

## **4TH GRADE – SLOW MOVEMENT**

### **Objective:**

Students will learn how slow movement changes the surface of the earth. Student will see how water, glacier, chemical erosion effect the shape of our earth.

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### **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)
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### **Docent Lab Guidelines:**

1. Docent(s) should plan to arrive early to set up before the class arrives. This lab session is messy and takes a lot of preparation if all the experiments are to be completed. If all the experiments and activities are completed this lab takes about 2 hours of classroom time, not including set up and clean up time. Depending on how much time your teachers allows, docents can choose which experiments they would like to complete.
2. Ideally, it is best to have at least 3 docents for this lab, especially if you are doing all the experiments.
3. This lab will require the teacher to check out the Chrome Books. When scheduling this lab let the teacher know so she can reserve them and the headphones.
4. Input the day and time into the Science Lab Master Schedule. Please make sure you add at least 30 minutes of set up time and about 30-45 minutes of clean up time to the overall class time.
5. Wear lab coats. It gets messy. Safety glasses are not required.

6. Give a short overview of weather, erosion and deposition. You can also opt to play a short. These are listed below.
  7. Allow enough time at the end for students to wash up afterwards. They will need it. Girls can wash up in the adjacent girl's restroom to keep the flow moving.
  8. The last 5-10 minutes of class review with the students their observations.
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### Information on Weathering Erosion: For Docent's Reference Only

Weathering is the process where rock is dissolved, worn away or broken down into smaller and smaller pieces. There are mechanical, chemical and organic weathering processes.

Mechanical weathering physically breaks up rock. One example is called frost action or frost shattering. Water gets into cracks and joints in bedrock. When the water freezes it expands and the cracks are opened a little wider. Over time pieces of rock can split off a rock face and big boulders are broken into smaller rocks and gravel. This process can also break up buildings.

Organic weathering happens when plants break up rocks with their growing roots or plant acids help dissolve rock.

Chemical weathering decomposes or decays rocks and minerals. An example of chemical weathering is water dissolving limestone.

Once the rock has been weakened and broken up by weathering it is ready for erosion. Erosion happens when rocks and sediments are picked up and moved to another place by ice, water, wind or gravity.

When ice melts or wind and water slow down they can't carry as much sediment. The sediment is dropped, or deposited, in landforms.

### Videos on Weathering & Erosion:

1. Weathering and Erosion: Crash Course Kids #10.2 (Run time 4 min.5 sec.)  
<https://www.youtube.com/watch?v=R-lak3Wvh9c>
2. Weathering and Erosion – Hard Rock Life Song (Funny Song. Run time 2 mins. 57 sec.)  
<https://www.youtube.com/watch?v=qGZa1n-9e6o>
3. Bill Nye on Erosion (runtime 5 min. 9 sec.)  
<https://www.youtube.com/watch?v=J-ULcVdeqgE>

## Lab Overview:

A day or two before the class arrives have the teacher email the following Powtoon link to all the students. While in the science lab the students will open up their email and play the video following along with the instructions.

<http://www.powtoon.com/show/etzKx9q8RaU/the-earth-is-a-changin>

This is an outline of the full lab session. It can be shortened according to the docent's available class time. Detailed instructions of the experiments are listed below.

- A. Introduce slow movement and the how nature changes the earth's landscape using these forces:
  - Chemical
  - Water
  - Wind
  - Glacier
  - Temperature
- B. These forces are driven by geological processes:
  - Weathering
  - Erosion
  - Deposition
- C. Working in groups of 2 – students will watch the video **“Earth is a Changin,”** and pause it at Team Challenge #1 (Weathering, Erosion & Deposition Matching Game.).
  - Hand each team an envelope with the game cards in it.
- D. When they have completed the game resume the video to check their answers.
- E. The video continues with an introduction to the first science experiment: **Weathering in Your Mouth.**
  - Hand out pieces of chocolate
- F. When the video ends the Chrome Books will be put away while the docents bring out the materials for the first experiment.
- G. Give a brief introduction to the next set of experiments. The students all gather around a demonstration table to watch a demo on how to do these experiments. Then they will be able assemble in groups of 3 to do the remaining experiments.
- H. Students are to conduct, observe and record their observations on the lab worksheet.
- I. Remaining experiments:
  - Experiment #2: Chemical Erosion
  - Experiment #3: Glacier Erosion
  - Experiment #4: Water Erosion
- J. There is a math worksheet related to this lab. If there is time left over they can work on it or take it back to class.

## Weathering, Erosion & Deposition Game:

### Materials:

- Envelopes with game cards (one per group)

### Preparation:

1. Before class arrives make sure all the game cards are in the envelopes.
2. If there are not enough sets run copies from the originals left in the vertical files.

### Instructions:

1. Hand each group an envelope.
2. Each group is to read the directions and play the game.

## Experiment #1: Weather in Your Mouth

Docents: Please check for any food allergies. There are some students with peanut and tree nut allergies so the chocolate provided is a brand called Enjoy Life and comes from a dedicated tree nut, peanut, dairy, wheat and egg free facility. Let the teacher know before hand and also check for any additional allergies as there may be new students.

### Materials:

- Enjoy Life Chocolate bars
- Knife
- Plate

### Preparation:

1. Cut the chocolate bar into bite size pieces. Enjoy for each student to have 1 piece.
2. Put on a plate and have ready for class time.

### Instructions:

1. When students raise their hands during the video bring them a piece of chocolate.
2. Let them know they are not to bite it but let it melt in their mouth. Hard to do with chocolate!!!!

## Experiment #2: Chemical Erosion Station

### Materials:

- Petri dishes
- Rock samples that contain mineral calcite (calcium carbonate); e.g., limestone, marble, chalk

- Other rock samples (brick, granite, most gravel)
- Weak acid (e.g., lemon juice or vinegar)
- Eyedropper or pipettes
- Magnifying glasses
- Paper towels
- Large plastic bin (used to discard completed experiment)

**Preparation:**

1. Prepare trays with rock samples on it. One per table.
2. Prepare small containers with the acid solution. Add droppers in containers.
3. Set out magnifying glasses. One per student.
4. Place roll of paper towels at each table.

**Instructions:**

1. Take one of the rocks and place it in the petri dish.
2. Slowly add drops of lemon juice/vinegar to the rock using the eye dropper.
3. Observe the rock with the magnifying glass.
4. Record your observations on your Erosion Worksheet. (Specifically, did the rock bubble when you placed the weak acid on it?)
5. Discuss with your partners why you think such a reaction occurred.
6. Remove the rock, dry it off, and set it off to the side with the rest of the rocks. Repeat with remaining rock samples.
7. When finished, student are to place petri dishes and acid in the large plastic bins.
8. Docents will collect the bin. Pour out any liquid from the petri dishes into the sink and rinse with soapy water.

## Experiment #3: Glacier Erosion Station

**Materials:**

- Ice cubes (1 for each group)
- Modeling clay (do NOT use Play-Doh®)
- Tray
- Sand
- Paper towels

**Preparation:**

1. Have modeling clay ready.
2. Put sand in small containers. 1 for each table.
3. Prepare small beakers of vinegar or lemon juice with droppers.

**Instructions:**

1. Take a ball of clay from the container (approximately 1-2 inches in diameter).
2. Flatten the clay onto the surface on the tray.
3. Press an ice cube against the flattened clay and move it back and forth several times.
4. Record your observations. (Does anything happen to the clay when you rub the ice cube on it?)
5. Place a small pile of sand on the clay and then place the ice cube on top of the sand for 1-2 minutes.
6. Pick up the ice cube and observe the surface of the cube that was touching the sand and record your observations. (What does the bottom of the ice cube look like?)
7. Place the same side of the ice cube on the sandy part of the clay and move it back and forth several times.
8. Remove the ice cube and wipe away the sand from the surface of the clay.
9. Record your observations. (What does the texture of the surface of the clay feel like?)
10. Throw away the clay and remaining ice and sand.

## Experiment #4: Water Erosion Station

**Materials:**

- Large plastic container (Use clear plastic tray with high sides)
- Moist soil
- 12 coins, poker chips or small plastic action figures
- Watering can (one with several holes in the spout)
- Water
- Ruler
- Paper towels and towels (if things get really messy)

**Preparation:**

- Docents can prefill the plastic containers before class arrives or have the students fill them during the experiment.
- Set up an area outside where the bags of soil can be placed. This will help eliminate messes inside the classroom.
- Have containers filled with coins, poker chips and action figures ready to go for each table.
- Have watering cans filled and ready to use.

**Instructions:**

1. Have the students fill their containers with soil. Or docents can pre-fill containers.
2. In a large container, form a mountain of soil about 3 inches across (wide at the top) and about 5 or 6 inches tall in the container. Firmly press down the soil.
3. Press the coins/chips/action figures into the surface of the dirt/clay. (Place them at different angles with the edge protruding out; leave about half the coin showing.)
4. Create a rainstorm by pouring water on the mountain with the watering can.

5. Record your observations. (Are the coins sticking out more or less? What does the bottom of the mountain look like?)
6. Remove the coins and put them in the large plastic bin. These will be washed later along with the large plastic containers.
7. Drain the water outside in the grass or around the trees.
8. Place used soil in large plastic container or pot to use for other experiments.

**Clean-Up Tips:**

- This particular experiment can get very messy. Some of the students get very involved in it and do not mind getting muddy. There are towels under the sink for large messes.
- Try to scrap out all the containers of soil before washing them in the sink. If it is too messy let Jose know and he will let you use the janitors sink.

Name: \_\_\_\_\_ Date: \_\_\_\_\_

## Glaciers, Water and Wind, Oh My! Activity – Erosion Worksheet



### Instructions

Answer the following questions as you experiment with each different erosion stations.

### *Chemical Erosion Experiment:*

1. What happened when you dropped vinegar/lemon juice on the rocks (which rocks bubbled)?

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2. Why did some rocks bubble when you added the acid?

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3. What other materials do you think are affected by chemical erosion?

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### *Water Erosion Experiment*

1. What caused the clay/dirt to run off the mountain?

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2. Are the coins sticking out more or less? Why?

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3. What does the bottom of the mountain look like?

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4. What are some other examples of water erosion?



Name: \_\_\_\_\_ Date: \_\_\_\_\_

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***Glacier Erosion Experiment:***

1. What happened to the clay the first time you wiped the ice cube against it?

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2. What happened to the bottom of the ice cube after it sat on the sand?

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3. What did the surface of the clay look like after you rubbed the ice cube against it the second time?

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4. What are some other examples of Glacier erosion?

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Name: \_\_\_\_\_ Date: \_\_\_\_\_

## Glaciers, Water and Wind, Oh My! Activity – Erosion Math Worksheet



1. If a 12-acre forest lost  $\frac{1}{4}$  of its trees due to acid rain, how many acres would be undamaged?

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2. If property damage due to erosion along the coast is \$60 million each year, how much money would be spent in 4 years?

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3. Your favorite beach has 42 large sand dunes. Throughout the course of the year, wind erosion destroys 8 sand dunes and creates 13 new ones. How many sand dunes would there be at the end of the year?

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4. One side of a mountain is 5,280 feet long. If a glacier were to start at the very top of the mountain and travel 3 feet per year, how long would it take the glacier to reach the bottom of the mountain?

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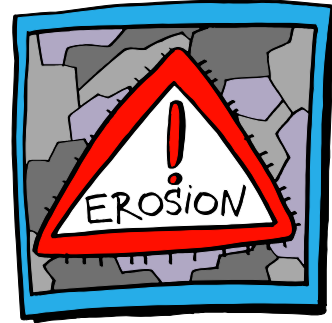
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5. On a cold day in July, you notice a new crack in the sidewalk at 10:30 a.m. At 11:13 a.m. you notice the crack has doubled in length. How much time did it take for the crack to double in length?

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## Glaciers, Water and Wind, Oh My! Activity – Erosion Math Worksheet – **Answers**



1. If a 12-acre forest lost  $\frac{1}{4}$  of its trees due to acid rain, how many acres would be undamaged?

$$12 \div 4 = 3$$

$$12 - 3 = \underline{9 \text{ acres}}$$

2. If property damage due to erosion along the coast is \$60 million each year, how much money would be spent in 4 years?

$$60 \times 4 = \underline{\$240 \text{ million}}$$

3. Your favorite beach has 42 large sand dunes. Throughout the course of the year, wind erosion destroys 8 sand dunes and creates 13 new ones. How many sand dunes would there be at the end of the year?

$$42 - 8 = 34$$

$$34 + 13 = \underline{47 \text{ sand dunes}}$$

4. One side of a mountain is 5,280 feet long. If a glacier were to start at the very top of the mountain and travel 3 feet per year, how long would it take the glacier to reach the bottom of the mountain?

$$5,280 \div 3 = \underline{1,760 \text{ years}}$$

5. On a cold day in July, you notice a new crack in the sidewalk at 10:30 a.m. At 11:13 a.m. you notice the crack has doubled in length. How much time did it take for the crack to double in length?

$$43 \text{ minutes}$$