Geology

Curriculum/Content Area: Science	**Course Length:** 1 Term
Course Title: Geology	**Date last reviewed:** 2018
Prerequisites: None	**Board approval date:** May 2018
Primary Resource: *tbd*	

Desired Results

Course description and purpose: This course is an introduction to the geological processes within and on the surface of the earth. Students will learn the description, classification and origin of minerals and rocks. Students will also study the internal and external processes that include volcanism, earthquakes, deformation, mountain building, weathering, mass wasting, glaciers and the action of water.

Enduring Understandings:	**Essential Questions**:
1. **Patterns:** Observed patterns in nature guide organization and classification and prompt questions about relationships and causes underlying them. 2. **Cause and Effect:** Events have causes, sometimes simple, sometimes multifaceted. Deciphering causal relationships, and the mechanisms by which they are mediated, is a major activity of science and engineering. 3. **Scale, Proportion, and Quantity:** In considering phenomena, it is critical to recognize what is relevant at different size, time, and energy scales, and to recognize proportional relationships between different quantities as scales change.	1. How do internal and surface processes cause the Earth to be ever-changing (Cause and Effect) 2. What evidence from Earth materials can be used to construct an account of Earth's formation and history? (Scale, Proportion and Quantity, Stability and Change) 3. How has the Earth been impacted by human activity and by the use of its natural resources? (Energy and Matter, Cause and Effect) 4. How do geologists use models to predict future events and construct an understanding of past events? (Systems and Models) 5. How does water significantly shape and alter the Earth and its materials

4. **Systems and System Models:** A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems. 5. **Energy and Matter:** Tracking energy and matter flows, into, out of, and within systems helps one understand their system's behavior. 6. **Structure and Function:** The way an object is shaped or structured determines many of its properties and functions. 7. **Stability and Change:** For both designed and natural systems, conditions that affect stability and factors that control rates of change are critical elements to consider and understand.	(Cause and Effect, Structure and Function) 6. How do geologist use identifiable features to classify and organize earth's rock, mineral and energy resources? (Patterns)

Unit: Formation of the Earth and Plate Tectonics
Topics of Study: 1. Formation of Earth 2. Characteristics of geosphere 3. Plate tectonics 4. Seismic Forces
Standards:
<u>Cross Cutting Concepts</u> 1. **Patterns -** Empirical evidence is needed to identify patterns. 2. **Stability and Change -** Much of science deals with constructing explanations of how things change and how they remain stable. 3. **Energy and Matter -** Energy drives the cycling of matter within and between systems. 4. **Systems and System Models -** When investigating or describing a system, the boundaries and initial conditions of the system need to be defined and their inputs and outputs analyzed and described using models. **<u>Scientific and Engineering Practices</u>**

1. **Engaging in Argument from Evidence -** Engaging in argument from evidence in 9–12 builds on K–8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about the natural and designed world(s). Arguments may also come from current scientific or historical episodes in science.
    - Evaluate evidence behind currently accepted explanations or solutions to determine the merits of arguments.
2. **Constructing Explanations and Designing Solutions -** Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.
    - Apply scientific reasoning to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion.
3. **Developing and Using Models -** Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed world(s).
    - Develop a model based on evidence to illustrate the relationships between systems or between components of a system.

Disciplinary Core Ideas

1. **ESS1.C: The History of Planet Earth**
    a. Continental rocks, which can be older than 4 billion years, are generally much older than the rocks of the ocean floor, which are less than 200 million years old.
    b. Although active geologic processes, such as plate tectonics and erosion, have destroyed or altered most of the very early rock record on Earth, other objects in the solar system, such as lunar rocks, asteroids, and meteorites, have changed little over billions of years. Studying these objects can provide information about Earth's formation and early history.
2. **ESS2.A: Earth Materials and Systems**
    a. Earth's systems, being dynamic and interacting, cause feedback effects that can increase or decrease the original changes.
    b. Evidence from deep probes and seismic waves, reconstructions of historical changes in Earth's surface and its magnetic field, and an understanding of physical and chemical processes lead to a model of Earth with a hot but solid inner core, a liquid outer core, a solid mantle and crust. Motions of the mantle and its plates occur primarily through thermal convection, which involves the cycling of matter due to the outward flow of energy from Earth's interior and gravitational movement of denser materials toward the interior.
    c. The geological record shows that changes to global and regional climate can be caused by interactions among changes in the sun's energy output or Earth's orbit, tectonic events, ocean circulation, volcanic activity, glaciers, vegetation, and human activities. These changes can occur on a variety of time scales

from sudden (e.g., volcanic ash clouds) to intermediate (ice ages) to very long-term tectonic cycles.
   d. Provides a framework for understanding its geologic history.
3. **ESS2.B: Plate Tectonics and Large-Scale System Interactions**
   a. Plate tectonics is the unifying theory that explains the past and current movements of the rocks at Earth's surface and provides a framework understanding it's geologic history.
4. **PS1.C: Nuclear Processes**
   a. Spontaneous radioactive decays follow a characteristic exponential decay law. Nuclear lifetimes allow radiometric dating to be used to determine the ages of rocks and other materials.

Learning Targets:

1. I can explain the process of Earth's formation (HS-ESS1-6) (Constructing Explanations and Designing Solutions, ESS1.C, Stability and Change)
2. I can identify evidence and use reasoning to explain Earth's early geologic history and age. (HS-ESS1-6) (Constructing Explanations and Designing Solutions, ESS1.C, PS1.C**,** Stability and Change)
3. I can identify the given explanation, that crustal materials of different ages are arranged on Earth's surface in a pattern that can be attributed to plate tectonic activity and formation of new rocks from magma rising where plates are moving apart. (HS-ESS1-5) (Engaging in Argument from Evidence, ESS1.C, ESS2.B, Patterns)
4. I can evaluate the reliability, strengths, and weaknesses of the theory of plate tectonics and continental drift along with its ability to support logical and reasonable arguments about the motion of crustal plates.(HS-ESS1-5) (Engaging in Argument from Evidence, ESS2.B, Patterns)
5. I can synthesize the relevant evidence to describe the relationship between the motion of continental plates and the patterns in the ages of crustal rocks. (HS-ESS1-5) (Engaging in Argument from Evidence, ESS1.C, ESS2.B, Patterns)
6. I can develop a model in which they identify and describe the components based on both seismic and magnetic evidence (e.g., the pattern of the geothermal gradient or heat flow measurements) from Earth's interior, including: i. Earth's interior in cross-section and radial layers (crust, mantle, liquid outer core, solid inner core) determined by density. (HS-ESS2-3) (Developing and Using Models, ESS2.A, Energy and Matter, Systems and System Models)
7. I can describe using a model the cycling of matter by thermal convection in earth's interior. (HS-ESS2-3) (Developing and Using Models, Scientific Knowledge is Based on Empirical Evidence, ESS2.A, ESS2.B, Energy and Matter)

Assessment Evidence:

Performance Assessment Options

May include, but are not limited to the following:

1. HS-ESS1-5. Evaluate evidence of the past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the ages of crustal rocks. [Clarification Statement: Emphasis is on the ability of plate tectonics to explain the ages of crustal rocks. Examples include evidence of the ages oceanic crust increasing with distance from mid-ocean ridges (a result of plate spreading) and the ages of North American continental crust decreasing with distance away from a central ancient core of the continental plate (a result of past plate interactions).]

2. HS-ESS1-6. Apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of Earth's formation and early history. [Clarification Statement: Emphasis is on using available evidence within the solar system to reconstruct the early history of Earth, which formed along with the rest of the solar system 4.6 billion years ago. Examples of evidence include the absolute ages of ancient materials (obtained by radiometric dating of meteorites, moon rocks, and Earth's oldest minerals), the sizes and compositions of solar system objects, and the impact cratering record of planetary surfaces.]

3. HS-ESS2-3. Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection. [Clarification Statement: Emphasis is on both a one-dimensional model of Earth, with radial layers determined by density, and a three-dimensional model, which is controlled by mantle convection and the resulting plate tectonics. Examples of evidence include maps of Earth's three-dimensional structure obtained from seismic waves, records of the rate of change of Earth's magnetic field (as constraints on convection in the outer core), and identification of the composition of Earth's layers from high-pressure laboratory experiments.]

Digital Tools & Supplementary Resources:

Unit: Earthquakes and Volcanoes

Topics of Study:

1. Earthquakes
2. Volcanoes
3. Technology used to predict and measure seismic activity

Standards:

Cross Cutting Concepts

1. **Stability and Change**
   - Much of science deals with constructing explanations of how things change and how they remain stable.
   - Change and rates of change can be quantified and modeled over very short or very long periods of time. Some system changes are irreversible.
   - Feedback (negative or positive) can stabilize or destabilize a system.

2. **Energy and Matter**
    - Energy drives the cycling of matter within and between systems.

3. **Interdependence of Science, Engineering, and Technology**
    - Science and engineering complement each other in the cycle known as research and development (R&D). Many R&D projects may involve scientists, engineers, and others with wide ranges of expertise.
4. **Cause and Effect**
    - Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.

Scientific and Engineering Practices

1. **Developing and Using Models -** Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed world(s).
    - Develop a model based on evidence to illustrate the relationships between systems or between components of a system.
    - Use a model to provide mechanistic accounts of phenomena.
2. **Constructing Explanations and Designing Solutions -** Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.
    - Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, theories, simulations, peer review) and the assumption that 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.
    - Apply scientific reasoning to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion.

Disciplinary Core Ideas

1. **ESS2.A: Earth Materials and Systems**
    a. Earth's systems, being dynamic and interacting, cause feedback effects that can increase or decrease the original changes.
    b. Evidence from deep probes and seismic waves, reconstructions of historical changes in Earth's surface and its magnetic field, and an understanding of physical and chemical processes lead to a model of Earth with a hot but solid inner core, a liquid outer core, a solid mantle and crust. Motions of the mantle and its plates occur primarily through thermal convection, which involves the cycling of matter due to the outward flow of energy from Earth's interior and gravitational movement of denser materials toward the interior.
2. **ESS2.B: Plate Tectonics and Large-Scale System Interactions**

a. The radioactive decay of unstable isotopes continually generates new energy within Earth's crust and mantle, providing the primary source of the heat that drives mantle convection. Plate tectonics can be viewed as the surface expression of mantle convection.

3. **ESS2.E Biogeology**
   a. The many dynamic and delicate feedbacks between the biosphere and other Earth systems cause a continual co-evolution of Earth's surface and the life that exists on it.
4. **PS4.A: Wave Properties**
   a. Geologists use seismic waves and their reflection at interfaces between layers to probe structures deep in the planet.
5. **ESS3.B: Natural Hazards**
   a. Natural hazards and other geologic events have shaped the course of human history; [they] have significantly altered the sizes of human populations and have driven human migrations.

Learning Targets:

1. I can identify and reason that the processes of volcanism and earthquakes result from plate tectonic movement and other geological forces. (HS-ESS1-6) (Constructing Explanations and Designing Solution, ESS1.C, Stability and Change, Cause and Effect)
2. I can describe the relationship between volcanism, mountain building and tectonic uplift as causal agents in building up Earth's surface over time. (HS-ESS2-1) (Developing and Using Models, ESS2.A, ESS2.B, ESS2.E, Stability and Change)
3. I can describe features that form or change rapidly due to processes that act on short time scales (e.g., volcanic eruptions) (HS-ESS2-1) (Developing and Using Models, ESS2.B, Stability and Change, Cause and Effect,)
4. I can describe using seismic evidence plate activity resulting in earthquakes. (HS-ESS2-3) (Cause and Effect, Developing and Using Models,ESS2.A, ESS2.B, ESS2.E, PS4.A, Energy and Matter)
5. I can reason the effects of natural hazards on human society. (HS-ESS3-1) (Using Mathematics and Computational Thinking, ESS3.B, Interdependence of Science, Engineering, and Technology)

Assessment Evidence:

Performance Assessment Options
May include, but are not limited to the following:

HS-ESS1-6. Apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of Earth's formation and early history. [Clarification Statement: Emphasis is on using available evidence within the solar system to reconstruct

the early history of Earth, which formed along with the rest of the solar system 4.6 billion years ago. Examples of evidence include the absolute ages of ancient materials (obtained by radiometric dating of meteorites, moon rocks, and Earth's oldest minerals), the sizes and compositions of solar system objects, and the impact cratering record of planetary surfaces.]

HS-ESS2-1. Develop a model to illustrate how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features. [Clarification Statement: Emphasis is on how the appearance of land features (such as mountains, valleys, and plateaus) and sea-floor features (such as trenches, ridges, and seamounts) are a result of both constructive forces (such as volcanism, tectonic uplift, and orogeny) and destructive mechanisms (such as weathering, mass wasting, and coastal erosion).] [*Assessment Boundary: Assessment does not include memorization of the details of the formation of specific geographic features of Earth's surface*.]

HS-ESS2-3. Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection. [Clarification Statement: Emphasis is on both a one-dimensional model of Earth, with radial layers determined by density, and a three-dimensional model, which is controlled by mantle convection and the resulting plate tectonics. Examples of evidence include maps of Earth's three-dimensional structure obtained from seismic waves, records of the rate of change of Earth's magnetic field (as constraints on convection in the outer core), and identification of the composition of Earth's layers from high-pressure laboratory experiments.]

HS-ESS3-1. Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity. [Clarification Statement: Examples of key natural resources include access to fresh water (such as rivers, lakes, and groundwater), regions of fertile soils such as river deltas, and high concentrations of minerals and fossil fuels. Examples of natural hazards can be from interior processes (such as volcanic eruptions and earthquakes), surface processes (such as tsunamis, mass wasting and soil erosion), and severe weather (such as hurricanes, floods, and droughts). Examples of the results of changes in climate that can affect populations or drive mass migrations include changes to sea level, regional patterns of temperature and precipitation, and the types of crops and livestock that can be raised.]

Digital Tools & Supplementary Resources

Unit: Earth's Geologic Resources

Topics of Study:

1. Characteristics of Minerals
2. Rock Cycle
3. Classification and identification of rocks and minerals
4. Energy resources

Standards:

Cross Cutting Concepts

1. **Energy and Matter**
    - Energy drives the cycling of matter within and between systems.
2. **Cause and Effect**
    - Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.
3. **Stability and Change**
    - Change and rates of change can be quantified and modeled over very short or very long periods of time. Some system changes are irreversible.
4. **Structure and Function**
    - The functions and properties of natural and designed objects and systems can be inferred from their overall structure, the way their components are shaped and used, and the molecular substructures of its various materials.

Scientific and Engineering Practices

1. **Developing and Using Models -** Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed world(s).
    a. Develop a model based on evidence to illustrate the relationships between systems or between components of a system.
    b. Use a model to provide mechanistic accounts of phenomena.
2. **Engaging in Argument from Evidence -** Engaging in argument from evidence in 9–12 builds on K–8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about the natural and designed world(s). Arguments may also come from current scientific or historical episodes in science.
    a. Construct an oral and written argument or counter-arguments based on data and evidence.
3. **Constructing Explanations and Designing Solutions -** Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific knowledge, principles, and theories.
    a. Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that 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.
    b. Design or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.

Disciplinary Core Ideas

1. **ESS2.B: Plate Tectonics and Large-Scale System Interactions**
    a. Plate tectonics is the unifying theory that explains the past and current movements of the rocks at Earth's surface and provides a framework for

understanding its geologic history. Plate movements are responsible for most continental and ocean-floor features and for the distribution of most rocks and minerals within Earth's crust.

2. **ESS3.A: Natural Resources**
    a. Resource availability has guided the development of human society.
    b. All forms of energy production and other resource extraction have associated economic, social, environmental, and geopolitical costs and risks as well as benefits. New technologies and social regulations can change the balance of these factors.
3. **ESS3.C: Human Impacts on Earth Systems**
    a. The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources.
    b. Scientists and engineers can make major contributions by developing technologies that produce less pollution and waste and that preclude ecosystem degradation.
4. **ETS1.B: Developing Possible Solutions**
    a. When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts.

Learning Targets:

1. I can describe using models the different formation processes of rocks and minerals (HS-ESS2-3) (Practices Developing and Using Models, Scientific Knowledge is Based on Empirical Evidence, ESS2.A, ESS2.B, Energy and Matter, Cause and Effect, Stability and Change)
2. I can identify rock and minerals based on identifiable features of provided samples (HS-ESS2-5) (Planning and Carrying Out Investigations, ESS2.C, Structure and Function)
3. I can analyze using evidence the economic cost and benefits of various mineral and energy resources. (HS-ESS3-2) (Engaging in Argument from Evidence, ESS3.A, ETS1.B,
4. Stability and Change)
5. I can analyze using evidence the environmental cost and benefits of various mineral and energy resources. (HS-ESS3-2) (Engaging in Argument from Evidence, ESS3.A, ETS1.B, Cause and Effect)

Assessment Evidence:

Performance Assessment Options
May include, but are not limited to the following:

- HS-ESS3-2. Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios. [Clarification Statement: Emphasis is on the conservation, recycling, and reuse of resources (such as

minerals and metals) where possible, and on minimizing impacts where it is not. Examples include developing best practices for agricultural soil use, mining (for coal, tar sands, and oil shales), and pumping (for petroleum and natural gas). Science knowledge indicates what can happen in natural systems—not what should happen.]

- HS-ESS2-3. Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection. [Clarification Statement: Emphasis is on both a one-dimensional model of Earth, with radial layers determined by density, and a three-dimensional model, which is controlled by mantle convection and the resulting plate tectonics. Examples of evidence include maps of Earth's three-dimensional structure obtained from seismic waves, records of the rate of change of Earth's magnetic field (as constraints on convection in the outer core), and identification of the composition of Earth's layers from high-pressure laboratory experiments.]

Digital Tools & Supplementary Resources

Unit: Weathering and Erosion

Topics of Study:

1. Weathering
2. Erosion

Standards:

Cross Cutting Concepts

1. **Stability and Change**
    - Much of science deals with constructing explanations of how things change and how they remain stable.
    - Change and rates of change can be quantified and modeled over very short or very long periods of time. Some system changes are irreversible.
2. **Cause and Effect**
    - Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.

Scientific and Engineering Practices

1. **Developing and Using Models -** Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed world(s).
    - Use a model to provide mechanistic accounts of phenomena.
2. **Planning and Carrying Out Investigations -** Planning and carrying out investigations in 9-12 builds on K-8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models.
    - Plan and conduct an investigation individually and collaboratively to produce

data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.

Disciplinary Core Ideas

1. **ESS2.A: Earth Materials and Systems**
    a. Earth's systems, being dynamic and interacting, cause feedback effects that can increase or decrease the original changes.
    b. The geological record shows that changes to global and regional climate can be caused by interactions among changes in the sun's energy output or Earth's orbit, tectonic events, ocean circulation, volcanic activity, glaciers, vegetation, and human activities. These changes can occur on a variety of time scales from sudden (e.g., volcanic ash clouds) to intermediate (ice ages) to very long-term tectonic cycles.
2. **ESS2.C: The Roles of Water in Earth's Surface Processes**
    a. The abundance of liquid water on Earth's surface and its unique combination of physical and chemical properties are central to the planet's dynamics. These properties include water's exceptional capacity to absorb, store, and release large amounts of energy, transmit sunlight, expand upon freezing, dissolve and transport materials, and lower the viscosities and melting points of rocks.
3. **ESS2.E Biogeology**
    a. The many dynamic and delicate feedbacks between the biosphere and other Earth systems cause a continual co-evolution of Earth's surface and the life that exists on it.

Learning Targets:

1. I can use evidence to identify and describe the surface processes of weathering and erosion (HS-ESS2-1) (Practices Developing and Using Models, ESS2.A, ESS2.B, Stability and Change)
2. I can describe the relationships between components including specific surface processes, mainly weathering and erosion, are identified as causal agents in wearing down Earth's surface over time (HS-ESS2-1) (Practices Developing and Using Models, ESS2.A, ESS2.B, Stability and Change)
3. I can describe the mechanical and chemical effects of water on Earth's materials(HS-ESS2-5) (Planning and Carrying Out Investigations, ESS2.C, Structure and Function)
4. I can analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems. (HS-ESS2-2). (Analyzing and Interpreting Data, ESS2.A, ESS2.D, Stability and Change, Influence of Engineering, Technology, and Science on Society and the Natural World).

Assessment Evidence:

Performance Assessment Options
May include, but are not limited to the following:

- HS-ESS2-1. Develop a model to illustrate how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features. [Clarification Statement: Emphasis is on how the appearance of land features (such as mountains, valleys, and plateaus) and sea-floor features (such as trenches, ridges, and seamounts) are a result of both constructive forces (such as volcanism, tectonic uplift, and orogeny) and destructive mechanisms (such as weathering, mass wasting, and coastal erosion).] [*Assessment Boundary: Assessment does not include memorization of the details of the formation of specific geographic features of Earth's surface*.]
- HS-ESS2-5. Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes. [Clarification Statement: Emphasis is on mechanical and chemical investigations with water and a variety of solid materials to provide the evidence for connections between the hydrologic cycle and system interactions commonly known as the rock cycle. Examples of mechanical investigations include stream transportation and deposition using a stream table, erosion using variations in soil moisture content, or frost wedging by the expansion of water as it freezes. Examples of chemical investigations include chemical weathering and recrystallization (by testing the solubility of different materials) or melt generation (by examining how water lowers the melting temperature of most solids).]
- HS-ESS2-2. Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems. [Clarification Statement: Examples should include climate feedbacks, such as how an increase in greenhouse gases causes a rise in global temperatures that melts glacial ice, which reduces the amount of sunlight reflected from Earth's surface, increasing surface temperatures and further reducing the amount of ice. Examples could also be taken from other system interactions, such as how the loss of ground vegetation causes an increase in water runoff and soil erosion; how dammed rivers increase groundwater recharge, decrease sediment transport, and increase coastal erosion; or how the loss of wetlands causes a decrease in local humidity that further reduces the wetland extent.]

Digital Tools & Supplementary Resources