



Grade 4 Science - Unit 1 - Earth's Systems: Processes that Shape the Earth

Unit Focus

In this unit, Grade 4 students will explore the dynamic processes that shape Earth's surface over time, including the role of rock formations, fossils, weathering, and erosion. Students will examine patterns in rock layers and fossils to understand how landscapes change and investigate the effects of natural processes like water, wind, ice, and vegetation on the Earth's surface. The unit also focuses on the importance of maps in recognizing patterns in Earth's landforms and natural hazards, while challenging students to think critically about how human-engineered solutions can reduce the impact of these natural processes.

Through a combination of Mystery Science investigations, additional hands-on activities, and data analysis, students will engage with scientific concepts such as how rock layers and fossils provide clues to past environments, how weathering and erosion reshape the land, and how engineers work to protect people from natural disasters. By the end of the unit, students will have a deeper understanding of the forces shaping Earth's surface and the role of engineering in minimizing the effects of geological events like earthquakes, floods, and volcanic eruptions.

Stage 1: Desired Results - Key Understandings

Standard(s)	Transfer	
Next Generation Science Standards Cross Cutting Concepts: 4 - Patterns can be used as evidence to support an explanation. (4-ESS1-1),(4-ESS2-2) (4.ES.CC.1.1) - Cause and effect relationships are routinely identified, tested, and used to explain change. (4-ESS2-1),(4-ESS3-2) (4.ES.CC.2.1) - Engineers improve existing technologies or develop new ones to increase their benefits, to decrease known risks, and to meet societal demands. (4-ESS3-2) (4.ES.CC. 3.1) - Science assumes consistent patterns in natural systems. (4-ESS1-1) (4.ES.CC.4.1) Disciplinary Core Ideas: 4 - Local, regional, and global patterns of rock formations reveal changes over time due to earth forces, such as earthquakes. The presence and location of certain fossil types indicate the order in which rock layers were formed. (4-ESS1-1) (4.ESS1.C.1) - 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. (4-ESS2-1) (4.ESS2.A.1) - 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.	<i>Students will be able to independently use their learning to...</i> T1 Create models to explore complex systems, show mastery of key science concepts, and/or develop solutions through creation of a product open to testing and redesign. T2 Use the scientific process to generate evidence that addresses the original questions.	
	Meaning	
	Understanding(s)	Essential Question(s)
	<i>Students will understand that...</i> U1 Fossils and rock layers provide evidence of past environments, helping scientists understand how landscapes have changed over time. U2 Weathering and erosion are natural processes that break down and reshape Earth's surface through forces like wind, water, ice, and vegetation. U3 Patterns in maps of Earth's landforms, such as mountain ranges, volcanoes, and earthquake locations, help us understand geologic activity and risks. U4 Engineers and scientists develop solutions to reduce the impact of natural hazards like earthquakes, floods, and volcanic eruptions on communities.	<i>Students will keep considering...</i> Q1 How do rock formations and fossils provide evidence of changes in Earth's landscapes over time? Q2 How do weathering and erosion shape Earth's surface? Q3 What patterns do maps reveal about Earth's landforms and natural hazards? Q4 How can humans design solutions to minimize the impact of natural disasters?

Stage 1: Desired Results - Key Understandings

	Acquisition of Knowledge and Skill	
	Knowledge	Skill(s)
Maps can help locate the different land and water features areas of Earth. (4-ESS2-2) (4.ESS2.B.1) - Living things affect the physical characteristics of their regions. (4-ESS2-1) (4.ESS2.E.1) - A variety of hazards result from natural processes (e.g., earthquakes, tsunamis, volcanic eruptions). Humans cannot eliminate the hazards but can take steps to reduce their impacts. (4-ESS3-2) (Note: This Disciplinary Core Idea can also be found in 3.WC.) (4.ESS3.B.1) - Testing a solution involves investigating how well it performs under a range of likely conditions. (secondary to 4-ESS3-2) (4.ETS1.B.1) Performance Expectations: 4 - Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time. (4-ESS1-1) - Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation. (4-ESS2-1) - Analyze and interpret data from maps to describe patterns of Earth's features. (4-ESS2-2) - Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans. (4-ESS3-2) Science and Engineering Practices: 4 - Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon. (4-ESS2-1) (4.ES.SEP.1.1) - Analyze and interpret data to make sense of phenomena using logical reasoning. (4-ESS2-2) (4.ES.SEP.2.1) - Identify the evidence that supports particular points in an explanation. (4-ESS1-1) (4.ES.SEP.3.1) - Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution. (4-ESS3-2) (4.ES.SEP.3.2) Madison Public Schools Profile of a Graduate Design: Engaging in a process to refine a product for an intended audience and purpose. (POG.2.2)	<i>Students will know...</i> K1 Rock layers and fossils provide clues about the history of a landscape. K2 Weathering and erosion are caused by natural forces such as wind, water, and ice. K3 Different variables, like slope, water flow, and vegetation, can affect the rate of erosion. K4 Topographic maps show the shape and elevation of land, while other maps display patterns of earthquakes, volcanoes, and other geological features. K5 Engineers design solutions to protect people and infrastructure from natural disasters. K6 Vocabulary: Volcano, Lava, Erupt, Basalt, Map, Pattern, Predict, Ring of Fire, Volcanologist, Active Volcano, Extinct Volcano, Rock Formations, Fossils, Rock Layers, Landforms, Fossils, Marine Fossils, Land Fossils, Impression, Sediment, Rock Layers, Geologic Time Periods, Geologist, Rock Cycle, Sedimentary Rocks, Metamorphic Rocks, Igneous Rocks, Erosion, Freeze, Ice Wedging, Landslide, Mountain, Natural Hazard, Root Wedging, Sinkhole, Slope, Steep, Weathering, Brainstorm, Engineer, Natural Processes.	<i>Students will be skilled at...</i> S1 Analyze rock layers and fossils to explain how landscapes have changed over time. S2 Identify patterns in fossil records to infer past environmental conditions. S3 Conduct observations and experiments to measure the effects of weathering and erosion. S4 Use maps to recognize patterns in Earth's features and understand their connections. S5 Compare and evaluate different engineering solutions for minimizing the impact of earthquakes, floods, and volcanic eruptions. S6 Communicate scientific ideas using data, models, and evidence-based reasoning.