

SECTION 1 **Weathering**

BEFORE YOU READ

After you read this section, you should be able to answer these questions:

- What is weathering?
- What causes mechanical weathering?
- What causes chemical weathering?

National Science Education Standards
ES 1c, 1d, 1k

What Is Weathering?

How do large rocks turn into smaller rocks?

Weathering is the process in which rocks break down. There are two main kinds of weathering: mechanical weathering and chemical weathering.

STUDY TIP

Compare Make a chart showing the ways that mechanical weathering and chemical weathering can happen.

What Is Mechanical Weathering?

Mechanical weathering happens when rocks are broken into pieces by physical means. There are many *agents*, or causes, of mechanical weathering. ✓

READING CHECK

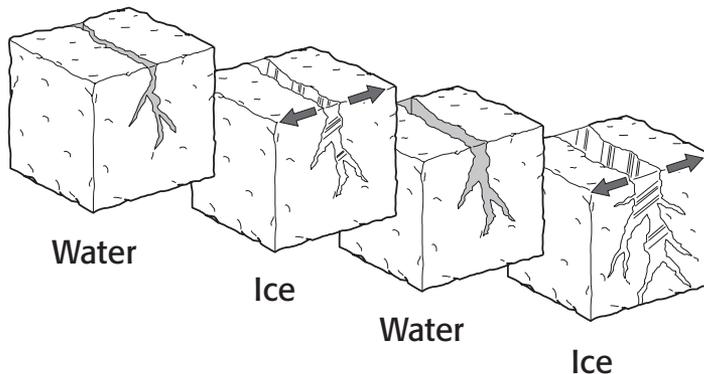
1. Define What is mechanical weathering?

ICE

Ice is one agent of mechanical weathering. Cycles of freezing and thawing can cause *ice wedging*, which can break rock into pieces.

The cycle of ice wedging starts when water seeps into cracks in a rock. When the water freezes, it expands. The ice pushes against the cracks. This causes the cracks to widen. When the ice melts, the water seeps further into the cracks. As the cycle repeats, the cracks get bigger. Finally, the rock breaks apart.

Ice Wedging



Critical Thinking

2. Infer Would ice wedging happen if water did not expand as it froze? Explain your answer.

SECTION 1 Weathering *continued*

WIND, WATER, AND GRAVITY

As you scrape a large block of chalk against a board, tiny pieces of the chalk rub off on the board. The large piece of chalk wears down and becomes smaller. The same process happens with rocks. **Abrasion** is a kind of mechanical weathering that happens when rocks are worn away by contact with other rocks. Abrasion happens whenever one rock hits another. Water, wind, and gravity can cause abrasion.



Discuss In a small group, talk about some different environments in which abrasion may happen.



Water can cause abrasion by moving rocks and making them hit each other. The rocks in this river are rounded because of abrasion.



Wind can cause abrasion when it blows sand against rocks. This rock has been shaped by blowing sand.



Gravity can cause abrasion by making rocks rub against each other as they slide downhill. As the rocks grind against each other, they are broken into smaller pieces.

TAKE A LOOK

3. Explain How does running water cause abrasion?

PLANT GROWTH

Have you ever seen sidewalks and streets that are cracked because of tree roots? Plant roots may grow into cracks in rock. As the plants grow, their roots get larger. The growing roots can make the cracks in the rock wider. In time, an entire rock can split apart. Roots don't grow fast, but they are very powerful!

SECTION 1 Weathering *continued*

ANIMALS

Did you know that earthworms cause a lot of weathering? They tunnel through the soil and move pieces of rock around. This motion breaks some of the rocks into smaller pieces. It also exposes more rock surfaces to other agents of weathering.

Any animal that burrows in the soil causes mechanical weathering. Ants, worms, mice, coyotes, and rabbits are just a few of the animals that can cause weathering. The mixing and digging that animals do can also cause chemical weathering, another kind of weathering.

What Is Chemical Weathering?

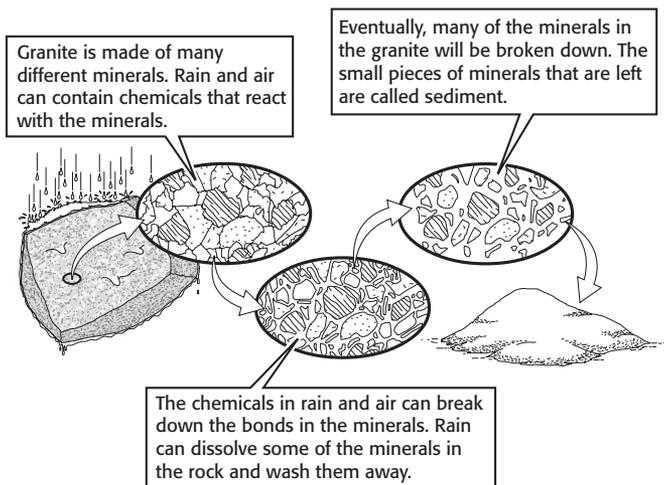
In addition to physical weathering, rocks can be broken down by chemical means. **Chemical weathering** happens when rocks break down because of chemical reactions.

Water, acids, and air are all agents of chemical weathering. They react with the chemicals in the rock. The reactions can break the bonds in the minerals that make up the rock. When the bonds in the minerals are broken, the rock can be worn away. ✓

WATER

If you drop a sugar cube into a glass of water, the sugar cube will dissolve after a few minutes. In a similar way, water can dissolve some of the chemicals that make up rocks. Even very hard rocks, such as granite, can be broken down by water. However, this process may take thousands of years or more.

Chemical Weathering in Granite



STANDARDS CHECK

ES 1k Living organisms have played many roles in the Earth system, including affecting the composition of the atmosphere, producing some types of rocks, and contributing to the weathering of rocks.

Word Help: role
a part or function; purpose

Word Help: affect
to change; to act upon

4. Describe How can earthworms cause weathering?

READING CHECK

5. List What are three agents of chemical weathering?

TAKE A LOOK

6. Infer What do you think is the reason it takes a very long time for granite to break down?

SECTION 1 Weathering *continued*

ACID PRECIPITATION

Precipitation, such as rain and snow, always contains a little bit of acid. However, sometimes precipitation contains more acid than normal. Rain, sleet, or snow that contains more acid than normal is called **acid precipitation**.

Acid precipitation forms when small amounts of certain gases mix with water in the atmosphere. The gases come from natural sources, such as active volcanoes. They are also produced when people burn fossil fuels, such as coal and oil. ✓

The acids in the atmosphere fall back to the ground in rain and snow. Acids can dissolve materials faster than plain water can. Therefore, acid precipitation can cause very rapid weathering of rock.

READING CHECK

7. Identify What are two sources of the gases that produce acid precipitation?

ACIDS IN GROUNDWATER

In some places, water flows through rock underground. This water, called *groundwater*, may contain weak acids. When the groundwater touches some kinds of rock, a chemical reaction happens. The chemical reaction dissolves the rock. Over a long period of time, huge caves can form where rock has been dissolved.

TAKE A LOOK

8. Explain Caves like the one in the picture are not found everywhere. What do you think controls where a cave forms?



This cave formed when acids in groundwater dissolved the rock.

SECTION 1 Weathering *continued*

ACIDS FROM LIVING THINGS

All living things make weak acids in their bodies. When the living things touch rock, some of these acids are transferred to the surface of the rock.

The acids react with chemicals in the rock and weaken it. The different kinds of mechanical weathering can more easily remove rock in these weakened areas. ✓

The rock may also crack in the weakened areas. Even the smallest crack can expose more of the rock to both mechanical weathering and chemical weathering.

 **READING CHECK**

9. Explain How can acids from living things cause weathering?

AIR

Have you ever seen a rusted car or building? Rusty metal is an example of chemical weathering. Metal reacted with something to produce rust. What did the metal react with? In most cases, the answer is air.

The oxygen in the air can react with many metals. These reactions are a kind of chemical weathering called *oxidation*. Rust is a common example of oxidation. Rocks can rust if they have a lot of iron in them.

Many people think that rust forms only when metal gets wet. In fact, oxidation can happen even without any water around. However, when water is present, oxidation happens much more quickly.

Oxidation can cause rocks to weaken. Oxidation changes the metals in rocks into different chemicals. These chemicals can be broken down more easily than the metals that were there before.

Factor	How does it cause chemical weathering?
Water	
Acid precipitation	
Acids in groundwater	
Acids from living things	
Air	

TAKE A LOOK

10. Describe Fill in the blank spaces in the table to describe how different factors cause chemical weathering.

Section 1 Review

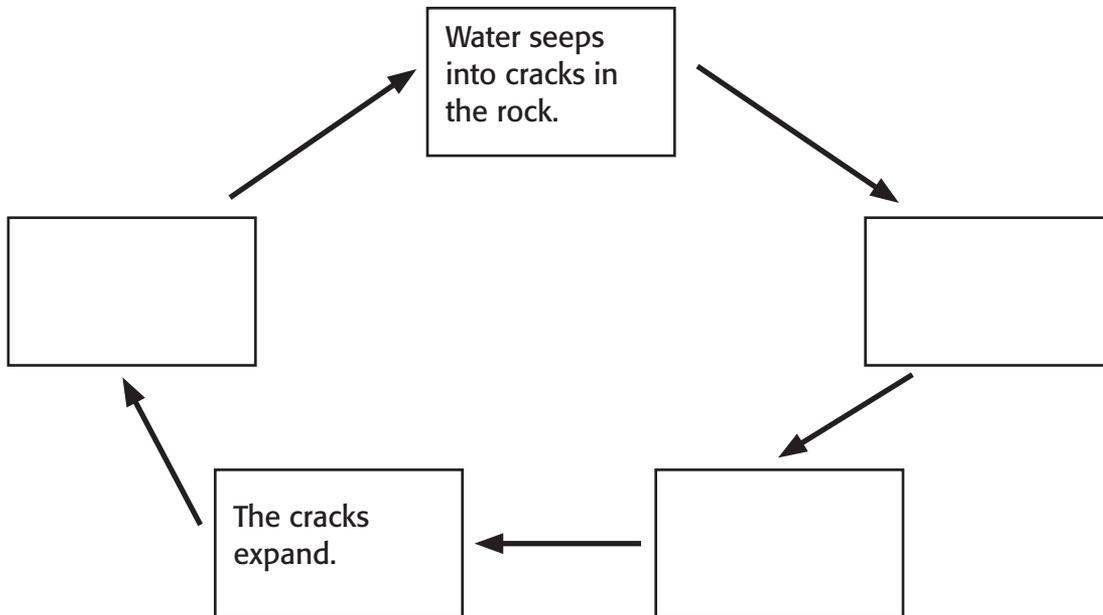
NSES ES 1c, 1d, 1k

SECTION VOCABULARY

<p>abrasion the grinding and wearing away of rock surfaces through the mechanical action of other rock or sand particles</p> <p>acid precipitation rain, sleet, or snow that contains a high concentration of acids</p> <p>chemical weathering the process by which rocks break down as a result of chemical reactions</p>	<p>mechanical weathering the process by which rocks break down into smaller pieces by physical means</p> <p>weathering the natural process by which atmospheric and environmental agents, such as wind, rain, and temperature changes, disintegrate and decompose rocks</p>
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1. **List** What are three things that can cause abrasion?

2. **Explain** Fill in the spaces to show the steps in the cycle of ice wedging.



3. **Identify** How can acids cause chemical weathering?

4. **Compare** How is mechanical weathering caused by ice wedging similar to mechanical weathering caused by plant roots?
