

15.1

KEY CONCEPT

The rock cycle shows how rocks change.

◀ BEFORE, you learned

- Minerals are basic components of Earth
- Minerals form in many different ways

▶ NOW, you will learn

- What the three types of rocks are
- How one type of rock can change into another
- How common each rock type is in Earth's crust

VOCABULARY

rock p. 503
rock cycle p. 506
igneous rock p. 506
sedimentary rock p. 506
metamorphic rock p. 506

EXPLORE Rocks and Minerals

How do rocks differ from minerals?

PROCEDURE

- 1 Closely examine the rock and mineral samples. What do you notice about the forms, shapes, colors, and textures of the rock and the mineral?
- 2 In your notebook, make lists of the characteristics of the rock and of the mineral.

MATERIALS

- mineral sample
- rock sample
- magnifying glass

WHAT DO YOU THINK?

- What are the similarities and differences between the rock and the mineral?
- What additional observations or tests might help you determine other differences between rocks and minerals?



Most rocks are made of minerals.

If you have ever put together a jigsaw puzzle, you know that each piece is an important part of the final picture. Just as the pieces combine to form the picture, minerals combine to form most rocks. Another way to consider the relationship between minerals and rocks is to compare rocks to words. Just as letters combine to make up words, minerals combine to make up rocks. A **rock** is a naturally formed solid that is usually made up of one or more types of minerals.

The structure of rocks is different from that of minerals. A mineral is always made of the same elements in the same proportions. All minerals have an orderly crystal structure. In contrast, the proportion of different minerals in a particular kind of rock may vary. In addition, the minerals in a rock can be all jumbled together.

A few types of rocks are made up of one kind of mineral, and a few contain no minerals at all. Limestone, for example, can be composed entirely of the mineral calcite. Obsidian (ahb-SIHD-ee-uhn) is a rock that contains no minerals. It consists of natural glass, which is not a mineral because it does not have a crystal structure. Coal is another rock that is not composed of minerals. It is made up of the remains of ancient plants that have been buried and pressed into rock.



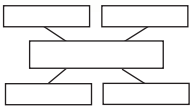
Gabbro, like most rocks, is made up of several types of minerals.



Obsidian is an unusual rock because it contains no minerals.

MAIN IDEA WEB

As you read, write each blue heading in a central box and record important details in boxes around it.



These huge cliffs on the coast of the Hawaiian island of Kauai show only a tiny part of the rock that makes up Earth.

Our world is built of rocks.

Earth is built almost entirely of rock. When you look at Earth's surface, you can see soil, plants, rivers, and oceans. These surface features, however, form only a very thin covering on the planet. Between this thin layer and Earth's metallic core, Earth is made of solid and molten rock.

Because rocks are so common, it is not surprising that people use them for many different purposes, including

- the building of houses and skyscrapers
- the sources of metals, such as iron, aluminum, and copper
- the carving of statues and other works of art
- as a base for pavement for roads and highways



People value rocks because rocks last a long time and because some are beautiful. Ancient rock structures and carvings give us a link to our distant past. Many famous monuments and sculptures are made from rocks. Granite blocks form part of the Great Wall of China. Limestone blocks make up the Great Pyramid in Egypt. The faces of four U.S. presidents are carved in the granite of Mount Rushmore.



CHECK YOUR READING Why do people use rocks for many different purposes?

People study rocks to learn how areas have changed through time. For example, rocks show that North America, as well as most of the rest of the world, has been buried under thick layers of ice many times. You could learn about the types of rocks in your area by collecting and identifying them. You could also examine a map that shows types of rocks and where they are located. This type of map is called a geologic map. The map may be of a large area, such as your state, or a smaller area, such as your county.

This sculptor in Indonesia, like artists throughout the world, shapes rocks into lasting works of art.

INVESTIGATE Classification of Rocks

How can rocks be classified?

Geologists classify rocks by their physical characteristics. Design your own system for classifying rocks, as a scientist might.

PROCEDURE

- 1 Examine the rock samples. Look at their physical characteristics.
- 2 Make a list of the differences in the physical characteristics of the rocks.
- 3 Use your list to decide which characteristics are most important in classifying the rocks into different types. Make a chart in which these characteristics are listed and used to classify the rocks into types.

WHAT DO YOU THINK?

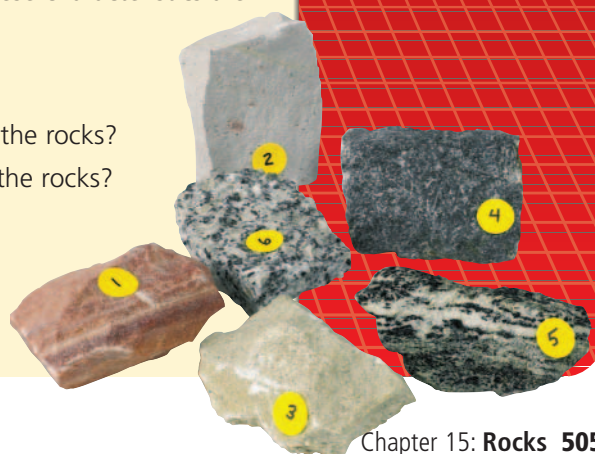
- Which physical characteristic is most helpful in classifying the rocks?
- Which physical characteristic is least helpful in classifying the rocks?

CHALLENGE Is it possible to classify rocks only by the characteristics you can see?

SKILL FOCUS
Classifying

MATERIALS
6 rock samples

TIME
20 minutes



Rocks change as they move through the rock cycle.

VOCABULARY

Add a magnet word diagram for *rock cycle* to your notebook. Then add diagrams for the names of the rock types.



When you want to describe a person you can depend on, you may say that he or she is “like a rock.” That’s the way people think of rocks—as solid and unchanging. Nevertheless, rocks do change. But the changes usually occur over a huge span of time—thousands to millions of years. The **rock cycle** is the set of natural processes that form, change, break down, and re-form rocks.

A cycle is made up of repeating events that happen one after another. This does not mean that rocks move through the rock cycle in a particular order. As the illustration shows on page 507, a rock at any point in the cycle can change in two or three different ways. Like all cycles, the rock cycle has no beginning or ending but goes on continually.

Rock Types

The three types of rocks are classified by how they form.

- **Igneous rock** (IHG-nee-uhs) forms when molten rock cools and becomes solid. Igneous rock can form within Earth, or it can form on Earth’s surface. Igneous rocks that originally formed at great depths can reach Earth’s surface over time. Deep rocks may be raised closer to the surface when mountains are pushed up. At the same time, other processes can wear away the rocks that cover the deeper rocks.
- Most **sedimentary rock** (SEHD-uh-MEHN-tuh-ree) forms when pieces of older rocks, plants, and other loose material get pressed or cemented together. Loose material is carried by water or wind and then settles out, forming layers. The lower layers of material can get pressed into rock by the weight of the upper layers. Also, new minerals can grow in the spaces within the material, cementing it together. Some sedimentary rocks form in other ways, as when water evaporates, leaving behind minerals that were dissolved in it.
- **Metamorphic rock** (MEHT-uh-MAWR-fihk) forms when heat or pressure causes older rocks to change into new types of rocks. For example, a rock can get buried deeper in the crust, where pressure and temperature are much greater. The new conditions cause the structure of the rock to change and new minerals to grow in place of the original minerals. The rock becomes a metamorphic rock. Like igneous rocks, metamorphic rocks can be raised to Earth’s surface over time.

READING TIP

When material dissolves in water, it breaks into many tiny parts. When the water evaporates, the parts join together and the material becomes solid again.

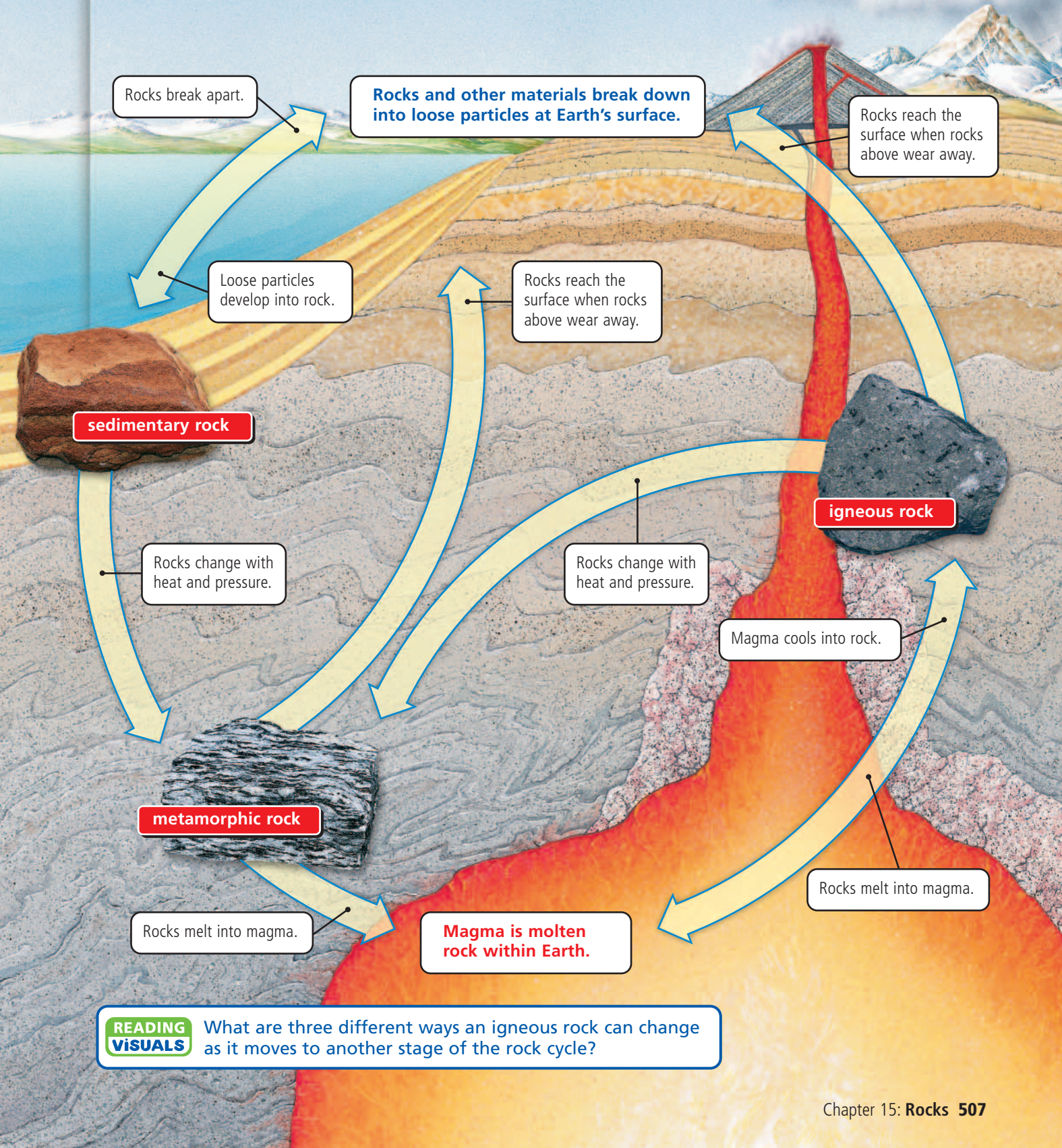


CHECK YOUR
READING

What are the three rock types? What questions do you have about how rocks move through the rock cycle?

The Rock Cycle

In the rock cycle, natural processes change each type of rock into other types. Rocks can take many paths through the rock cycle and change into other types in any order.

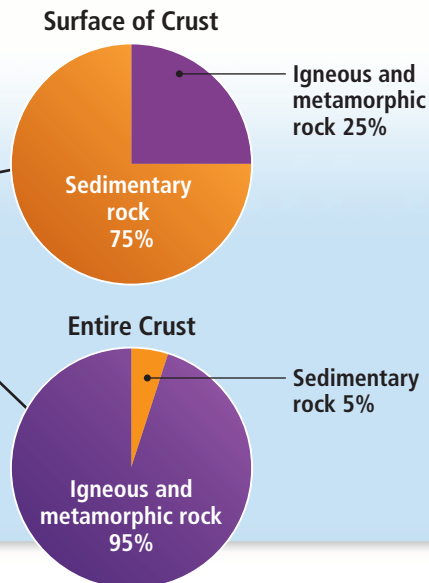
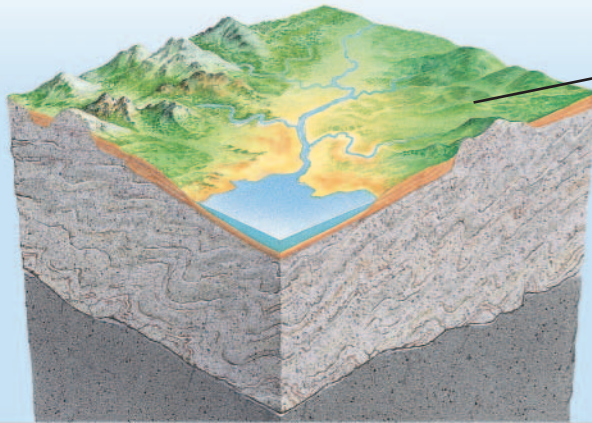


READING VISUALS

What are three different ways an igneous rock can change as it moves to another stage of the rock cycle?

Rocks in the Crust

Even though sedimentary rock is common at Earth's surface, as a whole the crust consists mainly of igneous and metamorphic rock.



Rocks in the Crust

Igneous, sedimentary, and metamorphic rocks are all found in Earth's crust. But these rock types are not evenly distributed. Most of Earth's crust—95 percent of it—consists of igneous rock and metamorphic rock. Sedimentary rock, which forms a thin covering on Earth's surface, makes up only 5 percent of the crust.

The distribution of rock types is a reflection of the rock cycle. Sedimentary rocks are most common at the surface because they are formed by processes that occur at the surface. Most igneous rocks and metamorphic rocks are formed by processes that occur deeper within Earth.



CHECK YOUR READING

Would you expect to find sedimentary rock deep in Earth's crust? Why or why not?

15.1 Review

KEY CONCEPTS

1. How are rocks and minerals different?
2. What are the three types of rock?
3. Which rock types are most common within Earth's crust? Which type is most common at Earth's surface?

CRITICAL THINKING

4. **Analyze** Why is the set of natural processes by which rocks change into other types of rocks called a cycle?
5. **Infer** Which type of rock would you expect to be common on the floor of a large, deep lake? Why?

CHALLENGE

6. **Synthesize** Draw a diagram showing how an igneous rock could change into a metamorphic rock and how the metamorphic rock could change into a sedimentary rock.