



4th Grade Science

Curriculum Sample

A Grade Ahead will challenge your students and help them achieve their goals!

In our 16-week science enrichment program, your child will learn and apply science concepts to real-world situations through experiments and develop strong critical thinking and analytical skills.

Each week will have an in-depth lesson and homework exercises. We make it easy to implement at home!

- 1. Learn a lesson:** new topics are introduced each week.
- 2. Begin the homework with a kitchen experiment each week.** A list of household supplies required is provided.
- 3. Complete four days of homework** to ensure complete understanding of the week's topic.
- 4. Check your success** with the answers provided.

Want to try an experiment and see what the homework looks like?

We have attached a full day's sample for you to print and try at home! Your kids can have fun and learn at the same time.

Special pricing for 16 weeks of science: \$250 upfront or three monthly payments of \$90.

Register Now!

Register online today or get more information at enrichmentathome.com!

Questions?

Call **866.628.4628** or email enrichmentathome@agradeahead.com.



Lesson Booklet Sample

4th Grade Science

Print it out and try it!

Earth Science: Weathering, Erosion, and Deposition**Key Terms**

landforms
 weathering
 chemical weathering
 acid rain
 mechanical weathering
 erosion
 glaciers
 gravity
 deposition

A. Landforms

The Earth's surface has very unique characteristics. If you were to travel the world, some of these features may be very unfamiliar to you. The characteristics that you see on land which are made up of rock and soil are called **landforms**. There are several different types of landforms that can be seen across the landscape of earth. Many of these landforms are created and altered by the processes of weathering, erosion, and deposition. Let us take a look at each of these processes while also considering that each of these processes are very closely related to each other.

B. Weathering

The natural process of breaking down rocks and soil is called **weathering**. When you first think of weathering, you may begin to think about rain, ice, snow, and varying temperatures. All of these things are involved in the process of weathering, but the actual definition of weathering needs to be broken up into the types of weathering that shape earth's surface.



Like metal, rocks also go through chemical weathering that cause the rock to form rust which has a different chemical make-up than the rock itself. In this picture, the rust is orange in color which is another indicator that the chemical make-up of the piece of matter has been changed.

Chemical weathering involves changes in the chemical make-up of rock and soil that help to break them into smaller pieces. When referring to "chemical make-up," think about the types of chemicals that are present in the matter. The biggest factor of chemical weathering involves water. As rocks and soil are exposed to water, sometimes the chemical make-up of the rocks and soil are changed. For example, a rock exposed to water over a period of time may begin to dissolve into the water while also taking on a different chemical make-up. Part of the rock has changed its chemical make-up to something else. Sometimes it is easy to spot chemical weathering when looking at rocks because the color of the rock that has went through chemical weathering will have changed. A great example of this is when certain types of metal that are exposed to water and air will rust. Rust can be seen on cars, bikes, fences, and even rocks. Even though chemical weathering is a natural process, it can be sped up due to human activity. For example, pollution from factories, cars, and other

polluting manmade objects can cause acid rain. **Acid rain** is any type of precipitation (rain, snow, etc.) that is unusually more acidic than normal precipitation. The acidic precipitation eats away materials and causes rocks and soil to change their chemical make-up faster than usual. The effects of acid rain on forests, lakes, rivers, and even cities can be devastating.



The Grand Canyon has been greatly weathered over time which has caused elaborate pathways through the rock that makes up the canyon.

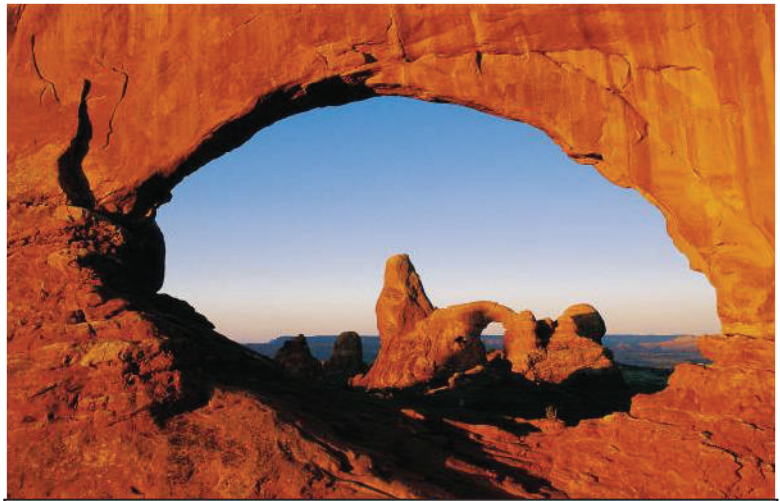
Mechanical weathering involves the physical changes of rocks and soil such as being broken down into smaller pieces. Unlike chemical weathering, mechanical weathering does not involve changing the chemical make-up of rocks and soil. Mechanical weathering is caused by changing temperatures and plant growth on land. An example of mechanical weathering caused by temperature change is when water seeps through the cracks of a rock and freezes, the water expands into ice causing stress on the rock. When the water melts, the stress that was placed on the rock causes the rock to breakdown into smaller pieces. Plant growth also causes mechanical weathering. This can be seen by taking a look at sidewalks that are surrounded by trees. Sometimes the roots from the trees cause the sidewalk to raise or even break apart. Roots from plants are very powerful in breaking apart rocks as they sometimes grow through the rocks and soil as they seek better sources of water for growth.

It is important to note that both types of weathering do not involve the movement of rocks and soil but only the processes that break them down into smaller pieces.

C. Erosion

The process that causes rocks and soil to move from one place to another is called **erosion**. Unlike weathering, erosion involves the movement of rocks and soil. Weathering helps erosion in that it allows for broken rocks and soil to be moved easier. *Think about it.* It is easier to move a smaller rock than it is to move a larger one. Weathering breaks Earth's rocks and soil up and erosion moves it from one place to another which causes the ever changing face of Earth's surface. There are many things that cause erosion. Water, wind, glaciers, waves, and gravity are the biggest factors of erosion.

An example of erosion caused by water is a rapidly rushing river near some mountains. The water carves away at the rock of the river bed repeatedly which causes the rock to break off and flow down the river. The rock will flow with the river until it is deposited in another place. Rivers like this can cut through mountains and canyons causing there to be a larger and deeper river. The Grand Canyon in Arizona is a great example of this because it was created by the erosion brought on by the Colorado River.



Erosion and weathering can carve out very interesting features throughout the face of Earth.



A glacier can move anywhere from 0 to 8 miles a year.

Erosion by wind is not looked positively upon by farmers. Farming requires soil that is filled with nutrients and minerals. The preferred soil that farmers use to farm is called top soil. If conditions of farm land are very dry, wind can blow this nutritious top soil to other areas causing the quality of the soil to diminish in that area. Erosion by wind can also cause disasters such as sand storms. These sandstorms are comprised of tiny rock particles and soil being picked up by wind and moved to a different place.

Glaciers are large chunks of ice that move very slowly across the surface of Earth. These chunks of ice will pick up rock and soil as they move. Once the glacier

melts, the rocks and soil have been transported to a different area, thus the glaciers have caused erosion. Glaciers also carve out mountains and rivers. For example, the Northwest part of Ohio is very flat due to the glaciers flattening the land over 1.5 million years ago.

If you have ever been to an ocean beach, you have witnessed erosion that is caused by waves. As waves come crashing in, the sand is either pulled back to the ocean or is pushed up farther up onto the beach. When the sand is pushed up farther on the beach, sand dunes are created.

Gravity is one of the largest causes of erosion. As weathering breaks down rocks and soil into smaller pieces, gravity causes these pieces to fall. **Gravity** is the force that attracts objects to the ground. Imagine a small rock that breaks off of a larger rock due to weathering. When the rock breaks, gravity causes the rock to fall down the mountain. The rock has moved to a different place which is why gravity is a form of erosion.

The process of weathering and erosion are very closely related but are also different. Weathering is the process of breaking down rocks and soil into smaller pieces and erosion causes these pieces to move from one place to another. After the pieces of rocks and soil are eroded they are deposited somewhere else. This is why Earth's landforms are always changing, although it sometimes takes millions of years for some of these processes to actually be seen.

D. Deposition

Now that we know what erosion is, what happens to the rocks and soil once it is moved from one place to another? It is deposited. The process of **deposition** is when the rock and soil that has been eroded from one landform is deposited at another landform. Deposition is also referred to as *sedimentation*. Many different types of landforms are created from deposition. In the example of a glacier eroding land, once the glacier melts, a huge deposit of rock and dirt will exist where it melted. As rocks and soil are eroded in a river they are eventually deposited somewhere along the river. This can be seen at the mouth of rivers where they connect with oceans. The deposited rocks and soil create small land features at the end of the river. Deposition also plays a part in creating mountains. As rock and soil are moved and deposited into a certain area, layers begin to build up. Over a long period of time, the buildup of layers of rock and soil will create mountainous like features. Overall, it is important to understand that deposition is the process of rocks and soil being deposited into a different area than they originated from.



Rocks eroded from the mountain in this picture have been deposited on the side of the river where the movement of water is no longer strong enough to move the rock anymore.

Experiment - Cookie Rocks

In this week's experiment, you will be using a cookie and other tools to further your knowledge of weathering, erosion, and deposition.

Teachers: This is an individual experiment. Be sure to buy enough cookies so that each student has one.

Date: _____

Start Time: _____ End Time: _____

Pre-Lab Score: _____/7

PRE-LAB QUESTIONS
(Mandatory for all Students)

1-7. Answer the following questions prior to starting either experiment.

1. What are landforms? List two examples of landforms.

2. Explain the differences between chemical and mechanical weathering.

3. The photo to the right is an example of which type of weathering?

- a. mechanical weathering b. heat weathering
- c. chemical weathering d. cold weathering



4-6. After a heavy rain, a rock breaks off of a mountain and falls into the river. The same rock then flows down the river until it catches on an island. Name and explain the series of geologic events that have occurred in order. [Hint: Three geologic events have occurred.]

4. _____

5. _____

6. _____

7. What is the main cause of erosion?

- a. gravity b. animals c. gas d. solids

Experiment 1 Score: _____/9

EXPERIMENT 1: KITCHEN SCIENCE
(Mandatory for all Students)

Experimentation: In this week's experiment you will be investigating the importance of surface area as it relates to weathering of rocks and minerals. By modeling chemical and mechanical weathering on mints with vinegar, you will be able to see how the two work together in nature. Be sure to carefully record all observations in the spaces provided.

Supplies Needed Per Student:

1 cup of Vinegar	2 large mints or similar candies
1 Hammer	(texture must be similar to chalk)
2 Clear Cups	1 Stop Watch

1-9. Experimentation: Follow the given procedure. Use the pictures as a guide, when necessary.

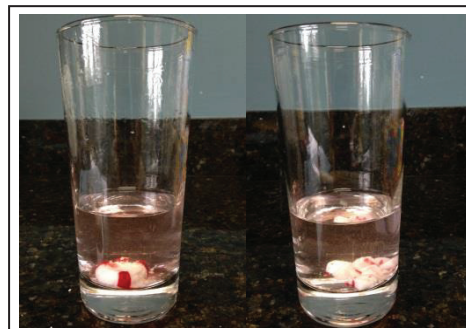
- With the help of an adult, select 1 mint and use the hammer to break it into small pieces.
- Put the smashed mint into one of your cups.

1. Is breaking the mint into small pieces a form of weathering? If so, is it physical or chemical weathering?

- Take the other mint, and place it whole in the empty clear cup.

2. **Make a Hypothesis:** You will be adding vinegar, a type of acid, to each cup. In which cup do you think the candies will dissolve faster, the one with the whole mint or the one with the broken mint?

- Add 1/2 cup of vinegar to each cup.
- If you spill any vinegar on yourself, make sure to wash your hands immediately.



- Using your stopwatch to keep track of time, let the mints sit in the vinegar for 3 minutes.
- Watch the two cups and record observations below.



3-4. Record your observations of the two cups below.

5. **Results:** Was your hypothesis correct? Explain.

6. **Challenge:** In your experiment, how did physical and chemical weathering work together to break down the mint?



7. Vinegar is a type of acid that is chemically weathering the mints. Name one event in nature that can cause chemical weathering of rocks and minerals?

8. Based on the results of your experiment, which do you think would dissolve in water faster: sugar cubes or grains of sugar? Why?

9. **Conclusion Question:** What did you learn from doing Experiment 1?

Week: 2 – Day 1**PRE-LAB**

- 1) Landforms are characteristics that you see on land that are made up of rock and soil. **Examples may vary.** Two examples of landforms are mountains and volcanoes.
- 2) Chemical weathering involves changes in the chemical make-up of rocks and soil that help to break them into smaller pieces. Mechanical weathering involves the physical changes of rocks and soil.
- 3) c
- 4) Weathering - rock breaks off due to heavy rain.
- 5) Erosion - the rock flows down the river and is carried away.
- 6) Deposition - the rock is deposited on an island.
- 7) a

EXPERIMENT 1

- 1) Yes. It is physical weathering.
- 2) **Answers may vary.** I think the cup with the broken pieces of candy will dissolve faster than the one with whole candy.
- 3-4) The broken candy dissolved much faster than the whole candy. The color of the vinegar changed and became the color of the candies.
- 5) **Answers may vary.** Yes, my hypothesis was correct. The smaller pieces dissolved faster than the large pieces.
- 6) The vinegar dissolving the candies was chemical weathering, and breaking the pieces up before was physical weathering. Physical weathering helped to speed up the chemical weathering process.
- 7) **Answers may vary.** Acid rain
- 8) I think that the grains of sugar will dissolve faster because just like we saw with the candies, something broken up into many pieces dissolves faster than when it is in a large block.
- 9) From this experiment, we have observed how much particle size makes a difference for chemical weathering. Larger rocks are much better able to withstand chemical weathering, while smaller broken down rocks are more likely to be damaged/affected by chemical weathering.



Now, more than ever, kids need supplemental education!

A Grade Ahead's science program makes it easy to provide academic enrichment for your students that is educational and fun!

Why A Grade Ahead?

For one thing, it's not boring and repetitive like some other programs. For another thing, our parents love us, with more than 90% referring us to their friends and families, year after year.

Here is what some other parents are saying:

"A Grade Ahead has a robust curriculum and has been really helpful in building a strong foundation for my kids. I recommend it to everyone especially for elementary level."

Nimsha, Illinois

"Helps improve performance of kids and boost confidence level."

K.U., Virginia

Is your student ready to join the 25,000 other students who have benefitted from our pragmatic, effective approach?

Register today to see what A Grade Ahead can do for your family.

Questions?

Call **866.628.4628**, chat at enrichmentathome.com or email enrichmentathome@agradeahead.com.