

On Level



SCIENCE • GRADE 4

Science Content Standards

Earth Sciences: 4.A

Earth Sciences: 4.B

Rocks and Minerals

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FOR:

California's
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Content Standards
Covered

•
Reproducible
Student Book

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Reproducible
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Arts Activities

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

2.0 READING COMPREHENSION

Structural Features of Informational Material 2.1—Identify structural patterns found in informational text (e.g., compare and contrast, cause and effect, sequential or chronological order, proposition and support) to strengthen 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 2.4—Evaluate new information and hypotheses by testing them against known information and ideas.

Comprehension and Analysis of Grade-Level-Appropriate Text 2.5—Compare and contrast information on the same topic after reading several passages or articles.

On Level



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California Content Standards

Earth Sciences: 4.A

Earth Sciences: 4.B

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.

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).
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GRADE 4 ENGLISH LANGUAGE ARTS

2.0 READING COMPREHENSION

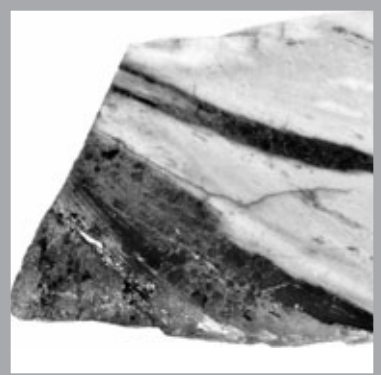
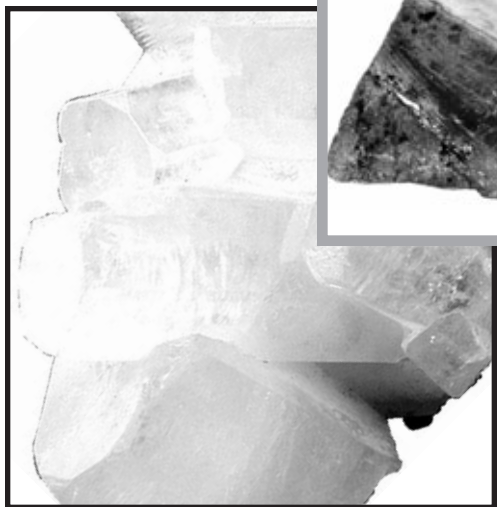
- Structural Features of Informational Material 2.1**—Identify structural patterns found in informational text (e.g., compare and contrast, cause and effect, sequential or chronological order, proposition and support) to strengthen comprehension.
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Rocks and Minerals

by Caitlin Scott





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Curriculum materials for **your** content standards

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INTRODUCTION

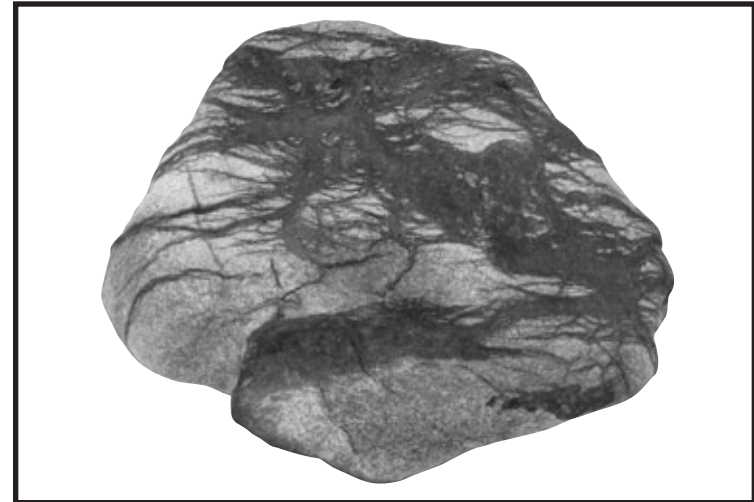
What Are Rocks and Minerals?

Rocks are everywhere. Some are as big as a car. 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 parts are called minerals.

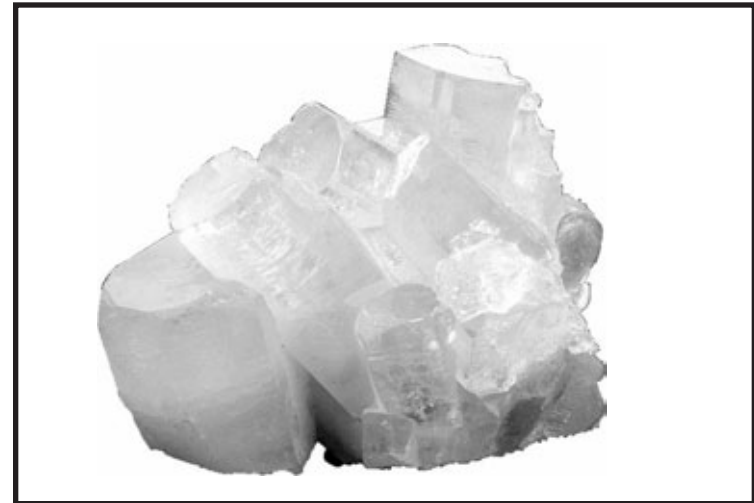
There are thousands of minerals on Earth, but only about 100 are common. How can you tell if something is a mineral? All minerals have these properties:

- 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.

Identifying Minerals

Scientists who study minerals are called **mineralogists**. They use hardness, luster, cleavage, streak, specific gravity, and other properties to tell minerals apart. You can also use these traits to learn about minerals.

Hardness

The Mohs Scale of Hardness ranks how hard minerals are. The softest mineral is talc. People often make powder out of talc. That is why it is called talcum powder.

The hardest mineral is diamond. A diamond can scratch glass. Other minerals can scratch glass, too. In fact, any mineral with a rank greater than 6 can scratch glass. Quartz has a rank of 7. It can scratch glass, but it cannot scratch 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 is how shiny a mineral is. Some minerals shine like metals, such as a penny or a nickel. These minerals are called **metallic** minerals. Some, like gold and pyrite, shine a lot. They might look like a clean new penny. Some shine just a little. They might look like an old, dull penny.

Other minerals do not shine. These are called **nonmetallic**. These minerals can look very different. Some, like mica, look greasy, as if they are covered in oil. Some look pearly. Some are clear. You can see right through them. A diamond is an example of a clear 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. Some break in just one direction. Some break in two directions. Some break into many pieces.

Some minerals always break the same way. Scientists say these have “perfect” cleavage. Breaking these minerals can help you tell which is which.

Other minerals don’t have perfect cleavage, though. Breaking doesn’t always help identify a mineral.

Color

Some minerals are just one color. If so, then color is a good clue to the mineral’s identity.

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 plate, they leave a streak. All minerals with a hardness of 6 or less leave a streak. This helps people name these softer minerals. For example, calcite leaves a white streak, but hornblende does not.

Specific Gravity

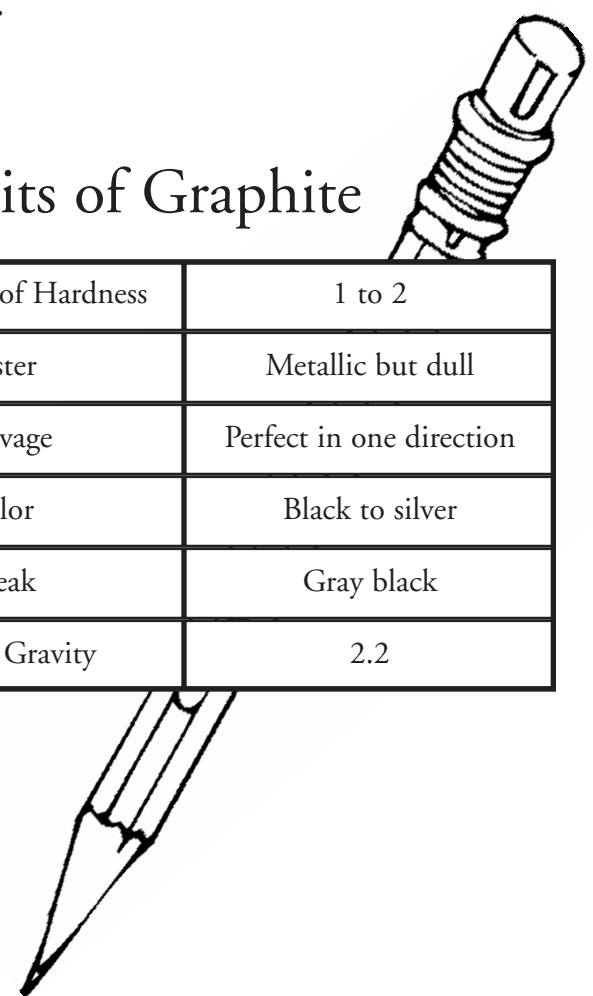
Two minerals can be the same size but have different weights, or they can have the same weight and different sizes. Specific gravity is a measure of size and weight of a mineral.

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

Types of Rocks

Pure minerals are rare. Instead, most minerals join together to form rocks. There are three different types of rocks—igneous, sedimentary, and metamorphic.

Igneous Rocks

What do igneous rocks look like? These rocks are formed when molten rock hardens. Molten rock may actually boil and bubble. So, 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 mixed together. The 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 ways. Sometimes, the rock forms when a volcano erupts. This happens quickly. Sometimes, the rocks slowly press up into the rock above them. This happens slowly. It means you might find igneous rock pressed into some other kind of rock.



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

Sedimentary Rocks

Sedimentary rock forms when weathered particles are pressed into layers. In these layers, you can see what the weather was like when the rock formed. If it was rainy, you might see ripple marks. If it was dry, you might see cracks where mud dried out.

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

Some layers have other useful things 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 fuel for cars.

Sedimentary rock is pressed into layers.



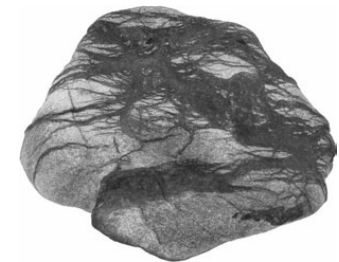
Metamorphic Rocks

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

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.

Sometimes the pressure on the rock is even. This gives the rock a solid or dotted look. All the grains of the rock are pressed together equally.

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



Compare the properties of igneous and metamorphic rocks. How are they similar? How are they different?

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	<ul style="list-style-type: none">• tiny grains in layers• feels gritty• reddish tan or gray
Conglomerate	Sedimentary	<ul style="list-style-type: none">• small rocks and pebbles stuck together• various colors• feels rough and lumpy
Pumice	Igneous	<ul style="list-style-type: none">• 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 3

The Rock Cycle

Rocks in the same family look alike. But, these rocks can change families. This takes millions of years. This slow process is called “the rock cycle.”

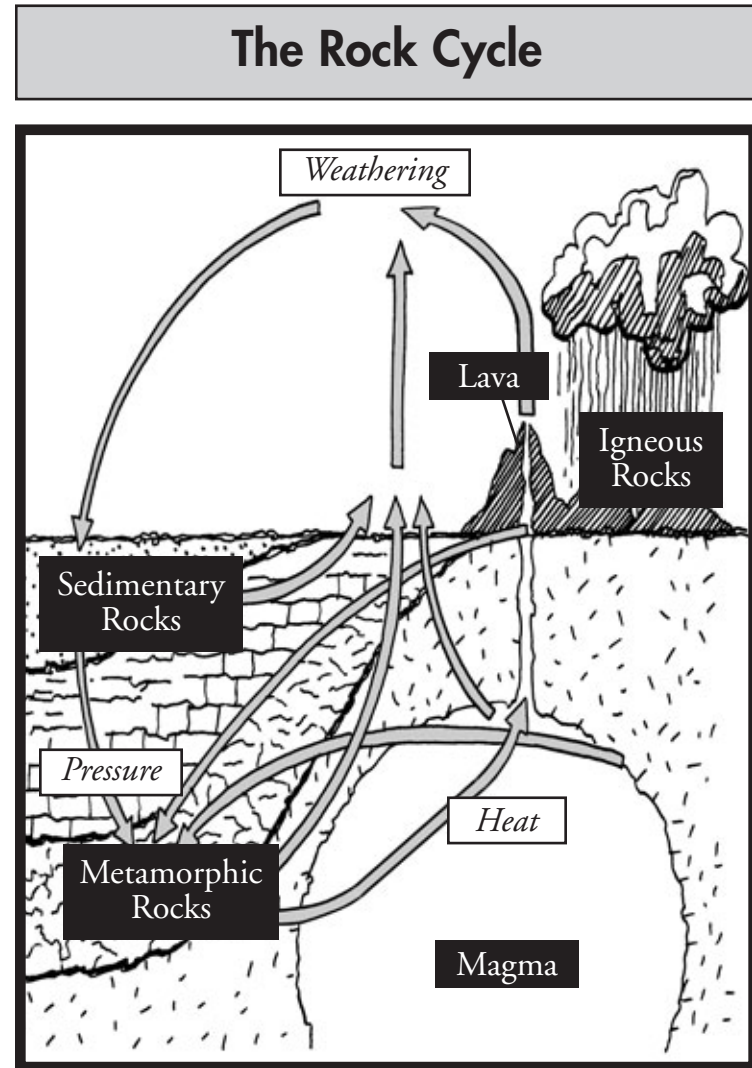
Picture a large rock on top of a mountain. Slowly, wind, water, and plant roots break off tiny parts of the rock. These tiny particles look like sand or dirt. They wash downhill. When they come to rest, they pile up. These tiny bits of igneous rock become sedimentary rock.

But that’s not the end of the story. More rock forms on top of this sedimentary rock. It gets buried and pushed down. Over millions of years, the rock is pressed down hard. Deep in Earth, this **pressure** turns the rock into metamorphic rock.

pressure: the force of something pressing down on something else

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

The metamorphic rock is deep in 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 under the surface of Earth. It heats up and melts. 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.



Over time, rocks change from igneous, to sedimentary, to metamorphic, and then back to igneous again. This is the rock cycle.

CHAPTER 4

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

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California Content Standards
Structural Features of Informational Materials: 2.1
Comprehension and Analysis of Grade-Level-Appropriate Text: 2.2
Comprehension and Analysis of Grade-Level-Appropriate Text: 2.4
Comprehension and Analysis of Grade-Level-Appropriate Text: 2.5

English-language Arts Activities

Rocks and Minerals

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

Proposition and Support

TRY THE SKILL

The proposition is the author's main point. A supporting detail tells more about the proposition.

Here is a passage from *Rocks and Minerals*. The graphic organizer below shows the proposition and supporting details.

The softest mineral is talc. People often make powder out of talc. That is why it is called talcum powder.

Proposition

The softest mineral is talc.

Supporting Details

- People often make powder out of talc.
- That is why it is called talcum powder.

Read this passage from *Rocks and Minerals*.

Cleavage is how a mineral breaks. Some break in just one direction. Some break in two directions. Some break into many pieces.

Now complete this graphic.

Proposition

Supporting Details

Locate Information

TRY THE SKILL

The table of contents tells the reader what is in the book. It also tells the page number.

Read the beginning of the table of contents from *Rocks and Minerals*.

Introduction:

What are Rocks and Minerals? 4

Chapter 1:

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Hardness 6

Luster 8

Cleavage 9

Color 9

Streak 10

Specific Gravity 10

Chapter 2:

The Rock Cycle 12

Igneous Rocks 15

Metamorphic Rocks 16

Sedimentary Rocks 18

What page has information about specific gravity?

Page 10, because the subheading on page 10 is “Specific Gravity.”

What chapter would you read to find information about specific gravity?

Chapter 1, because the subheading “Specific Gravity” is contained in Chapter 1.

Read the beginning of the table of contents from *Rocks and Minerals*. Answer the questions.

1. What page would you begin reading to find information about the color of minerals?
Ⓐ page 4
Ⓑ page 6
Ⓒ page 9
2. Which chapter would you read to find information about the color of minerals?
Ⓐ Introduction
Ⓑ Chapter 1
Ⓒ Chapter 2
3. What page would you begin reading to find information on metamorphic rocks?
Ⓐ page 12
Ⓑ page 14
Ⓒ page 16
4. Which chapter would you read to find information on the rock cycle?
Ⓐ Introduction
Ⓑ Chapter 1
Ⓒ Chapter 2

Compare and Contrast

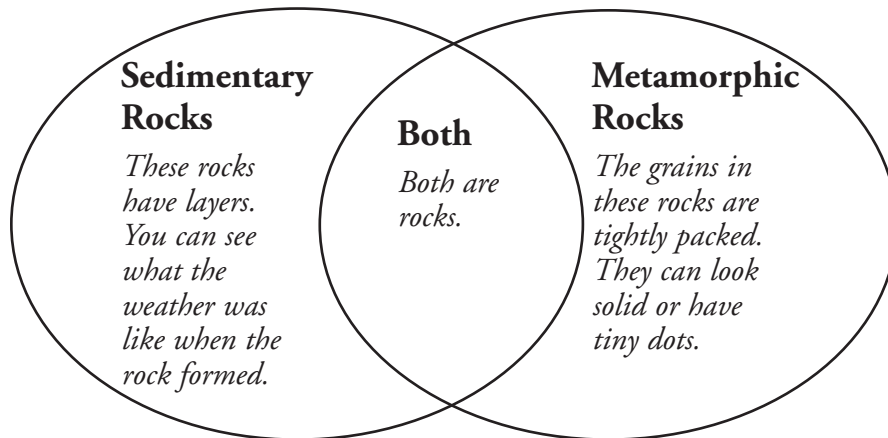
TRY THE SKILL

Comparing and contrasting can help you understand what you read. Comparing tells how things are alike. Contrasting tells how things are different.

Read these paragraphs from *Rocks and Minerals*. Then, read the Venn diagram that compares and contrasts.

What does sedimentary rock look like? It is weathered particles pressed into layers. In these layers, you can see what the weather was like when the rock formed.

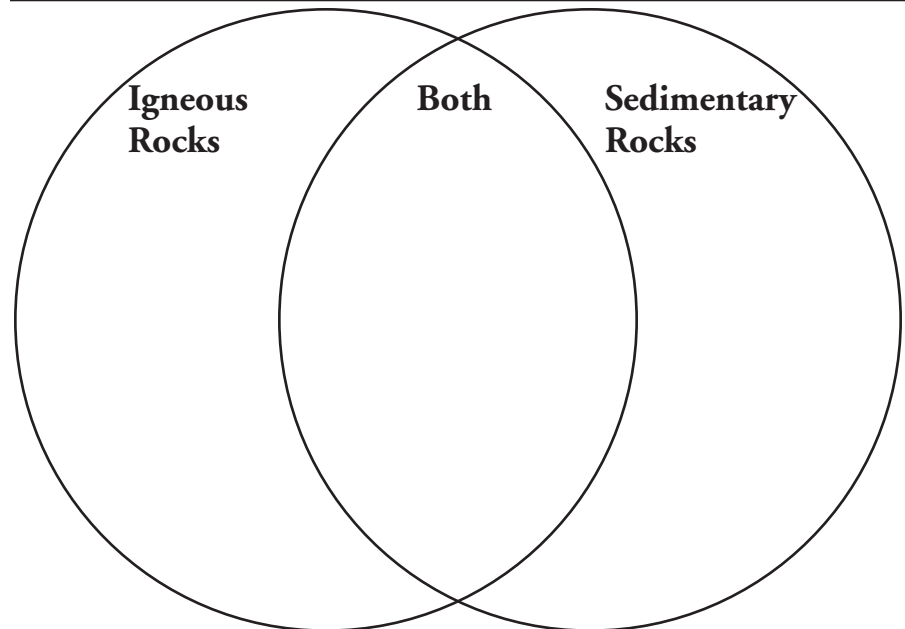
What does metamorphic rock look like? These rocks form when they are buried and under high pressure. The grains in these rocks are tightly packed. This can make the rock look striped. The rock can also look solid or have tiny dots.



Read the paragraphs. Think about comparing and contrasting. Then complete the Venn diagram.

What do igneous rocks look like? These rocks are formed when molten rock hardens. Molten rock may actually boil and bubble. So, igneous rocks sometimes develop air bubbles in them as they cool.

What does sedimentary rock look like? It is weathered particles pressed into layers. In these layers, you can see what the weather was like when the rock formed.



Testing Hypotheses

TRY THE SKILL

A hypothesis is a guess. You can make a guess about new information by testing it against known information—like the information in *Rocks and Minerals*.

Use this chart from *Rocks and Minerals* to answer the questions.

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

Read the questions and choose the correct answer.

1. You have an unknown mineral. It will not scratch feldspar, and feldspar will not scratch it. Which of the following is true?
 - (A) The unknown mineral is diamond.
 - (B) The unknown mineral will scratch apatite.
 - (C) The unknown mineral will scratch quartz.
2. You have an unknown mineral. It will not scratch calcite, and calcite will not scratch it. Which of the following is true?
 - (A) The unknown mineral is corundum.
 - (B) The unknown mineral will scratch apatite.
 - (C) The unknown mineral will scratch talc.
3. You have an unknown mineral. It will not scratch quartz, and quartz will not scratch it. Which of the following is true?
 - (A) The unknown mineral is feldspar.
 - (B) The unknown mineral will scratch corundum.
 - (C) The unknown mineral will scratch calcite.

Answer Key

Try This (Student Book)

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

Proposition and Support

Proposition:

Cleavage is how a mineral breaks.

Supporting Details:

- Some break in just one direction.
- Some break in two directions.
- Some break into many pieces.

Locate Information

1. C
2. B
3. C
4. C

Compare and Contrast

Igneous Rocks

These rocks are formed when molten rock hardens.
They sometimes have air bubbles in them.

Sedimentary Rocks

These rocks have layers. You can see what the weather was like when the rock formed.

Both

Both are rocks.

Testing Hypotheses

1. B
2. C
3. C