

## FOURTH GRADE: WEATHERING AND EROSION

### Standards Bundle

*Standards are listed within the bundle. Bundles are created with potential instructional use in mind, based upon potential for related phenomena that can be used throughout a unit.*

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. (SEP: 6; DCI: ESS1.C ; CCC: Patterns) **[Clarification Statement: Examples of evidence from patterns could include rock layers with marine shell fossils above rock layers with plant fossils and no shells, indicating a change from land to water over time; and, a canyon with different rock layers in the walls and a river in the bottom, indicating that over time a river cut through the rock.] [Assessment Boundary: Assessment does not include specific knowledge of the mechanism of rock formation or memorization of specific rock formations and layers. Assessment is limited to relative 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. (SEP: 3; DCI: ESS2.A, ESS2.E; CCC: Cause/Effect) **[Clarification Statement: Examples of variables to test could include angle of slope in the downhill movement of water, amount of vegetation, speed of wind, relative rate of deposition, cycles of freezing and thawing of water, cycles of heating and cooling, and volume of water flow.] [Assessment Boundary: Assessment is limited to a single form of weathering or erosion.]**

4-ESS2-2 Analyze and interpret data from maps to describe patterns of Earth's features. (SEP: 4; DCI: ESS2.B; CCC: Patterns) **[Clarification Statement: Maps can include topographic maps of Earth's land and ocean floor, as well as maps of the locations of mountains, continental boundaries, volcanoes, and earthquakes.]**

### Content Overview

*This section provides a generic overview of the content or disciplinary core ideas as an entry point to the standards.*

Earth's surface features have changed and continue to change over time. Water, ice, wind, and vegetation can affect how slow or fast weathering and erosion occur. As rocks and land formations erode, we are able to see layers in the rock formations, which helps explain how the landscape changes over time. Rock formations can be examined to identify patterns in rock layers and fossils found in those rock layers. Students should identify patterns by looking at maps and identifying changes in the landscape from these topographical and other land formation maps.

### Phenomena

*Phenomena can be used at varying levels of instruction. One could be used to anchor an entire unit, while another might be more supplemental for anchoring just a unit. Please remember that phenomena should allow students to engage in the SEP and use the CCC/DCI to understand and explain the phenomenon.*

- The Badlands formation.
- Finding marine shells fossils in the rock layers above those rock layers that have plant fossils.
- Canyon with different rock layers in the walls and a river on the bottom.

- A fossil found where no plants and animals currently live.
- Movement of icebergs.

### Storyline

*This section aims to decode not only the DCI connections, but also the SEP and CCC in a detailed account of how they possibly fit together in a progression for student learning, including both rationale and context for the bundle.*

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<p><b>Planning and Carrying Out Investigations</b></p> <ul style="list-style-type: none"> <li>● Make observations to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution.</li> </ul> <p><b>Constructing Explanations and Designing Solutions</b></p> <ul style="list-style-type: none"> <li>● Identify the evidence that supports particular points in an explanation.</li> <li>● Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon.</li> </ul> <p><b>Analyzing and Interpreting Data</b></p> <ul style="list-style-type: none"> <li>● Analyze and interpret data to make sense of phenomena using logical reasoning.</li> </ul>	<p><b>ESS1.C: The History of Planet Earth</b></p> <ul style="list-style-type: none"> <li>● 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.</li> </ul> <p><b>ESS2.A: Earth Materials and Systems</b></p> <ul style="list-style-type: none"> <li>● 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.</li> </ul> <p><b>ESS2.E: Biogeology</b></p> <ul style="list-style-type: none"> <li>● Living things affect the physical characteristics of their regions.</li> </ul> <p><b>ESS2.B: Plate Tectonics and Large-Scale System Interactions</b></p> <ul style="list-style-type: none"> <li>● 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</li> </ul>	<p><b>Patterns</b></p> <ul style="list-style-type: none"> <li>● Patterns can be used as evidence to support an explanation.</li> </ul> <p><b>Cause and Effect</b></p> <ul style="list-style-type: none"> <li>● Cause and effect relationships are routinely identified, tested, and used to explain change.</li> </ul>

	mountain chains form inside continents or near their edges. Maps can help locate the different land and water features areas of Earth.	
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In this bundle of performance expectations, students should be given the opportunity to analyze rock and fossil formations in order to identify patterns which can be used as evidence to support explanations that Earth's surface features change over time. Students can use the location of fossils in rock layers compared to other rock layers to begin to explain when those rock layers were formed. For example, if students see a layer of shell fossils above a layer of plant fossils, the student can use this evidence to create an explanation that the area where this rock formation was found was land at one time and was then covered with water for a period of time. This bundle allows students to obtain, record, and interpret data related to the sources that cause changes in land formations over time. Teachers can support students in setting up a variety of investigations that help students identify the effects water, ice, and wind, have on land. For example: the Badlands in western South Dakota were formed this way. Investigations to identify the effects living organisms and vegetation has on landforms could also be used to support student understanding.

Teachers can also set up simple investigations to explore the effects variables like wind speed, water movement, freezing and melting, and vegetation of areas have on landforms.

When students understand that landforms change over time and the factors that cause those changes, it can allow students to analyze patterns of Earth's features and construct explanations about how Earth's surface has changed over time.

Students should be given the opportunity to interpret and evaluate maps to determine and analyze patterns of the locations of mountain ranges, deep ocean trenches, and other bodies of water. As students locate these earth features they can support an explanation that these features caused the changes in the earth in the different areas.

### **Formative Assessment**

*Formative assessment is crucial because all learners benefit from timely and focused feedback from others. It promotes self-reflection, self-explanation, and social learning. It can also make learning more relevant. Each of the questions below might be used throughout the formative assessment process. Specific prompts may focus on individual practices, core ideas, or crosscutting concepts, but, together, the components need to support inferences about students' three-dimensional science learning as described in a given bundle, standard or lesson-level performance expectation.*

### SEP Constructing Explanations and Designing Solutions

- Create a model that explains and shows how the angle of a slope in the downhill movement of water changes the land formation..

### SEP Analyze and Interpret Data

- Use evidence to explain how fossils can tell us the order in which rock layers were formed.

### CCC Cause and Effect

- Explain how natural occurrences break rocks, soils, and sediments into smaller pieces and change land formations over time.

### CCC Patterns

- How are some rocks different from others?
- Why do some rock formations become smaller over time?

### Performance Outcomes

*These are statements of how students use knowledge and are similar to the standards in how they blend DCI, SEP, and CCC, but at a smaller grain-size. These are potential outcomes for instruction as it plays out in lessons and activities in the classroom. It is important to also think of these as smaller outcomes that build toward the larger goal of mastering the standards.*

- **Use evidence to explain** that the presence and location of certain fossil types indicate the *order in which rock layers were formed*.
- **Gather data** to explain that natural occurrences such as rain, wind, and ice *break rocks, soils, and sediments into smaller pieces*.
- **Plan an investigation** to show that rain, wind, ice, and gravity *move rocks, soils, and sediments around* from place to place on Earth's surface.
- **Conduct investigations** that show how rainfall, wind, or gravity *helps to shape the land*.
- **Analyze data** found in maps to determine that the locations of landforms such as mountain ranges, ocean floor structures, and bodies of water are located in *patterns*.
- **Obtain and evaluate information** from *maps* to help locate the different land and water features of Earth.