

Unit Name: **Glaciers, Water, and Wind, Oh My!**

Time Frame: **3 periods**

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UNIT

Subject: **Science/LAL/Math/21st Century**

Country: USA

Course/Grade: **5th**

State/Group: NJ

School: Egg Harbor Township School District

Materials:

To share with the entire class:

Chemical Erosion Station

- Glass tray or Petri dish
- Rock samples that contain mineral calcite (calcium carbonate); e.g., limestone, marble, certain cement/mortar
- Other rock samples (brick, granite, most gravel)
- Weak acid (e.g., lemon juice or vinegar)
- Eyedropper
- Magnifying glass
- Paper towels

Water Erosion Station

- Large container (e.g., a deep plastic bin at least 18 inches x 9 inches)
- Moist soil
- 12 coins or poker chips
- Paper towels
- Watering can (one with several holes in the spout)
- Water
- Ruler

Wind Erosion Station

- Sand
- Small-size motorized fan (handheld if possible)
- Large bin or box with no top

Glacier Erosion Station

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

Temperature Erosion Station

- Heat source (e.g., burner or hot plate) • 3 glass beakers
- Ice
- Water
- Plastic tongs
- Goggles
- Marbles (one for each group)

Each group should have:

- Two copies of the Erosion Worksheet (or, one per student).

The teacher should have:

- One stopwatch, clock or wristwatch to time 7-8 minute rotation intervals.

Keywords:

erosion, weathering, geology, acid rain, deposition, glacier, wind, water, ice, temperature, chemical, natural processes, landscape

Acid Rain: Rain containing acids that form in the atmosphere when industrial gas emissions (especially sulfur dioxide and nitrogen oxides) combine with water.

Deposition: The act or process by which an agent of erosion, such as wind or water, lays down matter (sediment).

Erosion: The wearing away of the surface of the Earth by natural processes (weathering, dissolution, abrasion, corrosion, etc.).

Geology: The scientific study of the origin, history and structure of the Earth.

Glacier: A huge mass of ice slowly flowing over a land mass, formed from compacted snow in an area where snow accumulation exceeds melting.

Limestone: A type of sedimentary rock consisting of the mineral calcium carbonate.

Sediment: Material that settles to the bottom of a liquid.

Weathering: Gradual physical and chemical wearing away of rocks.

UNIT SUMMARY:

This hands-on activity explores five different forms of erosion (chemical, water, wind, glacier and temperature). Students rotate through stations and model each type of erosion on rocks, soils and minerals. The students record their observations and discuss the effects of erosion on the Earth's landscape. Students learn about how engineers are involved in the protection of landscapes and structures from erosion. Math problems are included to help students think about the effects of erosion in real-world scenarios.

UNIT RESOURCES

Internet Resource Links:

http://www.teachengineering.org/view_activity.php?url=collection/cub_/activities/cub_earth/cub_earth_lesson5_activity1.xml

STAGE ONE

GOALS AND STANDARDS:

SCIENCE:

<http://www.nextgenscience.org/sites/ngss/files/5%20combined%20DCI%20standards%206.13.13.pdf>

5-ESS2- 2. Describe and graph the amounts and percentages of water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth

5-ESS2.C: The Roles of Water in Earth's Surface Processes

LAL:

CCSS.ELA-Literacy.W.5.1b - Provide logically ordered reasons that are supported by facts and details.

CCSS.ELA-Literacy.W.5.2 - Write informative/explanatory texts to examine a topic and convey ideas and information clearly.

Math:

CCSS.Math.Content.5.NBT.A.3 Read, write, and compare decimals to thousandths.

CCSS.Math.Content.5.NBT.A.1 Recognize that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and 1/10 of what it represents in the place to its left.

21st Century Learning:

9.1.8.A.2 – Implement problem-solving strategies to solve a problem in school or the community

9.1.8.C.1 - Determine an individual's responsibility for personal actions and contributions to group activities.

9.1.8.C.2 Demonstrate the use of compromise, consensus, and community building strategies for carrying out different tasks, assignments, and projects.

ENDURING UNDERSTANDINGS

Civil engineers need to carefully study the surrounding environment and soil type in order to safely build any sort of structure. Buildings, roads and bridges need to be built on a solid foundation and, if possible, in an area that is not prone to erosion (e.g., a flood plane). Engineers can also use materials that can resist the type of erosion that a particular area is exposed to (e.g., water-proof materials or materials that are not affected by acid rain). Environmental engineers plant trees and other vegetation in order to help prevent wind and water erosion (the roots make the land more stable and less exposed). Vegetation can also help neutralize acid rain. Engineers also design roads, bridges, and sidewalks in a way that allows them to expand and contract with temperature changes so that they will not crack too much (e.g., the grooves in the sidewalk and bridge expansion joints).

Learning Objectives:

After this activity, students should be able to:

- List several different types of erosion.
- Compare and contrast the effects of various types of erosion.
- Discuss how engineers work to prevent erosion.

STAGE TWO

PERFORMANCE TASKS:

Before the Activity

1. Gather materials and make copies of the Erosion Worksheet.
2. Set up five stations, and disperse the materials to the correct station.
 - Make sure to label the rock samples for the chemical erosion station.
 - Make sure to place soil in the container for the water erosion station.
 - Make sure to set up a pile of sand in the large box or outside for the sand erosion station. Note: Place the fan far enough away from the sand so that it will not blow it all over the place. (The idea is to move a layer of sand from the center, to the another side of the box; gradually moving the entire "sand dune.")

OTHER EVIDENCE:

Introduction:

What is erosion? Have you heard that word before? Erosion is the process of wearing away the surface of the Earth in different ways. Erosion can happen from wind, water, ice, temperature and even chemicals found in nature. Erosion is all around us. You have probably seen some type of erosion without even realizing it. Have you noticed bits of sand and dirt being carried away by water after a rainfall? How about the side of a building or a statue that has become smooth or worn down as it gets old? How about a crack in the sidewalk or road that was not there before? Or a sidewalk crack that you have noticed getting larger by the week? All of these

things can happen from erosion. Wind and water can carry away dirt, sand and soil from one area, rub it against an object (similar to the effects of sandpaper) that it moves over, and deposit it somewhere entirely different. Temperature changes can cause different things to contract (shrink) and expand, allowing them to crack over time. Acid rain from pollution causes chemicals in the air to slowly break down buildings, trees and statues. Even ice in the form of huge glaciers can drag away piece of land as they move downhill from gravity.

Erosion is constantly shaping the Earth's surface. Our Earth looks different than it did 100 years ago and will look even more different 100 years in the future. Erosion has built mountains and carved out deep valleys. All this erosion takes a toll on man-made structures as well. Significant landmarks, like the Sphinx in Egypt or pyramids in South America, can be destroyed if not properly protected. Damage caused by erosion can cost a lot of money to repair. Large-scale erosion is often dangerous and can cause landslides and flooding.

Engineers study erosion so that they can protect the environment, structures, landmarks and people's lives. Engineers design and build structures such as houses, buildings and roads for people to live and work in and, of course, on which to drive their automobiles. They develop designs that will help protect people from landslides and flooding, like levees and barriers. Engineers are also involved in protecting existing land formations and landmarks that people want to keep around, such as ancient pyramids and national monuments.

Today, we are going to look at five types of weathering. We are going to learn about the effects of each type on our surroundings on Earth. Then, we will be one step closer to working out problems like engineers, who need to know about erosion for so many things!

STAGE THREE

LEARNING PLAN:

With the Students

Station 1: Chemical Erosion Station

1. Take one of the rocks and place it in the glass tray.
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 of the rest of the rocks.
7. Pour out any liquid from the glass tray into the sink.
8. Repeat steps 1-7 with all the remaining rocks.

Station 2: Water Erosion Station

1. 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.

2. Press the coins/chips into the surface of the dirt/clay. (Place them at different angles with the edge protruding out; leave about half the coin showing.)
3. Create a rainstorm by pouring water on the mountain with the watering can.
4. Record your observations. (Are the coins sticking out more or less? What does the bottom of the mountain look like?)
5. Remove the coins and put them back onto a paper towel to dry.
6. Drain the water into a sink.

Station 3: Wind Erosion Station

1. Form a pile of sand in the center of the box (approximately 5 or 6 inches tall).
2. Using the fan, blow air lightly over the sand from one end of the box to the other.
3. Record your observations. (Did the pile of sand move?)

Station 4: Glacier Erosion Station

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. Place the clay back where it came from and throw away the remaining ice and sand.

Station 5: Temperature Erosion Station (this station should be used as a demonstration or done with an adult helper)

1. PUT ON SAFETY GOGGLES!!!!
2. Use the tongs to place the marble into the beaker.
3. Turn the burner on about $\frac{3}{4}$ of the way.
4. Leave the marble in the beaker for 5 minutes.
5. While you are waiting, make sure you have enough water in one beaker and ice in the other beaker.
6. After 5 minutes have passed, turn off the burner.
7. Use the tongs to place the marble briefly into the water and then into the beaker of ice.
8. Look at the marble and record your observations.
9. You may now take off your safety goggles.

Safety Issues

Use eye protection (goggles or safety glasses) during the Temperature Erosion Station.

It is advised if students are not accustomed to using hot plates/burners that an adult supervise the Temperature Erosion Station or conduct this station as a class demonstration.

Troubleshooting Tips

Some of the stations can be messy; therefore, clean up might be easier if this activity is done outside.

It is recommended that the temperature erosion station be conducted as demonstration for the whole class or done with an adult helper or teacher supervising the station.

Assessment

Pre-Activity Assessment

Discussion Questions: Solicit, integrate and summarize student responses.

- Do you know what erosion is?
- What is an example of erosion that you have seen in nature?

Activity Embedded Assessment

Worksheet: Have the students record their observations on the Erosion Worksheet; review their answers to gauge their mastery of the subject.

Post-Activity Assessment

Problem Solving: Present the class with the Erosion Math Worksheet and ask the students to calculate the effect of erosion in each of the scenarios. Discuss how engineers might need to solve similar problems when working to protect the environment, structures, landmarks and people's lives.

Define It! Drawing: Have students draw pictures of each of the five types of erosion that were discussed and write their own definition of erosion (and its effects) at the bottom of the page.

Activity Scaling

For upper grades: Have students complete the Erosion Math Worksheet when they finish the stations.

For lower grades: These stations can be done as demonstrations for the entire class. Have student volunteers help with each demonstration. Discuss observations as group.