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**Constructive and Destructive Processes:**

**Weathering, Erosion, and Deposition**

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| **Estimated Time:** 3-5 class sessions | |
| **GSE Standard(s) and Element(s):**  **S6E5. Obtain, evaluate, and communicate information to show how Earth’s surface is formed.**  d. Ask questions to identify types of weathering, agents of erosion and transportation, and environments of deposition. (Clarification statement: Environments of deposition include deltas, barrier islands, beaches, marshes, and rivers.)  e. Develop a model to demonstrate how natural processes (weathering, erosion, and deposition) and human activity change rocks and the surface of the Earth. | |
| **Science and Engineering Practices:**  **Developing and Using Models**  Develop and/or use a model to predict and/or describe phenomena.  **Constructing Explanations and Designing Solutions**  Construct an explanation using models or representations. | **Disciplinary Core Ideas:**  **Earth Materials and Systems**  All Earth processes are the result of energy flowing and matter cycling within and among the planet’s systems. This energy is derived from the sun and Earth’s hot interior. The energy that flows and matter that cycles produce chemical and physical changes in Earth’s materials and living organisms.  **The Roles of Water in Earth’s Surface Processes**  Water’s movements—both on the land and underground—cause weathering and erosion, which change the land’s surface features and create underground formations. |
| **Crosscutting Concepts:**  **Cause and Effect**  Cause and effect relationships may be used to predict phenomena in natural or designed systems.  **Stability and Change**  Stability might be disturbed either by sudden events or gradual changes that accumulate over time. |
| **Authentic Scenario (Phenomena):**  Show students the video:  [Providence Canyon State Park](https://www.youtube.com/watch?v=FpgdCWQgF2o&t=1s)  *Do not show the entire 14-minute video. Use the segment between 5:00 and 7:30 minutes to show students the creek bed and walls of the canyon (the world’s largest sandcastle).* | **Vocabulary:**   * constructive processes * destructive processes * weathering * erosion * deposition * geomorphology * landforms |
| **Guiding Questions:**  How are some processes constructive and some destructive? |
| **Materials:**   * *Erosion: Changing Earth’s Surface (Amazing Science)* byRobin Koontz * Legos * Investigation Graphic Organizer (one per student) * Read about Weathering and Erosion (one per student) * sugar cubes * paint pan liner * dirt * water * rock * sandpaper | **Safety Considerations:**   * N/A |
| **Technology Integration:**   * Devices with Internet access |

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| **5E Stage** | **Student Activities**  How will students engage actively in the three dimensions throughout the lesson?    **Teacher Activities**  How will the teacher facilitate and monitor student learning? |
| **Engage** | Show the students the video: [Providence Canyon State Park](https://www.youtube.com/watch?v=FpgdCWQgF2o&t=1s) (5:00 to 7:30 minutes)  Ask, “What do you notice? What do you wonder?”  Ask students to think of places they have seen cracks in Earth’s surface. Examples include potholes in the road or cracks on the sidewalk. Explain that there are many different natural processes in our environment that change the surface of Earth. Constructive and destructive processes known as weathering and erosion cause these changes. Mention that even humans cause weathering and erosion. For example, each time we dig soil, or just walk along the ground, we are slowly changing Earth’s surface.  Read *Erosion: Changing Earth’s Surface (Amazing Science)* by Robin Koontz  Provide each student with ten Lego pieces and instruct them to build something. Allow for students to use their imaginations and creativity.  In pair-share partners, have students reflect on their observations as they built the Lego structures. Then, lead a sharing out as a whole group. Attempt to lead the students to understand how the structure became taller and larger as they continued to add Lego pieces. In pair-share partners, have students discuss whether or not this process is constructive or destructive. To facilitate conversation, have the first partner decide if the action is a constructive or destructive force and the other partner reflect on whether he or she agrees or disagrees and explain why or why not.  Instruct students to take apart their Lego structures. Within their pair-share partners, have them discuss their observations during the disassembly. Then, lead a sharing out as a whole group. Attempt to lead the students to understand how the structure became smaller as they subtracted Lego pieces. In pair-share partners, have students discuss whether or not this process is constructive or destructive, in the same manner as earlier. |
| **Explore** | Explain to the students that today they are going to be a geomorphologist (geoscientist) by investigating weathering, erosion, and deposition. Ask them if they have ever heard of geomorphology. Explain to them that geomorphology is the study of where landforms come from and how they change over time.  *Teacher Note: There is a link to geomorphology in the Elaborate portion of the lesson.*  Give each student or group of students (depending on how you choose to complete the investigations) an Investigation Graphic Organizer.  **INVESTIGATION 1: WEATHERING**  For this investigation, students will model the process of physical weathering using sugar cubes to form an explanation of how rocks become soil.  Give each student a sugar cube (*you may want to also give them a paper towel or have them take out a piece of paper to collect the broken sugar cube once they have completed the experiment*). Explain to the students that the sugar cube represents a rock.  During the class discussion ask the students:   * Are all rocks the same? * Do you think there are different rocks in the different regions of Georgia? * How do you think they are different or alike? * What do you think will happen if you apply enough pressure to a rock?   Explain to the students that they are going to apply pressure to their sugar cube (rock). Ask them to fill in their “Prediction” portion of their Investigation Graphic Organizer (*under Investigation 1 Weathering)* with what they think will happen when they apply pressure to their sugar cube (rock).  Have the students press down on the sugar cube so that they crush it apart. *They will most likely have to place the sugar cube on their desktop and press down on it.* Have students discuss what they observed during this process and record their observations on the “Actual Results” portion of their Investigation Graphic Organizer. Ask the students why they think this happened. Have them record their responses in the “Why” portion of their Investigation Graphic Organizer. Explain that this is an example of weathering and how rocks are broken down to become soil.  During the class discussion ask the students:   * What are some ways you think weathering occurs in nature?   Using the handout Read about Weathering and Erosion (*for this Investigation you will only read the first page of the handout)* you could read together as a whole group and practice annotating the text (underlining the important material, circling the definitions, etc.) or have them read with partners and annotate the text (depending on the reading level of your class).    After reading, as a class discussion, a journal writing activity, or a ticket out the door ask the students: What is weathering? What are (or describe) the main ways weathering occurs in nature?  *Teacher Note: If you are breaking this lesson into 3 parts collect the students’ Investigation Graphic Organizer and Read About Weathering and Erosion handout for future use.*  **INVESTIGATION 2: EROSION AND DEPOSITION**  For this investigation, students will demonstrate the process of erosion and deposition by using water, gravity, and dirt to form an explanation about how pieces of Earth are moved from one place and deposited in another.  Place students in groups of 3-5. Give each group 1 paint pan liner, 1 bag of dirt, and a bottle of water (water bottles should be filled with water beforehand).  During the class discussion ask the students:   * What does it mean to erode a surface? * Thinking of rocks being broken down by weathering into the soil, what are some ways that soil is moved from one place to another?   Have the groups pour the dirt onto the sloped area of the paint pan liner (*students will most likely need to put something under the sloped end to keep it level or even slightly raised, i.e., a textbook).* Then with a pencil or a finger students should create a “river or stream” in the dirt from the top of the liner to the bottom of the slope. Explain to them that they are going to pour water from the top of their “river or stream” and observe what happens. Ask them to fill in their “Prediction” portion of their Investigation Graphic Organizer (*under Investigation 2 Erosion and Deposition).* Instruct the groups to pour the water first slowly and then more rapidly onto the top of their “river or stream” and observe what happens. Have students discuss what they observed during this process and record their observations on the “Actual Results” portion of their Investigation Graphic Organizer. Ask the students why they think this happened. Have them record their responses in the “Why” portion of their Investigation Graphic Organizer. Explain that when weathering breaks down the Earth's surface it forms small pieces of dirt, sand, and small rocks; all of this material can get moved through erosion. This happened in the model when flowing water in the “riverbed” moved some of the material down the hill. Eventually, these pieces ended up somewhere else. The process of the material being deposited at the bottom of the hill is called deposition.  During the class discussion ask the students:   * What are some ways you think erosion occurs in nature? * Where are some places eroded rocks get deposited in nature?   Using the handout Read about Weathering and Erosion (*you can either finish the rest of the handout or break it apart)* you could read together as a whole group and practice annotating the text (underlining the important material, circling the definitions, etc.) or have them read with partners and annotate the text (depending on the reading level of your class). After reading, as a class discussion, a journal writing activity, or a ticket out the door ask the students: What is erosion? What are (or describe) some ways erosion occurs in nature? Where are some places weathered rocks, or soil, get deposited?  **INVESTIGATION 3: WIND EROSION**  For this investigation, students will demonstrate the process of wind erosion and deposition by using a rock and sandpaper to form an explanation about how wind blowing sand against a structure can cause erosion.  Place students in groups of 3-5. Give each group 1 rock and 1 piece of sandpaper.  As a class discussion ask the students:   * Have you ever been outside when the wind is blowing very hard and felt the sand or dirt hit against your skin? * Where are some places you may have experienced this? * Thinking of rocks being broken down by weathering into the soil, what do you think would happen to a structure that had sand blasted against it repeatedly?   Explain to them that they are going to demonstrate sand being blown against a rock using sandpaper and rock and observe what happens. Ask them to fill in their “Prediction” portion of their Investigation Graphic Organizer (*under Investigation 3 Wind Erosion).* Instruct the groups to rub the sandpaper back and forth rapidly on the rock (*you may want to also give them a paper towel or have them take out a piece of paper to collect the broken rock pieces once they have completed the experiment)* and observe what happens. Have students discuss what they observed during this process and record their observations on the “Actual Results” portion of their Investigation Graphic Organizer. Ask the students why they think this happened. Have them record their responses in the “Why” portion of their Investigation Graphic Organizer. Explain that when the wind blows sand against a structure weathering breaks down the surface forming small pieces of dirt, sand, and small rocks; all of this material can get moved through erosion. This happened in the model when we rubbed the sandpaper (sand) against the rock causing some of the rock to break off. Eventually, those pieces can end up somewhere else. This could be demonstrated by blowing the pieces away (*you may or may not want to allow students to demonstrate this).* The process of the material being moved, or blown away, is erosion, and when it is deposited somewhere else that is deposition. This explains how the shape of a rock can change due to wind erosion.  **Differentiation:**  Assist as needed during investigations.  Group students with similar learning styles.  Teacher-led note-taking for Investigation Graphic Organizer |
| **Explain** | After students complete all investigations facilitate a classroom discussion about the differences between weathering and erosion. Reiterate that for weathering, the weather is not the only contributing factor. Human activities, plants, and other factors can also cause weathering. Review the different types of erosion and the features of each. Explain that Investigation 1 provided a visual of what happens to soft pieces of rock during weathering. Investigation 2 demonstrated what happens during water erosion, and Investigation 3 showed what happens when the wind blows particles such as sand against rock over a period of time.  Watch the [Generation Genius Weathering and Erosion Video](https://www.generationgenius.com/videolessons/weathering-and-erosion-video-for-kids/) as a class. Facilitate a class discussion using the following questions.  1. In small groups, have the students identify the causes of weathering. Then, discuss the answers as a large group (e.g., water, temperature, ice, plants, animals, and wind). Repeat this pattern for erosion (e.g., water, wind, ice, and gravity) and deposition (e.g., water and wind).  2. In small groups, have the students identify the results of weathering. Then, discuss the answers as a large group (e.g., breaking, wearing down, cave-formations, and cracking). Repeat this pattern for erosion (e.g., carrying away, moving mudslides, and landslides) and deposition (e.g., dropping off, deposit, delta, sand dune, and layers of sediment). |
| **Elaborate** | Use the link, [Wonderopolis: What is Geomorphology?](https://wonderopolis.org/wonder/What-Is-Geomorphology#:~:text=This%20science%20is%20all%20about,learning%20about%20erosion%20and%20deposition) to let students explore more about scientists that study weathering and erosion. Students could also complete the DID YOU GET IT formative assessment to check for understanding.  *Writing Connection:*   * Check out these [15 amazing landscapes and rock formations](http://www.bbc.com/earth/story/20150205-the-15-most-amazing-landforms). How do you think these formed? Which one would you most like to see in person? |
| **Evaluate** | *Teacher Note: You may want to take the class on a walkabout around your school campus for them to look for examples of weathering, erosion, and deposition in their local environment.*  Ask students to list examples of things they may have seen in nature that could have been caused by weathering, erosion, or deposition. For example, students can say they saw weeds growing through cracks or saw a large pothole in the ground. Have students state whether their example could have been caused by weathering, erosion, or deposition and if the result was constructive or destructive. Provide time for students to explain why they believe this to be true. |