

Unit 6: Weathering and Erosion (Earth's System)

Content Area: **Science**
Course(s):
Time Period: **Generic Time Period**
Length: **3 weeks**
Status: **Published**

Essential Questions

Weathering and Erosion

Specific NGSS: 4-ESS2-1 and 4-ESS1-1

Essential Unit Question:

- What do the shapes of landforms and rock formations tell us about the past?

Guiding Questions:

- How can evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation be observed or measured?
- What can rock formations tell us about the past?

Objectives:

- SWBAT make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.
- SWBAT identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time.

Concepts that will be taught...

1. Cause-and-effect relationships are routinely identified, tested, and used to explain change.
2. Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around.
3. Rainfall helps to shape the land and affects the types of living things found in a region.
4. Living things affect the physical characteristics of their regions.
5. Science assumes consistent patterns in natural systems.
6. Patterns can be used as evidence to support an explanation.
7. Local, regional, and global patterns of rock formations reveal changes over time due to earth forces, such as earthquakes.
8. The presence and location of certain fossil types indicate the order in which rock layers were formed.

Disciplinary Core Ideas

Earth Materials and Systems

- Rainfall helps to shape the land and affects the types of living things found in a region. Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around.

Plate Tectonics and Large-Scale System Interactions

- The locations of mountain ranges, deep ocean trenches, ocean floor structures, earthquakes, and volcanoes occur in patterns. Most earthquakes and volcanoes occur in bands that are often along the boundaries between continents and oceans. Major mountain chains form inside continents or near their edges. Maps can help locate the different land and water features areas of Earth.

Biogeology

- Living things affect the physical characteristics of their regions.

LA.4.W.4.7	Conduct short research projects that build knowledge through investigation of different aspects of a topic.
SCI.4-ESS2	Earth's Systems
LA.4.W.4.8	Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources.
SCI.4-ESS2-2	Analyze and interpret data from maps to describe patterns of Earth's features.
SCI.4-ESS2-1	Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.
MA.4.4.MD.A.1	Know relative sizes of measurement units within one system of units including km, m, cm, mm; kg, g; lb, oz.; l, ml; hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit. Record measurement equivalents in a two column table.
MA.4.4.MD.A.2	Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit. Represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale.
LA.4.RI.4.7	Interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, time lines, animations, or interactive elements on Web pages) and explain how the information contributes to an understanding of the text in which it appears.

Learning Activities

- In this unit of study, students are expected to develop understanding of the effects of weathering and the rate of erosion by water, ice, wind, or vegetation. As students plan and carry out investigations using models and observe the effects of earth processes in the natural environment, they learn to identify patterns of change; recognize cause-and-effect relationships among the forces that cause change in rocks, soil, and landforms; and construct explanations of changes that occur over time to earth materials.
- In the first portion of the unit, fourth graders develop an understanding of cause-and-effect relationships when studying physical weathering and the rate of erosion by water, wind, ice, or vegetation. Students learn that rainfall helps to shape the land and affects the types of living things found in a region, and that living things affect the physical characteristics of a region. Students should make observations of their local environment to observe the types of living things that are common in the region, and they should look for evidence that water, ice, wind, organisms, and gravity have broken down rocks, soils, and sediments into smaller pieces and have moved them from one place to another.
- In the classroom, students should build and use models that demonstrate how wind, water, and ice cause change to the surface of the earth. Students should use stream tables, soil, sand, and water to simulate the effects of moving water (rain, rivers) on rocks and soil. Following these types of experiences, students need opportunities to ask questions that will lead to further investigations. They can change a variable—such as the type of earth material (sand, soil, clay, silt), the angle of a hill’s slope, the volume of water flow, the speed of water flow, and the relative rate of deposition—then collect and analyze data in order to determine the effects.
- In addition to using models to understand the effects of water and ice on land, students should build and use models to simulate the effects of wind on earth materials. There are a variety of models that can be easily built. Students should have opportunities to change variables, such as the speed or volume of airflow. From these experiences, students should begin to understand that wind, water, and ice cause changes to the earth’s surface, and that the stronger or faster the flow of wind or water, the greater the change it causes.
- In this unit, students also need opportunities to observe ways in which plants affect the weathering and erosion of earth materials. Plants can have a variety of effects on rocks, soils, and landforms. Plants often slow or stop the effects of moving wind and water on land. Students can observe this phenomenon using models. As they make observations, students can change variables, such as the amount or type of plant used to slow or stop erosion, and they can collect and analyze data to determine cause-and-effect relationships between the amount of change and the plants used to prevent it. Then students can walk around the schoolyard and nearby neighborhoods to look for examples of plants that are used to prevent erosion.
- In addition to slowing or preventing erosion, plants can cause weathering of rocks. Students can easily find examples in their own environment of growing plant and tree roots causing rocks, sidewalks, and driveways to crack and break down into smaller and smaller components. This phenomenon can also be simulated with models in the classroom. Students can soak lima beans in water overnight, then “plant” them in small cups containing a 2–3 cm. layer of wet Plaster of Paris on top of potting soil. (One or two seeds should be placed in the wet layer of plaster.) After a few days, the seeds will germinate and grow, eventually causing the dried plaster to crack. Again, students need opportunities to change variables, such as the number of seeds planted (one seed vs. multiple seeds, for example) and the type of seeds, then make observations and collect data to determine the amount of weathering each change causes to the dried plaster.
- In the second portion of this unit, students learn that patterns can be used as evidence to explain changes to the earth’s landforms and rock formations, and that local, regional, and global patterns of rock formations

reveal changes over time due to earth forces. If possible, students should make observations of local landforms; however, pictures from books and online sources can give students the opportunity to identify evidence of change from patterns in rock formations and fossils in rock layers. Students can support explanations for changes in a landscape over time in multiple ways, including the following:

- Pictures of a variety of landforms, such as sand dunes and canyons, can be used to show change due to weathering and erosion that have occurred over time.
 - Pictures or diagrams of rock layers with marine shell fossils above rock layers with plant fossils and no shells can be used to indicate a change from land to water over long periods of time.
 - Pictures of a canyon with different rock layers in the walls and a river at the bottom can be used to show that over time a river cut through the rock to form the canyon.
- As students collect evidence, either from firsthand observations or from media resources, they should attempt to explain the changes that have occurred over time in each of the landscapes observed.

Mystery Science

Unit: The Birth of Rocks - Rock Cycle, Erosion, & Natural Hazards

*** These 4 Mysteries provide 4 weeks of content. This unit takes the perspective that every rock has a story. Students will develop an appreciation for the processes that shape the Earth's surface. After considering where volcanoes form and how they erupt, they turn to investigations of rocks breaking apart and creating potential hazards. Through hands-on investigation, students explore the world of rocks and design ways of protecting humans from their dangers.*

Mystery 1: Volcanoes, Rock Cycle & Earth's Surface

***In this Mystery, students will explore the patterns of where volcanoes exist in the world today and where volcanoes have existed in the past. In the activity, students will use coordinates to locate volcanoes in different regions of the world to identify a major pattern of volcanoes known as the Ring of Fire.*

Essential Question - Could a volcano pop up in your backyard?

Materials: SmartBoard/iPads, "Volcano Mapping" sheets (for 17-24 students, print 3 sets), "Volcano Discovery" sheets, red pencils, wall space, pins or tape to fasten the maps to the wall.

Procedure: Prior to teaching the lesson, watch activity instructions video and obtain/print out all necessary student materials & teacher answer keys. Access Mystery Science website on SmartBoard. Utilize classroom iPads for small group or individual use as desired. Begin Exploration video (20 min). Follow prompts for stopping points for questioning & discussion. Guide students in prepping for, and carrying out Activity: Mapping Volcanoes (35 min). Optional Extras (2 hrs) are available to supplement lesson.

Assessment: informal observation during exploration and activity, Mystery 1 assessment

Mystery 2: Volcanoes, Rock Cycle, and Earth's Surface

***In this Mystery, students will investigate how differences in lava types explain differences in the shape and eruption patterns among volcanoes. In the activity, students will experiment with "lava" of different thicknesses to solve the mystery.*

Essential Question - Why do some volcanoes explode?

Materials: Students will work in pairs. Each pair of students will need - newspaper, paper plate, plastic spoon, two 3 oz dixie cups, a sample of thin lava and a sample of thick lava, a paper mat. Each student will need - a straw, a pencil & a Lava Experiments worksheet. To prepare the thick lava you will need - a gallon-sized ziplock bag and a pair of scissors, 2 cups of flour, 1-1 1/2 cups water & red food coloring (optional).

Procedure: Prior to teaching the lesson, watch activity instructions video/lava preparation video, and print out necessary student materials and teacher answer keys. Access Mystery Science website on SmartBoard. Utilize classroom iPads for small group/individual use as desired. Begin Exploration video (25 min). Follow prompts for stopping points for questioning & discussion. Guide students in prepping for, and carrying out Activity: Bubble Trouble (30 min). Optional Extras are available to supplement lesson (2 hrs).

Assessment: informal observation during exploration and activity, Mystery 2 assessment

Mystery 3: Weathering & Destructive Forces

***In this Mystery, students will explore how solid rock breaks apart into smaller pieces through a process called weathering (including root-wedging and ice-wedging.) In the activity, students will model the process of weathering that occurs when rocks tumble and crash into each other using sugar cubes in a container.*

Essential Question - Will a mountain last forever?

Materials: Each pair of students will need - a container with a lid, 5 sugar cubes, two washable markers, a paper plate, 2 Sugar Shake Data Sheets, 2 pencils

Procedure: Prior to teaching the lesson, watch activity instructions and print out necessary student materials & teacher answer keys. Access Mystery Science website on SmartBoard. Utilize classroom iPads for small group/individual use as desired. Begin Exploration video (20 min). Follow prompts for stopping points for questioning & discussion. Guide students in prepping for, and carrying out Activity: Sugar Shake (45 min). Optional Extras are available to supplement lesson (2 hrs).

Assessment: informal observation during exploration & activity, Mystery 3 assessment

Mystery 4: Erosion, Natural Hazards & Engineering

***In this Mystery, students will learn about the types, causes, and dangers of landslides. Through a brainstorming process, students will become engineers who design solutions for preventing landslides, protecting property, and*

keeping people safe.

Essential Question - How could you survive a landslide?

Materials: Each student will need - several post-it notes measuring 3"X3", a pencil, a "Saving My Slide-City Home" worksheet. You will also need wall space where you can put up Post-it notes.

Procedure: Prior to teaching lesson, watch the video demonstration of brainstorming, as well as print all necessary student materials & teacher answer keys. Access Mystery Science website on SmartBoard. Utilize classroom iPads for small group/individual use as desired. Begin Exploration video (15 min). Follow prompts for stopping points for questioning & discussion. Guide students in prepping for, and carrying out Activity: Slide City (30 min). Optional Extras are available to supplement lesson (2 hrs).

Assessment: Informal observation during exploration and activity, Mystery 4 assessment, summative assessment

Assessment

Science Textbook

- Chapter Review
- Chapter Test

Mystery Science

- Individual Mystery Assessments
- Summative Assessment
- Informal Observation during explorations & activities

Teacher-Made Assessments

- Quizzes
- Tests

- Classwork
- Homework
- Projects

Materials & Resources

www.mysteryscience.org

Mystery 1: "Volcano Mapping" sheets (for 17-24 students, print 3 sets), "Volcano Discovery" sheets, red pencils, wall space, pins or tape to fasten the maps to the wall.

Mystery 2: Each pair of students will need - newspaper, paper plate, plastic spoon, two 3 oz dixie cups, a sample of thin lava and a sample of thick lava, a paper mat. Each student will need - a straw, a pencil & a Lava Experiments worksheet. To prepare the thick lava you will need - a gallon-sized ziplock bag and a pair of scissors, 2 cups of flour, 1-1 1/2 cups water & red food coloring (optional).

Mystery 3: Each pair of students will need - a container with a lid, 5 sugar cubes, two washable markers, a paper plate, 2 Sugar Shake Data Sheets, 2 pencils

Mystery 4: Each student will need - several post-it notes measuring 3"X3", a pencil, a "Saving My Slide-City Home" worksheet. You will also need wall space where you can put up Post-it notes.

Accommodations & Modifications

- Large print textbooks
- Additional time for assignments
- Review of directions
- Have student restate information
- Provision of notes or outlines
- Concrete examples
- Adaptive writing utensils
- Support auditory presentations with visuals
- Weekly home-school communication tools (notebook, daily log, phone calls or email messages)
- Space for movement or breaks
- Extra visual and verbal cues and prompts
- Books on tape
- Graphic organizers
- Quiet corner or room to calm down and relax when anxious
- Preferential seating
- Alteration of the classroom arrangement
- Reduction of distractions
- Answers to be dictated
- Hands-on activities
- Use of Manipulatives
- Follow a routine/schedule
- Alternate quiet and active time
- Teach time management skills
- Rest breaks
- Verbal and visual cues regarding directions and staying on task
- Daily check-in special education teacher
- Visual daily schedule

- Varied reinforcement procedures
- Immediate feedback
- Personalized examples