4th Grade Unit 1 - Processes that Shape the Earth

Content Area: **Science**
Course(s): **Science Grade 4**
Time Period: **MP1**
Length: **25 days**
Status: **Published**

NJSLS - Science

3-5-ETS1-1	Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
3-5-ETS1-2	Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
4-ESS1-1	Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time.
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.
4-ESS2-2	Analyze and interpret data from maps to describe patterns of Earth's features.
4-ESS3-2	Generate and compare multiple solutions to reduce the impacts of natural Earth processes and climate change have on humans.

Science and Engineering Practices

Constructing Explanations and Designing Solutions

Identify the evidence that supports particular points in an explanation. (4-ESS1-1)

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, 3-5-ETS1-2)

Planning and Carrying Out Investigations

Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon. (4-ESS2-1)

Analyzing and Interpreting Data

Analyze and interpret data to make sense of phenomena using logical reasoning. (4-ESS2-2)

Asking Questions and Defining Problems

Define a simple design problem that can be solved through the development of an object, tool, process, or

system and includes several criteria for success and constraints on materials, time, or cost. (3-5-ETS1-1)

Disciplinary Core Ideas

ESS1.C: The History of Planet Earth

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)

ESS2.A: 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. (4-ESS2-1)

ESS2.B: 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. (4-ESS2-2)

ESS2.E: Biogeology

Living things affect the physical characteristics of their regions. (4-ESS2-1)

ESS3.B: Natural Hazards

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)

ETS1.A: Defining and Delimiting Engineering Problems

Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. (3-5-ETS1-1)

ETS1.B: Developing Possible Solutions

Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions. (3-5-ETS1-2)

At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs. (3-5-ETS1-2)

Crosscutting Concepts

Patterns

Patterns can be used as evidence to support an explanation. (4-ESS1-1, 4-ESS2-2)

Cause and Effect

Cause and effect relationships are routinely identified, tested, and used to explain change. (4-ESS2-1, 4-ESS3-2)

Influence of Science, Engineering, and Technology on Society and the Natural World

People’s needs and wants change over time, as do their demands for new and improved technologies. (3-5-ETS1-1)

Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands. (3-5-ETS1-2)

Rationale and Transfer Goals

In this unit, students investigate the dynamic and ever-changing nature of our planet. By analyzing evidence from rock formations and fossil layers, students learn to decode Earth’s history, discovering how landscapes change over vast periods of time. Through hands-on investigations, students observe the destructive yet creative forces of weathering and erosion, exploring how water, ice, wind, and vegetation shape landforms.

Students will also master the use of maps to locate and analyze patterns in Earth’s features, identifying where mountains, volcanoes, and earthquakes frequently occur. Concluding the unit, students shift from scientific analysis to engineering design; they apply their knowledge of Earth's forces to evaluate and test solutions

meant to reduce the impact of natural hazards (like earthquakes, tsunamis, and volcanic eruptions) on human communities.

Enduring Understandings

The Earth is constantly changing over multiple timescales.

The history of the Earth is written in its layers.

Earth’s features follow predictable patterns.

Humans cannot stop natural hazards, but we can reduce their impact.

Essential Questions

How do we know the Earth is constantly changing?

What forces shape the landscapes we see today?

How can humans protect themselves from Earth's natural processes?

Content - What will students know?

- Rock layers are deposited chronologically, meaning that older layers (and the fossils within them) are generally found at the bottom, while newer layers are at the top.
- Fossils provide a snapshot of past environments. For example, finding marine fossils (like shells) on a mountain peak proves that the area was once covered by an ocean.
- Earth's landscapes change drastically over millions of years due to shifting environments (e.g., a forest becoming a desert or an ocean becoming land).
- Weathering is the mechanical or chemical process that breaks down rock into smaller pieces

(sediment), while erosion is the movement of that sediment by wind, water, ice, or gravity.

- Water, wind, ice, and even living things (like tree roots breaking rocks) are the primary forces driving the shaping and wearing down of landforms.
- Some earth processes happen rapidly (landslides, flash floods), while others happen so slowly they are nearly imperceptible over a human lifespan (the carving of a canyon by a river).
- Earth's features, such as mountain ranges, deep ocean trenches, and volcanoes, are not randomly scattered but occur in distinct, recognizable patterns.
- The locations of earthquakes and active volcanoes closely align with one another, typically concentrated along the edges of continents or specific oceanic bands (like the Pacific Ring of Fire).
- Earth processes like earthquakes, tsunamis, volcanic eruptions, and landslides present severe hazards to human life and infrastructure.
- While humans cannot prevent natural disasters, we can use historical data and monitoring tools to identify high-risk areas.
- Engineering solutions can reduce the impact of these hazards. Examples include building earthquake-resistant skyscrapers, constructing tsunami seawalls, or developing early-warning siren systems.

Skills - What will students be able to do?

- Read and interpret various types of maps (including topographic and physical maps) to identify and describe global patterns of Earth's features, such as the location of mountain ranges, volcanoes, and earthquake epicenters.
- Use evidence from ordered rock layers and fossil presence to explain how a specific landscape has changed over geologic time (e.g., explaining how a desert environment transitioned from an ancient ocean).
- Design and execute controlled investigations to observe, measure, and collect data on how water, wind, ice, or vegetation affect the rate of weathering and erosion on landforms.
- Compare multiple design solutions intended to reduce the impact of natural hazards (e.g., testing different levy designs for flooding or bracing systems for earthquakes) and determine which solution best meets the criteria for protecting human life and property.

Activities - How will we teach the content and skills?

- Mystery Science The Birth of Rocks Anchor Phenomenon
- Mystery Science The Birth of Rocks Lesson 1

- Mystery Science The Birth of Rocks Lesson 2
- Mystery Science The Birth of Rocks Lesson 3
- Mystery Science The Birth of Rocks Lesson 4
- Mystery Science The Birth of Rocks Lesson 5

Formative Assessments

- Mystery Science Grade 4 The Birth of Rocks: Lesson 1 Assessment
- Mystery Science Grade 4 The Birth of Rocks:Lesson 2 Assessment
- Mystery Science Grade 4 The Birth of Rocks: Lesson 3 Assessment
- Mystery Science Grade 4 The Birth of Rocks: Lesson 4 Assessment
- Mystery Science Grade 4 The Birth of Rocks: Lesson 5 Assessment
- Daily Exit Tickets

Summative Assessments

- Mystery Science Grade 4 The Birth of Rocks: Performance Task
- Mystery Science Grade 4 The Birth of Rocks Unit Assessment
- Tests/Quizzes
- Grade 4 Science Unit 1 Benchmark

Spiraling for Mastery

Content or Skill for this Unit	Spiral Focus from Previous Unit	Instructional Activity
Students of all ages may hold the view that the world was always as it is now, or that any changes that have occurred must have been sudden and comprehensive.	• Grade 2: Water is found in the ocean, rivers, lakes, and ponds. Water exists as solid ice and in liquid form.	2-ESS1-1 Activities 2-ESS2-1 Activities

	• Grade 2: Maps show where things are located. One can map the shapes and kinds of land and water in any area. • Grade 2: Wind and water can change the shape of the land.	2-ESS2-2 Activities 2-ESS2-3 Activities

Key Resources

Mystery Science

Glaciers, Water, and Wind, Oh My!

Bill Nye Erosion Video

Explaining Glaciers, Accurately

Engineering for the Three Little Pigs

Testing Model Structures: Jell-O Earthquake in the Classroom

Getting the Right Angle on the Story

Career Readiness, Life Literacies, & Key Skills

9.4.5.CI.1	Use appropriate communication technologies to collaborate with individuals with diverse perspectives about a local and/or global climate change issue and deliberate about possible solutions (e.g., W.4.6, 3.MD.B.3,7.1.NM.IPERS.6).

9.2.5.CAP.1	Evaluate personal likes and dislikes and identify careers that might be suited to personal likes.
9.1.5.CR.1	Compare various ways to give back and relate them to your strengths, interests, and other personal factors.
9.4.5.CI.2	Investigate a persistent local or global issue, such as climate change, and collaborate with individuals with diverse perspectives to improve upon current actions designed to address the issue (e.g., 6.3.5.CivicsPD.3, W.5.7).
9.2.5.CAP.3	Identify qualifications needed to pursue traditional and non-traditional careers and occupations.
9.2.5.CAP.4	Explain the reasons why some jobs and careers require specific training, skills, and certification (e.g., life guards, child care, medicine, education) and examples of these requirements.
9.4.5.DC.4	Model safe, legal, and ethical behavior when using online or offline technology (e.g., 8.1.5.NI.2).
9.4.5.DC.8	Propose ways local and global communities can engage digitally to participate in and promote climate action (e.g., 6.3.5.GeoHE.1).
9.4.5.IML.2	Create a visual representation to organize information about a problem or issue (e.g., 4.MD.B.4, 8.1.5.DA.3).
9.4.5.IML.3	Represent the same data in multiple visual formats in order to tell a story about the data.
9.4.5.TL.2	Sort and filter data in a spreadsheet to analyze findings.
9.4.5.TL.3	Format a document using a word processing application to enhance text, change page formatting, and include appropriate images graphics, or symbols.

Interdisciplinary Connections

4.OA.A.1	Interpret a multiplication equation as a comparison, e.g., interpret 35 = 5 × 7 as a statement that 35 is 5 times as many as 7 and 7 times as many as 5. Represent verbal statements of multiplicative comparisons as multiplication equations.
RI.CR.5.1	Quote accurately from an informational text when explaining what the text says explicitly and make relevant connections when drawing inferences from the text.
RI.CR.4.1	Refer to details and examples as textual evidence when explaining what an informational text says explicitly and make relevant connections when drawing inferences from the text.
RI.MF.5.6	Interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, timelines, animations, or interactive elements on web pages) and explain how the information contributes to an understanding of the text in which it appears.
RI.CT.5.8	Compare and contrast the authors' approaches across two or more informational texts within the same genre or about texts on the same or similar topics.
4.M.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.
4.M.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.
RI.MF.4.6	Use evidence to show how graphics and visuals (e.g., illustrations, charts, graphs, diagrams, timelines, animations) support central ideas.

W.WR.4.5	Conduct short research projects that use multiple reference sources (print and non-print) and build knowledge through investigation of different aspects of a topic.
W.SE.4.6	Gather relevant information from multiple print and digital sources; take notes, prioritize and categorize information; provide a list of sources.