Natural and Material World Connections to Nature of Science: Scientific Knowledge Assumes an Order and Consistency in Natural Systems	ELA/Literacy: RST.6-8.7 SL.8.1
18. **Talking it Over: Evaluating Site Risk** Students analyze and interpret data about four possible nuclear waste disposal sites from maps showing information such as natural hazard risk, location of natural resources, and human population density in the continental United States. Students are given the opportunity to apply their findings as they make a decision about which site should be studied further. Using evidence, they evaluate the risks and trade-offs of storing nuclear waste at each site. Students create connections between scientific knowledge and society by making a recommendation about which site should be considered for the long-term storage of nuclear waste. This activity provides a formal assessment opportunity for Performance Expectation MS-ESS3-2.	MS-ESS3.A MS-ESS3.B	Constructing Explanations and Designing Solutions Analyzing and Interpreting Data	Patterns Connections to Engineering, Technology, and Applications of Science: Influence of Science, Engineering, and Technology on Society and the Natural World Connections to the Nature of Science: Science Addresses Questions about the Natural and Material World	ELA/Literacy: WHST.6-8.2