Weathering Unit Plan

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Index
Abstract
Rationale
Objectives
Strategies
Classroom Activities
Annotated Bibliographies/Works Cited/Resources
Appendix/Content Standards

Abstract

This unit on Weathering is intended to be taught in a fourth or fifth grade elementary classroom. It includes many hands-on activities to encourage active participation in the lessons. The goal of the unit plan was to introduce weathering and erosion to students and have them complete activities to help them und gain a deeper understanding of the types of weathering and erosion that change our environment.

Weathering and erosion have a major impact on the world in which we live. As I completed my research, my goal was to create engaging lessons that students could understand. In addition to several experiments, I also included worksheets that involved sorting, comparing, and other skills. My intention was to create lessons that would meet the needs of individual learners.

Weathering and erosion are broad topics so the unit was designed to provide a one-day overview on each topic and then spend several days learning about the specific types of weathering and erosion. At the end of specific lessons, students will demonstrate their understanding by completing various worksheets in the appendix.

Rationale

The purpose of this unit is to improve students' knowledge of weathering and erosion, subjects which have been neglected in the elementary grades By the end of this unit, students will be able to describe the different types of weathering and erosion and describe the impact that weathering and erosion have on their environment. The school I work in serves students from Kindergarten through eighth grade. The students from

Kindergarten through sixth grades are in self-contained classrooms, except for a 45-minute lunch period and an hour prep or special period.

Our Earth is constantly changing, but students are not taught Science with fidelity in the lower elementary grades and they are unaware of the impact various forces have on our environment. Students need to understand how and why the Earth changes and how they can have an impact on these changes. This unit plan introduces students to the process of weathering and erosion and focuses on how wind, water and plants change our landscape. It also focuses on the difference between mechanical and chemical weathering.

Weathering occurs all around us, but it is usually occurring so slowly that people don't notice it. Weathering is the process where rocks are altered or broken down by wind, water, changes in temperature, freezing water, or plants. Over time, this forces change our environment drastically. In this unit, I will focus on three types of weathering: physical, chemical, and biological weathering.

Physical weathering is caused by pressure and temperature changes. Wind, water and ice can weaken the surface and break it. There are two main types of physical weathering. The first is freeze-thaw weathering. This is when water freezes inside the cracks in rocks. When the water freezes, it expands and causes the rock to break. In this unit, student will examine how this type of weathering affects our roads in the winter. They will complete a frozen water experiment to show that water expands as it freezes.

The second type of physical weathering is exfoliation. This is when a crack develops parallel to the land and it breaks in sheets. Once there is a crack and water seeps in it, it leads to the formation of new low-density minerals. The rocks then break off in slabs or sheets. When exfoliation occurs, the result is dome-like hills and boulders that are round.

Chemical weathering is the breaking down of rock due to the interaction with water and atmospheric gases. It happens when rain, which is acidic, reacts with rocks and forms new minerals. It can also change the composition of a mineral, which leads to the breakdown of the mineral, and thus, of the rock. Students see an example of chemical engineering when they see oxygen cause rust to form on iron and weaken it. Students who have left their bicycle outside may have experienced this type of weathering.

To understand chemical weathering, students will examine how water, carbon dioxide and oxygen are agents of chemical weathering. They will look at some examples and experiments to understand how it can impact their lives. For example, water dissolves certain substances and we will examine how it dissolves ions from minerals or how water washes away salt. Carbon Dioxide and Oxygen also causes

reactions with other elements. In this unit, they will examine how iron reacts with oxygen to create rust.

Biological weathering is the weakening and eventual disintegration of rocks by plants, animals, and microbes. It is also known as organic weathering.
There are three types of weathering we will examine in this unit. The first is weathering by plant. It occurs when roots grow in cracks. Eventually the roots cause the cracks to get wider and the rock eventually breaks. The second type is weathering by microbial activity. In this, plants release acidic compounds and iron and minerals are broken down. The final type of biological weathering is caused by animals. For example, some animals burrow in the ground and cause cracks to get larger. Humans can cause biological weathering by digging holes in the ground.

In this unit, students will examine factors the affect weathering like particle size. Students need to understand weathering in order to understand erosion. Weathering prepares rocks for erosion, which is the process that wears away the Earth surface through the movement of water, ice, wind, or gravity.

Erosion is the removal of surface material on the Earth's surface. Water, wind, moving ice, and gravity are the main agents of erosion. Since students frequently encounter these agents, they need to understand how they change the Earth's surface. In this unit, students will take a deep look at each agent of change, watch a video, and complete experiments. Students will also look at how moving water causes rocks to change over time, how glaciers can damage and carve deep valleys, how wind reshapes the surface or sand dunes, and how gravity can make ice and water move downhill.

Objectives

This unit is designed for fourth to fifth grade students. The objectives of this unit include the following:

- Students will be able to describe weathering and erosion and explain how they are visible in everyday life. They should also be able to explain how weathering and erosion are related, how they are similar and how they are different.
- Students will be able to identify various types of weathering and erosion and complete hands-on experiments that show examples of weathering and erosion.
- Students will be able to explain how humans can impact erosion and the environment. They will be able to give examples of various types of erosion and weathering that they see in their environment.
- Investigate the impact of water on erosion. Water is a powerful source of erosion. Students will be able to determine the ways water can change the environment.

Standards

NGSS Standards:
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-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.

PA S
PA Standards
PA:3.3.4 Science as Inquiry
- Understand that all scientific investigations involve asking and answering questions and comparing the answer with what is already known.
- Use simple equipment (tools and other technologies) to gather data and understand that this allows scientists to collect more information than relying only on their senses to gather information.
- Use data/evidence to construct explanations and understand that scientists develop explanations based on their evidence and compare them with their current scientific knowledge.

PA:3.3.4.A1 Describe basic landforms. Identify the layers of the Earth. Recognize that the surface of the Earth changes due to both slow and rapid processes.
PA: 3.3.4.A2 Identify basic properties and uses of Earth's materials including rocks, soils, water, and gases of the atmosphere.

Strategies
This unit on weathering and erosion will include various learning strategies to meet the needs of the diverse learners in the classroom. The teacher will use direct instruction, but will also use self-directed activities and hands-on activities to help encourage student engagement. The teacher will use classroom discussion to encourage participation and active engagement in the lessons. Prior to each lesson, the teacher will activate prior student knowledge. During the lesson, the teacher will encourage higher order thinking, assist students in making personal connections, and provide real world connections.

Activities

Lesson 1

Introduction to Weathering and Erosion

During this lesson, the teacher will read aloud chapter one of Weathering and Erosion and the Rock Cycle which defines Weathering and Erosion.

Materials
Weathering and Erosion and the Rock Cycle

Objective
Students will be able to define weathering and erosion.

Strategies
Students will participate in a turn and talk discussion with a partner after listening to a read aloud about weathering and erosion.

Procedures

- Teacher will Read Chapter one
- Teacher will ask students to turn and talk with a partner to answer the following questions:
    - Igneous rocks form when hot magma cools and hardens. What happens to the rocks as they erode? (They get mixed with other matter to create sediment which moves into water through erosion. At the end of the transport, the sediments settle and these layers become sedimentary rocks)
    - How do metamorphic rocks form? (Earth's heat or pressure changes the minerals in igneous and sedimentary rocks)
    - How do weathering and erosion play a part in the rock cycle? (They break down and transport rocks so new rocks can form.)
- Explain to students that tomorrow they will watch a video that compares weathering and erosion and they will complete a Venn diagram to show the similarities and differences.

Lesson 2

What is Weathering and Erosion?

During this lesson, students will investigate the forces of weathering and erosion.

Materials
Technology to play video from www.discoveryeducation.com
https://app.discoveryeducation.com/learn/videos/e42c8bc2-b71d-4cd9-a679-c19d98373307/
Paper for the graphic organizer

Objective
Students will be able to complete a graphic organizer in order to compare and contrast weathering and erosion.

Strategies
Students will compare weathering and erosion using a Venn diagram after watching an instructional video. Students will also jot down any questions they have during the video on post it notes. At the end of the lesson, students will work with a partner to share their graphic organizers.

Procedures

- Teacher will explain to students that they will watch a video about weathering and erosion. This is just an overview of weathering and erosion and they will examine the different types of weathering and agents of erosion as they work through this unit.
- Teacher will explain that weathering is the breaking up of rocks, soil and earth materials and erosion is the removal of surface material.
- Before the video is started, the teacher will explain that students will create a Venn diagram to take notes during the video. They will compare and contrast weathering and erosion. (Appendix A) If students are not familiar with Venn diagrams, they can fold their paper in half so that they have 2 long columns. On the left side, they will write WEATHERING and on the left side, they will write EROSION.
- During the video, students can use the Venn diagram to compare and contrast weathering and erosion or they can jot down 3 -5 facts about each topic. Students should write down any questions they think of on post it notes.
- At the end of the lesson, have some students share their graphic organizer or list with a partner and then have a few students share with the class. Be sure to ask students to share some of their questions too.

Lesson 3

A Close Look at Weathering

During this lesson the teacher will define weathering as the breaking up of rocks, soil and earth materials and define the three types of weathering.

Materials

Paper for students to create a foldable
Interactive Science notebook

Objective
Students will be able to define weathering and also be able to define the three types of weathering: physical, chemical, or biological.

Strategies
Students will list examples of weathering and use a think/pair/share strategy with a partner to share ideas and compare lists. Students will also create a graphic organizer for their new vocabulary words.

Procedures

- Teacher will define Weathering and review 3 types of weathering.
- Teacher will show a video, Types of Weathering Video by Double Decker Science on YouTube

  https://www.youtube.com/watch?v=5CusjLs4FME

Background Information: Weathering is the disintegration, breaking down, or alteration of rocks. It occurs near the surface and includes no movement. There are different types of weathering: physical, chemical, and biological. Physical is caused by pressure and temperature changes. Wind, water and ice can weaken the surface and break it. Animals and plants also cause weathering; this is known as biological weathering.

Chemical weathering is caused when elements like oxygen cause substances in rocks to change. Oxygen can cause rust to form on iron and weakens it. Another example is rain water that reacts with minerals in rocks to form new minerals.

After the lesson, the teacher will ask students to think of any examples of weathering they have seen and create a list. They will use the think/pair/share strategy to share out their ideas.

Students will create a vocabulary organizer by folding a sheet of paper in half vertically. On one side, they will make 1 cut so that there are 2 evenly spaced flaps. The top flaps will be labeled Physical and Chemical. Under each flap, students will write the definition of the type of weathering and they may draw an illustration, if they would like. These should be glued into their Science interactive notebooks

Lesson 4

Weathering Type 1- Physical Weathering

During this lesson the teacher will look closely at physical weathering and provide examples of physical weathering, freeze-thaw weathering and exfoliation. See Appendix B for student worksheet.

Materials Station 1
1 clear plastic cup
Water
Freezer
2 Sharpies, different colors

Materials Station 2
1 wide beaker
1 cup of salt
1 piece of dark colored chalk

Materials Station 3
River rocks with sharp edges and smooth
Sandstone, 4 pieces
Plastic container with a lid
Water

Objective
Students will be able to define physical weathering and learn about the types of physical weathering. They will participate in three activities to learn about the agents of weathering.

Strategies
Students will work with a partner in a carousel style to move to 3 different lab stations and complete the labs. After each lab, they will work with a partner to complete the lab worksheets. (See Appendix B, C, and D)

Procedures

- Teacher will define Physical Weathering

Physical weathering is also caused by temperature changes on rocks. There are 2 main types of physical weathering.

Freeze-thaw weathering is when water freezes inside cracks in rocks. During freezing, the water expands and causes the rock to break. Ask students to think/pair/share with a partner to discuss how this might impact our roads.

The second type is exfoliation. That is when a crack develops parallel to the land and it breaks in sheets. Physical weathering occurs in dry places with very little soil. As erosion occurs, the rock mass is under lower pressure which leads to tension in directions at right angles to the land surface. (www.gelosoc.org.uk)

- Teacher will explain the 3 main agents of weathering which include frozen water, wind, and running water.

The following 3 experiments will demonstrate how frozen water, wind and running water act as agents of weathering. Each experiment will be set up as a station. Students will work with partners and move through each of the 3 stations. (www.uen.org)

Station 1 Frozen Water Experiment (Appendix B)

Materials Station one
1 clear plastic cups
Water
Freezer
2 Sharpies, different colors

Student Instructions:
1. Work with a partner and get 1 clear plastic cup
2. Fill the cup with 1 cup of water
3. Draw a line on the cup at the level of the water
4. Place the cup in the freezer
5. Once frozen, examine the cup and ice level. Draw a line with a different color at the ice level.

*Note- Students should observe the frozen water line is higher than the liquid water line. Discuss how this impacts rocks and our roads.

Station 2 Wind (Appendix C)

Materials
1 wide beaker
1 cup of salt
1 piece of dark colored chalk

Student directions:

1. Fill up a beaker with 1 cup of salt.
2. Add one piece of dark colored chalk.

3. Have students take turns stirring the chalk through the salt.
4. Have students answer the questions on the lab sheet.

*Note- Explain that the salt represents sand that wears away at rocks.

Station 3 Running Water (Appendix D)

Materials
River rocks, some with sharp edges and some with smooth edges
Sandstone, 4 pieces
Plastic container with a lid
Water

Student Directions:
1. Compare river rocks with sharp and round edges.
2. Rub 2 pieces of sandstone together.
3. Fill the container with 3 cups of water or about ½ full.
4. Place 3 pieces of sandstone in the water.
5. Make sure the lid is on tight and observe the water and stones.
6. Shake the container vigorously for a few minutes.
7. Reexamine the water and stones.
8. Remove the stones from the water and observe any changes.

*Note- Students should observe the water may look dirty and have small pieces or particles or rock.

Lesson 5 Part A

Weathering Type 2- Chemical Weathering

During this lesson the teacher will look closely at chemical weathering and provide examples.

Materials
Whiteboard
Science interactive notebook
Paper for foldable
Chalk
Vinegar
2 cups
Paper Towels
Objective

Students will be able to define chemical weathering and learn about the agents of chemical weathering.

Strategies
Students will create a vocabulary graphic organizer to take notes on water, carbonic acid and oxygen. (Appendix E)

Procedures

- Teacher will provide direct instruction about Chemical Weathering.

Chemical weathering happens when rain water reacts with rocks and forms new minerals. Chemical weathering changes the composition of a mineral, which leads to the the breakdown of the mineral and thus, of the rock.

This happens because even clean rain water is acidic. These chemical processes occur more at warmer temperatures because of more abundant plant life.
The agents of chemical weathering are water, carbon dioxide and oxygen.

- Water / Hydrolysis is the breakdown of a mineral because of a chemical reaction between the mineral and water. Water dissolves ions from minerals. (ex: water washes away salt)
- Carbon Dioxide- Carbonic acid forms from interaction between CO2 and water.
- Oxygen / Oxidation- breakdown of rock when oxygen reacts with another element. The most common oxidation is when iron reacts with oxygen and creates rust.

- Students will create a 3 tab foldable in their science interactive notebooks. They will label the page "Chemical Weathering" They will label each flap Water, Carbonic Acid and Oxygen. Under each tab, they will write 2 facts about each agent of chemical weathering. (Foldable included in the appendix)

Experiment

1. State the objective for students: In this experiment you will see an example of chemical weathering and then make inferences about the connection between particle size and weathering.

2. Ask students the following question: How does the size of the rock affect the rate of chemical weathering?

3. Pass out the Chemical Weathering Experiment worksheet for students (Appendix F)

Student directions:

1. Pour one cup of vinegar into 2 similar cups.
2. Set aside a full piece of chalk and another that has been broken broken into 3 pieces.
3. Use a scale to find the mass of each piece of chalk and record in the table.
4. Drop the full piece of chalk into one cup and a broken piece into another cup. Notice what happens.
5. In 10 to 15 minutes, strain both cups and carefully dry both pieces of chalk with a paper towel.
6. Re-measure the mass of the chalk and record the data in the chart.
7. Determine the amount of chalk that reacted in each cup.
8. Complete the data table and answer the questions.

*Note- Students should observe the mass of the chalk decreases in both cases, but occurs more rapidly in the pieces that are broken.

Homework/ Extension: Create a poster about damage done by weathering and erosion in Philadelphia. Ask your community to help fix some of the damage being done.

Lesson 5 Part B

Climate and Weathering

During this lesson the students will examine the effects of temperature on chemical reactions.

Materials
2 cups, at least 16 oz. each
12 oz. cold water
12 oz. warm water
2 sugar cubes

Objective
Students will understand that warm, wet climates foster weathering and be able to describe weathering in terms of reaction rates, or rates of decomposition.

Strategies
Students will use the think/pair/share strategy to discuss hypothesis before demonstration and then again after it to confirm or correct their hypothesis.

Procedures

1. The teacher will ask students to make a hypothesis for the following question, how does temperature affect chemical reactions? After allowing students time to think/pair/share their hypothesis, the teacher will perform a demonstration for students.

2. The teacher will pour cold water into one cup and warm water into another. Students will drop one sugar cube into each cup and predict which one will dissolve faster. After a few minutes, remove the sugar cubes from the water and ask students to observe and discuss how each one dissolved.

3. After the demonstration, students will meet with partner again and use the think/pair/share strategy to confirm or correct their original hypothesis.

*Note- Students should observe the sugar cube dissolving faster in the warm water.

Lesson 6

Biological Weathering

During this lesson the teacher will look closely at biological weathering and provide real world examples

Materials
Notebooks to write examples

Objective
Students will be able to define biological weathering and provide real world examples.

Strategies
Students will use think/pair/share to work with a partner to think about examples of each of the types of biological weathering and then allow students to share with the class.

Background Information
Biological weathering is the weakening and eventual disintegration of rocks by plants, animals, and microbes. It is also known as organic weathering. (www.eartheclipse.com) Plants and trees grow into cracks or fractures in rocks and as the roots grow, they cause the crack to get wider and deeper, eventually leading to crumbling or disintegrating the rocks. Animals also cause biological weathering by burrowing in the ground and causing cracks to grow.

There are 3 main types of biological weathering
1. Growing Plants- roots grow in cracks and gradually cause the cracks to widen and

eventually the rocks break.
2. Microbial Activity- Some plants release organic acidic compounds that break down iron and minerals in rocks. (ex: Moss and algae can break down rocks)
3. Animals- Animals burrow in the ground and can deepen or widen cracks. (ex: moles and rabbits) Humans also cause biological weathering when they mine, dig up roads or do construction.

Think/Pair/Share – Ask students to work with a partner to think about examples of each of the types of biological weathering and then allow students to share with the class.

Lesson 7

A Review of Weathering

During this lesson, students will review how water, air and living things play a part in physical and chemical weathering.

Materials
Chart paper
Post it notes, 6 for each group

Objective
Students will be able to compare and contrast the differences between chemical, physical, and biological weathering

Strategies
Students will work with teacher to complete a graphic organizer/chart using post it notes on the board.

Procedures

- Teacher will explain to students that we will compare and contract the effects of water, air and living things on rocks in chemical and physical weathering.
- Teacher will create a chart to compare and contrast and allow students to work together to come up with one way each of the elements affects chemical or physical weathering. Students will write down their ideas on post it notes. As students are working, the teacher will circulate around to make sure students understand the differences.
- Below is the chart that the teacher will create on chart paper. As teacher asks students to share their ideas, they will add their post it notes to the chart paper, under the correct section.

	Air	Water	Plants/Animals

Physical Weathering			
Chemical Weathering			

- The following ideas can be added to the chart if the students need help with ideas.

  Physical Weathering

  Air- Wind blows against rocks and over time breaks them down into smaller pieces

  Water- water freezes in cracks and breaks apart

  Plants/Animals- plants grow and roots can split rocks

  Chemical Weathering

  Air- mixes with minerals to form new compounds and weakens rocks

  Water- dissolves minerals and can create acids

  Plants/ Animals- can give off acids that breaks down rocks

Lesson 8

Erosion Overview

During this lesson the teacher will provide students with an overview of erosion, explain the difference between weathering and erosion and give examples of the main agents of erosion. (wind, water, glaciers, and gravity)

Materials
Science notebooks
Paper for interactive notebook
Projector to show video

Objective

Students will be able to define erosion and be able to list at least 3 main agents of erosion: moving water, glaciers, wind, and gravity.

Strategies
Students will create a graphic organizer to list the agents of erosion.

Background
Erosion is the removal of surface material on the Earth's surface. Erosion can be caused by wind, water, moving ice or gravity. It can also happen from temperature and chemicals found in nature (www.teachengineering.org). These can change the Earth' s surface. Erosion occurs after rock has been weathered. It includes the transportation of weathered material from the point of degradation, but not the deposition of material at a new site.
-Water – Moving water is a major cause or erosion. Waves crash with force on sand and rocks and causes the coastline to erode and change. Rivers also flood and cause erosion.
-Glaciers- Ice can grind over land and cause damage and carve deep valleys.
-Wind- Wind can change the surface of land over time. It can also change the surface of sand dunes.
-Gravity- Gravity makes ice and water move downhill.

Procedure:
1. Teacher will provide background information.
2. Students will watch an introduction video on Erosion at https://www.youtube.com/watch?v=G5Rp9MJJGCU&playnext=1&list=PLbPwbM3wD7D0fKOeMcEx7dpU0eWLBOaaQ&feature=results_main
3. Students will create a foldable in their science notebook by folding a paper lengthwise and making 3 slits to create 4 sections. They will label the sections with the agents of erosion and write one important fact under each flap.

Lesson 9

Erosion – Water

In this lesson, the students will be able to explain how water is an agent of erosion and show how water can change Earth by moving sediment and re-depositing it someplace else.

Materials
Dirt
Small gravel
Sand
Aluminum pan
Book

Pencil
Paper Cups

Objective
Students will be able to compare the effect water has on landforms at various inclines.

Strategies
Students will participate in a hand-on experiment and complete the lab worksheet. (Appendix G)

Student Procedures
1. Pour sand, dirt and gravel in 3 layers at the end of the aluminum pan to create a landform.
2. Slowly drip water over land until it is wet. What do you notice about the water as it falls on the dry landform? Record your results. (repeat until the land is wet)
3. Place a book under the end of the aluminum pan with the land on it. (creating a hill)
4. Poke a hole in the bottom of a cup with the pencil. Pour water into the cup as you hold it over the land. Observe what happens? Is anything different this time? Record your observations.
5. Place a second book under the first book to create a steeper incline and add more water to the cup and hold over the land. Record your observations.

*Note- Students should observe the water moving faster when there is an incline. They may also observe more water pooling at the bottom on the incline.

Lesson 10

Erosion- Glaciers

In this lesson, students will examine how glaciers can erode land and redeposit sediments.

Materials
Ice cubes, one for each group
Modeling clay
Sand
Tray
Paper towels

Objective
Students will be able to describe glaciers as an agent of erosion and show how glaciers erode land.

Strategies
Students will participate in a hand-on experiment and complete the lab worksheet. (Appendix H)

Student Procedures
1. Shape clay into a ball that is about 1 to 2 inches in diameter.
2. Flatten the clay on the tray.
3. Put the ice cube on the clay and move it back and forth a few times.
4. Record your observations. What happens to the clay?
5. Place a small pile of sand on the clay and then place the ice cube on the sand for 1 to 2 minutes.
6. Remove the ice and observe the surface of the ice and sand. Record your observations.
7. Move the ice over the sand several times. Record your observations.
8. Wipe the sand off the ice cube and the surface of the clay. What does the surface or texture of the clay look or feel like?

*Note- Students should observe the sand will stick to the ice cube and the clay.

Lesson 11

Erosion – Wind

In this lesson, the students will be able to explain how wind is an agent of erosion and compare how water or moisture has an impact on wind erosion.

Materials
Aluminum pan, 2
1 cup of dry sand for each group
1 cup of wet sand for each group
Water
Cup
Goggles, eye protection

Objective
Students will be able to compare the effect water has on wind and erosion.

Strategies
Students will participate in a hand-on experiment and complete the lab worksheet. (Appendix I)

Procedures

Students will complete the Wind and Sand Erosion Worksheet (see appendix)

Student Directions
1. Place one cup of dry sand in aluminum pan. Pile sand at one end, to form a sand dune shape.
2. Place one cup of wet sand in the other aluminum pan. Pile sand at one end, to form a sand dune shape.
3. Observe the different textures of the sand.
4. Make a prediction. What do you think will happen to the sand if you blow on it? Will it be the same on both types of sand?
5. Carefully blow the dry sand for 20 seconds toward the empty end of the pan.

*Note- Students should observe the dry sand is easy to move. The wet sand is more difficult to move and may not be able to move at all.

Lesson 12

Weathering and Erosion Word Sort

In this lesson, students will complete an item sort to demonstrate their understanding of weathering and erosion.

Materials
Weathering and Erosion Word Sort (provided in appendix)
Scissors
Glue Sticks

Strategies
Students will participate in a hand-on experiment and complete the lab worksheet. (Appendix J)

Objective
Students will sort examples of weathering and erosion in order to demonstrate their understanding of the concepts
Weathering: Caves formed from rain dissolving limestone, flood waters wear down land, frost wedging, glaciers scraping rocks
Erosion: Rain washing soil down a hill, mudslides, wind moves sand to another location, muddy water is carried down a moving river, flood water moves soil to another location

Bibliography

Bill Nye Erosion (n.d) Retrieved from the web March 18, 2017 from

https://www.youtube.com/watch?v=J-ULcVdeqgE

This video by Bill Nye explains how the earth's surface is always changing. This video shows how various elements like liquid water, frozen water, and sand can change the shape of a landform. Water can wear away rocks, sand can wear away mountains, and frozen water can cause rocks to break.

Billy Blue Hair - What is Erosion? Retrieved from the web March 19 2017. https://www.youtube.com/watch?v=G5Rp9MJJGCU&playnext=1&list=PLbPwbM3wD7D0fKOeMcEx7dpU0eWLBOaaQ&feature=results_main

This video is an introduction to erosion for students. It is a cartoon that gives real-life examples to explain how landforms change. It first describes landforms as something nature created, like a beach or canyon. It also explains how landforms are often shaped by water, wind, and ice.

What is Biological Weathering? http://www.eartheclipse.com/geology/definition-types-of-biological-weathering.html Feb. 23 2017

Erosion. (2017). In *Encyclopedia Britannica*. Retrieved from http://proxy.library.upenn.edu:2738/levels/collegiate/article/erosion/32940

Earth Eclipse is a website with well researched articles that pertain to the Earth, global warning, astronomy, geology, and other Earth sciences.

Estigarribia, D. (2006). *Learning about rocks, weathering, and erosion with graphic organizers*. New York, NY: Rosen Classroom Books & Materials.

This book not only provides information text for students on rocks, weathering, and erosion, but it also pairs that information with useful graphic organizers. It includes Venn diagrams, charts, maps, timelines, and more to help students organize and understand the chapters.

Mattern, J. (2006). *Weathering and erosion and the rock cycle*. New York, NY: PowerKids Press.

This book explains the different kinds of weathering and erosion and gives students many real world examples to help them understand the weathering and erosion processes.

Reiche, P. (1950). *A survey of weathering processes and products.* Rev. ed. Albuquerque: University of New Mexico Press.

This was published in 1950 and includes information on soil formation, rocks, weathering, and erosion. It deals with physical processes and chemical weathering.

The Geological Society. Retrieved from the web March 20 2017.

https://www.geolsoc.org.uk/ks3/gsl/education/resources/rockcycle/page3563.html
The Geological Society is a non-profit organization in London that tries to improve the understanding of Earth sciences. It publishes many scholarly articles for public consumption.

Smith, M.J., Southard, J.B, & Mably, C. (2001). Investigating Earth Systems: An Inquiry Earth Science Program. Armonk, NY: It's About Time.
This book was created for students in middle school to learn about various Earth systems and how they are related. It is a curriculum program to teach students best science practices and was written by geoscience experts.

Teach Engineering. (n.d.) Retrieved March 14, 2007 from https://www.teachengineering.org/activities/view/cub_earth_lesson5_activity1
Teaching Engineering is a website with a collection of projects and curriculum material that can be searched for use by K-12 teachers. It is designed so that students would move through different stations for each type of erosion to learn about the effects erosion has on Earth's landscape.

Utah Education Network. Retrieved from the web March 18 2017. http://www.uen.org/Lessonplan/preview?LPid=9860
This is a lesson with classroom activities to explain the four types of weathering processes: wind, running water, plant growth, and freezing water. It includes background information for teachers, as well as student worksheets that can be printed.

Weathering. (2017). In *Encyclopedia Britannica*. Retrieved from http://proxy.library.upenn.edu:2738/levels/collegiate/article/weathering/76370
This article explains the connection between weathering and erosion. It also explains the factors that control the type of weathering and the rate at which weathering occurs.

Weathering and Erosion. Retrieved from the web March 12 2017 https://app.discoveryeducation.com/learn/videos/e42c8bc2-b71d-4cd9-a679-c19d98373307/
This video from Discovery Education explains weathering and erosion in easy to understand language for students. It shows how weathering can change things around us and explains mechanical and chemical weathering in detail. A five question quiz is included at the end of the video.

Appendix

A Venn Diagram

B Physical Weathering Station 1

C Physical Weathering Station 2

D Physical Weathering Station 3

E Vocabulary graphic organizer

F Chemical Weathering

G Water and Erosion

H Glaciers and Erosion

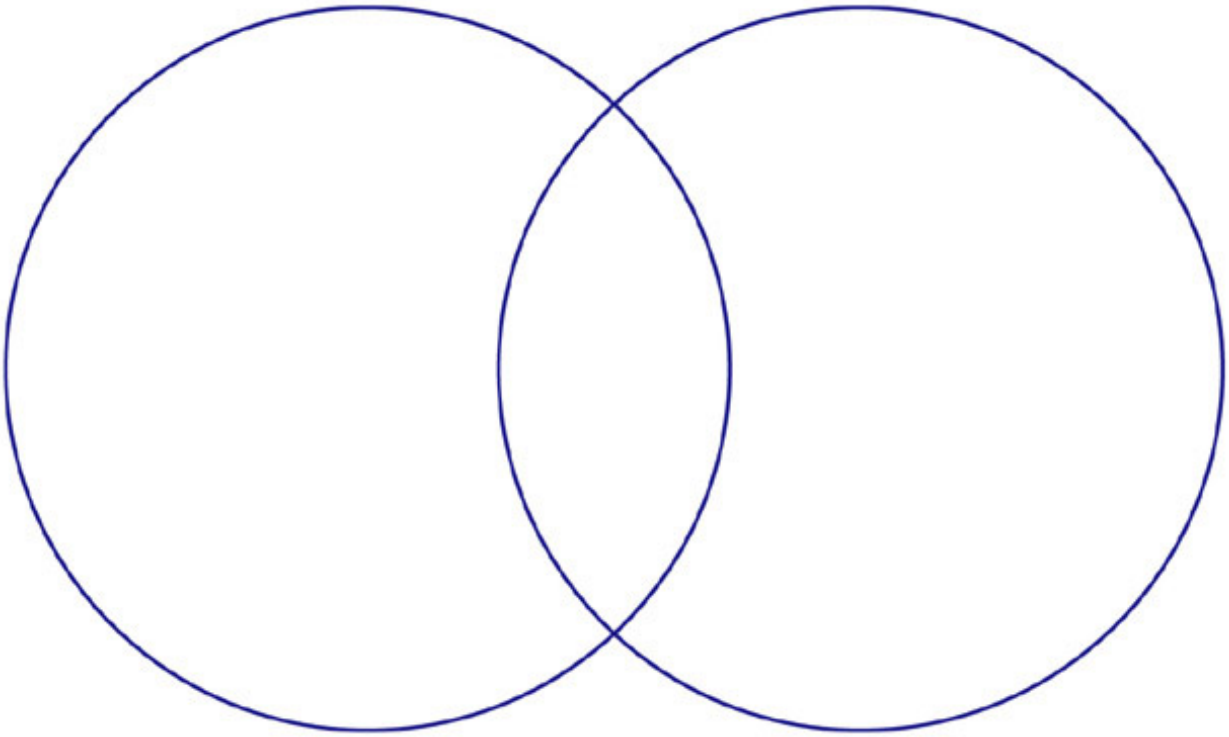
I Wind and Erosion

J Weathering and Erosion Word Sort

Appendix A

Name: _____ Date: _____

Weathering and Erosion Venn Diagram



Appendix B

Name(s):_____ Date: _____

Physical Weathering- Station 1 Frozen Water

Students will examine the effect frozen water has on weathering

Materials
1clear plastic cups
Water
Freezer
2 Sharpies, different colors

Student Instructions
1. Work with a partner and get 1 clear plastic cup
2. Fill the cup with 1 cup of water
3. Draw a line on the cup at the level of the water
4. Place the cup in the freezer
5. Once frozen, examine the cup and water level. Draw a line with a different color at the ice level.

Summary

1. Did the level of the water increase or decrease?

_____

_____

2. What do you expect to happen if we let the ice melt?

_____

_____

3. How would water freezing and melting effect our roads?

_____

_____

Appendix C

Name(s):_____ Date: _____

Physical Weathering- Station 2 Wind

Students will examine the blowing sand and wind on rocks

Materials
1 wide beaker
1 cup of salt
1 piece of dark colored chalk

Student directions

1. Fill up a beaker with 1 cup of salt.
2. Add one piece of dark colored chalk.
3. Have students take turns stirring the chalk through the salt.
4. Have students answer the questions on the lab sheet.

(Explain that the salt represents sand that wears away at rocks.)

5. Once frozen, examine the cup and water level. Draw a line with a different color at the ice level.

Summary

1. What happens when you stir the sand more aggressively?

_____

_____

2. What happened to the chalk? How does this represent what happens in real life?

_____

_____

Appendix D

Name(s):_____ Date: _____

Physical Weathering- Station 3 Running Water

Students will examine the effect frozen water has on weathering.

Materials
River rocks with sharp edges and smooth
Sandstone, 4 pieces
Plastic container with a lid
Water

Student Directions
1. Compare river rocks with sharp and round edges. Record observations on data chart.
2. Rub 2 pieces of sandstone together.
3. Fill the container with 3 cups of water or about ½ full.
4. Place 3 pieces of sandstone in the water.
5. Make sure the lid is on tight and observe the water and stones.
6. Shake the container vigorously for a few minutes.
7. Reexamine the water and stones. Record observations on data chart.
8. Remove the stones from the water and observe any changes. Record observations on data chart.

Observation- before river stones were added to water	
Observations – while stones were in water	
Observations- after stones were removed from the water	

Summary

1. What happened to the stones after they were shaken?

_____

_____

2. Would rocks show more signs of weathering in a river (moving water) or a pond (still water?) Why?

_____

Appendix E

	Water
	Carbonic Acid
	Oxygen

Appendix F

Name(s):_____ Date: _____

Chemical Weathering

Students will examine the effect size has on the rate of weathering.

Materials
2 cups
2 pieces of chalk
2 cups of vinegar
Scale
Paper Towel

Student directions
1. Pour one cup of vinegar into 2 similar cups.
2. Set aside a full piece of chalk and another that has been broken broken into 3 pieces.
3. Use a scale to find the mass of each piece of chalk and record in the table.
4. Drop the full piece of chalk into one cup and a broken piece into another cup. Notice what happens.
5. In 5 minutes, strain both cups and carefully dry both pieces of chalk with a paper towel.
6. Re-measure the mass of the chalk and record the data in the chart.
7. Determine the amount of chalk that reacted in each cup.
8. Complete the data table and answer the questions.

	Whole Piece of Chalk	Broken Piece of Chalk
Mass of Chalk- BEFORE		
Mass of Chalk – AFTER		
Difference in mass of Chalk		

Summary

1. In which cup did the reaction occur more quickly and how do you know?

_____

_____

2. Give an example in nature that causes chemical weathering like the vinegar did to the salt.

_____

Appendix G

Name(s):_____ Date: _____

Water and Erosion

In this lesson, the students will be able to explain how water is an agent of erosion and show how water can change Earth by moving sediment and re-depositing it someplace else.

Materials
Dirt
Small gravel
Sand
Aluminum pan
Books
Pencil
Paper Cup for each group

Student Procedures
1. Pour sand, dirt and gravel in 3 layers at the end of the aluminum pan to create a landform.
2. Slowly drip water over land until it is wet. What do you notice about the water as it falls on the dry landform? Record your results. (repeat until the land is wet)
3. Place a book under the end of the aluminum pan with the land on it. (creating a hill)
4. Poke a hole in the bottom of a cup with the pencil. Pour water into the cup as you hold it over the land. Observe what happens? Is anything different this time? Record your observations.
5. Place a second book under the first book to create a steeper incline and add more water to the cup and hold over the land. Record your observations.

Summary

1. What happened when you added water to the land?

_____

_____

2. What happened when you added one book under the land? What about when you added two books?

_____

Draw a picture of what your “landform” looked like before and after adding the books.

Landform before adding books	Landform after adding books

Appendix H

Name(s):_____ Date: _____

Wind and Erosion

Students will examine the water has on wind and erosion.
Materials
Aluminum pan, 2
1 cup of dry sand for each group
1 cup of wet sand for each group
Water
Cup
Goggles, eye protection
Ruler

Student Directions
1. Wear goggles to protect your eyes from sand.
2. Place one cup of dry sand in aluminum pan. Pile sand at one end, to form a sand dune shape.
3. Place one cup of wet sand in the other aluminum pan. Pile sand at one end, to form a sand dune shape.
4. Measure the height and width of the sand dune.
4. Observe the difference in the texture of the sand and record your answer below.
5. Make a prediction. What do you think will happen to the sand if you blow on it? Will it be the same on both types of sand?
6. Carefully blow the dry sand for 20 seconds toward the empty end of the pan.
7. Measure the height and width of both sand dunes.
8. Record the results and answer the questions below.

	Height – before	*Width- before*	*Height- after*	*Width - after*
Dry Sand				
Wet Sand				

Summary:

1. How was the texture of the dry sand different from the texture of the wet sand?

_____

_____

2. What happened when you blew on each sand dune? Did water or moisture in the sand have an effect on the results?

_____

Appendix I

Name: _____ Date: _____

Glaciers and Erosion

In this lesson, students will examine how glaciers can erode land and redeposit sediments.

Materials

Ice cubes, one for each group
Modeling clay
Sand
Tray
Paper towels

Objective

Students will be able to describe glaciers as an agent of erosion and show how glaciers and ice erode land.

Strategies

Direct Instruction
Think/Pair/Share
Hands-on experiment

Student Procedures

1. Shape clay into a ball that is about 1 to 2 inches in diameter.
2. Flatten the clay on the try.
3. Put the ice cube on the clay and move it back and forth a few times.
4. Record your observations. What happens to the clay?
5. Place a small pile of sand on the clay and then place the ice cube on the sand for 1 to 2 minutes.
6. Remove the ice and observe the surface of the ice and sand. Record your observations.
7. Move the ice over the sand several times. Record your observations.
8. Wipe the sand off the ice cube and the surface of the clay. What does the surface or texture of the clay look or feel like?

Summary

1. What happened to the clay when you rubbed the ice over it?

_____

_____

2. What happened to the ice when you added sand to the clay? Did the texture of the clay change?

_____

_____

Appendix J

Name: _____ Date: _____

Weathering and Erosion Word Sort

Weathering	Erosion
Rain Washing soil down a hill	Mudslides
Caves formed from rain dissolving limestone	Wind moves sand to another location
Muddy water is carried down a moving river	Flood water moves solids to another location
Wind blows sand and relocates it	Water freezes in the ground and breaks rocks