

Earth Science

Rocks, Minerals, and Soil

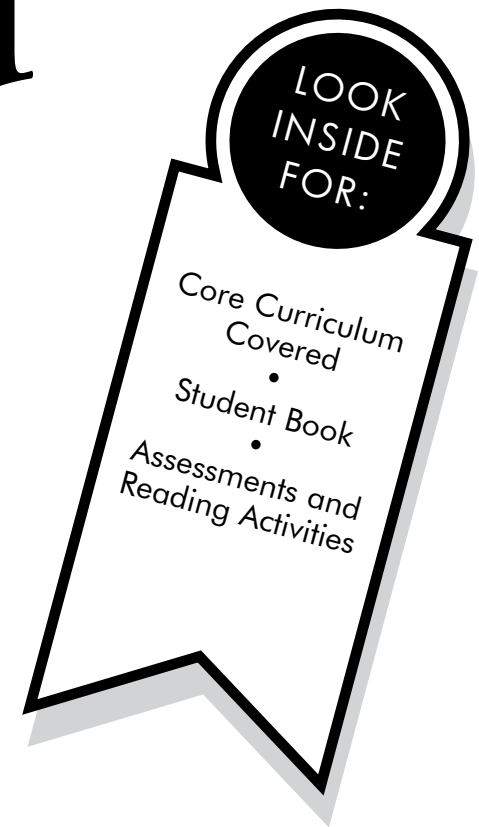
Advanced Level

Rocks and Minerals

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Rocks and Minerals

What materials make up the Earth?

CORE CURRICULUM STATEMENTS

Matter is made up of particles whose properties determine the observable characteristics of matter and its reactivity.

Matter has properties (color, hardness, odor, sound, taste, etc.) that can be observed through the senses.

Objects have properties that can be observed, described, and/or measured: length, width, volume, size, shape, mass or weight, temperature, texture, flexibility, reflectiveness of light.

Measurements can be made with standard metric units and nonstandard units.

The material(s) an object is made up of determine some specific properties of the object (sink/float, conductivity, magnetism). Properties can be observed or measured with tools such as hand lenses, metric rulers, thermometers, balances, magnets, circuit testers, and graduated cylinders.

Objects and/or materials can be sorted or classified according to their properties.

Some properties of an object are dependent on the conditions of the present surroundings in which the object exists. For example:

- temperature - hot or cold
- lighting - shadows, color
- moisture - wet or dry



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Advanced Level

Student Book

Rocks and Minerals

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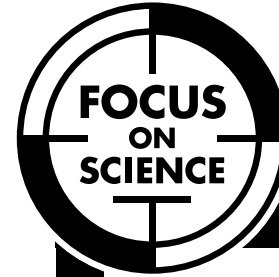
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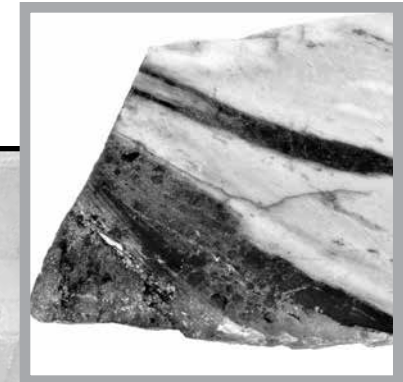
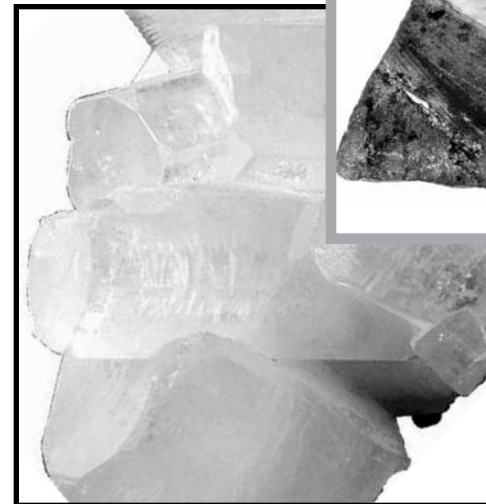


Earth Science

Rocks, Minerals, and Soil

Rocks and Minerals

by Caitlin Scott





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– Predict –

*What do you think you will
learn from reading this book?*

INTRODUCTION

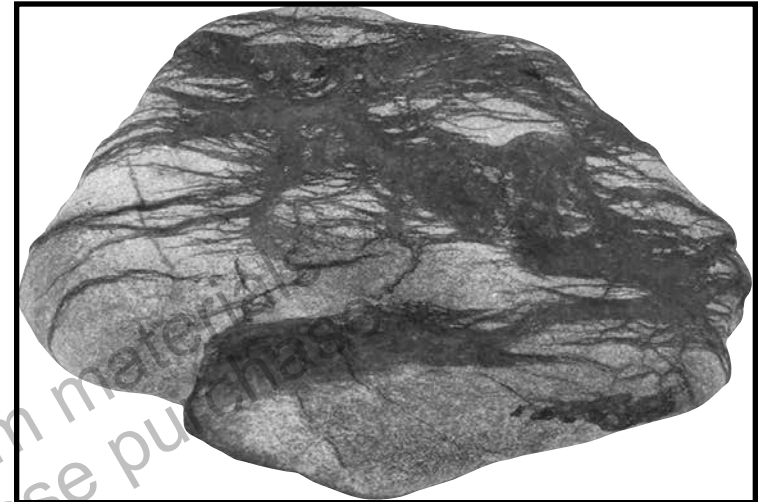
What Are Rocks and Minerals?

You can find rocks everywhere you go. If you look closely at rocks, you can see that they are made up of smaller parts. These smaller particles are called minerals.

There are thousands of minerals on Earth, but only about 100 minerals are common. How can you tell if something is a mineral? All minerals have the following properties:

- They are **natural**. That means they are not made by people.
- They are inorganic. That means they are not alive.
- They are crystalline. That means they have a regular crystal pattern or shape.

natural: not caused by people



This rock is made up of several different minerals. It has an irregular shape.



This is the mineral quartz. It has a crystal shape.

Identifying Rocks and Minerals

Go outside and gather a collection of different rocks. Then look closely at each one. How are they alike? How are they different?

Some rocks you find might be small pebbles or stones. They do not feel very heavy. Some may be large and might feel much heavier. Put each rock on a scale and record the weight of each one.

Look at the color of your rocks. Are they all one color, or do they have several colors. Sort your rocks by color.

Then soak all the rocks in water overnight. Do the rocks look different when they are wet? Did they change color?

Next, wipe off the water from the rocks. Weigh them again. Record the weight and compare it to the first time you weighed them. Did the weight change?

Sort your rocks into categories by how they feel. Put all the rocks that feel rough in one group. Put the rocks that feel smooth in another. Is there another category you could put some of the rock in according to how they feel?

How else can you describe what each rock looks like? Are any of them clear? Do any of them sparkle? Are some dull or shiny? Sort your rocks by how they look.

Are your rocks hard or soft? Scratch each rock with something hard, such as spoon. Did anything come off the rock? Drop your rocks on the sidewalk. Did any of the rocks break?

All of these activities help you learn about the properties of rocks and minerals. Scientists do similar activities to help identify the minerals found in rocks.

Scientists who study minerals are called mineralogists. They use different mineral properties, such as hardness, luster, cleavage, color, streak, and specific gravity, to identify minerals. You can also use these properties to identify different minerals.

Hardness

Friedrich Mohs was a German mineralogist who created the “Mohs Scale of Hardness.” This scale ranks the hardness of minerals from one to ten.

The softest mineral is talc, which has a Mohs rank of 1. Because it is so soft, people often make talcum powder out of talc. Gypsum has a Mohs rank of 2, so it is also soft, but it is a little harder than talc. Calcite has a Mohs rank of 3 and is a little harder than gypsum.

The hardest mineral is diamond. A diamond can scratch glass. But, other minerals can scratch glass, too. In fact, any mineral with a rank greater than 6 can scratch glass.

Mohs Scale of Hardness

Mohs Scale of Hardness	Mineral
1	Talc
2	Gypsum
3	Calcite
4	Fluorite
5	Apatite
6	Orthoclase
7	Quartz
8	Topaz
9	Corundum
10	Diamond

–Apply–
Will topaz cut glass? Will gypsum?

Luster

Luster is how shiny a mineral is. Luster can help you identify minerals. The shiniest minerals look like metals. These minerals are called **metallic** minerals. Some are shinier than others. Some shine like a clean new penny. Others are duller. They might look like an old dull penny.

Other minerals aren't shiny at all. These are called **nonmetallic** minerals. These minerals can look very different. Some look greasy, as if they are covered in oil. Some look pearly. Some are transparent, which means you can see right through them. A diamond is an example of a transparent, nonmetallic mineral, so is some quartz.

<p>metallic: something that looks like metal nonmetallic: something that does not look like metal</p>

Cleavage

Cleavage is how a mineral breaks. When you strike minerals, some break in just one direction. Others break in two directions, while still others break into many pieces.

Some minerals always break the same way. Scientists say these minerals have "perfect" cleavage. Breaking these minerals can help you identify them.

Color

Color may be the first thing you notice when you look at a mineral. Some minerals are always just one color. If so, then color is a good clue to the mineral's identity.

But, some minerals can be many colors. Sometimes color will help you identify a mineral, but sometimes it won't.

Streak

When you rub some minerals on a special “streak plate,” they leave a colored mark. This mark is called a streak. All minerals with a hardness of 6 or less leave a streak. Looking at this streak helps people identify some of these softer minerals.

Specific Gravity

Two minerals can be the same size but have different weights, or they can have the same weight and different sizes. Specific gravity compares the size and weight of a mineral.

Each mineral has its own specific gravity value. A mineral with a high specific gravity is heavier than a mineral that is the same size with a lower specific gravity. Measuring specific gravity can help people identify many minerals.

The lead in your pencil is made of the mineral graphite. The table below shows the traits of graphite.

Traits of Graphite



Mohs Scale of Hardness	1 to 2
Luster	Metallic but dull
Cleavage	Perfect in one direction
Color	Black to silver
Streak	Gray black
Specific Gravity	2.2

Weathering

As you have learned, there are many ways to classify rocks and minerals. Here is one way you may not have thought of.

Fossils

Did you know that fossils are rocks? After a living thing dies, its skin, muscles, and other soft parts quickly **decay**. Left behind are any hard parts, such as teeth, bones, claws, or a shell. Sometimes these hard parts become buried in mud.

Over millions of years the mud turns into rock. As water flows through cracks in the rock, it **dissolved** the hard parts. Left behind is an empty space in the rock. This space had the same shape as the plant or animal.

In time, minerals from the soil filled up the empty space. The minerals hardened and formed a rock in the shape of the plant or animal.

decay: to rot or break down

dissolved: changed from a solid to a liquid

You might think rocks last forever, and most do last a long time. But, rocks don't last forever because over thousands of years, they slowly wear away.

This natural process of wearing away is called weathering. Wind, water, and ice are all forces that cause weathering. It happens so slowly, we cannot see it happening.

Imagine rocks on the top of a mountain or on the bank of a river. Strong winds whip by the rocks, rain beats down on them, and ice forms on the rocks. All these forces slowly break up the rock. Often the pieces that break off are very tiny. These pieces become soil. This process can take hundreds, even thousands of years.

Wind

Wind is a force that can weather rock over a long period of time. Utah and Arizona have beautiful rock formations that were carved out by the wind sweeping across the deserts.



Water

Like wind, water can also wear down and transport rocks to other places. Most of the time this happens very slowly.

For example, rain on a rocky cliff can wear down the rock over many years, or water can slowly wear down rocks in a riverbed. Waves on a lake or ocean can also cause rocks to wear away. Crashing waves break down beaches, rocks, and cliffs over time and move the rocks to other places.

Ice

Ice doesn't weather rocks in quite the same way as wind and water do. When water freezes, it **expands** rapidly. Have you ever left a soda can in the freezer by accident? If so, you know that the soda can swells, pushing out the top and bottom of the can. It almost looks as if the soda is about to break out of the aluminum can.

The same thing happens when water seeps into cracks in rock. When the water freezes, it expands and causes stress, or pressure, in the crack. As the stress increases, the crevice widens and breaks the rock or mineral apart.

Plants

Plants can weather rocks and minerals in a similar way. Plant roots grow into cracks and slowly wedge the rock apart as they grow larger.

expands: gets bigger

Glossary

decay—to rot or break down

dissolved—changed from a solid to a liquid

expands—gets bigger

geologist—someone who studies rocks

metallic—something that looks like metal

natural—not caused by people

nonmetallic—something that does not look like metal

To Find Out More . . .

Want to learn more about rocks and minerals?

Try these books

The Best Book of Fossils, Rocks, and Minerals by Chris Perrault. King Fisher, 2000.

The Rock Factory: A Story about the Rock Cycle by Jacqui Bailey. Picture Window Books, 2006.

Access these Web sites

Mineralogy 4 Kids

http://www.minsocam.org/MSA/K12/K_12.html

The Mineral and Gemstone Kingdom

<http://www.minerals.net/index.htm>

Write for more information

Mineralogical Society of America
3635 Concorde Pkwy Suite 500
Chantilly, VA 20151-1125

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Advanced Level

Assessments

Rocks and Minerals

Print pages 18–20 of this PDF for the assessments.

Check Understanding

Shade the circle next to the correct answer.

1. A student finds two rocks of the same size. The rocks have very different weights. This property is called
 (A) streak
 (B) luster
 (C) cleavage
 (D) specific gravity
2. A mineral that looks shiny is metallic. What is this property called?
 (A) streak
 (B) luster
 (C) cleavage
 (D) specific gravity

3. The chart below is Mohs Scale of Hardness.

Mohs Scale of Hardness	Mineral
1	Talc
2	Gypsum
3	Calcite
4	Fluorite
5	Apatite
6	Orthoclase
7	Quartz
8	Topaz
9	Corundum
10	Diamond

Which mineral is softer than fluorite?

-
- (A) calcite
-
-
- (B) apatite
-
-
- (C) topaz
-
-
- (D) corundum

Check Understanding

Shade the circle next to the correct answer or write your answer on the lines provided.

4. Weathering can occur through wind, water, ice, and

- Ⓐ minerals
- Ⓑ fossils
- Ⓒ plants
- Ⓓ mud

5. A scientist has two rocks. The rocks share the same color, luster, cleavage, streak, hardness, and specific gravity. But the rocks are different sizes. This suggests that

- Ⓐ The rocks are the same mineral.
- Ⓑ The rocks are two different minerals.
- Ⓒ The rocks came from the same location.
- Ⓓ The rocks came from a different location.

6. Identify **two** properties that all minerals share.

(1) _____

(2) _____

Assessment Scoring Guidelines

1. Answer D is correct.
2. Answer B is correct.
3. Answer A is correct.
4. Answer C is correct.
5. Answer A is correct.
6. They are natural; They are inorganic;
They are crystalline.

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Advanced Level

English Language Arts Activities

Rocks and Minerals

Print pages 22–26 of this PDF for the reading activities.

Fact and Opinion

TRY THE SKILL

A fact is a statement that can be proven.

For example:

Some rocks are metallic, while others are nonmetallic.

An opinion is a statement based on what someone thinks or believes. It may or may not be a fact. For example:

Metallic rocks are prettier than nonmetallic rocks.

Sometimes writers mix facts and opinions.

It is important to ask questions when you read.

Ask yourself, "Is this always true or is this what someone thinks?" If the answer is "always true," then it is a fact.

Mark each statement below *F* for fact or *O* for opinion.

1. Scientists who study minerals are mineralogists.

2. Mineralogists are the most interesting kind of scientists. _____

3. Everyone should have a rock collection. _____

4. Rocks can be put in categories based on their properties. _____

5. Diamonds are more beautiful than topaz. _____

6. It takes millions of years for fossils to form.

Make Predictions

TRY THE SKILL

You can use pictures to help make predictions. Study the picture of a rock formation. It can help you predict what caused this rock to weather.



How did this rock get to look like this?

You know this rock formation is in the desert. Deserts are very dry. So, you can infer that water did not weather the rock. Since deserts are hot, you can infer that ice did not weather the rock. Wind must have created this shape.

Look at the picture and, making a prediction, answer the question.

1. What will this rock look like in one thousand years?

Draw Conclusions

TRY THE SKILL

It is important to draw conclusions about what you read. You should be able to support your conclusions with details.

Read the paragraph. Then look at the graphic.

Two minerals can be the same size but have different weights, or they can have the same weight and different sizes. Specific gravity compares the size and weight of a mineral. Measuring specific gravity can help people identify many minerals.

Conclusion

Measuring specific gravity can help people identify minerals.

Supporting Details

- Two minerals can be the same size but have different weights, or they can have the same weight and be different sizes.
- Specific gravity compares size and weight.

Read this paragraph from *Rocks and Minerals*. Then complete the graphic.

When you rub some minerals on a special “streak plate,” they leave a colored mark. This mark is called a streak. All minerals with a hardness of 6 or less leave a streak. Looking at this streak helps people identify some of these softer minerals.

Conclusion

Supporting Details

Suffixes

TRY THE SKILL

Suffixes are short syllables at the ends of words that change the meaning of the word. Knowing suffixes can help you understand what you read.

The suffix *-er* compares one thing to another.

The suffix *-est* compares three or more things.

Read this paragraph from *Rocks and Minerals*. Find words that end with these suffixes.

Luster is how shiny a mineral is. Luster can help you identify minerals. The shiniest minerals look like metals. These minerals are called metallic minerals. Some are shinier than others. Some shine like a clean new penny. Others are duller. They might look like an old dull penny.

What do the words *shinier* and *shiniest* mean?

Shinier means “more shiny.”

Shiniest means “most shiny.”

Read the paragraph. Find three words that use the *-er* or *-est* suffix. Write the word and the definition in the chart.

The softest mineral is talc, which has a Mohs rank of 1. Gypsum has a Mohs rank of 2, so it is also soft, but it is a little harder than talc. Calcite has a Mohs rank of 3 and is a little harder than gypsum. The hardest mineral is diamond. A diamond can scratch glass.

Word	Definition

Answer Key

Interpret Graphics

1. F
2. O
3. O
4. F
5. O
6. F

Make Predictions

The wind will make the hole bigger and bigger until the rock collapses to the ground.

Draw Conclusions

Conclusion

Streak helps people identify minerals with a hardness 6 or less.

Supporting Details

- When you rub some minerals on a special “streak plate,” they leave a colored mark.
- All minerals with a hardness of 6 or less leave a streak.

Suffixes

softest: most soft

harder: more hard

hardest: most hard