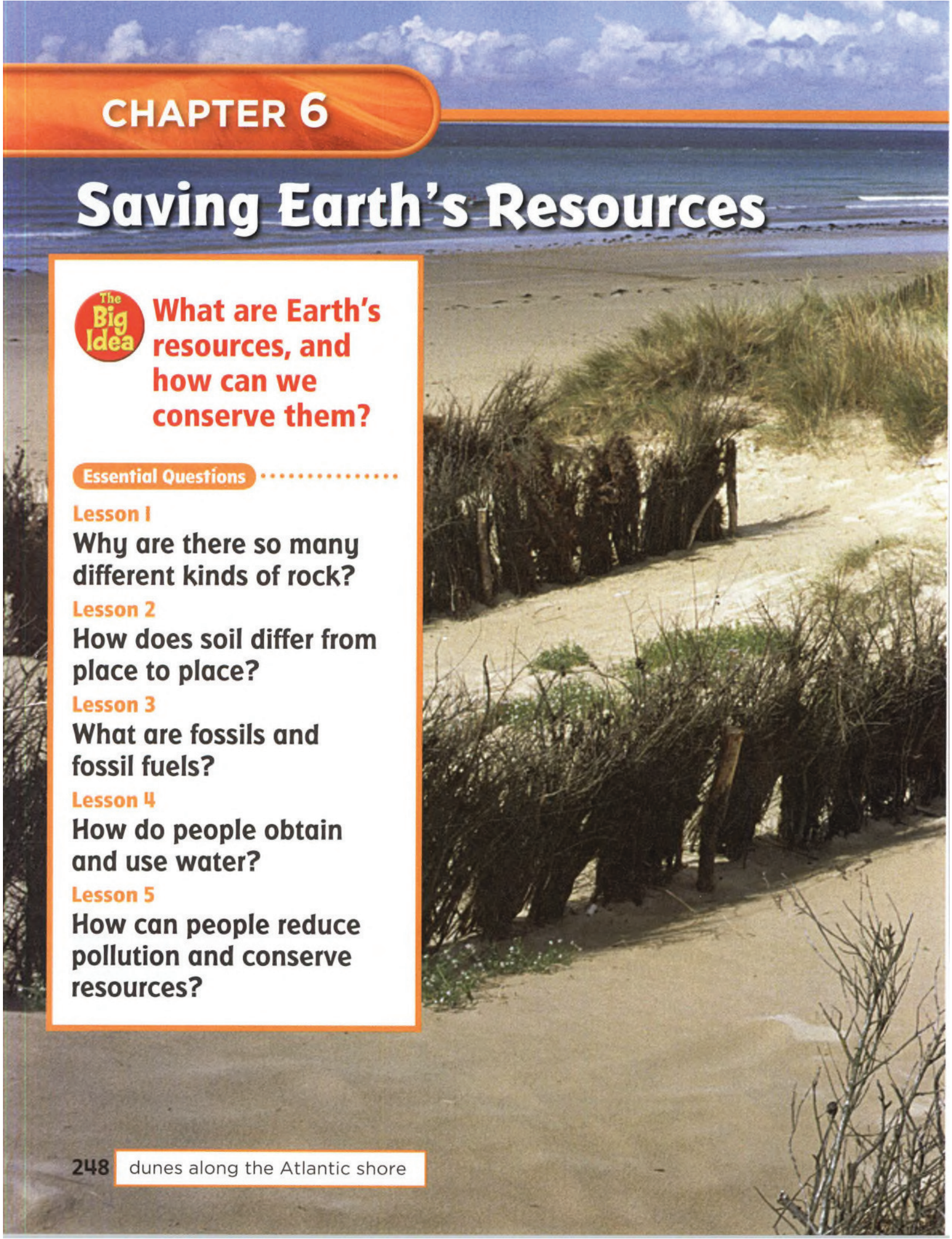
CHAPTER 6

Saving Earth's Resources



The Big Idea

What are Earth's resources, and how can we conserve them?

Essential Questions

Lesson 1
Why are there so many different kinds of rock?

Lesson 2
How does soil differ from place to place?

Lesson 3
What are fossils and fossil fuels?

Lesson 4
How do people obtain and use water?

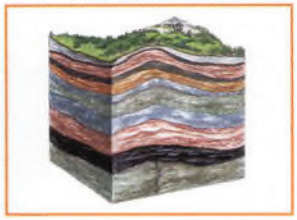
Lesson 5
How can people reduce pollution and conserve resources?

dunes along the Atlantic shore

The Big Idea Big Idea Vocabulary

mineral a natural, nonliving, usually solid material from Earth's crust (p. 252)

topsoil surface soil layer rich in nonliving plant and animal matter and minerals (p. 265)



fossil fuel an energy source from the remains of an organism that lived millions of years ago (p. 278)

reservoir a storage area for holding and managing freshwater (p. 288)

pollution harmful or unwanted material that has been added to the environment (p. 296)

conservation the wise use of resources (p. 298)

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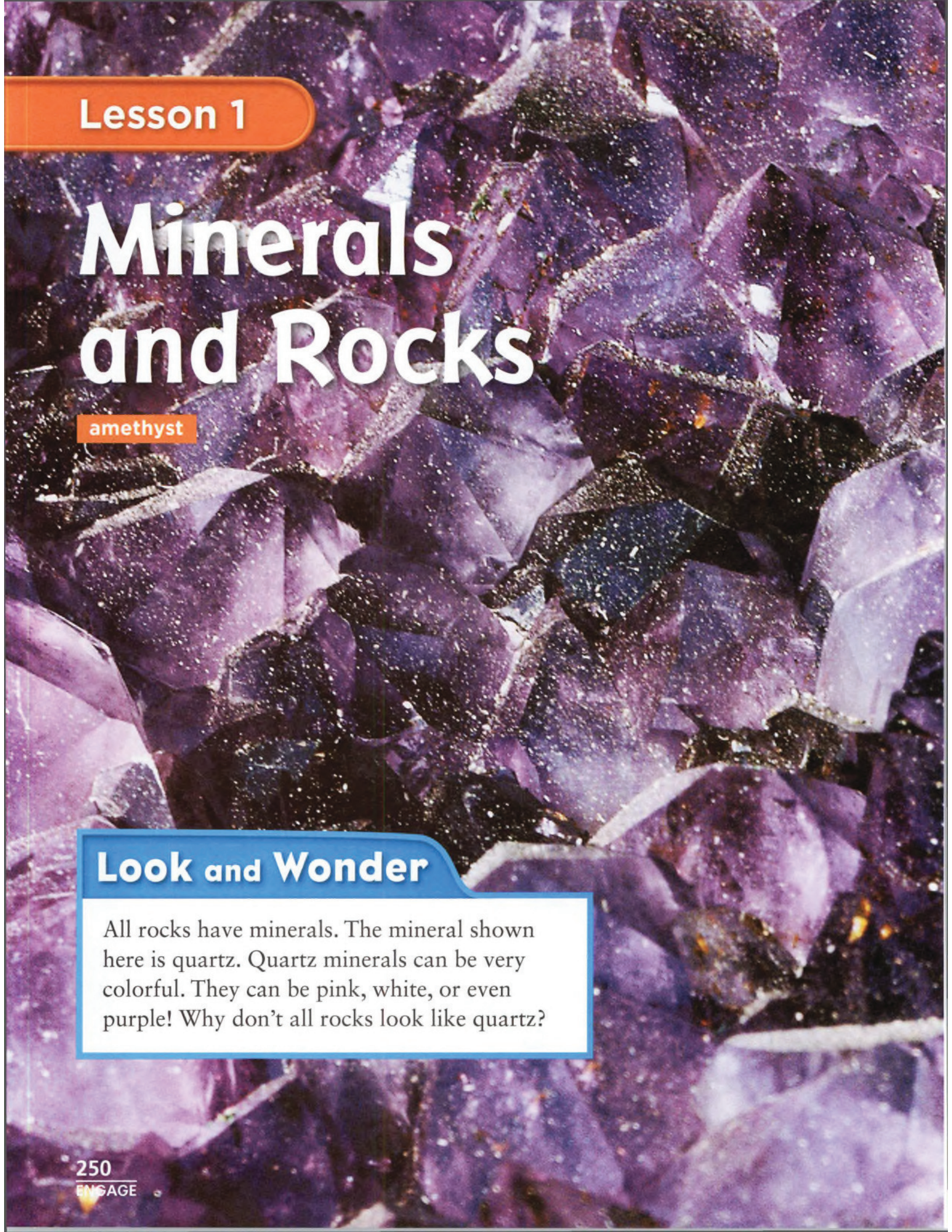
Lesson 1

Minerals and Rocks



amethyst

Look and Wonder

All rocks have minerals. The mineral shown here is quartz. Quartz minerals can be very colorful. They can be pink, white, or even purple! Why don't all rocks look like quartz?

Explore

Inquiry Activity

What makes rocks different from one another?

Purpose

Explore the properties of different rocks.

Procedure

1. Look at each rock. What color is the rock? What is its shape? How does it feel?
2. **Communicate** Make a chart to record all your observations.
3. **Observe** Choose a rock that has more than one color. Using a hand lens, compare the parts that are the same color. Are those parts shiny or dull? Rough or smooth? Record your observations in your chart.
4. Choose another color in the same rock. How do the parts with this color compare?

Draw Conclusions

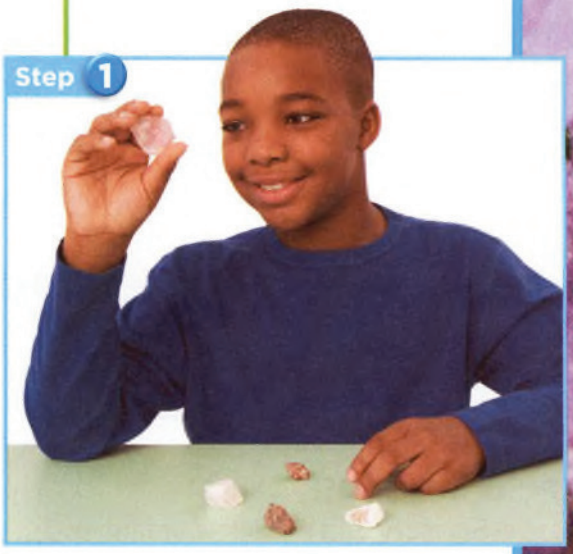
5. **Infer** Are the differently colored parts of the rock made of the same or different materials? Explain your answer.
6. What do you think makes these rocks different from one another?

Explore More

Choose one of the rocks. How could you identify the rock and tell what it is made of? Do some research. Report your findings.

Materials

- several different rocks
- hand lens



Read and Learn

Essential Question

Why are there so many different kinds of rock?

Vocabulary

mineral, p. 252

igneous rock, p. 254

sedimentary rock, p. 255

relative age, p. 255

metamorphic rock, p. 256

rock cycle, p. 256

resource, p. 258

Reading Skill

Sequence

First

Next

Last

Technology

e-Glossary and e-Review online at www.macmillanmh.com

What is a mineral?

Why are rocks so different from each other? To answer that question, it helps to know about minerals (MIH•nuh•rulz). A **mineral** is a natural, nonliving substance that makes up rock. In fact, minerals are the building blocks of rocks.

Scientists have identified more than 3,000 kinds of minerals. How? They observe minerals' properties. A *property* is a characteristic that describes something. Look at the minerals shown on these pages. Each has different properties.

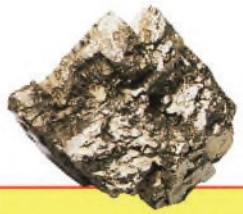
Color

One property is color. Talc, for example, is white. Topaz can be blue. Color alone, however, cannot identify minerals. Many minerals have the same color. Quartz can be many different colors!

Hardness

Hardness is a property that refers to a mineral's ability to scratch another mineral or be scratched by another mineral. Mohs' scale shows the hardness of a few common minerals. Each mineral has a number from one to ten. Ten is the hardest kind. The harder a mineral is, the more it resists scratching. As the scale shows, diamond is the hardest mineral of all.

Properties of Minerals

Mineral	mica	pyrite	feldspar	hematite
Color	white, green, silver, or brown	gold or brassy yellow	white, pink, gray, or smoky black	gray or brown
Luster	pearly	metallic	glassy	metallic or dull
Streak	white	green-black	white	red
Hardness	2–2.5	6–6.5	6–6.5	5–6

Luster

Luster refers to the way light bounces off the surface of a mineral. Some minerals have a *metallic*, or shiny, luster. Minerals that have no shine at all have a dull luster. As the table shows, other minerals have glassy or pearly lusters.

Streak

When you scratch a mineral along a white tile, it leaves behind a powder. *Streak* is the color of that powder. The streak may be different from the color of a mineral's surface.

Quick Check

Sequence What steps would you follow to identify a mineral?

Critical Thinking Why do scientists use several properties to identify a mineral?

Read a Table

Which is harder—feldspar or calcite?

Clue: Compare the values for these minerals on Mohs' scale.





feldspar — quartz — topaz — corundum — diamond

6 — 7 — 8 — 9 — 10 hardest

What are igneous and sedimentary rocks?

Have you ever wondered how a rock forms? Its minerals offer clues.

Igneous Rocks

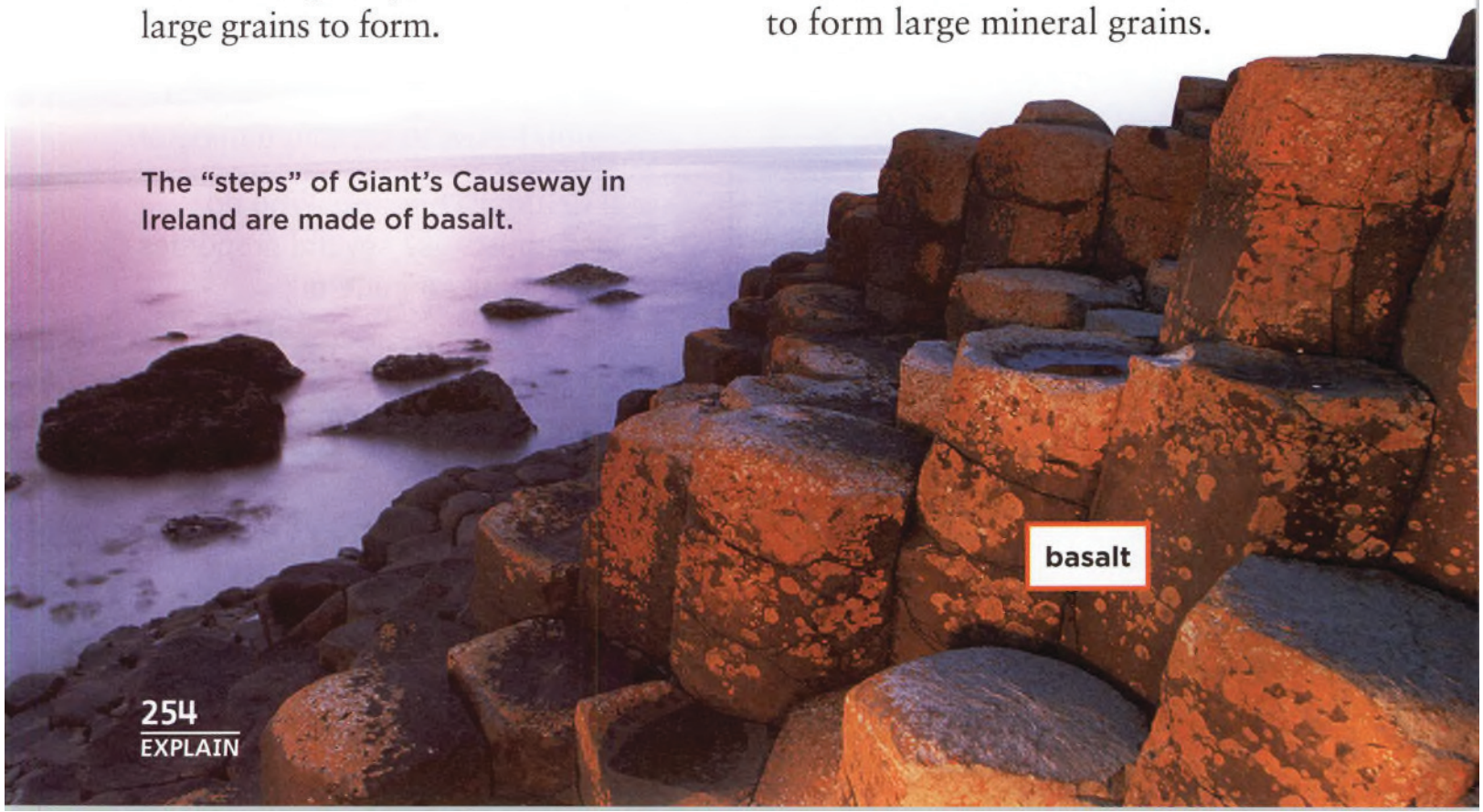
Below Earth's surface are areas of melted rock called magma. When magma cools and hardens, igneous (IG•nee•us) rocks form. *Igneous* is a Latin word meaning "fire." **Igneous rocks** form from melted rock—either from magma below Earth's crust or from lava above it.

When a rock cools slowly, large mineral grains can form. The cooled rock looks rough or coarse. *Texture* is a property that describes the appearance of a rock. It is related to the size of the mineral grains. If a rock cools quickly, there is no time for large grains to form.

Ancient North American hunters used obsidian to make spears.

Examples of Igneous Rocks

Both obsidian (ub•SIH•dee•un) and basalt (buh•SAWLT) cooled quickly. Obsidian is smooth and glassy. It cooled so quickly that mineral grains did not have time to form. Basalt has small mineral grains because it cooled more slowly than obsidian. Granite (GRA•nut) is different. It cooled slowly underground. It had enough time to form large mineral grains.



The "steps" of Giant's Causeway in Ireland are made of basalt.

Sedimentary Rocks

Look at the picture of sandstone. Do you see its layers? These layers are made of tiny pieces called *sediment* (SE•duh•munt). Some sediments are from rocks or minerals. Others are bits of plants, shells, or other hard materials.

Sedimentary rocks form from sediments that are cemented or pressed together. Wind and water deposit most of the sediments. Over time, new sediments are deposited on top of older layers. Sometimes dissolved minerals will cement the sediments together. Other times the weight of the top layers presses the sediment together. It can take millions of years for sediment to become rock.

Relative Age

The layers in sedimentary rock are stacked in order of their relative ages. **Relative age** is the age of one thing compared to another. The older the relative age of a rock layer, the lower it is found. Relative age also applies to any fossils in the rock layers. A *fossil* is a trace of something that was once alive.

Quick Check

Sequence How do sedimentary rocks form?

Critical Thinking Can you observe sedimentary rocks forming? Explain.

FACT A rock can be made from more than one mineral.

Quick Lab

Observing Igneous Rocks

1. Obtain a piece of pumice and a piece of granite. How do these two igneous rocks compare in size and weight?
2. **Predict** Will the rocks sink or float? Explain your prediction.
3. Place both rocks in water. What happens?
4. **Infer** What property might have contributed to whether the rocks sink or float?

sandstone

Sandstone has the minerals quartz and feldspar. It is often used as a building stone.

What are metamorphic rocks?

Temperatures below Earth's surface can be very high. Pressure there is high too. When rocks are under so much heat and pressure, their chemical properties can change.

Rocks formed from other rocks by extreme heat and pressure are called **metamorphic** (me•tuh•MOR•fik) **rocks**. These rocks can form from igneous, sedimentary, or even other metamorphic rocks. The chart shows some metamorphic rocks and the rocks they formed from.

How Metamorphic Rocks Form

The properties of metamorphic rocks depend on the amounts of heat and pressure. In some rocks, the minerals get rearranged and pressed into thin layers. These layers are called *bands*. Bands may be straight or wavy.

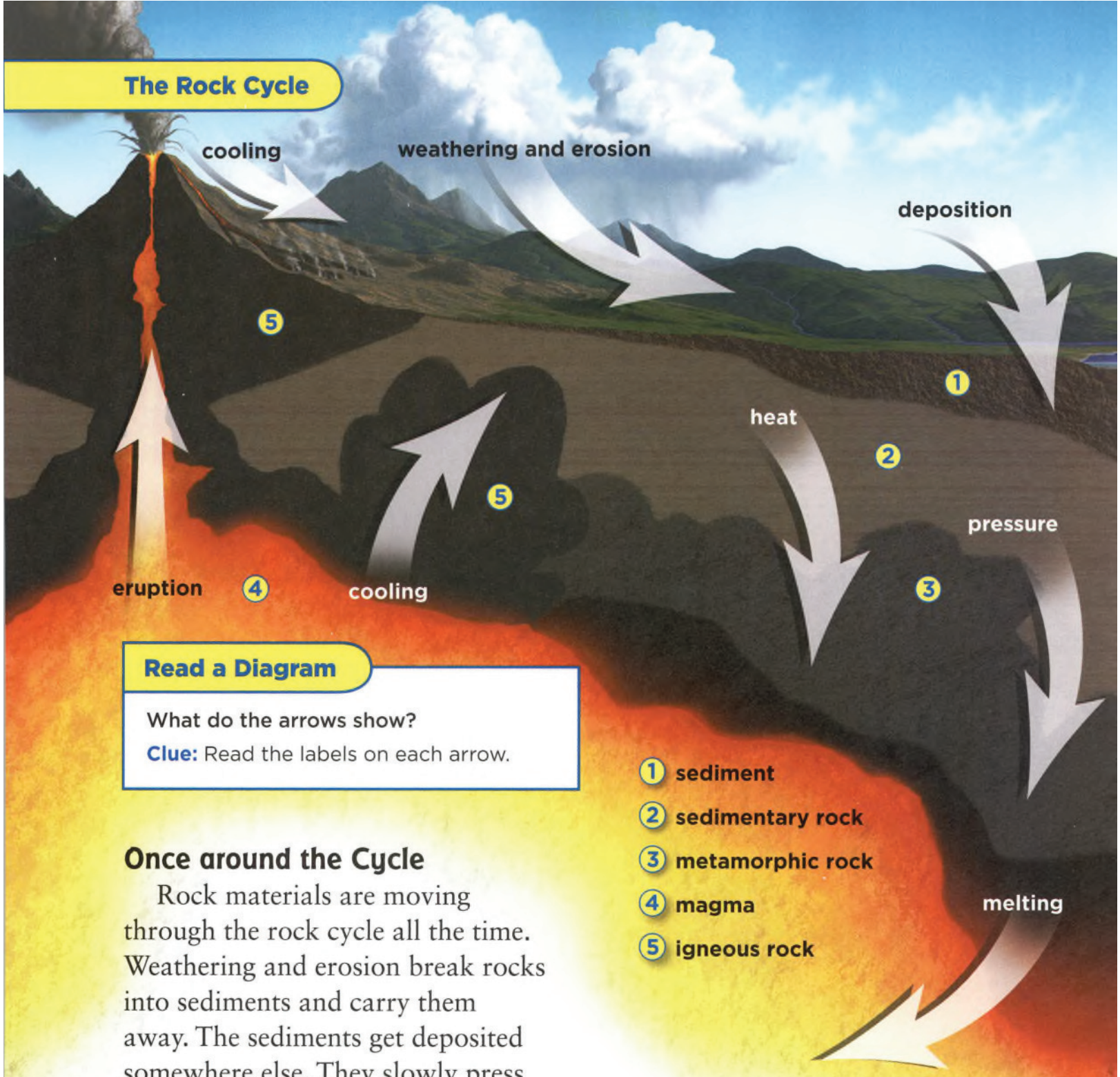
You can see an example of banding in a metamorphic rock called gneiss (NISE). Gneiss starts out as granite—an igneous rock. It takes lots of heat and pressure for those colorful bands to form.

Some metamorphic rocks form from sedimentary rocks. Marble, for example, forms from limestone. Unlike gneiss, marble does not have bands. Quartzite is another metamorphic rock that does not have bands. It forms from sandstone.

The Rock Cycle

You have learned how igneous, sedimentary, and metamorphic rocks form. Does it surprise you that they can all change from one type to another?

The **rock cycle** shows how rocks change from one form to another. It shows how all rocks are related to one another. As you can see on the next page, the rock cycle has many paths. It also takes millions of years!



Read a Diagram

What do the arrows show?

Clue: Read the labels on each arrow.

Once around the Cycle

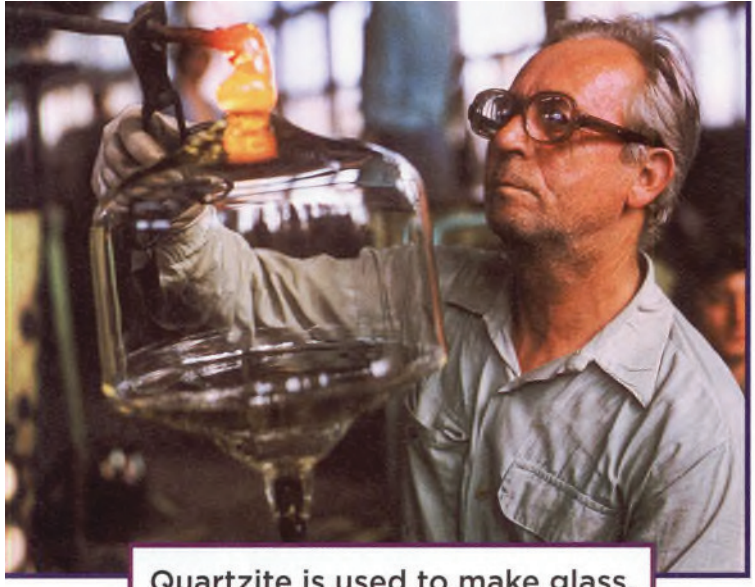
Rock materials are moving through the rock cycle all the time. Weathering and erosion break rocks into sediments and carry them away. The sediments get deposited somewhere else. They slowly press together to form sedimentary rock.

Any rock can melt and cool to form igneous rock. Under extreme heat and pressure, some rocks become metamorphic. In time, weathering and erosion break those rocks apart, and the cycle goes on.

Quick Check

Sequence Describe one path through the rock cycle.

Critical Thinking Compare slow and fast events in the rock cycle.



Quartzite is used to make glass.

▼ This guardian lion in Thailand is made of marble.

How do we use rocks?

Rocks and minerals are **resources**—materials from Earth that have useful properties. You can see examples all around you.

Uses of Igneous Rocks

Granite is strong and long lasting. These qualities make it ideal for building schools and other structures. Pumice is found in some soaps and cleansers. Its rough texture helps to scrub off dirt.

Uses of Sedimentary Rocks

Limestone is often used to make glass. Shale is used to make bricks, china, and pottery. When shale is combined with limestone, it can be used to make cement. Scientists use the layers in sedimentary rocks to piece together Earth's history.

Uses of Metamorphic Rocks

Slate is waterproof. It is a good choice as tiles for roofs, billiard tables, and walkways. Marble is valued for its beauty and strength. We use it in flooring, hearths, monuments, and statues. It is easy to carve and it resists fire.

Quick Check

Sequence How can a rock end up in a building?

Critical Thinking How have you used rocks today?

Lesson Review

Visual Summary

Minerals are the building blocks of rocks. Scientists use several properties to identify minerals.

Rock classification includes igneous, sedimentary, and metamorphic rocks.

Rocks change form slowly during **the rock cycle.** Many rocks make useful resources.

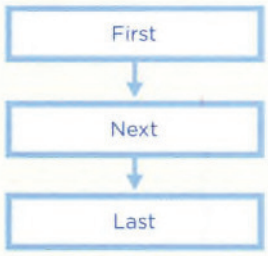
Make a FOLDABLES® Study Guide

Make a three-tab book. Use it to summarize what you read about rocks and minerals.

Think, Talk, and Write

1. **Vocabulary** Rocks that have been changed into new rock by heat and pressure are called _____.

2. **Sequence** What happens in the rock cycle?



3. **Critical Thinking** Would you be more likely to find a fossil in a metamorphic rock or a sedimentary rock? Explain.

4. **Test Prep** **Which property of a mineral does Mohs' scale measure?**
   - **A** luster
   - **B** texture
   - **C** color
   - **D** hardness

5. **Essential Question** Why are there so many different kinds of rock?

Math Link

Solve a Problem
José has 33 rock samples. Exactly $\frac{1}{3}$ are igneous, $\frac{1}{3}$ are sedimentary, and $\frac{1}{3}$ are metamorphic. How many samples of each type does he have?

Social Studies Link

Learn about Rocks in Your Area
What types of rock make up the land where you live? Research the answer at the library. Write a report about your findings.

Focus on Skills

Inquiry Skill: Communicate

Metamorphic rocks have many grains of minerals. By observing these minerals, scientists can tell what transformed one rock type into another. They make models to show how the size and shape of the minerals change. You **communicate** to tell others your findings.

▶ Learn It

When you **communicate**, you share information with others. In science, it is important to be as clear as you can be about your results. Then people can understand what you did and what you found. It is a good idea to communicate in more than one way. You can show your results as a diagram, chart, or table. You can write a report too.

▶ Try It

Model the effect of pressure on metamorphic rock. Then **communicate** your results.

Materials **clay, mat or tray, ruler, wood block**

1. Roll modeling clay into three balls on a mat or tray. Make them equal in size. Flatten the clay balls slightly so they have two sides. Smooth the sides so you can stack the balls on top of one another. These model the grains of minerals in rock.
2. Make a data chart like the one shown on the opposite page.
3. Observe the shape of your model grains. Draw their shapes in your data chart.
4. Measure the height of the grains in centimeters. Record the measurement in your data chart. Do the same for the width of the grains.

5. Place the flat part of the wood block at the top of the stack. Slowly but firmly push down on the block. This models how pressure squeezes the grains of minerals from above.
6. Repeat steps 3 and 4. Enter your results in the chart where it says *After Squeezing*.

	Drawing of Grains	Height of Grains (cm)	Width of Grains (cm)
Before Squeezing			
After Squeezing			

▶ Apply It

Using your data chart, **communicate** your results in a report.

1. Write a summary sentence describing how the grains changed.
2. How did the height and width change? Did your measurements increase or decrease? Write two sentences explaining how the measurements of your model changed.
3. Write a short paragraph explaining how your model is like a real metamorphic rock below the ground. Communicate your conclusions.
4. What would happen if you squeezed the model grains from side to side? How would they change? Finish your report with your prediction.

Lesson 2

Soil

vineyard, Napa Valley, California

Look and Wonder

Farmers depend on soil to grow healthy crops. That means you depend on soil too! Just what is soil? How does it form?

Explore

Inquiry Activity

What is soil made of?

Purpose

Compare the parts and properties of different soil samples.

Procedure

1. Spread newspaper over a desk or table. Then spread three sheets of paper towel on the newspaper. Place one soil sample on each towel.
2. **Observe** Use the pencil to separate pieces from each sample. Observe the pieces closely with the hand lens. Record your observations.
3. Place ten drops of water on each sample. After a few minutes, lift the paper towels. Observe any water stains on the newspaper.

Draw Conclusions

4. **Interpret Data** Which sample takes up the most water? Explain your evidence.
5. How are the soil samples alike? How are they different?
6. What kind of materials do you think make up each soil sample?
7. **Infer** Why is the ability to hold water an important property of soil?

Materials

- newspaper
- paper towels
- 3 soil samples
- pencil
- hand lens
- eyedropper
- water

Explore More

Exactly how much water is in each soil sample? Form a hypothesis. Design an experiment to test your idea. Try it and report your results.

Read and Learn

Essential Question

How does soil differ from place to place?

Vocabulary

humus, p. 264

horizon, p. 265

soil profile, p. 265

topsoil, p. 265

subsoil, p. 265

pore spaces, p. 266

porous, p. 266

permeability, p. 266

Reading Skill

Draw Conclusions

Text Clues	Conclusions

Technology

e-Glossary, e-Review, and animations online at www.macmillanmh.com

What is soil made of?

If you look at soil with a hand lens, you find many different things. You find small pieces of rocks and minerals. You also find humus (HYEW•mus). **Humus** is nonliving plant or animal matter. What else is in soil? Some things you may not see are water, air, and living things.

How Soil Forms

Soil can take hundreds or thousands of years to form. Through weathering, rock becomes sediment. The sediment gets deeper the longer the rock is weathered. Plants take root in the sediment and weather more of the rock. Animals move and mix the sediment.

When plants and animals die, bacteria and fungi decompose them. Humus forms. Humus has nutrients for new plants to grow. In this way, living things renew the soil year after year.

Weathering Caused by Living Things

Read a Photo

How can animals contribute to the soil?

Clue: Look closely at where the rabbit is.

Science in Motion Watch animals in the soil at www.macmillanmh.com

Soil Horizons

Soil forms in layers called **horizons** (huh•RI•zunz). Each horizon has a different amount of sediment, rock, and humus. A **soil profile** shows these horizons. In some places, the soil profile might look like the one on this page.

The layer of soil at the surface is called the A horizon. It is rich in humus and minerals. Another name for the A horizon is **topsoil**. Topsoil is home to many living things.

The next layer down is the B horizon, or **subsoil**. It is often lighter and harder than topsoil. It has bits of clay and minerals that trickle down from the topsoil. The roots of strong plants grow down into the subsoil.

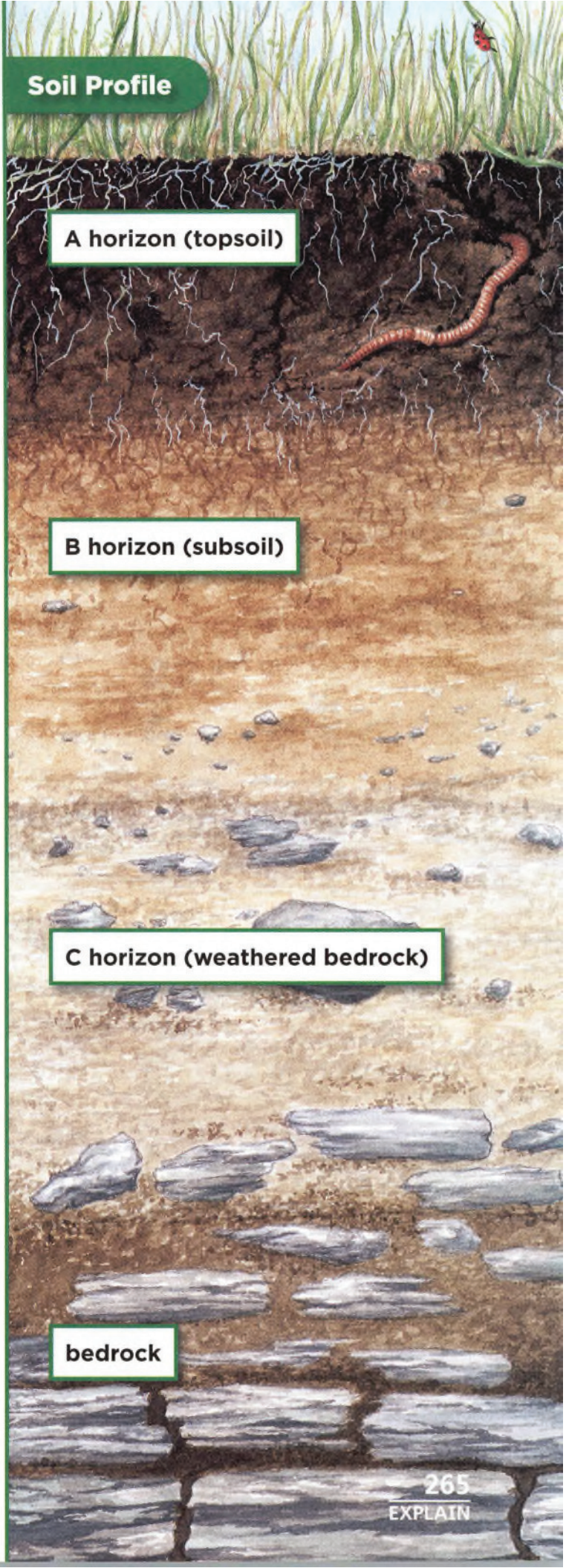
At the bottom of most profiles lies bedrock. The C horizon is above the bedrock and below the subsoil. It is made up of weathered bedrock.

The rock and humus that make up soil are not the same everywhere. That is why soil profiles are different from place to place.

Quick Check

Draw Conclusions How does bedrock change as soil forms?

Critical Thinking How might cold winters help form soil?



▲ Sandy soil has a coarse texture.

▲ Silty soil has a medium texture.

▲ Clay soil has a fine texture.

What are some properties of soil?

There are dozens of different kinds of soils. Each has its own set of properties. One soil property is color. Another is texture. Texture refers to the size of the particles of soil.

Pore Spaces

The spaces between particles of soil are called **pore spaces**. The pore spaces in soil act like filters. They remove certain substances from the water as it moves through. This keeps the water clean. Materials with pore spaces are said to be **porous** (POR•uhs). They hold air and water.

Permeability

The sizes and numbers of pore spaces affect a soil's permeability (pur•mee•uh•BIH•luh•tee). **Permeability** describes how fast water passes through a porous material. Sandy soil has high permeability. The size and shape of the sand lets water move freely between the pore spaces.

Permeability of Soils

Read a Photo

How does the permeability of fine soil differ from coarse soil?

Clue: Look at the pore spaces shown in the circles.

Factors That Affect Soils

The properties and thicknesses of soils depend on the climate, the ecosystem, and the bedrock. The steepness of the land is a factor too. Time also affects soils.

Steep slopes often have thin soils because they erode quickly. Thin soils are poor for growing crops. Thicker soils can build up on flat lands. Any soil can thicken over time if it is left alone.

Water, wind, and ice can erode soil and move it from place to place. This kind of *transported soil* covers large parts of the central United States. Minerals in transported soil may be very different from those in the bedrock.

Quick Lab

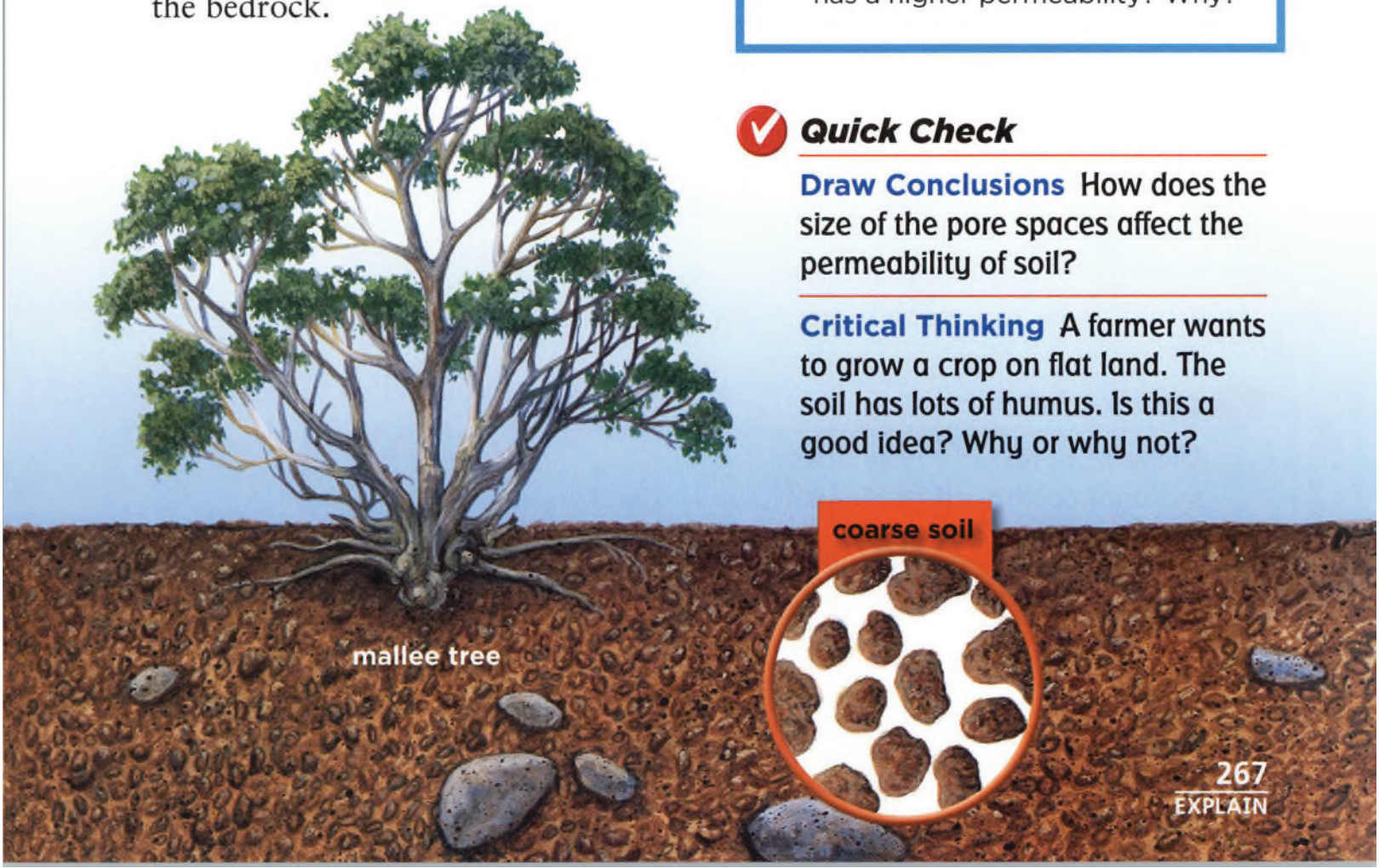
Rate of Flow

1. Make two containers like the one shown. Fill each with a different type of soil.
2. Hold one container over a measuring cup. Begin timing as you slowly pour one cup of water into the soil.
3. Record the amount of time it takes for the water to stop flowing into the cup.
4. **Use Numbers** Calculate how much water remains in the soil. Repeat steps 2 and 3 with the second soil sample.
5. **Interpret Data** Which soil type has a higher permeability? Why?

Quick Check

Draw Conclusions How does the size of the pore spaces affect the permeability of soil?

Critical Thinking A farmer wants to grow a crop on flat land. The soil has lots of humus. Is this a good idea? Why or why not?



Why is soil type important?

Soil permeability is important to plants that live on land. That means the type of soil in which plants grow is also important.

Topsoil is home to a large variety of living things. All living things need at least a little water. They need air too. Plants and animals can survive in soil only if the soil is porous enough.

Soil permeability is especially important for farmers. Sandy soil is very porous. Water moves through quickly, carrying minerals as it goes. The minerals often travel below the reach of plant roots. If the soil holds too little water, crops dry up.

Fine soil is porous, but it has low permeability. Water soaks into it slowly. The water may stay in the pore spaces for a long time. This is not good for plants either. A crop can drown from too much water.

Quick Check

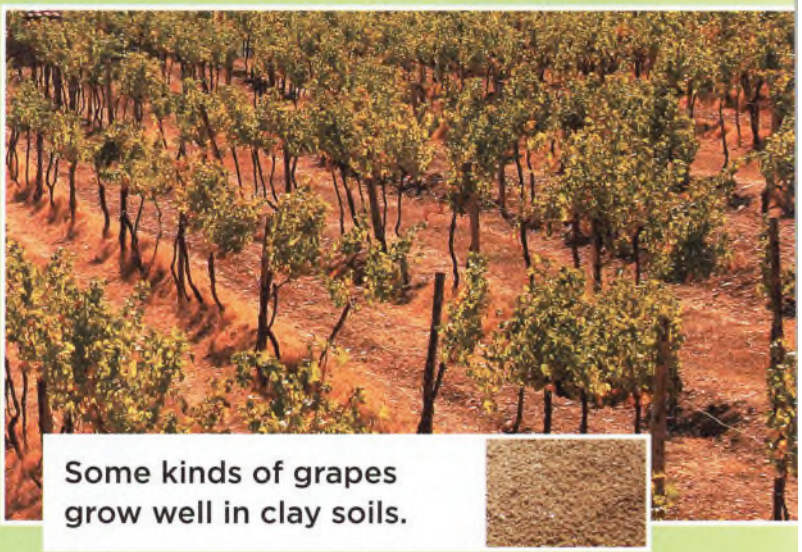
Draw Conclusions How does soil permeability affect plants?

Critical Thinking Why might farmers grow different kinds of plants in different kinds of soil?

Plant Adaptations to Soils

Desert plants are adapted to grow in sandy soils.

Medium-textured soils are good for many crops.



Some kinds of grapes grow well in clay soils.

FACT Sandy deserts are not lifeless.

Lesson Review

Visual Summary

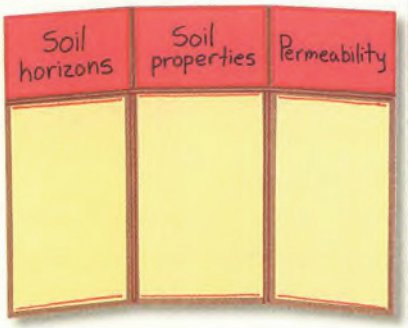
Soil is made of humus, weathered rock, and minerals. **Soil horizons** show the different layers of soil.

Soil properties include color, texture, and the number of pore spaces. Permeability is another property of soil.

Soil **permeability** affects the organisms that live in soil. Plants are adapted to certain kinds of soils.

Make a FOLDABLES® Study Guide

Make a trifold book. Use it to summarize what you read about soil.



Think, Talk, and Write

1. **Vocabulary** Soil forms in layers called _____.

2. **Draw Conclusions** What can you conclude about a soil's permeability by observing its texture?

Text Clues	Conclusions

3. **Critical Thinking** Why might a desert plant grow poorly in clay soils?

4. **Test Prep** **What can pore spaces hold in soil?**
   - **A** air only
   - **B** water only
   - **C** air and water
   - **D** humus

5. **Test Prep** **Which soil is likely to have the thinnest layers?**
   - **A** soil along a steep slope
   - **B** soil on flat land
   - **C** any transported soil
   - **D** any clay soil

6. **Essential Question** How does soil differ from place to place?

Writing Link

Write a Report

What kind of soil is common in your area? What crops does it support? Research the answers. Report your findings.

Math Link

Solve an Equation

A student adds 35 milliliters of water to a soil sample. Then 28 mL drip out. How much water is the soil still holding? Write a math sentence.

Be a Scientist

Materials

filter paper, funnel

measuring cup, teaspoon

500 mL beaker, 1,000 mL beaker

drink mix

water

potting soil, sand, clay soil

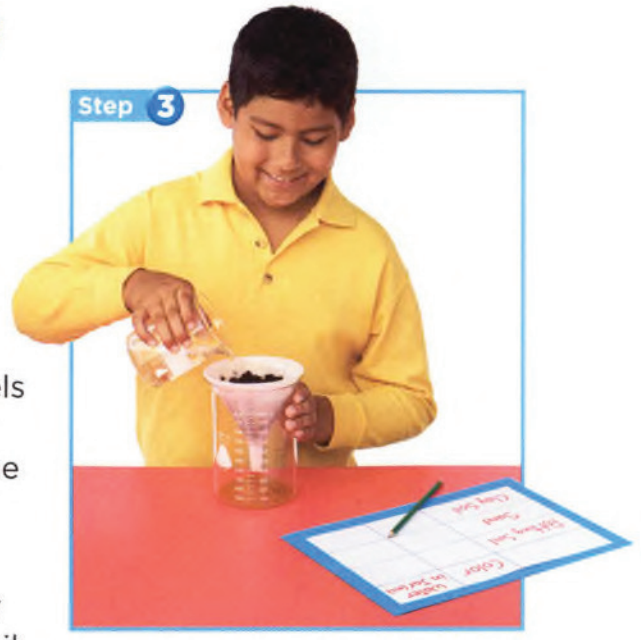
Structured Inquiry

How do different soil types hold minerals when it rains?

Form a Hypothesis

Does soil type affect the amount of nutrients that the soil can hold? Consider three types—potting soil, sand, and clay. Write your answer in the form "In a heavy rain, the soil type that loses the most nutrients is..."

Test Your Hypothesis



1. Place a piece of filter paper in a funnel. Put the funnel in a 1,000 mL beaker.
2. **Make a Model** Mix one cup of potting soil with one teaspoon of drink mix. The drink mix models the nutrients that plants need for growth. Pour the mixture into the funnel.
3. **Measure** Put 250 mL of water in a beaker. Slowly pour the water on the soil mixture. Make your data table while the water drips into the jar. When it stops dripping, record the color and amount of water in your table.
4. **Use Variables** Repeat steps 1 through 3 with sand. Repeat again with clay soil. Record your observations.

	Soil	Sand	Clay
Color of water			
Amount of water			

Draw Conclusions

5. What differences did you observe among the types of soils you tested?
6. Which type of soil lost the most nutrients? Which type held the least amount of nutrients?
7. **Infer** Why might some plants have trouble growing in sandy soil?

Guided Inquiry

How does soil permeability affect plant growth?

Form a Hypothesis

How does the permeability of soil affect the kinds of plants that grow in it? Write a hypothesis.

Test Your Hypothesis

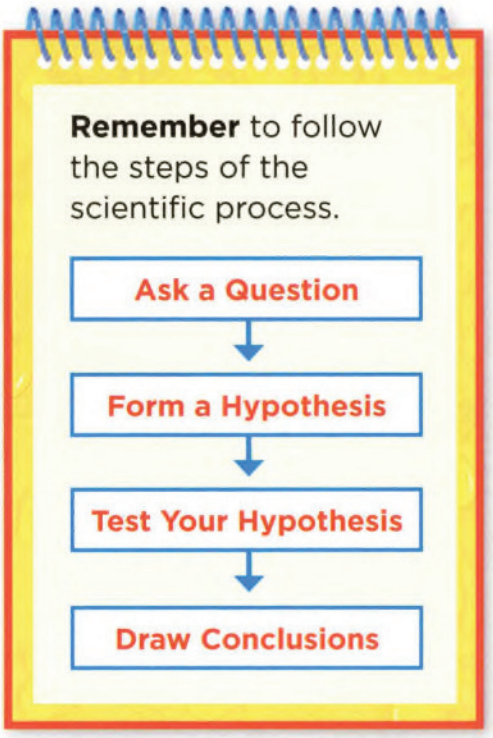
Design an experiment to find the best soil permeability for growing lima beans. Which variable will you test? Which variables will you control? Write out the materials you need and the steps you will follow. Then try it. Record your observations in a data table. Explain your results.

Draw Conclusions

Did your results support your hypothesis? Which soil type is best for growing lima beans? Which type is worst?

Open Inquiry

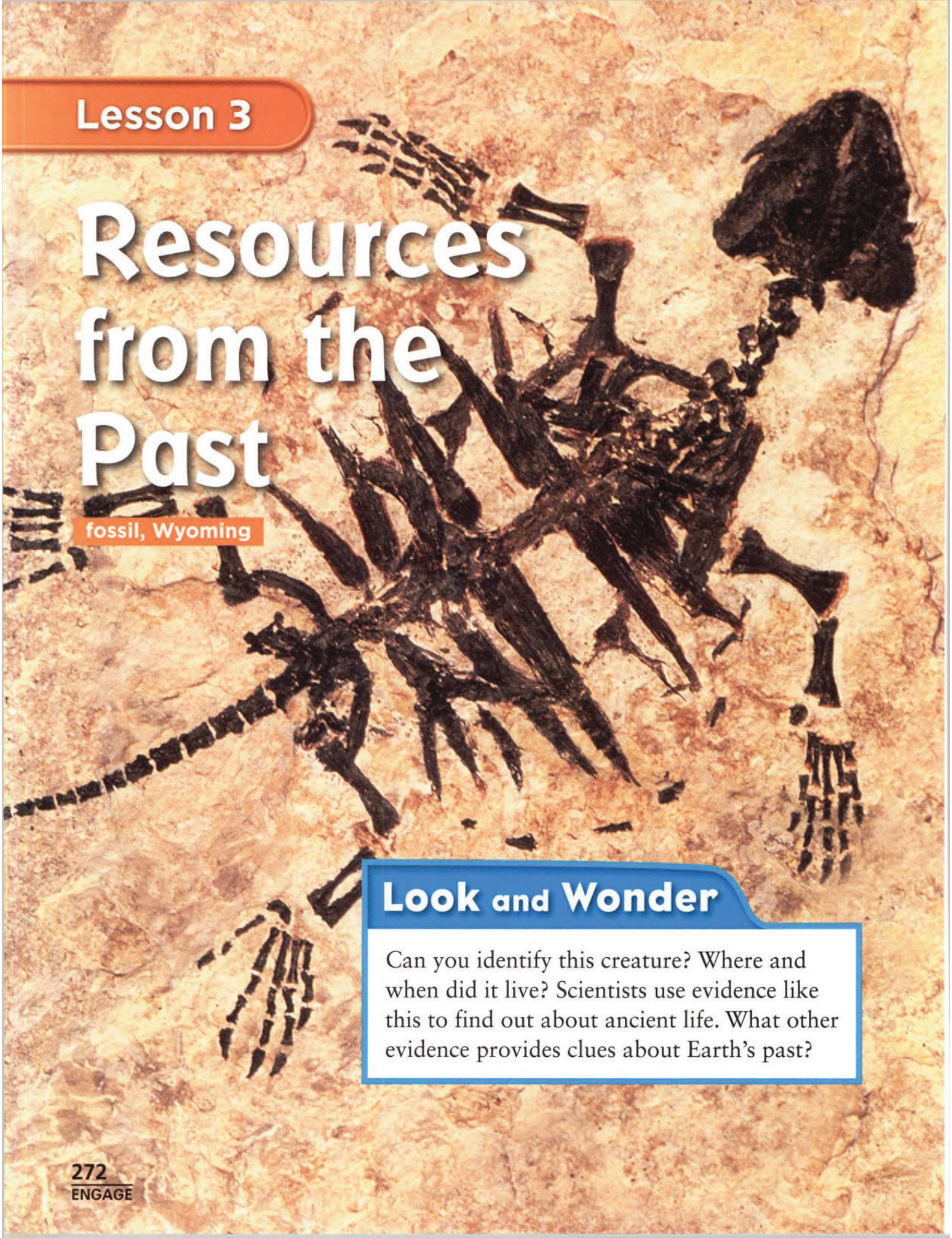
What else would you like to learn about soil types? Design an investigation to answer your question. Write the steps of your investigation so that another group can complete it by following your instructions.



Lesson 3

Resources from the Past

fossil, Wyoming



Look and Wonder

Can you identify this creature? Where and when did it live? Scientists use evidence like this to find out about ancient life. What other evidence provides clues about Earth's past?

Explore

Inquiry Activity

What can you learn from footprints?

Purpose

Make inferences from observations of footprints.

Procedure

1. **Make a Model** Flatten some modeling clay. Make model footprints by pressing small objects into the clay. Model different animals—heavy, light, walking, and running.
2. **Communicate** Write a brief story about two or more different animals. Tell how they interact.
3. Flatten the clay to form a smooth surface. Use the objects to make model footprints that show your story.
4. **Infer** Exchange clay models with another group. Try to infer the story that the other group modeled.

Draw Conclusions

5. What do prints in clay reveal about the objects that made them?
6. **Interpret Data** How can footprints show whether an animal was walking or running?
7. What do you think scientists can infer from footprints made long ago?

Materials

- modeling clay
- small common objects such as pencil, shell, eraser, coin, paper clip

Explore More

How can you tell whether footprints were made by an animal walking on two legs? On four legs? Do some research and make observations. Share your findings with the class.

Read and Learn

Essential Question

What are fossils and fossil fuels?

Vocabulary

fossil, p. 274

amber, p. 274

mold, p. 275

cast, p. 275

imprint, p. 275

fossil fuel, p. 278

nonrenewable resource, p. 278

renewable resource, p. 280

Reading Skill

Fact and Opinion

Fact	Opinion

Technology

e-Glossary and e-Review online at www.macmillanmh.com

What are fossils?

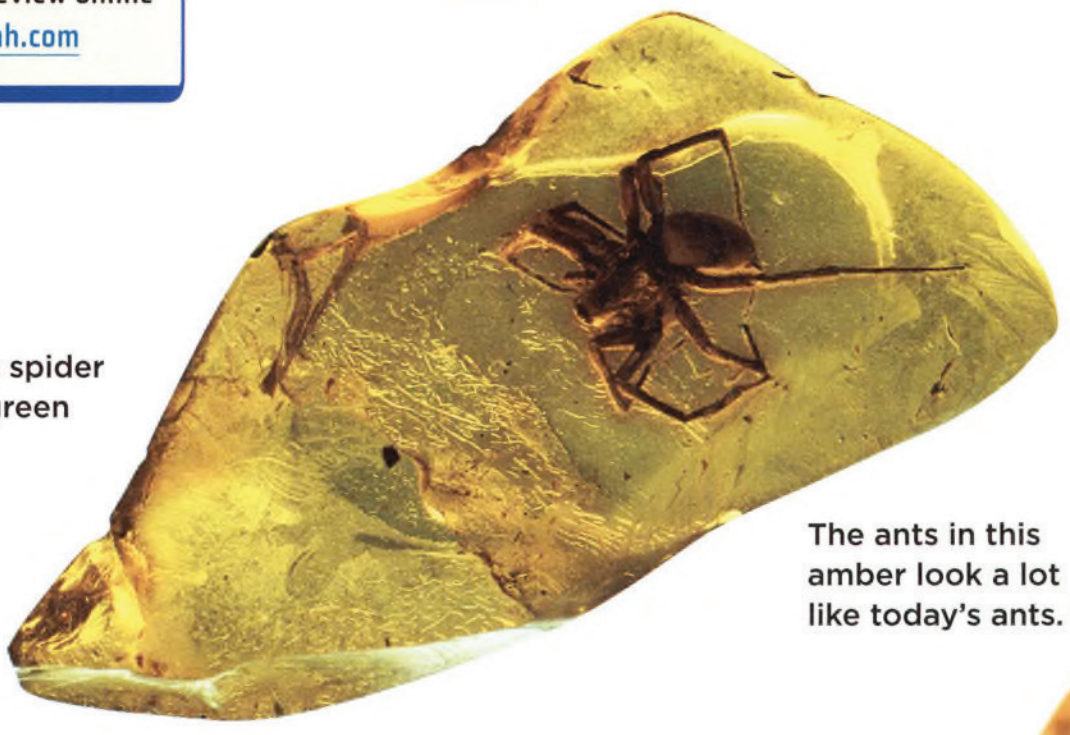
Scientists use clues from fossils to learn about the past. A **fossil** is evidence of an organism that lived long ago. For instance, scientists have found dinosaur tracks. By observing the patterns that the footprints made, scientists learned how the dinosaurs walked.

How Fossils Form

Most fossils are found in sedimentary rocks. Sediments bury whatever remains from a plant or animal that once lived. As the sediments turn to rock, the buried remains can become fossils.

When a plant or animal dies, the soft parts quickly decay or are eaten. Bones, teeth, and shells last longer. These hard parts are more likely to become fossils.

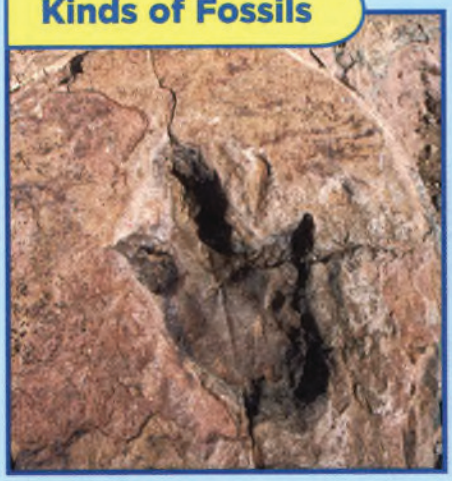
Sometimes entire organisms are preserved. Large animals called mammoths have been found frozen in the tundra ice. Insects and spiders can become trapped in sticky tree sap. The sap can harden into **amber**—a hard, smooth material.



The body of this spider is preserved in green amber. ▶

The ants in this amber look a lot like today's ants. ▶

Kinds of Fossils



foot imprint

trilobite cast

petrified wood

Molds and Casts

Shells often leave behind fossils known as molds. A **mold** is a hollow form with a certain shape. How does a mold form? Water can seep into the spaces in the rock where an organism is buried. Slowly, the water washes away the shell. It leaves a hollow space, or mold, where the shell was.

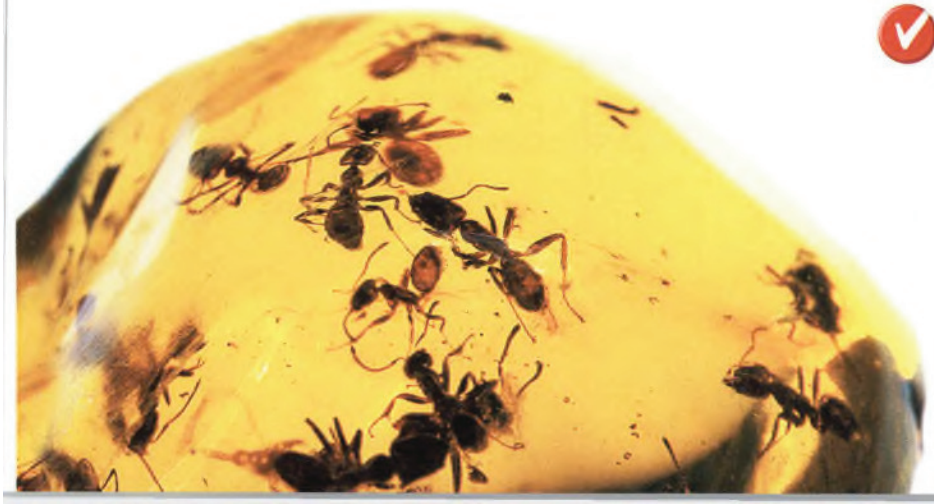
If minerals build up inside a mold, another kind of fossil may form. A **cast** is a fossil that is formed or shaped in a mold. Have you ever made gelatin in a shaped cup? The cup was a mold. The hardened gelatin was a cast.

Imprints

Sometimes a shallow print is the only fossil evidence we have. Tracks, body outlines, and leaf prints are called imprint fossils. An **imprint** is a mark made by pressing.

Stony Fossils

Wood and bones can become *petrified,* or turned to stone. As minerals slowly seep inside a dead tree or animal, the minerals replace its insides. The organism becomes a fossil of rock!



Quick Check

Fact and Opinion How do we know about dinosaurs?

Critical Thinking How could you model a cast fossil and its mold?

How do we study fossils?

Scientists use powerful computers and microscopes to learn about ancient life. When a new fossil is discovered, scientists compare it to similar living organisms. In doing so, scientists must consider that organisms change over time.

Sometimes a fossil's location is more puzzling than the fossil itself. For example, fossils of ferns have been found in icy Antarctica. Antarctica is a polar biome. It is much too cold for ferns to grow!

Geologic Time

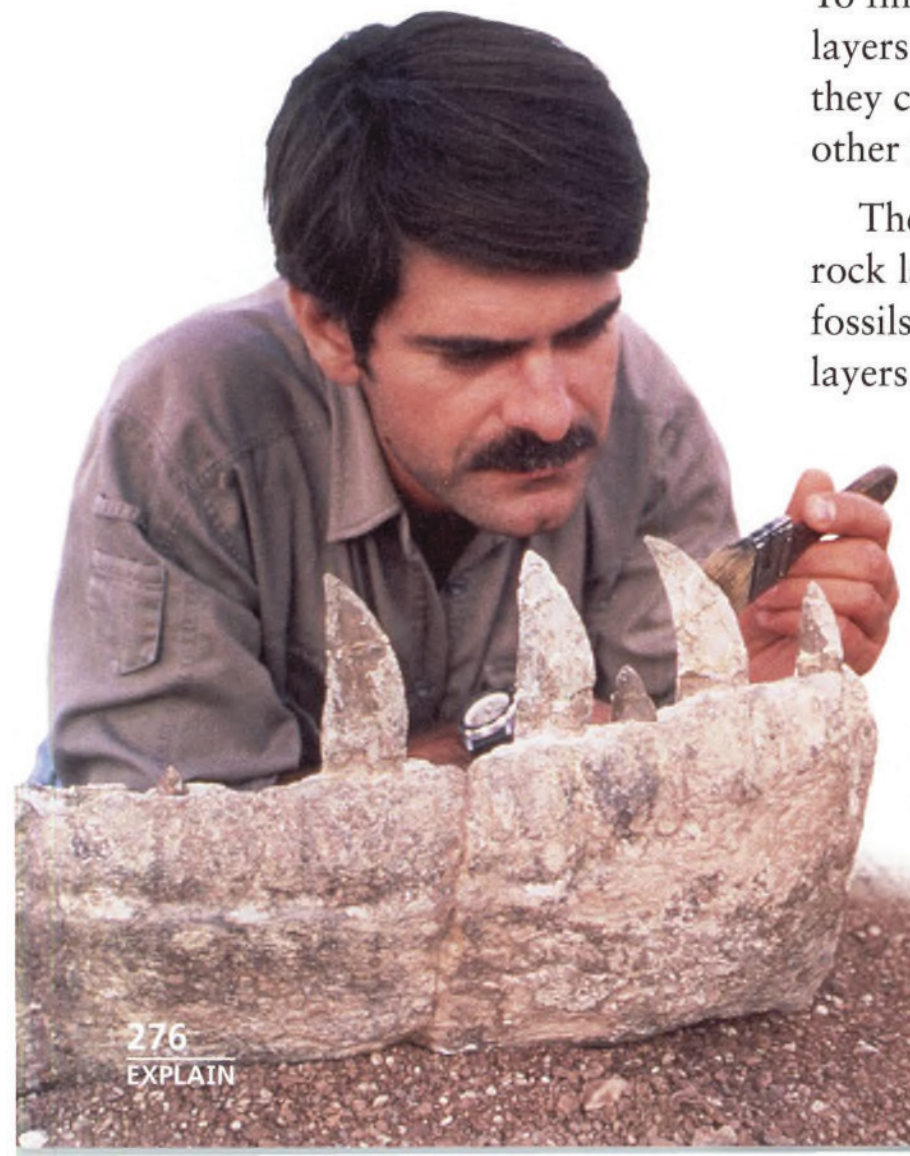
Organisms are not the only things that change over time. Earth's land changes too. You are familiar with fast changes such as hurricanes and landslides. However, most of Earth's changes are very, very slow.

Scientists measure Earth's history in millions—even billions—of years. We call such long spans *geologic time*. When scientists study fossils, they are also studying geologic time.

Examining Rock Layers

How have Earth's land and living things changed over geologic time? To find out, scientists examine rock layers. They look for fossils. Then they compare those fossils with other fossils in the same rock.

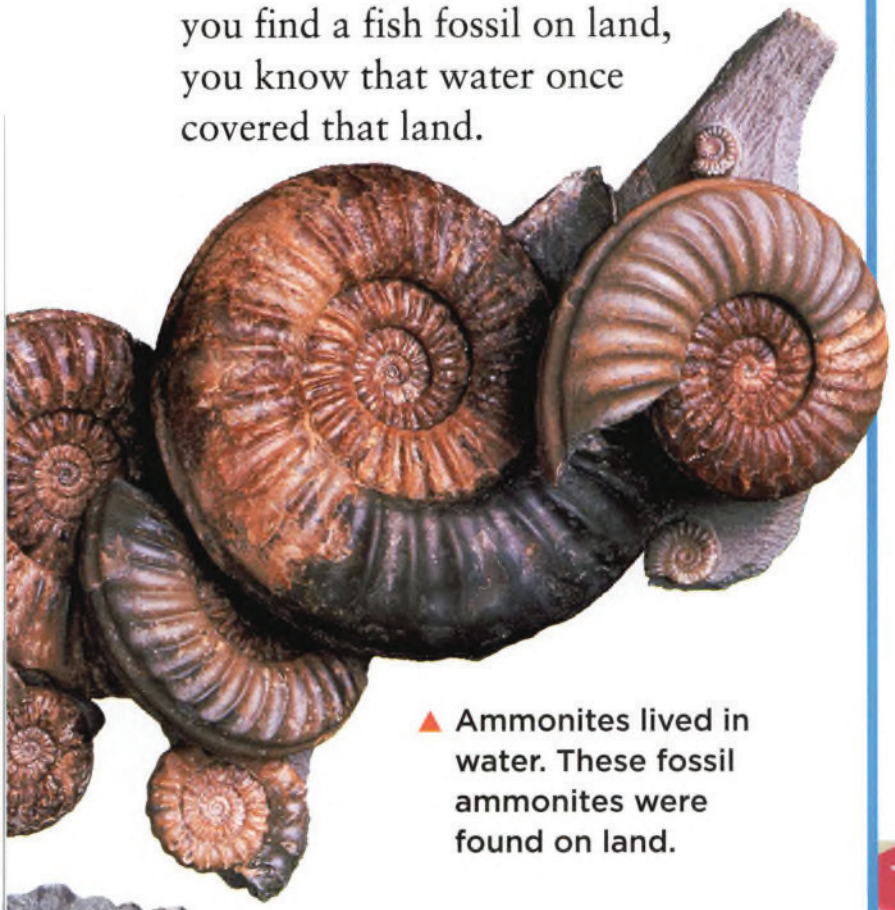
The oldest fossils are in the oldest rock layers at the bottom. Younger fossils are found in upper rock layers. Those layers formed later.



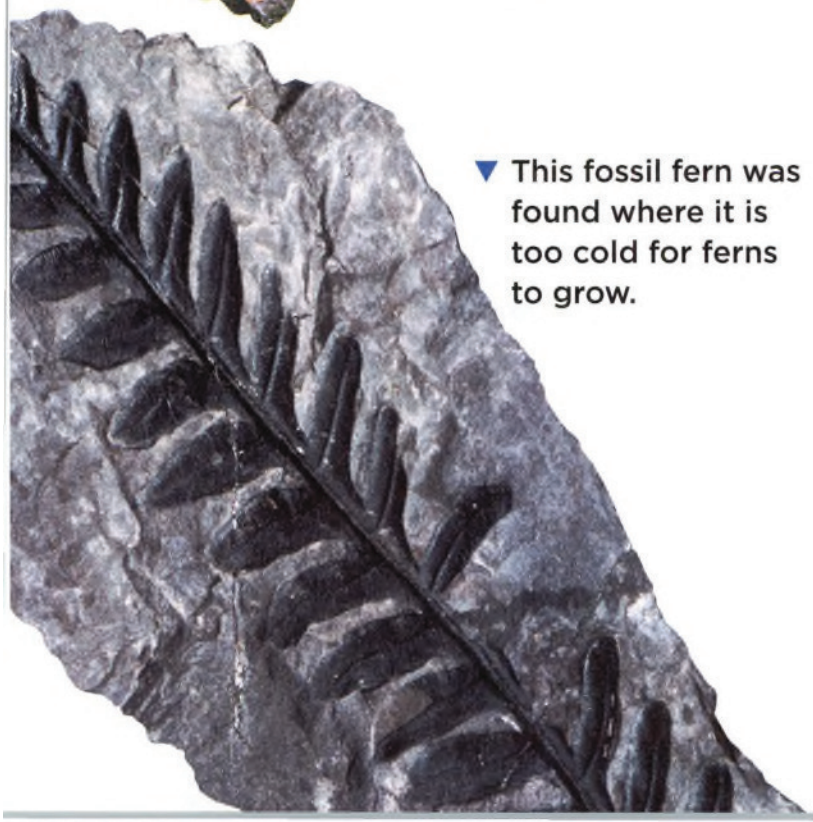
Scientists must work carefully to clean and prepare fossils for study.

Finding Evidence

Rock layers and fossils are evidence of Earth's changes over time. In the past, Earth's climate was warmer than it is now. At other times in the past, it was cooler. If you find a fish fossil on land, you know that water once covered that land.



▲ Ammonites lived in water. These fossil ammonites were found on land.



▼ This fossil fern was found where it is too cold for ferns to grow.

Quick Lab

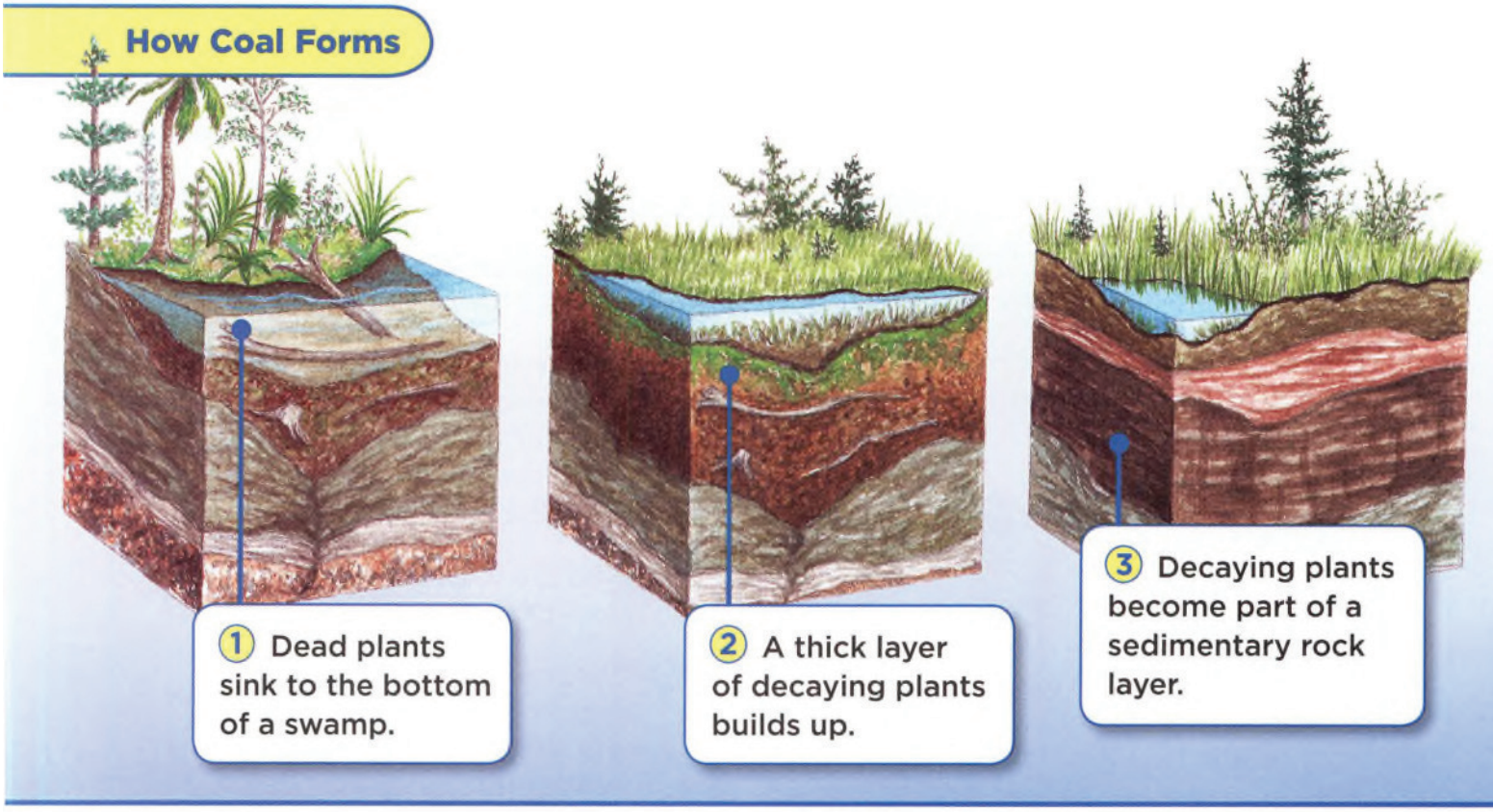
Older and Younger

1. Cut a piece of paper into four pieces. Draw a fossil on each.
2. **Make a Model** Have a partner place each fossil inside the front cover of four different books. Stack the books. The stack models Earth's rock layers.
3. Find the fossils. Arrange them from oldest to youngest.
4. **Communicate** How did you decide which fossil was oldest and which was youngest? Explain this to your partner.

Quick Check

Fact and Opinion Scientists are certain that dinosaurs and mammals once lived together. How can they know this?

Critical Thinking How could ferns have lived on Antarctica?



What are fossil fuels?

Where do people get energy to make electricity and drive vehicles? Most of it comes from fossil fuels such as coal, oil, and natural gas. A **fossil fuel** is an energy source that formed millions of years ago. Fossil fuels form from the remains of plants and animals.

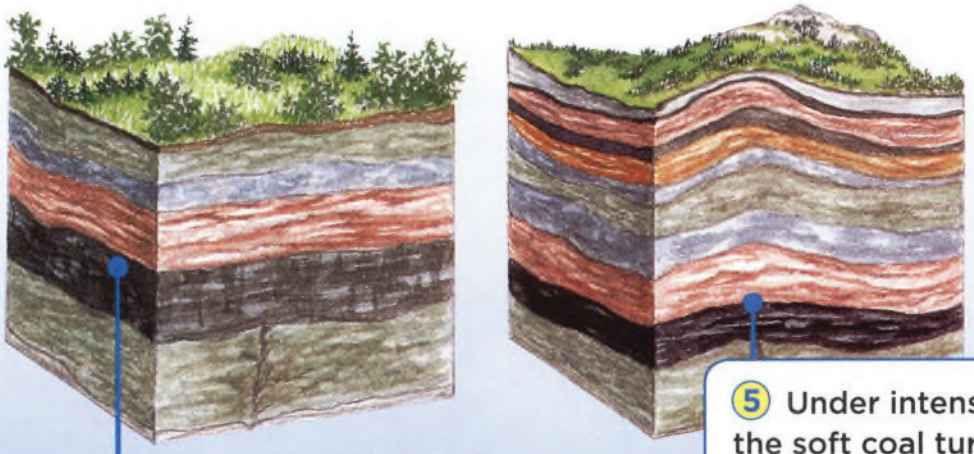
Fossil fuels are nonrenewable resources (NON•ree•NEW•uh•bul REE•sors•ez). A **nonrenewable resource** is a useful material that cannot be replaced easily. Once it is used up, it is gone forever. To release the energy stored in fossil fuels, we have to burn them. When we burn the fuels, we destroy the resource.

Finding Fossil Fuels

Searching for fossil fuels can be difficult. It involves mining and drilling deep below Earth's surface. We need large power plants to get the energy from fossil fuels. We also need ways to deliver that energy. These are all expensive processes.

Using Fossil Fuels

One liter of natural gas takes millions of years to form. It burns within a few seconds! Burning fossil fuels causes air pollution. People who breathe the polluted air can become sick. Polluted air may cause acid rain. Acid rain can harm other organisms as well. Do we have other choices? Yes, we do.



4 The rock layer is pressed into soft coal.

5 Under intense heat and pressure, the soft coal turns to hard coal. It is now a fossil fuel.

Read a Diagram

How can dead plants or animals become a fossil fuel?

Clue: Follow the steps in the diagram.

Alternative Energy

No one knows how long our fossil fuel supply will last. That is why scientists are always looking for other ways to produce energy. These are called *alternative energy sources*. Can you think of some?

This machine is an oil pump. It gets oil from below the ground.

Quick Check

Fact and Opinion *Fossil fuels store energy.* Is this statement a fact or an opinion? Explain.

Critical Thinking How do you and your family rely on fossil fuels?

What can we use instead of fossil fuels?

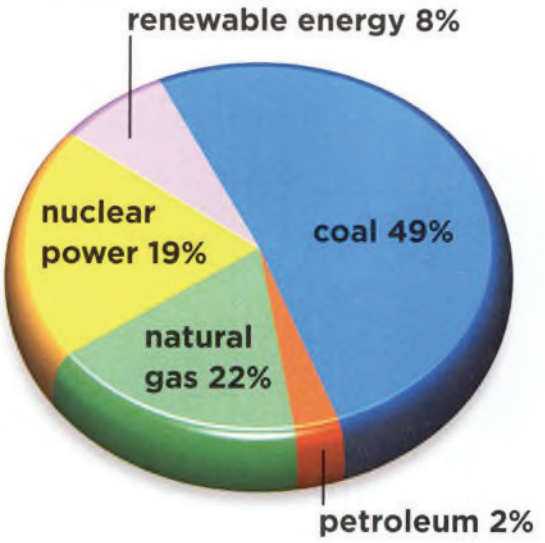
Earth and the Sun supply us with renewable resources. A **renewable resource** is a useful material that is replaced quickly in nature.

The Sun provides us with a source of energy every day. A tool called a solar cell can change the energy from sunlight into electricity.

Windmills can harness the wind. We can get energy from flowing water too. Ocean tides carry usable energy. In some places, people get energy from the heat inside Earth.

The pie chart shows where the United States got energy for electricity in 2007. You can see that 8 percent of the energy came from renewable resources. The rest were nonrenewable resources.

Sources of Electricity



Source: National Energy Information Center

Read a Chart

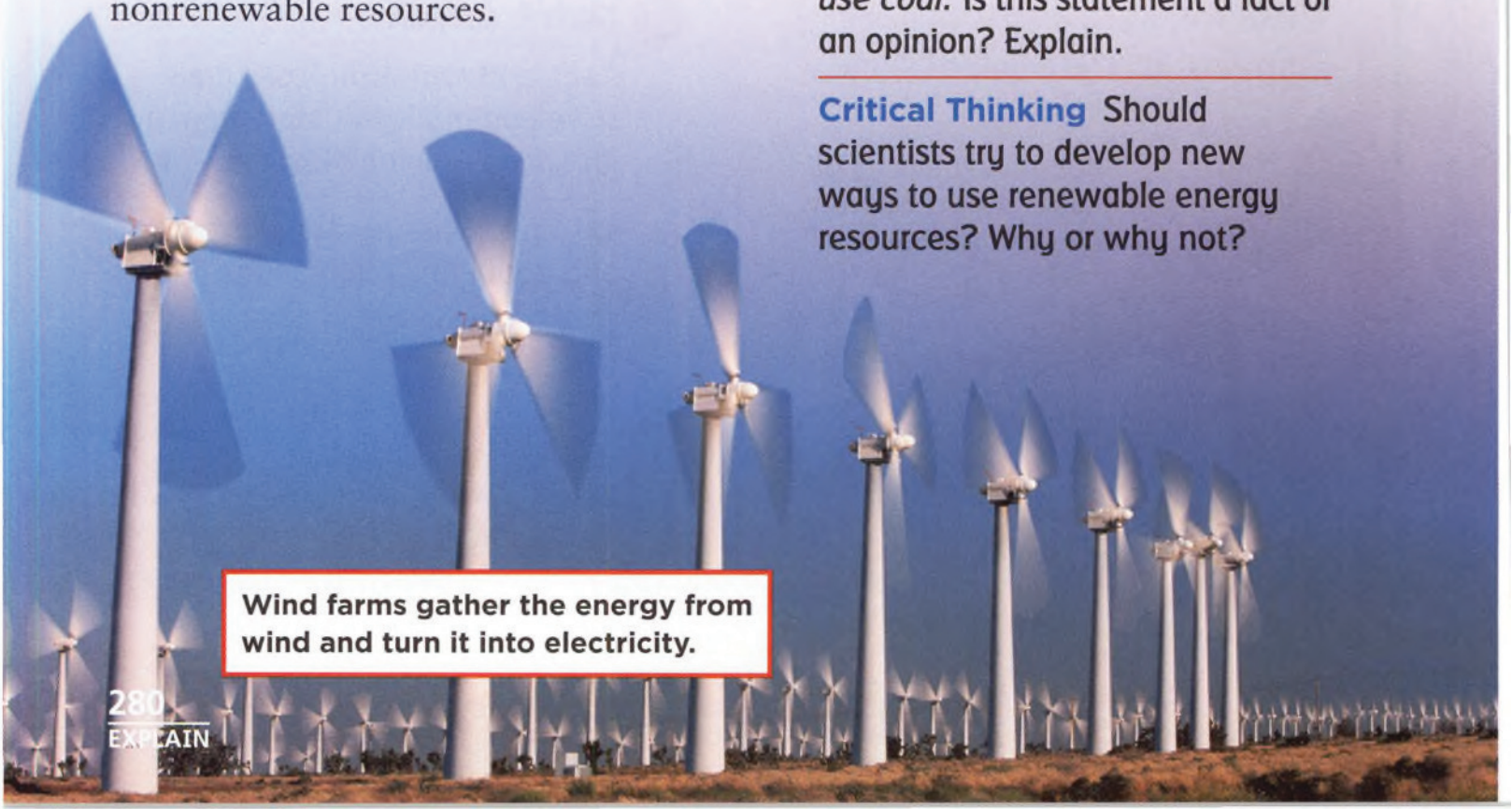
Which energy source provided the most electricity? The least?

Clue: Compare the sizes of the slices in the circle graph.

Quick Check

Fact and Opinion *We should not use coal.* Is this statement a fact or an opinion? Explain.

Critical Thinking Should scientists try to develop new ways to use renewable energy resources? Why or why not?



Wind farms gather the energy from wind and turn it into electricity.

Lesson Review

Visual Summary

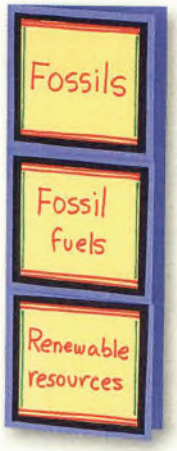
Fossils provide clues about what Earth was like in the past. There are different kinds of fossils.

Fossil fuels such as coal, oil, and natural gas are nonrenewable resources. They cannot be replaced quickly.

Renewable resources include wind, water, and sunlight. They are replaced quickly.

Make a FOLDABLES® Study Guide

Make a three-tab book. Use it to summarize what you read about fossils and fossil fuels.



Think, Talk, and Write

1. **Vocabulary** The energy from wind can be used again and again. This makes wind a(n) _____.

2. **Fact and Opinion** List facts about the use of fossil fuels. Write your opinion about each use.

Fact	Opinion

3. **Critical Thinking** How do the fossils displayed in museums compare with those in the ground?

4. **Test Prep** **Which resource is renewable?**

   A coal
   B diamonds
   C silver
   D wind

5. **Essential Question** What are fossils and fossil fuels?

Writing Link

Write a Short Story
Write a short story in which a fossil plays an important role. Describe the organism that left the fossil. Tell about the people who find or study the fossil.

Social Studies Link

Write a Report
What is the price of gasoline in your community? Ask adults what they think about energy costs. How do these costs affect them? Write a report about what you learned.

Be a Scientist

Materials

model of fossil *T. rex* tooth

model of fossil *Edmontosaurus* tooth

model of fossil shark tooth

horse tooth

colored pencils

Structured Inquiry

How do scientists learn about dinosaurs?

Form a Hypothesis

Scientists use fossils to infer things about dinosaurs. For example, scientists look at fossil teeth to infer what a dinosaur would have eaten. What can you learn from teeth? Write your answer in the form "If a dinosaur's tooth is flat, the dinosaur would have eaten..."

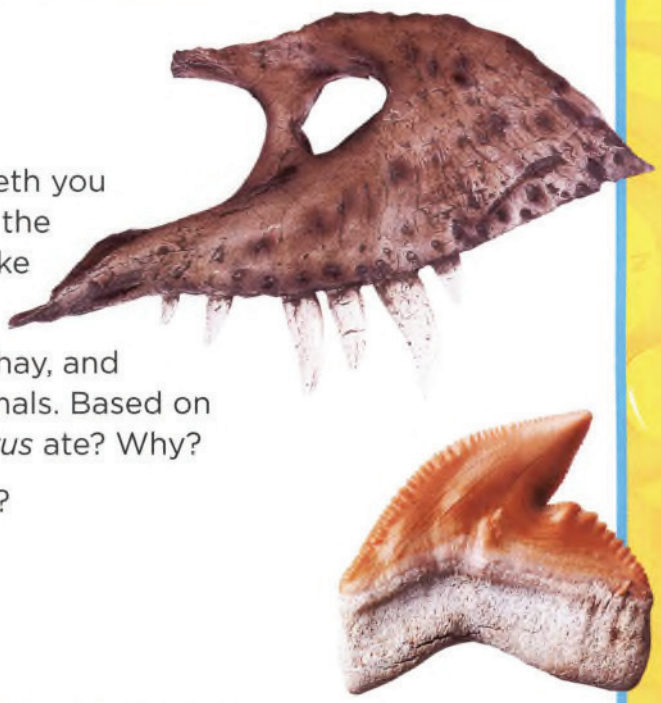
Test Your Hypothesis

1. Create a data table that includes rows for length and width. Make a row in your data table for drawings.
2. **Observe** Look closely at each model tooth. Draw its picture in your table.
3. **Measure** Find the length and width of each tooth. Record each measurement in your table.

	T. rex	Edmontosaurus	Shark	Horse
Drawing				
Length (cm)				
Width (cm)				

Draw Conclusions

4. **Interpret Data** Compare and contrast the teeth you examined. Which dinosaur tooth is more like the horse tooth? Which dinosaur tooth is more like the shark tooth? Explain your answers.
5. The diet of modern horses includes grasses, hay, and wheat. Modern sharks eat fish and other animals. Based on your results, what do you think *Edmontosaurus* ate? Why?
6. **Infer** What did *T. rex* eat? How do you know?
7. Was your hypothesis correct? Explain.



Guided Inquiry

What else can you learn from fossil teeth?

Form a Hypothesis

What other information can scientists infer from animal teeth? Write your answer as a hypothesis.

Test Your Hypothesis

Design an investigation to find out whether tooth size can tell you the size of an animal. Write out the materials you need and the steps you will follow. Record your results and observations.

Draw Conclusions

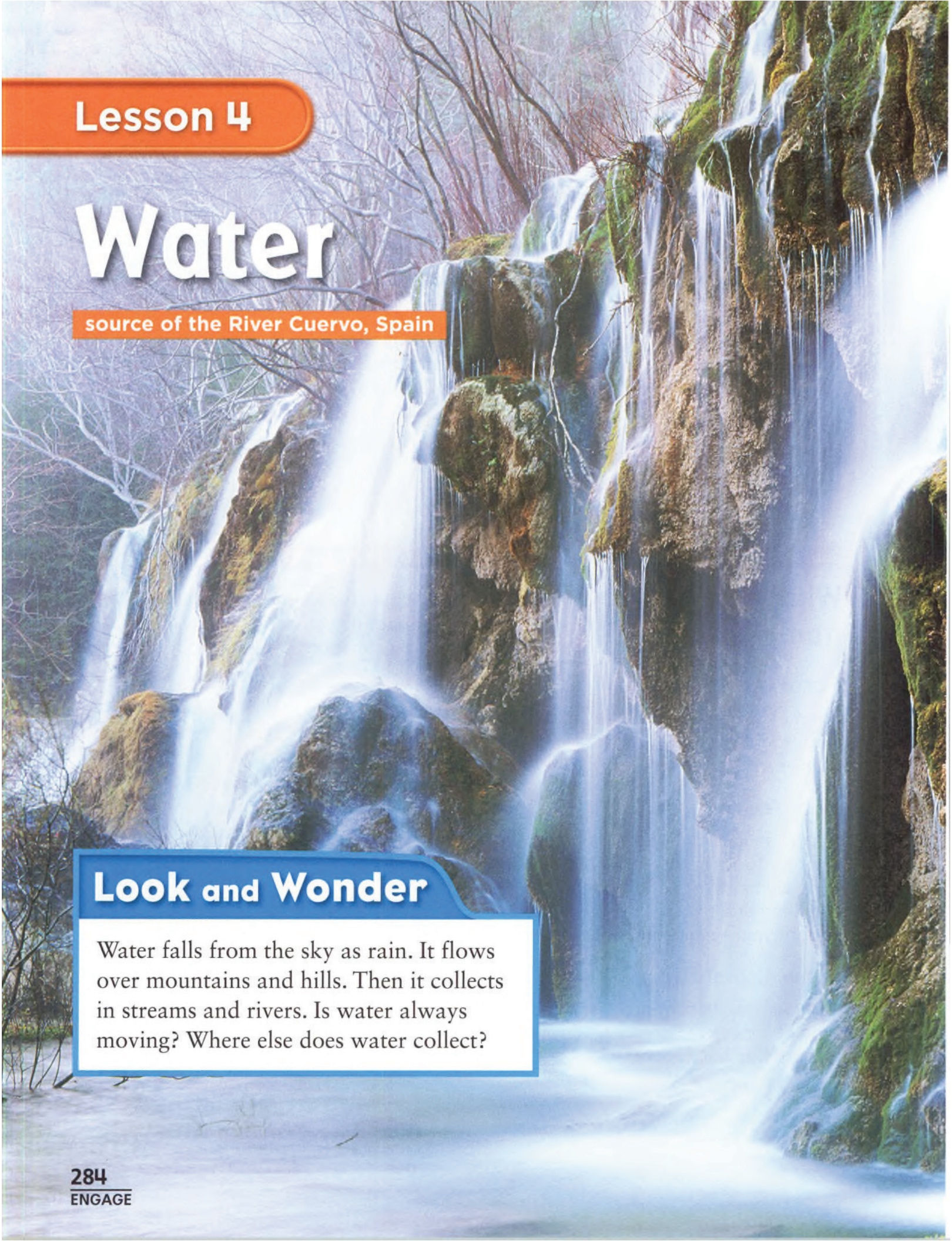
Did your results support your hypothesis? Why or why not? Form a new hypothesis if yours was not supported.

Open Inquiry

What else would you like to learn about dinosaur fossils? Design an investigation to answer your question.

Remember to follow the steps of the scientific process.

- Ask a Question
- Form a Hypothesis
- Test Your Hypothesis
- Draw Conclusions



Lesson 4

Water

source of the River Cuervo, Spain

Look and Wonder

Water falls from the sky as rain. It flows over mountains and hills. Then it collects in streams and rivers. Is water always moving? Where else does water collect?

Explore

Inquiry Activity

Does water flow faster through soil or gravel?

Form a Hypothesis

Will water flow faster through a cup of soil or a cup of gravel? Recall what you know about soil and rock. Then write a hypothesis.

Test Your Hypothesis

1. With a pencil tip, make a small hole in the bottom of one paper cup. Make a mark on the inside of the cup, close to the top.
2. **Measure** Place your finger over the hole. Fill the cup to the mark with perlite or soil. Hold the cup over a plastic container. Have your partner pour in 100 mL of water.
3. Remove your finger. Time how long it takes the water to drain. Record the time in a data table.
4. Repeat steps 1, 2, and 3 using gravel.

Draw Conclusions

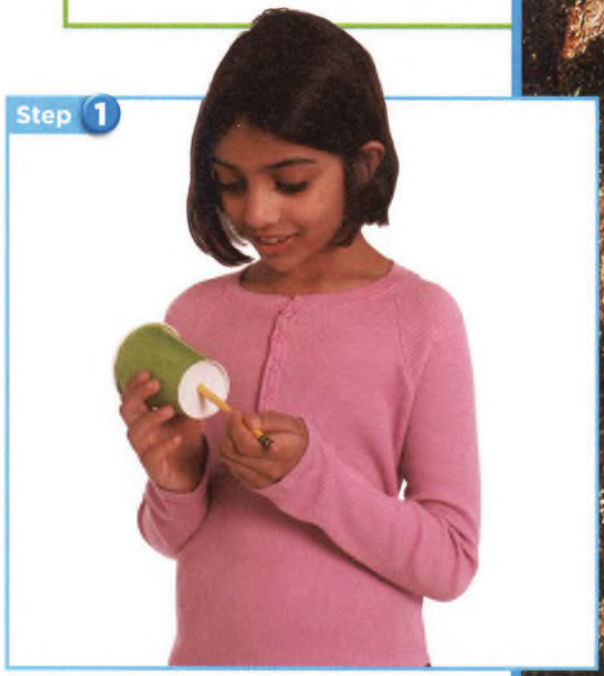
5. **Interpret Data** Which material lets water soak through faster?
6. What might happen to rainwater when it falls on soil? On gravel?
7. **Infer** Which material might support more plant growth—soil or gravel? Explain.

Explore More

Which holds more water after the water first flows through—soil or gravel? Design a test of your hypothesis. Use evidence to support your conclusion.

Materials

- pencil
- two 12-oz. paper cups
- perlite or soil
- plastic container
- 200 mL of water
- measuring cup
- stopwatch
- gravel



Read and Learn

Essential Question

How do people obtain and use water?

Vocabulary

soil water, p. 287

groundwater, p. 287

watershed, p. 287

reservoir, p. 288

well, p. 288

runoff, p. 288

irrigation, p. 290

Reading Skill

Problem and Solution

Technology

e-Glossary and e-Review online at www.macmillanmh.com

Where is Earth's water found?

Have you ever wondered whether some places have more water than others? Look at a globe. You will see that we live in a watery world.

Salt Water

Oceans and seas cover almost three fourths of Earth's surface. That is a lot of water! Can people drink it? Can we use it to grow plants? Ocean water, or *seawater,* contains a great deal of salt. We cannot drink it or use it on soil.

Freshwater

Freshwater is water without much salt. Most streams, rivers, lakes, wells, and ponds contain freshwater. However, most of Earth's freshwater is not in a liquid state. It is solid!

Glaciers and ice caps hold most of Earth's freshwater. *Ice caps* are thick layers of ice on land. Giant ice caps cover Greenland and Antarctica— the continent at the South Pole.

Most of Earth's fresh water is solid ice.

Read a Map

How could a ship travel from Chicago, Illinois, to the Atlantic Ocean?

Clue: Trace a path on the map through water.

Below the Ground

When water soaks into soil, it becomes **soil water**. Plants use some of the soil water. The rest travels farther down below the surface. It seeps downward until it reaches a layer without cracks or pore space. Then the water collects in the spaces above. **Groundwater** is the term for water that fills the cracks and spaces of rocks under the ground.

Watersheds

On land, water may flow downhill into a common stream, lake, or river. Such areas are known as **watersheds**. People who live in a watershed tend to use the water that drains through it. Laws and government agencies help us protect watersheds.

Quick Check

Problem and Solution Where would you go to find water?

Critical Thinking How could we use salt water?

A wetland can contain freshwater, salt water, or a mixture of both.

How is freshwater supplied?

Most large towns and cities get their water from reservoirs (REH•zuh•vworz). A **reservoir** is a storage area for holding and managing freshwater. Some are natural lakes or ponds. Others are built by people. Pipelines supply people with the water in reservoirs.

Groundwater is another source of freshwater. A well is the most common way of getting groundwater. **Wells** are deep holes drilled or dug below the ground. Pumps get the water to the surface.

Freshwater is rarely pure. It may have bacteria or harmful chemicals in it. Such substances are often carried to a water source by runoff. **Runoff** is water that flows over the land without evaporating or soaking into the ground.

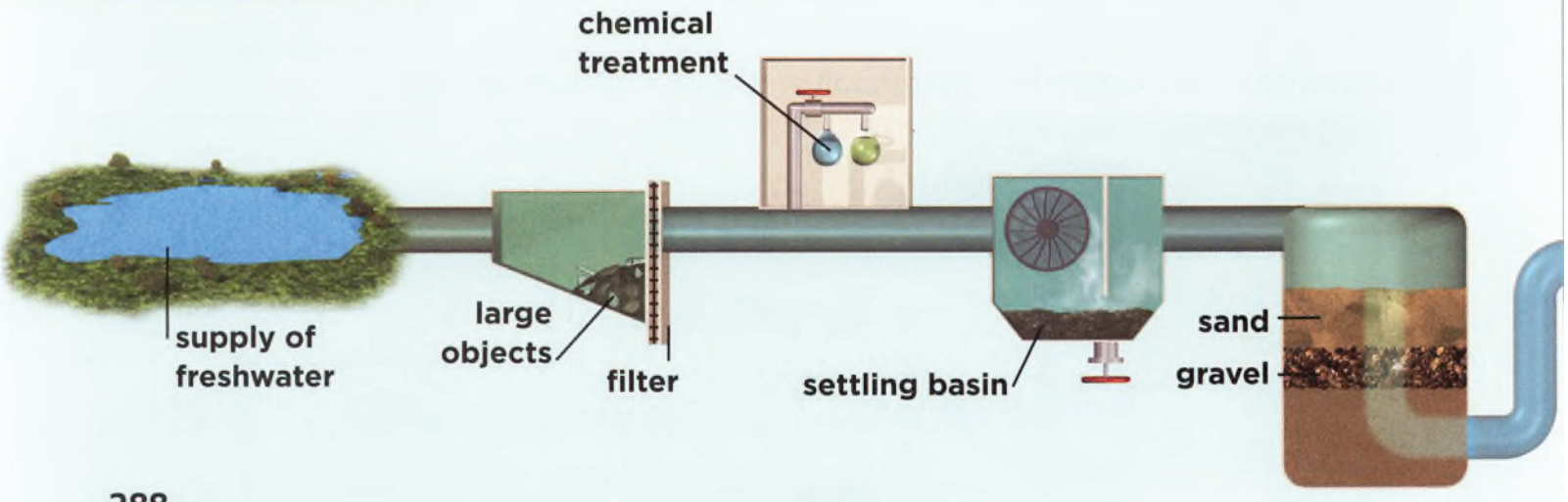
Lake Mead is a reservoir shared by Arizona and Nevada.

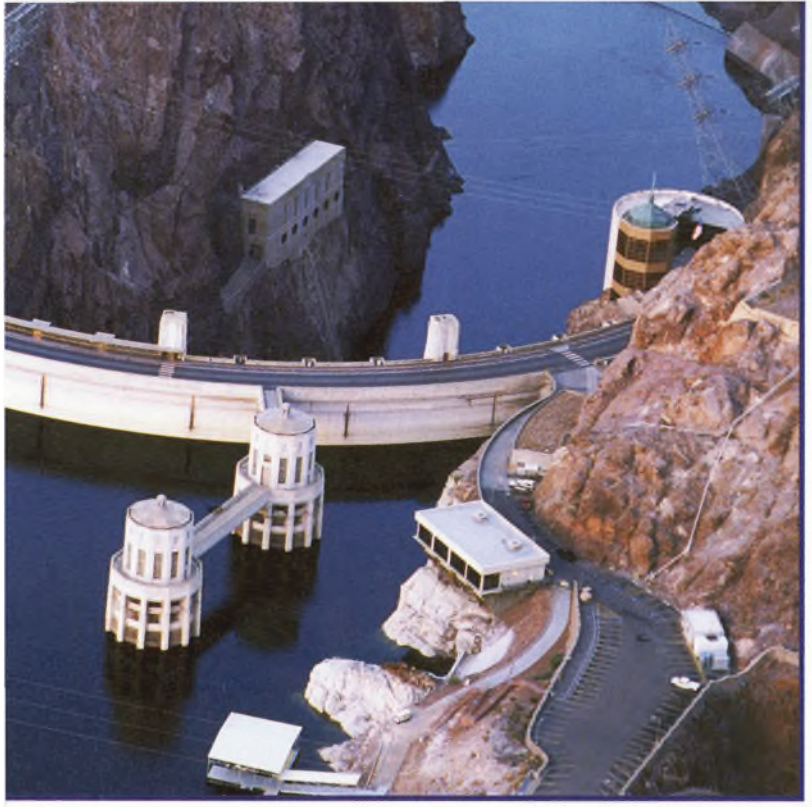
Water Treatment Plants

Water cannot be supplied to people before it is safe to use. A *water treatment plant* is a place where water is made clean and pure.

First, the water passes through a filter. The filter removes trash and other large objects. Next, chemicals are added to kill harmful organisms.

Water Treatment



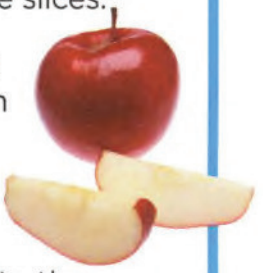


Look at the diagram below. It shows the sequence of events at a water treatment plant. After the water is cleaned, it is stored in reservoirs until it is needed.

Quick Lab

Freshwater in Plants

1. **Measure** Using a balance, measure the mass of some apple slices.
2. Leave the apple slices on an open tray. When they are completely dry, measure their mass again.

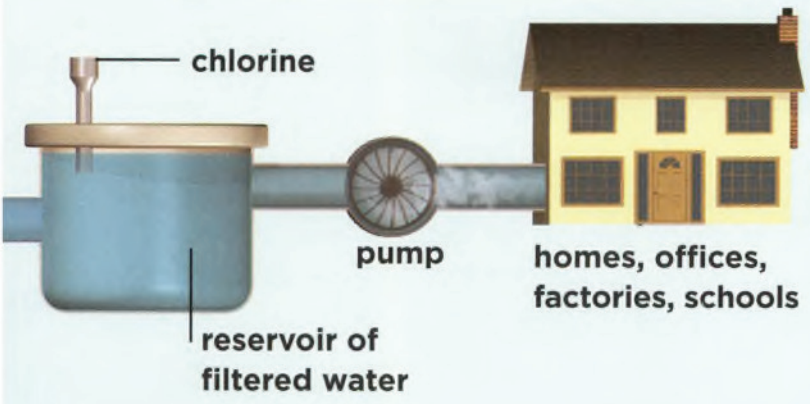


3. **Use Numbers** Calculate the difference between the masses of the apple slices before and after you dried them. What does this difference show?
4. Repeat with another kind of fruit. Compare the results from this fruit and the apple.

Read a Diagram

How does water reach homes and other buildings?

Clue: Trace a path from the water supply to the end of the diagram.



Quick Check

Problem and Solution How do people make water safe for drinking?

Critical Thinking Why should you not drink water directly from streams or lakes?

▲ Some farms grow plants in water instead of soil.

▲ Waterways help people move things from place to place.

How else do we use water?

People use Earth's water in all sorts of ways. Freshwater is used in farming. In some places, irrigation (ihr•uh•GAY•shun) supplies the water for growing crops. **Irrigation** is a way to bring water into the soil through pipes or ditches.

Water is important to industry too. It is used to generate electricity. Ships need water to transport goods.

What are other ways people use freshwater? They use it to have fun! Swimming, boating, and fishing are some of the many examples.

Quick Check

Problem and Solution What problem does irrigation solve?

Critical Thinking Describe three ways that people could use a river.

Many people use water for fun and recreation.

Lesson Review

Visual Summary

Forms of Earth's water include oceans, lakes, rivers, streams, groundwater, and watersheds.

People get drinking water from wells and reservoirs. The water must be cleaned before it is used.

Uses of freshwater include farming, irrigation, transportation, and recreation.

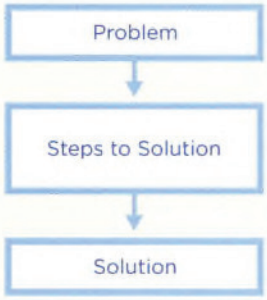
Make a FOLDABLES® Study Guide

Make a trifold book. Use it to summarize what you read about Earth's water.

Think, Talk, and Write

1. **Vocabulary** All the water in a(n) _____ drains into one river or stream.

2. **Problem and Solution** How can people make sure their water is safe to drink?



3. **Critical Thinking** How does the Sun help provide you with freshwater?

4. **Test Prep** **Where is most of Earth's freshwater found?**

   A in lakes, rivers, and streams
   B in glaciers and ice caps
   C in the atmosphere
   D below the ground

5. **Essential Question** How do people obtain and use water?

Math Link

Solve a Problem
A leaky faucet wastes about 300 milliliters of water each day. About how much water does this leaky faucet waste in one year?

Social Studies Link

Learn about Water Use
The Southwest United States is hot and dry. It is home to many growing cities, like Phoenix, Tucson, and Las Vegas. Research how these cities are meeting their water needs.

Writing in Science

Saving Water

Dear Editor,

All life depends on water. We need clean water to drink. Plants and animals need water to survive. We also use water to make food.

Every year the population grows, so every year the amount of water we need increases. But the water supply doesn't always increase.

I believe each of us can make a difference. Here are some simple actions everyone can take right now.

- Fix any leaky faucets.
- Grow only plants that are adapted to local climate and rainfall, rather than plants that must be watered often.
- Run the dishwasher only when it is full.

All of us can help. We cannot let this important resource drip away!

Persuasive Writing

Good persuasive writing

- states an opinion about a topic;
- uses convincing reasons for that opinion;
- includes a call to action.

You can save water by turning off the faucet while brushing your teeth.

Write About It

Persuasive Writing Write a letter to the editor of your local newspaper. Your letter should inform people about the need to keep the groundwater clean. Include facts and details to make your letter persuasive.

LOG ON e-Journal Research and write about it online at www.macmillanmh.com

How much water do you use?

How much water do you use each day? You probably use more than you think you do.

The table below shows how much water people use doing different tasks each day. Keep a journal of your water use for one day. Record every time you do one of the tasks below. Then use the table to calculate how much water you used.

Daily Water Use

Task	Average Number of Gallons Used
take a bath	50
use a dishwasher	20 per load
use a washing machine	10 per load
wash dishes by hand	5 per load
flush a toilet	1.6 per flush
take a shower	2 per minute
brush your teeth	1
wash your hands	1
drink a glass of water	0.06

Add Decimals

- Adding decimals is like adding money amounts. Write the numbers in a column. Line up the decimal points.

```
  50
 0.06
+1.6
```

- If a number does not have a decimal point, you can give it one. Insert zeros after the decimal point so the amounts line up correctly.

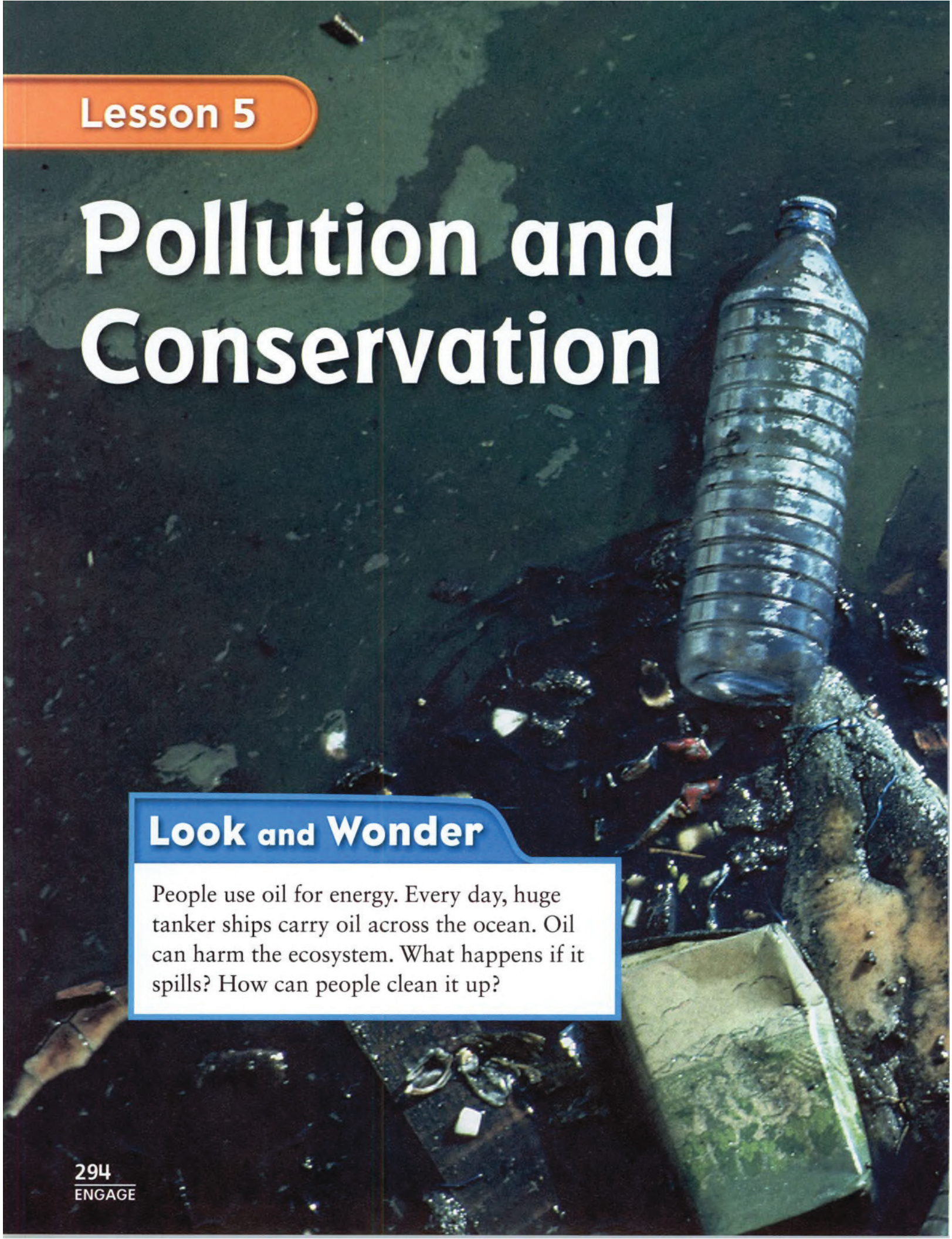
```
 50.00
+ 0.06
+ 1.60
```

- Add each column. Remember to write the decimal point in the sum.

```
 50.00
+ 0.06
+ 1.60
 51.66
```

Solve It

1. How much water did you use in one day?
2. Try to conserve water for one day. What are some ways you can cut down on the amount of water you use? Keep a journal on your water conservation day. How many gallons did you save?



Lesson 5

Pollution and Conservation

Look and Wonder

People use oil for energy. Every day, huge tanker ships carry oil across the ocean. Oil can harm the ecosystem. What happens if it spills? How can people clean it up?

Explore

Inquiry Activity

How can you clean an oil spill?

Make a Prediction

Oil and water do not mix. How could you separate oil from the surface of water? From the surface of a solid? Make a prediction.

Test Your Prediction

1. Fill a plastic container halfway with water. Float a cork in the water.
2. **Make a Model** Using an eyedropper, carefully drip 6–7 drops of oil onto the water's surface.
3. **Observe** Watch the oil, water, and cork for about 30 seconds. Record your observations.
4. Based on your observations, make a plan to test your prediction. Use only the materials your teacher gives you.
5. Carry out your plan to clean the oil from the water and cork. Record your results.

Draw Conclusions

6. **Communicate** How well were you able to clean the oil from the water? From the cork? Describe your findings.
7. Was your prediction correct? Explain. What other materials do you think might have worked?
8. **Infer** What can be done to clean up an oil spill in the ocean?

Materials

- plastic container
- water
- cork
- eyedropper
- vegetable oil
- paper towels
- sponge

Explore More

Research the 1989 oil spill from the *Exxon Valdez.* Where did the oil spill? How far did it travel? How was it cleaned? Report your findings.

Read and Learn

Essential Question

How can people reduce pollution and conserve resources?

Vocabulary

environment, p. 296

pollution, p. 296

acid rain, p. 296

conservation, p. 298

compost, p. 298

reduce, p. 300

reuse, p. 300

recycle, p. 300

Reading Skill

Main Idea and Details

Main Idea	Details

Technology

e-Glossary and e-Review online at www.macmillanmh.com

What is pollution?

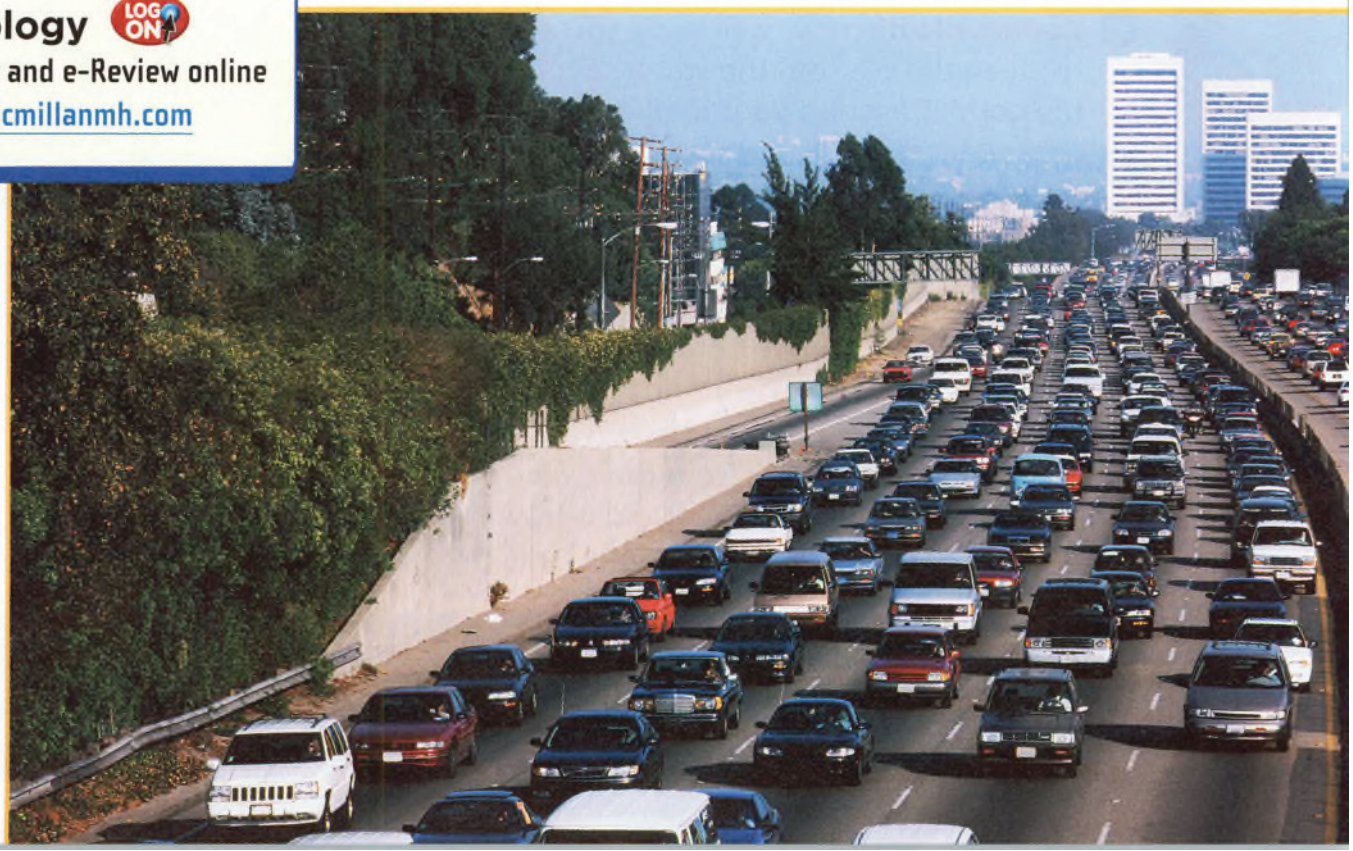
The living and nonliving things that make up an area form an **environment**. All living things need a healthy environment. A healthy environment has clean air, water, and land.

When a harmful substance is added to the environment, it causes **pollution** (puh•LEW•shun). Some pollution comes from natural sources, like forest fires and volcanoes. Most pollution comes from human activities.

Air Pollution

When we burn fossil fuels, gases and bits of dust go into the air. Some of the gases combine with water droplets in the air. When this happens, **acid rain** forms. Acid rain can harm living things and damage buildings.

Water vapor, other gases, and dust can form smog, which hangs in the air like fog. Smog makes the air dangerous to breathe.



Water and Land Pollution

What happens when people dump wastes from homes or factories into oceans, lakes, or rivers? They cause water pollution. Polluted water can kill plants and animals. It can make people sick.

Even chemicals that help people can pollute the water. Fertilizers and pesticides can be washed into nearby waters during a storm. Storm drains lead to an ocean or stream. Oil spills from ships can pollute water and beaches. Many fish, birds, and mammals are harmed in this way.

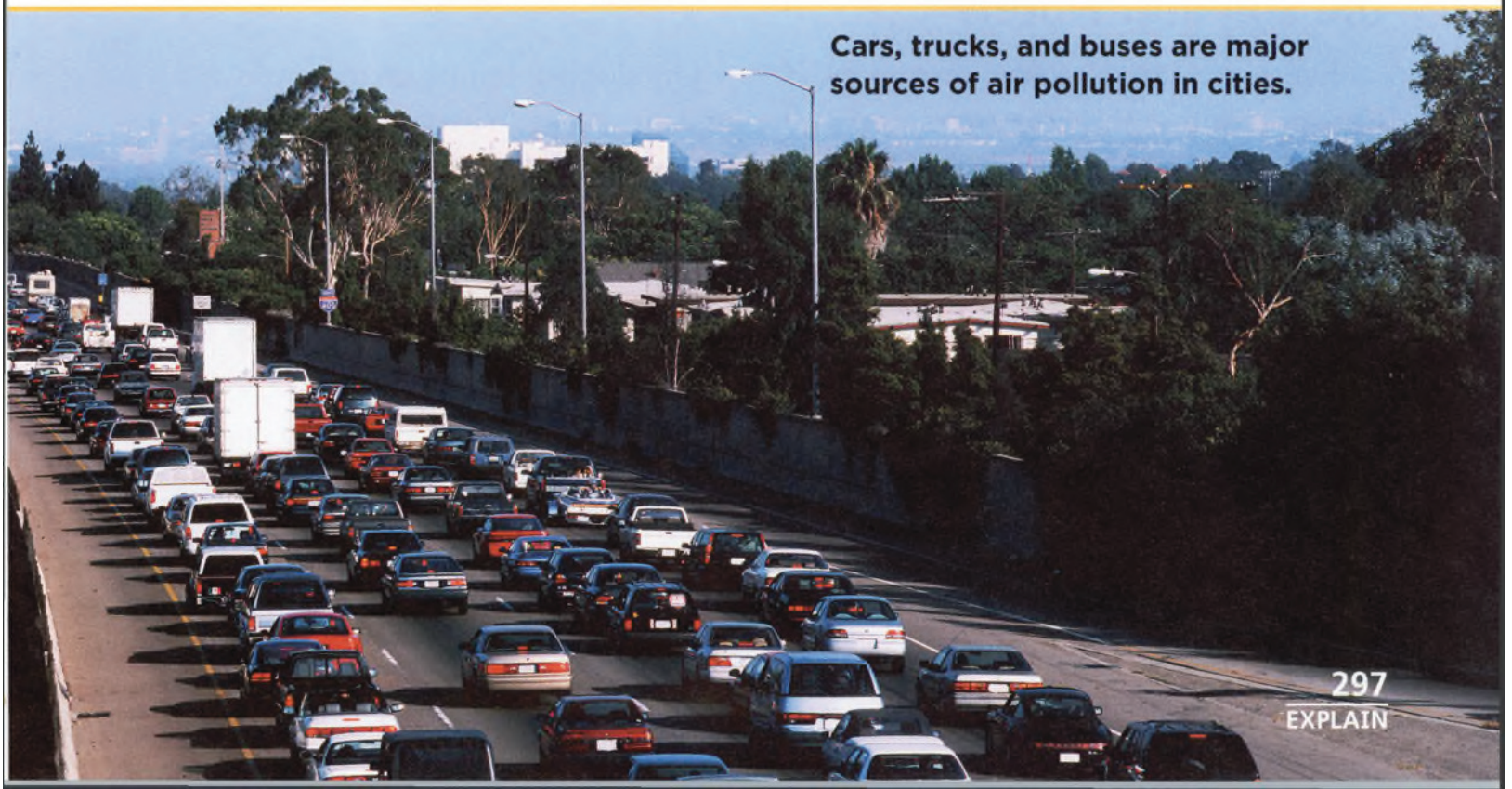
You know better than to *litter,* or throw trash on the ground. Littering is ugly. It is also against the law. Littering, chemicals, solid wastes, and acid rain pollute the land. They can harm or kill plants and animals.

People cause land pollution by leaving tires, paper, and other trash on the ground.

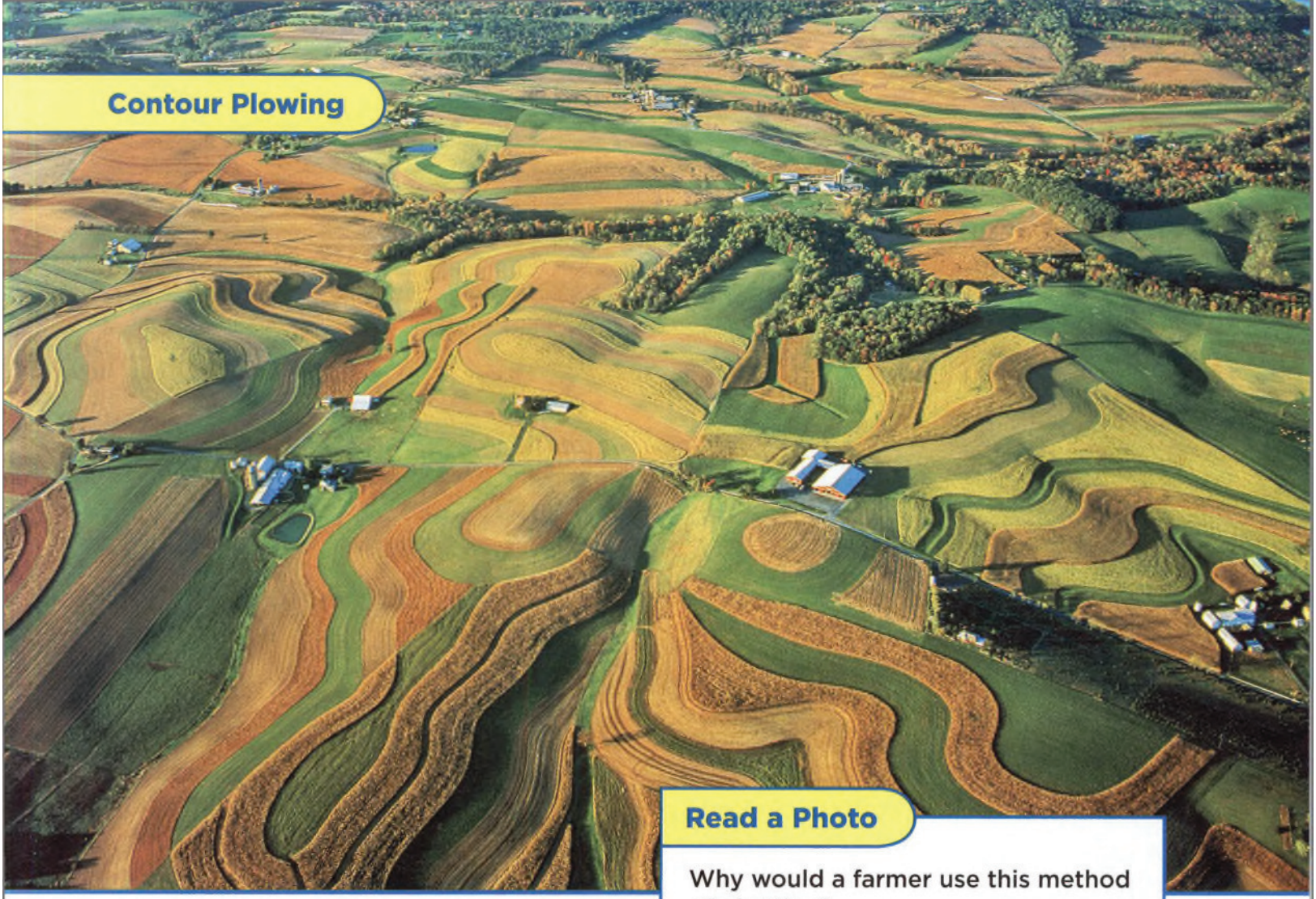
Quick Check

Main Idea and Details How can pollution harm the environment?

Critical Thinking Are people always aware of the pollution they cause? Give examples.



Cars, trucks, and buses are major sources of air pollution in cities.



Contour Plowing

Read a Photo

Why would a farmer use this method of planting?

Clue: Look at the relationship of the crop rows to the slope of the land.

How can we protect the soil and water?

Everyone can conserve resources. **Conservation** (kahn•sur•VAY•shun) means using resources wisely.

Soil Conservation

You have learned how easily soil can be carried away, or eroded. Farmers use methods to slow erosion. These methods are called soil conservation. They keep the soil in place to support plants. One method is to plant a row of trees that slows down the wind.

On sloping lands, farmers plow fields in curved rows that follow the shape of the land. This method is called *contour plowing*. When farmers change crops every year, it is called *crop rotation*. Crop rotation conserves the nutrients in soil.

People can conserve soil by spreading compost in their gardens. **Compost** is a mix of dead or decaying matter, such as food scraps, fallen leaves, and cut grass.

Water Conservation

No one has an unlimited water supply. How can we conserve water?

Many towns and cities collect used water, or *wastewater,* from homes and businesses. They pass it through a system of pipes called *sewers*. The pipes lead to a sewage treatment plant. There the water is cleaned and released.

How can you conserve water? Turn off the faucet when you are not using it. Run only full loads in laundry machines and dishwashers. Ask your family to fix leaky toilets and faucets. By saving water, you conserve it!

Quick Lab

Conservation Plan

1. **Observe** How does your school use resources? Find out. Consider water use, energy use, and garbage disposal.
2. Think of ways your school could conserve resources or produce less waste. Write down your ideas.
3. **Communicate** Share your ideas with your classmates. As a class, write a plan to present to your principal.

Quick Check

Main Idea and Details Describe some methods of conservation.

Critical Thinking What kinds of things can you do to conserve soil and water?

People in desert regions can conserve water by growing native plants instead of grass. ▼

What are the 3 *Rs*?

Three ways to conserve resources start with the letter *R*.

Reduce

To **reduce** means to use less of something. This is the simplest way to conserve. How do you reduce your use of paper? Write on both sides of the sheet. How do you reduce your energy use? Turn off the lights when you do not need them.

Reuse

To **reuse** means to use something over again. You can reuse glass or plastic cups instead of throwing away paper cups. You can reuse old clothes as cleaning rags.

Recycle

To **recycle** means to make a new product from old materials. Recycling keeps materials in use and out of landfills. Many communities recycle paper, plastic, glass, and metal. Can you think of other ways to recycle?

Quick Check

Main Idea and Details What are the 3 *Rs* of conservation?

Critical Thinking How can the 3 *Rs* help us conserve fossil fuels?

Read a Photo

Which of the 3 *Rs* does each picture show?

Clue: Look closely at what is being conserved.

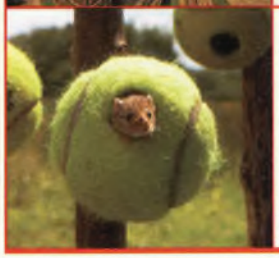
The 3 *Rs* in Action

Lesson Review

Visual Summary

Human activities can cause **pollution** of Earth's land, air, and water.

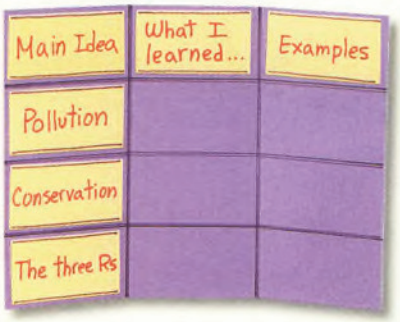
Conservation means using resources wisely. There are many ways to conserve the soil and water.



Anyone can practice **the 3 *Rs*** of conservation—reduce, reuse, and recycle.

Make a FOLDABLES® Study Guide

Make a trifold table. Use it to summarize what you read about pollution and conservation.



Think, Talk, and Write

1. **Vocabulary** You can form _____ from table scraps and grass cuttings.

2. **Main Idea and Details** Give one example for each of the 3 *R*s of conservation.

Main Idea	Details

3. **Critical Thinking** Write a plan that your family can follow to conserve water. Which of the steps do you think will help conserve the most water? Explain.

4. **Test Prep** **The burning of which product can cause acid rain?**

   A composts
   B fertilizers
   C pesticides
   D fossil fuels

5. **Essential Question** How can people reduce pollution and conserve resources?

Writing Link

Write a Report
Research how your community treats wastewater. Do people pay for this service? How much? Write a report to show what you found out.

Art Link

Make a Poster
Make a poster that teaches people about one or more of the 3 *R*s. Use bright colors or good humor to express your message.

LOG ON e-Review Summaries and quizzes online at www.macmillanmh.com

Real World

Reading in Science

SAVING THE SOIL

Much of the food we eat comes from plants grown in soil. Sometimes the way we grow our food can harm the soil. It's important that we have good soil to grow crops. Farmers can use different methods to protect the soil now and in the future.

Plowing is pulling a blade that turns over the soil. Some farmers use a method called contour plowing. They follow the curves of a hillside instead of plowing straight up and down. This method makes "steps" that stop or channel the flow of rainwater. Then the water soaks into the soil. Without contour plowing, the water runs downhill, carrying loose soil and nutrients with it. The problem is that contour plowing takes longer than plowing in straight lines. It also uses more fuel.

Many farmers use tractors during planting season.

Step farming is a type of contour plowing.

Connect to AMERICAN MUSEUM of NATURAL HISTORY at www.macmillanmh.com

Other farmers do not plow their fields after a harvest. A protective cover forms over the soil. This cover lasts through the winter. When it's time to plant, the farmers don't need to plow. They just dig holes in the field and place seeds in the holes. This method is called no-till planting. No-till planting also has its problems. Farmers may need to use chemicals to kill weeds that plowing would have removed.

Some farmers plant seeds at the end of a harvest to protect the soil. The plants that grow are called cover crops. They add nutrients to the soil. Common cover crops include rye, clover, and fava beans. When farmers are ready to plant again, they plow the cover crop into the soil. Then they plant seeds for the new crop.

Soybeans can be used as a cover crop. ▲

Wheat also makes a good cover crop. ▶

Main Idea and Details

- The main idea is the focus of the entire article.
- Details support and explain the main idea.

Write About It

Main Idea and Details

1. Why do farmers need to protect the soil?
2. What are some ways that farmers protect the soil? List the advantages and disadvantages of these methods.

LOG ON e-Journal Research and write about it online at www.macmillanmh.com

CHAPTER 6 Review

Visual Summary

Lesson 1 Rocks are made up of minerals. The rock cycle describes how rocks form and change.

Lesson 2 Soil is made of weathered rock and other materials. Soil forms slowly in layers.

Lesson 3 Fossils give us clues about Earth's past. Fossil fuels are nonrenewable resources.

Lesson 4 Water collects on Earth's surface and below the ground. It is stored and used in many ways.

Lesson 5 People may pollute the land, air, and water. We can protect our resources through conservation.

Make a FOLDABLES® Study Guide

Tape your lesson study guides to a piece of paper as shown. Use your study guide to review what you have learned.

Vocabulary

DOK 1

Fill each blank with the best term from the list.

environment, p. 296 — **mineral**, p. 252

fossil, p. 274 — **permeability**, p. 266

groundwater, p. 287 — **renewable resource**, p. 280

humus, p. 264 — **resource**, p. 258

irrigation, p. 290 — **rock cycle**, p. 256

1. All the living and nonliving things in an area make up a(n) _____.
2. The nonliving substance that makes up rock is called a(n) _____.
3. Nature can quickly replace a(n) _____, such as air or water.
4. Many farmers depend on _____ to bring water to their crops.
5. Sandy soils have a higher _____ than clay soils.
6. To tap into _____, people drill or dig a deep hole called a well.
7. A material or object that people can use is called a(n) _____.
8. The evidence of a living thing from long ago is a(n) _____.
9. Rocks change form through the _____.
10. Nonliving plant and animal matter, called _____, has nutrients for plants to grow.

LOG ON e-Glossary Words and definitions online at www.macmillanmh.com

Skills and Concepts

DOK 2–3

Answer each of the following.

11. **Main Idea and Details** How are the three types of rock formed? Provide an example for each.

12. **Communicate** Write a public notice. Explain how a water treatment plant works. Describe how it makes water safe for drinking.

13. **Critical Thinking** Which renewable energy source do you think will be most important in the future? Explain your answer.

14. **Persuasive Writing** Write a letter to your school newspaper convincing other students to conserve resources. Suggest ways that they can reduce, reuse, and recycle.

15. The properties of soil

A vary from place to place.

B are the same in all climates.

C are similar in all horizons.

D cannot be observed easily.

16. **Problem and Solution** How can drinking water become polluted? What can be done to keep it safe?

17. **True or False** *Fossil fuels are a renewable resource.* Is this statement true or false? Explain.

18. **True or False** *Heat and pressure can change the properties of a rock.* Is this statement true or false? Explain.

19. **Critical Thinking** What do fossils tell scientists about how life on Earth has changed?

The Big Idea

20. What are Earth's resources, and how can we conserve them?

Performance Assessment

DOK 3

Marvelous Minerals

Learn more about the properties and uses of different minerals.

What to Do

1. Use resources to find information about diamond, quartz, chromite, and copper. What properties does each mineral have?

2. Find out how each mineral is used. In what common objects can each mineral be found?

3. Copy the chart below. Use your chart to record your findings.

Mineral	Properties	Uses
diamond		
quartz		
chromite		
copper		

Analyze Your Results

Explain how the uses of each mineral are related to its properties.

Test Preparation

1 Which mineral is softest?

Moh's Hardness Scale	
Mineral	**Hardness**
gypsum	2
calcite	3
quartz	7
diamond	10

A diamond

B gypsum

C quartz

D calcite

DOK 1

2 The fossil shown below was found in a tundra biome.

What can you most likely infer from this finding?

A The climate has gotten colder.

B The climate has gotten warmer.

C Fossil fuels can be found nearby.

D Fossil fuels cannot be found here.

DOK 2

3 Which properties are most helpful in identifying minerals?

A luster, streak

B size, ability to float

C weight, shape

D shape, width

DOK 1

4 The properties of soils

A vary from place to place.

B are the same in all biomes.

C are similar in all horizons.

D can only be observed with scientific equipment.

DOK 1

5 Which human activity most likely has a negative impact on the environment?

A composting

B conserving resources

C recycling notebook paper

D burning fossil fuels

DOK 1

6 Most fossils are found in

A minerals.

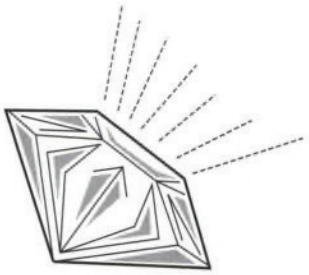
B igneous rocks.

C sedimentary rocks.

D metamorphic rocks.

DOK 1

7 Look at the diamond below.



In which group does this diamond belong?

A renewable resource

B fossil fuel

C building material

D mineral resource

DOK 1

8 A soil sample has a coarse texture and high permeability. It is most likely

A clay.

B sand.

C humus.

D bedrock.

DOK 1

9 A rock is soft and has layers. The rock is most likely

A sedimentary.

B igneous.

C metamorphic.

D granite.

DOK 1

10 Windmills are a renewable source of electricity.

Name another renewable energy source.

DOK 1

Explain how using this renewable energy source can reduce pollution.

DOK 2

Check Your Understanding

Question	Review	Question	Review
1	pp. 252–253	6	pp. 274-277
2	pp. 276–277	7	pp. 252-253, 278–280
3	pp. 252–253	8	pp. 267–268
4	pp. 266–268	9	pp. 254-255
5	pp. 278–280	10	pp. 278–280

Careers in Science

Survey Technician

How can you find out exactly where your front yard ends and your neighbor's begins? You need the help of a survey technician! Survey technicians use certain instruments to find the borders of lands. They help plan where new roads, bridges, and homes are built.

To join a surveying crew, you will probably need a technical degree in surveying. You will also need a steady hand and strong math skills. Computer skills are especially useful.

▲ Surveyors use high-tech tools to measure land area.

Geologist

If you are curious about planet Earth, you may want to become a geologist. Geologists are also called Earth scientists.

Not all geologists study rocks. Some work with businesses to locate oil or other resources in the ground. Others study earthquakes or volcanoes. Geologists also look at how Earth has changed over time. They make predictions about the future.

To be a geologist, you need a college degree. Most geologists go to school for several more years after college. If you want to be a real "rock hound," you'd better bone up on science!

▲ Geologists who study volcanoes wear thermal suits for protection.

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