SCIENCE • GRADE 4

Science Content Standards
Earth Sciences: 4.A
Earth Sciences: 4.B

Above Level

Rocks and Minerals

LOOK INSIDE FOR:

- California's Academic Content Standards Covered
- Reproducible Student Book
- Reproducible English-language Arts Activities

FOCUScurriculum

Curriculum materials for **your** content standards

33 Milford Drive, Suite 1, Hudson, OH 44236

(330) 656-9008 • www.focuscurriculum.com

Rocks and Minerals
California's Content Standards Met

GRADE 4 SCIENCE

EARTH SCIENCES: 4—The properties of rocks and minerals reflect the processes that formed them. As a basis for understanding this concept:

a. Students know how to differentiate among igneous, sedimentary, and metamorphic rocks by referring to their properties and methods of formation (the rock cycle).

b. Students know how to identify common rock-forming minerals (including quartz, calcite, feldspar, mica, and hornblende) and ore minerals by using a table of diagnostic properties.

GRADE 4 ENGLISH LANGUAGE ARTS

1.0 WORD ANALYSIS, FLUENCY, AND SYSTEMATIC VOCABULARY DEVELOPMENT

***Vocabulary and Concept Development 1.4*—**Know common roots and affixes derived from Greek and Latin and use this knowledge to analyze the meaning of complex words (e.g., international).

2.0 READING COMPREHENSION

***Comprehension and Analysis of Grade-Level-Appropriate Text 2.2*—**Use appropriate strategies when reading for different purposes (e.g., full comprehension, location of information, personal enjoyment).

***Comprehension and Analysis of Grade-Level-Appropriate Text 2.3*—**Make and confirm predictions about text by using prior knowledge and ideas presented in the text itself, including illustrations, titles, topic sentences, important words, and foreshadowing clues.

***Comprehension and Analysis of Grade-Level-Appropriate Text 2.4*—**Evaluate new information and hypotheses by testing them against known information and ideas.

SCIENCE • GRADE 4

California Content Standards
Earth Sciences: 4.A
Earth Sciences: 4.B

Above Level

Student Book

Rocks and Minerals

Print pages 5–18 of this PDF for the student book.

How to Make the Student Book

- **The student book is contained on pages 5–18 of this PDF. It begins on the next page.**
- **To make one student book, or a two-sided master copy that can be photocopied, you will print on both sides of seven sheets of 8.5″ x 11″ paper.**
- **Do a test printout of one book first to familiarize yourself with the procedure.**
- **Follow these instructions carefully.**

First–Select the Paper

Since you will be printing on both sides of the sheets of paper, select a good quality white paper. We recommend using at least a 22lb sheet.

Second–Check Printer Settings

Be sure you have the correct page setup settings for your computer and printer. You will print these pages in landscape format.

Third–Print EVEN Pages

Open the PDF of the book you want to print. Select print from your file menu. In your printer's dialogue box enter pages 5–18 to print. Then select EVEN pages only. It is important to print only the EVEN pages first. Click "Print" to print the even pages. (**Important note**: The first page that prints will be blank. DO NOT discard this page. It will be needed to print the cover in the next step.)

Forth–Print ODD Pages

When the even pages have printed, flip the stack of pages over to print the odd pages. Place the stack back in your printer. Select print from the file menu again. In your printer's dialogue box, select ODD pages. Click "Print" to print the odd the pages.

Fifth–Fold the Book

You now have a complete book. Check to be sure the pages are in the correct order with the book's cover as the top page. Then fold the stack of paper in half.

Sixth–Staple the Book

Use an extended-length stapler to staple the pages together. Place three staples in the spine of the book.

Please note that printers vary in how they output pages. Do a test printing with one book and adjust the procedure as necessary.

If you want to make a one-sided master copy, print ALL pages 5–18 at once. Then select "one-sided to two-sided" on the copy machine.

AL

Rocks and Minerals
California's Content Standards Met

GRADE 4 SCIENCE

EARTH SCIENCES: 4—The properties of rocks and minerals reflect the processes that formed them. As a basis for understanding this concept:

a. Students know how to differentiate among igneous, sedimentary, and metamorphic rocks by referring to their properties and methods of formation (the rock cycle).

b. Students know how to identify common rock-forming minerals (including quartz, calcite, feldspar, mica, and hornblende) and ore minerals by using a table of diagnostic properties.

GRADE 4 ENGLISH LANGUAGE ARTS

1.0 WORD ANALYSIS, FLUENCY, AND SYSTEMATIC VOCABULARY DEVELOPMENT

Vocabulary and Concept Development 1.4—Know common roots and affixes derived from Greek and Latin and use this knowledge to analyze the meaning of complex words (e.g., international).

2.0 READING COMPREHENSION

Comprehension and Analysis of Grade-Level-Appropriate Text 2.2—Use appropriate strategies when reading for different purposes (e.g., full comprehension, location of information, personal enjoyment).

Comprehension and Analysis of Grade-Level-Appropriate Text 2.3—Make and confirm predictions about text by using prior knowledge and ideas presented in the text itself, including illustrations, titles, topic sentences, important words, and foreshadowing clues.

Comprehension and Analysis of Grade-Level-Appropriate Text 2.4—Evaluate new information and hypotheses by testing them against known information and ideas.

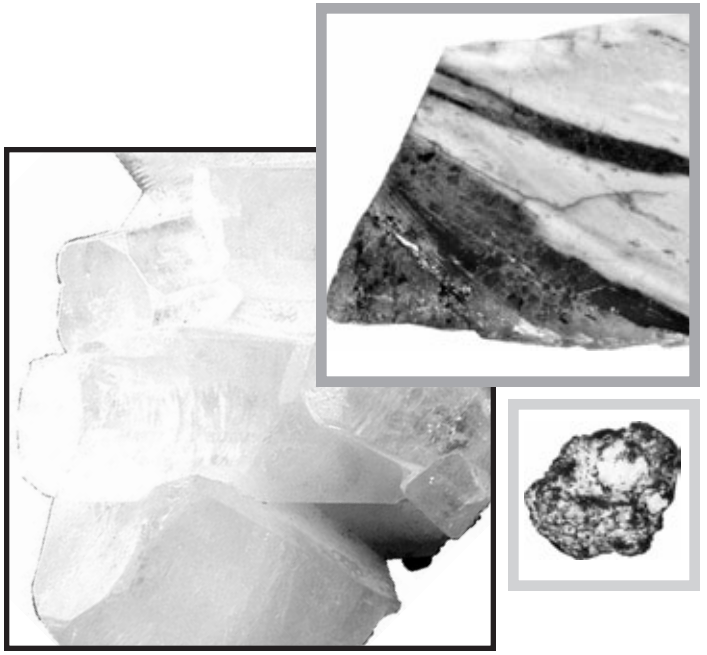
FOCUS ON CALIFORNIA STANDARDS

SCIENCE • GRADE 4

California Content Standards
Earth Sciences: 4.A
Earth Sciences: 4.B

Rocks and Minerals

by Caitlin Scott



SCIENCE • GRADE 4

California Content Standards

Earth Sciences: 4.A

Earth Sciences: 4.B

Rocks and Minerals

by
Caitlin Scott

FOCUScurriculum

Curriculum materials for **your** content standards

Table of Contents

INTRODUCTION

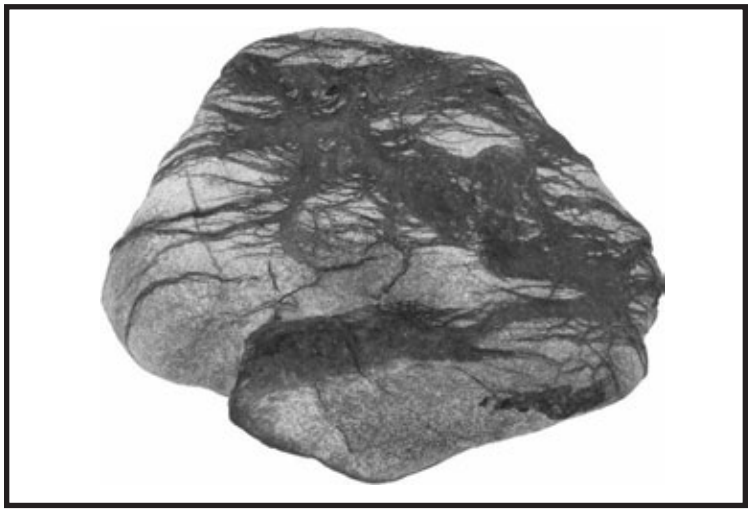
What Are Rocks and Minerals?

You can find rocks everywhere you go. Some are as big as a car, but some are so small you can put them in your pocket. If you look closely at rocks, you can see that they are made up of smaller parts. These smaller particles are called minerals.

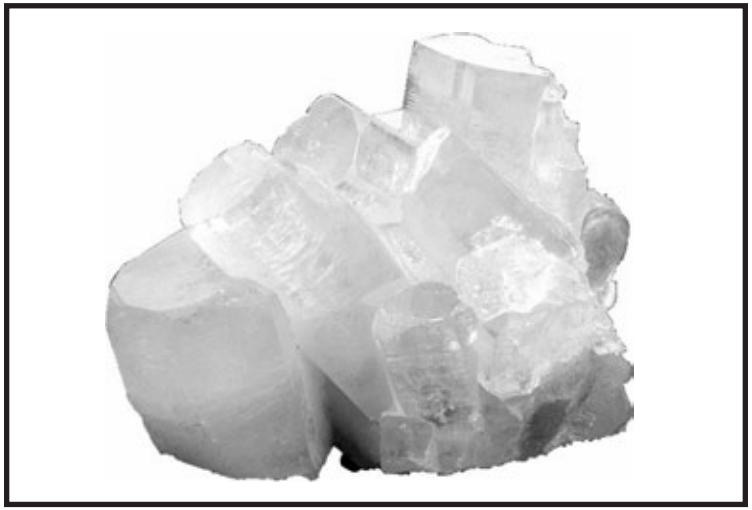
There are thousands of minerals on Earth, but only about 100 minerals are common. How can you tell if something is a mineral? All minerals have the following properties:

- 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.

Remember these properties of minerals. Read them to yourself several times.



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



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

CHAPTER 1

Identifying Minerals

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

Hardness

The Mohs Scale of Hardness 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. For example, Quartz has a rank of 7, so it can scratch glass, but it cannot scratch a diamond.

mineralogists: scientists who study minerals

Mohs Scale of Hardness

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

Will topaz scratch glass? Will gypsum?

Luster

Luster describes how shiny a mineral is. Luster can help you identify minerals. The shiniest minerals look like metals, such as a clean, new penny or nickel. These minerals are called **metallic** minerals. Some are shinier than others. For example, gold and pyrite 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, such as mica, 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 mineral, so is some quartz.

metallic: something that looks like metal
nonmetallic: something that does not look like metal

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.

Other minerals don't have perfect cleavage. So, breaking doesn't always help identify a mineral.

Color

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. For example, calcite is always white, but mica can be dark brown, black, or silver white.

cleavage: how something breaks

Streak

When you rub some minerals on a special "streak plate," they leave a colored mark 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. For example, calcite always leaves a white streak, but hornblende never leaves a streak.

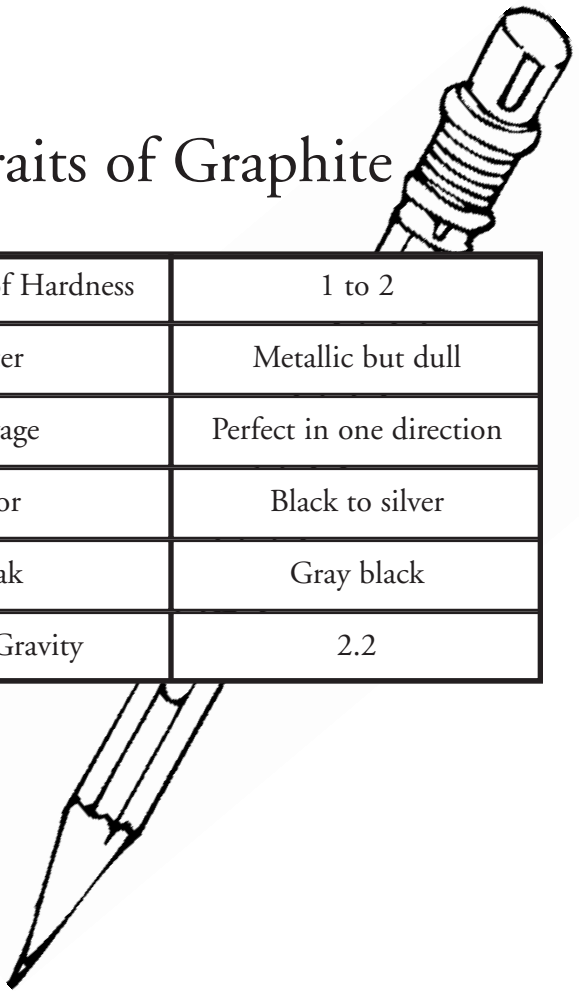
Specific Gravity

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.

specific gravity: a measure of size and weight

Your pencil lead 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

CHAPTER 2

Types of Rocks

Pure minerals are rare, but rocks are common. Rocks are simply minerals that have been fused together. There are three different types of rocks on Earth—igneous, metamorphic, and sedimentary.

Igneous Rocks

The word *igneous* comes from the Latin word for "fire." All igneous rocks began as hot, fluid material. What do igneous rocks look like? These rocks are formed when molten rock hardens. Molten rock may actually boil and bubble. Because of this boiling, igneous rocks sometimes develop air bubbles in them as they cool. They are also usually a dark color. The grains in the rock may be different sizes, but these grains look well mixed together. Igneous rock does not have layers or lines in it.

Remember the three rock families.
Read their names to yourself several times.

This rock travels to the surface in two different ways. Sometimes, the rock forms when a volcano erupts. This happens suddenly. But sometimes, the igneous rocks slowly press up into the metamorphic or sedimentary rock above them. This happens very slowly. It means you might find igneous rock pressed into some other type of rock.

Pumic is an example of an igneous rock formed when lava cooled quickly above ground. You can see where little pockets of air had been. This rock is so light, that many pumice rocks will actually float in water. Because this rock is so light, it is used quite often as a decorative landscape stone. Ground to a powder, it is used as an abrasive in polishing compounds.

Pumice is an igneous rock with a lot of air bubbles.

Sedimentary Rocks

What does sedimentary rock look like? Sedimentary rock is formed when weathered particles are pressed into layers. By studying these layers, you can discover what the weather was like when the rock formed. If the weather was rainy, you might see ripple marks. If it was dry, you might see cracks where mud dried out.

Sometimes you can see old plants and animal bones in the layers. Over millions of years, these plants and animals turned into fossils. Scientists know about dinosaurs because of fossils.

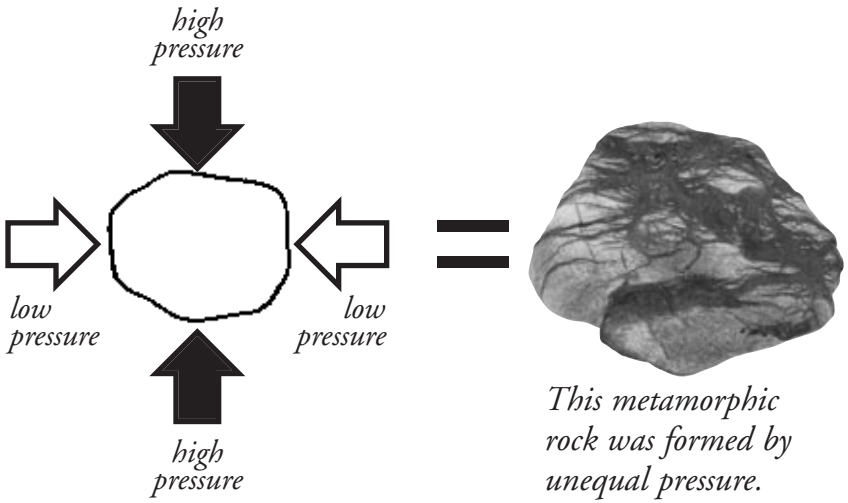
Some layers of sedimentary rock have other useful things trapped in them. Some have huge pockets of water or oil. People can use this clean water for drinking and washing things. People can turn the oil into gasoline for cars.

Sedimentary rock is pressed into layers.

Metamorphic Rocks

What does metamorphic rock look like? Metamorphic rocks form when they are buried under very high pressure. The particles in these rocks are tightly packed. This can make the rock look striped, solid, or have tiny dots.

What gives metamorphic rock these different looks? Sometimes the pressure on the rock is greater in one direction than in another. This gives the rock a striped look. The stripes will be in the direction of the weaker pressure.



This metamorphic rock was formed by unequal pressure. It looks striped.

Classifying Rocks

There are many ways to classify rocks. The chart below is one example. Draw this chart in your notebook and use it to investigate and classify the rocks in your area.

Rock	Type	Description
Limestone	Sedimentary	• tiny grains in layers • feels gritty • reddish tan or gray
Conglomerate	Sedimentary	• small rocks and pebbles stuck together • various colors • feels rough and lumpy
Pumice	Igneous	• light grey • looks like a sponge • lightweight • feels rough

Compare the properties of the three rocks listed in the chart. How are they similar? How are they different?

CHAPTER 2

The Rock Cycle

Pure minerals are rare, but rocks are common. Rocks are simply minerals that have been fused together. There are three different types of rocks on Earth—igneous, metamorphic, and sedimentary.

Rocks in the same family look alike. Igneous rocks look like other igneous rocks, sedimentary rocks look like other sedimentary rocks, and metamorphic rocks look like other metamorphic rocks. Individual rocks can change families. This may take millions of years. This gradual process is called "the rock cycle."

Picture a rock on top of a mountain. It is an igneous rock formed by great heat below the surface of Earth. Slowly, wind and water break off tiny parts of this igneous rock. These tiny parts look like sand or dirt. They wash downhill and pile up. After they are pressed together for many years, these tiny bits of igneous rock fuse together to become sedimentary rock.

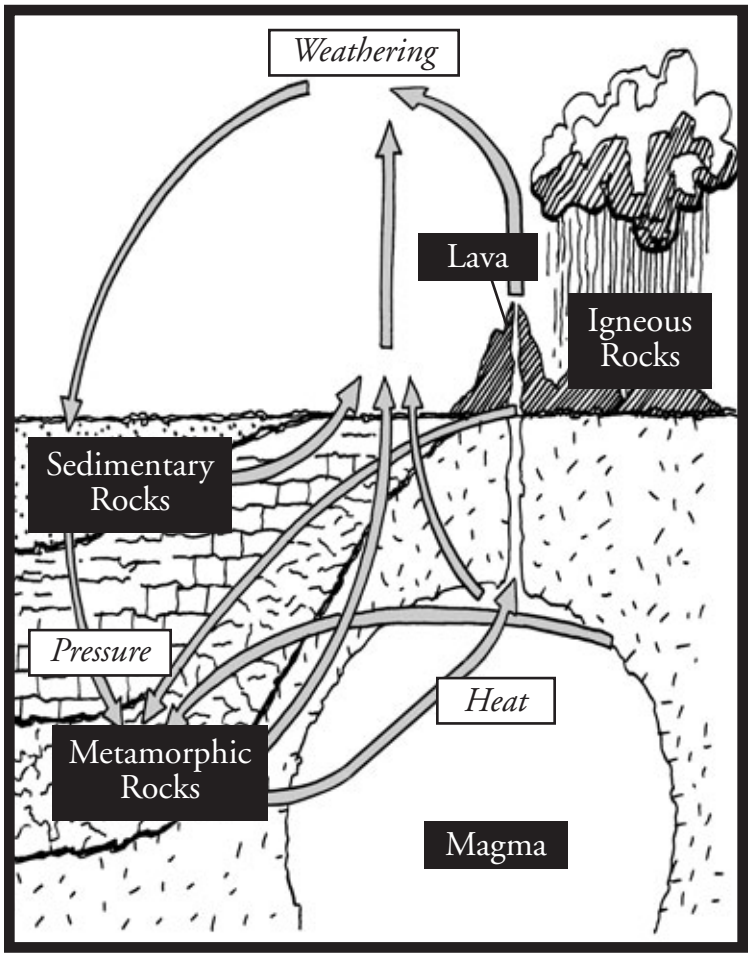
Remember the three rock families.
Read their names to yourself several times.

But that's not the end of the story. More rock forms on top of this sedimentary rock. It gets buried and pushed deep into Earth. Over millions of years, the pressure on the sedimentary rock builds up. Deep in Earth, this **pressure** turns the sedimentary rock into metamorphic rock.

The metamorphic rock is deep inside Earth, but all the rock on Earth is moving slowly. This motion is so slow you cannot see it. After millions of years, the metamorphic rock comes to a hot layer inside Earth. When the metamorphic rock gets too hot, it starts to melt. This melting changes the metamorphic rock into magma or molten rock. When magma is pushed to Earth's surface through an opening such as a volcano, it is called lava. When lava cools, it becomes igneous rock and the rock cycle begins again.

pressure: the force of something pressing down on something else

The Rock Cycle



In this example of the rock cycle, rocks gradually change from igneous to sedimentary, to metamorphic, and back to igneous.

CHAPTER 3

Try This

Ask your teacher to provide you with samples of the following minerals—quartz, feldspar, mica, calcite, and hornblende. Try identifying each mineral using the properties listed in each chart.

1. Name of Mineral:

Mohs Hardness Scale	7
Luster	Glassy
Cleavage	Weak in 3 directions
Color	Clear most common
Streak	White
Specific Gravity	2.65

2. Name of Mineral:

Mohs Hardness Scale	6.5
Luster	Glassy to dull
Cleavage	Perfect in one direction; nearly perfect in another; forms nearly right angled prism
Color	White or gray
Streak	White
Specific Gravity	2.7

3. Name of Mineral:

Mohs Hardness Scale	2.5
Luster	Glassy to pearly
Cleavage	Perfect in one direction
Color	White, silver, yellow, brown, green
Streak	White
Specific Gravity	2.8

4. Name of Mineral:

Mohs Hardness Scale	3
Luster	Glassy to dull
Cleavage	Perfect in three directions
Color	Generally white or colorless
Streak	White
Specific Gravity	2.7

5. Name of Mineral:

Mohs Hardness Scale	5.5
Luster	Glassy
Cleavage	Perfect in two directions
Color	Dark green to black
Streak	Gray to greenish gray
Specific Gravity	3.0

Glossary

cleavage—how something breaks

metallic—something that looks like metal

mineralogists—scientists who study minerals

nonmetallic—something that does not look like metal

pressure—the force of something pressing down on something else

specific gravity—a measure of size and weight

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

The Mineralogy Society: Mineralogy for 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 USA

Hershel Friedman
The Mineral and Gemstone Kingdom
17 Valencia Dr.
Monsey, N.Y. 10952

Index

ENGLISH-LANGUAGE ARTS • GRADE 4

Above Level

California Content Standards
Vocabulary and Concept Development: 1.4
Comprehension and Analysis of Grade-Level-Appropriate Text: 2.2
Comprehension and Analysis of Grade-Level-Appropriate Text: 2.3
Comprehension and Analysis of Grade-Level-Appropriate Text: 2.4

English-language Arts Activities

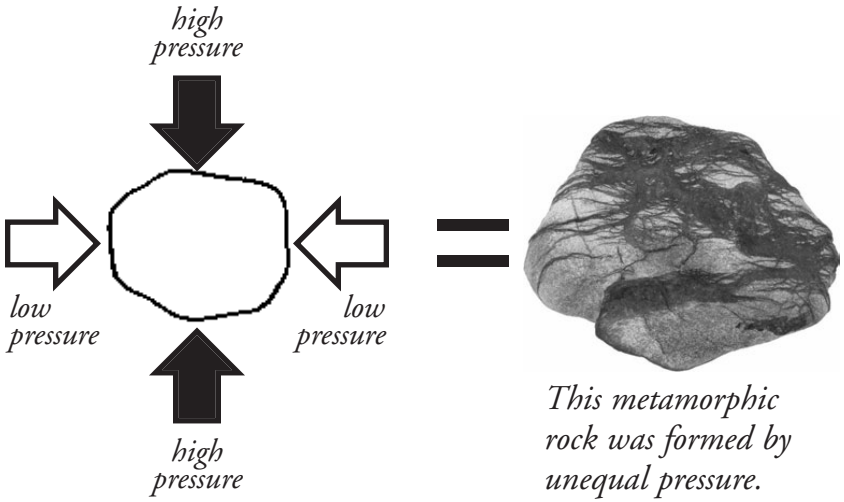
Rocks and Minerals

Print pages 20–24 of this PDF for the reading activities.

Locate Information on Graphics

TRY THE SKILL

Graphics can give you information quickly and help you understand how something works. Look at the graphic showing a form of metamorphic rock.



This metamorphic rock was formed by unequal pressure. It looks striped.

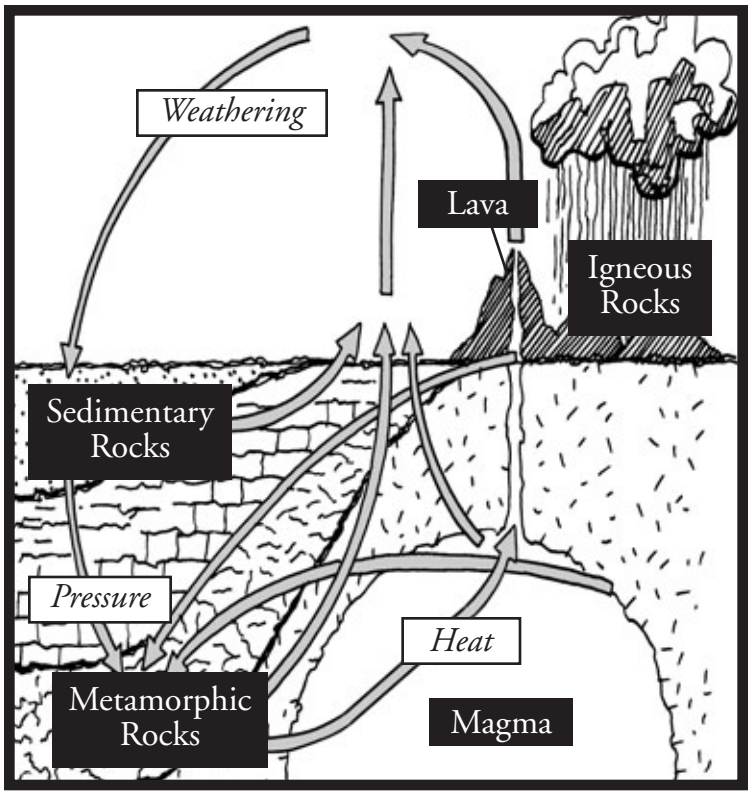
How is this metamorphic rock formed?

- Forces of high pressure press up and down on the rock. Less force is exerted on the sides of the rock. This unequal pressure causes the rock to look striped.

Study this picture from *Rocks and Minerals*. What does it tell you about sedimentary rocks? Write about it.

Make Predictions

You can use information in illustrations to help make predictions. Study the rock cycle illustration. It can help you predict what type of rock will form.



What kind of rock is likely to be created by wind and water washing igneous rock bits downhill?

Remember that sedimentary rock is created after other rocks break up.

TRY THE SKILL

Now read the paragraphs from *Rocks and Minerals*. Using the illustration, answer the questions.

But that's not the end of the story. More rock forms on top of this sedimentary rock. It gets buried and pushed deep into Earth. Over millions of years, the pressure on the sedimentary rock builds up. Deep in Earth, this pressure turns the sedimentary rock into...

1. What kind of rock is the sedimentary rock likely to turn into?

_____

The metamorphic rock is deep inside Earth, but all the rock on Earth is slowly moving. This motion is so slow you cannot see it. After millions of years, the metamorphic rock comes to a hot layer inside Earth. When the metamorphic rock gets too hot, it starts to melt. This melting changes the metamorphic rock into magma which may cool to form...

2. What kind of rock is the metamorphic rock likely to turn into?

_____

Make Hypotheses

Hypothesis are logical guesses or conclusions. You should be able to support your hypotheses with details from the reading. Here is a passage from *Rocks and Minerals*. The graphic organizer below shows one hypotheses you might make and the details that support this hypotheses.

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.

Hypothesis
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 different sizes.
- Specific gravity compares size and weight.
- A mineral with a high specific gravity is heavier than a mineral of the same size with a low specific gravity.

TRY THE SKILL

Read this passage from *Rocks and Minerals*.

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 name some of these softer minerals.

Now complete this graphic.

Hypothesis

Supporting Details

Suffixes

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 the following paragraph from *Rocks and Minerals* and find words that end with these suffixes.

> Luster describes how shiny a mineral is. Luster can help you identify minerals. The shiniest minerals look like metals, such as a clean new penny or a nickel. These minerals are called metallic minerals. Some are shinier than others. For example, gold and pyrite shine like a clean new penny. Some are duller. They might look like an old, dull penny.

What do the words *shinier, shiniest,* and *duller* mean? Use the suffixes.

Shinier means "more shiny."

Shiniest means "most shiny."

Duller means "more dull."

TRY THE SKILL

Read this passage from *Rocks and Minerals*. 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. 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.

Word	Definition

Answer Key

Try This (Student Book)

1. Quartz
2. Feldspar
3. Mica
4. Calcite
5. Hornblende

Locate Information on Graphics

Sedimentary rock is pressed into layers.

Make Predictions

1. Metamorphic rock
2. Igneous rock

Make Hypotheses

Hypotheses

A streak plate will not help people identify minerals with a hardness greater than 6.

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