



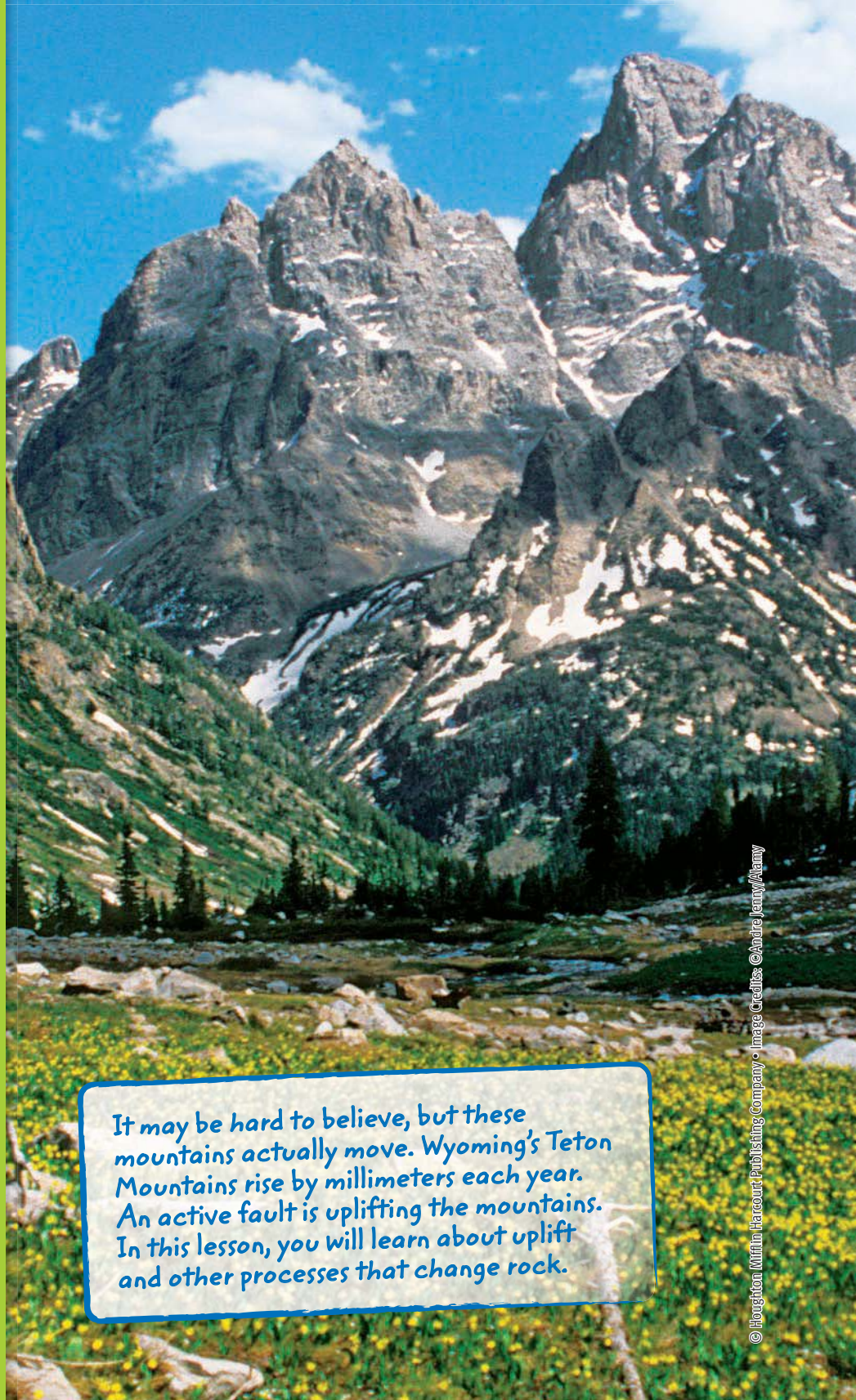
The Rock Cycle

ESSENTIAL QUESTION

What is the rock cycle?

By the end of this lesson, you should be able to describe the series of processes and classes of rocks that make up the rock cycle.

8.ESS2.3



It may be hard to believe, but these mountains actually move. Wyoming's Teton Mountains rise by millimeters each year. An active fault is uplifting the mountains. In this lesson, you will learn about uplift and other processes that change rock.



Quick Labs

- Crayon Rock Cycle
- Modeling Weathering



Engage Your Brain

- 1 Describe** Fill in the blank with the word or phrase that you think correctly completes the following sentences.

Most of Earth is made of _____

Rock is _____ changing.

The three main classes of rock are igneous, metamorphic, and _____

- 2 Describe** Write your own caption for this photo.



Active Reading

- 3 Synthesize** Many English words have their roots in other languages. Use the Latin words below to make an educated guess about the meaning of the words *erosion* and *deposition*.

Latin Word	Meaning
<i>erosus</i>	eaten away
<i>depositus</i>	laid down

Vocabulary Terms

- weathering
- erosion
- deposition
- igneous rock
- sedimentary rock
- metamorphic rock
- rock cycle
- uplift
- subsidence
- rift zone

- 4 Apply** As you learn the definition of each vocabulary term in this lesson, create your own definition or sketch to help you remember the meaning of the term.

Erosion:

Deposition:

Let's Rock!

What is rock?

The solid parts of Earth are made almost entirely of rock. Scientists define rock as a naturally occurring solid mixture of one or more minerals that may also include organic matter. Most rock is made of minerals, but some rock is made of nonmineral material that is not organic, such as glass. Rock has been an important natural resource as long as humans have existed. Early humans used rocks as hammers to make other tools. For centuries, people have used different types of rock, including granite, marble, sandstone, and slate, to make buildings, such as the pyramids shown below.

It may be hard to believe, but rocks are always changing. People study rocks to learn how areas have changed through time.

5 List How is rock used today?

The ancient Egyptians used a rock called limestone to construct the Great Sphinx and the pyramids at Giza.



These rock formations in Goreme, Turkey, are known as fairy chimneys. They were shaped by erosion.

Think Outside the Book

6 Design Create a travel brochure for Goreme, Turkey.

What processes change rock?

Natural processes make and destroy rock. They change each type of rock into other types of rock and shape the features of our planet. These processes also influence the type of rock that is found in each area of Earth's surface.



Active Reading 7 Identify As you read, underline the processes and factors that can change rock.

Weathering, Erosion, and Deposition

The process by which water, wind, ice, and changes in temperature break down rock is called **weathering**. Weathering breaks down rock into fragments called *sediment*. The process by which sediment is moved from one place to another is called **erosion**. Water, wind, ice, and gravity can erode sediments. These sediments are eventually deposited, or laid down, in bodies of water and other low-lying areas. The process by which sediment comes to rest is called **deposition**.

Temperature and Pressure

Rock that is buried can be squeezed by the weight of the rock or the layers of sediment on top of it. As pressure increases with depth beneath Earth's surface, so does temperature. If the temperature and pressure are high enough, the buried rock can change into metamorphic rock. In some cases, the rock gets hot enough to melt and forms *magma*, or molten rock. If magma reaches Earth's surface, it is called *lava*. The magma or lava eventually cool and solidify to form new rock.

Classified Information!

What are the classes of rocks?

Rocks fall into three major classes based on how they form.

Igneous rock forms when magma or lava cools and hardens to become solid. It forms beneath or on Earth's surface. **Sedimentary rock** forms when minerals that form from solutions or sediment from older rocks get pressed and cemented together. **Metamorphic rock** forms when pressure, temperature, or chemical processes change existing rock. Each class can be divided further, based on differences in the way rocks form. For example, some igneous rocks form when lava cools on Earth's surface, and others form when magma cools deep beneath the surface. Therefore, igneous rock can be classified based on how and where it forms.



Active Reading

8 Identify As you read the paragraph, underline the three main classes of rocks.

Think Outside the Book Inquiry

9 Apply With a classmate, discuss the processes that might have shaped the rock formations in the Valley of Fire State Park.

Sedimentary

Sedimentary rock is composed of minerals formed from solutions or sediments from older rock. Sedimentary rock forms when the weight from above presses down on the layers of minerals or sediment, or when minerals dissolved in water solidify between sediment pieces and cement them together.

Sedimentary rocks are named according to the size and type of the fragments they contain. For example, the rock shown here is made of sand and is called sandstone. Rock made primarily of the mineral calcite (calcium carbonate) is called limestone.

These formations in Valley of Fire State Park in Nevada are made of sandstone, a sedimentary rock.



Enchanted Rock in Texas is a large dome made of granite, an intrusive igneous rock.

Igneous Rock

Igneous rock forms from cooling lava and magma. As molten rock cools and becomes solid, the minerals crystallize and grow. The longer the cooling takes, the more time the crystals have to grow. The granite shown here cooled slowly and is made of large crystals. Rock that forms when magma cools beneath Earth's surface is called intrusive igneous rock. Rock that forms when lava cools on Earth's surface is called extrusive igneous rock.



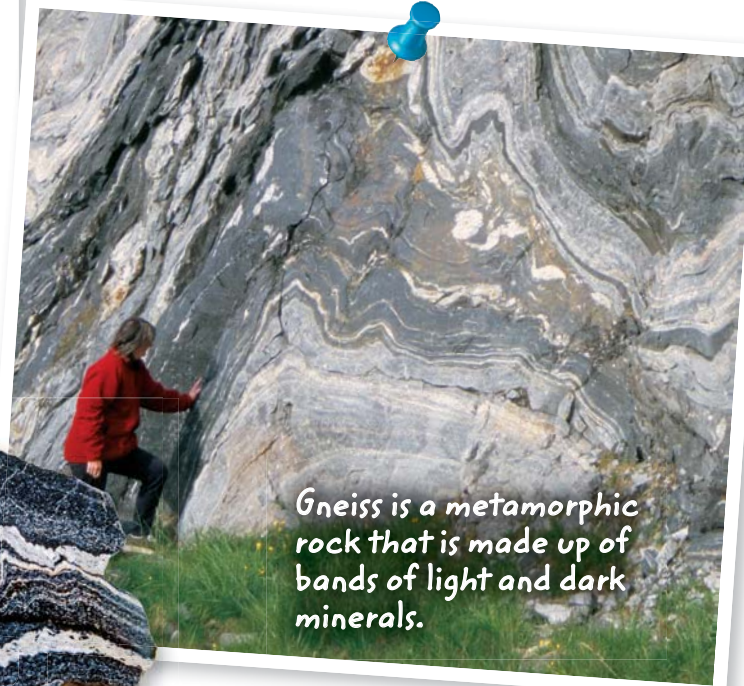
granite

Metamorphic Rock

Metamorphic rock forms when high temperature and pressure change the texture and mineral content of rock. For example, a rock can be buried in Earth's crust, where the temperature and pressure are high. Over millions of years, the solid rock changes, and new crystals are formed. Metamorphic rocks may be changed in four ways: by temperature, by pressure, by temperature and pressure combined, or by fluids or other chemicals. Gneiss, shown here, is a metamorphic rock. It forms at high temperatures deep within Earth's crust.



gneiss



Gneiss is a metamorphic rock that is made up of bands of light and dark minerals.

10 Compare Fill in the chart to compare and contrast sedimentary, igneous, and metamorphic rock.

Classes of Rocks

Sedimentary rock	Igneous rock	Metamorphic rock

What is the rock cycle?

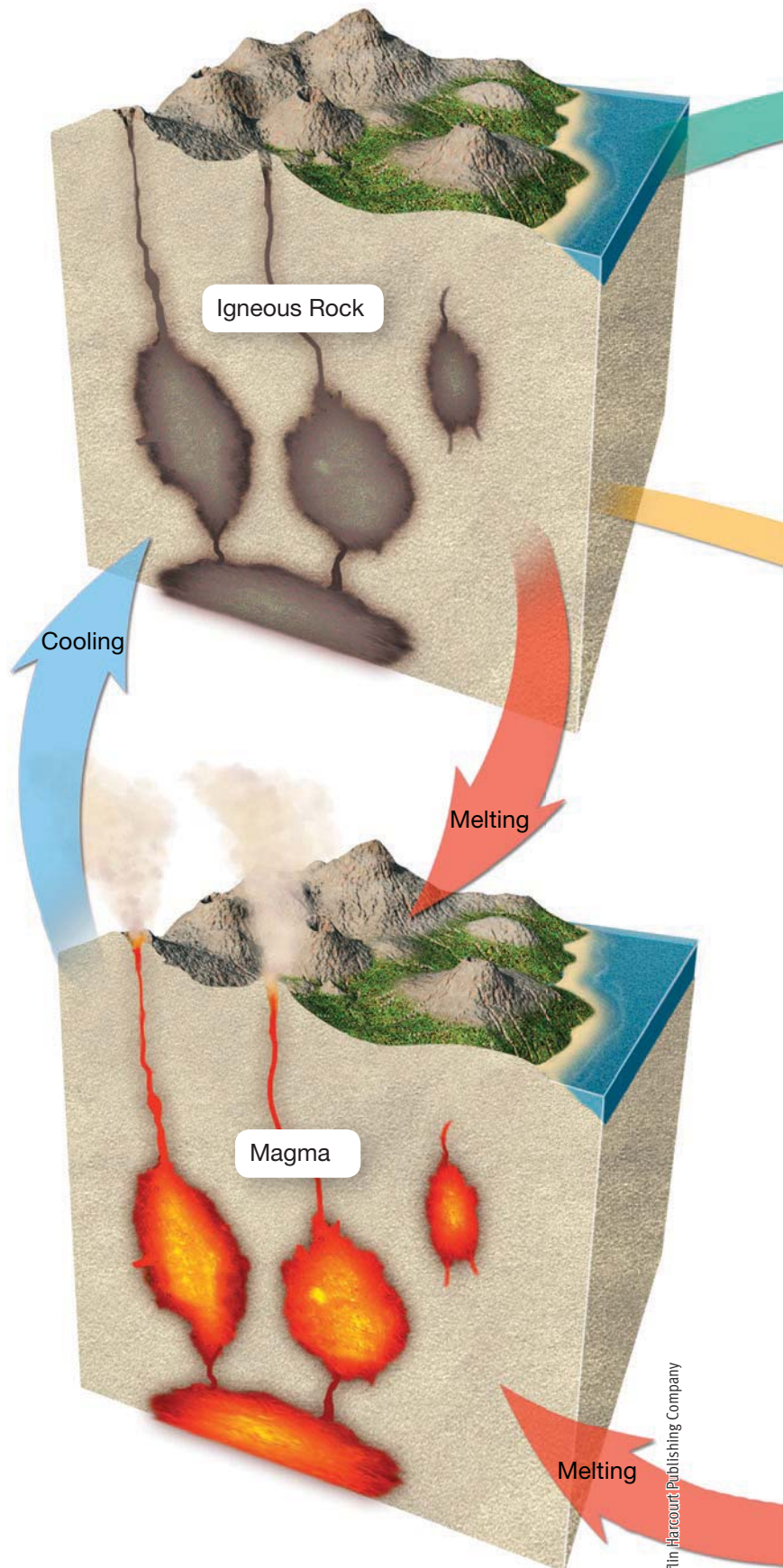
Active Reading 11 Apply As you read, underline the rock types that metamorphic rock can change into.

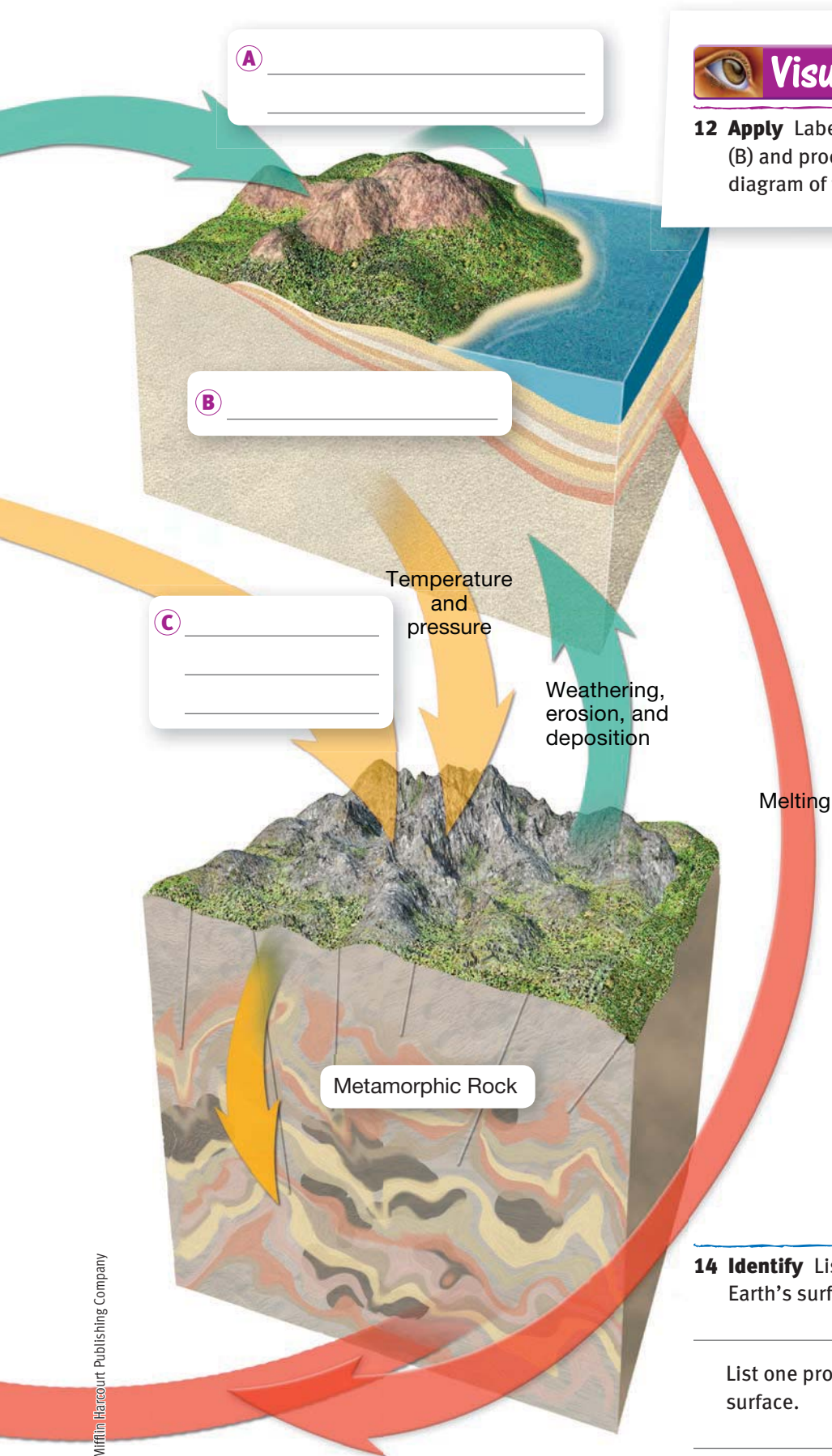
Rocks may seem very permanent, solid, and unchanging. But over millions of years, any of the three rock types can be changed into another of the three types. For example, igneous rock can change into sedimentary or metamorphic rock, or back into another kind of igneous rock. This series of processes in which rock changes from one type to another is called the **rock cycle**. Rocks may follow different pathways in the cycle. Examples of these pathways are shown here. Factors, including temperature, pressure, weathering, and erosion, may change a rock's identity. Where rock is located on a tectonic plate and whether the rock is at Earth's surface also influence how it forms and changes.

When igneous rock is exposed at Earth's surface, it may break down into sediment. Igneous rock may also change directly into metamorphic rock while still beneath Earth's surface. It may also melt to form magma that becomes another type of igneous rock.

When sediment is pressed together and cemented, the sediment becomes sedimentary rock. With temperature and pressure changes, sedimentary rocks may become metamorphic rocks, or they may melt and become igneous rock. Sedimentary rock may also be broken down at Earth's surface and become sediment that forms another sedimentary rock.

Under certain temperature and pressure conditions, metamorphic rock will melt and form magma. Metamorphic rock can also be altered by heat and pressure to form a different type of metamorphic rock. Metamorphic rock can also be broken down by weathering and erosion to form sediment that forms sedimentary rock.





Visualize It!

12 Apply Label the missing rock type (B) and processes (A and C) on the diagram of the rock cycle.

Think Outside the Book

13 Apply Write a series of blog entries from the viewpoint of igneous rock that is changing into sedimentary rock.

14 Identify List one process that happens above Earth's surface.

List one process that happens below Earth's surface.

How do tectonic plate motions affect the rock cycle?

Tectonic plate motions can move rock around. Rock that was beneath Earth's surface may become exposed to wind and rain. Sediment or rock on Earth's surface may be buried. Rock can also be changed into metamorphic rock by tectonic plate collisions because of increased temperature and pressure.

By Moving Rock Up or Down

15 Compare How does uplift differ from subsidence?

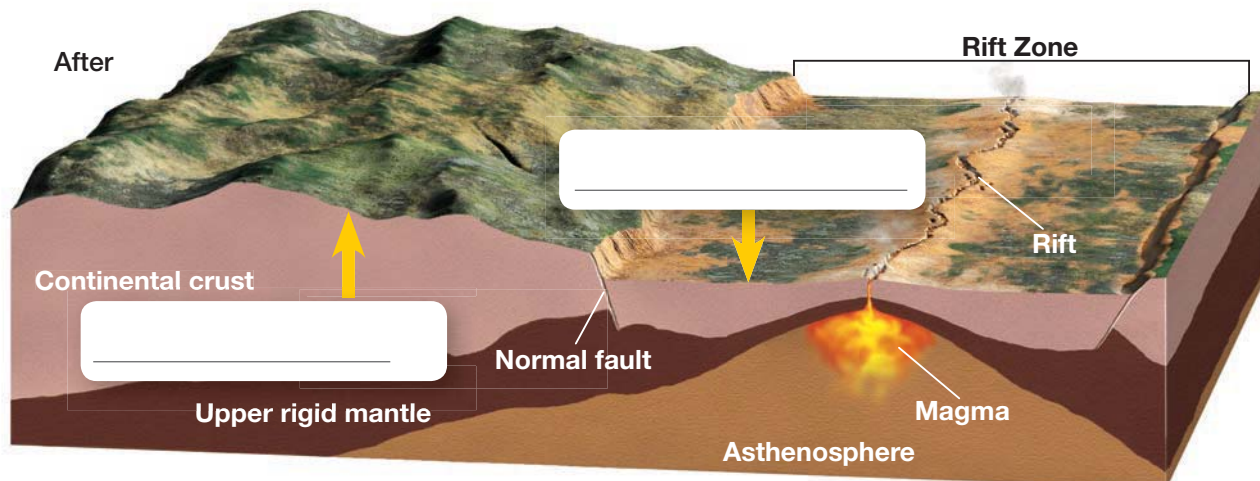
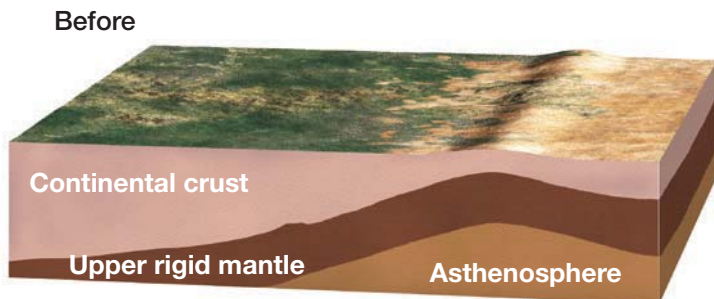
There are two types of vertical movements in Earth's crust: uplift and subsidence. **Uplift** is the rising of regions of the crust to higher elevations. Uplift increases the rate of erosion on rock. **Subsidence** is the sinking of regions of the crust to lower elevations. Subsidence leads to the formation of basins where sediment can be deposited.

By Pulling Apart Earth's Surface

A **rift zone** is an area where a set of deep cracks form. Rift zones are common between tectonic plates that are pulling apart. As they pull apart, blocks of crust in the center of the rift zone subside and the pressure on buried rocks is reduced. The reduction in pressure allows rock below Earth's surface to rise up. As the rock rises, it undergoes partial melting and forms magma. Magma can cool below Earth's surface to form igneous rock. If it reaches the surface, magma becomes lava, which can also cool to form igneous rock.



16 Predict Label uplift and subsidence on this diagram. What pathway in the rock cycle might rock take next if it is subjected to uplift? Explain.



Why It Matters

Cliff Dwellings

WEIRD
SCIENCE

Can you imagine living on the side of a cliff? Some ancient peoples could! They created dwellings from cliff rock. They also decorated rock with art, as you can see in the pictographs shown below.

Cliff Palace

This dwelling in Colorado is called the Cliff Palace. It was home to the Ancient Puebloans from about 550 to 1300 CE.

Cliff Art

These pictographs are located at the Gila Cliff Dwellings in New Mexico.

A Palace in Rock

Ancient cliff dwellings are also found outside the United States. These dwellings from about 70 CE are located in Petra, Jordan.

Extend

- 17 Identify** Describe how ancient people used rock to create shelter.
- 18 Research** Find out how people lived in one of the cliff dwelling locations. How did living in a rock environment affect their daily lives?

- 19 Produce** Illustrate how the people lived by doing one of the following: write a play, write a song, or create a graphic novel.

Inquiry

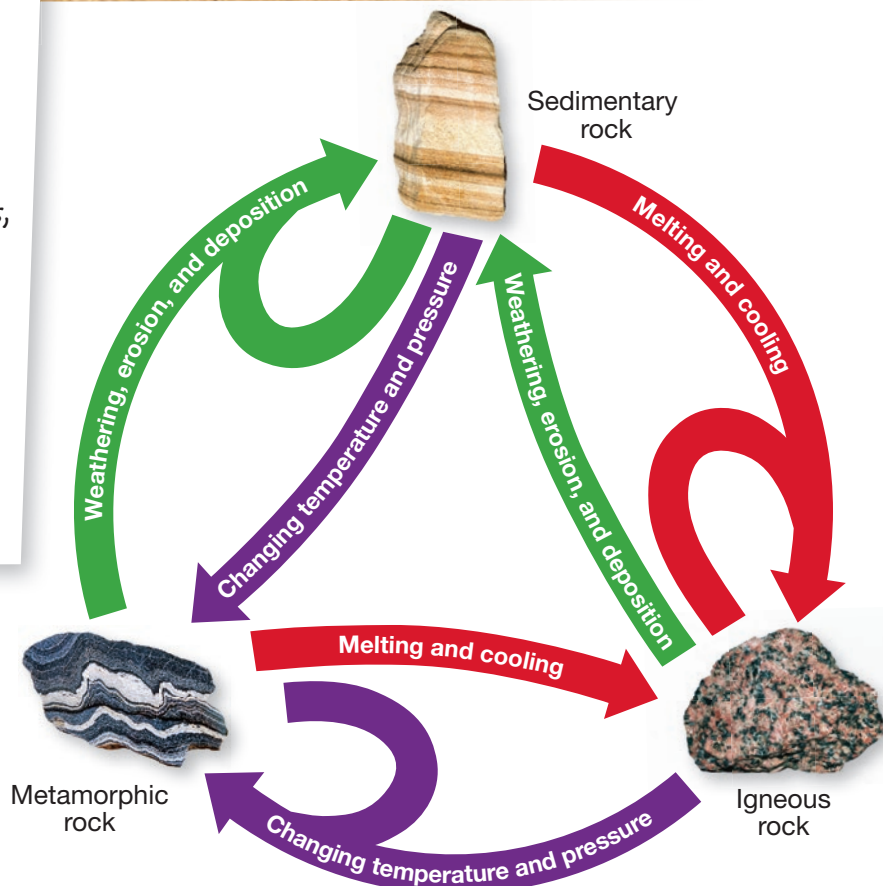
Visual Summary

To complete this summary, use what you know about the rock cycle to fill in the blanks below. Then use the key below to check your answers. You can use this page to review the main concepts of the lesson.

Each rock type can change into another of the three types.

- 20 When sediment is pressed together and cemented, the sediment becomes _____
- 21 When lava cools and solidifies, _____ forms.
- 22 Metamorphic rock can be altered by temperature and pressure to form a different type of _____

Rock Cycle



Answers: 20 sedimentary rock; 21 igneous rock; 22 metamorphic rock

- 23 **Explain** What factors and processes can affect the pathway that igneous rock takes in the rock cycle?

Lesson Review

Vocabulary

In your own words, define the following terms.


1 Rock cycle

2 Weathering

3 Rift zone

Key Concepts

Use these photos to classify the rock as sedimentary, igneous, or metamorphic.

Example	Type of rock
4 Classify This rock is made up of the mineral calcite, and it formed from the remains of organisms that lived in water.	
5 Classify Through high temperature and pressure, this rock formed from a sedimentary rock.	
6 Classify This rock is made of tiny crystals that formed quickly when molten rock cooled at Earth's surface.	

7 Describe How can sedimentary rock become metamorphic rock?

8 Explain How can subsidence lead to the formation of sedimentary rock?

9 Explain Why are rift zones common places for igneous rock to form?

Critical Thinking

10 Hypothesize What would happen to the rock cycle if erosion did not occur?

11 Criticize A classmate states that igneous rock must always become sedimentary rock next, according to the rock cycle. Explain why this statement is not correct.

12 Predict Granite is an igneous rock that forms from magma cooled below Earth's surface. Why would granite have larger crystals than igneous rocks formed from lava cooled above Earth's surface?

My Notes

